Highways Department
Hong Kong

Agreement No. CE 35/95

Widening of Tolo Highway and Traffic Surveillance and Information System

Feasibility Assignment

ENVIRONMENTAL IMPACT ASSESSMENT

Final Report

MAUNSELL CONSULTANTS ASIA LTD

Agreement No. CE 35/95 Document No. 90896/E8

Feasibility Assignment for
Widening of Tolo Highway and
Traffic Surveillance and Information System

ENVIRONMENTAL IMPACT ASSESSMENT

Final Report

Maunsell Consultants Asia Ltd.
in association with
Delcan International Corporation
Consultants in Environmental Sciences (Asia) Ltd.
Urbis Travers Morgan Limited

Issue 1
April 1997

EIA-116/BC

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**Feasibility Assignment for
Widening of Tolo Highway and
Traffic Surveillance and Information System**

ENVIRONMENTAL IMPACT ASSESSMENT

Executive Summary

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Introduction

1. Highways Department commissioned Maunsell Consultants Asia Ltd. to undertake a feasibility study for the Widening of Tolo Highway and Traffic Surveillance and Information System under Agreement No. CE 35/95. As part of this feasibility study, an Environmental Impact Assessment (EIA) Study has been undertaken by Consultants in Environmental Science (Asia) Ltd., and this Executive Summary Report summarises the findings of the EIA study, which is reported in greater detail in the EIA Final Report and EM&A Manual.

2. Tolo Highway is an expressway in the North East New Territories connecting the Fanling Highway at Tai Po (near Hong Lok Yuen) and Tai Po Road near the Sha Tin racecourse (shown in **Figure 1**). The highway alignment under consideration is bordered by the Island House interchange at Tai Po and Ma Liu Shui Interchange at Sha Tin. The existing Tolo Highway is located on a strip of reclaimed land which forms a man-made coastline along the eastern edge of Tolo Harbour. The reclamation supports not only the Tolo Highway but also the KCRC railway (which runs parallel and immediately to the west of the road) and a footpath with cycletrack (immediately to the east of the road). The immediate lower hill slopes and areas around the area of reclamation comprises abandoned agricultural land, rough grassland and scattered trees around settlements. These join a series of steep hillsides which are highly dissected by stream valleys and are well vegetated with dense woodland, tall shrub and grassland. Much of the densely wooded hillslopes above Tai Po Kau are included within the Tai Po Kau Nature Reserve.

3. Particularly notable natural local features include Yuen Chau Tsai, a well wooded promontory at the northern limit of the scheme. It comprises mature fung shui woodland around the temple at the base of the hill as well as ornamental trees in the garden of Island House. To the north of the promontory is a public open space with extensive amenity planting. On another small promontory adjacent to the Highway lies Tolo Harbour Garden, comprising ornamental tree and shrub planting set within a small *Acacia* woodland.

Alternative Alignments

4. This Assignment requires 3 options to be studied. Two working papers were issued by MCA and the Engineering Working Group concluded that there is only one practical alignment from Island House Interchange to Hong Kong Institute of Biotechnology (HKIB). All three alternatives are within the section from HKIB to Ma Liu Shui Interchange. **Figure 2** summaries the 3 options.

Option I follows the alignment proposed in the Preliminary Project Feasibility Study. It requires the reprovisioning of the Laboratory Bridge. The footpath/cycle track are adjacent to HKIB will be narrowed to 4.4 m and follows a path slightly offset towards the university campus.

Option II avoids the reconstruction of the Laboratory Bridge but requires the reconstruction and lowering of about 140 m of existing southbound carriageway to achieve adequate headroom clearance under the existing bridge. The footpath/cycle track for Option II will also be narrowed to 4.4 m similar to Option I.

Option III differs considerably. It does not require reprovisioning of the Laboratory Bridge but reconstruction and lowering of about 140 m of the southbound carriageway identical to that of Option II is required. The proposed cycle track and footpath will be positioned to the rear of the CUHK Eastern Campus and require additional reclamation.

Issues of concern to the Community - Noise Impacts

5. During construction, the construction noise levels are predicted to be within established noise limits for all noise sensitive receivers except one when the use of quietened equipment is assumed. The CUHK staff accommodation of Institute of Biotechnology will be affected by Option I and III respectively. Option I is predicted to breach the noise standard (55dB(A) according to Noise Construction Ordinance's Established Noise Level) for about six nights when placement of precast beams of reprovisioned Laboratory Bridge and removal of existing precast beams are carried out. The predicted level is 63dB(A). Option III is predicted to breach the daytime noise limit (75dB(A)) for about 3 days for the construction of haul road located close to CUHK Institute of Biotechnology staff accommodation. The predicted noise level is 85dB(A). To further mitigate the construction noise impact of Option III, installation of temporary noise barrier is recommended which can reduce the noise level to the daytime noise limit.

6. During operation, the traffic noise impacts are predicted to exceed the HKPSG's standards and limit for most of the identified noise facades when mitigation measures are not introduced. Noise mitigation options are confined to the use of vertical noise barriers (with/without canopies) located both at the road kerb and the central median because of space problem along the Highway. The use of such barriers effectively reduces noise levels to within established limits at almost all noise sensitive facades.

7. For existing or committed development, the predicted noise level can be effectively reduced to established standards with the use of noise barriers. No adverse impact is expected.

8. For future developments along the Tolo Highway including the residential development in Pak Shek Kok Public Dump Reclamation, the GIC sites in Area 39 Tai Po and several CUHK student hostels; there are some residual noise impacts after the use of noise barriers. It is therefore recommended that planning control in terms of building orientation such as facing windows away from the Highway or locating noise non-sensitive facilities (e.g. toilet, kitchen, staircases) towards the Highway should be considered in the planning layout. It is expected that the residual noise impact of most

receivers can be further reduced to within established limits. The necessity of providing noise barriers for the future developments in Area 39 will be reviewed at detailed design stage when there are firm proposals on the developments.

Figure 3 shows the location of noise barriers.

Issues of Concern to the Community - Air Quality

9. During construction, there are predicted to be no dust impacts, with levels within the relevant standards (1-hour guidance level and 24-hour average AQO for TSP) at existing air sensitive receivers if good site practices are followed. For future planned developments adjacent to the Highway, results indicated that there would be no exceedances beyond 40 metres from the outer hard shoulder. In particular, the Marine Science Laboratory fish ponds are predicted to receive dust levels within the AQO guidelines.

10. It is recommended that controls on dust generation are included in the works contract. These practices including controlling mean vehicle speed of haulage trucks at 20 kmh^{-1}, watering of all open site areas once every 1.5 hours, provision and use of vehicle wheel washing facilities, and provision of suitable side and tailboard on haulage vehicles. Temporary stockpiles should be frequently watered.

11. During operation, assessments were undertaken for the worst case year of 2001 as well as 2010 and assuming the implementation of recommended noise barriers. For both years, vehicle emissions to air are predicted to meet relevant standards (under the AQO) at the existing air sensitive receivers apart from the KCRC Hostel building and Marine Science Laboratory.

For the KCRC Hostel building, a range of mitigation measures were considered, and minor modification to the recommended noise barriers were found to provide cost-effective mitigation at the building.

For the Marine Science Laboratory, a range of mitigation measures were considered and assessed, including various barriers and complete Highway enclosure. The most cost-effective and technically feasible measure was found to be the modification of 6 to 7 of the air conditioners at the road facade of these buildings, by upgrading them to split-type air conditioners.

12. Vehicle emissions from traffic using Tolo Highway will constrain future planned development adjacent to the Highway. The results of the assessment predicts that there is a minimum buffer distance requirement to any air sensitive recievers from the edge of the outer hard shoulder of Tolo Highway. These buffer distances are summarised below in Table 1.

Table 1. Summary of Buffer Zones Requirements

Future Development Area	Buffer Zone Required in 2001	Buffer Zone Required in 2011
Area 39 - Northern G/IC site	67m	53m
Area 39 - Sports Ground (HKIEd)	45m - 55m	41m - 49m
Area 39 - Southern G/IC site	35m - 50m	29m - 44m
Pak Shek Kok Public Dump - Stage I	45m	40m
Pak Shek Kok Public Dump - Stage II	37m	33m
Pak Shek Kok Public Dump - Stage III	51m	44m

Within these buffer zones it is recommended that development be limited to non-sensitive uses (such as car parks or amenity/ landscape areas) or that buildings are sealed with central air conditioning (with air intakes located where air concentrations comply with AQO criteria). The provision of enclosure to the highway is considered not practicable as it would introduce ventilation problem and fire fighting hazards.

Issues of Concern to the Community - Ecology

13. The ecological resources within the study site include landscaped areas either side of the highway and in the vicinity of the Island House interchange, estuarine habitats around Tai Hang Bridge and intertidal and subtidal areas seaward of the existing highway.

14. The ecological assessment identified terrestrial habitats on either side of the existing highway comprising landscaped plantations of exotic species and predisturbed areas such as the grassland at the foot of St Christopher's Head. The potential ecological losses are predicted to be of little significance.

15. Estuarine habitats at Tai Hang Bridge will be affected by a small amount of reclamation required on the landward side of the existing highway. No significant impacts are predicted on the mangrove community further upstream provided excessive siltation in the area during construction can be prevented and tidal flows are maintained. Temporary impacts may arise during construction due to the disturbance of birds using the Tai Hang estuary, though these are not predicted to be severe.

16. The intertidal area of the coastline supported a community of marine organisms typical of such areas in Hong Kong, and was used as foraging habitat by some birds. Impacts to the avifauna of the area will arise from the temporary loss of this foraging habitat as the project is under construction. It is predicted that the new shoreline will fulfil much the same function as the existing one. Sub-tidal impacts are not predicted to be significant provided widespread distribution of high levels of suspended sediments is avoided.

17. Recommended ecological mitigation measures are based on utilisation of buffer zones and landscaping areas to provide opportunities for planting to replace lost plantations. Because the Tai Hang Bridge mangrove is used by occasional large flocks of herons and egrets for feeding and roosting, there is also the potential for a small flat area at the eastern extent of the Tai Hang Bridge mangrove to be planted with bamboo as a potential nesting site.

Issues of Concern to the Community - Water quality

18. During construction, site activities may cause adverse impacts on the water quality of Tolo Harbour due to silty site runoff, dredging and reclamation activities. Silty runoff from construction inadvertently discharged to the nearby water courses will cause an increase of suspended solids in the receiving waters. Heavy metals, oil and grease, nutrients and other pollutants attached to the silty particles can also be washed into watercourses, and at Tai Po Kau could potentially be detrimental to the mangrove ecosystem.

19. It is recommended that impacts on water quality runoff be mitigated by implementing the control measures identified in the guidance (*EPD - Practice Note for Professional Persons PN 1/94)*, supported by the recommended Environmental Monitoring and Audit programme. Effluent can be controlled by provision of treatment and control systems where necessary. Potential problems of accidental spillage are minimal if spills are contained and drainage is not directed to surface water courses. With the recommended mitigation measures properly undertaken, the potential water quality impact of the scheme should be local and minimal.

20. During operation of the Highway, the potential impacts on water quality due to surface runoff are of significantly less concern than those during construction. Typical highway runoff would contain low levels of sediment and contaminants, largely arising from fuel combustion, eroded brake linings, tyre deposits and discarded refuse. The discharge of the runoff generally is unlikely to produce any quantifiable adverse effects and the only pollution control measures recommended are the provision of silt traps where appropriate.

Issues of Concern to the Community - Construction Waste

21. It is recommended that the different categories of wastes should be segregated, stored, transported and disposed of separately in accordance with EPD's required procedures. It will be the contractors' responsibility for disposal of excavated spoil and they should make use of excavated spoil as much as possible to minimise off-site fill material requirements and spoil disposal. The contractor should separate construction waste into non-inert and inert materials. The former, such as wood, glass, plastic, steel and other metals (including excavated pipelines), should only be disposed of at strategic landfills. The latter, such as concrete, together with any spoil, should only be disposed of at a public dump site(eg Pak Shek Kok public dump site).

22. The study has demonstrated that the marine sediments are highly contaminated and that off-site disposal is required. A feasible disposal option at East Sha Chau has been identified.

Issues of Concern to the Community -Visual, Landscape and Land-use

23. The main source of visual and landscape impact during the construction period will be the loss of vegetation along both sides of the road which currently screens the traffic in part and provides a landscape setting to the road and from the cutting of the slope at St. Christopher's Head. Impact will also arise from the introduction of traffic and activities associated with the works and the construction of the widened carriageway, noise barriers and street furniture.

24. Upon completion of the works the absence of mature vegetation alongside the road and on the cutting, together with the increased extent of road carriageway and traffic, and the noise barrier structures, will continue to have a landscape and visual impact. The establishment of the proposed planting will reduce both landscape and visual impacts over time although long term impacts will result from the increased extent of road carriageway and traffic, and from the noise barrier structures.

25. During construction and operation, the scheme would result in high visual impacts around the Institute of Biotechnology, Marine Science Laboratory and the CUHK Water Sports Centre due to their close proximity to the scheme. The CUHK Staff Quarters would be particularly affected by the scheme due to its sensitivity, elevated nature and the loss of an existing vegetation screen. Views from the other ground-level receivers including pedestrians, cyclists & ferry users would be effectively blocked by the proposed mitigation screening measures of planting alongside the road and water front and the erection of noise barriers.

26. Other visually sensitive receivers include residents of the high quality residential properties on the hillslopes above the scheme and workers, students and residents at the CUHK. The visual impact of the scheme would be difficult to mitigate for these receivers as they have extensive views down onto the highway. However, the proposed mitigation measures including a 5 m wide planting strip along the outer edge of the highway would result in a greener, softer edge to the highway and this would represent overall a great improvement on existing views. Construction related visual impacts would generally be greater than operational visual impacts as the project would involve reclamation whereas its would upon completion represent only an enlargement of what is an existing feature in the landscape. A major deterioration in existing views during construction would only be experienced by receivers close to the works at ground level or with elevated views from near and intermediate distances.

27. Substantial adverse visual impacts would be experienced by cyclists and pedestrians during the construction phase. Beneficial visual impacts are predicted after completion

of the works, when the opportunity exists for the establishment of a buffer zone and screen between the highway and the new cycletrack/footpath. Substantial adverse impact would also result from the land cut at St. Christopher's Head, the loss of vegetation and modification of the landform at the slopes.

28. The landscape impacts generated through disturbance of the landscape pattern and loss of landscape resources (vegetation, topography, natural features etc.) are likely to be relatively small and marginal in nature and will tend to be localised to the existing highway corridor which is considered to be of low landscape value due to the relatively small amount of existing vegetation, the lack of natural features and the dominance of the man made elements of the various transport corridors.

The quality of the wider landscape, which tends to be derived from the impressive scale and nature of Tolo Harbour and the surrounding hills, is considered to be high, and its character would be unaffected by the works.

It is considered, therefore, that the scheme overall would generate only low level landscape impact.

29. On landscape amenity grounds, there would be a loss of amenity for cycletrack users during construction. There would be a loss of part of Tolo Harbour Garden and difficulties in access to the garden during construction.

30. Mitigation measures have been recommended which aim to minimise the potential landscape and visual impacts of the proposed scheme and to provide a comprehensive landscape treatment for the highway and associated cycle track/footpath. These mitigation measures include planting of the St. Christopher's Head cut slope and other disturbed slopes, between the road and the cycle track to screen the road and along the central divider of the road to reduce the visual impact of the noise barriers. Architectural treatment of the noise barriers is also proposed to help tone down their appearance and blend them into the surrounding landscape setting. These mitigation proposals represent major landscape and visual improvements for the highway corridor and would reduce landscape and visual impacts to within established guidelines.

Issues of Concern to the Community - Landuse & Archaeology

31. The land use impact assessment has identified the major land uses affected by the proposed widening of Tolo Highway. Most of these uses, which are G/IC or recreational facilities, would require reprovisioning to another location. Major reprovisioning sites comprise the Marine Police Station and the cycle track/footpath. Where possible, retention of existing uses (e.g. Tolo Harbour Garden) has been recommended.

The road may have a marginal impact on the Island House Temple and Island House sites of archaeological/historic importance on Yuen Chau Tsai that are listed in the Hong Kong Government's register of Antiquities and Monuments.

Although the known area of artefacts would be unaffected by the proposed widening works, there is a possibility that the surrounding area may contain features of archaeological importance and some of these may be within the area of the proposed works. It is suggested that a detailed examination is undertaken, before the highway widening works commence, of any areas around the Island so that any valuable artefacts can be removed prior to construction.

Implementation of the Project

32. The EIA study has assessed the proposed Tolo Highway Widening scheme, identified environmental impacts and made a number of recommendations as regards mitigation measures. These are summarised below in Table 2.

Table 2 Summary of Impacts, Quantities and Mitigation Measures

Environmental Impact	Quantity (without mitigation)	Mitigation Measures and Implementation
Construction Noise	No adverse impacts for all options if quietened equipment is used, apart from [illegible] Option I and III have 1 receiver affected	Suitably quietened construction equipment recommended. Option I is not preferable to adopt. Temporary noise barrier recommended for Option III. Implemented through contractors contract clauses and EM&A Programme.
Operational Noise	Scheme fails to comply with noise guidelines at sensitive receivers comprising 350 households (approx. 1050 persons). Building in planning development areas may also fail to comply with noise guidelines.	Noise barriers recommended for both existing and planned noise sensitive receivers/buildings. Noise barriers implemented and built as part of Widening project.
Construction Dust	No adverse effects at the existing ASRs (standards achieved) Marine Science Laboratory fish ponds expected to meet existing dust criteria.	Good site practices to control dust generation. Implemented through contractors contract clauses and EM&A Programme. As highly sensitive use, specific monitoring programme will implemented as part of EM&A programme.
Traffic Emissions to Air	No adverse effects at the existing buildings except the CUHK Marine Science Laboratory and KCRC Hostel Building.	Upgrading of air conditioning systems at the Marine Science Laboratory to ensure that they involve no air intakes at the road facade. Implemented by upgrading the existing air conditioners to split-type air conditioners as part of the Widening project. Noise barriers modified to mitigate effects (i.e. barrier at N/B of CH 1428 to CH 1657 upgraded to 7m high x 2.5 m overhang barrier and barrier at N/B of CH 1657 to CH 1912 upgraded to 7m high x 4m overhang barrier). Implemented as part of

		the Tolo Widening project.
	For future development areas, air buffer zones have been identified as a constraint on any air sensitive development.	Setback distances have been identified and measures, including central air conditioned buildings, identified as suitable for use in buffer zones. Implemented by Departments responsible for future developments along the Highway (TDD, Planning and CUHK).
Water Quality Impacts from Construction	No adverse effects anticipated if good site practices adopted.	Construction practice guidelines recommended. Implemented through EM&A Programme and contractors contract clauses.
Runoff from Road Operation	No adverse effect anticipated	-
Construction Waste	Disposal option identified for contaminated sediment	Implemented through detailed design proposals.
	No adverse effect anticipated if good site practices adopted.	Construction practice guidelines recommended. Implemented through EM&A Programme and contractors contract clauses.
Visual Impacts	Substantial impacts at Institute of Biotechnology, Marine Science Laboratory, Water Sports Centre and CUHK Staff Quarters during construction and operation. Also cyclists & pedestrians during construction.	Landscape proposals will improve visual aspects of Highway when in operation (though drivers may have more confined views). Implemented through detailed design proposals and suitable landscape/planting and maintenance works as part of Widening project.
Landscape Amenity Impacts	Cycletrack users and access to Tolo Harbour Garden during construction. Also landscape setting of Yuen Chau Tsai.	Landscape planting proposals recommended. Implemented through detailed design proposals and suitable landscape/planting and maintenance works as part of Widening project.
Land-use Impacts	Reprovision of Marine Police Station and cycletrack/ footpath	Enhancement of footpath/ cycletrack. Reprovision of Tolo Harbour Garden. Implemented by suitable detailed design proposals.
Ecology	No major effects-habitats temporarily affected by construction.	Localised planting schemes. Implemented through suitable planting and maintenance works as part of Widening project.

In particular, it has recommended the installation of a number of noise barriers along the widened Highway (see **Figure 3**). The study has also recommended a set of guidelines on good site construction practices for inclusion as contractual controls during construction.

33. For the three Options considered, preferences between the options were only able to be identified and expressed for certain environmental disciplines - in terms of construction noise (where Option II was preferred), visual and landscape (with a preference for Option III) and land-use (with Option I least preferred and Option III most preferred). Taken overall, the EIA study finds that, on environmental grounds, Option II and III are recommended.

34. It is recommended that an Environmental Monitoring and Audit (EM&A) Programme is undertaken to monitor compliance of emissions and discharges from the construction activities with environmental standards and objectives. In the event of non-compliance, this will enable an immediate response to review practices and mitigation measures. An Environmental Monitoring and Audit Manual has been provided as a basis for contracting and implementing an independent EM&A Programme for this scheme.

Acceptability of Residual Impacts and Conclusions

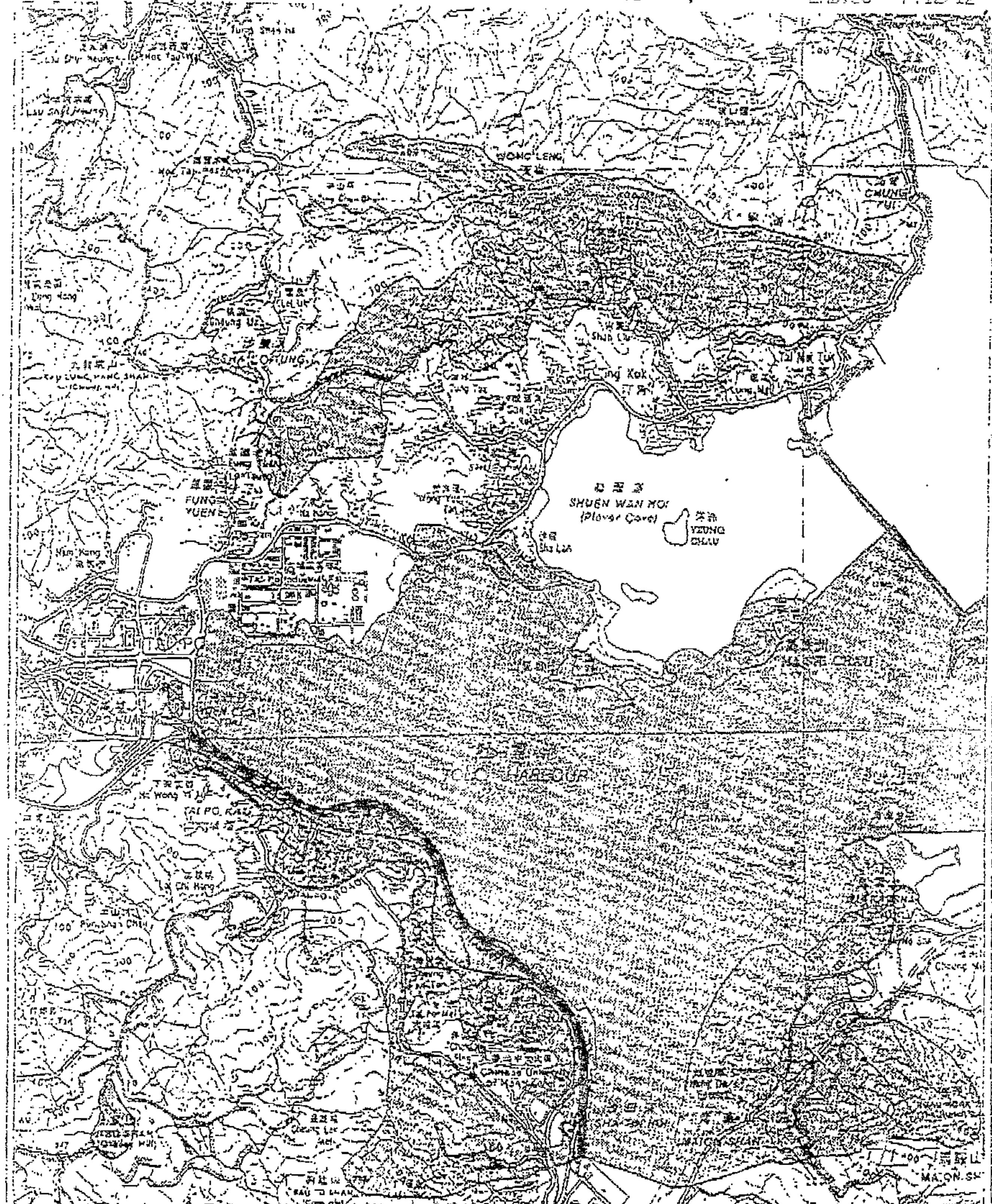
35. With the implementation of the mitigation measures as recommended in Table 2, the residual impacts and concerns are outlined below.

For the future development along both sides of Tolo Highway including Pak Shek Kok Public Dump and Area 39, it is recommended that the following measures should be taken into consideration in the detail planning stage and the preparation of the relevant layout plan.

- proposed development at the relevant location should be set back for a distance as given in Table 1 to satisfy the air quality requirements. Detailed assessment should be conducted in the detailed design of the relevant development.

- as far as the residual noise impact is concerned, consideration of building orientation and set back of development should be taken into account in the preparation of the development to satisfy the planning guideline for road traffic noise, otherwise, noise non-sensitive development should considered at the concerned location.

36. Taking these points overall, and taking into account the positive longer term benefits arising from improvements to vehicle, walking and cycling facilities along the route, the study concludes that the construction and operational characteristics of the Highway Widening scheme are within the environmental established guidelines, and that the scheme is feasible on environmental grounds.



TOLO HIGHWAY WIDENING SCHEME
吐露港公路擴闊工程計劃

Scale 1:50,000

Maunsell
茂盛工程顧問有限公司

Figure no. 圖
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1 INTRODUCTION AND SCOPE

Maunsell Consultants Asia Ltd, in partnership with Consultants in Environmental Sciences (Asia) Ltd, Ecosystems Ltd and Urbis Ltd, has been commissioned by Highways Department under Agreement CE 35/95 to undertake a feasibility study for the widening of Tolo Highway and Traffic Surveillance and Information System. The project proponent is Highways Department.

As part of this feasibility study, an Environmental Impact Assessment (EIA) has been undertaken, and this report presents the findings of the EIA study. This EIA Report is intended to fulfil the requirements of PELB General Circular 2/94 on Public Access to EIA Reports, and can be used for public consultation.

1.1 Study Objectives

The Tolo Highway Feasibility Study aims to provide:

- an in-depth investigation of the viability of the proposed widening works;
- a full impact assessment on the environment;
- a technically sound and cost effective preliminary design.

The specific objectives of the EIA study are defined in the study brief (given in Appendix A).

1.2 Scope of the EIA

Highways Department has provided an EIA study brief for the project (Appendix A). This requires consideration to be given to the key environmental issues identified in the PPFS, defines the reporting requirements for the EIA, and includes a requirement for the production of an environmental monitoring and audit manual. The EIA addresses the following aspects:

- Construction assessment. The key environmental issues identified for the construction activities are:
    - impact of construction activities on noise;
    - impact of construction dust on air quality;
    - impact of construction activities on water quality;
    - impact of construction waste;
- Operational assessment. The key environmental issues identified for the operational activities are:
    - impact of operational activities on traffic noise;
    - impact of operational traffic air emissions;
    - impact of operational activities on water discharges and water quality;
- Ecological assessment;
- Visual, Landscape and Townscape assessment;
- Land-use and Archaeological assessment;
- EM&A for construction works.

2 PROJECT DESCRIPTION

2.1 Site Description

Tolo Highway is an expressway in the North East New Territories connecting the New Territories Circular Road at Tai Po (near Hong Lok Yuen) and Tai Po Road near the Sha Tin racecourse. The alignment under consideration is bordered by the Island House interchange at Sha Tin and Ma Lui Shui Interchange at Tai Po.

The existing Tolo Highway is located on a strip of reclaimed land which forms a smooth man-made coastline along the eastern edge of Tolo Harbour. The reclamation supports not only the Tolo Highway but also the KCR railway (which runs parallel and immediately to the west of the road) and a footpath and cycle track (immediately to the east of the road). There are some dense tree belts between the highway and the KCR.

The Pak Shek Kok valley comprises mainly abandoned agricultural land, rough grassland and scattered trees around settlements. There are a number of discrete, high-quality, residential developments set within the low-lying wooded hillslopes. Residential properties are currently under construction at the St. Christopher's Home site above the Pak Shek Kok valley.

The land rises steeply to the landward side of the KCR to form a series of steep hillsides dissected by stream valleys. These hillslopes are well vegetated with dense woodland, tall scrub and grassland. Much of the densely wooded hillslopes above Tai Po Kau are included within the Tai Po Kau Nature Reserve.

There are a number of features on the seaward side of the Highway, Yuen Chau Tsai is a well wooded promontory at the northern limit of the scheme. It comprises mature fung shui woodland around the temple at the base of the hill as well as ornamental trees in the garden of Island House. To the north of the promontory is a public open space with extensive amenity planting. On another small promontory, lies Tolo Harbour Garden. The garden comprises ornamental tree and shrub planting set within a small *Acacia* woodland.

The Tolo Highway corridor is set within a high quality scenic landscape comprising a natural harbour framed by undeveloped mountain ranges. The coastline of the harbour to the north, south and west is predominantly man made, comprising extensive areas of reclaimed land. The character of the old pre-reclamation shoreline is still discernible at St. Christopher's Head. To the east, across the open waters of Tolo Harbour, lies the natural shoreline of the Yim Tin Tsai Peninsula. Built development is restricted mainly to the areas of reclaimed land and the lower coastal hillslopes.The most dominant man-made features within the landscape are the transport corridor comprising Tolo Highway and the KCR route, the high-rise residential blocks and industrial area at Tai Po, the residential towers at Ma On Shan and, to a lesser extent, the medium-rise buildings at the CUHK.

2.2 Proposed Works

The project addresses the feasibility of upgrading Tolo Highway from dual 3-lane to dual 4-lane standard with hard shoulders while maintaining and improving adjacent cycle ways and footpaths. The widening adopts both symmetrical and parallel widening principles. Given the existence of the KCR track immediately adjacent to the road on the landward (Eastern) side, upon which the alignment cannot encroach, there is relatively little scope for alternative alignments. Widening on the seaward side will inevitably require some level of reclamation. The feasibility study is considering 3 variant options for a widened Highway, all of which are assessed in this EIA study. The proposed general alignment for the widened Highway is given in Figures 2.1 - 2.6.

The northernmost section runs South from Island House Interchange and is represented in Figure 2.1 and 2.2. This section runs adjacent to the KCR line and will require the demolition of the marine Police Station. The alignment runs past public piers at Tai Po Kau for which the Director of Marine has requested that normal operation is not disrupted. This section contains Tolo Harbour Garden, a small piece of natural landscape that the study brief stipulates should be preserved as far as possible. The alignment then runs along the coast, over a modified Tai Hang Bridge and past Saint Christopher's Head.

The middle section follows the KCR line south along the coast (represented in Figure 2.3). This section is bordered by the Pak Shek Kok reclamation and public dump on the seaward side, and therefore the reclamation works overlap with that for the Pak Shek Kok site. It is anticipated that the Highway Widening works will overlap with Phase II of the Pak Shek Kok works.

The southernmost section runs past the Chinese University of Hong Kong (CUHK), under the Laboratory Bridge of the CUHK to the Ma Liu Shui Interchange at Sha Tin. This section contains public piers at Ma Liu Shui for which the Director of Marine has requested that normal operation is not disrupted. There are three alternative options considered within the southernmost section:

- Option I is represented in Figure 2.4, and is the main alignment defined in the PPFS which includes for the reprovisioning of Laboratory Bridge. The footpath and cycletrack remain in their present position, adjacent to the Highway.

- Option II is represented in Figure 2.5 , and has the same road alignment as Option I, with the existing Laboratory bridge being maintained and keeping the footpath and cycletrack in their present position. To incorporate the Southbound carriageway widening, the carriageway is proposed to be lowered to achieve adequate headroom beneath the laboratory Bridge.

- Option III is represented in Figure 2.6 and involved maintaining the existing Laboratory Bridge and re-routing the cycletrack and footpath to the rear of the HK Institute of Biotechnology. The remaining space is then used for the widened carriageway. The precise alignment of the footpath/cycletrack in this option is to some extent dependent on the detailed plans for the Phase I reclamation/Science Park.

The construction of the widened Highway aims to comply with the following general constraints:

- minimum traffic disruption;
- maintain cycletrack and footpath throughout construction period;
- maintain operation of public piers;
- maintenance of adequate safety work zones.

The reclamation works generally follows that identified in the PPFS, with removal of marine muds and the use of surcharge preloading techniques to ensure the stability of existing and future formation. The area required for preloading will be greater than that required for road widening and this represents an opportunity for its use as a buffer zone between the road and cycletrack/ footpath. It also provides area for traffic diversion and access during construction.

2.3 Other Local Developments

The Tolo Highway Widening scheme needs to be considered in the context of progressing and proposed schemes and works along the route.

2.3.1 Site Formation of Area 39

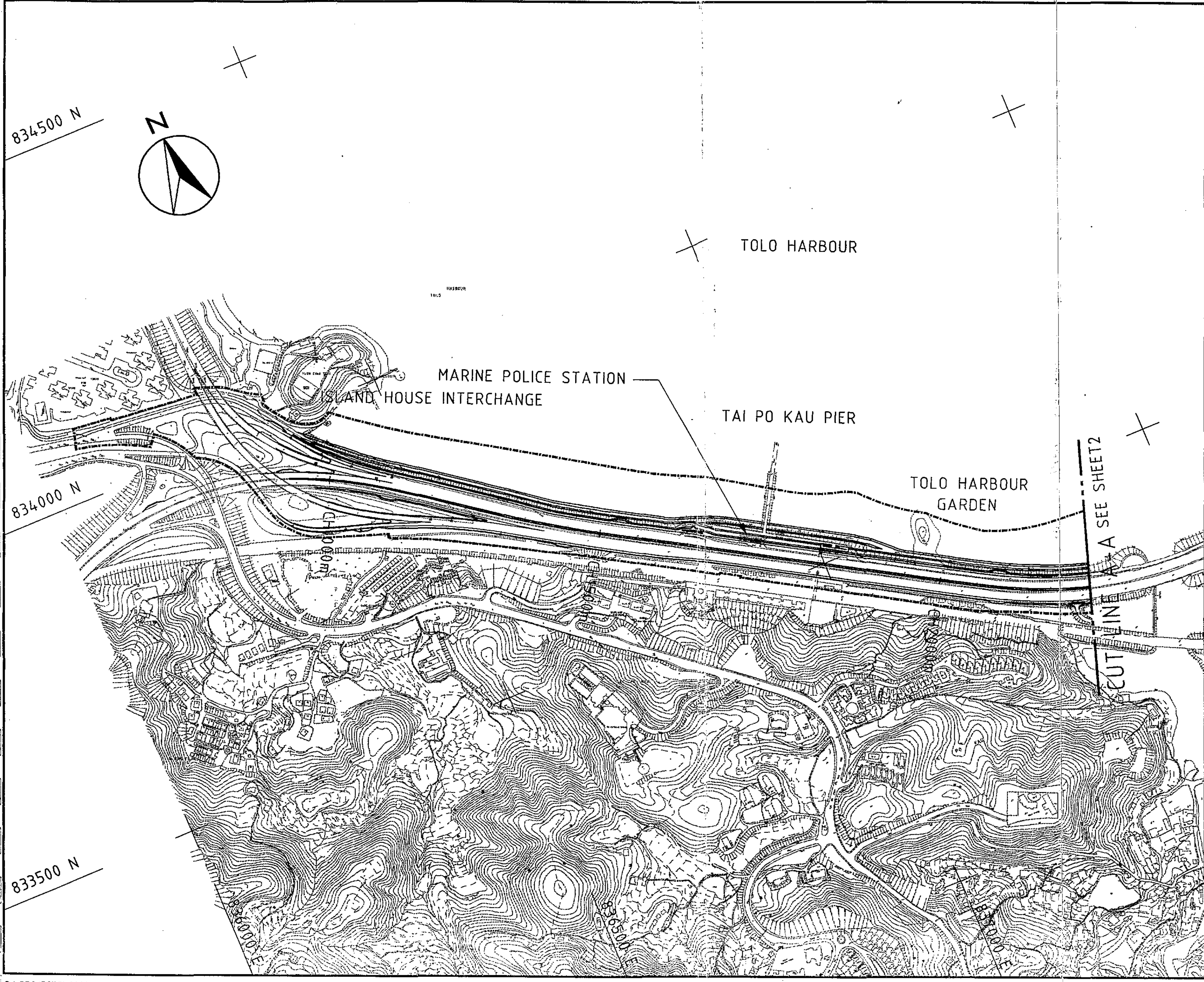

FIGURE 2.1

GENERAL ALIGNMENT (NORTH)

Highways Department 路政署

MAJOR WORKS PROJECT MANAGEMENT OFFICE

WIDENING OF TOLO HIGHWAY & TRAFFIC SURVEILLANCE & INFORMATION SYSTEM

GENERAL LAYOUT

MAUNSELL CONSULTANTS ASIA LTD.

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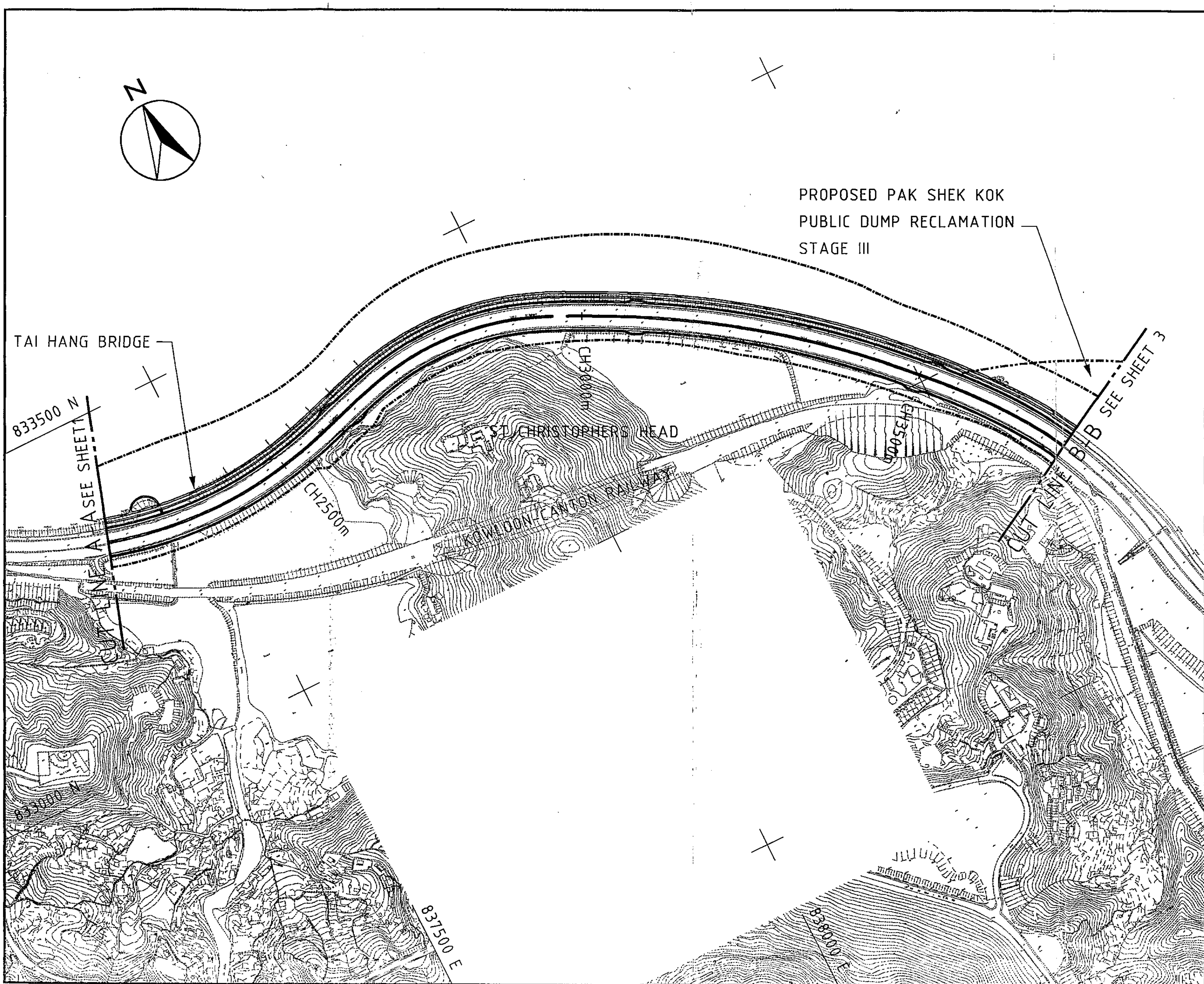

FIGURE 2.2

GENERAL ALIGNMENT (MIDDLE)

Highways Department 路政署

MAJOR WORKS PROJECT MANAGEMENT OFFICE

WIDENING OF TOLO HIGHWAY & TRAFFIC SURVEILLANCE & INFORMATION SYSTEM

GENERAL LAYOUT

MAUNSELL CONSULTANTS ASIA LTD.

DRG.NO. 90896/IIIP/2

PRELIMINARY

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METRES

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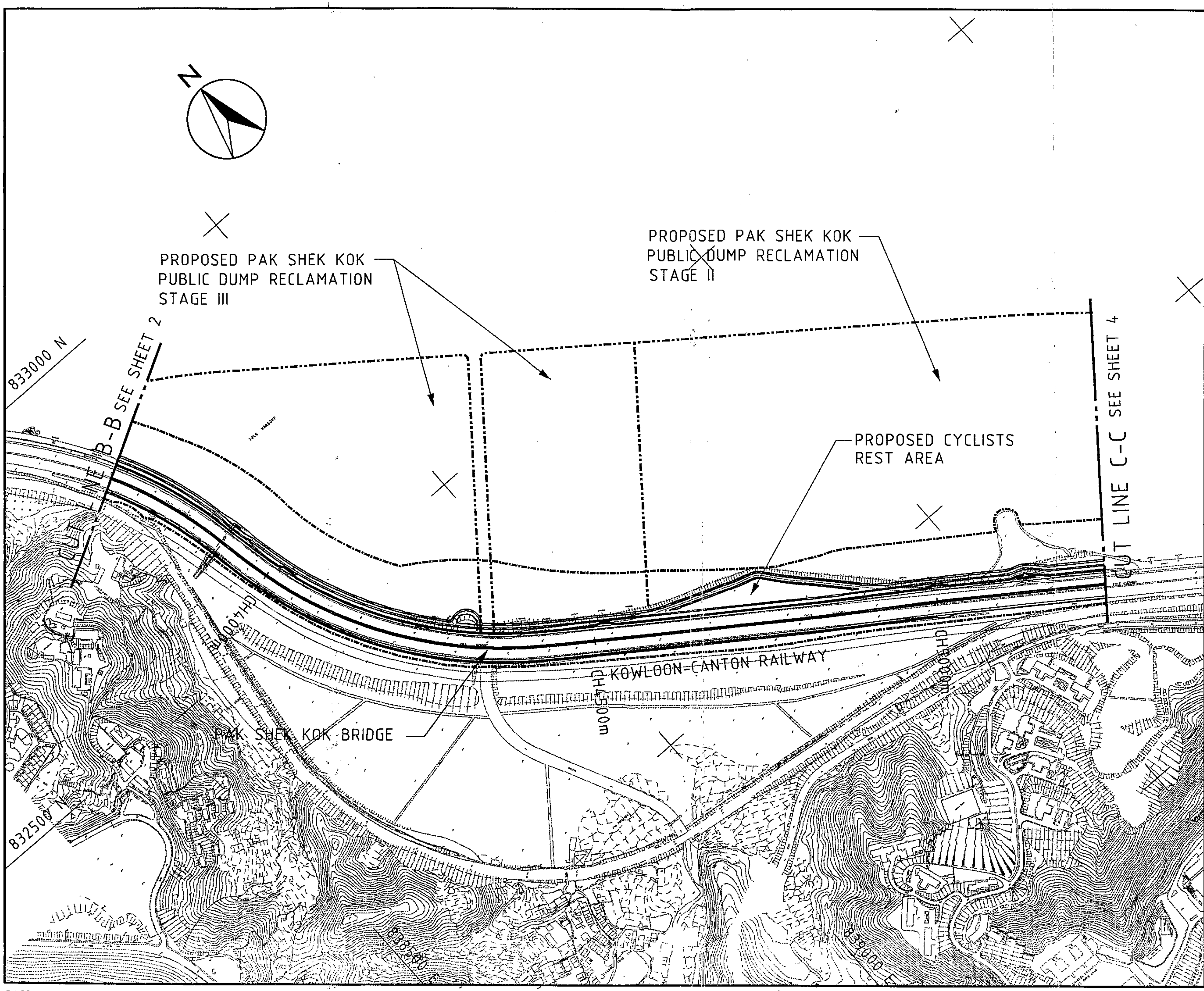

FIGURE 2.3

GENERAL ALIGNMENT (MIDDLE)

Highways Department 路政署
MAJOR WORKS PROJECT MANAGEMENT OFFICE

WIDENING OF TOLO HIGHWAY & TRAFFIC SURVEILLANCE & INFORMATION SYSTEM

GENERAL LAYOUT

MAUNSELL CONSULTANTS ASIA LTD.

DRG.NO. 90896/IIIP/3

R.M
M.C
1:5000
METRES

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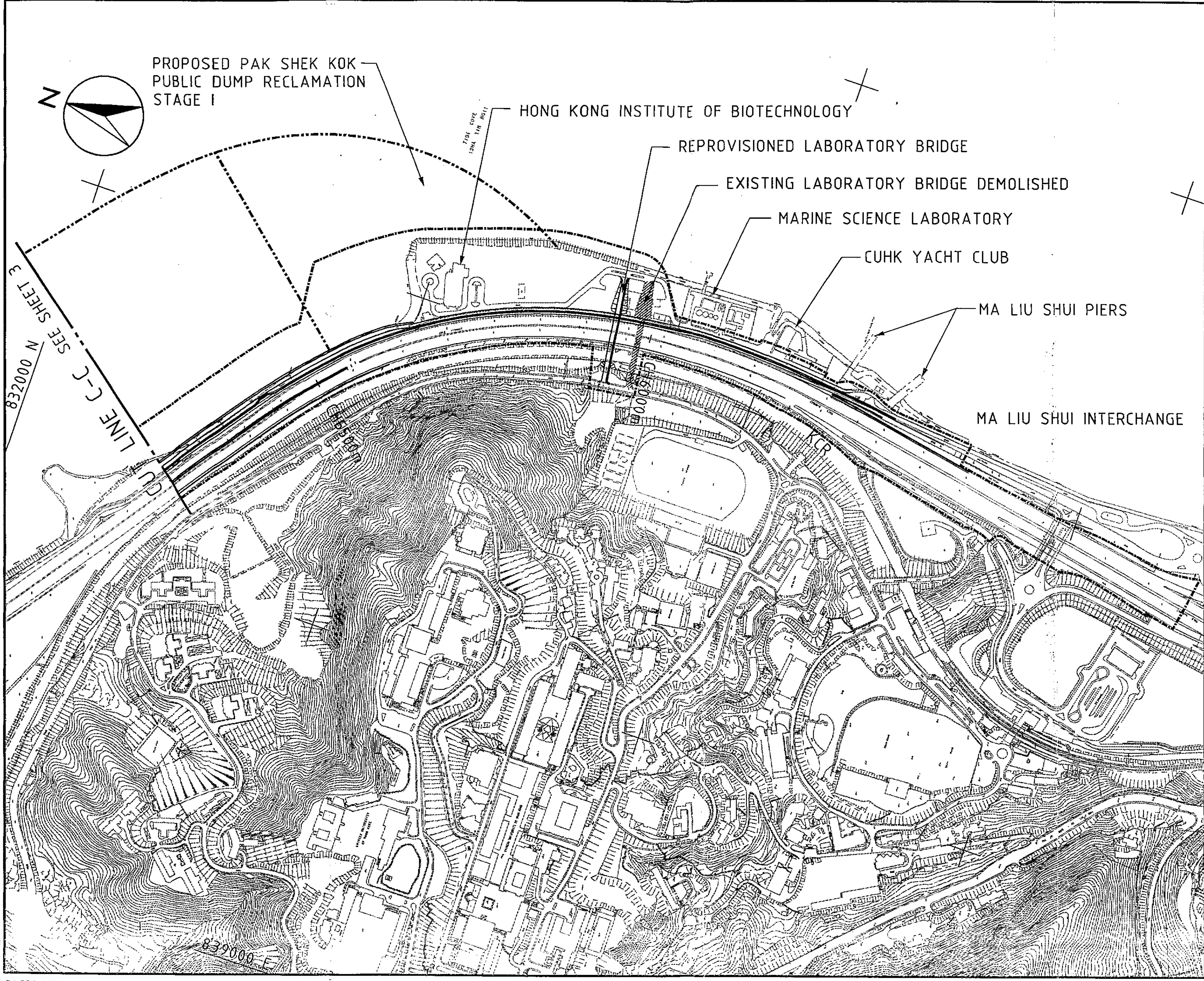

FIGURE 2.4

OPTION I ALIGNMENT

Highways Department 路政署

WIDENING OF TOLO HIGHWAY & TRAFFIC SURVEILLANCE & INFORMATION SYSTEM

GENERAL LAYOUT

MAUNSELL CONSULTANTS ASIA LTD.

DRG.NO. 90896/IIIP/41

R.M

M.C

1:5000

METRES

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LEGEND :

F1 - NOISE SENSITIVE RECEIVER

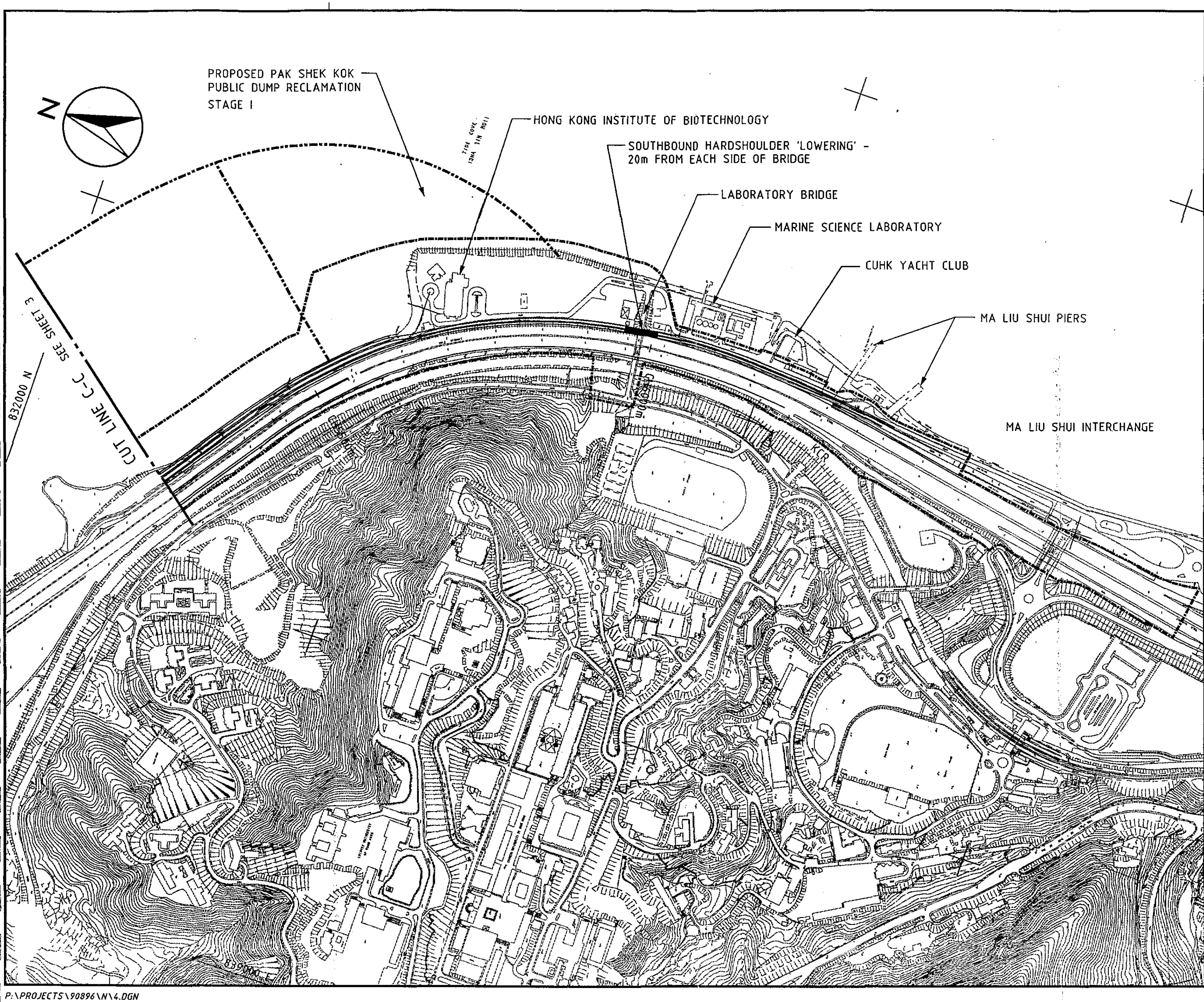

Figure 2.5

Option II Alignment

Highways Department 路政署

WIDENING OF TOLO HIGHWAY & TRAFFIC SURVEILLANCE & INFORMATION SYSTEM

PROPOSED NOISE MITIGATION MEASURES - CHAINAGE 5000-6500

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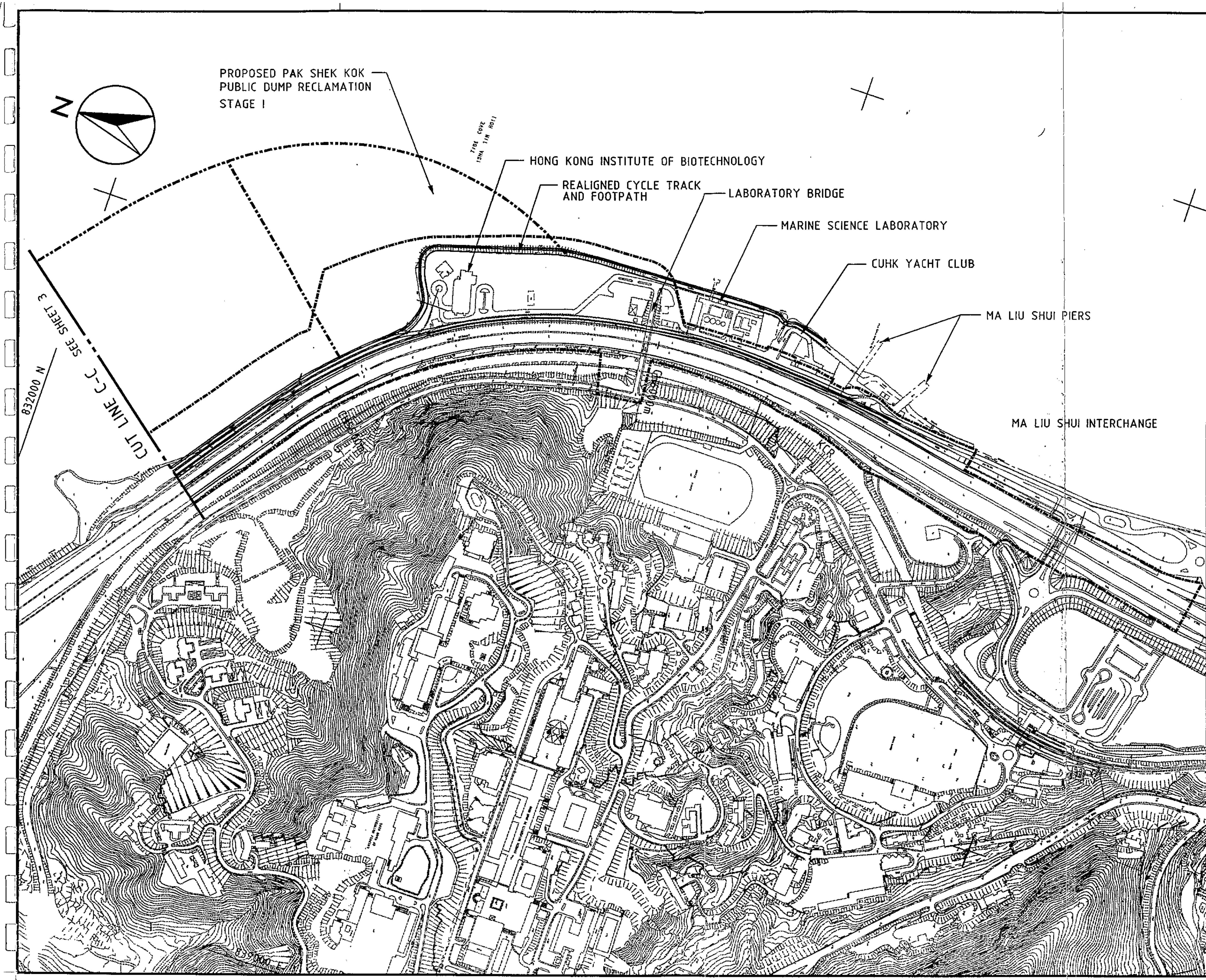

LEGEND :

F1 - NOISE SENSITIVE RECEIVER

Figure 2.6

Option III Alignment

Highways Department 路政署
MAJOR WORKS PROJECT MANAGEMENT OFFICE

WIDENING OF TOLO HIGHWAY & TRAFFIC SURVEILLANCE & INFORMATION SYSTEM

PROPOSED NOISE MITIGATION MEASURES - CHAINAGE 5000-6500

MAUNSELL CONSULTANTS ASIA LTD.

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Tai Po Area 39 is being developed under a contract 'The formation and servicing of Tai Po Area 12 (part) and 39'. Historically, Area 39 has been reclaimed from the sea, formed by the construction of the original Tolo Highway. The KCR has recently been realigned from the landward side of Area 39 to the seaward side, adjacent to Tolo Highway, thereby allowing access to the site. The northern part of the site is designated for use by HKIEd as a sports ground.

2.3.2 Pak Shek Kok Reclamation (Public Dump)

The 68-ha Pak Shek Kok Public Dump is identified as an Urban Potential Opportunity Area in the North East New Territories Development Strategy Review. Information on the Pak Shek Kok Reclamation (Public Dump) site is available from a EIA Report dated April 1994. This scheme provides for an area of Tolo Harbour adjacent to Tolo Highway to be reclaimed by public dumping in three phases. This reclaimed area is presently zoned for residential development, and is also the preferred site for a Science Park. Pak Shek Kok is considered a site of strategic importance in the NENT Development Strategy due to its location, size, and physical characteristics. The Public Dump site is identified as having substantial potential to accommodate a range of uses, including a Science Park (of Territorial importance), residential (although environmental constraints limit the site's suitability for this landuse), and large-scale recreation.

2.3.3 Science Park

A Science Park, probably comprising fourteen 2- to 6-storey multi-tenant industrial/office buildings and purpose-built premises for leaseholders, is proposed for Phase 1 of the Pak Shek Kok Reclamation - Public Dump. In addition to high-technology industrial and office buildings, the Park may include service apartments and amenities located within its Management Centre. Recreational facilities such as a jogging trail and tennis courts are also suggested.

A preliminary layout plan for the Science Park places the closest building facade about 45m from the edge of the existing Tolo Highway alignment. Intervening land is to be formed into a mounded and heavily planted amenity strip.

Science Park buildings are not expected to be sensitive to traffic noise since they will be centrally ventilated. The Science Park is expected to have limited environmental impacts. Airborne emissions will not be significant and waste water will be connected to the sewer network for treatment and disposal.

2.3.4 Route 16

The Route 16 expressway will distribute traffic from Sha Tin and the area to its north, to Lai Chi Kok, Kwai Chung and the future airport at Chek Lap Kok, or to Mong Kok, Yau Ma Tei and then Hong Kong Island West through the Western Harbour Crossing. The road is expected to be dual 3 lane expressway.

As Route 16 connects at Sha Tin near the southern end of the town (near Che Kung Miu Road and proposed Trunk Road T3), it is geographically remote from the Tolo Highway study area. The major environmental influence of Route 16 on the present study area will result from increased traffic flows generated by its presence.

2.3.5 Other Developments

Further developments that are in progress or planned in the vicinity of the route include the St.

Christopher's Home site redevelopment, which is presently in the process of construction.

2.3.6 Overall Programme Implications

The programme for all these developments, as far as information is available, is summarized below:

Table 2.1 Development Programme

Development	Proposed/Likely Programme
Tolo Highway Widening	Apr. 1998 - 2001
Tai Po Development - Formation and Servicing of Area 12 (Part) and 39, Phase I.	Apr. 1997 - Dec. 1998
Tai Po Development - Formation and Servicing of Area 12 (Part) and 39, Phase II.	mid 1998 - mid 2000
Pak Shek Kok Public Dump - Stage I	Oct. 1996 - Feb. 1998
Pak Shek Kok Public Dump - Stage II	March 1998 – Jul. 2001
Pak Shek Kok Public Dump - Stage III	Aug. 2001 - Dec. 2004
St. Christopher's Home	Construction in progress

2.4 References

1. Segal Quince Wicksteed (Asia) Ltd. *Hong Kong Science Park Study (Stage 2): Final Report* (September 1995).

2. Shankland Cox Ltd. *North East New Territories Development Strategy Review: Final Report* (Planning Department, August 1995).

   - Volume I (Main Report)
   - Volume II (Appendices)

3. Mouchel Asia Ltd. *Agreement No. CE 42/93: Feasibility Study* [illegible] *Route 16 from West Kowloon to Sha Tin* (Highways Department, August 1995).

   - Volume 1 (Engineering Feasibility Final Report)
   - Volume 4 (Final Report Drawings)

4. Mouchel Asia Ltd. *Agreement No. CE 13/93: Pak Shek Kok Rec*[illegible]*ation - Public Dump: Environmental Impact Assessment Study (Draft Final Report)* (Civil Engi[illegible]ing Department, March 1994).

3 SENSITIVE RECEIVERS

3.1 Sensitive Receivers (Noise)

The identification of representatives noise sensitive receivers (NSRs) was carried out as a desktop exercise at the initial stage, followed by site verification at each selected location. The NSRs identified include residential areas, GIC sites and hostel. Future noise sensitive developments are also included.

The procedure adopted follows the Hong Kong Planning Standards and Guidelines (HKPSG). Representative NSRs within 300 metres from the road widening works were identified. The locations of the NSRs are indicated in Figure 3.1 and Table 3.1 gives a description of facades involved. Figure 3.1 also shows the landuse along Tolo Highway and within the study area.

For the assessment of operation phase noise impacts, planned noise sensitive developments located on the hills of Tai Po Kau, Area 39 and Pak Shek Kok Reclamation area have been included as NSRs.

Table 3.1 Representatives Noise Sensitive Receivers

Noise Receiver Identification		Description
F1	CUHK - Staff Accommodation of Institute of Biotechnology	5-storey residential block for staff at the Institute of Biotechnology adjacent to Pak Shek Kok Reclamation Phase I
F2	CUHK - Xuesi Hall	6-storey students' hostel at New Asia Campus
F3	CUHK - Residence No. 10	10-storey staff residence
F4	CUHK - Residence No. 13	14-storey staff residence
F5	CUHK - Residence No. 7	10-storey staff residence
F6	Cheung Shue Tan Village Residence	Cheung Shue Tan 3-storey village housing
F7	Tsiu Hang future village development area	Designated 'R3' Residential site
F8	TPTL 135 - Sheng Kung Hui, Tai Po Kau Development	Low density residential development at St Christopher's Home comprising 575 units to be completed by 1998
F9	TPTL 150 - San Wai/Lo Wai Development	Comprehensive recreational & low density residential development of 464 units, Year 2001 completion
F10 & F10a	Seaview Villa	2-storey detached bungalows off Yin Tse Lane at Tai Po Kau
F11	KCRC Club Hostel	6-storey training Hostel at Tai Po Kau
F12	Care Village, Tai Po Kau	New 3-storey private residential blocks
F13	Island House Conservation Centre	2-storey environmental research centre at Yuen Chau Tsai
F14*	Low Density Residential/Hotel	Proposed future low-density residential/hotel development on PSKPDR area.
F15* F16* F17*	Area 39	Possible tertiary educational Institution and associated uses
F18*	Cheung Shue Tan future development area	Zone 'R2' residential site
F19*	Area 39	GIC site
F20* F21*	Area 39	Proposed Hong Kong Institute of Education Sports Centre (Confirmed by Arch SD, not noise sensitive)
F22	St. Christopher's Head	1 storey bungalow
F23	CUHK - Chung Chi Campus Block C24	5 storey student residential block
F24*	CUHK - Chung Chi Campus Block C33 & C34	Prospective hostel building
F25	KCRC Staff Quarter	5 storey residential block
F26*	Area 39	GIC site

Note: *denote planned development

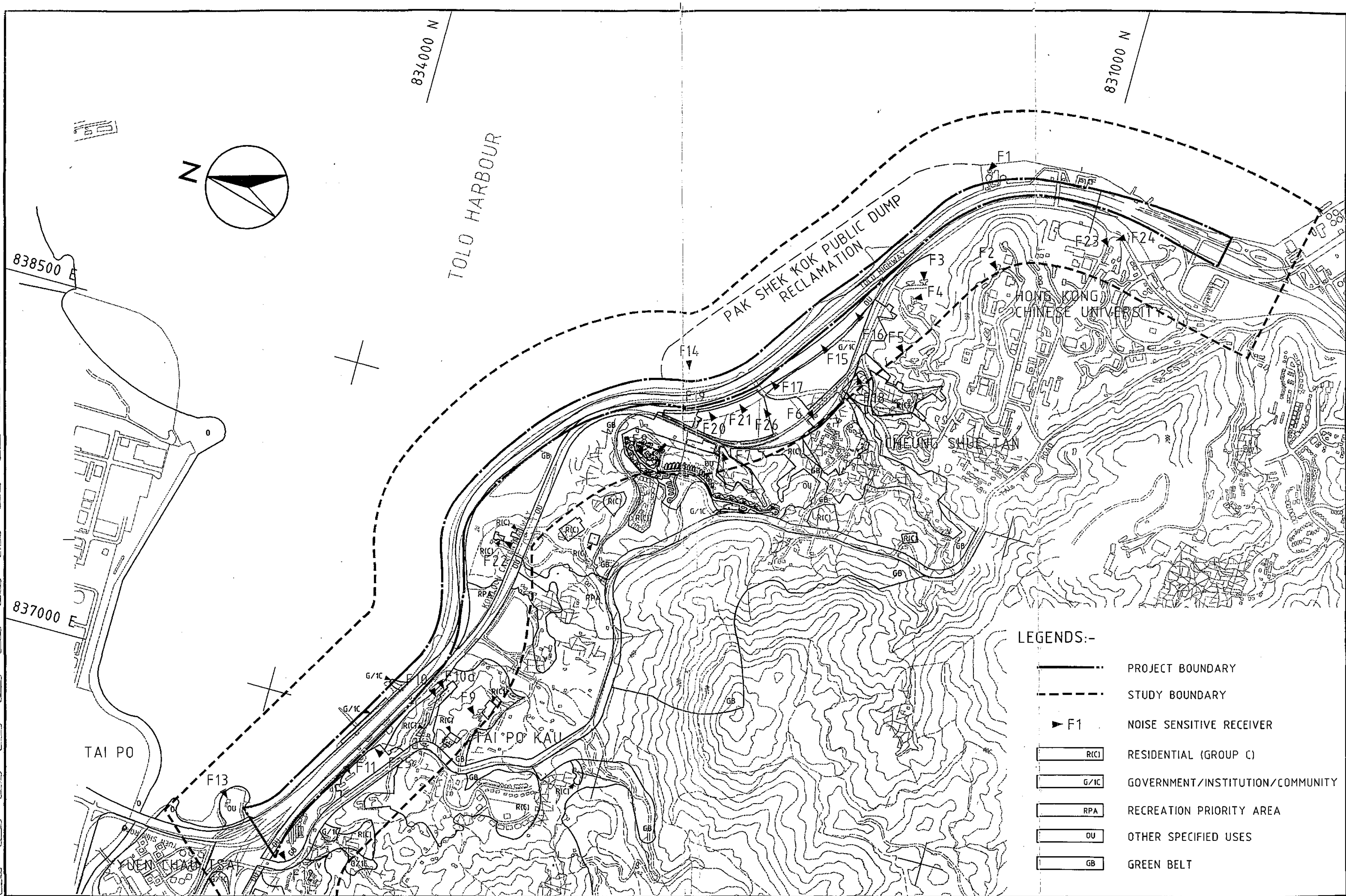
3.2. Sensitive Receivers (Air Quality)

A site survey has identified ninety representative Air Sensitive Receptors/Assessment Points (ASRs) in the vicinity of the Tolo Highway Corridor, summarised in the Table 3.2. ASRs 1-81 and ASRs 123-126 were used for the construction phase assessment, whereas ASRs 1-122 were employed for the operational phase assessment (Figures 6.1 to 6.3 & 6.7 to 6.9).

Table 3.2 Representatives Sensitive Receivers/ Assessment Point (Air Quality)

Air Receiver Identification		Description
A1	Kwong Fuk Estate	highrise estate
A2	Island House Conservation Centre	WWF environmental research centre at Yuen Chau Tsai
A3	Care Village/THA	private residential units adjacent to THA at Tai Po Kau
A4, A86-88	KCRC Club Hostel	hostel at Tai Po Kau
A5	Seaview Villa	2-storey detached bungalows off Yin Tse Lane at Tai Po Kau
A6	Tai Po Kau Village House	traditional village housing
A7	CUHK - Residence No. 10	staff residence
A8	CUHK - Grace Tien Hall	student residence
A9	CUHK - Institute of Biotechnology	laboratories and offices, including interior rooms for which "clean room" certification may be pursued. Centralised A/C system with FAI at roof level (17.5m above local ground level)
A10	CUHK - Marine Science Laboratory	teaching and research facility
A11	Marine Police Base/pier	marine police base/pier
A12	Marine Police Northern Division Base	marine police base
A13	Residential flat next to Marine Science Laboratory	residential house
A14 - A18	Future Sensitive Use at Areas 39 & 12	North of Area 39
A19 - A23	Future Sensitive Use at Areas 39 & 12	Area 39 North
A24 - A43	Future Sensitive Use at Areas 39 & 12	Area 39 Sports Ground
A44 - A73	Future Sensitive Use at Areas 39 & 12	Area 39 South - GIC
A74- A77	Future Sensitive Use at Dump Site Area	future dump site Stage III
A78 - A81	Future Sensitive Use at Dump Site Area	future dump site Stage II
A82 - A85	Future Sensitive Use at Dump Site Area	future dump site Stage I
A89, A94 - A103	CUHK Marine Science Lab	research facility
A90 - A93	CUHK Yacht Club	Considered Non-sensitive - of only transitory use
A104 - A122	CUHK Eastern Campus	Buildings E5, E6, E7 and E9
A123 - A126	Fish Ponds at CUHK Marine Science Lab	Fish ponds, Sensitive to dust

In addition to the existing ASRs, a 25m X 25m grid has been used over the whole study area, including future planned locations, to estimate the general pollutant distribution.



TOLO HIGHWAY WIDENING & TRAFFIC SURVEILLANCE AND INFORMATION SYSTEM FEASIBILITY ASSIGNMENT LOCATION OF REPRESENTATIVE NOISE SENTSITIVE RECEIVERS Figure 3.1	Maunsell 茂盛工程顧問有限公司	DRAWING NO.: 90896/N/1	SCALE: 1:15000

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3.3 Sensitive Receivers (Water)

Tolo Highway runs along the western seafront of Tolo Harbour. Tolo Harbour and Channel were designated as a Water Control Zone in 1987. The Control Zone is subdivided into three subzones: the harbour subzone, the buffer subzone and the channel subzone. Water Quality Objectives (WQOs) have been set for each subzone. The existing water quality in the zones is influenced by a number of factors, significant among them being discharges and activities in the zone itself and the quality of the nearby water bodies. These are the stormwater and domestic outfalls along the seafront and also the water courses across the corridor which drain into Tolo Harbour.

Water sensitive receivers in the vicinity of the Tolo Highway corridor are the different users of Tolo Harbour and the water courses across the corridor. These are shown on Figure 3.2 and include:

- four mariculture zones in Tolo Harbour: Yim Tin Tsai East, Yim Tin Tsai West, Yung She Au and Lo Fu Wat;
- four non-gazetted beaches in Tolo Harbour: Sha Lan, Yim Tin Tsai, Lok Wo Sha and Lung Mei;
- the seawater intake at the Marine Science Laboratory (MSL) of the Chinese University of Hong Kong (CUHK) for stock holding, culture and experimental facilities;
- various WSD seawater intakes along the seafront for flushing purposes;
- secondary contact recreation: Yacht Club of the CUHK near Ma Liu Shui;
- a mangrove community at Tai Hang Bridge of Tai Po Kau.

It is considered that the mariculture zones in Tolo Harbour and various seawater intakes along the seafront represent a group of sensitive receivers in relation to dredging and spoil disposal activities which may take place during the construction phase of the project. Any consideration of impact on water quality should consider the specific impact on these identifiable users in addition to the broader impact on the area as a whole.

3.4 Sensitive Receivers (Ecology)

Mangrove habitat at Tai Hang Bridge: This area of mature mangrove is in good condition, and is the only mangrove remaining between Shatin and Tai Po. It provides foraging habitat for wading birds, and, considering the nature of much of the nearby shoreline, probably acts as a nursery area for juvenile fish. It is subject to degradation due to direct loss of mangrove trees or to alteration in the existing tidal flushing regime. Birds occupying the mangrove are also potentially subject to disturbance during project construction.

Yuen Chau Tsai: The southern shoreline of Yuen Chau Tsai may be affected by the Island House Interchange, for which plans are not yet available. This shoreline consists of a small area of mangrove, some boulders and an area of concrete seawall and a helipad. Island House itself is considered a sensitive receiver due to the mature woodland on the island and

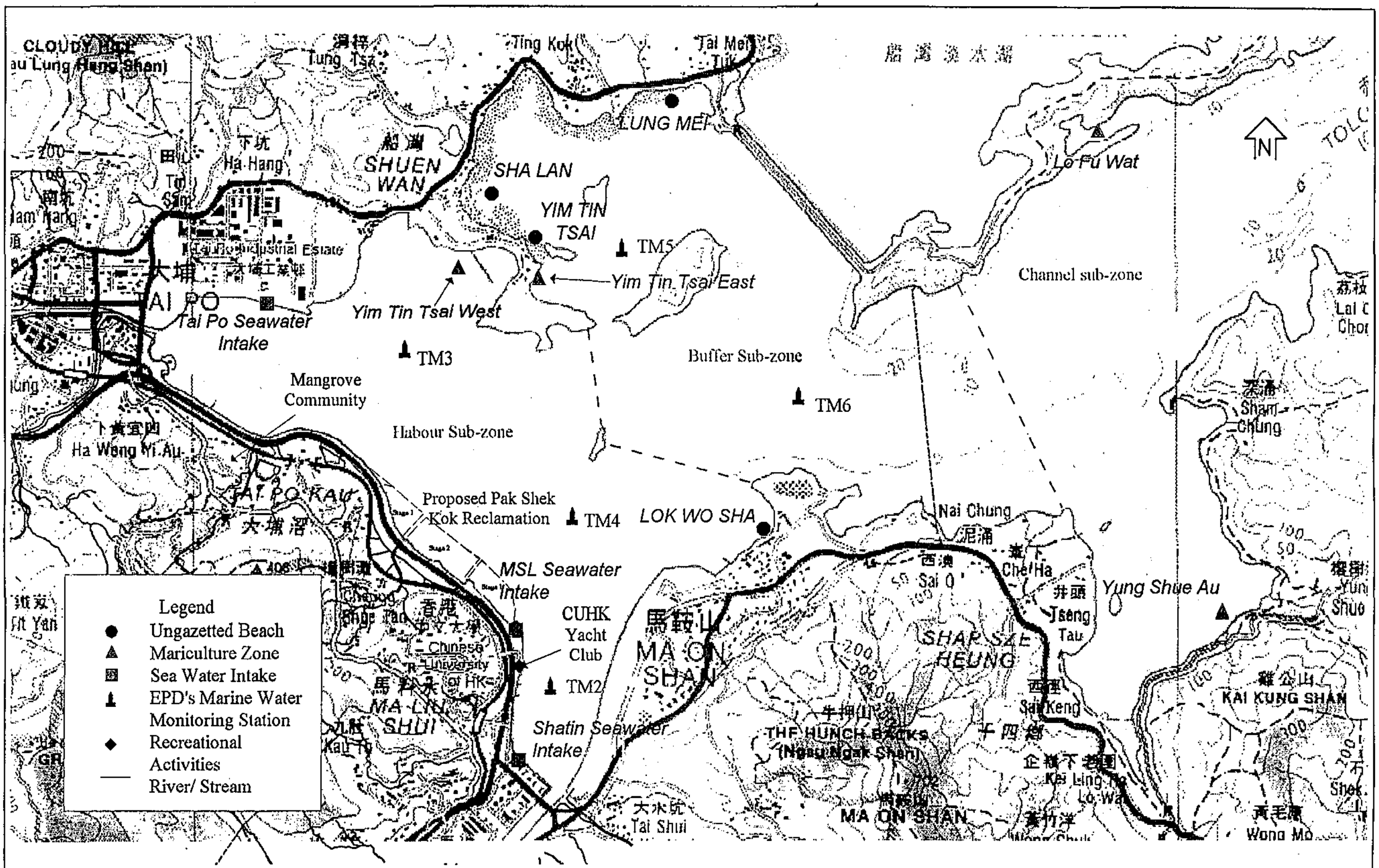

Figure 3.2 Marine Water Quality Sensitive Receivers

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its importance to birds.

3.5 Sensitive Receivers (Visual Impact and Landscape)

Zone of Visual Influence

Figure 10.6 in the main visual impact section of the report illustrates the potential extent of visibility or "zone of visual influence" of the scheme. This zone defines the area from which views of the scheme would be possible. The study area for the visual impact assessment covers the land within a 500m distance of the proposed road alignments. However, all sensitive receivers regarding the visual imapct assessment are regardless of the distance from the proposed road alignments.

Sensitive Receivers

Visually sensitive receivers are those people within the zone of visual influence whose views would be affected by the scheme. For the purposes of this assessment the sensitive receivers have been grouped into the following four categories:

Those people who would view the scheme from their homes: Residential viewers are considered to be the most sensitive to any visual intrusion associated with the scheme. This is because the attractiveness, or otherwise, of any changes the view would have a notable affect on a home owners' general quality of life and acceptability of their home environment.

Those people who would view the scheme from their workplace: Occupational viewers i.e. those people who view the scheme from their workplace, are considered to be less sensitive to visual intrusion. This is because they are employed in activities where visual outlook plays a less important role in the perception of the quality of the working environment.

Those people who would view the scheme during outdoor leisure activities: The sensitivity to visual intrusion of those people taking part in outdoor leisure activities is dependent on the type of activity being enjoyed. Hill walkers, for example, would have greater sensitivity to the quality of the landscape than say a sports enthusiast.

Those people who would view the scheme whilst travelling along public roads or footpaths: For those people who view the scheme from public thoroughfares, the degree of visual intrusion experienced depends on the speed of travel and whether views are continuous or only occasional. Generally, the slower the speed of travel and the more continuous the viewing experience then the greater the degree of sensitivity.

General residential receivers are more sensitive than recreational receivers who are in turn more sensitive than travellers. Occupational sensitive receivers are considered to be the category of people who are generally the least sensitive to visual intrusion. Figure 10.7 in the visual impact section illustrates the visually sensitive receivers within the study area and these are identified below according to the references on the plan. The distance between these potential viewers and the development is detailed in the following tables, together with a brief description of the context in which views of the development would be seen.

Table 3.3 Visually Sensitive Receivers (Residential)

Visually Sensitive Receivers, Plan Reference[1], and Distance between Viewer and Development		Remarks
A	Tai Po New Town: Fu Shin Estate (1000 m distance)	High-rise blocks at Fu Shin Estate would have distant oblique views across Tolo Harbour. High-rise blocks at Wang Fuk Court and Kwong Fuk Estate would have views over Yuen Chau Tsai and Tolo Harbour. Residents would view the scheme against a backdrop of the harbour, highway, KCR and wooded hillslopes.
B	Wang Fuk Court (200m distance) and Kwong Fuk Estate (350m distance)	
C	Tai Po Road-Yuen Chau Tsai-CARE village housing and adjoining development under construction (100m distance)	Residents of low rise housing would have top floor views only towards the KCR, existing highway and harbour beyond.
D	Tai Po Road-Tai Po Kau: Red Land Garden (100m distance) and KCRC Housing (50m distance)	Viewers from Red Land Garden and KCR housing would experience elevated views down towards the KCR, existing vegetation, Highway and Tolo Harbour beyond. Views from the residential developments on the hillslopes of Tai Po Kau would have elevated views, over a wide arc, down to the highway KCR and Tolo Harbour.
E	Residential Development (150m distance)	
F	Tai Po Kau San Wai (600m distance)	Residents of the squatter settlement on the wooded slopes would experience elevated but partial views through the vegetation towards to the highway and harbour beyond two ponds and the KCR would be seen in the foreground.
G	Individual properties, St.Christopher's Head (15m distance)	Residents would experience elevated, limited views through vegetation towards the highway across a large pond and these views would be seen against a backdrop of Tai Po, Tai Po Kau and Tolo Harbour.
H	Villa Costa (400m distance), Individual Properties, Lookout Link (400m distance)	Residents in medium-rise housing at Villa Costa would have elevated views, framed by wooded hills, towards the KCR and highway and these views would be seen against a backdrop of Tolo Harbour. Low-rise individual properties would have elevated limited views through woodland towards the KCR and highway, against a backdrop of Tolo Harbour.

NOTE: 1 See Figure 10.7

Table 3.3 Visually Sensitive Receivers (Residential) (continued)

Visually Sensitive Receivers, Plan Reference[1], and Distance between Viewer and Development		Remarks
I	Pak Shek Kok Valley - Tsui Hang (400m distance), Cheung Shue Tan (400m distance) , Tai Po Mai (1000m distance)	Residents in the traditional villages of Tsui Hang, Cheung Shue Tan and Wong Nai Fai would experience only top-storey views towards the highway, across an area of agricultural land, reclaimed land and the KCR. Residents of Tai Po Mei would have distant, elevated views towards the highway across the Pak Shek Kok valley, reclaimed land and the KCR.
J	Residential Development at St. Christopher's Home site (250m distance)	
K	Halls of Residence, Chinese University of Hong Kong, Ma Liu Shui (100-500m distance)	Students and staff would experience elevated views of the highway from mid to high-rise blocks at these locations. These views would be seen across wooded slopes of Pak Shek Kok valley, reclaimed land and the KCR and would have a backdrop of the Tolo Harbour.
L	Staff Accommodation, Institute of Biotechnology (100-300m distance)	Residents on all floors would experience west-facing views towards the highway against a backdrop of the KCR, wooded hillslopes of Ma Liu Shui and the CUHK main campus.
M	High-rise residentail towers in southern Ma On Shan (1000-2000m distance)	Residents would experience distant, slightly elevated views of the scheme across Tolo Harbour against a backdrop of wooded hills.
M1	Wu Kai Sha village area and the high-rise residential towers in northern Ma On Shan (2000-4000 distance)	Residents would experience distant (and slightly elevated views in the case of the high-rise residential towers) views of the scheme across Tolo Harbour against a backdrop of wooded hills.
M2	Planned residential development at Tai Po Area 39 (100-300m distance)	Residents would experience close elevated views of the scheme against a backdrop of the Tolo Harbour.

NOTE: 1 See Figure 10.7

Table 3.4 **Visually Sensitive Receivers (Occupational)**

Visually Sensitive Receivers, Plan Reference[1], and Distance between Viewer and Development		Remarks
K	CUHK Main Campus (300-600m distance)	Workers in the Institute of Biotechnology would have north-west and south-east facing views across internal roads and carparking through boundary vegetation, against a backdrop of wooded hillslopes and CUHK. Users of the MSL would experience direct ground-level views of the scheme, with the wooded hills of the CUHK seen beyond.
L	Institute of Biotechnology and Marine Science Lab (MSL)	Workers in the Institute of Biotechnology would have north-west and south-east facing views across internal roads and carparking through boundary vegetation, against a backdrop of wooded hillslopes and CUHK. Users of the MSL would experience direct ground-level views of the scheme, with the wooded hills of the CUHK seen beyond.
L1	Planned Science park on the Pak Shek Kok Reclamation. (100-300m distance)	Workers would experience close, ground level or slighly elevated views of the scheme against a backdrop of wooded hills.
N	Tai Po Industrial Estate, Tai Po (1500m distance)	Workers would experience long-distance views across the urban edge of Tai Po and Tolo Harbour towards the highway, against a backdrop of wooded hills.
O	Island House Conservation Studies Centre (200m distance)	Users of the conservation facilities at Island House would have occasional filtered views down onto the highway through tall vegetation.
P	CUHK (0-20m distance)	Workers in the Institute of Biotechnology would have north-west and south-east facing views across internal roads and carparking through boundary vegetation, against a backdrop of wooded hillslopes and CUHK. Users of the MSL would experience direct ground-level views of the scheme, with the wooded hills of the CUHK seen beyond.

NOTE: 1 See Figure 10.7

Table 3.5 **Visually Sensitive Receivers (Recreational)**

Visually Sensitive Receivers, Plan Reference[1], and Distance between Viewer and Development		Remarks
Q	Yuen Chau Tsai Pier, Island House and Temple (150-200m distance)	The pier and small beach at Yuen Chau Tsai is the starting point for the annual Dragon Boat Races and also a stop-off point along the cycletrack. Users would experience views towards the scheme up to St.Christopher's Head, and these would be seen across open water against a backdrop of hills and the Tolo Harbour. Users of the temple would experience direct views onto the highway.
R	Tolo Harbour Garden (0m distance)	Users would experience close range views of the highway, with views of the KCR and hillslopes beyond.
S	University Sports Field (300m distance)	Users would have elevated views of the scheme across the KCR. These views would be partially screened by hillside vegetation and would be set against the Tolo Harbour beyond.
T	Water Sports Centre CUHK and Tolo Harbour (0-3000m distance)	Users of the centre would experience direct ground-level views of the highway, with the wooded hills of the CUHK beyond. Views towards the harbour are partially screened by a belt of trees. Leisure craft, canoeists etc. on the open water of Tolo Harbour would have uninterrupted views of the scheme over a wide arc, set against the hillslopes beyond.
T1	Walkers on the hillslopes to the south of the highway	Walkers on the hillslopes to the south and south-west of the highway would experience elevated long-distance views of the highway widening works. These views however, would be partially screened by landform and vegetation located between the hills and the highway.
T2	Walkers on the hillslopes to the north and east of the site	Walkers on the hillslopes to the north and east of the highway would experience distant, slightly elevated views of the scheme across Tolo Harbour against a backdrop of wooded hills. Walkers on the hillslopes to the north of the highway would experience views of the proposed land-cut at St. Christopher's Head.

NOTE: 1 See Figure 10.7

Table 3.6 Visually Sensitive Receivers (Travellers)

Visually Sensitive Receivers, Plan Reference[1], and Distance between Viewer and Development		Remarks
U	Cycletrack (0-50m distance)	Cyclists and pedestrians would experience direct, close distance views of the scheme along its entire length, and these would be set against the KCR and hillslopes beyond.
V	Kowloon-Canton-Railway (30-200m distance)	Passengers would have direct views of the scheme along its entire length except where the KCR enters a tunnel at St. Christopher's Head and where vegetation would partially screens views.
W	Public Ferries to Ma Liu Shui Pier and Tai Po Kau and other watercraft (100+m distance)	Passengers on ferries and other watercraft would have uninterrupted views of the scheme over a wide arc These views would be available both at piers and on the open water of Tolo Harbour, and would be set against the hillslopes and development beyond.
X	Motorists-on Tolo Highway (0-10m distance)	Motorists on Tolo Highway would have direct close-distance views of the scheme along its entire length. Motorists on Tai Po Road would experience elevated glimpses of the scheme through the vegetation on hillslopes below. Users of the CUHK access road would experience direct, elevated views onto the scheme from the MSL bridge. Elsewhere, road users would experience views towards the scheme across the KCR, set against the backdrop of Tolo Harbour beyond.
Y	Tai Po Road (150-600m distance)	
Z	Access Road (0-500m distance)	

NOTE: 1 See Figure 10.7

4 BASELINE CONDITIONS

4.1 Noise

Baseline noise measurements were conducted to gauge the existing noise environment of NSRs.

The noise measurements were carried out during the morning peak period from 0730 to 0930 hours on a weekday in March 1996, coinciding with peak traffic flows along Tolo Highway.

Baseline noise levels were measured with two sets of integrated sound level meter, model B&K 2231. The meters conform with the International Electrotechnical Commission Publication 651:1980 and 804:1985 for Type 1 precision sound level meters. Noise calibration was made at 94.0 dB(A) using a Calibrator, model B&K 4231, both before and after each measurement to ensure the validity of the measured data.

Noise measurements were made at 1 metre from the external facade of the selected NSR. Noise parameters in L_{10}(1 hour), L_{90}(1 hour) and L_{eq}(30 minutes) were measured.

The dominant noise sources are traffic noise from Tolo Highway and intermittent train noise from the KCRC railway. The results of the baseline noise measurements are summarised in Table 3.

In terms of L_{10}(1 hour), the noise levels at the NSRs are in the range of 65.3 to 77.1 dB(A) whereas L_{90}(1 hour) measurements ranged from 57.4 to 73.9 dB(A). It is noted that the following facades are at present already exposed to unacceptable noise levels:

(i) CUHK - Staff accommodation of Institute of Biotechnology
(ii) CUHK - Xuesi Hall
(iii) CUHK - Residence Block No.10
(iv) CUHK - Residence Block No.13
(v) Sea View Villa
(vi) KCRC Club Hostel
(vii) Island House Conservation Centre

With further traffic growth, it would appear that the design year traffic noise levels at these facades are almost certain to exceed the limits and hence noise mitigation measures will be required.

Table 4.1 Baseline Noise Measurement Results

Selected NSRs		Facade Noise Level in dB(A)		
		L_{10} (1 hour)	L_{eq} (30 min)	L_{90} (1 hour)
F1	CUHK - Staff Accommodation of Institute of Biotechnology	77.1	75.1	72.3
F2	CUHK - Xuesi Hall	67.9	66.1	65.2
F3	CUHK - Residence No. 10	76.9	75.6	73.9
F4	CUHK - Residence No. 13	71.9	70.5	68.4
F6	Cheung Shue Tan Village Residence	61.9	60.5	57.4
F10	Seaview Villa	73.2	71.7	69.9
F11	KCRC Club Hostel	75.9	74.3	71.9
F12	Care Village/THA	69.9	65.3	63.4
F13	Island House Conservation Centre	65.3	65.7	61.4

4.2 Air Quality

Physical factors which influence dispersion and concentration of emission factors include topography, wind speed, prevailing wind direction, and diurnal effects. Of particular concern in the study area are confined air-sheds at Tai Po and Sha Tin, defined as areas surrounded by high ground. Pollutants generated within the airshed have a reduced ability to disperse. The Tai Po airshed is broadly limited by the high ground of the Pat Sin Leng Country Park (to the northwest) and a horseshoe of high ground which lies to the north, west and south of Tai Po (Tai To Yan at 566m, Kwun Yan sham at 546m, Tai Mo Shan at 957m and the ridges running east back to Tolo Harbour). The Sha Tin airshed enclosed Sha Tin to the north, west and south (Tso Shan at 647m, Chan Shan at 532m, Pat Ka Shan at 457m, Lion Rock at 495m, Tate's Cairn at 577 and the ridges running east to Ma On Sha at 702m).

In an attempt to reduce emissions in the airshed, Sha Tin is restricted to use gaseous fuel only under the Air Pollution Control (Fuel Restriction) Regulations 1990.

In addition to the confined airshed, extented periods of light onshore breezes at Sha Tin further reduce dispersion potential.

In order to define ambient air conditions, in situ monitoring of air quality is carried out by EPD at a number of fixed and mobile sites throughout the Territory. At nine, eight air quality monitoring stations are operated in the Territory, including one at Tai Po (since 1989) and one at Sha Tin (since 1991).

The results of the Tai Po and Sha Tin monitoring programmes are discussed here.

- Since only gaseous fuel is allowed in Sha Tin, SO_2 (sulphur dioxide) concentrations do not exceed the AQO at the Sha Tin monitoring station.

- Atmospheric suspended particulates are generated as dust and fumes which are classified according to size as total or respirable suspended particulates (TSP and RSP). Future TSP and RSP levels may be affected by the Pak Shek Kok public dump, which will accept inert construction waste.

- Nitrous oxides (NO_2 and NO_x) are a combustion product of petroleum and diesel fuels. There have been no reported exceedences of this parameter at either the Sha Tin or Tai Po monitoring station.

4.3 Water Quality

4.3.1 Tolo Harbour is a shallow semi-enclosed water body with a limited tidal exchange. The normal estimated residence time in the inner Tolo Harbour has been estimated to be between 16 and 42 days, which means that pollutants entering the Harbour cannot be dispersed and flushed quickly to the open waters of Mirs Bay. Historically, the Harbour suffered from poor water quality due to discharges from domestic sources, wastewater treatment plants, and agricultural activities within its catchment.

4.3.2 In 1986, the government established a Tolo Harbour Action Plan to reduce the pollution loads entering the Harbour and improve its water quality. Since the implementation of the Action Plan, water quality has improved. According to the EPD publication *Marine Water Quality in Hong Kong for 1994*, full compliance with the Water Quality Objectives (Table 8.1) was observed in 1994 for dissolved oxygen in the water column, except at Station TM5 in the buffer subzone. Full compliance for depth averaged *E. coli* was also achieved except at station TM2.

4.3.3 The most recent marine water quality data were obtained from EPD for the period between January 1993 to March 1996. Statistics for different parameters are listed in Table 4.2 for Stations TM3 and TM4 in the harbour subzone. Variations of dissolved oxygen, suspended solids and chlorophyll-*a* over the same period are given in Figure 4.1. The harbour was in most cases well oxygenated although the average BOD level was relatively high. The nutrient level and chlorophyll-*a* were also high, indicating that algal activity is a major issue of the area.

4.3.4 The bacteriological water quality at the four non-gazetted beaches was also reported by EPD. All the four beaches had fair water quality for the bathing season in 1995. Annual rankings of the four beaches are shown in Table 4.3 below.

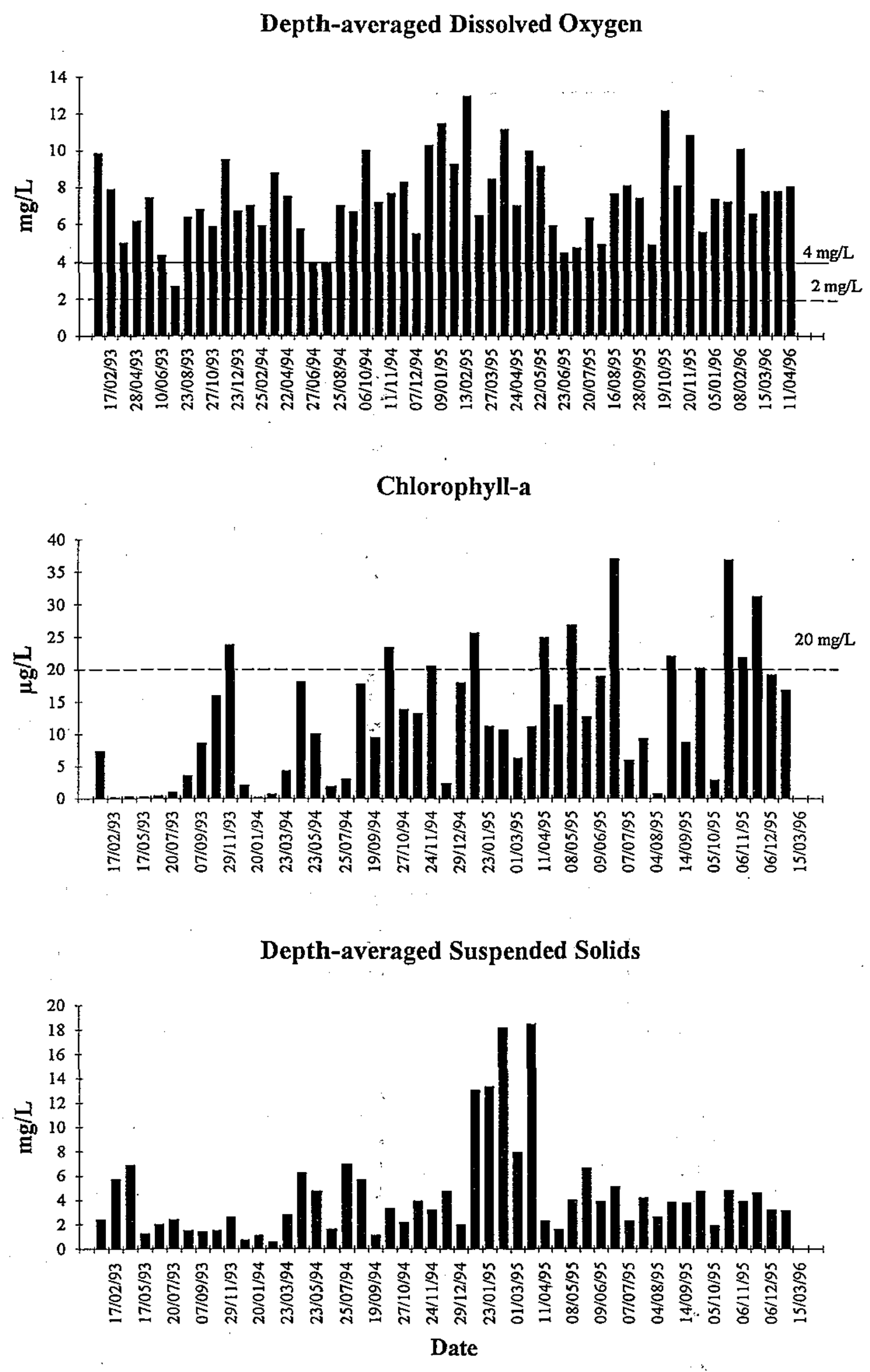

Figure 4.1 Variation of Water Quality at TM3 and TM4 between 1/93 and 3/96

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Table 4.2 Statistics of Marine Water Quality at EPD Monitoring Stations TM3 and TM4 (1/93 to 3/96)

Parameters	Minimum	Average	Maximum	Standard Deviation
Physico-chemical				
dissolved oxygen (mg L^{-1})	2.6	7.4	13.4	2.2
salinity (ppt)	20.4	30.8	33.8	2.1
pH	7.9	8.3	8.8	0.2
turbidity (NTU)	0.6	2.5	7.2	1.1
suspended solids (mg L^{-1})	0.6	4.4	20.0	4.2
BOD_5 (mg L^{-1})	0.4	2.2	5.4	1.0
Microbiology				
E. coli (count per 100 ml)	3	74*	2750	443
Nutrients and algal pigments				
total Kjeldahl nitrogen (mg L^{-1})	0.15	0.59	1.39	0.24
total nitrogen (mg L^{-1})	0.23	0.67	1.79	0.27
total phosphorus (mg L^{-1})	0.05	0.12	0.29	0.05
chlorophyll-*a* (µg L^{-1})	0.2	12.6	51.0	11.3

Note * : geometric mean of *E. coli*

Table 4.3 Annual Ranking of Four Tolo Harbour Beaches (1993 to 1995)

Beach	1993	1994	1995
Sha Lan	Good	Fair	Fair
Lung Mei	Good	Fair	Fair
Yim Tin Tsai	Fair	Fair	Fair
Lok Wo Sha	Fair	Fair	Fair

Note : Good = bathing season geometric mean *E. coli* count < 24 per 100 ml
Fair = bathing season geometric mean *E. coli* count between 25 and 180 per 100 ml

4.4 Ecology

Sub-tidal

Horikoshi and Thompson (1980) recorded the bivalves *Paphia undulata* and *Arcuatula elegans* to be fairly common in waters 6-7m deep offshore from the present highway, as was the gastropod *Philine orientalis*. The mollusc fauna was otherwise sparse, the species present indicating a high degree of embayment and with evidence of previous mass mortalities in the inner harbour fauna, probably as a result of decreased tidal flushing of the inner bay, and increased development of the surrounding coastline. Other subtidal benthos recorded from inner Tolo Harbour include the starfish *Luidia longispina* (Chiu, Lam and Shin, 1985). Shin (1985) reported the dominant bivalve in the inner Harbour to be the previously unrecorded cockle, *Fulvia hungerfordi*. The invasion of the inner bay by this bivalve may have been facilitated by a reduction in one of it's predators, the starfish *L. longispina,* and also due to the cockles suitability to an environment of patchy noxiousness. Shin (1985) also noted that species diversity in the inner Harbour to be the lowest relative to the Tolo Channel and Mirs Bay. Shin (1990) reported that the Tolo Harbour benthic assemblage was dominated by *Theora lata,* as well as the polychaetes *Sigambra tentaculata, Minuspio cirrifera, Leannates persica* and *Tharyx* sp. Cheung (1990) reported that the dominant portunid crab was *Portunus hastatoides.*

All the records indicate that the benthic communities of the inner Tolo Harbour are of reduced diversity and strongly influenced by the increased levels of organic pollution. Mass benthic mortality may also occur as a result of oxygen depletion during the summer months. This condition is normally a consequence of algal blooms arising due to eutrophic conditions, but may also occur if the water column becomes strongly stratified.

Intertidal Areas

The major part of the intertidal area that borders the seaward edge of the present highway is composed of rip-rap slope protection, offering very little in the way of ecological value. The substrate of the adjacent shallows is generally coarse sand and gravel, with areas of small stones and pebbles. Little of interest has been observed during preliminary surveys. A small area of mangrove dominated by *Aegiceras corniculatum* exists along the south shore of Yuen Chau Tsai (Figure 7.5).

Estuarine Habitats

The mangrove community at Tai Hang Bridge is dominated by *Kandelia candel,* with some *Avicennia marina* and *Aegiceras corniculatum*. The mangrove occurs in two areas of semi-enclosed water created behind the present highway and KCRC alignment (Figure 7.5). This area is the original mouth of a stream that has its source in Tai Po Kau Nature Reserve. A belt of trees runs along the southern edge of the lagoon, and a larger stand exists on the north shore from the KCRC bridge. The mangrove was modified and probably reduced in area by construction of the KCRC rail line and the existing Tolo Highway. A large pond west of the KCRC alignment was probably also excavated from former mangrove area. The mouth of the bay at Tai Hang was greatly reduced in width by construction of Tolo Highway. However, this had no apparent adverse impact on the remaining mangrove.

- Avifauna

Although these projects reduced the size of the mangrove, birds continue to occupy and feed at the site. Little Egrets (*Egretta garzetta*), Cattle Egrets (*Bubulcus ibis*), and Chinese Pond Herons (*Ardeola bacchus*) have been recorded. Other herons and egrets may also use this area for feeding or possibly for roosting. The site has not been used by nesting birds in the past, and the nearest active egretry is located near the Tai Po Hui KCRC station. The mangrove at Yuen Chau Tsai is smaller in area, but closer to the Tai Po Hui egretry. Bird use has also been recorded both in the mangrove and in the woodlands on the island. Other areas along the proposed alignment support habitats which provide little bird habitat, therefore impacts are predicted to be minimal.

- Vegetation

The vegetation that will be affected by the widening of the highway is primarily landscape or ornamental plantings associated with the cycle tracks along the seaward edge of the current highway. Major species of the plantations includes stands of the exotic trees *Acacia confusa* and *Casuarina equisetifolia* as well as isolated individuals of the native trees *Ficus microcarpa* and *Hibuscus tiliaceus* in planting pots. This type of vegetation has little ecological value. To the landward side of the highway, plantations with exotic trees are still the major vegetation type. Area with natural vegetation is scanty and fairly disturbed within the study area, for example, St. Christopher's Head, the foothill of which is mainly dominated by grasses.

References

1. Cheung, S.G., (1990). The distribution and population structure of Portunidae (Crustacea: Decapoda) in Tolo Harbour, Tolo Channel and Mirs Bay, Hong Kong. In : *Proceedings of the Second International Marine Biological Workshop: The Marine Flora and Fauna of Hong Kong and Southern China, Hong Kong, 1986.* (Ed. B.Morton). 2: 935-941. Hong Kong: Hong Kong University Press.

2. Chiu, S.T., Lam, V.W.W., and Shin, P.K.S., (1985). Mollusc predation by *Ludia* spp. (Echinodermata : Asteroidea) in Tolo Harbour and Channel, Hong Kong. In: *Proceedings of the Second International Workshop on the Malacofauna of Hong Kong and Southern China, Hong Kong, 1983.* (Eds. B.Morton and D.Dudgeon). Hong Kong University Press, Hong Kong, pp365-380

3. Shin, P.K.S., (1985). A trawl survey of the subtidal mollusca of Tolo harbour and Mirs Bay, Hong Kong. In : *Proceedings of the Second International Workshop on the Malacofauna of Hong Kong and Southern China, Hong Kong, 1983* (Eds. B.S.Morton & D. Dudgeon). 2: 439-447. Hong Kong University Press, Hong Kong.

4. Shin, P.K.S., (1990). Benthic invertebrate communities in Tolo Harbour and Mirs Bay: a review. In: *Proceedings of the Second International Marine Biological Workshop: The*

Marine Flora and Fauna of Hong Kong and Southern China, Hong Kong, 1986. (Ed. B.Morton). 2: 883-898. Hong Kong: Hong Kong University Press.

4.5 Landscape and Visual Impact

. Landscape Context: Topography/Landform

The existing Tolo Highway is located on a strip of reclaimed land which forms a smooth man-made coastline along the eastern edge of Tolo Harbour. This area of reclaimed land varies in width between 350m at Pak Shek Kok and 80 m at a point immediately to the west of Tai Po Kau. The reclamation supports not only the Tolo Highway but also the KCRC railway (which runs parallel and immediately to the west of the road) and a cycletrack (immediately to the east of the road). The natural landform immediately adjacent to this area of reclamation is highly variable, comprising a series of steep hillsides which are highly dissected by stream valleys. The spurs that lead off these hillsides form dramatic headlands.

The landform rises steeply to the landward side of the KCR to form a series of ridge spurs (up to 400 mPD in many places), which rise up to a peak of 645 mPD on Grassy Hill located approximately 4 km to the southwest.

The landscape to the north is dominated by the hills within the Pat Sin Leng and Plover Cove Country Parks. The peaks of the Ma On Shan Country Park (up to 702 mPD) enclose views across Tolo Harbour to the east.

Landscape Context: Vegetation

The hillslopes located to the west of the highway are well vegetated with dense woodland, tall scrub and grassland. Much of the densely wooded hillslopes above Tai Po Kau are included within the Tai Po Kau Nature Reserve. The vegetation along the lower hill slopes and around the area of reclamation is more varied as described below.

Vegetation in the Pak Shek Kok valley comprises mainly abandoned agricultural land, rough grassland and scattered tree clumps around the settlements.

Yuen Chau Tsai is a well wooded promontory at the northern limit of the scheme. It comprises mature fung shui woodland around the temple at the base of the hill as well as ornamental trees in the garden of Island House. To the north of the promontory is a public open space with extensive amenity planting.

To the east of Yuen Chau Tsai, on another small promontory, lies Tolo Harbour Garden. The garden comprises ornamental tree and shrub planting set within a small *Acacia* woodland.

Further to the east, on the small promontory directly to the north of Chinese University of Hong Kong (CUHK) campus, there are clumps of *Casuarina equisitifolia* and rough grassland.

The reclaimed land which supports the CUHK Marine Research Laboratory (MSL) and other buildings is well vegetated with clumps of semi-mature and mature trees *(mainly Acacia and*

Casuarina sp.). There is a belt of bamboo planting in front of the Institute of Biotechnology which lines the cycletrack for some 20-30 metres.

Along the seaward side of the cycletrack there is a row of amenity tree planting. It comprises individual semi-mature trees planted in concrete rings set at intervals of approximately 5m. Many of the trees have died or are in poor condition.

There is little notable vegetation between the cycletrack and highway. The only exceptions are the two dense clumps of *Acacia* trees which are set in grassland where the cycletrack deviates from the highway alignment around Pak Shek Kok valley.

A partial screen is provided by some dense tree belts and semi-mature amenity planting between the highway and the KCR. However, the realigned KCR embankments between Pak Shek Kok valley and St. Christopher's Head are sparsely vegetated.

Landscape Context: Historical and Cultural Features

There are two sites of archaeological/historic importance located close to the Tolo Highway and these are listed in the Hong Kong Government's register of Antiquities and Monuments. These are the Tai Po Kau Railway Station and the Island House Temple at Yuen Chau Tsai. Both sites lie close to the proposed widening works.

The KCRC's Tai Po Kau Railway Station is recorded as an historic building of architectural significance, although it is no longer in use. It lies outside the area of the works proposed under the study, so there would be no direct impact on the structure. As the proposed highway widening works are in the context of the existing Tolo Highway it is considered that they should not have an adverse impact on the character of the setting of the Station Building.

The Island House Temple is a traditional Tin Hau Temple, noted for its antiquity, cultural significance and its landscape setting close to the waters edge, (the prospect of the sea is considered to be of special fung shui significance). The area immediately around the temple structure is also been identified as having archaeological importance as antique pottery has in the past been discovered there. The extent of these artefacts is not known, but as they appear to be associated with the temple, they are likely to be confined to the area of the island.

The Temple structure would not be directly affected by the proposed widening works, and as the views of Tolo Harbour would not be impeded, it is considered that the highway widening works would not materially alter the character of the landscape setting of the temple. There is a possibility, however, that the surrounding area may contain features of archaeological importance and some of these features may be included within the area of the proposed works. It is suggested, therefore, that a detailed examination is undertaken, before the highway widening works commence, of any areas around the Temple that have not yet been investigated in archaeological terms, and that any valuable artefacts are removed prior to construction works commencing.

There is in addition, one small village temple located in the valley located to the south-west of Pak Shek Kok. However, this temple is located more than 500m from the Tolo Highway and would not be disturbed by the proposed works.

Landscape Character

The study area has been classified into broadly homogenous character types. The Tolo Highway corridor is set within a high quality scenic landscape comprising a natural harbour framed by undeveloped mountain ranges.

The coastline of the harbour to the north, south and west is predominantly man-made, comprising extensive areas of reclaimed land. To the east lie open waters and the natural shoreline of the Yim Tin Tsai Peninsula.

Built development is restricted mainly to these areas of reclaimed land and the lower coastal hillslopes.

The most dominant man-made features within the landscape are the transport corridor comprising Tolo Highway and the KCR, the high rise residential blocks and industrial area at Tai Po, the residential towers at Ma On Shan, and, to a lesser extent, the medium-rise buildings at the CUHK. There are in addition a number of discrete, high-quality residential developments set within the low wooded hillslopes.

Overall, the built development does not greatly detract from the impressive scale of the surrounding natural landscape due to the overall moderate to high quality of the structures and the concentration of the built form on the flat,coastal reclamation areas.

Within the context of the local landscape, the character of the transportation corridor is of a low quality. This is on account of the poor integration of the transport uses (i.e., KCR railway and cycletrack) into the local landscape. Poor quality materials (e.g., chain-link fencing, plain concrete barriers etc.) have been used for these developments and the inter-relationship between the various uses is poor (e.g., no buffer planting between the highway and the cycletrack in many places). The transportation corridor contrasts with the traditional agricultural settlements and high quality developments set within the hillslopes and rural landscape beyond. It forms a linear, man-made, mainly unvegetated, edge to Tolo Harbour.

The existing cycletrack runs parallel to the highway and forms an important recreational corridor within the study area. The track has pleasant scenic views out over Tolo Harbour and the surrounding countryside. However, there is little or no landscape buffer between the track and the highway. For the majority of its length, only a grass verge and an unattractive fence separate cyclists from the highway traffic.

Zones of different landscape character in and around the highway corridor are identified at Figure 4.2. An assessment is provided in Section 10.3.3 of the visual imprtance or senic quality of these landscape character zones and the criteria that have been used to rank the zones are also detailed in this section.

These zones have been ranked according to the following criteria:

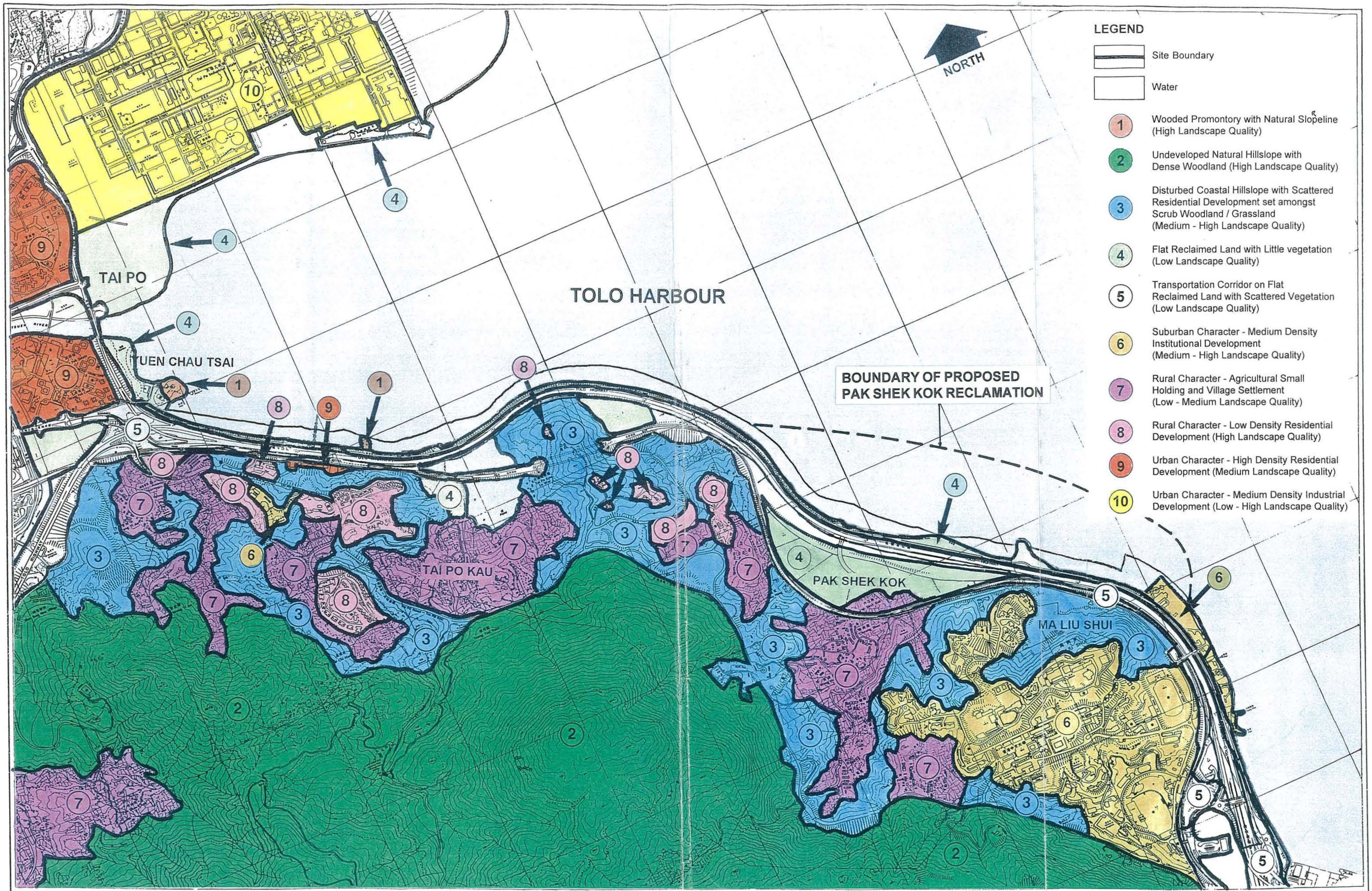

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Figure no. 4.2

- Planning control designations for features of landscape or historical interest (e.g. the Tai Po Kau Railway Station and the Island House Temple at Yuen Chau Tsai. These are both sites of archaeological/historic importance located within the study area and are listed in the Hong Kong Government's register of Antiquities and Monuments).

- Areas of natural topography and natural foreshore (e.g. at Yuen Chau Tsai)

- Areas that are unspoilt by man-made development

- Dominance of natural features in the landscape (e.g. high mountains and large expanses of open water)

- Quality and degree of vegetation cover

- Quality and age of man-made features

The identified landscape zones are described and assessed as follows:

1. Landscape Character Zone No. 1 (a high landscape value zone) covers undeveloped natural hillslopes with either dense woodland (predominantly native species) or grassland.

2. Landscape Character Zone No. 2 (a medium to high landscape value zone) covers disturbed coastal hillslope with scattered residential development set amongst scrub/woodland (predominantly native species)/grassland.

3. Landscape Character Zone No. 3 (a low landscape value zone) covers areas of flat reclaimed land with little vegetation (any trees within this area are predominantly non-native species).

4. Landscape Character Zone No. 4 (a low landscape value zone) covers the transportation corridor associated with the existing Tolo Highway and has a man-made edge to the harbour (any trees with this area are predominantly non-native species).

5. Landscape Character Zone No. 5 (a high landscape value zone) contains medium-density institutional development and has a suburban character (any trees within this area are predominantly non-native species).

6. Landscape Character Zone No. 5 (a high landscape value zone) contains agricultural holdings and village settlements and has a rural character. (predominantly native species)

7. Landscape Character Zone No. 7 (a high landscape value zone) contains low density residential development and has a rural character. (predominantly native species)

8. Landscape Character Zone No. 8 (a medium landscape value zone) contains high

density residential development and has an urban character (any trees within this area are predominantly non-native species).

9. Landscape Character Zone No. 9 (a low to high landscape value zone) contains medium density industrial development and has an urban character (any trees within this area are predominantly non-native species).

10. Landscape Character Zone No. 10 (a high landscape value zone) contains a wooded promontory (predominantly native species) with a natural shoreline.

All the above character zones, with the exception of the steep hillslopes in Character Zone No. 1, are vulnerable to change on account of intense development pressure in the lower and more developable areas of hillslope that overlook the scenic Tolo Harbour.

5. NOISE ASSESSMENT

5.1 Construction Noise Assessment

5.1.1 Noise generated by construction activities comes under the control of Noise Control Ordinance (NCO) enacted in 1988. Specific criteria and procedures for noise impact assessment during construction are set out in three Technical Memoranda associated with the Ordinance; i.e. the *Technical Memorandum on Noise from Construction Work other than Percussive Piling,* the *Technical Memorandum on Noise from Percussive Piling and the Technical Memorandum on Noise From Construction Work in Designated Area.*

Based on the Technical Memorandum on Noise form Construction Work in Designated Area, the work site for the widening project is outside the Designated Area. The procedures require the use of quiet machinery by permitting longer working hours if the noise levels are acceptable in relation to the local conditions. In other words, noise emission from a particular site must comply with the acceptable noise levels (ANL's) during the restricted periods and contractors are required to obtain a Construction Noise Permit (CNP) to carry out works involving powered mechanical equipment (PME). The restricted periods include night time (i.e. 1900 hours - 0700 hours), Sunday and public holiday.

For CNP considerations, the applicable noise limits depend upon the existing noise environment the NSR is located which is reflected in an Area Sensitivity Rating (ASR). An ASR of `C' is assumed for the NSRs within the study area which comprises of mainly low density, isolated high-rise developments and directly affected by Tolo Highway. Therefore the ANL for the daytime and evening during holidays is 70 dB(A) and all days during the night time is 55 dB(A). However, the assignment of ASR and the issue of a CNP are entirely at the discretion of the Noise Control Authority.

In addition, the NCO requires that hand-held percussive breakers over 10 kg and air compressors comply with noise emission standards by bearing the official Noise Emission Labels.

There is no statutory control on construction noise (other than percussive piling) over the daytime (i.e. between 0700 hours - 1900 hours) on normal weekdays. However, EPD's Practice Note for Professions Persons PN 2/93 sets a non-statutory daytime noise limit of 75 dB(A) L_{eq} (30 min) at residential dwellings and 70 dB(A) L_{eq} (30 min) at facades of schools or 65 dB(A) L_{eq} (30 min) during examinations.

5.1.2 Construction Sequence and Methodology

The following description on the construction sequence and methodology only reflects one of the best estimated scenarios to be employed in the road work construction. The actual construction sequence and methods employed by the contractor performing the work is likely to be different to some degree. The actual performance will be closely monitored according to the specification given in the Environmental Monitoring and Auditing Maunal prepared for this project. Figure 5.1 (Drawings No. 90896/CN/001-010) illustrate the work areas referred to in this assessment.

The construction is expected to be undertaken over a 32-month period. The road widening works are split into two phases; one involves reclamation and seawall construction which will mainly be carried out by sea while the other involves the remaining landside construction.

It has been assumed that normal daytime hours of working would by adopted by the contractor on weekdays and Saturdays. However, some low-noise activities may be carried out during night time such as road studs installation and markings which involve lane closures.

It is assumed that Stage I of the PSKPDR has completed and therefore the main worksyard will be formed on the PSKPDR following construction of the main construction access from the southbound slow lane of Tolo Highway. Satellite work sites will be established as works progress.

Where practicable, quiet equipment shall be used in all construction work. This involves the use of silencers, mufflers, acoustic linings and hydraulic powered system.

5.1.3 Construction Activities

Worksyard

For the main worksyard area at PSKPDR Phase I, the major equipments that will be employed are indicated in Table 5.1 below.

