

**Trunk Road T7 in Ma On Shan
Environmental Impact Assessment**

**ENVIRONMENTAL MONITORING
& AUDIT MANUAL**

February 1998

Maunsell Consultants Asia Ltd.
in association with
ERM (Hong Kong) Ltd.
Hassell Ltd.

Trunk Road T7 in Ma On Shan: EM&A Manual

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1. INTRODUCTION

1.1 Background

1.1.1 On 20 March 1997, the Territory Development Department (New Territories East Development Office) of the Hong Kong Government commissioned Maunsell Consultants Asia Ltd (hereafter known as Maunsell) as the lead consultant for the Environmental Impact Assessment Study (hereafter known as the EIA Study) of Trunk Road T7 in Ma On Shan (hereafter known as T7).

1.1.2 The purpose of the Assignment is to provide information on the nature and extent of environmental impacts arising from the construction and operation of the proposed project and all related activities taking place concurrently. This information will contribute to decisions on whether:

- the predicted levels of any environmental impacts that are likely to arise as a result of the proposed trunk road are within the established standards and guidelines;
- there are any specific conditions and requirements for environmental protection that should be applied to the detailed design, construction and operation of the proposed trunk road; and
- any residual impacts identified in the EIA are within the established standards and guidelines after proposed mitigation measures are implemented.

1.1.3 This Environmental Monitoring and Audit (EM&A) Manual provides details of monitoring and audit requirements identified in the EIA. Hong Kong environmental regulations, planning and standards guidelines have been used as the basis for the environmental standards set out in the Manual.

1.2 Construction Description

1.2.1 The Proposed Trunk Road T7 will connect the existing Ma On Shan Road and Sai Sha Road, allowing traffic destined for north Ma On Shan, Lok Wo Sha and Sai Kung to by-pass the busy Ma On Shan Town Centre. The current programme (see *Figure 1.2a*) indicates that construction is expected to commence at the beginning of January 2000, with a 36 month construction schedule proposed. Completion of the Project is therefore expected at the end of December 2002.

1.3 Objectives of Environmental Monitoring & Audit

1.3.1 This Environmental Monitoring and Audit (EM&A) Manual provides information, guidance and instruction to site staff who are in charge of environmental issues and are undertaking environmental monitoring works for the Project. The objectives of carrying out the EM&A Manual for the Trunk Road T7 include the following:

- To provide a database against which environmental impact of the project can be determined;
- To provide an early indication should any of the environmental control measures or practices fail to achieve the acceptable standards;
- To monitor the performance of the Project and the effectiveness of mitigation measures;
- To verify the environmental impacts predicted in the EIA Study;
- To determine project compliance with regulatory requirements, standards and government policies;
- To take remedial action if unexpected problems or unacceptable impacts arise; and
- To provide data to enable an environmental audit.

1.4 The Scope of the EM&A Study

1.4.1 This EM&A Manual is prepared for the construction of Trunk Road T7 in Ma On Shan. The scope of the EM&A Study are to set out the EM&A procedures as summarised below:

- establish baseline dust and noise levels at specified locations and review these baseline levels every six months;
- implement construction dust and noise impact monitoring programmes;
- implement air quality monitoring of tunnels;
- liaise with and provide environmental advice (as requested or when otherwise necessary) to construction site staff in the comprehension and consequences of the EM&A Study; identify and resolve of environmental issues and other functions as they may arise from the works;
- check and quantify the Contractor's overall environmental performance, implement Event Contingency Plans (ECP's), and recommend and implement remedial actions to mitigate adverse environmental effects as identified by the EM&A programme, the EIA and others;
- conduct monthly review of monitored impact data as the basis for assessing compliance with defined criteria and to ensure that necessary mitigation measures are identified, designed and implemented, and to undertake additional *ad hoc* monitoring and auditing as required by special circumstances;

- evaluate and interpret all environmental monitoring data, to provide an early indication, should any of the environmental control measures or practices fail to achieve the acceptable standards, and to verify the environmental impacts predicted in the EIA;
- manage and liaise with other individuals or parties concerning any other environmental issues deemed to be relevant to the construction process;
- conduct regular site audits of a formal or informal nature to assess:
 - the level of the Contractors general environmental awareness;
 - the Contractor's implementation of the recommendations in the EIA;
 - the Contractor's performance as measured by the EM&A;
 - the need for specific mitigation measures to be implemented or the continued usage of those previously agreed;
 - to advise the site staff of any identified potential environmental issues; and
- submit monthly EM&A reports which summarise project monitoring and auditing data, with full interpretation illustrating the acceptability or otherwise of any environmental impacts and identification or assessment of the implementation status of agreed mitigation measures.

1.5 Structure of The EM&A Manual

1.5.1 Following this introductory *Section*, the Manual is set out as follows:

- *Section 2* of the Manual provides the organisation and structure of the Environmental Team, outlines the various parties involved in the EM&A process, the responsibilities and contact details of key individuals;
- the general elements of the EM&A process are set out in *Section 3*, including a summary of the EIA;
- *Sections 4* and *5* detail the requirements for baseline and impact monitoring for noise and air and set out the relevant monitoring locations, compliance criteria and event contingency plans (ECPs) governing the monitoring process;
- *Section 6* describes the scope and frequency of onsite audits works;
- *Annex A* provides an example of a complaints proforma; and
- *Annex B* presents a summary of all the mitigation measures recommended in the EIA Report.

- 1.5.2 The EM&A Manual is an evolving document that shall be updated as necessary during the construction phase of the Project.

2. ORGANISATION AND STRUCTURE OF THE ENVIRONMENTAL TEAM

2.1 Project Organisation

2.1.1 An Environmental Team (ET), employed by the Engineer under the Contract and independent from the Contractor, shall be set up for the construction of the Project. The project organisation and lines of communication with respect to environmental works is shown in *Figure 2.1a*.

2.2 Environmental Team

2.2.1 The duties of the ET are:

- to monitor the various environmental parameters as required in this EM&A Manual;
- to investigate and audit the Contractors' equipment and work methodologies with respect to pollution control and environmental mitigation, and anticipate environmental issues for proactive action before problem arise;
- to audit and prepare audit reports on the environmental monitoring data and the site environmental conditions; and
- to report on the environmental monitoring and audit results to the Contractor, the Engineer and the EPD.