Table 5.1 Main Worksyard Activities and Equipment

Operation	Equipment Type	Number	SWL dB(A) per piece
Storage Area	Mobile Crane	2	112
	Lorry	2	112
Prefabrication Yard	Mobile Crane	2	112
	Compressor (silenced)	2	100
	Winch (pneumatic)	2	110
	Concrete mixer truck	2	109
	Concrete Pump	1	109
	Vibratory Pokers	2	113

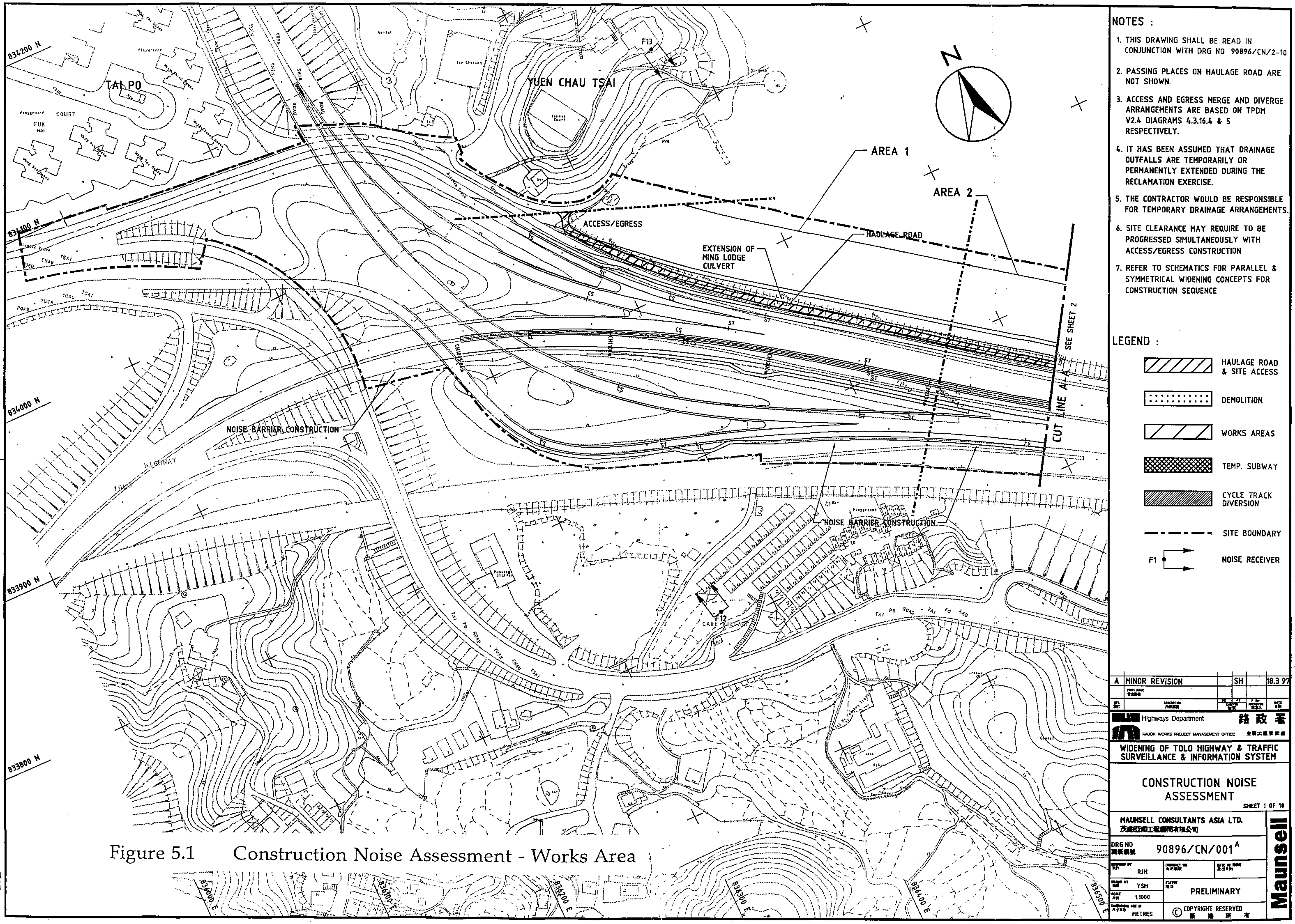


Figure 5.1 Construction Noise Assessment - Works Area

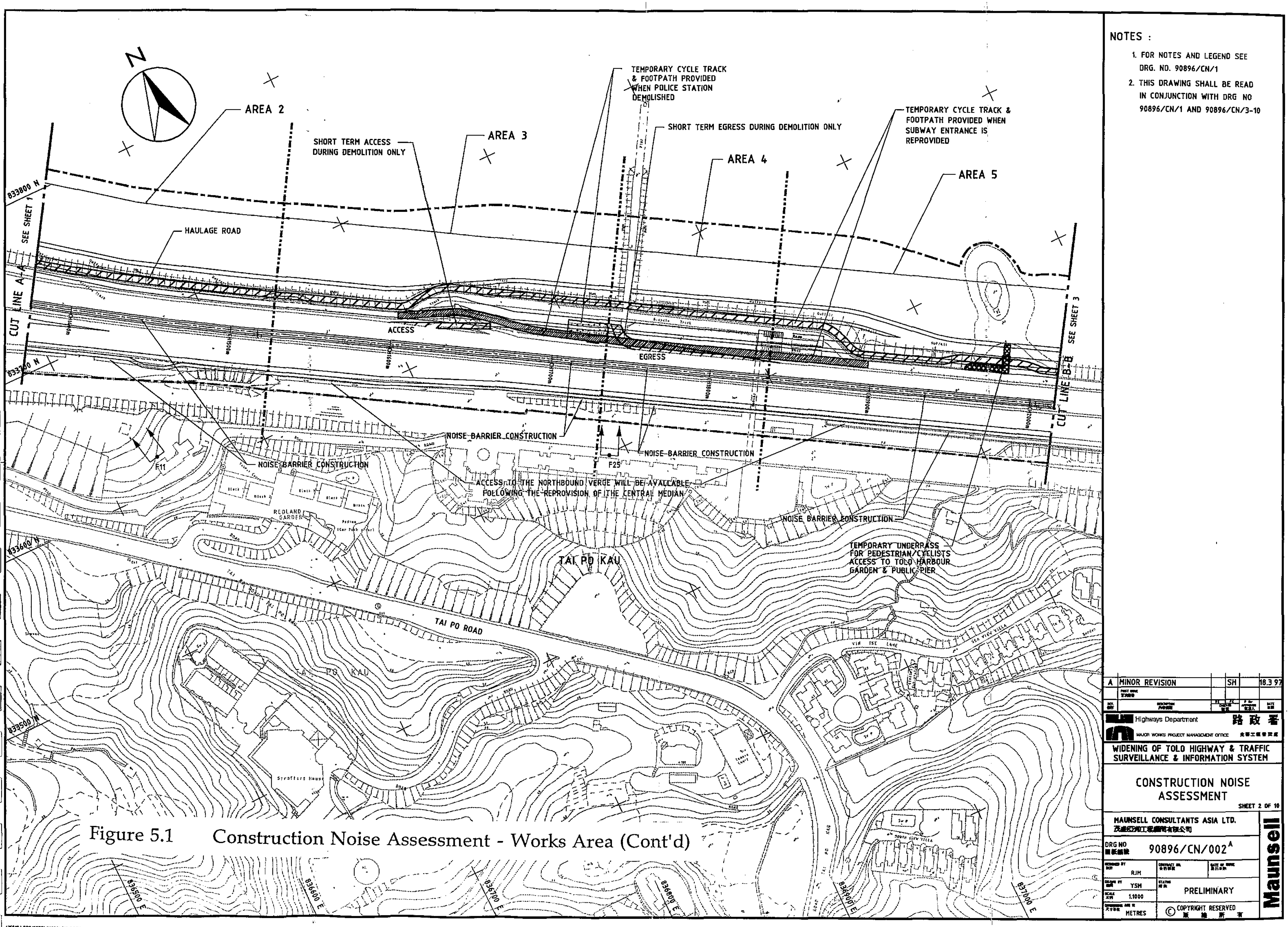


Figure 5.1 Construction Noise Assessment - Works Area (Cont'd)

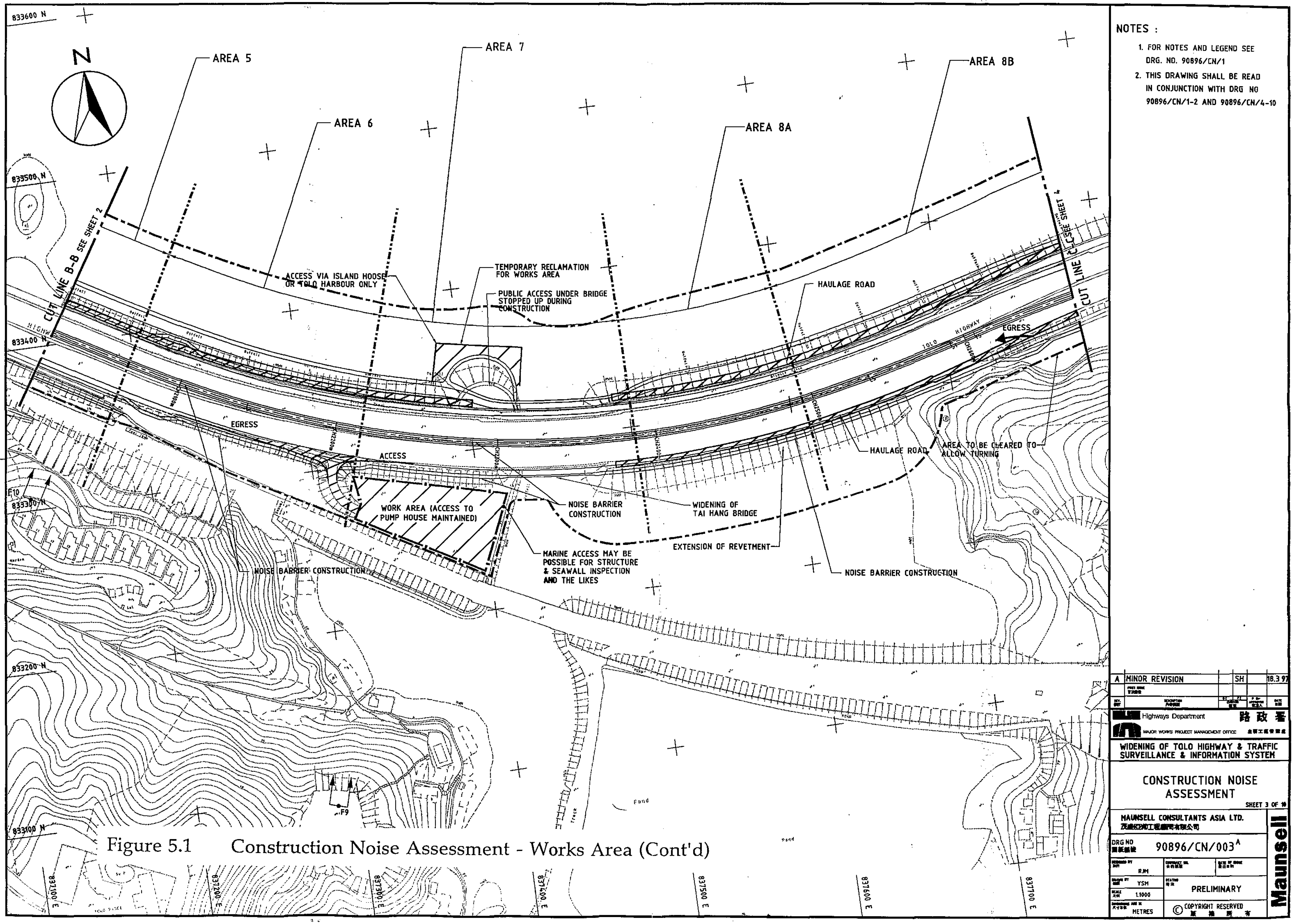


Figure 5.1 Construction Noise Assessment - Works Area (Cont'd)

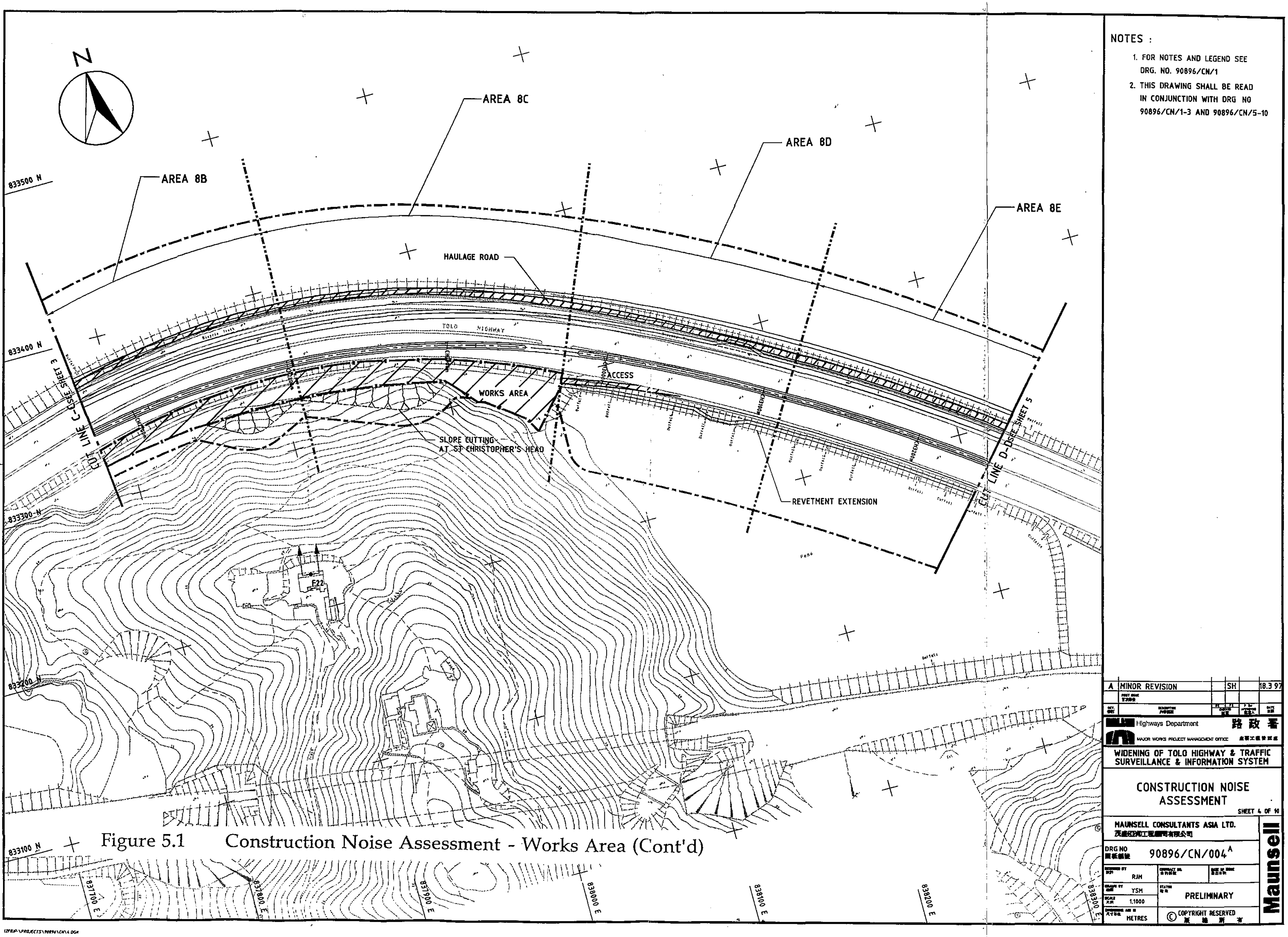
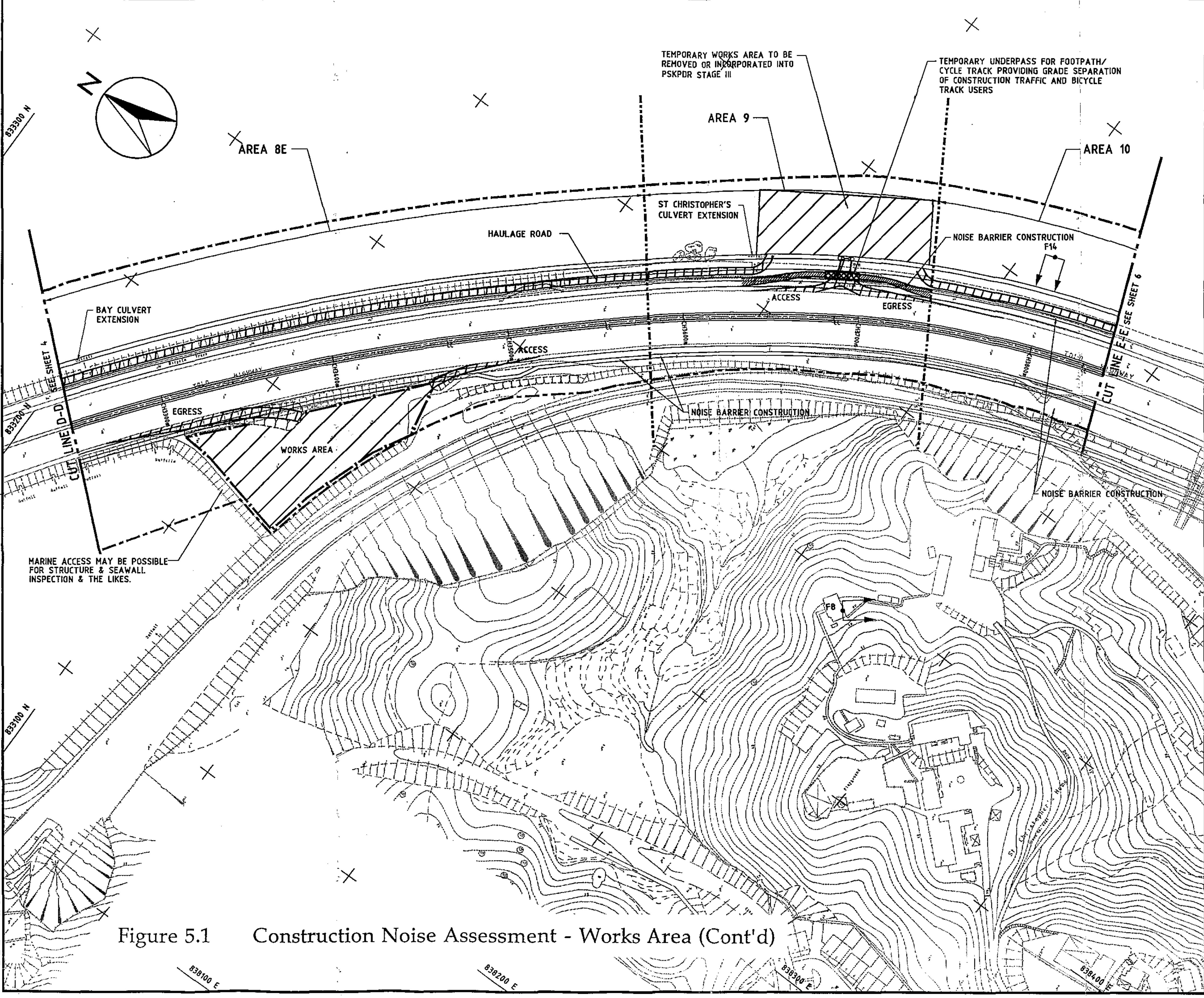


Figure 5.1 Construction Noise Assessment - Works Area (Cont'd)



NOTES :

1. FOR NOTES AND LEGEND SEE DRG. NO. 90896/CN/1
2. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH DRG NO 90896/CN/1-4 AND 90896/CN/6-10

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MAJOR WORKS PROJECT MANAGEMENT OFFICE

WIDENING OF TOLO HIGHWAY & TRAFFIC SURVEILLANCE & INFORMATION SYSTEM

CONSTRUCTION NOISE ASSESSMENT

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Figure 5.1 Construction Noise Assessment - Works Area (Cont'd)

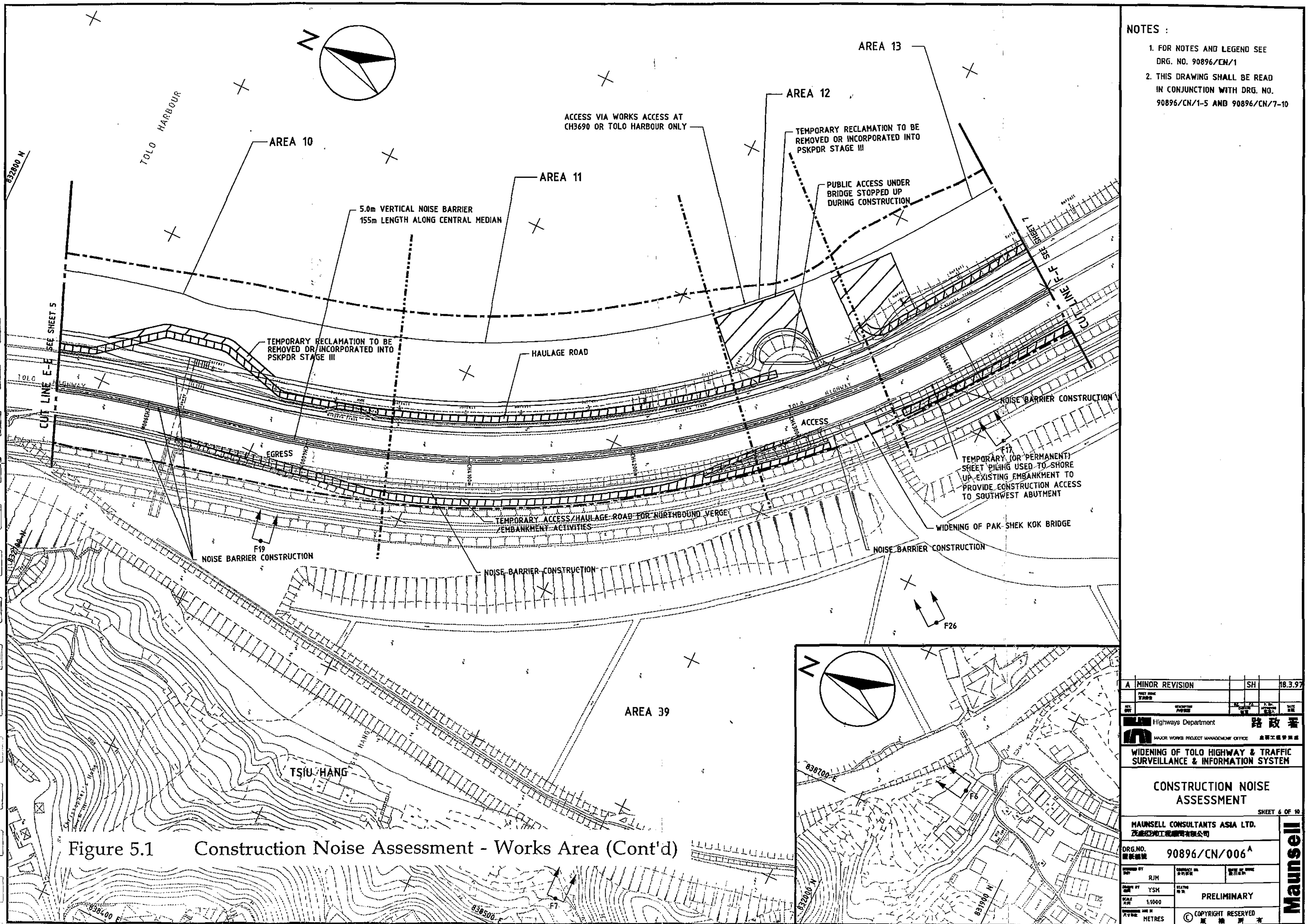

Figure 5.1 Construction Noise Assessment - Works Area (Cont'd)

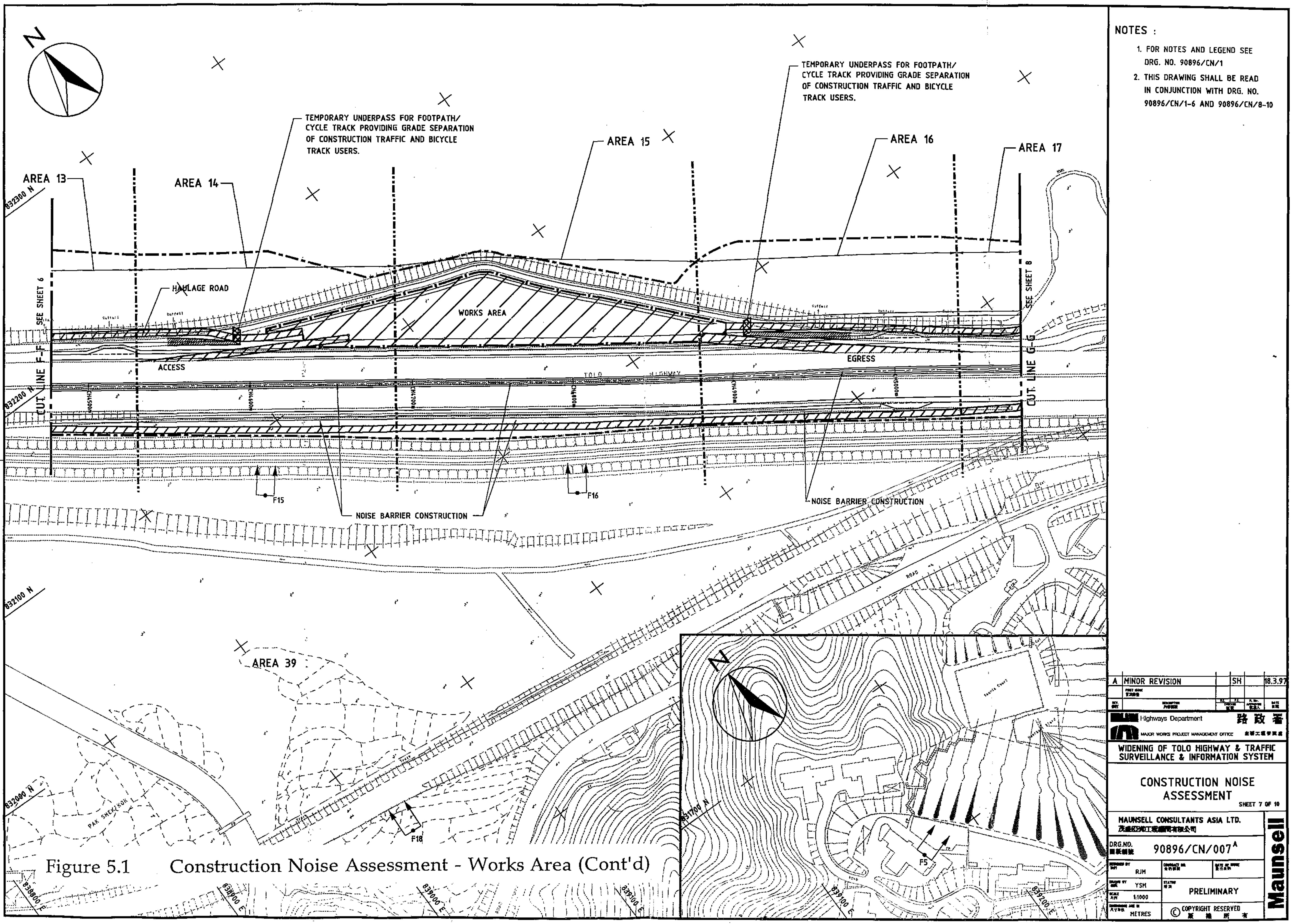

Figure 5.1 Construction Noise Assessment - Works Area (Cont'd)

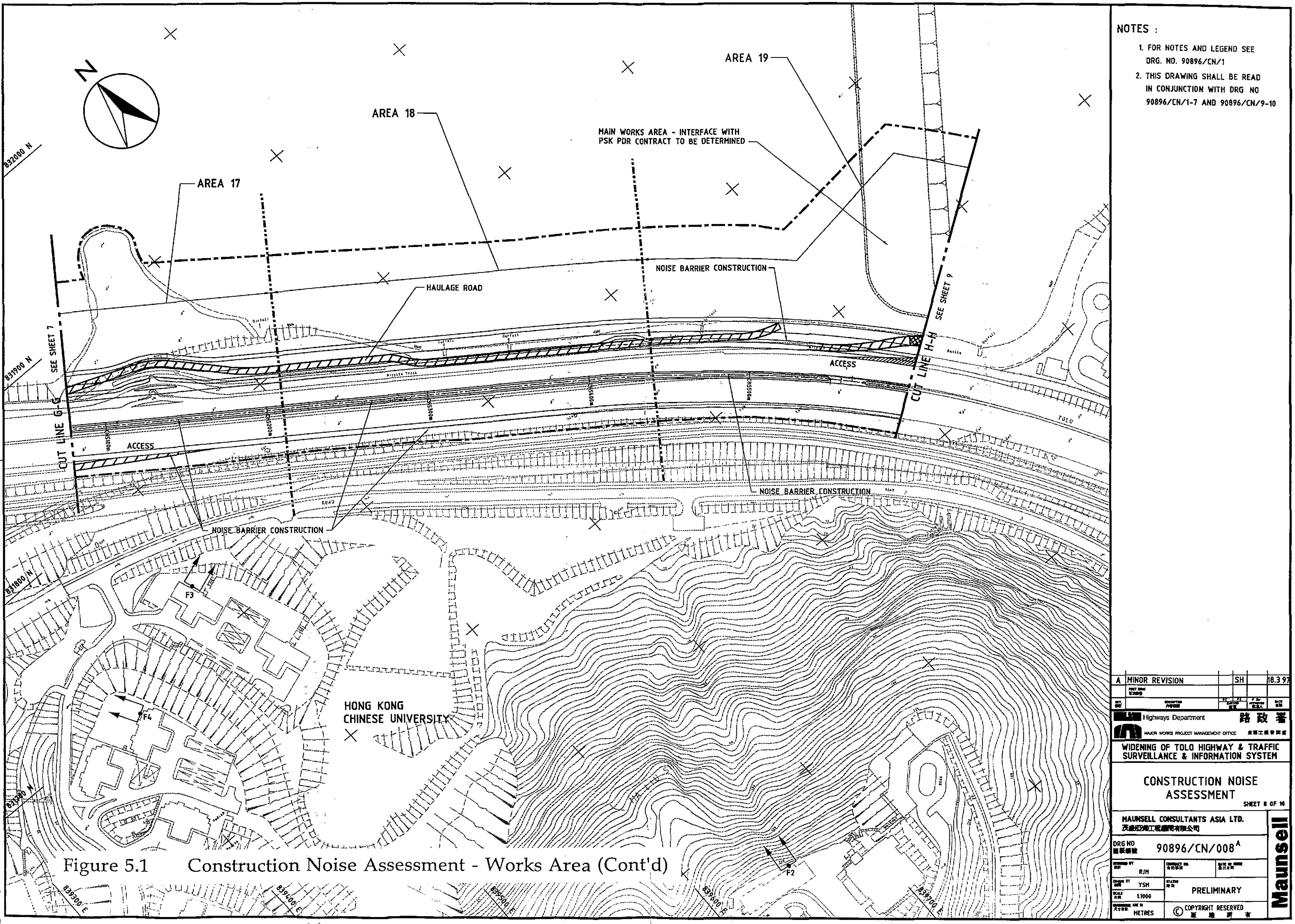

Figure 5.1 Construction Noise Assessment - Works Area (Cont'd)

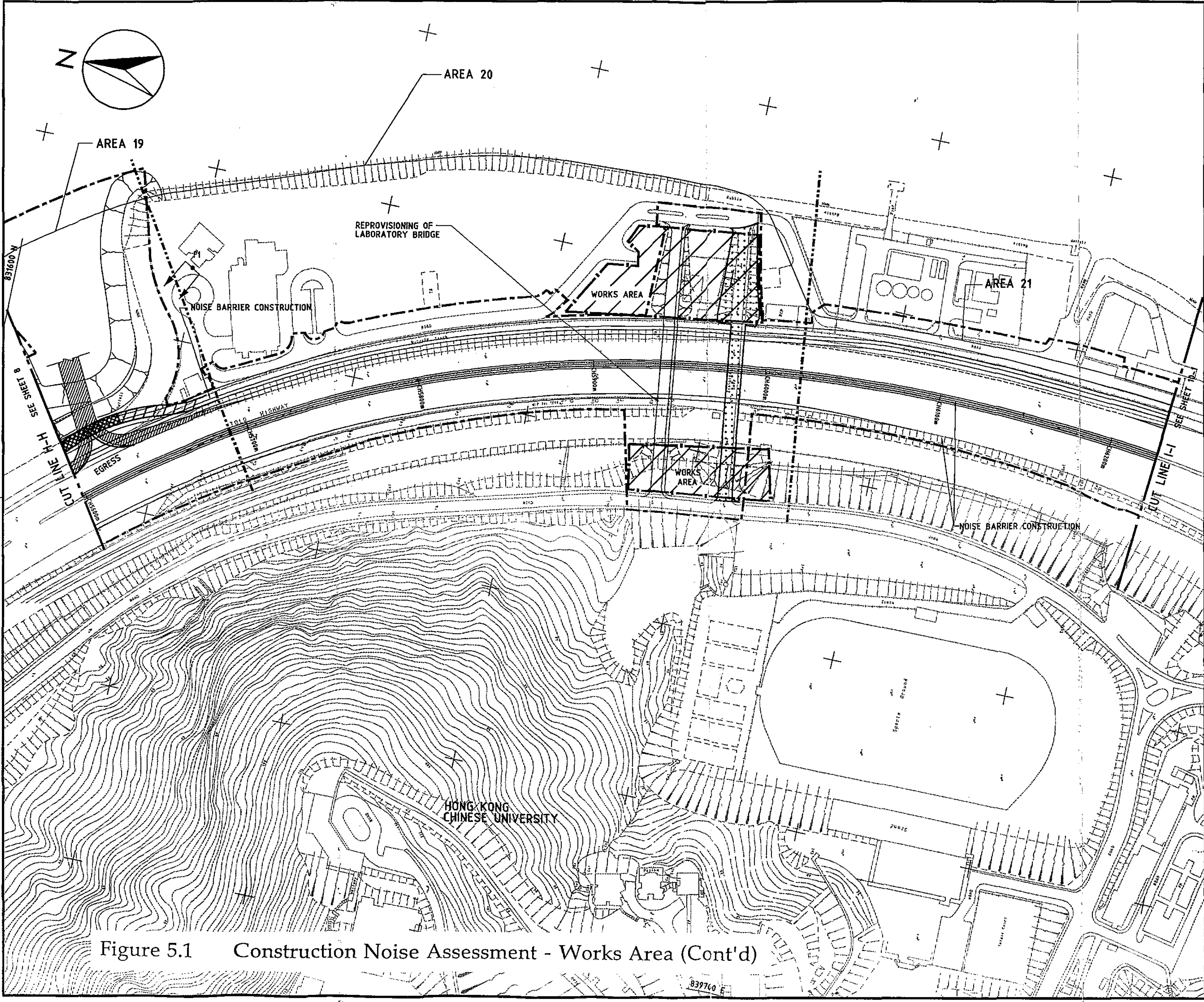

Figure 5.1 Construction Noise Assessment - Works Area (Cont'd)

NOTES :

1. FOR NOTES AND LEGEND SEE DRG. NO. 90896/CN/1
2. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH DRG NO 90896/CN/1-8 AND 90896/CN/10

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Highways Department 路政署

MAJOR WORKS PROJECT MANAGEMENT OFFICE

WIDENING OF TOLO HIGHWAY & TRAFFIC SURVEILLANCE & INFORMATION SYSTEM

CONSTRUCTION NOISE ASSESSMENT OPTION I

SHEET 9 OF 10

MAUNSELL CONSULTANTS ASIA LTD.

DRG NO 90896/CN01/009A

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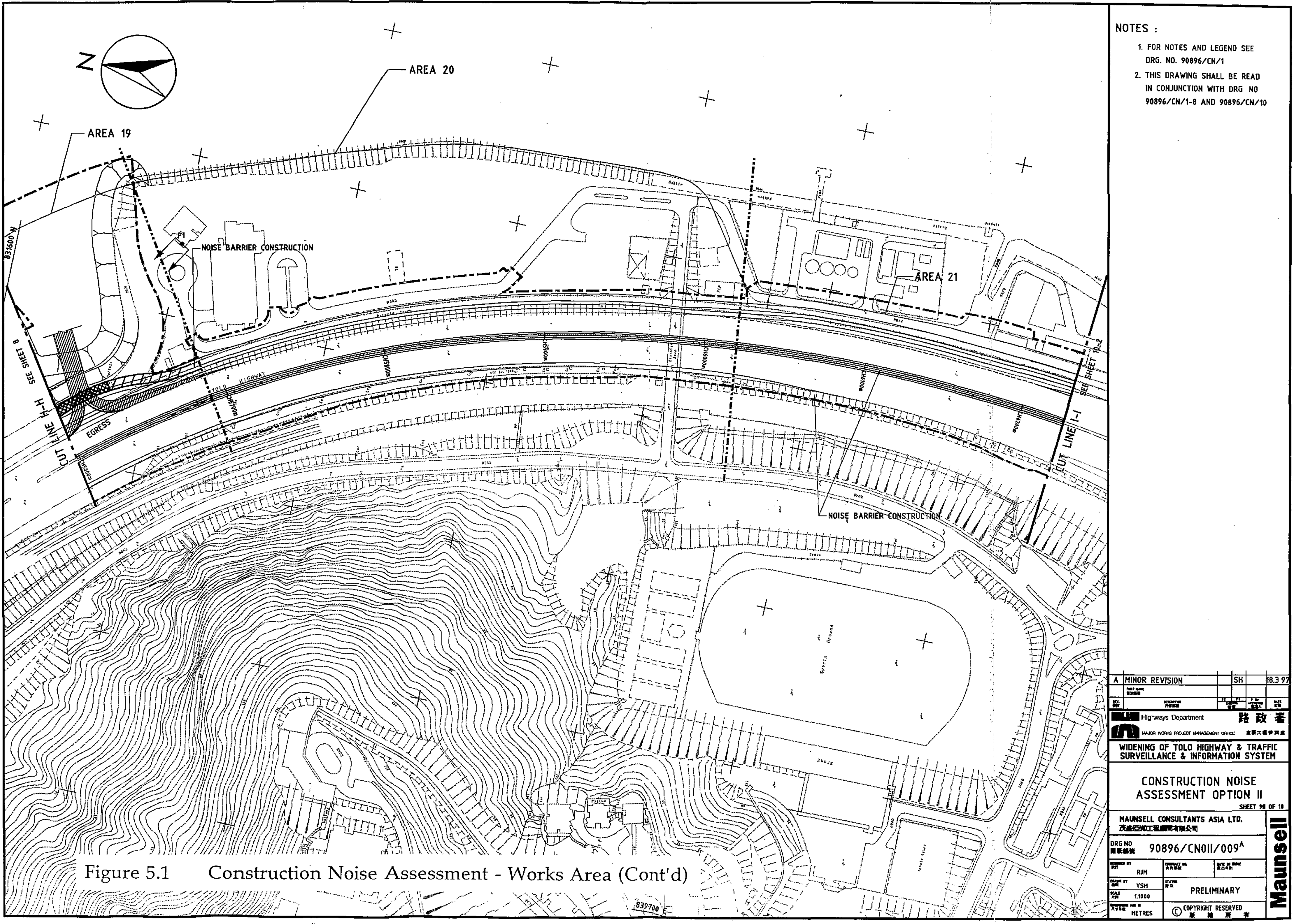


Figure 5.1 Construction Noise Assessment - Works Area (Cont'd)

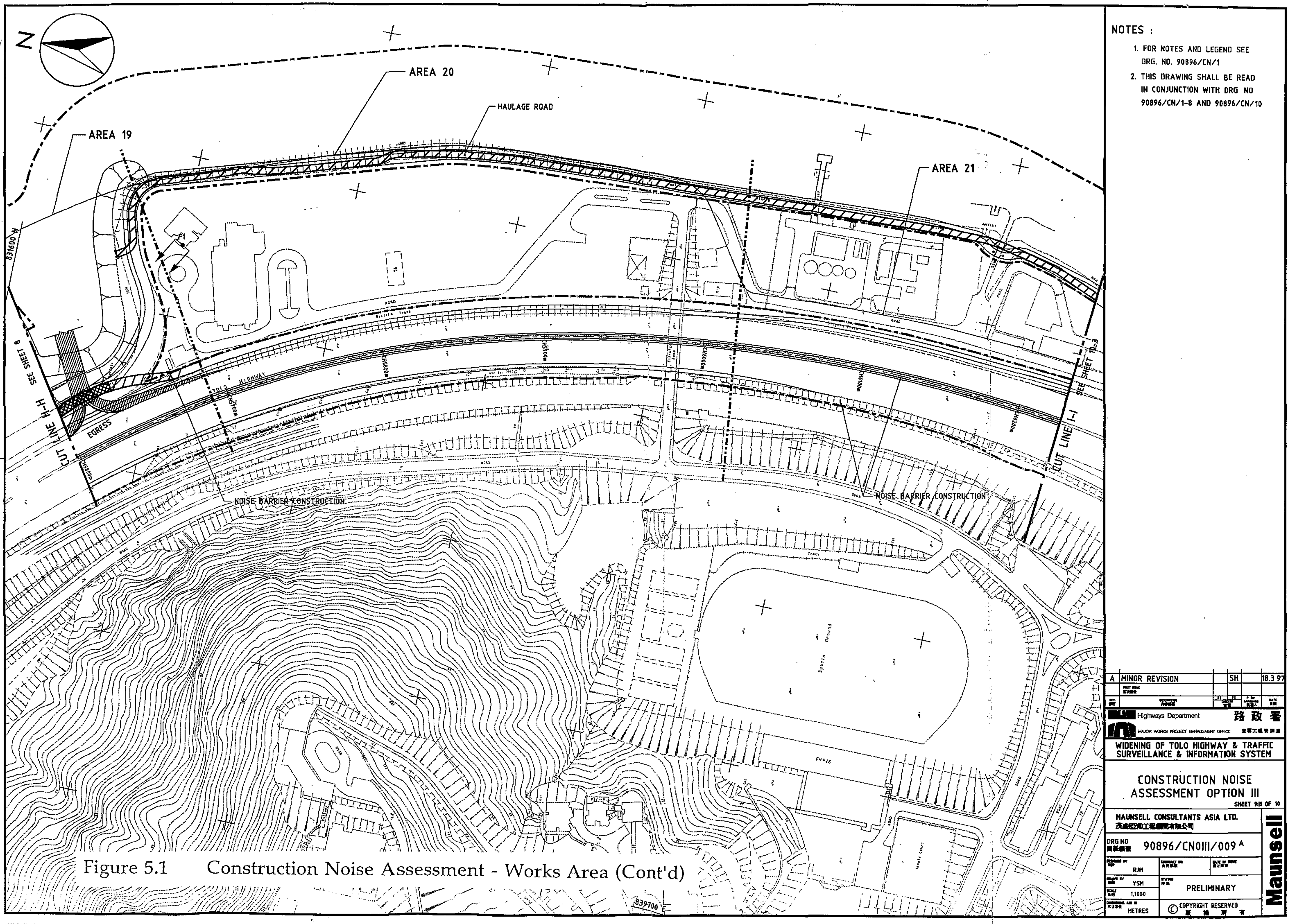


Figure 5.1 Construction Noise Assessment - Works Area (Cont'd)

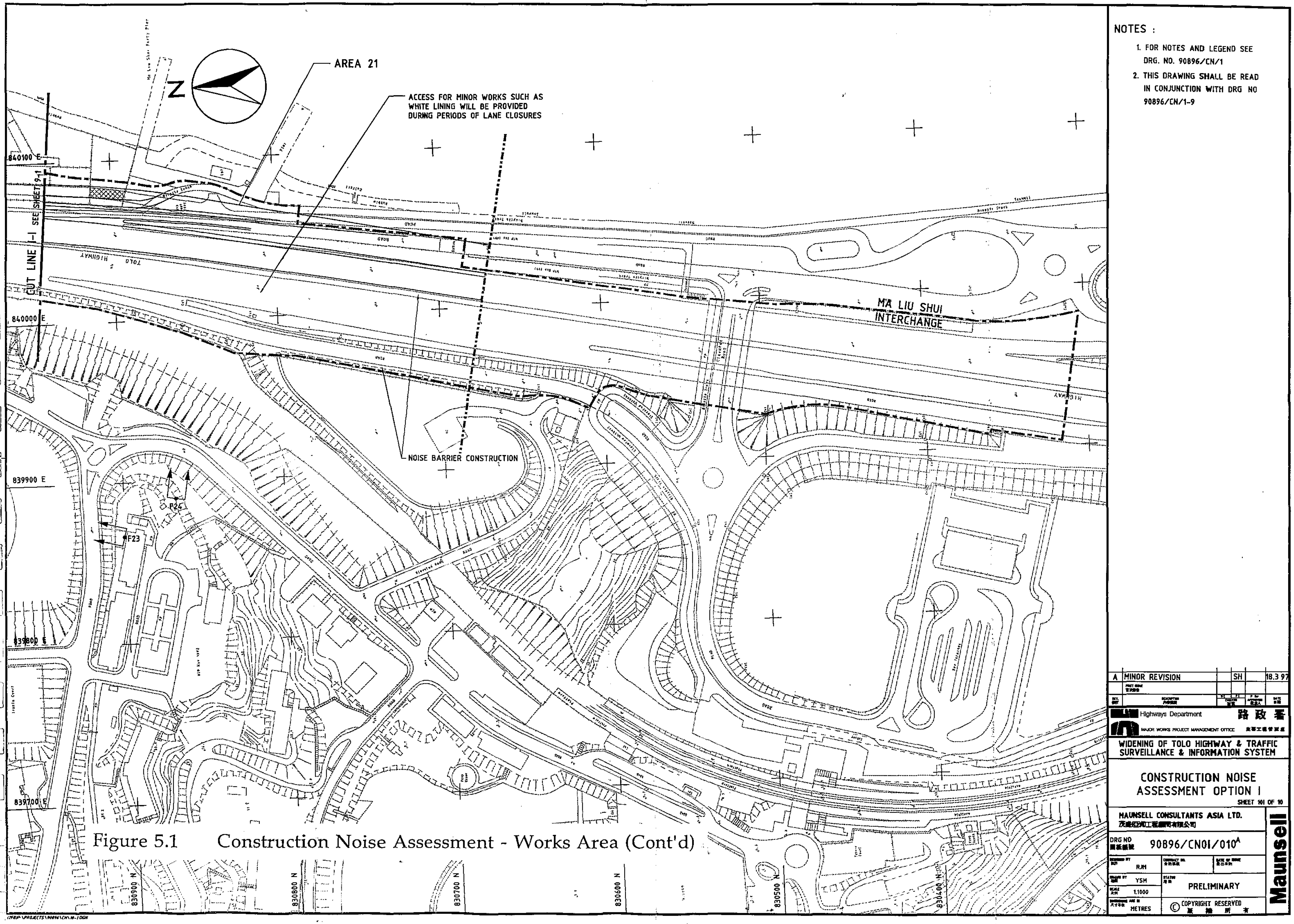


Figure 5.1 Construction Noise Assessment - Works Area (Cont'd)

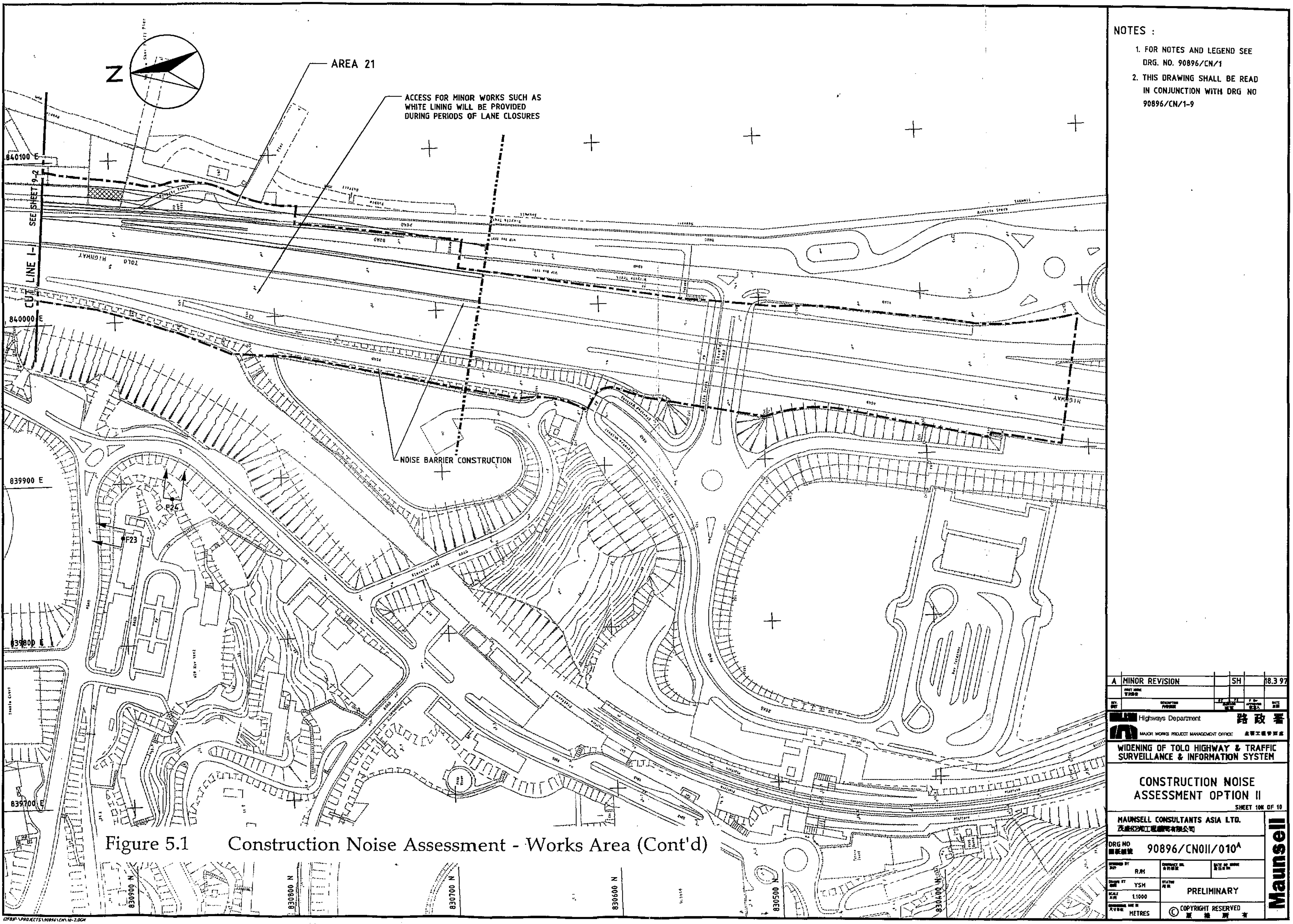


Figure 5.1 Construction Noise Assessment - Works Area (Cont'd)

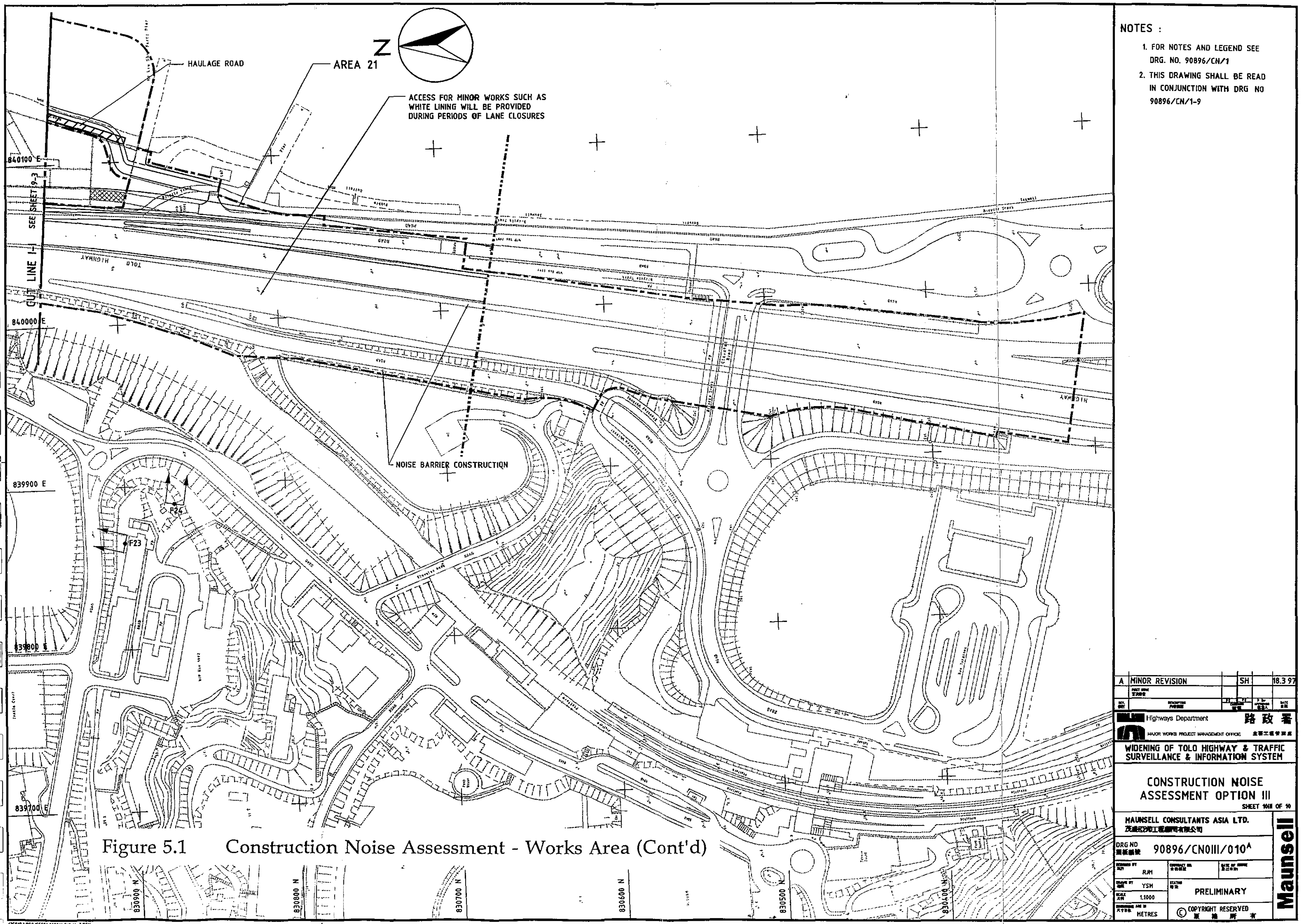


Figure 5.1 Construction Noise Assessment - Works Area (Cont'd)

Dredging, Reclamation and Seawall Construction

Dredging of marine mud will be required along a 700m length stretch at Tai Po Kau Pier. Dredging and removal of spoilt will be by sea. Dredging and backfilling with general fill/marine sand brought to site by sea will follow immediately. Reclamation will then proceed.

It is anticipated that reclamation and construction of seawall will be progressed at four locations simultaneously. These operations will be carried out by derrick and hopper barges and bulldozers. The probable equipment that will be used at each location are listed in Table 5.2 below.

Table 5.2 Equipment List for Dredging, Reclamation and Seawall Construction

Operation	Equipment Type	Number	SWL dB(A) per piece
Dredging of marine mud	Chain bucket dredger	1	118
	Grab dredger	1	112
	Hopper barge	1	104
	Derrick barge	1	104
	Tug	2	110
Reclamation	Hopper barge	2	104
	Derrick barge	2	104
	Tug	4	110
Seawall Construction	Hopper barge	2	104
	Derrick barge	2	104
	Tug	4	110
	Bulldozer	4	115

Haul Roads Construction

Haul roads will be constructed off the mainline alignment on both sides. They provide access to critical working areas such as Tai Hang Bridge and Pak Shek Kok Bridge. The activities involved and the equipment required are listed in Table 5.3 below.

Table 5.3 Equipment List for Haul Roads Construction

Operation	Equipment Type	Number	SWL dB(A) per piece
Roadway levelling	Grader	1	113
	Bulldozer	1	115
Laying of sub-base material	Dumptruck	1	117
	Roller	1	108

Reprovisioning of Central Median

For the sections of road where parallel widening is involved, the central median will be shifted seawards. The reprovisioning of the central profile barrier will involve reconstruction of drainage channels and demolition of existing median. The probable equipment involved are listed below in Table 5.4.

Table 5.4 Equipment List for Reprovisioning of Central Median

Operation	Equipment Type	Number	SWL dB(A) per piece
Drainage Works	Excavator	1	112
	Dumptruck	1	117
	Mobile diesel crane	1	112
	Backhoe	1	112
Install Profile barrier	Lorry	1	112
	Mobile diesel crane	1	112
Demolition of old median barrier	Breaker (silenced hand-held pneumatic)	3	110
	Breaker (excavator-mounted, pneumatic)	1	122
	Backhoe	1	112
	Lorry	1	112

Subway Extension and Temporary Crossings for pedestrian and cyclists

Two pedestrian subways are to be extended as part of the widening works. These are located in Work Area 4 and Area 10. Also, several accesses from the Tolo Highway would be created to reach specific work sites and construction locations. Where such access crosses the pedestrian/cycle track, a temporary subway will be built. The locations of these subways are indicated in Figure 5.1 (drawing series No. 90896/CN/001-010). The probable equipment involved are listed in Table 5.5 below.

Table 5.5 Equipment List for Subway Construction/Extension

Operation	Equipment Type	Number	SWL dB(A) per piece
Trench Excavation	Excavator	1	112
	Dumptruck	1	117
Sheet Piling	Drop hammer driving sheet pile	1	129
	Electric vibratory extractor	1	125
Placement of prefabricated boxed channel	Lorry	1	112
	Mobile diesel crane	1	112
	Backhoe	1	112
In-situ concreting	concrete lorry mixer	1	109
	concrete pump (lorry mounted)	1	109
	vibratory Poker (handheld)	1	113

Culverts Extension

The majority of the existing culvert outfalls will have to be extended. The major ones are the Ming Lodge, Bay and St. Christopher's Culverts. At these locations, sheet piling will be required. The equipment list for the task is similar to the provision of temporary subways as indicated in Table 5.5.

Widening of Tai Hang Bridge and Pak Shek Kok Bridge

The above bridges will require widening on both sides. This entails partial removal of the protective seawall revetment, extending the abutments (founded on piles), breaking out the existing verge detail, placing additional beams, reconstructing a new verge arrangement and replacing the revetment. Table 5.6 highlights the list of equipment that will be required for the widening.

Table 5.6 Equipment List for Bridge widening works

Operation	Equipment Type	Number	SWL dB(A) per piece
Removal of revetment and sheet piling	Excavator Dumptruck Drop hammer driving sheet pile Electric vibratory extractor	1 1 1 1	112 117 129 125
Pile placement	Drop hammer driving concrete pile	1	129
Placement of prefabricated beams	Lorry Mobile diesel crane	1 1	112 112
In-situ concreting	concrete lorry mixer concrete pump (lorry mounted) vibratory Poker (handheld)	1 1 1	109 109 113

Reprovisioning of Laboratory Bridge for Alignment Option I

Under Option I, the Laboratory Bridge will require to be reprovisioned. Not only will the new structure have to cross the widened expressway, it will also require to cross the KCR line. The new three span structure will require two piers which will be founded on piles. It is anticipated that the precast concrete beams which form the deck, will be placed during the night time when lane closures are permitted.

The construction of new abutments, approach ramps, piers including pile caps, three span deck, surfacing and ancillaries is likely to take approximately 10 months. Demolition of the existing structure would take another two months. Table 5.7 below indicates the list of equipment likely to be used.

Table 5.7 Equipment List for reprovisioning of Laboratory Bridge under Option I

Operation	Equipment Type	Number	SWL dB(A) per piece
Bore pile placement	Large diameter bored piling rig (oscillator or grab-and-chisel)	1	115
	Concrete mixer truck	1	109
	Concrete pump	1	109
	Water pump	1	103
Pile capping	Excavator	1	112
	Backhoe	1	112
	Earth-moving truck	1	117
	Mobile diesel crane	1	112
	Compressor (silenced)	1	100
	Bar bender/cutter (electric)	1	90
	Concrete mixer truck	1	109
	Vibratory poker	2	113
	Handheld pneumatic breaker	1	110
Pier and Abutment construction	Mobile diesel crane	1	112
	Compressor (silenced)	1	100
	Bar bender/cutter	1	90
	Concrete mixer truck	1	109
	Vibratory poker	2	113
	Concrete pump truck	1	109
	Excavator	1	112
	Dumptruck	1	117
Placement of prefabricated beam decking	Lorry	1	112
	Mobile diesel crane	1	112
Road surfacing on bridge	Compressor (silenced)	1	100
	Asphalt paver	1	109
	Road roller	1	108
Demolition of existing bridge	Breaker (silenced hand-held pneumatic)	3	110
	Breaker (excavator-mounted, pneumatic)	1	122
	Mobile diesel crane	1	112
	Backhoe	1	112
	Lorry	2	112

<u>New Road Construction and Paving</u>

Upon completion of widening of the carriageway, pavement construction will take place. The list of equipment that will be required for the task is given in Table 5.8.

Table 5.8 Equipment List for new road construction and paving

Operation	Equipment Type	Number	SWL dB(A) per piece
Roadway levelling	Grader Bulldozer	1 1	113 115
Laying of sub-base material	Dumptruck Roller	1 1	117 108
Kerbing	Concrete mixer truck Concrete saw	1 1	109 115
Laying new surface	Compressor Asphalt paver Roller	1 1 1	100 109 108

Existing Road Resurfacing

The wearing and friction courses of existing pavement are to be scarified and relaid to obtain a continuous flush running surface together with the widened section of the road. Table 5.9 highlights the list of equipment that will be required.

Table 5.9 Equipment List for Existing Road Resurfacing

Operation	Equipment Type	Number	SWL dB(A) per piece
Breaking existing surface	Breaker (excavator mounted) Breaker (silenced handheld)	1 3	122 110
Removal of broken surface	Backhoe	1	112
Scarifying for overlay	Surface planer Lorry	1 1	111 112
Laying new surface	Compressor Asphalt paver Roller	1 1 1	100 109 108

Northbound Carriageway Widening

Under the symmetrical widening scenario, widening for the northbound carriageway is required to fill up part of the two ponds adjacent to the carriageway. It is proposed that the existing revetment is not to be disturbed and rock fill will be placed on it from vehicles on the northbound verge. Also, a cutting at St. Christopher's Head is required for the widening. Table 5.10 below shows the list of equipment likely to be used.

Table 5.10 Equipment list for slope cutting

Operation	Equipment Type	Number	SWL dB(A) per piece
Breaking existing slope	Breaker (excavator mounted)	1	122
Removal of broken surface	Excavator	1	112
	Dump Truck	1	117

Installation of noise barrier

As far as noise level is concerned in operational stage, noise barrier of various forms need to be erected along the central median and kerbs of carriageway. The list of equipment that will be required for the task is given in Table 5.11.

Table 5.11 Equipment list for installation of noise barrier

Operation	Equipment Type	Number	SWL dB(A) per piece
Breaking existing surface	Breaker (silenced handheld)	1	110
Piling	Earth auger	1	114
Pile capping	Excavator	1	112
	Dump Truck	1	117
	Compressor (silenced)	1	100
	Concrete lorry mixer	1	109
	Vibratory Poker	1	113

Minor Works and Low Noise Activities

The remaining minor works will involve the use of low noise generating equipment. The works comprise of reinstatement of pedestrian/cycle track, street lighting, road markings, installation of TSIS equipments, fencing and landscaping.

5.1.4 Impact Assessment

The assessment of construction noise impacts is based on the work activities as described in Section 5.1.3. The assessment of noise impact on NSRs is confined to a distance of 300 metres from the construction noise sources. Table 5.12 summarises the assessment results. The locations of the various construction activities are indicated in Figure 5.1 (Drawings No. 90896/CN/001-010).

Table 5.12: Predicted Construction Noise Impacts

CONSTRUCTION ACTIVITY	FACADE NOISE LEVEL (Leq (30 mins) dB(A)) @															
	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	F22	F23	F25
HAUL ROAD CONSTRUCTION	66.8 (I,II) 85.1 (III)	65.1	70.5	68.9	63.9	64.9	67.9	68.1	67.2	71.2	73.8	69.6	69.6	67.6	-	61.5
REPROVISIONING OF CENTRAL MEDIAN	-	-	72.8	68.0	61.1	-	-	-	65.3	69.6	73.4	68.8	67.6	73.5	-	70.6
NEW ROAD CONSTRUCTION & PAVING	67.1	62.9	72.1	67.3	60.4	61.6	64.7	64.9	64.8	70.2	72.7	68.1	67.0	68.5	-	67.1
EXISTING ROAD RESURFACING	61.0	56.9	66.2	61.3	54.4	55.6	58.7	58.9	58.8	64.2	66.8	62.2	61.0	72.9	69.8	70.2
CULVERT EXTENSION	-	-	-	-	-	-	-	-	-	-	64.6	67.5	67.5	-	-	60.1
RECLAMATION	-	-	61.6	-	-	-	-	-	-	-	67.2	-	-	69.0	-	62.0
SEAWALL CONSTRUCTION	-	-	65.1	-	-	-	-	-	-	-	70.6	-	-	65.9	-	59.0
WORKSYARD	74.3	62.9	-	-	-	-	-	65.5	67.2	-	-	-	-	-	-	-
PEDESTRIAN SUBWAYS	63.0	-	-	63.5	-	-	-	62.7	-	68.6	-	-	-	-	-	-
SLOPE CUTTING	-	-	-	-	-	-	-	-	-	-	-	-	-	78.0	-	-
INSTALLATION OF NOISE BARRIER	60.0	64.3	74.7	69.0	-	-	-	69.8	66.7	71.7	75.9	72.5	65.1	-	65.9	77.6
WIDENING OF TAI HANG BRIDGE																
- REMOVAL OF REVETMENT & SHEET PILING	-	-	-	-	-	-	-	-	62.9	60.3	-	-	-	-	-	-
- PILE PLACEMENT	-	-	-	-	-	-	-	-	63.5	60.9	-	-	-	-	-	-
- PLACEMENT OF PREFABRICATED BEAMS	-	-	-	-	-	-	-	-	64.3	61.7	-	-	-	-	-	-
- IN-SITU CONCRETING	-	-	-	-	-	-	-	-	62.3	60.5	-	-	-	-	-	-
REPROVISIONING OF LABORATORY BRIDGE UNDER ALIGNMENT OPTION I																
- BORED PILES	61.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
- CONCRETING (BORED PILES)	58.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
- PILE CAP	67.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
- COLUMN (REINFORCEMENT)	58.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
- COLUMN (CONCRETING)	63.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
- PLACEMENT OF PREFABRICATED BEAMS	63.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
- ABUTMENT CONSTRUCTION	64.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
- ROAD SURFACE ON NEW BRIDGE	57.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
- DEMOLITION OF EXISTING BRIDGE	67.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

NOTES:- (I) Refers to Alignment Option I
(II) Refers to Alignment Option II
(III) Refers to Alignment Option III

NSRs F14 to F21, F24 and F26 are future developments that have been programmed for completion by year 2001 and beyond. Hence, these NSRs would not be subject to construction noise impacts from Tolo Highway widening.

For haul roads construction, most of the affected NSRs are expected to experience noise levels below 75 dB(A) except of F1 under alignment Option III. The proximity of the haul road to the facade is likely to generate noise levels exceeding 85 dB(A).

Reprovisioning of central median only involves sections of the alignment under parallel widening. It is predicted that the affected NSRs would experience noise levels below 75 dB(A).

For new road construction and paving, the closest NSRs are F11 at Care Village. Construction noise level is predicted to be approximately 73 dB(A). Hence, no exceedance of the daytime noise limit is expected from this activity.

For road resurfacing on existing carriageway, no noise problem is expected with the highest predicted noise levels at F11 to be approximately 67 dB(A) only.

Between reclamation and seawall construction, the latter activity is found to have more noise impact. However, noise levels arising from this activity at the critical facade is predicted to be approximately 71 dB(A), which is within the daytime noise limit.

Worksyard's activity is found to generate noise levels of up to 74.3 dB(A) at facade F1. Other satellite work sites tend to generate less noise. Hence, no breach on the daytime noise limit is anticipated.

Noise levels are calculated to be less than 70 dB(A) at the affected facades for the extension of subways and provision of temporary pedestrian/cyclists crossings.

For the northbound widening works, the nearest NSRs are F8 and F10. Both are over 300 metres away from the construction noise sources and hence the noise impact is considered negligible.

For slope cutting works at St. Christopher's Head, the nearest NSR is F22. The result of noise assessment reveals that the noise level of the said facade is expected to have 78 dB(A).

For noise barrier installation, no major noise problem is expected for all the sensitive receivers except for F11 and F25. The NSR F11 and F25 are expected to experience noise level of 76 and 78 dB(A) respectively. Noise mitigation measure needs to be investigated to minimise the noise impact.

For the widening of Tai Hang Bridge, the critical facades are F9 and F10, located some 250 metres to 300 metres away from the work area. Predicted construction noise levels are within the daytime noise limit. For Pak Shek Kok Bridge widening, construction noise is considered to have no impact on existing NSR which is over 300 metres away. Facades at Area 39 would not be affected as it come under proposed future developments.

Under Alignment Option I, the Laboratory Bridge is to be reprovisioned. The affected facade is F1, some 250 metres away. Predicted construction noise levels are expected to stay within the daytime noise limits. However, the removal and placement of structural beams is expected to take place over night time. NCO's Acceptable Noise Level (ANL) for ASR `C' is 55 dB(A). The calculated noise level for beam removal and placement is 63 dB(A). Hence, the NCO's noise limit will be breached for this activity during the night time. It is envisaged that the placement of beams will be carried out over 6 consecutive nights when lane closures are possible on Tolo Highway.

Upon completion of the new bridge, the existing bridge would be demolished. The removal of the beams would also be carried out at night with lane closures. This activity would be similar to beam placement as discussed above with the same effect on breaching the NCO's noise limit.

5.1.5 Proposal Mitigation Measures

The results of the noise assessment indicated that most of the construction activities will comply with the EPD's Practice Note for Professions Persons PN 2/93 and no mitigation measures are required.

In view of slope cutting works will be operated at St. Christopher Head, the noise level of the nearest facade (i.e., F22) is expected to exceed the established guideline. However, with the installation of temporary noise barrier, a noise reduction of about 10 dB (A) is expected to be achieved. As such, the day time noise limit could be met.

For the installation of noise barrier, the noise level for F11 and F25 are expected to be exceeded the established guideline with the installation of temporary noise barrier during the construction period, it is expected a noise reduction of about 10 dB(A) could be achieved and the noise levels of the said NSRs are expected to within the established guideline..

For haul roads construction under Option III, the NSR F1 is expected to experience noise level of 85 dB(A). Therefore, the NSR F1 shall be protected during the haul road construction by installing temporary noise barrier. It is expected that these barriers could achieve a noise reduction of about 10 dB(A) and the daytime noise limit could be met.

For the reprovisioning of Laboratory Bridge under Option I, the removal of existing beam and the placement of precast structural beam will breach the NCO's night time noise limit for about six days. However, no practical mitigation measures have been identified.

5.1.6 Conclusions

The construction noise assessment focused on the impact to existing NSR facades. The identified facades subject to future developments would not be affected over the construction period of Tolo Highway widening.

With most of the construction work assumed to be carried out over the daytime, 6 days a week excluding public holidays, the predicted noise levels at all facades arising from the various construction activities are found to be within the daytime noise limit of 75 dB(A), if quiet equipment are employed for all construction work and temporary noise barriers are provided for the construction of haul road near NSR F1 under Option III.

The noise impact arising from the night time construction for Alignment Option I would breach the NCO's ANL limits for about 6 days. However, no breach in noise limits at night is expected under Alignment Option II and III which are the preferred options.

5.2 Operational Noise Assessment

5.2.1 Assessment Criteria

Table 5.13 highlights the guidelines for road traffic noise as stipulated in the HKPSG. The guideline apply to landuses which rely on opened windows for ventilation in the peak hour in terms of L_{10} dB(A) 1 hr.

Table 5.13 HKPSG Road Traffic Noise Limits

Land Uses	Noise Levels dB(A)
Residential dwellings	70
Educational Institutions	65

The operation stage assessment covers the road traffic noise generated by the widened Tolo Highway. The assessment methodology follows those given in the Calculation of Road Traffic Noise, DoT/UK 1988 and the guidelines included in the HKPSG Chapter 9, Environment. For NSRs adversely affected by the increase in traffic noise, direct technical mitigation measures will be provided where possible and practical to satisfy the HKPSG standards.

The current ExCo directive "Equitable Redress for Persons Exposed to Increased Noise Resulting from the Use of New Roads, XCC(89)157" requires the implementation of direct technical remedies where possible and practical at the affected noise sensitive receivers to satisfy the Hong Kong Planning Standards and Guidelines (HKPSG) for noise. In case where direct technical remedies are not practical, indirect technical remedies, in the form of noise insulation, should be considered. The following criteria are used to determine whether a noise sensitive receiver would be eligible for consideration for indirect technical remedies.

(i) the predicted overall noise level from the new road together with other traffic noise in the vicinity must be above a specified noise level [eg. 70db(A) for domestic premises in L_{10}(1 hour)],

(ii) the predicted overall noise level is at least 1.0 dB(A) more than the prevailing traffic noise level, i.e., the total traffic noise level existing before the works to construct the road were commenced, and

(iii) the contribution to the increase in the predicted overall noise level from the new road must be at least 1.0 dB(A).

If the affected properties are satisfied with all of the above criteria, these properties are eligible for consideration in the application of indirect mitigation measures.

5.2.2 Future Traffic Flow Projections

The Study Brief requires the calculation of operation traffic noise to be based on the highest peak hour traffic projection for the appropriate design year within a period of 15 years after the opening of the widened Tolo Highway.

For this assessment, the 2011 AM Peak Hour traffic projection has been adopted as the worst case scenario in terms of traffic flows on Tolo Highway. The projection is based on the traffic forecast model developed specifically for this Feasibility Assignment and used for traffic impact assessment purposes.

Year 2011 is referred to as the long term planning horizon for which reliable growth trends pertaining to landuse and transportation are available from government agencies. In addition, two strategic transport links have been omitted from the traffic forecast model to derive the maximum traffic flow scenario for Tolo Highway. These transport links are:

(i) North-South Highway which connects Kowloon to the northeast Border Areas bypassing the new towns of Sha Tin, Tai Po and Fanling/Sheung Shui and
(ii) Route Y which is a high capacity cross border link between Northwest New Territories and Shekou (China).

It should be noted that the timing for the implementation of these transport links is uncertain and may take place after 2011. In any case, the traffic implication on Tolo Highway is such that a reduction in traffic flow would be expected.

The traffic flow projections on Tolo Highway used in the traffic noise impact assessment are shown in Table 5.14.

Table 5.14 : 2011 AM Peak Hour Traffic Projections on Tolo Highway

Parameter	Northbound	Southbound
Peak Hour Flow (veh/hr)	5,695	6,959
Percent Heavy Vehicles[a]	63%	36%
Design Speed (km/hr)	100	100

Note:- a. Heavy vehicle defined by unladen weight greater than 1,525 kg.
b. Friction course shall be the road surface material

5.2.3 Noise Impact Assessment

The assessment of operational noise impact on existing and planned development has been carried out. Noise impact on NSRs is confined to a distance of 300 metres from the widened Tolo Highway. Table 5.15 summarises the assessment results.

Chinese University Eastern Campus(NSF F1): Traffic noise levels of up to 76 dB(A) are expected at the staff quarters of the Institute of Biotechnology. The affected facades exposure to high traffic noise levels from the northwest whereas facades facing the south are shielded from traffic noise by the HKIB building.

Chinese University Main Campus(NSRs F2, F3, F4 & F5): The staff residence closest to the Tolo Highway is expected to experience noise levels of 79 dB(A). This includes Residence No. 10 and No.11. Residence No. 12 and No.13 can also expect noise levels which exceed the established guideline, about 75 dB(A). However, noise levels at Residence No. 7 , No. 8 and Xuesi Hall hostel are found to be less than 70 dB(A) and hence no mitigation measures will be necessary.

Chung Chi Campus(NSRs F23 and F24): Predicted traffic noise levels of up to 73 dB(A) are expected at the student hostel Block C24. The affected facade exposes to high traffic noise level from the northwest bound traffic. There are also two proposed hostel building (Block C33 and C34) in this campus. The expected noise levels are upto 77 dB(A).

Cheung Shue Tan(NSRs F6 and F18): It is expected that this village will undergo changes as part of development of Area 39. Future `R2' residential sites represented by facade F18 are proposed. A new access Road L39/1 fronting the village will be provided together with a large carpark and bus terminal. This is to service the planned Sports Centre and Tertiary Institutions located opposite. The maximum traffic noise contribution from Tolo Highway is found to be approximately 71 dB(A), just exceeding established guideline for residential uses.

Area 39(NSRs F15-F17, F19, F26): The key developments proposed for this area are the Sport Centre of Hong Kong Institute of Education, tertiary education institutions site and GIC sites. The sport centre is not noise sensitive. The noise levels of facades for the remaining sites are found to be very high with some exceeding 82 dB(A).

Tsui Hang: Similar to Cheung Shue Tan, this sparsely populated village zoned as Village Development area (VDA) has frontage access to Road L39/1. A `R3' residential site has been proposed in the vicinity represented by facade F7. Noise calculations indicated that noise levels will be 70 dB(A) and hence no mitigation measures will be required.

St. Christopher's Home Redevelopment(NSR F8): A low density residential development is currently under construction at this location identified as TPTL 135. The closest facades to Tolo Highway are expected to experience noise levels of 73 dB(A) exceeding the HKPSG limits.

San Wai(NSR F9): A low density residential development has been approved at TPTL 150 which is expected to be completed by 2001. Noise exposure to Tolo Highway is expected to reach 72 dB(A) which just exceeds the established guideline.

Tai Po Kau(NSR F10-F12 and F25): The Seaview Villa (Facade 10) bungalows which is located on the hills of Tai Po Kau overlooking the Tolo Harbour, are expected to experience high noise levels close to 79 dB(A) at the upper floor. Towards the north at a lower level, the KCRC Club Hostel and KCRC Staff Quarter also expected to experience high noise levels of 79 dB(A) and 83 dB(A) respectively from Tolo Highway. To the north, the newly completed low-rise residential units at Care Village is found to exceed the HKPSG limits marginally by 3 dB(A) at the upper floor.

Yuen Chau Tsai(NSR F13): The Island House Conservation Centre is likely to be affected by the Tolo Highway widening. The Centre is an educational institution and is located at the headland shielded by dense vegetation and trees. Noise levels are found to be 67 dB(A) exceeding the HKPSG limits marginally by 2 dB(A).

Pak Shek Kok Public Dump Reclamation Area(NSR F14): There is a tentative proposal to utilise the reclaimed area for the establishment of a Science Park, hotel and low density residential developments. This Study has assumed a NSR location at the northern edge of the reclaimed area. The affected facades are found to experience high noise level of about 84 dB(A).

5.2.4 PROPOSED MITIGATION MEASURES

General Philosophy

As some of the noise sensitive receivers will experience noise levels exceeding the HKPSG limit, mitigation measures need to provide as far as practicable to reduce the noise impact to established guideline.

For planning control such as building set-back and orientation of noise sensitive facades can mitigate part of the impact from the identified traffic noise. However, these mitigation measures at receivers are considered not effective as compared with mitigation at noise sources and it is usually applicable to planned development. Therefore, recommended mitigation measures at noise sources i.e. noise barrier should be proposed first along the Highway and the residual noise impact, if any, on planned development will then be tackled by planning control.

With the exposed coastal environment of the Tolo Highway, the evaluation of noise barriers is confined to vertical barriers and noise canopies. The use of enclosures should be avoided because of the physical constraints and wind conditions of the widened highway. Besides, there are other concerns such as enormous cost implication, maintenance difficulties and hindrance to accident recovery and fire fighting operations. For noise barriers lying in between the Tolo Highway and KCRC track as well as those flanked substantially on both sides of the carriageway , sound absorptive noise barriers should be used to reduce reflection of railway noise as well as road traffic noise to the developments nearby.

Some of the proposed noise barriers are included on the basis of the findings recommended in the Noise Impact Assessment for 24 Hour Opening of the Borders Crossings. Such barrier provision will further improve the effects of noise mitigation during the normal peak hour periods. Likewise, there are barriers canopies proposed in this project not just to satisfy the noise requirements but they are included for air quality reasons.

Noise Mitigation

The results of the assessment of noise barriers are tabulated in Table 5.15 below with the location of proposed barriers indicated in Figure 5.2 (Drawings No. 90896/ON/001 -010). The shape of the barriers are shown in Figure 5.3.

Chinese University Eastern Campus(NSF F1): A 3.5m vertical barrier (No. BA24) for a length of 250 metres along the edge of the southbound carriageway is proposed to reduce the predicted noise levels from 76 dB(A) to 70 dB(A) as required in the established guidelines for the affected staff quarters of HKIB. The proposed barrier can be of reflective type.

Chinese University Main Campus(NSRs F2, F3, F4 & F5): The identified NSRs are all existing residential development. Facade F2 is located away from Tolo Highway and it does not require any mitigation measures to meeting this HKPSG. The residential blocks represented by Facades 3 and 4 are subject to the noise impact from the road widening scheme. These residential blocks are also subject to night time noise impact from the cross border traffic which requires further mitigation measures.

A canopy of 5.5m x 2.5m (No. BA22) along the edge of the northbound carriageway over a length of 415 metres together with a 4 metres high vertical barrier (No. BA23) over a section of 515 metres at the median are proposed for Facades 3 and 4. The proposed 4 metre high central barrier need to increase the height to 5 metres over a length of 245 metres Barrier No. BA19 as indicated in Figures 5.7 (Drawing No. 90896/ON/008B) to protect the future developments (Facade F15 and F16) in Area 39.

As far as the implementation of the proposed noise barriers is concerned. The median barriers will includes Nos. BA19 and BA23. The proposed noise barriers and canopy would reduce night time noise levels back to the prevailing noise levels as measured prior to the opening of the border crossing for 24 hour operation. As a result, the predicted peak hour noise levels for Facade 3 would be below 63 dB(A) and likewise, the predicted noise levels at Facade 4 would be below 59 dB(A).

The other identified NSR within this campus also includes Facade F5 which away from Tolo Highway and would require no mitigation measure to satisfy the HKPSG.

Chung Chi Campus(NSRs F23 and F24): The affected hostels are expected to experience noise levels up to 73 dB(A). Facade F23 represents the existing hostel development. Facade 24 represents a planned hostel. To satisfy the HKPSG for the planned development, a 7 metre vertical barrier for a length of 475 metres and 220 metres of 2 metre high barrier (No. BA25) are required along the near side edge of the slip road from Ma Liu Shui Interchange (Barrier Nos. BA26 and BA30) together with the median barrier (No. BA29) which is a 5 metre vertical barrier. These vertical barriers are of absorptive type such that noise reflection can be reduced at the affected facades. With above proposed mitigation measures Facade 23 would also be beneficial and expected to achieve noise levels below 57 dB(A) in the peak hour periods.

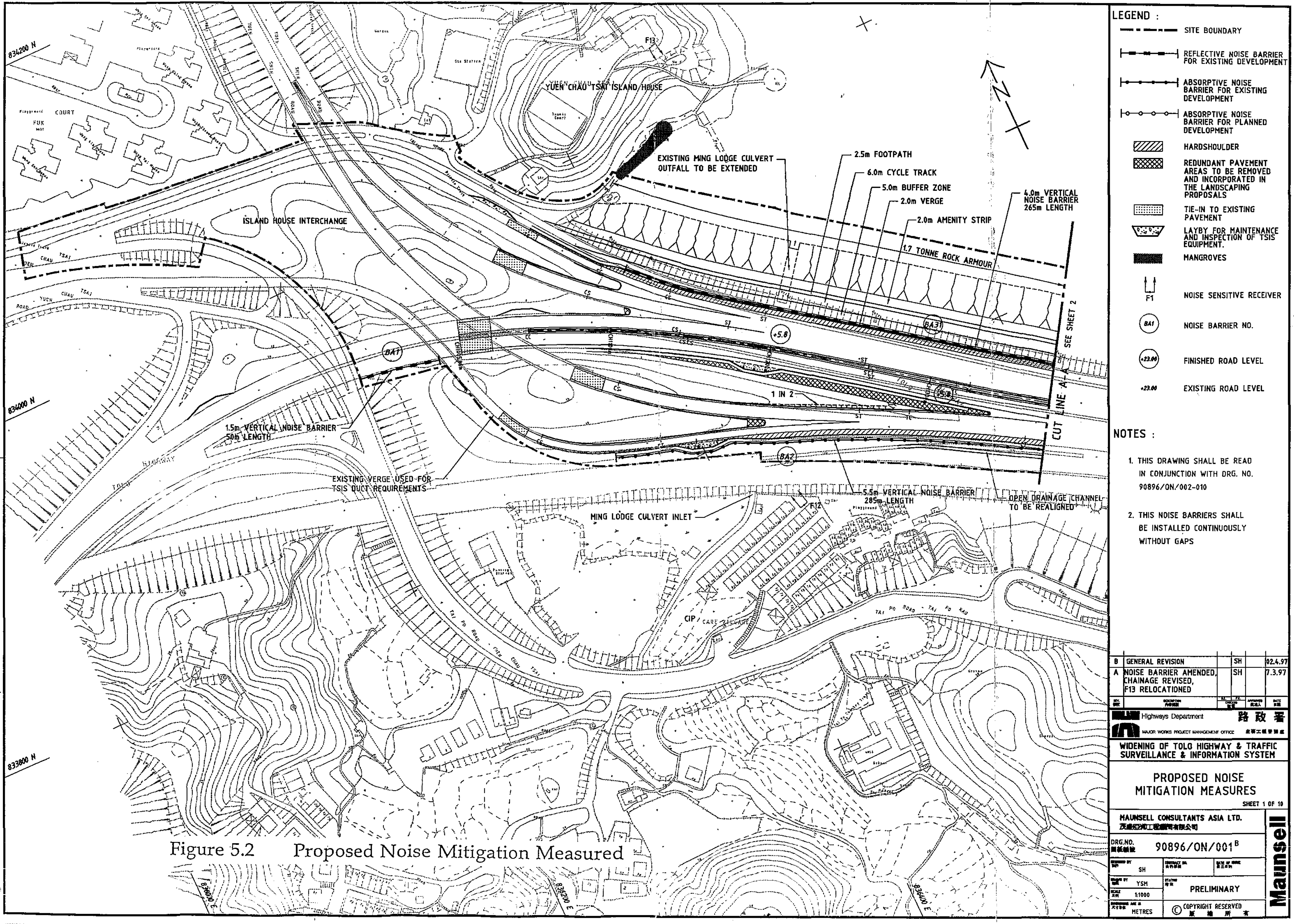


Figure 5.2 Proposed Noise Mitigation Measured

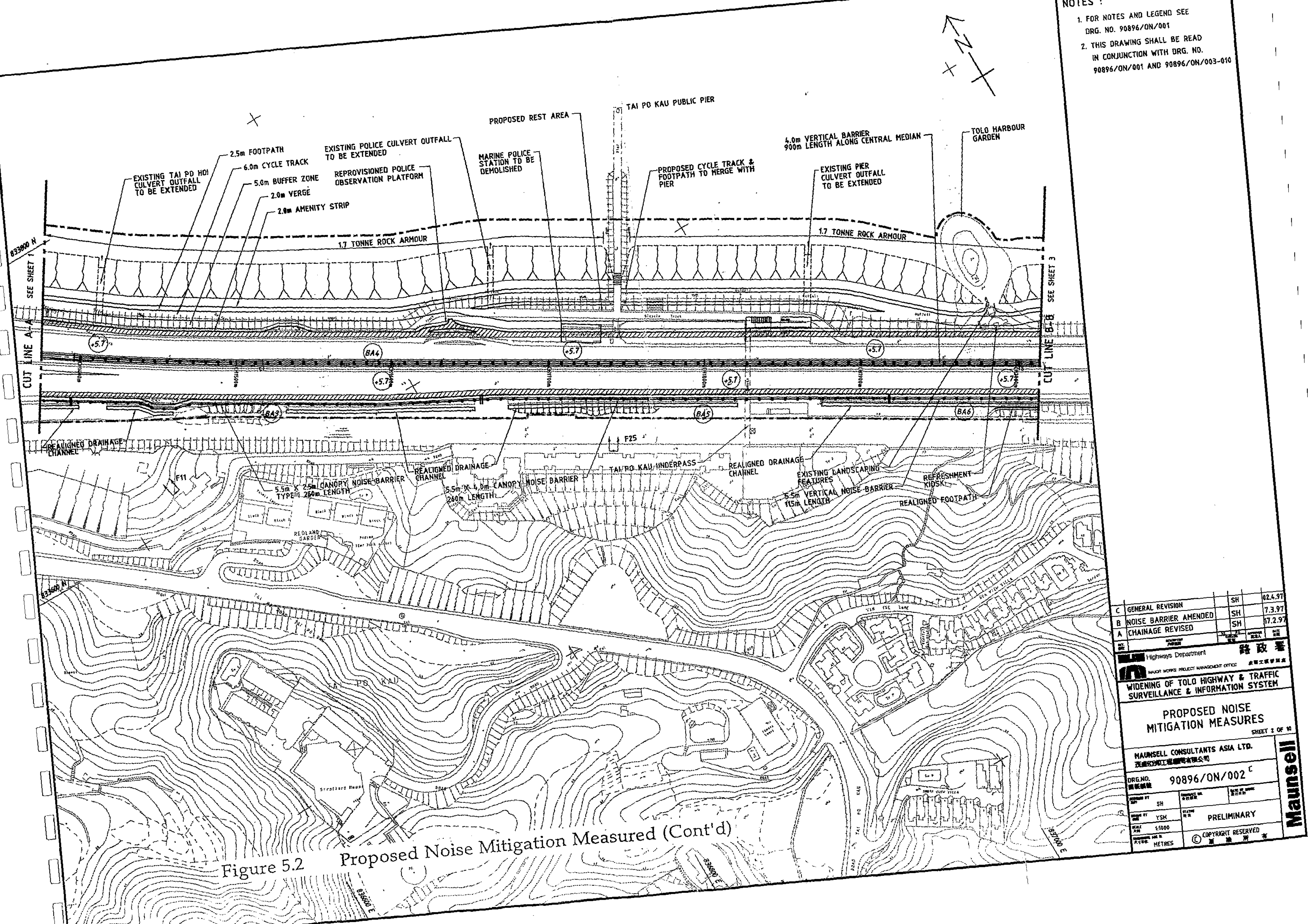


Figure 5.2 Proposed Noise Mitigation Measured (Cont'd)

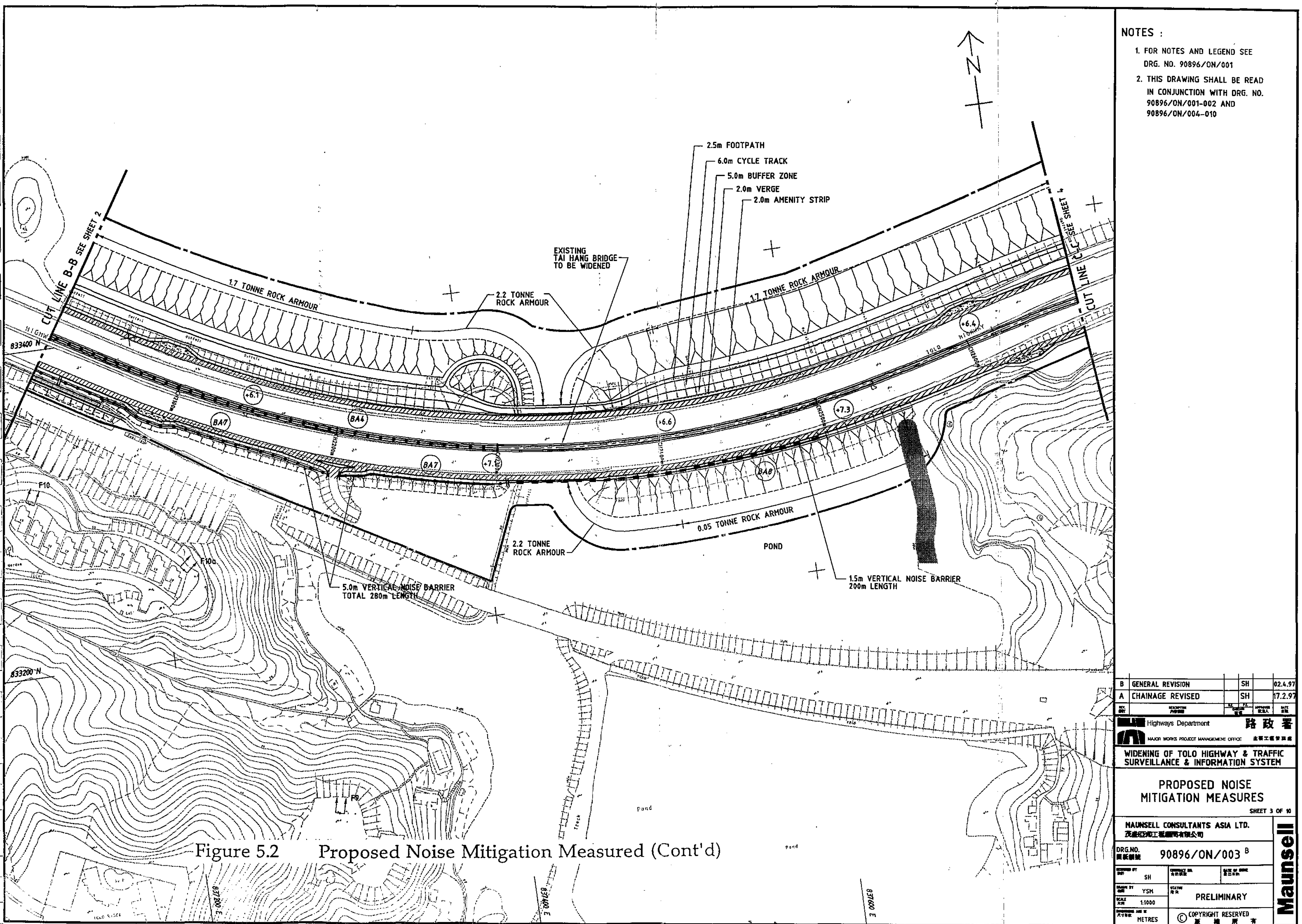


Figure 5.2 Proposed Noise Mitigation Measured (Cont'd)

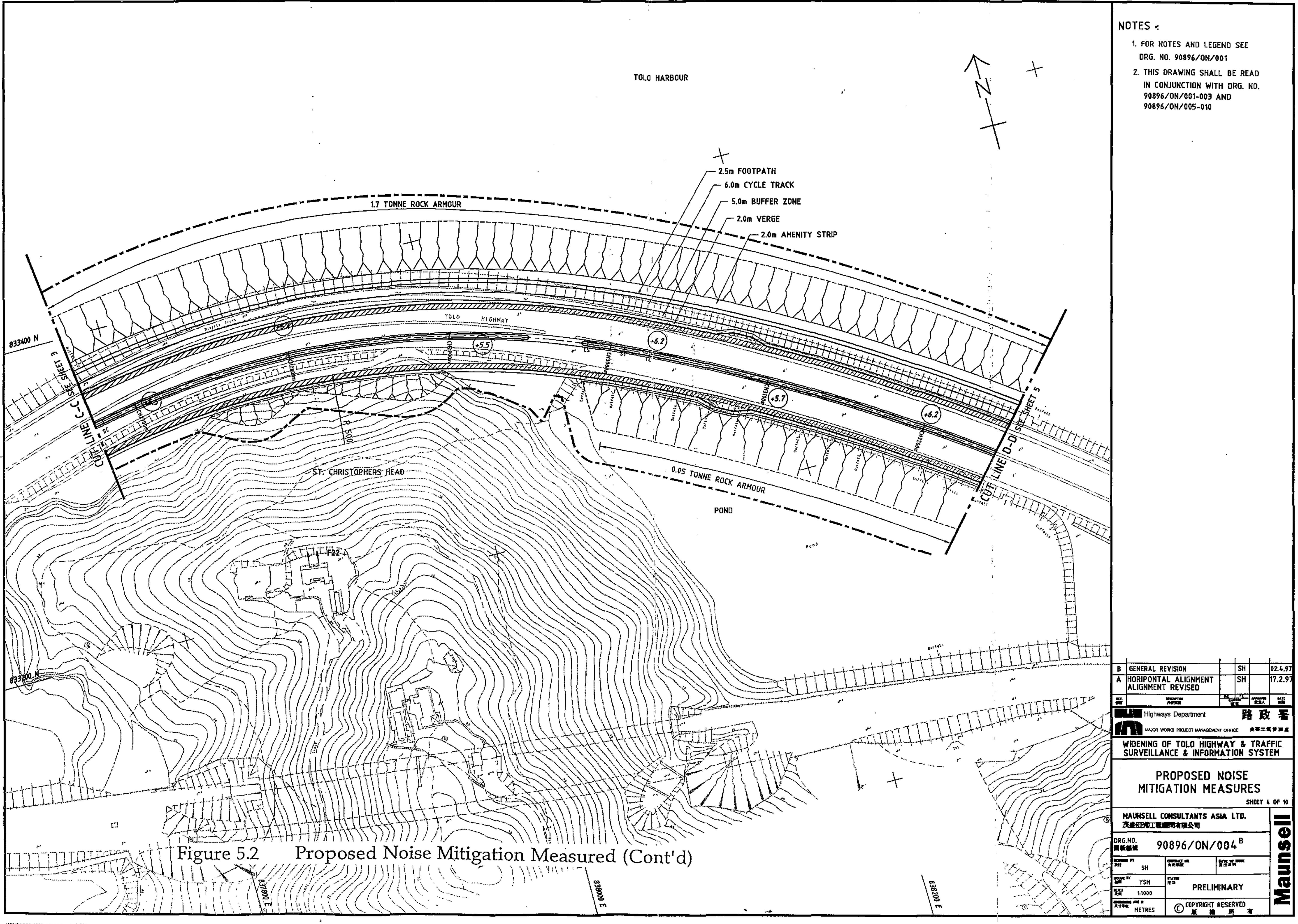
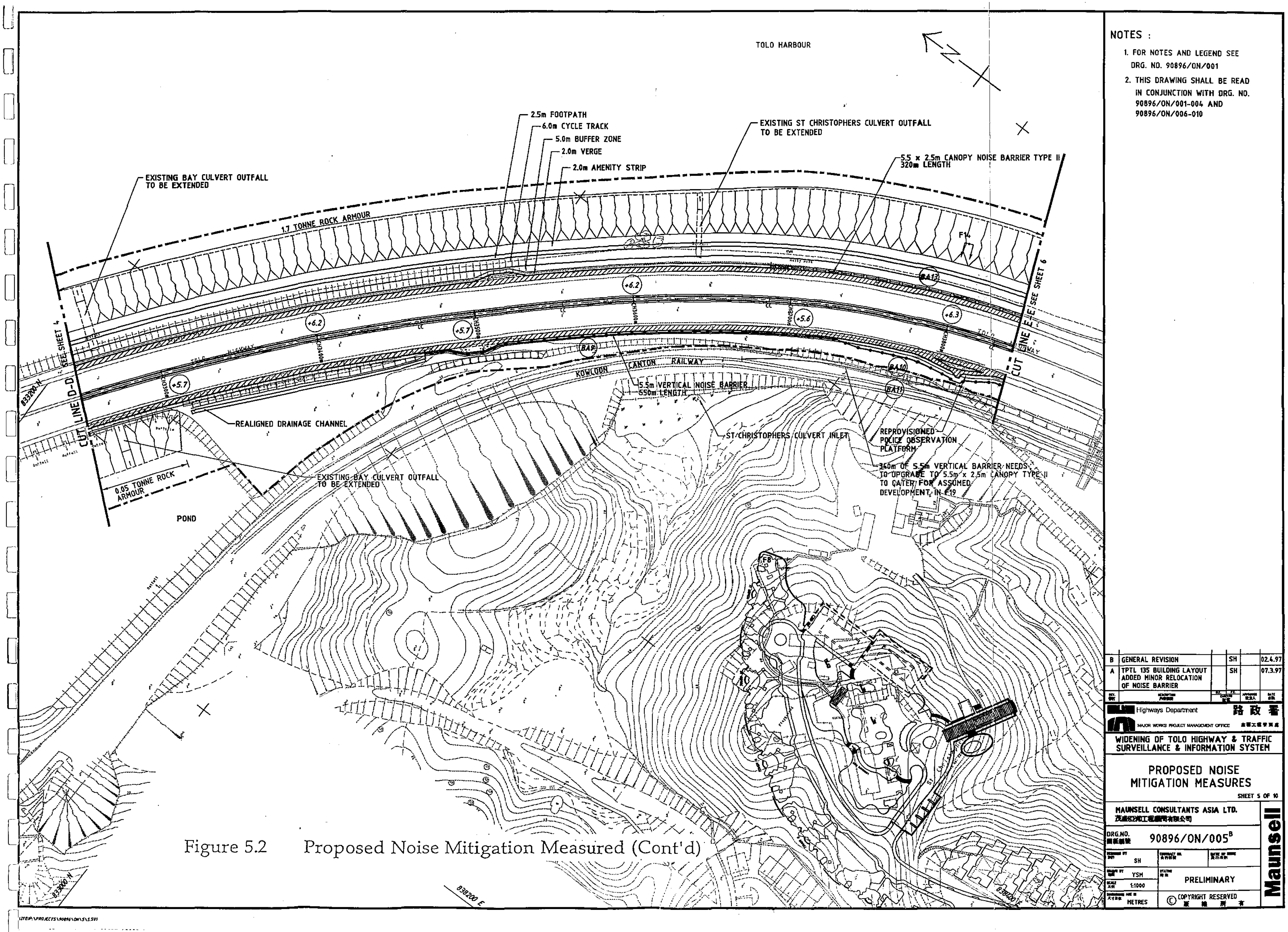


Figure 5.2 Proposed Noise Mitigation Measured (Cont'd)



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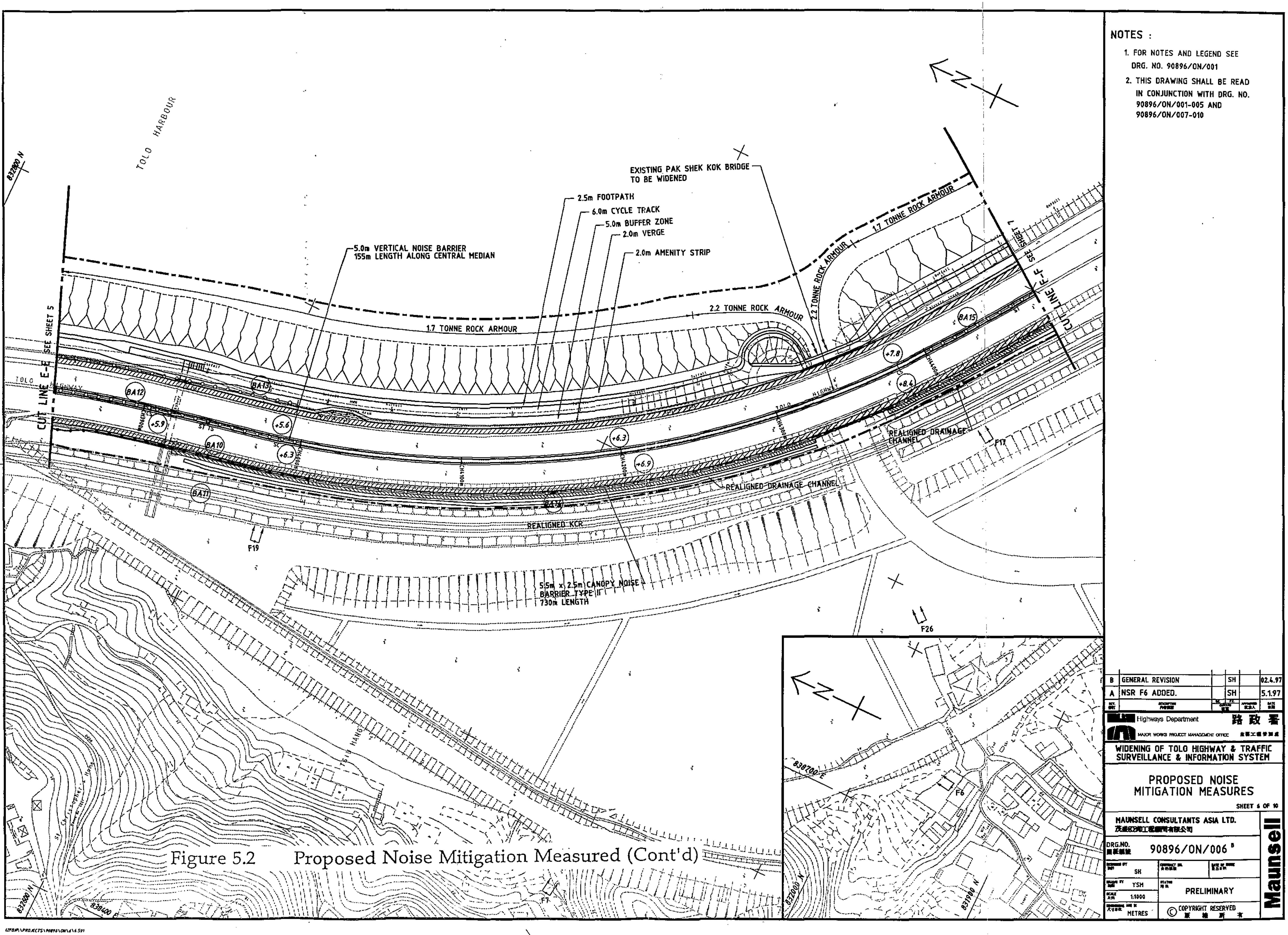


Figure 5.2 Proposed Noise Mitigation Measured (Cont'd)

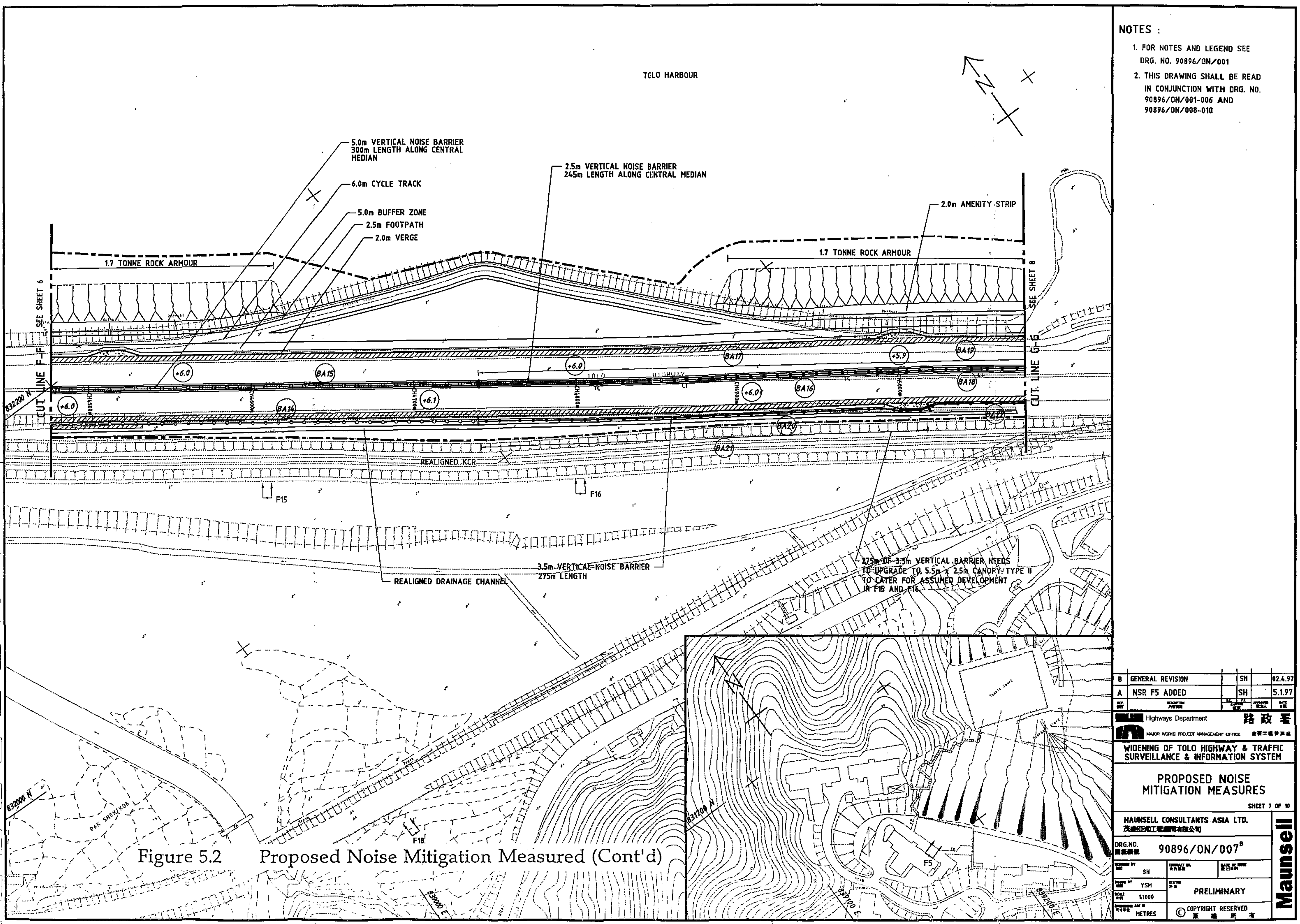


Figure 5.2 Proposed Noise Mitigation Measured (Cont'd)

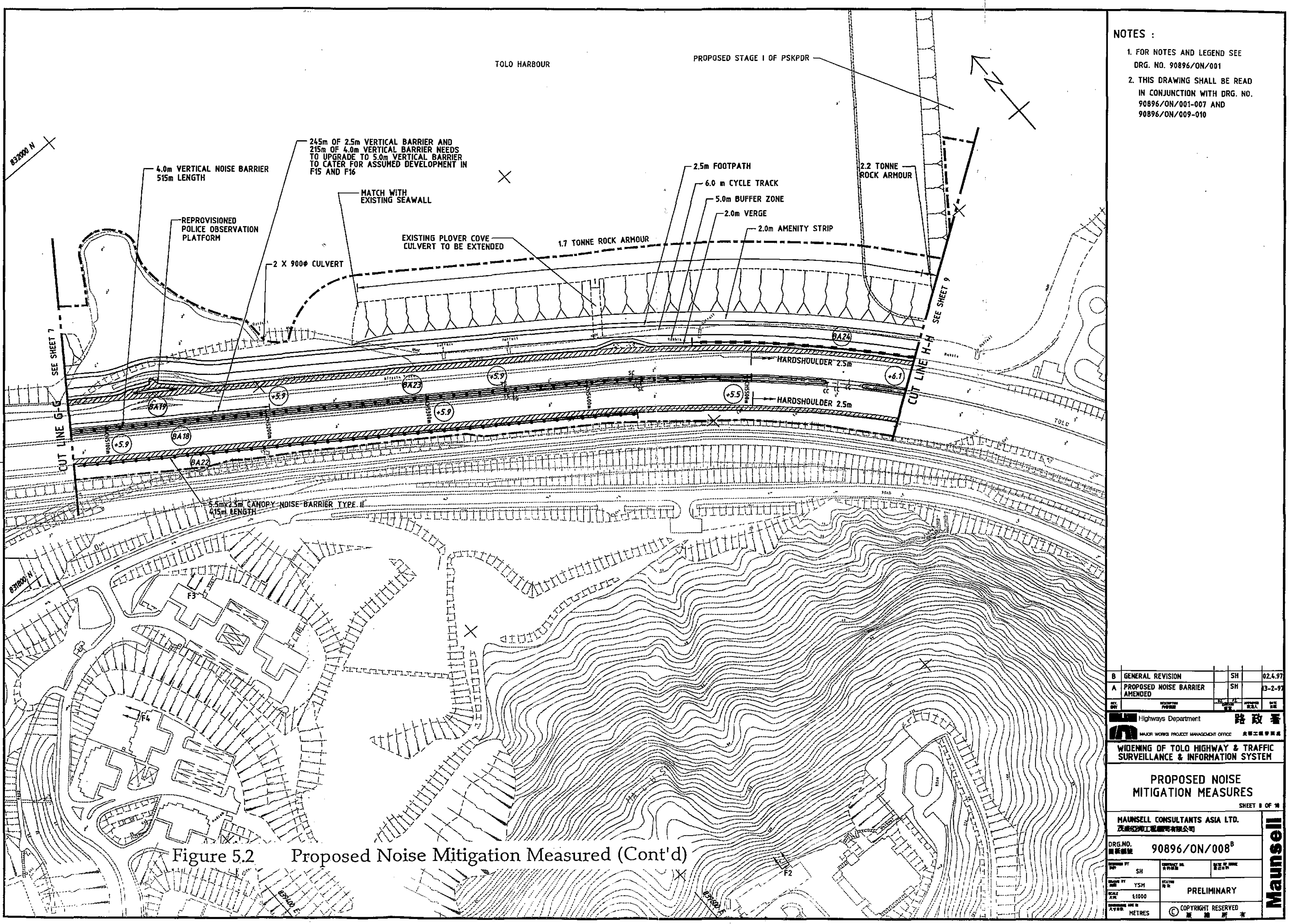
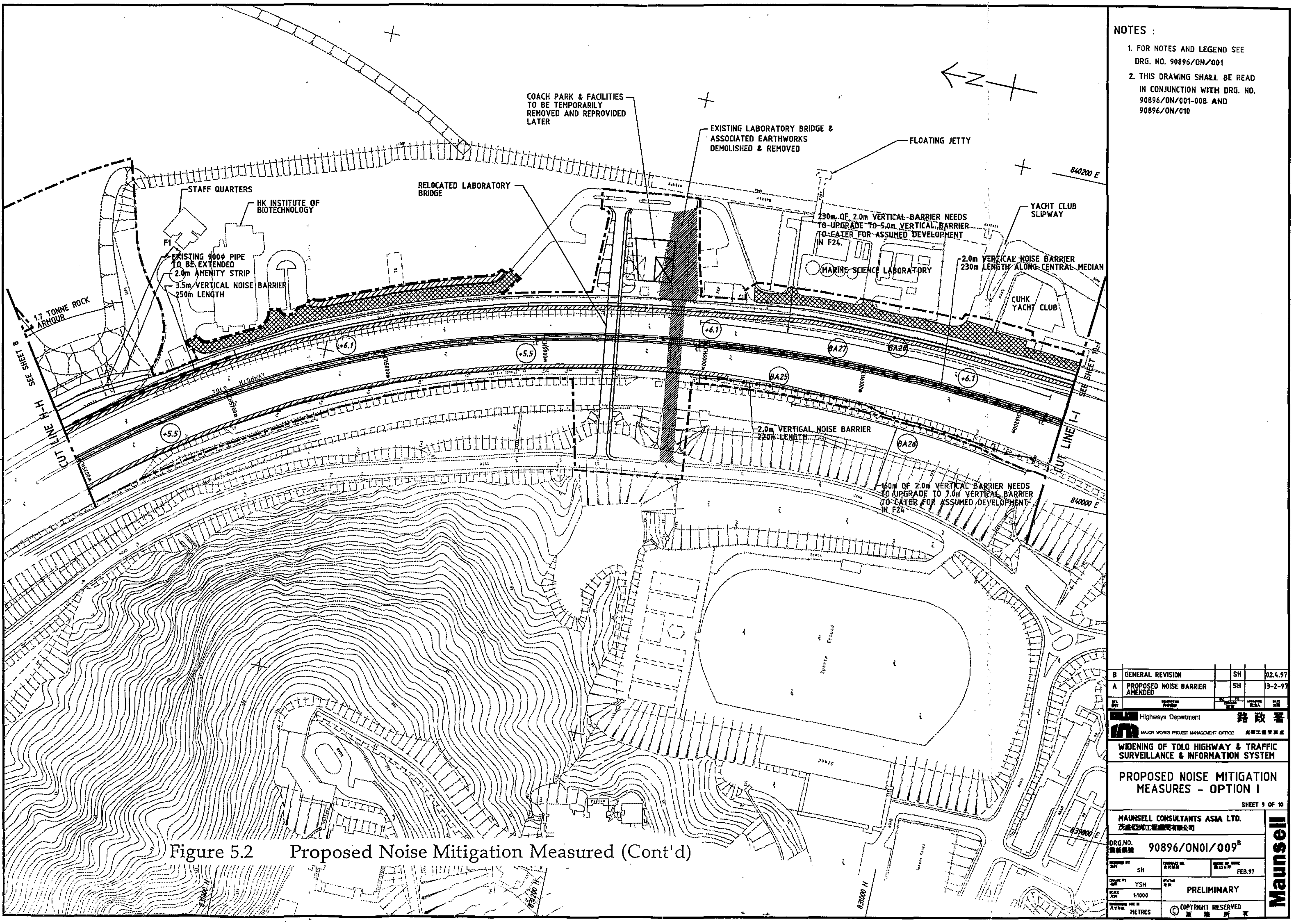


Figure 5.2 Proposed Noise Mitigation Measured (Cont'd)



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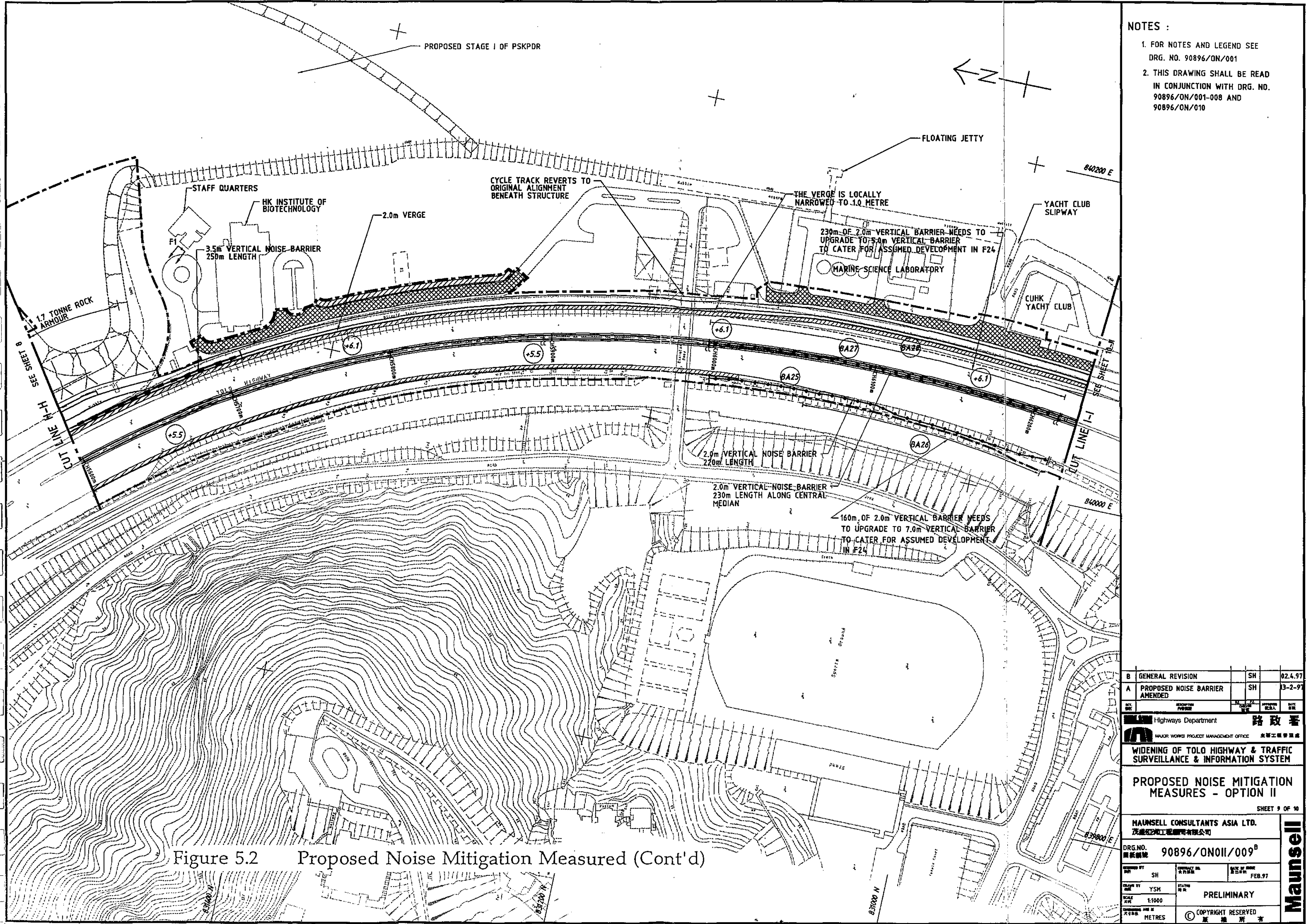

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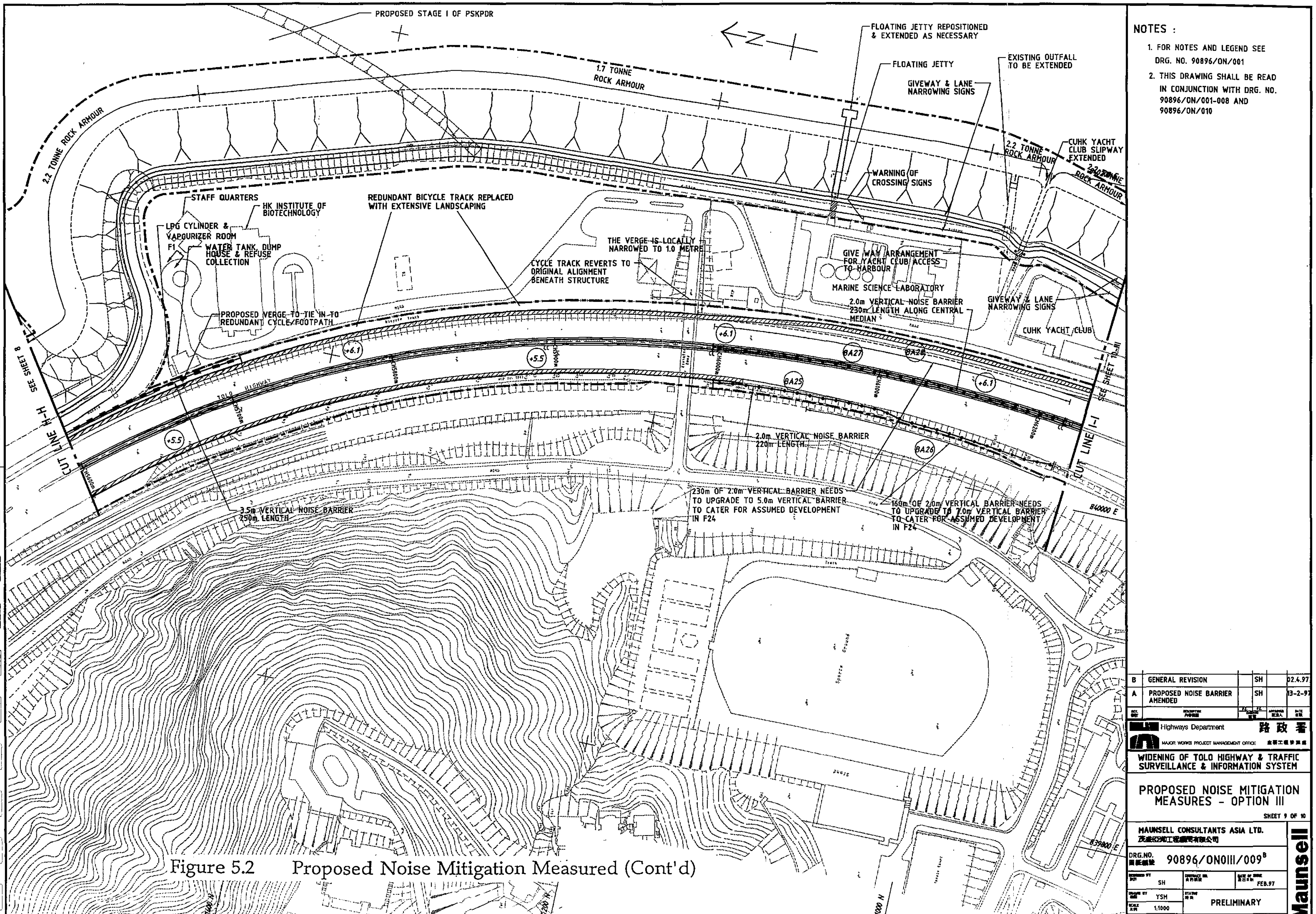

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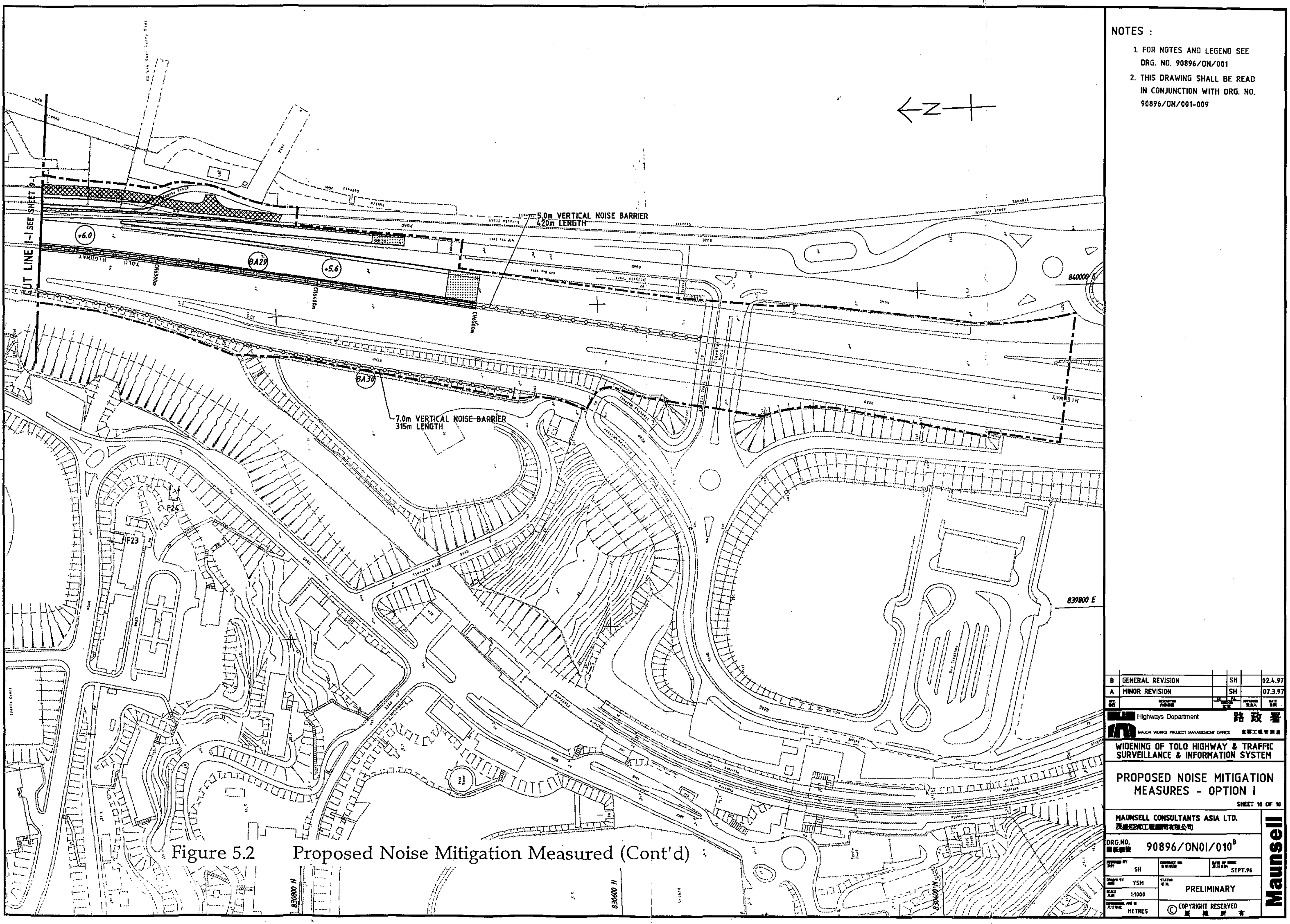

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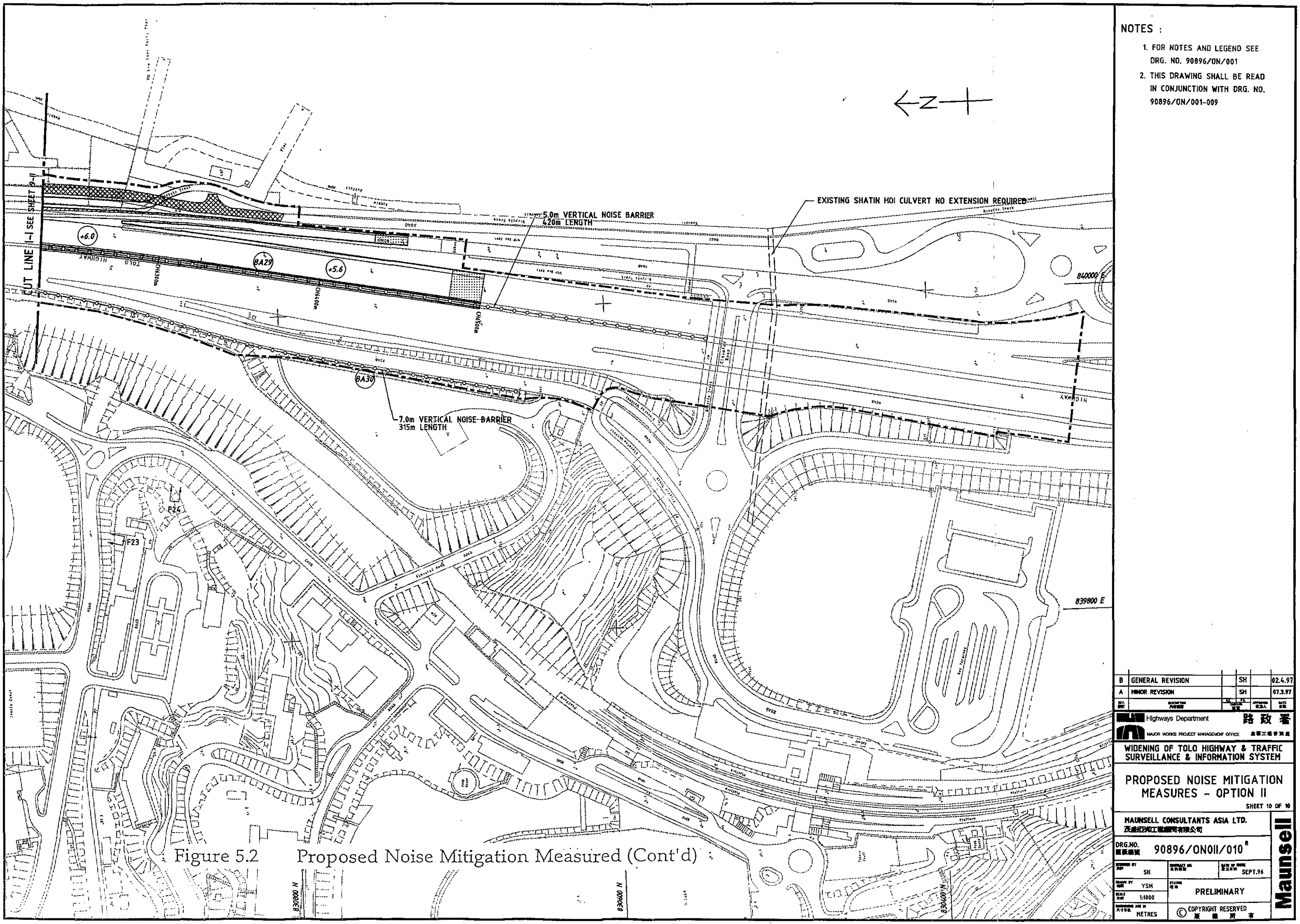


Figure 5.2 Proposed Noise Mitigation Measured (Cont'd)

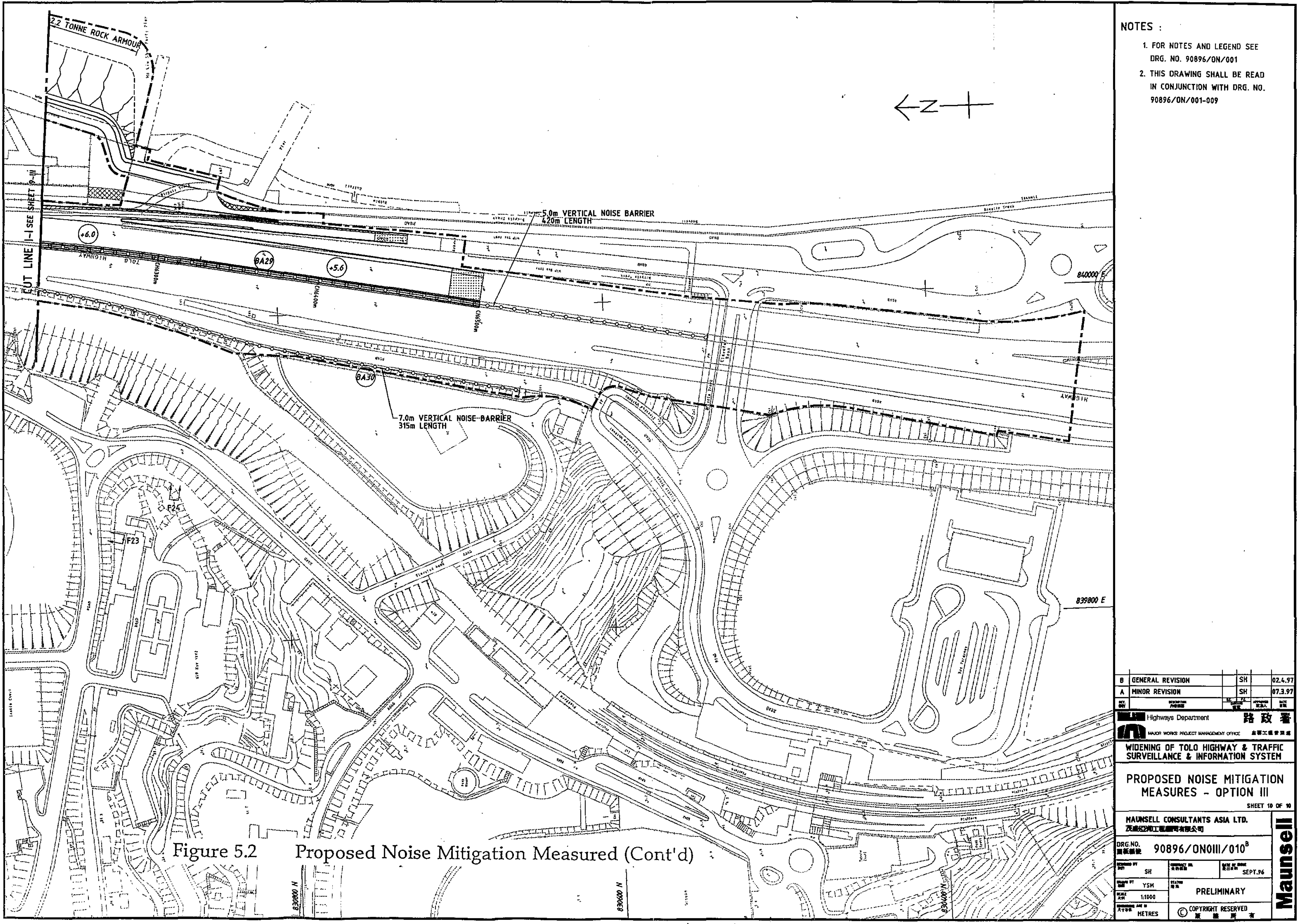
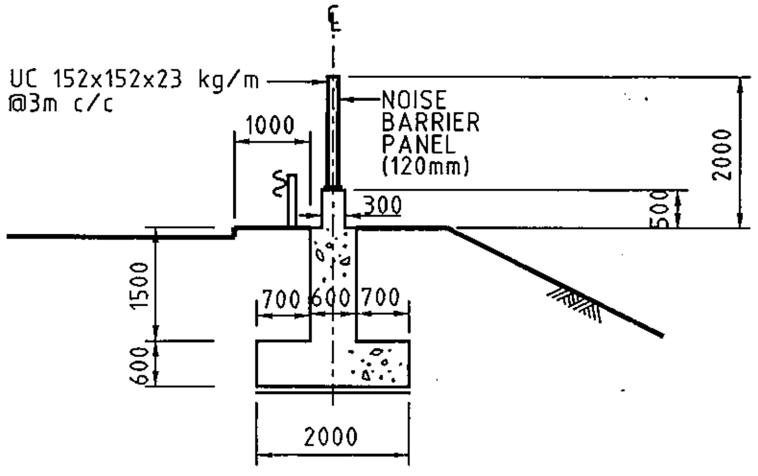
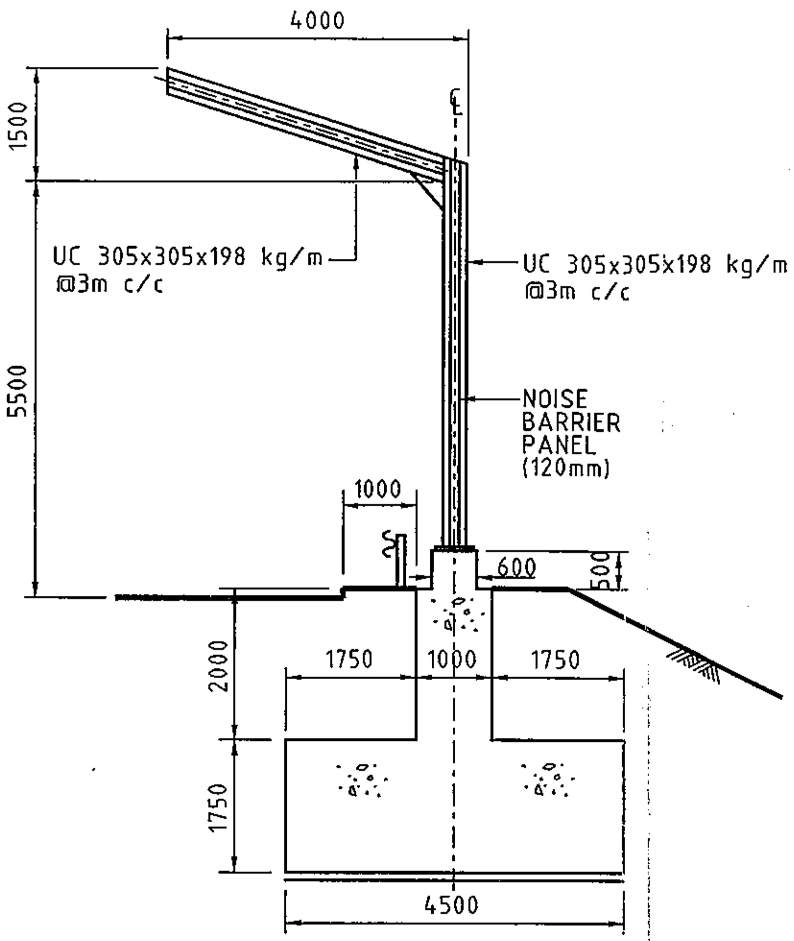


Figure 5.2 Proposed Noise Mitigation Measured (Cont'd)



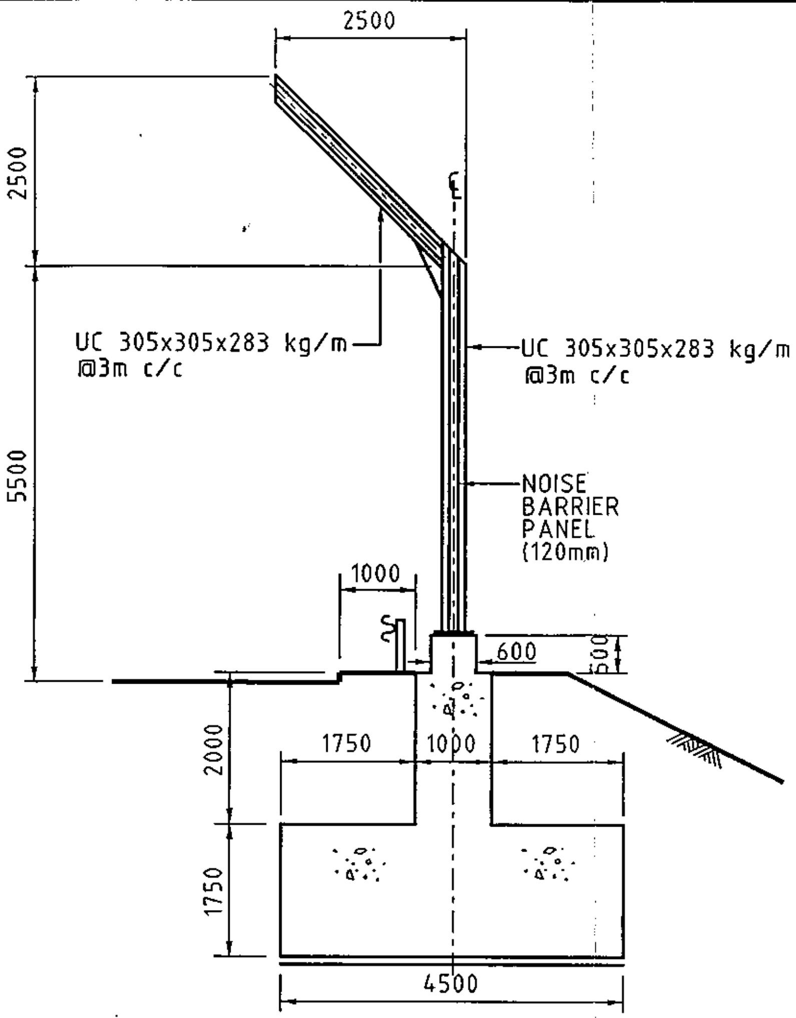
2-METRE VERTICAL BARRIER

SCALE 1:100



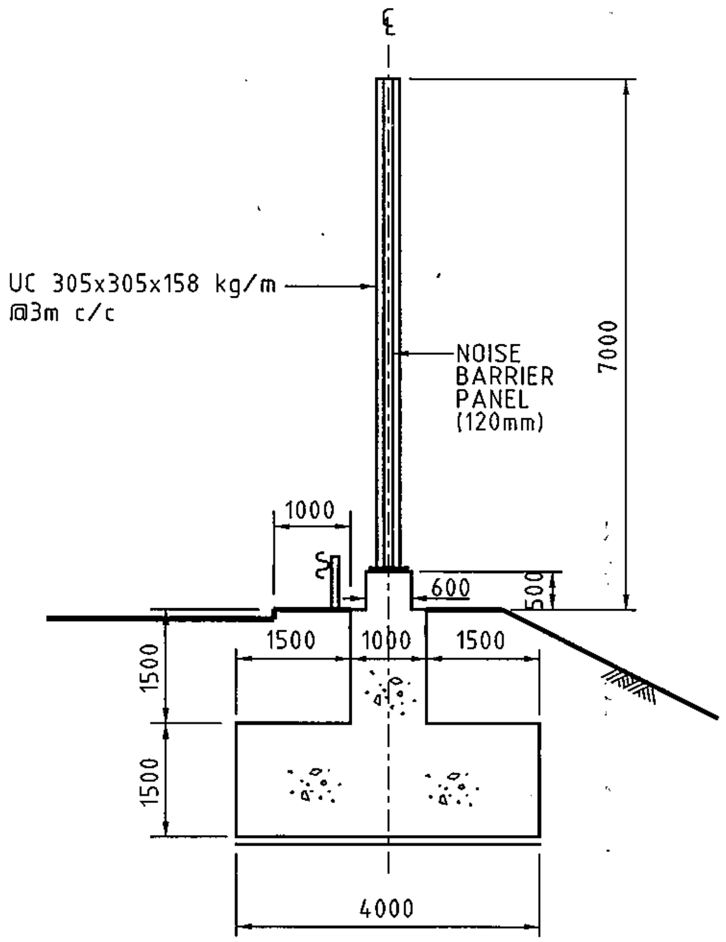
5.5mx4.0m CANOPY BARRIER

SCALE 1:100



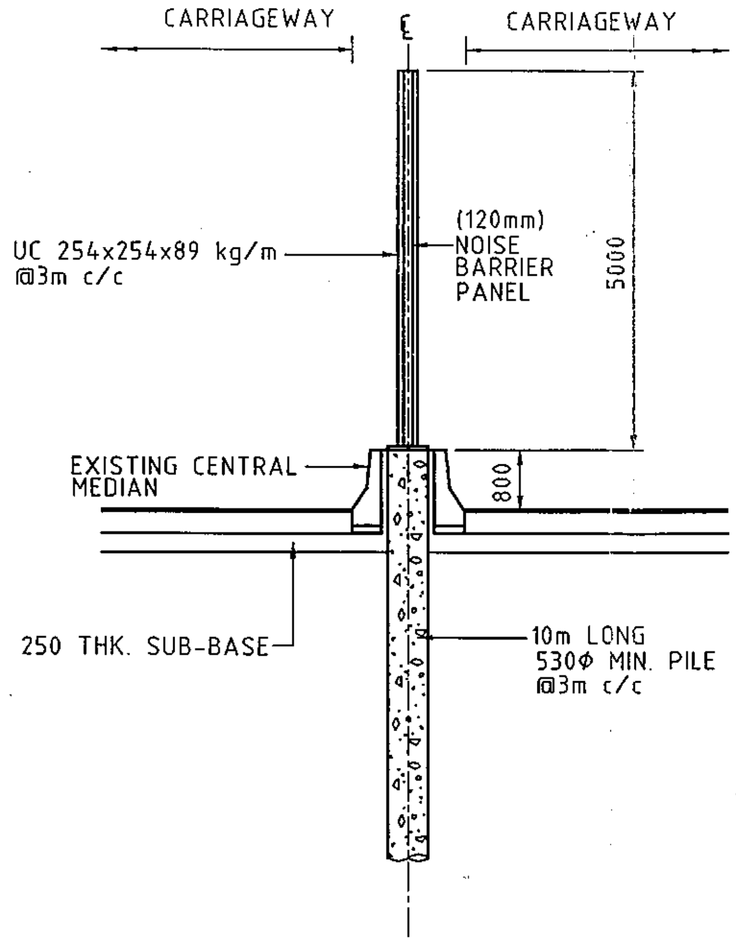
5.5mx2.5m CANOPY BARRIER TYPE II

SCALE 1:100



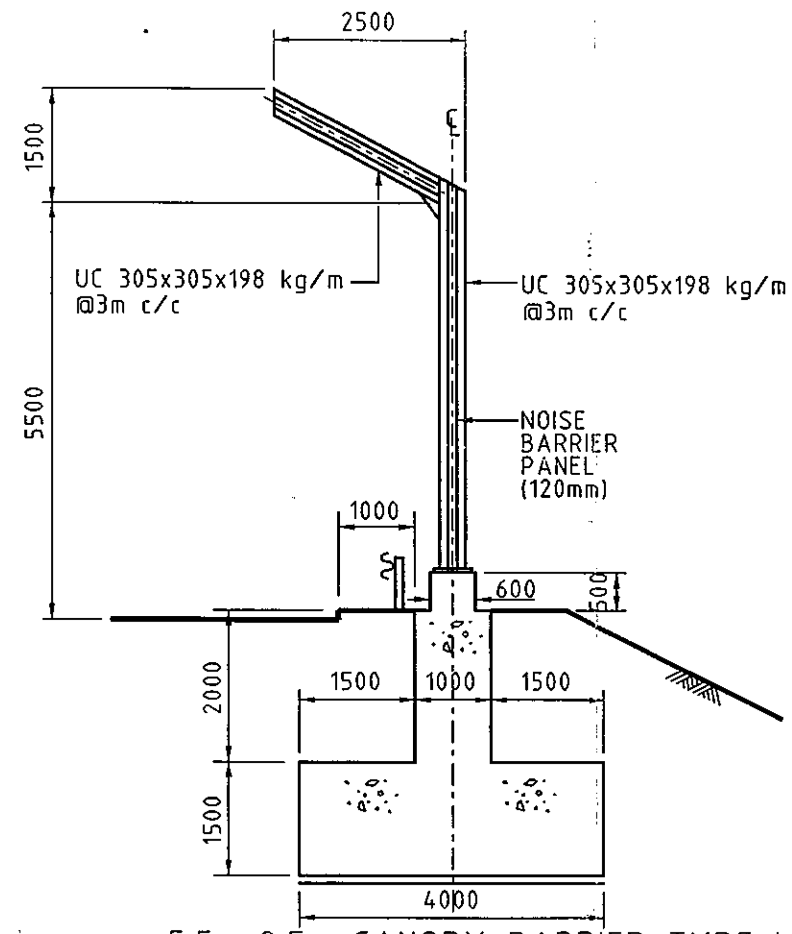
7-METRE VERTICAL BARRIER

SCALE 1:100



5-METRE HEIGHT BARRIER MOUNTED ON CENTRAL MEDIAN

SCALE 1:100



5.5mx2.5m CANOPY BARRIER TYPE I

SCALE 1:100

NOTES:

1. DIMENSIONS ARE IN MILLIMETRES.
2. DETAILS ARE INDICATIVE ONLY AND ARE SUBJECT TO DETAILED DESIGN. ASPECTS SUCH AS CLADDING WOULD BE SUBJECT TO VISUAL ASSESSMENT.
3. TRANSPARENT AND ABSORPTIVE NOISE BARRIER PANELS SHALL BE USED AT THE OVERHANG AND VERTICAL PORTIONS RESPECTIVELY OF THE CANOPY BARRIERS
4. TRANSPARENT OR ABSORPTIVE NOISE BARRIER PANELS SHALL BE USED FOR VERTICAL BARRIERS ACCORDING TO THE DRAWING NO. 90896/0N/001-010.

FIGURE 5.3
NOISE BARRIER

Highways Department 路政署

MAJOR WORKS PROJECT MANAGEMENT OFFICE 主要工程管理處

WIDENING OF TOLO HIGHWAY & TRAFFIC SURVEILLANCE & INFORMATION SYSTEM

TYPICAL NOISE BARRIER SECTIONS

SHEET 1 OF 2

MAUNSELL CONSULTANTS ASIA LTD.

DRG.NO. 90896/TD/010

R/M SEPT. 96

M.C PRELIMINARY

1:100

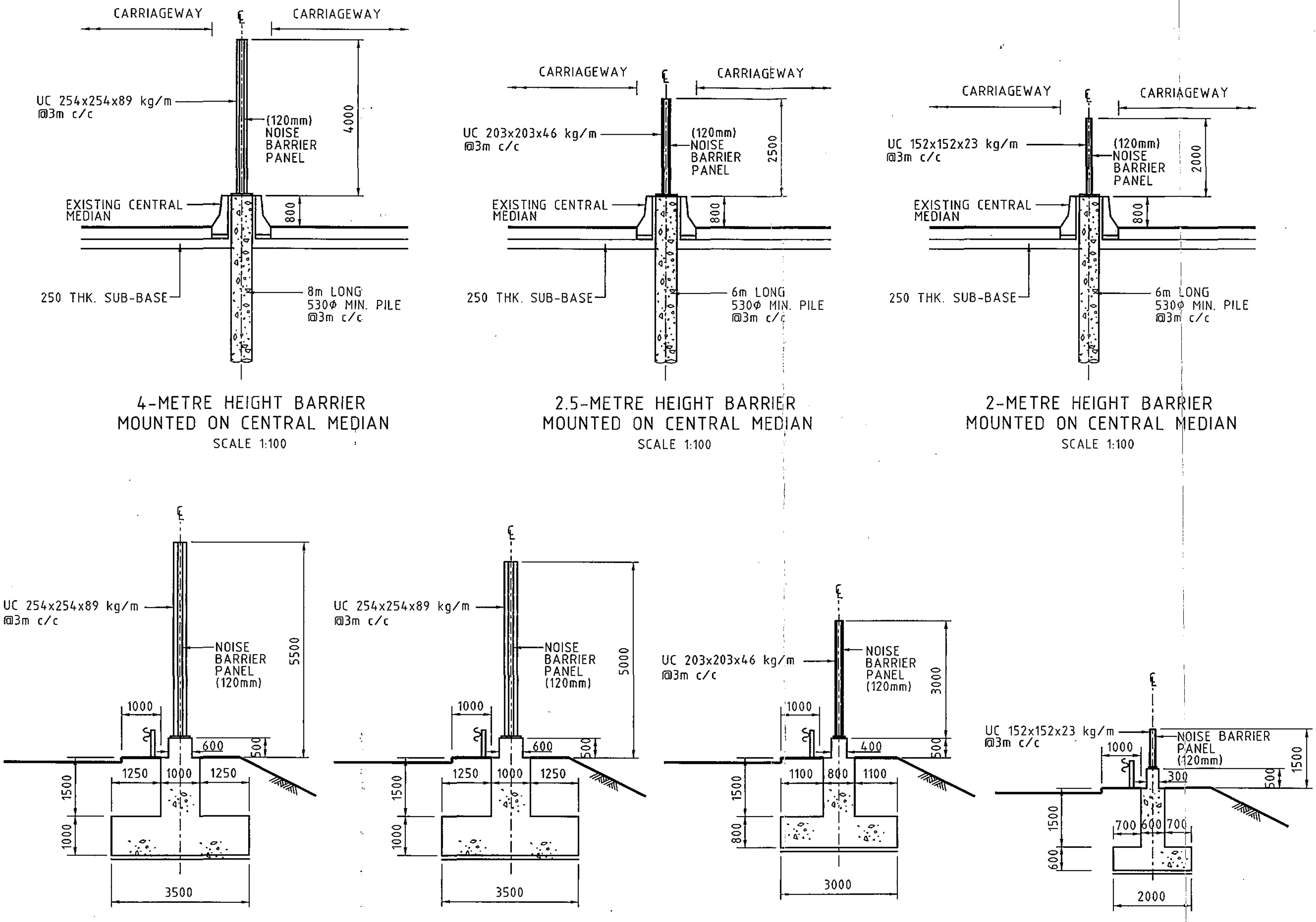
MILLIMETRES

Maunsell

(2FB) P:\PROJECTS\90896\TD\010.DGN

NOTES:

1. DIMENSIONS ARE IN MILLIMETRES.
2. DETAILS ARE INDICATIVE ONLY AND ARE SUBJECT TO DETAILED DESIGN. ASPECTS SUCH AS CLADDING WOULD BE SUBJECT TO VISUAL ASSESSMENT.
3. TRANSPARENT OR ABSORPTIVE NOISE BARRIER PANELS SHALL BE USED FOR VERTICAL BARRIERS ACCORDING TO THE DRAWING NO. 90896/0N/001-010.



4-METRE HEIGHT BARRIER MOUNTED ON CENTRAL MEDIAN
SCALE 1:100

2.5-METRE HEIGHT BARRIER MOUNTED ON CENTRAL MEDIAN
SCALE 1:100

2-METRE HEIGHT BARRIER MOUNTED ON CENTRAL MEDIAN
SCALE 1:100

5.5-METRE VERTICAL BARRIER
SCALE 1:100

5-METRE VERTICAL BARRIER
SCALE 1:100

3.5-METRE VERTICAL BARRIER
SCALE 1:100

1.5-METRE VERTICAL BARRIER
SCALE 1:100

FIGURE 5.3
NOISE BARRIER

Highways Department 路政署
MAJOR WORKS PROJECT MANAGEMENT OFFICE

WIDENING OF TOLO HIGHWAY & TRAFFIC SURVEILLANCE & INFORMATION SYSTEM

TYPICAL NOISE BARRIER SECTIONS

SHEET 2 OF 2

MAUNSELL CONSULTANTS ASIA LTD.

DRG.NO. 90896/TD/012

R.M | SEPT. 96
M.C | PRELIMINARY
1:100
MILLIMETRES

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(2FB) P:\PROJECTS\90896\TD\010.DGN

Cheung Shue Tan(NSRs F6 and F18): Both identified facades represent Cheung Shui Tan Village. No mitigation measures are required to satisfy the HKPSG but they are protected by the proposed noise canopy and median barriers for the future developments in Area 39 and expected to achieve noise levels below 53 dB(A) during the peak hour period. The proposed barriers include No. BA14, BA15, BA17 and BA21 as shown in Figure 5.2 (Drawing Nos. 90896/ON/006^{B} and 007^{B}).

Area 39(NSR F15 - F17, F19, F26): The key noise sensitive development include tertiary education institutions and GIC Sites which may be use for educational purposes. The representative facades include F15, F16, F17, F19 and F26 for those future development in Area 39. The proposed barriers include 275m length of 3.5 metre high vertical noise barrier (No. BA20) and a 5.5m x 2.5m noise canopy over a length of 730 metres (No. BA14) along the northbound carriageway. Barrier No. BA20 is included for the existing and committed development but it needs to be replaced by a 5.5m x 2.5m noise canopy to satisfy the recommendation from the Noise Impact Assessment for 24 hour Opening of Border Crossing Study.

In addition to the road side barrier, a 5m high vertical barrier is also required at the median over a length of 360 metres for the planned developments in Area 39. This median barrier includes Barrier Nos. BA15 and BA19 as shown in Figure 5.2 (Drawing Nos. 90896/ON/006^{B} and 007^{B}).

Tsui Hang(NSR F7): This site consists of a committed village type of development situated behind the planned development in Area 39. It has been identified that the affected residential buildings would have noise levels within the HKPSG. The development will also be protected by the proposed barriers along Tolo Highway and achieve predicted noise levels below 54 dB(A).

St. Christopher's Home Redevelopment(NSR F8): The proposed redevelopment which is represented by Facade F8 is to be low density residential development. The development requires the protection of a 5.5 metre high barrier (No. BA10) over a length of 550 metres along the edge of the northbound carriageway to achieve the HKPSG noise level.

San Wai(NSR F9): It is another committed low density development near Tai Po Kau. A 5 metre high vertical barrier (No. BA7) over a length of 280 metres along the northbound carriageway and a 4m high median barrier (No. BA4) which are mainly provided for Facades 10 and 10a provide the required noise mitigation for this development.

Tai Po Kau(NSR F10 - F12, and F25): For the existing residential development which is represented by Facades F10 and F10a requires the protection from Barrier Nos. BA6 and BA4, i.e. a 5 metre high vertical barrier on the road side and a 4 metre high barrier on the median. Both barriers need to be absorptive type to reduce the reflection.

The existing KCRC Staff Quarter presented by Facade F25 will also need the above median barrier and noise canopies (Nos. BA3 and BA5). These canopies are 5.5m x 2.5m and 5.5m x 4.0m respectively. The provision of these canopies is not just to satisfy the HKPSG noise requirement but it is also a way to reduce the impact due to vehicle exhaust emission on the road. As a result, the predicted noise levels at the KCRC Staff Quarter due to road traffic would be below 67 dB(A). The proposed barrier provision is also applied to Facade F11.

Facade 11 represents the KCRC Club Hostel which is experiencing noise levels up to 79dB(A). The proposed noise barriers for this development include barrier No. BA2, BA3 and BA4, i.e. a 5.5m x 2.5m canopy, 5.5m vertical barrier and a 4m vertical barrier at the median. Such provision would reduce the facade noise to 70 dB(A). This barrier system also provide addition protection to the existing village represented by F12.

Within the vicinity of Tai Po Kau, an existing development immediately adjacent to Tolo Highway is represented by Facade F12. The development requires part of a 5.5 metre vertical barrier (No. BA2) over a length of 285 meters along the near side carriageway and Barrier No. BA1 to the size of 1.5 metre high and 50 metre long to achieve the required level given in the HKPSG. Details are shown in Figure 5.2 (Drawing No. 90896/ON/001B).

Yuen Chau Tsai (NSR F13): The Affected development is the Island House Conservation center which is classified as Educational Institution. A proposed 4 m vertical barrier (No. BA31) for a length of 265 metres will reduce the noise levels below 65 dB(A).

Pak Shek Kok Public Dump Reclamation Area (NSR 14): This is an area under planning consideration. Facade F14 has been used as a typical location for assessment. Barrier No. BA13 is the proposed noise canopy with the size of 5.5 m x 2.5m for the future development. This canopy together with the median barrier for the committed development would reduce the noise levels at the lower floors to below 70 dB(A). Any high rise development would expect to have noise levels as high as 79 dB(A) at the location close to the carriageway. Further increase of the barrier provision entails the need for noise enclosure on both carriageways and it was found not practical. The planning of land uses at this site need careful consideration to comply with the HKPSG for residential development, simply set back of the building from the carriageway is not feasible to meet the HKPSG limits and special building design is required.

<u>Summary of Barrier Provision</u>

The proposed noise barriers including noise canopies for the existing/committed and planned future development are summarised in Table 5.16. There are 1894 total residential units which have been identified to have noise levels greater than 70 dB(A) prior to the proposed mitigation measures. No propriety has been identified to be eligibly for indirect noise mitigation measures. After the implementation of the proposed barriers, all affected households will comply with the HKPSG.

Table 5.15 Assessment of Noise Mitigation Measures

REPRESENTATIVE NOISE SENSITIVE RECEIVERS	NOISE STANDARD dB(A) L_{10} (1-hr)	LEVEL ABOVE GROUND (mPD)	NOISE LEVEL WITHOUT MITIGATION MEASURE dB(A) L_{10} (1-hr)	PROPOSED NOISE MITIGATION MEASURE FOR EXISTING NSRs	NOISE LEVEL WITH MITIGATION MEASURE FOR EXISTING NSRs dB(A) L_{10} (1-hr)	PROPOSED NOISE MITIGATION MEASURE FOR BOTH EXISTING AND PLANNED NSRs	NOISE LEVEL WITH MITIGATION MEASURE FOR BOTH EXISTING AND PLANNED NSRs FULLY IMPLEMENTED dB(A) L_{10} (1-hr)
F1	70	7	74	3.5m Vertical Barrier	65	3.5m Vertical Barrier	65
(Existing Residential)		10	75	(Barrier No. BA 24) at Road Edge	66	(Barrier No. BA24) at Road Edge	66
		13	76		67		67
		16	76		69		69
		19	76		70		70
F2	70	141	64	Not Required	59	N.A.	59
(Existing Residential)		147	70		68		68
		150	70		68		68
		153	70		68		68
		156	70		68		68
F3	70	35	79	5.5m x 2.5m Canopy	62	5.5m x 2.5m Canopy (Barrier	61
(Existing Residential)		41	79	(Barrier No. BA22*) at Road Edge &	63	No. BA22*) at Road Edge, 4.0m	62
		47	79	4.0m Vertical Barrier	63	and 5.0m Vertical Barrier	62
		53	79	(Barrier Nos. BA18* & BA23*) at	64	(Barrier Nos. BA19 & BA23*) at	63
		62	79	Central Median	65	Central Median	63
F4	70	46	73	3.5m Vertical Barrier	60	5.5m x 2.5m Canopy	57
(Existing Residential)		52	74	(Barrier No. BA20*) & 5.5m x 2.5m	61	(Barrier No. BA21 & BA22*) at	57
		58	75	Canopy (Barrier No. BA22*) at Road	61	Road Edge & 5.0m Vertical	57
		76	75	Edge, 2.5m &4.0m Vertical Barrier	62	Barrier(Barrier No. BA17 &	58
		82	75	(Barrier Nos. BA16* &BA18*) at Central Median	63	BA19) at Central Median	59

REPRESENTATIVE NOISE SENSITIVE RECEIVERS	NOISE STANDARD dB(A) L_{10} (1-hr)	LEVEL ABOVE GROUND (mPD)	NOISE LEVEL WITHOUT MITIGATION MEASURE dB(A) L_{10} (1-hr)	PROPOSED NOISE MITIGATION MEASURE FOR EXISTING NSRs	NOISE LEVEL WITH MITIGATION MEASURE FOR EXISTING NSRs dB(A) L_{10} (1-hr)	PROPOSED NOISE MITIGATION MEASURE FOR BOTH EXISTING AND PLANNED NSRs	NOISE LEVEL WITH MITIGATION MEASURE FOR BOTH EXISTING AND PLANNED NSRs FULLY IMPLEMENTED dB(A) L_{10} (1-hr)
F5 (Existing Residential)	70	71	61	Not Required	49	N.A.	47
		77	67		54		50
		83	68		55		51
		89	68		55		51
		98	68		55		51
F6 (Existing Residential)	70	11	69	Not Required	69	N.A.	52
		17	69		69		53
F7 (Committed future Residential)	70	11	70	Not Required	70	N.A.	54
		14	70		70		54
		17	70		70		54
F8 (Existing Residential)	70	48.9	66	5.5m Vertical Barrier (Barrier Nos. BA9 & BA10) at Road Edge	63	5.5m Vertical Barrier (Barrier No. BA9) & 5.5m x 2.5m Canopy Barrier No. BA11) at Road Edge, 5.0m Vertical Barrier (Barrier No. BA12*) at Central Median	59
		51.9	68		65		61
		57.9	70		68		62
		60.9	72		70		63
		63.9	73		70		64
F9 (Existing Residential)	70	33.9	71	5.0m x 1.5m Vertical Barrier (Barrier Nos. BA7 & BA8) at Road Edge, 4.0m Vertical Barrier (Barrier No. BA4) at Central Median	64	5.0m x 1.5m Vertical Barrier (Barrier Nos. BA7 & BA8) at Road Edge, 4.0m Vertical Barrier (Barrier No. BA4) at Central Median	64
		36.9	71		65		65
		39.9	71		65		65
		42.9	72		65		65
		45.9	72		66		66

REPRESENTATIVE NOISE SENSITIVE RECEIVERS	NOISE STANDARD dB(A) L_{10} (1-hr)	LEVEL ABOVE GROUND (mPD)	NOISE LEVEL WITHOUT MITIGATION MEASURE dB(A) L_{10} (1-hr)	PROPOSED NOISE MITIGATION MEASURE FOR EXISTING NSRs	NOISE LEVEL WITH MITIGATION MEASURE FOR EXISTING NSRs dB(A) L_{10} (1-hr)	PROPOSED NOISE MITIGATION MEASURE FOR BOTH EXISTING AND PLANNED NSRs	NOISE LEVEL WITH MITIGATION MEASURE FOR BOTH EXISTING AND PLANNED NSRs FULLY IMPLEMENTED dB(A) L_{10} (1-hr)
F10 (Existing Residential)	70	44.8	78	5.5m x 4.0m Canopy (Barrier No. BA5**) & 5.5m Vertical Barrier (Barrier No. BA6) & 5.0m Vertical Barrier (Barrier No. BA7) at Road Edge, 4.0m Vertical Barrier (Barrier No. BA4) at Central Median	66	5.5m x 4.0m Canopy (Barrier No. BA5**), 5.5m Vertical Barrier (Barrier No. BA6) & 5.0m Vertical Barrier (Barrier No. BA7) at Road Edge, 4.0m Vertical Barrier (Barrier No. BA4) at Central Median	66
		47.8	79		67		67
F10a (Existing Residential)		44.8	80		69		69
		47.8	81		70		70
F11 (Existing Residential)	70	15	78	5.5m Vertical Barrier (Barrier No. BA2) & 5.5m x 2.5m Canopy (Barrier No. BA3**) at Road Edge, 4.0m Vertical Barrier (Barrier No. BA4) at Central Median	63	5.5m Vertical Barrier (Barrier No. BA2) & 5.5m x 2.5m Canopy (Barrier No. BA3**) at Road Edge,4.0m Vertical Barrier (Barrier No.BA4) at Central Median	63
		21	79		66		66
		24	79		68		68
		27	79		69		69
		30	79		70		70
F12 (Existing Residential)	70	6.5	73	1.5m and 5.5m Vertical Barrier (Barrier Nos. BA1 & BA2) at Road Edge	65	1.5m x 5.5m Vertical Barrier (Barrier Nos. BA1 & BA2) at Road Edge	65
		9.5	75		66		66
		12.5	77		68		68
F13 (Research Institution)	65	17.2	67	4.0m Vertical Barrier (Barrier No. BA31) at Road Edge	64	4.0m Vertical Barrier (Barrier Nos.BA1 & BA2) at Road Edge	64
		20.2	67		65		65
F14 (Planned Residential)	70	6.5	79	N.A.	-	5.5m x 2.5m Canopy (Barrier No. BA13) at Road Edge, 5.0m Vertical Barrier (Barrier No. BA12) at Central Median	63
		15.5	83		-		68
		21.5	84		-		73
		27.5	84		-		78
		33.5	84		-		79
		36.5	83		-		79
		51.5	83		-		79
		63.5	82		-		79

REPRESENTATIVE NOISE SENSITIVE RECEIVERS	NOISE STANDARD dB(A) L_{10} (1-hr)	LEVEL ABOVE GROUND (mPD)	NOISE LEVEL WITHOUT MITIGATION MEASURE dB(A) L_{10} (1-hr)	PROPOSED NOISE MITIGATION MEASURE FOR EXISTING NSRs	NOISE LEVEL WITH MITIGATION MEASURE FOR EXISTING NSRs dB(A) L_{10} (1-hr)	PROPOSED NOISE MITIGATION MEASURE FOR BOTH EXISTING AND PLANNED NSRs	NOISE LEVEL WITH MITIGATION MEASURE FOR BOTH EXISTING AND PLANNED NSRs FULLY IMPLEMENTED dB(A) L_{10} (1-hr)
F15 (Planned G1C)	65	6.7	79	N.A.	-	5.5m x 2.5m Canopy (Barrier Nos.BA14 & BA21) at Road Edge, 5.0m Vertical Barrier (Barrier Nos. BA15 & BA17) at Central Median	60
		12.7	81		-		62
		15.7	81		-		63
		18.7	81		-		63
		21.7	82		-		65
F16 (Planned G1C)	65	6.7	79	N.A.	-	5.5m x 2.5m Canopy (Barrier Nos.BA14, BA21 & BA22*) at Road Edge, 5.0m Vertical Barrier (Barrier Nos.BA15, BA17 & BA19) at Central Median	59
		12.7	81		-		61
		15.7	81		-		62
		18.7	82		-		63
		21.7	82		-		63
F17 (Planned G1C)	65	6.6	79	N.A.	-	5.5m x 2.5m Canopy (Barrier No BA14) at Road Edge, 5.0m Vertical Barrier (Barrier No. BA15) at Central Median	60
		12.6	82		-		62
		15.6	82		-		63
		18.6	82		-		64
		21.6	82		-		65
F18 (Planned Residential)	70	9.1	68	N.A.	-	5.5m x 2.5m Canopy (Barrier Nos.BA14 & BA21) at Road Edge, 5.0m Vertical Barrier (Barrier Nos.BA15 & BA17) at Central Median	50
		15.1	69		-		51
		21.1	70		-		51
		39.1	70		-		52
		45.1	71		-		53

REPRESENTATIVE NOISE SENSITIVE RECEIVERS	NOISE STANDARD dB(A) L_{10} (1-hr)	LEVEL ABOVE GROUND (mPD)	NOISE LEVEL WITHOUT MITIGATION MEASURE dB(A) L_{10} (1-hr)	PROPOSED NOISE MITIGATION MEASURE FOR EXISTING NSRs	NOISE LEVEL WITH MITIGATION MEASURE FOR EXISTING NSRs dB(A), L_{10} (1-hr)	PROPOSED NOISE MITIGATION MEASURE FOR BOTH EXISTING AND PLANNED NSRs	NOISE LEVEL WITH MITIGATION MEASURE FOR BOTH EXISTING AND PLANNED NSRs FULLY IMPLEMENTED dB(A) L_{10} (1-hr)
F19 (Planned G1C)	65	6.5	79	N.A.	-	5.5m x 2.5m Canopy (Barrier Nos.BA11 & BA14) at Road Edge,5.0m Vertical Barrier (Barrier No.BA12*) at Central Median	61
		12.5	81		-		63
		15.5	81		-		64
		18.5	82		-		66
		21.5	82		-		67
F22 (Existing Residential)	70	50.1	67	Not Required	-	N.A.	-
F23 (Existing Residential)	70	37	64	2.0m Vertical Barrier (Barrier No. BA 25) at Road Edge, 2.0m Vertical Barrier (Barrier No. BA27) at Central Median	61	7.0m Vertical Barrier (Barrier Nos.BA26 & BA30) at Road Edge,5.0m Vertical Barrier (Barrier Nos.BA28 & BA29) at Central Median	50
		40	68		65		55
		43	70		68		57
		46	72		70		57
		49	73		70		57
F24 (Planned Residential)	70	37	74	N.A.	-	7.0m Vertical Barrier (Barrier Nos.BA26 & BA30) at Road Edge,5.0m Vertical Barrier (Barrier Nos. BA28 & BA29) at Central Median	66
		40	75		-		68
		43	76		-		69
		46	76		-		69
		49	77		-		70
F25 (Existing Residential)	70	13.5	65	5.5m x 2.5m Canopy (Barrier No. BA3**), 5.5m x 4.0m Canopy (Barrier No. BA5**) & 5.5m Vertical Barrier (Barrier No. BA6) at Road Edge, 4.0m Vertical Barrier (Barrier No. BA4) at Central Median	64	5.5m x 2.5m Canopy (Barrier No. BA3**), 5.5m x 4.0m Canopy (Barrier No. BA5**) & 5.5m Vertical Barrier (Barrier No. BA6) at Road Edge, 4.0m Vertical Barrier(Barrier No. BA4) at	64
		19.5	81		66		66
		22.5	83		66		66
		25.5	83		67		67
		28.5	83		67		67

REPRESENTATIVE NOISE SENSITIVE RECEIVERS	NOISE STANDARD dB(A) L_{10} (1-hr)	LEVEL ABOVE GROUND (mPD)	NOISE LEVEL WITHOUT MITIGATION MEASURE dB(A) L_{10} (1-hr)	PROPOSED NOISE MITIGATION MEASURE FOR EXISTING NSRs	NOISE LEVEL WITH MITIGATION MEASURE FOR EXISTING NSRs dB(A), L_{10} (1-hr)	PROPOSED NOISE MITIGATION MEASURE FOR BOTH EXISTING AND PLANNED NSRs	NOISE LEVEL WITH MITIGATION MEASURE FOR BOTH EXISTING AND PLANNED NSRs FULLY IMPLEMENTED dB(A) L_{10} (1-hr)
F26 (Planned GIC)	65	3.6	73	N.A.	-	5.5m x 2.5m Canopy (Barrier No. BA4) at Road Edge, 5.0m Vertical Barrier (Barrier No. BA15) at Central Median	56
		9.6	74		-		57
		12.6	75		-		58
		15.6	75		-		58
		18.6	75		-		58

Notes:

* Noise barrier to be upgraded to follow up with the recommendations of the NIA for 24 Hour Opening of Border Crossings.

** Noise barrier required to satisfy the air quality requirement.

Table 5.16 Summary of Barriers for committed and proposed developments

BARRIER NO.	DESCRIPTION	EXISTING FACADE	PLANNED FACADE
BA1	1.5m Vertical Barrier, 50m length	F12	
BA2	5.5m Absorptive Vertical Barrier, 250m length	F11, F12	
BA3	5.5m x 2.5m Absorptive Canopy Barrier Type I, 260m length	F11, F25	
BA4	4.0m Absorptive Vertical Barrier, 900m length	F9, F10, F11, F25	
BA5	5.5m x 4.0m Absorptive Canopy Barrier, 260 length	F10, F25	
BA6	5.5m Absorptive Vertical Barrier, 115m length	F10, F25	
BA7	5.0m Absorptive Vertical Barrier, 280 length	F9, F10	
BA8	1.5m Vertical Barrier, 200m length	F9	
BA9	5.5m Absorptive Vertical Barrier, 210m length	F8	
BA10	5.5m Absorptive Vertical Barrier, 340m length	F8	
BA11	5.5m x 2.5m Absorptive Canopy Barrier Type II, 340m length		F19
BA12	5.0m Absorptive Vertical Barrier, 155m length		F14, F19
BA13	5.5m x 2.5m Absorptive Canopy Barrier Type II, 320m length		F14
BA14	5.5m x 2.5m Absorptive Canopy Barrier Type II, 730m length		F15, F16, F17, F18, F19
BA15	5.0m Absorptive Vertical Barrier, 300m length		F15, F16, F17 F18
BA16	2.5m Absorptive Vertical Barrier, 245m length	F4	
BA17	5.0m Absorptive Vertical Barrier, 245m length		F15, F16, F18
BA18	4.0m Absorptive Vertical Barrier, 215m length	F3, F4	
BA19	5.0m Absorptive Vertical Barrier, 215m length		F16

BARRIER NO.	DESCRIPTION	EXISTING FACADE	PLANNED FACADE
BA20	3.5m Absorptive Vertical Barrier, 275m length	F4	
BA21	5.5m x 2.5m Absorptive Canopy Barrier Type II, 275m length		F15, F16, F18
BA22	5.5m x 2.5m Absorptive Canopy Barrier Type II, 415m length	F3, F4	F16
BA23	4.0m Absorptive Vertical Barrier, 300m length	F3	
BA24	3.5m Vertical Barrier, 250m length	F1	
BA25	2.0m Absorptive Vertical Barrier, 220m length	F23	
BA26	7.0m Absorptive Vertical Barrier, 160m length		F24
BA27	2.0m Absorptive Vertical Barrier, 230m length	F23	
BA28	5.0m Absorptive Vertical Barrier, 230m length		F24
BA29	5.0m Absorptive Vertical Barrier, 420m length		F24
BA30	7.0m Absorptive Vertical Barrier, 315m length		F24
BA31	4.0m Vertical Barrier, 265m length	F13	

Note: For details of lapping sections of proposed barriers, please refer to Table 5.15 and Figure 5.2.

The remaining facades are found to be within the established guideline and no mitigation measures are required. With the mitigation measures recommended for the affected facades, the predicted noise levels will meet the established guidelines.

As far as the noise barrier/canopy design is concerned, to improve the appearance of the barriers and to utilize natural light, the cantilevered portion of the canopy type should be constructed with transparent panel while the vertical portion may be constructed with solid panels or sound absorbing panels. The use of proprietary noise barrier/canopy products should be considered. This type of noise screening systems are purpose designed for highway traffic noise mitigation, with safety, ease of installation, maintenance and aesthetics factors taken into consideration. As the proposed noise barrier/canopy is extensive and would become a dominate feature of the highway, consideration of the visual aspect is also important. However, the noise reduction effect of the barrier/canopy should not be compromised in any case.

Any gaps or openings in the noise barrier/canopy would greatly reduce the sound screening effect. Thus, in the detail design of the noise barrier/canopy, should ensure that the barrier/canopy would be a continuous structure with no gap or opening except where access roads are required. In particular, there should be no gap between the noise barrier panels and the concrete plinth and any street lamp and sign post etc. would need to be integrated with the noise barrier/canopy.

5.2.5 Conclusions

Most of the identified NSRs are predicted to have traffic noise level exceeding the established guidelines with the widened Tolo Highway.

With the constraints imposed by sight distance and the wind conditions of the coastal environment, noise mitigation is confined to the use of vertical barriers and noise canopies. In addition, the proposed height of noise barriers are kept at a low level with the effective use of barriers located at both the road edge and the central median.

With the recommended mitigation measures, the noise level at all existing NSRs would comply with the established guideline.

For those NSRs identified in the proposed future developments, the noise levels have been substantially reduced with the installation of noise barriers and canopies. However, there are still residual noise impact on some NSRs in the planned development (F14) at Pak Shek Kok Public Dump Reclamation (PSKPDR) area and the GIC Site (F19) in Area 39.

For the planned development at PSKPDR area, an EIA study is being carried out by the Territory Development Department taking the residual traffic noise impact from the widened Tolo Highway as a constraint on the planned noise sensitive uses.

For the GIC site in Area 39, if the site is to be used for educational purpose, the future school building should be designed such that the classrooms would not have more than 90 degree of angle of view on the Tolo Highway. In case where this is not possible, noise insulation would be provided for those classrooms still exposed to the residual impact as a last resort.

For sites which have not been designated for any particular uses, consideration should be given to the identified residual noise impact highlighted in this aspect. Otherwise planning control for further reduction of the residual noise impact would be necessary.

This study follows up and implements the recommendations of the 24 hour opening of the border crossings study.

Similarly, addition barrier provision has also been included to reduce the impact due to the air-emission on the adjacent roads as part of the road widening project.

6 AIR QUALITY ASSESSMENT

6.1 Construction Assessment

6.1.1 Assessment Criteria

The Air Pollution Control Ordinance (Cap. 311) provides powers for controlling air pollutants from a variety of stationary and mobile sources, including fugitive dust emissions from construction sites. It encompasses a number of Air Quality Objectives (AQOs). Construction dust impacts were assessed with reference to relevant legislation including the Air Pollution Control Ordinance (APCO) and with reference to the 1-hour average TSP concentration guideline level. Further detail is given in Appendix B.

6.1.2 Sensitive Receivers

Eighty-five representative air quality sensitive receivers/air assessment points (ASRs 1-81 and ASRs 123-126) were adopted for the purposes of this assessment, comprising existing buildings and future sensitive development located along the road alignment. Selected air quality sensitive receivers are shown in Figures 6.1 to 6.3 (schematic location plan). The receiver height used for the analysis was 1.5 metres above local ground level. This was selected as representative of the breathing zone.

A 25m x 25m resolution contour grid was used over the whole study area in order to estimate the general pollutant distribution over the area.

6.1.3 Methodology

The major pollutant emission of concern during the construction phase of the project is particulate matter (dust). Vehicle and plant exhaust emissions from the site are not considered to constitute a significant source of air pollutants. In order to assess the potential dust impact on the sensitive receivers, dust emissions from the construction site and the plant operating during the most intensive periods were modelled.

Construction dust impacts were assessed with reference to relevant legislation including the Air Pollution Control Ordinance (APCO), which defines statutory Air Quality Objectives (AQOs) and with reference to the 1-hour average TSP concentration guideline level. Dust will be generated during road construction, and cut and fill operations, which may potentially cause nuisance at nearby sensitive receivers.

Construction activities for three design options were identified and dust impacts assessed in terms of total suspended particulate (TSP) levels. The dispersion of TSP was modelled using multiple runs of the USEPA approved Fugitive Dust Model (FDM var 95279) to assess potential impacts from the construction activities. Modelling was undertaken to establish TSP concentrations at the identified sensitive receivers for 1-hour and 24-hour average time periods. Surface roughness of the terrain in the study area was taken as one metre in the FDM model, a height which is generally applied in Hong Kong. The mixing height was assumed to be 500m and the height of emission was set to local ground level.

Dispersion modelling was undertaken for 360 predefined separate meteorological categories in order to ascertain the worst-case condition. The resolution on the wind direction was set to 10 degree increments. The model was run with 2 stability classes (B and D), and 5 wind speed conditions of 1ms^{-1}, 2 ms^{-1}, 4 ms^{-1}, 6 ms^{-1} and 8 ms^{-1}. At each receiver location the 1-hour average concentration for TSP was predicted for each of the categories. The maximum 1-hour average TSP concentration was calculated at each air sensitive receiver for each of the 360 meteorological categories.

A 12-hour working day was assumed and the TSP emission in this period was considered to be the worst-case condition. It was assumed that good site practices will be imposed, with the amount of stockpiled material, and the area of the open site being kept to a minimum. All emissions were assumed with mitigation measures in place. The 24-hour average TSP (without background) is therefore estimated to be half of the 1-hour TSP concentration. This is derived by averaging out twelve 1-hour TSP emissions over a 24-hour time period.

It was assumed that with sufficient watering, proper covering/shielding of the open material, minimal disturbance of the soil, emissions during the 12 non-working hours would be minimal, compared with the day time emissions.

6.1.4 Assumptions and Input Information

Emission sources for dust release from the construction activities included the following:

- Bulldozing constructed material and overburden;
- Grading of embankment;
- Loading and unloading of construction material;
- Plant vehicles travel on unpaved site roads;
- Wind erosion of stockpiles and open site.

The prediction of dust emissions was based on typical values and emission factors from USEPA 'Compilation of Air Pollutant Emission Factors' (AP-42), Supplement F of 4th Edition, 1993. The emission factor for general construction activities taken from AP-42 was used to incorporate all the general road construction activities within the site, including bulldozing, grading, loading and unloading of materials, plant vehicles which travel on unpaved site roads and wind erosion.

As stated in the AP-42, the emission factor for general construction activities has already incorporated a large proportion of the emissions resulting from traffic over temporary roads within the construction site. In view of the general road construction activities that will be involved in the development, the emission factor for general construction activities is representative.

During construction, it was assumed that a maximum of 40% of the site area would be actively operated at any one time. No blasting, concrete batching plant or rock crushing plant was identified in the assessment. It is assumed that [1]periodic watering of once every 1.5 hours will be applied over the active area. It is estimated this will result in a 75% decrease in dust generation.

1 "Control of Fugitive and Hazardous Dusts", Pollution Technology Review No. 192, Noyes Data Corporation, by C Cowherd, G E Muleski, P Englehart, J S Kinsey & K D.

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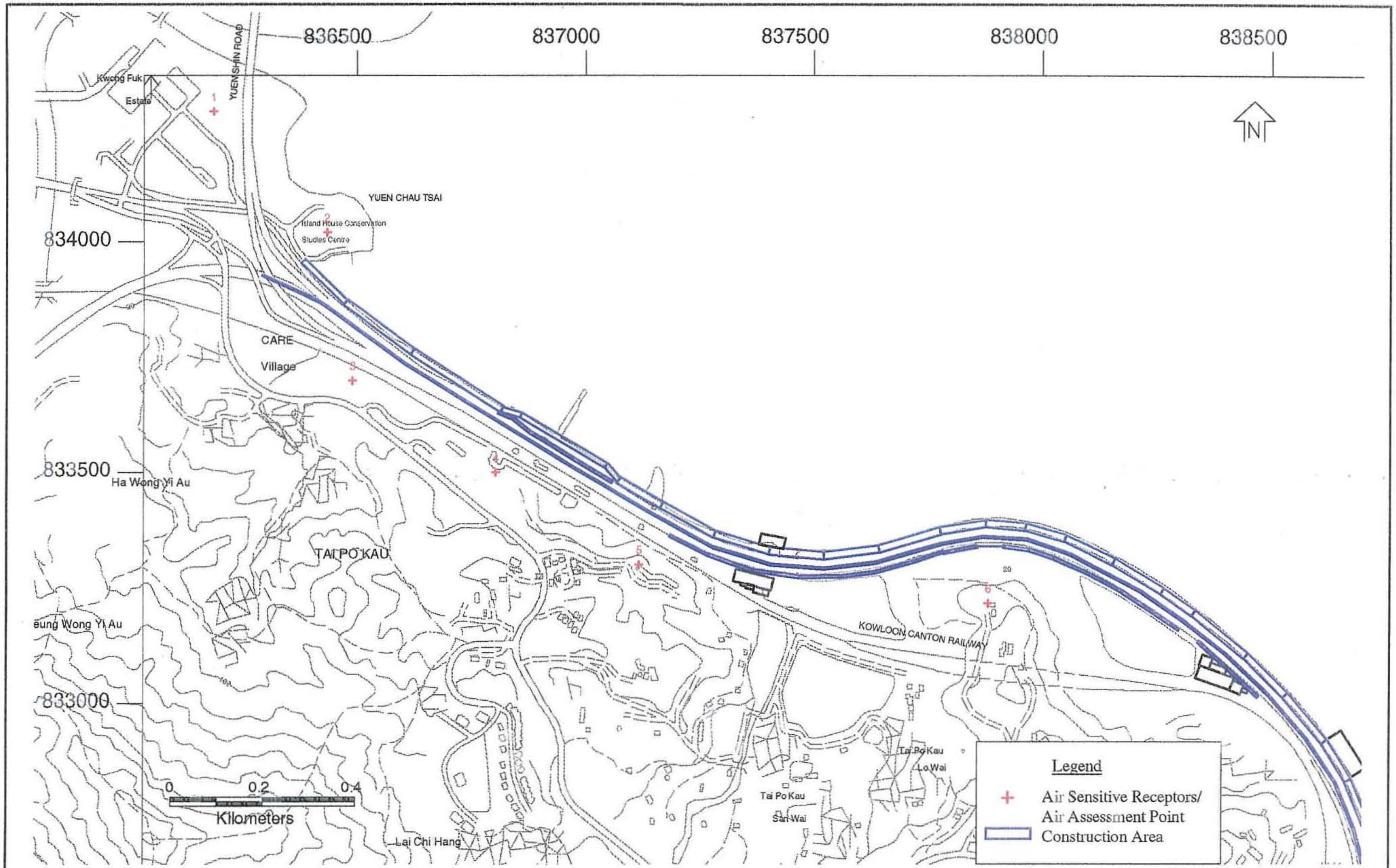

Figure 6.1 Locations of Air Sensitive Receivers and Construction Area (Options I-III), Northernmost Section

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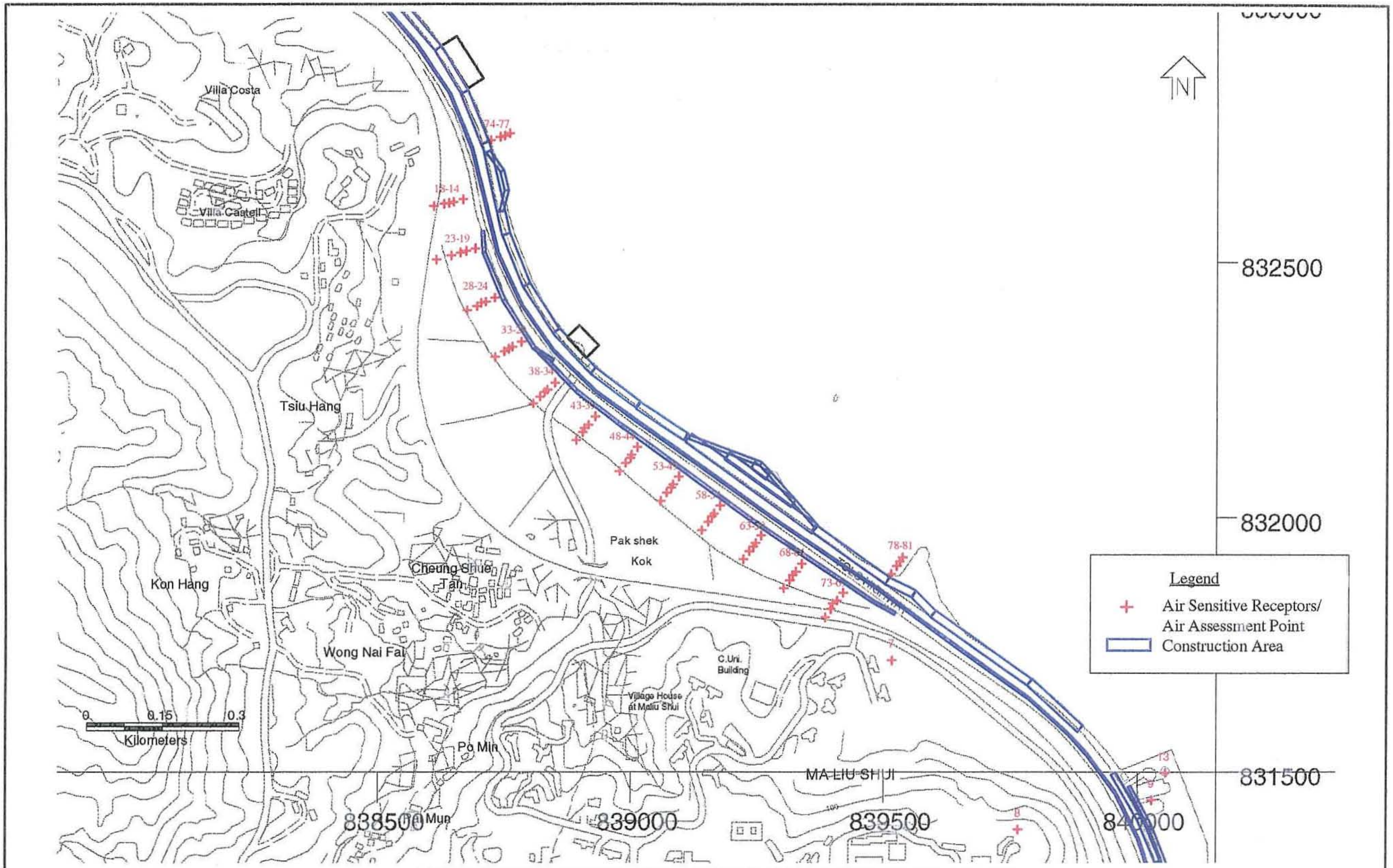

Figure 6.2 Locations of Air Sensitive Receivers and Construction Area (Option I-III), Middle Section

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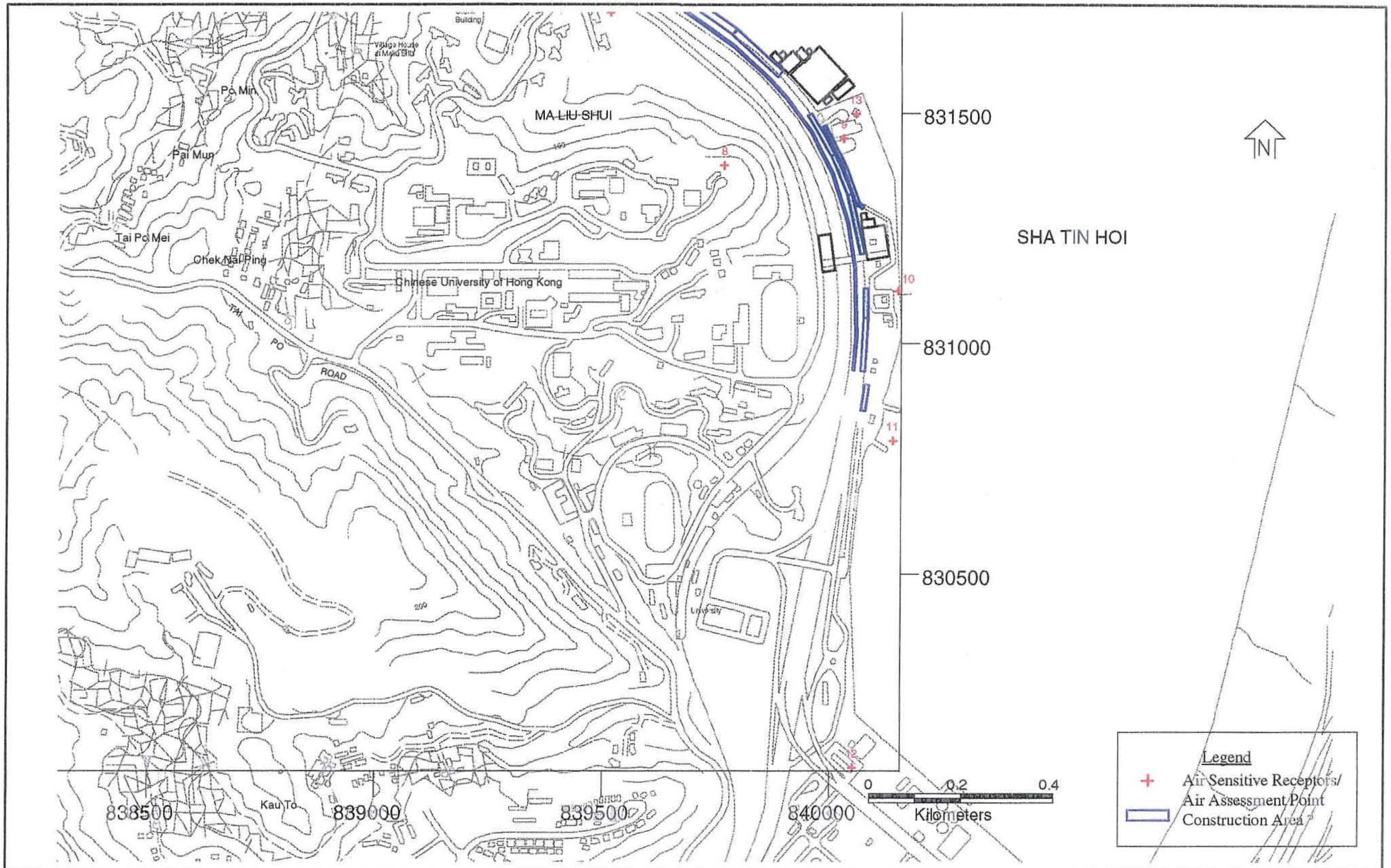

Figure 6.3a Locations of Air Sensitive Receivers and Construction Area (Option I), Southernmost Section

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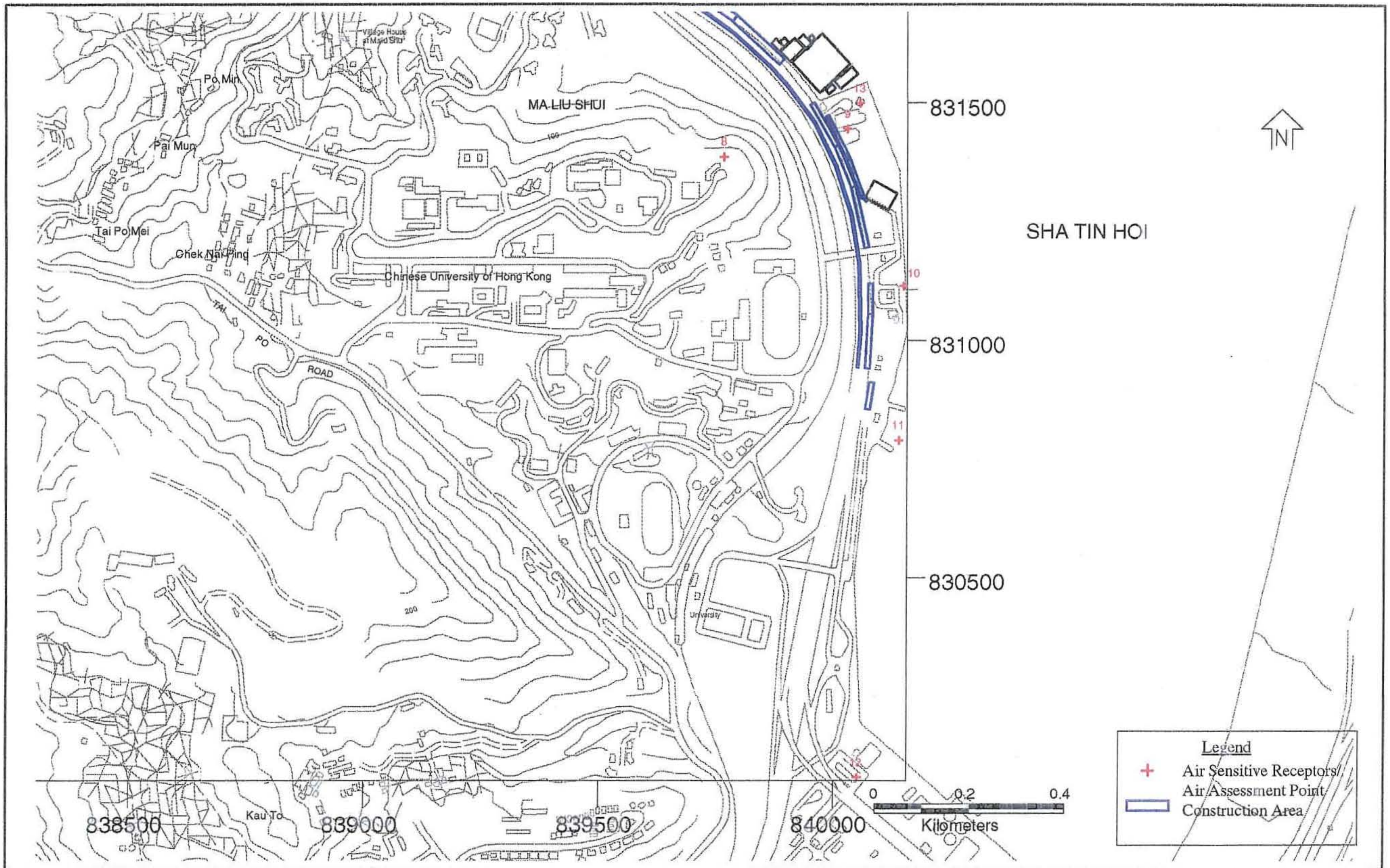

Figure 6.3b Locations of Air Sensitive Receivers and Construction Area (Option II), Southernmost Section

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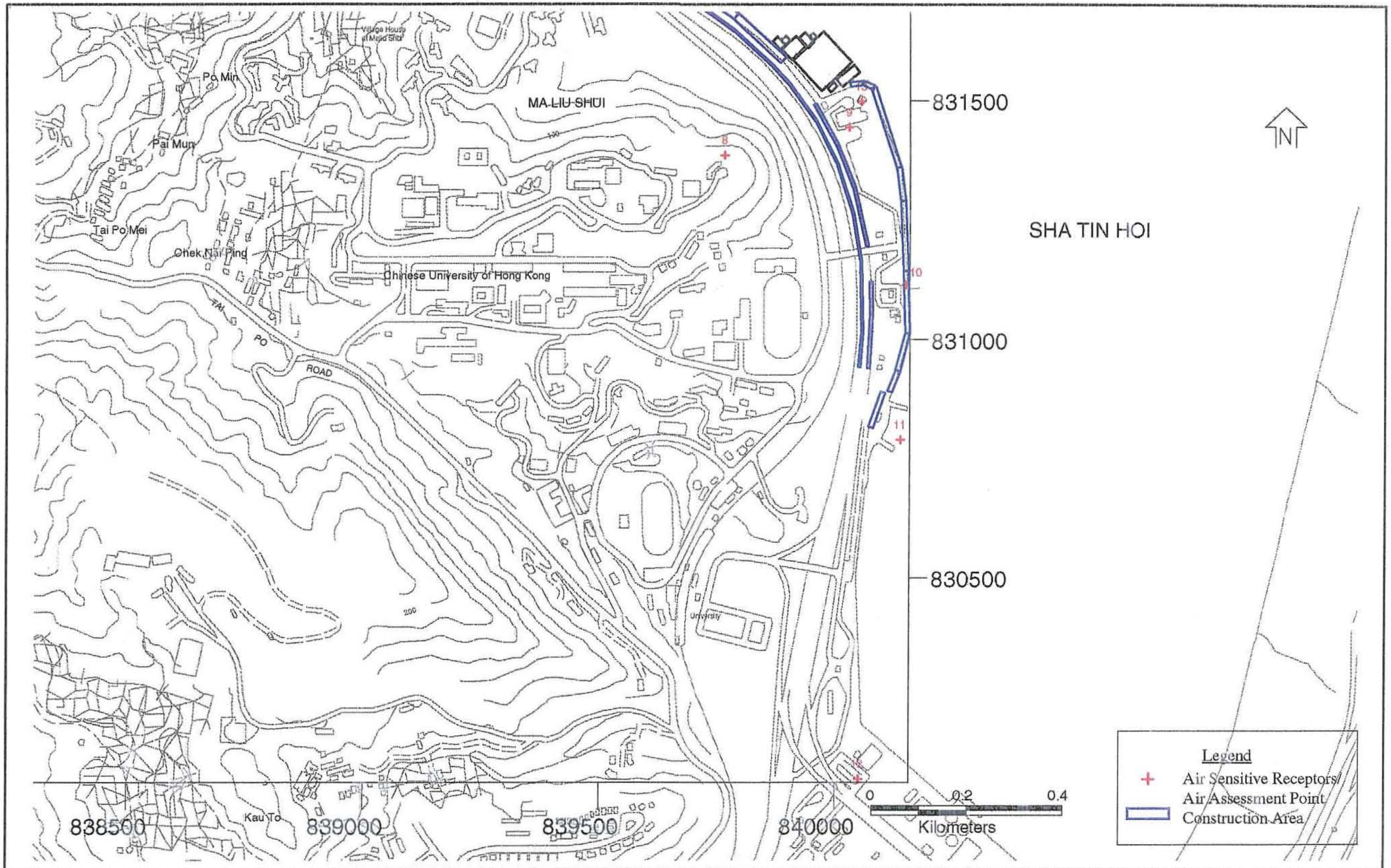

Figure 6.3c Locations of Air Sensitive Receivers and Construction Area (Option III), Southernmost Section

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6.1.5 Cumulative Impacts due to Pak Shek Kok Reclamation - Public Dump

It has been identified that Phase II of the Pak Shek Kok Reclamation - Public Dump works will be undertaken concurrently with the development. Therefore the background pollutant concentrations together with the impacts from the reclamation works need to be taken into account. Predicted results of the 1-hour average and 24-hour average TSP concentration with mitigation measures (periodic watering of once every 1.5 hours applied over the active area) are tabulated in Table 6.1. It is suggested that the 90th percentile values of the assessed results at the sensitive receiver locations would be employed as the cumulative background 1-hour and 24-hour TSP concentrations. These values are 238 μgm^{-3} and 146 μgm^{-3} respectively.

Table 6.1 Predicted Cumulative Background TSP Concentrations

Location	Air Sensitive Receiver Identification (Mouchel)	1-hr TSP (μgm^{-3})	24-hr TSP (μgm^{-3})
Lookout Link (Villa Costa)	LL1 LL2	187 182	139 139
Chinese University	CU HK3	265	141
Villa Castell	VC	199	141
Wong Nai Fai	WNF	204	143
Po Min	PM	201	144
Cheung Shue Tan	CST1 CST 2	226 226	146 146
Recommended Background with Cumulative Impacts From Other Projects (90th Percentile):		238	146

6.1.6 Proposed Mitigation Measures

In this assessment, the following impact mitigation measures have been proposed and taken into account in the modelling analysis:

Good Site Practice Procedures

(a) Mean vehicle speed of haulage trucks at 20 kmh^{-1}.
(b) Watering of all open site areas once every 1.5 hours (assumed to have 75% dust reduction, reference, AP-42).
(c) Vehicle wheel washing facilities.
(d) Suitable side and tailboard on haulage vehicles.
(e) Watering of temporary stockpiles.
(f) Only 40% of the site would be in operation at a time

The sample input and output files for FDM modelling, and the calculations of the dust emission factors for different dust generating activities are given in Appendix G. The predicted dust generated from general construction activities including the adoption of dust suppression measures was estimated to be 160 kg, 155 kg and 157 kg per day for Options I - III, respectively.

6.1.7 Impact Prediction

Existing Development

With the good site practices as proposed in Section 6.1.6, the predicted 1-hour average and 24-hour average TSP concentrations at the existing sensitive receivers will comply with the guidance level and the AQO. The maximum predicted hourly TSP concentrations for the worst scenario are shown in Appendix G. The worst case predicted 1-hour average and 24-hour average TSP concentration (including cumulative impacts from nearby development) for the existing ASRs are 89% of the guidance level and 96% of the AQO respectively.

Future Planned Uses

The predicted results (as shown in Appendix G) indicate that there will be no exceedance of 1-hour guidance level. However there will be some exceedances of the 24-hour AQO for TSP at localised areas associated with larger construction sites. The 24-hour average TSP isopleths for three design options at 1.5m above local ground are illustrated in Figures 6.4 to 6.6. The areas of exceedance are illustrated as the Affected Zones A to D. Sufficient setback, as shown in Table 6.1a, should be provided for the planned uses development. It is expected that all planned uses near these impacted Zones on the new PSKPDR or at Area 39 Pak Shek Kok, including the proposed Science Park, will not be occupied before the Tolo Highway Road widening construction, and will not be affected.

Table 6.1a Maximum Setback Requirement For The Future Planned Uses

Affected Zone	Maximum Setback Distance (m) Required From the Outermost Edge of the Driving Lane
Zone "A"	71.4
Zone "B"	63
Zone "C"	78.2
Zone "D"	149.1

Pak Shek Kok Public Dump Reclamation Development

In the above assessment, the construction site impacts arising from the PSKPDR construction works has been incorporated. It has been assumed that in the PSKPDR site, dust will be released from the following construction activities included:

- Bulldozing constructed material and overburden;
- Grading of embankment;
- Loading and unloading of construction material;
- Plant vehicles travel on unpaved site roads;
- Wind erosion of stockpiles and from open site.

The prediction of dust emissions was based on typical values and emission factors from USEPA 'Compilation of Air Pollutant Emission Factors' (AP-42), Supplement F of 4th Edition, 1993. The emission factor for general construction activities taken from AP-42 was used to

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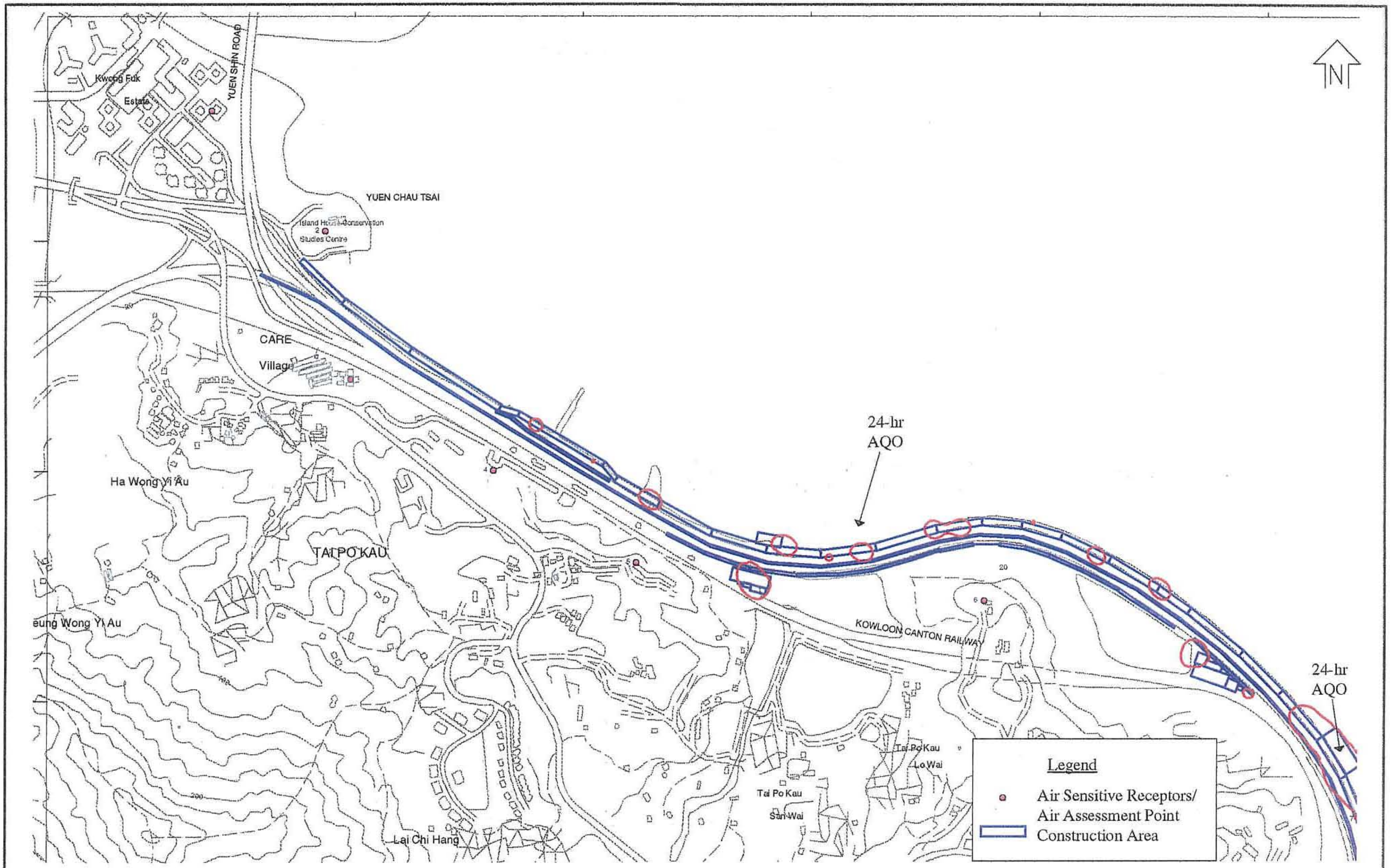

Figure 6.4 24-Hour Average TSP Isopleth (μg/m3) at 1.5m above Local Ground, Options I-III, Northernmost Section

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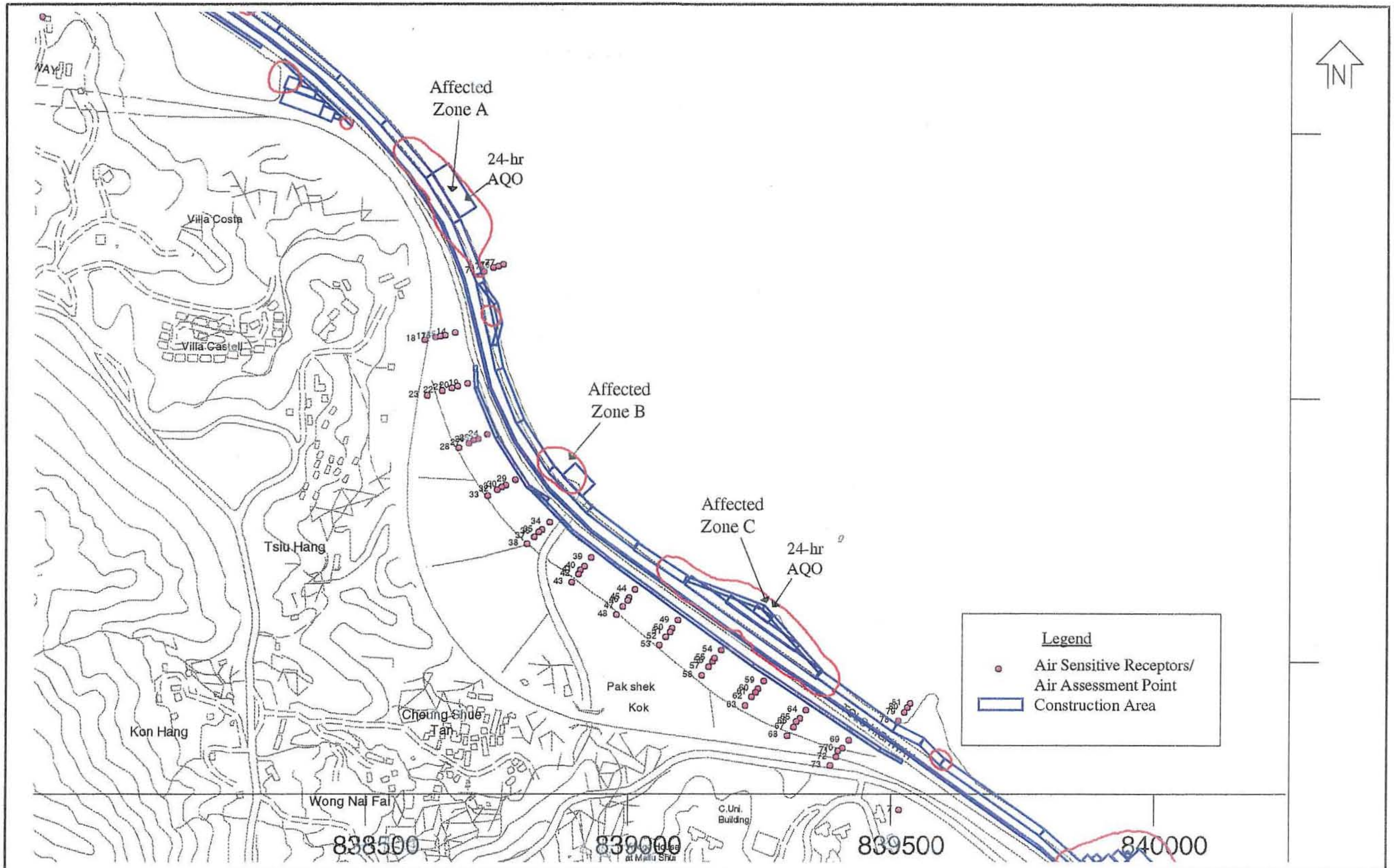

Figure 6.5 24-Hour Average TSP Isopleth (μg/m3) at 1.5m above Local Ground, (Options I-III), Middle Section

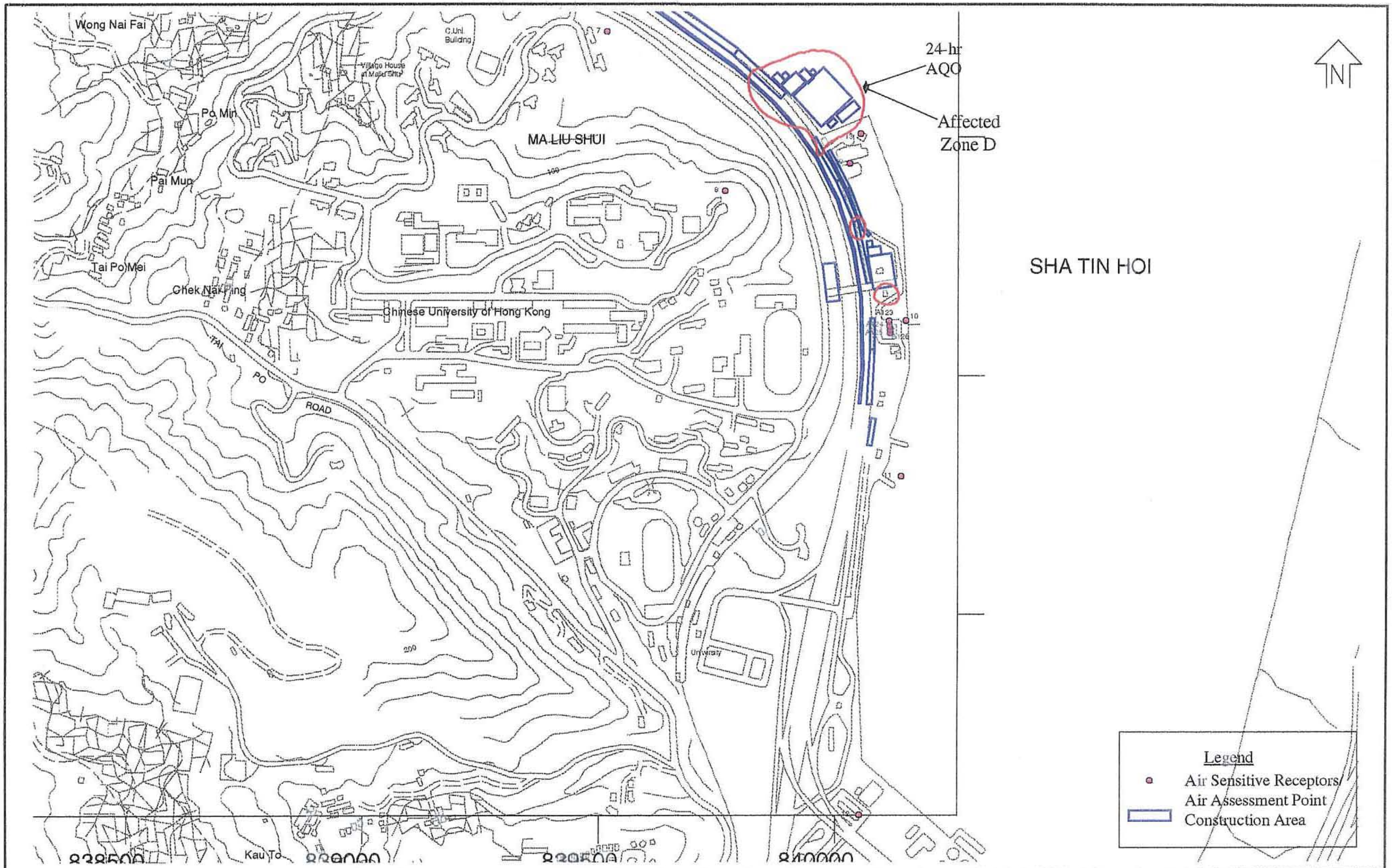

Figure 6.6a 24-Hour Average TSP Isopleth (μg/m3) at 1.5m above Local Ground, (Option I), Southernmost Section

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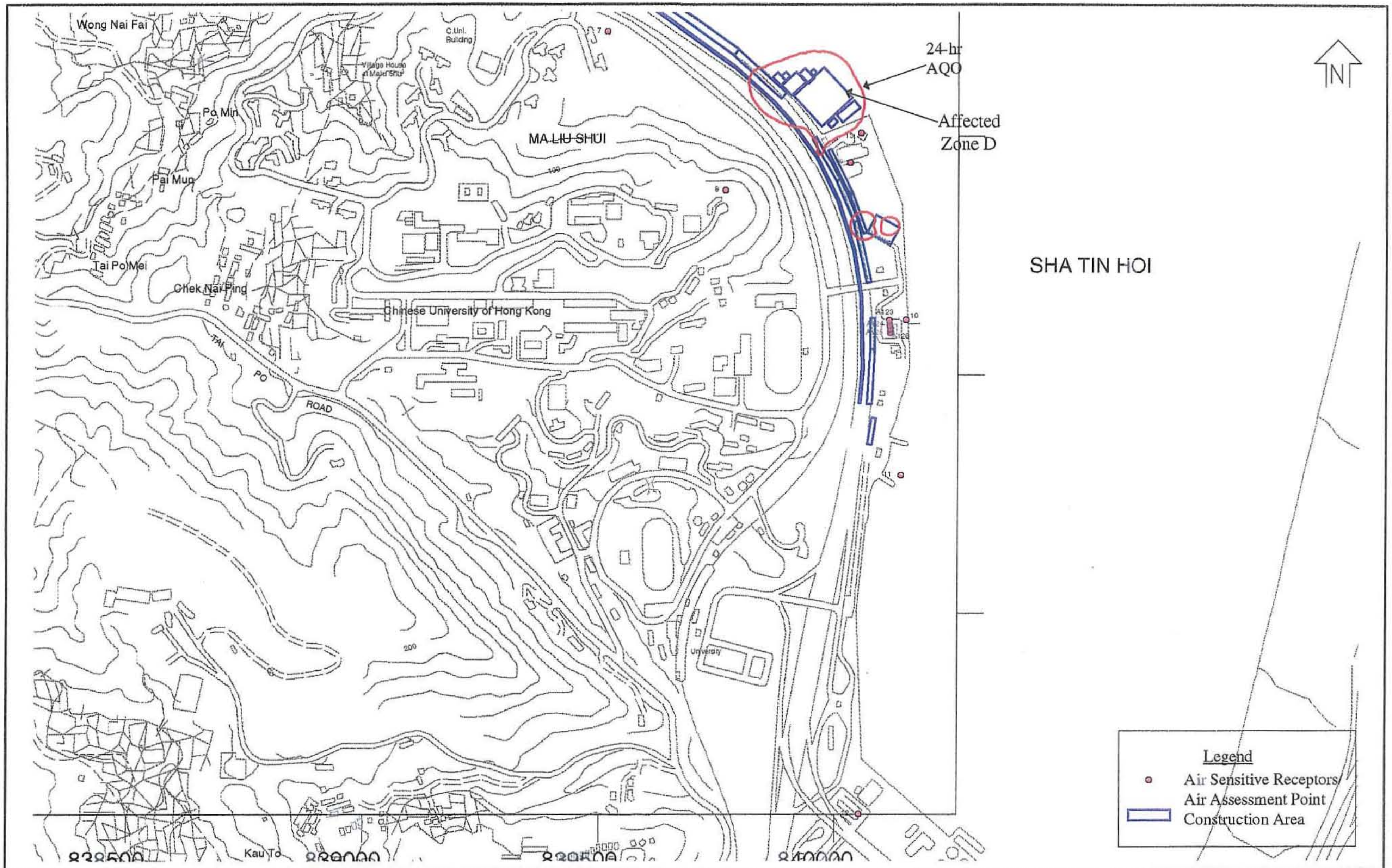

Figure 6.6b 24-Hour Average TSP Isopleth (μg/m3) at 1.5m above Local Ground, (Option II), Southernmost Section

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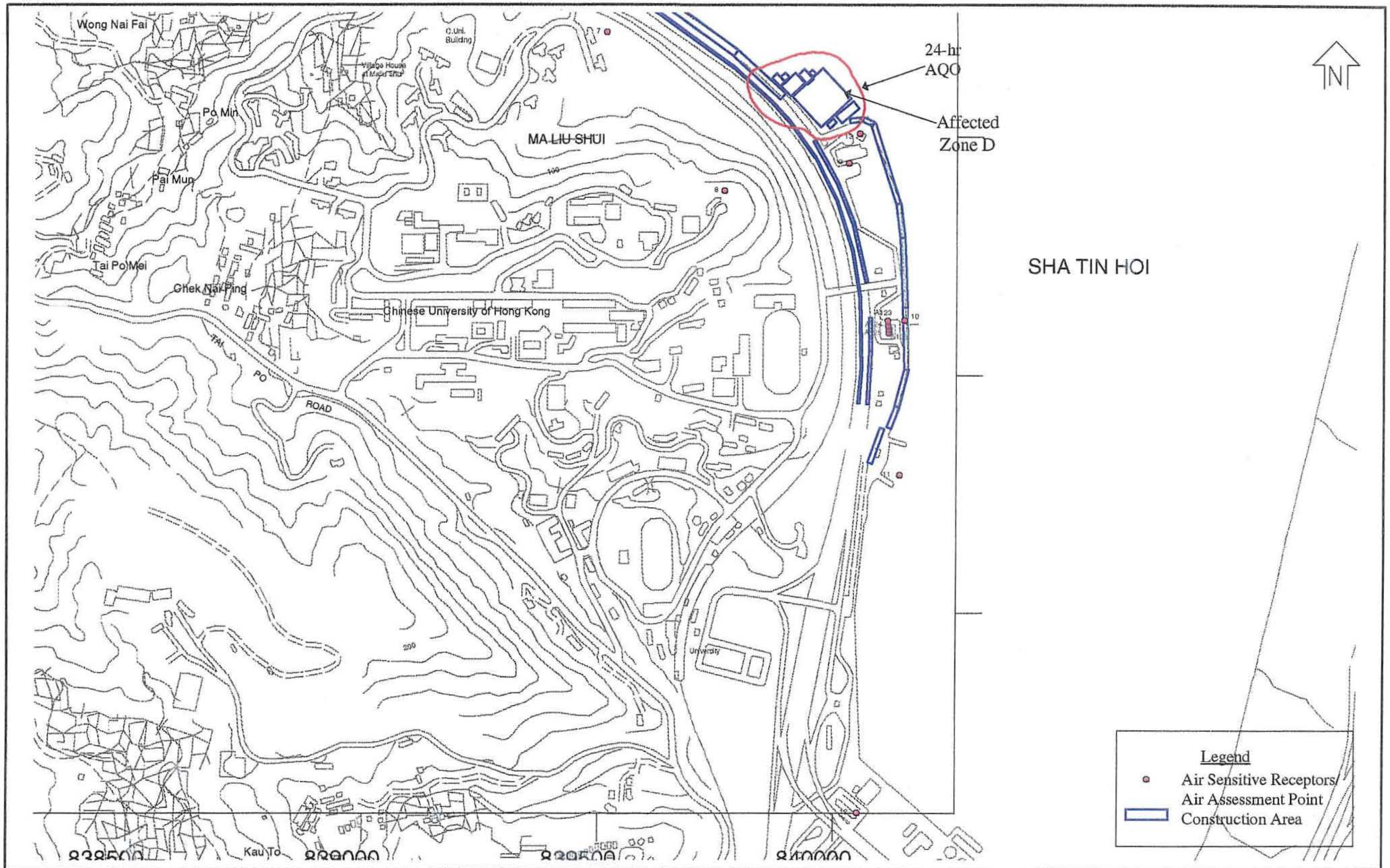

Figure 6.6c 24-Hour Average TSP Isopleth (µg/m3) at 1.5m above Local Ground, (Option III), Southernmost Section

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incorporate all the general road construction activities within the site, including bulldozing, grading, loading and unloading of materials, construction of buffer strip, and plant vehicles which travel on unpaved site roads.

In this assessment, it has been proposed that with the implementation of the following good site practice procedures, the dust emission originated from the PSKPDR site would be significantly reduced. No additional impact would be envisaged.

Good Site Practice Procedures

(a) Mean vehicle speed of haulage trucks at 20 kmh^{-1}.
(b) Watering of all open site areas once every 1.5 hours (assumed to have 75% dust reduction, reference, AP-42).
(c) Vehicle wheel washing facilities.
(d) Suitable side and tailboard on haulage vehicles.
(e) Watering of temporary stockpiles.
(f) Only 40% of the site would be in operation at any one time
(g) Paved/hard surfaced access and frequently used haul roads

Shared Road Access at PSKPDR Phase I

During construction stage, a joint access for the Tolo Highway construction site and PSKPDR stage I is proposed. This would give rise to a total of 100 heavy goods vehicles using the access during the peak hour. As stated in the AP-42, the emission factor for general construction activities has already incorporated a large proportion of the emissions resulting from traffic over temporary roads within the construction site. In view of the nature of the construction acess, and assuming that it would be hard surfaced, the dust emission impact from the 100 heavy goods vehicles coming in/out of the shared access would not change the findings, or affect the assumptions made, in the general assessment of the PSKPDR site.

Fish Ponds at CUHK Marine Science Laboratory

In order to prevent dust emission affecting the fish in the Marine Science Lab, air assessment points have been employed to predict the dust emission impacts. Predicted results indicated that the maximum 1-hour and 24-hour TSP concentrations at the ponds are 357 $\mu g/m^3$ and 206 $\mu g/m^3$ respectively. Both values are both below the 1-hour guidance level and 24-hour AQO standard.

Due to the sensitivity of the fish ponds to dust, it is recommended that good site practice procedures should be implemented and specific auditing programmes targetted in this area. Although the scope of road works near the fish ponds is not extensive, comprising largely the lowering of the road, it is recommended that specific monitoring procedures and audit plans be included in the EM&A Programme in order to monitor the dust impact conditions and ensure satisfactory dust levels.

6.1.8 Summary of Construction Impacts

For the construction phase, it is predicted that there will be no exceedances of the 1-hour guidance level and 24-hour average AQO for TSP at the existing air sensitive receivers (ASRs 1-13). On future planned developments adjacent to the Highway, results (using a refined grid system) indicated that there would be some local areas of exceedances at the PSK Public Dump Site Areas, but that no planned uses would be occupied during construction within setback distances defined for these areas. With the adoption of good site practice procedures, the fish ponds in the Marine Science Laboratory should not be affected.

It is recommended that controls on dust generation are included in the works contract. These practices including controlling mean vehicle speed of haulage trucks at 20 kmh^{-1}, watering of all open site areas once every 1.5 hours, provision and use of vehicle wheel washing facilities, and provision of suitable side and tailboard on haulage vehicles. Temporary stockpiles should be frequently watered. It is also recommended that dust monitoring within the site EM&A programme be carried out at the Marine Science Laboratory fish tanks to ensure dust levels are acceptable.

6.2 Operational Assessment

6.2.1 Introduction

There are no significant differences for the road alignments for three design options (Options I to III). Therefore, the air quality impacts of the operational phase of a widened Tolo Highway are addressed in this section as a single scheme.

6.2.2 Assessment Criteria

The Air Pollution Control Ordinance (Cap. 311) provides powers for controlling air pollutants from a variety of stationary and mobile sources. It encompasses a number of Air Quality Objectives (AQOs). Currently AQOs stipulate concentrations for a range of air pollutants, of which carbon monoxide (CO), nitrogen dioxide (NO_2) respirable suspended particulates (RSP) are relevant to the study on operational phase air impact. The AQOs are given in Appendix B.

6.2.3 Selected Sensitive Receivers

The sensitive receivers as defined for construction impact assessment are used for the operational air quality assessment (see section 6.1.2). In addition, sensitive receivers for future developments in Tai Po Area 39 and Pak Shek Kok Public Dump Reclamation are also included. The locations of the sensitive receivers in relation to the road links are given in Figures 6.7 to 6.9. The receiver heights used for the analysis were 1.5, 10, 15 and 17.5 metres above local ground level.

For the assessment of secondary air quality impact (ie the assessment of air quality including the effect of noise barriers), additional receiver heights were employed in the assessment, ranging from 3 to 7 metres.

A 25m x 25m resolution contour grid covering the study area was used to assess the pollutant concentrations at areas of future planned uses. Grid height employed for the assessment was 1.5 metre above local ground level.

6.2.4 Methodology

The key area of concern regarding operational impacts are traffic emissions. Potential air quality sensitive receivers were chosen at a range of heights from 1.5 to 17.5 metres above ground. An assessment on a regular grid (25m x 25m resolution) was employed to predict the impact over the area of future sensitive uses. The fleet average emission factors from EPD were used for traffic emissions.

There are no data available to estimate future non-traffic related background NO_2 concentrations in the study area. Therefore a background of 40 μgm^{-3} (annual average at Tai

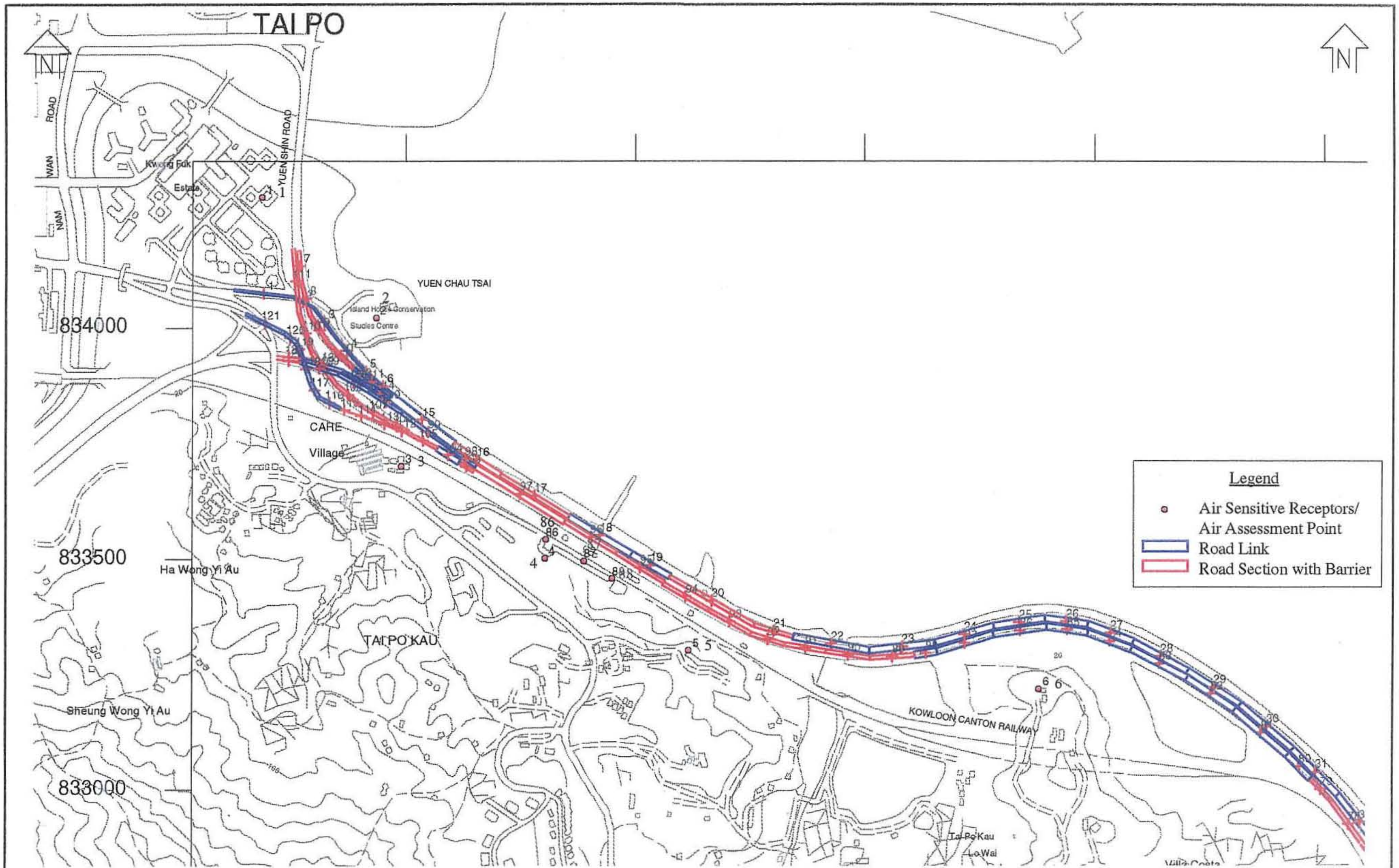

Figure 6.7 Location of Air Sensitive Receivers and Road Links (with Noise Mitigatin), Northernmost Section

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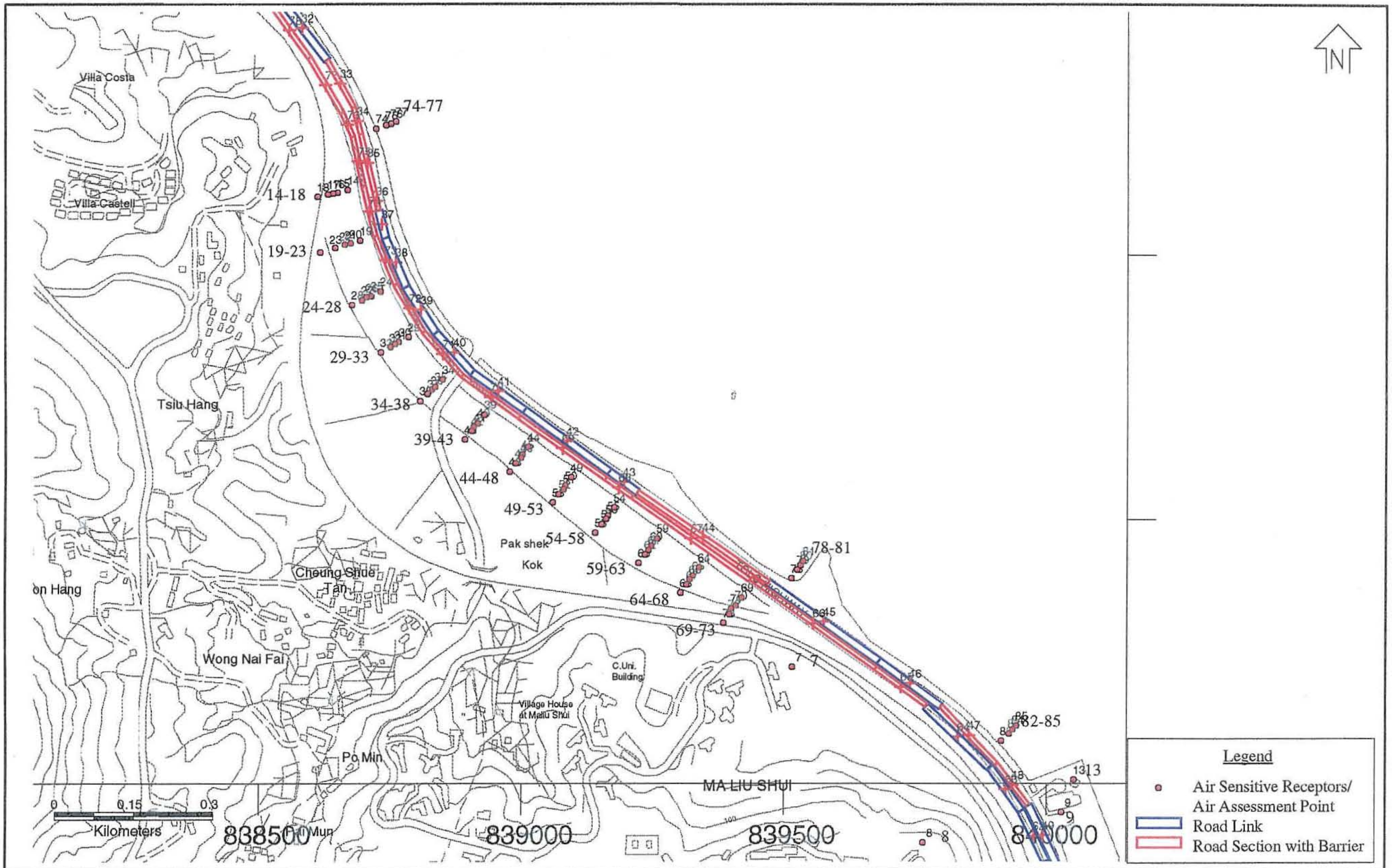

Figure 6.8 Location of Air Sensitive Receivers and Road Links (with Noise Mitigatin), Middle Section

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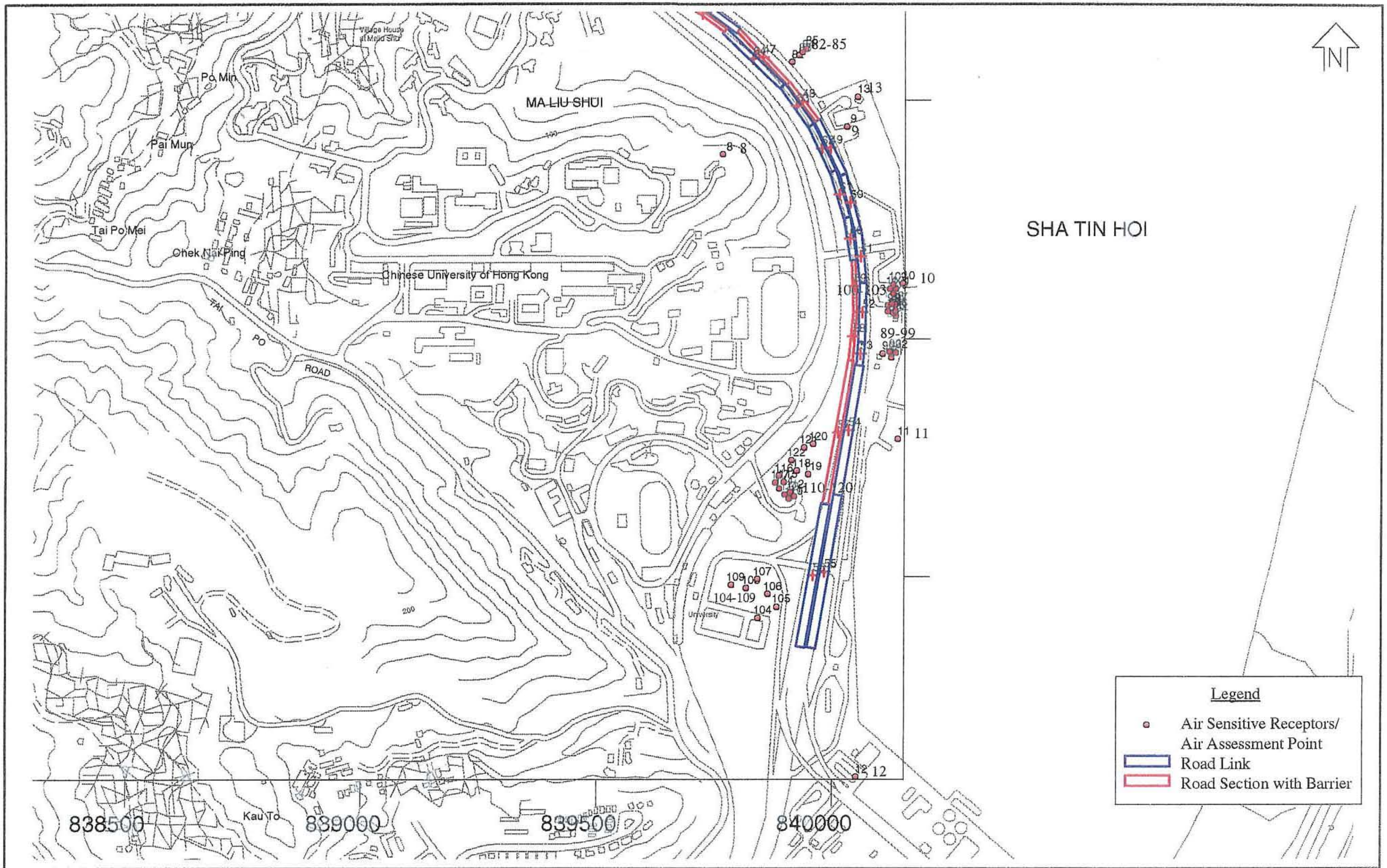

Figure 6.9 Location of Air Sensitive Receivers and Road Links (with Noise Mitigatin), Southernmost Section

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Po Area) has been incorporated. With reference to the Guideline on Air Quality Models (Revised July 1986), the suggested wind standard deviation would be 18 degree (Extracted from Table 9-3, using Stability Category D, Surface Roughness of 100cm and Surface Roughness Factor of 1.46).

The CALINE4 model was used to perform worst-case run with the following input parameters in order to assess the worst case scenario:

1)	Stability Class:	D
2)	Wind Speed:	1 m/s
3)	Temperature:	25 degrees
4)	Wind Standard Derivation:	18 degrees
5)	Surface Roughness:	100 cm

In view of the recommended noise barriers, secondary air quality impacts including the traffic noise barriers was assessed. A range of barrier heights from 1.5m to 5.5m have been proposed. It has been assumed that, with the installation of noise barriers, all the traffic pollutants at the barrier section were emitted from the top of the noise barriers. The elevation of the road section (with noise barrier constructed) was therefore set to the elevation of the barrier top. There were no corrections/ adjustments to the ASR assessment heights. The width of the mixing zone employed in the model was set to the actual road width owing to the physical obstruction of the barrier wall. Fill option was set in the CALINE4 model for the vertical barrier.

Barrier with canopy were suggested at some sections of Tolo Highway for noise reduction proposes. These sections of barriers are 5.5 m/7 m in height and equipped with 2.5 m/4 m long canopies. It was assumed that vertical barriers would effectively change the source height and source line relative to the receiver. It was assumed that the dispersion of the air pollutants would in effect be similar to physically shifting the road section by a distance equal to the covered extent (towards the central divider). The traffic pollutants were assumed to emit from the top of the noise barriers. The barrier acted as an filled section with height equal to the barrier height. The mixing width was set to the actual road width.

The assessments were based on the vehicular emission for the year 2011. Transport Department endorsed traffic flow figures and composition for Tolo Highway were used. Traffic flows were broken down into six catalogues; cars, taxis, buses, public light buses (PLB), light goods vehicles(LGV) & heavy goods vehicles (HGV). These categorisations were based on the 1994 composition ratio at Core Station 5013, Tolo Highway, as given in the Traffic Census. The aggregated traffic composition with emission factors of different types of vehicles are given in Table 6.2.

Emission factors for CO, NO_X and RSP were taken from the *Fleet Average Emission Factors - EURO2 Model* provided by EPD for the Year 2011. No speed correction or other adjustments were made. 20% of NO_X was assumed to be NO_2 as normally adopted for each assessment. Details of the simulated road links and the corresponding emission rates are shown in Appendix G4. The composite vehicle emission factors are tabulated in Table 6.2 for the different vehicle proportions on the Tolo Highway.

It is estimated that the project would be completed at Year 2001. Taking the aggregated effects of the traffic flow and corresponding emission factor, the emission impacts at Year 2001 and Year 2011 were compared (see Appendix G9). Based on the traffic figures provided, the impact at year 2001 would represent the worst case. The emission impact at 2001 would be 6.9% higher than that at 2011. Therefore, the predicted 1-hour NO_2 concentration at 2001 is estimated by multiplying the predicted concentration at 2011 (excluding background) by 1.069, and then adding the future background.

Petrol vehicles contribute more carbon monoxide to the atmosphere than diesel-powered vehicles, however diesel-powered vehicles (particularly the heavy goods vehicles) emit more nitrogen oxides and particulates. Current controls on traffic emissions are likely to lead to reduced emissions from petrol vehicles as a result of more vehicles being fitted with catalytic convertors. In view of the anticipated lower emission rates of carbon monoxide and the high statutory limit of carbon monoxide, the key air quality issue in this study is considered to be NO_2. The majority of air quality studies undertaken in Hong Kong and monitoring undertaken by EPD also indicate this to be the case. For this reason, this assessment has concentrated on potential future NO_2 concentrations arising from the proposed road network.

Table 6.2 Composite Vehicle Emission Factor (Year 2011)

RoadError	VehicleType	Propotion	Emission Factor ($g\,km^{-1}\,vehicle^{-1}$)		
			CO	NO_x	RSP
Tolo Highway S/B	Car	64.3	13.508	1.321	0.282
	Taxi	6.7	0.910	0.779	0.238
	LGV	8.4	1.122	1.803	0.361
	HGV	16.8	8.410	7.061	0.566
	PLB	1.6	1.064	1.782	0.352
	Buses	2.1	9.017	8.578	0.894
	Composite Emission Factor		10.460	2.448 (0.490 as NO_2)	0.347
Tolo Highway N/B	Car	38	13.508	1.321	0.282
	Taxi	4	0.91	0.779	0.238
	LGV	16.9	1.122	1.803	0.361
	HGV	33.6	8.41	7.061	0.566
	PLB	3.2	1.064	1.782	0.352
	Buses	4.3	9.017	8.578	0.894
	Composite Emission Factor		8.607	3.636 (0.727 as NO_2)	0.418

The proposed noise mitigation measures (noise barriers) have taken into consideration in the air quality assessment including all the "future planned" noise barriers. As this is the preliminary design stage, there may be some changes in future land uses or building designs and the nature of future developments may be changed from noise sensitive to non-sensitive. Therefore, the "future planned" noise barriers may not necessarily be implemented to protect future development. However, there are only minor changes in the predicted air quality levels with, and without, the planned noise barriers. Notwithstanding this, a detailed air quality assessment is recommended where there are changes in the planned noise barrier design to ensure the air quality for all the nearby sensitive developments can meet AQO guidelines.

In order to choose the most cost-effective barrier design for both noise and air quality impacts, the design can be further optimised and minor adaptations made. This optimisation procedure is recommended to be done at the detailed design stage. This would include assessing slight modifications to length of barrier and where appropriate different extent of overhang. The effectiveness of protection against air and noise impacts can then be optimised against the cost of construction and maintenance.

In the detailed design stage, it is also recommended to use other more sophisticated models to reflect the actual impact induced by the noise barriers. The assessment undertaken by other more sophisticated models will facilitate the identification of the most cost-effective barrier design mentioned above.

6.2.5 Predicted Impacts

Impacts on the Existing Developments

Predicted 1-hour average NO_2 concentrations were modelled and assessed for years 2011 and 2001 at the existing sensitive receivers. The resulting NO_2 concentrations were similar in magnitude for all options and all predictions complied with the AQO. The only exceedances at existing ASRs are the Marine Science Laboratory and the KCRC Hostel building. Predicted maximum hourly NO_2 concentrations for the worst affected representative sensitive receivers are given in Table 6.3. Detailed results for each representative sensitive receiver are tabulated in Appendix G. The worst case 1-hour average NO_2 concentration was predicted to be at the front facade of the Marine Science Lab. Samples of the input and output files are attached in Appendix G for reference.

Table 6.3 Predicted 1-Hour Average NO_2 Concentration at the Existing Air Sensitive Receptors

Receiver (and Height m)	Maximum Predicted 1-hour NO_2 Concentration (ug/m^3) - 2011	Maximum Predicted 1-hour NO_2 Concentration (ug/m^3) - 2001
A1 - Kwong Fuk Estate (1.5)	151	159
A2 - Island House Conservation Centre (1.5)	145	152
A3 - Care Village (1.5)	213	225
A4, A86-88 - KCRC Club Hostel (1.5)	289	306
A5 - Sea View Villas (1.5)	223	236
A6 - Tai Po Kau Village House (1.5)	191	202
A7 - CUHK Res. 10 (1.5)	197	208
A8 - CUHK Grace Tien Hall (1.5)	129	135
A9 - CUHK Inst. Of Biotechnology (17.5)	274	291
A11 - Marine Police Station (1.5)	212	224
A12 - Marine Police N. Division Base (1.5)	150	157
A13 - Residential House adjacent I.o.Biotechnology (1.5)	212	224
A10, A94-103 - CUHK Marine Science Lab (1.5)	316	335
A104-122 - CUHK Eastern Campus (1.5)	230	243

Remarks: (1) $40\mu g/m^3$ NO_2 has been incorporated as future background.
(2) Assessment for the Institute of Biotechnology is only made at the FAI location, i.e. 17.5m above ground.

Predicted 1-hour average NO_2 concentration isopleth for the alignment at heights 1.5 metres above ground, are illustrated in Figures 6.10 to 6.12 respectively.

Impact on CUHK Marine Science Laboratory

In view of the impact at the Marine Science Lab, a range of mitigation measures have been proposed. These have included using of different extent of overhung barriers and Highway enclosures adjacent to the Marine Science Lab. However, the predicted results indicated that there are still some exceedances at the front facades of the Marine Science Lab for the barrier options, and at portal areas for the Highway enclosure options. Details of the prediction results are listed in Appendix G10.

The most cost-effective and feasible mitigation measure identified was that of upgrading the air conditioning systems at the facades of the Marine Science Laboratory to ensure that the air conditioning systems involved no air intakes at the road facade. This can be accomplished by upgrading the existing air conditioners to split-type air conditioners.

A site visit to the Marine Science Laboratory, and consideration of the building plans, identified that 6 or 7 air conditioners would need to be upgraded from through-air types to split types. Provisional details of the locations are shown in Appendices G8-1 and G8-2 (though not all the air conditioners are specified on the plans available). Adequate fresh air ventilation to the laboratories was considered available from the ventilation and air conditioners on the seaward side of the buildings.

The work involved in replacing the existing air conditioners is expected to be minimal, and it is expected that the replacement split-type air conditioners can use the existing fixtures, and take up the same space. The work involved for all 6 or 7 upgraded air conditioners would expected to be completed within a day, at minimum inconvenience to MSL occupants.

Detailed evaluation and implementation details of the proposed upgrade of air conditioners would occur, should the Widening project proceed to the next stage, during detailed design of the project.

KCRC Hostel Building

There is a slight exceedance of the AQO in 2001 at the KCRC Hostel. The recommended mitigation measure at this site is to slightly modify the noise barriers to the following specification. Two sections of revised noise barriers to accomodate air quality mitigation are recommended and listed as follows:

1) The barrier at CH 1428 to CH 1657 upgraded to 5.5m height barrier with 2.5m overhang (260m long x 7m overall height).

2) The barrier at CH 1657 to CH 1912 upgraded to 5.5m height barrier with 4m overhang (260m long x 7m overall height).

The air quality predictions with such mitigation measures implemented are as follows, and show compliance with the AQO guideline.

Receiver (and Height m)	Maximum Predicted 1-hour NO_2 Concentration (ug/m^3) - 2011	Maximum Predicted 1-hour NO_2 Concentration (ug/m^3) - 2001
A4, A86-88 - KCRC Club Hostel (1.5)	282	298

CUHK Yacht Club / Water Sports Centre

Consideration has also been given to the impacts on the adjacent water sports centre/ yacht club. The centre comprises a number of converted containers, and is used for storage and changing rooms. Some more permanent buildings comprise changing rooms and toilet facilities. Because of this, and the transitory nature of its use, the centre is not considered a sensitive receiver for air quality under the meaning of the 'Environmental Guidelines for Planning in Hong Kong'.

Impacts on Future Development Sites (Pak Shek Kok and Public Dump Site)

The assessment results indicated that there would be constraints on future planned development from a widened Tolo Highway. For indicative purposes, a set of points were chosen (ASRs 14 -43 & 74 - 85)to predict the impacts at Tai Po Area 39 and at the Pak Shek Kok Public Dump Site. The results are given in Appendix G. These show that there would be a buffer zones within which the AQO standards are likely to be exceeded and which therefore represent a constraint on any future planned air sensitive uses. The buffer zone distances are summarised in Table 6.4. The buffer zone distance is measured at 1.5m above ground, from the outermost edge of the driving lane of the Tolo Highway to points representing possible future ASRs. This buffer zone impact from NO_2 levels was distributed along the two sides of the Tolo Highway and varies according to the road alignment and prevailing wind (Figures 6.10- 6.12).

The buffer zones we have defined under the study are summarised in Tables 6.4 to 6.6. These would provide the indicative buffer zone area. Please note that these buffer zones are calculated from the outermost edge of the driving lane. The attached Air Quality Buffer Zone drawings illustrate the affected areas in detail.

Table 6.4. Summary of Air Buffer Zone Impacts

Future Development Area	**Buffer Zone Required in 2001**	**Buffer Zone Required in 2011**
Area 39 - Northern G/IC site	67m	53m
Area 39 - Sports Ground (HKIEd)	45m - 55m	41m - 49m
Area 39 - Southern G/IC site	35m - 50m	29m - 44m
Pak Shek Kok Public Dump - Stage I	45m	40m
Pak Shek Kok Public Dump - Stage II	37m	33m
Pak Shek Kok Public Dump - Stage III	51m	44m

Table 6.5. Indicative Distances to Planned Development Areas in Area 39

Future Development Area	Defined Buffer Zone (from edge of hard shoulder) for 2001	Verge	Clearance to KCRC Area	KCRC Area (Approx. width)	Extent future development area affected (indicative only)
Area 39 - Northern GIC site	67m	2m	5m	24m - 26m	36m - 34m
Area 39 - Sports Ground (HKIEd)	45m - 55m	2m	5m - 7m (average 6m)	24m - 26m (average 25m)	12m - 22m
Area 39 - South GIC site	35m - 50m	2m	5m - 9.4m (average 7.2m)	26m - 28m (average 27m)	0m - 13.8m

Table 6.6. Indicative Distances to Planned Development Areas in PSKPDR

Future Development Area	Defined Buffer Zone (from edge of hard shoulder) for 2001	Verge	Planting Zone	Cycletrack & Footpath	Extent future development area affected (indicative only)
PSKPDR - Stage I	45m	2m	5m	8.5m	29.5m
PSKPDR - Stage II	37m	2m	5m - 28m (rest area)	8.5m	21.5m - 0m (rest area)
PSKPDR - Stage III	51m	2m	5m	8.5m	35.5m

These air buffer zones arise from vehicle emissions on the Highway, and will arise under existing conditions and even if the Highway is not widened. Due to improvements in vehicle technology, vehicle emissions are expected to improve in the future, and therefore future air buffer zones will be smaller for the same amount of traffic. The effect of noise barriers on air buffer zones is minimal. The prediction method presently used will predict a slight decrease (in the order of 1 metre) in the buffer zone if a noise barrier is present. There is little that can be done to mitigate these impacts short of complete Highway enclosure, which is not considered a cost-effective or feasible solution in this situation (and in any case only moves the emissions to the portals of the enclosure where the impacts are correspondingly higher).

Within the air buffer zones on planned development areas, it is recommended that development be limited to non-sensitive uses, such as car parks, footpaths, amenity and landscape areas. In addition, though cycle tracks are not considered air sensitive, they should preferably be located as far as possible from Tolo Highway in the design.

For sensitive building uses planned within these air buffer areas, it would be necessary to provide sealed buildings with central air conditioning on the affected floors. The air intakes should be located where NO_2 concentrations comply with AQO criteria.

For these planned development areas, a detailed assessment is recommended to predict the air quality impact at sensitive locations once the detailed layout designs are finalised.

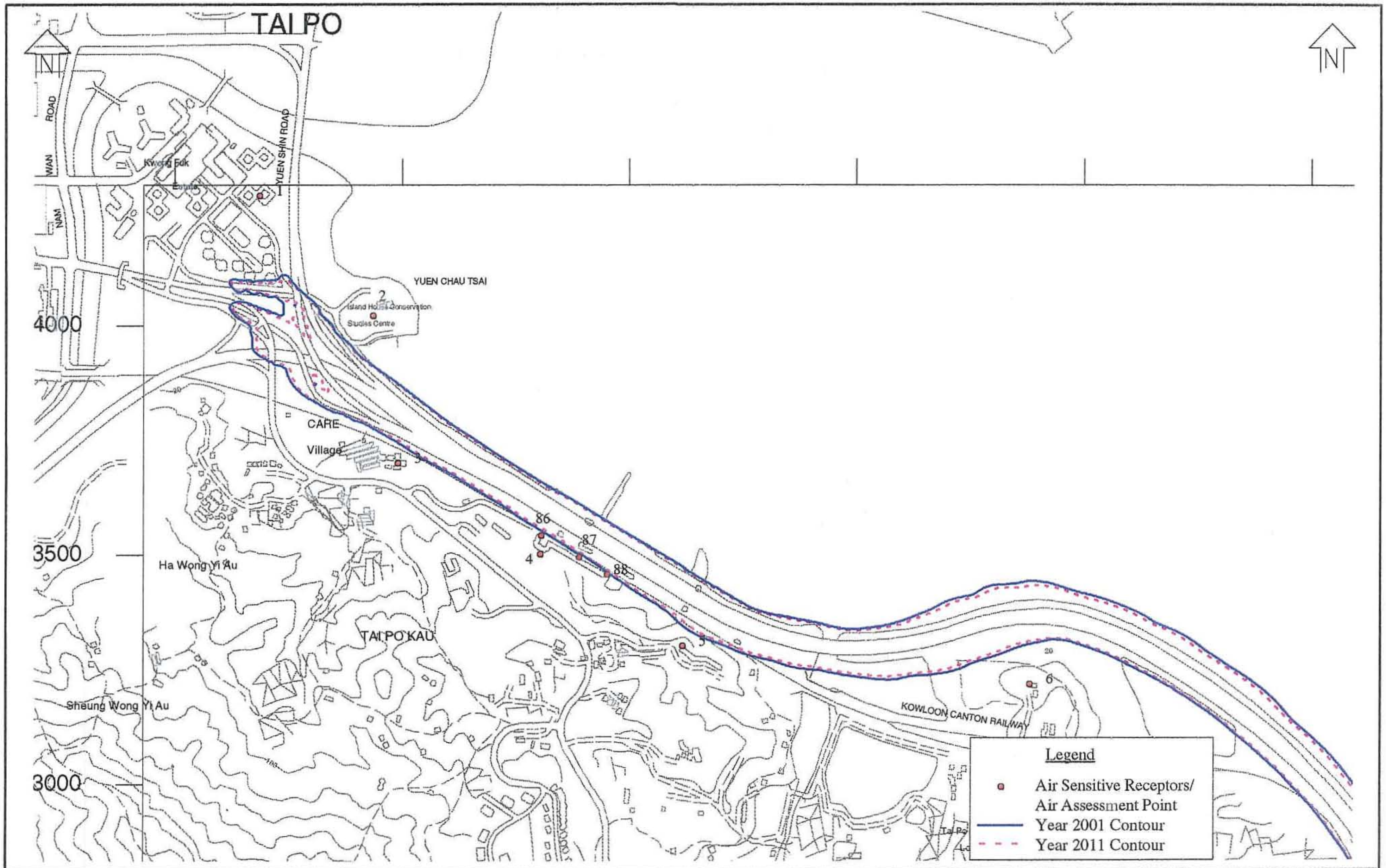

Figure 6.10 Predicted 1-hour Average NO2 Isopleth (μg/m3) at 1.5m above Local Ground Level, Northernmost Section

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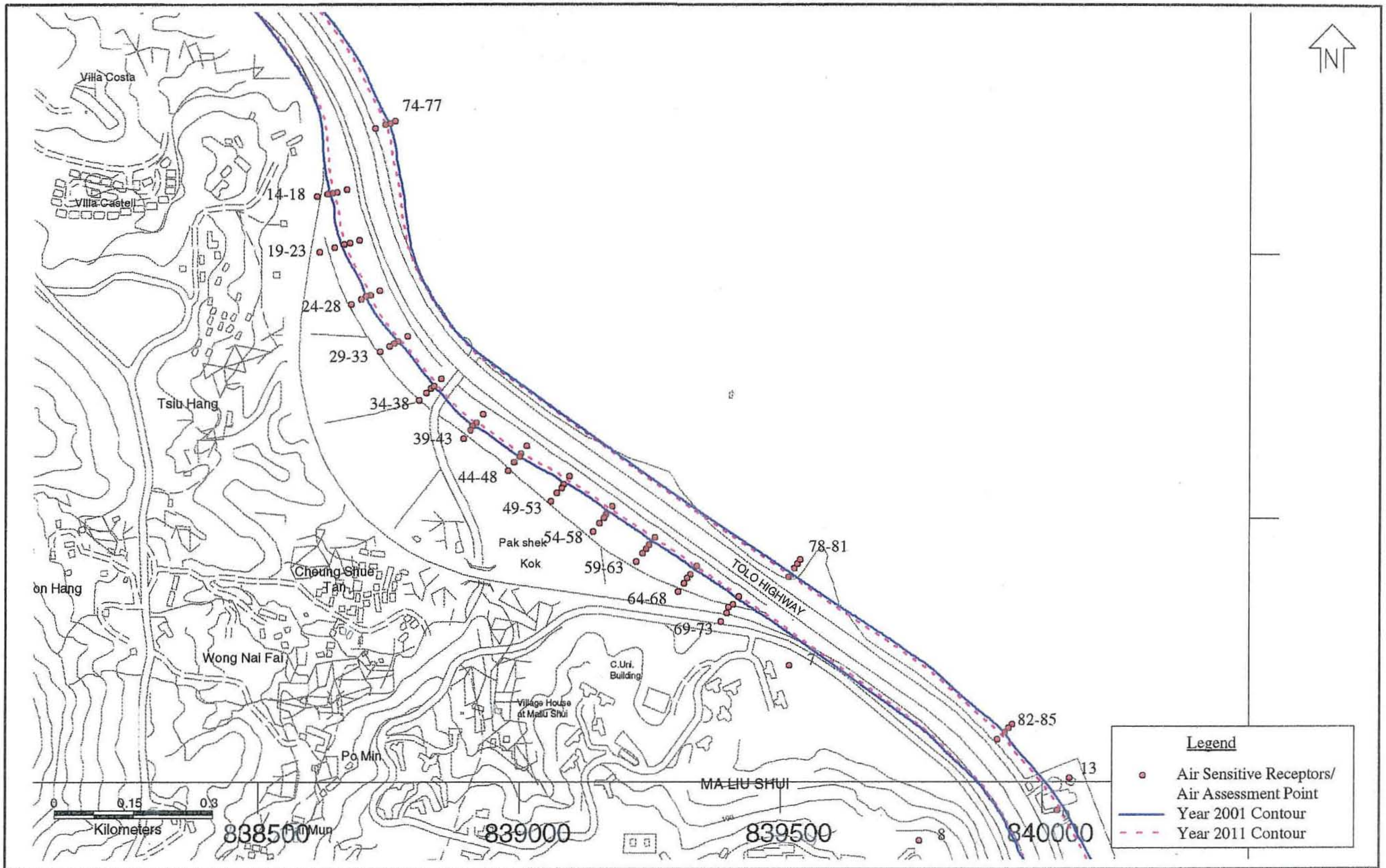

Figure 6.11 Predicted 1-hour Average NO2 Isopleth (μg/m3) at 1.5m above Local Ground Level, Middle Section

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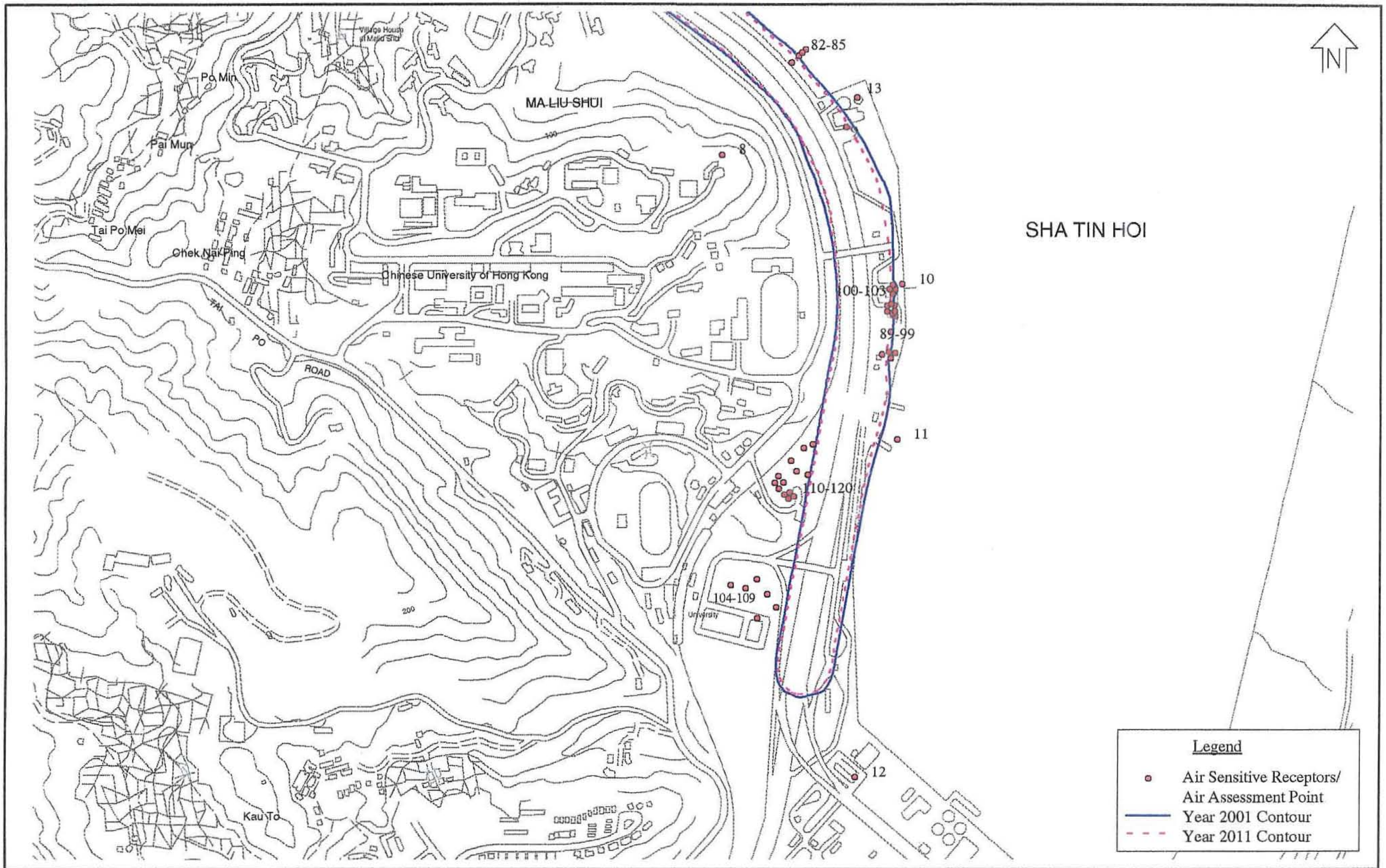

Figure 6.12 Predicted 1-hour Average NO2 Isopleth (μg/m3) at 1.5m above Local Ground Level, Southernmost Section

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Impacts on Future Development Sites (CUHK Buildings E5-E7 & E9)

For the future developments at the eastern campus of the CUHK, there would be no exceedances at the future buildings. These buildings include Shanghai Fraternity Association Research Services Centre (E5), prospective transport depot (E6), prospective garbage collection depot (E7) and building complex for B.A., C.S. & Convention Centre (E9). No constraints due to emission impact would be envisaged due to vehicular emission impact.