2.2.2 The roles and responsibilities of the ET and key members of the ET are presented below.

Environmental Manager

2.2.3 The Environmental Manager (EM) is responsible for and in charge of the ET, including:

- the broad supervision of the EM&A Study Programme, its members and in the timely production and quality of the outputs;
- managing the various specialist teams and other professionals designated as part of the Environmental Team;
- meeting the agreed objectives and deadlines as set out in this Manual; and
- ensuring the quality of the deliverables.

Engineer's Representative

2.2.4 The Engineer Representative (ER), shall appoint an appropriate member of the resident site staff, who shall:

- monitor the Contractor's compliance with contract specifications, including the effective implementation and operation of environmental mitigation measures;
- instruct the Contractor to follow the agreed protocols or those in the Contract Specifications in the event of exceedances or complaints; and
- comply with the agreed Event Contingency Plan in the event of any exceedances.

Environmental Coordinator

2.2.5 Reporting to the EM, the Environmental Coordinator (EC) shall have responsibility for:

- assisting the EM in the day to day coordination tasks associated with EM&A of the Project;
- the management and coordination of the day to day activities of the monitoring staff;
- liaison with the construction site staff for the training and communication of specific mitigation and other instructions pertaining to environmental matters;
- ensuring that the advice provided by the ET and taken up by the ER, is followed through on site; and
- ensuring that the ET is kept up to date with all relevant on site developments.

Environmental Technician

2.2.6 The Environmental Technician is responsible for:

- day to day noise and air monitoring activities; and
- environmental site inspection works.

3. EM&A GENERAL REQUIREMENTS

3.1 Introduction

3.1.1 In this *Section*, a summary of the EIA findings is presented, and the general requirements and scope of the EM&A are described and the means by which these interrelate are discussed.

3.1.2 *Figure 3.1a* illustrates how an environmental problem identified by the EM&A monitoring process should be resolved and how the results of increased monitoring will feedback into the EM&A process and provide details on mitigation performance.

3.2 Summary of the EIA

3.2.1 A summary of the EIA findings and mitigation measures that require EM&A is presented below. Details of the recommended mitigation measures are detailed in Annex B.

Noise

3.2.2 The construction of both new roads and the alteration of existing roads, within the T7 road network, have the potential to generate noise impacts at properties which lie alongside, while the operational phase will potentially result in noise impacts generated from traffic travelling along the T7 and other associated roads.

3.2.3 It is anticipated that a large number of properties alongside the proposed T7 route are likely to experience construction noise impacts unless ameliorative action is taken. A precasting yard located in the centre of the T7 Interchange will, if unmitigated, has the potential to generate noise impacts at distances up to 250 m and to contribute to impacts within a radius of 500 m, which would include a number of properties in Cheung Muk Tau, proposed developments in the vicinity of the interchange and Lee On Estate. Due to very shallow rockhead levels and the relatively short lengths of the tunnels, drill and blast method will be adopted for tunnel construction, which also has the potential for causing noise impacts on the surrounding areas.

3.2.4 Findings of the study indicate that potential noise impacts resulting from the construction of T7 can be avoided through the use of suitable mitigation measures. The necessary measures include the use of quiet plant and construction techniques, where practicable, the use of temporary noise barriers (with a set back distance of 150m) and reducing the percentage on-time of plant operating simultaneously. Where possible, noisy activities should be scheduled to avoid particularly sensitive periods such as school examination periods. Blasting used for the construction of the two tunnels in the interchange should be controlled within the guidance provided by the Mines and Quarries (M&Q) Division of the Civil Engineering Department (CED). While it is unlikely that noise impacts from blasting can be prevented altogether, it is possible to minimise potential impacts by adopting

appropriate blasting techniques and the implementation of a good public relations programme.

- 3.2.5 Potential noise impacts attributable to the operation of T7 can be successfully mitigated through the use of low noise road surfaces, road side barriers and a single semi-enclosure. Four NSRs, all proposed developments (i.e., the Railway Depot, Lee On Residential Development, Residential Development TPTL 146 and Residential Development STTL 446), were identified as potential sites for experiencing residual noise impacts due to the operation of the Trunk Road T7. For these sites, it is recommended that optimal design and layout of the planned developments be ensured and noise insulation installed. Noise insulation is also recommended for the 20th floor of Kam Yiu House.

Air Quality

- 3.2.6 The principal air quality impacts during the construction phase will be fugitive dust emission impacts on the adjacent ASRs. Site clearance, excavation, materials handling and vehicle movements on unpaved site roads will be the major dust sources. There will be no major dust generating activities in the casting yard and no concrete batching plant on site, as ready mixed concrete will be delivered from elsewhere, however, the resulting increase in traffic along the haul road may generate additional dust impacts. Exhaust emissions from construction plant (primarily RSP, NO₂ and CO) are not expected to result in adverse impacts as the number of pieces of equipment will be relatively small. The only blasting that may occur would be for the construction of two tunnels at the T7 Interchange.
- 3.2.7 T7 is a dual-2 carriageway connecting Sai Sha Road and Ma On Shan Road. Bypassing the town centre of Ma On Shan, it will ease the traffic congestion of the town and should lead to an overall decrease in pollutant levels in the town centre. However, T7 will also generate additional traffic and the exhaust emissions from the new road will affect the identified ASRs. Vehicle exhaust emissions will be the major source of air pollutants during the operation of T7, primarily NO₂, CO, and RSP. In this particular case, the presence of noise barrier near Kam Yiu Mansion at Kam Ying Court recommended in *Final Assessment Report*, will result in the shifting of the dispersion of the vehicular emission to the opposite side, i.e., away from the ASRs. Two tunnels are planned at the T7 Interchange, with one spanning approximately 210 m and the other about 270 m. Ventilation fans will be installed along both tunnels.
- 3.2.8 To mitigate dust impacts arising from construction activities, dust control measures, such as water sprays and minimising dropping heights, should be incorporated into the Contract Specification and duly implemented as part of good construction practice. Whilst adverse impacts are not anticipated during blasting, appropriate measures such as watering and the use of dust filters, blast doors, wire mesh, gunny sacks and sandbags, should also be implemented.