6.2.6 Summary of Operational Air Quality Impacts

Taking into consideration the implication on air quality of the proposed noise barriers, it is predicted that there will be compliance with the statutory AQOs at the existing air sensitive receivers except the CUHK Marine Science Laboratory and KCRC Hostel.

At the Marine Science Lab, a range of mitigation measures have been investigated. These have included using of different extent of overhang barriers and a Highway enclosure next to the Marine Science Lab. However, the predicted results indicated that there are still some exceedances at the front facades of the Marine Science Lab for the barrier options, and at portal areas for the Highway enclosure options. The most cost-effective and feasible mitigation measure identified was that of upgrading the air conditioning systems at the facades of the Marine Science Laboratory to ensure that the air conditioning systems involved no air intakes at the road facade. This can be accomplished by upgrading the existing air conditioners to split-type air conditioners.

There is only a slight exceedance of the AQO in 2001 at the KCRC Hostel. The recommended mitigation measure at this site is to slightly modify two sections of noise barriers to canopies. The air quality prediction will then show compliance with the AQO guideline.

Emissions from traffic using the Tolo Highway will constrain future planned development adjacent to Tolo Highway. Assessment results for the year 2001 predict that there would be a buffer distance requirement of up to 67m in some areas. The buffer distance is measured from the outermost edge of the driving lane of the Tolo Highway to any future planned ASRs. This buffer zone represents a constraint on Area 39 (G/IC and HKIEd sports ground site) and the Pak Shek Kok Public Dump Reclamation site. It is recommended that these buffer areas should be limited to non-sensitive uses such as car parks, landscape areas, warehouses and buildings which have central air conditioning.

7 ECOLOGICAL ASSESSMENT

Most of the area to be affected by the proposed project was disturbed during the initial Tolo Highway construction project. Areas of natural habitat which remained largely unaffected by the earlier project and are of local importance for conservation are located in the vicinity of Tai Hang Bridge and on the south shore of Yuen Chau Tsai. The differences between the three alignment options are slight with regard to their potential ecological impacts at these sites and at other portions of the alignment.

Field surveys were carried out in March through June 1996 to describe the ecological resources of the study area and to assess the overall impact of road widening. Attention was focused on design variations to evaluate the relative additional impacts or benefits arising from the different options.

7.1 Survey Methodology

The study area was defined as the area within the site boundaries for the different alignments. Initial surveys were carried out to produce a 1:5000 scale habitat map and to identify sensitive areas to be affected by the proposed alignments. Further surveys were then performed to describe the areas identified and assess the probable impacts arising from each alignment option. Mitigation and impact avoidance measures were also developed.

7.1.1 Flora

Botanical surveys were conducted within the site boundary on 13 March, 24 April and 11 June 1996. Surveys were conducted by walking the study site, mainly the cycle track and footpaths along the highway, to develop a species list with a non-quantitative estimate of relative abundance (common, locally common, rare). Local abundance was compared with Territory-wide and regional abundance estimates to determine which species are of conservation importance based on relative rarity. Attention was given to the location and identification of species that are rare, endangered, or protected under local regulations or international conventions. The importance of each habitat identified was evaluated based on habitat maturity, community composition, and regional occurrence and distribution. Major habitats were mapped on 1:5000 maps.

7.1.2 Avifauna

Avifauna surveys were carried out on 19 May and 11 June 1996. On Sunday 19 May 1996 a survey was conducted from 13:15 hours to dark from Yuen Chau Tsai to the Tai Hang Bridge mangrove. Weather conditions were mild, skies clear, winds calm, and the air temperature was estimated at 26°C. On Tuesday 11 June 1996 a survey was conducted over the same area between 07:45-10:30 hours. Weather conditions were hot, skies clear, winds calm to 5km east, and the air temperature was estimated at 30-33°C.

Surveys were conducted non-systematically by walking along the shoreline and around the perimeter of the Tai Hang mangrove.

During bird surveys observations were recorded of other fauna heard or seen.

7.1.3 Herpetofauna and Mammalian Fauna

Survey for reptiles, amphibians, and mammals was carried out simultaneous with the flora and avifauna surveys.

7.1.4 Intertidal

Qualitative intertidal surveys were carried out during May and June 1996 to assess and describe the nature of the intertidal flora and fauna along the coastline to be affected. Information regarding the sub-tidal ecology was obtained from literature review.

7.2 Survey Results

7.2.1 Habitats

Both aquatic and terrestrial habitats were represented within the study area, including coastline, mangroves, plantations, and grassland (Figures 7.1 - 7.5). Woodlands in the vicinity of the study area are also shown. The entire study area was generally disturbed by previous construction works except for limited areas at Yuen Chau Tsai, along the Tolo Harbour coast, and near Tai Hang Bridge.

7.2.2 Flora

Within the study area 62 species were recorded, 27 of which were planted and/or exotic species (Appendix E). No species which are endangered or protected under local or international regulations were recorded.

The vegetation consisted predominantly of landscape or ornamental plantings associated with the cycle tracks, along both sides of the current highway and at and around the Island House Interchange (Figures 7.1 - 7.4). Major plantations included stands of *Acacia*, *Casuarina* and *Eucalyptus* and isolated trees of *Leucanea leucocephela*, *Ficus microcarpa Hibiscus tiliaceus*, *Acacia* and *Casuarina* planted in rows or in planter boxes. At Tolo Garden were a mixture of exotics (mainly *Acacia* and *Casuarina*) and native trees including *Schefflera octophylla*, *Sterculia lanceolata* and *Bridelia tomentosa*.

Besides plantations, the only other habitat within the site boundary was a fairly disturbed grassland at the foothill of St. Christopher's Head. Major species included tall grasses such as *Miscanthus floridulus* and *Neyraudia reynaudiana* with a few isolated trees such as *Mallotus paniculatus*.

Most woodlands were located landward of the KCRC boundary. Two exceptions were the woodlands at Island House on the seaward side of the existing Tolo Highway, and at St. Christopher's Head where the KCRC passes through a tunnel. Both woodlands are outside the works boundary.

7.2.3 Avifauna

Birds recorded during field surveys are listed in Table 7.1. A total of 120 birds of 21 species representing 13 families were recorded during field surveys.

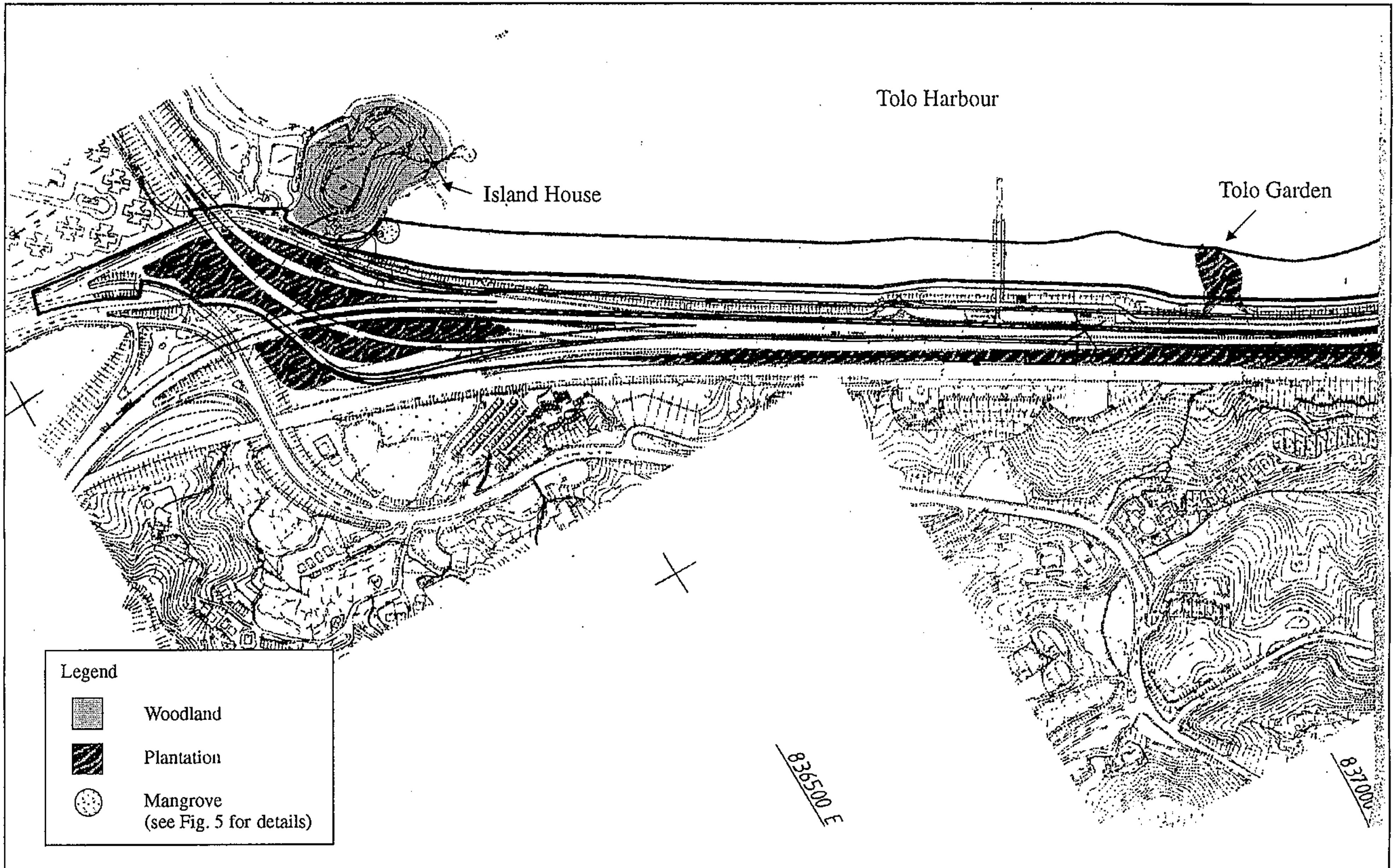

Figure 7.1 Habitat Map, Tolo Highway (from Shatin to Tai Po)

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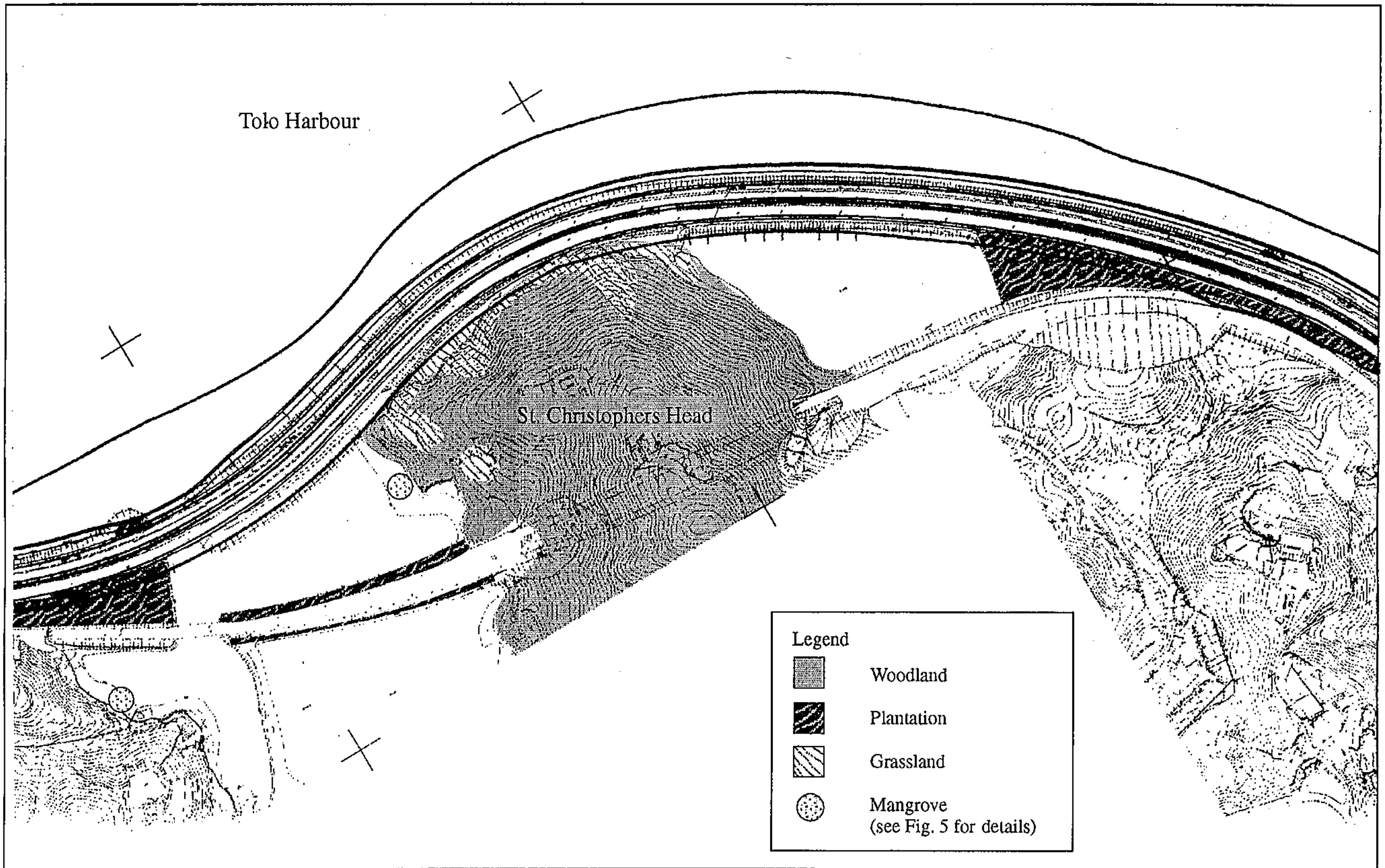

Figure 7.2 Habitat Map, Tolo Highway (from Shatin to Tai Po)

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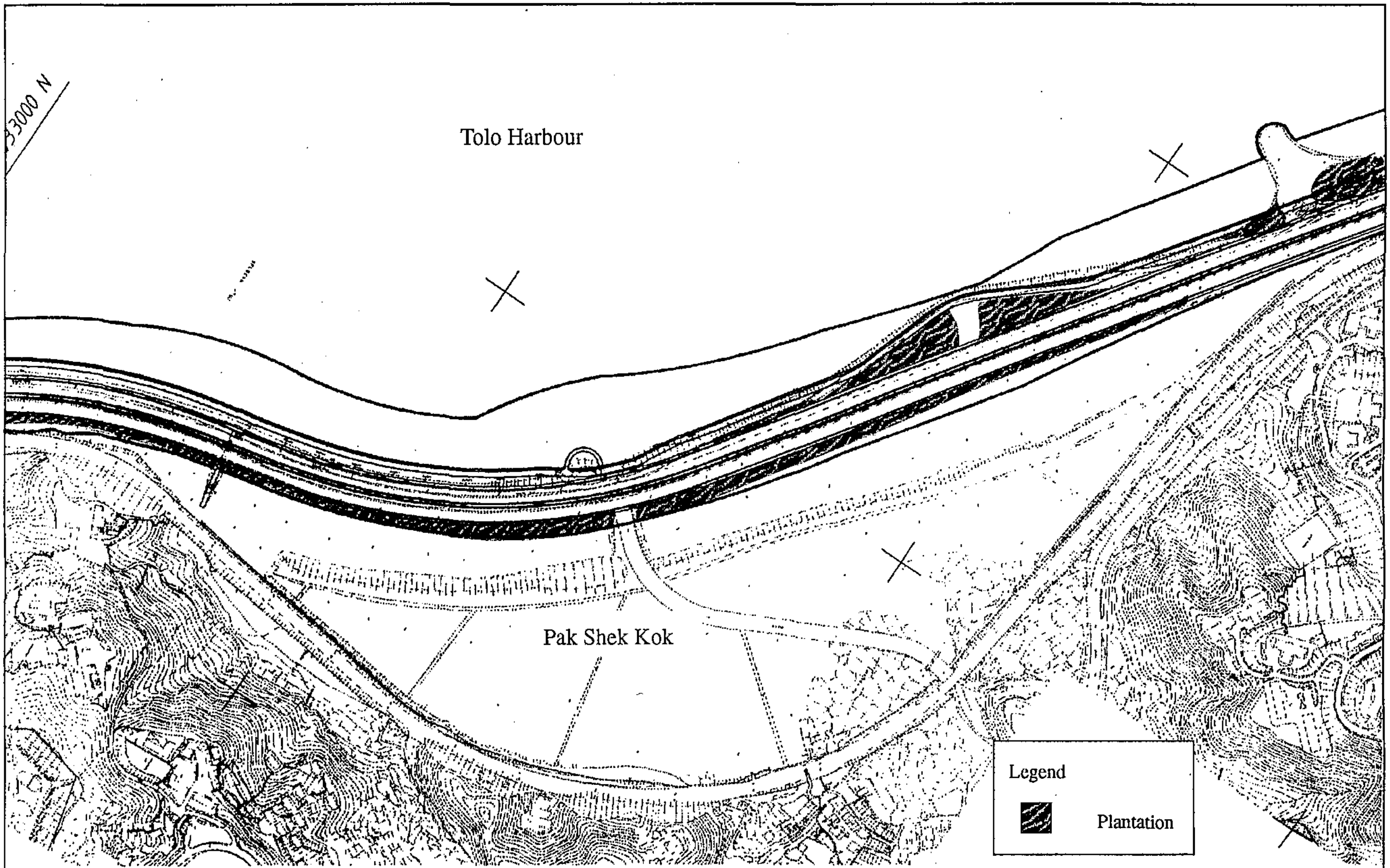

Figure 7.3 Habitat Map, Tolo Highway (from Shatin to Tai Po)

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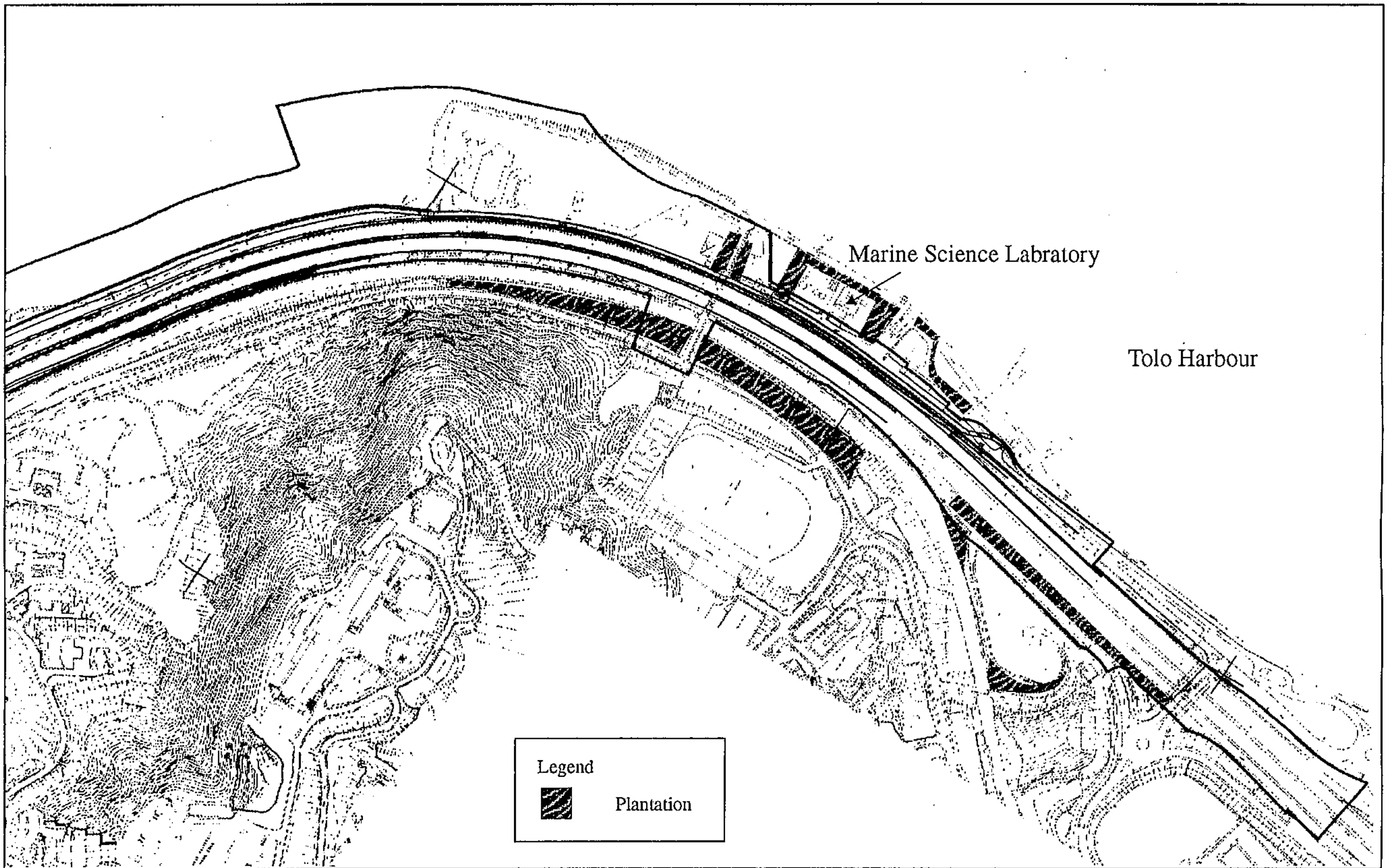

Figure 7.4 Habitat Map, Tolo Highway (from Shatin to Tai Po)

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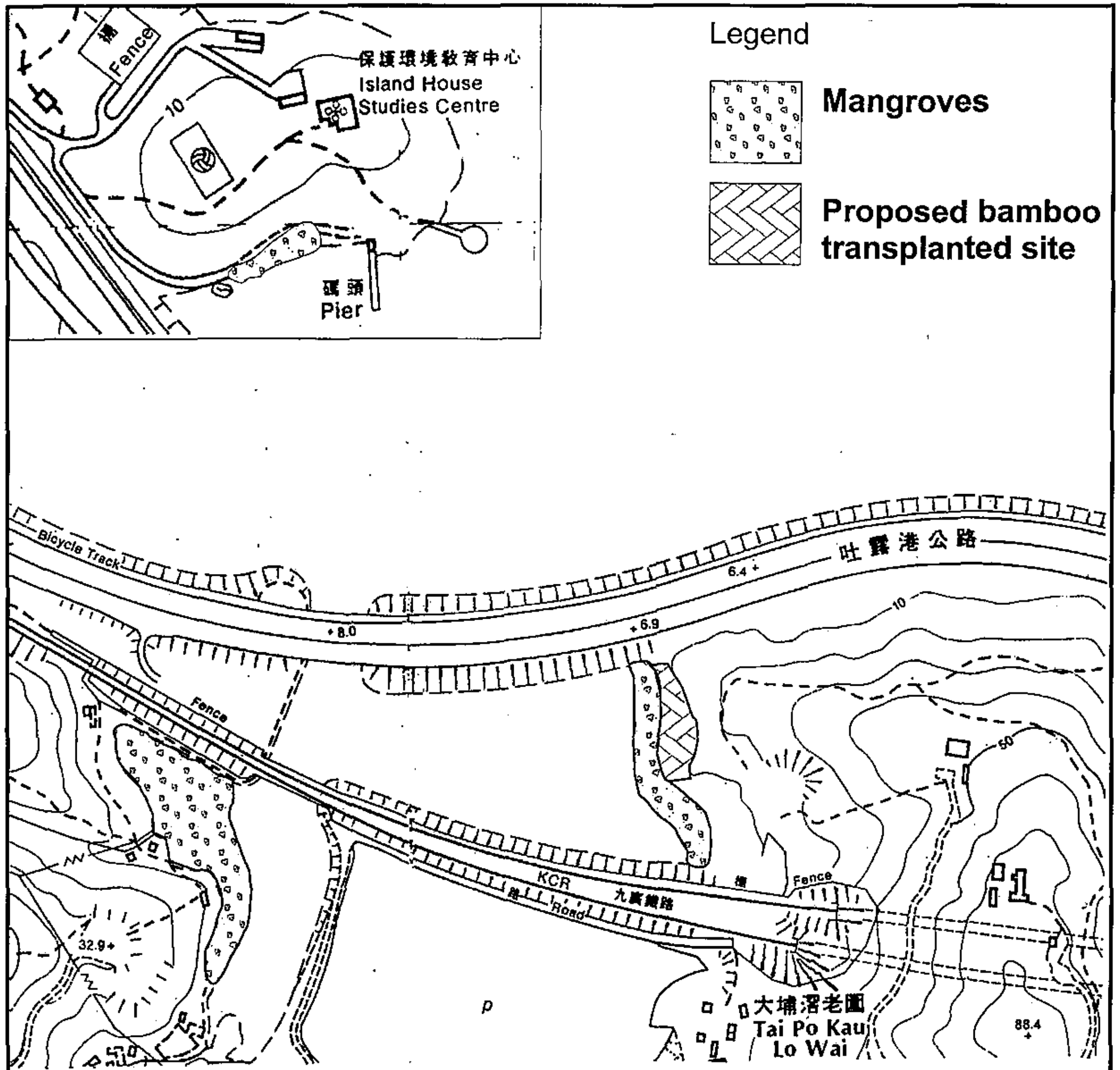


Figure 7.5 **Approximate Extent of Mangrove Habitat at Tai Hang Bridge and Island House.**

The species observed in greatest numbers was the Little Egret, which accounted for 43% of total observations (52 birds). Little Egrets were observed along the coast and in the mangrove and associated habitats near Tai Hang Bridge.

Of the 21 species recorded, 18 were residents, and 3 were migrants. Of the migrants, the Large Hawk Cuckoo and the Black Drongo are summer visitors to Hong Kong, and the Grey-tailed Tattler is a passage migrant which was presumably en route to breeding areas in northeast Asia.

Table 7.1 Birds Recorded on the Tolo Highway Works Area between Island House and Tai Hang Bridge on 19 May and 11 June 1996

Common Name	Species Name	Status	No.	Habitat
Chinese Pond Heron	*(Ardeola bacchus)*	R	2	shore
			1	mudflat
			2	mudflat
			1	shore
Night Heron	*(Nycticorax nycticorax)*	R	2	shore
			1	shore
			1	shore
			1	shore
Little Egret	*(Egretta garzetta)*	R	3	shore
			1	buoy
			8	mudflat
			1	shore
			1	shore
			1	shore
			1	shore
			22	shore
			8	shore
			6	shore
Great Egret	*(Casmerodius albus)*	R	1	buoy
White-breasted Waterhen	*(Amaurornis phoenicurus)*	R	1	mangrove
Grey-Tailed Tattler	*(Tringa brevipes)*	PM	3	shore
Feral Pigeon	*(Columba livia)*	R	5	bridge
Koel	*(Eudynamis scolopacea)*	R	1	upland wood
Large Hawk Cuckoo	*(Cuculus sparverioides)*	SV	1	upland wood
Common Kingfisher	*(Alcedo atthis)*	R	1	pond
Chinese Bulbul	*(Pycnonotus sinensis)*	R	1	coast shrub
Crested Bulbul	*(Pycnonotus jocosus)*	R	1	mangrove
Rufous-backed Shrike	*(Lanius schach)*	R	1	mangrove
Magpie Robin	*(Copsychus saularis)*	R	1	mangrove
			1	coast shrub
Plain Prinia	*(Prinia inornata)*	R	1	coast shrub
			1	coast shrub

Table 7.1 Birds Recorded on the Tolo Highway Works Area between Island House and Tai Hang Bridge on 19 May and 11 June 1996 (Cont'd)

Common Name	(Species Name)	Status	No.	Habitat
Common Tailorbird	*(Orthotomus sutorius)*	R	1	upland trees
			1	mangrove
			3	coast shrub
			2	coast shrub
Japanese White-eye	*(Zosterops japonica)*	R	1	mangrove
			4	coast shrub
Tree Sparrow	*(Passer montanus)*	R	1	mangrove
			4	coast shrub
Black-necked Starling	*(Sturnus nigricollis)*	R	2	upland wood
Crested Mynah	*(Acridotheres cristatellus)*	R	2	shore
			1	backshore
			1	shore
			1	mangrove
Black Drongo	*(Dicrurus macrocercus)*	SV	2	upland wood
			3	coast shrub

Key to Status: R= resident
SV= summer visitor
WV = winter visitor
PM = passage migrant

Tolo Harbour Shoreline

The shoreline of Tolo Harbour between Island House and Tai Hang Bridge was almost entirely constructed as part of the initial Tolo Highway project. The shore line consisted primarily of reaches of large boulders with smaller reaches of cobble or gravel. Although it was man-made, the boulder shore has developed into a useful habitat for both marine and avian fauna. The only remaining reaches of natural shoreline were at Yuen Chau Tsai and Tolo Harbour Garden. Habitat value of the shoreline was compromised by the general lack of habitat diversity and the frequent and intensive human and vehicle disturbance on the adjacent cycle path and expressway.

The boulder shore provided habitat for marine invertebrates and small fish, while simultaneously providing foraging perches for birds. The shore line was inhabited by ardeid and scolopacid birds which fed on the intertidal prey base amongst the boulders.

Although the spring migration of shore birds had passed before the survey date, presence of the Grey-tailed Tattler indicates that shore birds use the Tolo Harbour intertidal zone along the highway. The number and diversity of charadriiform birds (plovers, sandpipers, curlews and allies) using the intertidal zone may be greater during autumn migration, winter season, and spring migration than during the late spring to early summer months when the survey was conducted.

Little Egrets, Chinese Pond Herons, and Night Herons were distributed along the entire shore from Yuen Chau Tsai to Tai Hang Bridge. Near Tolo Harbour Garden the boulder shore extended some 50 m off shore, and this area appeared to attract the greatest numbers of Little

Egrets. This may have been due to greater availability of prey, or to the reduced threat of human disturbance afforded by the slightly greater distance of foraging perches from the cycle path and highway. The east shore of Yuen Chau Tsai peninsula also attracted groups of Little Egrets on weekdays when human use of the area was not intensive.

Tai Hang Bridge Mangrove

Bird species richness was greater in the mangrove and associated habitats near Tai Hang Bridge (13 species) than along the Tolo Harbour shore (8 species). This was probably attributable to the season of the year during which surveys were carried out, to the greater diversity of habitats available near Tai Hang Bridge, and to the relatively low levels of human and vehicle disturbance.

The Tai Hang mangrove and stream estuary was initially reduced in extent by construction of the KCRC rail and Tolo Highway. Formation of a freshwater pond east of the mangrove also greatly reduced the area of the former estuary. In spite of these earlier losses of habitat, the remaining mangals, mudflats, and surrounding shrub and wooded habitats supported abundant bird life.

Egrets and herons were observed feeding on the mudflats and along the shore, and roosted in trees surrounding the estuary. However, no evidence of heron or egret nesting at the site was recorded.

Habitat Use

Habitat use by birds recorded during the surveys is summarised in Table 7.2. The habitat used by the greatest number of birds was the intertidal boulder shore (48% of total birds). Backshore (below the cycle path along Tolo Highway) and coastal shrub (near Tai Hang Bridge) habitats combined accounted for 20% of bird numbers. The mangrove and mudflat habitats at Tai Hang Bridge together accounted for 15% of bird numbers.

Possibly the most interesting, and certainly the most humorous observation was of a Great Egret which stood on a floating rectangular piece of styrofoam as it drifted across Tolo Harbour. The bird was not observed foraging from its "raft", but only stood as the light breeze drifted the styrofoam across the surface. For lack of a more appropriate habitat category, this observation was grouped with that of a Little Egret which was observed perched on a buoy.

Table 7.2 Habitat Use by Birds Recorded between Yuen Chau Tsai and Tai Hang Bridge on 19 May and 11 June 1996

Habitat	No. of Birds	Percent of Total Birds
Shore	57	48%
Coastal shrub	16	13%
Mudflat	11	9%
Bridge	11	9%
Backshore	8	7%
Mangrove	7	6%
Upland wood	7	6%
Buoy	2	2%
Pond	1	1%
Total	120	100%

7.2.4 Herpetofauna and Mammalian Fauna

There was little freshwater habitat within the works area, therefore there were few observations of amphibians. Guenther's Frog (*Rana guentheri*) was heard calling at the upper margin of the Tai Hang mangrove from a small stream. No reptiles or mammals were observed.

7.2.5 Estuarine Habitats

The mangrove community at Tai Hang Bridge is dominated by *Kandelia candel,* with some *Avicennia marina* and *Aegiceras corniculatum.* The mangrove occurs in two areas of semi-enclosed water created behind the present highway and KCRC alignment (Figure 7.5), and is located outside the proposed works area for the highway widening project. This area is the original mouth of a stream that has its source in Tai Po Kau Nature Reserve. A belt of trees runs along the southern edge of the lagoon, and a larger stand exists on the north shore from the KCRC bridge. The mangrove was modified and probably reduced in area by construction of the KCRC rail line and Tolo Highway. A large pond west of the KCRC alignment was probably also excavated from former mangrove area. The mouth of the bay at Tai Hang was greatly reduced in width by construction of Tolo Highway. However, this had no apparent adverse impact on the surviving mangals.

7.2.6 Intertidal Areas

The major part of the intertidal area that borders the seaward edge of the present highway is composed of rip-rap slope protection, offers little ecological value. The substrate of the adjacent shallows is generally coarse sand and gravel, with areas of small stones and pebbles.

The intertidal habitats to be affected by the project consist almost entirely of the boulder reinforced slope put in place during the construction of Tolo Highway. Due to the sheltered nature of the coastline, the intertidal zone has not been extended upshore by wave action, and is confined to a strip representing the limits of high and low tide. This strip has become colonised by fauna typical of such habitats in Hong Kong, although the large crevices and holes between the jumbled boulders has lead to the presence of a mixture of species often separated by their varying tolerances to wave exposure, with the distribution of fauna on individual boulders mirroring the larger scale zonation found over the whole eulittoral zone.

As is common on boulder shores, the sea slater (*Ligia exotica)* was present in huge numbers. The eulittoral zone was dominated by the barnacle *Balanus amphitrite amphitrite,* below which there was a narrow band comprised mainly of rock oysters (*Saccostrea cucullata).* Within crevices between boulders were clusters of the oyster *Pinctada fucata*, with very occasionally a mussel or two belonging to the species *Septifer bilocularis* and *Brachidontes atratus*. Empty shells of the green-lipped mussel, *Perna viridis*, were recorded, but no living individuals were found. The gastropod fauna of the coastline was quite limited, with just one neritid recorded (*Nerita albicella)* and two whelks, *Thais clavigera* and *Morula musiva*. The distributions of all three species were patchy, and they were nowhere abundant. In the shadows under boulders were scattered anemones (*Haliplanella luciae*). In the shallow subtidal, the rocks had a covering of green algae, predominantly *Ulva conglobata*. In places *Codium cylindricum* had washed ashore.

In the few areas of cobble shore, the fauna was not particularly abundant. *Saccostrea* was the dominant species, and under the stones were small aggregations of the top-shell, *Monodonta australis.*

A small area of mangrove dominated by *Aegiceras corniculatum* existed along the south shore of Yuen Chau Tsai (Fig 7.5)

7.2.7 Sub-tidal Areas

Horikoshi and Thompson (1980) recorded the bivalves *Paphia undulata* and *Arcuatula elegans* to be fairly common in waters 6-7m deep offshore from the present highway, as was the gastropod *Philine orientalis*. The mollusc fauna was otherwise sparse, the species present indicating a high degree of embayment, with evidence of previous mass mortalities in the inner harbour fauna, probably as a result of decreased tidal flushing of the inner bay, and increased development of the surrounding coastline. Other subtidal benthos recorded from inner Tolo Harbour include the starfish *Luidia longispina* (Chiu, Lam and Shin, 1985). Shin (1985) reported the dominant bivalve in the inner Harbour to be the previously unrecorded cockle, *Fulvia hungerfordi*. The invasion of the inner bay by this bivalve may have been facilitated by a reduction in one of its predators, the starfish *L. longispina,* and also due to the cockle's adaptability to an environment of patchy noxiousness. Species diversity in the inner Harbour lower than that in Tolo Channel and Mirs Bay (ibid.). Shin (1990) reported that the Tolo Harbour benthic assemblage was dominated by *Theora lata,* as well as the polychaetes *Sigambra tentaculata, Minuspio cirrifera, Leannates persica* and *Tharyx* sp. Cheung (1990) reported that the dominant portunid crab was *Portunus hastatoides.*

All the available records indicate that the benthic communities of the inner Tolo Harbour are of reduced diversity and are strongly influenced by high levels of organic pollution. Mass benthic mortality may also occur as a result of oxygen depletion during the summer months. This condition is normally a consequence of algal blooms arising due to eutrophic conditions, but may also occur if the water column becomes strongly stratified.

7.3 Potential Impacts

7.3.1 Habitat Loss and Vegetation

Two thirds of the projects length will involve symmetrical widening of the existing highway and therefore the loss of plantations on both sides of Tolo Highway and along the cycle track will be a direct impact of the project. Since most of the trees in the plantations are exotics planted in rows, the potential ecological loss is of minimal significance. There may also be some loss of disturbed grassland at the foot of St Christopher's head. Tolo Harbour Garden will be encroached mainly by the new cycle track, but most of its landform and vegetation will be retained during and after construction. Major woodlands including the ones at Yuen Chau Tsai and on the crest of St. Christopher Head will be avoided by all alignment options. Therefore, the impact on woodland habitats will be minimal.

The three alignment options differ in the southernmost section where alignment Options I and II vary in elevation while option III differs from option I only in the location of the cycle track, which will be provided to the seaward side of HKIB, and require some additional reclamation. In terms of potential impacts to terrestrial vegetation there are no differences between the three options. While Option III will involve a small amount of additional reclamation, the impacts to the marine ecology of the area are not predicted to be significant. All three options will result in impacts of minimal ecological significance.

7.3.2 Impacts to Avifauna

Tolo Harbour Shore

Impacts to bird habitats along the Tolo Harbour shore will result from loss of the existing shoreline and creation of a new shoreline some 10-20 m seaward. Because the existing shore provides foraging habitat which attracts resident and migrant birds, there will be a short-term impact due to habitat loss. This impact would gradually diminish in importance as the restored shore developed invertebrate communities to replace those that were lost during construction. Functional replacement of the lost foraging habitat is estimated to require 2-3 years at a minimum, and should be complete in no more than 5 years.

Tai Hang Mangrove

The mangrove at Tai Hang is mostly located outside the proposed works area, and should not be significantly affected by the construction project. Symmetrical widening of the highway at this point will be carried out mainly on the existing revetment, although a small amount of reclamation within the Tai Hang "lagoon" will be necessary. As the Main mangrove area id further back, the landward side of the KCR track, there will be no significant impact to the mangrove as a result of the bridge and road widening. The primary potential source of impact would be further restriction of tidal flushing, which would not be expected to be caused to a detectable degree by lengthening of Tai Hang Bridge to the extent proposed. Any sedimentation which might occur due to construction works would probably be minimal.

Protection of the mangrove would ensure protection of the exiting bird habitats. Therefore, no adverse impacts are predicted to avifauna at the Tai Hang mangrove due to habitat losses.

Disturbance of birds due to presence and activity of construction equipment and staff may cause adverse impacts to birds during the construction project. This would be a short-term impact, and, because no colonial nest sites occur on the site, would not affect bird communities which are considered to be of local conservation importance.

Operational impacts would not be expected to be greater than those in the baseline condition.

7.3.3 Impacts to Estuarine Habitats

With the exception of the limited reclamation described above, all three options will avoid direct impacts to the Tai Hang Bridge area of mangroves and the associated stream estuary. High levels of sedimentation can have deleterious effects on mangrove health and excessive levels of sediment in the estuary arising from the works should be prevented by the introduction of sediment traps.

7.3.4 Impacts to Intertidal and Subtidal Habitats

The shoreline that will be affected by all 3 alignment options is primarily man-made rock embankment formed during construction of the existing highway. It is of little ecological interest other than as shorebird foraging habitat.

The strip of sub-tidal habitat to be lost during due to highway widening is also of little ecological interest. Literature review suggests that the sub-tidal benthic ecology of the inner Tolo Harbour indicates a high degree of embayment, with slow flushing and water exchange. The area has experienced eutrophic conditions and probably periodic oxygen depletion leading to high benthic mortality. Consequently, many of the more sensitive benthic organisms are no longer found in the area. The extant benthic community is neither diverse nor of local or regional conservation significance, and will be readily restored through recolonisation of the new highway embankment. Therefore, impacts to sub-tidal ecology are not considered ecologically significant.

Although a large proportion of the shoreline will be disturbed by the proposed highway widening, the impacts will only be temporary, as an identical habitat will be put in place along the new coastline. The new embankment will be recolonised by the same species as are presently found there. The impacts due to the project are therefore considered temporary.

7.4 Impact Avoidance and Mitigation

A tree survey is required to fell trees over 95mm dbh within the site boundary and should be submitted to Regional Services Department, Tai Po and Shatin District for approval. Extent of disturbance to the plantations should be determined during the detail design stage, when trees to be fell should be numbered, measured and their locations recorded on 1:1000 scale maps.

Both sides of the new highway, additional areas utilized as buffer zones, and landscaping areas will provide opportunity for planting to replace lost plantations. Native species such as *Ficus microcarpa*, *Hibiscus tiliaceus* and *Cerbera manghas* which are lost due to construction should be replanted. Planting of native tree species in clumps, if possible, will enhance the ecological values of the area.

Tidal flushing of the Tai Hang Bridge estuary should not be hindered in any way by the roadworks to avoid impacts to the mangrove there.

A second habitat enhancement measure could be implemented for the potential benefit of the Territorial population of breeding herons and egrets. At the eastern extent of the Tai Hang

Bridge mangrove a belt of coastal trees stands adjacent to the eastern limit of the mangal. East of the coastal trees lies a flat area, presumably an abandoned paddy (see Figure 7.5). The area is overgrown with grasses, and has yet to be colonised by shrubs or trees.

Because the Tai Hang Bridge mangrove is used by occasionally large flocks of herons and egrets for feeding and roosting, it may have potential to become a colonial nest site, or egretry. There are abundant foraging habitats in the immediate vicinity, and the area is reasonable secure from human disturbance and future development.

Based on the preference of herons and egrets at Tai Po and in Kam Tin Valley (CES 1995) for bamboo groves as nesting sites, it may be reasonable to assume that bamboo groves would enhance potential for nesting at Tai Hang Bridge. The abandoned paddy described above would be a suitable location for bamboo planting for several reasons. First, the area appears to be a former agricultural site, now overgrown with colonising grasses. This indicates that soils would be suitable for plant growth. Second, the site is protected from the prevailing easterly winds by St. Christopher's Head and the woodlands on it. Protection from wind is beneficial in that high winds cause a whip action of bamboo which tends to dislodge eggs and chicks from bird nests. Third, the area lies on crown land between the KCRC line and Tolo Highway, suggesting that potential for disturbance would be minimal.

Because the identified site is small, it is recommended that only 20 individual bamboo (*Bambusa* sp.) transplants be made. The site is accessible on foot, and hand tools would be appropriate for transplanting. It is estimated that the resulting bamboo stand would require 3-5 years for bamboo density and height to reach a level that would be suitable for heron and egret nesting.

The proposed bamboo transplant site lies outside, but adjacent to the project works area. Therefore, the logistic difficulties of implementing the transplanting project would be minimal. The proposal is considered practicable, and financial resource implications are negligible. The project should be implemented at the outset of the highway widening project, and should not require monitoring or audit.

7.5 References

CES. 1995. Route 3 Tai Lam Tunnel & Yuen Long Approach, Northern Section, Vol. 1, Detailed Environmental Impact Assessment, Final Report, Section 7, Ecology. Consultants in Environmental Sciences (Asia) Ltd. for Route 3 Contractors Consortium, Hong Kong.

Cheung, S.G., (1990). The distribution and population structure of Portunidae (Crustacea: Decapoda) in Tolo Harbour, Tolo Channel and Mirs Bay, Hong Kong. In :*Proceedings of the Second International Marine BiologicalWorkshop: The Marine Flora and Fauna of Hong Kong and Southern China, Hong Kong, 1986.* (Ed. B.Morton). 2:935-941. Hong Kong: Hong Kong University Press.

Chiu, S.T., Lam, V.W.W., and Shin, P.K.S., (1985). Mollusc predation by *Ludia* spp. (Echinodermata : Asteroidea) in Tolo Harbour and Channel, Hong Kong. In:*Proceedings of the Second International Workshop on the Malacofauna of Hong Kong and Southern China, Hong Kong, 1983.* (Eds. B.Morton and D.Dudgeon). Hong Kong University Press, Hong Kong, pp365-380

Shin, P.K.S., (1985). A trawl survey of the subtidal mollusca of Tolo harbour and Mirs Bay, Hong Kong. In : *Proceedings of the 2nd International Workshop on the Malacofauna of Hong*

Kong and Southern China, Hong Kong, 1983 (Eds. B.S.Morton & D. Dudgeon). 2: 439-447. Hong Kong University Press, Hong Kong.

Shin, P.K.S., (1990). Benthic invertebrate communities in Tolo Harbour and Mirs Bay: a review. In :*Proceedings of the Second International Marine BiologicalWorkshop: The Marine Flora and Fauna of Hong Kong and Southern China, Hong Kong, 1986.* (Ed. B.Morton). 2:883-898. Hong Kong: Hong Kong University Press.

8 WATER QUALITY ASSESSMENT

8.1 Construction Phase Impact Assessment

8.1.1 Construction Impacts

Potential water quality impacts are not expected to differ greatly in terms of the three options considered since the alternative changes in each option are based on land works. Construction activities include cutting at St. Christopher's head (maximum of 2,000 m^3), fill embankment along the majority of the northbound carriage (24 m^3 per metre length for 4,000 m), dredging of marine mud near Tai Po Kau pier (maximum of 100,000 m^3 from a 700 m length stretch), some temporary reclamation for works area and the land-based highway construction works.

Construction activities may cause adverse impacts on the water quality of Tolo Harbour due to silty site runoff, dredging and reclamation activities. Silty runoff from construction inadvertently discharged to the nearby water courses will cause an increase of suspended solids content in the receiving waters. Heavy metals, oil and grease, nutrients and other pollutants attached to the silty particles will also be washed to the natural environment. Silty runoff into Tai Po Kau could potentially be detrimental to the mangrove ecosystem. In addition to polluting the receiving water bodies, suspended solids in run-off may affect the seawater intakes for the CUHK marine science laboratory and the yacht club.

For all three Options, dredging is anticipated along at the Tai Po Kau Pier (Section I, near island House interchange), dredging a total volume of 100,000 m^3 of marine mud. Dredging will be carried out by one chain bucket dredger and one grab dredger, at an estimated dredging rate of 4,000 m^3 per day. Dredging is expected to be completed in approximately four weeks. Despite the short construction period, dredging will disturb the likely contaminated bottom sediments and pollutants already trapped in the sediment may be released into the water column. The use of closed grab dredgers with silt screen can reduce the loss of material by up to 80% in comparison with those without silt screen. Thus an estimated material loss of 6% being reduced to under 2%. This would only result in a loss of approximately 80 m^3 per day over the 700 m shoreline. Dredging activities are subject to the dredging licence; dredging operation should be carried out carefully to minimize the impact.

Despite filling of embankment and reclamation will alter the Tolo Harbour shoreline, little impact is expected regarding the hydrodynamic conditions, since the new reclamation for this scheme will mainly involve widening of the existing shoreline to a small extent, which will not change the basic shape of the harbour. Effects of reclamation may be reviewed and when the total volume of reclamation becomes available. Major marine works (dredging, backfill, reclamation, placing of surcharge and the temporary protective seawall) will span over three months and silt curtains should be in place during dredging, backfilling and reclamation activities, until the construction of the permanent seawall is complete. Silt curtains are used to contain the dispersion of sediment plumes and encourage the settlement of the suspended solids within the water column. A number of factors which affects the performance of the silt curtain includes the water current velocity. Silt curtains are generally ineffective when water currents are greater than 0.26 ms^{-1}. Water velocities in Tolo harbour tend to be around 0.05 ms^{-1}. A silt curtain can be efficient at such velocity. The effectiveness of the silt curtain will also depend on the physical characteristics of the dredged material. Nevertheless, water quality monitoring will be implemented to ensure the compliance with established standards and guidelines. Details of the proposed monitoring programme are outlined in the Environmental Monitoring & Audit section.

Since the widening of Tolo Highway will be running concurrently with the Pak Shek Kok development. Potential cumulative impact from the dredging and reclamation works of the two projects should be reduced by a stringent programme and careful timing of the two reclamations, to minimise impact at any one time. Some of the temporary reclaimed working area will be included into the Pak Shek Kok site at a later stage.

Other potential water quality impacts may be the disposal of sewage from canteen and toilet facilities, generated by a maximum workforce of 300 construction workers. Accidental spillage of fuel stored on site and run-off from road and vehicle holding areas contaminated with by-products from vehicle usage, may also add impact on the already poor water quality in Tolo harbour and nearby small watercourses.

8.1.2 Mitigation Measures

Impacts on water quality runoff can be mitigated by implementing the control measures identified in the guidance issued by the EPD - *Practice Note for Professional Persons PN 1/94* and should be followed, supported by the recommended environmental monitoring and audit programme. Effluent can be controlled by provision of treatment and control systems where necessary. Potential problems of accidental spillage are minimal if spills are contained and drainage is not directed to surface water courses. Impacts from dredging and reclamation activities will have to be mitigated to acceptable levels. Following is a list of mitigation measures / site practices which are relevant to this study :

- planning of a site drainage system, which includes sand/silt removal facilities (silt traps, sediment basins) and oil interceptors at appropriate locations, to divert contaminated run-off through drainage channels away from the sensitive receivers. Catchpits and perimeter channels should be constructed in advance of site formation works and earthworks;

- provision of grease traps with sufficient retention time for canteen effluent (guidelines given in EPD publication "Grease Traps for Restaurants and Food Processors" should be followed);

- chemical toilets should be provided and it is recommended that all the sewage generated will be collected and disposed off-site;

- sand traps, oil interceptors and other pollution prevention installations should be properly cleaned and maintained;

- open stockpiles should be covered with tarpaulin of similar materials to avoid weather erosion which may wash fines into stormwater during the wet season, and prevent dust arisings during the dry season;

- during the wet season, any exposed top soils should be covered with tarpaulin, shotcreted or hydroseeded as soon as possible;

- wash-water from the wheel washing basins located at every site exit should have sand and silt settled out before discharging into storm drains;

- fuels should be stored in bunded areas such that they can be easily collected in case of leakage;

- Silt curtains should be in place during all marine works until the permanent seawall has been completed to minimise the dispersion of sediment plume;

- for dredging of marine mud, appropriate water-tight dredgers , grabbers and hoppers should be used to minimise leakage or loss of dredged material during lifting and transport;

- clean material should be used for filling of the embankment;

- the water quality near seawater intakes can be protected by silt curtain when there are marine works nearby.

With the above mitigation measures properly undertaken, the potential water quality impact of the scheme should be local and minimal.

8.2 Operational Assessment

The potential operational phase impacts on water quality are of significantly less concern than those of the construction phase. The only impact on water quality during normal operation of the road would be that due to surface runoff. It is anticipated that additional stormwater runoff would result from the increase in total paved area during the operational phase of the project. Typical highway runoff would contain low levels of SS and several different contaminants resulting from fuel combustion, as well as eroded brake linings and tyre deposits and discarded refuse. The discharge of the runoff generally would be unlikely to produce any quantifiable adverse effects.

In addition the road is likely to be used for transport of a variety of materials, some of which may be hazardous or generally polluting. The spillage from road traffic accidents would be anticipated to be infrequent, but by its nature is difficult to predict and assess. The potential for spills and their subsequent containment should be allowed for in the design of pollution control mechanisms.

Notwithstanding the minimal impacts aforementioned, it is recommended that appropriate Best Management Practices (BMPs) be incorporated into the design to further reduce stormwater runoff impact during the operational phase as far as practicable. Since construction and operation works of the highway will be designed in accordance with standards/guidelines set by relevant authorities such as the Highways Department, it is suggested that the evaluation and design of BMPs for controlling highway runoff pollution can be incorporated as part of overall design of transport facilities.

The following structural BMP is found to be suitable and applicable to reduce stormwater runoff pollution during operation phase.

- Provision of silt traps to reduce the concentration of silt/sediments in stormwater runoff. These silt traps will be cleaned and maintained regularly to ensure that they function properly.

9 CONSTRUCTION WASTE MANAGEMENT

9.1 Waste Generation and Handling During Construction Phase

9.1.1 Waste from Site Clearance and Excavation and Their Re-use

It is anticipated that hard and soft spoil will be generated as a result of site preparation. The construction activities related to spoil generation will include site clearance, excavation of cuttings, breaking up and removal of pavements as well decommissioning and reprovisioning of drainage. It is estimated that there would be approximately 500 m^3 of top soil being excavated. This excavated spoil should be re-used on the site where possible.

9.1.2 Dredging Material

Reclamation will be undertaken along the road alignment at Tolo Harbour. It is estimated that a total of 100,000 m^3 of marine sediment would be dredged and required for removal. The disposal option will depend upon the sediment quality to be dredged.

As previously stated in baseline water quality (Section 3), effluents from domestic sources, wastewater treatment plants and agricultural activities were historically discharged into the Harbour. The marine sediments are suspected to be contaminated.

Sediment quality investigation along the proposed sewerage pipelines was carried out during the "Tolo Harbour Effluent Export Scheme" study. Twelve out of sixteen sampling locations were near the study area (Figure 9.1) and is considered to provide a good indication of sediment qualities in the study area. The findings of the sediment investigation are briefly described below.

Mud samples along the sewerage pipelines were taken at surface level (0 m) and 1 m, 1.5 m, 2 m and 3 m below the surface. Seven metals, including cadmium, chromium, copper, lead, mercury, nickel and zinc were tested for each sample. Based on the final report of "*Tolo Harbour Effluent Export Scheme Mud Sampling and Testing*", concentrations of chromium, mercury and nickel tested in the study were within Class A level. The other four parameters, concentrations reached Class B or Class C limit at some stations. Generally, lead levels were high for most of the samples and fell in the Class B or C (Figure 9.2). Cadmium concentrations mostly fells within Class A and some reached the Class B for samples collected between 2 m and 3 m (Figure 9.3). Similar to cadmium, zinc concentrations were within the Class A limit for most of the samples, but some samples taken at 0 m, 2 m and 3 m reached Class B limit (Figure 9.4). Copper levels were quite consistent across all the layers, except that one Class B and C were found on the surface level at the sampling stations 7 and 2 respectively (Figure 9.5). Overall, the results indicated that the metal concentrations were not a function of depth.

EPD have also monitored marine sediment quality across Tolo Harbour. The monitoring stations to closest to the study area are T2, T3 and T4. A review of their monitoring data collected between 1993 and 1995, revealed that lead concentrations were high and reached Class C level.

Based upon the above information, it is clear that marine sediments in Tolo Harbour are contaminated by heavy metals. Depending upon the locations and depth, degrees of contamination are varied. At some places, contamination falls in EPD's classification of Class C, which means special dredging and handling procedures will have be adopted. In order to obtain site-specific sediment contamination levels in the area to be dredged under this study, it is recommended that site investigation should be carried out. Appropriate handling and disposal options can therefore be determined.

9.1.3 Waste from Construction Material and Process

During development of the site, construction activities would include demolition of structures (eg the Marine Police Station), modifications of existing bridges and subways, removal of some pavement, excavation of earth for road widening and the provision of and decommissioning of drainage pipelines. These activities will generate various types of wastes, which would tend to be heavy and bulky, including:

- demolished structures containing:
  - wood/timber, bamboo, concrete, glass, and plastics from buildings
  - metals from ventilation equipment, framework and drainage pipes
- cement and grout from on-site concreting activities
- wood from formwork

9.1.4 Workforce Waste

Throughout the period of Construction, the workforce engaged in construction will generate general refuse, comprising food scraps, paper, empty containers etc. The waste generation rate will be determined by the number of staff on site at one time which is subject to the contractors' own arrangements.

9.1.5 Chemical Waste

Construction plant and equipment will require regular maintenance and servicing which will require the use of and will generate chemical substances such as cleaning fluids, solvents, lubrication oil and fuel. Thus chemical waste will be generated on site. It is anticipated that this waste will mainly arise at the works yard where equipment storage and maintenance facilities are located. Some of the chemical substances are dangerous goods such as fuel and lubrication oil. Thus proper material and waste storage and handling must be adopted at those major work sites.

9.2 Mitigation Measures and Recommendations

9.2.1 Waste Disposal

Overall, it is recommended that the different categories of wastes should be segregated, stored, transported and disposed of separately in accordance with EPD's required procedures.

It will be the contractors' responsibility for disposal of excavated spoil. The contractors should make use of excavated spoil as much as possible to minimise off-site fill material requirements and disposal of spoil. The excavated material would be landbased containing rock, gravel, sand, clay, soil and hard surface material water content should be less than 30%. In addition, the excavation will take place along the existing route alignment. Land contamination caused

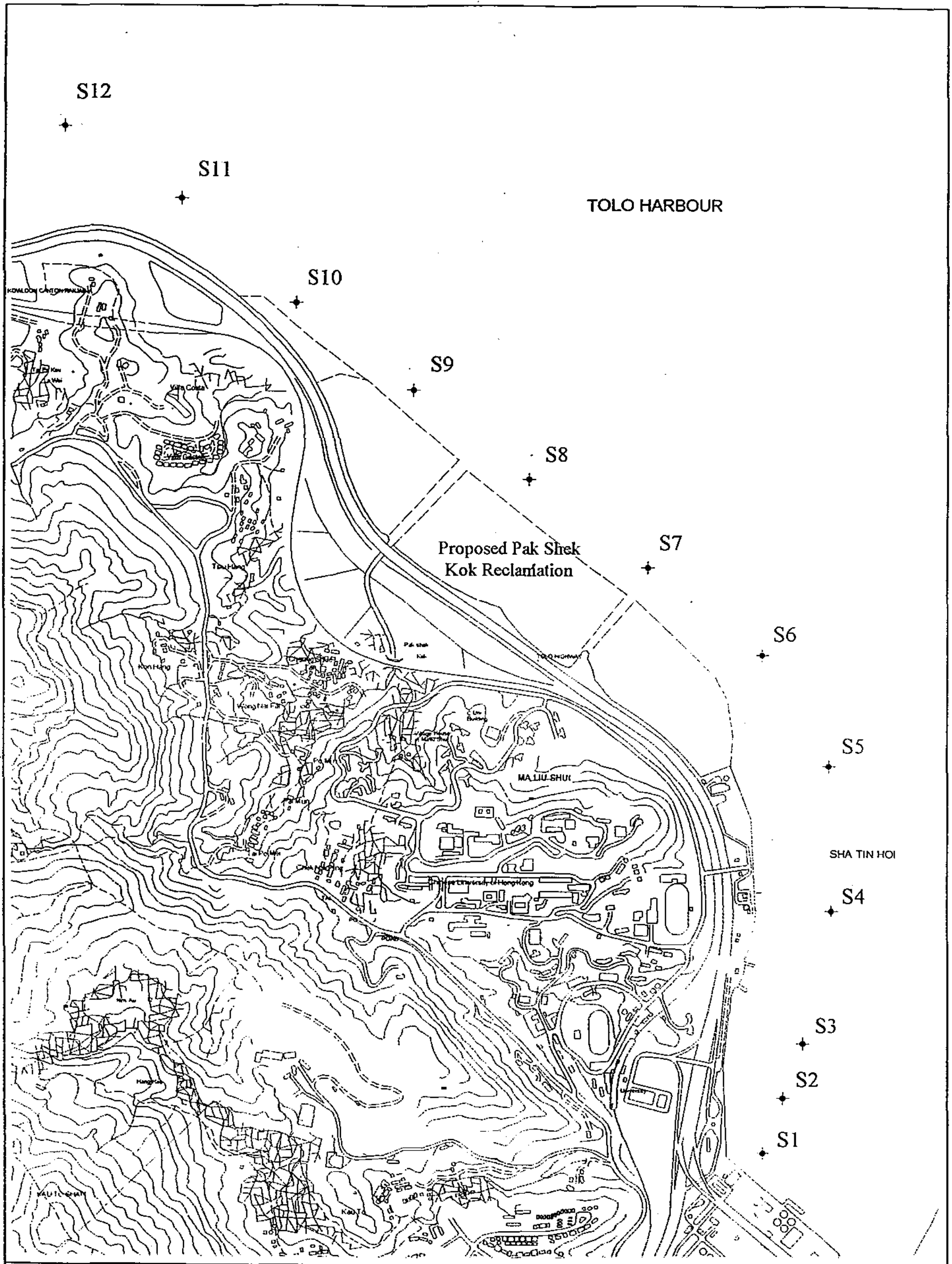


Figure 9.1 Marine Sediment Sampling Locations

Consultants in Environmental Sciences (Asia) Ltd

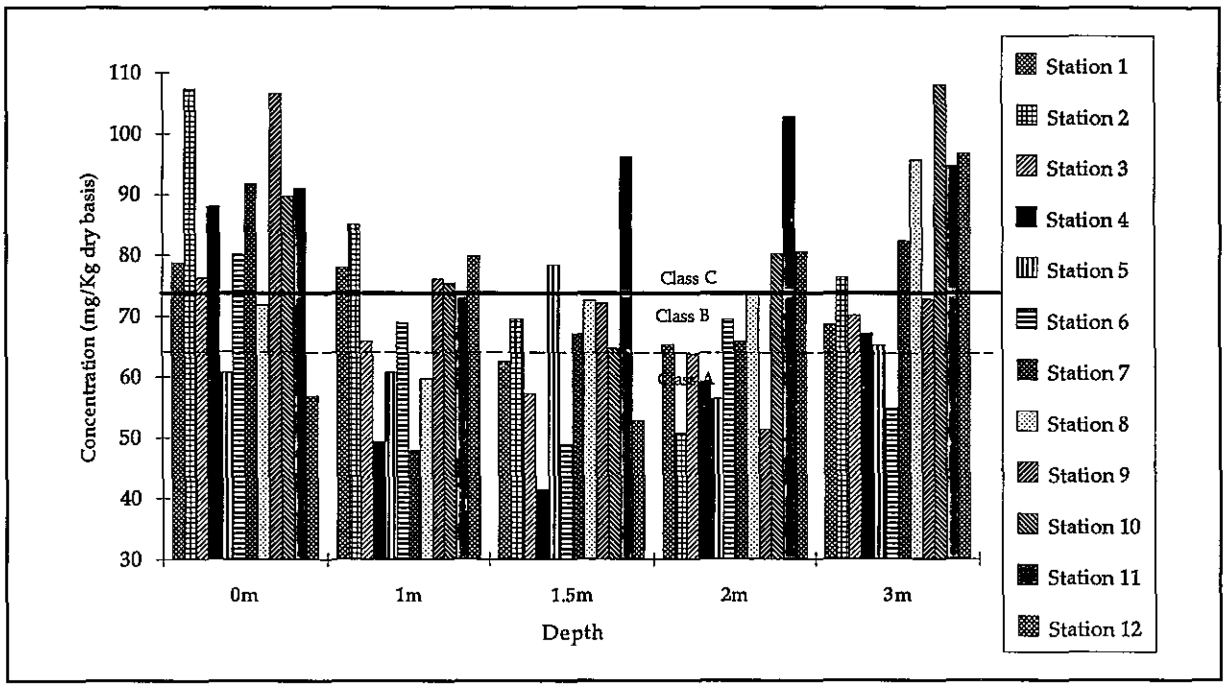


Figure 9.2 Distribution of Lead in Tolo Harbour Mud

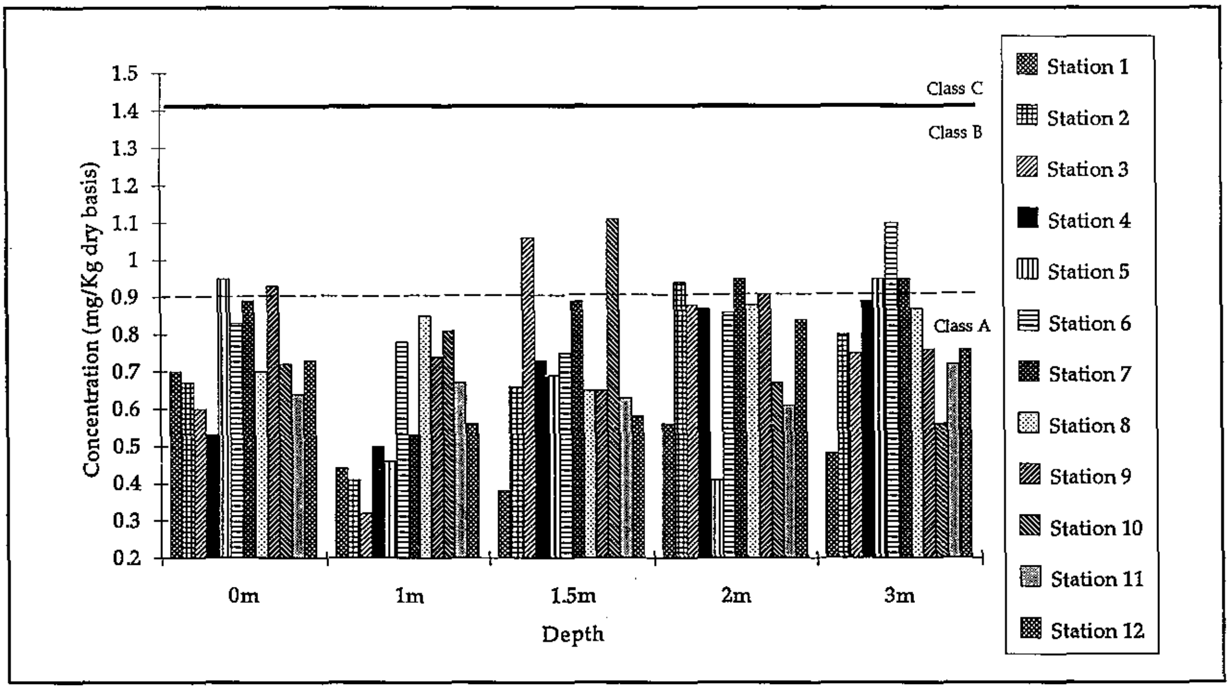


Figure 9.3 Distribution of Cadmium in Tolo Harbour Mud

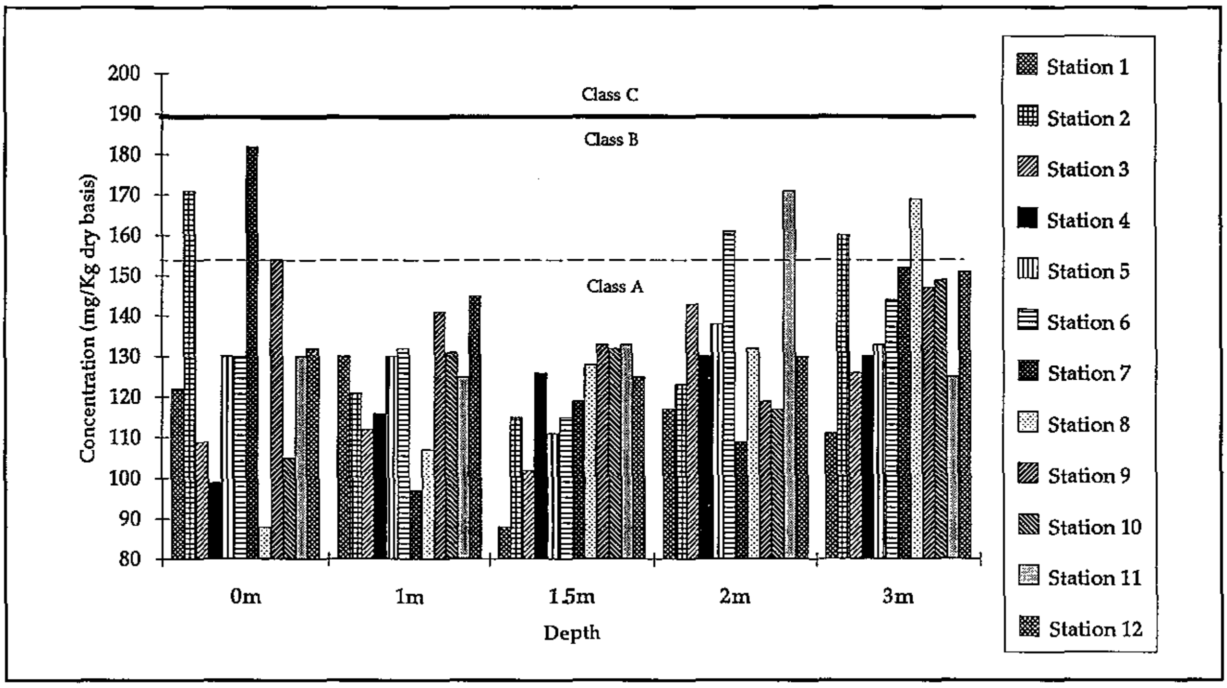


Figure 9.4 Distribution of Zinc in Tolo Harbour Mud

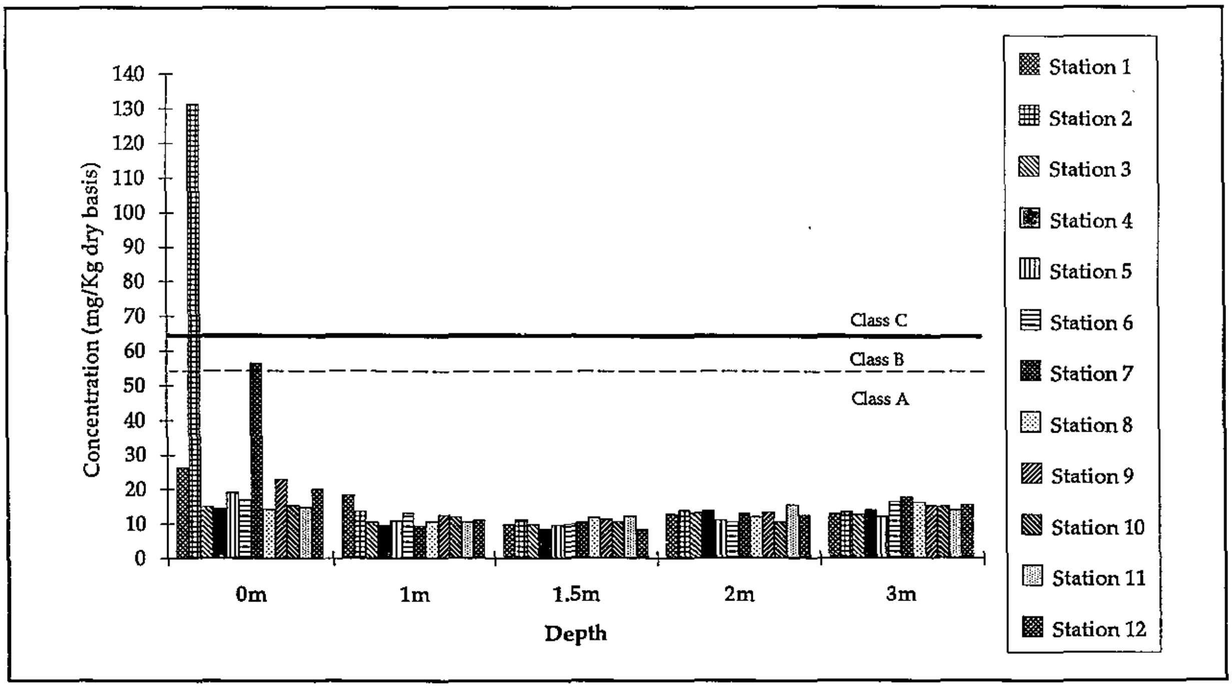


Figure 9.5 Distribution of Copper in Tolo Harbour Mud

by previous landuses, such as industrial practise, is unlikely to occur. Thus it is considered that the excavated surplus spoil should be dumped at a public dump site (the proposed Pak Shek Kok public dump site) if possible.

Under the WDO, construction waste is classified as a trade waste. The waste producers should be responsible for its disposal. Its handling should comply with the New Disposal Arrangement for Construction Waste (1991), whereby wastes should be separated into non-inert and inert materials. The former, such as wood, glass, plastic, steel and other metals (including excavated pipelines), should only be disposed of at strategic landfills. The latter, such as concrete, should only be disposed of at a public dump (eg Pak Shek Kok).

For marine sediments, the contractor should minimise the quantity of mud to be dredged out. When off-site disposal of the dredged material is required, it will be necessary to apply for a marine dumping licence before the commencement of dredging according to Dumping At Sea Act. With reference to the Technical Circular (No 22/92) on Marine Disposal of Dredged Mud, EPD and Fill Management Committee should be notified of the marine disposal requirement together with a proposal for contamination investigation at least eight months prior to the contract tendering or dredging (whichever is earlier). The marine sediment to be dredged under this project should be analysed for heavy metal contamination. Analytical parameters should include cadmium, chromium, copper, lead, mercury, nickel and zinc A report of the sediment quality should be submitted to EPD at least three months prior to contract tendering or dredging for a decision to be made with regards to a final marine disposal point. Depending upon the volume and degree of contamination of the marine sediments to be disposed of, the dumping site may be allocated by EPD or the Fill Management Committee.

For chemical and maintenance wastes, the contractors should register with the EPD as chemical waste producers and such wastes should be collected by authorised collectors. Refuse and human waste should also be collected by licensed collectors.

9.2.2 Chemical Material and Other Waste Storage

Chemical waste, including cleaning fluids, solvents, lubrication oil and fuel, should be recycled on-site or removed by licensed companies. It should be stored on-site in containers (drums and tanks) of suitable design to prevent leakage or spillage under normal conditions of handling, storage and transportation. When off-site disposal is required, it should be collected and delivered by licensed contractors to Tsing Yi Chemical Waste Treatment Facility and be disposed of in accordance with the Chemical Waste (General) Regulation. In addition, mitigation measures should be adopted to prevent the uncontrolled disposal of chemical and hazardous waste to the air, soil and waters.

Dangerous materials, including fuel, oil and lubricants, as defined under the DGO, should be stored and be properly labelled on site in accordance with the requirements in the DGO. If transportation of hazardous materials is necessary, the contractor should ensure that hazardous materials, chemical wastes and fuel are packed or stored in containers or vessels of suitable design and construction to prevent leakage, spillage or escape.

Refuse containers such as open skips should be provided at every work site for use by the workforce.

Human waste should be discharged into septic tanks provided by the Contractors and be removed regularly by hygiene services' companies.

9.3 Reference

CES. 1993. *Tolo Harbour Effluent Export Scheme Mud Sampling & Testing, Final Report.* Consultants in Environmental Sciences (Asia) Ltd for Drainage Services Department, Hong Kong

10 LANDSCAPE VISUAL AND TOWNSCAPE ASSESSMENT

10.1 Introduction

This section of the report identifies, describes and evaluates the potential visual and landscape impacts associated with the various options for the proposed widening of Tolo Highway. Measures are then recommended to mitigate the potential landscape and visual impacts that are identified.

The following route options have been assessed :

- Option I (formed by Alignments IA, IIA, and IIIA(i).
- Option II (formed by Alignments IA, IIA, and IIIA(iv).
- Option III (formed by Alignments IA, IIA, and IIIB).

There are only minor differences between the three route alignment options that are considered in this study and these centre around the section of the scheme around Ma Lui Shui. Option 1 comprises the mainline alignment as detailed in the PPFS and includes the re-provisioning of the Laboratory Bridge. Option II comprises the same mainline as for Option I with the arrangement of the existing Laboratory Bridge being modified to incorporate the southbound carriageway widening and leaving the existing footpath / cycle track unaffected. Option III involves the retention of the existing Laboratory Bridge and the re-routing of the footpath / cycle track to the rear of the HK Institute of Biotechnology.

The assessment has been initially undertaken on the basis of the common elements of all three options. The potential impacts generated by each of the three options in the Ma Lui Shui area are then detailed and the potential impacts associated with the differences described.

The section of the existing Tolo Highway that would be affected by the proposed highway widening works is located between the Island House interchange at Sha Tin and the Ma Lui Shui Interchange at Tai Po. The study area for the landscape impact assessment covers the land within a 300m distance of the proposed road alignments. The study area for the visual impact assessment covers the land within a 500m distance of the proposed road alignments. However, all sensitive receivers regarding the visual impact assessment are regardless of the distance from the proposed road alignments.

10.2 Methodology

For the purpose of this assessment a distinction is drawn between visual impacts and impacts on the landscape :

- visual impacts relate to the changes arising from a development to people's view of the landscape.
- landscape impacts relate to the effect that a development would have upon the physical characteristics or components of a landscape, e.g. the topography, vegetation, watercourses, settlements, transport corridors, etc.

10.2.1 Landscape Impact Assessment Methodology

The landscape impact assessment process has involved the following activities :

(i) Identification and assessment of the landscape context of Tolo Highway in terms of the surrounding topography, vegetation cover, water courses, settlements and transport corridors, and landscape character and quality, in order to evaluate objectively any subsequent impacts.

(ii) Identification of the sources of impact that would be generated by the scheme, i.e. the elements of the construction works and the proposed development as well as the operational procedures.

(iii) Identification of key landscape impacts which are assessed at two levels :

- the impact on the existing elements of the physical landscape, such as vegetation and topography.
- the impact on the character and quality of the existing broader landscape.

(iv) Potential landscape impacts (both positive and negative) are considered at three points in time :

- during construction
- on the opening day
- 10 years after operation

Through the assessment of impacts at these three points in time, distinction has been drawn between temporary, short-term impacts and permanent residual impacts.

(v) Identification of possible mitigation measures.

10.2.2 Visual Impact Assessment Methodology

The visual impact assessment process has involved the following activities :

(i) Identification of the area from within which views of the proposed development would be possible, i.e. the 'zone of visual influence' (ZVI) or visual envelope.

(ii) Identification of the key visual receiver groups within the zone visual influence who would be affected by the development. For the purposes of this study the potential visual receivers have been grouped into the following categories :

- Those people who would view the scheme from their home
- Those people who would view the scheme from their workspace
- Those people who would view the scheme during leisure activities
- Those people who would view the scheme whilst travelling along public roads or footpaths

(iii) Identification of key visual impacts and the assessment of the visual impacts of the scheme on the identified visual receiver groups.

The degree of severity of visual impact is dependent on the complex inter-relationship of a number of factors including :

- value of existing views
- degree of change to existing views
- distance of receiver from scheme
- sensitivity of receiver
- availability and amenity value of alternative views

The visual impact assessment compares the quality of the existing views experienced by sensitive receivers with the quality of the views which would result if the scheme were constructed. The degree of change was categorised according to the following scale.

- substantial adverse impact - where the scheme would cause an obvious deterioration in the existing view;
- moderate adverse impact - where the scheme would cause a noticeable deterioration in the existing view;
- slight adverse impact - where the scheme would cause a perceptible in the existing view;
- no change - no discernible deterioration or improvement in the existing view;
- slight beneficial impact - where the scheme would cause a perceptible improvement in the existing view;
- moderate beneficial impact - where the scheme would cause a noticeable improvement in the existing view;
- substantial beneficial impact - where the scheme would cause an obvious improvement in the existing view.

(iv) Potential visual impacts (both positive and negative) are considered at three points in time :

- during construction
- on the opening day
- 10 years after operation

Through the assessment of impacts at these three points in time, distinction has been drawn between temporary, short-term impacts and permanent residual impacts.

(viii) Identification of possible mitigation measures.

10.3 Existing Landscape Context

10.3.1 Topography / Land Form

The existing Tolo Highway is located on a strip of reclaimed land which forms a smooth man-made coastline along the eastern edge of Tolo Harbour. This area of reclaimed land varies in width between 350m (at Pak Shek Kok) and 80m (at a point immediately to the west of Tai Po Kau). (See Figure 10.1 for the location of the proposed site of the Pak Shek Kok reclamation). The reclamation supports not only the Tolo Highway but also the KCR railway (which runs parallel and immediately to the west of the road) and a cycle track (immediately to the east of the road). The natural land form immediately adjacent to this area of reclamation is highly variable, comprising a series of steep hillsides which are highly dissected by stream valleys. The spurs that lead off these hillsides form dramatic headlands.

The Land Form rises steeply to the land-ward side of the KCR to form a series of ridge spurs (up to 400mPD in many places), which rise up to a peak of 645 mPD on Grassy Hill located approximately 4 km to the south-west.

The hills support a number of small watercourses that discharge into Tolo Harobur, via culverts below the existing road. Most of these are seasonal, with only the streams running through Tai Po Mei and Tai Po Kau being notable landscape features.

The landscape to the north is dominated by the hills within the Pat Sin Leng and Plover Cove Country Parks. The peaks of within the Ma On Shan Country Park (up to 702 mPD) enclose views across Tolo Harbour to the east.

10.3.2 Vegetation

Broad vegetation types in and around the Tolo Highway corridor are identified at Figure 10.1 and are described as follows:

The hill slopes located to the west of the highway are well vegetated with dense woodland, tall scrub and grassland. Much of the densely wooded hill slopes above Tai Po Kau are included within the Tai Po Kau Nature Reserve. The vegetation along the lower hill slopes and around the area of reclamation is more varied as described below.

Vegetation in the Pak Shek Kok valley comprises mainly abandoned agricultural land, rough grassland and scattered tree clumps around the settlements.

Yuen Chau Tsai is a well wooded promontory at the northern limit of the scheme. It comprises mature fung shui woodland around the temple at the base of the hill as well as ornamental trees in the garden of Island House. To the north of the promontory is a public open space with extensive amenity planting.

To the east of Yuen Chau Tsai, on another small promontory, lies Tolo Harbour Garden. The garden comprises ornamental tree and shrub planting set within a small *Acacia* woodland.

Further to the east, on the small promontory directly to the north of Chinese University of Hong Kong (CUHK) campus, there are clumps of *Casuarina equisetifolia* and rough grassland.

The area of reclaimed land which supports the CUHK Marine Research Laboratory (MSL) and other buildings is well vegetated with clumps of semi-mature and mature trees (*mainly Acacia and Casuarina sp.*). There is a belt of bamboo planting in front of the Institute of Biotechnology which lines the cycle track for some 20-30 metres.

Along the seaward side of the cycle track there is a row of amenity tree planting. It comprises individual semi-mature trees planted in concrete rings set at intervals of approximately 5m. Many of the trees have died or are in poor condition.

There is little notable vegetation between the cycle track and highway. The only exceptions are the two dense clumps of *Acacia* trees which are set in grassland where the cycle track deviates from the highway alignment around Pak Shek Kok valley.

A partial screen is provided by some dense tree belts and semi-mature amenity planting between the highway and the KCR. However, the realigned KCR embankments between Pak Shek Kok valley and St. Christopher's Head are sparsely vegetated.

10.3.3 Settlements and Transport Corridors

The most dominant man-made features within the landscape are the transport corridor comprising Tolo Highway and the KCR route, the high-rise residential blocks and industrial area at Tai Po, the residential towers at Ma On Shan and, to a lesser extent, the medium-rise buildings at the CUHK. There are, in addition, a number of discrete, high-quality, residential developments set within the low-lying wooded hill slopes. Residential properties are currently under construction at the St. Christopher's Home site above the Pak Shek Kok valley

Overall, the built development does not greatly detract from the impressive scale of the surrounding natural landscape. This is due to the overall moderate to high quality of the structures and the concentration of the built form on the flat, coastal reclamation areas.

Within the context of the local landscape, the character of the transportation corridor is of a low quality. This is on account of the poor integration of the transport uses into the local landscape. Poor quality materials (e.g. chain-link fencing, plain concrete barriers etc.) have been used for these developments and the inter-relationship between the various uses is poor (e.g. no buffer planting between the highway and the cycle track in many places). The transportation corridor contrasts with the traditional agricultural settlements and high quality developments set within the hill slopes and rural landscape beyond. It forms a linear, man-made, largely un-vegetated, edge to Tolo Harbour.

The existing cycle track runs parallel to the highway and forms and important recreational corridor within the study area. The track has pleasant scenic views out over Tolo Harbour and the surrounding countryside. However, there is little or no landscape buffer between the track and the highway. For the majority of its length, only a grass verge and an unattractive fence separate cyclists from the highway traffic.

10.3.4 Landscape Character

To Tolo Highway corridor is se within a high quality scenic landscape comprising a natural harbour framed by undeveloped mountain ranges. The landscape character of the existing road corridor and the surrounding landscape is illustrated at Figure 10.1. Photographs showing the landscape character of the highway corridor are provided at Figures 10.2 to 10.4. Locations of these photographic viewpoints are indicated at Figure 10.5.

the coastline of the harbour to the north, south and west is predominantly man made, comprising extensive areas of reclaimed land. The character of the old pre-reclamation shoreline is till discernible at St. Christopher's Head. To the east, across the open waters of Tolo Harbour, lies the natural shoreline of the Yim Tin Tsai Peninsula. Built development is restricted mainly to the areas of reclaimed land and the lower coastal hill slopes.

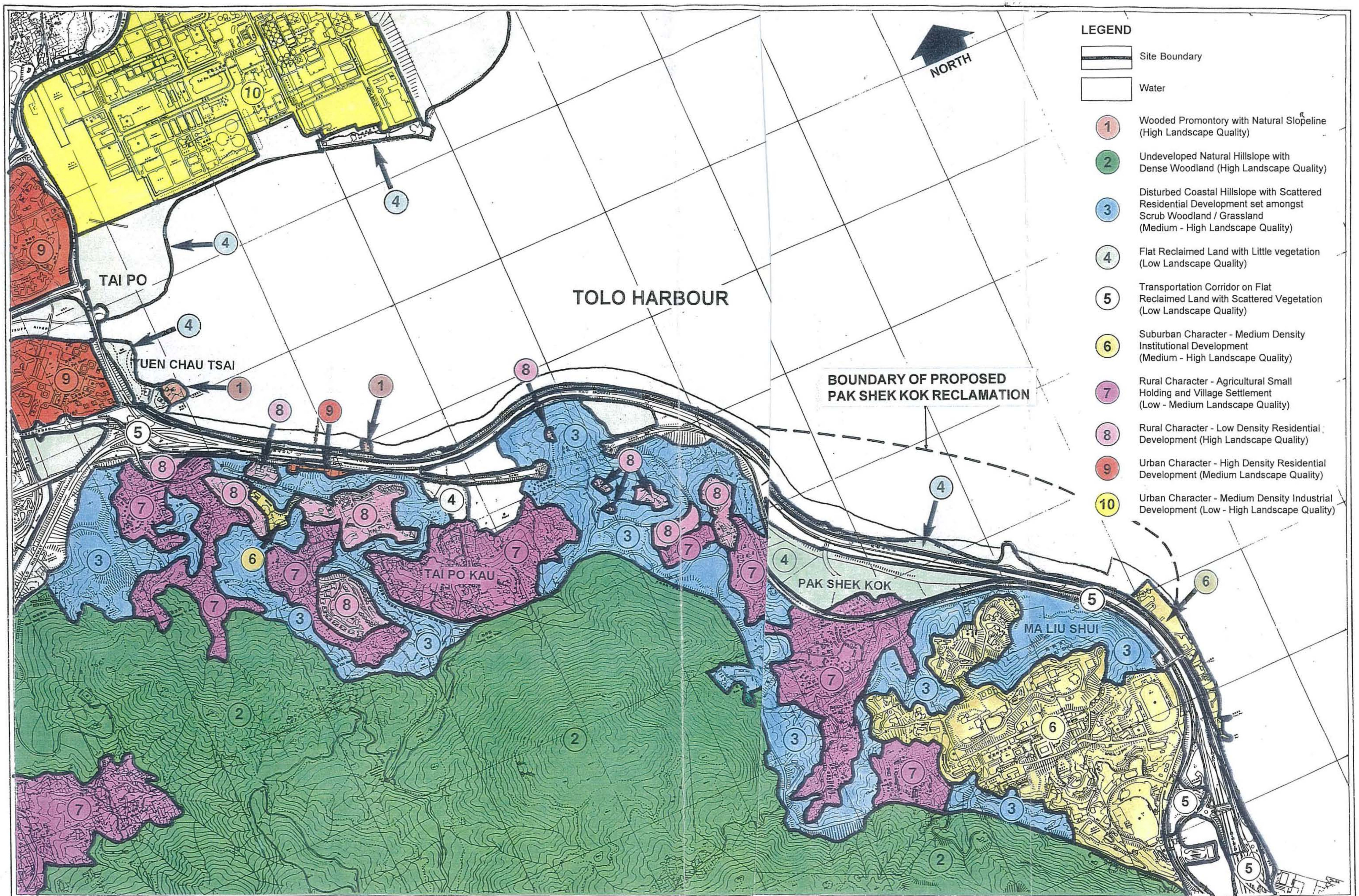
Zones of different landscape character in and around the highway corridor are identified at Figure 10.1. An assessment is provided below of the visual importance or scenic quality of these landscape character zones. These zones have been ranked (high, medium or low) according to the following criteria:

- Planning control designations for features of landscape or historical interest (e.g. the Tai Po Kau Railway Station and the Island House Temple at Yuen Chau Tsai. These are both sites of archaeological/historic importance located within the study area and are listed in the Hong Kong Government's register of Antiquities and Monuments).
- Areas of natural topography and natural foreshore (e.g. at Yuen Chau Tsaï)
- Areas that are unspoilt by man-made development
- Dominance of natural features in the landscape (e.g. high mountains and large expanses of open water)
- Quality and degree of vegetation cover
- Quality and age of man-made features

The identified landscape zones are described and assessed as follows:

1. Landscape Character Zone No. 1 (high landscape value zone)
   The zone covers two small wooded promontories set out from the rest of the waterfront, which represent remnants of the natural coast with an unaltered topography and shoreline, with and only minor man-made elements and some historical artefacts at Yuen Chau Tsai. The vegetation on the promontories is of high quality and consists largely of mature, native tree species.

2. Landscape Character Zone No. 2 (high landscape value zone)
   The zone covers the extensive areas of undeveloped upland hill slopes. The natural topography has not been altered by man made element. The vegetation on the hill slopes is of high quality and consists largely of mature, native grass, scrub and woodland species



EXISTING LANDSCAPE CHARACTER

SCALE 1 : 15,000

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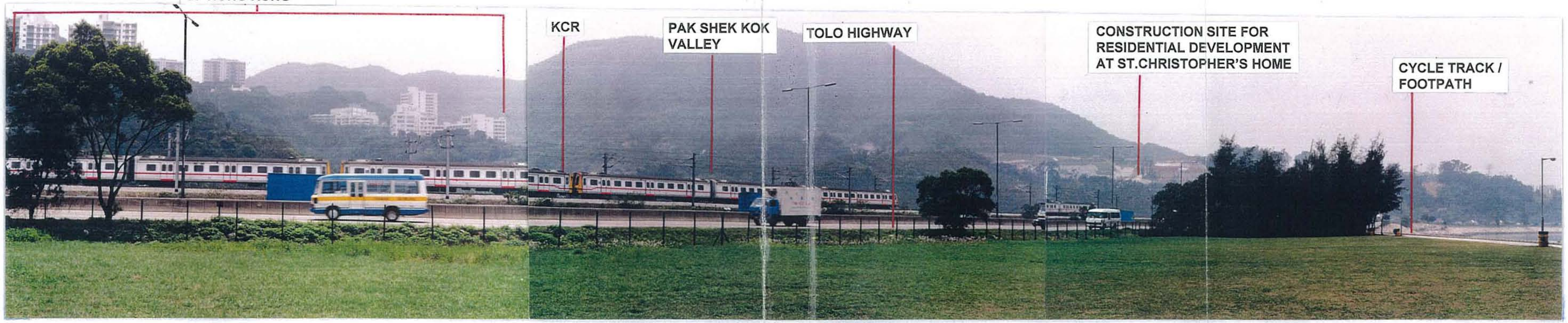
Figure no. 10.1

VIEW FROM CYCLETRACK/FOOTPATH LOOKING SOUTH-WEST TOWARDS LABORATORY BRIDGE

(A)



VIEW FROM CYCLETRACK/FOOTPATH ACROSS HIGHWAY AND KCR TOWARDS PAK SHEK KOK VALLEY

(B)

EXISTING SITE PHOTOGRAPHS

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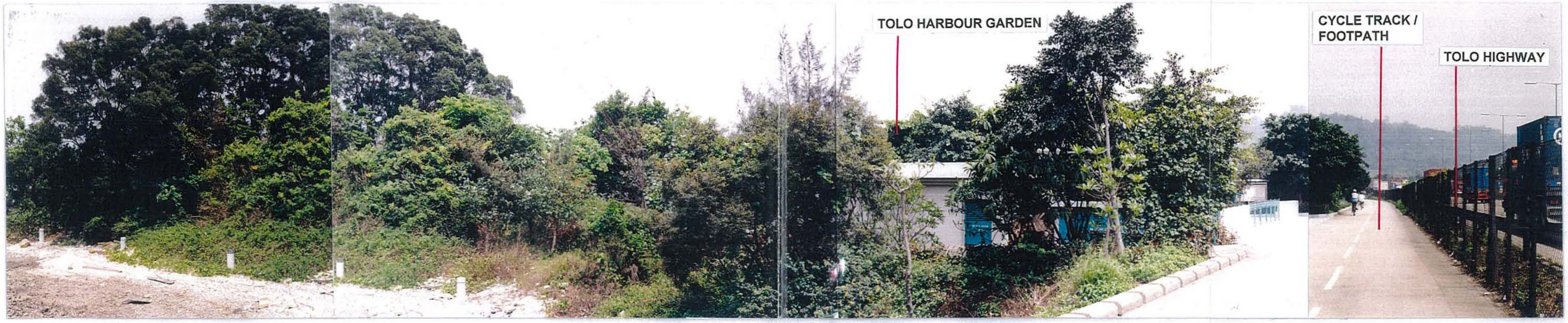
茂盛工程顧問有限公司

Figure no.
10.2



VIEW FROM CYCLETRACK/FOOTPATH
AT TOLO HARBOUR GARDEN
LOOKING SOUTH-WEST

C

VIEW FROM CYCLETRACK/FOOTPATH
LOOKING NORTH-WEST TOWARDS
TAI PO KAU AND TAI PO

D

EXISTING SITE PHOTOGRAPHS

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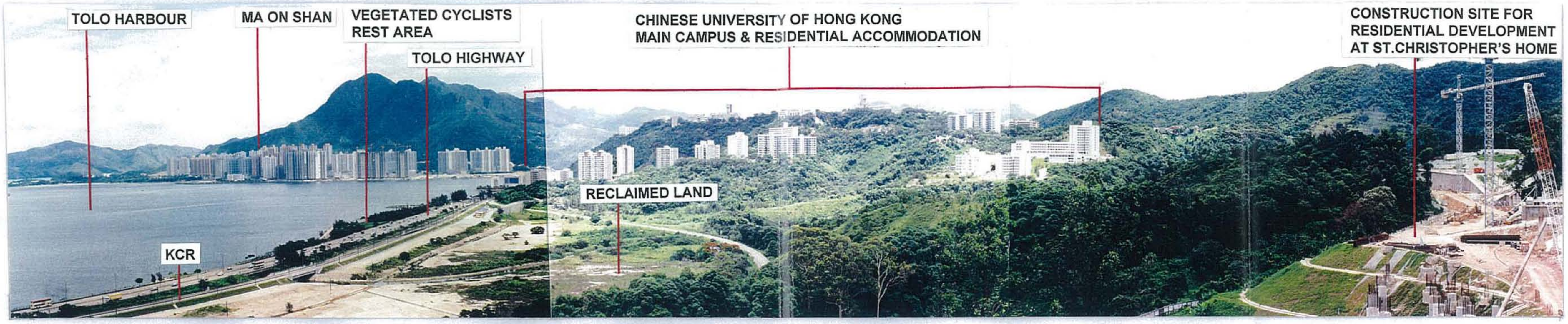
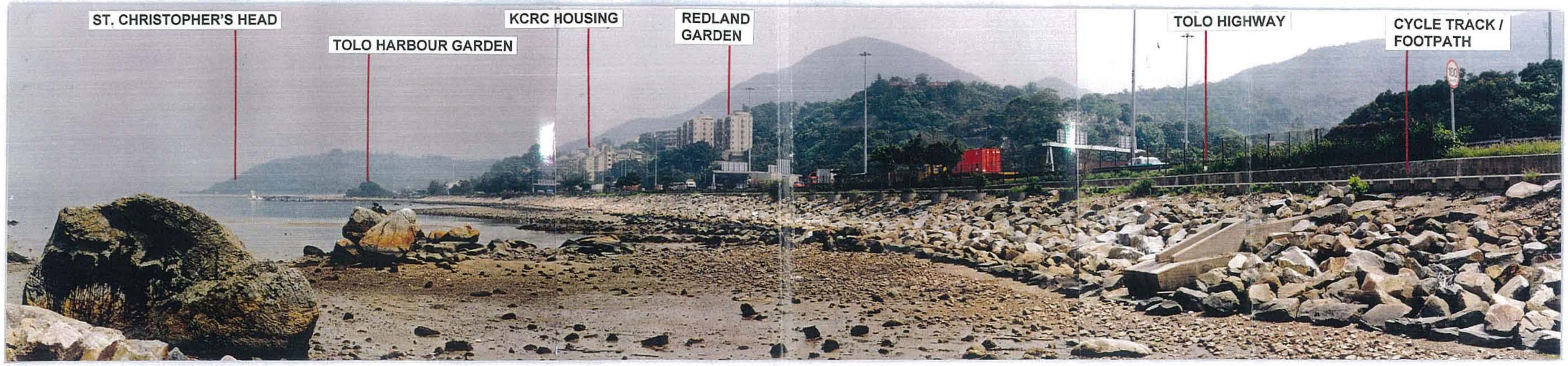
Figure no.
10.3



VIEW FROM FUTURE DEVELOPMENT ON ST. CHRISTOPHER'S HOME
LOOKING SOUTH-EAST ACROSS PAK SHEK KOK VALLEY

F



VIEW FROM YUEN CHAU TSAI
LOOKING SOUTH-WEST TOWARDS
ST. CHRISTOPHER'S HEAD

E

EXISTING SITE PHOTOGRAPHS

Maunsell
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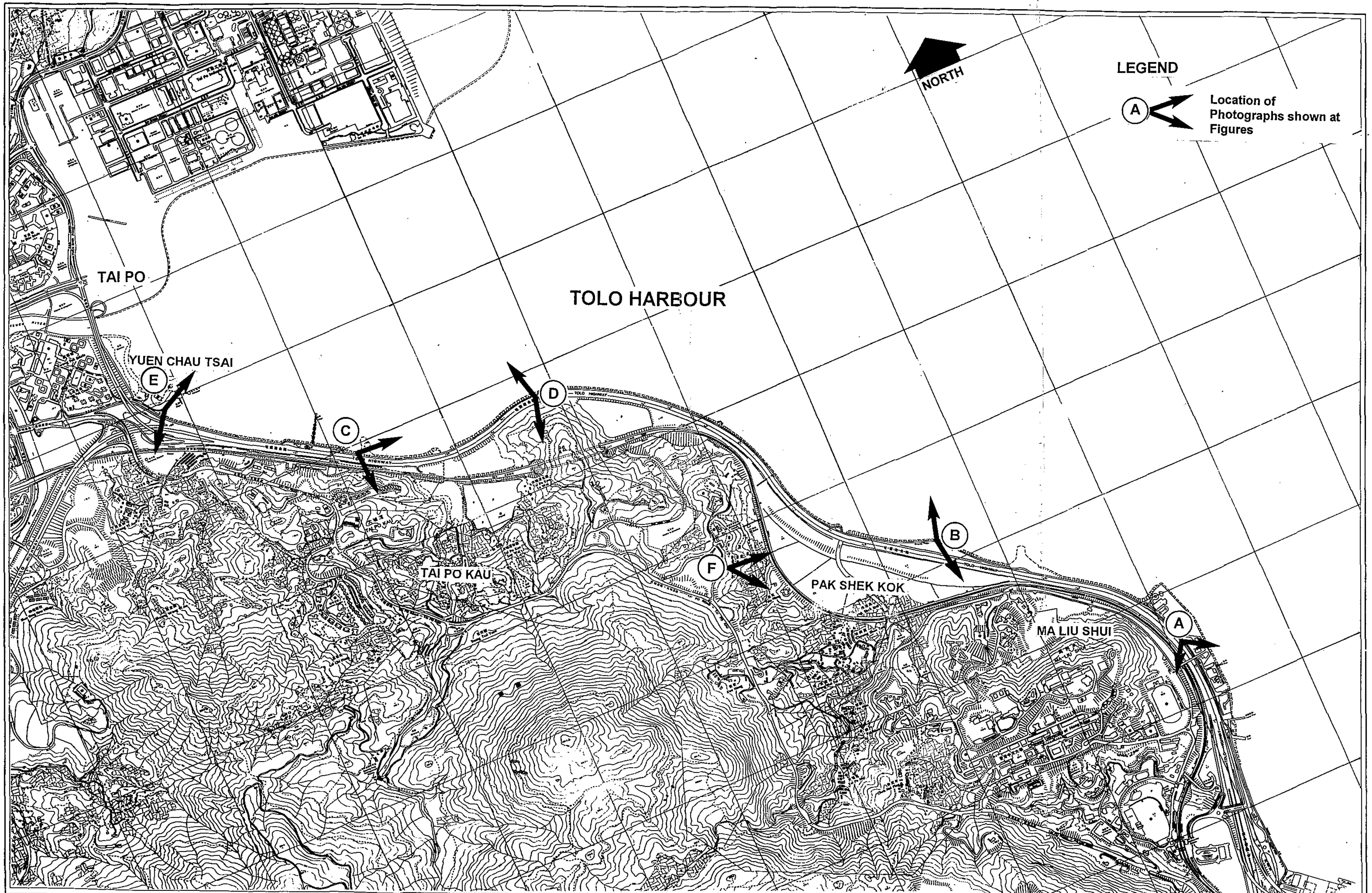
Figure no.
10.4



LOCATION OF PHOTOGRAPHIC VIEWPOINTS

SCALE 1 : 15,000

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Figure no. 10.5

3. Landscape Character Zone No. 3 (medium to high landscape value zone)
The zone covers disturbed coastal hill slopes. The natural slopes have been noticeably altered by the development of scattered residential development and roads and power lines. The developments are surrounded by remnant hill slope vegetation is of a similar high quality to that of Zone 2, but in less contiguous blocks, and consists largely of mature, native grass, scrub and woodland species.

4. Landscape Character Zone No. 4 (medium landscape value zone)
The zone covers the long linear strip of reclaimed land along the edge of Tolo Harbour. It marks the transition between the man-made transport corridors and the open water of the Harbour. The area is characterised by the cycle track and foot path and the artificial rock sea wall, and the vegetation consists of scattered groups of mature but non-native trees and scrub set in amenity grass.

5. Landscape Character Zone No. 5 (low landscape value zone)
The zone covers the transportation corridor associated with the existing Tolo Highway and has a man-made edge to Tolo Harbour. There are few remaining natural features, and the vegetation consists mainly of sparse road side non-native trees.

6. Landscape Character Zone No. 6 (medium landscape value zone)
The zone contains the medium-density institutional development on the natural hill slopes above the Harbour. It has a predominantly suburban character with the topography of the area disturbed by the development of large scale buildings, surrounded by the remnant woodland vegetation of the hill slope intermixed with mature exotic trees.

7. Landscape Character Zone No. 7 (medium landscape value zone)
The zone contains mostly agricultural holdings and village settlements and has a small scale rural character derived from the size of the buildings and the pattern of the land use. The marginal vegetation is predominantly the native woodland vegetation of the hill slope.

8. Landscape Character Zone No. 8 (medium landscape value zone)
The zone contains low density residential development on the natural hill slopes above the Harbour. It has a predominantly rural character with the topography of the area disturbed by the development of small scale buildings, surrounded by the remnant woodland vegetation of the hill slope intermixed with mature exotic trees.

9. Landscape Character Zone No. 9 (low landscape value zone)
The zone contains high density residential development on the reclamation within the former Tai Po Bay area. It has an urban character dominated by the large scale high rise residential towers. Although there are no natural features, the spaces around the buildings are heavily planted with exotic tree and shrub species giving the whole area a pleasant landscaped environment.

10. Landscape Character Zone No. 10 (low to medium landscape value zone)
The zone contains medium to high density industrial development on the reclamation within the former Tai Po Bay area. It has an urban character dominated by the large scale industrial buildings. There are no natural features, and although the road side

and waterfront areas are heavily planted with exotic tree and shrub species the whole area retains a predominantly industrial character.

All the above character zones, with the exception of the steep hill slopes in Character Zone No. 10, are vulnerable to change on account of intense development pressure in the lower and more developable areas of hill slope that overlook the scenic Tolo Harbour.

10.3.5 Historical and Cultural Features

There are two sites of archaeological/historic importance located close to the Tolo Highway widening works and these are listed in the Hong Kong Government's register of Antiquities and Monuments. These are the Tai Po Kau Railway Station and the Island House Temple and Island House both located on Yuen Chau Tsai.

The KCRC's Tai Po Kau Railway Station is recorded as an historic building of architectural significance, although it is no longer in use. It lies outside the area of the works proposed under the study, so there would be no direct impact on the structure. As the proposed highway widening works are in the context of the existing Tolo Highway it is considered that they should not have an adverse impact on the character of the setting of the Station Building.

The Island House Temple is a traditional Tin Hau Temple, noted for its antiquity, cultural significance and its landscape setting close to the waters edge, (the prospect of the sea from the surrounding areas is considered to be of special fung shui significance). The Temple current faces the Tolo Highway.

The Temple structure would not be directly affected by the proposed widening works, and as the views of Tolo Harbour would not be impeded, it is considered that the highway widening works would not materially alter the character of the landscape setting of the temple.

The Island House is an area on the east side of the island immediately around an ancient building structure which has been identified as having archaeological importance as antique pottery has in the past been discovered there. The extent of these artefacts is not known, but as they appear to be associated with the temple, they are likely to be confined to the area of the island.

Although the known area of artefacts would be unaffected by the proposed widening works, there is a possibility, however, that the surrounding area may contain features of archaeological importance and some of these features may be included within the area of the proposed works. It is suggested, therefore, that a detailed examination is undertaken, before the highway widening works commence, of any areas around the Island that have not yet been investigated in archaeological terms, and that any valuable artefacts are removed prior to construction works commencing.

There is, in addition, one small village temple located in the valley located to the south-west of Pak Shek Kok. However, this temple is located more than 500m from the Tolo Highway and would not be disturbed by the proposed works.

10.4 Sources of Landscape Impact

Before an assessment can be made of the potential landscape impacts of the proposed project it is necessary to identify the elements of the project that would generate impacts at both construction and operational phases. These are summarised as follows :

Sources of Impact

The construction phase of the scheme will comprise the following :

- Construction works on a new sea wall.
- Land reclamation works along the existing shoreline, including dredging and stock-piling of materials
- Slope cuttings, notably at St. Christopher's Head
- Proposed road widening works, including relocation of the central divider, any necessary diversions and re-provision of lay-bys.
- Works associated with the re-provision of the cycle track and footpath.
- Widening of Tai Hang and Pak Shek Kok Road bridges
- The presence of construction vehicles, machinery and temporary site buildings (proposed on the site of Stage I of the Pak Shek Kok Reclamation).
- Construction works for access points at Island House and Ma Lui Shui
- Extension works, including demolition and re-provision of existing ramps and steps, to Tai Po Kau pedestrian underpass (situated immediately to the south of the Marine Police Station) and Pak Shek Kok underpass
- Erection of noise barriers

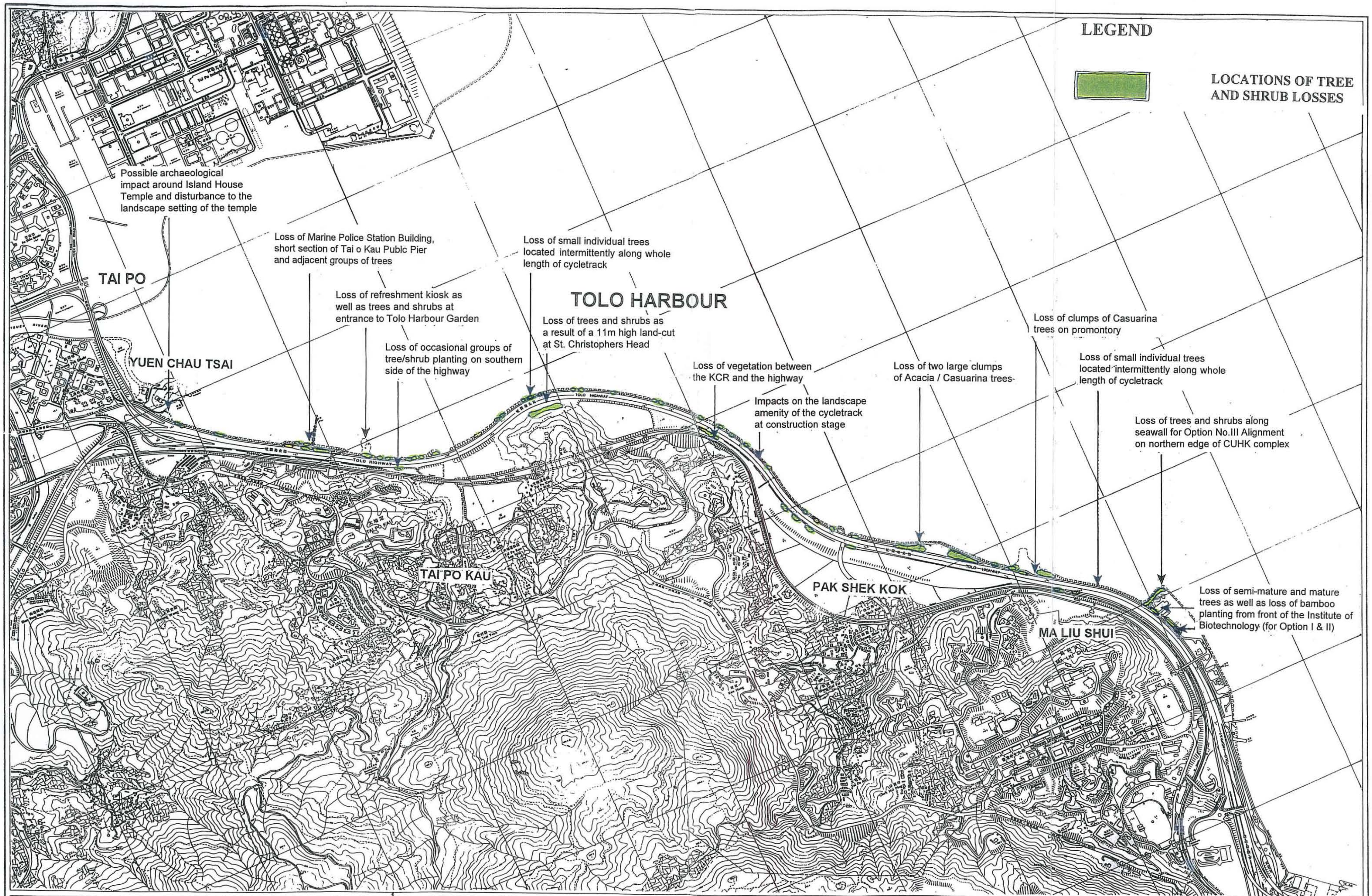
10.5 Potential Impacts on the Physical Landscape and on Landscape Character

The proposed scheme would generate impacts on both the physical landscape and the landscape character of the study area. These are identified below and at Figure 10.5.1 and are assessed as follows:

- The existing sea wall, comprising mainly un-vegetated rip-rap, would be covered as part of the proposed harbour reclamation for the highway widening works. Its removal and re-provision would constitute only a minor landscape impact. This applies to all Options.
- All Options would involve the loss of roadside vegetation. However, in the context of the whole scheme, this vegetation loss would represent only a low level negative landscape impact as there is very little vegetation along the area of the proposed highway widening and most of this is of a low quality. The existing vegetated hill slopes located to the west of the highway would be largely undisturbed by the

proposed development and these will continue to dominate the landscape of the area at the operational stage of the project. The planned provision of a buffer planting strip (approx. 5m wide but varies in width along the route) between the highway and the footpath / cycle track would represent a net positive landscape impact. Notable vegetation that would be lost as a result of the development are as follows:

- Loss of ornamental tree and shrub planting within Tolo Harbour Garden for all Options.
- Loss of individual semi-mature trees planted at intervals along cycle track for all Options.
- Loss of clumps of Casuarina equisetifolia and rough grassland on the small promontory directly to the north of Chinese University of Hong Kong (CUHK). The loss would be for all Options.
- Loss of a 20-30 metre belt of bamboo planting in front of the Institute of Biotechnology for Options I and II.
- Loss of two dense clumps of Acacia trees and grassland where the cycle track deviates from the highway alignment around Pak Shek Kok valley.
- Loss of some dense tree belts and semi-mature amenity planting on the embankments between the highway and the KCR
- Loss of clumps of semi-mature and mature trees (mainly Acacia and Casuarina sp.) on the area of reclaimed land which supports the CUHK Marine Research Laboratory (MSL), and other buildings. This would be for Options I and II.
- Loss of clumps of trees and shrubs along the sea wall at the Institute of Biotechnology, MSL resulting from the re-provision of the cycle track along the shoreline. This would be for Option III only.
- The proposed scheme would involve cut slope works to a section of existing hill slope at St. Christopher's Head. This cut slope would be approximately 11m high and 30m long and would involve the loss of approximately 17m2 of tree and shrub growth.
- The proposed highway widening works would have high impacts on the landscape amenity of the area at construction stage. The disruption of the existing cycle track, in particular, would represent a high impact on landscape amenity to users of this recreational facility during construction stage.
- There would be a loss of part of Tolo Harbour Garden and difficulties in access to the garden during construction. This, together with the loss of vegetation identified above, would represent a high local landscape impact at construction stage.
- Removal and relocation of the existing Marine Police Station.
- The loss and disturbance of areas of existing mangrove vegetation resulting from the re-provisioning of the existing sea wall, especially near Yuen Chau Tsai.



POTENTIAL LANDSCAPE IMPACTS

SCALE 1 : 15,000

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Figure no. 10.5.1

- There may also be off-site indirect impacts resulting from the proposed construction works, for example, those generated by construction traffic movements or from the extraction and the deposition of materials.

- The landscape setting of the temple and surrounding fung shui woodland on Yuen Chau Tsai would be adversely affected and this would represent a high local landscape impact.

- The existing Tolo Highway is set within a scenic landscape, of an overall high quality, comprising Tolo Harbour enclosed by undeveloped mountain ranges. The proposed road-widening scheme would have only a minor impact on the impressive scale of this landscape and it is predicted that the wider landscape character impact of the scheme would be low at construction stage and minimal at the operational stage of the project. .

- The proposed highway widening options at the operational stage would have only minor impacts on the landscape character of the highway i.e. Landscape Character Zone No. 2 identified above. This is due to the visual dominance of the existing vegetated hill slopes located to the west of the road, the presence of the large existing area of road and the poor quality of the road-level landscape (e.g. lengths of chain-link fencing and plain concrete).

10.6 Potential Visual Impacts

The objective of this section of the report is to assess the potential visual impacts of the scheme on the surrounding landscape and its population. This assessment involves a comparison between the existing views of the Tolo Highway and the future views which would include the proposed scheme.

10.6.1 Elements of the project that would generate visual impacts

Elements of the project that would generate visual impacts on the surrounding landscape and its population are listed below.

(i) At the construction phase of the scheme:

- Construction associated with the proposed replacement sea wall.

- Activities associated with the land reclamation, including dredging, stock piling of materials and the movement of machinery

- Road widening works (including relocation of the central divider, any necessary diversions and re-provision of lay-bys) involving removal of vegetation and excavations.

- Construction works on the re-provision of the existing footpath / cycle track.

- Widening works for the Tai Hang and Pak Shek Kok Road bridges

- The presence of construction vehicles, machinery and temporary site buildings (proposed on the site of Stage I of the Pak Shek Kok Reclamation)

- Construction of access points at Island House and Ma Lui Shui

- Extension works, including demolition and re-provision of existing ramps and steps to Tai Po Kau pedestrian underpass (situated immediately to the south of the Marine Police Station) and Pak Shek Kok underpass

- Construction works for noise barriers

(ii) Sources of Impacts at Operational Phase

- The presence of a new sea wall located further to the east (particularly prominent at St. Christopher's Head).

- The presence of two additional carriageways and associated structures and traffic

- The presence of a 6m wide cycle track, a 2.5m wide footpath and an up-graded belt of buffer planting between these features and the Tolo Highway.

- The presence of noise barriers along the western end of the works limit.

10.6.2 Extent of Visibility of the Existing Tolo Highway and its proposed section of widening.

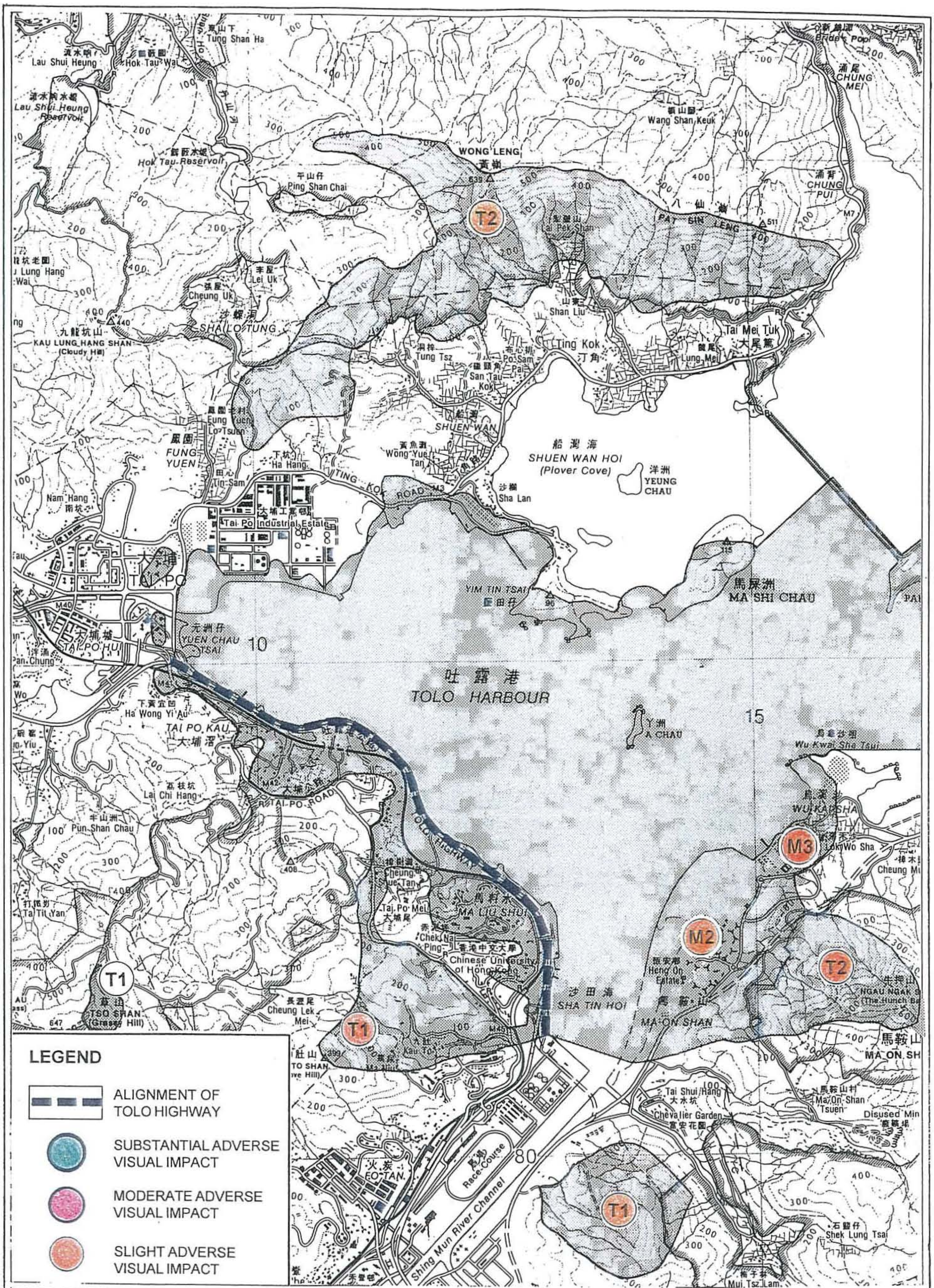
Figures 10.6 and 10.7 illustrate the "zone of visual influence" of the existing highway. i.e. the area from which views of the scheme would be possible. Visually sensitive receivers are also identified at this Figure by reference letters and these are described in Section 10.6.4.

The visual horizon inland of the highway corridor is defined by a series of ridge spurs. There are potential distant views from the high ridge line at over 300 mPD but most views, from footpaths on the middle hill slopes are obscured by the dense woodland in which the footpaths are located.

Extensive elevated views of the extended highway are possible from the CUHK which is located on the headland at Ma Lui Shui. Filtered views through dense vegetation are possible from the residences on the headland at St. Christopher's Head. More distant elevated views are possible for the residents of the tower blocks on the northern edge of Tolo Harbour at Tai Po.

Lower lying views are possible from the villages on the gentle slopes surrounding the bays of the pre-reclamation shoreline at Pak Shek Kok and Tai Po Kau San Wai. Views here are often limited by the embankments of the KCR, by vegetation associated with the hill slopes and by small agricultural holdings.

Near-distance views of the highway are experienced by cyclists and pedestrians on the existing cycle track and by passengers on the KCR. Both of these routes run parallel to the highway for much of its length. These views are occasionally screened or filtered by amenity tree planting along the road corridor. Views from the KCR are also blocked for a short while as trains enter a tunnel at St. Christopher's Head.



ZONE OF VISUAL INFLUENCE AND DISTANT VISUALLY SENSITIVE RECEIVERS Scale 1:50,000

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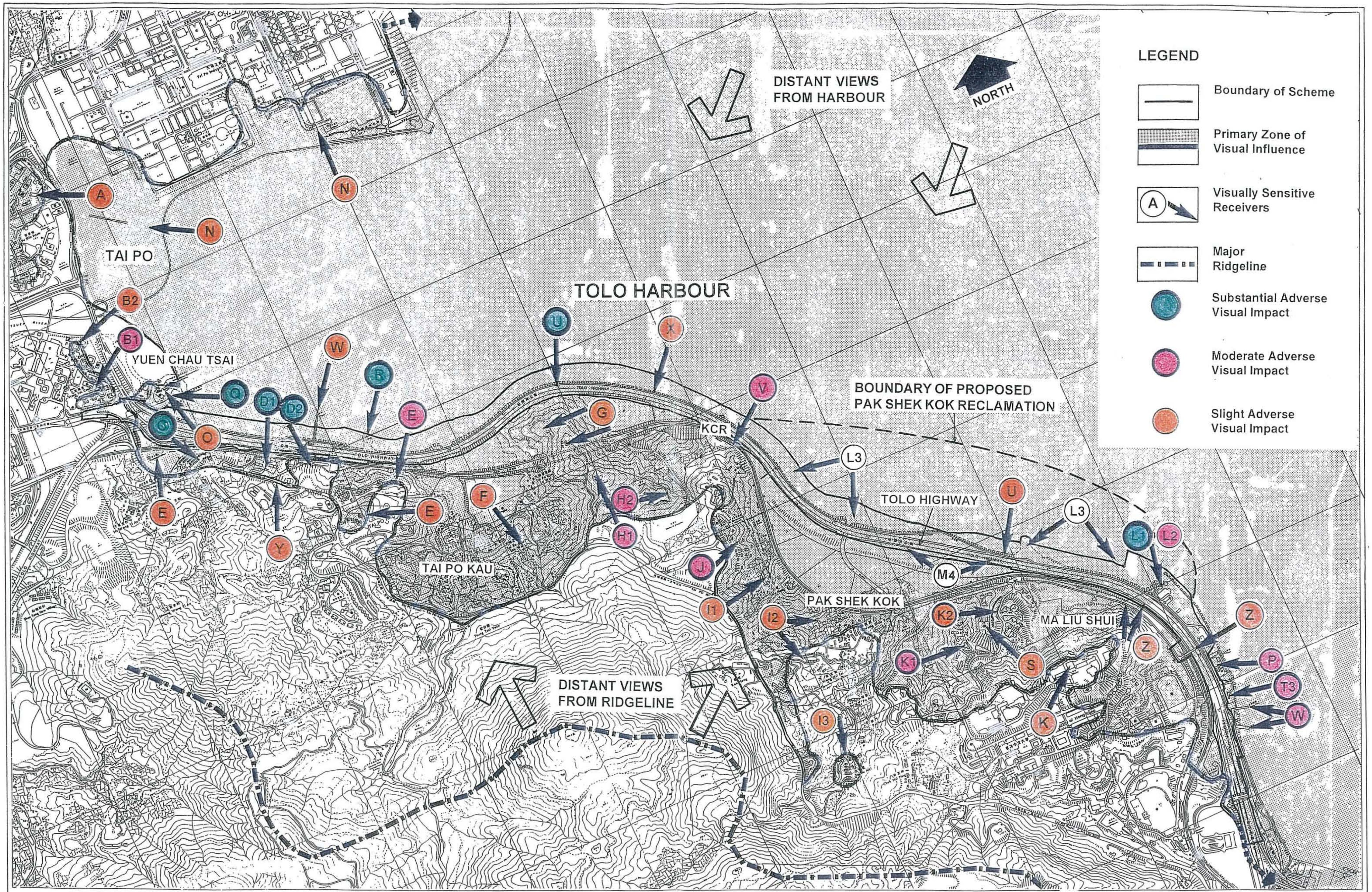
Figure no. 10.6



ZONE OF VISUAL INFLUENCE AND CLOSE DISTANCE VISUALLY SENSITIVE RECEIVERS

SCALE 1 : 15,000

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Figure no. 10.7

The open water of Tolo Harbour lies to the east of the highway and there are long distance views towards the highway from the eastern edge of the harbour at Ma On Shan and from the ferries and water craft on the water itself. Frequent atmospheric haze reduces the visibility of the highway from these distant viewpoints and the road is viewed only as a thin strip of hard material against a backdrop of vegetated hills. Near distance views are available for boat and ferry passengers travelling to the piers at Tai Po Kau and Ma Lui Shui.

10.6.3 Categories of Sensitive Receivers

Visually sensitive receivers are those people within the zone of visual influence whose views would be affected by the scheme. For the purposes of this assessment the sensitive receivers have been grouped into the following four categories:

i. Those people who would view the scheme from their homes

Residential viewers are considered to be the most sensitive to any visual intrusion associated with the scheme. This is because the attractiveness, or otherwise, of any changes the view would have a notable affect on a home owners' general quality of life and acceptability of their home environment.

ii. Those people who would view the scheme from their workplace

Occupational viewers i.e. those people who view the scheme from their workplace, are considered to be less sensitive to visual intrusion. This is because they are employed in activities where visual outlook plays a less important role in the perception of the quality of the working environment.

iii. Those people who would view the scheme during outdoor leisure activities

The sensitivity to visual intrusion of those people taking part in outdoor leisure activities is dependent on the type of activity being enjoyed. Hill walkers, for example, would have greater sensitivity to the quality of the landscape than say a sports enthusiast.

iv. Those people who would view the scheme whilst travelling along public roads, footpaths or from the sea.

For those people who view the scheme from public thoroughfares, the degree of visual intrusion experienced depends on the speed of travel and whether views are continuous or only occasional. Generally, the slower the speed of travel and the more continuous the viewing experience then the greater the degree of sensitivity e.g. cyclists would be more visually sensitive than passengers travelling on the KCR.

10.6.4 Identification of Visually Sensitive Receivers

Figures 10.6 and 10.7 identifies the locations of the visually sensitive receivers within the study area and these are described below according to the references on the plan. The visually sensitive receivers are grouped below into the various categories of viewer (i.e. residential viewers, occupational viewers, recreational viewers and travelling viewers). For each sensitive receiver, the distance between these potential viewers and the highway is detailed and a summary of this information is provided at Table 10.1.

10.6.5 Assessment of Potential Visual Impacts at Construction Stage

All of the visually sensitive receivers within the study area would experience some degree of adverse visual impact during the construction stage. An obvious deterioration in existing views would only be experienced by those receivers close to the works at ground level or with elevated views from near and intermediate distances. The cyclists and pedestrians using the cycle track, users of both Tolo Harbour Garden and the Pier / Temple at Yuen Chau Tsai are in close proximity to the works - all are sensitive receivers with high visual expectations and would experience particularly high visual impacts during construction. The staff quarters would also experience high negative impacts from the scheme.

Cumulative construction impacts would result from any coincidence of the reclamation work at Pak Shek Kok with the construction work on the highway. However, the large scale of the reclamation works and after use as a public dump would tend to reduce the perceived visual impact of the highway widening. This would reduce the impact of the scheme on receivers in the Pak Shek Kok area to a low level. The HKIB staff quarters would be the only visually sensitive receiver adversely affected to any great extent by the cumulative impact of the scheme and the reclamation. An assessment of possible impacts on future development on the reclaimed land has not been included in this assessment due to the provisional nature of the development plans for this area.

The level of potential visual impacts that would be generated by the proposed scheme on surrounding sensitive receivers during the construction phase are assessed below and are summarised in Table 10.1

10.6.6 Assessment of Potential Visual Impacts at Operational Stage (Opening Year)

The level of potential visual impacts generated by the proposed scheme on surrounding visually sensitive receivers during the operational are described below and are summarised in Table 10.1. Operational impacts experienced ten years after the opening of the scheme are discussed as part of the residual impacts in Section 10.10

Noise barriers are to be constructed along several lengths of the north bound carriageway and in the central divider to mitigate noise impact on adjacent properties. These will vary in height between 1.5 and 5.5 metres and will constitute large-scale elements in views across the road from neighbouring visually sensitive receptors and result in a level of visual obstruction.

The operational phase of the scheme would result in fewer and lower level adverse visual impacts compared to the construction phase. The increase in carriageway width and the construction of noise barriers would result in a slight increase in visual impact on most receivers with intermediate to far distance views. A moderate deterioration in existing views would be experienced by those receivers with near distance views or intermediate views from above of the highway. Of these, the Staff Accommodation of the HKIB would be the most affected by the operational scheme due to its sensitivity as a residential receiver, boundary vegetation losses and its elevated, close-proximity view of the scheme.

Users of the cycle track/footpath would experience a moderate beneficial visual impacts as the proposed buffer strip would considerably increase the existing distance between the highway and track, and in some areas beneficial impacts would result from traffic being screened by noise barriers. The proposed buffer planting will at maturity help screen views of the highway from cycle track users.

The existing highway, its structures and traffic already create a substantial adverse visual impact on surrounding areas. In this context, the proposed scheme would only slightly increase the degree of severity of visual impact. Cumulative construction impacts would result from any coincidence of the Stage III reclamation work at Pak Shek Kok, and the operations of the proposed highway redevelopment. However, the large scale of the reclamation works would tend to reduce the perceived visual impact of the widened highway, thereby reducing the operational impact of the scheme on receivers in the Pak Shek Kok valley to a low level.

The level of potential visual impacts that would be generated by the proposed scheme on surrounding sensitive receivers during the operational phase are assessed below and are summarised in Table 10.1

10.6.7 Assessment of Potential Long Term Visual Impacts at Year 10 (Residual Impacts)

The level of potential visual impacts generated by the proposed scheme on surrounding visually sensitive receivers at a point when the planting proposed as part of the landscape mitigation measures has grown sufficiently to form an effective screen are described below and are summarised in Table 10.1. This is assumed to be approximately ten years after the opening of the road, and are considered as residual impacts.

The adoption of the mitigation measures outlined above would do much to reduce the adverse visual impact of the scheme to acceptable levels. In time, the road would become better integrated into its surroundings as the mitigation planting matures. (Planting at a wide range of New Territory sites indicates that proposed tree cover would be successfully established within 10 years). In the long-term, the proposed planting measures would successfully screen ground-level views of the highway from pedestrians and cyclists, sensitive receivers at Ma Lui Shui and from Tolo Harbour.

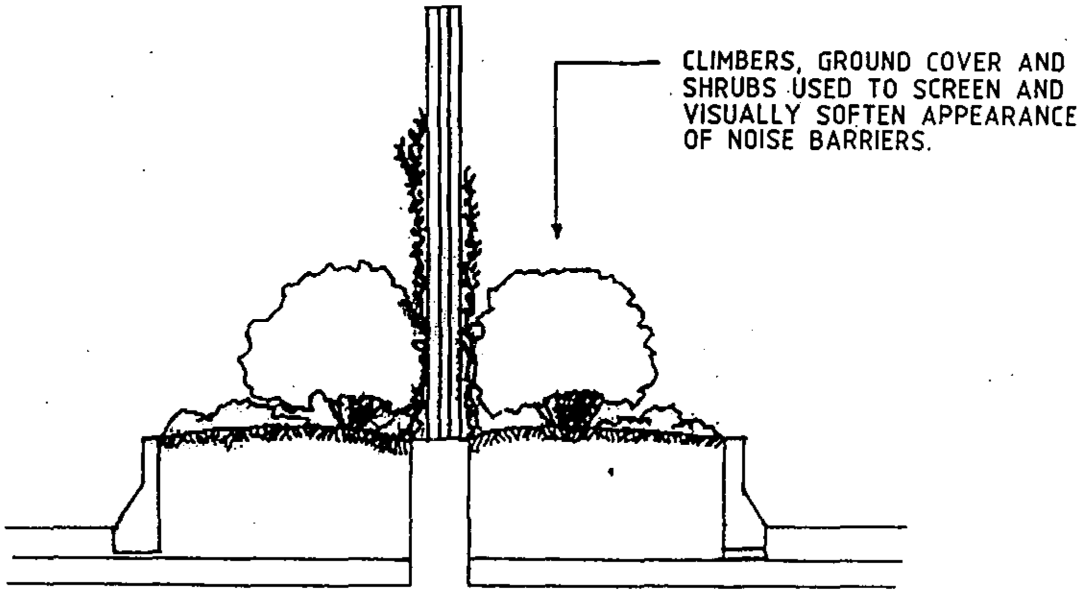
Some low-level residual visual impacts are predicted for users of elevated residential properties, the CUHK, and upper floors of the staff accommodation of HKIB. Screening of these receivers is not possible due to the elevated nature of their views and these would represent residual visual impacts. The landscape buffer adjoining the highway would help to partially screen these elevated views and soften views of the edge of the highway.

Motorists would continue to experience moderate adverse impacts resulting from the views out towards Tolo Harbour. This reduction in the extent and quality of views experienced by motorists would be partly mitigated by the lowering of the level of the cycle track and the inclusion of gaps in the buffer zone planting.

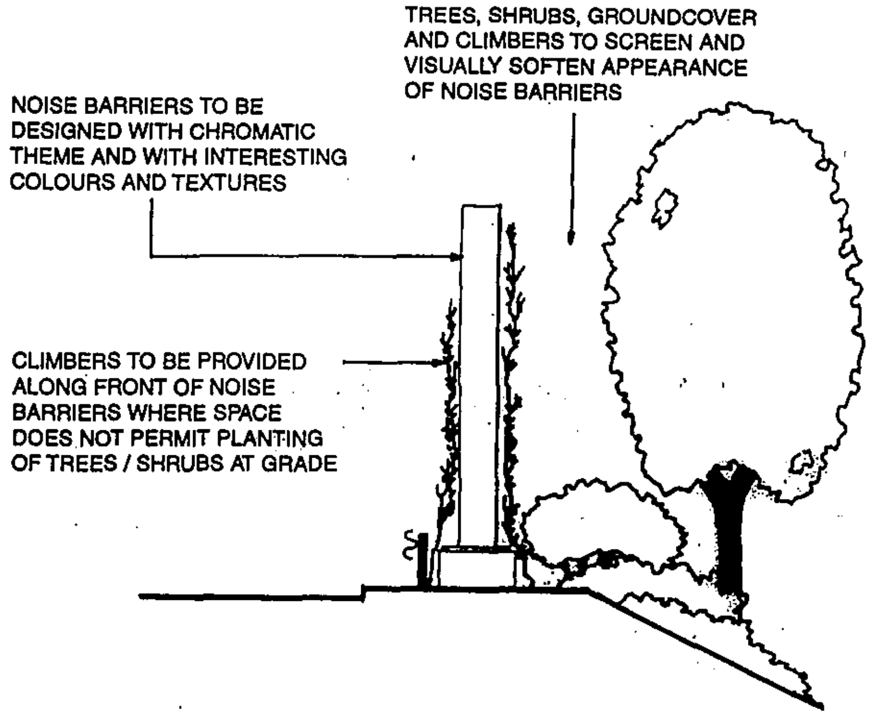
The proposed Pak Shek Kok Public Dump would have a major impact on the future landscape of the area during the construction and operational phases of the scheme. In the long term, the landscape and visual impacts created by the scheme around the Pak Shek Kok valley are negligible compared to the potential impacts resulting from the other proposed dump and possible after uses. Mitigation planting between the proposed projects will need to be co-ordinated to create a comprehensive landscape strategy for the area, to minimise damage to the mitigation measures related to the Highway widening scheme and to reduce the visual impact of the highway to a minimum.

Noise barriers will constitute large scale elements in views across the road from neighbouring visually sensitive receptors and result in a level of visual obstruction. Sensitive architectural treatment of the noise barriers would help to reduce their visual mass and blend them into the surrounding vegetation tone down their appearance and the incorporation of vision panels should mitigate the potential visual obstruction to some degree.

Sufficient available space is a pre-requisite to the successful establishment of planting to form a visual screen. Where the erection of noise barriers is proposed along the central median as part of the noise mitigation measures, additional width of central median may need to be considered to achieve the planting proposed as part of the landscape and visual impact mitigation measures. A conceptual sketch showing screen planting in association with noise barriers is shown at Figure 10.8A to mitigate the visual impact of the proposed noise barriers.



CENTRAL MEDIAN BARRIER



ROADSIDE BARRIER

TYPICAL TREATMENT OF NOISE BARRIER	Maunsell 茂盛(亞洲)工程顧問有限公司	JOB NO. 90896	FIGURE: 10.8A

Table 10.1 Summary of Visual Impact Assessment (1)

REF. NO.	TYPE AND LOCATION OF RECEIVER	NO.	SOURCE OF VISUAL IMPACT	VISIBILITY D=Direct O=Oblique F=Full View P=View Partial E=Elevated View G=Ground Level View	DISTANCE TO ROAD	DURAT'N OF VIEW	POTENTIAL VISUAL IMPACT AT CONSTR'N	POTENTIAL VISUAL IMPACT AT OPENING	POTENTIAL VISUAL IMPACT AT YEAR 10
[redacted]									
A	Fu Shin Estate	many	loss of waterfront vegetation, construction activity	O, F, E	1000m	constant	Slight Adverse	Slight Averse	Slight Beneficial
B1	Wang Fuk Court	many	loss of road side vegetation, construction activity	D, F, E	200m	constant	Moderate Adverse	Slight Adverse	Slight Beneficial
B2	Kwong Fuk Estate	many	loss of road side vegetation, construction activity	D, F, E	350m	constant	Slight Adverse	Slight Adverse	Slight Beneficial
C	CARE village housing	some	loss of road side vegetation, visual obstruction from noise barriers, proximity of construction activity	D, F, E	100m	constant	Substantial Adverse	Moderate Adverse	V.Slight Beneficial
D1	Red Land Garden	some	loss of road side vegetation, visual obstruction from noise barriers, proximity of construction activity	D, F, E	100m	constant	Substantial Adverse	Moderate Adverse	Slight Beneficial
D2	KCRC Housing	some	loss of road side vegetation, visual obstruction from noise barriers, proximity of construction activity	D, F, E	50m	constant	Substantial Adverse	Moderate Adverse	Slight Beneficial
E	Residential Development	some	loss of road side vegetation, visual obstruction from noise barriers, proximity of construction activity	D, F, E	150m	constant	Moderate Adverse	Moderate Adverse	Slight Beneficial
F	Tai Po San Wai	few	loss of road side vegetation, construction activity	D, P, E	600m	constant	Slight Adverse	Slight Adverse	Slight Beneficial

Table 10.1 Summary of Visual Impact Assessment (2)

REF.NO.	TYPE AND LOCATION OF RECEIVER	NO.	SOURCE OF VISUAL IMPACT	VISIBILITY D=Direct O=Oblique F=Full View P=View Partial E=Elevated View G=Ground Level View	DISTANCE TO ROAD	DURAT'N OF VIEW	POTENTIAL VISUAL IMPACT AT CONSTR'N	POTENTIAL VISUAL IMPACT AT OPENING	POTENTIAL VISUAL IMPACT AT YEAR 10
G	Individual property, St.Christopher's Head	few	loss of road side vegetation, proximity of construction activity	D, P, E	150m	constant	Slight Adverse	Slight Adverse	Slight Beneficial
H1	Villa Costa	some	loss of road side vegetation, construction activity	D, F, E	400m	constant	Moderate Adverse	Moderate Adverse	Slight Adverse
H2	Lookout Link	few	loss of road side vegetation, construction activity	D, P, E	400m	constant	Moderate Adverse	Slight Adverse	Slight Adverse
I1	Tsui Hang	few	loss of road side vegetation, visual obstruction from noise barriers, proximity of construction activity	D, P, F	400m	constant	Slight Adverse	Slight Adverse	Slight Beneficial
I2	Cheung Shue Tan	few	loss of road side vegetation, construction activity	D, P, E	400m	constant	Slight Adverse	Slight Adverse	Slight Beneficial
I3	Tai Po Mai	few	loss of road side vegetation, construction activity	D, F, E	1000m	constant	Slight Adverse	Slight Adverse	Slight Beneficial
J	Future Property at St. Christopher's Home	some	loss of road side vegetation, proximity of construction activity	D, F, E	250m	constant	Moderate Adverse	Slight Adverse	Slight Adverse
K1	Halls of Residence -CUHK	many	loss of road side vegetation, cut slope at St C's Head, construction activity	D/O, F, E	100-500m	constant	Moderate Adverse	Slight Adverse	Slight Adverse
L1	Staff Accommodation -HKIB	some	loss of road side vegetation, visual obstruction from noise barriers, cut slope at St C's Head, proximity of construction activity	D/O, F, E	<100m	constant	Substantial Adverse	Moderate Adverse	Slight Beneficial

Table 10.1 Summary of Visual Impact Assessment (3)

REF.NO.	TYPE AND LOCATION OF RECEIVER	NO.	SOURCE OF VISUAL IMPACT	VISIBILITY D=Direct O=Oblique F=Full View P=View Partial E=Elevated View G=Ground Level View	DISTANCE TO ROAD	DURAT'N OF VIEW	POTENTIAL VISUAL IMPACT AT CONSTR'N	POTENTIAL VISUAL IMPACT AT OPENING	POTENTIAL VISUAL IMPACT AT YEAR 10
M1	High-rise residential towers in southern Ma On Shan	many	loss of waterfront vegetation, cut slope at St C's Head, construction activity	D, F, E, P	1000-2000m	constant	Slight Adverse	Slight Adverse	Slight Beneficial
M2	High-rise residential towers in northern Ma On Shan	many	loss of waterfront vegetation, cut slope at St C's Head, construction activity	D, F, E, G, P	2000-4000m	constant	Slight Adverse	Slight Adverse	Slight Beneficial
M3	Wu Kai Sha village area	many	loss of waterfront vegetation, cut slope at St C's Head, construction activity	D, F, E, G, P	2000-4000m	constant	Slight Adverse	Slight Adverse	Slight Beneficial
M4	Planned residential development at Tai Po Area 39	many	loss of road side vegetation, construction activity	D, F, E.	100-300m	constant	(Not Applicable)	(Not Applicable)	Slight Beneficial
	OCCUP[illegible]								
N	Tai Po Industrial Estate	some	loss of waterfront vegetation, construction activity	D, F, G/E	1500m	work hrs	Slight Adverse	Slight Adverse	Slight Beneficial
O	Island House Conservation Studies Centre	few	loss of waterfront vegetation, proximity of construction activity	D/O, P, E	200m	work hrs	Slight Adverse	Slight Adverse	Slight Beneficial
P	Marine Science Lab	few	loss of road side vegetation, proximity of construction activity	D, F/P, G	0-20m	work hrs	Moderate Adverse	Slight Adverse	Moderate Beneficial
K2	Main Campus, CUHK	many	loss of road side vegetation, cut slope at St C's Head, construction activity	D/O, F, E	300-600m	work hrs	Slight Adverse	Slight Adverse	Slight Beneficial

Table 10.1 Summary of Visual Impact Assessment (4)

REF.NO.	TYPE AND LOCATION OF RECEIVER	NO.	SOURCE OF VISUAL IMPACT	VISIBILITY D=Direct O=Oblique F=Full View P=View Partial E=Elevated View G=Ground Level View	DISTANCE TO ROAD	DURAT'N OF VIEW	POTENTIAL VISUAL IMPACT AT CONSTR'N	POTENTIAL VISUAL IMPACT AT OPENING	POTENTIAL VISUAL IMPACT AT YEAR 10
L2	HKIB	some	loss of road side vegetation, visual obstruction from noise barriers, proximity of construction activity	D/O, P, E	0-50m	work hrs	Moderate Adverse	Slight Adverse	Slight Beneficial
L3	Planned Science Park on the Pak Shek Kok Reclamation.	some	Not Applicable	D/O, F, G.	100-300m	work hrs	(Not Applicable)	(Not Applicable)	Slight Beneficial
[redacted]									
Q	Yuen Chau Tsai Pier and Temple	many / few	loss of waterfront vegetation, construction activity	D, F/P, G	20-100m	daytime	Substantial Adverse	Slight Adverse	Substantial Beneficial
R	Tolo Harbour Garden	few	loss of road side vegetation, visual obstruction from noise barriers, proximity of construction activity	D/O,F/P,E/G	0-20m	daytime	Substantial Adverse	Moderate Adverse	Moderate Beneficial
S	University Sports Field	few	loss of road side vegetation, cut slope at St C's Head, construction activity	D, P, E	300m	18 hrs	Slight Adverse	Slight Adverse	Slight Beneficial
T1	Walkers on hillslopes to the south of the highway	few	loss of road side vegetation, cut slope at St C's Head, construction activity	D, O, E	1000-3000m	daytime	Slight Adverse	Slight Adverse	Slight Beneficial
T2	Walkers on hillslopes to the north and east of the highway	few	loss of road side vegetation, cut slope at St C's Head, construction activity	D, F, E, P	3000-7000m	daytime	Slight Adverse	Slight Adverse	Slight Beneficial
T3	CUHK Water Sports Centre / Tolo Harbour	few	loss of waterfront vegetation, cut slope at St C's Head, construction activity	D, F, G	0-3000m	daytime	Moderate Adverse	Moderate Adverse	Moderate Beneficial

Table 10.1 Summary of Visual Impact Assessment (5)

REF. NO.	TYPE AND LOCATION OF RECEIVER	NO.	SOURCE OF VISUAL IMPACT	VISIBILITY D=Direct O=Oblique F=Full View P=View Partial E=Elevated View G=Ground Level View	DISTANCE TO ROAD	DURAT'N OF VIEW	POTENTIAL VISUAL IMPACT AT CONSTR'N	POTENTIAL VISUAL IMPACT AT OPENING	POTENTIAL VISUAL IMPACT AT YEAR 10
	TRAVELLERS								
U	Cycletrack/footpath	some	loss of road side vegetation, proximity of construction activity	D, F, G	0-50m	<1 hr	Substantial Adverse	Moderate Beneficial	Substantial Beneficial
V	KCR	many	loss of road side vegetation, visual obstruction from noise barriers, construction activity	D, F/P, E	30-200m	>5 min	Moderate Adverse	Slight Adverse	Moderate Beneficial
W	Public Ferries & other Water Craft	some	loss of waterfront vegetation, cut slope at St C's Head, construction activity	D, F, G	100-3000m	18 hours	Moderate Adverse	Slight Adverse	Moderate Beneficial
X	Motorists on Tolo Highway	many	loss of road side vegetation, cut slope at St C's Head, visual obstruction from noise barriers, construction activity	D, F, G	0-10m	<5 min	Moderate Adverse	Moderate Adverse	Moderate Adverse
Y	Motorists on Tai Po Road	some	loss of road side vegetation, cut slope at St C's Head,	O, F/P, E	150-600m	<1 min	Slight Adverse	Slight Adverse	Slight Adverse
Z	Motorists on CUHK Access Road	some	loss of road side vegetation, construction activity	O, F, E	0-500m	<1 min	Slight Adverse	Slight Adverse	Slight Adverse

10.6.8 Assessment of Impact by Sensitive Receiver

i. Residential Viewers

Residential viewers who would experience visual impacts generated by the proposed scheme are as follows:

- **Ref. A** : Tai Po New Town : - Fu Shin Estate (1000m distance)

  High-rise blocks at Fu Shin Estate would have distant oblique views of the development across Tolo Harbour. Residents would view the scheme against a backdrop of the harbour, existing highway, KCR and wooded hill slopes.

  There would be a slight adverse visual impact during construction, where the loss of waterfront vegetation would open up the view of the existing road, and construction activity would replace the existing waterfront activities. This would cause a barely perceptible deterioration in the existing view.

  The widened road corridor would represent the same loss of amenity in existing views at operational stage resulting in a slight adverse visual impact upon completion, but screen planting along the waterfront and in the area of the junction would grow to obscure views the additional carriageway and provide a more attractive setting to the road and its relationship with the water. There would be a small improvement in the existing view resulting in a slight beneficial visual impact at Year 10.

- **Ref. B1** Wang Fuk Court (200m distance)

  High-rise blocks at Wang Fuk Court have views of the development over Yuen Chau Tsai and Tolo Harbour. Residents would have views along the line of the new carriageway, against a backdrop of the harbour, highway, KCR and wooded hill slopes.

  There would be a moderate adverse visual impact during construction, resulting from the loss of waterfront vegetation and the introduction of construction activity in place of views of the existing waterfront activities. This would cause a noticeable deterioration in the existing view.

  The widened road corridor and its traffic would represent the similar loss of amenity in existing views at operational stage although with the reinstatement of the waterfront the impact upon completion is likely to be slight adverse. Screen planting along the waterfront and in the area of the junction would grow to obscure views the additional carriageway and provide a more attractive setting to the road and its relationship with the water. There would be a small improvement in the existing view resulting in a slight beneficial visual impact at Year 10.

- **Ref. B2** Kwong Fuk Estate (350m distance)

High-rise blocks at Kwong Fuk Estate have views of the development over Yuen Chau Tsai and Tolo Harbour. Residents would view the scheme against a backdrop of the harbour, highway, KCR and wooded hill slopes.

There would be a similar impact on these views as those for Wang Fuk Court, although due to the increased distance visual impact during construction is likely to be slight adverse, resulting from the loss of waterfront vegetation and the introduction of construction activity in place of views of the existing waterfront activities. This would cause a barely perceptible deterioration in the existing view.

The widened road corridor and its traffic would represent the similar loss of amenity in existing views at operational stage although with the reinstatement of the waterfront the impact upon completion is likely to be slight adverse. Screen planting along the waterfront and in the area of the junction would grow to obscure views the additional carriageway and provide a more attractive setting to the road and its relationship with the water. There would be a small improvement in the existing view resulting in a slight beneficial visual impact at Year 10.

- **Ref. C** : Tai Po Road - Yuen Chau Tsai - CARE village housing and adjoining development under construction (100m distance)

Residents of low-rise housing would have top-floor views out over the KCR, to the existing highway and harbour beyond. The visual impact of the loss of vegetation along the waterfront and within the existing junction and construction activity associated with the 1.5 metre high noise barriers would result in an obvious deterioration in the existing view both from loss of amenity and visual obstruction and a substantial adverse visual impact during construction.

The widened road corridor and noise barriers would represent the similar loss of amenity and visual obstruction in existing views at operational stage although with planting below the barrier and screening of some of the traffic by the noise barrier, the visual impact upon completion is likely to be moderate adverse at operational stage, because of a noticeable deterioration in the existing view. Over time the planting will grow to screen out the barriers and new and existing traffic resulting in a small improvement in the existing view, and a slight beneficial visual impact at Year 10.

- **Ref. D1** Tai Po Road - Tai Po Kau : - Red Land Garden (100m distance)

Viewers from Red Land Garden would experience elevated views down towards the KCR, existing vegetation, the proposed highway and its extension and Tolo Harbour beyond.

The visual impact of the loss of vegetation along both sides of the highway and construction activity associated with the 5.5 metre high noise barriers would result in an obvious deterioration in the existing view both from loss of amenity and visual obstruction and a substantial adverse visual impact during construction.

The widened road corridor and noise barriers would represent the similar loss of amenity and visual obstruction in existing views at operational stage although with planting below the barrier and screening of some of the traffic by the noise barrier, the visual impact upon completion is likely to be moderate adverse at operational stage, because of a noticeable deterioration in the existing view. Over time the planting will grow to screen out the barriers and new and existing traffic resulting in a small improvement in the existing view, and a slight beneficial visual impact at Year 10.

- **Ref. D2** Tai Po Road - Tai Po Kau : KCRC Housing - (50m distance)

Viewers from the KCR housing would experience elevated views down towards the KCR, existing vegetation, the proposed highway and its extension and Tolo Harbour beyond. Substantial adverse visual impacts, that is where the scheme would cause a obvious deterioration in the existing view, would be experienced by residents.

The visual impact of the loss of vegetation along both sides of the highway and construction activity associated with the 5.5 metre high noise barriers would result in an obvious deterioration in the existing view both from loss of amenity and visual obstruction and a substantial adverse visual impact during construction.

The widened road corridor and noise barriers would represent the similar loss of amenity and visual obstruction in existing views at operational stage although with planting below the barrier and screening of some of the traffic by the noise barrier, the visual impact upon completion is likely to be moderate adverse at operational stage, because of a noticeable deterioration in the existing view. Over time the planting will grow to screen out the barriers and new and existing traffic resulting in a small improvement in the existing view, and a slight beneficial visual impact at Year 10.

- **Ref. E** Residential Development (150m distance)

Views from the residential developments on the hill slopes of Tai Po Kau would have elevated views, over a wide arc, down to the highway, KCR and Tolo Harbour.

The visual impact of the loss of vegetation along both sides of the highway and construction activity associated with the 4.5 metre high noise barriers would result in an noticeable deterioration in the existing view both from loss of amenity and visual obstruction and a moderate adverse visual impact during construction.

The widened road corridor and noise barriers would represent the similar loss of amenity and visual obstruction in existing views at operational stage although with planting below the barrier and screening of some of the traffic by the noise barrier, the visual impact upon completion is likely to be moderate adverse at operational stage, because of a noticeable deterioration in the existing view. Over time the planting will grow to screen out the barriers and new and existing traffic resulting in a small improvement in the existing view, and a slight beneficial visual impact at Year 10.

- **Ref. F** Tai Po Kau San Wai (600m distance)

Residents of the squatter settlement on the wooded slopes would experience elevated but partial views through the vegetation towards to the highway and harbour beyond. Two ponds and the KCR would be seen in the foreground.

The visual impact of the loss of vegetation along both sides of the highway and associated construction activity would result in an barely perceptible deterioration in the existing view through loss of amenity, and a slight adverse visual impact during construction.

The widened road corridor and noise barriers would represent the similar loss of amenity at operational stage, with the visual impact upon completion also likely to be slight adverse. Over time the planting will grow to screen out the new and existing traffic resulting in a small improvement in the existing view, and a slight beneficial visual impact at Year 10.

- **Ref. G** Individual properties. St. Christopher's Head (15m distance)

Residents would experience elevated, limited views through vegetation towards the highway across a large pond and these views would be seen against a backdrop of Tai Po, Tai Po Kau and Tolo Harbour.

The visual impact of the loss of vegetation along both the near lane and the waterfront and associated construction activity would result in an barely perceptible deterioration in the existing view through loss of amenity, and a slight adverse visual impact during construction.

The widened road corridor would represent the similar loss of amenity at operational stage, with the visual impact upon completion also likely to be slight adverse. Over time the planting along the waterfront will grow to screen out the new and existing traffic resulting in a small improvement in the existing view, and a slight beneficial visual impact at Year 10.

- **Ref. H1** Villa Costa - Individual Properties (400m distance)

Residents in medium-rise housing at Villa Costa would have elevated views, framed by wooded hills, down over the KCR, onto the existing highway and its proposed extension. These views would be seen against a backdrop of Tolo Harbour.

Visual impact resulting from the loss of vegetation along both the near lane and the waterfront and the introduction of associated construction activity into the view would result in an noticeable deterioration in the existing view through loss of amenity, and a moderate adverse visual impact during construction.

The widened road corridor would represent the similar loss of amenity at operational stage, with the visual impact upon completion also likely to be moderate adverse. Over time the planting along the waterfront will grow to screen out some of the new and existing traffic but the increased visual width of road visible the project would still result in a perceptible deterioration in the existing view, and a slight adverse visual impact at Year 10.

- **Ref. H2** Lookout Link (400m distance)

Residents in low-rise individual properties would have elevated limited views through woodland towards the KCR, the highway and its proposed extension, against a backdrop of Tolo Harbour.

Visual impact resulting from the loss of vegetation along both the near lane and the waterfront and the introduction of associated construction activity into the view would result in an noticeable deterioration in the existing view through loss of amenity, and a moderate adverse visual impact during construction.

The widened road corridor would represent the similar but smaller loss of amenity at operational stage, with the visual impact upon completion also likely to be slight adverse. Over time the planting along the waterfront will grow to screen out some of the new and existing traffic but the increased visual width of road visible the project would still result in a perceptible deterioration in the existing view, and a slight adverse visual impact at Year 10.

- **Ref. I1** Pak Shek Kok Valley - Tsui Hang (400m distance)

Residents in the traditional village of Tsui Hang would experience only top-storey views towards the highway extension, across an area of agricultural land, reclaimed land and the KCR. Views would be set against a backdrop of the Pak Shek Kok Public Dump reclamation once the reclamation works have commenced. Less elevated views would be especially dominated by the reclamation works and the operational activities of the public dump.

The visual impact of the loss of vegetation along both sides of the highway and introduction of construction activity for the widened road and 3.5 noise barriers along the near land and central divider (in views to the west) would represent small scale but obvious elements in these views and would result in an barely perceptible deterioration in the existing view through loss of amenity, and some visual obstruction, and a slight adverse visual impact during construction.

The widened road corridor and noise barriers would represent the similar loss of amenity at operational stage, with the visual impact upon completion also likely to be slight adverse. Over time the planting would grow to screen out the new and existing traffic resulting in a small improvement in the existing view, and a slight beneficial visual impact at Year 10.

- **Ref. I2** Pak Shek Kok Valley, Cheung Shue Tan / Wong Nai Fai (400m distance)

  Residents in the traditional villages of Cheung Shue Tan / Wong Nai Fai would experience only top-storey views towards the highway extension, across an area of agricultural land, reclaimed land and the KCR.

  Views would be set against a backdrop of the Pak Shek Kok Public Dump reclamation once their reclamation works have commenced. Less elevated views would be especially dominated by the reclamation works and the operational activities of the public dump.

  The visual impact of the loss of vegetation along both sides of the highway and introduction of construction activity for the widened road and 3.5 noise barriers along the near land and central divider would represent small scale but obvious elements in these views and would result in an barely perceptible deterioration in the existing view through loss of amenity, and a slight adverse visual impact during construction.

  The widened road corridor and noise barriers would represent the similar loss of amenity at operational stage, with the visual impact upon completion also likely to be slight adverse. Over time the planting would grow to screen out the new and existing traffic resulting in a small improvement in the existing view, and a slight beneficial visual impact at Year 10.

- **Ref. I3** Pak Shek Kok Valley - Tai Po Mai (1000m distance)

  Residents of Tai Po Mei would have distant, elevated views towards the highway and extension across the Pak Shek Kok valley, reclaimed land and the KCR.

  Views would be set against a backdrop of the Pak Shek Kok Public Dump reclamation once their reclamation works have commenced. Less elevated views would be especially dominated by the reclamation works and the operational activities of the public dump.

  The visual impact of the loss of vegetation along both sides of the highway and introduction of construction activity for the widened road and 3.5 noise barriers along the near land and central divider would represent small scale in these long range views, but would result in an barely perceptible deterioration in the existing view through loss of amenity, and a slight adverse visual impact during construction.

  The widened road corridor and noise barriers would represent the similar loss of amenity at operational stage, with the visual impact upon completion also likely to be slight adverse. Over time the planting would grow to screen out the new and existing traffic resulting in a small improvement in the existing view, and a slight beneficial visual impact at Year 10.

- **Ref. J** Future Residential Development at St. Christopher's Home site (250m distance)

Residents of the future residential development at St. Christopher's Home site would have elevated views out to the highway extension seen against a backdrop of Tolo Harbour.

Views would be set against a backdrop of the Pak Shek Kok Public Dump reclamation once their reclamation works have commenced. Less elevated views would be especially dominated by the reclamation works and the operational activities of the public dump.

The visual impact of the loss of vegetation along both sides of the highway and introduction of construction activity for the widened road and 3.5 noise barriers along the near land and central divider would be obvious elements in these views and would result in an noticeable deterioration in the existing view through loss of amenity, and a <u>moderate adverse</u> visual impact during construction.

The widened road corridor would represent the similar but smaller loss of amenity at operational stage, with the visual impact upon completion also likely to be <u>slight adverse</u>. Over time the planting along the waterfront will grow to screen out some of the new and existing traffic but the increased visual width of road visible the project would still result in a perceptible deterioration in the existing view, and a <u>slight adverse</u> visual impact at Year 10.

- **Ref. K1** Halls of Residence, Chinese University of Hong Kong, Ma Lui Shui (CUHK) (100-500m distance)

Students and staff would experience elevated view of the highway extension from mid to high-rise blocks at these locations. These views would be seen across wooded slopes of Pak Shek Kok valley, reclaimed land and the KCR and would have a backdrop of the Tolo Harbour. View of the general areas from the CUHK would change dramatically once the Pak Shek Kok Public Dump reclamation works have commenced. Views would be dominated by the reclamation works and the operational activities of the public dump.

The visual impact of the loss of vegetation along both sides of the highway and introduction of construction activity for the widened road and 3.5 noise barriers along the near land and central divider would be obvious elements in these views and would result in an noticeable deterioration in the existing view through loss of amenity, and a <u>moderate adverse</u> visual impact during construction.

The widened road corridor would represent the similar but smaller loss of amenity at operational stage, with the visual impact upon completion also likely to be <u>slight adverse</u>. Over time the planting along the waterfront will grow to screen out some of the new and existing traffic but the increased visual width of road visible the project would still result in a perceptible deterioration in the existing view, and a <u>slight adverse</u> visual impact at Year 10.

- **Ref. L1** Staff Accommodation, Hong Kong Institute of Biotechnology (HKIB) (100-300m distance)

  Residents on all floors would experience west-facing views towards the highway extension, seen against a backdrop of the KCR, wooded hill slopes of Ma Lui Shui and the CUHK main campus.

  Views from the HKIB would change dramatically once the Pak Shek Kok Public Dump reclamation works have commenced. Views to the north would be dominated by the reclamation works and the operational activities of the public dump.

  Although the existing views to the west are of low quality, the loss of vegetation along the highway and construction activity associated with the 3.5 metre high noise barriers would result in an obvious deterioration in the view from loss of amenity and visual obstruction and a substantial adverse visual impact during construction.

  The widened road corridor and noise barriers would represent the similar loss of amenity and visual obstruction in existing views at operational stage although with planting below the barrier and screening of some of the traffic by the noise barrier, the visual impact upon completion is likely to be moderate adverse at operational stage. Over time the planting will grow to screen out the barriers and new and existing traffic resulting in a small improvement in the existing view, and a slight beneficial visual impact at Year 10.

- **Ref. M1** Residential Towers at Southern Ma On Shan (1000-2000m distance)

  Residents would experience distant, slightly elevated views of the scheme across Tolo Harbour against a backdrop of wooded hills. Distant views of the Pak Shek Kok reclamation works and dump would be possible once works have commenced. The reclamation and dumping works would screen most views of the scheme around Pak Shek Kok.

  A slight adverse visual impact would result during construction, where construction activity together with loss of waterfront vegetation opening up views of existing traffic would cause a barely perceptible deterioration in the existing view.

  A similar slight adverse visual impact would result at operational stage, although in time as the planting grew to form an effective screen against new and existing traffic causing a small improvement in the existing view and a slight beneficial visual impact at Year 10.

- **Ref. M2** Residential Towers at Northern Ma On Shan (2000-4000m distance)

  Residents would experience distant (and slightly elevated views in the case of the high-rise residential towers) views of the scheme across Tolo Harbour against a backdrop of wooded hills. Distant views of the Pak Shek Kok reclamation works and dump would be possible once works have commenced. The reclamation and dumping works would screen most views of the scheme around Pak Shek Kok.

A slight adverse visual impact would result during construction, where construction activity together with loss of waterfront vegetation opening up views of existing traffic would cause a barely perceptible deterioration in the existing view.

A similar slight adverse visual impact would result at operational stage, although in time as the planting grew to form an effective screen against new and existing traffic causing a small improvement in the existing view and a slight beneficial visual impact at Year 10.

- **Ref. M3** Wu Kai Sha Residential Area Ma On Shan (2000-4000m distance)

Residents would experience distant (and slightly elevated views in the case of the high-rise residential towers) views of the scheme across Tolo Harbour against a backdrop of wooded hills. Distant views of the Pak Shek Kok reclamation works and dump would be possible once works have commenced. The reclamation and dumping works would screen most views of the scheme around Pak Shek Kok.

A slight adverse visual impact would result during construction, where construction activity together with loss of waterfront vegetation opening up views of existing traffic would cause a barely perceptible deterioration in the existing view.

A similar slight adverse visual impact would result at operational stage, although in time as the planting grew to form an effective screen against new and existing traffic causing a small improvement in the existing view and a slight beneficial visual impact at Year 10.

- **Ref. M4** Planned residential development at Tai Po Area 39 (100-300m distance).

Future residents would experience close, elevated views of the scheme against a backdrop of the Tolo Harbour .

As the road widening works would be completed before any occupancy of the area took place, there would be no existing views, and consequently no visual impact. The planting proposed alongside the road, however, would represent an improvement in these future views over what would be visible if no planting was undertaken.

ii. Occupational Viewers

Occupational viewers who would experience visual impacts generated by the proposed scheme are as follows:

- **Ref. N** Tai Po Industrial Estate, Tai Po (1500m distance)

  Workers would experience long-distance views across the urban edge of Tai Po and Tolo Harbour towards the highway extension and these would be seen against a backdrop of wooded hills and the proposed cut slope at St. Christopher's Head.

  There would be a slight adverse visual impact during construction, where extensive loss of waterfront vegetation would open up the view of the existing road, and construction activity would replace the existing waterfront activities. Although existing views are considered less sensitive than those from adjacent residential areas a long length of the road, which constitutes a major element in an important existing view, would be affected, causing a barely perceptible deterioration in the existing view.

  The widened road corridor would represent the same loss of amenity in existing views at operational stage resulting in a slight adverse visual impact upon completion, but planting along the waterfront would grow to screen views of the additional carriageway and provide a more attractive setting to the road and the hill slopes behind. There would be a small improvement in the existing view resulting in a slight beneficial visual impact at Year 10.

- **Ref. O** Island House Conservation Studies Centre (200m distance)

  Users of the conservation facilities at Island House would have occasional filtered views down onto the highway extension through tall vegetation.

  There would be a slight adverse visual impact during construction, where loss of vegetation would open some views of the existing road, and construction activity would replace the existing waterfront activities. The vegetation is an important element and its loss would cause a barely perceptible deterioration in the existing view.

  The widened road corridor would represent the same loss of amenity in existing views at operational stage resulting in a slight adverse visual impact upon completion, but planting along the waterfront would grow to screen views of the additional carriageway and provide a more attractive setting to the road and the hill slopes behind. There would be a small improvement in the existing view resulting in a slight beneficial visual impact at Year 10.

- **Ref. K2** CUHK Main Campus (300-600m distance),

  Students and staff would experience elevated views of the highway extension from mid to high-rise blocks at the CUHK, seen across wooded slopes of Pak Shek Kok valley and reclaimed land the KCR all set against a backdrop of Tolo Harbour.

Views would change dramatically once the Pak Shek Kok Public Dump reclamation works have commenced. Views of the highway extension to the north would be dominated by the reclamation works and the operational activities of the public dump.

The visual impact of the loss of vegetation along both sides of the highway and introduction of construction activity for the widened road and 3.5 noise barriers along the near land and central divider would be obvious elements in these views and would result in an perceptible deterioration in the existing view through loss of amenity, and a slight adverse visual impact during construction.

The widened road corridor would represent the similar loss of amenity at operational stage, with the visual impact upon completion also likely to be slight adverse. Over time the planting along the roadside would grow to screen out some of the new and existing traffic and result in a small improvement in the quality of the existing view, and a slight beneficial visual impact at Year 10.

- **Ref. L2** Institute of Biotechnology

Workers in the Institute of Biotechnology would have north-west and south-east facing views of the highway extension and a possible construction area. These views would be available across internal roads and car parking and would be seen through boundary vegetation and against a backdrop of wooded hill slopes.

Views would change dramatically once the Pak Shek Kok Public Dump reclamation works have commenced. Views of the highway extension to the north would be dominated by the reclamation works and the operational activities of the public dump.

The impact would be similar to that on the Staff Accommodation Block but as the receivers are less sensitive the impact would be reduced. The loss of vegetation along the highway and construction activity associated with the 3.5 metre high noise barriers would result in an obvious deterioration in the view from loss of amenity and visual obstruction and a moderate adverse visual impact during construction.

The widened road corridor and noise barriers would represent the similar loss of amenity and visual obstruction in existing views at operational stage although with planting below the barrier and screening of some of the traffic by the noise barrier, the visual impact upon completion is likely to be slight adverse at operational stage. Over time the planting will grow to screen out the barriers and new and existing traffic resulting in a small improvement in the existing view, and a slight beneficial visual impact at Year 10.

- **Ref. P** Marine Science Lab (MSL) (0-20m distance)

Users of the MSL would experience direct ground-level views of the scheme, with the wooded hills of the CUHK campus seen beyond.

Views would change dramatically once the Pak Shek Kok Public Dump reclamation works have commenced. Views of the highway extension to the north would be dominated by the reclamation works and the operational activities of the public dump.

The loss of vegetation along the highway and construction activity associated with the 3.5 metre high noise barriers would result in an obvious deterioration in the view from loss of amenity and visual obstruction and a moderate adverse visual impact during construction.

The widened road corridor and noise barriers would represent the similar loss of amenity and visual obstruction in existing views at operational stage although with planting below the barrier and screening of some of the traffic by the noise barrier, the visual impact upon completion is likely to be slight adverse at operational stage. Over time the planting will grow to screen out the barriers and new and existing traffic resulting in a small improvement in the existing view, and a slight beneficial visual impact at Year 10.

- **Ref. L3** Planned Science Park on the Pak Shek Kok Reclamation. (100-300m distance)

  Workers would experience close, ground level or slightly elevated views of the scheme against a backdrop of wooded hills.

  As the road widening works would be completed before any occupancy of the future Science Park took place, there would be no existing views, and consequently no visual impact. The planting proposed alongside the road, however, would represent an improvement in these future views over what would be visible if no planting was undertaken.

iii. Recreational Viewers

Recreational viewers who would experience visual impacts generated by the proposed scheme are as follows:

- **Ref. Q** Yuen Chau Tsai Pier, Island House and Temple (150-200m distance)

  The pier and small beach at Yuen Chau Tsai is the starting point for the annual Dragon Boat Races and also a stop-off point for cyclists using the cycle track. Users of the area would experience views towards the scheme up to St. Christopher's Head, and these views would be available across open water against a backdrop of hills and the Tolo Harbour. Users of the temple would experience direct views onto the highway.

  The loss of vegetation along the highway and construction activity associated with the road widening along the waterfront and sections of high noise barriers would result in an obvious deterioration in the view from loss of amenity, and a substantial adverse visual impact during construction.

  As the view points are below the level of the road, visual impact upon completion of the works is likely to arise from the more obvious views of the traffic, and is considered to be slight adverse at operational stage. Over time the planting will grow to screen out the barriers and new and existing traffic resulting in a small improvement in the existing view, and a slight beneficial visual impact at Year 10.

- **Ref. R** Tolo Harbour Garden (2m+ distance)

  Users would experience very close range views of the proposed widening works, but in the context of the existing road and the KCR, with the generally wooded hill slopes beyond.

  Due to its very close proximity there would be an obvious deterioration in the existing views from the Garden through loss of vegetation and the introduction of construction activity associated with the road and noise barriers, resulting in a loss of visual amenity and some visual obstruction, and therefore a substantial adverse visual impact during construction.

  The widened road corridor and noise barriers would represent the similar loss of amenity and visual obstruction in views from the Garden, although the noise barriers would serve to screen north bound traffic. There would be a moderate adverse visual impact at operational stage, resulting from a noticeable deterioration in the existing view. Re-provisioning of Garden Facilities to favour views out to sea, and planting works alongside the road should serve to screen out views of the road and create a more attractive environment for the Garden than at present.

- **Ref. S** University Sports Field (300m distance)

  Users would have elevated views of the proposed widening works especially the cut slope at St Christopher's Head, in the context of the existing road and the KCR, and against the backdrop of mixed wooded hill slope and residential development. These views would be partially screened by hillside vegetation and would be set against the Tolo Harbour beyond. These potential views would be dominated by the Pak Shek Kok Public Dump reclamation works once the works have commenced.

  The visual impact of the loss of vegetation along both sides of the highway and introduction of construction activity for the widened road and 3.5 noise barriers along the near land and central divider would be obvious elements in these views and would result in an noticeable deterioration in the existing view through loss of amenity, and a slight adverse visual impact during construction.

  The widened road corridor would represent a similar loss of amenity at operational stage, with the visual impact upon completion also likely to be slight adverse. Over time the planting along side the road would grow to screen out the new and existing traffic resulting in a small improvement in the existing view, and a slight beneficial visual impact at Year 10.

- **Ref.T1** Walkers on the hill slopes to the south of the highway

  Walkers on the hill slopes to the south and south-west of the highway would experience elevated medium and long distance views of the highway widening works in the context of the existing road and KCR, and against a backdrop of wooded hills, and be over a considerable time span during the daytime. These views however, would be partially screened by land form and vegetation located between the hills and the highway.

A slight adverse visual impact would result during construction, where the excavation of the cut slope, general construction activity, and the loss of roadside vegetation opening up views of existing traffic, would cause a barely perceptible deterioration in the existing view.

A similar slight adverse visual impact would result at operational stage, although in time as the planting grew to form an effective screen against new and existing traffic and obscure the cut slope, causing a small improvement in the existing view and a slight beneficial visual impact at Year 10.

- **Ref.T2** Walkers on the hill slopes to the north and east of the site

Walkers on the hill slopes to the north and east of the highway would experience very long range, slightly elevated views of the scheme across Tolo Harbour in the context of the existing road and KCR, and against a backdrop of wooded hills, and be over a considerable time span during the daytime.

Distant views of the Pak Shek Kok reclamation works and dump would be possible once works have commenced. Walkers on the hill slopes to the north of the highway would experience clear views of the proposed cut slope at St. Christopher's Head.

A slight adverse visual impact would result during construction, where construction activity together with loss of waterfront vegetation opening up views of existing traffic would cause a barely perceptible deterioration in the existing view.

A similar slight adverse visual impact would result at operational stage, although in time as the planting grew to form an effective screen against new and existing traffic causing a small improvement in the existing view and a slight beneficial visual impact at Year 10.

- **Ref. T3** Water Sports Centre CUHK / Tolo Harbour (0-3000m distance)

  Users of the centre would experience direct ground-level views of the proposed widening works; in the context of the existing road, and against the wooded hills of the CUHK beyond. Views towards the harbour are partially screened by a belt of trees. Leisure craft, canoeists etc. on the open water of Tolo Harbour would have uninterrupted views of the scheme over a wide arc, set against the hill slopes beyond. Views from Tolo Harbour would be interrupted once the Pak Shek Kok Public Dump reclamation works have commenced. These views are likely to be of considerable duration throughout the day.

  The reclamation works and the operational activities of the public dump would screen most views towards the highway around Pak Shek Kok.

  The loss of vegetation along the highway, the cut slope at St Christopher's Head, and construction activity associated with the road widening along the waterfront and sections of high noise barriers would result in an noticeable deterioration in the view from loss of amenity and some visual obstruction, and a moderate adverse visual impact during construction.

As the view points are below the level of the road, visual impact upon completion of the works is likely to arise from the more obvious views of the traffic, but due to the potential proximity is also considered to be moderate adverse at operational stage. Over time the planting will grow to screen out the barriers and new and existing traffic resulting in a noticeable improvement in the existing view, and a moderate beneficial visual impact at Year 10.

iv. Travelling Viewers

Travelling viewers who would experience visual impacts generated by the proposed scheme are as follows:

- **Ref. U** Cycle track (0-50m distance)

  Cyclists and pedestrians would experience direct, close distance views of the scheme along its entire length, possibly for up to an hour. The road widening works would seen in the context of the existing road and would be set against the KCR and hill slopes beyond. Views of the proposed cut slope at St. Christopher's Head would also be clearly visible for this group of potential viewers.

  Views from the cycle track/footpath around Pak Shek Kok would be dominated by the Pak Shek Kok Public Dump reclamation works once the works have commenced.

  Due to its very close proximity to the line of the widened there would be an obvious deterioration in the existing views from the cycle track/ through loss of vegetation and the introduction of construction activity associated with the road and noise barriers, resulting in substantial adverse visual impact during construction.

  Re-alignment of the cycle track/footpath would take cyclists/pedestrians further away from the road corridor resulting in a noticeable improvement in the quality of views obtained along the cycle track/footpath, and a moderate beneficial visual impact at operational stage. Planting works alongside the road should, in time, further serve to screen out views of the road and create a more attractive environment for the cycle track/footpath than at present, resulting in an obvious improvement in the existing view, and a substantial beneficial visual impact.

- **Ref. V** Kowloon-Canton-Railway (30-200m distance)

  Passengers would have direct views of the proposed widening works along its entire length except where the KCR enters a tunnel at St. Christopher's' Head and where vegetation would partially screens views. The views would be seen in the context of the existing road and against the scenic backdrop of Tolo Harbour. They would be experienced for several minutes,

Views of the highway from the KCR around Pak Shek Kok would be set against a backdrop of the Pak Shek Kok reclamation works once the construction has commenced.

The loss of vegetation along both sides of the highway and construction activity associated with the road widening and sections of noise barriers would result in an noticeable deterioration in the existing close range views, and in a moderate adverse visual impact during construction.

The widened road corridor and noise barriers would represent the similar but smaller loss of amenity and visual obstruction in existing views at operational stage although with screening of some of the traffic by the noise barriers, the visual impact upon completion is likely to be slight adverse at operational stage, because of a noticeable deterioration in the existing view.

Over time the planting will grow to screen out the barriers and new and existing traffic and create a more attractive setting to views of the harbour, resulting in a noticeable improvement in the existing view, and a moderate beneficial visual impact at Year 10.

- **Ref. W** Public Ferries to Ma Lui Shui Pier and Tai Kau and other water craft (100+m distance)

Passengers on ferries and other water craft would have uninterrupted views of the scheme over a wide arc. These views would be available both at piers and on the open water of Tolo Harbour, and would be set against the hill slopes and development beyond, and would be experienced for a considerable length of time.

Views from Tolo Harbour would be interrupted once the Pak Shek Kok Public Dump reclamation works have commenced. The reclamation works and the operational activities of the public dump would screen most views towards the highway around Pak Shek Kok.

The loss of vegetation along the highway the extensive new cut slope at St Christopher's Head and construction activity along the waterfront result in an noticeable deterioration in the view from loss of amenity and some visual obstruction, and a moderate adverse visual impact during construction.

As the view points are generally below the level of the road, so visual impact upon completion of the works is likely to arise from the more open views of the traffic, and the cut slope and is considered to be slight adverse at operational stage. Over time the planting will grow to screen out the new and existing traffic and obscure the cut slope resulting in a noticeable improvement in the existing view, and a moderate beneficial visual impact at Year 10.

- **Ref. X** Motorists - on Tolo Highway (0-10m distance)

Motorists on Tolo Highway would have direct close-distance views of the scheme along its entire length seen largely against a backdrop of Tolo Harbour and surrounding hillsides. Views out to Tolo harbour would be screened by the proposed landscape buffer zone. Views of the proposed cut slope at St. Christopher's Head would also be clearly visible for this group of potential viewers.

Although time span for which the views would be possible is relatively short, the loss of marginal vegetation and introduction of extensive construction activities would result in a moderate adverse visual impact during construction.

The visual impact upon completion is likely to be of a similar moderate adverse magnitude owing to the loss of vegetation, the additional traffic, and visual obstruction from some sections of noise barrier in the central divider. Although the screen planting along the road should grow to replace the vegetation lost and create an improvement in the landscape setting of the road, the visual impact in the long term is likely to remain as moderate adverse.

- **Ref. Y** Tai Po Road (150-600m distance)

Motorists on Tai Po Road would experience elevated glimpses of the scheme over some sections of Tai Po Road, with the road widening works being seen from a distance, through the vegetation on hill slopes below, in the context of the existing road and KCR, set against the backdrop of Tolo Harbour beyond.

Views of the proposed cut slope at St. Christopher's Head would also be clearly visible in some sections for this group of potential viewers, and this together with the loss of vegetation would represent a barely perceptible deterioration in the existing view, and a slight adverse visual impact during construction.

The visual impact both upon completion and at Year 10 is also likely to be slight adverse owing to the loss of vegetation, the presence of noise barriers and slope cut works at St. Christopher's Head.

- **Ref. Z** CUHK Access Road (0-500m distance)

Motorists on the CUHK access road would experience direct, elevated views down onto the scheme from the MSL bridge. The widening works would be seen in the context of the existing road and KCR, and set against the backdrop of Tolo Harbour beyond.

Views from the highway and CUHK Access Road around Pak Shek Kok would be dominated by the Pak Shek Kok Public Dump reclamation works once the reclamation and dumping works have commenced.

Although seen from close to, the sensitivity of the viewers is low, and the loss of vegetation and the introduction of construction activities into the view would be experienced for only a short period of time. They would represent a barely perceptible deterioration in the existing view, and consequently a slight adverse visual impact during construction.

The visual impact both upon completion and at Year 10 is also likely to be slight adverse owing to the loss of vegetation, the presence of noise barriers and slope cut works at St. Christopher's Head.

10.7 Comparative Assessment of Options

A comparative assessment of the three options is summarised in Table 10.2.

It is considered that there would only be minor differences in the overall level of visual impact for Options I, II and III at the construction phase. For Option I, all receivers around Ma Lui Shui would experience visual impacts as a result of the construction of the new laboratory bridge. During construction, Option III would generate particular visual impacts due to the re-provision of the existing cycle track along the shoreline and this would impinge on seaward views from the HKIB, MSL and CUHK Water Sports Centre. However, of the three alternatives, Option III would, overall, have a lowest adverse visual impact as the re-provision of the existing cycle track along the shoreline would allow a slightly wider planting screen to be introduced between the HKIB / MSL and the highway. A sketch perspective showing the differences between the landscape structure that would be associated with Option 3 and that which would be associated with both Options 1 and 2 on the seaward side of HKIB is illustrated at Figure 10.8. However, it should be noted that if the proposed landscape impact mitigation measure of providing tree planting along the inner edge of the sea wall is adopted, then the landscape structure along the cycle track/footpath would provide more enclosure and shade for pedestrians and cyclists.

There would be substantial benefits for cyclists and pedestrians with regard to landscape and visual amenity if Option III was chosen. Unlike the situation for Options I and II, the cycle track could be maintained at a standard width of 6 metres and the 2.5 m footpath would be retained. Users of the cycle track/footpath would also benefit from the waterfront location and separation from the highway. Options I and II would both result in the cycle track and footpath being generally less attractive than at present. Figure 10.9 shows the relative widths of landscape buffer planting, set in the context of the CUHK buildings, proposed by the various alignment options.

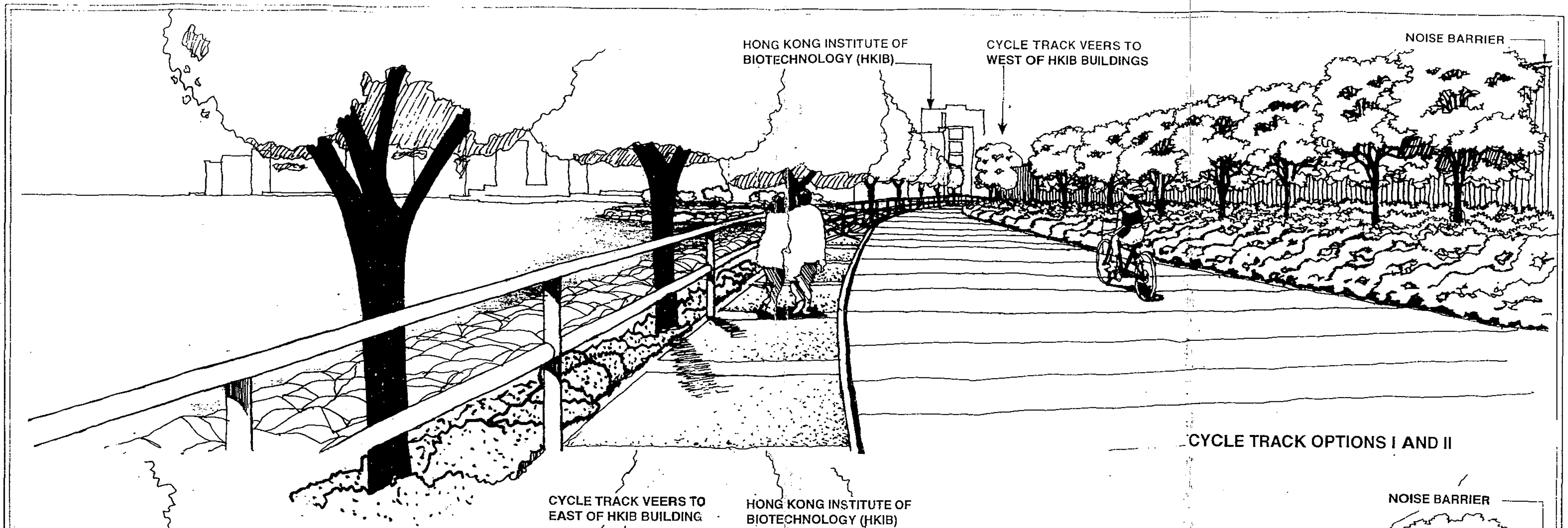
There is a negligible difference between Options I, II and III with regard to landscape character impact. All Options would have high adverse construction impacts on the landscape amenity of the area but beneficial impacts on landscape amenity in the longer term.

Table 10.2 Comparative Assessment of Options

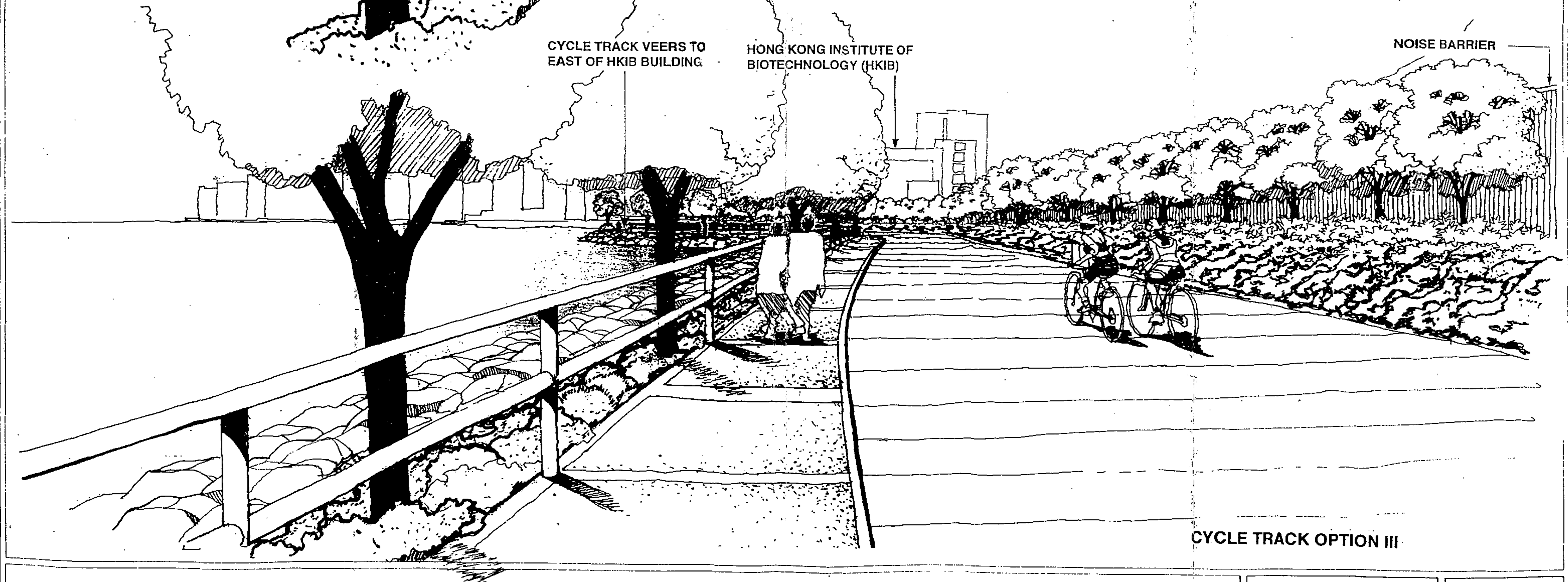
Potential Impact	Option I	Option II	Option III
Negative Landscape Visual Impacts			
Visual Impact and severance of access incurred by Demolition and Reprovision of Laboratory Bridge	+		
Visual impact and disruption to amenity incurred by re-construction of over 200m of carriageway and cycle track around HKIB/MSL		+	
Interface Problems with PSK Reclamation			+
Visual and landscape impact incurred by traffic moving slightly closer to receivers on seaward side	+	+	+
Visual amenity reduced by providing less distance between southbound traffic and the cycle track	+	+	
Visual impact incurred by reduction of distance between cycle track and MSL/CUHK Yacht Club	+	+	+
Landscape impacts and visual impact on receivers in Harbour and HKI/MSL due to reprovision of cycle track along shoreline			+
Conflict point between cycle track and CUHK internal access/ PSK construction access at Ferry Pier	+	+	+
Positive Landscape & Visual Impacts			
Provision of cyclist's rest area at Pak Shek Kok.	+	+	+
Seafront aspect increases visual amenity of cycletrack/ footpath			+
Provision of 2.5m wide footpath in addition to 6m cycle track			+
Increased opportunity for provision of landscaped buffer between Highway at HKIB.			+

10.8 Mitigation Measures

The following mitigation measures are proposed to help ameliorate assessed landscape and visual impacts identified above. The proposed highway widening provides an opportunity to visually upgrade the existing poor quality roadside environment by the introduction of a well designed landscape/recreational corridor. With careful design the existing cycle track could be transformed into a linear park which takes full advantage of this popular public routeway and its magnificent views across Tolo Harbour. A sketch perspective showing the proposed highway widening along the northern end of the scheme is shown at Figure 10.10. However, it should be noted that if the proposed landscape impact mitigation measure of providing tree planting along the inner edge of the sea wall is adopted, then the landscape structure along the cycle track/footpath would provide more enclosure and shade for pedestrians and cyclists. Proposed landscape and visual impact mitigation measures are shown at Figure 10.11. In



CYCLE TRACK OPTIONS I AND II



CYCLE TRACK OPTION III

LANDSCAPE STRUCTURE FOR CYCLE TRACK OPTIONS

Scale 1 : 5000

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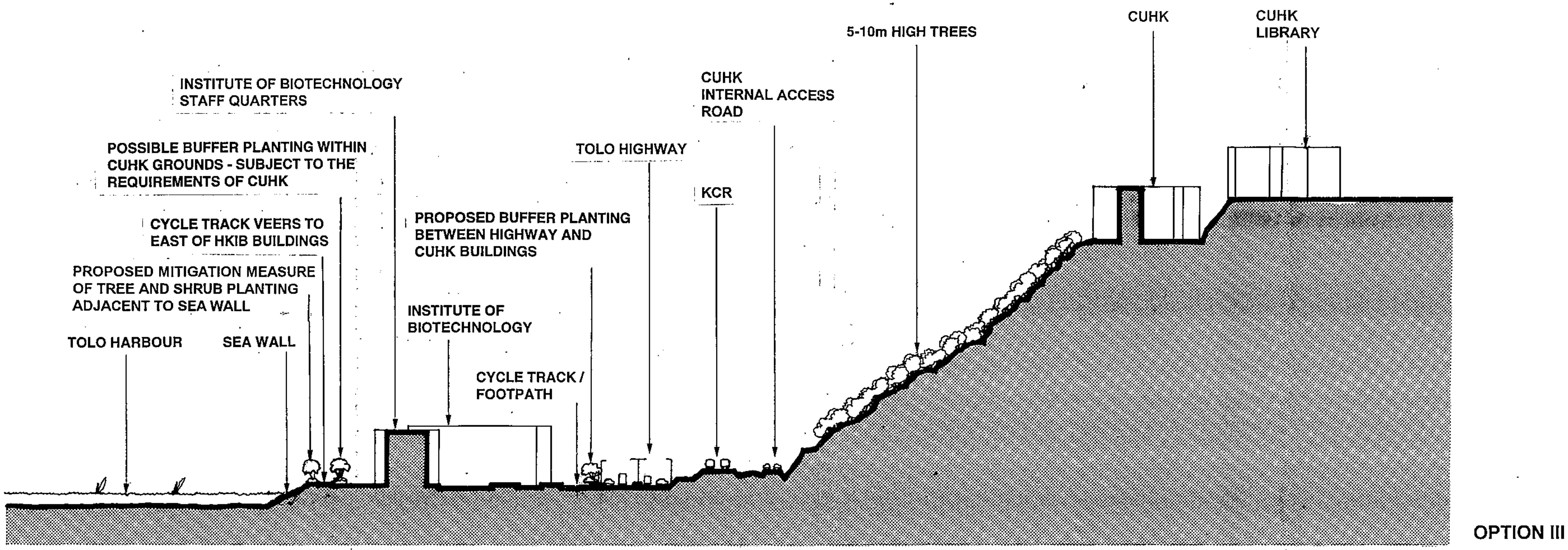
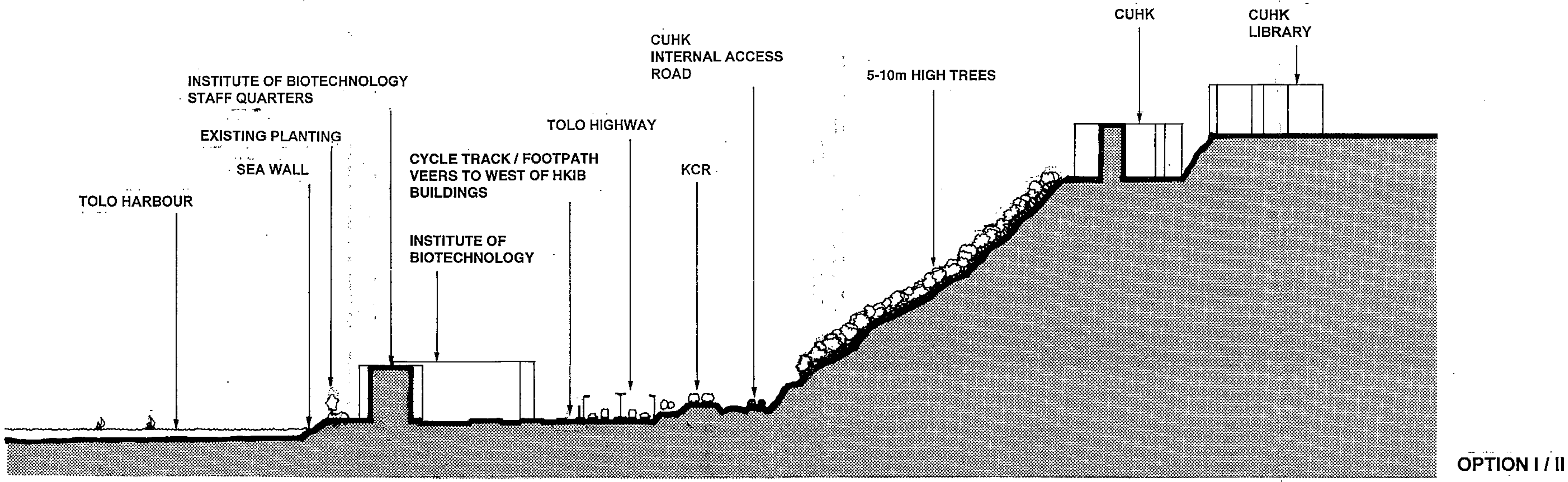
Figure no.
10.8





TOLO HIGHWAY AND CYCLE TRACK ROUTE OPTIONS IN CONTEXT OF
CHINESE UNIVERSITY OF HONG KONG BUILDINGS

Scale 1 : 2000

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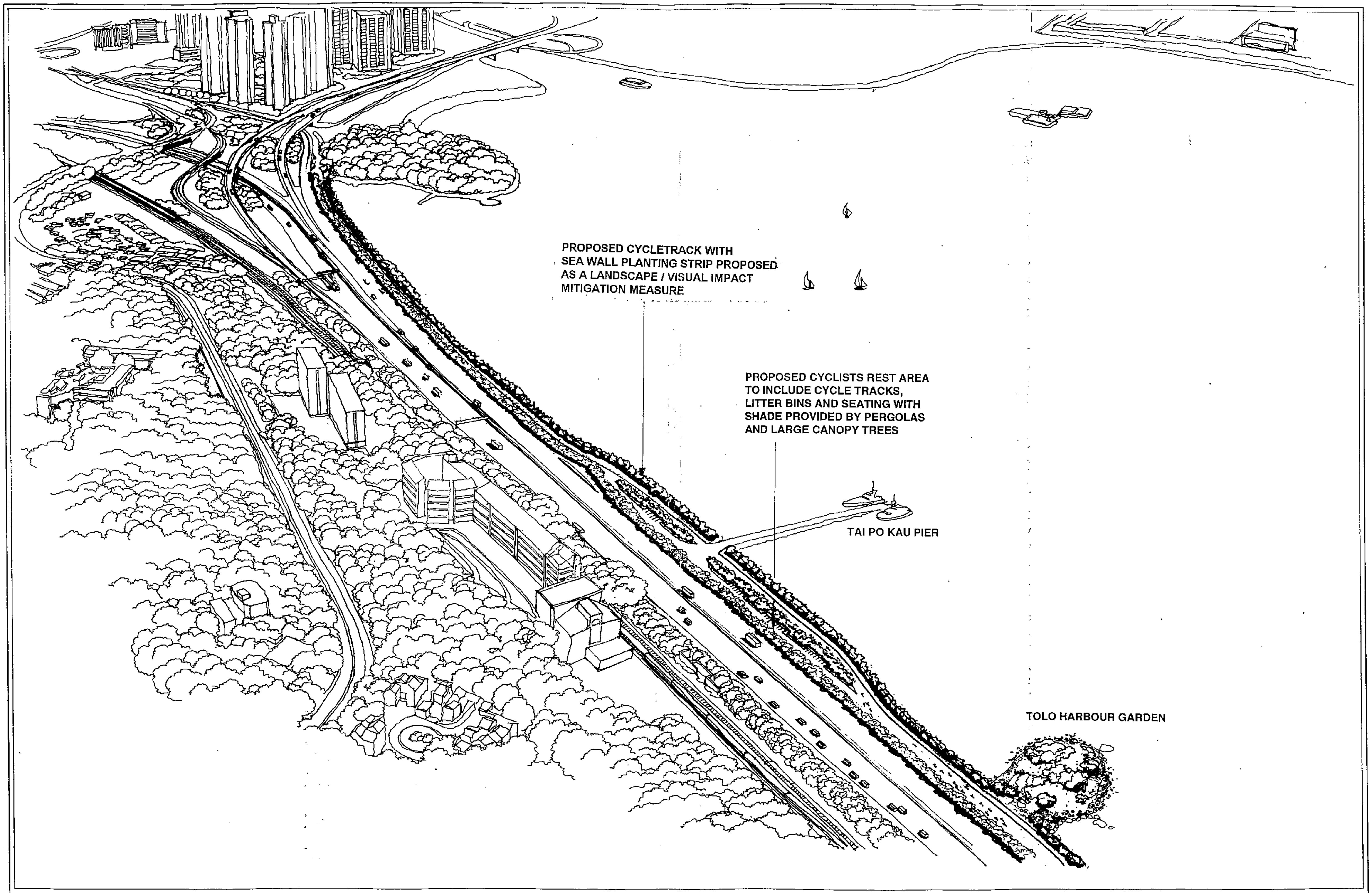
Figure no.
10.9



AERIAL PERSPECTIVE - Tolo Harbour Garden To Yuen Chau Tsai

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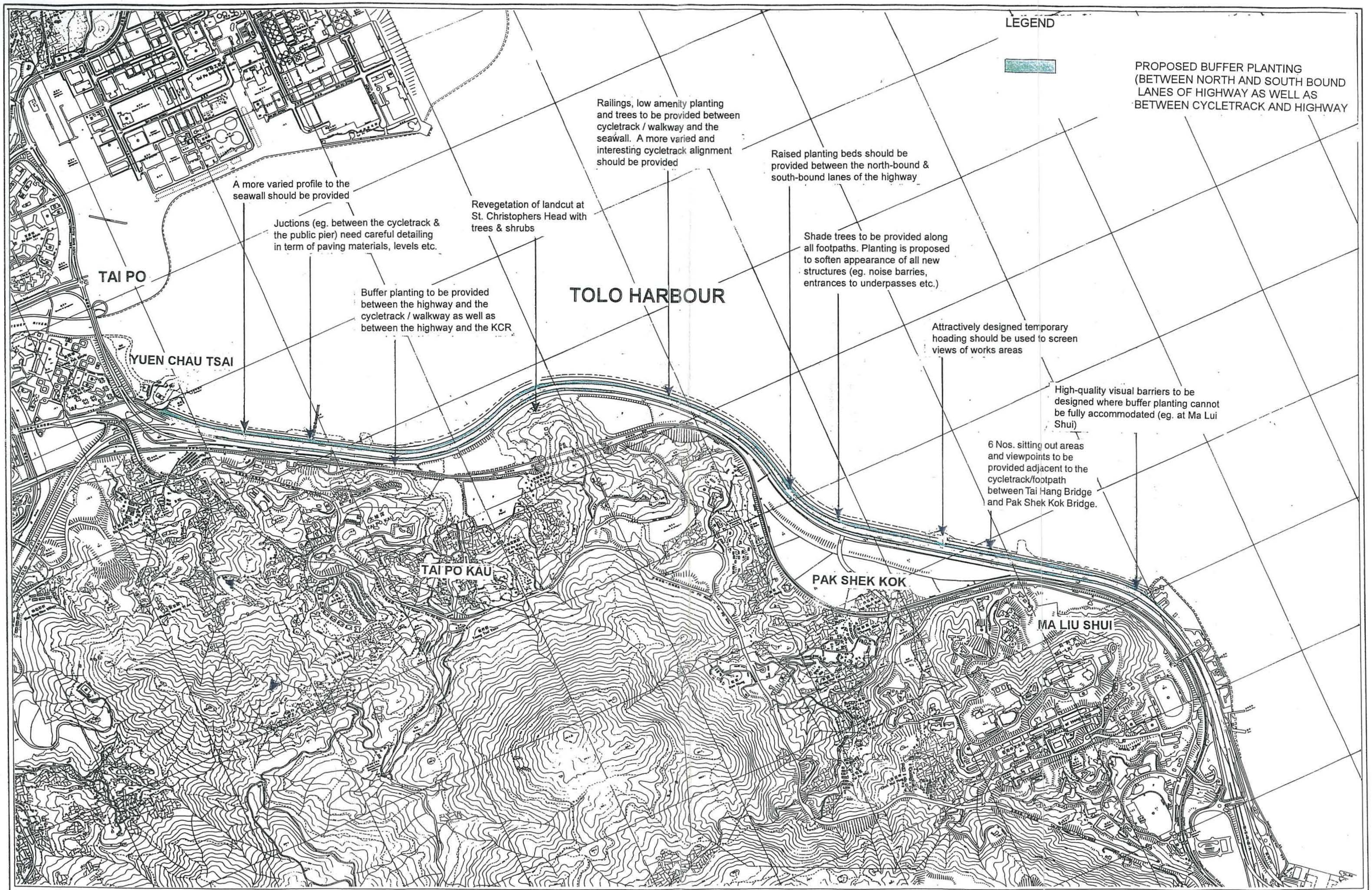
Figure no.
10.10



LANDSCAPE / VISUAL IMPACT MITIGATION MEASURES	SCALE 1 : 15,000	Maunsell 茂盛工程顧問有限公司	Figure no. 10.11

addition to this, more detailed plans showing the retention of vegetation, screen planting, re-vegetation of disturbed land and the re-provisioning of amenity areas / open spaces will be provided in the Final Engineering Report.

Temporary Mitigation Measures - During Construction

The following mitigation measures are recommended to reduce temporary landscape and visual impacts during the construction of the scheme:

- Detailed alignment of road, restriction of construction work areas and use of protective fencing to reduce loss of existing vegetation.

- To reduce ground level construction impacts on the cycle track/footpath, Tolo Harbour Garden, Yuen Chai Tsai Pier/Temple, MSL, HKIB, CUHK Water Sports Centre and ferry/water craft users, working areas should be enclosed within an attractively designed temporary hoarding (but not restricting views of the harbour for cyclists).

- Phasing of construction works and restriction of working areas to help reduce visual impacts from elevated viewpoints.

- Minimise night time working and lighting to reduce visual impacts. Night lighting should be angled directly to the area required to minimise glare, especially to Red Land Garden/KCRC Housing, HKIB residents and motorists.

- Increase the proposed width of the buffer planting strip between the highway and the cycle track / footpath.

Permanent Mitigation Measures - After Construction

The following permanent measures are recommended to reduce the landscape and visual impact of the road at the operational stage, integrate the highway more fully into the surrounding landscape and to introduce environmental improvement measures along the route.

- Consideration should be given at Detail Design stage to the widening of the 5m wide (average) buffer planting strip proposed between the cycle track/footpath and the highway. This buffer planting strip should be widened to 10m wide (average). This would help provide a more effective visual screen between the highway and the cycle track/footpath. It would also provide a more effective visual 'presence' to the planting strip adjacent to what will be a very substantial area of highway when viewed by visually sensitive receivers on the hills above. A low wall (approx. 450mm high) should be provided on the highway side of this mounded planting strip which would slope down to meet a 100mm high kerb where it joins the cycle track

(See Figure 10.12). High quality materials should be used adjacent to the cycle track/footpath (e.g. natural granite block work). This planting strip would provide visual and physical separation of pedestrians/cyclists and vehicular traffic. These amenity planters should contain signage to reduce obstructions on the cycle track/footpath and avoid unnecessary visual clutter. The amenity planting should provide an attractive edge to the road with species chosen for their flowers, varied foliage, form and colour. Wide canopied, evergreen trees should be planted at a regular spacing not just along the buffer planting strip but also along all footpaths within the project boundary. Detailed consideration should include the implications for the need for additional reclamation, land acquisition and the proposed road layout (in respect to the gazetted layout plans), together with the necessary revisions to the programme and budget for the works.

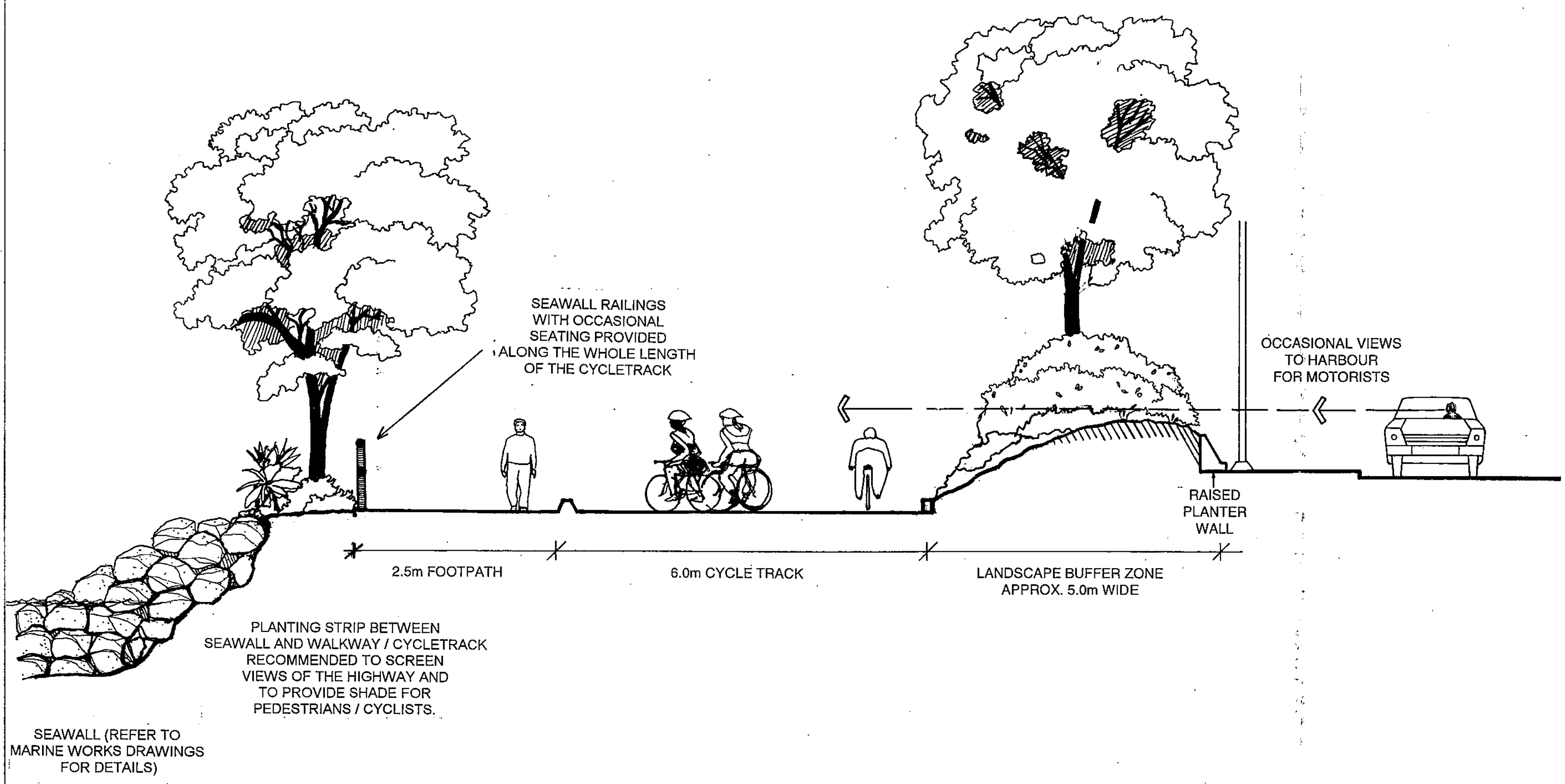
- Planting proposals should include species which are tolerant to wind, pollution and high salt levels. Tall planting should be carefully positioned to avoid blocking views towards signage. Low groundcovers should be used at all junctions in order to allow clear sight lines for cyclists. Watering points should be placed at regular intervals along the route for ease of maintenance. Planting along both the central medians and the buffer planting strip should allow road users to enjoy views of Tolo Harbour rather than to totally screen the views.

- Low growing amenity planting and a continuous line of trees should be provided along the top of the sea wall to provide shade for pedestrians and cyclists. These trees should be wide canopied, evergreen trees planted at a regular spacing. The planting pits should be a minimum 2m x 2m x 2m in size have unrestricted access to the fill material that would be provided underneath the cycle track/footpath.

- Consideration should be given at Detail Design stage to the provision of raised planting beds between the southbound and northbound lanes of the highway. These planting beds should be 3m wide minimum to help provide an effective visual 'presence' and to allow for vegetation maintenance operations to be carried out in safety. Furthermore, these planting beds would help screen and soften the appearance of any noise barriers located within the central divider.

- Wherever trees are required to be moved as a result of the proposed development works, transplantation shall be undertaken rather than felling of the trees.

- Where space allows, the existing embankment planting between the KCR and the highway should be infilled with dense tree and shrub planting. There will, however, be many areas where it will not be possible to screen views of the highway.



PROPOSED PLANTING MITIGATION MEASURES ASSOCIATED WITH THE PROPOSED FOOTPATH / CYCLETRACK

Scale 1:75

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Figure no. 10.12

However, the attention of train passengers near these areas will more likely be drawn to views of the harbour.

- Planting should be provided to help screen and visually soften the appearance of all new structures (e.g. noise barriers, entrances to under-bridges etc.). This planting should comprise trees, shrubs, groundcovers and, where appropriate, climbers. Plans showing the location of this proposed planting are shown in the Final Report (Main). Space should be provided at Detail Design stage for a planting strip to be provided on each side of the proposed noise barriers. This measure would require slightly higher noise barriers but these may be effectively screened by the planting of trees, shrubs and climbers located in these planting strips.

- The proposed cutting at St. Christopher's Head should be re-vegetated either by the planting of trees and shrubs, or if areas of rock are exposed, by the planting of climbers to help screen views of the rock.

- A sensitively designed fence/barrier would help to visually separate the cycle track and highway where an adequate landscape screen is not possible due to site constraints, such as at Ma Lui Shui and Tolo Harbour Garden. Any visual barriers should be designed with variations in colour and texture to provide visual interest.

- Railings are proposed on the outer edge of the footpath immediately adjacent to the sea wall (See Figure 10.8). These railings should have a very light appearance so that views across the harbour are not unnecessarily obscured.

- The detailed design of street furniture, such as bollards, shelters and litter bins should be carefully considered. Street furniture and barriers around the footpath/cycle track and amenity areas should have a distinctive style and chromatic theme.

- Wherever possible, road signage, lighting, junction boxes etc. should be located in the central reservation of the Highway. The opportunity should also be taken to improve the visual qualities of the highway itself by the use of attractively designed central dividers, signs and gantries, all with high quality finishes.

- More sitting-out areas and viewpoints should be provided adjacent to the cycle track/footpath on small promontories, similar to those proposed at Tai Hang Bridge and Pak Shek Kok Bridge (see Figure 10.13). These should be provided at 500m intervals between Tai Hang Bridge (at CH 2300m) and Pak Shek Kok Bridge (at CH 4300m) and would require minor extensions to the sea wall at those locations. Alternatively, small piers could be constructed immediately adjacent to the sea wall to accommodate these facilities. In this regard it is proposed that any additional areas of reclamation required for use as temporary works areas/construction vehicle turning areas should be utilised such as sitting out areas and lookout points.

- Consideration should be given at Detail Design stage to providing a greater width of land between the sea wall and the road so that a more varied and interesting horizontal alignment of the cycle track may be provided.

- Opportunities for providing a more varied and interesting vertical alignment of the cycle track should be considered at Detail Design stage. This will be particularly important in sections close to the proposed rest areas and other junctions where cyclists should have to ride slightly uphill when approaching these junctions so as to slow for the safety of pedestrians.

- Junction points between the CUHK access road, ferry access paths and footpath/cycle track demand careful treatment. Changes in surface material should be introduced at potential conflict points. Bollards should be located to deter vehicles from using the cycle path.

- Pedestrians and cyclists should be separated physically separated by the use of a minor change in level, and visually separated by the use of contrasting surface materials.

- Proposed mitigation measures should blend in with, and be consistent with, other mitigation proposals for the future infrastructure projects around Pak Shek Kok Dump Reclamation. The water-front location of the cycle track is a valuable visual amenity which would be lost as the reclamation works at Pak Shek Kok is undertaken. A long-term mitigation measure involving the relocation of the cycle track along the new waterfront has been considered during the route options assessment and it is strongly recommended that this option is studied in more detail and developed as a long-term aim.

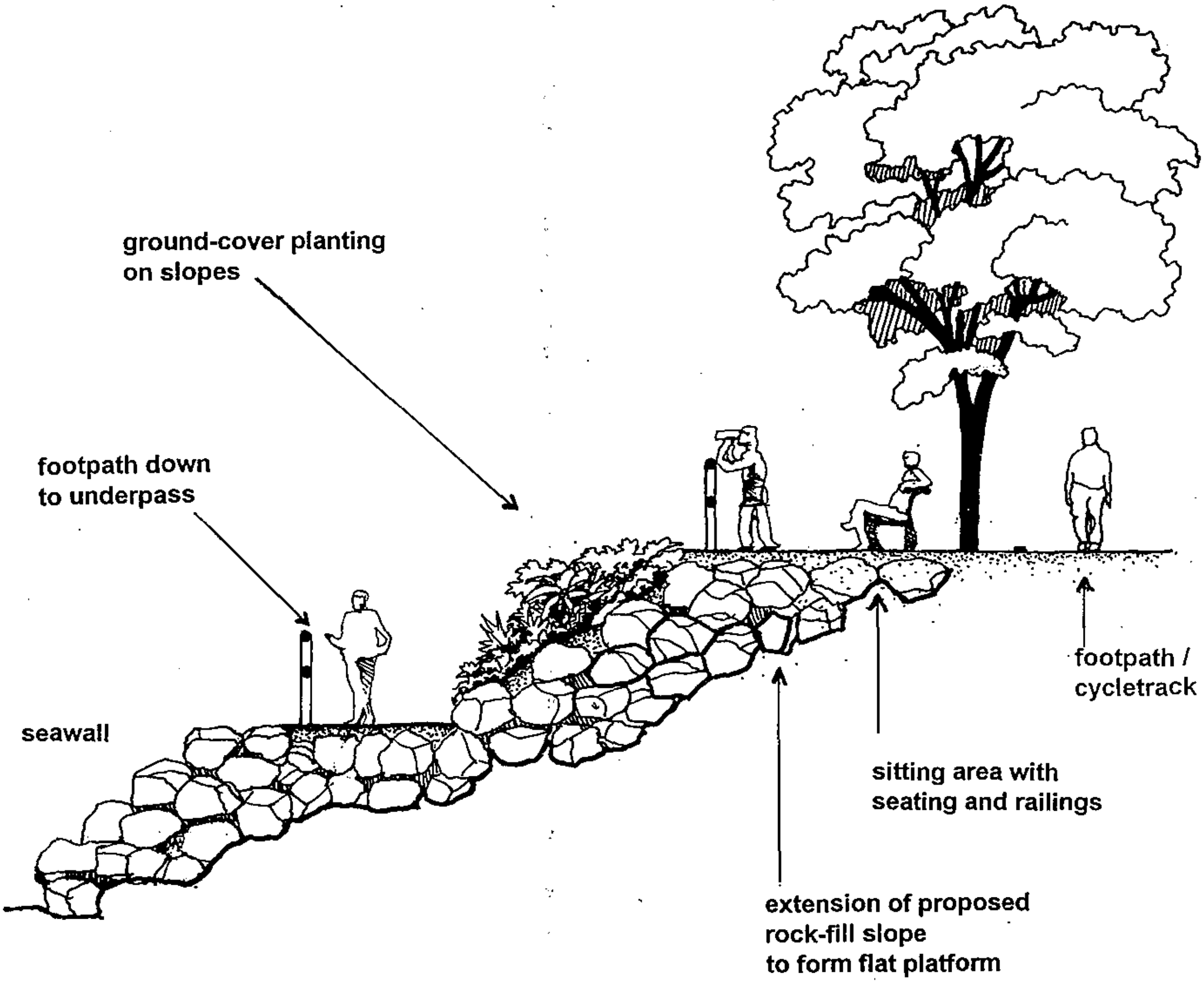
- Consideration should be given at Detail Design stage to the provision of a more sympathetic treatment of the sea wall. The creation of a more varied profile and a vegetated edge to the sea wall is recommended to improve the visual appearance of the sea wall and to provide replacement mangrove planting for that lost as a result of the proposed widening works. Consideration should be given at Detail Design stage to the reinstatement of large areas of mangrove planting that were present prior to the original Tolo Highway development. This measure would help compensate for the adverse visual and landscape impacts that would be generated by the proposed works.

- The design concept for the noise barriers should seek to reduce their visual impact by maximising the extent of vision panels, by reducing the linear elements and providing a textured and colour patterned surface to the solid panels to blend into the surrounding landscape. In particular they should include :

  - variety in the height in the panelled sections of the barriers with a staggered upper and lower line,
  - variety in the widths of the panel sections and changes in sequence,
  - variety in the size of the solid and clear vision panels, to reduce the uniformity of the appearance,
  - ribbed or patterned finish to the solid panels, in a range of four colours to blend in with the colour tones and textures of the surrounding roadside landscape and mitigation planting proposals.

10.9 Conclusion

There would only be minor differences in the overall visual and landscape impacts associated with developing either Options I, II or III. A detailed comparative assessment of each option and related impacts in the Ma Lui Shui area was undertaken as part of this study. This concluded that all options would generate similar levels of visual and landscape impacts at



PROPOSED SITTING AREAS
AT PROMONTORIES ADJACENT TO
TAI HANG BRIDGE AND PAK SHEK KOK BRIDGE

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Figure no.
10.13

the construction stage but that Option III would result in much greater landscape and visual benefits during the operational phase.

All three alignment options would result in substantial to moderate visual impacts during construction and operations around the Institute of Biotechnology, Marine Science Laboratory and the CUHK Water Sports Centre due to their close proximity to the scheme. The Staff Quarters would be particularly affected by the scheme due to its sensitivity, elevated nature and the loss of an existing vegetation screen. Views from the other ground-level receivers would be effectively blocked by mitigation screening measures.

Other visually sensitive receivers include residents of the high quality residential properties on the hill slopes above the scheme and workers, students and residents at the CUHK. The visual impact of the scheme would be difficult to mitigate for these receivers as they have extensive views down onto the highway. However, the proposed mitigation measures would result in a greener, softer edge to the highway which would be a slight improvement on existing views.

Construction related visual impacts would generally be greater than operational visual impacts as sensitive receivers are already affected by the presence of the highway. A major deterioration in existing views during construction would only be experienced by receivers close to the works at ground level or with elevated views from near and intermediate distances.

One of the primary environmental considerations of the project on visual impact grounds is the substantial adverse visual impacts that would be experienced by cyclists and pedestrians during the construction phase. Beneficial visual impacts are predicted during the operational phase when the opportunity exists for the establishment of a buffer zone and screen between the highway and the new cycle track/footpath.

Overall, the proposed options would generate only low level impacts on the existing landscape and landscape character of the study area due to the paucity of existing vegetation adjacent to the route, the poor quality of the existing road corridor and the impressive scale of the wider landscape of Tolo Harbour. The most notable landscape impact is likely to be the impact caused by the cutting at St Christopher's Head.

There are also a number of key environmental considerations on landscape amenity grounds. There would be a loss of amenity for cycle track users during construction. There would be a loss of part of Tolo Harbour Garden and difficulties in access to the garden during construction. The landscape setting of the temple and surrounding fung shui woodland on Yuen Chau Tsai would also be adversely affected.

Mitigation measures have been proposed which aim to minimise the potential landscape and visual impacts of the proposed scheme and to provide a comprehensive landscape treatment for the highway and associated cycle track/footpath. These mitigation proposals, if implemented in full, would represent major landscape and visual improvements for the highway corridor. Mitigation measures would reduce landscape and visual impacts to acceptable levels. Low-level residual impacts are predicted on elevated views down onto the scheme, from residential properties, the CUHK and upper floors only of the staff accommodation of the HKIB. Motorists would have reduced views of Tolo Harbour resulting overall in a moderate adverse impact where the noise barriers would screen views.

TABLE 10.3 : SUMMARY OF IMPACTS

REF. NO.	TYPE AND LOCATION OF RECEIVER	SOURCE OF VISUAL IMPACT	POTENTIAL IMPACT AT CONSTR'N	POTENTIAL IMPACT AT OPENING	POTENTIAL IMPACT AT YEAR 10	MITIGATION MEASURES
	RESIDENTIAL					
A	Fu Shin Estate	loss of waterfront vegetation, construction activity	Slight Adverse	Slight Adverse	Slight Beneficial	screen planting alongside the road and within the junction
B1	Wang Fuk Court	loss of road side vegetation, construction activity	Moderate Adverse	Slight Adverse	Slight Beneficial	screen planting alongside the road and within the junction
B2	Kwong Fuk Estate	loss of road side vegetation, construction activity	Slight Adverse	Slight Adverse	Slight Beneficial	screen planting alongside the road and within the junction
C	CARE village housing	loss of road side vegetation, visual obstruction from noise barriers, proximity of construction activity	Substantial Adverse	Moderate Adverse	Slight Beneficial	screen planting alongside the road, architectural treatment of noise barriers
D1	Red Land Garden	loss of road side vegetation, visual obstruction from noise barriers, proximity of construction activity	Substantial Adverse	Moderate Adverse	Slight Beneficial	screen planting alongside the road, architectural treatment of noise barriers
D2	KCRC Housing	loss of road side vegetation, visual obstruction from noise barriers, proximity of construction activity	Substantial Adverse	Moderate Adverse	Slight Beneficial	screen planting alongside the road, architectural treatment of noise barriers
E	Residential Development	loss of road side vegetation, visual obstruction from noise barriers, proximity of construction activity	Moderate Adverse	Moderate Adverse	Slight Beneficial	screen planting alongside the road, architectural treatment of noise barriers
F	Tai Po San Wai	loss of road side vegetation, construction activity	Slight Adverse	Slight Adverse	Slight Beneficial	screen planting alongside the road
G	Individual property, St.Christopher's Head	loss of road side vegetation, proximity of construction activity	Slight Adverse	Slight Adverse	Slight Beneficial	screen planting alongside the road
H1	Villa Costa	loss of road side vegetation, construction activity	Moderate Adverse	Moderate Adverse	Slight Adverse	screen planting alongside the road
H2	Lookout Link	loss of road side vegetation, construction activity	Moderate Adverse	Slight Adverse	Slight Adverse	screen planting alongside the road
I1	Tsui Hang	loss of road side vegetation, visual	Slight Adverse	Slight Adverse	Slight Beneficial	screen planting alongside the road,

TABLE 10.3 : SUMMARY OF IMPACTS

REF. NO.	TYPE AND LOCATION OF RECEIVER	SOURCE OF VISUAL IMPACT	POTENTIAL IMPACT AT CONSTR'N	POTENTIAL IMPACT AT OPENING	POTENTIAL IMPACT AT YEAR 10	MITIGATION MEASURES
		obstruction from noise barriers, proximity of construction activity				architectural treatment of noise barriers
I2	Cheung Shue Tan	loss of road side vegetation, construction activity	Slight Adverse	Slight Adverse	Slight Beneficial	screen planting alongside the road
I3	Tai Po Mai	loss of road side vegetation, construction activity	Slight Adverse	Slight Adverse	Slight Beneficial	screen planting alongside the road
J	Future Property at St. Christopher's Home	loss of road side vegetation, proximity of construction activity	Moderate Adverse	Slight Adverse	Slight Adverse	screen planting alongside the road
K1	Halls of Resid'n -CUHK	loss of road side vegetation, cut slope at St C's Head, construction activity	Moderate Adverse	Slight Adverse	Slight Adverse	screen planting alongside the road and to face of cut slope
L1	Staff Accomm'n -HKIB	loss of road side vegetation, visual obstruction from noise barriers, cut slope at St C's Head, proximity of construction activity	Substantial Adverse	Moderate Adverse	Slight Beneficial	screen planting alongside the road and to face of cut slope, architectural treatment of noise barriers
M1	High-rise towers southern Ma On Shan	loss of waterfront vegetation, cut slope at St C's Head, construction activity	Slight Adverse	Slight Adverse	Slight Beneficial	screen planting alongside the road and to face of cut slope
M2	High-rise towers northern Ma On Shan	loss of waterfront vegetation, cut slope at St C's Head, construction activity	Slight Adverse	Slight Adverse	Slight Beneficial	screen planting alongside the road and to face of cut slope
M3	Wu Kai Sha village area	loss of waterfront vegetation, cut slope at St C's Head, construction activity	Slight Adverse	Slight Adverse	Slight Beneficial	screen planting alongside the road and to face of cut slope
M4	Planned resid'l dev't Tai Po Area 39	loss of road side vegetation, construction activity	(Not Applicable)	(Not Applicable)	Slight Beneficial	screen planting alongside the road

TABLE 10.3 : SUMMARY OF IMPACTS

REF. NO.	TYPE AND LOCATION OF RECEIVER	SOURCE OF VISUAL IMPACT	POTENTIAL IMPACT AT CONSTR'N	POTENTIAL IMPACT AT OPENING	POTENTIAL IMPACT AT YEAR 10	MITIGATION MEASURES
	OCCUPATIONAL					
N	Tai Po Industrial Estate	loss of waterfront vegetation, construction activity	Slight Adverse	Slight Adverse	Slight Beneficial	screen planting along the waterfront
O	Island House Conservation Studies Centre	loss of waterfront vegetation, proximity of construction activity	Slight Adverse	Slight Adverse	Slight Beneficial	screen planting alongside the road and the waterfront
P	Marine Science Lab	loss of road side vegetation, proximity of construction activity	Moderate Adverse	Slight Adverse	Moderate Beneficial	screen planting alongside the road
K2	Main Campus, CUHK	loss of road side vegetation, cut slope at St C's Head, construction activity	Slight Adverse	Slight Adverse	Slight Beneficial	screen planting alongside the road and to face of cut slope
L2	HKIB	loss of road side vegetation, visual obstruction from noise barriers, proximity of construction activity	Moderate Adverse	Slight Adverse	Slight Beneficial	screen planting alongside the road and to face of cut slope, architectural treatment of noise barriers
L3	Science Park Pak Shek Kok Reclamation.	Not Applicable	(Not Applicable).	(Not Applicable)	Slight Beneficial	screen planting alongside the road and to face of cut slope
	RECREATIONAL					
Q	Yuen Chai Tsai Pier and Temple	loss of waterfront vegetation, construction activity	Substantial Adverse	Slight Adverse	Substantial Beneficial	screen planting along the waterfront and to face of cut slope
R	Tolo Harbour Garden	loss of road side vegetation, visual obstruction from noise barriers, proximity of construction activity	Substantial Adverse	Moderate Adverse	Moderate Beneficial	screen planting along the waterfront, reprovisioning of Garden facilities, architectural treatment of noise barriers
S	University Sports Field	loss of road side vegetation, cut slope at St C's Head, construction activity	Slight Adverse	Slight Adverse	Slight Beneficial	screen planting alongside the road and to face of cut slope
T1	Walkers on hillslopes to the south of the highway	loss of road side vegetation, cut slope at St C's Head, construction activity	Moderate Adverse	Moderate Adverse	Moderate Beneficial	screen planting alongside the road and to face of cut slope

TABLE 10.3 : SUMMARY OF IMPACTS

REF. NO.	TYPE AND LOCATION OF RECEIVER	SOURCE OF VISUAL IMPACT	POTENTIAL IMPACT AT CONSTR'N	POTENTIAL IMPACT AT OPENING	POTENTIAL IMPACT AT YEAR 10	MITIGATION MEASURES
T2	Walkers on hillslopes to the north and east of the highway	loss of road side vegetation, cut slope at St C's Head, construction activity	Moderate Adverse	Moderate Adverse	Moderate Beneficial	screen planting alongside the road and to face of cut slope
T3	CUHK Water Sports Centre / Tolo Harbour	loss of waterfront vegetation, cut slope at St C's Head, construction activity	Moderate Adverse	Moderate Adverse	Moderate Beneficial	screen planting along the waterfront and to face of cut slope
[illegible]	TRAVELLERS					
U	Cycletrack/footpath	loss of road side vegetation, proximity of construction activity	Substantial Adverse	Moderate Beneficial	Substantial Beneficial	screen planting alongside the road and the waterfront, reprovisioning of cycle track/footpath
V	KCR Passengers	loss of road side vegetation, visual obstruction from noise barriers, construction activity	Moderate Adverse	Slight Adverse	Moderate Beneficial	screen planting alongside the road and to face of cut slope, architectural treatment of noise barriers
W	Public Ferries etc.	loss of waterfront vegetation, cut slope at St C's Head, construction activity	Moderate Adverse	Slight Adverse	Substantial Beneficial	screen planting along the waterfront and to face of cut slope
X	Motorists Tolo Highway	loss of road side vegetation, cut slope at St C's Head, visual obstruction from noise barriers, construction activity	Moderate Adverse	Moderate Adverse	Moderate Adverse	screen planting alongside the road and to face of cut slope, architectural treatment of noise barriers
Y	Motorists Tai Po Road	loss of road side vegetation, cut slope at St C's Head,	Slight Adverse	Slight Adverse	Slight Beneficial	planting alongside the road
Z	Motorists CUHK Access Road	loss of road side vegetation, construction activity	Slight Adverse	Slight Adverse	Slight Beneficial	screen planting alongside the road

11 LAND USE IMPACT ASSESSMENT

11.1 Introduction

11.1.1 This section presents the land use impact assessment of the proposed widening of a six kilometres length of the Tolo Highway. The intention to widen the Tolo Highway from a dual-3 to dual-4 lane highway would affect, some adjacent existing buildings and facilities. Certain of these uses would have to be demolished and reprovisioned. It is intended that much of the road widening would be done on the seaward side to avoid encroaching on the existing Kowloon-Canton Railway Line (KCR). A narrow strip of additional reclamation would be required along much of the Tolo Highway to provide the platform for road widening and for the reprovisioning of the existing cycle track. Three alignment options have been proposed. These are assessed with regard to their respective level of impacts on adjacent land uses.

11.2 Land Use Impacts

11.2.1 A number of land uses have been identified as common potential sensitive receivers common to all three alignment options given that the main alignment is similar for all three options. Towards the Ma Liu Shui end of the alignment, three options are proposed. The three options are briefly described below:

- <u>Option I</u> : Comprises the mainline alignment and includes reprovisioning of the Laboratory Bridge (see Figure 2.4).

- <u>Option II</u> : Comprises the same mainline as for Option I with the arrangement at the existing Laboratory Bridge being modified to incorporate the widening of the road carriageway (see Figure 2.5).

- <u>Option III</u> : Involves maintaining the existing Laboratory Bridge and re-routing the footpath and cycle track to the rear of the HKIB (see Figure 2.6).

As a corollary, land use impacts for the three options differ only towards the Ma Liu Shui end of the alignment.

11.2.2 Most of the land uses affected are existing Government/Institution/Community and open space/ recreational uses (as depicted on Tai Po Outline Zoning Plan (OZP) No. S/TP/7) which are located on the seaward side of the Tolo Highway. The uses identified as possibly being affected by the road widening project are as follows:

- Marine Police Station;
- Tai Po Kau & Ma Liu Shui Piers;
- Tolo Harbour Garden;
- Cycle Track & Footpath;
- Pak Shek Kok Reclamation;
- Hong Kong Institute of Biotechnology, Marine Science
- Laboratory, & Chinese University Yacht Club; and
- Bridges & Underpasses.

The land use impacts for the sites identified are discussed individually in the following paragraphs.

Marine Police Station

11.2.3 The existing Marine Police Station, zoned G/IC on the Tai Po OZP No. S/TP/7, would have to be demolished to make way for the road widening project. Reprovisioning of the station, approximately 2.5 ha, would have to be considered prior to commencement of construction works. A possible site for reprovisioning of this facility is at the Marine North Division Base at Ma Liu Shui. More detailed assessment of possible reprovisioning sites would have to be undertaken when the whole alignment of the road widening project has been determined.

Tai Po Kau & Ma Liu Shui Piers

11.2.4 The Tai Po Kau Pier is located just north of the existing Marine Police Station. The Ma Liu Shui Pier is located east of the Chinese University Yacht Club. The former is annotated 'Ferry Pier' on the Tai Po OZP No. S/TP/7 and the latter is zoned G/IC on the Sha Tin OZP No. S/ST/6. Both piers are currently in service to the public and are quite well used. Access to the piers would be hampered by the construction activities for the road widening project. The vehicular and pedestrian access to these two piers would have to be maintained or alternative access arrangements provided in order not to disrupt existing operations in the final scheme and temporary works. Director of Marine has requested that minimum disruption of the two piers should occur during construction.

Tolo Harbour Garden

11.2.5 The Tolo Harbour Garden, zoned G/IC on the Tai Po OZP, is an existing natural landscape area located immediately adjacent to the Tolo Highway. The designation of G/IC for the site is apparently intended for its future use as a boat club. Given the current proposed alignment, it is envisaged that the site would be partially affected by the road widening scheme although a large part of the site would remain intact. The environmental impact assessment would provide inputs to the extent of physical impacts on the natural landscape. Vehicular and pedestrian access to the site would also have to be duly considered and provided for especially during the construction phase. Much of the existing vegetation affected would have to be reinstated to its original state as far as possible after construction has been completed.

Cycle Track & Footpath

11.2.7 The existing cycle track cum footpath currently runs along the seaward side of Tolo Highway. This recreational facility is very well used by residents in Sha Tin and Tai Po. A number of rest stops for cyclists have also been provided along the cycling route. Almost the entire stretch of the cycle track/ footpath, approximately 5 km in length, would be affected by the widening proposal. Being an important recreational amenity, planning considerations should include the reprovisioning of the cycle track and footpath. The current scheme recommends that the entire stretch of cycle track/ footpath affected be re-aligned alongside the Tolo Highway after it has been widened. The new cycle track would tie in with the existing one at the Ma Liu Shui Piers.

Pak Shek Kok Reclamation

11.2.8 The Pak Shek Kok (PSK) reclamation area is located within the lower portion of the Tolo Highway (see Figure 10.7). Under the North East New Territories Development Strategy Review (NENTDSR), it was recommended that the PSK reclamation area be developed comprehensively as a Science Park, given its proximity to the Hong Kong Chinese University. Under Civil Engineering Department's (CED) current programme, the staging of the PSK reclamation is as follows:

Table 11.1 PSK Reclamation Staging

Stage	Commencement Date	Completion Date	Duration (months)
Stage I	October 1996	February 1998	16
Stage II	February 1998	May 2001	40
Stage III	June 2001	October 2004	40

11.2.11 It is envisaged that the widening of Tolo Highway would begin in April 1998 (by which time Stage I of the PSK reclamation would have been completed) and be completed towards the end of 2000 (by which time Stage II of the PSK reclamation would be almost completed). As such, there are several interface issues between the reclamation and the road widening project, both during the construction and operational phases.

11.2.11 The road widening project would encroach upon part of the PSK reclamation area, especially given that the cycle track and footpath would be re-aligned on the reclaimed land. However, the amount of land-take would be minimal, given that the cycle track cum footpath is only 8.5 m wide. Industry Department has commented that loss of land resulting from the road widening project on the PSK reclamation should be minimised as far as possible.

11.2.11 Land use and road interface issues within the proposed reclamation include noise and air pollution from the highway which may impact upon sensitive receivers on the reclamation. Sufficient mitigation measures would then have to be adopted to ameliorate these impacts. These may include locating non noise-sensitive uses near the road or prescribing design control measures such as single aspect building design or internally ventilated buildings.

11.2.12 Besides the PSK reclamation, the current scheme requires the complete replacement of the existing seawall and additional reclamation of a strip of land to accommodate the increased highway width and the reprovisioned cycle track/footpath.

Hong Kong Institute of Biology, Marine Science Laboratory & Chinese University Yacht Club

11.2.13 The Hong Kong Institute of Biology (HKIB), Marine Science Laboratory (MSL) and the Chinese University Yacht Club (CUYC) are currently located in proximity to the Tolo Highway, and are all separated from the highway by a landscape buffer, cycle track/footpath and an internal road. All three sites are zoned G/IC on the Sha Tin OZP. The road widening scheme would encroach on the existing cycle track adjacent to the three sites. Based on the current scheme, there are three options which address reprovisioning of the cycle track. These are addressed in the following paragraphs.

Option 1 (see Figure 2.4)

11.2.14 In this option, the existing Laboratory Bridge would have to be demolished and reprovisioned, and the existing cycle track and footpath would have to be re-aligned towards the HKIB. This would encroach partially on the existing internal ring road within HKIB, MSL and the CUYC. As the land is currently held by CUHK, resumption may be required. This option thus might involve negotiations with the Chinese University with respect to resumption/compensation which may be a lengthy exercise.

11.2.15 In addition, there are potential noise impacts from the widened highway on the adjacent HKIB. Within this area, the widened road would be about 5 to 6 m nearer to the existing buildings. The acceptability of this interface is being considered separately under noise and air assessments included under this assignment. It is likely that noise mitigation measures may have to be imposed to ameliorate the noise levels emanating from the highway.

Option 2 (see Figure 2.5)

11.2.16 The existing Laboratory Bridge would not have to be modified to accommodate the widened carriageway. However, the existing cycle track/footpath would encroach on the CUHK campus and sections of the internal access road would have to be realigned where located to the west of the HKIB, the MSL and the CUYC. This option would therefore involve negotiations with the Chinese University with respect to resumption/compensation and this may be a lengthy exercise.

Option 3 (see Figure 2.6)

11.2.17 This option differs from the preceding in that it is proposed that the cycle track and footpath are to be reprovisioned along the seaward side of the HKIB, MSL and the CUYC. The alignment of the new cycle track would be along the waterfront and at some distance away from the Tolo Highway. This would ameliorate environmental impacts and enhance the recreational amenity of the cycle track. This also provides an opportunity to link the reprovisioned cycle track to the future PSK reclamation along waterfront. The new cycle track alignment would marginally affect the sea access for the CUYC although special 'give-way' arrangements could be provided. However, it should be noted that there are also several disadvantages associated with the possible development of Option 3. In the first instance, it is likely that CUHK would have strong objections to this option. These objections are likely to be based on concerns about potential security problems and possible noise disturbance that may result from having members of the public pass along the seaward side of the campus. Secondly, any cycletrack/footpath that is re-provisioned on the seaward side of the CUHK campus may become abortive if it eventually proves necessary further re-align the cycletrack to fit in with the long-term planning of the PSKPDR area.

Bridges & Underpasses

11.2.18 Besides the above major uses, there are two other bridges and pedestrian underpasses which have to be widened to provide the north-south access across Tolo Highway. The two bridges are namely Tai Hang Bridge and Pak Shek Kok Bridge. One of pedestrian underpasses are located near the Tai Po Kau Pier and the other near Pak Shek Kok Bridge. These provide the necessary access to the ferry pier and cycle track/footpath for residents and students located on the west of the Tolo Highway and would remain vital linkages. Access should therefore be maintained during and after construction of the road widening project.

Other landuses in the vicinity of the project

11.2.19 Other landuses in the vicinity of the project include Recreation Priority Areas, Green Belt interspersed with small areas Residential (Group C) housing and an area of G/IC in Area 39. The proposed highway widening works would have long term impacts on this area on account of the additional noise and air pollution that would be generated by the project. Future development plots in Areas 12 and 39 should be provided with buffer zones to separate the developments from the highway. These buffer zones would serve to mitigate potential air-quality impacts but would also result in constraint on the future development of Areas 12 and 39. Landuses that could be accommodated within these buffer zones would be limited to non-sensitive uses such as amenity uses, passive recreation or carparks. Alternatively, for sensitive-use buildings planned within these zones, buildings should have appropriate mitigation measures as described in the sections of the report that deal with potential noise and air quality impacts.

11.3 Summary

11.3.1 The above land use impact assessment has identified the major land uses affected by the proposed widening of Tolo Highway. High landuse impacts are predicted in both the short and long term as a result of the proposed highway widening works. Most of these uses, which are G/IC or recreational facilities, would require either effective land-use mitigation measures to be implemented or reprovisioning to another location. Major sites to be reprovisioned comprise the Marine Police Station and the cycle track/footpath. Where possible, retention of existing uses (e.g. Tolo Harbour Garden) has been advocated.

11.3.2 Of the three alignment options, Option 1 appears to be the least desirable in terms of potential land-use impacts. Land use impact and resumption costs are likely to be high given that as private land is affected by the proposal. In addition, the cycle track/footpath and the Laboratory Bridge would be affected. Reprovisioning of these could be costly and time consuming.

11.3.3 Option 2 is less disruptive compared to Option 1. It causes less disruption to the adjacent HKIB, MSL and the CUYC while the existing laboratory brdige and cycle track/footpath are retained. Option 2 would effect moderate land-use impacts on existing facilities and recreational provision.

11.3.4 In terms of the users of the cycletrack/footpath, Option 3 is the better option as it provides the least inconvenience to this user group during the construction stage. Option 3 also appears to be the most desirable long-term option subject to the completion of he PSK reclamation. A continuous cycle track along the waterfront would definitely be more preferable than an alignment inland along Tolo Highway as the recreational amenity of the cycle track would be enhanced. It should be noted, however, that the proposed alignment of the cycle track/footpath along the seaward side of the CUYC may constrain their access to the Harbour and would generate CUHK concerns about possible disturbance and security problems that may be generated by opening up the seaward edge of the CUHK campus to members of the public. In addition, any cycletrack/footpath that is re-provisioned on the seaward side of the CUHK campus may become abortive if it eventually proves necessary further re-align the cycletrack to fit in with the long-term planning of the PSKPDR area. Provisional measures to cope with ensuring sea access for the CUYC could be introduced to make the scheme work. However, when considered purely in land-use impact terms, Options 3 is considered to be the most preferable option and is predicted to generate overall medium-level land use impacts.

12 IMPACTS SUMMARY AND CONCLUSIONS

12.1 Noise

12.1.1 Construction Impacts

The predicted construction noise levels have been assessed and found to be within the daytime noise limits when the use of quietened equipment andtemporary noise barriers are assumed.

For the three alignment options, Option II and III are the preferred option with construction noise levels being assessed as acceptable, even at night. Alignment Option I is expected to breach the NCO's ANL limits for night time work.

12.1.2 Operational Impacts

The assessment of operational noise impacts, without mitigation, predicted that traffic noise levels exceed the HKPSG's limit for most of the identified noise facades.

With the constraints imposed by sight distance and wind consitions of the coastal environment, noise mitigation options are confined to the use of vertical barriers and noise canopies. The proposed height of noise barriers is kept low by the effective use of barriers located both at the road curb and the central median. The use of such barriers effectively reduces noise levels to acceptable levels at all existing NSRs and some planned NSRs.

For those NSRs identified as future developments, if there are still some residual noise impacts after practical barriers are recommended, planning control in terms of landuse, building orientation and set-back should be considered when the sites are developed. Noise insulation of noise sensitive facades should also be included in the design if necessary.

No preference or major difference in noise impacts has been demonstrated between Options I - III.

12.2 Air Quality

12.2.1 Construction Impacts

For the construction phase, it is predicted that there will be no exceedances of the 1-hour guidance level and 24-hour average AQO for TSP at the existing air sensitive receivers (ASRs 1-13). For future planned developments adjacent to the Highway, results indicate that there would be some local areas of exceedance at the PSK Dump Site Areas, but that no planned uses are expected to be occupied during construction within set-back distances defined for thes areas. With the implementation of good construction site practices and procedures, the fish ponds in the Marine Science Lab should not be affected. No major differences were demonstrated between Options I -III.

It is recommended that controls on dust generation are included in the works contract. These practices including controlling mean vehicle speed of haulage trucks at 20 kmh^{-1}, watering of all open site areas once every 1.5 hours, provision and use of vehicle wheel washing facilities, and provision of suitable side and tailboard on haulage vehicles. Temporary stockpiles should be frequently watered. It is also recommended that dust monitoring within the EM&A programme be undertaken at the Marine Science Laboratory to ensure dust levels are acceptable.

12.2.2 Operational Impacts

Taking into consideration the implication on air quality of the proposed noise barriers, it is predicted that there will be compliance with the statutory AQOs at the existing air sensitive receivers except the CUHK Marine Science Laboratory and KCRC Hostel.

At the Marine Science Lab, a range of mitigation measures have been investigated. These have included using of different extent of overhang barriers and a Highway enclosure next to the Marine Science Lab. However, the predicted results indicated that there are still some exceedances at the front facades of the Marine Science Lab for the barrier options, and at portal areas for the Highway enclosure options. The most cost-effective and feasible mitigation measure identified was that of upgrading the air conditioning systems at the facades of the Marine Science Laboratory to ensure that the air conditioning systems involved no air intakes at the road facade. This can be accomplished by upgrading the existing air conditioners to split-type air conditioners.

There is only a slight exceedance of the AQO in 2001 at the KCRC Hostel. The recommended mitigation measure at this site is to slightly modify two sections of noise barriers to canopies. The air quality prediction will then show compliance with the AQO guidelines.

Emissions from traffic using the Tolo Highway will constrain future planned development adjacent to Tolo Highway. Assessment results for the year 2001 predict that there would be a buffer distance requirement of up to 67m in some areas. The buffer distance is measured from the outermost edge of the driving lane of the Tolo Highway to any future planned ASRs. This buffer zone represents a constraint on Area 39 (G/IC and HKIEd sports ground site) and the Pak Shek Kok Public Dump Reclamation site. It is recommended that these buffer areas should be limited to non-sensitive uses such as car parks, landscape areas, warehouses and buildings which have central air conditioning.

12.3 Ecology

The ecological resources within the study site include landscaped areas either side of the highway and in the vicinity of the Island House interchange, estuarine habitats around Tai Hang Bridge and intertidal and subtidal areas seaward of the existing highway. The intertidal area of the coastline supported a community of marine organisms typical of such areas in Hong Kong, and was used as foraging habitat by resident and migrant birds. Records of the subtidal ecology of the site indicate that the area has suffered from previous environmental degradation.

The terrestrial habitats to the either side of the existing highway were primarily landscaped plantations of exotic species and predisturbed areas such as the grassland at the foot of St Christopher's Head. The potential ecological losses are predicted to be of little significance. No major differences in impacts were demonstrated between Options I - III.

Estuarine habitats at Tai Hang Bridge will be affected by a small amount of reclamation required on the landward side of the existing highway. No significant impacts are predicted on the mangrove community further upstream provided excessive siltation in the area during construction can be prevented. Intertidal habitats along the length of the existing highway will be temporarily disturbed, but the new shoreline will provide much the same habitat as that lost. A small number of mangrove trees may be lost on the south shore of Yuen Chau Tsai. Sub-tidal impacts are not predicted to be significant provided widespread distribution of high levels of suspended sediments is avoided.

Impacts to the avifauna of the area will arise from the temporary loss of foraging habitat along the existing coastline as the project is under construction. It is predicted that the new shoreline will fulfil much the same function as the existing one, and mitigation measures are proposed to enhance that function (section 7.4). Temporary impacts may arise during construction due to the disturbance of birds using the Tai Hang estuary. To protect the mangrove area upstream of the Tai Hang Bridge tidal flushing of the Tai Hang Bridge estuary should not be hindered in any way by the roadworks.

Proposed mitigation measures for flora are based on the consideration that both sides of the new highway, additional areas utilised as buffer zones, and landscaping areas will provide opportunity for planting to replace lost plantations. Native species such as *Ficus microcarpa*, *Hibiscus tiliaceus* and *Cerbera manghas* which are lost due to construction should be replanted. Planting of native tree species in clumps, if possible, will enhance the ecological values of the area.

Proposed mitigation measures for birds is recommended through a habitat enhancement measure for the potential benefit of the Territorial population of breeding herons and egrets. The recommended enhancement uses a flat abandoned paddy area at the eastern extent of the Tai Hang Bridge mangrove as a colonial nest site, or egretry.The abandoned paddy described above would be a suitable location for bamboo planting, and should be implemented at the outset of the highway widening project, and should not require monitoring or audit.

12.4 Water quality

12.4.1 Construction Impacts

Construction activities may cause adverse impacts on the water quality of Tolo Harbour due to silty site runoff, dredging and reclamation activities. Silty runoff from construction inadvertently discharged to the nearby water courses will cause an increase of suspended solids content in the receiving waters. Heavy metals, oil and grease, nutrients and other pollutants attached to the silty particles will also be washed to the natural environment. Silty runoff into Tai Po Kau could potentially be detrimental to the mangrove ecosystem. In addition to polluting the receiving water bodies, suspended solids in run-off may affect the seawater intakes for the CUHK marine science laboratory and the yacht club.

Impacts on water quality runoff can be mitigated by implementing the control measures identified in the guidance issued by the EPD - *Practice Note for Professional Persons PN 1/94* and should be followed, supported by the recommended environmental monitoring and audit programme. Effluent can be controlled by provision of treatment and control systems where necessary. Potential problems of accidental spillage are minimal if spills are contained and drainage is not directed to surface water courses. Recommended mitigation requirements are given in Section **8.1**.

With the above mitigation measures properly undertaken, the potential water quality impact of the scheme should be local and minimal. On this basis there should be no major differences in impacts between Options I - III.