- 3.2.9 During the operational phase, the set back distance of T7 has been designed to comply with the HKPSG and even with the proposed noise barriers in place, air quality levels at the ASRs are predicted to comply with the AQOs and no additional mitigation measures are required. To ensure compliance with the TAQG, monitoring of air quality within the tunnel is recommended and sufficient ventilation capacity should be allowed to ensure that the TAQG would be maintained.

Water Quality

- 3.2.10 Potential water quality impacts from the construction of the Trunk Road T7 will be from typically land based construction activities involving : construction runoff and drainage; litter and debris; and spillages. With the implementation of proper site management and good construction practices, it is unlikely that construction activities would result in breaching of the Water Quality Objectives (WQO).
- 3.2.11 The adoption and incorporation of an appropriate drainage collection system will ensure that no residual detrimental operational water quality impacts arise. It is considered that provided these drainage facilities are implemented, along with regular cleaning and maintenance practices, operational water quality will be compliant with the WPCO standards.

Waste Management

- 3.2.12 After re-use of excavated materials on-site, it is likely that only small quantities of surplus spoil, if any, will require disposal off-site in either a public dump (Pak Shek Kok Reclamation Public Dump) or landfill (NENT), and only small volumes of construction, demolition and chemical wastes will be generated. Mitigation measures relating to good practice are recommended to ensure that adverse environmental impacts are prevented and that opportunities for waste minimisation and recycling are followed. It is expected that if the measures are taken, the storage, handling, collection, transport and disposal of waste should present minimal environmental impacts.
- 3.2.13 It is recommended that auditing of each waste stream should be carried out periodically by the Trunk Road T7 contractor to determine if wastes are being managed in accordance with approved procedures and the site waste management plan, and to see if waste reduction targets are being achieved or could be improved. The audits should look at all aspects of waste management including waste generation, storage, recycling, treatment, transport, and disposal. An appropriate audit programme would be to undertake a first audit at the commencement of the construction works and then to audit quarterly thereafter.

Terrestrial Ecology

- 3.2.14 The key ecological issue associated with the proposed T7 relates to the loss of 2.5 ha of secondary woodland and 2.5 ha of old plantation woodland. The

Ma On Shan SSSI will not be affected by the current project and only a small portion of the Ma On Shan Country Park will be subjected to any impacts. The latter can be considered insignificant when compared to the rest of the entire conservation area.

- 3.2.15 Mitigation measures have been recommended to limit the potential impacts, including advance and compensatory on-site replanting over the area in between the proposed alignment and the Ma On Shan Country Park during or after completion of the construction work. Other mitigation measures, such as minimising the woodland to be encroached upon and good construction practice, are also recommended. The potential impact during the operational phase is mainly related to fragmentation of habitat, but as no important wildlife is expected to be affected, the impact is considered as negligible.

Landscape and Visual

Landscape/Townscape Impact

- 3.2.16 The scheme proposals in the context of its design, location and the overall character area has resultant landscape and townscape impacts that are significant adverse but generally localised. These major impacts arise due to: the loss of vegetation and recreational resource of amenity woodland areas, although this is a localised effect adjacent to Kam Ying and Lee On Estate; and modifications to topography, loss of vegetation, loss of recreational resource and introduction of major landscape element to the Hunch Backs.
- 3.2.17 In consideration of the two options for the northern interchange the Overland Option route will cause a highly significant adverse landscape impact due to the extensive cutting and loss of vegetation required. The Tunnel Option route, however, will only cause moderate adverse impacts.
- 3.2.18 Minor townscape impacts will occur to the high-rise residential areas with the scheme being relatively remote to the majority of the area. The quarry will also suffer minor landscape impacts due to small modifications to topography and loss of young plantation trees, but benefits from the opportunity the scheme provides for mitigation measures.

Visual Impact

- 3.2.19 The scheme proposals in the context of its visual character will have the resultant impacts in existing views that are significant adverse but only on a limited number of visually sensitive receivers. These are: the introduction of a dominating feature to views from Kam Ying Court, Saddle Ridge Garden, Lee On Estate and STTL 446 developments; and local impacts for trail walkers and Hunch Backs users.

- 3.2.20 The Overland Option for the northern interchange will heighten these impacts for Lee On Estate, or STTL 446, as well as being a major feature in views from local pedestrians. The Tunnel Option would be a much lesser feature within the aforementioned views.
- 3.2.21 There are a number of impacts to other visually sensitive receivers, however these are generally only slight adverse as the scheme is only a small extension of the existing urbanisation within their views or is screened.

Land Use

- 3.2.22 According to the approved Ma On Shan OZP S/MOS/5, the land use impacts of the construction and operation of the Trunk Road T7, would be minimal. However, consultation with AFD has revealed that the development boundary shown on the approved Ma On Shan OZP S/MOS/5 does not match with the Country Park Boundary. A small section of Trunk Road T7 in front of the WSD service reservoir has been found to encroach into the Ma On Shan Country Park. The area affected is about 900m². A site inspection identified that the affected area is only an earth track and does not have any ecological or recreational value. Therefore, its loss will not have an adverse effect on either the Country Park or the public. Consent for the encroachment into Country Park should be sought from the Authority of the Country and Marine Parks and in consultation with the Country and Marine Parks Board.

3.3 Construction Phase EM&A

- 3.3.1 The general requirements for the monitoring of air and noise and for conducting site audits are presented below.

Environmental Monitoring

Monitoring Programme

- 3.3.2 The monitoring of environmental impacts shall be carried out by the ET; the monitoring work will comprise dust and noise impacts at sensitive receivers in the vicinity of the works.
- 3.3.3 The monitoring programme for the Project is summarised in *Table 3.3a*.

Table 3.3a Summary of Monitoring Programme

	<i>Dust</i>	<i>Noise</i>
Parameters	TSP 1-hour and 24-hour	Restricted period: three consecutive L_{Aeq} 5 minutes; Unrestricted period: six consecutive readings L_{Aeq} 5 minutes.
Locations	See Table 5.1b	See Table 4.4a
Initial Baseline	24-hour TSP daily for two weeks prior to construction and three 1-hour TSP daily for two weeks. 1-hour sample should be conducted at least three times per day while the highest dust impact is expected.	Daily at 30 minute intervals for two weeks prior to construction.
Baseline Check	Every three months	Twice per year
Impact Monitoring	One 24-hour TSP and three 1-hour TSP every six days, undertaking when the highest dust impacts occur.	One set of measurement (three consecutive L_{Aeq} 5 min) in restricted hours and one set of measurement (six consecutive L_{Aeq} 5 min) in unrestricted periods every week when noise generating activities are underway.
Additional Requirements	<i>Ad hoc</i> monitoring as required.	<i>Ad hoc</i> monitoring as required.

Action and Limit Levels

3.3.4 Action and Limit (A/L) Levels are defined levels of impact recorded by the environmental monitoring activities which represent levels at which a prescribed response is required. These levels are quantitatively defined later in the relevant sections of this manual and described in principle below:

- *Action Limits*: beyond which there is a clear indication of a deteriorating ambient environment for which appropriate remedial actions are likely to be necessary to prevent environmental quality from falling outside the *Limit Levels*, which would be unacceptable; and
- *Limit Levels*: statutory and/or agreed contract limits stipulated in the relevant pollution control ordinances, HKPSG or Environmental Quality Objectives established by EPD. If these are exceeded, works should not proceed without appropriate remedial action, including a critical review of plant and working methods.

Event Contingency Plans

- 3.3.5 The purpose of the Event Contingency Plans (ECP's) is to provide, in association with the monitoring and audit activities, procedures for ensuring that if any significant environmental incident (either accidental or through inadequate implementation of mitigation measures on the part of the Contractor) does occur, that the cause is quickly identified and remedied, and that the risk of a similar event recurring is reduced. This also applies to the exceedance of statutory or agreed A/L criteria identified by the EM&A programme.
- 3.3.6 The format of the ECP's to be used during construction of the Project is set out in *Section 4.8* and *Section 5.1.5*.

Environmental Auditing

- 3.3.7 In addition to the monitoring of dust and noise levels as a means of assessing the ongoing performance of the Contractor, the ET shall undertake regular audits of the Contractor's onsite practices and procedures. The primary objective of the audit programme will be to assess the effectiveness of the management systems established by the Contractor to implement the environmental mitigation measures recommended in the EIA for noise, air quality, water quality, waste management, terrestrial ecology and landscaping as detailed in *Annex B*.
- 3.3.8 Whilst the audit programme will undoubtedly complement the monitoring activity with regard to the effectiveness of dust suppression and noise attenuation measures, the criteria against which the audits will be undertaken shall be derived from the clauses within the Contract Document which seek to enforce the recommendations of the EIA and the established management systems.
- 3.3.9 The findings of site audits shall be made known to site staff at the time of the audit to enable the rapid resolution of identified non-compliances. Non-compliances, and the corrective actions undertaken, shall also be reported in the monthly EM&A Report.
- 3.3.10 *Section 6* presents the scope and frequency of onsite audits and defines the range of issues the audit protocols shall be designed to address.

Enquiries, Complaints and Requests for Information

- 3.3.11 Enquiries, complaints and requests for information can be expected from a wide range of individuals and organisations including members of the public, Government departments, the press and television media and community groups. The vast majority of the correspondence is likely to be received directly by TDD, although the other major receiver will be the site offices.

3.3.12 All enquiries concerning the environmental effects of the works, irrespective of how they are received, shall be reported to the ET who shall set up procedures for the handling, investigation and storage of such information. The following steps shall then be followed.

- 1) The ET shall notify the ER of the nature of the enquiry.
- 2) An investigation shall be initiated to determine the validity of the complaint and to identify the source of the problem.
- 3) The ER shall undertake the following steps, as necessary:
 - investigate and identify the source of the problem (the ER may request additional dust or noise monitoring);
 - liaise with the EM to identify remedial measures;
 - require the Contractor to take action to mitigate the situation;
 - repeat monitoring to check compliance with A/L level criteria; and
 - if monitoring results show exceedances, repeat review procedures to identify further possible areas of improvement.
- 4) The outcome of the investigation and the action taken shall be documented on the complaints proforma (see *Annex A*). Where possible, a formal response to each complaint received shall be prepared, within a maximum of seven days, in order to notify the concerned person(s) that action has been taken.
- 5) All enquiries which trigger this process shall be reported in the monthly reports to the EPD which shall include details of the mitigation measures taken and the additional monitoring results recorded for the period.

3.3.13 It should be noted that the receipt of complaints or enquiries will not, in itself, be sufficient reason to introduce additional mitigation measures. They will however initiate the ECP and this procedure may lead to the introduction of further measures if they are considered necessary.

3.3.14 In all cases the complainant shall be notified of the findings of the ECP and audit procedures put in place to ensure that the problem does not recur.

3.4 Operation Phase EM&A

3.4.1 During operation of the T7 Interchange Tunnels, continuous measurement of carbon monoxide, nitrogen dioxide and visibility should be conducted inside tunnels. The tunnel management should ensure that the ventilation system

is operated at the appropriate level and the Tunnel Air Quality Guidelines are met.

- 3.4.2 Should air quality inside the T7 Interchange Tunnels exceed the Tunnel Air Quality Guideline, the tunnel management should regulate the ventilation system or reduce the traffic flow to decrease the concentration of pollutants to the acceptable levels.

4. NOISE MONITORING

4.1 Introduction

- 4.1.1 In this *Section*, the requirements, methodology, equipment, monitoring locations and mitigation measures for the monitoring and audit of noise impacts from the construction of Trunk Road T7 are presented.