12.4.2 Operational Impacts

The potential operational phase impacts on water quality are of significantly less concern than those of the construction phase. The only impact on water quality during normal operation of the road would be that due to surface runoff. It is anticipated that additional stormwater runoff would result from the increase in total paved area during the operational phase of the project, though this would not be significantly different from the existing Highway. Typical highway runoff would contain low levels of SS and several different contaminants resulting from fuel combustion, as well as eroded brake linings and tyre deposits and discarded refuse. The discharge of the runoff generally would be unlikely to produce any quantifiable adverse effects. On this basis, the only pollution control measures recommended are the provision of silt traps where appropriate.

12.5 Construction Waste

It is recommended that the different categories of wastes should be segregated, stored, transported and disposed of separately in accordance with EPD's required procedures. It will be the contractors' responsibility for disposal of excavated spoil. The contractors should make use of excavated spoil as much as possible to minimise off-site fill material requirements and disposal of spoil. The excavated surplus spoil should be dumped at a public dump site (the proposed Pak Shek Kok public dump site) if possible.

The contractor should separate construction waste into non-inert and inert materials. The former, such as wood, glass, plastic, steel and other metals (including excavated pipelines), should only be disposed of at strategic landfills. The latter, such as concrete, should only be disposed of at a public dump (eg Pak Shek Kok).

For marine sediments, if off-site disposal is required, investigating for sediment contamination should be carried out so to determine final disposal option.

For chemical and maintenance wastes, the contractors should register with the EPD as chemical waste producers and such wastes should be collected by authorised collectors. Refuse and human waste should also be collected by licensed collectors.

12.6 Visual, Landscape and Townscape

There would only be minor differences in the overall visual and landscape impacts associated with developing either Options I, II or III. A detailed comparative assessment of each option and related impacts in the Ma Lui Shui area was undertaken as part of this study. This concluded that all options would generate similar levels of visual and landscape impacts at the construction stage but that Option III would result in much greater landscape and visual benefits during the operational phase.

All three alignment options would result in substantial to moderate visual impacts during construction and operations around the Institute of Biotechnology, Marine Science Laboratory and the CUHK Water Sports Centre due to their close proximity to the scheme. The Staff Quarters would be particularly affected by the scheme due to its sensitivity, elevated nature and the loss of an existing vegetation screen. Views from the other ground-level receivers would be effectively blocked by mitigation screening measures.

Other visually sensitive receivers include residents of the high quality residential properties on the hillslopes above the scheme and workers, students and residents at the CUHK. The visual impact of the scheme would be difficult to mitigate for these receivers as they have extensive views down onto the highway. The visual impact both upon completion and at Year 10 is also likely to be slight adverse owing to the loss of vegetation, the presence of noise barriers and slope cut works at St. Christopher's Head.

Construction related visual impacts would generally be greater than operational visual impacts as sensitive receivers are already affected by the presence of the highway. A major deterioration in existing views during construction would only be experienced by receivers close to the works at ground level or with elevated views from near and intermediate distances.

One of the primary environmental considerations of the project on visual impact grounds is the substantial adverse visual impacts that would be experienced by cyclists and pedestrians during the construction phase. Beneficial visual impacts are predicted during the operational phase when the opportunity exists for the establishment of a buffer zone and screen between the highway and the new cycletrack/footpath.

Overall, the proposed options would generate only low level impacts on the existing landscape and landscape character of the study area due to the paucity of existing vegetation adjacent to the route, the poor quality of the existing road corridor and the impressive scale of the wider landscape of Tolo Harbour.

There are also a number of key environmental considerations on landscape amenity grounds. There would be a loss of amenity for cycletrack users during construction. There would be a loss of part of Tolo Harbour Garden and difficulties in access to the garden during construction. The landscape setting of the temple and surrounding fung shui woodland on Yuen Chau Tsai would also be adversely affected.

Mitigation measures have been proposed which aim to minimise the potential landscape and visual impacts of the proposed scheme and to provide a comprehensive landscape treatment for the highway and associated cycle track/footpath. These mitigation proposals, if implemented in full, would represent major landscape and visual improvements for the highway corridor. Mitigation measures would reduce landscape and visual impacts to acceptable levels. Low-level residual impacts are predicted on elevated views down onto the scheme, from residential properties, the CUHK and upper floors only of the staff accommodation of the HKIB. Motorists would have reduced views of Tolo Harbour resulting overall in a slight adverse impact where the buffer planting would screen views.

12.7 Landuse & Archaeology

The above land use impact assessment has identified the major land uses affected by the proposed widening of Tolo Highway. Most of these uses, which are G/IC or recreational facilities, would require reprovisioning to another location. Major reprovisioning sites comprise the Marine Police Station and the cycle track/footpath. Where possible, retention of existing uses (e.g. Tolo Harbour Garden) has been advocated.

Of the three alignment options, Option I appears to be the least desirable. Land use impact and resumption costs are likely to be high given that as private land is affected by the proposal. In addition, the cycle track/footpath and the Laboratory Bridge would be affected. Reprovisioning of these could be costly and time consuming.

Option II, compared to Option I, is less disruptive. It causes the least disruption to the adjacent HKIB, MSL and the CUYC while the existing cycle track and footpath are retained. Option II would effect moderate land use impacts on existing facilities and recreational provision.

Option III appears to be the most desirable long term option subject to the completion of the PSK reclamation. Although the proposed alignment of the cycle track/footpath along the seaward side of the CUYC may constrain their access to the Harbour, a continuous cycle track along the waterfront would definitely be more preferable than an alignment inland along Tolo Highway. The recreational amenity of the cycle track would be enhanced. Provisional measures to cope with ensuring sea access for the CUYC could be introduced to make the scheme work. Option III would therefore be considered to have medium land use impacts.

12.8 Recommendation of Options

The relative preferences of each environmental discipline for the Options I-III are summarised in Table 12.1 below.

Table 12.1 Option Preferences

Discipline	Option I	Option II	Option III
Construction Noise	Not Preferred (unacceptable night-time levels)	Preferred (acceptable levels)	Preferred (acceptable levels)
Operational Noise	No preference	No preference	No preference
Air Quality - Constuction Dust	No preference	No preference	No preference
Air Quality - Traffic Emissions	No preference	No preference	No preference
Ecology	No preference	No preference	No preference
Water Quality	No preference	No preference	No preference
Construction Waste	No preference	No preference	No preference
Visual/ Landscape/ Townscape	Not preferred	Not preferred	Preferred
Land-use	Least preferred		Most Preferred
Archeology	No preference	No preference	No preference

Taken overall, the study finds that, on environmental grounds, Options II and III are preferred and recommends that either of these schemes is taken forward.

12.9 Summary of Mitigation Measures

A summary of environmental impacts, their quantities and mitigation measures is given below in Table 12.2.

Table 12.2 Summary of Impacts, Quantities and Mitigation Measures

Environmental Impact	Quantity (without mitigation)	Mitigation Measures and Implementation
Construction Noise	No adverse impacts for options I & II if quitened equipment is used. Option I has 1 receiver exceeding standards (again, assuming the use of quitened equipment)	Suitably quietened construction equipment recommended. Implemented through contractors contract clauses and EM&A Programme.
Operational Noise	Scheme fails to comply with noise guidelines at sensitive receivers comprising 350 households (approx. 1050 persons). Buildings in planned development areas may also fail to comply with noise guidelines.	Noise barriers recommended for both existing and planned noise sensitive receivers/ buildings. Noise barriers implemented and built as part of Widening project.
Construction Dust	No adverse effects at the existing ASRs (standards achieved) Buffer zones identified for future development areas, but these not expected to be occupied during construction phase. Marine Science Laboratory fish ponds expected to meet existing dust criteria.	- - As highly sensitive use, specific monitoring programme will be implemented as part of EM&A programme.
Traffic Emissions to Air	No adverse effects at the existing buildings except the CUHK Marine Science Laboratory - and CUHK Hostel building. For future development areas, air buffer zones have been identified as a constraint on any air sensitive development.	Upgrading of air conditioning systems at the Marine Science Laboratory to ensure that they involve no air intakes at the road facade. Implemented by upgrading the existing air conditioners to split-type air conditioners as part of the Widening project. Noise barriers modified to mitiagte effects (ie barrier at N/B of CH 1428 to CH 1657 upgraded to 7m high x 2.5m overhang barrier and barrier at N/B of CH 1657 to CH 1912 upgraded to 7m high x 4m overhang barrier). Implemented as part of the Tolo Widening project. Stand-off distances have been identified and measures, including central air conditioned buildings, identified as suitable for use in buffer zones. Implemented by Departments responsible for built developments along the Highway (TDD, Planning and CUHK).

Table 12.2. Summary of Impacts, Quantities and Mitigation Measures (Cont'd)

Water Quality Impacts from Construction	No adverse effects anticipated if good site practices adopted.	Construction practice guidelines recommended. Implemented through EM&A Programme and contractors contract clauses.
Runoff from Road Operation	No adverse effects anticipated	-
Construction Waste	Disposal option identified for contaminated sediment No adverse effects anticipated if good site practices adopted.	Implemented through detailed design proposals. Construction practice guidelines recommended. Implemented through EM&A Programme and contractors contract clauses.
Visual Impacts	Substantial impacts at Institute of Biotechnology, Marine Science Laboratory, Water Sports Centre and CUHK Staff Quarters during construction and operation. Also cyclists & pedestrians during construction.	Landscaping proposals will improve visual aspects of Highway when in operation (though drivers may have more confined views). Implemented through detailed design proposals and suitable landscape/ planting and maintenance works as part of Widening project.
Landscape Amenity Impacts	Cycletrack users and access to Tolo Harbour Garden during construction. Also landscape setting of Yuen Chau Tsai.	Landscape planting proposals recommended. Implemented through detailed design proposals and suitable landscape/ planting and maintenance works as part of Widening project.
Land-use Impacts	Reprovision of Marine Police Station and cycletrack/ footpath	Enhancement of footpath/ cycletrack. Reprovision of Police Station to include TSIS. Implemented by suitable detailed design proposals.
Ecology	No major effects - habitats temporarily affected by construction	Localised planting schemes. Implemented through suitable planting and maintenance works as part of Widening project.

Cost estimates (shown in Table 12.3) have been made for the mitigation measures associated with the Highway Widening project, as recommended in this Report (Figures as at March, 1997).

Table 12.3 Cost Estimate of Mitigation Measures

	Description	Total Cost (HK$)
1.	Noise and Air Impact: Noise Barriers (including a short length at KCRC Hostel which also mitigates air impacts)	347,475,000
2.	Air Impact: Marine Science Laboratory - replacement of 6 - 7 air conditioners at facade.	150,000
3.	Ecology: Tai Hang Bamboo planting area	30,000
	Total Cost	347,655,000

For the ecological costs, note that for the planting of native species in buffer zones and landscaped areas, this measure can simply be incorporated into the landscape plan, and should entail little or no additional cost.

Total estimate of recommended environmental mitigation works is HK$347,655,000. The estimate of costs for environmental monitoring and audit over the period of construction is estimated as HK$ 5,750,000.

Further details of the implementation of these mitigation measures will be developed during the detailed design. The role of detailed design in implementing specific measures is summarised below.

- The recommended cost-effective and feasible mitigation measure identified at the Marine Science Laboratory is that of upgrading the air conditioning systems to split-type air conditioners to ensure that the air conditioning systems involved no air intakes at the road facade. Specific details of the proposed works will be identified at detailed design stage.
- In order to choose the most cost-effective barrier design for both noise and air quality impacts, the barrier design can be further optimised and minor adaptations made. This optimisation procedure is recommended to be done at the detailed design stage. This would include assessing slight modifications to length of barrier with different extent of overhang. The effectiveness of protection against air and noise impacts can then be optimised against the cost of construction and maintenance.

12.10 Overall Conclusions

The study has assessed the proposed Tolo Highway Widening scheme, identified a range of environmental impacts and made a number of recommendations as regards mitigation measures to be employed.

It is recommended that guidelines on good site construction practices are included as contractual controls during construction, and these are outlined further in Appendix D.

It is recommended that an Environmental Monitoring and Audit (EM&A) Programme is undertaken to monitor compliance of emissions and discharges from the construction activities with environmental standards and objectives. In the event of non-compliance, this will enable an immediate response to review practices and mitigation measures. An Environmental Monitoring and Audit Manual has been provided as a separate report in this study as the basis for contracting and implementing an independent EM&A Programme for this scheme. This programme includes field monitoring for dust at the Marine Science Laboratory,,within a system of audits and controls on construction works.

With the implementation of the mitigation measures and buffer areas as recommended above, the outstanding major residual impacts and concerns are identified below.

- For proposed future developments along the Highway, including those on reclaimed areas at Pak Shek Kok Public Dump and Area 39, then there remain concerns for future developments for which the design and use is not known in detail. Specifically:

    - Noise sensitive developments will need to consider building set-back, orientation and possible noise insulation of facades in the building layout.

    - Any air sensitive developments within a 37-67m defined air buffer zone (measured from the edge of the hard shoulder) along the widened Highway. Within this zone, air quality mitigation measures will need to be considered including set-back of buildings, use of air-conditioned buildings and non-sensitive uses such as car parks and landscaping areas.

- Low-level residual visual impacts are predicted on elevated views down onto the scheme, from residential properties, the CUHK and upper floors of the staff accommodation of the HKIB. Motorists would have reduced views of Tolo Harbour resulting overall in a moderate adverse impact where the noise barriers would screen views.

Taking these points overall, and taking into account the positive benefits arising from improvements to facilities along the route, the study concludes that the construction and operational characteristics of the Highway Widening scheme are environmentally acceptable, and that the scheme is feasible on environmental grounds.

APPENDIX A

EIA STUDY BRIEF

Agreement No. CE 35/95

Feasibility Assignment for Widening of Tolo Highway and Traffic Surveillance and Information System

Brief

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Appendices

Agreement No. CE 35/95

Feasibility Assignment for Widening of Tolo Highway and Traffic Surveillance and Information System

Brief

1. Introduction

1.1 This Brief is to be read in conjunction with the Memorandum of Agreement, General Conditions of Employment for a Feasibility Assignment (1994 Edition), Special Conditions of Employment, Schedule of Fees, and any other detailed instructions issued by the Director's Representative.

2. Description of the Project

2.1 Tolo Highway is an expressway in the North East New Territories forming a vital part of Route 1. It connects the New Territories Circular Road at Tai Po near Hong Lok Yuen and Tai Po Road (Sha Tin Section) near the Sha Tin Race Course. At present, the section between the Island House Interchange at Tai Po and the Ma Liu Shui Interchange at Sha Tin is of dual 3-lane cross section. The Project is to upgrade this section to dual 4-lane standard to cope with the increasing traffic demand along this corridor, and to provide a traffic surveillance and information system. A preliminary layout plan for the works is shown on Drawing Nos. PMH 6561/0001E, 0002C to 0005C **at Appendix A.**

2.2 In the past several years, particularly after the opening of the Tate's Cairn Tunnel in mid 1991, the annual average daily traffic on Tolo Highway has increased substantially at about 18% per annum. Traffic flow of 5400 vehicles per hour exceeding its practical capacity by about 30% has been observed in the southbound direction in morning peak hours.

2.3 In view of the increasing transport demand in the NENT and across the border, the traffic situation on Tolo Highway between Tai Po and Sha Tin is expected to deteriorate further with increasingly unstable traffic condition and broadening peak period if no improvements to this corridor are made. The parallel Tai Po Road is also expected to operate beyond its capacity in peak hours. The Updating of the Second Comprehensive Transport Study (CTS-2 Update) hence recommended provision of addition capacity by implementing a new project "Tai Po - Sha Tin Link (Additional)" between 2002 and 2006. Widening of Tolo Highway from dual 3-lane to dual 4-lane with provision of standard 3.3m hard shoulder in each traffic direction is proposed to provide this additional capacity. The recommendation in the CTS-2 Update was based on the assumption of significant restraint in the growth of the private vehicle fleet. As the actual private vehicle fleet has exceeded the assumed figure and in light of the observed traffic growth on Tolo Highway, it is now considered that improvements to this corridor should be brought forward earlier than 2002.

2.4 The proposed Traffic Surveillance and Information System (TSIS) will provide close monitoring of the traffic situation so that effective traffic management and timely response to incidents can be provided. It will also provide up to date traffic information to motorists including guidance on alternative routes to Kowloon in the event of tunnel closure or major incidents on the approach roads. The TSIS will comprise traffic surveillance, control and information aids, which include but not limited to, emergency telephone (ET), closed circuit television (CCTV), automatic incident detectors (AID), variable message signs (VMS), lane use signals (LUS), central control facilities together with the necessary computer and communication equipment to form a complete system. Examples of the system are Tsing Ma Control Area traffic control and surveillance system and the Tuen Mun Road TSIS. The control and monitoring facilities for the latter system are to be installed in the Police's New Territories Regional Command and Control Centre (RCCC) in Tai Po. Provisionally, the control centre for the Tolo Highway TSIS will also be located in the Police's Tai Po RCCC. However, the Consultants should be aware of the possible development of Strategic Road Network strategy in the Territory and therefore allowance should be made in the design for the relocation/integration of control centre(s) in future.

2.5 The Project is now in Category B of the Public Works Programme, PWP Item no. 6561TH. The current proposed construction programme is scheduled to start in April 1998 for completion in 32 months' time. Widening of Tolo Highway should be completed to tie in with the opening of Route 16 connecting West Kowloon and Sha Tin which is expected to be in place by 2001.

2.6 A Preliminary Project Feasibility Study (PPFS) for the Project was completed by Highways Department in August 1995. A copy of the Study report will be provided to the Consultants for reference.

2.7 A draft preliminary layout plan for the Project was circulated twice to all relevant Government departments, Kowloon-Canton Railway Corporation (KCRC), and the Chinese University of Hong Kong (CUHK) in December 1994 and May 1995 respectively. A summary of the comments received is at **Appendix B**. Necessary amendments have been incorporated into Drawing Nos. PMH 6561/0001E, 0002C to 0005C. The draft preliminary layout plan has also been circulated to utility companies to obtain information on existing utility installations and planned installation works.

2.8 Due to the constraint of the existing Kowloon-Canton Railway (KCR) along the land side of Tolo Highway, the required road widening works is preliminarily proposed to be carried out along the seaward side of the Highway, and the majority of the land necessary for the new road formation is proposed to be reclaimed from Tolo Harbour.

2.9 Checking have been made with District Lands Offices of Sha Tin (DLO/ST) and Tai Po (DLO/TP) with respect to status of the existing land within the proposed work site limits. The proposed works areas are mainly on government land. The only private lot affected by the project works is part of Lot 725 in DD 42, which is currently occupied by the CUHK, and negotiation with the University for their voluntary surrender of the land is required. If the negotiation is unsuccessful, it may need to invoke a resumption clause of the lease of Lot 725. The clause stipulates that a 12 months' resumption notice should be given to the grantee.

2.10 KCRC has completed the realignment work of the railway track at Pak Shek Kok, and there is a 15m wide, about 700m long, road widening reserve between the KCR re-alignment limit and edge of the existing carriageway. This road reserve is intended for any necessary alignment adjustment of the proposed widening works and may be used for traffic diversion purposes during the construction stage of the Project.

2.11 As indicated in the typical cross section on the attached Drawing No. PMH 6561/0002C, there are some marine deposits trapped under the existing road formation which will be difficult to remove without disturbing the stability of the existing road. It is proposed to accelerate the rate of consolidation of these deposits by means of appropriate surcharge load with vertical drains, so as to ensure that settlement of the reclaimed land will have been substantially completed before the proposed road widening section is formed. It is expected that the required temporary surcharge will cover a much wider area than that is needed for road widening purpose and a sloping rubble mound seawall will be required to protect the leading edge of the surcharge load. In order to make use of the reclaimed land formed by the surcharge load and to minimize multiple handling of the seawall rubble mound and the surcharge filling materials, it is proposed to form a wider road section and to treat the surplus area (that is the area remained after making necessary provision for the required road widening works, cycle track, footpath and other street furniture) as a landscaped buffer zone. The stability of the slopes in stages for construction as shown in the typical cross section shall be assessed.

2.12 It is noted that the marine deposits will be beneath the future cycle track and footpath and it is these areas which will be mainly subject to future settlement. As such facilities are relatively tolerant in settlement, the cost effectiveness of an elaborate scheme to accelerate settlement should be weighted against the long term maintenance costs that may be incurred to repair possible deformation/cracking of the cycle track and footpath surfacing as a result of settlement.

2.13 The project will have interface with the proposed Pak Shek Kok Public Dump Reclamation (PSKPDR) project which is being managed by Chief Engineer/Solid Waste (CE/SW), Civil Engineering Department. According to the latest advice of CE/SW, PSKPDR Phase I will be completed in late 1997. Part of the area reclaimed under PSKPDR Phase I is proposed to be used as temporary works area for the road project and the exact extent of the temporary works area shall be agreed with CE/SW. Temporary drainage channels formed under the PSKPDR project to intercept the existing outfall discharge to Tolo Harbour may need to be modified to suit the drainage works of the Project.

2.14 There are facilities to be provided within the CUHK Eastern Campus under PSKPDR Phase I for the purpose of mitigating the adverse impacts on the Campus due to the use of the internal access road (to be upgraded) by public dump vehicles. These temporary facilities which include noise/dust barrier wall, a footbridge, barrier gates and check point offices will have to be maintained until alternative access is available for the public dump vehicles. Some of these facilities will be affected by the road widening works and may need to be relocated or re-provided. It is envisaged that the road widening works along this section of the highway can be deferred until alternative access, probably from Tolo Highway, is available for the public dump vehicles and this will avoid the need to re-provide the temporary facilities in the Campus under the road project. The practicability of providing access from Tolo Highway for the PSKPDR project, and usage of joint construction access for both projects will need to be assessed.

2.15 Provision of adequate temporary construction accesses to the works site/areas and traffic diversions during construction stage are important issues to be considered. Four possible construction access points are identified: one from the Island House Lane or Tai Po Road at the northern limit of the project, one along the existing Tolo Highway near the Phase I reclamation of PSKPDR project, one from the CUHK internal ring road via the existing flyover near the Marine Science Laboratory, and one from the Ma Liu Shui Interchange at the southern limit of the project. If the proposed access point along the existing Tolo Highway is adopted, advance reclamation works need to be carried out under Phase II of the PSKPDR project to provide the necessary area for provision of declaration and acceleration lanes and vehicle stacking area.

2.16 There is a very tight land constraint along the highway section adjacent to the Eastern Campus of CUHK. An initial survey indicated that the proposed road widening works would affect the internal access road (to be upgraded), the Laboratory Bridge, a pump house, a water tank, a refuse collection depot, a vaporizer room, and a LPG cylinder room in the Campus and part of the Research Block of the Hong Kong Institute of Biotechnology (HKIB). It is necessary to reduce the extent of the encroachment upon the Campus and to minimize the adverse impacts on the facilities and activities in it.

2.17 The road widening extent adjacent to the CUHK Campus is thus proposed to be minimized by reducing the width of the hard shoulder, cycle track and the landscaped buffer zone. The effects on the Campus will then only involve slight re-alignment of the internal access road (to be upgraded), and possible demolition and re-construction of the Laboratory Bridge.

2.18 More detailed assessment shall be carried out to investigate if other acceptable road alignment option is available to avoid re-construction of the Laboratory Bridge and provide a continuous footpath along this section of the Highway to connect with the existing footpaths at Ma Liu Shui.

2.19 The existing Tolo Harbour Garden currently managed by Regional Services Department (RSD) will be affected by the Project. Some of the existing buildings/structures in the Garden may need to be modified or re-constructed to suit the proposed road works. Modification works for the Garden shall be considered in conjunction with the overall landscape proposal of the Project. This small piece of natural landscape shall be preserved as far as possible.

2.20 There are five sets of existing Government moorings on the west side of Tai Po Kau Public Pier. These moorings will be affected by the road widening works and need to be relocated. The relocation works have to be carried out before or after the northeast monsoon season. Under no circumstances shall the mooring of any Government vessels to these moorings be interrupted by any means during the widening of Tolo Highway.

2.21 Director of Marine requests that normal operation of the public piers at Tai Po Kau and Ma Liu Shui shall not be affected during the construction stage of the Project. The existing road access to the Ma Liu Shui public pier and pedestrian access to the Tai Po Kau pier from the adjacent subway shall be maintained at all time.

2.22 The existing Marine Police Facility at Tai Po Kau will be affected by the Project. It is necessary to investigate the feasibility of reprovisioning the Facility at the Marine North Division Base at Ma Liu Shui. The reprovisioning programme is required to be dealt with earlier so that the Property Services Branch of Architectural Services Department could give advice at the early stage. In addition, since the electric power supply to the pier light at the Tai Po Kau Public Pier is connected to the existing Marine Police Facility, alternative means of power supply to the pier light should be provided if the Facility is relocated.

2.23 The Pak Shek Kok reclamation site is one of the two sites shortlisted for possible development of a science park. In the event that it is chosen as the location of the park, any possible interface issues between the science park development and the Project shall be studied to avoid any impediment to the establishment of the science park.

2.24 Under the Tolo Harbour Effluent Export Scheme, a submarine pipeline of one metre diameter has been laid in the seabed of Tolo Harbour to convey effluent from Tai Po Sewage Treatment Plant to Sha Tin Sewage

Treatment Plant. The existence of the submarine pipeline may pose constraints to the dredging operation of the Project and the pipeline may also be easily damaged by the dredging plant. Appropriate protection and monitoring measures shall be proposed for preventing the pipeline from being damaged by the works of the Project.

2.25 The existing Tai Hang Bridge and Pak Shek Kok Bridge need to be widened to accommodate the additional road section, cycle track and footpath, and the landscaped buffer zone, which is reduced to be a 2m verge to minimize the extent of structural works. The widened section may incur difficulty in inspection and maintenance of the bridges, and this issue shall be addressed.

2.26 It is proposed that the promontory beside Tai Hang Bridge and Pak Shek Kok Bridge should be properly landscaped to form a sitting out area with some bicycle racks. The feasibility of this proposal shall be investigated, taking into account that part of the promontory will be on a slope.

2.27 The proposed alignment of the re-aligned cycle track will intersect with the access road to PSKPDR Phase I site area and the Marine Science Laboratory near the Ma Liu Shui Ferry Pier (Drawing No. PMH 6561/0005C refers). The possibilities of eliminating this at grade intersection shall be investigated. Consideration shall be given to conversion of a temporary cyclist subway to be constructed at this intersection under the PSKPDR project into a permanent one.

2.28 To ease future maintenance and to fulfil the latest standards, it is intended that the lighting system for the widened Tolo Highway should be provided at either side of the carriageway instead of along the central median as in the existing system. This is however only possible if adequate safety clearance exists between the lighting columns and the KCR overhead line. The situation may also be complicated by the fact that KCRC has completed realignment of its track at Pak Shek Kok. Liaison with KCRC is required to obtain their clearance requirements in the cases when 12m high or 15m high lighting columns are used, so as to determine the feasibility of this proposal.

2.29 In November 1993, Environmental Protection Department conducted an environmental review on the Project. Given the type, scale and location of the Project, an environmental impact assessment (EIA) study is required. As some coastal habitats may be affected by the reclamation works in the Project, an ecological impacts assessment shall be included in the EIA study.

2.30 The existing buildings at the HKIB and Marine Science Laboratory will be adversely affected by the Project in that the cumulative effects of noise impact generated by the traffic/construction activities in the widened Tolo Highway and the access road to the Pak Shek Kok Public Dump Reclamation Phase I and the dust and odour impacts generated by the Pak Shek Kok Public Dump Area may need to be considered altogether.

2.31 The Project would require extension of the various existing drainage outfall to Tolo Harbour and re-routing of the existing drainage pipes along Tolo Highway. These works would have significant impact on the existing drainage systems along the Highway. A Drainage Impact Assessment (DIA) study is required to identify all the adverse drainage impacts resulting from the proposed works and to suggest appropriate mitigation measures. This may involve not only drainage works within the Highway boundary but also works outside the boundary.

2.32 The TTD's project 'Tai Po Development Remaining Works, Formation and Servicing of Area 12 (Part) and 39' is now in the detailed design stage and a drainage impact assessment is being carried out. As the future developed Areas 39 and 12 will rely heavily on the existing nullah next to the Pak Shek Kok Bridge for drainage, the hydraulic capacity of the outfall of the nullah should not be adversely affected by the works of the Project.

2.33 For the Assignment, reference shall be made to, but not limited to, the following layout plans prepared by the Planning Department :-

a) Sha Tin Outline Zoning Plan No. S/ST/6;

b) Tai Po Outline Zoning Plan No. S/TP/7;

c) Sha Tin New Town Areas 47B & 68 Layout Plan - Ma Liu Shui, Plan No. L/ST 68/4;

d) Tai Po Areas 12 (Part) & 39 Layout Plan, Plan No. L/TP 39/C; and

e) Tai Po Area 24 Layout Plan, Plan No. L/TP 24/1A.

2.34 The scope of the Project includes all civil (including drainage and sewerage), TSIS, structural, geotechnical, architectural, electrical, mechanical and instrumental works, noise, air and visual environmental, landscaping and treatment of amenity areas and traffic management works (both temporary and permanent) necessary for completion of the Project, and includes the following major items of works : -

a) widening of existing Tolo Highway to provide one additional lane with standard 3.3m wide hard shoulder in each direction of the Highway between Island House Interchange and Ma Liu Shui Interchange;

b) provision of a traffic surveillance and information system (TSIS) comprising traffic surveillance and control and information aids, which include closed circuit televisions (CCTVs), gantries for lane signs, automatic incident detection devices, lane use signals (LUS), variable message signs (VMS) and emergency telephones with central control facilities, for the same section of the Highway, and study of the requirements of providing VMS on some major roads connecting the section of Tolo Highway in Tai Po and Sha Tin for effective traffic diversions to both New Territories North and Kowloon.

c) re-alignment and widening of the existing cycle tracks to 6m along the same section of the Highway, and provision of a 2.5m wide footpath along the seaward side of the re-aligned cycle tracks;

d) minor modifications at the two merge-in end connections to the Island House Interchange and the Ma Liu Shui Interchange;

e) re-alignment of the internal access road (to be upgraded) serving the Eastern Campus of the CUHK, the HKIB and the PSK reclamation;

f) reclamation and seawall construction works for the road widening and necessary construction works areas;

g) drainage works including extension of various existing outfall to Tolo Harbour and re-routing of existing drainage pipes;

h) widening, extension or re-construction of three existing vehicular bridges and two existing pedestrian/cyclist subways;

i) reprovisioning of existing and planned works affected by the Project, which may include facilities within the Eastern Campus of the CUHK, facilities provided under PSKPDR, RSD's structures/buildings at Tolo Harbour Garden, the government moorings near Tai Po Kau Public Pier, the Marine Police Station Building at Tai Po Kau and the existing sign gantries on the Highway;

j) landscape works, and pedestrian and cyclist facilities; and

k) mitigation measures which may be identified and recommended in the impact assessment studies.

3. Objectives of the Assignment

3.1 The objectives of the Assignment are upon its completion to have :-

a) an in depth investigation on the viability of the proposed widening works and TSIS,

b) a full impact assessment on existing traffic during construction, the environment, and existing drainage systems,

c) a technically sound and cost effective preliminary design for the Project,

d) a detailed Design Memorandum for the Project,

e) a more accurate estimate on the project capital and recurrent costs and expenditure cash flow, and

f) a more realistic implementation programmes for the Project,

so that detailed design works of the Project could be proceeded as soon as possible.

4. Description of the Assignment

4.1 The Consultants shall, based on the previous preliminary works and other available latest information, carry out further investigation and studies (including TIA, EIA and DIA studies) to evaluate the engineering feasibility of the Project and derive the optimum alignment for the proposed widening. The Consultants shall develop traffic management strategies, identify civil works requirements and propose implementation scheme for the TSIS. The Consultants shall carry out preliminary design for all the project works including the TSIS and produce implementation programme, cost estimates and design manual for the Project. Details of the tasks to be accomplished by the Consultants shall be referred to Clause 6.

4.2 The Consultants shall liaise with the relevant project offices regarding the interfaces of the Project with, inter alia, the following projects.

(a) PWP Item 5405CL : Pak Shek Kok Reclamation - Public Dump, managed by Solid Waste Division of Civil Engineering Department.

(b) KCRC - ATP Project : Realignment of Railway Tracks at Pak Shek Kok, managed by Heavy Rail Division of KCRC.

(c) Agreement No. CE 18/94 - Tolo Harbour Sewerage of Unsewered Areas Stage I Phase II, managed by Consultants Management Division of Drainage Services Department.

(d) Tolo Harbour Effluent Export Scheme, managed by the Consultants Management Division of the Drainage Services Department

(e) WSD - Water Supply to Pak Shek Kok, managed by the Planning Division of Water Supplies Department.

(f) Project 'Tai Po Development Remaining Works, Formation and Servicing of Area 12 (Part) and 39', managed by the New Territories North Development Office of the Territory Development Department.

5. Deliverables

5.1 The Consultants shall submit to Director's Representative the following Feasibility Study Reports for the overall Project before the deadlines for submission, and circulate to relevant parties:

Report Type	Report Content	No. of Copies	Deadline for submission
Inception Report	a) brief descriptions of the proposed approach and methodology for undertaking the key elements of the Feasibility Study, in particular the study and design of the TSIS, and the relevant authorities to be consulted; b) a comprehensive programme for the Assignment containing all activities, their timing, consultation required, key dates for receipt of approvals, reporting and meetings; and c) a list of staff together with their respective responsibilities.	40 (draft Inception Report) 40 (Final Inception Report)	within 3 weeks from the commencement date of the Agreement
Draft Final Report	a summary of the findings, conclusions and recommendations by the Consultants to achieve the objectives as stated in Clause 3.1 above and the results after accomplishment of tasks of Assignment listed in Clause 6.	100	within 5 months from the commencement date of the Agreement
Final Report	base on the Draft Final Report but incorporate also any alterations considered necessary since the issue of the Draft Final Reports, comments received and the Consultants' responses thereto.	160	within 7 months from the commencement date of the Agreement
Executive Summary	contain information in condensed form of the key elements of the Final Report. It shall be in both English and Chinese.	200	simultaneously with the Final Report

5.2 The Consultants shall submit reports on TIA, EIA and DIA studies as follows:-

5.2.1 Reports on TIA study:-

Report Type	Report Content	No. of Copies	Deadline for submission
Inception Report	Refer to Clause 6.8.5 (i)	40	within 2 months from the commencement date of the Agreement

Draft Report	Refer to Clause 6.8.5 (ii)	100	within 4 months from the commencement date of the Agreement
Final Report	Refer to Clause 6.8.5 (iii)	100	within 6 months from the commencement date of the Agreement
Executive Summary Report	Refer to Clause 6.8.5 (iv)	200 (in both Chinese and English versions)	within 6 months from the commencement date of the Agreement

5.2.2 Reports on EIA study :-

Report Type	Report Content	No. of Copies	Deadline for submission
Inception Report	Refer to Clause 6.9.8.1 (i)	40 (draft) 40 (final)	within 4 weeks from the commencement date of the Agreement
Initial Assessment Report	Refer to Clause 6.9.8.1 (ii)	40 (draft) 100 (final)	within 3 months from the commencement date of the Agreement
Key Issue Report	Refer to Clause 6.9.8.1 (iii)	40 (draft) 100 (final)	within 4 months from the commencement date of the Agreement
Final Assessment Report	Refer to Clause 6.9.8.1 (iv)	40 (draft) 100 (final)	within 6 months from the commencement date of the Agreement
Executive Summary Report	Refer to Clause 6.9.8.1 (v)	40 (draft) 200 (final) (in both Chinese and English versions)	within 6 months from the commencement date of the Agreement
Working Paper	Refer to Clause 6.9.8.1 (vi)	40 (draft) 100 (final)	As required
Environmental Monitoring & Audit Manual	Refer to Clause 6.9.5.6	40	within 6 months from the commencement date of the Agreement

5.2.3 Reports on DIA study :-

Report Type	Report Content	No. of Copies	Deadline for submission
Draft Drainage Impact Assessment Report	Refer to Clause 6.10.6 (i)	40	within 4 months from the commencement date of the Agreement
Final Drainage Impact Assessment Report	Refer to Clause 6.10.6 (ii)	80	within 6 months from the commencement date of the Agreement
Executive Summary Report	Refer to Clause 6.10.6 (iii)	200 (in both Chinese and English versions)	simultaneously with the Final DIA Report
Drainage Monitoring & Audit Manual	Refer to Clause 6.10.4.4	25	within 6 months from the commencement date of the Agreement

5.2.4 The Consultants shall supply sufficient copies of such reports, technical notes, working papers, briefs, supporting documents and other relevant inputs as may be required by the Director's Representative during the TIA, EIA and DIA studies or any public consultation exercise.

5.3 The Consultants shall also submit the following Deliverables to the Director's Representative :-

(i) sufficient copies of plans, drawings, papers, design manual, programmes, estimates, summary of comments, land requirement plans and gazette plans which are required in accordance with Clause 6.1;

(ii) sufficient copies of programme as required in accordance with Clause 8;

(iii) five copies each of the monthly progress report and financial report within the first seven working days of each month in accordance with Clauses 9 and 10 respectively;

(iv) ten copies of preliminary land and marine ground investigation report;

(v) minutes of Study Management Groups, Working Groups, and any ad-hoc and liaison meetings within seven working days of the meetings. The Consultants shall also distribute the minutes to the attendants of the meetings within seven days of the meetings;

(vi) sufficient copies of plans, drawings, papers and other information as may be required by the Director's Representative for the purpose of or in connection with the Project, such as coordinated layout plans of the roadwork, land requirement plans and gazette plans; and

(vii) any other submissions as required in Clauses 6 to 20.

5.4 The Consultants shall prepare, supply and present all documents, drawings and display materials required for press release and submission to District Boards (DB), the Town Planning Board and the Regional Council as and when required by the Director's Representative and for compliance with various statutory and Government procedures required for the Project, including submission to the Advisory Council on the Environment (ACE) and the Advisory Committee on the Appearance of Bridges and Associated Structures (ACABAS). In this connection, the Consultants shall be required to attend a maximum of 30 meetings for the purpose of public consultation and endorsement of findings, conclusions and recommendations of the Project works. These meetings shall exclude Study Management and Steering Group meetings, Working Group meetings, progress meetings, liaison meetings and the like.

5.5 The Consultants shall prepare and circulate sufficient copies of working papers for discussion in Working Group meetings and other ad-hoc meetings. These papers shall be circulated to the respective members at least two weeks before the meetings.

5.6 Reports shall be in A4 size and accompanying drawings should be in convenient sizes but not exceeding A3 size unless otherwise approved by the Director's Representative. All drawings produced for circulation other than those incorporated in the working papers and Final Report shall be in A1 size.

5.7 The Consultants shall submit a set of velographs (A1 size) and a set of data diskettes in 'Microstation .DGN' format for all drawings submitted during the study.

5.8 The Consultants shall draw to the Employer's attention any Deliverables that are under licence and any pre-existing copyright or patent on any Deliverables and any other restriction whatsoever affecting the Employer's use of the same and, if required by the Director's Representative, to establish the existence of any licence, copyright, patent or restriction.

5.9 The Consultants shall adopt the following green measures in preparing the deliverables required above :-

i) all Tender Documents, Tender Submissions, Reports, Technical Notes and Working Papers are to be printed on both sides.

ii) Final Report and Executive Summary have to be printed on recycled paper. The use of recycled paper with no less than 50% recycled materials and not exceeding 80 gsm should be used as a general rule. The logo of recycled paper should be printed in a prominent area of the report.

iii) documents other than Final Report and Executive Summary should preferably be printed on recycled paper.

iv) bleached papers should not be used if possible.

v) unnecessary or excessive use of plastic laminates, glossy covers or double covers should be avoided as far as possible. Use of recyclable non-glossy art board paper as document covers should be encouraged.

vi) Final Report and Executive Summary should be of single line spacing on the both sides of the paper.

vii) excessive white space around the borders and in between the paragraphs of all documents prepared by the Consultants should be avoided. A margin of 2 cm should be sufficient.

viii) excessive use of blank papers should be avoided as far as possible.

ix) number of pages can be reduced by reducing the size of typeface (font). For example, "Time Roman" or "CG Times" larger than point 12 or 10 characters per inch (cpi) should be used in balancing legibility and clarify against our waste reduction objective. The appearance and readability of the document can be improved by using two columns where the font size used is ≤ 12 points.

6. Services to be provided by the Consultants

6.1 The Consultants are required to carry out but not be limited to the following activities and procedures in producing the Deliverables:

a) Review and evaluate the latest technology and identify the system components for implementing a comprehensive TSIS for the Project with due consideration of existing TSIS in the Territory or those being constructed.

b) Investigate and develop traffic management strategies for the TSIS including incident management, traffic diversion and variable message signing strategies. The subsequent operation requirements including vehicle recovery service and maintenance requirements should also be investigated.

c) Design the locations for installing the TSIS equipment taking into account (a) and (b) above. In order to implement effective traffic diversion plans, the locations requiring VMS may, for example, for advance warning purposes, have to go beyond the section of Tolo Highway to be widened. In this context, the study should cover the approach roads connecting the section of Tolo Highway in Tai Po and Sha Tin including the area east of the Shing Mun River Channel.

d) Investigate and suggest methods for establishing close linkages between the Tolo Highway TSIS control centre and the other control centres including but not limited to the Shing Mun Tunnels, Lion Rock Tunnel, Tate's Cairn Tunnel and the future Route 16. Develop strategies for notifying motorists the tunnel traffic situation and guidance of alternative routes to Kowloon.

e) Identify civil works requirements for the TSIS including the construction of ducts, gantries for VMS/LUS and poles for above ground vehicle detectors/CCTV cameras. In addition, utilities connection for power supply of all TSIS equipment and connection for leased telephone/video circuits for data transmission shall be investigated.

f) Investigate and propose how the TSIS including the civil works within and outside the road widening section are to be implemented and incorporated into the overall road widening project, taking into account the requirement of relocation, integration of existing ETs installed at Tolo Highway.

g) Carry out a preliminary system design taking account of various sub-systems required, namely VMS, AID, LUS, CCTV, ET, communications, control centres and system integration links to other traffic control centres. In conjunction with such a design, an assessment should be made on further maintenance requirements particularly the requirement of laybys, civil work supports to facilitate safe and efficient repair works on all gantry-mounted and roadside equipment proposed for the TSIS.

h) Carry out or have carried out all necessary surveys, levels and sounding and make such investigations and inquiries as are necessary for the satisfactory completion of the Assignment.

i) Prepare and submit a report to the Director's Representative on the results, findings and conclusions of the surveys, levels, sounding, investigations and inquiries carried out under sub Clause (h) above.

j) Recommend a preliminary land and marine ground investigation including associated in-situ and laboratory testings to be carried out during the Assignment with reference to available geological, topographical and ground investigation data. The Consultants shall within 4 weeks from the commencement date of the Agreement submit the detailed requirements and estimated cost of the investigation work to the Director's Representative for approval. The ground investigation shall be carried out by Geotechnical Engineering Office (GEO) administered contracts for ground investigation, and the Consultants shall liaise direct with GEO and supervise the works of the GEO term contractors. If the GEO administered contracts are not available, the Consultants shall be required to call for tender from the Site Investigation Category in the List of Approval Suppliers of Materials and Specialist Contractors for Public Works following normal government tendering procedures. In this case, the Consultants shall prepare all relevant tender and contract documents, arrange to calling for tenders, assess the tenders, make tender recommendations, prepare the tender reports, administer the ground investigation contract, and supervise the ground investigation works and associated insitu and laboratory testings. The Consultants shall assist in obtaining DLO's approval to enter the land required for the land investigation work and the approval of Marine Department in respect of the marine site investigation work. The Consultants shall not fix a date for commencement of any site investigation until approval has been obtained from DLO and Marine Department. The Consultants shall also recommend detailed ground investigations with implementation programme and cost estimate necessary for the detailed design of the Project. The Consultants shall take note of WBTC No.13/90.

k) Identify the quantity and quality of contaminated spoil/dredged material generated as a result of dredging and reclamation; and recommend suitable handling and disposal measures for any spoils/mud (contaminated and/or uncontaminated) as a result of dredging and reclamation. Attention should be paid to the requirements under the Works Branch Technical Circular No. 22/92 'Marine Disposal of Dredged Mud'.

l) Prepare and submit the preliminary land and marine ground investigation report to the Director's Representative on results, findings and conclusions of the tests, trials and investigations carried out under sub Clauses (j) and (k) above.

m) Identify three alternative options for road alignment of the proposed widening of Tolo Highway.

n) Draw to the attention of the Director's Representative the need to consider any legal implications and consequences arising out of or in relation to the Assignment and the alternative options.

o) Identify any resumption, clearance and reprovisioning works that may be required and liaise with relevant bodies and assist in negotiations for the resumption, clearance and reprovisioning works, in particular the land falling under the jurisdiction of the CUHK.

p) Identify all existing and proposed developments, facilities, installations, and existing rights and easements that may be affected by the Assignment and alternative options, and recommend solutions. The affected facilities/developments may include Tolo Harbour Garden, the existing government moorings and Marine Police Station Building at Tai Po Kau, the possible development of a science park at Pak Shek Kok, planned facilities under PSKPDR, the submarine pipeline laid in the seabed of Tolo Harbour under the Tolo Harbour Effluent Export Scheme, and the Laboratory Bridge and other existing facilities of the CUHK.

q) Prepare necessary land requirement plans for Application for Acquisition and Clearance of Land showing the extent of land requirements for the Assignment and alternative options.

r) Carry out a Traffic Impact Assessment (TIA) for the Assignment and alternative options. Detailed requirements of the TIA shall be referred to Clause 6.8. The TIA study shall identify the impact of the Project on the existing traffic flow of Tolo Highway and the existing and proposed roads in Sha Tin and Tai Po areas during its construction stage. It shall include but not be limited to establishment of a traffic model, identification of the traffic impact and interfacing problems with existing roads, and recommendation of suitable temporary traffic diversion schemes and traffic management measures.

s) Carry out an Environmental Impact Assessment (EIA) and a Drainage Impact Assessment (DIA) study for the Assignment and alternative options. Detailed requirements of EIA and DIA shall be referred to Clauses 6.9 and 6.10 respectively.

t) Carry out an impact assessment on archaeological and historical monuments for the Assignment and alternative options, and recommend solutions.

u) Carry out a landscape impact assessment for the Assignment and alternative options. Prepare method statements of mitigation measures for reducing the impacts, illustrated by a sketch landscape design proposal supported by sketches, sections and details.

v) Carry out an assessment of slope stability of the existing and proposed seawalls at various construction stages for the Assignment and alternative options.

w) Prepare estimated expenditure cash flow schedules and cost estimates for the Assignment and the alternative options, including breakdown of cost for each item of works, cost of reprovisioning, cost of civil works and other E&M components of the TSIS, cost on environmental mitigation measures etc. The Consultants shall assess the recurrent (operation and maintenance) cost, staff requirements and other related expenditure for the TSIS. The base date for the cost estimates shall be December 1995 or such other date as may be advised by the Director's Representative. In preparing the cost estimates for the purpose of or in connection with the Assignment, risk analysis estimating approach shall be adopted in accordance with WBTC No. 22/93. The Consultants shall also be required to update the cost estimates and cash flow schedules as and when required by the Director's Representative.

x) Advise the Director's Representative on the feasibility and practicability of the Assignment and alternative options.

y) Consider in detail the strategic and local town planning, economic, financial, technical, environmental, legal and social implications of the Assignment and alternative options and recommend to the Director's Representative an order of preference for the alternative options.

z) Identify whether the Design and Build type of contract is suitable for the implementation of the works of any part or the whole of the Assignment; and advise the Director's Representative on the type and form of contract most suitable for the implementation of the Assignment.

aa) Determine the extent of further ground investigations and surveys and further studies required to implement the recommended options.

ab) Propose and agree with concerned government departments on locations of borrow areas, dump sites and works areas required at various stages of the Project, and the necessary temporary accesses to these areas. Investigate the viability of using joint accesses for both PSKPDR project (of 3 phases) and the Project and providing accesses from Tolo Highway for PSKPDR.

ac) Investigate and identify the locations of existing and proposed public and private utility services which may be affected by the

Assignment, and agree with the utility companies and concerned parties on the necessary utility diversions (with detailed programme and requirements).

ad) Prepare a general layout (scale 1: 1000) for the recommended option acceptable to the Director's Representative and all parties concerned. The layout drawings should include horizontal and vertical alignments, and typical cross-sections of the road, earthworks, the TSIS, associated structures, cyclist and pedestrian facilities, and landscaping works. Based on the agreed general layout, carry out a preliminary design for all civil (including drainage and sewerage), TSIS, structural, geotechnical, architectural, electrical, mechanical, instrumental and landscaping works to the usual degree of accuracy such that detailed design may proceed therefrom.

ae) Prepare a programme in Timeline format (or other format acceptable to the Director's Representative) with the critical activities identified for the implementation of the Project through the design and construction stages. The project programme should take cognisance and allow for all potential risks to project delivery. It should also include a time schedule for land clearance and acquisition.

af) Prepare a detailed Design Memorandum for the Project, stating the framework of design acceptable to Government, design approval and checking procedures that will be used throughout the design stage. The design Memorandum shall cover all aspects of the Project.

ag) Prepare gazette plans and other documents for gazettal under Roads (Works, Use and Compensation) Ordinance and Foreshore and Sea-bed (Reclamations) Ordinance.

ah) Prepare minutes of Study Management Groups, Working Groups, ad-hoc and liaison meetings.

ai) Prepare a summary of comments on the Project received from various Government offices, authorities, bodies and persons as a result of consultations or circulation of the Project. The summary should include the Consultants' replies to, advice and recommendations for further action on, and/or report on action taken arising out of, those comments that have an influence on the design and/or construction of the Project.

6.2 The Consultants are expected to communicate and correspond direct with other Government departments and offices and their consultants, appropriate authorities and private organisations to obtain information, comment and agreement in connection with the Assignment. The Consultants shall prepare reports or copy relevant correspondence related to these communication, liaison or coordination to the Director's Representative. Any problem in communication or liaison should be referred to the Director's Representative for assistance. In particular, consultation may be required with but shall not necessarily be limited to the following:

a) Agriculture and Fisheries Department
b) Architectural Services Department
c) Buildings Department
d) Civil Engineering Department
e) Correctional Services Department
f) Drainage Services Department
g) Environmental Protection Department
h) Electrical and Mechanical Services Department
i) Fire Services Department
j) Highways Department
k) Home Affairs Department
l) Housing Department
m) Industry Department
n) Lands Department
o) Marine Department
p) Planning Department
q) Recreation and Culture Branch
r) Regional Services Department
s) Royal Hong Kong Police Force
t) Transport Branch
u) Transport Department
v) Territory Development Department
w) Water Supplies Department
x) Kowloon Canton Railway Corporation
y) Chinese University of Hong Kong
z) China Light & Power Co. Ltd.
aa) Hong Kong & China Gas Co. Ltd.
ab) Hong Kong Telephone Co.

ac) Hutchison Communication Limited

ad) New T & T Hong Kong Limited

ae) New World Telephone Company Limited

af) Wharf Cable Ltd.

ag) Kowloon Motor Bus Co. Ltd.

6.3 The Consultants shall take account of in providing the Services all Government regulations including but not limited to Financial and Accounting Regulations, Secretariat Instructions, Lands & Works Branch Technical Circulars, Works Branch Technical Circulars, Engineering Development Department Technical Circulars, Highways Department/Civil Engineering Services Department Instructions, Highways Department Technical Circulars, Civil Engineering Department Technical Circulars, Highways Office Instructions and all PWD Technical Circulars. Particular attention shall be paid to Road Traffic (Expressway) Regulations and its requirement on safety.

6.4 The Consultants shall take cognizance of the projects listed in Clause 4.2 and other projects or interface issues which may affect the Project, and identify potential conflicts and recommend solutions.

6.5 The Consultants shall also take cognizance of all related studies, that are either completed or currently/to be carried out, in particular the following:-

(a) Feasibility Study for Route 16 - From West Kowloon to Sha Tin;

(b) Noise Impact Assessment Study for 24 hours Opening of Border Crossing;

(c) Pak Shek Kok Reclamation - Public Dump : Environmental Impact Assessment Study;

(d) Hong Kong Science Park Stage 2 Study;

(e) Strategic Review on Provision, Management and Operation of Traffic Control and Surveillance Facilities for Strategic Road Network; and

(f) North East New Territories Development Strategy Review.

(g) Water Supply to Pak Shek Kok

(h) Drainage Impact Assessment Study for the TTD project 'Tai Po Development Remaining Works, Formation and Servicing of Area 12 (Part) and 39'

(i) Sha Tin and Ma On Shan Traffic Study

(j) Ma On Shan Railway Study

6.6 The Consultants shall prepare and supply all necessary drawings, documents and presentations for complying with various statutory and Government procedures required for the Project, including procedures in respect of submission for approval of the ACABAS regarding the concept design of the proposed highway structures (including noise barriers), preparation of draft gazette documents and public consultation at District Board and other local committee meetings. The Consultants will be required to attend and answer queries at these meetings.

6.7 The Consultants shall advise on the formulation and application of criteria for the identification, assessment, evaluation and adoption of options.

6.8 <u>Traffic Impact Assessment (TIA)</u>

6.8.1 <u>Introduction</u>

6.8.1.1 The section of Tolo Highway to be widened is one of the most important strategic corridors in the Territory. The road is now operating as a high speed road and is gazetted as an Expressway under the Road Traffic (Expressway) Regulation 1991.

6.8.1.2 The main objectives of the Traffic Impact Assessment (TIA) are :-

(i) to assess the traffic implications of carrying out the road works at the various stages/phases throughout the construction period, taking account of other related strategic road projects in the Area of Influence (AOI);

(ii) to devise appropriate temporary traffic management measures to ameliorate the traffic impact of the road works.

6.8.2 <u>Requirements of the Traffic Impact Assessment</u>

6.8.2.1 The Consultants shall include the following in the traffic impact assessment :-

(i) a sub-regional traffic model covering the Area of Influence (AOI). The AOI shall include, but not limited to the following districts/roads :-

a) the full stretch of Route 1 (NT section), i.e., from Lok Ma Chau to Lion Rock Tunnel;

b) all the Trunk roads, Distributor Roads in Tai Po, Sha Tin and Ma On Shan Districts;

c) Tai Po Road (sections connecting Shui Wai, Tai Po, Chinese University and Sha Tin);

d) External links connecting Sha Tin and Kowloon, including Tate's Cairn Tunnel, Lion Rock Tunnel, Shing Mun Tunnel and Tai Po Road.

(ii) the model shall be developed based on the boundary conditions of the latest CTS-2 matrices/trip ends,

(iii) the model shall be calibrated against observed flows in 1995/96 on major road links and key interchanges and junctions within the AOI to the satisfaction of the Commissioner for Transport and Director's Representative.

(iv) the model shall provide forecasts for the road networks within the AOI for the following years :-

Year 1999	-	without Route 3 (Country Park Section)
Year 2000/01	-	before completion of Tolo Highway widening assuming Route 3 (Country Park Section) in place

(v) the Consultants' attention shall be drawn to Clause 14.2 regarding the responsibility of making independent assessment.

6.8.2.2 In the assessment of the traffic impact of carrying out the road works, the Consultants shall devise appropriate temporary traffic management measures, in the light of the forecast situations at the various critical stages and phasing of traffic diversion/lane closure proposals, to ameliorate the traffic impact of the road works. The measures shall include :-

(i) the derivation of the necessary traffic diversion/lane closure schemes and construction access arrangement at the various stages/phases of the works,

(ii) preparation of drawings showing temporary works, temporary road signs/road markings for implementation prior to and during the construction period,

(iii) circulation of the proposals to and subsequent consultation with the concerned parties, and when necessary, attending the Traffic & Transport Committee Meetings of the North, Tai Po and Sha Tin District Boards.

6.8.3 Considerations relating to other road users and cyclists

6.8.3.1 The Consultants shall be aware of the fact that even if reduction in the existing speed limit is imposed during the course of the works, the majority of the vehicles is still expected to keep travelling at considerable high speeds. In view of this, due consideration must be given to providing adequate supporting measures, including the provision of the necessary deceleration/acceleration facilities and other appropriate traffic aids in compliance with the high speed road standard to ensure road safety and reflect the actual road conditions. Construction access branching off direct from adjoining travelling lane into the works area without the provision of acceleration/deceleration lane is not appropriate to the road traffic conditions of the Highway and is therefore not acceptable. Consideration should also be given to providing either a grade-separated arrangement or appropriate cycle-track re-alignment to avoid conflict with the cyclist traffic by the construction vehicles.

6.8.3.2 The existing cycle-track is required to open to public use throughout the construction period. In view of this, considerations have to be given to providing adequate precautionary measures to protect the safety of the cyclists which shall be included in the temporary traffic measures.

6.8.4 Feasibility of providing a permanent grade-separated cyclist track crossing facility at Ma Liu Shui

6.8.4.1 A temporary cyclist subway will be constructed by CED near the Ma Liu Shui Ferry Pier under the Pak Shek Kok Reclamation - Public Dump Project.

6.8.4.2 The Consultants shall investigate the feasibility of converting this cyclist subway, which is of temporary nature, to a permanent one with standards complying with the relevant TD's and HyD's requirements.

6.8.5 Report Requirements

The assessment shall consist of at least the following :-

(i) an **Inception Report** with at least the following content :-

a) the Consultants' understanding and appreciation of the objective of the assessment;

b) the approach and methodology for the various parts of the assessment, including the identification of the Area of Influence;

c) a study programme detailing the programme for submission of reports; and

d) organisation and staffing of the study team.

(ii) a **Draft Traffic Impact Assessment Report** containing, but not limited to, the following :-

a) an initial assessment and evaluation of the traffic impact in the Area of Influence during the construction period with details outlining the situation at the various critical stages and phasing of the works;

b) provision of a sub-regional traffic model covering the Area of Influence to the satisfaction of the Commissioner for Transport and Director's Representative;

c) derivation of temporary traffic measures, in the light of the forecast situations at the various critical stages and phasing of traffic diversion/lane closure and construction access arrangement;

d) circulation of the proposed temporary traffic measures to and subsequent consultation with the concerned parties including the North, Tai Po and Sha Tin District Boards; and

e) an initial response to the various comments given by the concerned parties.

(iii) a **Final Traffic Impact Assessment Report** containing, but not limited to, the following :-

a) a full assessment of the traffic impact based on the sub-regional traffic model at the various critical stages of the works with traffic forecasts for the road networks within the Area of Influence as specified in Clause 6.8.2;

b) a full details with implementation programme and administration procedures of all the temporary traffic measures with respect to the various stages and phasing of the works, immediately prior to and during construction, and immediately before the completion of the Project;

c) the preparation of traffic aids drawings, specification etc for the above various temporary traffic measures, covering the affected carriageway, approaches, cycle track and footpath; and

d) assessment findings, conclusions and recommendations.

(iv) an **Executive Summary Report**, in both Chinese and English, of the assessment, highlighting the issues of concern to the community, the acceptability of the anticipated traffic impacts and cumulative effects, requirements for implementation of the Project, and the basis for and implications of those requirements. It is intended that the information contained therein would assist the Government in undertaking the DB's and other public consultations; and

(v) any revisions or supplements to the above as might be required by the Commissioner for Transport through the Director's Representative.

6.9 <u>Environmental Impact Assessment (EIA)</u>

6.9.1 Introduction

6.9.1.1 The purpose of this Environmental Impact Assessment (EIA) Study is to provide information on the nature and extent of environmental impacts arising from the construction and operation of the Project and all related activities taking place concurrently. This information will contribute to decisions on :

i) the overall acceptability of any adverse environmental or ecological consequences that are likely to arise as a result of the Project;

ii) the conditions and requirements for the detailed design, construction and operation of the Project; and

iii) the acceptability of residual impacts after the proposed mitigation measures are implemented.

6.9.2 Study Area

6.9.2.1 The boundary of the Study Area for the EIA shall be defined by a distance of 300m from the proposed road alignments except that :

For visual impact assessment, the study area shall generally be defined by a distance of 500m from the proposed road alignments. However, all sensitive receivers regarding the visual impact assessment shall be regardless of the distance from the proposed road alignments.

6.9.3 Objectives of the Environmental Impact Assessment Study

6.9.3.1 The objectives of the assessment are as follows :

i) to describe the Project and associated works together with the requirements for carrying out the Project;

ii) to identify and describe the elements of the community and environment likely to be affected by the Project, and/or likely to cause adverse impacts upon the Project, including both the natural and man-made environment;

iii) to identify and quantify emission sources and determine the significance of impacts on sensitive receivers and potential affected uses;

iv) to identify and quantify any potential losses or damage to flora, fauna and natural habitats;

v) to propose the provision of infrastructure or mitigation measures so as to minimize pollution, ecological and environmental disturbance and nuisance during construction and operation of the Project;

vi) to identify, predict and evaluate the residual (i.e. after practicable mitigation) ecological and environmental impacts and cumulative effects expected to arise during the construction and operation phases of the Project in relation to the sensitive receivers and potential affected uses;

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

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

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

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

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

6.9.4 Requirements of the Environmental Impact Assessment Study

6.9.4.1 The Consultants shall meet the objectives listed in Clause 6.9.3 above by:

i) carrying out the necessary background studies to identify, collect and analyze existing information relevant to the EIA study;

ii) carrying out any necessary environmental survey, site investigations and baseline monitoring work to achieve the objectives;

iii) quantifying, by use of models or other predictive methods, the residual and cumulative environmental impacts (specifying whether these are transient, long term and/or irreversible) arising from the construction and operation of the Project;

iv) proposing practicable, effective and enforceable methods, measures and standards to effectively mitigate any significant environmental impacts in the short and long term; and

v) outlining a programme by which the environmental impacts of the Project can be assessed, monitored and audited.

In further defining the scope of the EIA Study, consideration should be given to beneficial and adverse effects, short and long term effects, secondary and induced effects, cumulative effects, synergistic effects and transboundary effects.

6.9.5 Technical Requirements of the Environmental Assessment Study

The Environmental Assessment study shall include, but shall not necessary be limited to the following tasks :-

6.9.5.1 Construction Phase Assessment

6.9.5.1.1 Noise Impact Study

Task 1 : Identification of Representative Sensitive Receivers

From a consideration of the existing and future land uses in the Study Area, prepare schedules and plans to identify representative noise sensitive receivers. Locations of representative sensitive receivers shall be agreed with the Director of Environmental Protection. Noise sensitive receivers (NSRs) should include those described in the Environment Chapter of the Hong Kong Planning Standards & Guidelines (HKPSG). The future land users are those who will occupy the land by the time of construction works commence.

Task 2 : Analysis of Construction Activities

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

Task 3 : Assessment of Construction Noise Levels

Identify the interactions between the NSRs and construction activities and determine the extent of potentially unacceptable construction noise impacts. The assessment should follow the requirements contained in all the Ordinances & their Regulations governing the control of construction noise currently in force in Hong Kong and the guidelines as advised by the Director of Environmental Protection.

Task 4 : Proposals for Noise Control Measures

Formulate appropriate noise control measures for the inclusion into the contract documents. Where appropriate, compliance monitoring should be proposed.

6.9.5.1.2 Air Pollution Impact Study

Task 1 : Identification of Representative Receptors

From a consideration of existing and future land use in the Study Area, prepare plans identifying representative receptors in the vicinity of the proposed project (including off-site works area). The locations of the representative receptors shall be agreed with the Director of Environmental Protection.

Task 2 : Analysis of Construction Activities

From a knowledge of the likely type, sequence and duration of construction activities required for the project implementation, identify those construction activities likely to cause potential dust (or other air pollutant) problems to the receptors.

Task 3 : Air Pollution Impact Assessment

Assess the air pollution impact of the Project to receptors by dispersion modelling. The Consultants should provide detailed methodology statement and key assumptions of the selected dispersion model such as emission factors and other input parameters etc. to the Director of Environmental Protection for comment and consent before commencement of the Study. For evaluation of dust impact from construction activities, Fugitive Dust Model (FDM) is preferred.

Task 4 : Proposal for Air Pollution Control Measures

Recommend appropriate air pollution control measures for the inclusion into the contract documents. Where appropriate, compliance monitoring should be proposed.

6.9.5.1.3 Water Quality Impact Study

Task 1 : Identification of Sensitive Receivers

Based on the proposed alignments, identify the watercourses/water bodies likely to affected.

Task 2 : Analysis of Construction Activities

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

Task 3 : Assessment of Water Pollution Problems

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

Task 4 : Proposal for Water Pollution Control Measures

Recommend appropriate control measures for the inclusion into contract documents. Where appropriate, practical mitigation measures and compliance monitoring should be proposed. Measures should also be recommended to ensure natural flow of water is maintained to avoid flooding.

6.9.5.1.4 Construction Waste Impact Study

Task 1 : Analysis of Construction Activities

Identify the quantity, quality and timing of the waste (including dredged marine mud (contaminated and/or uncontaminated) and bentonite slurry if any) and surplus excavated material arisings (including those with high clay/water content) as a result of the construction activities.

Task 2 : Proposal for Waste Handling and Disposal

Recommend appropriate waste handling and disposal measures/routings in accordance with the current legislative/administrative arrangements on the disposal of construction waste; including the reuse, recycle and/or reduction of construction waste, for the inclusion into contract documents.

(N.B. Construction Waste should be sorted/separated as far as practicable to mainly two portions : the `inert materials' (including soil, rock, concrete, brick, cement plaster/mortar, inert building debris, aggregates and asphalt) and the `non-inert materials' (including timber, paper, glass, junk, general garbage and other organics). Suitable materials complying with conditions as set out in public dumping licence should be disposed of at public dumps. Construction Waste with a small amount of inert materials (not more than 20% by volume) can be allowed to be disposed of at landfills.

The handling and disposal of bentonite slurries should follow the requirements as set out in the Practice Note For Professional Persons ProPECC PN 1/94 - Construction Site Drainage.

The Consultants shall assess the construction waste in accordance with these arrangements and consult Waste Disposal Authority on the final disposal of these waste.)

6.9.5.1.5 Ecological Impact (both aquatic and terrestrial)

The Project should take into account the importance of ecological components for natural flora/fauna habitats in Hong Kong. It is essential to observe the importance of protecting, rehabilitating and maintaining the natural environment. In particular, the Project should avoid locations in the vicinity of Sites of Special Scientific Interests and/or Sites of Special Archaeological Interest as far as possible. The assessment shall focus on the following :

i) description of the physical environmental background and habitat characterization of the site(s);

ii) investigation of the existing flora/fauna likely to be affected, such as, species list and counts, endangered/rare species, information on composition/community structures, population size, important habitats and inter-dependent relationships;

iii) identification and quantification as far as possible of any direct/indirect and on-site/off-site impacts that lead to the destruction, displacement or adverse effect on flora and fauna (such as, loss of shelter and food, reduced species diversity, loss of breeding ground(s), loss of wetland, loss of fisheries, species extraction, loss of carrying capacity); and

iv) evaluation of the impacts and proposals for any mitigation measures.

6.9.5.2 <u>Operation Phase Assessment</u>

6.9.5.2.1 Traffic Noise Impact Study

Task 1 : Identification of Representative Sensitive Receivers

Identify representative noise sensitive receivers, as described in the Environment Chapter of the Hong Kong Planning Standards & Guideline (HKPSG), for both existing and planned land uses. Locations of representative noise sensitive receivers (NSRs) shall be agreed with the Director of Environmental Protection.

Task 2 : Calculation of Future Noise Levels

Calculate the future road traffic noise using methods described in the U.K. Department of the Transport's publication "Calculation of Road Traffic Noise" (1988) published by H.M. Stationery Office. Calculations shall be based on the worst traffic projection for the appropriate design year within a period of 15 years (or prior agreement with EPD on traffic forecast data) after opening of the proposed road and the volume of traffic, speed and percentage of heavy vehicles used in the calculation shall be agreed with the Director of Environmental Protection.

Future traffic noise shall be calculated at the nearest facade of any existing building classified as a noise sensitive receiver. For planned developments, representative points are to be selected from draft Layout Plans. Noise levels and contours in L10 (1 hr) at representative level (in m P.D.) of the facades of the NSRs as identified in Task 1 above should be presented in tables and on a plan of suitable scale. Traffic at the hour of peak traffic flow shall be used in the calculation. Quantitative assessment at the identified NSRs for each alignment shall be compared against the criteria set out in the HKPSG. The potential noise impact of each proposed alignment on the existing and planned NSRs shall be quantified by estimating the total number of dwellings and/or classrooms that will be exposed to a level above the HKPSG criteria.

Task 3 : Presentation of Existing Noise Level

Measures the existing noise levels in L10 (1 hr) and L90 (1 hr) at the identified NSRs at representative level (in m P.D.) and present them on a plan of suitable scale as advised by the Director of Environmental Protection. This information may be required in the context of Task 5.

Task 4 : Assessment of Needs for Noise Amelioration Measures

Assess the needs for noise amelioration measures in relation to the extent to which an existing or planned building classified as a NSR would be subject to a predicted traffic noise level in the design year which is 1 dB(A) or more in excess of the maxima recommended in the HKPSG.

Task 5 : Proposals for Noise Amelioration Measures

Propose direct technical remedies in all situation where the predicted traffic noise level exceeds the HKPSG maxima. For planned noise sensitive developments, indications in the form of suitable measures to be incorporated in the Project should be proposed for further development in the subsequent detailed design. Specific reasons for not adopting certain direct technical remedies in the design to reduce the traffic noise levels to a level within HKPSG or to maximize the protection for existing noise sensitive receivers as far as possible should be clearly laid down. In case where direct technical remedies appear impracticable, the report should identify the NSRs which may qualify for indirect technical remedies under the ExCO directive for "Equitable Redress for Persons Exposed to Increased Noise Resulting from the Use of New Roads" and the associated costs and the implications for such implementation.

Task 6 : Assessment of Side Effects and Constraints

Identify and assess the side effects and/or the potential constraints of the inclusion of the identified noise mitigation measures. Propose means to minimize the effects and/or to resolve the constraints. When decking over roadways is identified to be necessary, the air quality aspect within the cover and the increased noise levels within the cover and at the portals of the cover should be addressed.

6.9.5.2.2 Air Pollution Impact Study

Task 1 : Identification of Representative Receptors

From a consideration of existing and future land use in the study area, prepare plans identifying receptors that would likely be affected by vehicular emissions from traffic. The locations shall be agreed with the Director of Environmental Protection.

Task 2 : Presentation of Background Air Pollution Levels

Background air pollution levels at the Study Area should be established for assessment of cumulative air impacts and used in Task 3.

Task 3 : Air Pollution Impact Assessment

Assess the net and cumulative air pollution impact of the Project to receptors by dispersion modelling. The Consultants should provide detailed methodology statement and key assumptions of the selected model such as emission factors and other input parameters etc. to the Director of Environmental Protection for comment and consent before commencement of the Study. For evaluation of traffic air impact, CALINE4 is usually preferred.

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

Air pollution Isopleths should be produced as an output of the study.

The Consultants should also assess the air quality implications of any proposed noise mitigation measures. If noise mitigation measures such as noise canopy, which will affect dispersion of air pollutants are proposed to mitigate noise impact due to traffic flow, then the Consultants should also assess the implications of such mitigation measures on air quality impact. If noise canopy in the form of total enclosure is proposed, then both 'tunnel' portal emissions and air quality inside the 'tunnel' should also be addressed.

Task 4 : Proposal of Amelioration Measures

Propose effective amelioration measures in situations where the predicted (cumulative) air pollution levels exceed the Hong Kong Air Quality

Objectives.

6.9.5.2.3 Water Quality Impact Study

Task 1 : Assessment of Water Pollution Impact

Assess the adverse effects, if any, of the traffic and the proposed alignments, infrastructures and facilities on the water quality of the watercourse/water bodies traversed by the alignments. This should include surface runoff and spillage due to accidents and the investigation of locations of existing and proposed public stormwater drains and sewers which may be affected by the project. Any necessary drainage and sewerage diversions should be agreed with Drainage Services Department (with detailed programme and requirements).

Task 2 : Proposals for Amelioration Measures

Recommend appropriate cost effective amelioration measures to minimize any adverse effects identified in Task 1 above.

6.9.5.2.4 Visual, Landscape and Townscape Impacts

Task 1 : Assessment of Visual, Landscape and Townscape Impacts

Assess the visual, landscape and townscape (including streetscape) impacts of the Project. The assessment shall include but not restricted to the following :

a. Identification and plotting of visibility contours of the road within the study area as defined in Section 6.9.2.

b. Identification of the key groups of sensitive receivers within the visibility contours with regard to views from both street level and high-rise developments/elevated vangate points.

c. The severity of visual impacts in terms of distance, number of sensitive receivers etc. will be identified.

d. Analysis of the existing landscape and townscape character and quality within the study area and identify the degree of compatibility of the road with its environs.

e. Analysis of construction activities and related adverse landscape and visual impacts.

f. Analysis of landscape and visual impacts of any proposed structures (such as noise barriers or noise enclosure) to be constructed under the Project.

g. Analysis of operational activities (after commissioning) and its related landscape and visual impacts.

Task 2 : Proposals for Mitigation Measures

Recommend mitigation measures to minimize the adverse effects identified in Task 1 above, with the inclusion of an landscape and townscape design. The mitigation measures should also include, but not be restricted to the retention of vegetation, provision of screen planting, revegetation of disturbed land, reprovisioning of amenity areas and open spaces, design of structures and provision of finishes to structures, and any measures to mitigate the disturbance of the existing agricultural and horticultural landuse. The Consultants shall seek advice from the Advisory Committee on the Appearance of Bridges and Associated Structures (ACABAS) and present photo montage of the proposed road in the existing urban setting illustrating the effectiveness of visual, landscape and townscape impact mitigation measures.

6.9.5.2.5 Land Use Impact

Task 1 : Assessment of the Implication on Land Use

Assess the implications on land uses in the vicinity of the project (including works areas). Both the long and short term implications have to be assessed.

Task 2 : Proposals for Mitigation Measures

Recommend appropriate cost effective mitigation measures to minimise the adverse effects identified in Task 1 above. Special attention should be paid to minimise restraints on the development potential of the areas in the vicinity. The method of assessing the development potential of the area shall be agreed with the Director of Planning.

6.9.5.2.6 Ecological Impact (both aquatic and terrestrial)

Same requirement as Section 6.9.5.1.5 above.

6.9.5.3 Conservation

The Consultants shall observe the importance of environmental conservation and incorporate it into design, construction and operation of the Project, wherever possible. The general outlines shall address the following:

i) maintenance of the balance of the use of resources; and

ii) reduction, reuse and re-cycle resources wherever practical.

6.9.5.4 Use of EIA models/Survey Techniques/Analytical Methods

The use of models, survey protocols and analytical methods (includes laboratory techniques) proposed in the Inception Report shall be agreed and approved by the Director of Environmental Protection prior to commencing with detailed studies. This shall include the following:

i) elaboration of background assumptions;

ii) confirmation with data validation;

iii) calibration of model;

iv) prescription of tool application (such as, questionnaire, numerical/stochastic algorithm); and

v) presentation of scenario projection and interpretation of results.

6.9.5.5 Impacts Summary

An EIA Study is based on different techniques, interpretations and measurements. It is important to present the findings in simple terms to sum up all environmental impacts and select the acceptable alternative for the Project. The study shall address the following:

i) elaboration of alternatives, including where appropriate the 'do nothing' scenario;

ii) discussion of the extent of impacts and the proposed ranking system;

iii) presentation of the recommendations on overall acceptability;

iv) justification of the proposed methodology to be adopted for an impacts summary and be agreed with the Director of Environmental Protection; and

v) application of impacts summary.

6.9.5.6 Environmental Monitoring and Audit (EM&A) Requirements

i) Environmental Monitoring

The Consultants shall identify and recommend environmental monitoring requirements for all construction, post-project and operational phases of the development. These requirements shall include but not be limited to the identification of sensitive receivers, monitoring locations, monitoring parameters and frequencies, monitoring equipment to be used, and any other necessary programmes for baseline monitoring, impact and compliance monitoring, and data management of monitoring results.

ii) Environmental Audit

The Consultants shall identify and recommend environmental audit requirements for all construction, post-project and operational phases of the development. These requirements shall include but not be limited to:

a) organisation and management structure, and procedures for auditing of the implementation of respective environmental mitigation measures recommended for the detailed design, contract document preparation, construction, post-project operation stages of the development;

b) environmental quality performance limits for compliance auditing for each of the recommended monitoring parameters to ensure compliance with relevant environmental quality objectives, statutory or planning standards, or acceptance criteria recommended by the EIA. These limits shall give indication of a deteriorating environmental quality and shall allow proactive responses to be taken. (The commonly used approach is a set of trigger, action and target levels);

c) organisation and management structure, and procedures for reviewing the monitoring results and auditing the compliance of the monitoring data with the environmental quality performance limits (point (b) above), project contractual and regulatory requirements, and environmental policies and standards;

d) Event/Action plans for impact and compliance monitoring;

e) complaints handling, liaison and consultation procedures; and

f) reporting procedures, report formats and reporting frequency including periodical reports and annual reviews to cover all construction and post-project/operational phases of the development.

iii) The Consultants shall prepare an Environmental Schedule (Manual) which covers the requirements and recommendations in (i) and (ii) above. The Manual shall also contain a summary list of recommended environmental mitigation measures. This Manual shall be used as a guideline for environmental monitoring and audit during the construction and post-project operational phases. This Manual shall be a stand-alone document and form part of the EIA report.

6.9.6 Compliance with Environmental Law

6.9.6.1 An EIA Study is a tool to identify potential environmental impacts arising from the Project and to provide a basis for decisions for the implementation of the Project, but it does not automatically exempt the proposal from licensing requirements and the approvals from relevant authorities.

6.9.6.2 The Consultants shall comply with and observe all Ordinances, bye-laws, regulations and rules for the time being in force in Hong Kong governing the control of any form of pollution for environmental protection.

6.9.7 Liaison and Administration

6.9.7.1 The Consultants shall liaise with relevant Government departments and agencies, and all other parties involved in this and any other projects or developments likely to be affected by this development. Any correspondence, notes or minutes arising from this liaison shall be copied to the Director's Representative and the Director of Environmental Protection.

6.9.7.2 The EIA Study will be managed by a Study Management Group (SMG) chaired by a representative of the Director of Environmental Protection. This shall be the forum for liaison with Government departments and agencies, providing guidance to the study consultant, and for comment and review on the work and outputs of the study. The Consultants shall prepare and circulate minutes of the SMG meetings.

6.9.7.3 The Consultants should make himself available to be present in Advisory Council on the Environment (ACE), District Board (DB) and/or any public consultation meeting(s) (if necessary) to brief the proposed case(s) against the relevant environmental impacts generated.

6.9.8 Report Requirements

6.9.8.1 The assessment shall consist of at least the following :

i) an **Inception Report** should be prepared and submitted, within 4 weeks of the Study commencing, by the Consultants (their agents, sub-consultants or representative). The Inception Report shall include, inter-alia the following :

a) the Consultants' understanding and appreciation of the objectives of the Study;

b) the approach and methodology for the various parts of the Study;

c) a work programme, with major work tasks and key decision points identified and briefly described;

d) a schedule detailing the submission of reports and Study Management Group meetings (where necessary); and

e) organisation and staffing of the environmental study team and the curricula vitae of the key study team members.

ii) an **Initial Assessment Report** which

a) provides an initial assessment and evaluation of the environmental impacts and cumulative effects arising from the Project sufficient to identify those issues of key concern during the construction and operation of the Project which are likely to influence decisions on the Project;

b) defines measurable environmental parameters and environmental features likely to be affected by the Project and identifies the environmental monitoring programmes which are required both to provide a baseline profile of existing environmental conditions and to monitor impacts and compliance during construction, commissioning and operation of the Project;

c) defines the environmental audit requirements for compliance and post-project audit, which would include a review of the monitoring data both to identify compliance with regulatory requirements, policies and standards and to define any remedial works required to redress unanticipated or unacceptable consequential environmental impacts; and

d) proposes a detailed programme of investigation able to meet all other objectives of the assessment.

iii) **Key Issue Reports** covering those issues of key concern identified through the Initial Assessment Report or the review of the Initial Assessment Report by the Director of Environmental Protection;

iv) a **Final Assessment Report** which

a) fully satisfies the requirements of this brief in respect to the prediction and assessment of impacts, the identification of environmental impact mitigation measures and the associated residual impacts;

b) describes the agreed schedules and programmes for monitoring and audit requirements;

c) prescribes the specification for detailed design, construction and operation requirements of the Project; and

d) provides with the impacts summary, the study findings, conclusions, recommendations and a mechanism for implementation;

v) an **Executive Summary** in both English and Chinese of the study, highlighting the issues of concern to the community, the acceptability of residual environmental impacts and cumulative effects, requirements for implementation of the Project, and the basis for and implications of those requirements. It is intended that the information contained therein would assist the Government in undertaking ACE, DB and other public consultation(s);

vi) all working papers comprising Initial Assessment Report, Key Issue Report and Final Assessment Report should be prepared and submitted in draft to the Director of Environmental Protection for comment; and

vii) any revisions or supplements to the above as might be required by the Director of Environmental Protection through the Director's Representative.

6.9.8.2 Public Projects

The requirements in the PELB's General Circular 2/94 on the Public Access to Environmental Impact Assessment (EIA) Reports shall be complied with. The final EIA reports and the Executive Summary will be made available to the public according to the provisions in the circular. The EIA study findings may be presented to the Advisory Council on the Environment (ACE).

6.9.8.3 In accordance with PELB T/C 2/92, if there is any disagreement on the finding of the study or on the necessary environmental protection and pollution control measures, the issue will be referred to the Secretary for Planning, Environment and Lands who shall resolve the differences in consultation with the Advisory Council on the Environment (ACE), appropriate Branches and Departments.

6.9.9 General Reference

The EIA Study should be carried out with due regard to the information, policies, regulations and procedures contained in :-

a) All anti-pollution Ordinances, Technical Memoranda, advisory booklets etc;

b) PEL Branch/Works Branch, April 1992 : 'EIA of major private sector projects' (Technical Circular No. 2/92, 14/92);

c) PEL Branch, May 1994 : 'Public access to EIA reports' (General Circular No. 2/94);

d) EPD and Planning Department, April 1991 : 'Environmental Guidelines for Planning in Hong Kong' (Chapter 9 of `HKPSG');

e) EPD : 'Environment Hong Kong' (Annual Review);

f) PEL Branch, November 1993 : 'The Hong Kong Environment : A green Challenge for the Community'; and

g) EPD, February 1994 : Consultancy Documents Submitted to EPD - Working Greener' DTC No. 15.2.94.

6.10 Drainage Impact Assessment (DIA)

6.10.1 Introduction

The purpose of this Drainage Impact Assessment (DIA) Study is to provide information on the nature and extent of potential drainage impacts arising from the construction and operation of the Project and all related activities taking place concurrently. This information will contribute to decisions on:-

i) the overall acceptability of any potential adverse drainage consequences that are likely to arise as a result of the Project;

ii) the conditions and requirements for the detailed design, construction and operation of the Project; and

iii) the acceptability of residual impacts after the proposed mitigation measures are implemented.

6.10.2 Objectives of the Drainage Impact Assessment Study

The objectives of the assessment are as follows:

i) to describe the Project and associated works together with the requirements for carrying out the Project;

ii) to identify and describe the elements of the community and the existing drainage characteristics likely to be affected by the Project, and/or likely to cause adverse impacts upon the Project, including both the natural and man-made drainage systems;

iii) to introduce a structured and systematic approach to identifying, assessing and mitigating potential adverse drainage impacts which might arise from the Project;

iv) to ensure that adequate connections are provided between the project drainage works and the existing and planned river training drainage system such that gravity drainage will be permitted at all times.

v) to propose the provision of infrastructure or mitigation measures so as to minimize the potential adverse drainage impacts during construction and operation of the Project;

vi) to identify, predict and evaluate the residual (i.e. after practicable mitigation) drainage impacts and cumulative effects expected to arise during the construction and operation phases of the Project;

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

viii) to demonstrate that with all mitigation measures introduced, the development will have no detrimental flooding effects upstream or downstream of the development;

ix) to design and specify the monitoring and audit requirements necessary to ensure the implementation and the effectiveness of the mitigation measures adopted;

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

xi) to identify constraints associated with the mitigation measures recommended in the Study; and

xii) to identify any additional studies necessary to fulfil the objectives to the requirements of this DIA Study.

6.10.3 Requirements of the Drainage Impact Assessment Study

The Consultants shall meet the objectives listed in Clause 6.10.2 above by:

i) carrying out the necessary background studies to identify, collect and analyze existing information relevant to the DIA study;

ii) carrying out any necessary survey, site investigations and monitoring work to achieve the objectives;

iii) quantifying, by use of mathematical models or other predictive methods, the residual and cumulative environmental impacts (specifying whether these are transient, long term and/or irreversible) arising from the construction and operation of the Project;

iv) proposing practicable, effective and enforceable methods, measures and standards to effectively mitigate any significant adverse drainage impacts in the short and long term; and

v) outlining a programme by which the drainage impacts of the Project can be assessed, monitored and audited.

In further defining the scope of the DIA Study, consideration should be given to beneficial and adverse effects, short and long term effects, secondary, induced and cumulative effects.

6.10.4 Technical Requirements of the Drainage Assessment Study

The Consultants shall consider all aspects of the activities arising from the Project in any stage of implementation and the DIA Study shall provide and address the following :

6.10.4.1 An Outline of the Current Flooding Susceptibility and Proposed Drainage

i) an assessment of the susceptibility of the project site to flooding, preferably with a record of any past flooding which occurred within or adjacent to the project site. The Consultants shall review all relevant sections of previous related studies and their recommendations, including the Territorial Land Drainage and Flood Control Strategy Study Phase II (TELADFLOCOSSII); and

ii) a detailed layout plan at an appropriate scale of the project site with the site boundary, existing and proposed ground levels, existing and proposed drainage systems including any necessary upgrading drainage works within the catchment, and existing and proposed land uses, all identified. If the ground levels or drainage or land uses adjacent to but outside the project site are likely to change, details should be provided if possible or, alternatively, attention drawn to the fact that changes are likely.

6.10.4.2 <u>An Outline of the Changes to the Drainage Characteristics and Potential Drainage Impacts which might arise from the Project</u>

6.10.4.2.1 The Consultants shall provide the following details to quantify the changes to the drainage characteristics of the catchment arising from the Project. Considerations should be given to all Government and private land development, highways, land drainage and other infrastructure facilities currently planned and under construction in the catchment basin.

i) changes in land use and surface runoff characteristics;

ii) changes to surface runoff hydrographs for 2, 10, 50 and 200 years return period flood events for the project site and at the affected watercourses;

iii) change in flood storage caused by the Project;

iv) assessment of timing of peak runoff from project site relative to timing of catchment peak runoff;

v) an evaluation of the peak runoff from the catchment upstream of the project site for 2, 10, 50 and 200 years return period flood events;

vi) approximate hydraulic bankfull capacity of existing drainage upstream, within and downstream of project site;

vii) approximate hydraulic bankfull capacity of proposed drainage upstream, within and downstream of project site;

viii) changes in flood levels and/or velocities for 2, 10, 50 and 200 years return period flood events; and

ix) details of temporary drainage during construction including hydraulic capacities.

6.10.4.2.2 The Consultants shall provide details of all potential impacts which might arise as a result of changes to the drainage characteristics caused by the Project and identify land users which might be affected. Details of impacts caused by the following should be provided:

i) changes in flood levels, flood frequency and/or velocities;

ii) changes in timing and magnitude of runoff peaks;

iii) changes to maintenance requirements and access for maintenance;

iv) changes to the drainage paths and regime during construction and thereafter;

v) cumulative effects taking account of other developments in catchment; and

vi) other relevant considerations.

The potential impact should be considered on upstream, downstream and adjacent land users and land uses should be identified (e.g. residential, commercial, institutional, industrial, infrastructure, agricultural, recreational, conservation areas).

6.10.4.3 Details of Any Proposed Drainage Impact Mitigation Measures and Any Further Drainage Impact Implications

The Consultants shall provide details of any proposed drainage impact mitigation measures including necessary improvement works to existing and planned drainage systems which have effects on the Project. The following is a non-exhaustive list of items which should be considered:

i) channel improvements;

ii) flood storage and runoff control devices (e.g. orifices, throttle pipes, weirs and float or electrically operated gates);

iii) stormwater pumping;

iv) soakaways;

v) floodproofing/flood compatible materials;

vi) enhanced maintenance;

vii) contractual controls (during construction); and

viii) other compensation measures.

The Consultants shall propose measures to mitigate any adverse drainage impacts to acceptable levels through application of best practical and cost effective means which preferably will require minimal management, operational and maintenance commitments and shall recommend the priorities in the provision of these measures and produce a programme for implementation of the mitigation works. The Consultants shall also consider the landscape and visual impacts of the proposed mitigation measures on the potential receptors.

6.10.4.4 <u>Monitoring and Audit Requirements</u>

i) Monitoring Requirements

The Consultants shall identify and recommend monitoring requirements for all construction, post-project and operational phases of the development. These requirements shall include but not be limited to the identification of monitoring locations, monitoring parameters and frequencies, monitoring equipment to be used, and any other necessary programmes for baseline monitoring, impact and compliance monitoring, and data management of monitoring results.

ii) Audit Requirements

The Consultants shall identify and recommend audit requirements for all construction, post-project and operational phases of the development. These requirements shall include but not be limited to :

a) organisation and management structure, and procedures for auditing of the implementation of respective mitigation measures recommended for the detailed design, contract document preparation, construction, post-project operation stages of the development;

b) quality performance limits for compliance auditing for each of the recommended monitoring parameters to ensure compliance with relevant quality objectives, statutory or planning standards, or acceptance criteria recommended by the DIA. These limits shall give indication of a deteriorating quality and shall allow proactive responses to be taken. (The commonly used approach is a set of trigger, action and target levels);

c) organisation and management structure, and procedures for reviewing the monitoring results and auditing the compliance of the monitoring data with the quality performance limits (point (b) above), project contractual and regulatory requirements, and current policies and planning standards;

d) Event/Action plans for impact and compliance monitoring;

e) complaints handling, liaison and consultation procedures; and

f) reporting procedures, report formats and report frequency including periodical reports and annual reviews to cover all construction and post-project/operational phases of the development.

iii) The Consultants shall prepare a Monitoring and Audit Schedule (Manual) which covers the requirements and recommendations in (i) and (ii) above. The Manual shall also contain a summary list of recommended mitigation measures. This Manual shall be used as a guideline for monitoring and audit during the construction and post-project operational phases. This Manual shall be a stand-alone document and form part of the DIA report.

6.10.5 Liaison and Administration

6.10.5.1 The Consultants shall liaise with relevant Government departments and agencies, and all other parties involved in this and any other projects or developments likely to be affected by this development. Any correspondence, notes or minutes arising from this liaison shall be copied to the Director's Representative and the Director of Drainage Services (DDS).

6.10.5.2 The DIA Study will be managed by a Study Management Group (SMG) chaired by the Director's Representative. The Consultants shall attend the SMG meetings as and when required. This shall be the forum for liaison with Government departments and agencies, providing guidance to the Study Consultants, and for comment and review on the work and outputs of the Study. The Consultants shall prepare and circulate minutes of the SMG meetings.

6.10.5.3 The Consultants shall make themselves available to be present in the District Boards (DB) and/or any public consultation meetings, if necessary, to brief the proposed cases against the relevant drainage impacts generated.

6.10.6 Report Requirements

The assessment shall consist of at least the following :

i) a **Draft Drainage Impact Assessment Report** which

a) provides an initial assessment and evaluation of the drainage impacts and cumulative effects arising from the Project sufficient to identify those issues of key concern during the construction, operation and decommissioning of the Project which are likely to influence decisions on the Project;

b) defines measurable drainage parameters and features likely to be affected by the Project and identifies the monitoring programme which is required both to provide a baseline profile of existing drainage conditions and to monitor impacts and compliance during construction, commissioning, operation (and decommissioning) of the Project;

c) defines the audit requirements for compliance and post-project audit, which would include a review of the monitoring data both to identify compliance with regulatory requirement, policies and standards and to define any remedial works required to redress unanticipated or unacceptable consequential drainage impacts; and

d) proposes a detailed programme of investigation able to meet all other objectives of the assessment.

ii) a **Final Drainage Assessment Report** which

a) fully satisfies the requirements of this Brief in respect of the prediction and assessment of impacts, the identification of drainage impact mitigation measures and the associated residual impacts;

b) describes the agreed schedules and programmes for monitoring and audit requirements;

c) prescribes the specification for detailed design, construction and operation requirements of the Project; and

d) provides the study findings, conclusions, recommendations and a mechanism for implementation.

iii) an **Executive Summary Report**, in both English and Chinese, of the Study, highlighting the issues of concern to the community, the acceptability of residual drainage impacts and cumulative effects, requirements for implementation of the Project, and the basis for and implications of those requirements. It is intended that the information contained therein would assist the Government in undertaking the DB and other public consultations; and

iv) any revisions or supplements to the above as might be required by the Director of Drainage Services through the Director's Representative.

7. Response to Queries

7.1 The Consultants shall respond to queries under Clause 20 of the General Conditions of Employment raised prior to a date 12 months after the final submission of the Deliverables required under the Agreement. Such date shall be confirmed in writing to the Consultants by the Director's Representative.

8. Programme of Implementation

8.1 The due date for commencement of the Agreement is 31 January 1996.

8.2 Pursuant to Clause 26(B) of the general Conditions of Employment, the Consultants shall submit the draft programme and revised draft programmes and the Director's Representative shall agree, or instruct, within the following periods:

Submission of the draft programme	:	Within 4 weeks of the due date for commencement of the Agreement
Agreement of the draft programme	:	Within 4 weeks from receipt of the draft programme or instruction for submission of the revised draft programme
Submission of revised draft programme	:	Within 2 weeks from the instruction of the Director's Representative

The draft programme and revised draft programmes shall detail the activities to be carried out, target dates for particular tasks and any decision dates that may be required for the uninterrupted progress of the Assignment. The Consultants shall discuss with the Director's Representative during the above periods to agree the timing of submission of reports, other documents and plans for each of the main elements of the Assignment, for inclusion in the draft programme and revised draft programme.

8.3 The key dates referred to in Clause 8.2 of this Brief shall include but not be limited to :

(i) The date of submission of the detailed requirements and estimated cost of the preliminary ground investigation - Within 4 weeks from the commencement date of the Agreement

(ii) The dates of submission of TIA study reports

Inception Report	-	March 1996
Draft Report	-	May 1996
Final Report and Executive Summary	-	July 1996

(iii) The dates of submission of EIA study reports

Inception Report	-	Within 4 weeks from the commencement date of the Agreement
Initial Assessment Report	-	April 1996
Key Issue Report	-	May 1996
Final Assessment Report, Executive Summary, and Environmental Monitoring & Audit Manual	-	July 1996

(iv) The dates of submission of DIA study reports

Draft Drainage Impact Assessment Report	-	May 1996
Final Drainage Impact Assessment Report, Executive Summary Report, and Drainage Monitoring & Audit Manual	-	July 1996

(v) The dates of submission of the Project Feasibility Study reports

Inception Report	-	Within 3 weeks from the commencement date of the Agreement
Draft Final Report	-	June 1996
Final Report and Executive Summary	-	August 1996

8.4 All the Deliverables as mentioned in Clause 5 shall be submitted within 7 months from the commencement date of the Agreement, except otherwise specified in the Agreement.

8.5 The Consultants shall endeavour to ensure that the Assignment is carried out in accordance with the Programme and shall submit regular programme reviews as part of the progress reports referred to in Clause 9 of this Brief.

9. Progress Reports

9.1 The Consultants shall submit to the Director's Representative progress report at monthly intervals on all aspects of the Services relating progress to the Programme referred to in Clause 8 of this Brief. The report shall include a list of those parts of the Services the execution of which is behind the Programme, together with proposals to expedite progress, so as to complete the work on time. The report shall also include updated expenditure forecasts in accordance with Clause 10 of this Brief.

9.2 The Consultants shall attend meetings with the Director's Representative at monthly or as agreed intervals to review the Consultants' Services and progress and to receive guidance and instructions from the Director's Representative.

10. Financial Management

10.1 At monthly intervals or at such other intervals as the Director's Representative may require, the Consultants shall submit a report on the current and forecast expenditure on the Assignment and the fees due to the Consultants, in a form to be agreed by the Director's Representative.

11. Standards and Specifications

11.1 The Consultants shall adopt such technical and design standards and specifications as are in current use by the Building, Civil Engineering, Drainage Services, Electrical and Mechanical Services, Environment Protection, Fire Services, Highways, Lands, Planning, Transport and Water Supplies Departments or, if non-existent, British Standard Codes of Practice and Specifications. Should instances arise for which suitable standards or specifications do not exist or for which the current standards or specifications appear to require modification or if by the adoption of current standards the Consultants would incur additional expenses not within reasonable contemplation, the Consultants shall submit recommendations on appropriate alternatives to the Director's Representative for agreement.

12. Director's Representative

12.1 The Director's Representative as defined in the General Conditions of Employment shall be Assistant Director/Major Works or such other person as may be authorised by the Director in writing and notified to the Consultants. The Director' Representative may delegate any of the powers and functions vested in him to other officers. If the Consultants are dissatisfied with a decision or instruction of any such officer the matter shall be referred to the Director's Representative for a ruling.

12.2 During the course of the Agreement the Consultants shall report direct to the Director's Representative.

13. Control of the Project and Assignment

13.1 In amplification of Clause 13 of the General Conditions of Employment, the Consultants will be required to attend Steering Group, Study Management Group, Working Group and other ad hoc meetings in connection with the Project and the TIA, EIA and DIA studies, and also meetings of District Board, other committees or public consultation bodies as required by the Director's Representative.

14. Information and Facilities Provided by the Employer

14.1 All available information relevant to the Assignment will be provided to the Consultants. Relevant documents including reports and other background materials are listed in **Appendix B** to this Brief. The Consultants shall indicate for guidance those documents which they currently hold and those of which a copy may be needed, should the Assignment be awarded to them. A copy of each of the documents indicated as needed will be supplied free of charge by the Director's Representative on request from the Consultants, except those currently available from the Sales section of the Information Services Department. In the case of plans and drawing, one transparency and two prints of each plan or drawing may be provided free of charge if requested by the Consultants.

14.2 Notwithstanding any other provisions in this Brief, future year trip matrices from the CTS-2 Model will not be available to the Consultants. Daily vehicle trip ends may be available for reference upon request. The provision of data shall not relieve the Consultants' responsibility of making independent assessments for the Study.

15. Consultants' Office and Staffing

15.1 The Consultants shall maintain for the duration of this Agreement an office in Hong Kong under the control of the Project Director of the Consultants who shall be responsible for the Project. He shall have adequate authority and sufficient professional, technical and administrative support staff in all relevant disciplines to ensure progress to the satisfaction of the Director's Representative.

16. Specialist and Sub-consultant Services

16.1 The Consultants shall provide all specialist and sub-consultant services required for the satisfactory completion of the Assignment. No additional fees or expenses for the provision of such services rendered locally or overseas shall be payable by the Employer except as otherwise provided for in the Schedule of Fees.

17. Surveys

17.1 One velograph and two prints of topographical mapping at 1:20,000, 1:5,000 and 1:1,000 scales prepared by the Survey and Mapping Office of the Lands Department and also one set of digital data for the above 1:20,000 and 1:1,000 basic mapping series in "Microstation .DGN" format prepared by the Highways Department, where available for the area covered by the Project of which the Assignment forms a part, can be obtained free of charge on application to the Director's Representative. The Consultants shall update and verify the accuracy of the information supplied. All field survey work required for the proper execution of the Assignment shall unless otherwise provided for in the Agreement, be the duty of the Consultants. A copy of field notes, field data and resultant plans both of velograph and digital data in "Microstation .DGN" format arising from these surveys shall be handed over to the Director's Representative upon completion of the Assignment. The accuracy as well as presentation of these surveys shall be of a standard agreed by the Director's Representative. **Appendix C** specifies the division of responsibility for other surveying between the Consultants, the Lands Administration Office and Survey and Mapping Office as well as the relevant sub-offices at district level of the Lands Department. The Appendix also sets out the terms and conditions that the Consultants shall observe for the supply of the digital map data.

18. <u>Insurance</u>

18.1 The amount of insurance cover to be maintained in accordance with sub-clause (A) of Clause 47 of the General Conditions of Employment shall be <u>Hong Kong Dollars Seven Million and Eighty Thousand (HK$7,080,000.00)</u>.

APPENDIX B

LEGISLATION AND GUIDELINES

APPENDIX B - LEGISLATION & GUIDELINES

1 NOISE

1.1 Construction Noise

The Noise Control Ordinance (NCO) provides for the control of construction noise in Hong Kong. Assessment procedures and standards are set out in three Technical Memoranda (TM) associated with the Ordinance: the *Technical Memorandum on Noise from Construction Work other than Percussive Piling, Technical Memorandum on Noise from Construction Work in Designated Areas* and the *Technical Memorandum on Noise from Percussive Piling*.

Under the existing provisions, there is no legal restriction on noise generated by construction activities (other than percussive piling) between the hours of 07.00 and 19.00 on normal weekdays. However, EPD's *Practice Note for Professional Persons PN 2/93* sets a non-statutory daytime noise limit of 75 dB(A) $L_{eq\ (30\ min)}$ at the facades of dwellings, and 70 dB(A) at the facades of schools (65 dB(A) during examinations).

For activities outside the hours of 07.00 to 19.00, as well as for percussive piling, the NCO applies and contractors are required to obtain a Construction Noise Permit (CNP) from the Noise Control Authority. CNPs are issued at the discretion of the Noise Control Authority, and any conditions which may be attached to such CNPs should be strictly complied with. Applicable noise limits depend on the Area Sensitivity Rating (ASR) of the area in which the activity takes place. The ASR is itself a function of the type of area, and the degree to which it is influenced by noise sources such as major roads and industry. The areas under consideration in the present assessment can be characterised as:

- ASR "A": rural, village, or low density residential areas not affected by noise from major roads or industry;
- ASR "B": rural, village, or low density residential areas in which noise from major roads is noticeable, but is not a dominant feature;
- ASR "C": urban area.

The applicable acceptable noise limits for evening, night-time and holiday works are shown in Table B.1.

In addition, the NCO requires that hand-held percussive breakers over 10 kg and air compressors bear Noise Emission Labels, certifying that they comply with noise emission standards.

Percussive piling is subject to noise control in the daytime, and is prohibited between 19.00 and 07.00 on normal weekdays and all day on public holidays (including Sunday). Permitted hours of piling depend on the noise levels as received at the worst-affected NSRs. The Acceptable Noise Level (ANL) for piling at these NSRs is 85 dB(A), based on the assumption that the NSRs have windows and no central air conditioning. The permitted hours of piling are shown in Table B.2. CNPs are required for percussive piling.

Table B.1 Hong Kong Construction Noise Level Limits

Time Period	Acceptable Noise Level L_{eq} (dB(A)) at Facade of nearest NSR[3]		
	ASR = A	ASR = B	ASR = C
All days during the evening (1900 to 2300 hours) and general holidays during the daytime and evening (0700 to 2300 hours)[1]	45	50	55
All days during the night-time (2300 to 0700 hours)[1]	30	35	40
Non-holiday daytime (0700 to 1900 hours)[2]	75	75	75

NB: [1] From the NCO *Technical Memorandum on Noise from Construction Working in Designated Areas.*.
[2] From EPD guidelines concerning daytime construction noise levels.
[3] Does not apply to noise from percussive piling.

Table B.2 Construction Noise: Permitted Hours of Operation for Piling

Amount by which Noise from Piling Exceeds the ANL	Permitted Hours of Operation on any Day not being a General Holiday
More than 10 dB(A)	08.00 - 09.00, 12.30 - 13.30 and 17.00 - 18.00
1 to 10 dB(A)	08.00 - 09.30, 12.00 - 14.00 and 16.30 - 18.00
No exceedance	07.00 - 19.00

1.2 Operational Noise

There are currently no statutory controls to limit the impacts from road traffic noise, however the *Hong Kong Planning Standards and Guidelines* (HKPSG) provides criteria which are shown in Table B.3.

Table B.3 Summary of Road Traffic Noise Standards (from HKPSG)

Receiver	Road Traffic $L_{A10 (Peak Hour)}$, dB(A)
Dwelling	70
Hotel and Hostel	70
Office	70
Technical Institute or School	65
Hospital	55

Note: These standards apply to receivers that rely on open windows for ventilation.

In the event of excessive noise resulting from schemes involving new roads, residential premises may be eligible for indirect technical remedies under the ExCo directive "Equitable Redress for Persons Exposed to Increased Noise Resulting from the Use of New Roads," provided that defined criteria are met. These are given as follows:

1. The predicted overall noise level from the new road together with other traffic noise in the vicinity must be above the HKPSG criteria.

2. The predicted noise level must be at least 1.0 dB(A) more than the prevailing noise level, ie the total traffic noise level existing before the works to construct the road were commenced.

3. The contribution to the increase in the noise level from the new road must be at least 1.0 dB(A).

The current policy of EPD is that recommendation for indirect technical remedies can only be made if all of the above criteria are satisfied and if direct technical remedies (eg. pervious road surfacing, noise barriers, enclosures, etc.) have been exhaustively investigated and fail to provide the necessary protection.

2 AIR QUALITY

2.1 Construction Air Quality

The Air Pollution Control Ordinance (Cap. 311) provides powers for controlling air pollutants from a variety of stationary and mobile sources, including fugitive dust emissions from construction sites. It encompasses a number of Air Quality Objectives (AQO). Currently AQOs stipulate concentrations for a range of pollutants, of which total suspended particulates (TSP) is relevant to the study on construction phase air impact. The AQOs are measured at 298 K and 101.325 kPa. The AQO for 24-Hour TSP is 260 μgm^{-3} (not to be exceeded more than once per year) and for annual TSP is 80 μgm^{-3} (arithmetic mean). In addition to the above established legislative controls, it is generally accepted that an hourly average TSP concentration of 500 μgm^{-3} should not be exceeded. Such a control limit is particularly relevant to construction work and has been imposed on a number of construction projects in Hong Kong in the form of contract clauses.

2.2 Operational Air Quality

The Air Pollution Control Ordinance (Cap. 311) provides powers for controlling air pollutants from a variety of stationary and mobile sources. It encompasses a number of Air Quality Objectives (AQO). Currently AQOs stipulate concentrations for a range of air pollutants, of which carbon monoxide (CO), nitrogen dioxide (NO_2) respirable suspended particulates (RSP) are relevant to this Study. The AQOs are listed in Table B.4.

Table B.4 Hong Kong Air Quality Objectives

Parameter	Maximum Average Concentration (μgm^{-3})[1]			
	1-Hour[2]	8-Hour[3]	24-Hour[3]	Annual[4]
CO	30000	10000	-----	-----
NO_2	300	-----	150	80
RSP	-----	-----	180	55

1 Measured at 298 K and 101.325 kPa.
2 Not to be exceeded more than three times per year.
3 Not to be exceeded more than once per year.
4 Arithmetic mean.

3 ECOLOGY

Hong Kong Government legislation and guidelines relevant to this report include the following:

- The Forests and Countryside Ordinance (Cap. 96), which protects both natural and planted forests.
- The Forestry Regulations, which provide for protection of specified local wild plant species.
- The Wild Animals Protection Ordinance (Cap. 170), which provides for protection of listed species of wild animals (excluding fish and marine invertebrates) by prohibiting the disturbance, taking or removal of animals and/or their nests or eggs.
- The Animals and Plants (Protection of Endangered Species) Ordinance (Cap. 187).
- Hong Kong Planning Standards and Guidelines. Chapter 10 (Conservation).

4 WATER QUALITY

The Water Pollution Control Ordinance (WPCO) 1980 (Cap. 358) is the principal legislation governing water quality of marine waters in Hong Kong. Under Sections 4 and 5 of the Ordinance, Water Control Zones (WCZs) may be declared and Water Quality Objectives (WQOs) established for each zone or subzone (for example the WQO for a Fish Culture Subzone may generally be more stringent than for marine waters). The site for the proposed area lies within the Tolo Harbour and Channel Water Control Zone which was gazetted in 1991. Principle features of the WPCO and its subsidiary legislation are as follows:

- The Ordinance specifies prohibited discharges and deposits.
- The Technical Memorandum re-enforces the WPCO, providing further standards for effluent discharged into drainage and sewerage systems, inland waters and coastal waters.
- The Water Pollution Control (Amendment) Ordinance 1990 made various changes to the WPCO including the removal of the 'right to discharge' certain pollutants taking place prior to the gazetting of a Water Pollution Control Zone.

The relevant legislation pertinent to water quality includes:

- Water Pollution Control Ordinance : Cap 358 (1993)
- Water Pollution Control General Regulations (1988)
- Water Pollution Control (Southern Water Control Zone) Order (1988)
- Water Pollution Control (North Western Water Control Zone) Order (1992)
- Water Pollution Control (Western Buffer Water Control Zone) Order (1993)
- Legal Supplement No.2 1990:Water Pollution Control (Amendment) Regulations 1990
- Special Supplement No.5: Technical Memorandum Standards for Effluent Discharged into Drains and Sewerage Systems, Inland and Coastal Waters.
- Dumping at Sea Act 1974 (Overseas Territories Order (1975).

Construction activities at Pak Shek Kok are included within the definition of Civil Engineering Works (including all building works) and are therefore controlled under the WPCO. Water quality objectives for marine waters of Tolo Harbour and Channel WCZ are listed in Table B.5.

Table B.5 Selection of Water Quality Objectives for Marine Waters of Tolo Harbour & Channel WCZ

Water Quality Parameters	Harbour Subzone	Buffer Subzone	Channel Subzone
E. coli (no./100 ml) (annual geometric mean)	not to exceed 610	not to exceed 610	not to exceed 610
Chlorophyll-a (μgL^{-1}) (5 days running mean)	not to exceed 20	not to exceed 10	not to exceed 6
D.O. within 2 m of bottom (mgL^{-1})	not to exceed 2	not to exceed 3	not to exceed 4
D.O. in rest of water column (mgL^{-1})	not to exceed 4	not to exceed 4	not to exceed 4
Light penetration reduction (%)	not to exceed 20% of normal level	not to exceed 15% of normal level	not to exceed 10% of normal level
pH value	not to exceed 0.5	not to exceed 0.3	not to exceed 0.1
Salinity change (ppt)	not to exceed 3	not to exceed 3	not to exceed 3
Temperature change (°C)	not to exceed 1	not to exceed 1	not to exceed 1
Settleable material adversely influencing bottom living communities or basic Harbour geometry	not to be present	not to be present	not to be present
Toxicants	not to be present at levels producing significant toxic effects	not to be present at levels producing significant toxic effects	not to be present at levels producing significant toxic effects

A Technical Memorandum to the WPCO, defines standards for effluents discharged to drainage and sewerage systems, inland and coastal waters. The standard for discharges to Tolo Harbour are given in Table B.6.

All effluents covered by this TM are required to be licensed. For the purposes of this legislation, inshore waters refer to all waters of less than 6m depth at mean low water (MLW) or within 200 metres of the low water mark.

Restrictions are placed on the location of new discharges. According to the TM, no new discharge will be allowed:

- within 100 m of the boundaries of a gazetted beach in any direction;
- within 200 m of the seaward boundary of a marine fish culture zone or a Site of

Special Scientific Interest (SSSI), and within 100 m of the landward boundary;
- in any typhoon shelter;
- in any marina;
- within 100 m of a seawater intake point.

Table B.6 Standards for Effluent Discharged into Coastal Waters of Tolo and Port Shelter Water Control Zone

Flow rate (m^3/day) Determinant	≤10	>10 and ≤200	>200 and ≤400	>400 and ≤600	>600 and ≤800	>800 and ≤1000	>1000 and ≤1500	>1500 and ≤2000	>2000 and ≤3000	>3000 and ≤4000	>4000 and ≤5000	>5000 and ≤6000
pH (pH units)	6-9	6-9	6-9	6-9	6-9	6-9	6-9	6-9	6-9	6-9	6-9	6-9
Temp. (°C)	45	45	45	45	45	45	45	45	45	45	45	45
Colour (lovibond units)	1	1	1	1	1	1	1	1	1	1	1	1
Suspended solids	30	30	30	30	30	30	15	15	15	15	15	15
BOD	20	20	20	20	20	20	10	10	10	10	10	10
COD	80	80	80	80	80	80	50	50	50	50	50	50
Oil & Grease	20	20	20	20	20	20	10	10	10	10	10	10
Iron	10	10	10	7	5	4	2.7	2	1.3	1	0.8	0.6
Boron	5	4	3	2.5	2	1.6	1.1	0.8	0.5	0.4	0.3	0.2
Barium	5	4	3	2.5	2	1.6	1.1	0.8	0.5	0.4	0.3	0.2
Mercury	0.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Cadmium	0.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Other toxic metals	1	1	0.8	0.5	0.5	0.4	0.1	0.1	0.1	0.1	0.1	0.1
Total toxic metals	2	2	1.6	1	1	0.8	0.2	0.2	0.2	0.2	0.14	0.1
Cyanide	0.1	0.1	0.1	0.1	0.1	0.1	0.05	0.05	0.03	0.02	0.02	0.01
Phenols	0.5	0.5	0.5	0.25	0.25	0.25	0.1	0.1	0.1	0.1	0.1	0.1
Sulphide	5	5	5	5	5	5	2.5	2.5	1.5	1	1	0.5
Total residual chlorine	1	1	1	1	1	1	1	1	1	1	1	1
Total N	20	20	20	15	15	15	15	15	10	10	10	10
Total P	8	8	5	5	5	5	5	5	5	5	5	5
Surfactant total	15	15	15	15	15	15	10	10	10	10	10	10
E.coli No/100 ml	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000

Source : EPD Technical Memorandum on Effluent Standards, Table 7
NB: All units in $mg.l^{-1}$ unless otherwise stated; all figures are upper limits unless otherwise indicated

The water quality at seawater intakes is subject to additional criteria depending on its use. For flushing water, Water Supplies Department (WSD) has stipulated the criteria shown in Table B.7.

Table B.7 Water Quality Objectives for WSD Flushing Water

Parameter		WSD Flushing Water Target
colour	(HU)	< 20
turbidity	(NTU)	< 10
threshold odour no.		< 100
ammoniacal nitrogen	(mg L^{-1})	< 1
suspended solids	(mg L^{-1})	< 10
dissolved oxygen	(mg L^{-1})	> 2
biochemical oxygen demand	(mg L^{-1})	< 10
synthetic detergents	(mg L^{-1})	< 5
E. coli	(per 100 ml)	< 20,000

5 WASTE

The principal legislation controlling waste materials in Hong Kong is the Waste Disposal Ordinance [Cap.354] (WDO)). Enacted in 1980, this ordinance generally encompasses all stages of the complex waste management chain from the place of arising the final disposal point.

Under the WDO, a number of provisions for dealing with certain types of waste are also available. They include the Waste Disposal (Chemical Waste) (General) Regulation under the WDO relevant to the project. Enacted in 1992, it has provided control on all aspects of chemical waste disposal. This includes storage, collection, transport, treatment and final disposal.

Another existing ordinance pertaining to hazardous materials is the Dangerous Goods Ordinance [Cap 259](DGO). This ordinance provides for the definition of dangerous goods by category and controls of their storage and transport.

Dredging and dumping for land formation is controlled under the Dumping at Sea Act 1974 (Overseas Territories) Order 1975. It provides for the control of marine dumping by means of a licence.

The Works Branch of the Government Secretariat has released a Technical Circular (No 22/92) on Marine Disposal of Dredged Mud, in which it specifies the procedures for large volumes of uncontaminated mud (more than 0.5 Mm^3) and any volume of contaminated mud. It also defines degree of contamination criteria which are presented in Table B.8.

Table B.8 Classification of Sediments by Metals Content ($mgkg^{-1}$ dry weight)

	Cadmium	Chromium	Copper	Mercury	Nickel	Lead	Zinc
Class A	0.0-0.9	0-49	0-54	0.0-0.7	0-34	0-64	1-140
Class B	1.0-1.4	50-79	55-64	0.8-0.9	35-39	65-74	150-190
Class C	1.5 or more	80 or more	65 or more	1.0 or more	40 or more	75 or more	200 or more

Depending upon the degree of contamination, disposal options are determined as follows:

- Class A spoil is regarded as uncontaminated or as mildly contaminated material. For this class, no restrictions will be required during dredging, transportation and disposal beyond those normally applied.
- Class B spoil is treated as moderately contaminated and special care is required during dredging and transportation of such material.
- Class C spoil is considered heavily contaminated. Special dredging and transportation procedures should be adopted. Sediments of this type can not be

dumped in gazetted marine disposal grounds and should be disposed off at a special borrow pit.

It should be noted that it is only necessary for the criterion of one element to be exceeded for a sediment to be put into a particular class.

APPENDIX C

PRELIMINARY SEDIMENT QUALITY REPORT

Appendix C. Preliminary Sediment Quality Report

1. Classification Criteria for Contaminated Sediments

A "*Technical Circular (No 22/92) on Marine Disposal of Dredged Mud*", released by the Works Branch of the Government Secretariat, specifies criteria for defining the degree of sediment contamination. These standards are presented in Table 1.

Table 1 Classification of Sediments by Metals Content (mgkg^{-1} dry weight)

	Cadmium	Chromium	Copper	Mercury	Nickel	Lead	Zinc
Class A	0.0-0.9	0-49	0-54	0.0-0.7	0-34	0-64	1-140
Class B	1.0-1.4	50-79	55-64	0.8-0.9	35-39	65-74	150-190
Class C	1.5 or more	80 or more	65 or more	1.0 or more	40 or more	75 or more	200 or more

Depending upon the degree of contamination, disposal options are determined as follows:

- Class A spoil is regarded as uncontaminated or as mildly contaminated material. For this class, no restrictions will be required during dredging, transportation and disposal beyond those normally applied.
- Class B spoil is treated as moderately contaminated and special care is required during dredging and transportation of such material.
- Class C spoil is considered heavily contaminated. Special dredging and transportation procedures should be adopted.

It should be noted that it is only necessary for the criterion of one element to be exceeded for a sediment to be put into a particular class.

2. Analytical Results and Conclusions

In order to determine an appropriate sediment disposal method, marine mud samples along the proposed road alignment (Figure 1) were collected and analysed at 3 stations, VC1, VC2 and VC3 in August/September 1996. There was a total of 14 sediment samples being collected at 0 m, 1.0m, 2.0m, 3.0m and 3.5m below the surface level for each station, except the one at 0m for station VC1. Each sample was analyzed for copper, cadmium, chromium, lead, nickel, zinc and mercury content. Their analytical results are tabulated in Table 2. In additional, the graphical results for copper, chromium, lead, nickel and zinc are also presented in Figures 2 to 6.

Table 2   **Analytical Results (mgkg^{-1}, dry at 103 - 105°C)**

Sample Identification	Cu	Cd	Cr	Pb	Ni	Zn	Hg	Classification of Contamination Level (*)
VC1 0.9-1.9m	16	<0.2	15	140	4.1	130	0.19	C
VC1 1.9-2.0m	11	<0.2	18	90	6.0	150	<0.05	C
VC1 2.9-3.0m	13	<0.2	19	110	6.1	160	<0.05	C
VC1 3.4-3.5m	15	<0.2	19	120	6.5	170	<0.05	C
VC2 0.0-0.1m	16	<0.2	7.3	71	2.9	91	<0.05	B
VC2 0.9-1.0m	31	0.31	30	120	5.2	260	0.18	C
VC2 1.9-2.0m	5.4	<0.2	1.7	17	<1	20	<0.05	A
VC2 2.9-3.0m	9.3	<0.2	14	77	4.0	97	<0.05	C
VC2 3.4-3.5m	8.3	<0.2	10	57	3.0	75	<0.05	A
VC3 0.0-0.1m	17	<0.2	21	76	7.1	88	<0.05	C
VC3 0.9-1.0m	10	<0.2	26	62	9.7	110	<0.05	A
VC3 1.9-2.0m	12	<0.2	27	77	10	130	<0.05	C
VC3 2.9-3.0m	13	<0.2	25	77	8.3	110	<0.05	C
VC3 3.4-3.5m	12	<0.2	23	66	8.6	110	<0.05	B

Source: Volume II, Laboratory Testing, Final laboratory Testing Report (HOKLAS Results and AGS Data)

These results show that except for lead and zinc, concentrations of the other metals were in the Class A level. Contamination levels against depths for lead and zinc are presented in Figures 7 and 8. Figure 7 indicates that serious contamination of Class C level for lead occurred across all depths at all the stations. Particularly at VC1, Class C contamination was found at all the measured depths. For zinc, concentrations were within Class A for VC3 and were between Classes A and B levels at other stations except one measured at 1.0m at VC2 which reached Class C limit.

In accordance with the criteria mentioned above, concentration of only one metallic element to be exceeded for a sediments to be put into a particular class and because contamination of Class C level for lead was found at all stations across all depths, the tested samples are classified as seriously contaminated. Therefore, special handling is required for the marine sediments to be dredged for this study.

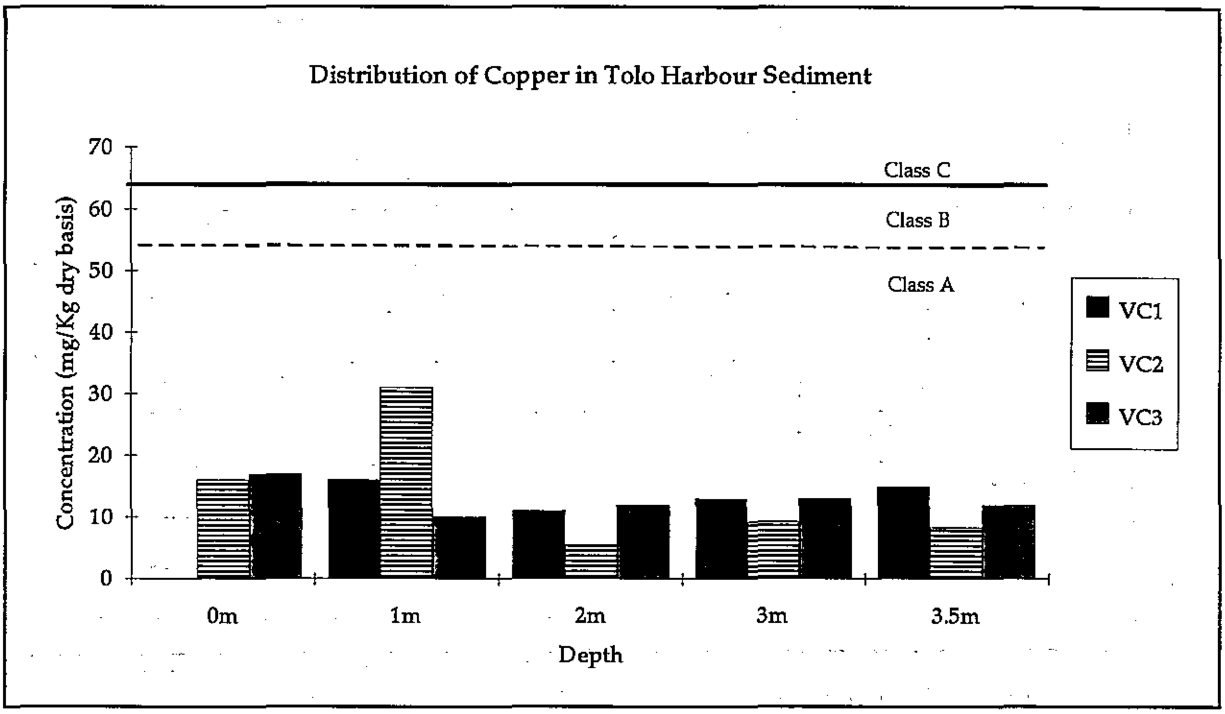

Figure 2 Distribution of Copper in Tolo Harbour Sediment

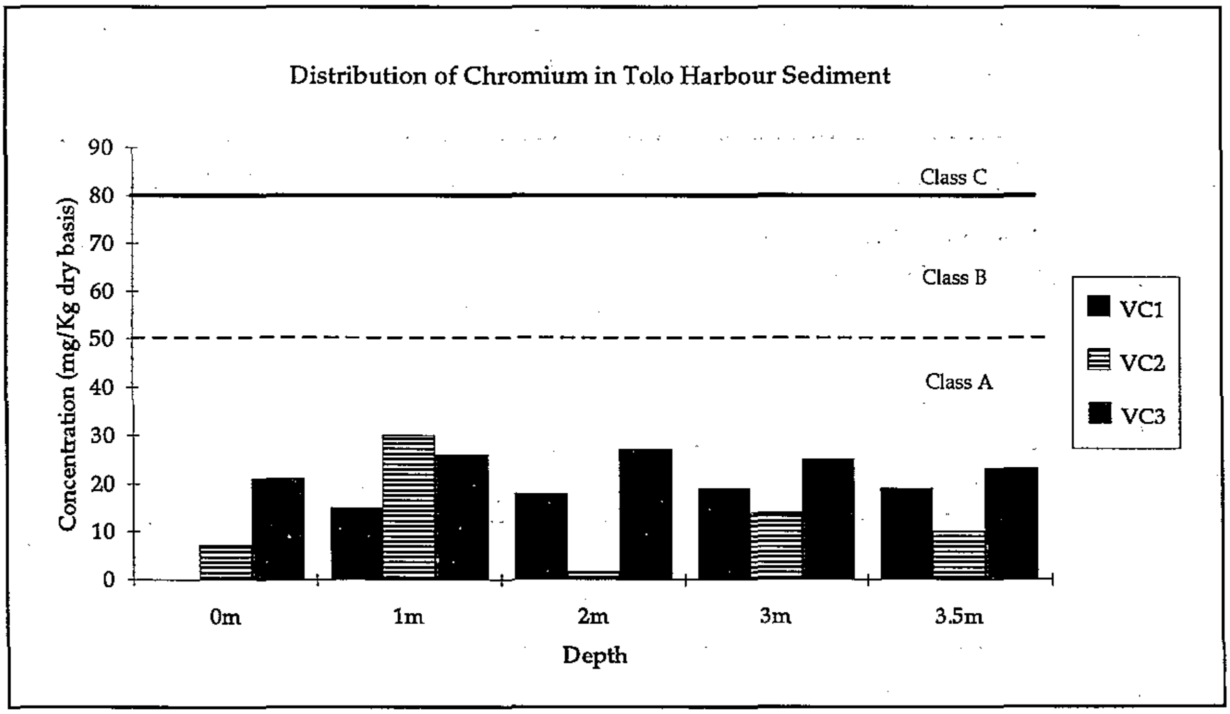

Figure 3 Distribution of Chromium in Tolo Harbour Sediment

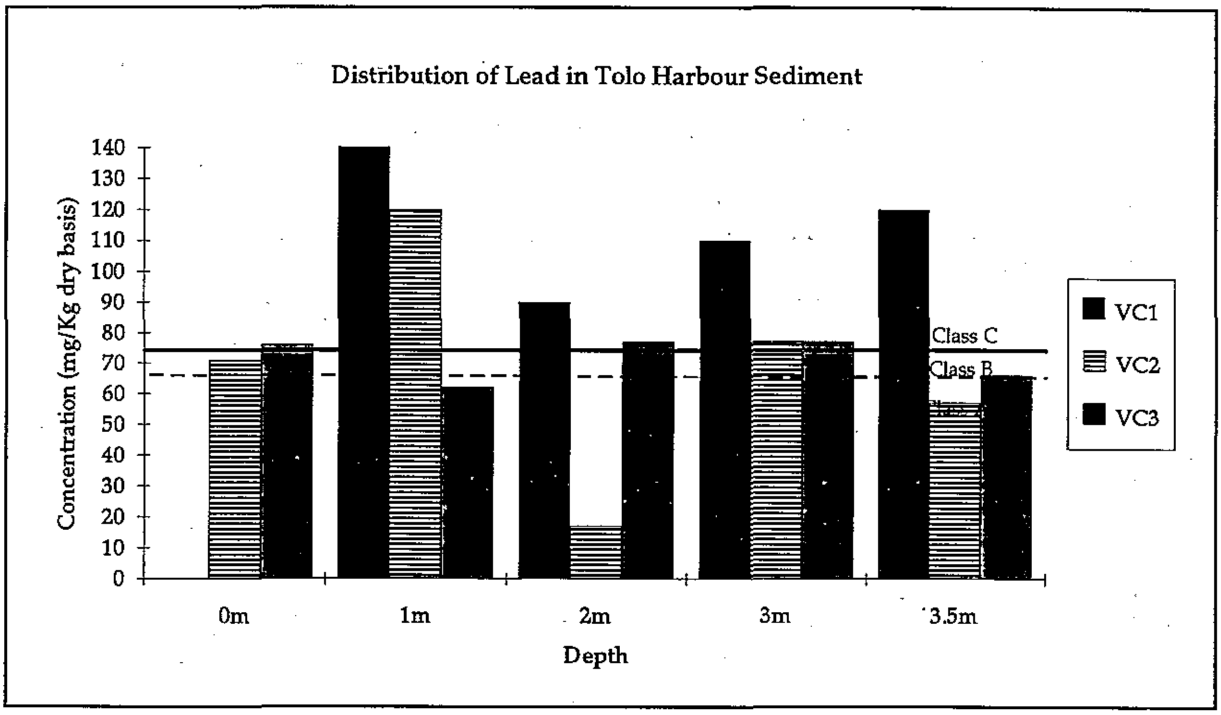

Figure 4 Distribution of Lead in Tolo Harbour Sediment

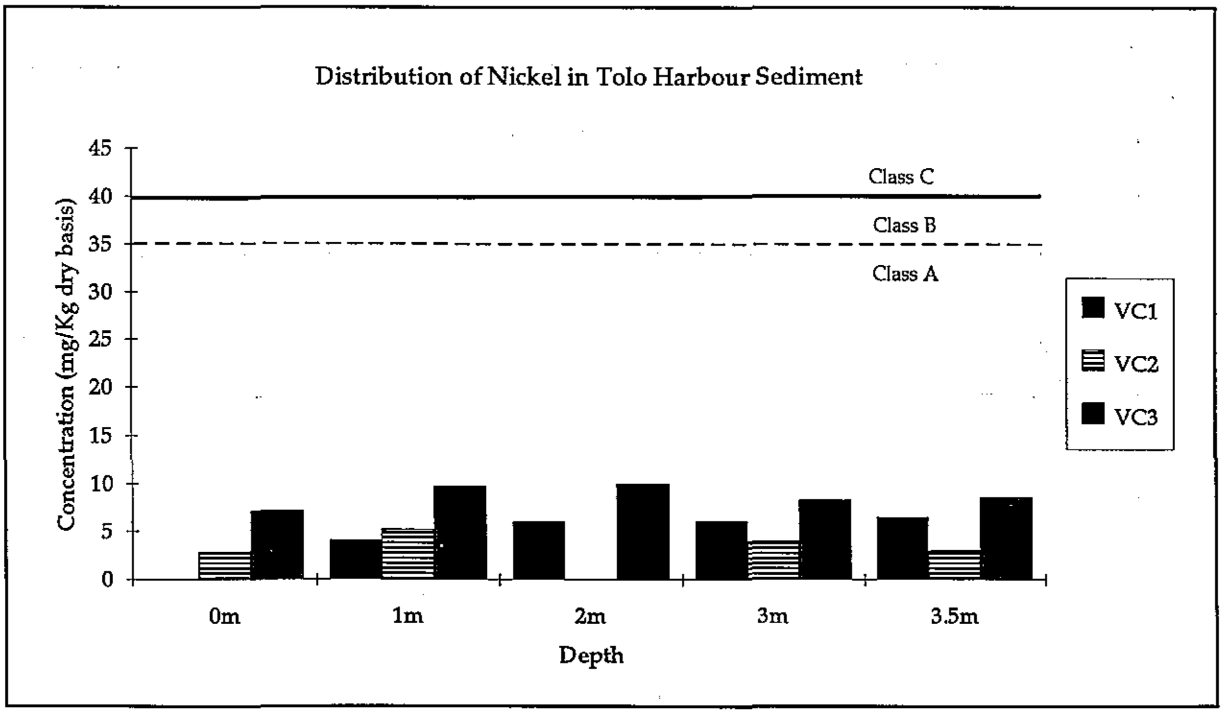

Figure 5 Distribution of Nickel in Tolo Harbour Sediment

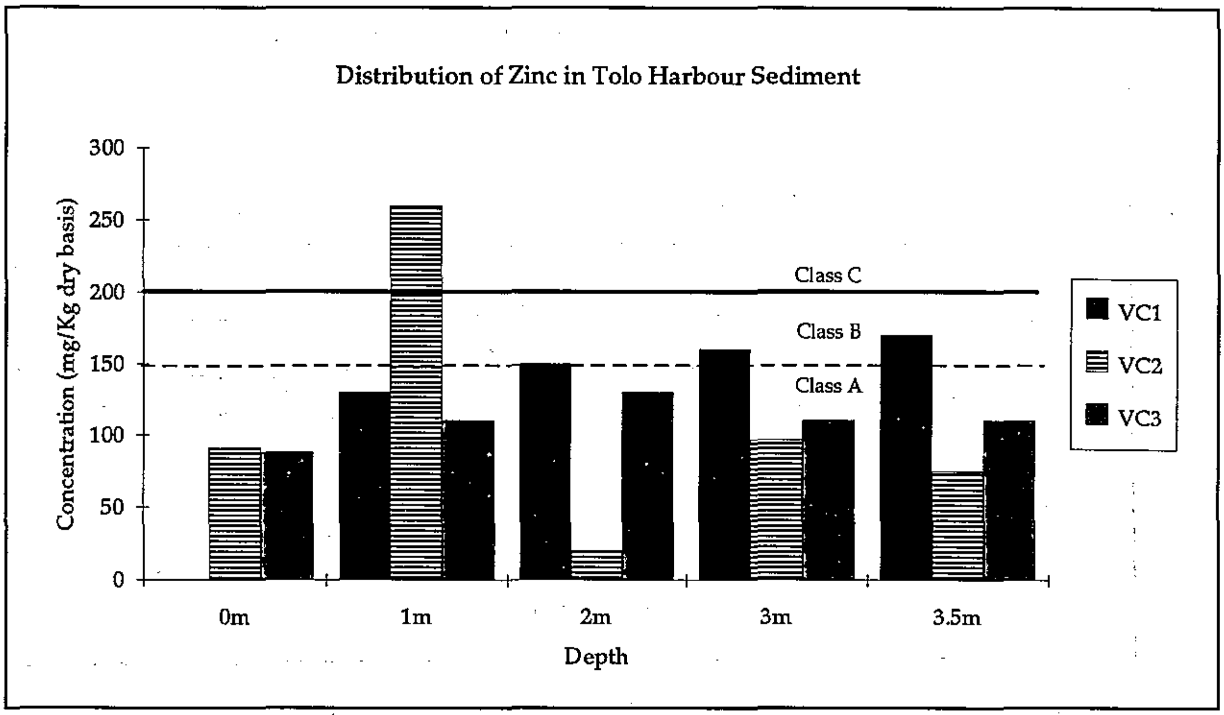

Figure 6 Distribution of Zinc in Tolo Harbour Sediment

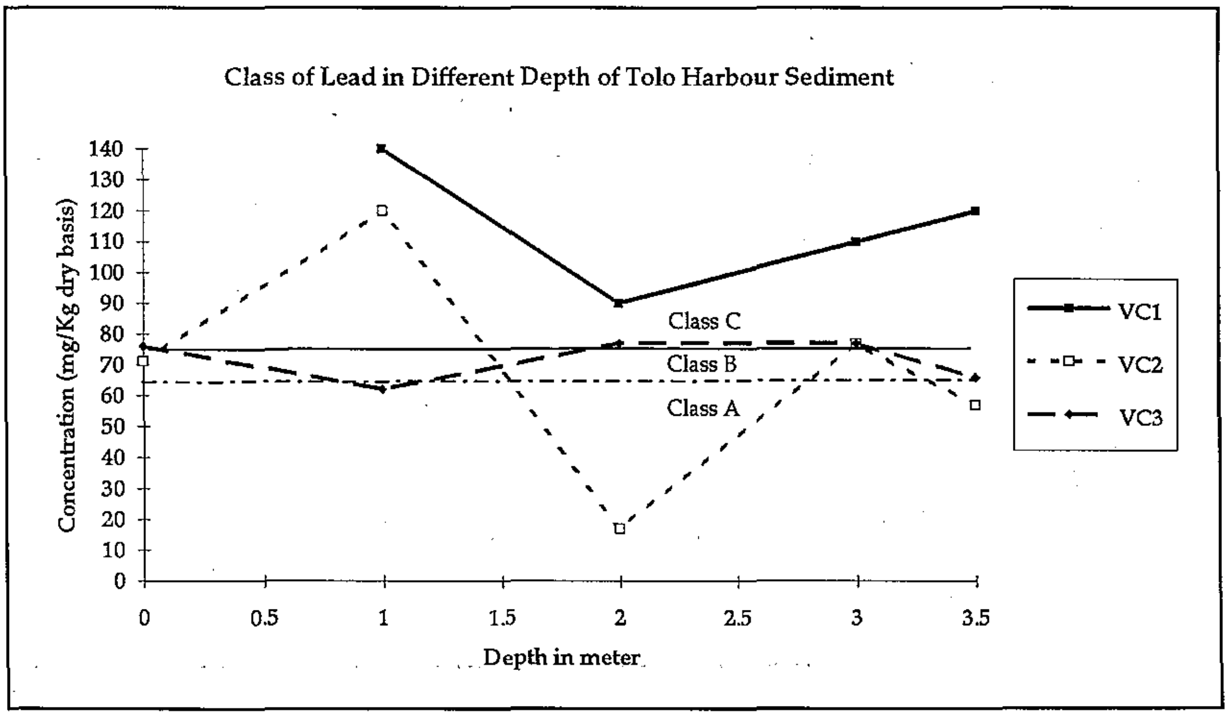

Figure 7 Class of Lead in Different Depth of Tolo Harbour Sediment

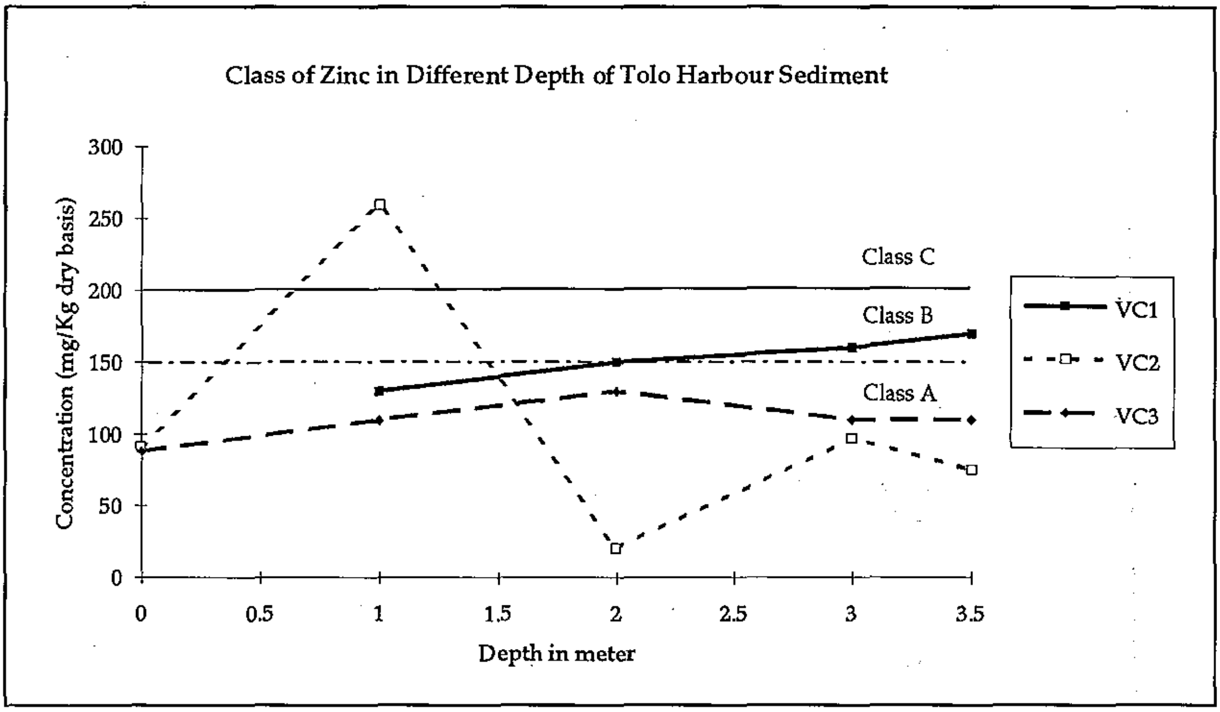

Figure 8 Class of Zinc in Different Depth of Tolo Harbour Sediment

APPENDIX D

SPECIMEN ENVIRONMENTAL CONTROL CLAUSES

APPENDIX D: RECOMMENDED POLLUTION CONTROL CLAUSES FOR CONSTRUCTION CONTRACTS

CES

The following Recommended Pollution Control Clauses are generally good engineering practice to minimise inconvenience and environmental nuisance to nearby residents and other sensitive receivers. Modifications may be necessary to suit specific site conditions and detailed construction methods.

1. AVOIDANCE OF NUISANCE & POLLUTION

(a) The Contractor shall take all reasonable precautions to avoid any nuisance arising from its operations. This should be accomplished where at all possible by suppression of the nuisance at source rather than abatement of the nuisance once generated.

(b) All works are to be carried out in such a manner as to cause as little inconvenience as possible to nearby residents, property and to the public in general, and the Contractor shall be held responsible for any claims which may arise from such inconvenience.

(c) The Contractor shall be responsible for the adequate maintenance and clearance of channels, gullies etc and shall also provide and maintain such pedestrian and vehicular access as shall be directed within the works site.

(d) Water shall be used to prevent dust rising and the Contractor shall take every precaution to prevent the excavated materials from entering into the public drainage system.

(e) The Contractor shall carry out the Works in such a manner as to minimise adverse impacts on the environment during execution of the Works.

(f) The Contractor shall comply with all current legislation and regulations including:

a) Noise Control Ordinannce (Cap 400)

b) Air Pollution Control Ordinance (Cap 311)

c) Water Pollution Control Ordinance (Cap 358)

d) Dumping at Sea Act 1974 (Overseas Territory Order) 1975

e) Merchant Shipping (Oil Pollution) (Hong Kong) Order 1975

f) Summary Offences Ordinance (Cap 228)

g) Factories and Industrial Undertakings Ordinance (Cap 59)

h) Waste Disposal Ordinance (Cap 354)

i) Public Cleansing and Prevention of Nuisances (Regional Council) By-Laws (Cap 132)

j) Public Cleansing and Prevention of Nuisances (Urban Council) By-Laws (Cap 132)

k) Building Ordinance (Cap 123)

l) Building Ordinance (Application to New Territories) Ordinance (Cap 121)

m) Public Health and Municipal Services Ordinance (Cap 132)

n) Waste Disposal (Chemical Waste) (General) Regulation (Cap 354)

2. NOISE POLLUTION CONTROL

Clauses that should always be included in the Contract

To comply with Environmental Protection Legislation

(a) The Contractor shall comply with and observe the Noise Control Ordinance and its subsidiary regulations in force in Hong Kong.

Non-Statutory Noise Control

(b) In addition to the requirements imposed by the Noise Control Ordinance, to control noise generated from equipment and activities for the purpose of carrying out any construction work other than percussive piling during the time period from 0700 to 1900 hours on any day not being a general holiday (including Sundays), the following requirements shall also be complied with:

(i) The noise level measured at 1m from the most affected external facade of the nearby noise sensitive receivers from the construction work alone during any 30 minute period shall not exceed an equivalent sound level (L_{eq}) of 75 dB(A).

(ii) The noise level measured at 1m from the most affected external facade of the nearby schools from the construction work alone during any 30 minute period shall not exceed an equivalent sound level (L_{eq}) of 70 dB(A) [65 dB(A) during school examination periods].

The Contractor shall liaise with the schools and the Examination Authority to ascertain the exact dates and times of all examination periods during the course of the contract.

(Guidance note:- Sub-clause (c) (ii) can be deleted if the schools are either:

1) more than 800m away from the construction site with no obstructions in between.

2) more than 300m away from the Construction Site with obstructions in between that can effectively screen off the construction noise).

(iii) Any stoppage or reduction in output resulting from compliance with this clause shall not entitle the Contractor to any extension of time for completion or to any additional costs whatsoever.

Housekeeping Clauses to Promote Noise Consciousness at Site

(c) Before the commencement of any work, the Engineer may require the methods of working, equipment and sound-reducing measures intended to be used on the Site to be made available for inspection and approval to ensure that they are suitable for the project.

(d) The Contractor shall devise, arrange methods of working and carry out the Works in such a manner so as to minimise noise impacts on the surrounding environment, and shall provide experienced personnel with suitable training to ensure that these methods are implemented.

(Guidance note:- The noise reduction methods include scheduling of works; Siting of facilities; Selection of quiet equipment; and Use of purpose-built acoustic panels and enclosures.)

(e) The Contractor shall ensure that all plant and equipment to be used on site are properly maintained in good operating condition and noisy construction activities shall be effectively sound-reduced by means of silencers, mufflers, acoustic linings or shields, acoustic sheds or screens or other means to avoid disturbance to any nearby noise sensitive receivers.

(f) Notwithstanding the requirements and limitations set out in clause (c) above and subject to compliance with clauses (e) and (f) above, the Engineer may upon application in writing by the Contactor, allow the use of any equipment and the carrying out of any construction activities for any duration provided that he is satisfied with the application which, in his opinion, to be of absolute necessity and adequate noise insulation has been provided to the educational institutions to be affected, or of emergency nature, and not in contravention with the Noise Control Ordinance in any respect.

Contract Clauses to be considered when the Construction Site is located close to Noise Sensitive Receivers

(g) No excavator mounted breaker shall be used within 125m from any nearby noise sensitive receivers. The Contractor shall use hydraulic concrete crusher whenever applicable.

(Guidance note:- This should be encouraged for demolition contracts where the site is less than 125m from nearby noise sensitive receivers. Quieter hydraulic concrete crushers will be expected to meet the relevant noise limits in the contracts).

(h) The only equipment that shall be allowed on the Site for rock drilling works will be quiet drilling rigs with a sound power level not exceeding 110 dB(A). Conventional pneumatically driven drilling rigs are specifically prohibited.

(Guidance note:- This should be encouraged for site formation contracts where the site is less than 250m from nearby noise sensitive receivers. The 110 dB(A) sound power level specified for drilling rigs may be relaxed if the site is more than 141m from nearby noise sensitive receivers).

(i) Do not operate the ________________ during the period from ______ to ________ __ in locations ____________________ .

(Guidance notes:-

1) Whatever equipment or processes to be inserted in the first blank shall be determined by the Engineer who is aware of the constraints involved in the site conditions and the specific method of construction.

2) This clause will be particularly useful in situations where there are many schools around the site.)

(j) Provide air-conditioners to ________________.

(Guidance note:-

1) The blank is there for specific premises identified for each site. It is likely that educational institutes will need to be considered.

2) A judgement need to be made having regards to the cost of providing air-conditioning and the delay to the project that would have otherwise resulted due to the imposition of other controls. It is therefore appropriate that this clause be used in conjunction with clause (h).)

(k) For the purposes of the above clauses, any domestic premises, hotels, hostel, temporary housing accommodation, hospital, medical clinic, educational institution, place of public worship, library, court of law, performing arts centre or office building shall be considered a noise sensitive receiver.

<u>Other Useful Contract Clauses related to Noise Control</u>

(l) The Contractor shall, when necessary, apply as soon as possible for a construction noise permit in accordance with the Noise Control (General) Regulations, display the permit as required and copy to the Engineer. The Contractor is to note that neither the Authority nor its employees can influence the issue or terms of a construction noise permit.

(Guidance note:- This clause is suitable where percussive piling or nightwork is anticipated.)

3. DUST SUPPRESSION MEASURES

(a) The Contractor shall undertake at all times to prevent dust nuisance as a result of construction activities. Installed air pollution control systems shall be operated whenever the plant is in operation.

(b) The Contractor shall at his own cost, and to the satisfaction of the Engineer, install effective dust suppression equipment and take such other measures as may be necessary to ensure that the levels given in the following table are not exceeded at the site boundary and any nearby sensitive receiver.

Concentration limits in micrograms per cubic metre measured at 25°C and one atmosphere for an averaging time of:

	1 hr (i)	24 hr (ii)	1 year (iii)
Total Suspended Particulates	500	260	80
Respirable Suspended Particulates	-	180	55

Notes:

(i) Not to be exceeded more than 3 times per year
(ii) Not to be exceeded more than once per year
(iii) Arithmetic mean

(c) In the process of material handling, any material which has the potential to create dust shall be treated with water or sprayed with wetting agent.

(d) Where dusty materials are being discharged to vehicle from a conveying system at a fixed transfer point, a three-sided roofed enclosure with a flexible curtain across the entry shall be provided. Exhaust should be provided for this enclosure and vented to a fabric filter system.

(e) Any vehicle with an open load carrying area used for moving materials which have the potential to create dust shall have properly fitting side and tail boards. Materials having the potential to create dust shall not be loaded to a level higher than the side and tail boards, and shall be covered by a clean tarpaulin. The tarpaulin shall be properly secured and shall extend at least 300mm over the edges of the side and tail boards.

(f) Stockpiles of sand and aggregate greater than 20m^3 shall be enclosed on three sides, with wall extending above the pile and 2 meters beyond the front of the pile. In addition, water sprays shall be provided and used both to dampen stored materials and when receiving raw material.

(g) The Contractor shall frequently clean and water the site to minimise the fugitive dust emissions.

(h) The Contractor shall restrict all motorised vehicles to a maximum speed of 8km per hour and confine haulage and delivery vehicles to designated roadways inside the site. Areas of roadway longer than 100m where movement of motorised vehicles exceeds 100 vehicular movements/day or as directed by the Engineer shall be furnished with a flexible pavement surfacing.

(i) Wheel washing facilities shall be installed and used by all vehicles leaving the site. No earth, mud, debris, dust and the like shall be deposited on public roads. Water in the wheel cleaning facility shall be changed at frequent intervals and sediments shall be removed regularly. The Contractor shall submit details of proposals for the wheel cleaning facilities to the Engineer prior to construction of the facility. Such wheel washing facility shall be usable prior to any earthworks excavation activity on the Site. The Contractor shall also provide a hard-surfaced road between washing facility and the public road.

(j) Conveyor belts shall be fitted with windboards, and conveyor transfer points and hopper discharge areas shall be enclosed to minimise emission of dust. All conveyors carrying materials which have the potential to create dust shall be totally enclosed and fitted with belt cleaners.

(k) Cement or pulverised fuel ash delivered in bulk shall be stored in closed silos fitted with high level alarm indicator. The high level alarm indicators shall be interlocked with the filling line such that in the event of the hopper approaching an overfull condition, an audible alarm will operate, and after 1 minute the pneumatic line to the filling tanker will close.

(l) All air vents on cement silo shall be fitted with fabric filters provided with either shaking or pulse-air cleaning mechanisms. The fabric filter area shall be determined using the air to cloth ratio (0.01 - 0.03 m/s) or the filtering velocity.

(m) Weigh hoppers shall be vented to suitable filter.

(n) The filter bags in the cement silo dust collector must be thoroughly shaken after cement is blown into the silo to ensure adequate dust collection for subsequent loading.

(o) For dry mix bathing, the process should be done in total enclosure with exhaust to fabric filter.

(p) All cement and concrete trucks are to be effectively washed down after loading and prior to leaving the works.

(Guidance Note:

1) Discretion should be exercised to select the appropriate clauses from above for different situations. The following are some suggestion :

i)	*Construction sites without concrete batching*	*delete 3(k) to 3(p)*
ii)	*Small works area and storage of material*	*delete 3(h) to 3(p)*
iii)	*Very simple case*	*delete 3(b) to 3(p)*

2) Item 3(c) is not applicable to the handling of cement and the like.

3) The Contractor should note that concrete bactching in the main urban area is not normally allowed.)

4. <u>CONSENT TO OPERATE EQUIPMENT AND PROCESSES</u>

(a) The Contractor shall not install any furnace, boiler or other plant or equipment or use any fuel that might in any circumstance produce smoke or any other air pollution without the prior consent of the Engineer. Unless specifically instructed by the Engineer, the Contractor shall not light fires on site for the burning of debris or any other matter.

(b) The Contractor's attention is drawn to the Air Pollution Control Ordinance and its subsidiary legislation, particularly the Air Pollution (Furnaces, Ovens and Chimneys) (Installation and Alteration) Regulations and the Air Pollution Control (Smoke) Regulations.

5. REMOVAL OF WASTE MATERIAL

Liquid Waste

(a) The Contractor shall not permit any sewage, waste water or effluent containing sand, cement, silt or any other suspended or dissolved material to flow from the site onto any adjoining land or allow any waste mater or refuse to be deposited anywhere within the site or onto any adjoining land and shall have all such matter removed from the site.

(b) The Contractor shall be liable for any damages caused to adjoining land through his failure to comply with clause 5(a).

(c) The Contractor shall be responsible for temporary training, diverting or conducting of open streams or drains intercepted by any works and for reinstating these to their original courses on completion of the Works.

(d) The Contractor shall be responsible for adequately maintaining any existing site drainage system at all times including removal of solids in sand traps, manholes and stream beds.

(e) Any proposed stream course and nullah temporary diversions shall be submitted to the Engineer for agreement one month prior to such diversion works being commenced. Diversions shall be constructed to allow the water flow to discharge without overflow, erosion or washout. The area through which the temporary diversion runs is to be reinstated to its original condition or as agreed by the Engineer after the permanent drainage system has been completed.

(f) The Contractor shall furnish, for the Engineer's information, particulars of the Contractor's arrangements for ensuring that material from any earthworks does not wash into the drainage system. If at any time such arrangements prove to be ineffective the Contractor shall take such additional measures are the Engineer shall deem necessary and shall remove all silt which may have accumulated in the drainage system whether within the Site or not.

Solid Waste

(g) The Contractor shall segregate all inert construction waste material suitable for reclamation or land formation and shall dispose of such material at such public dumping area(s) as may be specified from time to time by the Director of Civil Engineering Services.

(h) Inert meterial deemed unsuitable for reclamation or land formation and all non-inert construction waste material deemed unsuitable for reclamation or land formation and all other waste material shall be disposal of at a public landfill.

(i) Chemical waste as defined by Schedule 1 of the Waste Regulations (Chemical 1992, should be stored in accordance with approved methods defined in the Regulations and the chemical waste disposed of at the Chemical Waste Treatment Facility located at Tsing Yi.

(j) The Contractor's attention is drawn to the Waste Disposal Ordinance, the Public Health the Municipal Services Ordinance and the Water Pollution Control Ordinance.

Any dredged material shall be disposed of at an approved marine dumping ground. One of the approved marine dumping grounds is the Gazetted Marine Dumping

Ground at the _________. The Contractor shall apply to relevant authorities under the Dumping at Sea Act for a marine dumping licence.

6. <u>DISCHARGE INTO SEWERS AND DRAINS</u>

(a) The Contractor shall not discharge directly or indirectly (by runoff) or cause or permit or suffer to be discharged into any public sewer, storm-water drain, channel, stream-course or sea any effluent or foul or contaminated water or cooling or hot water without the prior consent of the Engineer who may require the Contractor to provide, operate and maintain at the Contractor's own expense, within the premises or otherwise, suitable works for the treatment and disposal of such effluent or foul or contaminated or cooling or hot water. The design of such treatment works shall be submitted to the Engineer for approval not less than one month prior to the commencement of construction or as agreed by the Engineer.

(b) All water and other liquid waste products arising on the Site shall be collected, removed from Site via a suitable and properly designed temporary drainage system and disposed of at a location and in a manner that shall not cause either pollution or nuisance. In addition, the effluents shall comply with the standards stated in the "Technical Memorandum on Standards for Effluent discharged into Drainage and Sewerage Systems, Inland and Coastal Waters" for the appropriate Water Control Zone, whether or not the Zone has been declared as one subject to control of discharges.

(c) If any office, site canteen or toilet facilities is erected, foul water effluent shall be directed to a foul sewer or to a sewage treatment facility either directly or indirectly by means of pumping or other means approved by the Engineer.

(d) The Contractor's attention is drawn to the Buildings Ordinance, Water Pollution Control Ordinance and the Technical Memorandum "Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters" issued by EPD.

APPENDIX E

TECHNICAL DATA: ECOLOGY

APPENDIX E: TECHNICAL DATA - ECOLOGY

1. Species List of Terrestrial Vegetation along Tolo Highway.

Species	Life	Abundance	Status	Exotic
Bambusa vulgaris	bamboo	++	planted	exotic
Smilax china	climber	++		
Bauhinia championi	climber	++		
Bougainvillea glabra	climber	++	planted	exotic
Buettneria cochinchinensis	climber	++		
Cocculus orbiculatus	climber	+		
Embelia laeta	climber	++		
Gymnema sylvestre	climber	+		
Paederia scandens	climber	++		
Nephrolepis hirsutata	fern	+		
Pteris semipinnata	fern	++		
Imperata cylindrica	grass	++		
Miscanthus floridulus	grass	++		
Neyraudia reynaudiana	grass	+++		
Panicum maximum	grass	+++	naturalize	exotic
Rhynchelytrum repens	grass	+++		
Bidens pilosa	herb	++	naturalize	exotic
Bryophyllum pinnatum	herb	++		
Conyza bonariensis	herb	+		
Musa paradisiaca	herb	+	planted	exotic
Polygonum chinense	herb	+		
Praxelis clematidae	herb	++	naturalize	exotic
Sonchus oleraceus	herb	+		
Wedelia chinensis	herb	+		
Rhapis excelsa	palm	+	planted	exotic
Roystonea regia	palm	+		
Breynia fruticosa	shrub	+		
Calliandra haematocephala	shrub	++	planted	exotic
Clerodendrum inerme	shrub	++		
Lantana camara	shrub	++	naturalize	exotic
Ligustrum sinense	shrub	++	planted	
Malvaviscus arboreus	shrub	+	planted	exotic
Murraya exotica	shrub	++	planted	exotic
Psychotria rubra	shrub	++		
Rhaphiolepis indica	shrub	+++		
Rhododendron pulchrum	shrub	++	planted	exotic
Rhus chinensis	shrub	++		

Wikstroemia indica	shrub	+		
Acacia confusa	tree	+++	planted	exotic
Albizia lebbeck	tree	++	planted	exotic
Araucaria cunninghamii	tree	+	planted	exotic
Bauhinia variegata	tree	+	planted	exotic
Bombax malabricum	tree	+	planted	exotic
Bridelia tomentosa	tree	++		
Casuarina equisetifolia	tree	+++	planted	exotic
Cerbera manghas	tree	++		
Cinnamomum camphora	tree	+		
Dimocarpus longan	tree	+	planted	exotic
Eucalyptus citriodora	tree	+	planted	exotic

Species	Life	Abundance	Status	Exotic
Eucalyptus robusta	tree	+	planted	exotic
Ficus microcarpa	tree	+++	planted	
Ficus virens	tree	+		
Hibiscus tiliaceus	tree	+++		
Juniperus chinensis	tree	+	planted	exotic
Leucaena leucocephala	tree	+++	naturalize	exotic
Litsea glutinosa	tree	++		
Melaleuca quinquenervia	tree	++	planted	exotic
Morus alba	tree	+		
Pinus elliottii	tree	++	planted	exotic
Schefflera octophylla	tree	+++		
Sterculia lanceolata	tree	++		
Trema orientalis	tree	+		

APPENDIX F

NOT USED

APPENDIX G
TECHNICAL DATA : AIR QUALITY

1) Dust emmision factors & input and output file for FDM modelling
2) Predicted 1-hr & 24-hr TSP from construction (3 options)
3) Summary of Predicted TSP concentration at different ASR locations
4) Summary of road links and emission rates
5) Predicted 1-hr average NO_2 concentration at Yrs 2011 (3 options)
6) Caline4 input and output sample files for air quality assessment
7) Summary of Predicted NO_2 concentration at different ASR locations
8) Marine science laboratory - mitigation proposals
9) Comparison of emissions over different years
10) Marine science laboratory - mitigation options

APPENDIX G

1) Dust emmision factors & input and output file for FDM modelling

97530	Tolo Highway Widening, Construction Phase Air Quality (75% reduction & 40% active site)		
	option 1 area (sq.m)	154189	
	option 2 area (sq. m)	150193	
	option 3 area (sq. m)	151802	
Item	Description	TSP	Remarks
1	Road Construction Area, Including Cut & Fill Operations		
General construction	Mitigation efficiency (%)	75	*estimated mitigation efficiency of twice daily watering
	Percentage active operating area (%)	40	estimated by Engineer
	E (kg/day/sq.m)	1.0346E-03	**estimated (Emission rate of general construction activities)
	Option 1 E (kg/day)	160	calculated as in AP-42
	Option 2 E (kg/day)	155	calculated as in AP-42
	Option 3 E (kg/day)	157	calculated as in AP-42
	E (g/sq.m/s) wsd=0	2.3950E-05	calculated
Remarks:			
* Extracted from S 11.2.4.4, AP-42 Vol 1, Control Methods of Heavy Construction Operations			
** Extracted from S 11.2.4.3, AP-42 Vol 1, Emission Factor of Heavy Construction Operations			
Assumptions: The assessment based on construction operations with			
(1) medium activity level			
(2) moderate silt content (~30 percent)			
(3) semiarid climate (PE~50)			
(4) Refined the construction working area			

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Tolo Highway Widening, Option 1 sample file (ASR1) with 75% mitigation
 1 1 1 1 1 1 3 1 1 1 1 1 1 2
142    1  5    360
60.         100.        1.          2.5
1.25        3.75        7.5         12.5        20.
0.0262      0.0678      0.1704      0.1536      0.5820
836186.8  834282.9   1.5
 2 9.5799E-05           836294.1  833929.2  836417.9  833872.3  0.0        4.0
 2 9.5799E-05           836417.9  833872.3  836604.6  833738.7  0.0        4.0
 2 9.5799E-05           836604.6  833738.7  836982.8  833507.1  0.0        4.0
 2 9.5799E-05           836982.8  833507.1  837153.1  833408.9  0.0        4.0
 2 9.5799E-05           837153.1  833408.9  837280.1  833339.5  0.0        4.0
 2 9.5799E-05           837280.1  833339.5  837407.7  833301.9  0.0        4.0
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 2 9.5799E-05           837524.1  833293.7  837636.6  833306.6  0.0        4.0
 2 9.5799E-05           837636.6  833306.6  837781.0  833347.4  0.0        4.0
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 2 9.5799E-05           838062.1  833324.4  838216.1  833243.2  0.0        4.0
 2 9.5799E-05           838216.1  833243.2  838312.6  833176.6  0.0        4.0
 2 9.5799E-05           838312.6  833176.6  838402.9  833107.2  0.0        4.0
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 2 1.4370E-04           837367.3  833289.7  837469.3  833275.2  0.0        6.0
 2 1.4370E-04           837469.3  833275.2  837561.6  833276.2  0.0        6.0
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 2 1.4370E-04           838705.8  832560.7  838707.6  832519.6  0.0        6.0
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 2 1.4370E-04           838891.4  832248.1  838981.5  832179.6  0.0        6.0
 2 1.4370E-04           838981.5  832179.6  839238.1  831994.7  0.0        6.0
 2 1.4370E-04           839238.1  831994.7  839479.4  831834.7  0.0        6.0
 2 1.4370E-04           839479.4  831834.7  839522.0  831811.6  0.0        6.0
 2 2.8740E-04           836382.1  833960.0  836475.2  833871.8  0.0        12.0
 2 3.8320E-04           836475.2  833871.8  836621.2  833764.0  0.0        16.0
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2	1.6765E-04	840026.3	831392.9	840059.5	831304.7	0.0	7.0
2	1.6765E-04	840059.5	831304.7	840070.2	831294.2	0.0	7.0
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2	2.3950E-04	840004.7	831409.5	840040.4	831323.4	0.0	10.0
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2	2.3950E-04	840079.9	830911.5	840070.9	830855.6	0.0	10.0
3	2.3950E-05	837368.9	833269.0	85.7	27.2	0.0	-13.9
3	2.3950E-05	837385.9	833243.9	34.0	13.2	0.0	-14.0
3	2.3950E-05	837361.8	833253.0	17.7	8.8	0.0	-14.6
3	2.3950E-05	837347.9	833257.3	11.5	5.0	0.0	-14.1
3	2.3950E-05	838356.6	833092.3	23.5	23.6	0.0	-19.7
3	2.3950E-05	838383.5	833077.6	37.0	13.8	0.0	-19.9
3	2.3950E-05	838376.3	833056.7	79.0	29.0	0.0	-19.9
3	2.3950E-05	838423.7	833035.3	25.6	21.8	0.0	-22.1
3	2.3950E-05	838442.0	833029.3	12.2	8.4	0.0	-18.9
3	2.3950E-05	837410.3	833352.0	54.2	23.7	0.0	-10.4
3	2.3950E-05	838664.9	832890.9	98.7	36.1	0.0	-57.2
3	2.3950E-05	838903.3	832345.0	54.7	33.9	0.0	-46.9
3	2.3950E-05	839878.1	831621.7	24.1	13.8	0.0	-46.3
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3	2.3950E-05	839936.6	831628.0	28.4	16.9	0.0	-47.3
3	2.3950E-05	839950.5	831635.4	10.9	9.8	0.0	-49.7
3	2.3950E-05	839971.0	831584.0	88.2	88.3	0.0	-47.1
3	2.3950E-05	839991.3	831529.1	10.8	18.5	0.0	-49.3
3	2.3950E-05	840024.6	831553.0	19.5	48.5	0.0	-50.4
3	2.3950E-05	840070.7	831276.0	13.6	12.2	0.0	-81.8
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2.0	220.0	4	500.0	298.0

2.0	230.0	4	500.0	298.0
2.0	240.0	4	500.0	298.0
2.0	250.0	4	500.0	298.0
2.0	260.0	4	500.0	298.0
2.0	270.0	4	500.0	298.0
2.0	280.0	4	500.0	298.0
2.0	290.0	4	500.0	298.0
2.0	300.0	4	500.0	298.0
2.0	310.0	4	500.0	298.0
2.0	320.0	4	500.0	298.0
2.0	330.0	4	500.0	298.0
2.0	340.0	4	500.0	298.0
2.0	350.0	4	500.0	298.0
4.0	0.0	4	500.0	298.0
4.0	10.0	4	500.0	298.0
4.0	20.0	4	500.0	298.0
4.0	30.0	4	500.0	298.0
4.0	40.0	4	500.0	298.0
4.0	50.0	4	500.0	298.0
4.0	60.0	4	500.0	298.0
4.0	70.0	4	500.0	298.0
4.0	80.0	4	500.0	298.0
4.0	90.0	4	500.0	298.0
4.0	100.0	4	500.0	298.0
4.0	110.0	4	500.0	298.0
4.0	120.0	4	500.0	298.0
4.0	130.0	4	500.0	298.0
4.0	140.0	4	500.0	298.0
4.0	150.0	4	500.0	298.0
4.0	160.0	4	500.0	298.0
4.0	170.0	4	500.0	298.0
4.0	180.0	4	500.0	298.0
4.0	190.0	4	500.0	298.0
4.0	200.0	4	500.0	298.0
4.0	210.0	4	500.0	298.0
4.0	220.0	4	500.0	298.0
4.0	230.0	4	500.0	298.0
4.0	240.0	4	500.0	298.0
4.0	250.0	4	500.0	298.0
4.0	260.0	4	500.0	298.0
4.0	270.0	4	500.0	298.0
4.0	280.0	4	500.0	298.0
4.0	290.0	4	500.0	298.0
4.0	300.0	4	500.0	298.0
4.0	310.0	4	500.0	298.0
4.0	320.0	4	500.0	298.0
4.0	330.0	4	500.0	298.0
4.0	340.0	4	500.0	298.0
4.0	350.0	4	500.0	298.0
6.0	0.0	4	500.0	298.0
6.0	10.0	4	500.0	298.0
6.0	20.0	4	500.0	298.0
6.0	30.0	4	500.0	298.0
6.0	40.0	4	500.0	298.0
6.0	50.0	4	500.0	298.0
6.0	60.0	4	500.0	298.0
6.0	70.0	4	500.0	298.0
6.0	80.0	4	500.0	298.0
6.0	90.0	4	500.0	298.0
6.0	100.0	4	500.0	298.0
6.0	110.0	4	500.0	298.0
6.0	120.0	4	500.0	298.0
6.0	130.0	4	500.0	298.0
6.0	140.0	4	500.0	298.0
6.0	150.0	4	500.0	298.0
6.0	160.0	4	500.0	298.0
6.0	170.0	4	500.0	298.0
6.0	180.0	4	500.0	298.0
6.0	190.0	4	500.0	298.0
6.0	200.0	4	500.0	298.0
6.0	210.0	4	500.0	298.0
6.0	220.0	4	500.0	298.0
6.0	230.0	4	500.0	298.0
6.0	240.0	4	500.0	298.0
6.0	250.0	4	500.0	298.0
6.0	260.0	4	500.0	298.0
6.0	270.0	4	500.0	298.0
6.0	280.0	4	500.0	298.0
6.0	290.0	4	500.0	298.0
6.0	300.0	4	500.0	298.0
6.0	310.0	4	500.0	298.0
6.0	320.0	4	500.0	298.0
6.0	330.0	4	500.0	298.0
6.0	340.0	4	500.0	298.0
6.0	350.0	4	500.0	298.0
8.0	0.0	4	500.0	298.0
8.0	10.0	4	500.0	298.0
8.0	20.0	4	500.0	298.0
8.0	30.0	4	500.0	298.0
8.0	40.0	4	500.0	298.0
8.0	50.0	4	500.0	298.0
8.0	60.0	4	500.0	298.0
8.0	70.0	4	500.0	298.0
8.0	80.0	4	500.0	298.0
8.0	90.0	4	500.0	298.0
8.0	100.0	4	500.0	298.0
8.0	110.0	4	500.0	298.0

8.0	120.0	4	500.0	298.0
8.0	130.0	4	500.0	298.0
8.0	140.0	4	500.0	298.0
8.0	150.0	4	500.0	298.0
8.0	160.0	4	500.0	298.0
8.0	170.0	4	500.0	298.0
8.0	180.0	4	500.0	298.0
8.0	190.0	4	500.0	298.0
8.0	200.0	4	500.0	298.0
8.0	210.0	4	500.0	298.0
8.0	220.0	4	500.0	298.0
8.0	230.0	4	500.0	298.0
8.0	240.0	4	500.0	298.0
8.0	250.0	4	500.0	298.0
8.0	260.0	4	500.0	298.0
8.0	270.0	4	500.0	298.0
8.0	280.0	4	500.0	298.0
8.0	290.0	4	500.0	298.0
8.0	300.0	4	500.0	298.0
8.0	310.0	4	500.0	298.0
8.0	320.0	4	500.0	298.0
8.0	330.0	4	500.0	298.0
8.0	340.0	4	500.0	298.0
8.0	350.0	4	500.0	298.0

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FUGITIVE DUST MODEL (FDM)
VERSION 95279
OCT, 1995
DATE AT START OF RUN: 08/19/96   TIME AT START OF RUN: 17:21:18.57

RUN TITLE:
Tolo Highway Widening, Option 1 sample file (ASR1) with 75% mitigation

INPUT FILE NAME: op75ds1.IN
OUTPUT FILE NAME: op75ds1.OUT

CONVERGENCE OPTION 1=OFF, 2=ON	1
MET OPTION SWITCH, 1=CARDS, 2=PREPROCESSED	1
PLOT FILE OUTPUT, 1=NO, 2=YES	1
MET DATA PRINT SWITCH, 1=NO, 2=YES	1
POST-PROCESSOR OUTPUT, 1=NO, 2=YES	1
DEP. VEL./GRAV. SETL. VEL., 1=DEFAULT, 2=USER	1
PRINT 1-HOUR AVERAGE CONCEN, 1=NO, 2=YES	3
PRINT 3-HOUR AVERAGE CONCEN, 1=NO, 2=YES	1
PRINT 8-HOUR AVERAGE CONCEN, 1=NO, 2=YES	1
PRINT 24-HOUR AVERAGE CONCEN, 1=NO, 2=YES	1
PRINT LONG-TERM AVERAGE CONCEN, 1=NO, 2=YES	1
BYPASS RAMMET CALMS RECOGNITION, 1=NO, 2=YES	1
READ HOURLY EMISSION RATES, 1=NO, 2=YES	1
NUMBER OF SOURCES PROCESSED	142
NUMBER OF RECEPTORS PROCESSED	1
NUMBER OF PARTICLE SIZE CLASSES	5
NUMBER OF HOURS OF MET DATA PROCESSED	360
LENGTH IN MINUTES OF 1-HOUR OF MET DATA	60.
ROUGHNESS LENGTH IN CM	100.00
SCALING FACTOR FOR SOURCE AND RECPTORS	1.0000
PARTICLE DENSITY IN G/CM**3	2.50
ANEMOMETER HEIGHT IN M	10.00

GENERAL PARTICLE SIZE CLASS INFORMATION

PARTICLE SIZE CLASS	CHAR. DIA. (UM)	GRAV. SETTLING VELOCITY (M/SEC)	DEPOSITION VELOCITY (M/SEC)	FRACTION IN EACH SIZE CLASS
1	1.2500000	**	**	0.0262
2	3.7500000	**	**	0.0678
3	7.5000000	**	**	0.1704
4	12.5000000	**	**	0.1536
5	20.0000000	**	**	0.5820

** COMPUTED BY FDM

1

RECEPTOR COORDINATES (X,Y,Z)

(836187., 834283., 2.) (
1

SOURCE INFORMATION

TYPE	ENTERED EMIS. RATE (G/SEC, G/SEC/M OR G/SEC/M**2)	TOTAL EMISSION RATE (G/SEC)	WIND SPEED FAC.	X1 (M)	Y1 (M)	X2 (M)	Y2 (M)	HEIGHT (M)	WIDTH (M)
2	0.000095799	0.01305	0.000	836294.	833929.	836418.	833872.	0.50	4.00
2	0.000095799	0.02200	0.000	836418.	833872.	836605.	833739.	0.50	4.00
2	0.000095799	0.04248	0.000	836605.	833739.	836983.	833507.	0.50	4.00
2	0.000095799	0.01884	0.000	836983.	833507.	837153.	833409.	0.50	4.00
2	0.000095799	0.01386	0.000	837153.	833409.	837280.	833340.	0.50	4.00
2	0.000095799	0.01274	0.000	837280.	833340.	837408.	833302.	0.50	4.00
2	0.000095799	0.01118	0.000	837408.	833302.	837524.	833294.	0.50	4.00
2	0.000095799	0.01085	0.000	837524.	833294.	837637.	833307.	0.50	4.00
2	0.000095799	0.01437	0.000	837637.	833307.	837781.	833347.	0.50	4.00
2	0.000095799	0.00867	0.000	837781.	833347.	837870.	833363.	0.50	4.00
2	0.000095799	0.00924	0.000	837870.	833363.	837967.	833358.	0.50	4.00
2	0.000095799	0.00969	0.000	837967.	833358.	838062.	833324.	0.50	4.00
2	0.000095799	0.01668	0.000	838062.	833324.	838216.	833243.	0.50	4.00
2	0.000095799	0.01123	0.000	838216.	833243.	838313.	833177.	0.50	4.00
2	0.000095799	0.01091	0.000	838313.	833177.	838403.	833107.	0.50	4.00
2	0.000095799	0.01164	0.000	838403.	833107.	838491.	833023.	0.50	4.00
2	0.000095799	0.01231	0.000	838491.	833023.	838575.	832926.	0.50	4.00
2	0.000095799	0.01110	0.000	838575.	832926.	838640.	832831.	0.50	4.00
2	0.000095799	0.01114	0.000	838640.	832831.	838684.	832723.	0.50	4.00
2	0.000095799	0.00968	0.000	838684.	832723.	838709.	832625.	0.50	4.00
2	0.000095799	0.01011	0.000	838709.	832625.	838734.	832522.	0.50	4.00
2	0.000095799	0.01100	0.000	838734.	832522.	838782.	832418.	0.50	4.00
2	0.000095799	0.01051	0.000	838782.	832418.	838845.	832329.	0.50	4.00
2	0.000095799	0.01115	0.000	838845.	832329.	838929.	832248.	0.50	4.00
2	0.000095799	0.00815	0.000	838929.	832248.	838998.	832198.	0.50	4.00
2	0.000095799	0.01691	0.000	838998.	832198.	839142.	832096.	0.50	4.00
2	0.000095799	0.01623	0.000	839142.	832096.	839281.	831999.	0.50	4.00
2	0.000095799	0.02462	0.000	839281.	831999.	839494.	831855.	0.50	4.00
2	0.000095799	0.01640	0.000	839494.	831855.	839633.	831755.	0.50	4.00
2	0.000095799	0.01785	0.000	839633.	831755.	839785.	831647.	0.50	4.00

2	0.000095799	0.01037	0.000	839785.	831647.	839865.	831575.	0.50	4.00
2	0.000095799	0.00503	0.000	839865.	831575.	839901.	831536.	0.50	4.00
2	0.000095799	0.00929	0.000	839901.	831536.	839958.	831458.	0.50	4.00
2	0.000095799	0.00954	0.000	839958.	831458.	840003.	831369.	0.50	4.00
2	0.000095799	0.01061	0.000	840003.	831369.	840037.	831264.	0.50	4.00
2	0.000095799	0.00966	0.000	840037.	831264.	840053.	831164.	0.50	4.00
2	0.000095799	0.01418	0.000	840053.	831164.	840056.	831016.	0.50	4.00
2	0.000095799	0.00700	0.000	840056.	831016.	840049.	830944.	0.50	4.00
2	0.000143700	0.01298	0.000	837185.	833365.	837266.	833325.	0.50	6.00
2	0.000143700	0.01539	0.000	837266.	833325.	837367.	833290.	0.50	6.00
2	0.000143700	0.01480	0.000	837367.	833290.	837469.	833275.	0.50	6.00
2	0.000143700	0.01327	0.000	837469.	833275.	837562.	833276.	0.50	6.00
2	0.000143700	0.01025	0.000	837562.	833276.	837632.	833285.	0.50	6.00
2	0.000143700	0.01312	0.000	837632.	833285.	837720.	833310.	0.50	6.00
2	0.000143700	0.00937	0.000	837720.	833310.	837783.	833329.	0.50	6.00
2	0.000143700	0.01092	0.000	837783.	833327.	837858.	833342.	0.50	6.00
2	0.000143700	0.00816	0.000	837858.	833342.	837915.	833342.	0.50	6.00
2	0.000143700	0.00827	0.000	837915.	833342.	837972.	833334.	0.50	6.00
2	0.000143700	0.00786	0.000	837972.	833334.	838024.	833317.	0.50	6.00
2	0.000143700	0.01129	0.000	838024.	833317.	838096.	833286.	0.50	6.00
2	0.000143700	0.01303	0.000	838096.	833286.	838176.	833243.	0.50	6.00
2	0.000143700	0.02099	0.000	838176.	833243.	838298.	833162.	0.50	6.00
2	0.000143700	0.02556	0.000	838340.	833137.	838471.	833016.	0.50	6.00
2	0.000143700	0.00591	0.000	838706.	832561.	838708.	832520.	0.50	6.00
2	0.000143700	0.01464	0.000	838708.	832520.	838747.	832426.	0.50	6.00
2	0.000143700	0.01608	0.000	838747.	832426.	838808.	832332.	0.50	6.00
2	0.000143700	0.00637	0.000	838808.	832332.	838845.	832308.	0.50	6.00
2	0.000143700	0.01655	0.000	838811.	832331.	838891.	832248.	0.50	6.00
2	0.000143700	0.01627	0.000	838891.	832248.	838982.	832180.	0.50	6.00
2	0.000143700	0.04546	0.000	838982.	832180.	839238.	831995.	0.50	6.00
2	0.000143700	0.04160	0.000	839238.	831995.	839479.	831835.	0.50	6.00
2	0.000143700	0.00696	0.000	839479.	831835.	839522.	831812.	0.50	6.00
2	0.000287400	0.03685	0.000	836382.	833960.	836475.	833872.	0.50	12.00
2	0.000383200	0.06955	0.000	836475.	833872.	836621.	833764.	0.50	16.00
2	0.000383200	0.08894	0.000	836621.	833764.	836817.	833640.	0.50	16.00
2	0.000287400	0.01241	0.000	836818.	833639.	836859.	833627.	0.50	12.00
2	0.000287400	0.06228	0.000	836859.	833627.	837046.	833517.	0.50	12.00
2	0.000287400	0.01222	0.000	837046.	833517.	837074.	833485.	0.50	12.00
2	0.000143700	0.00523	0.000	836809.	833633.	836843.	833619.	0.50	6.00
2	0.000143700	0.00671	0.000	836843.	833619.	836879.	833590.	0.50	6.00
2	0.000143700	0.03017	0.000	836879.	833590.	837059.	833481.	0.50	6.00
2	0.000383200	0.04149	0.000	837073.	833485.	837167.	833431.	0.50	16.00
2	0.000383200	0.05079	0.000	837167.	833431.	837284.	833368.	0.50	16.00
2	0.000383200	0.04825	0.000	837284.	833368.	837404.	833331.	0.50	16.00
2	0.000383200	0.04601	0.000	837404.	833331.	837524.	833321.	0.50	16.00
2	0.000383200	0.04643	0.000	837524.	833321.	837644.	833336.	0.50	16.00
2	0.000383200	0.05354	0.000	837644.	833336.	837778.	833375.	0.50	16.00
2	0.000383200	0.03866	0.000	837777.	833375.	837877.	833391.	0.50	16.00
2	0.000383200	0.03352	0.000	837877.	833391.	837964.	833384.	0.50	16.00
2	0.000383200	0.03451	0.000	837964.	833384.	838050.	833360.	0.50	16.00
2	0.000383200	0.04480	0.000	838050.	833360.	838156.	833309.	0.50	16.00
2	0.000383200	0.04735	0.000	838156.	833309.	838262.	833245.	0.50	16.00
2	0.000383200	0.03196	0.000	838262.	833245.	838330.	833198.	0.50	16.00
2	0.000383200	0.05654	0.000	838330.	833198.	838445.	833105.	0.50	16.00
2	0.000383200	0.04661	0.000	838445.	833105.	838531.	833019.	0.50	16.00
2	0.000383200	0.05087	0.000	838531.	833019.	838617.	832918.	0.50	16.00
2	0.000383200	0.03863	0.000	838617.	832918.	838670.	832832.	0.50	16.00
2	0.000383200	0.04089	0.000	838670.	832832.	838710.	832733.	0.50	16.00
2	0.000383200	0.00718	0.000	838710.	832734.	838715.	832716.	0.50	16.00
2	0.000383200	0.04574	0.000	838715.	832716.	838741.	832599.	0.50	16.00
2	0.000383200	0.01766	0.000	838741.	832599.	838752.	832554.	0.50	16.00
2	0.000383200	0.04090	0.000	838752.	832554.	838792.	832456.	0.50	16.00
2	0.000383200	0.04120	0.000	838792.	832456.	838851.	832366.	0.50	16.00
2	0.000383200	0.04076	0.000	838851.	832366.	838924.	832288.	0.50	16.00
2	0.000383200	0.04249	0.000	838924.	832288.	839013.	832222.	0.50	16.00
2	0.000191600	0.00904	0.000	838715.	832716.	838744.	832678.	0.50	8.00
2	0.000191600	0.00751	0.000	838744.	832678.	838753.	832640.	0.50	8.00
2	0.000191600	0.00792	0.000	838753.	832640.	838742.	832600.	0.50	8.00
2	0.000383200	0.04306	0.000	839014.	832219.	839108.	832158.	0.50	16.00
2	0.000191600	0.03019	0.000	839109.	832159.	839256.	832104.	0.50	8.00
2	0.000191600	0.03184	0.000	839256.	832104.	839368.	831981.	0.50	8.00
2	0.000479000	0.14715	0.000	839113.	832156.	839363.	831977.	0.50	20.00
2	0.000383200	0.06162	0.000	839190.	832121.	839321.	832027.	0.50	16.00
2	0.000335300	0.01234	0.000	839240.	832102.	839270.	832080.	0.50	14.00
2	0.000383200	0.06839	0.000	839361.	831979.	839507.	831876.	0.50	16.00
2	0.000383200	0.02228	0.000	839507.	831876.	839559.	831850.	0.50	16.00
2	0.000383200	0.02092	0.000	839559.	831850.	839598.	831812.	0.50	16.00
2	0.000383200	0.08922	0.000	839598.	831812.	839788.	831677.	0.50	16.00
2	0.000383200	0.05183	0.000	839788.	831677.	839888.	831586.	0.50	16.00
2	0.000167650	0.01504	0.000	839984.	831472.	840026.	831393.	0.50	7.00
2	0.000167650	0.01580	0.000	840026.	831393.	840060.	831305.	0.50	7.00
2	0.000167650	0.00251	0.000	840060.	831305.	840070.	831294.	0.50	7.00
2	0.000239500	0.02455	0.000	839953.	831498.	840005.	831410.	0.50	10.00
2	0.000239500	0.02233	0.000	840005.	831410.	840040.	831323.	0.50	10.00
2	0.000239500	0.03140	0.000	840040.	831323.	840069.	831195.	0.50	10.00
2	0.000239500	0.01552	0.000	840077.	831121.	840077.	831056.	0.50	10.00
2	0.000239500	0.02751	0.000	840077.	831056.	840070.	830941.	0.50	10.00
2	0.000239500	0.01355	0.000	840080.	830912.	840071.	830856.	0.50	10.00
3	0.000023950	0.05583	0.000	837369.	833269.	86.	27.	0.50	-13.90
3	0.000023950	0.01075	0.000	837386.	833244.	34.	13.	0.50	-14.00
3	0.000023950	0.00373	0.000	837362.	833253.	18.	9.	0.50	-14.60
3	0.000023950	0.00138	0.000	837348.	833257.	12.	5.	0.50	-14.10
3	0.000023950	0.01328	0.000	838357.	833092.	24.	24.	0.50	-19.70
3	0.000023950	0.01223	0.000	838384.	833078.	37.	14.	0.50	-19.90
3	0.000023950	0.05487	0.000	838376.	833057.	79.	29.	0.50	-19.90
3	0.000023950	0.01337	0.000	838424.	833035.	26.	22.	0.50	-22.10
3	0.000023950	0.00245	0.000	838442.	833029.	12.	8.	0.50	-18.90

3	0.000023950	0.03076	0.000	837410.	833352.	54.	24.	0.50	-10.40
3	0.000023950	0.08534	0.000	838665.	832891.	99.	36.	0.50	-57.20
3	0.000023950	0.04441	0.000	838903.	832345.	55.	34.	0.50	-46.90
3	0.000023950	0.00797	0.000	839878.	831622.	24.	14.	0.50	-46.30
3	0.000023950	0.00408	0.000	839892.	831628.	13.	13.	0.50	-49.90
3	0.000023950	0.02870	0.000	839910.	831612.	29.	41.	0.50	-46.90
3	0.000023950	0.01150	0.000	839937.	831628.	28.	17.	0.50	-47.30
3	0.000023950	0.00256	0.000	839951.	831635.	11.	10.	0.50	-49.70
3	0.000023950	0.18652	0.000	839971.	831584.	88.	88.	0.50	-47.10
3	0.000023950	0.00479	0.000	839991.	831529.	11.	19.	0.50	-49.30
3	0.000023950	0.02265	0.000	840025.	831553.	20.	49.	0.50	-50.40
3	0.000023950	0.00397	0.000	840071.	831276.	14.	12.	0.50	-81.80
3	0.000023950	0.01205	0.000	840081.	831262.	18.	28.	0.50	-82.40
3	0.000023950	0.08142	0.000	840097.	831220.	69.	49.	0.50	-80.80
3	0.000023950	0.05020	0.000	839989.	831197.	80.	26.	0.50	-82.80

TOTAL EMISSIONS 0.36928E+01 GRAMS/SEC

LONG DISTANCE (50,000 M) MASS CONSERVATION CORRECTION FACTORS USED

1

TOP 50 TABLE FOR 1 HOUR AVERAGES

RANK	RECEPTOR	X-COORDINATE	Y-COORDINATE	ENDING HOUR	CONCENTRATION	DEPOSITION
1	1	836186.8	834282.9	194	13.1657	0.2095
2	1	836186.8	834282.9	195	12.6795	0.2154
3	1	836186.8	834282.9	230	10.9033	0.2921
4	1	836186.8	834282.9	231	9.9832	0.2724
5	1	836186.8	834282.9	193	9.1343	0.1370
6	1	836186.8	834282.9	196	8.6143	0.1532
7	1	836186.8	834282.9	229	7.8772	0.2081
8	1	836186.8	834282.9	232	6.5162	0.1802
9	1	836186.8	834282.9	266	6.3545	0.2923
10	1	836186.8	834282.9	267	5.6931	0.2638
11	1	836186.8	834282.9	265	4.6662	0.2135
12	1	836186.8	834282.9	302	4.2372	0.2866
13	1	836186.8	834282.9	197	4.0366	0.0737
14	1	836186.8	834282.9	303	3.7929	0.2581
15	1	836186.8	834282.9	192	3.7197	0.0541
16	1	836186.8	834282.9	268	3.6532	0.1702
17	1	836186.8	834282.9	14	3.5231	0.0770
18	1	836186.8	834282.9	15	3.4437	0.0756
19	1	836186.8	834282.9	228	3.2740	0.0860
20	1	836186.8	834282.9	338	3.2653	0.2997
21	1	836186.8	834282.9	13	3.2189	0.0702
22	1	836186.8	834282.9	301	3.1134	0.2097
23	1	836186.8	834282.9	16	3.0251	0.0668
24	1	836186.8	834282.9	233	2.9773	0.0830
25	1	836186.8	834282.9	339	2.9109	0.2683
26	1	836186.8	834282.9	12	2.5381	0.0553
27	1	836186.8	834282.9	304	2.4327	0.1663
28	1	836186.8	834282.9	337	2.4065	0.2202
29	1	836186.8	834282.9	17	2.3998	0.0535
30	1	836186.8	834282.9	50	2.2921	0.0767
31	1	836186.8	834282.9	51	2.2269	0.0746
32	1	836186.8	834282.9	49	2.1005	0.0703
33	1	836186.8	834282.9	264	1.9525	0.0891
34	1	836186.8	834282.9	52	1.9375	0.0650
35	1	836186.8	834282.9	340	1.8606	0.1721
36	1	836186.8	834282.9	18	1.6953	0.0382
37	1	836186.8	834282.9	48	1.6588	0.0555
38	1	836186.8	834282.9	269	1.6528	0.0773
39	1	836186.8	834282.9	11	1.6166	0.0352
40	1	836186.8	834282.9	53	1.5155	0.0510
41	1	836186.8	834282.9	300	1.3029	0.0876
42	1	836186.8	834282.9	86	1.2393	0.0752
43	1	836186.8	834282.9	198	1.2040	0.0223
44	1	836186.8	834282.9	87	1.2016	0.0730
45	1	836186.8	834282.9	85	1.1369	0.0690
46	1	836186.8	834282.9	305	1.1005	0.0755
47	1	836186.8	834282.9	47	1.0589	0.0354
48	1	836186.8	834282.9	54	1.0523	0.0355
49	1	836186.8	834282.9	88	1.0421	0.0634
50	1	836186.8	834282.9	19	1.0303	0.0234

1

HIGHEST AND SECOND HIGHEST VALUES FOR 1 HOUR AVERAGES

RECEPTOR	X-COORDINATE	Y-COORDINATE	HIGHEST VALUE	ENDING HOUR	DEPOSITION	SECOND HIGH	ENDING HOUR	DEPOSTION
1	836186.8	834282.9	13.1657	194.	0.2095	12.6795	195.	0.2154