4.2 Methodology and Noise Criteria

- 4.2.1 Noise level measurements shall be carried out by suitably qualified members of the ET using the methodology set out in Section 3 of the *Technical Memorandum on Noise from Construction Work other than Percussive Piling*.
- 4.2.2 The appropriate parameter for measuring construction noise impacts shall be the equivalent A-weighted sound pressure level (L_{Aeq}) measured in decibels (dB).
- 4.2.3 The criterion against which the recorded noise levels shall be assessed refers to the noise level 1 m from the nearest part of the building façade and at a height approximately 1.2 m above the ground or at the height that has the least obstructed view of the construction activity in relation to the receiver.
- 4.2.4 Whilst the *Noise Control Ordinance* (NCO) does not provide for the statutory control of construction activities occurring on weekdays during normal working hours (i.e. Monday to Saturday inclusive 0700-1900), a voluntary daytime limit of $L_{Aeq, 30 \text{ min}}$ 75 and 70 dB, recommended in the *Practice Note for Professional Persons - Noise from Construction Activities - Non-statutory Controls*, EPD, May 1993 (ProPECC PN 2/93) was proposed in the EIA and agreed with EPD as the appropriate criterion for all residential dwellings and education institution respectively.
- 4.2.5 The Technical Memorandum on Noise from Construction Work Other than Percussive Piling and Technical Memorandum on Noise from Construction Work in Designated Areas specifies the Acceptable Noise Levels (ANLs) for restricted hours working. Depending on the Area Sensitivity Rating of the NSRs, on all days during the evening (19:00 - 23:00 hours) and general holidays including Sundays (07:00 - 23:00 hours), the statutory noise limit shall be the $L_{eq, (5 \text{ min})}$ 65 or 70 dB(A) for the non-SPME and prescribe works and 50 or 55 for the SPME and prescribe works; during the night-time period (23:00-07:00 hours) on any day, the maximum noise level shall be or 50 or 55 dB(A) for the non SPME and prescribe works and 35 or 40 for the SPME and prescribe works.

4.3 Monitoring Equipment

- 4.3.1 The EM shall provide sufficient numbers of noise meters to conduct the necessary baseline sampling at the agreed monitoring locations. Sound level meters and calibrators shall comply with the *International Electrotechnical Commission (IEC) Publication 651:1979 (Type 1) and 804:1985 (Type 1)* specification as referred to in the TM. The sound level meters shall be supplied and used with the manufacturers recommended wind shield and with a tripod.
- 4.3.2 The calibration of the sound level meters and their respective calibrators shall be carried out in accordance with the manufacturer's requirements. The sound level meters, including the calibrators, shall be verified by the manufacturers once every two years to ensure they perform to the same level of accuracy as stated in the manufacturers specifications. Calibrated hand-held anemometers shall also be supplied for the measurement of wind speeds during noise monitoring periods.
- 4.3.3 The equipment shall be kept in a good state of repair in accordance with the manufacturer's recommendations and maintained in proper working order with sufficient spare equipment available in the event of breakdown to maintain the planned monitoring programme.
- 4.3.4 Noise measurements should not be made in the presence of fog, rain, wind with a steady speed exceeding 5ms^{-1} or wind with gusts exceeding 10ms^{-1} . The wind speed shall be checked with the hand-held anemometers capable of measuring the wind speed in ms^{-1} .
- 4.3.5 Table 4.3a presents recommended noise monitoring equipment.

Table 4.3a Noise Monitoring Equipment

<i>Description</i>	<i>Quantity</i>
Noise meter	Two unit
Calibrator	Two unit
Hand held anemometer	Two unit

4.4 Monitoring Locations

- 4.4.1 Noise monitoring stations have been identified for the construction of Trunk Road T7 and are listed below in Table 4.4a and depicted in Figures 4.4a and b. Prior to the commencement of the EM&A Programme, the proposed noise monitoring locations will be discussed and agreed with the EPD.

Table 4.4a EM&A Noise Monitoring Locations

<i>Monitoring Station</i>	<i>NSR</i>	<i>Location</i>
NM1	N1	Ma On Shan Area 86B/Shing On THA
NM2	N3	Lutheran Primary School
NM3	N7	Heng Shan House

NM4	N19	Kam Yiu House
NM5	N30	Proposed Rail Depot and Residential Development at Lee On
NM6	N35	Proposed Residential Development TPTL 146, Block 1
NM7	N40	Proposed Residential Development STTL 446, Block 13

4.5 Baseline Monitoring

4.5.1 To obtain fully satisfactory baseline results, a waterproof sound level meter and noise logger shall be used. Baseline noise levels shall be measured over two weeks at interval of 5 minutes. The A-weighted noise level L_{eq} , L_{10} and L_{90} shall be recorded at the specified interval. The survey period shall be selected prior to the commencement of construction activities and so as to avoid other atypical noise sources. The proper functioning of the logger shall be ensured during this period and shall be visited for a period not less than one hour every two days to ensure its continued operation and to detail specific noise sources audible at the monitoring location. Measurements shall be recorded to the nearest 0.1 dB.

4.6 Impact Monitoring

4.6.1 During normal construction working hours (07:00-19:00 Monday to Saturday), monitoring of $L_{Aeq, 30min}$ noise levels (as six consecutive $L_{Aeq, 5 min}$ readings) shall be carried out at the agreed monitoring locations once every week in accordance with the methodology in the TM. If restricted hours works are undertaken, monitoring of $L_{Aeq, 15min}$ noise levels (as three consecutive $L_{Aeq, 5 min}$ readings) shall be carried out at the agreed monitoring stations at the same frequency as specified for normal working hours.

4.6.2 In relation to the monitored noise levels, other noise sources such as road traffic may make a significant contribution to the overall noise environment. Therefore, the results of noise monitoring activities will take into account such influencing factors which were not present during the baseline monitoring period. All measurements shall be recorded to the nearest 0.1 dB.

4.7 Compliance Assessment

4.7.1 The A/L Levels provide an appropriate framework for the interpretation of monitoring results. The noise impact monitoring data shall be checked against the agreed A/L Levels as listed in Table 4.7a.

Table 4.7a Action and Limit Levels for Construction Noise dB(A)

Time Period	Action	Limit
0700-1900 on normal weekdays;	When one documented complaint is received	75 dB(A)
0700-2300 hrs on holidays; and 1900-2300 hrs on all other days	When one documented complaint is received	50 or 55 dB(A) ⁽¹⁾ 65 or 70 dB(A) ⁽²⁾

<i>Time Period</i>	<i>Action</i>	<i>Limit</i>
2300-0700 of next day	When one documented complaint is received	35 or 40 dB(A) ⁽¹⁾ 50 or 55 dB(A) ⁽²⁾

Notes:

(1) for the SPME and prescribe works

(2) for non-SPME and prescribe works

4.7.2 To account for cases where ambient noise levels as identified by baseline monitoring approaches or exceeds the stipulated Limit Level prior to commencement of construction, an Exceedance Level may be defined and agreed with EPD, which incorporates the baseline noise level and the 75 dB(A), construction Limit level specified in the ProPECC. The exceedance level will be therefore greater than 75 dB(A) and represents the maximum acceptable noise level at each monitoring station. Correction factors for the effects of acoustic screening and/or architectural features of NSRs may also be applied for from the EPD as specified in the TM.

4.7.3 For the purposes of compliance checking, after taking into account any adjustments agreed with EPD, comparison with either the Limit or Exceedance Level shall represent the governing criteria for noise impact assessment during the T7 EM&A.

4.8 Event Contingency Plan

4.8.1 The principle on which the ECP is based is the prescription of procedures and actions associated with the measurement of defined levels of noise impact recorded by the environmental monitoring process and defined in the tables above. In cases where exceedance of these criteria occurs, the EM, ER and the Contractor shall strictly observe the relevant actions of the ECP shown in *Table 4.8a*.

Table 4.8a Noise Monitoring Event Contingency Plan

EVENT	ACTION		
	Environmental Manager	Engineer Representative	Contractor
Action Level Exceedance	Discuss with the ER and seek to identify potential noise source	Inform Contractor immediately	Submit proposals within three working days to the ER for remedial actions to reduce noise exposure
	Undertake noise measurement to confirm the validity of the complaint	Review Contractor's working methods	
	If an exceedance is recorded, discuss with the ER further appropriate mitigation measures	Discuss with the EM and the Contractor remedial actions required	Amend proposals if required by the ER.
	Increase noise monitoring frequency to demonstrate efficacy of remedial measures	Assess the effectiveness of remedial actions and keep the Contractor informed	Implement immediately the agreed proposals
	If exceedance stops, additional noise monitoring can be ceased	Inform Complainant of the Action taken	
Limit Level Exceedance	Inform the ER	Inform Contractor immediately	Take immediate action to avoid further exceedance
	Investigate the cause of the exceedance and identify main noise source	Review the Contractor's working methods	
	Repeat noise measurement to confirm findings	Discuss with the EM and the Contractor remedial actions required	Submit a further proposal for remedial actions to the ER immediately
	Liaise with the ER to develop appropriate remedial measures	Assess the effectiveness of remedial actions and keep Contractor informed	Implement immediately the agreed proposals
	Increase noise monitoring frequency to demonstrate efficacy of remedial measures		Resubmit proposals if problem still not resolved
	Assess efficacy of remedial actions and keep ER informed of the results		
	If exceedance stops, additional noise monitoring can be ceased		

5. AIR QUALITY MONITORING

5.1 Construction Dust

- 5.1.1 In this *Section*, the requirements, methodology, equipment, monitoring locations, criteria and protocols for the monitoring and audit of air quality impacts during the construction of Trunk Road T7 are presented.

Monitoring Methodology

- 5.1.2 The impact of fugitive dust on ambient air pollution depends on the quantity, as well as the drift potential of the dust particles injected into the atmosphere. Large dust particles will settle out near the source and particles that are 30 - 100 μm in diameter are likely to undergo impeded settling. These particles, depending on the extent of atmospheric turbulence, would settle within a distance of 100 m from the source. The main dust impact will arise from fine particles of a diameter less than 30 μm , measured as Total Suspended Particulates (TSP), dispersed over greater distances from the sources. TSP levels will, therefore, be monitored to evaluate the dust impact during the construction phase of the Project.
- 5.1.3 The TSP levels shall be measured by following the standard high volume sampling method as set out in the Title 40 of the Code of Federal Regulations, Chapter 1 (Part 50), Appendix B. 24-hour average TSP concentrations should be measured by drawing air through a high volume sampler (HVS) fitted with a conditioned, pre-weighed filter paper, at a controlled rate. After sampling for 24-hours, the filter paper with retained particles should be collected and returned to the laboratory for drying in a desiccator followed by accurate weighing. 24-hour average TSP levels are calculated from the ratio of the mass of particulates retained on the filter paper to the total volume of air sampled. The analysis process normally takes approximately two days.
- 5.1.4 1-hour average TSP concentrations can be measured either by the same monitoring method as 24-hour average TSP or with hand-held direct reading dust meter. 1-hour average TSP concentrations measured by a hand-held direct reading dust meter require no laboratory analysis and will give an instant reading of the dust levels to ensure that any deteriorating air quality could be readily detected and timely action taken to rectify the situation. Air samples are drawn through the optically-sensitive area of the monitor for a continuous period of 1-hour and the monitor will calculate the time-averaging dust levels.

Objectives and Criteria

- 5.1.5 The objectives of TSP monitoring are:
- to identify the extent of construction dust impacts on sensitive receivers;

- to determine the effectiveness of mitigation measures to control dust from construction activities;
- to audit the compliance of the Contractor with regard to dust control contract conditions and the relevant dust impact criteria;
- to recommend further mitigation measures if found to be necessary; and
- to verify the prediction of the dust impacts in the EIA during each phase of the construction works.

5.1.6 The criteria against which the dust (measured as TSP) monitoring shall be assessed are:

- the Hong Kong Air Quality Objectives (AQO) for TSP, 24-hour TSP levels of $260 \mu\text{g m}^{-3}$; and
- the EPD recommended 1-hour TSP limit of $500 \mu\text{g m}^{-3}$.

5.1.7 These levels are not to be exceeded at the sensitive receptors.

Baseline Monitoring

5.1.8 Baseline monitoring shall be carried out to determine the ambient 1-hour and 24-hour TSP levels at the monitoring locations prior to the commencement of the construction works.

5.1.9 Baseline monitoring shall be carried out for a continuous period of at least two week under typical weather conditions with the 24-hour and three 1-hour ambient measurements taken daily at each monitoring location. As noted above, monitoring results of HVS and the hand held direct reading dust meter are not directly comparable and the same method must be used for baseline and impact monitoring. General meteorological conditions (wind speed and direction and precipitation) and notes regarding any significant adjacent dust producing sources shall also be recorded throughout the baseline monitoring period.