DATE AT END OF RUN: 08/19/96 TIME AT END OF RUN: 17:21:42.51
ELAPSED TIME FOR THIS RUN: 0.23940E+02 SECONDS
OR 0 HOURS 0 MINUTES 23.94 SECONDS

```
Tolo Highway Widening, Option 2 sample file (ASR1), with 75% mitigation
 1 1 1 1 1 1 3 1 1 1 1 1 2
138    1  5    360
60.         100.        1.          2.5
1.25        3.75        7.5         12.5        20.
0.0262      0.0678      0.1704      0.1536      0.5820
836186.8    834282.9     1.5
 2 9.5799E-05           836294.1  833929.2  836417.9  833872.3  0.0        4.0
 2 9.5799E-05           836417.9  833872.3  836604.6  833738.7  0.0        4.0
 2 9.5799E-05           836604.6  833738.7  836982.8  833507.1  0.0        4.0
 2 9.5799E-05           836982.8  833507.1  837153.1  833408.9  0.0        4.0
 2 9.5799E-05           837153.1  833408.9  837280.1  833339.5  0.0        4.0
 2 9.5799E-05           837280.1  833339.5  837407.7  833301.9  0.0        4.0
 2 9.5799E-05           837407.7  833301.9  837524.1  833293.7  0.0        4.0
 2 9.5799E-05           837524.1  833293.7  837636.6  833306.6  0.0        4.0
 2 9.5799E-05           837636.6  833306.6  837781.0  833347.4  0.0        4.0
 2 9.5799E-05           837781.0  833347.4  837870.2  833362.8  0.0        4.0
 2 9.5799E-05           837870.2  833362.8  837966.5  833357.5  0.0        4.0
 2 9.5799E-05           837966.5  833357.5  838062.1  833324.4  0.0        4.0
 2 9.5799E-05           838062.1  833324.4  838216.1  833243.2  0.0        4.0
 2 9.5799E-05           838216.1  833243.2  838312.6  833176.6  0.0        4.0
 2 9.5799E-05           838312.6  833176.6  838402.9  833107.2  0.0        4.0
 2 9.5799E-05           838402.9  833107.2  838490.5  833023.0  0.0        4.0
 2 9.5799E-05           838490.5  833023.0  838575.2  832926.4  0.0        4.0
 2 9.5799E-05           838575.2  832926.4  838640.2  832830.5  0.0        4.0
 2 9.5799E-05           838640.2  832830.5  838684.1  832722.9  0.0        4.0
 2 9.5799E-05           838684.1  832722.9  838708.9  832624.9  0.0        4.0
 2 9.5799E-05           838708.9  832624.9  838733.6  832522.3  0.0        4.0
 2 9.5799E-05           838733.6  832522.3  838781.8  832418.1  0.0        4.0
 2 9.5799E-05           838781.8  832418.1  838845.1  832328.5  0.0        4.0
 2 9.5799E-05           838845.1  832328.5  838928.9  832247.7  0.0        4.0
 2 9.5799E-05           838928.9  832247.7  838997.9  832198.0  0.0        4.0
 2 9.5799E-05           838997.9  832198.0  839142.2  832096.3  0.0        4.0
 2 9.5799E-05           839142.2  832096.3  839280.6  831998.7  0.0        4.0
 2 9.5799E-05           839280.6  831998.7  839493.9  831855.3  0.0        4.0
 2 9.5799E-05           839493.9  831855.3  839632.6  831755.1  0.0        4.0
 2 9.5799E-05           839632.6  831755.1  839784.6  831647.3  0.0        4.0
 2 9.5799E-05           839784.6  831647.3  839865.0  831574.8  0.0        4.0
 2 9.5799E-05           839865.0  831574.8  839900.5  831536.2  0.0        4.0
 2 9.5799E-05           839900.5  831536.2  839958.0  831458.1  0.0        4.0
 2 9.5799E-05           839958.0  831458.1  840002.7  831369.2  0.0        4.0
 2 9.5799E-05           840002.7  831369.2  840036.8  831263.8  0.0        4.0
 2 9.5799E-05           840036.8  831263.8  840052.9  831164.3  0.0        4.0
 2 9.5799E-05           840052.9  831164.3  840056.1  831016.4  0.0        4.0
 2 9.5799E-05           840056.1  831016.4  840049.4  830943.6  0.0        4.0
 2 1.4370E-04           837185.2  833364.8  837266.0  833324.5  0.0        6.0
 2 1.4370E-04           837266.0  833324.5  837367.3  833289.7  0.0        6.0
 2 1.4370E-04           837367.3  833289.7  837469.3  833275.2  0.0        6.0
 2 1.4370E-04           837469.3  833275.2  837561.6  833276.2  0.0        6.0
 2 1.4370E-04           837561.6  833276.2  837632.4  833285.1  0.0        6.0
 2 1.4370E-04           837632.4  833285.1  837720.3  833309.7  0.0        6.0
 2 1.4370E-04           837720.3  833309.7  837782.5  833329.4  0.0        6.0
 2 1.4370E-04           837783.3  833327.3  837857.9  833341.8  0.0        6.0
 2 1.4370E-04           837857.9  833341.8  837914.7  833341.8  0.0        6.0
 2 1.4370E-04           837914.7  833341.8  837971.7  833334.0  0.0        6.0
 2 1.4370E-04           837971.7  833334.0  838023.8  833317.4  0.0        6.0
 2 1.4370E-04           838023.8  833317.4  838095.6  833285.5  0.0        6.0
 2 1.4370E-04           838095.6  833285.5  838175.7  833243.0  0.0        6.0
 2 1.4370E-04           838175.7  833243.0  838297.5  833162.4  0.0        6.0
 2 1.4370E-04           838340.1  833136.7  838470.7  833015.9  0.0        6.0
 2 1.4370E-04           838705.8  832560.7  838707.6  832519.6  0.0        6.0
 2 1.4370E-04           838707.6  832519.6  838747.0  832425.6  0.0        6.0
 2 1.4370E-04           838747.0  832425.6  838808.0  832331.8  0.0        6.0
 2 1.4370E-04           838808.0  832331.8  838845.2  832307.6  0.0        6.0
 2 1.4370E-04           838810.9  832330.5  838891.4  832248.1  0.0        6.0
 2 1.4370E-04           838891.4  832248.1  838981.5  832179.6  0.0        6.0
 2 1.4370E-04           838981.5  832179.6  839238.1  831994.7  0.0        6.0
 2 1.4370E-04           839238.1  831994.7  839479.4  831834.7  0.0        6.0
 2 1.4370E-04           839479.4  831834.7  839522.0  831811.6  0.0        6.0
 2 2.8740E-04           836382.1  833960.0  836475.2  833871.8  0.0        12.0
 2 3.8320E-04           836475.2  833871.8  836621.2  833764.0  0.0        16.0
 2 3.8320E-04           836621.2  833764.0  836817.3  833639.9  0.0        16.0
 2 2.8740E-04           836817.5  833638.9  836859.0  833627.0  0.0        12.0
 2 2.8740E-04           836859.0  833627.0  837045.7  833517.0  0.0        12.0
 2 2.8740E-04           837045.7  833517.0  837073.8  833485.1  0.0        12.0
 2 1.4370E-04           836809.1  833632.8  836842.7  833618.7  0.0        6.0
 2 1.4370E-04           836842.7  833618.7  836879.1  833589.5  0.0        6.0
 2 1.4370E-04           836879.1  833589.5  837058.8  833480.9  0.0        6.0
 2 3.8320E-04           837073.3  833485.2  837167.1  833431.1  0.0        16.0
 2 3.8320E-04           837167.1  833431.1  837283.5  833367.7  0.0        16.0
 2 3.8320E-04           837283.5  833367.7  837404.0  833331.2  0.0        16.0
 2 3.8320E-04           837404.0  833331.2  837523.6  833320.9  0.0        16.0
 2 3.8320E-04           837523.6  833320.9  837643.9  833335.8  0.0        16.0
 2 3.8320E-04           837643.9  833335.8  837777.9  833375.4  0.0        16.0
 2 3.8320E-04           837777.0  833375.4  837876.6  833391.3  0.0        16.0
 2 3.8320E-04           837876.6  833391.3  837963.8  833384.3  0.0        16.0
 2 3.8320E-04           837963.8  833384.3  838050.4  833359.5  0.0        16.0
 2 3.8320E-04           838050.4  833359.5  838155.8  833309.0  0.0        16.0
 2 3.8320E-04           838155.8  833309.0  838261.7  833245.3  0.0        16.0
 2 3.8320E-04           838261.7  833245.3  838330.1  833197.6  0.0        16.0
 2 3.8320E-04           838330.1  833197.6  838445.1  833105.2  0.0        16.0
 2 3.8320E-04           838445.1  833105.2  838530.8  833018.9  0.0        16.0
 2 3.8320E-04           838530.8  833018.9  838617.3  832918.2  0.0        16.0
 2 3.8320E-04           838617.3  832918.2  838669.8  832832.1  0.0        16.0
 2 3.8320E-04           838669.8  832832.1  838709.6  832733.1  0.0        16.0
 2 3.8320E-04           838710.1  832733.7  838715.3  832715.7  0.0        16.0
 2 3.8320E-04           838715.3  832715.7  838741.3  832599.2  0.0        16.0
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2	3.8320E-04	838741.3	832599.2	838751.8	832554.3	0.0	16.0
2	3.8320E-04	838751.8	832554.3	838792.2	832455.5	0.0	16.0
2	3.8320E-04	838792.2	832455.5	838851.0	832365.5	0.0	16.0
2	3.8320E-04	838851.0	832365.5	838924.0	832288.1	0.0	16.0
2	3.8320E-04	838924.0	832288.1	839012.9	832221.8	0.0	16.0
2	1.9160E-04	838715.4	832715.6	838743.8	832678.0	0.0	8.0
2	1.9160E-04	838743.8	832678.0	838752.8	832639.9	0.0	8.0
2	1.9160E-04	838752.8	832639.9	838742.3	832599.9	0.0	8.0
2	3.8320E-04	839014.0	832219.4	839107.9	832157.6	0.0	16.0
2	1.9160E-04	839108.6	832159.1	839256.4	832104.4	0.0	8.0
2	1.9160E-04	839256.4	832104.4	839367.5	831980.8	0.0	8.0
2	4.7900E-04	839113.1	832155.7	839362.9	831976.8	0.0	20.0
2	3.8320E-04	839189.9	832120.5	839320.7	832027.0	0.0	16.0
2	3.3530E-04	839240.3	832102.3	839269.7	832080.1	0.0	14.0
2	3.8320E-04	839361.4	831978.7	839507.0	831875.5	0.0	16.0
2	3.8320E-04	839507.0	831875.5	839559.3	831850.1	0.0	16.0
2	3.8320E-04	839559.3	831850.1	839598.0	831811.6	0.0	16.0
2	3.8320E-04	839598.0	831811.6	839788.2	831677.3	0.0	16.0
2	3.8320E-04	839788.2	831677.3	839888.3	831586.4	0.0	16.0
2	1.6765E-04	839985.0	831473.1	840031.1	831381.5	0.0	7.0
2	1.6765E-04	840031.1	831381.5	840060.3	831298.9	0.0	7.0
2	2.3950E-04	839953.0	831498.0	840004.7	831409.5	0.0	10.0
2	2.3950E-04	840004.7	831409.5	840040.4	831323.4	0.0	10.0
2	2.3950E-04	840040.4	831323.4	840068.7	831195.4	0.0	10.0
2	2.3950E-04	840076.5	831120.6	840076.6	831055.8	0.0	10.0
2	2.3950E-04	840076.6	831055.8	840070.3	830941.1	0.0	10.0
2	2.3950E-04	840079.9	830911.5	840070.9	830855.6	0.0	10.0
3	2.3950E-05	837368.9	833269.0	85.7	27.2	0.0	-13.9
3	2.3950E-05	837385.9	833243.9	34.0	13.2	0.0	-14.0
3	2.3950E-05	837361.8	833253.0	17.7	8.8	0.0	-14.6
3	2.3950E-05	837347.9	833257.3	11.5	5.0	0.0	-14.1
3	2.3950E-05	838356.6	833092.3	23.5	23.6	0.0	-19.7
3	2.3950E-05	838383.5	833077.6	37.0	13.8	0.0	-19.9
3	2.3950E-05	838376.3	833056.7	79.0	29.0	0.0	-19.9
3	2.3950E-05	838423.7	833035.3	25.6	21.8	0.0	-22.1
3	2.3950E-05	838442.0	833029.3	12.2	8.4	0.0	-18.9
3	2.3950E-05	837410.3	833352.0	54.2	23.7	0.0	-10.4
3	2.3950E-05	838664.9	832890.9	98.7	36.1	0.0	-57.2
3	2.3950E-05	838903.3	832345.0	54.7	33.9	0.0	-46.9
3	2.3950E-05	839878.1	831621.7	24.1	13.8	0.0	-46.3
3	2.3950E-05	839892.2	831627.5	13.1	13.0	0.0	-49.9
3	2.3950E-05	839909.5	831611.6	29.3	40.9	0.0	-46.9
3	2.3950E-05	839936.6	831628.0	28.4	16.9	0.0	-47.3
3	2.3950E-05	839950.5	831635.4	10.9	9.8	0.0	-49.7
3	2.3950E-05	839971.0	831584.0	88.2	88.3	0.0	-47.1
3	2.3950E-05	839991.3	831529.1	10.8	18.5	0.0	-49.3
3	2.3950E-05	840024.6	831553.0	19.5	48.5	0.0	-50.4
3	2.3950E-05	840099.0	831305.4	55.5	40.2	0.0	-28.6

1.0	0.0	2	500.0	298.0
1.0	10.0	2	500.0	298.0
1.0	20.0	2	500.0	298.0
1.0	30.0	2	500.0	298.0
1.0	40.0	2	500.0	298.0
1.0	50.0	2	500.0	298.0
1.0	60.0	2	500.0	298.0
1.0	70.0	2	500.0	298.0
1.0	80.0	2	500.0	298.0
1.0	90.0	2	500.0	298.0
1.0	100.0	2	500.0	298.0
1.0	110.0	2	500.0	298.0
1.0	120.0	2	500.0	298.0
1.0	130.0	2	500.0	298.0
1.0	140.0	2	500.0	298.0
1.0	150.0	2	500.0	298.0
1.0	160.0	2	500.0	298.0
1.0	170.0	2	500.0	298.0
1.0	180.0	2	500.0	298.0
1.0	190.0	2	500.0	298.0
1.0	200.0	2	500.0	298.0
1.0	210.0	2	500.0	298.0
1.0	220.0	2	500.0	298.0
1.0	230.0	2	500.0	298.0
1.0	240.0	2	500.0	298.0
1.0	250.0	2	500.0	298.0
1.0	260.0	2	500.0	298.0
1.0	270.0	2	500.0	298.0
1.0	280.0	2	500.0	298.0
1.0	290.0	2	500.0	298.0
1.0	300.0	2	500.0	298.0
1.0	310.0	2	500.0	298.0
1.0	320.0	2	500.0	298.0
1.0	330.0	2	500.0	298.0
1.0	340.0	2	500.0	298.0
1.0	350.0	2	500.0	298.0
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2.0	110.0	2	500.0	298.0
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2.0	340.0	2	500.0	298.0
2.0	350.0	2	500.0	298.0
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4.0	330.0	2	500.0	298.0
4.0	340.0	2	500.0	298.0
4.0	350.0	2	500.0	298.0
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6.0	330.0	2	500.0	298.0
6.0	340.0	2	500.0	298.0
6.0	350.0	2	500.0	298.0
8.0	0.0	2	500.0	298.0
8.0	10.0	2	500.0	298.0

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8.0	330.0	2	500.0	298.0
8.0	340.0	2	500.0	298.0
8.0	350.0	2	500.0	298.0
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2.0	120.0	4	500.0	298.0
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2.0	140.0	4	500.0	298.0
2.0	150.0	4	500.0	298.0
2.0	160.0	4	500.0	298.0
2.0	170.0	4	500.0	298.0
2.0	180.0	4	500.0	298.0
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2.0	300.0	4	500.0	298.0
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6.0	340.0	4	500.0	298.0
6.0	350.0	4	500.0	298.0
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8.0	330.0	4	500.0 298.0
8.0	340.0	4	500.0 298.0
8.0	350.0	4	500.0 298.0

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FUGITIVE DUST MODEL (FDM)
VERSION 95279
OCT, 1995
DATE AT START OF RUN: 08/19/96 TIME AT START OF RUN: 17:20:42.65

RUN TITLE:
Tolo Highway Widening, Option 2 sample file (ASR1), with 75% mitigation

INPUT FILE NAME: op75ds2.IN
OUTPUT FILE NAME: op75ds2.OUT

CONVERGENCE OPTION 1=OFF, 2=ON	1
MET OPTION SWITCH, 1=CARDS, 2=PREPROCESSED	1
PLOT FILE OUTPUT, 1=NO, 2=YES	1
MET DATA PRINT SWITCH, 1=NO, 2=YES	1
POST-PROCESSOR OUTPUT, 1=NO, 2=YES	1
DEP. VEL./GRAV. SETL. VEL., 1=DEFAULT, 2=USER	1
PRINT 1-HOUR AVERAGE CONCEN, 1=NO, 2=YES	3
PRINT 3-HOUR AVERAGE CONCEN, 1=NO, 2=YES	1
PRINT 8-HOUR AVERAGE CONCEN, 1=NO, 2=YES	1
PRINT 24-HOUR AVERAGE CONCEN, 1=NO, 2=YES	1
PRINT LONG-TERM AVERAGE CONCEN, 1=NO, 2=YES	1
BYPASS RAMMET CALMS RECOGNITION, 1=NO, 2=YES	1
READ HOURLY EMISSION RATES, 1=NO, 2=YES	1
NUMBER OF SOURCES PROCESSED	138
NUMBER OF RECEPTORS PROCESSED	1
NUMBER OF PARTICLE SIZE CLASSES	5
NUMBER OF HOURS OF MET DATA PROCESSED	360
LENGTH IN MINUTES OF 1-HOUR OF MET DATA	60.
ROUGHNESS LENGTH IN CM	100.00
SCALING FACTOR FOR SOURCE AND RECPTORS	1.0000
PARTICLE DENSITY IN G/CM**3	2.50
ANEMOMETER HEIGHT IN M	10.00

GENERAL PARTICLE SIZE CLASS INFORMATION

PARTICLE SIZE CLASS	CHAR. DIA. (UM)	GRAV. SETTLING VELOCITY (M/SEC)	DEPOSITION VELOCITY (M/SEC)	FRACTION IN EACH SIZE CLASS
1	1.2500000	**	**	0.0262
2	3.7500000	**	**	0.0678
3	7.5000000	**	**	0.1704
4	12.5000000	**	**	0.1536
5	20.0000000	**	**	0.5820

** COMPUTED BY FDM

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RECEPTOR COORDINATES (X,Y,Z)

(836187., 834283., 2.) (

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SOURCE INFORMATION

TYPE	ENTERED EMIS. RATE (G/SEC, G/SEC/M OR G/SEC/M**2)	TOTAL EMISSION RATE (G/SEC)	WIND SPEED FAC.	X1 (M)	Y1 (M)	X2 (M)	Y2 (M)	HEIGHT (M)	WIDTH (M)
2	0.000095799	0.01305	0.000	836294.	833929.	836418.	833872.	0.50	4.00
2	0.000095799	0.02200	0.000	836418.	833872.	836605.	833739.	0.50	4.00
2	0.000095799	0.04248	0.000	836605.	833739.	836983.	833507.	0.50	4.00
2	0.000095799	0.01884	0.000	836983.	833507.	837153.	833409.	0.50	4.00
2	0.000095799	0.01386	0.000	837153.	833409.	837280.	833340.	0.50	4.00
2	0.000095799	0.01274	0.000	837280.	833340.	837408.	833302.	0.50	4.00
2	0.000095799	0.01118	0.000	837408.	833302.	837524.	833294.	0.50	4.00
2	0.000095799	0.01085	0.000	837524.	833294.	837637.	833307.	0.50	4.00
2	0.000095799	0.01437	0.000	837637.	833307.	837781.	833347.	0.50	4.00
2	0.000095799	0.00867	0.000	837781.	833347.	837870.	833363.	0.50	4.00
2	0.000095799	0.00924	0.000	837870.	833363.	837967.	833358.	0.50	4.00
2	0.000095799	0.00969	0.000	837967.	833358.	838062.	833324.	0.50	4.00
2	0.000095799	0.01668	0.000	838062.	833324.	838216.	833243.	0.50	4.00
2	0.000095799	0.01123	0.000	838216.	833243.	838313.	833177.	0.50	4.00
2	0.000095799	0.01091	0.000	838313.	833177.	838403.	833107.	0.50	4.00
2	0.000095799	0.01164	0.000	838403.	833107.	838491.	833023.	0.50	4.00
2	0.000095799	0.01231	0.000	838491.	833023.	838575.	832926.	0.50	4.00
2	0.000095799	0.01110	0.000	838575.	832926.	838640.	832831.	0.50	4.00
2	0.000095799	0.01114	0.000	838640.	832831.	838684.	832723.	0.50	4.00
2	0.000095799	0.00968	0.000	838684.	832723.	838709.	832625.	0.50	4.00
2	0.000095799	0.01011	0.000	838709.	832625.	838734.	832522.	0.50	4.00
2	0.000095799	0.01100	0.000	838734.	832522.	838782.	832418.	0.50	4.00
2	0.000095799	0.01051	0.000	838782.	832418.	838845.	832329.	0.50	4.00
2	0.000095799	0.01115	0.000	838845.	832329.	838929.	832248.	0.50	4.00
2	0.000095799	0.00815	0.000	838929.	832248.	838998.	832198.	0.50	4.00
2	0.000095799	0.01691	0.000	838998.	832198.	839142.	832096.	0.50	4.00
2	0.000095799	0.01623	0.000	839142.	832096.	839281.	831999.	0.50	4.00
2	0.000095799	0.02462	0.000	839281.	831999.	839494.	831855.	0.50	4.00
2	0.000095799	0.01640	0.000	839494.	831855.	839633.	831755.	0.50	4.00
2	0.000095799	0.01785	0.000	839633.	831755.	839785.	831647.	0.50	4.00

2	0.000095799	0.01037	0.000	839785.	831647.	839865.	831575.	0.50	4.00
2	0.000095799	0.00503	0.000	839865.	831575.	839901.	831536.	0.50	4.00
2	0.000095799	0.00929	0.000	839901.	831536.	839958.	831458.	0.50	4.00
2	0.000095799	0.00954	0.000	839958.	831458.	840003.	831369.	0.50	4.00
2	0.000095799	0.01061	0.000	840003.	831369.	840037.	831264.	0.50	4.00
2	0.000095799	0.00966	0.000	840037.	831264.	840053.	831164.	0.50	4.00
2	0.000095799	0.01418	0.000	840053.	831164.	840056.	831016.	0.50	4.00
2	0.000095799	0.00700	0.000	840056.	831016.	840049.	830944.	0.50	4.00
2	0.000143700	0.01298	0.000	837185.	833365.	837266.	833325.	0.50	6.00
2	0.000143700	0.01539	0.000	837266.	833325.	837367.	833290.	0.50	6.00
2	0.000143700	0.01480	0.000	837367.	833290.	837469.	833275.	0.50	6.00
2	0.000143700	0.01327	0.000	837469.	833275.	837562.	833276.	0.50	6.00
2	0.000143700	0.01025	0.000	837562.	833276.	837632.	833285.	0.50	6.00
2	0.000143700	0.01312	0.000	837632.	833285.	837720.	833310.	0.50	6.00
2	0.000143700	0.00937	0.000	837720.	833310.	837783.	833329.	0.50	6.00
2	0.000143700	0.01092	0.000	837783.	833327.	837858.	833342.	0.50	6.00
2	0.000143700	0.00816	0.000	837858.	833342.	837915.	833342.	0.50	6.00
2	0.000143700	0.00827	0.000	837915.	833342.	837972.	833334.	0.50	6.00
2	0.000143700	0.00786	0.000	837972.	833334.	838024.	833317.	0.50	6.00
2	0.000143700	0.01129	0.000	838024.	833317.	838096.	833286.	0.50	6.00
2	0.000143700	0.01303	0.000	838096.	833286.	838176.	833243.	0.50	6.00
2	0.000143700	0.02099	0.000	838176.	833243.	838298.	833162.	0.50	6.00
2	0.000143700	0.02556	0.000	838340.	833137.	838471.	833016.	0.50	6.00
2	0.000143700	0.00591	0.000	838706.	832561.	838708.	832520.	0.50	6.00
2	0.000143700	0.01464	0.000	838708.	832520.	838747.	832426.	0.50	6.00
2	0.000143700	0.01608	0.000	838747.	832426.	838808.	832332.	0.50	6.00
2	0.000143700	0.00637	0.000	838808.	832332.	838845.	832308.	0.50	6.00
2	0.000143700	0.01655	0.000	838811.	832331.	838891.	832248.	0.50	6.00
2	0.000143700	0.01627	0.000	838891.	832248.	838982.	832180.	0.50	6.00
2	0.000143700	0.04546	0.000	838982.	832180.	839238.	831995.	0.50	6.00
2	0.000143700	0.04160	0.000	839238.	831995.	839479.	831835.	0.50	6.00
2	0.000143700	0.00696	0.000	839479.	831835.	839522.	831812.	0.50	6.00
2	0.000287400	0.03685	0.000	836382.	833960.	836475.	833872.	0.50	12.00
2	0.000383200	0.06955	0.000	836475.	833872.	836621.	833764.	0.50	16.00
2	0.000383200	0.08894	0.000	836621.	833764.	836817.	833640.	0.50	16.00
2	0.000287400	0.01241	0.000	836818.	833639.	836859.	833627.	0.50	12.00
2	0.000287400	0.06228	0.000	836859.	833627.	837046.	833517.	0.50	12.00
2	0.000287400	0.01222	0.000	837046.	833517.	837074.	833485.	0.50	12.00
2	0.000143700	0.00523	0.000	836809.	833633.	836843.	833619.	0.50	6.00
2	0.000143700	0.00671	0.000	836843.	833619.	836879.	833590.	0.50	6.00
2	0.000143700	0.03017	0.000	836879.	833590.	837059.	833481.	0.50	6.00
2	0.000383200	0.04149	0.000	837073.	833485.	837167.	833431.	0.50	16.00
2	0.000383200	0.05079	0.000	837167.	833431.	837284.	833368.	0.50	16.00
2	0.000383200	0.04825	0.000	837284.	833368.	837404.	833331.	0.50	16.00
2	0.000383200	0.04601	0.000	837404.	833331.	837524.	833321.	0.50	16.00
2	0.000383200	0.04643	0.000	837524.	833321.	837644.	833336.	0.50	16.00
2	0.000383200	0.05354	0.000	837644.	833336.	837778.	833375.	0.50	16.00
2	0.000383200	0.03866	0.000	837777.	833375.	837877.	833391.	0.50	16.00
2	0.000383200	0.03352	0.000	837877.	833391.	837964.	833384.	0.50	16.00
2	0.000383200	0.03451	0.000	837964.	833384.	838050.	833360.	0.50	16.00
2	0.000383200	0.04480	0.000	838050.	833360.	838156.	833309.	0.50	16.00
2	0.000383200	0.04735	0.000	838156.	833309.	838262.	833245.	0.50	16.00
2	0.000383200	0.03196	0.000	838262.	833245.	838330.	833198.	0.50	16.00
2	0.000383200	0.05654	0.000	838330.	833198.	838445.	833105.	0.50	16.00
2	0.000383200	0.04661	0.000	838445.	833105.	838531.	833019.	0.50	16.00
2	0.000383200	0.05087	0.000	838531.	833019.	838617.	832918.	0.50	16.00
2	0.000383200	0.03863	0.000	838617.	832918.	838670.	832832.	0.50	16.00
2	0.000383200	0.04089	0.000	838670.	832832.	838710.	832733.	0.50	16.00
2	0.000383200	0.00718	0.000	838710.	832734.	838715.	832716.	0.50	16.00
2	0.000383200	0.04574	0.000	838715.	832716.	838741.	832599.	0.50	16.00
2	0.000383200	0.01766	0.000	838741.	832599.	838752.	832554.	0.50	16.00
2	0.000383200	0.04090	0.000	838752.	832554.	838792.	832456.	0.50	16.00
2	0.000383200	0.04120	0.000	838792.	832456.	838851.	832366.	0.50	16.00
2	0.000383200	0.04076	0.000	838851.	832366.	838924.	832288.	0.50	16.00
2	0.000383200	0.04249	0.000	838924.	832288.	839013.	832222.	0.50	16.00
2	0.000191600	0.00904	0.000	838715.	832716.	838744.	832678.	0.50	8.00
2	0.000191600	0.00751	0.000	838744.	832678.	838753.	832640.	0.50	8.00
2	0.000191600	0.00792	0.000	838753.	832640.	838742.	832600.	0.50	8.00
2	0.000383200	0.04306	0.000	839014.	832219.	839108.	832158.	0.50	16.00
2	0.000191600	0.03019	0.000	839109.	832159.	839256.	832104.	0.50	8.00
2	0.000191600	0.03184	0.000	839256.	832104.	839368.	831981.	0.50	8.00
2	0.000479000	0.14715	0.000	839113.	832156.	839363.	831977.	0.50	20.00
2	0.000383200	0.06162	0.000	839190.	832121.	839321.	832027.	0.50	16.00
2	0.000335300	0.01234	0.000	839240.	832102.	839270.	832080.	0.50	14.00
2	0.000383200	0.06839	0.000	839361.	831979.	839507.	831876.	0.50	16.00
2	0.000383200	0.02228	0.000	839507.	831876.	839559.	831850.	0.50	16.00
2	0.000383200	0.02092	0.000	839559.	831850.	839598.	831812.	0.50	16.00
2	0.000383200	0.08922	0.000	839598.	831812.	839788.	831677.	0.50	16.00
2	0.000383200	0.05183	0.000	839788.	831677.	839888.	831586.	0.50	16.00
2	0.000167650	0.01720	0.000	839985.	831473.	840031.	831382.	0.50	7.00
2	0.000167650	0.01469	0.000	840031.	831382.	840060.	831299.	0.50	7.00
2	0.000239500	0.02455	0.000	839953.	831498.	840005.	831410.	0.50	10.00
2	0.000239500	0.02233	0.000	840005.	831410.	840040.	831323.	0.50	10.00
2	0.000239500	0.03140	0.000	840040.	831323.	840069.	831195.	0.50	10.00
2	0.000239500	0.01552	0.000	840077.	831121.	840077.	831056.	0.50	10.00
2	0.000239500	0.02751	0.000	840077.	831056.	840070.	830941.	0.50	10.00
2	0.000239500	0.01355	0.000	840080.	830912.	840071.	830856.	0.50	10.00
3	0.000023950	0.05583	0.000	837369.	833269.	86.	27.	0.50	-13.90
3	0.000023950	0.01075	0.000	837386.	833244.	34.	13.	0.50	-14.00
3	0.000023950	0.00373	0.000	837362.	833253.	18.	9.	0.50	-14.60
3	0.000023950	0.00138	0.000	837348.	833257.	12.	5.	0.50	-14.10
3	0.000023950	0.01328	0.000	838357.	833092.	24.	24.	0.50	-19.70
3	0.000023950	0.01223	0.000	838384.	833078.	37.	14.	0.50	-19.90
3	0.000023950	0.05487	0.000	838376.	833057.	79.	29.	0.50	-19.90
3	0.000023950	0.01337	0.000	838424.	833035.	26.	22.	0.50	-22.10
3	0.000023950	0.00245	0.000	838442.	833029.	12.	8.	0.50	-18.90
3	0.000023950	0.03076	0.000	837410.	833352.	54.	24.	0.50	-10.40

3	0.000023950	0.08534	0.000	838665.	832891.	99.	36.	0.50	-57.20
3	0.000023950	0.04441	0.000	838903.	832345.	55.	34.	0.50	-46.90
3	0.000023950	0.00797	0.000	839878.	831622.	24.	14.	0.50	-46.30
3	0.000023950	0.00408	0.000	839892.	831628.	13.	13.	0.50	-49.90
3	0.000023950	0.02870	0.000	839910.	831612.	29.	41.	0.50	-46.90
3	0.000023950	0.01150	0.000	839937.	831628.	28.	17.	0.50	-47.30
3	0.000023950	0.00256	0.000	839951.	831635.	11.	10.	0.50	-49.70
3	0.000023950	0.18652	0.000	839971.	831584.	88.	88.	0.50	-47.10
3	0.000023950	0.00479	0.000	839991.	831529.	11.	19.	0.50	-49.30
3	0.000023950	0.02265	0.000	840025.	831553.	20.	49.	0.50	-50.40
3	0.000023950	0.05343	0.000	840099.	831305.	56.	40.	0.50	-28.60

TOTAL EMISSIONS 0.35971E+01 GRAMS/SEC

LONG DISTANCE (50,000 M) MASS CONSERVATION CORRECTION FACTORS USED

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TOP 50 TABLE FOR 1 HOUR AVERAGES

RANK	RECEPTOR	X-COORDINATE	Y-COORDINATE	ENDING HOUR	CONCENTRATION	DEPOSITION
1	1	836186.8	834282.9	194	13.0896	0.2086
2	1	836186.8	834282.9	195	12.6388	0.2150
3	1	836186.8	834282.9	230	10.8293	0.2903
4	1	836186.8	834282.9	231	9.9437	0.2714
5	1	836186.8	834282.9	193	9.0840	0.1364
6	1	836186.8	834282.9	196	8.6076	0.1532
7	1	836186.8	834282.9	229	7.8284	0.2069
8	1	836186.8	834282.9	232	6.5098	0.1800
9	1	836186.8	834282.9	266	6.3076	0.2902
10	1	836186.8	834282.9	267	5.6681	0.2627
11	1	836186.8	834282.9	265	4.6352	0.2121
12	1	836186.8	834282.9	302	4.2058	0.2845
13	1	836186.8	834282.9	197	4.0364	0.0737
14	1	836186.8	834282.9	303	3.7762	0.2570
15	1	836186.8	834282.9	192	3.7090	0.0540
16	1	836186.8	834282.9	268	3.6492	0.1701
17	1	836186.8	834282.9	14	3.5021	0.0766
18	1	836186.8	834282.9	15	3.4250	0.0752
19	1	836186.8	834282.9	228	3.2637	0.0857
20	1	836186.8	834282.9	338	3.2407	0.2975
21	1	836186.8	834282.9	13	3.1994	0.0698
22	1	836186.8	834282.9	301	3.0926	0.2083
23	1	836186.8	834282.9	16	3.0119	0.0665
24	1	836186.8	834282.9	233	2.9771	0.0830
25	1	836186.8	834282.9	339	2.8978	0.2671
26	1	836186.8	834282.9	12	2.5236	0.0550
27	1	836186.8	834282.9	304	2.4299	0.1661
28	1	836186.8	834282.9	17	2.3929	0.0533
29	1	836186.8	834282.9	337	2.3902	0.2187
30	1	836186.8	834282.9	50	2.2769	0.0762
31	1	836186.8	834282.9	51	2.2134	0.0742
32	1	836186.8	834282.9	49	2.0865	0.0698
33	1	836186.8	834282.9	264	1.9460	0.0888
34	1	836186.8	834282.9	52	1.9279	0.0647
35	1	836186.8	834282.9	340	1.8585	0.1719
36	1	836186.8	834282.9	18	1.6932	0.0381
37	1	836186.8	834282.9	269	1.6527	0.0773
38	1	836186.8	834282.9	48	1.6484	0.0551
39	1	836186.8	834282.9	11	1.6085	0.0350
40	1	836186.8	834282.9	53	1.5105	0.0509
41	1	836186.8	834282.9	300	1.2985	0.0873
42	1	836186.8	834282.9	86	1.2308	0.0747
43	1	836186.8	834282.9	198	1.2040	0.0223
44	1	836186.8	834282.9	87	1.1941	0.0725
45	1	836186.8	834282.9	85	1.1290	0.0685
46	1	836186.8	834282.9	305	1.1004	0.0755
47	1	836186.8	834282.9	47	1.0531	0.0352
48	1	836186.8	834282.9	54	1.0508	0.0355
49	1	836186.8	834282.9	88	1.0368	0.0630
50	1	836186.8	834282.9	19	1.0300	0.0234

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HIGHEST AND SECOND HIGHEST VALUES FOR 1 HOUR AVERAGES

RECEPTOR	X-COORDINATE	Y-COORDINATE	HIGHEST VALUE	ENDING HOUR	DEPOSITION	SECOND HIGH	ENDING HOUR	DEPOSTION
1	836186.8	834282.9	13.0896	194.	0.2086	12.6388	195.	0.2150

DATE AT END OF RUN: 08/19/96 TIME AT END OF RUN: 17:21:05.33
ELAPSED TIME FOR THIS RUN: 0.22680E+02 SECONDS
OR 0 HOURS 0 MINUTES 22.68 SECONDS

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Tolo Highway Widening, Option 3 sample file (ASR1), with 75% mitigation
 1 1 1 1 1 1 3 1 1 1 1 1 1 2
143    1  5    360
60.        100.       1.         2.5
1.25       3.75       7.5        12.5       20.
0.0262     0.0678     0.1704     0.1536     0.5820
836186.8  834282.9    1.5
 2 9.5799E-05         836294.1  833929.2  836417.9  833872.3  0.0       4.0
 2 9.5799E-05         836417.9  833872.3  836604.6  833738.7  0.0       4.0
 2 9.5799E-05         836604.6  833738.7  836982.8  833507.1  0.0       4.0
 2 9.5799E-05         836982.8  833507.1  837153.1  833408.9  0.0       4.0
 2 9.5799E-05         837153.1  833408.9  837280.1  833339.5  0.0       4.0
 2 9.5799E-05         837280.1  833339.5  837407.7  833301.9  0.0       4.0
 2 9.5799E-05         837407.7  833301.9  837524.1  833293.7  0.0       4.0
 2 9.5799E-05         837524.1  833293.7  837636.6  833306.6  0.0       4.0
 2 9.5799E-05         837636.6  833306.6  837781.0  833347.4  0.0       4.0
 2 9.5799E-05         837781.0  833347.4  837870.2  833362.8  0.0       4.0
 2 9.5799E-05         837870.2  833362.8  837966.5  833357.5  0.0       4.0
 2 9.5799E-05         837966.5  833357.5  838062.1  833324.4  0.0       4.0
 2 9.5799E-05         838062.1  833324.4  838216.1  833243.2  0.0       4.0
 2 9.5799E-05         838216.1  833243.2  838312.6  833176.6  0.0       4.0
 2 9.5799E-05         838312.6  833176.6  838402.9  833107.2  0.0       4.0
 2 9.5799E-05         838402.9  833107.2  838490.5  833023.0  0.0       4.0
 2 9.5799E-05         838490.5  833023.0  838575.2  832926.4  0.0       4.0
 2 9.5799E-05         838575.2  832926.4  838640.2  832830.5  0.0       4.0
 2 9.5799E-05         838640.2  832830.5  838684.1  832722.9  0.0       4.0
 2 9.5799E-05         838684.1  832722.9  838708.9  832624.9  0.0       4.0
 2 9.5799E-05         838708.9  832624.9  838733.6  832522.3  0.0       4.0
 2 9.5799E-05         838733.6  832522.3  838781.8  832418.1  0.0       4.0
 2 9.5799E-05         838781.8  832418.1  838845.1  832328.5  0.0       4.0
 2 9.5799E-05         838845.1  832328.5  838928.9  832247.7  0.0       4.0
 2 9.5799E-05         838928.9  832247.7  838997.9  832198.0  0.0       4.0
 2 9.5799E-05         838997.9  832198.0  839142.2  832096.3  0.0       4.0
 2 9.5799E-05         839142.2  832096.3  839280.6  831998.7  0.0       4.0
 2 9.5799E-05         839280.6  831998.7  839493.9  831855.3  0.0       4.0
 2 9.5799E-05         839493.9  831855.3  839632.6  831755.1  0.0       4.0
 2 9.5799E-05         839632.6  831755.1  839784.6  831647.3  0.0       4.0
 2 9.5799E-05         839784.6  831647.3  839865.0  831574.8  0.0       4.0
 2 9.5799E-05         839865.0  831574.8  839900.5  831536.2  0.0       4.0
 2 9.5799E-05         839900.5  831536.2  839958.0  831458.1  0.0       4.0
 2 9.5799E-05         839958.0  831458.1  840002.7  831369.2  0.0       4.0
 2 9.5799E-05         840002.7  831369.2  840036.8  831263.8  0.0       4.0
 2 9.5799E-05         840036.8  831263.8  840052.9  831164.3  0.0       4.0
 2 9.5799E-05         840052.9  831164.3  840056.1  831016.4  0.0       4.0
 2 9.5799E-05         840056.1  831016.4  840049.4  830943.6  0.0       4.0
 2 1.4370E-04         837185.2  833364.8  837266.0  833324.5  0.0       6.0
 2 1.4370E-04         837266.0  833324.5  837367.3  833289.7  0.0       6.0
 2 1.4370E-04         837367.3  833289.7  837469.3  833275.2  0.0       6.0
 2 1.4370E-04         837469.3  833275.2  837561.6  833276.2  0.0       6.0
 2 1.4370E-04         837561.6  833276.2  837632.4  833285.1  0.0       6.0
 2 1.4370E-04         837632.4  833285.1  837720.3  833309.7  0.0       6.0
 2 1.4370E-04         837720.3  833309.7  837782.5  833329.4  0.0       6.0
 2 1.4370E-04         837783.3  833327.3  837857.9  833341.8  0.0       6.0
 2 1.4370E-04         837857.9  833341.8  837914.7  833341.8  0.0       6.0
 2 1.4370E-04         837914.7  833341.8  837971.7  833334.0  0.0       6.0
 2 1.4370E-04         837971.7  833334.0  838023.8  833317.4  0.0       6.0
 2 1.4370E-04         838023.8  833317.4  838095.6  833285.5  0.0       6.0
 2 1.4370E-04         838095.6  833285.5  838175.7  833243.0  0.0       6.0
 2 1.4370E-04         838175.7  833243.0  838297.5  833162.4  0.0       6.0
 2 1.4370E-04         838340.1  833136.7  838470.7  833015.9  0.0       6.0
 2 1.4370E-04         838705.8  832560.7  838707.6  832519.6  0.0       6.0
 2 1.4370E-04         838707.6  832519.6  838747.0  832425.6  0.0       6.0
 2 1.4370E-04         838747.0  832425.6  838808.0  832331.8  0.0       6.0
 2 1.4370E-04         838808.0  832331.8  838845.2  832307.6  0.0       6.0
 2 1.4370E-04         838810.9  832330.5  838891.4  832248.1  0.0       6.0
 2 1.4370E-04         838891.4  832248.1  838981.5  832179.6  0.0       6.0
 2 1.4370E-04         838981.5  832179.6  839238.1  831994.7  0.0       6.0
 2 1.4370E-04         839238.1  831994.7  839479.4  831834.7  0.0       6.0
 2 1.4370E-04         839479.4  831834.7  839522.0  831811.6  0.0       6.0
 2 2.8740E-04         836382.1  833960.0  836475.2  833871.8  0.0       12.0
 2 3.8320E-04         836475.2  833871.8  836621.2  833764.0  0.0       16.0
 2 3.8320E-04         836621.2  833764.0  836817.3  833639.9  0.0       16.0
 2 2.8740E-04         836817.5  833638.9  836859.0  833627.0  0.0       12.0
 2 2.8740E-04         836859.0  833627.0  837045.7  833517.0  0.0       12.0
 2 2.8740E-04         837045.7  833517.0  837073.8  833485.1  0.0       12.0
 2 1.4370E-04         836809.1  833632.8  836842.7  833618.7  0.0       6.0
 2 1.4370E-04         836842.7  833618.7  836879.1  833589.5  0.0       6.0
 2 1.4370E-04         836879.1  833589.5  837058.8  833480.9  0.0       6.0
 2 3.8320E-04         837073.3  833485.2  837167.1  833431.1  0.0       16.0
 2 3.8320E-04         837167.1  833431.1  837283.5  833367.7  0.0       16.0
 2 3.8320E-04         837283.5  833367.7  837404.0  833331.2  0.0       16.0
 2 3.8320E-04         837404.0  833331.2  837523.6  833320.9  0.0       16.0
 2 3.8320E-04         837523.6  833320.9  837643.9  833335.8  0.0       16.0
 2 3.8320E-04         837643.9  833335.8  837777.9  833375.4  0.0       16.0
 2 3.8320E-04         837777.0  833375.4  837876.6  833391.3  0.0       16.0
 2 3.8320E-04         837876.6  833391.3  837963.8  833384.3  0.0       16.0
 2 3.8320E-04         837963.8  833384.3  838050.4  833359.5  0.0       16.0
 2 3.8320E-04         838050.4  833359.5  838155.8  833309.0  0.0       16.0
 2 3.8320E-04         838155.8  833309.0  838261.7  833245.3  0.0       16.0
 2 3.8320E-04         838261.7  833245.3  838330.1  833197.6  0.0       16.0
 2 3.8320E-04         838330.1  833197.6  838445.1  833105.2  0.0       16.0
 2 3.8320E-04         838445.1  833105.2  838530.8  833018.9  0.0       16.0
 2 3.8320E-04         838530.8  833018.9  838617.3  832918.2  0.0       16.0
 2 3.8320E-04         838617.3  832918.2  838669.8  832832.1  0.0       16.0
 2 3.8320E-04         838669.8  832832.1  838709.6  832733.1  0.0       16.0
 2 3.8320E-04         838710.1  832733.7  838715.3  832715.7  0.0       16.0
 2 3.8320E-04         838715.3  832715.7  838741.3  832599.2  0.0       16.0
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2	3.8320E-04	838741.3	832599.2	838751.8	832554.3	0.0	16.0
2	3.8320E-04	838751.8	832554.3	838792.2	832455.5	0.0	16.0
2	3.8320E-04	838792.2	832455.5	838851.0	832365.5	0.0	16.0
2	3.8320E-04	838851.0	832365.5	838924.0	832288.1	0.0	16.0
2	3.8320E-04	838924.0	832288.1	839012.9	832221.8	0.0	16.0
2	1.9160E-04	838715.4	832715.6	838743.8	832678.0	0.0	8.0
2	1.9160E-04	838743.8	832678.0	838752.8	832639.9	0.0	8.0
2	1.9160E-04	838752.8	832639.9	838742.3	832599.9	0.0	8.0
2	3.8320E-04	839014.0	832219.4	839107.9	832157.6	0.0	16.0
2	1.9160E-04	839108.6	832159.1	839256.4	832104.4	0.0	8.0
2	1.9160E-04	839256.4	832104.4	839367.5	831980.8	0.0	8.0
2	4.7900E-04	839113.1	832155.7	839362.9	831976.8	0.0	20.0
2	3.8320E-04	839189.9	832120.5	839320.7	832027.0	0.0	16.0
2	3.3530E-04	839240.3	832102.3	839269.7	832080.1	0.0	14.0
2	3.8320E-04	839361.4	831978.7	839507.0	831875.5	0.0	16.0
2	3.8320E-04	839507.0	831875.5	839559.3	831850.1	0.0	16.0
2	3.8320E-04	839559.3	831850.1	839598.0	831811.6	0.0	16.0
2	3.8320E-04	839598.0	831811.6	839788.2	831677.3	0.0	16.0
2	3.8320E-04	839788.2	831677.3	839888.3	831586.4	0.0	16.0
2	1.4370E-04	839955.1	831493.4	840004.9	831405.0	0.0	6.0
2	1.4370E-04	840004.9	831405.0	840038.8	831319.6	0.0	6.0
2	1.4370E-04	840038.8	831319.6	840066.1	831197.7	0.0	6.0
2	1.4370E-04	840074.5	831121.6	840075.2	831052.6	0.0	6.0
2	1.4370E-04	840075.2	831052.6	840069.1	830941.0	0.0	6.0
2	2.3950E-04	840030.0	831535.0	840057.0	831538.3	0.0	10.0
2	2.3950E-04	840057.0	831538.3	840079.6	831528.7	0.0	10.0
2	2.3950E-04	840079.6	831528.7	840133.6	831361.3	0.0	10.0
2	2.3950E-04	840133.6	831361.3	840142.3	831290.4	0.0	10.0
2	2.3950E-04	840142.3	831290.4	840148.0	831144.8	0.0	10.0
2	2.3950E-04	840148.0	831144.8	840151.6	831014.3	0.0	10.0
2	2.3950E-04	840151.6	831014.3	840131.2	830935.9	0.0	10.0
2	2.3950E-04	840131.2	830935.9	840114.3	830892.3	0.0	10.0
2	2.3950E-04	840100.2	830890.2	840073.9	830817.1	0.0	10.0
3	2.3950E-05	837368.9	833269.0	85.7	27.2	0.0	-13.9
3	2.3950E-05	837385.9	833243.9	34.0	13.2	0.0	-14.0
3	2.3950E-05	837361.8	833253.0	17.7	8.8	0.0	-14.6
3	2.3950E-05	837347.9	833257.3	11.5	5.0	0.0	-14.1
3	2.3950E-05	838356.6	833092.3	23.5	23.6	0.0	-19.7
3	2.3950E-05	838383.5	833077.6	37.0	13.8	0.0	-19.9
3	2.3950E-05	838376.3	833056.7	79.0	29.0	0.0	-19.9
3	2.3950E-05	838423.7	833035.3	25.6	21.8	0.0	-22.1
3	2.3950E-05	838442.0	833029.3	12.2	8.4	0.0	-18.9
3	2.3950E-05	837410.3	833352.0	54.2	23.7	0.0	-10.4
3	2.3950E-05	838664.9	832890.9	98.7	36.1	0.0	-57.2
3	2.3950E-05	838903.3	832345.0	54.7	33.9	0.0	-46.9
3	2.3950E-05	839878.1	831621.7	24.1	13.8	0.0	-46.3
3	2.3950E-05	839892.2	831627.5	13.1	13.0	0.0	-49.9
3	2.3950E-05	839909.5	831611.6	29.3	40.9	0.0	-46.9
3	2.3950E-05	839936.6	831628.0	28.4	16.9	0.0	-47.3
3	2.3950E-05	839950.5	831635.4	10.9	9.8	0.0	-49.7
3	2.3950E-05	839971.0	831584.0	88.2	88.3	0.0	-47.1
3	2.3950E-05	839991.3	831529.1	10.8	18.5	0.0	-49.3
3	2.3950E-05	840024.6	831553.0	19.5	48.5	0.0	-50.4

1.0	0.0	2	500.0	298.0
1.0	10.0	2	500.0	298.0
1.0	20.0	2	500.0	298.0
1.0	30.0	2	500.0	298.0
1.0	40.0	2	500.0	298.0
1.0	50.0	2	500.0	298.0
1.0	60.0	2	500.0	298.0
1.0	70.0	2	500.0	298.0
1.0	80.0	2	500.0	298.0
1.0	90.0	2	500.0	298.0
1.0	100.0	2	500.0	298.0
1.0	110.0	2	500.0	298.0
1.0	120.0	2	500.0	298.0
1.0	130.0	2	500.0	298.0
1.0	140.0	2	500.0	298.0
1.0	150.0	2	500.0	298.0
1.0	160.0	2	500.0	298.0
1.0	170.0	2	500.0	298.0
1.0	180.0	2	500.0	298.0
1.0	190.0	2	500.0	298.0
1.0	200.0	2	500.0	298.0
1.0	210.0	2	500.0	298.0
1.0	220.0	2	500.0	298.0
1.0	230.0	2	500.0	298.0
1.0	240.0	2	500.0	298.0
1.0	250.0	2	500.0	298.0
1.0	260.0	2	500.0	298.0
1.0	270.0	2	500.0	298.0
1.0	280.0	2	500.0	298.0
1.0	290.0	2	500.0	298.0
1.0	300.0	2	500.0	298.0
1.0	310.0	2	500.0	298.0
1.0	320.0	2	500.0	298.0
1.0	330.0	2	500.0	298.0
1.0	340.0	2	500.0	298.0
1.0	350.0	2	500.0	298.0
2.0	0.0	2	500.0	298.0
2.0	10.0	2	500.0	298.0
2.0	20.0	2	500.0	298.0
2.0	30.0	2	500.0	298.0
2.0	40.0	2	500.0	298.0
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2.0	60.0	2	500.0	298.0
2.0	70.0	2	500.0	298.0

2.0	80.0	2	500.0	298.0
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2.0	100.0	2	500.0	298.0
2.0	110.0	2	500.0	298.0
2.0	120.0	2	500.0	298.0
2.0	130.0	2	500.0	298.0
2.0	140.0	2	500.0	298.0
2.0	150.0	2	500.0	298.0
2.0	160.0	2	500.0	298.0
2.0	170.0	2	500.0	298.0
2.0	180.0	2	500.0	298.0
2.0	190.0	2	500.0	298.0
2.0	200.0	2	500.0	298.0
2.0	210.0	2	500.0	298.0
2.0	220.0	2	500.0	298.0
2.0	230.0	2	500.0	298.0
2.0	240.0	2	500.0	298.0
2.0	250.0	2	500.0	298.0
2.0	260.0	2	500.0	298.0
2.0	270.0	2	500.0	298.0
2.0	280.0	2	500.0	298.0
2.0	290.0	2	500.0	298.0
2.0	300.0	2	500.0	298.0
2.0	310.0	2	500.0	298.0
2.0	320.0	2	500.0	298.0
2.0	330.0	2	500.0	298.0
2.0	340.0	2	500.0	298.0
2.0	350.0	2	500.0	298.0
4.0	0.0	2	500.0	298.0
4.0	10.0	2	500.0	298.0
4.0	20.0	2	500.0	298.0
4.0	30.0	2	500.0	298.0
4.0	40.0	2	500.0	298.0
4.0	50.0	2	500.0	298.0
4.0	60.0	2	500.0	298.0
4.0	70.0	2	500.0	298.0
4.0	80.0	2	500.0	298.0
4.0	90.0	2	500.0	298.0
4.0	100.0	2	500.0	298.0
4.0	110.0	2	500.0	298.0
4.0	120.0	2	500.0	298.0
4.0	130.0	2	500.0	298.0
4.0	140.0	2	500.0	298.0
4.0	150.0	2	500.0	298.0
4.0	160.0	2	500.0	298.0
4.0	170.0	2	500.0	298.0
4.0	180.0	2	500.0	298.0
4.0	190.0	2	500.0	298.0
4.0	200.0	2	500.0	298.0
4.0	210.0	2	500.0	298.0
4.0	220.0	2	500.0	298.0
4.0	230.0	2	500.0	298.0
4.0	240.0	2	500.0	298.0
4.0	250.0	2	500.0	298.0
4.0	260.0	2	500.0	298.0
4.0	270.0	2	500.0	298.0
4.0	280.0	2	500.0	298.0
4.0	290.0	2	500.0	298.0
4.0	300.0	2	500.0	298.0
4.0	310.0	2	500.0	298.0
4.0	320.0	2	500.0	298.0
4.0	330.0	2	500.0	298.0
4.0	340.0	2	500.0	298.0
4.0	350.0	2	500.0	298.0
6.0	0.0	2	500.0	298.0
6.0	10.0	2	500.0	298.0
6.0	20.0	2	500.0	298.0
6.0	30.0	2	500.0	298.0
6.0	40.0	2	500.0	298.0
6.0	50.0	2	500.0	298.0
6.0	60.0	2	500.0	298.0
6.0	70.0	2	500.0	298.0
6.0	80.0	2	500.0	298.0
6.0	90.0	2	500.0	298.0
6.0	100.0	2	500.0	298.0
6.0	110.0	2	500.0	298.0
6.0	120.0	2	500.0	298.0
6.0	130.0	2	500.0	298.0
6.0	140.0	2	500.0	298.0
6.0	150.0	2	500.0	298.0
6.0	160.0	2	500.0	298.0
6.0	170.0	2	500.0	298.0
6.0	180.0	2	500.0	298.0
6.0	190.0	2	500.0	298.0
6.0	200.0	2	500.0	298.0
6.0	210.0	2	500.0	298.0
6.0	220.0	2	500.0	298.0
6.0	230.0	2	500.0	298.0
6.0	240.0	2	500.0	298.0
6.0	250.0	2	500.0	298.0
6.0	260.0	2	500.0	298.0
6.0	270.0	2	500.0	298.0
6.0	280.0	2	500.0	298.0
6.0	290.0	2	500.0	298.0
6.0	300.0	2	500.0	298.0
6.0	310.0	2	500.0	298.0
6.0	320.0	2	500.0	298.0

6.0	330.0	2	500.0	298.0
6.0	340.0	2	500.0	298.0
6.0	350.0	2	500.0	298.0
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8.0	10.0	2	500.0	298.0
8.0	20.0	2	500.0	298.0
8.0	30.0	2	500.0	298.0
8.0	40.0	2	500.0	298.0
8.0	50.0	2	500.0	298.0
8.0	60.0	2	500.0	298.0
8.0	70.0	2	500.0	298.0
8.0	80.0	2	500.0	298.0
8.0	90.0	2	500.0	298.0
8.0	100.0	2	500.0	298.0
8.0	110.0	2	500.0	298.0
8.0	120.0	2	500.0	298.0
8.0	130.0	2	500.0	298.0
8.0	140.0	2	500.0	298.0
8.0	150.0	2	500.0	298.0
8.0	160.0	2	500.0	298.0
8.0	170.0	2	500.0	298.0
8.0	180.0	2	500.0	298.0
8.0	190.0	2	500.0	298.0
8.0	200.0	2	500.0	298.0
8.0	210.0	2	500.0	298.0
8.0	220.0	2	500.0	298.0
8.0	230.0	2	500.0	298.0
8.0	240.0	2	500.0	298.0
8.0	250.0	2	500.0	298.0
8.0	260.0	2	500.0	298.0
8.0	270.0	2	500.0	298.0
8.0	280.0	2	500.0	298.0
8.0	290.0	2	500.0	298.0
8.0	300.0	2	500.0	298.0
8.0	310.0	2	500.0	298.0
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8.0	330.0	2	500.0	298.0
8.0	340.0	2	500.0	298.0
8.0	350.0	2	500.0	298.0
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1.0	10.0	4	500.0	298.0
1.0	20.0	4	500.0	298.0
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1.0	170.0	4	500.0	298.0
1.0	180.0	4	500.0	298.0
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1.0	340.0	4	500.0	298.0
1.0	350.0	4	500.0	298.0
2.0	0.0	4	500.0	298.0
2.0	10.0	4	500.0	298.0
2.0	20.0	4	500.0	298.0
2.0	30.0	4	500.0	298.0
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2.0	50.0	4	500.0	298.0
2.0	60.0	4	500.0	298.0
2.0	70.0	4	500.0	298.0
2.0	80.0	4	500.0	298.0
2.0	90.0	4	500.0	298.0
2.0	100.0	4	500.0	298.0
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4.0	20.0	4	500.0	298.0
4.0	30.0	4	500.0	298.0
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4.0	90.0	4	500.0	298.0
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6.0	50.0	4	500.0	298.0
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6.0	330.0	4	500.0	298.0
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6.0	350.0	4	500.0	298.0
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8.0	20.0	4	500.0	298.0
8.0	30.0	4	500.0	298.0
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8.0	60.0	4	500.0	298.0
8.0	70.0	4	500.0	298.0
8.0	80.0	4	500.0	298.0
8.0	90.0	4	500.0	298.0
8.0	100.0	4	500.0	298.0

8.0	110.0	4	500.0	298.0
8.0	120.0	4	500.0	298.0
8.0	130.0	4	500.0	298.0
8.0	140.0	4	500.0	298.0
8.0	150.0	4	500.0	298.0
8.0	160.0	4	500.0	298.0
8.0	170.0	4	500.0	298.0
8.0	180.0	4	500.0	298.0
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8.0	240.0	4	500.0	298.0
8.0	250.0	4	500.0	298.0
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8.0	270.0	4	500.0	298.0
8.0	280.0	4	500.0	298.0
8.0	290.0	4	500.0	298.0
8.0	300.0	4	500.0	298.0
8.0	310.0	4	500.0	298.0
8.0	320.0	4	500.0	298.0
8.0	330.0	4	500.0	298.0
8.0	340.0	4	500.0	298.0
8.0	350.0	4	500.0	298.0

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                FUGITIVE DUST MODEL (FDM)
                VERSION 95279
                OCT, 1995
      DATE AT START OF RUN: 08/19/96    TIME AT START OF RUN: 17:19:55.57
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RUN TITLE:
Tolo Highway Widening, Option 3 sample file (ASR1), with 75% mitigation

INPUT FILE NAME: op75ds3.IN
OUTPUT FILE NAME: op75ds3.OUT

CONVERGENCE OPTION 1=OFF, 2=ON	1
MET OPTION SWITCH, 1=CARDS, 2=PREPROCESSED	1
PLOT FILE OUTPUT, 1=NO, 2=YES	1
MET DATA PRINT SWITCH, 1=NO, 2=YES	1
POST-PROCESSOR OUTPUT, 1=NO, 2=YES	1
DEP. VEL./GRAV. SETL. VEL., 1=DEFAULT, 2=USER	1
PRINT 1-HOUR AVERAGE CONCEN, 1=NO, 2=YES	3
PRINT 3-HOUR AVERAGE CONCEN, 1=NO, 2=YES	1
PRINT 8-HOUR AVERAGE CONCEN, 1=NO, 2=YES	1
PRINT 24-HOUR AVERAGE CONCEN, 1=NO, 2=YES	1
PRINT LONG-TERM AVERAGE CONCEN, 1=NO, 2=YES	1
BYPASS RAMMET CALMS RECOGNITION, 1=NO, 2=YES	1
READ HOURLY EMISSION RATES, 1=NO, 2=YES	1
NUMBER OF SOURCES PROCESSED	143
NUMBER OF RECEPTORS PROCESSED	1
NUMBER OF PARTICLE SIZE CLASSES	5
NUMBER OF HOURS OF MET DATA PROCESSED	360
LENGTH IN MINUTES OF 1-HOUR OF MET DATA	60.
ROUGHNESS LENGTH IN CM	100.00
SCALING FACTOR FOR SOURCE AND RECPTORS	1.0000
PARTICLE DENSITY IN G/CM**3	2.50
ANEMOMETER HEIGHT IN M	10.00

GENERAL PARTICLE SIZE CLASS INFORMATION

PARTICLE SIZE CLASS	CHAR. DIA. (UM)	GRAV. SETTLING VELOCITY (M/SEC)	DEPOSITION VELOCITY (M/SEC)	FRACTION IN EACH SIZE CLASS
1	1.2500000	**	**	0.0262
2	3.7500000	**	**	0.0678
3	7.5000000	**	**	0.1704
4	12.5000000	**	**	0.1536
5	20.0000000	**	**	0.5820

** COMPUTED BY FDM

1

RECEPTOR COORDINATES (X,Y,Z)

(836187., 834283., 2.) (
1

SOURCE INFORMATION

TYPE	ENTERED EMIS. RATE (G/SEC, G/SEC/M OR G/SEC/M**2)	TOTAL EMISSION RATE (G/SEC)	WIND SPEED FAC.	X1 (M)	Y1 (M)	X2 (M)	Y2 (M)	HEIGHT (M)	WIDTH (M)
2	0.000095799	0.01305	0.000	836294.	833929.	836418.	833872.	0.50	4.00
2	0.000095799	0.02200	0.000	836418.	833872.	836605.	833739.	0.50	4.00
2	0.000095799	0.04248	0.000	836605.	833739.	836983.	833507.	0.50	4.00
2	0.000095799	0.01884	0.000	836983.	833507.	837153.	833409.	0.50	4.00
2	0.000095799	0.01386	0.000	837153.	833409.	837280.	833340.	0.50	4.00
2	0.000095799	0.01274	0.000	837280.	833340.	837408.	833302.	0.50	4.00
2	0.000095799	0.01118	0.000	837408.	833302.	837524.	833294.	0.50	4.00
2	0.000095799	0.01085	0.000	837524.	833294.	837637.	833307.	0.50	4.00
2	0.000095799	0.01437	0.000	837637.	833307.	837781.	833347.	0.50	4.00
2	0.000095799	0.00867	0.000	837781.	833347.	837870.	833363.	0.50	4.00
2	0.000095799	0.00924	0.000	837870.	833363.	837967.	833358.	0.50	4.00
2	0.000095799	0.00969	0.000	837967.	833358.	838062.	833324.	0.50	4.00
2	0.000095799	0.01668	0.000	838062.	833324.	838216.	833243.	0.50	4.00
2	0.000095799	0.01123	0.000	838216.	833243.	838313.	833177.	0.50	4.00
2	0.000095799	0.01091	0.000	838313.	833177.	838403.	833107.	0.50	4.00
2	0.000095799	0.01164	0.000	838403.	833107.	838491.	833023.	0.50	4.00
2	0.000095799	0.01231	0.000	838491.	833023.	838575.	832926.	0.50	4.00
2	0.000095799	0.01110	0.000	838575.	832926.	838640.	832831.	0.50	4.00
2	0.000095799	0.01114	0.000	838640.	832831.	838684.	832723.	0.50	4.00
2	0.000095799	0.00968	0.000	838684.	832723.	838709.	832625.	0.50	4.00
2	0.000095799	0.01011	0.000	838709.	832625.	838734.	832522.	0.50	4.00
2	0.000095799	0.01100	0.000	838734.	832522.	838782.	832418.	0.50	4.00
2	0.000095799	0.01051	0.000	838782.	832418.	838845.	832329.	0.50	4.00
2	0.000095799	0.01115	0.000	838845.	832329.	838929.	832248.	0.50	4.00
2	0.000095799	0.00815	0.000	838929.	832248.	838998.	832198.	0.50	4.00
2	0.000095799	0.01691	0.000	838998.	832198.	839142.	832096.	0.50	4.00
2	0.000095799	0.01623	0.000	839142.	832096.	839281.	831999.	0.50	4.00
2	0.000095799	0.02462	0.000	839281.	831999.	839494.	831855.	0.50	4.00
2	0.000095799	0.01640	0.000	839494.	831855.	839633.	831755.	0.50	4.00
2	0.000095799	0.01785	0.000	839633.	831755.	839785.	831647.	0.50	4.00

2	0.000095799	0.01037	0.000	839785.	831647.	839865.	831575.	0.50	4.00
2	0.000095799	0.00503	0.000	839865.	831575.	839901.	831536.	0.50	4.00
2	0.000095799	0.00929	0.000	839901.	831536.	839958.	831458.	0.50	4.00
2	0.000095799	0.00954	0.000	839958.	831458.	840003.	831369.	0.50	4.00
2	0.000095799	0.01061	0.000	840003.	831369.	840037.	831264.	0.50	4.00
2	0.000095799	0.00966	0.000	840037.	831264.	840053.	831164.	0.50	4.00
2	0.000095799	0.01418	0.000	840053.	831164.	840056.	831016.	0.50	4.00
2	0.000095799	0.00700	0.000	840056.	831016.	840049.	830944.	0.50	4.00
2	0.000143700	0.01298	0.000	837185.	833365.	837266.	833325.	0.50	6.00
2	0.000143700	0.01539	0.000	837266.	833325.	837367.	833290.	0.50	6.00
2	0.000143700	0.01480	0.000	837367.	833290.	837469.	833275.	0.50	6.00
2	0.000143700	0.01327	0.000	837469.	833275.	837562.	833276.	0.50	6.00
2	0.000143700	0.01025	0.000	837562.	833276.	837632.	833285.	0.50	6.00
2	0.000143700	0.01312	0.000	837632.	833285.	837720.	833310.	0.50	6.00
2	0.000143700	0.00937	0.000	837720.	833310.	837783.	833329.	0.50	6.00
2	0.000143700	0.01092	0.000	837783.	833327.	837858.	833342.	0.50	6.00
2	0.000143700	0.00816	0.000	837858.	833342.	837915.	833342.	0.50	6.00
2	0.000143700	0.00827	0.000	837915.	833342.	837972.	833334.	0.50	6.00
2	0.000143700	0.00786	0.000	837972.	833334.	838024.	833317.	0.50	6.00
2	0.000143700	0.01129	0.000	838024.	833317.	838096.	833286.	0.50	6.00
2	0.000143700	0.01303	0.000	838096.	833286.	838176.	833243.	0.50	6.00
2	0.000143700	0.02099	0.000	838176.	833243.	838298.	833162.	0.50	6.00
2	0.000143700	0.02556	0.000	838340.	833137.	838471.	833016.	0.50	6.00
2	0.000143700	0.00591	0.000	838706.	832561.	838708.	832520.	0.50	6.00
2	0.000143700	0.01464	0.000	838708.	832520.	838747.	832426.	0.50	6.00
2	0.000143700	0.01608	0.000	838747.	832426.	838808.	832332.	0.50	6.00
2	0.000143700	0.00637	0.000	838808.	832332.	838845.	832308.	0.50	6.00
2	0.000143700	0.01655	0.000	838811.	832331.	838891.	832248.	0.50	6.00
2	0.000143700	0.01627	0.000	838891.	832248.	838982.	832180.	0.50	6.00
2	0.000143700	0.04546	0.000	838982.	832180.	839238.	831995.	0.50	6.00
2	0.000143700	0.04160	0.000	839238.	831995.	839479.	831835.	0.50	6.00
2	0.000143700	0.00696	0.000	839479.	831835.	839522.	831812.	0.50	6.00
2	0.000287400	0.03685	0.000	836382.	833960.	836475.	833872.	0.50	12.00
2	0.000383200	0.06955	0.000	836475.	833872.	836621.	833764.	0.50	16.00
2	0.000383200	0.08894	0.000	836621.	833764.	836817.	833640.	0.50	16.00
2	0.000287400	0.01241	0.000	836818.	833639.	836859.	833627.	0.50	12.00
2	0.000287400	0.06228	0.000	836859.	833627.	837046.	833517.	0.50	12.00
2	0.000287400	0.01222	0.000	837046.	833517.	837074.	833485.	0.50	12.00
2	0.000143700	0.00523	0.000	836809.	833633.	836843.	833619.	0.50	6.00
2	0.000143700	0.00671	0.000	836843.	833619.	836879.	833590.	0.50	6.00
2	0.000143700	0.03017	0.000	836879.	833590.	837059.	833481.	0.50	6.00
2	0.000383200	0.04149	0.000	837073.	833485.	837167.	833431.	0.50	16.00
2	0.000383200	0.05079	0.000	837167.	833431.	837284.	833368.	0.50	16.00
2	0.000383200	0.04825	0.000	837284.	833368.	837404.	833331.	0.50	16.00
2	0.000383200	0.04601	0.000	837404.	833331.	837524.	833321.	0.50	16.00
2	0.000383200	0.04643	0.000	837524.	833321.	837644.	833336.	0.50	16.00
2	0.000383200	0.05354	0.000	837644.	833336.	837778.	833375.	0.50	16.00
2	0.000383200	0.03866	0.000	837777.	833375.	837877.	833391.	0.50	16.00
2	0.000383200	0.03352	0.000	837877.	833391.	837964.	833384.	0.50	16.00
2	0.000383200	0.03451	0.000	837964.	833384.	838050.	833360.	0.50	16.00
2	0.000383200	0.04480	0.000	838050.	833360.	838156.	833309.	0.50	16.00
2	0.000383200	0.04735	0.000	838156.	833309.	838262.	833245.	0.50	16.00
2	0.000383200	0.03196	0.000	838262.	833245.	838330.	833198.	0.50	16.00
2	0.000383200	0.05654	0.000	838330.	833198.	838445.	833105.	0.50	16.00
2	0.000383200	0.04661	0.000	838445.	833105.	838531.	833019.	0.50	16.00
2	0.000383200	0.05087	0.000	838531.	833019.	838617.	832918.	0.50	16.00
2	0.000383200	0.03863	0.000	838617.	832918.	838670.	832832.	0.50	16.00
2	0.000383200	0.04089	0.000	838670.	832832.	838710.	832733.	0.50	16.00
2	0.000383200	0.00718	0.000	838710.	832734.	838715.	832716.	0.50	16.00
2	0.000383200	0.04574	0.000	838715.	832716.	838741.	832599.	0.50	16.00
2	0.000383200	0.01766	0.000	838741.	832599.	838752.	832554.	0.50	16.00
2	0.000383200	0.04090	0.000	838752.	832554.	838792.	832456.	0.50	16.00
2	0.000383200	0.04120	0.000	838792.	832456.	838851.	832366.	0.50	16.00
2	0.000383200	0.04076	0.000	838851.	832366.	838924.	832288.	0.50	16.00
2	0.000383200	0.04249	0.000	838924.	832288.	839013.	832222.	0.50	16.00
2	0.000191600	0.00904	0.000	838715.	832716.	838744.	832678.	0.50	8.00
2	0.000191600	0.00751	0.000	838744.	832678.	838753.	832640.	0.50	8.00
2	0.000191600	0.00792	0.000	838753.	832640.	838742.	832600.	0.50	8.00
2	0.000383200	0.04306	0.000	839014.	832219.	839108.	832158.	0.50	16.00
2	0.000191600	0.03019	0.000	839109.	832159.	839256.	832104.	0.50	8.00
2	0.000191600	0.03184	0.000	839256.	832104.	839368.	831981.	0.50	8.00
2	0.000479000	0.14715	0.000	839113.	832156.	839363.	831977.	0.50	20.00
2	0.000383200	0.06162	0.000	839190.	832121.	839321.	832027.	0.50	16.00
2	0.000335300	0.01234	0.000	839240.	832102.	839270.	832080.	0.50	14.00
2	0.000383200	0.06839	0.000	839361.	831979.	839507.	831876.	0.50	16.00
2	0.000383200	0.02228	0.000	839507.	831876.	839559.	831850.	0.50	16.00
2	0.000383200	0.02092	0.000	839559.	831850.	839598.	831812.	0.50	16.00
2	0.000383200	0.08922	0.000	839598.	831812.	839788.	831677.	0.50	16.00
2	0.000383200	0.05183	0.000	839788.	831677.	839888.	831586.	0.50	16.00
2	0.000143700	0.01457	0.000	839955.	831493.	840005.	831405.	0.50	6.00
2	0.000143700	0.01320	0.000	840005.	831405.	840039.	831320.	0.50	6.00
2	0.000143700	0.01796	0.000	840039.	831320.	840066.	831198.	0.50	6.00
2	0.000143700	0.00992	0.000	840075.	831122.	840075.	831053.	0.50	6.00
2	0.000143700	0.01606	0.000	840075.	831053.	840069.	830941.	0.50	6.00
2	0.000239500	0.00651	0.000	840030.	831535.	840057.	831538.	0.50	10.00
2	0.000239500	0.00589	0.000	840057.	831538.	840080.	831529.	0.50	10.00
2	0.000239500	0.04212	0.000	840080.	831529.	840134.	831361.	0.50	10.00
2	0.000239500	0.01712	0.000	840134.	831361.	840142.	831290.	0.50	10.00
2	0.000239500	0.03489	0.000	840142.	831290.	840148.	831145.	0.50	10.00
2	0.000239500	0.03127	0.000	840148.	831145.	840152.	831014.	0.50	10.00
2	0.000239500	0.01941	0.000	840152.	831014.	840131.	830936.	0.50	10.00
2	0.000239500	0.01119	0.000	840131.	830936.	840114.	830892.	0.50	10.00
2	0.000239500	0.01860	0.000	840100.	830890.	840074.	830817.	0.50	10.00
3	0.000023950	0.05583	0.000	837369.	833269.	86.	27.	0.50	-13.90
3	0.000023950	0.01075	0.000	837386.	833244.	34.	13.	0.50	-14.00
3	0.000023950	0.00373	0.000	837362.	833253.	18.	9.	0.50	-14.60
3	0.000023950	0.00138	0.000	837348.	833257.	12.	5.	0.50	-14.10

3	0.000023950	0.01328	0.000	838357.	833092.	24.	24.	0.50	-19.70
3	0.000023950	0.01223	0.000	838384.	833078.	37.	14.	0.50	-19.90
3	0.000023950	0.05487	0.000	838376.	833057.	79.	29.	0.50	-19.90
3	0.000023950	0.01337	0.000	838424.	833035.	26.	22.	0.50	-22.10
3	0.000023950	0.00245	0.000	838442.	833029.	12.	8.	0.50	-18.90
3	0.000023950	0.03076	0.000	837410.	833352.	54.	24.	0.50	-10.40
3	0.000023950	0.08534	0.000	838665.	832891.	99.	36.	0.50	-57.20
3	0.000023950	0.04441	0.000	838903.	832345.	55.	34.	0.50	-46.90
3	0.000023950	0.00797	0.000	839878.	831622.	24.	14.	0.50	-46.30
3	0.000023950	0.00408	0.000	839892.	831628.	13.	13.	0.50	-49.90
3	0.000023950	0.02870	0.000	839910.	831612.	29.	41.	0.50	-46.90
3	0.000023950	0.01150	0.000	839937.	831628.	28.	17.	0.50	-47.30
3	0.000023950	0.00256	0.000	839951.	831635.	11.	10.	0.50	-49.70
3	0.000023950	0.18652	0.000	839971.	831584.	88.	88.	0.50	-47.10
3	0.000023950	0.00479	0.000	839991.	831529.	11.	19.	0.50	-49.30
3	0.000023950	0.02265	0.000	840025.	831553.	20.	49.	0.50	-50.40

TOTAL EMISSIONS 0.36356E+01 GRAMS/SEC

LONG DISTANCE (50,000 M) MASS CONSERVATION CORRECTION FACTORS USED

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TOP 50 TABLE FOR 1 HOUR AVERAGES

RANK	RECEPTOR	X-COORDINATE	Y-COORDINATE	ENDING HOUR	CONCENTRATION	DEPOSITION
1	1	836186.8	834282.9	194	13.1144	0.2089
2	1	836186.8	834282.9	195	12.6522	0.2151
3	1	836186.8	834282.9	230	10.8536	0.2909
4	1	836186.8	834282.9	231	9.9568	0.2717
5	1	836186.8	834282.9	193	9.1018	0.1366
6	1	836186.8	834282.9	196	8.6101	0.1532
7	1	836186.8	834282.9	229	7.8458	0.2073
8	1	836186.8	834282.9	232	6.5122	0.1801
9	1	836186.8	834282.9	266	6.3231	0.2909
10	1	836186.8	834282.9	267	5.6765	0.2630
11	1	836186.8	834282.9	265	4.6463	0.2126
12	1	836186.8	834282.9	302	4.2162	0.2852
13	1	836186.8	834282.9	197	4.0365	0.0737
14	1	836186.8	834282.9	303	3.7818	0.2574
15	1	836186.8	834282.9	192	3.7139	0.0540
16	1	836186.8	834282.9	268	3.6507	0.1701
17	1	836186.8	834282.9	14	3.5098	0.0767
18	1	836186.8	834282.9	15	3.4318	0.0753
19	1	836186.8	834282.9	228	3.2685	0.0858
20	1	836186.8	834282.9	338	3.2489	0.2982
21	1	836186.8	834282.9	13	3.2066	0.0700
22	1	836186.8	834282.9	301	3.1001	0.2088
23	1	836186.8	834282.9	16	3.0166	0.0666
24	1	836186.8	834282.9	233	2.9772	0.0830
25	1	836186.8	834282.9	339	2.9022	0.2675
26	1	836186.8	834282.9	12	2.5290	0.0551
27	1	836186.8	834282.9	304	2.4310	0.1662
28	1	836186.8	834282.9	337	2.3961	0.2192
29	1	836186.8	834282.9	17	2.3953	0.0534
30	1	836186.8	834282.9	50	2.2825	0.0764
31	1	836186.8	834282.9	51	2.2184	0.0743
32	1	836186.8	834282.9	49	2.0917	0.0700
33	1	836186.8	834282.9	264	1.9490	0.0890
34	1	836186.8	834282.9	52	1.9314	0.0648
35	1	836186.8	834282.9	340	1.8593	0.1720
36	1	836186.8	834282.9	18	1.6940	0.0381
37	1	836186.8	834282.9	269	1.6527	0.0773
38	1	836186.8	834282.9	48	1.6523	0.0553
39	1	836186.8	834282.9	11	1.6116	0.0351
40	1	836186.8	834282.9	53	1.5123	0.0509
41	1	836186.8	834282.9	300	1.3006	0.0874
42	1	836186.8	834282.9	86	1.2339	0.0749
43	1	836186.8	834282.9	198	1.2040	0.0223
44	1	836186.8	834282.9	87	1.1968	0.0727
45	1	836186.8	834282.9	85	1.1319	0.0687
46	1	836186.8	834282.9	305	1.1004	0.0755
47	1	836186.8	834282.9	47	1.0553	0.0353
48	1	836186.8	834282.9	54	1.0514	0.0355
49	1	836186.8	834282.9	88	1.0387	0.0632
50	1	836186.8	834282.9	19	1.0301	0.0234

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HIGHEST AND SECOND HIGHEST VALUES FOR 1 HOUR AVERAGES

RECEPTOR	X-COORDINATE	Y-COORDINATE	HIGHEST VALUE	ENDING HOUR	DEPOSITION	SECOND HIGH	ENDING HOUR	DEPOSTION
1	836186.8	834282.9	13.1144	194.	0.2089	12.6522	195.	0.2151

DATE AT END OF RUN: 08/19/96 TIME AT END OF RUN: 17:20:19.52
ELAPSED TIME FOR THIS RUN: 0.23950E+02 SECONDS
OR 0 HOURS 0 MINUTES 23.95 SECONDS

APPENDIX G

2) Predicted 1-hr & 24-hr TSP from construction

Predicted 1-hr average, 24-hr average TSP concentration (µg/m3) at different ASRs
(Option 1)

ASR ID	Location	*Setback Distance (m)	X-co	Y-co	1-hr Conc	24-hr Conc	Height
A1	Kwong Fuk Estate	63.0	836186.8	834282.9	251	153	1.5
A2	Island Hse Conservation Study Centre	91.8	836435.1	834021.4	266	160	1.5
A3	Care Village	65.8	836490.6	833701.0	270	162	1.5
A4	KCRC Club Hostel	79.6	836804.3	833501.6	273	164	1.5
A5	Sea View Villas	91.2	837118.1	833302.1	293	173	1.5
A6	Tai Po Kau Village Hse	116.6	837881.3	833218.6	274	164	1.5
A7	CUHK Res 10	80.7	839515.3	831720.3	288	171	1.5
A8	CUHK Grace Tien Hall	182.5	839765.3	831387.3	275	165	1.5
A9	CUHK Inst of Biotechnology	38.0	840028.0	831445.0	346	200	1.5
A10	Marine Science Lab	69.3	840147.3	831115.3	352	203	1.5
A11	Marine Police Base	81.2	840137.3	830790.2	277	165	1.5
A12	Marine Police N. Div Base	112.1	840050.3	830077.2	245	149	1.5
A13	Resid Hse next to Inst of Biotech	88.5	840054.9	831499.0	425	240	1.5
A14	North of Area 39	23.4	838667.1	832622.2	322	188	1.5
A15	North of Area 39	43.3	838648.1	832617.0	309	181	1.5
A16	North of Area 39	52.7	838638.7	832615.2	306	180	1.5
A17	North of Area 39	62.1	838629.4	832613.8	303	178	1.5
A18	North of Area 39	82.7	838609.6	832609.1	296	175	1.5
A19	Area 39 North - G/IC	22.8	838691.2	832526.5	376	215	1.5
A20	Area 39 North - G/IC	42.1	838672.7	832521.2	332	193	1.5
A21	Area 39 North - G/IC	53.4	838661.6	832518.5	318	186	1.5
A22	Area 39 North - G/IC	72.6	838643.1	832512.7	305	179	1.5
A23	Area 39 North - G/IC	102.0	838614.8	832504.4	293	173	1.5
A24	Area 39 - Sports	22.9	838729.6	832430.7	383	219	1.5
A25	Area 39 - Sports	42.7	838711.9	832422.2	336	195	1.5
A26	Area 39 - Sports	51.1	838703.1	832420.0	324	189	1.5
A27	Area 39 - Sports	61.5	838694.5	832413.9	313	184	1.5
A28	Area 39 - Sports	83.3	838675.0	832405.2	300	177	1.5
A29	Area 39 - Sports	22.2	838783.1	832344.3	398	226	1.5
A30	Area 39 - Sports	42.8	838764.6	832334.6	340	197	1.5
A31	Area 39 - Sports	51.1	838757.3	832330.9	327	191	1.5
A32	Area 39 - Sports	61.1	838748.4	832325.3	316	185	1.5
A33	Area 39 - Sports	82.1	838730.5	832314.7	298	176	1.5
A34	Area 39 - Sports	25.3	838848.3	832264.1	360	207	1.5
A35	Area 39 - Sports	45.2	838833.9	832250.4	326	190	1.5
A36	Area 39 - Sports	52.3	838827.9	832246.1	318	186	1.5
A37	Area 39 - Sports	65.3	838819.0	832237.0	307	180	1.5
A38	Area 39 - Sports	83.8	838805.6	832223.8	295	174	1.5
A39	Area 39 - Sports	24.5	838928.3	832198.0	371	213	1.5
A40	Area 39 - Sports	44.8	838914.9	832181.6	329	191	1.5
A41	Area 39 - Sports	54.9	838907.3	832175.0	318	186	1.5
A42	Area 39 - Sports	63.4	838903.6	832167.2	311	182	1.5
A43	Area 39 - Sports	83.8	838891.0	832151.2	297	175	1.5
A44	Area 39 South - G/IC	25.5	839011.8	832137.2	362	208	1.5
A45	Area 39 South - G/IC	44.1	839000.4	832122.4	325	189	1.5
A46	Area 39 South - G/IC	50.0	838997.8	832116.7	318	186	1.5
A47	Area 39 South - G/IC	64.5	838988.0	832106.0	307	180	1.5
A48	Area 39 South - G/IC	84.1	838976.1	832090.1	296	175	1.5
A49	Area 39 South - G/IC	25.0	839093.8	832079.4	377	215	1.5
A50	Area 39 South - G/IC	43.5	839082.5	832064.2	338	196	1.5
A51	Area 39 South - G/IC	50.0	839079.1	832057.4	328	191	1.5
A52	Area 39 South - G/IC	64.5	839070.0	832047.6	315	184	1.5
A53	Area 39 South - G/IC	84.0	839058.5	832031.9	302	178	1.5
A54	Area 39 South - G/IC	24.6	839176.1	832022.7	381	218	1.5
A55	Area 39 South - G/IC	44.0	839163.8	832007.0	344	199	1.5
A56	Area 39 South - G/IC	51.4	839159.9	832001.1	335	195	1.5
A57	Area 39 South - G/IC	65.0	839151.9	831991.0	322	188	1.5
A58	Area 39 South - G/IC	84.4	839139.4	831974.9	307	180	1.5
A59	Area 39 South - G/IC	24.5	839257.3	831964.3	381	217	1.5
A60	Area 39 South - G/IC	43.4	839246.1	831949.7	344	199	1.5
A61	Area 39 South - G/IC	50.4	839241.7	831942.4	333	194	1.5
A62	Area 39 South - G/IC	63.3	839234.4	831933.8	322	188	1.5
A63	Area 39 South - G/IC	84.2	839222.6	831917.9	307	180	1.5
A64	Area 39 South - G/IC	25.2	839337.7	831909.1	378	216	1.5
A65	Area 39 South - G/IC	43.7	839326.2	831893.8	338	196	1.5
A66	Area 39 South - G/IC	52.1	839319.6	831887.3	326	190	1.5
A67	Area 39 South - G/IC	63.4	839314.2	831876.8	315	185	1.5
A68	Area 39 South - G/IC	83.1	839302.2	831861.0	302	178	1.5
A69	Area 39 South - G/IC	27.2	839419.4	831852.1	358	206	1.5
A70	Area 39 South - G/IC	46.4	839407.7	831837.0	326	190	1.5
A71	Area 39 South - G/IC	56.1	839398.9	831831.8	317	186	1.5
A72	Area 39 South - G/IC	66.6	839395.4	831820.7	308	181	1.5
A73	Area 39 South - G/IC	86.5	839384.2	831804.5	297	175	1.5
A74	PSK Dump Stage III	22.7	838721.4	832738.1	480	267	1.5
A75	PSK Dump Stage III	42.4	838739.9	832745.1	357	206	1.5
A76	PSK Dump Stage III	52.5	838749.5	832747.7	340	197	1.5
A77	PSK Dump Stage III	62.8	838759.2	832751.5	332	193	1.5
A78	PSK Dump Stage II	23.5	839514.2	831888.9	421	238	1.5
A79	PSK Dump Stage II	42.8	839525.1	831905.0	336	195	1.5
A80	PSK Dump Stage II	53.6	839530.9	831914.0	317	186	1.5
A81	PSK Dump Stage II	62.8	839530.9	831914.0	308	181	1.5
A123	Marine Sci. Lab. Fish Ponds	34.0	840112.2	831114.2	357	206	1.5
A124	Marine Sci. Lab. Fish Ponds	34.0	840113.1	831105.3	345	199	1.5
A125	Marine Sci. Lab. Fish Ponds	34.0	840113.4	831096.9	335	195	1.5
A126	Marine Sci. Lab. Fish Ponds	34.0	840113.9	831089.9	329	192	1.5
	Maximum		existing		425	240	
			future PSK		398	226	
			future Dump site		480	267	

Remark: *Setback distance is measured from the sensitive receptor to the outer-edge of driving lane

Predicted 1-hr average, 24-hr average TSP concentration (μg/m3) at different ASRs (Option 2)

ASR ID	Location	*Setback Distance (m)	X-co	Y-co	1-hr Conc	24-hr Conc	Height
A1	Kwong Fuk Estate	63.0	836186.8	834282.9	251	153	1.5
A2	Island Hse Conservation Study Centre	91.8	836435.1	834021.4	266	160	1.5
A3	Care Village	65.8	836490.6	833701.0	270	162	1.5
A4	KCRC Club Hostel	79.6	836804.3	833501.6	273	164	1.5
A5	Sea View Villas	91.2	837118.1	833302.1	293	173	1.5
A6	Tai Po Kau Village Hse	116.6	837881.3	833218.6	274	164	1.5
A7	CUHK Res 10	80.7	839515.3	831720.3	288	171	1.5
A8	CUHK Grace Tien Hall	182.5	839765.3	831387.3	275	165	1.5
A9	CUHK Inst of Biotechnology	38.0	840028.0	831445.0	346	200	1.5
A10	Marine Science Lab	69.3	840147.3	831115.3	292	173	1.5
A11	Marine Police Base	81.2	840137.3	830790.2	271	163	1.5
A12	Marine Police N. Div Base	112.1	840050.3	830077.2	244	149	1.5
A13	Resid Hse next to Inst of Biotech	88.5	840054.9	831499.0	425	240	1.5
A14	North of Area 39	23.4	838667.1	832622.2	322	188	1.5
A15	North of Area 39	43.3	838648.1	832617.0	309	181	1.5
A16	North of Area 39	52.7	838638.7	832615.2	305	180	1.5
A17	North of Area 39	62.1	838629.4	832613.8	302	178	1.5
A18	North of Area 39	82.7	838609.6	832609.1	296	175	1.5
A19	Area 39 North - G/IC	22.8	838691.2	832526.5	376	215	1.5
A20	Area 39 North - G/IC	42.1	838672.7	832521.2	331	193	1.5
A21	Area 39 North - G/IC	53.4	838661.6	832518.5	317	186	1.5
A22	Area 39 North - G/IC	72.6	838643.1	832512.7	305	179	1.5
A23	Area 39 North - G/IC	102.0	838614.8	832504.4	293	173	1.5
A24	Area 39 - Sports	22.9	838729.6	832430.7	383	218	1.5
A25	Area 39 - Sports	42.7	838711.9	832422.2	336	195	1.5
A26	Area 39 - Sports	51.1	838703.1	832420.0	324	189	1.5
A27	Area 39 - Sports	61.5	838694.5	832413.9	313	184	1.5
A28	Area 39 - Sports	83.3	838675.0	832405.2	300	177	1.5
A29	Area 39 - Sports	22.2	838783.1	832344.3	398	226	1.5
A30	Area 39 - Sports	42.8	838764.6	832334.6	340	197	1.5
A31	Area 39 - Sports	51.1	838757.3	832330.9	327	191	1.5
A32	Area 39 - Sports	61.1	838748.4	832325.3	316	185	1.5
A33	Area 39 - Sports	82.1	838730.5	832314.7	298	176	1.5
A34	Area 39 - Sports	25.3	838848.3	832264.1	360	207	1.5
A35	Area 39 - Sports	45.2	838833.9	832250.4	326	190	1.5
A36	Area 39 - Sports	52.3	838827.9	832246.1	318	186	1.5
A37	Area 39 - Sports	65.3	838819.0	832237.0	307	180	1.5
A38	Area 39 - Sports	83.8	838805.6	832223.8	295	174	1.5
A39	Area 39 - Sports	24.5	838928.3	832198.0	371	213	1.5
A40	Area 39 - Sports	44.8	838914.9	832181.6	329	191	1.5
A41	Area 39 - Sports	54.9	838907.3	832175.0	318	186	1.5
A42	Area 39 - Sports	63.4	838903.6	832167.2	311	182	1.5
A43	Area 39 - Sports	83.8	838891.0	832151.2	297	175	1.5
A44	Area 39 South - G/IC	25.5	839011.8	832137.2	362	208	1.5
A45	Area 39 South - G/IC	44.1	839000.4	832122.4	325	189	1.5
A46	Area 39 South - G/IC	50.0	838997.8	832116.7	318	186	1.5
A47	Area 39 South - G/IC	64.5	838988.0	832106.0	307	180	1.5
A48	Area 39 South - G/IC	84.1	838976.1	832090.1	296	175	1.5
A49	Area 39 South - G/IC	25.0	839093.8	832079.4	377	215	1.5
A50	Area 39 South - G/IC	43.5	839082.5	832064.2	338	196	1.5
A51	Area 39 South - G/IC	50.0	839079.1	832057.4	328	191	1.5
A52	Area 39 South - G/IC	64.5	839070.0	832047.6	315	184	1.5
A53	Area 39 South - G/IC	84.0	839058.5	832031.9	302	178	1.5
A54	Area 39 South - G/IC	24.6	839176.1	832022.7	381	218	1.5
A55	Area 39 South - G/IC	44.0	839163.8	832007.0	344	199	1.5
A56	Area 39 South - G/IC	51.4	839159.9	832001.1	335	195	1.5
A57	Area 39 South - G/IC	65.0	839151.9	831991.0	322	188	1.5
A58	Area 39 South - G/IC	84.4	839139.4	831974.9	307	180	1.5
A59	Area 39 South - G/IC	24.5	839257.3	831964.3	381	217	1.5
A60	Area 39 South - G/IC	43.4	839246.1	831949.7	344	199	1.5
A61	Area 39 South - G/IC	50.4	839241.7	831942.4	333	194	1.5
A62	Area 39 South - G/IC	63.3	839234.4	831933.8	322	188	1.5
A63	Area 39 South - G/IC	84.2	839222.6	831917.9	307	180	1.5
A64	Area 39 South - G/IC	25.2	839337.7	831909.1	378	216	1.5
A65	Area 39 South - G/IC	43.7	839326.2	831893.8	338	196	1.5
A66	Area 39 South - G/IC	52.1	839319.6	831887.3	326	190	1.5
A67	Area 39 South - G/IC	63.4	839314.2	831876.8	315	185	1.5
A68	Area 39 South - G/IC	83.1	839302.2	831861.0	302	178	1.5
A69	Area 39 South - G/IC	27.2	839419.4	831852.1	358	206	1.5
A70	Area 39 South - G/IC	46.4	839407.7	831837.0	326	190	1.5
A71	Area 39 South - G/IC	56.1	839398.9	831831.8	317	186	1.5
A72	Area 39 South - G/IC	66.6	839395.4	831820.7	308	181	1.5
A73	Area 39 South - G/IC	86.5	839384.2	831804.5	297	175	1.5
A74	PSK Dump Stage III	22.7	838721.4	832738.1	480	267	1.5
A75	PSK Dump Stage III	42.4	838739.9	832745.1	357	206	1.5
A76	PSK Dump Stage III	52.5	838749.5	832747.7	340	197	1.5
A77	PSK Dump Stage III	62.8	838759.2	832751.5	332	193	1.5
A78	PSK Dump Stage II	23.5	839514.2	831888.9	420	237	1.5
A79	PSK Dump Stage II	42.8	839525.1	831905.0	334	194	1.5
A80	PSK Dump Stage II	53.6	839530.9	831914.0	317	186	1.5
A81	PSK Dump Stage II	62.8	839536.6	831921.8	308	181	1.5
A123	Marine Sci. Lab. Fish Ponds	34.0	840112.2	831114.2	300	177	1.5
A124	Marine Sci. Lab. Fish Ponds	34.0	840113.1	831105.3	296	175	1.5
A125	Marine Sci. Lab. Fish Ponds	34.0	840113.4	831096.9	294	174	1.5
A126	Marine Sci. Lab. Fish Ponds	34.0	840113.9	831089.9	292	173	1.5
	Maximum		existing		425	240	
			future PSK		398	226	
			future Dump site		480	267	

Remark: *Setback distance is measured from the sensitive receptor to the outer-edge of driving lane

Predicted 1-hr average, 24-hr average TSP concentration (µg/m3) at different ASRs
(Option 3)

ASR ID	Location	*Setback Distance (m)	X-co	Y-co	1-hr Conc	24-hr Conc	Height
A1	Kwong Fuk Estate	63.0	836186.8	834282.9	251	153	1.5
A2	Island Hse Conservation Study Centre	91.8	836435.1	834021.4	266	160	1.5
A3	Care Village	65.8	836490.6	833701.0	270	162	1.5
A4	KCRC Club Hostel	79.6	836804.3	833501.6	273	164	1.5
A5	Sea View Villas	91.2	837118.1	833302.1	293	173	1.5
A6	Tai Po Kau Village Hse	116.6	837881.3	833218.6	274	164	1.5
A7	CUHK Res 10	80.7	839515.3	831720.3	288	171	1.5
A8	CUHK Grace Tien Hall	182.5	839765.3	831387.3	275	165	1.5
A9	CUHK Inst of Biotechnology	38.0	840028.0	831445.0	345	199	1.5
A10	Marine Science Lab	69.3	840147.3	831115.3	446	250	1.5
A11	Marine Police Base	81.2	840137.3	830790.2	279	166	1.5
A12	Marine Police N. Div Base	112.1	840050.3	830077.2	244	149	1.5
A13	Resid Hse next to Inst of Biotech	88.5	840054.9	831499.0	431	242	1.5
A14	North of Area 39	23.4	838667.1	832622.2	322	188	1.5
A15	North of Area 39	43.3	838648.1	832617.0	309	181	1.5
A16	North of Area 39	52.7	838638.7	832615.2	305	180	1.5
A17	North of Area 39	62.1	838629.4	832613.8	302	178	1.5
A18	North of Area 39	82.7	838609.6	832609.1	296	175	1.5
A19	Area 39 North - G/IC	22.8	838691.2	832526.5	376	215	1.5
A20	Area 39 North - G/IC	42.1	838672.7	832521.2	331	193	1.5
A21	Area 39 North - G/IC	53.4	838661.6	832518.5	317	186	1.5
A22	Area 39 North - G/IC	72.6	838643.1	832512.7	305	179	1.5
A23	Area 39 North - G/IC	102.0	838614.8	832504.4	293	173	1.5
A24	Area 39 - Sports	22.9	838729.6	832430.7	383	219	1.5
A25	Area 39 - Sports	42.7	838711.9	832422.2	336	195	1.5
A26	Area 39 - Sports	51.1	838703.1	832420.0	324	189	1.5
A27	Area 39 - Sports	61.5	838694.5	832413.9	313	184	1.5
A28	Area 39 - Sports	83.3	838675.0	832405.2	300	177	1.5
A29	Area 39 - Sports	22.2	838783.1	832344.3	398	226	1.5
A30	Area 39 - Sports	42.8	838764.6	832334.6	341	197	1.5
A31	Area 39 - Sports	51.1	838757.3	832330.9	327	191	1.5
A32	Area 39 - Sports	61.1	838748.4	832325.3	316	185	1.5
A33	Area 39 - Sports	82.1	838730.5	832314.7	298	176	1.5
A34	Area 39 - Sports	25.3	838848.3	832264.1	360	207	1.5
A35	Area 39 - Sports	45.2	838833.9	832250.4	326	190	1.5
A36	Area 39 - Sports	52.3	838827.9	832246.1	318	186	1.5
A37	Area 39 - Sports	65.3	838819.0	832237.0	307	180	1.5
A38	Area 39 - Sports	83.8	838805.6	832223.8	295	174	1.5
A39	Area 39 - Sports	24.5	838928.3	832198.0	371	213	1.5
A40	Area 39 - Sports	44.8	838914.9	832181.6	329	191	1.5
A41	Area 39 - Sports	54.9	838907.3	832175.0	318	186	1.5
A42	Area 39 - Sports	63.4	838903.6	832167.2	311	182	1.5
A43	Area 39 - Sports	83.8	838891.0	832151.2	297	175	1.5
A44	Area 39 South - G/IC	25.5	839011.8	832137.2	362	208	1.5
A45	Area 39 South - G/IC	44.1	839000.4	832122.4	325	189	1.5
A46	Area 39 South - G/IC	50.0	838997.8	832116.7	318	186	1.5
A47	Area 39 South - G/IC	64.5	838988.0	832106.0	307	180	1.5
A48	Area 39 South - G/IC	84.1	838976.1	832090.1	296	175	1.5
A49	Area 39 South - G/IC	25.0	839093.8	832079.4	377	215	1.5
A50	Area 39 South - G/IC	43.5	839082.5	832064.2	338	196	1.5
A51	Area 39 South - G/IC	50.0	839079.1	832057.4	328	191	1.5
A52	Area 39 South - G/IC	64.5	839070.0	832047.6	315	184	1.5
A53	Area 39 South - G/IC	84.0	839058.5	832031.9	302	178	1.5
A54	Area 39 South - G/IC	24.6	839176.1	832022.7	381	218	1.5
A55	Area 39 South - G/IC	44.0	839163.8	832007.0	344	199	1.5
A56	Area 39 South - G/IC	51.4	839159.9	832001.1	335	195	1.5
A57	Area 39 South - G/IC	65.0	839151.9	831991.0	322	188	1.5
A58	Area 39 South - G/IC	84.4	839139.4	831974.9	307	180	1.5
A59	Area 39 South - G/IC	24.5	839257.3	831964.3	381	217	1.5
A60	Area 39 South - G/IC	43.4	839246.1	831949.7	344	199	1.5
A61	Area 39 South - G/IC	50.4	839241.7	831942.4	333	194	1.5
A62	Area 39 South - G/IC	63.3	839234.4	831933.8	322	188	1.5
A63	Area 39 South - G/IC	84.2	839222.6	831917.9	307	180	1.5
A64	Area 39 South - G/IC	25.2	839337.7	831909.1	378	216	1.5
A65	Area 39 South - G/IC	43.7	839326.2	831893.8	338	196	1.5
A66	Area 39 South - G/IC	52.1	839319.6	831887.3	326	190	1.5
A67	Area 39 South - G/IC	63.4	839314.2	831876.8	315	185	1.5
A68	Area 39 South - G/IC	83.1	839302.2	831861.0	302	178	1.5
A69	Area 39 South - G/IC	27.2	839419.4	831852.1	358	206	1.5
A70	Area 39 South - G/IC	46.4	839407.7	831837.0	326	190	1.5
A71	Area 39 South - G/IC	56.1	839398.9	831831.8	317	186	1.5
A72	Area 39 South - G/IC	66.6	839395.4	831820.7	308	181	1.5
A73	Area 39 South - G/IC	86.5	839384.2	831804.5	297	175	1.5
A74	PSK Dump Stage III	22.7	838721.4	832738.1	480	267	1.5
A75	PSK Dump Stage III	42.4	838739.9	832745.1	357	206	1.5
A76	PSK Dump Stage III	52.5	838749.5	832747.7	340	197	1.5
A77	PSK Dump Stage III	62.8	838759.2	832751.5	332	193	1.5
A78	PSK Dump Stage II	23.5	839514.2	831888.9	419	237	1.5
A79	PSK Dump Stage II	42.8	839525.1	831905.0	334	194	1.5
A80	PSK Dump Stage II	53.6	839530.9	831914.0	317	186	1.5
A81	PSK Dump Stage II	62.8	839536.6	831921.8	308	181	1.5
A123	Marine Sci. Lab. Fish Ponds	34.0	840112.2	831114.2	280	167	1.5
A124	Marine Sci. Lab. Fish Ponds	34.0	840113.1	831105.3	280	167	1.5
A125	Marine Sci. Lab. Fish Ponds	34.0	840113.4	831096.9	280	167	1.5
A126	Marine Sci. Lab. Fish Ponds	34.0	840113.9	831089.9	280	167	1.5
	Maximum		existing		446	250	
			future PSK		398	226	
			future Dump site		480	267	

Remark: *Setback distance is measured from the sensitive receptor to the outer-edge of driving lane

APPENDIX G

3) Summary of predicted TSP concentration at different ASR locations

Predicted 1-hour average, 24-hour average TSP concentrations at different ASRs locations for three design options (Existing Air Sensitive Receptors Only)

ASR ID	ASR Location	Predicted TSP concentration (µg/m3) for different ASRs at 1.5m above ground level, With Future Cummulative Background							
		1-hr average				24-hr average			
		Option1	Option2	Option3	Sub-Max	Option1	Option2	Option3	Sub-Max
A1	Kwong Fuk Estate	251	251	251	251	153	153	153	153
A2	Island Hse Conservation Study Centre	266	266	266	266	160	160	160	160
A3	Care Village	270	270	270	270	162	162	162	162
A4	KCRC Club Hostel	273	273	273	273	164	164	164	164
A5	Sea View Villas	293	293	293	293	173	173	173	173
A6	Tai Po Kau Village Hse	274	274	274	274	164	164	164	164
A7	CUHK Res 10	288	288	288	288	171	171	171	171
A8	CUHK Grace Tien Hall	275	275	275	275	165	165	165	165
A9	CUHK Inst of Biotech	346	346	345	346	200	200	199	200
A10	Marine Science Lab	352	292	446	446	203	173	250	250
A11	Marine Police Base	277	271	279	279	165	163	166	166
A12	Marine Police N. Div Base	245	244	244	245	149	149	149	149
A13	Resid Hse next to Inst of Biotech	425	425	431	431	240	240	242	242
A123	Marine Sci. Lab. Fish Ponds	357	300	280	357	206	177	167	206
A124	Marine Sci. Lab. Fish Ponds	345	296	280	345	199	175	167	199
A125	Marine Sci. Lab. Fish Ponds	335	294	280	335	195	174	167	195
A126	Marine Sci. Lab. Fish Ponds	329	292	280	329	192	173	167	192
			Overall Max		446			Overall Max	250
			% guidance level		89			% AQO	96

Predicted 1-hour average, 24-hour average TSP concentrations at different Assessment locations for three design options (Planned Development Only)

Location	Description	Average * Setback (m) distance	Predicted TSP concentration (µg/m3) for different Assessment Locations at 1.5m above ground level, With Future Cummulative Background							
			1-hr average				24-hr average			
			Option1	Option2	Option3	Sub-Max	Option1	Option2	Option3	Sub-Max
Tai Po Develop Area 12 & 39	Area 39 North - G/IC	23	376	376	376	398	215	215	215	215
	Area 39 North - G/IC	42	332	331	331	341	193	193	193	193
	Area 39 North - G/IC	53	318	317	317	327	186	186	186	186
	Area 39 North - G/IC	73	305	305	305	316	179	179	179	179
	Area 39 North - G/IC	102	293	293	293	300	173	173	173	173
	Area 39 - Sports	24	398	398	398	381	226	226	226	226
	Area 39 - Sports	44	340	340	341	344	197	197	197	197
	Area 39 - Sports	52	327	327	327	335	191	191	191	191
	Area 39 - Sports	63	316	316	316	322	185	185	185	185
	Area 39 - Sports	83	300	300	300	307	177	177	177	177
	Area 39 South - G/IC	25	381	381	381	381	218	218	218	218
	Area 39 South - G/IC	44	344	344	344	344	199	199	199	199
	Area 39 South - G/IC	52	335	335	335	335	195	195	195	195
	Area 39 South - G/IC	65	322	322	322	322	188	188	188	188
	Area 39 South - G/IC	84	307	307	307	307	180	180	180	180
Public Dump Site	PSK Dump Stage III	23	480	480	480	480	*267*	*267*	*267*	*267*
	PSK Dump Stage III	42	357	357	357	357	206	206	206	206
	PSK Dump Stage III	53	340	340	340	340	197	197	197	197
	PSK Dump Stage III	63	332	332	332	332	193	193	193	193
	PSK Dump Stage II	24	421	420	419	421	238	237	237	238
	PSK Dump Stage II	43	336	334	334	336	195	194	194	195
	PSK Dump Stage II	54	317	317	317	317	186	186	186	186
	PSK Dump Stage II	63	308	308	308	308	181	181	181	181

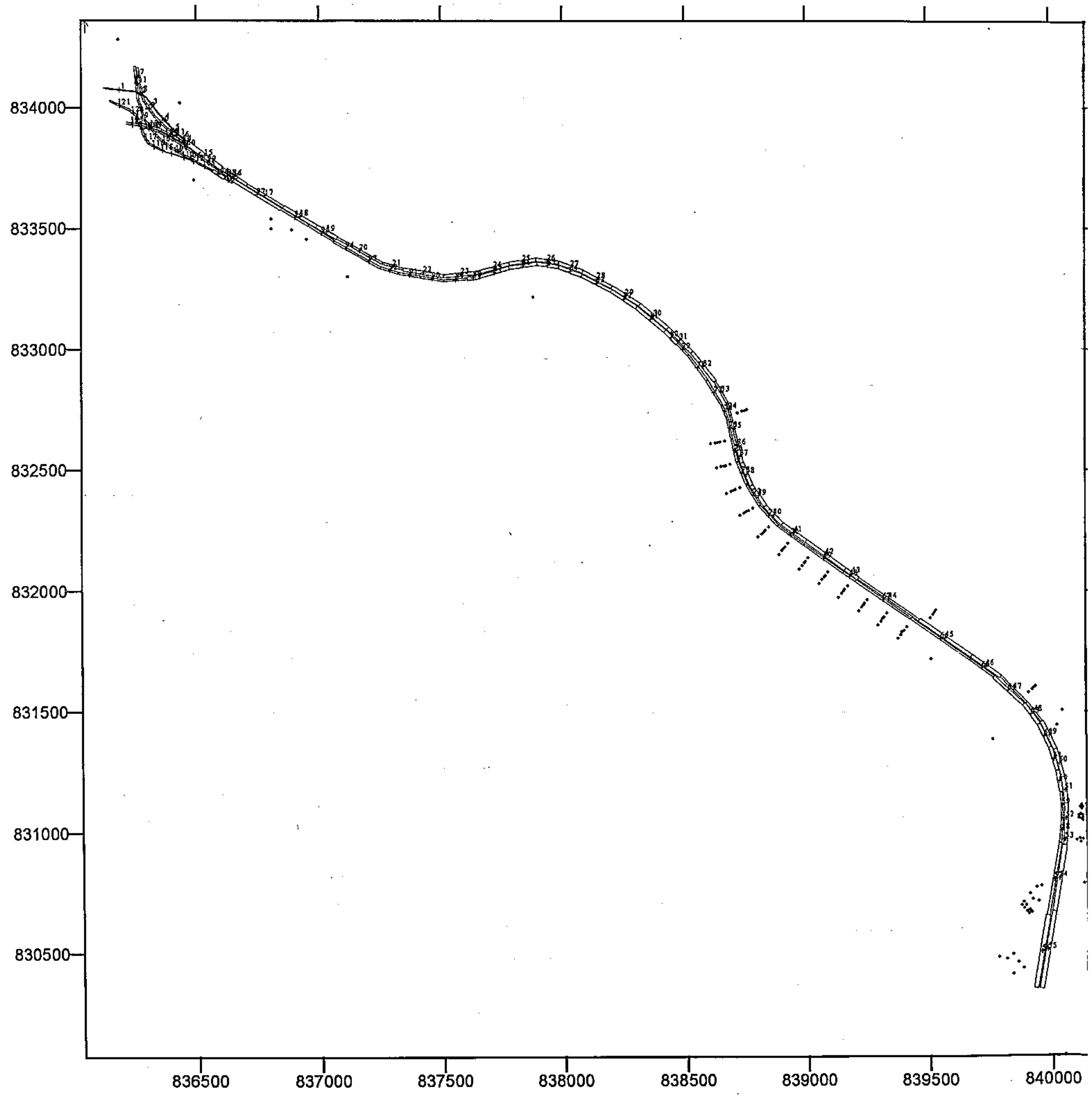
1-hr Max at PSK	398	24-hr Max at PSK	226
% 1-hr guidance level at PSK	80	% 24-hr AQO at PSK	87
1-hr Max at Dump Site	480	24-hr Max at Dump Site	*267*
% 1-hr guidance level at Dump	96	% 24-hr AQO at Dump	*103*

Remarks: * Setback Distance is measured from the assessment point to the outermost edge of the driving lane

APPENDIX G

4) Summary of road links and emission rates for NO_2

Locations of Air Sensitive Receptors and Road Links



97530/eiafin

Summary of the Road Link & Emission Rate (Yr 2011)
(with 2.5/4m overhung barrier at KCRC building)

Link ID	Mid-pt of Rd Link x-co	y-co	Traffic Flow (veh/hr)	Emission Rate (g/ml/veh)
1	836189.9	834075.4	2317	0.789
2	836275.4	834057.2	2317	0.789
3	836322.4	834013.2	2317	0.789
4	836372.0	833952.0	2317	0.789
5	836413.1	833907.4	2317	0.789
6	836449.6	833875.6	2317	0.789
7	836268.5	834134.0	2317	0.789
8	836281.8	834063.9	2317	0.789
9	836311.7	833997.0	2317	0.789
10	836357.5	833941.4	2317	0.789
11	836425.2	833885.4	2317	0.789
12	836315.9	833921.3	2317	0.789
13	836398.4	833888.6	2317	0.789
14	836448.9	833860.1	2317	0.789
15	836535.3	833802.3	6950	0.789
16	836655.2	833716.1	6950	0.789
17	836781.2	833637.3	6950	0.789
18	836924.1	833552.1	6950	0.789
19	837034.1	833488.1	6950	0.789
20	837168.5	833411.0	6950	0.789
21	837303.5	833345.5	6950	0.789
22	837429.3	833318.2	6950	0.789
23	837584.0	833311.5	6950	0.789
24	837719.3	833338.0	6950	0.789
25	837838.6	833364.4	6950	0.789
26	837940.8	833366.2	6950	0.789
27	838037.0	833341.3	6950	0.789
28	838146.2	833291.0	6950	0.789
29	838263.0	833222.6	6950	0.789
30	838377.4	833137.6	6950	0.789
31	838484.0	833039.0	6950	0.789
32	838580.9	832928.5	6950	0.789
33	838653.5	832823.3	6950	0.789
34	838685.6	832753.1	6950	0.789
35	838705.4	832673.2	6950	0.789
36	838722.4	832601.3	6950	0.789
37	838732.7	832557.8	6950	0.789
38	838758.9	832485.4	6950	0.789
39	838807.0	832395.9	6950	0.789
40	838869.9	832315.3	6950	0.789
41	838954.9	832242.3	6950	0.789
42	839086.0	832148.6	6950	0.789
43	839194.0	832071.2	6950	0.789
44	839346.0	831966.5	6950	0.789
45	839576.0	831806.8	6950	0.789

Summary of the Road Link & Emission Rate (Yr 2011)
(with 2.5/4m overhung barrier at KCRC building)

Link ID	Mid-pt of Rd Link x-co	y-co	Traffic Flow (veh/hr)	Emission Rate (g/ml/veh)
46	839740.2	831689.5	6950	0.789
47	839852.1	831591.7	6950	0.789
48	839935.4	831497.5	6950	0.789
49	839993.6	831401.4	6950	0.789
50	840036.8	831286.5	6950	0.789
51	840054.1	831173.0	6950	0.789
52	840058.4	831056.2	6950	0.789
53	840054.7	830970.2	6950	0.789
54	840029.9	830809.4	6950	0.789
55	839983.3	830511.8	6950	0.789
56	839958.8	830503.6	5700	1.17
57	840011.6	830805.0	5700	1.17
58	840042.8	831006.2	5700	1.17
59	840045.2	831111.0	5700	1.17
60	840036.0	831210.3	5700	1.17
61	840014.0	831303.6	5700	1.17
62	839975.8	831399.9	5700	1.17
63	839922.7	831489.4	5700	1.17
64	839831.0	831588.3	5700	1.17
65	839723.5	831683.1	5700	1.17
66	839555.9	831803.5	5700	1.17
67	839322.9	831964.7	5700	1.17
68	839185.1	832060.0	5700	1.17
69	839077.5	832134.9	5700	1.17
70	838940.6	832232.1	5700	1.17
71	838849.2	832312.7	5700	1.17
72	838785.5	832398.8	5700	1.17
73	838739.5	832489.3	5700	1.17
74	838709.1	832582.3	5700	1.17
75	838687.7	832676.1	5700	1.17
76	838667.0	832745.5	5700	1.17
77	838625.7	832820.5	5700	1.17
78	838556.7	832924.5	5700	1.17
79	838496.1	833000.5	5700	1.17
80	838448.2	833050.5	5700	1.17
81	838365.4	833125.4	5700	1.17
82	838255.9	833209.1	5700	1.17
83	838143.4	833275.2	5700	1.17
84	838035.1	833324.2	5700	1.17
85	837942.9	833348.5	5700	1.17
86	837840.0	833346.8	5700	1.17
87	837720.7	833319.7	5700	1.17
88	837635.4	833297.1	5700	1.17
89	837562.7	833289.7	5700	1.17
90	837466.2	833293.7	5700	1.17

Summary of the Road Link & Emission Rate (Yr 2011)
(with 2.5/4m overhung barrier at KCRC building)

Link ID	Mid-pt of Rd Link x-co	Mid-pt of Rd Link y-co	Traffic Flow (veh/hr)	Emission Rate (g/ml/veh)
91	837373.0	833308.5	5700	1.17
92	837290.7	833327.7	5700	1.17
93	837206.9	833365.7	5700	1.17
94	837111.3	833420.0	5700	1.17
95	837012.0	833483.5	5700	1.17
96	836903.5	833549.0	5700	1.17
97	836749.1	833641.1	5700	1.17
98	836629.2	833718.4	1900	1.17
99	836549.0	833775.9	1900	1.17
100	836455.4	833841.4	1900	1.17
101	836385.5	833883.4	1900	1.17
102	836311.0	833914.4	1900	1.17
103	836631.2	833701.0	3800	1.17
104	836592.0	833726.0	3800	1.17
105	836537.0	833757.1	3800	1.17
106	836481.1	833789.4	1900	1.17
107	836428.2	833818.8	1900	1.17
108	836373.3	833857.2	1900	1.17
109	836321.6	833913.3	1900	1.17
110	836281.4	833989.5	1900	1.17
111	836260.7	834101.3	1900	1.17
112	836490.7	833778.1	1900	1.17
113	836453.1	833793.3	1900	1.17
114	836403.1	833810.6	1900	1.17
115	836366.0	833823.5	1900	1.17
116	836332.8	833840.0	1900	1.17
117	836300.7	833867.2	1900	1.17
118	836282.0	833912.0	1900	1.17
119	836266.8	833954.9	1900	1.17
120	836248.0	833979.5	1900	1.17
121	836193.0	834010.4	1900	1.17
122	836244.5	833930.0	1900	1.17
123	836244.5	833938.0	1900	1.17

APPENDIX G

5) Predicted 1-hr average NO_2 concentrations

Table G-5: Predicted Maximum 1-hour average NO2 concentration (µg/m3): Yr 2001
(4m & 2.5m overhang barriers at the KCRC bldg)

ASR ID	ASR Location		ASR Description	Setback Distance**	Predicted maximum 1-hour average NO2 concentration (µg/m3) at different height							
	X-co	Y-co			1.5m	3m	3.5m	4m	5m	10m	15m	17.5m
A1	836187	834283	Kwong Fuk Estate	63.0	159	158	158	158	158	155	150	147
A2	836435	834021	Island Hse Conservation Study Centre	91.8	152	152	152	152	151	150	147	146
A3	836491	833701	Care Village	65.8	225	225	225	225	224	220	213	210
A4	836804	833502	KCRC Club Hostel	79.6	223	223	223	222	222	218	212	209
A5	837118	833302	Sea View Villas	91.2	236	235	235	235	234	229	220	215
A6	837881	833219	Tai Po Kau Village Hse	116.6	202	201	201	201	201	197	192	188
A7	839515	831720	CUHK Res 10	80.7	208	208	208	207	207	204	200	197
A8	839765	831387	CUHK Grace Tien Hall	182.5	135	135	135	135	135	134	133	132
A9	840028	831445	CUHK Inst of Biotechnology *	38.0	---	---	---	---	---	---	---	291
A10	840147	831115	Marine Science Lab	69.3	282	281	281	280	279	270	256	248
A11	840137	830790	Marine Police Base	81.2	224	224	223	223	222	217	208	203
A12	840050	830077	Marine Police N. Div Base	112.1	157	157	157	157	157	155	153	152
A13	840051	831507	Resid Hse next to Inst of Biotech	88.5	224	224	223	223	223	219	213	210
A14	838667	832622	North of Area 39	23.4	423	419	417	414	409	370	324	301
A15	838648	832617	North of Area 39	43.3	344	343	342	341	339	321	296	282
A16	838639	832615	North of Area 39	52.7	320	318	318	317	315	302	282	271
A17	838629	832614	North of Area 39	62.1	300	299	298	298	296	286	270	261
A18	838610	832609	North of Area 39	82.7	267	266	266	266	265	258	246	240
A19	838691	832527	Area 39 North - G/IC	22.8	433	428	426	423	418	378	333	311
A20	838672	832521	Area 39 North - G/IC	42.1	344	342	341	340	338	321	297	284
A21	838662	832518	Area 39 North - G/IC	53.4	316	315	314	313	312	299	281	271
A22	838653	832515	Area 39 North - G/IC	72.6	294	293	293	292	291	281	267	258
A23	838634	832510	Area 39 North - G/IC	102.0	261	260	260	260	259	253	243	237
A24	838730	832431	Area 39 - Sports	22.9	422	418	416	414	409	374	333	313
A25	838712	832422	Area 39 - Sports	42.7	333	331	331	330	328	312	291	279
A26	838703	832418	Area 39 - Sports	51.1	304	303	302	302	300	289	273	264
A27	838694	832414	Area 39 - Sports	61.5	281	280	280	279	278	270	258	250
A28	838675	832405	Area 39 - Sports	83.3	244	243	243	243	242	237	228	223
A29	838783	832344	Area 39 - Sports	22.2	409	405	404	402	397	364	326	308
A30	838766	832334	Area 39 - Sports	42.8	307	305	305	304	302	289	271	261
A31	838757	832330	Area 39 - Sports	51.1	278	277	276	276	274	264	250	242

Table G-5: Predicted Maximum 1-hour average NO2 concentration (µg/m3): Yr 2001
(4m & 2.5m overhang barriers at the KCRC bldg)

ASR	ASR Location		ASR	Setback	Predicted maximum 1-hour average NO2 concentration (µg/m3) at different height							
ID	X-co	Y-co	Description	Distance**	1.5m	3m	3.5m	4m	5m	10m	15m	17.5m
A32	838748	832324	Area 39 - Sports	61.1	254	253	253	253	251	243	232	225
A33	838731	832315	Area 39 - Sports	82.1	221	221	221	221	220	215	207	202
A34	838848	832264	Area 39 - Sports	25.3	393	390	388	386	382	350	312	293
A35	838834	832251	Area 39 - Sports	45.2	307	306	305	304	303	288	268	257
A36	838827	832244	Area 39 - Sports	52.3	279	278	277	277	275	264	249	240
A37	838820	832237	Area 39 - Sports	65.3	256	255	255	254	253	244	232	224
A38	838806	832224	Area 39 - Sports	83.8	222	222	222	221	221	215	206	201
A39	838928	832198	Area 39 - Sports	24.5	416	412	410	408	403	368	325	304
A40	838916	832183	Area 39 - Sports	44.8	330	329	328	327	325	308	286	274
A41	838909	832175	Area 39 - Sports	54.9	301	300	299	299	297	285	268	259
A42	838904	832167	Area 39 - Sports	63.4	278	277	277	276	275	266	252	244
A43	838891	832151	Area 39 - Sports	83.8	243	243	243	242	242	235	226	220
A44	839012	832137	Area 39 South - G/IC	25.5	382	379	378	376	373	346	312	295
A45	839000	832122	Area 39 South - G/IC	44.1	316	315	314	313	311	298	278	267
A46	838998	832117	Area 39 South - G/IC	50.0	301	300	299	298	297	285	269	259
A47	838988	832106	Area 39 South - G/IC	64.5	273	272	272	271	270	262	250	243
A48	838976	832090	Area 39 South - G/IC	84.1	244	243	243	243	242	237	228	223
A49	839094	832079	Area 39 South - G/IC	25.0	362	360	359	357	354	331	303	288
A50	839083	832064	Area 39 South - G/IC	43.5	298	297	297	296	295	284	268	259
A51	839079	832057	Area 39 South - G/IC	50.0	282	281	280	280	279	270	257	249
A52	839070	832048	Area 39 South - G/IC	64.5	259	258	258	258	257	250	240	234
A53	839059	832032	Area 39 South - G/IC	84.0	234	233	233	233	232	227	220	216
A54	839176	832023	Area 39 South - G/IC	24.6	355	352	351	350	347	327	300	286
A55	839164	832007	Area 39 South - G/IC	44.0	288	287	287	286	285	275	261	253
A56	839160	832001	Area 39 South - G/IC	51.4	273	272	271	271	270	262	250	243
A57	839152	831991	Area 39 South - G/IC	65.0	250	249	249	249	248	242	233	228
A58	839139	831975	Area 39 South - G/IC	84.4	225	225	224	224	224	220	213	210
A59	839257	831964	Area 39 South - G/IC	24.5	336	335	334	333	331	314	291	278
A60	839246	831950	Area 39 South - G/IC	43.4	279	278	278	277	276	267	255	248
A61	839242	831942	Area 39 South - G/IC	50.4	261	261	260	260	259	253	242	236
A62	839234	831934	Area 39 South - G/IC	63.3	243	243	243	242	242	237	229	224
A63	839223	831918	Area 39 South - G/IC	84.2	219	219	219	219	218	215	209	205
A64	839338	831909	Area 39 South - G/IC	25.2	330	328	327	326	324	308	287	276

Table G-5: Predicted Maximum 1-hour average NO2 concentration (µg/m3): Yr 2001
(4m & 2.5m overhang barriers at the KCRC bldg)

ASR	ASR Location		ASR	Setback	Predicted maximum 1-hour average NO2 concentration (µg/m3) at different height							
ID	X-co	Y-co	Description	Distance**	1.5m	3m	3.5m	4m	5m	10m	15m	17.5m
A65	839326	831894	Area 39 South - G/IC	43.7	271	270	270	269	268	261	250	243
A66	839320	831887	Area 39 South - G/IC	52.1	253	253	252	252	251	245	236	231
A67	839314	831877	Area 39 South - G/IC	63.4	235	235	235	234	234	229	222	218
A68	839302	831861	Area 39 South - G/IC	83.1	213	213	212	212	212	209	204	200
A69	839419	831852	Area 39 South - G/IC	27.2	*322*	*321*	*320*	*319*	*317*	*302*	282	272
A70	839408	831837	Area 39 South - G/IC	46.4	265	264	264	264	263	256	245	239
A71	839399	831832	Area 39 South - G/IC	56.1	247	247	247	246	246	240	232	227
A72	839395	831821	Area 39 South - G/IC	66.6	230	230	230	230	229	225	219	215
A73	839384	831805	Area 39 South - G/IC	86.5	209	208	208	208	208	205	200	197
A74	838721	832738	PSK Dump Stage III	22.7	*407*	*402*	*400*	*397*	*391*	*350*	*306*	286
A75	838740	832745	PSK Dump Stage III	42.4	*322*	*321*	*320*	*319*	*316*	299	275	262
A76	838750	832748	PSK Dump Stage III	52.5	295	294	294	293	291	279	260	251
A77	838759	832752	PSK Dump Stage III	62.8	275	274	273	273	272	261	247	239
A78	839514	831889	PSK Dump Stage II	23.5	*354*	*350*	*349*	*347*	*343*	*313*	279	264
A79	839525	831905	PSK Dump Stage II	42.8	278	276	276	275	273	261	243	234
A80	839531	831914	PSK Dump Stage II	53.6	254	253	253	252	251	242	229	222
A81	839537	831922	PSK Dump Stage II	62.8	238	237	237	236	235	228	218	212
A82	839913	831581	PSK Dump Stage I	21.5	*385*	*381*	*380*	*378*	*373*	*338*	298	286
A83	839928	831595	PSK Dump Stage I	42.1	*311*	*309*	*308*	*307*	*305*	290	267	254
A84	839935	831602	PSK Dump Stage I	52.0	288	287	286	285	284	271	254	243
A85	839942	831609	PSK Dump Stage I	62.0	269	268	268	267	266	256	241	233
A86	836806	833543	KCRC Club Hostel	42.2	278	277	277	277	275	267	254	247
A87	836889	833496	KCRC Club Hostel	41.6	291	290	289	289	287	277	263	254
A88	836951	833458	KCRC Club Hostel	42.5	298	297	297	296	295	284	269	260
A89	840116	831058	Marine Science Lab	37.1	*330*	*328*	*327*	*326*	*323*	*303*	277	263
A90	840105	830969	Yacht Club (non-sensitive)	30.8	*331*	*329*	*328*	*326*	*323*	*301*	273	259
A91	840123	830961	Yacht Club (non-sensitive)	49.2	287	286	285	285	283	271	253	243
A92	840133	830972	Yacht Club (non-sensitive)	58.4	276	275	274	274	272	262	247	238
A93	840119	830974	Yacht Club (non-sensitive)	44.3	298	297	296	295	293	279	259	248
A94	840133	831048	Marine Science Lab	55.7	294	293	292	292	290	278	260	250
A95	840127	831054	Marine Science Lab	49.2	*306*	*304*	*304*	*303*	*301*	287	266	255
A96	840132	831059	Marine Science Lab	53.9	298	297	296	296	294	281	263	253
A97	840131	831071	Marine Science Lab	52.5	300	299	298	298	296	283	265	255

Table G-5: Predicted Maximum 1-hour average NO2 concentration (µg/m3): Yr 2001
(4m & 2.5m overhang barriers at the KCRC bldg)

ASR ID	ASR Location		ASR Description	Setback Distance**	Predicted maximum 1-hour average NO2 concentration (µg/m3) at different height							
	X-co	Y-co			1.5m	3m	3.5m	4m	5m	10m	15m	17.5m
A98	840124	831074	Marine Science Lab	45.5	315	313	312	312	309	294	272	261
A99	840116	831070	Marine Science Lab	38.0	335	332	332	330	328	307	280	266
A100	840127	831095	Marine Science Lab	48.5	311	310	309	308	306	292	272	261
A101	840133	831105	Marine Science Lab	55.4	301	300	300	299	297	285	267	257
A102	840127	831114	Marine Science Lab	49.3	314	312	312	311	309	295	274	263
A103	840120	831105	Marine Science Lab	42.3	327	325	324	323	321	304	280	267
A104	839842	830413	CUHK Bldg E9	78.5	167	166	166	166	166	162	156	152
A105	839882	830436	CUHK Bldg E9	43.7	211	210	210	209	208	200	189	182
A106	839863	830463	CUHK Bldg E9	68.2	177	177	176	176	175	171	163	159
A107	839841	830495	CUHK Bldg E9	95.9	152	151	151	151	151	148	143	140
A108	839817	830476	CUHK Bldg E9	115.5	140	140	140	140	139	137	133	131
A109	839785	830483	CUHK Bldg E9	148.6	125	125	125	125	125	123	120	118
A110	839907	830664	CUHK Bldg E7	62.5	183	182	181	181	179	170	160	155
A111	839918	830669	CUHK Bldg E7	52.1	199	197	197	196	193	181	169	163
A112	839910	830678	CUHK Bldg E7	62.7	184	183	182	182	180	170	160	154
A113	839898	830673	CUHK Bldg E7	72.7	172	171	171	170	166	158	150	146
A114	839887	830686	CUHK Bldg E6	85.8	159	159	158	158	156	149	140	137
A115	839896	830699	CUHK Bldg E6	79.5	166	164	164	163	162	152	144	140
A116	839886	830712	CUHK Bldg E6	93.0	156	155	155	154	153	145	136	132
A117	839878	830698	CUHK Bldg E6	97.6	152	151	151	150	149	142	134	130
A118	839924	830723	CUHK Bldg E5	57.4	193	191	190	190	188	175	162	156
A119	839948	830715	CUHK Bldg E5	33.7	243	240	239	238	235	213	194	184
A120	839959	830779	CUHK Bldg E5	34.8	243	241	240	239	236	217	193	181
A121	839939	830772	CUHK Bldg E5	53.7	200	199	199	198	196	185	169	160
A122	839913	830745	CUHK Bldg E5	72.5	172	172	171	171	170	161	149	142

Remarks:

* For the Institute of Biotechnology, a central A/C system was installed with FAI located on roof level (17.5m above ground)

**Setback distance is measured from the sensitive receptor to the outer-edge of driving lane

Table G-5: Predicted Maximum 1-hour average NO2 concentration (µg/m3): Yr 2011
(4m & 2.5m overhang barriers at the KCRC bldg)

ASR ID	ASR Location		ASR Description	Setback Distance**	Predicted maximum 1-hour average NO2 concentration (µg/m3) at different height							
	X-co	Y-co			1.5m	3m	3.5m	4m	5m	10m	15m	17.5m
A1	836187	834283	Kwong Fuk Estate	63.0	151	151	151	150	150	147	143	140
A2	836435	834021	Island Hse Conservation Study Centre	91.8	145	145	145	144	144	143	140	139
A3	836491	833701	Care Village	65.8	213	213	213	213	212	208	202	199
A4	836804	833502	KCRC Club Hostel	79.6	211	211	211	211	210	207	201	198
A5	837118	833302	Sea View Villas	91.2	223	223	222	222	222	217	209	204
A6	837881	833219	Tai Po Kau Village Hse	116.6	191	191	191	191	190	187	182	179
A7	839515	831720	CUHK Res 10	80.7	197	197	197	197	196	194	189	187
A8	839765	831387	CUHK Grace Tien Hall	182.5	129	129	129	129	129	128	127	126
A9	840028	831445	CUHK Inst of Biotechnology *	38.0	---	---	---	---	---	---	---	274
A10	840147	831115	Marine Science Lab	69.3	267	266	265	265	264	255	242	235
A11	840137	830790	Marine Police Base	81.2	212	212	212	211	211	205	197	193
A12	840050	830077	Marine Police N. Div Base	112.1	150	150	150	149	149	148	146	145
A13	840051	831507	Resid Hse next to Inst of Biotech	88.5	212	212	212	211	211	207	202	199
A14	838667	832622	North of Area 39	23.4	*399*	*394*	*392*	*390*	*385*	*348*	*305*	285
A15	838648	832617	North of Area 39	43.3	*325*	*323*	*322*	*321*	*319*	*303*	280	267
A16	838639	832615	North of Area 39	52.7	*302*	300	300	299	298	285	267	256
A17	838629	832614	North of Area 39	62.1	283	282	282	281	280	270	255	247
A18	838610	832609	North of Area 39	82.7	252	252	252	251	250	244	233	227
A19	838691	832527	Area 39 North - G/IC	22.8	*407*	*403*	*401*	*399*	*393*	*357*	*314*	293
A20	838672	832521	Area 39 North - G/IC	42.1	*324*	*323*	*322*	*321*	*319*	*303*	281	268
A21	838662	832518	Area 39 North - G/IC	53.4	298	297	296	296	294	283	266	256
A22	838653	832515	Area 39 North - G/IC	72.6	278	277	277	276	275	266	252	244
A23	838634	832510	Area 39 North - G/IC	102.0	247	246	246	246	245	239	230	224
A24	838730	832431	Area 39 - Sports	22.9	*397*	*393*	*392*	*390*	*385*	*352*	*314*	295
A25	838712	832422	Area 39 - Sports	42.7	*314*	*313*	*312*	*311*	*309*	295	274	263
A26	838703	832418	Area 39 - Sports	51.1	287	286	285	285	284	273	258	249
A27	838694	832414	Area 39 - Sports	61.5	265	265	264	264	263	255	244	237
A28	838675	832405	Area 39 - Sports	83.3	231	230	230	230	229	224	216	212
A29	838783	832344	Area 39 - Sports	22.2	*385*	*382*	*380*	*378*	*374*	*343*	*308*	291
A30	838766	832334	Area 39 - Sports	42.8	290	288	288	287	285	273	256	247
A31	838757	832330	Area 39 - Sports	51.1	263	262	261	261	259	249	237	229

Table G-5: Predicted Maximum 1-hour average NO2 concentration (µg/m3): Yr 2011
(4m & 2.5m overhang barriers at the KCRC bldg)

ASR ID	ASR Location X-co	ASR Location Y-co	ASR Description	Setback Distance**	Predicted maximum 1-hour average NO2 concentration (µg/m3) at different height 1.5m	3m	3.5m	4m	5m	10m	15m	17.5m
A32	838748	832324	Area 39 - Sports	61.1	240	240	239	239	238	230	219	213
A33	838731	832315	Area 39 - Sports	82.1	210	209	209	209	208	204	196	192
A34	838848	832264	Area 39 - Sports	25.3	*370*	*367*	*365*	*364*	*360*	*330*	295	277
A35	838834	832251	Area 39 - Sports	45.2	290	289	288	287	286	272	253	243
A36	838827	832244	Area 39 - Sports	52.3	263	262	262	261	260	250	235	227
A37	838820	832237	Area 39 - Sports	65.3	242	241	241	240	239	231	219	213
A38	838806	832224	Area 39 - Sports	83.8	210	210	210	210	209	204	196	191
A39	838928	832198	Area 39 - Sports	24.5	*392*	*388*	*386*	*384*	*380*	*347*	*307*	287
A40	838916	832183	Area 39 - Sports	44.8	*312*	*310*	*309*	*308*	*306*	291	270	259
A41	838909	832175	Area 39 - Sports	54.9	284	283	283	282	281	270	254	245
A42	838904	832167	Area 39 - Sports	63.4	263	262	262	261	260	251	238	231
A43	838891	832151	Area 39 - Sports	83.8	230	230	230	229	229	223	214	208
A44	839012	832137	Area 39 South - G/IC	25.5	*360*	*357*	*356*	*355*	*351*	*326*	294	278
A45	839000	832122	Area 39 South - G/IC	44.1	298	297	296	296	294	281	263	253
A46	838998	832117	Area 39 South - G/IC	50.0	284	283	282	282	280	270	254	245
A47	838988	832106	Area 39 South - G/IC	64.5	258	257	257	256	255	248	236	230
A48	838976	832090	Area 39 South - G/IC	84.1	231	230	230	230	229	224	216	211
A49	839094	832079	Area 39 South - G/IC	25.0	*342*	*339*	*338*	*337*	*334*	*313*	286	272
A50	839083	832064	Area 39 South - G/IC	43.5	282	281	280	280	278	269	254	245
A51	839079	832057	Area 39 South - G/IC	50.0	266	265	265	264	263	255	243	236
A52	839070	832048	Area 39 South - G/IC	64.5	245	244	244	244	243	237	227	222
A53	839059	832032	Area 39 South - G/IC	84.0	221	221	221	220	220	215	208	204
A54	839176	832023	Area 39 South - G/IC	24.6	*334*	*332*	*331*	*330*	*328*	*308*	283	270
A55	839164	832007	Area 39 South - G/IC	44.0	272	271	271	270	269	260	246	239
A56	839160	832001	Area 39 South - G/IC	51.4	258	257	256	256	255	247	236	230
A57	839152	831991	Area 39 South - G/IC	65.0	236	236	236	235	235	229	221	216
A58	839139	831975	Area 39 South - G/IC	84.4	213	213	213	212	212	208	202	199
A59	839257	831964	Area 39 South - G/IC	24.5	*317*	*316*	*315*	*314*	*312*	296	274	263
A60	839246	831950	Area 39 South - G/IC	43.4	264	263	262	262	261	253	241	234
A61	839242	831942	Area 39 South - G/IC	50.4	247	246	246	246	245	239	229	224
A62	839234	831934	Area 39 South - G/IC	63.3	230	230	230	229	229	224	216	212
A63	839223	831918	Area 39 South - G/IC	84.2	208	208	207	207	207	203	198	195
A64	839338	831909	Area 39 South - G/IC	25.2	*311*	*309*	*309*	*308*	*306*	291	271	260

Table G-5: Predicted Maximum 1-hour average NO2 concentration (µg/m3): Yr 2011
(4m & 2.5m overhang barriers at the KCRC bldg)

ASR ID	ASR Location		ASR Description	Setback Distance**	Predicted maximum 1-hour average NO2 concentration (µg/m3) at different height							
	X-co	Y-co			1.5m	3m	3.5m	4m	5m	10m	15m	17.5m
A65	839326	831894	Area 39 South - G/IC	43.7	256	255	255	255	254	247	236	230
A66	839320	831887	Area 39 South - G/IC	52.1	240	239	239	238	238	232	224	219
A67	839314	831877	Area 39 South - G/IC	63.4	223	222	222	222	221	217	210	207
A68	839302	831861	Area 39 South - G/IC	83.1	202	201	201	201	201	198	193	190
A69	839419	831852	Area 39 South - G/IC	27.2	*304*	*303*	*302*	*301*	299	285	266	257
A70	839408	831837	Area 39 South - G/IC	46.4	250	250	250	249	248	242	232	226
A71	839399	831832	Area 39 South - G/IC	56.1	234	234	233	233	232	227	220	215
A72	839395	831821	Area 39 South - G/IC	66.6	218	218	218	218	217	213	207	203
A73	839384	831805	Area 39 South - G/IC	86.5	198	198	197	197	197	194	190	187
A74	838721	832738	PSK Dump Stage III	22.7	*384*	*379*	*377*	*374*	*369*	*330*	289	270
A75	838740	832745	PSK Dump Stage III	42.4	*304*	*302*	*302*	*301*	299	282	260	248
A76	838750	832748	PSK Dump Stage III	52.5	279	278	277	277	275	263	246	237
A77	838759	832752	PSK Dump Stage III	62.8	260	259	258	258	257	247	234	226
A78	839514	831889	PSK Dump Stage II	23.5	*334*	*330*	*329*	*327*	*323*	296	264	249
A79	839525	831905	PSK Dump Stage II	42.8	262	261	261	260	258	246	230	222
A80	839531	831914	PSK Dump Stage II	53.6	240	239	239	238	237	229	217	210
A81	839537	831922	PSK Dump Stage II	62.8	225	224	224	224	223	216	206	201
A82	839913	831581	PSK Dump Stage I	21.5	*363*	*359*	*358*	*356*	*351*	*319*	281	270
A83	839928	831595	PSK Dump Stage I	42.1	293	292	291	290	288	273	252	240
A84	839935	831602	PSK Dump Stage I	52.0	272	271	270	269	268	256	240	230
A85	839942	831609	PSK Dump Stage I	62.0	254	253	253	253	251	242	228	221
A86	836806	833543	KCRC Club Hostel	42.2	263	262	262	261	260	252	241	234
A87	836889	833496	KCRC Club Hostel	41.6	275	274	273	273	272	262	248	241
A88	836951	833458	KCRC Club Hostel	42.5	282	281	280	280	278	268	254	246
A89	840116	831058	Marine Science Lab	37.1	*311*	*309*	*308*	*307*	*305*	286	262	249
A90	840105	830969	Yacht Club (non-sensitive)	30.8	*312*	*310*	*309*	*308*	*305*	284	258	245
A91	840123	830961	Yacht Club (non-sensitive)	49.2	271	270	270	269	267	256	239	230
A92	840133	830972	Yacht Club (non-sensitive)	58.4	261	260	259	259	257	247	233	225
A93	840119	830974	Yacht Club (non-sensitive)	44.3	282	280	280	279	277	264	245	235
A94	840133	831048	Marine Science Lab	55.7	278	277	276	275	274	263	246	237
A95	840127	831054	Marine Science Lab	49.2	289	287	287	286	284	271	252	241
A96	840132	831059	Marine Science Lab	53.9	282	280	280	279	278	266	249	239
A97	840131	831071	Marine Science Lab	52.5	284	282	282	281	280	268	251	241

Table G-5: Predicted Maximum 1-hour average NO2 concentration (µg/m3): Yr 2011
(4m & 2.5m overhang barriers at the KCRC bldg)

ASR ID	ASR Location		ASR Description	Setback Distance**	Predicted maximum 1-hour average NO2 concentration (µg/m3) at different height							
	X-co	Y-co			1.5m	3m	3.5m	4m	5m	10m	15m	17.5m
A98	840124	831074	Marine Science Lab	45.5	297	295	295	294	292	278	257	246
A99	840116	831070	Marine Science Lab	38.0	316	314	313	312	309	290	265	251
A100	840127	831095	Marine Science Lab	48.5	294	292	292	291	289	276	257	246
A101	840133	831105	Marine Science Lab	55.4	285	283	283	282	281	269	253	243
A102	840127	831114	Marine Science Lab	49.3	296	295	294	293	292	278	259	249
A103	840120	831105	Marine Science Lab	42.3	309	307	306	305	303	287	265	253
A104	839842	830413	CUHK Bldg E9	78.5	159	158	158	158	157	154	148	145
A105	839882	830436	CUHK Bldg E9	43.7	200	199	199	199	197	189	179	173
A106	839863	830463	CUHK Bldg E9	68.2	168	168	168	167	167	162	155	151
A107	839841	830495	CUHK Bldg E9	95.9	145	144	144	144	144	141	136	133
A108	839817	830476	CUHK Bldg E9	115.5	134	133	133	133	133	130	127	125
A109	839785	830483	CUHK Bldg E9	148.6	120	120	120	120	119	118	115	113
A110	839907	830664	CUHK Bldg E7	62.5	174	173	172	172	170	161	152	147
A111	839918	830669	CUHK Bldg E7	52.1	189	187	186	186	184	172	161	155
A112	839910	830678	CUHK Bldg E7	62.7	175	174	173	173	171	161	152	147
A113	839898	830673	CUHK Bldg E7	72.7	164	163	162	162	157	151	143	139
A114	839887	830686	CUHK Bldg E6	85.8	152	151	151	150	149	142	134	130
A115	839896	830699	CUHK Bldg E6	79.5	157	156	156	155	154	145	137	133
A116	839886	830712	CUHK Bldg E6	93.0	148	148	147	147	146	138	130	126
A117	839878	830698	CUHK Bldg E6	97.6	145	144	144	143	142	136	128	124
A118	839924	830723	CUHK Bldg E5	57.4	183	181	181	180	178	167	154	148
A119	839948	830715	CUHK Bldg E5	33.7	230	228	226	225	222	202	184	175
A120	839959	830779	CUHK Bldg E5	34.8	230	228	227	226	223	205	183	172
A121	839939	830772	CUHK Bldg E5	53.7	190	189	188	188	186	176	161	153
A122	839913	830745	CUHK Bldg E5	72.5	164	163	163	162	161	153	142	136

Remarks:
* For the Institute of Biotechnology, a central A/C system was installed with FAI located on roof level (17.5m above ground)
**Setback distance is measured from the sensitive receptor to the outer-edge of driving lane

APPENDIX G

6) Caline4 input and output sample files for air quality assessment

File: 753NON.DAT, Sample input file(design 97530/flc70313.01, ASR99)

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Tolo Highway Widening (design 97530/flc70313.01, ASR99)
4Nitrogen Dioxide
  100.0000   1.0000      .0000       .0000     1  123   1.0000  0  0
840115.9  831069.6  1.5
   1  836125.8  834083.1  836253.9  834067.7  0.00  10.0      0.00      0.00   0
   1  836253.9  834067.7  836296.8  834046.6  0.00  10.0      0.00      0.00   0
   1  836296.8  834046.6  836348.0  833979.7  0.00  10.0      0.00      0.00   0
   1  836348.0  833979.7  836395.9  833924.2  0.00  10.0      0.00      0.00   0
   1  836395.9  833924.2  836430.2  833890.5  0.00  10.0      0.00      0.00   0
   1  836430.2  833890.5  836469.0  833860.6  0.00  10.0      0.00      0.00   0
   4  836265.5  834167.0  836271.5  834101.0  7.00  13.0      0.00      0.00   0
   4  836271.5  834101.0  836292.0  834026.7  7.00  13.0      0.00      0.00   0
   4  836292.0  834026.7  836331.4  833967.2  5.00  13.0      0.00      0.00   0
   4  836331.4  833967.2  836383.5  833915.5  2.00  13.0      0.00      0.00   0
   1  836383.5  833915.5  836466.8  833855.3  0.00  13.0      0.00      0.00   0
   1  836269.0  833935.0  836362.7  833907.6  0.00  13.0      0.00      0.00   0
   1  836362.7  833907.6  836434.0  833869.6  0.00  13.0      0.00      0.00   0
   1  836434.0  833869.6  836463.8  833850.6  0.00  13.0      0.00      0.00   0
   1  836466.6  833854.9  836604.0  833749.7  0.00  24.0      0.00      0.00   0
   3  836604.0  833749.7  836706.4  833682.5  4.00  18.0      0.00      0.00   0
   3  836706.4  833682.5  836856.0  833592.0  4.00  14.0      0.00      0.00   0
   1  836856.0  833592.0  836992.2  833512.2  0.00  20.0      0.00      0.00   0
   1  836992.2  833512.2  837076.0  833464.0  0.00  20.0      0.00      0.00   0
   3  837076.0  833464.0  837261.0  833358.0  3.00  14.0      0.00      0.00   0
   3  837261.0  833358.0  837346.0  833333.0  3.00  14.0      0.00      0.00   0
   1  837346.0  833333.0  837512.5  833303.3  0.00  20.0      0.00      0.00   0
   1  837512.5  833303.3  837655.5  833319.6  0.00  20.0      0.00      0.00   0
   1  837655.5  833319.6  837783.0  833356.3  0.00  20.0      0.00      0.00   0
   1  837783.0  833356.3  837894.2  833372.5  0.00  20.0      0.00      0.00   0
   1  837894.2  833372.5  837987.3  833359.8  0.00  20.0      0.00      0.00   0
   1  837987.3  833359.8  838086.7  833322.7  0.00  20.0      0.00      0.00   0
   1  838086.7  833322.7  838205.7  833259.2  0.00  20.0      0.00      0.00   0
   1  838205.7  833259.2  838320.2  833186.0  0.00  20.0      0.00      0.00   0
   1  838320.2  833186.0  838434.5  833089.1  0.00  20.0      0.00      0.00   0
   1  838434.5  833089.1  838533.5  832988.9  0.00  20.0      0.00      0.00   0
   1  838533.5  832988.9  838628.2  832868.0  0.00  20.0      0.00      0.00   0
   3  838628.2  832868.0  838678.8  832778.5  5.50  14.0      0.00      0.00   0
   3  838678.8  832778.5  838692.3  832727.7  5.50  14.0      0.00      0.00   0
   3  838692.3  832727.7  838718.4  832618.7  5.50  14.0      0.00      0.00   0
   3  838718.4  832618.7  838726.4  832583.9  5.50  14.0      0.00      0.00   0
   1  838726.4  832583.9  838739.0  832531.7  0.00  20.0      0.00      0.00   0
   1  838739.0  832531.7  838778.8  832439.1  0.00  20.0      0.00      0.00   0
   1  838778.8  832439.1  838835.1  832352.7  0.00  20.0      0.00      0.00   0
   1  838835.1  832352.7  838904.7  832277.8  0.00  20.0      0.00      0.00   0
   1  838904.7  832277.8  839005.0  832206.7  0.00  20.0      0.00      0.00   0
   1  839005.0  832206.7  839167.0  832090.4  0.00  20.0      0.00      0.00   0
   1  839167.0  832090.4  839221.0  832052.0  0.00  20.0      0.00      0.00   0
   3  839221.0  832052.0  839471.0  831881.0  2.50  14.0      0.00      0.00   0
   1  839471.0  831881.0  839681.0  831732.6  0.00  20.0      0.00      0.00   0
   1  839681.0  831732.6  839799.3  831646.3  0.00  20.0      0.00      0.00   0
   3  839799.3  831646.3  839904.8  831537.0  3.50  14.0      0.00      0.00   0
   3  839904.8  831537.0  839966.0  831458.0  3.50  14.0      0.00      0.00   0
   1  839966.0  831458.0  840021.2  831344.8  0.00  20.0      0.00      0.00   0
   1  840021.2  831344.8  840052.4  831228.1  0.00  20.0      0.00      0.00   0
   1  840052.4  831228.1  840063.8  831118.0  0.00  20.0      0.00      0.00   0
   1  840063.8  831118.0  840060.9  830994.3  0.00  20.0      0.00      0.00   0
   1  840060.9  830994.3  840056.5  830945.3  0.00  20.0      0.00      0.00   0
   1  840056.5  830945.3  840011.2  830672.5  0.00  24.0      0.00      0.00   0
   1  840011.2  830672.5  839955.4  830351.0  0.00  24.0      0.00      0.00   0
   1  839932.5  830353.2  839985.0  830654.0  0.00  24.0      0.00      0.00   0
   3  839985.0  830654.0  840038.2  830955.9  7.00  18.0      0.00      0.00   0
   3  840038.2  830955.9  840047.3  831056.5  2.00  14.0      0.00      0.00   0
   3  840047.3  831056.5  840043.0  831165.4  2.00  14.0      0.00      0.00   0
   1  840043.0  831165.4  840028.9  831255.1  0.00  20.0      0.00      0.00   0
   1  840028.9  831255.1  839999.0  831352.0  0.00  20.0      0.00      0.00   0
   1  839999.0  831352.0  839952.5  831447.8  0.00  20.0      0.00      0.00   0
   1  839952.5  831447.8  839892.9  831531.0  0.00  20.0      0.00      0.00   0
   1  839891.4  831530.9  839770.5  831645.6  0.00  20.0      0.00      0.00   0
   3  839772.1  831647.5  839674.9  831718.6  5.50  14.0      0.00      0.00   0
   3  839674.9  831718.6  839436.9  831888.3  5.50  14.0      0.00      0.00   0
   3  839435.5  831886.3  839210.3  832043.0  3.50  14.0      0.00      0.00   0
   3  839210.3  832043.0  839159.9  832077.0  5.50  14.0      0.00      0.00   0
   3  839159.9  832077.0  838995.0  832192.8  5.50  14.0      0.00      0.00   0
   3  838995.0  832192.8  838886.1  832271.3  5.50  14.0      0.00      0.00   0
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   3  838594.7  832872.7  838518.7  832976.3  5.50  14.0      0.00      0.00   0
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   1  838307.8  833174.3  838203.9  833243.9  0.00  20.0      0.00      0.00   0
   1  838203.9  833243.9  838082.8  833306.4  0.00  20.0      0.00      0.00   0
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   1  837898.3  833355.1  837781.6  833338.4  0.00  20.0      0.00      0.00   0
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   3  837610.9  833293.1  837514.4  833286.3  1.50  14.0      0.00      0.00   0
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File: 753NON.DAT, Sample input file(design 97530/flc70313.01, ASR99)

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 4  836504.8  833777.2  836457.4  833801.6  2.00  13.0    0.00    0.00   0
 4  836457.4  833801.6  836399.0  833836.0  5.00  13.0    0.00    0.00   0
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 4  836347.6  833878.3  836295.5  833948.2  8.00  13.0    0.00    0.00   0
 4  836295.5  833948.2  836267.2  834030.8  7.00  13.0    0.00    0.00   0
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File: 753NON.DAT, Sample input file(design 97530/flc70313.01, ASR99)

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File: 753NON.DAT, Sample input file(design 97530/flc70313.01, ASR99)

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File: 753NON.LST, Sample output file(design 97530/flc70313.01, ASR99)

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION
PAGE 1

JOB: Tolo Highway Widening (design 97530/flc7
RUN: NO2 (WORST CASE ANGLE)
POLLUTANT: Nitrogen Dioxide
(NOTE: OUTPUT IN MICRO-GRAMS/METER**3. IGNORE PPM LABEL)

I. SITE VARIABLES

```
      U=   1.0 M/S              Z0= 100. CM          ALT=     0. (M)
    BRG= WORST CASE             VD=    .0 CM/S
   CLAS=     4 (D)              VS=    .0 CM/S
   MIXH=  500. M               AMB=    .0 PPM
  SIGTH=   18. DEGREES        TEMP= 25.0 DEGREE (C)
```

II. LINK VARIABLES

LINK DESCRIPTION	LINK COORDINATES (M) X1	Y1	X2	Y2	TYPE	VPH	EF (G/MI)	H (M)	W (M)
AA. LINK AA	*****	*****	*****	*****	AG	2317	.8	.0	10.0
AB. LINK AB	*****	*****	*****	*****	AG	2317	.8	.0	10.0
AC. LINK AC	*****	*****	*****	*****	AG	2317	.8	.0	10.0
AD. LINK AD	*****	*****	*****	*****	AG	2317	.8	.0	10.0
AE. LINK AE	*****	*****	*****	*****	AG	2317	.8	.0	10.0
AF. LINK AF	*****	*****	*****	*****	AG	2317	.8	.0	10.0
AG. LINK AG	*****	*****	*****	*****	BG	2317	.8	7.0	13.0
AH. LINK AH	*****	*****	*****	*****	BG	2317	.8	7.0	13.0
AI. LINK AI	*****	*****	*****	*****	BG	2317	.8	5.0	13.0
AJ. LINK AJ	*****	*****	*****	*****	BG	2317	.8	2.0	13.0
AK. LINK AK	*****	*****	*****	*****	AG	2317	.8	.0	13.0
AL. LINK AL	*****	*****	*****	*****	AG	2317	.8	.0	13.0
AM. LINK AM	*****	*****	*****	*****	AG	2317	.8	.0	13.0
AN. LINK AN	*****	*****	*****	*****	AG	2317	.8	.0	13.0
AO. LINK AO	*****	*****	*****	*****	AG	6950	.8	.0	24.0
AP. LINK AP	*****	*****	*****	*****	FL	6950	.8	4.0	18.0
AQ. LINK AQ	*****	*****	*****	*****	FL	6950	.8	4.0	14.0
AR. LINK AR	*****	*****	*****	*****	AG	6950	.8	.0	20.0
AS. LINK AS	*****	*****	*****	*****	AG	6950	.8	.0	20.0
AT. LINK AT	*****	*****	*****	*****	FL	6950	.8	3.0	14.0
AU. LINK AU	*****	*****	*****	*****	FL	6950	.8	3.0	14.0
AV. LINK AV	*****	*****	*****	*****	AG	6950	.8	.0	20.0
AW. LINK AW	*****	*****	*****	*****	AG	6950	.8	.0	20.0
AX. LINK AX	*****	*****	*****	*****	AG	6950	.8	.0	20.0
AY. LINK AY	*****	*****	*****	*****	AG	6950	.8	.0	20.0
AZ. LINK AZ	*****	*****	*****	*****	AG	6950	.8	.0	20.0
BA. LINK BA	*****	*****	*****	*****	AG	6950	.8	.0	20.0
BB. LINK BB	*****	*****	*****	*****	AG	6950	.8	.0	20.0
BC. LINK BC	*****	*****	*****	*****	AG	6950	.8	.0	20.0
BD. LINK BD	*****	*****	*****	*****	AG	6950	.8	.0	20.0
BE. LINK BE	*****	*****	*****	*****	AG	6950	.8	.0	20.0
BF. LINK BF	*****	*****	*****	*****	AG	6950	.8	.0	20.0
BG. LINK BG	*****	*****	*****	*****	FL	6950	.8	5.5	14.0
BH. LINK BH	*****	*****	*****	*****	FL	6950	.8	5.5	14.0
BI. LINK BI	*****	*****	*****	*****	FL	6950	.8	5.5	14.0
BJ. LINK BJ	*****	*****	*****	*****	FL	6950	.8	5.5	14.0
BK. LINK BK	*****	*****	*****	*****	AG	6950	.8	.0	20.0
BL. LINK BL	*****	*****	*****	*****	AG	6950	.8	.0	20.0
BM. LINK BM	*****	*****	*****	*****	AG	6950	.8	.0	20.0
BN. LINK BN	*****	*****	*****	*****	AG	6950	.8	.0	20.0
BO. LINK BO	*****	*****	*****	*****	AG	6950	.8	.0	20.0
BP. LINK BP	*****	*****	*****	*****	AG	6950	.8	.0	20.0
BQ. LINK BQ	*****	*****	*****	*****	AG	6950	.8	.0	20.0
BR. LINK BR	*****	*****	*****	*****	FL	6950	.8	2.5	14.0
BS. LINK BS	*****	*****	*****	*****	AG	6950	.8	.0	20.0
BT. LINK BT	*****	*****	*****	*****	AG	6950	.8	.0	20.0
BU. LINK BU	*****	*****	*****	*****	FL	6950	.8	3.5	14.0
BV. LINK BV	*****	*****	*****	*****	FL	6950	.8	3.5	14.0
BW. LINK BW	*****	*****	*****	*****	AG	6950	.8	.0	20.0
BX. LINK BX	*****	*****	*****	*****	AG	6950	.8	.0	20.0
BY. LINK BY	*****	*****	*****	*****	AG	6950	.8	.0	20.0
BZ. LINK BZ	*****	*****	*****	*****	AG	6950	.8	.0	20.0
CA. LINK CA	*****	*****	*****	*****	AG	6950	.8	.0	20.0
CB. LINK CB	*****	*****	*****	*****	AG	6950	.8	.0	24.0
CC. LINK CC	*****	*****	*****	*****	AG	6950	.8	.0	24.0
CD. LINK CD	*****	*****	*****	*****	AG	5700	1.2	.0	24.0
CE. LINK CE	*****	*****	*****	*****	FL	5700	1.2	7.0	18.0
CF. LINK CF	*****	*****	*****	*****	FL	5700	1.2	2.0	14.0
CG. LINK CG	*****	*****	*****	*****	FL	5700	1.2	2.0	14.0
CH. LINK CH	*****	*****	*****	*****	AG	5700	1.2	.0	20.0
CI. LINK CI	*****	*****	*****	*****	AG	5700	1.2	.0	20.0
CJ. LINK CJ	*****	*****	*****	*****	AG	5700	1.2	.0	20.0
CK. LINK CK	*****	*****	*****	*****	AG	5700	1.2	.0	20.0
CL. LINK CL	*****	*****	*****	*****	AG	5700	1.2	.0	20.0
CM. LINK CM	*****	*****	*****	*****	FL	5700	1.2	5.5	14.0

File: 753NON.LST, Sample output file(design 97530/flc70313.01, ASR99)

```
 CN. LINK CN     * ***** ***** ***** ***** *  FL    5700    1.2     5.5  14.0
 CO. LINK CO     * ***** ***** ***** ***** *  FL    5700    1.2     3.5  14.0
 CP. LINK CP     * ***** ***** ***** ***** *  FL    5700    1.2     5.5  14.0
 CQ. LINK CQ     * ***** ***** ***** ***** *  FL    5700    1.2     5.5  14.0
 CR. LINK CR     * ***** ***** ***** ***** *  FL    5700    1.2     5.5  14.0
 CS. LINK CS     * ***** ***** ***** ***** *  FL    5700    1.2     5.5  14.0
 CT. LINK CT     * ***** ***** ***** ***** *  FL    5700    1.2     5.5  14.0
 CU. LINK CU     * ***** ***** ***** ***** *  FL    5700    1.2     5.5  14.0
 CV. LINK CV     * ***** ***** ***** ***** *  FL    5700    1.2     5.5  14.0
 CW. LINK CW     * ***** ***** ***** ***** *  FL    5700    1.2     5.5  14.0
 CX. LINK CX     * ***** ***** ***** ***** *  FL    5700    1.2     5.5  14.0
 CY. LINK CY     * ***** ***** ***** ***** *  FL    5700    1.2     5.5  14.0
 CZ. LINK CZ     * ***** ***** ***** ***** *  FL    5700    1.2     5.5  14.0
 DA. LINK DA     * ***** ***** ***** ***** *  FL    5700    1.2     5.5  14.0
 DB. LINK DB     * ***** ***** ***** ***** *  AG    5700    1.2      .0  20.0
 DC. LINK DC     * ***** ***** ***** ***** *  AG    5700    1.2      .0  20.0
 DD. LINK DD     * ***** ***** ***** ***** *  AG    5700    1.2      .0  20.0
 DE. LINK DE     * ***** ***** ***** ***** *  AG    5700    1.2      .0  20.0
 DF. LINK DF     * ***** ***** ***** ***** *  AG    5700    1.2      .0  20.0
 DG. LINK DG     * ***** ***** ***** ***** *  AG    5700    1.2      .0  20.0
 DH. LINK DH     * ***** ***** ***** ***** *  AG    5700    1.2      .0  20.0
 DI. LINK DI     * ***** ***** ***** ***** *  AG    5700    1.2      .0  20.0
 DJ. LINK DJ     * ***** ***** ***** ***** *  AG    5700    1.2      .0  20.0
 DK. LINK DK     * ***** ***** ***** ***** *  FL    5700    1.2     1.5  14.0
 DL. LINK DL     * ***** ***** ***** ***** *  FL    5700    1.2     1.5  14.0
 DM. LINK DM     * ***** ***** ***** ***** *  FL    5700    1.2     5.0  14.0
 DN. LINK DN     * ***** ***** ***** ***** *  FL    5700    1.2     5.0  14.0
 DO. LINK DO     * ***** ***** ***** ***** *  FL    5700    1.2     5.0  14.0
 DP. LINK DP     * ***** ***** ***** ***** *  FL    5700    1.2     5.5  14.0
 DQ. LINK DQ     * ***** ***** ***** ***** *  FL    5700    1.2     7.0  14.0
 DR. LINK DR     * ***** ***** ***** ***** *  FL    5700    1.2     7.0  14.0
 DS. LINK DS     * ***** ***** ***** ***** *  FL    5700    1.2     7.0  18.0
 DT. LINK DT     * ***** ***** ***** ***** *  AG    1900    1.2      .0  13.0
 DU. LINK DU     * ***** ***** ***** ***** *  AG    1900    1.2      .0  13.0
 DV. LINK DV     * ***** ***** ***** ***** *  AG    1900    1.2      .0  13.0
 DW. LINK DW     * ***** ***** ***** ***** *  AG    1900    1.2      .0  13.0
 DX. LINK DX     * ***** ***** ***** ***** *  AG    1900    1.2      .0  13.0
 DY. LINK DY     * ***** ***** ***** ***** *  FL    3800    1.2     5.5  12.0
 DZ. LINK DZ     * ***** ***** ***** ***** *  AG    3800    1.2      .0  18.0
 EA. LINK EA     * ***** ***** ***** ***** *  FL    3800    1.2     1.5  12.0
 EB. LINK EB     * ***** ***** ***** ***** *  BG    1900    1.2     2.0  13.0
 EC. LINK EC     * ***** ***** ***** ***** *  BG    1900    1.2     5.0  13.0
 ED. LINK ED     * ***** ***** ***** ***** *  BG    1900    1.2     7.0  13.0
 EE. LINK EE     * ***** ***** ***** ***** *  BG    1900    1.2     8.0  13.0
 EF. LINK EF     * ***** ***** ***** ***** *  BG    1900    1.2     7.0  13.0
 EG. LINK EG     * ***** ***** ***** ***** *  BG    1900    1.2     7.0  13.0
 EH. LINK EH     * ***** ***** ***** ***** *  FL    1900    1.2     1.5   7.0
 EI. LINK EI     * ***** ***** ***** ***** *  FL    1900    1.2     1.5   7.0
 EJ. LINK EJ     * ***** ***** ***** ***** *  FL    1900    1.2     1.5   7.0
 EK. LINK EK     * ***** ***** ***** ***** *  FL    1900    1.2     1.5   7.0
 EL. LINK EL     * ***** ***** ***** ***** *  AG    1900    1.2      .0  13.0
 EM. LINK EM     * ***** ***** ***** ***** *  AG    1900    1.2      .0  13.0
 EN. LINK EN     * ***** ***** ***** ***** *  AG    1900    1.2      .0  13.0
 EO. LINK EO     * ***** ***** ***** ***** *  AG    1900    1.2      .0  13.0
 EP. LINK EP     * ***** ***** ***** ***** *  AG    1900    1.2      .0  13.0
 EQ. LINK EQ     * ***** ***** ***** ***** *  AG    1900    1.2      .0  13.0
 ER. LINK ER     * ***** ***** ***** ***** *  FL    1900    1.2     1.5   7.0
 ES. LINK ES     * ***** ***** ***** ***** *  FL    1900    1.2     1.5   7.0

 III.  RECEPTOR LOCATIONS

                *     COORDINATES (M)
   RECEPTOR     *    X         Y       Z
 ---------------*----------------------
  1. RECPT    1 * 840116 831070    1.5

  IV.  MODEL RESULTS (WORST CASE WIND ANGLE )

               *         * PRED  *                      CONC/LINK
               *   BRG   * CONC  *                        (PPM)
  RECEPTOR     *  (DEG)  * (PPM) *  AA    AB    AC    AD    AE    AF    AG    AH
 --------------*---------*-------*------------------------------------------------
  1. RECPT   1 *  328.   * 275.6 *   .0    .0    .0    .0    .0    .0    .0    .0
```

APPENDIX G

7) Summary of Predicted NO_2 connection at different ASR locations

Proposed Setback Distance at different Assessment Year
(By linear interpolation of the predicted results)

Location (Future Development)		Setback Distance* (m) at Year	
		Yr2011	Yr2001
North of Area 39		53.3	62.0
Area 39 North - G/IC		52.5	67.4
Area 39 - Sports	max	49.0	55.3
	min	40.6	44.8
Area 39 South - G/IC	max	43.5	50.3
	min	28.7	34.5
PSK Dump Stage III		44.0	50.8
PSK Dump Stage II		32.6	37.2
PSK Dump Stage I		40.1	45.1

Remark: *Setback Distance is measured from the sensitive use development to the outer-edge of the driving-lane

Predicted Maximum 1-hour average NO2 concentration (µg/m3): Yr 2001, Existing ASRs
(4m & 2.5m overhang barriers at the KCRC bldg)

ASR	ASR Location		ASR	Setback	Predicted maximum 1-hour average NO2 concentration (µg/m3) at different height							
ID	X-co	Y-co	Description	Distance**	1.5m	3m	3.5m	4m	5m	10m	15m	17.5m
A1	836187	834283	Kwong Fuk Estate	63.0	151	151	151	150	150	147	143	140
A2	836435	834021	Island Hse Conservation Study Centre	91.8	145	145	145	144	144	143	140	139
A3	836491	833701	Care Village	65.8	213	213	213	213	212	208	202	199
A4	836804	833502	KCRC Club Hostel	79.6	211	211	211	211	210	207	201	198
A5	837118	833302	Sea View Villas	91.2	223	223	222	222	222	217	209	204
A6	837881	833219	Tai Po Kau Village Hse	116.6	191	191	191	191	190	187	182	179
A7	839515	831720	CUHK Res 10	80.7	197	197	197	197	196	194	189	187
A8	839765	831387	CUHK Grace Tien Hall	182.5	129	129	129	129	129	128	127	126
A9	840028	831445	CUHK Inst of Biotechnology *	38.0	---	---	---	---	---	---	---	274
A10	840147	831115	Marine Science Lab	69.3	267	266	265	265	264	255	242	235
A11	840137	830790	Marine Police Base	81.2	212	212	212	211	211	205	197	193
A12	840050	830077	Marine Police N. Div Base	112.1	150	150	150	149	149	148	146	145
A13	840051	831507	Resid Hse next to Inst of Biotech	88.5	212	212	212	211	211	207	202	199
A86	836806	833543	KCRC Club Hostel	42.2	263	262	262	261	260	252	241	234
A87	836889	833496	KCRC Club Hostel	41.6	275	274	273	273	272	262	248	241
A88	836951	833458	KCRC Club Hostel	42.5	282	281	280	280	278	268	254	246
A89	840116	831058	Marine Science Lab	37.1	*311*	*309*	*308*	*307*	*305*	286	262	249
A90	840105	830969	Yacht Club (non-sensitive)	30.8	*312*	*310*	*309*	*308*	*305*	284	258	245
A91	840123	830961	Yacht Club (non-sensitive)	49.2	271	270	270	269	267	256	239	230
A92	840133	830972	Yacht Club (non-sensitive)	58.4	261	260	259	259	257	247	233	225
A93	840119	830974	Yacht Club (non-sensitive)	44.3	282	280	280	279	277	264	245	235
A94	840133	831048	Marine Science Lab	55.7	278	277	276	275	274	263	246	237
A95	840127	831054	Marine Science Lab	49.2	289	287	287	286	284	271	252	241
A96	840132	831059	Marine Science Lab	53.9	282	280	280	279	278	266	249	239
A97	840131	831071	Marine Science Lab	52.5	284	282	282	281	280	268	251	241
A98	840124	831074	Marine Science Lab	45.5	297	295	295	294	292	278	257	246
A99	840116	831070	Marine Science Lab	38.0	*316*	*314*	*313*	*312*	*309*	290	265	251
A100	840127	831095	Marine Science Lab	48.5	294	292	292	291	289	276	257	246
A101	840133	831105	Marine Science Lab	55.4	285	283	283	282	281	269	253	243
A102	840127	831114	Marine Science Lab	49.3	296	295	294	293	292	278	259	249
A103	840120	831105	Marine Science Lab	42.3	*309*	*307*	*306*	*305*	*303*	287	265	253
A104	839842	830413	CUHK Bldg E9	78.5	159	158	158	158	157	154	148	145
A105	839882	830436	CUHK Bldg E9	43.7	200	199	199	199	197	189	179	173
A106	839863	830463	CUHK Bldg E9	68.2	168	168	168	167	167	162	155	151
A107	839841	830495	CUHK Bldg E9	95.9	145	144	144	144	144	141	136	133
A108	839817	830476	CUHK Bldg E9	115.5	134	133	133	133	133	130	127	125
A109	839785	830483	CUHK Bldg E9	148.6	120	120	120	120	119	118	115	113
A110	839907	830664	CUHK Bldg E7	62.5	174	173	172	172	170	161	152	147
A111	839918	830669	CUHK Bldg E7	52.1	189	187	186	186	184	172	161	155
A112	839910	830678	CUHK Bldg E7	62.7	175	174	173	173	171	161	152	147
A113	839898	830673	CUHK Bldg E7	72.7	164	163	162	162	157	151	143	139
A114	839887	830686	CUHK Bldg E6	85.8	152	151	151	150	149	142	134	130
A115	839896	830699	CUHK Bldg E6	79.5	157	156	156	155	154	145	137	133
A116	839886	830712	CUHK Bldg E6	93.0	148	148	147	147	146	138	130	126
A117	839878	830698	CUHK Bldg E6	97.6	145	144	144	143	142	136	128	124
A118	839924	830723	CUHK Bldg E5	57.4	183	181	181	180	178	167	154	148
A119	839948	830715	CUHK Bldg E5	33.7	230	228	226	225	222	202	184	175
A120	839959	830779	CUHK Bldg E5	34.8	230	228	227	226	223	205	183	172
A121	839939	830772	CUHK Bldg E5	53.7	190	189	188	188	186	176	161	153
A122	839913	830745	CUHK Bldg E5	72.5	164	163	163	162	161	153	142	136
				Sub-max:	*316*	*314*	*313*	*312*	*309*	290	265	274
				Overall max:	*316*							
				AQO%:	*105*							

Remarks:

* For the Institute of Biotechnology, a central A/C system was installed with FAI located on roof level (17.5m above ground)

**Setback distance is measured from the sensitive receptor to the outer-edge of driving lane

Predicted Maximum 1-hour average NO2 concentration (µg/m3): Yr 2001, Existing ASRs
(4m & 2.5m overhang barriers at the KCRC bldg)

ASR	ASR Location		ASR	Setback	Predicted maximum 1-hour average NO2 concentration (µg/m3) at different height							
ID	X-co	Y-co	Description	Distance**	1.5m	3m	3.5m	4m	5m	10m	15m	17.5m
A1	836187	834283	Kwong Fuk Estate	63.0	159	158	158	158	158	155	150	147
A2	836435	834021	Island Hse Conservation Study Centre	91.8	152	152	152	152	151	150	147	146
A3	836491	833701	Care Village	65.8	225	225	225	225	224	220	213	210
A4	836804	833502	KCRC Club Hostel	79.6	223	223	223	222	222	218	212	209
A5	837118	833302	Sea View Villas	91.2	236	235	235	235	234	229	220	215
A6	837881	833219	Tai Po Kau Village Hse	116.6	202	201	201	201	201	197	192	188
A7	839515	831720	CUHK Res 10	80.7	208	208	208	207	207	204	200	197
A8	839765	831387	CUHK Grace Tien Hall	182.5	135	135	135	135	135	134	133	132
A9	840028	831445	CUHK Inst of Biotechnology *	38.0	---	---	---	---	---	---	---	291
A10	840147	831115	Marine Science Lab	69.3	282	281	281	280	279	270	256	248
A11	840137	830790	Marine Police Base	81.2	224	224	223	223	222	217	208	203
A12	840050	830077	Marine Police N. Div Base	112.1	157	157	157	157	157	155	153	152
A13	840051	831507	Resid Hse next to Inst of Biotech	88.5	224	224	223	223	223	219	213	210
A86	836806	833543	KCRC Club Hostel	42.2	278	277	277	277	275	267	254	247
A87	836889	833496	KCRC Club Hostel	41.6	291	290	289	289	287	277	263	254
A88	836951	833458	KCRC Club Hostel	42.5	298	297	297	296	295	284	269	260
A89	840116	831058	Marine Science Lab	37.1	*330*	*328*	*327*	*326*	*323*	*303*	277	263
A90	840105	830969	Yacht Club (non-sensitive)	30.8	*331*	*329*	*328*	*326*	*323*	*301*	273	259
A91	840123	830961	Yacht Club (non-sensitive)	49.2	287	286	285	285	283	271	253	243
A92	840133	830972	Yacht Club (non-sensitive)	58.4	276	275	274	274	272	262	247	238
A93	840119	830974	Yacht Club (non-sensitive)	44.3	298	297	296	295	293	279	259	248
A94	840133	831048	Marine Science Lab	55.7	294	293	292	292	290	278	260	250
A95	840127	831054	Marine Science Lab	49.2	*306*	*304*	*304*	*303*	*301*	287	266	255
A96	840132	831059	Marine Science Lab	53.9	298	297	296	296	294	281	263	253
A97	840131	831071	Marine Science Lab	52.5	300	299	298	298	296	283	265	255
A98	840124	831074	Marine Science Lab	45.5	*315*	*313*	*312*	*312*	*309*	294	272	261
A99	840116	831070	Marine Science Lab	38.0	*335*	*332*	*332*	*330*	*328*	*307*	280	266
A100	840127	831095	Marine Science Lab	48.5	*311*	*310*	*309*	*308*	*306*	292	272	261
A101	840133	831105	Marine Science Lab	55.4	*301*	300	300	299	297	285	267	257
A102	840127	831114	Marine Science Lab	49.3	*314*	*312*	*312*	*311*	*309*	295	274	263
A103	840120	831105	Marine Science Lab	42.3	*327*	*325*	*324*	*323*	*321*	*304*	280	267
A104	839842	830413	CUHK Bldg E9	78.5	167	166	166	166	166	162	156	152
A105	839882	830436	CUHK Bldg E9	43.7	211	210	210	209	208	200	189	182
A106	839863	830463	CUHK Bldg E9	68.2	177	177	176	176	175	171	163	159
A107	839841	830495	CUHK Bldg E9	95.9	152	151	151	151	151	148	143	140
A108	839817	830476	CUHK Bldg E9	115.5	140	140	140	140	139	137	133	131
A109	839785	830483	CUHK Bldg E9	148.6	125	125	125	125	125	123	120	118
A110	839907	830664	CUHK Bldg E7	62.5	183	182	181	181	179	170	160	155
A111	839918	830669	CUHK Bldg E7	52.1	199	197	197	196	193	181	169	163
A112	839910	830678	CUHK Bldg E7	62.7	184	183	182	182	180	170	160	154
A113	839898	830673	CUHK Bldg E7	72.7	172	171	171	170	166	158	150	146
A114	839887	830686	CUHK Bldg E6	85.8	159	159	158	158	156	149	140	137
A115	839896	830699	CUHK Bldg E6	79.5	166	164	164	163	162	152	144	140
A116	839886	830712	CUHK Bldg E6	93.0	156	155	155	154	153	145	136	132
A117	839878	830698	CUHK Bldg E6	97.6	152	151	151	150	149	142	134	130
A118	839924	830723	CUHK Bldg E5	57.4	193	191	190	190	188	175	162	156
A119	839948	830715	CUHK Bldg E5	33.7	243	240	239	238	235	213	194	184
A120	839959	830779	CUHK Bldg E5	34.8	243	241	240	239	236	217	193	181
A121	839939	830772	CUHK Bldg E5	53.7	200	199	199	198	196	185	169	160
A122	839913	830745	CUHK Bldg E5	72.5	172	172	171	171	170	161	149	142
				Sub-max:	*335*	*332*	*332*	*330*	*328*	*307*	280	291
				Overall max:	*335*							
				AQO%:	*112*							

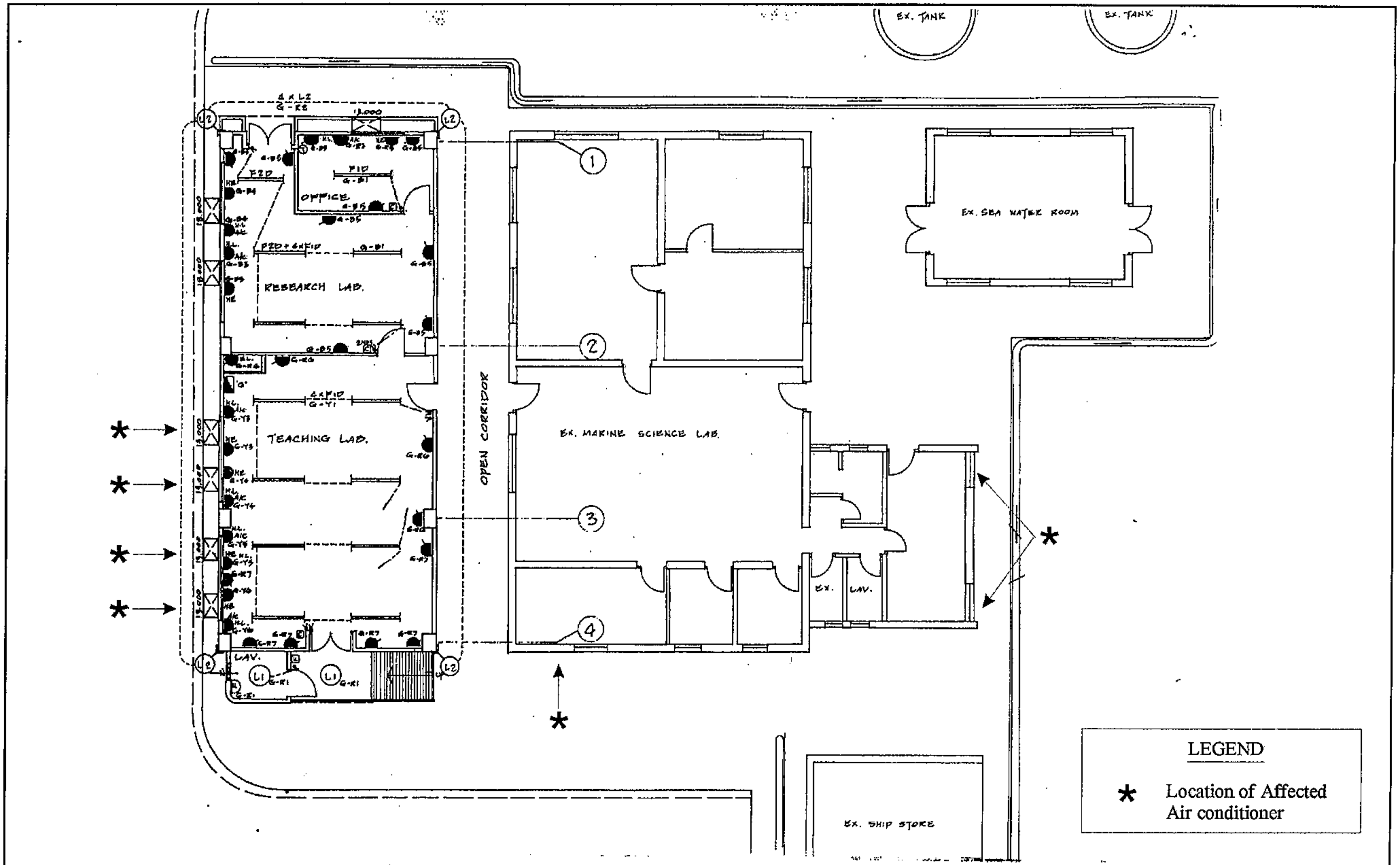
Remarks:

* For the Institute of Biotechnology, a central A/C system was installed with FAI located on roof level (17.5m above ground)

**Setback distance is measured from the sensitive receptor to the outer-edge of driving lane

APPENDIX G

8) Marine science laboratory - mitigation proposals



G8-1 Location of Affected Air Conditioners

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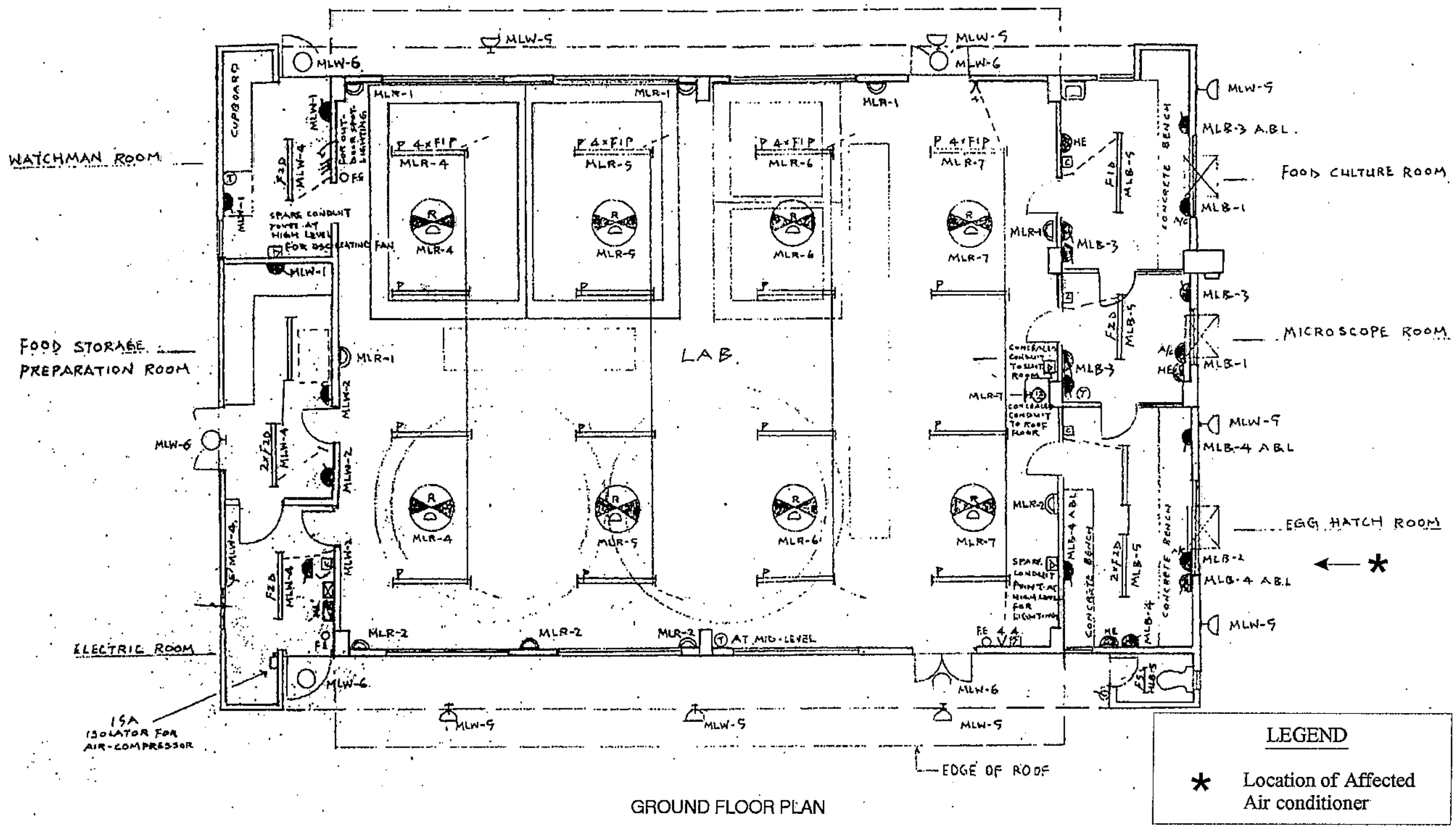

LEGEND

* Location of Affected Air conditioner

G8-2 Location of Affected Air Conditioners

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APPENDIX G

9) Comparison of emissions over different years

Comparison table of Emission Rate Between 2001 and 2011

Road	Vehicle Type	Proportion	Emission Factor NOx	Product of Traffic Flow and NO2 Emission Factor
Tolo Highway S/B Yr 2011 (Traffic Flow: 6950)	Car	64.30%	1.321	
	Taxi	6.70%	0.779	
	LGV	8.40%	1.803	
	HGV	16.80%	7.061	
	PLB	1.60%	1.782	
	Buses	2.10%	8.578	
	Composite Emission Factor NOx		2.448	
	Composite Emission Factor NO2		0.490	3402.6
Tolo Highway N/B Yr 2011 (Traffic Flow: 5700)	Car	38.00%	1.321	
	Taxi	4.00%	0.779	
	LGV	16.90%	1.803	
	HGV	33.60%	7.061	
	PLB	3.20%	1.782	
	Buses	4.30%	8.578	
	Composite Emission Factor NOx		3.636	
	Composite Emission Factor NO2		0.727	4145.3
Tolo Highway S/B Yr 2001 (Traffic Flow: 5950)	Car	64.30%	1.504	
	Taxi	6.70%	0.778	
	LGV	8.40%	1.975	
	HGV	16.80%	9.599	
	PLB	1.60%	1.861	
	Buses	2.10%	11.270	
	Composite Emission Factor NOx		3.064	
	Composite Emission Factor NO2		0.613	3646.4
Tolo Highway N/B Yr 2001 (Traffic Flow: 4700)	Car	38.00%	1.504	
	Taxi	4.00%	0.778	
	LGV	16.90%	1.975	
	HGV	33.60%	9.599	
	PLB	3.20%	1.861	
	Buses	4.30%	11.270	
	Composite Emission Factor NOx		4.706	
	Composite Emission Factor NO2		0.941	4423.5

Sub-total (Yr 2011) - Products of Traffic Flow&Emission Factor
7547.9

Sub-total (Yr 2001) - Products of Traffic Flow&Emission Factor
8069.9

Percentage of Emission btw 2001 and 2011: 106.9

APPENDIX G

10) Marine science laboratory - mitigation options

Table G10: Predicted Maximum 1-hour NO2 Concentration at Marine Science Lab & CUHK Eastern Campus
Yr 2001

ASR ID	ASR Description	Predicted Maximum 1-hour Average NO2 Concentration (µg/m3) with Different Mitigation Measures				
		With Noise Barriers Only (Base Case)	Base Case plus 4m overhang barriers at MSL	Base Case plus 6m overhang barriers at MSL	Base Case plus 8m overhang barriers at MSL	Base Case plus 10m overhang barriers at MSL
A94	Marine Science Lab	294.1	283.7	280.5	278.8	277.3
A95	Marine Science Lab	***305.8***	294.4	290.7	288.4	286.6
A96	Marine Science Lab	298.1	287.4	283.6	281.8	280.1
A97	Marine Science Lab	***300.3***	290.4	285.9	284.1	282.4
A98	Marine Science Lab	***314.6***	***303.3***	298.6	296.2	294.2
A99	Marine Science Lab	***334.6***	***320.3***	***315.4***	***312.5***	310.0
A100	Marine Science Lab	***311.1***	***301.3***	295.9	293.7	291.7
A101	Marine Science Lab	***301.5***	293.6	287.9	285.7	283.8
A102	Marine Science Lab	***313.8***	***305.0***	298.4	295.9	293.9
A103	Marine Science Lab	***327.0***	***315.2***	***309.0***	***306.5***	304.5
	Max:	***334.6***	***320.3***	***315.4***	***312.5***	***310.0***
Predicted No. of Exceedances in 1991:		11	4	4	4	4
Predicted No. of Exceedances in 1992:		12	5	5	5	5
Predicted No. of Exceedances in 1993:		8	2	2	2	2

Table G10: Predicted Maximum 1-hour NO2 Concentration at Marine Science Lab & CUHK Eastern Campus
Yr 2011

ASR ID	ASR Description	Predicted Maximum 1-hour Average NO2 Concentration (µg/m3) with Different Mitigation Measures: With Noise Mitigation Only	4m overhang barriers at KCRC & M. Science Lab	6m overhang barriers at M. Science Lab & 4m overhang at KCRC	8m overhang barriers at M. Science Lab & 4m overhang at KCRC	10m overhang barriers at M. Science Lab & 4m overhang at KCRC	No mitigation at M. Science Lab but 4m overhang barriers at KCRC Bldg
A94	Marine Science Lab	277.7	268.0	265.0	263.4	262.0	277.7
A95	Marine Science Lab	288.6	278.0	274.5	272.4	270.7	288.6
A96	Marine Science Lab	281.4	271.4	267.9	266.2	264.6	281.5
A97	Marine Science Lab	283.5	274.2	270.0	268.3	266.8	283.5
A98	Marine Science Lab	296.9	286.3	281.9	279.7	277.8	296.9
A99	Marine Science Lab	***315.6***	***302.2***	297.6	294.9	292.6	***315.6***
A100	Marine Science Lab	293.6	284.4	279.4	277.3	275.5	293.6
A101	Marine Science Lab	284.6	277.2	271.9	269.8	268.1	284.6
A102	Marine Science Lab	296.1	287.9	281.7	279.4	277.5	296.1
A103	Marine Science Lab	***308.5***	297.4	291.6	289.3	287.4	***308.5***
	Max:	***315.6***	***302.2***	297.6	294.9	292.6	***315.6***
	No. of Exceedance Cases in Yr91:	11	4	---	---	---	11
	No. of Exceedance Cases in Yr92:	12	5	---	---	---	12
	No. of Exceedance Cases in Yr93:	8	2	---	---	---	8

Review Of Different Mitigation Measures
(Assessment at Yr 2001)

TABLE G10

Description	Different Mitigation Measures Reviewed in the Assessment						
	With Noise Barriers (Basic Design)	4m overhang barriers at MSL*	6m overhang barriers at MSL *	8m overhang barriers at MSL *	10m overhang barriers at MSL*	Full enclosure of road at MSL*	Adapting A/C system at MSL
Max 1-hour Average NO2 Concentration (µg/m3) at Marine Science Lab	***334.6***	***320.3***	***315.4***	***312.5***	***310.0***	244.0	not relevant
Expected No. of Exceedance Cases Per Year	10	4	4	4	4	0	0
Effectiveness of Mitigation Measures	Exceedance remains at the front & middle facades of the MSL	Exceedance remains at the front & middle facades of the MSL	Exceedance remains at the front & middle facades of the MSL	Exceedance remains at the front & middle facades of the MSL	Exceedance remains at the front & middle facades of the MSL	No Exceedances at the MSL but portal effects give rise to exceedance at the new CUHK Bldgs	No Exceedances at the MSL. Design is feasible and cost effective

Remarks: * In addition to the basic design, extra mitigation measures for air quality impact have been incorporated
**** MSL = Marine Science Lab**