5.1.10 The baseline monitoring will provide data for the determination of the appropriate action levels with the limit levels set against statutory or otherwise agreed limits.

5.1.11 Baseline checking of ambient dust levels shall be carried out every three months at each monitoring location. The checking shall be carried out when dusty construction activities are not taking place and detailed notes shall be provided by the monitoring personnel as to any significant dust producing sources during the baseline checking.

Impact Monitoring

5.1.12 The monthly schedule of the compliance and impact monitoring programme shall be drawn up by the EC, one month prior to the commencement of the scheduled construction period. TSP monitoring shall include the following:

- collection of 24-hour samples once every six days; and
- collection of three 1-hour measurements every six days, the measurements shall coincide with the construction activities with significant dust emissions.

5.1.13 Dust monitoring data shall be recorded on a standard record form developed for the Project.

Equipment

5.1.14 High volume sampler (HVS) in compliance with the following specifications shall be used for carrying out the 1-hr and 24-hr TSP monitoring:

- $1.7 \text{ m}^3 \text{ min}^{-1}$ (20-60 SCFM) adjustable flow range;
- equipped with a timing/control device with ± 5 minutes accuracy for 24 hours operation;
- installed with elapsed-time meter with ± 2 minutes accuracy for 24 hours operation;
- capable of providing a minimum exposed area of 406 cm^2 (63 in^2);
- flow control accuracy: $\pm 2.5\%$ deviation over 24-hr sampling period;
- incorporated with an electronic mass flow rate controller or other equivalent devices;
- equipped with a flow recorder for continuous monitoring;
- provided with a peaked roof inlet;
- incorporated with a manometer;
- able to hold and seal the filter paper to the sampler housing at horizontal position;
- easy to change the filter; and
- capable of operating continuously for 24-hr period.

- 5.1.15 A hand-held direct reading dust meter, sampling in the range of 0.1-100 mg m⁻³ and capable of achieving results comparable to a high volume air sampler shall be used for 1-hr TSP sampling.
- 5.1.16 Equipment shall be maintained in calibration at all times and recalibration will be carried out in accordance with requirements stated in the manufacturers operating manual and as described below.
- 5.1.17 The flow rate of each high volume sampler with mass flow controller will be calibrated using an orifice calibrator. Initial calibration will be conducted upon installation and prior to commissioning. One point flow rate calibration will be carried out every two months. Five point calibration will be carried out every six months.
- 5.1.18 The samplers shall be properly maintained and frequently calibrated. Prior to dust monitoring commencing, appropriate checks shall be made to ensure that all equipment and necessary power supply are in good working condition.
- 5.1.19 *Table 5.1a* presents the recommended types and quantities of TSP monitoring equipment.

Table 5.1a TSP Monitoring Equipment

Description	Quantity
High volume sampler	Four units
Hand-held direct reading dust meter	One unit

Monitoring Locations

- 5.1.20 The *Trunk Road T7 Final Assessment Report* has identified four dust monitoring locations for the construction phase of T7. Locations of the monitoring stations are presented in *Table 5.1b* and depicted in *Figures 5.1a* and *b*.
- 5.1.21 Prior to the commencement of the EM&A programme, the proposed dust monitoring stations shall be discussed and agreed with the EPD.

Table 5.1b EM&A Dust Monitoring Locations

Monitoring Station	ASR	Location
AM1	A1	Ma On Shan Area 86B/Shing On THA
AM2	A2	Heng On Estate
AM3	A3	Chiu Chow Association Secondary School
AM4	A12	Proposed Residential Development TPTL 146

Compliance Check

- 5.1.22 Environmental limits, termed Action and Limit (A/L) levels, provide an appropriate framework for the interpretation of monitoring results. The air

quality monitoring data shall be checked against the agreed A/L levels as listed in *Tables 5.1c* and *5.1d*.

Table 5.1c Derivation of Action and Limit Levels for 24-Hour Air Quality Monitoring

Level	Total Suspended Particulates ($\mu\text{g m}^{-3}$)
Baseline	Derived from physical measurements prior to construction commencing
Action	For baseline $<108 \mu\text{g m}^{-3}$, average of 130% of baseline and the Limit level
Limit	AQO for TSP: $260 \mu\text{g m}^{-3}$ averaged over 24-hours

Table 5.1d Derivation of Action and Limit Levels for 1-hour Air Quality Monitoring

Level	Total Suspended Particulates
Baseline	Derived from physical measurements prior to construction commencing
Action	For baseline $<154 \mu\text{g m}^{-3}$, average of 130% of baseline and the Limit level For $154 < \text{baseline} < 269 \mu\text{g m}^{-3}$, $350 \mu\text{g m}^{-3}$ For baseline $>269 \mu\text{g m}^{-3}$, 130% of baseline level
Limit	$500 \mu\text{g m}^{-3}$

Event Contingency Plan

- 5.1.23 The principle upon which the ECP is based is the prescription of procedures and actions associated with the measurement of certain defined levels of air pollution (the Action and Limit levels), recorded by the environmental monitoring process, during the construction phase of Trunk Road T7. The ECP for exceedance of various levels and the responsibilities of relevant parties in the event of an exceedance of the dust A/L levels is given in *Table 5.1e*.

Table 5.1e Dust Monitoring Event Contingency Plan

<i>EVENT</i>	<i>ACTION</i>	<i>ET</i>	<i>ER</i>	<i>CONTRACTOR</i>
ACTION LEVEL				
Exceedance for one sample	Identify source		Notify Contractor	Rectify any unacceptable practice
	Inform ER		Checking monitoring data and Contractor's working methods	Amend working methods if appropriate
	Repeat measurement to confirm finding			
	Identify source		Confirm receipt of notification of failure in writing	Submit proposals for remedial actions to ER within 3 working days of notification
Exceedance for two or more consecutive samples	Inform ER		Notify Contractor	Implement the agreed proposals
	Increase monitoring frequency to daily		Check monitoring data and Contractor's working methods	Amend proposal if appropriate
	Discuss with ER for remedial actions required		Discuss with Environmental Supervisor and Contractor on potential remedial actions	
	If exceedance continues, arrange meeting with ER		Ensure remedial actions properly implemented	
If exceedance stops, cease additional monitoring				
LIMIT LEVEL				
Exceedance for one sample	Identify source		Confirm receipt of notification of failure in writing	Take immediate action to avoid further exceedance
	Inform ER and EPD		Notify Contractor	Submit proposals for remedial actions to ER within 3 working days of notification
	Repeat measurement to confirm finding		Check monitoring data and Contractor's working methods	Implement the agreed proposals
	Increase monitoring frequency to daily		Discuss with Environmental Team Leader and contractor potential remedial actions	Amend proposal if appropriate
Assess effectiveness of Contractor's remedial actions and keep EPD and ER informed of the results				
			Ensure remedial actions properly implemented	

<i>EVENT</i>	<i>ACTION</i>		
	<i>ET</i>	<i>ER</i>	<i>CONTRACTOR</i>
Exceedance for two or more consecutive samples	Identify source	Confirm receipt of notification of failure in writing	Take immediate action to avoid further exceedance
	Inform ER and EPD the causes & actions taken for the exceedances	Notify Contractor	Submit proposals for remedial actions to ER within 3 working days of notification
	Repeat measurement to confirm findings	Carry out analysis of Contractor's working procedures to determine possible mitigation to be implemented	Implement the agreed proposals
	Increase monitoring frequency to daily		Resubmit proposals if problem still not under control
	Investigate the causes of exceedance	Discuss amongst Environmental Team Leader and the Contractor potential remedial actions	Stop the relevant portion of works as determined by the ER until the exceedance is abated
	Arrange meeting with EPD and ER to discuss the remedial action to be taken	Review Contractor's remedial actions whenever necessary to assure their effectiveness	
	Assess effectiveness of Contractor's remedial actions and keep EPD and ER informed of the results		
	If exceedance stops, cease additional monitoring	If exceedance continues, consider what portion of the work is responsible and instruct the Contractor to stop that portion of work until the exceedance is abated	

5.2 Operation Phase

5.2.1 This *Section* presents the tunnel air quality monitoring requirements for the control of air pollution in vehicle tunnels.

Tunnel Air Quality Monitoring

5.2.2 The following air quality guidelines should be attained and maintained inside a vehicle tunnel:-

Table 5.2a Tunnel Air Quality Guideline

Air Pollutants	Averaging Time	Maximum Concentration	
		Microgrammes Per Cubic Metre ($\mu\text{g m}^{-3}$)	Parts Per Million (ppm)
Carbon monoxide	5 minutes	115,000	100
Nitrogen dioxide	5 minutes	1,800	1
Sulphur dioxide	5 minutes	1,000	0.4

5.2.3 In addition, the visibility in the tunnel should be controlled to a level equivalent to an extinction coefficient of 0.005 per metre or less during any 5-minute interval.

Operation Practice

5.2.4 Effective control of air pollution requires proper supervision on the maintenance and operation of the ventilation system and the monitoring equipment. Good preventive maintenance should be employed.

5.2.5 Staff should be properly trained on their duties relating to control of air pollution.

5.2.6 The tunnel management should, based on the historical correlation between the traffic flow and air pollutant concentration or otherwise, ensure the number of vehicles entering the tunnel at any time will, as far as practicable, not exceed any level that may threaten the limit mentioned in *Table 5.2a* above.

5.2.7 When the concentrations of pollutants inside either tunnel have exceeded the Tunnel Air Quality Guidelines during normal and/or congested traffic operation, the traffic conditional flow and, fan and sensor operation should be logged and possible cause identified. The Director of Environmental Protection (DEP) should be advised as soon as reasonably practicable.

Monitoring Requirement

5.2.8 Concentrations of carbon monoxide, nitrogen dioxide and visibility should be monitored inside the T7 Interchange tunnel. The tunnel management should install and operate at least one analyser for each pollutant at each kilometre section of the tunnel.

5.2.9 The monitoring of nitrogen dioxide may be replaced by nitric oxide through the application of the following equation or any correlation relationship between these two parameters demonstrated to have a regression coefficient of not less than 0.85:-

$$\begin{array}{lcl} \text{Nitrogen dioxide} & = & 320 + 0.1056 \times \text{Nitric oxide} \\ \text{concentration } (\mu\text{g}/\text{m}^3) & & \text{concentration } (\mu\text{g}/\text{m}^3) \end{array}$$

- 5.2.10 Direct measurement of NO₂ should be conducted when more suitable NO₂ sensors become available in market. In case NO sensors are installed, they would have to be replaced over reasonable period of time when more suitable NO₂ sensors become available in market.
- 5.2.11 The tunnel management should forward the results of monitoring in a floppy disk with such a format agreeable to the DEP once per month.
- 5.2.12 All monitoring instruments should be checked for zero and span once a week and calibrated and certified by an independent environmental laboratory in accordance with the criteria.
- 5.2.13 The analyzers should activate an audible alarm at the main control room of the tunnel whenever the measured carbon monoxide and nitrogen dioxide concentrations exceed 92,000 $\mu\text{g}/\text{m}^3$ and 1,440 $\mu\text{g}/\text{m}^3$ respectively. Prompt action including increasing the fan operation, restriction of the traffic flow and other means acceptable to the DEP should be taken whenever appropriate.

6. ENVIRONMENTAL AUDITING

6.1 Site Inspections

6.1.1 Site Inspections provide a direct means to trigger and enforce the specified environmental protection and pollution control measures. They shall be undertaken routinely to inspect the construction activities in order to ensure that appropriate environmental protection and pollution control mitigation measures are properly implemented. With well defined pollution control and mitigation specifications and a well established site inspection, deficiency and action reporting system, the site inspection is one of the most effective tools to enforce the environmental protection requirements on the construction site.

6.1.2 The EM is responsible for formulation of the environmental site inspection, deficiency and action reporting system, and for carrying out the site inspection works. He shall submit a proposal on the site inspection, deficiency and action reporting procedures within 21 days of the construction contract commencement to the Contractor for agreement and to the ER for approval.

6.1.3 Regular site inspections shall be carried out at least once per week. The areas of inspection shall not be limited to the environmental situation, pollution control and mitigation measures within the site; it should also review the environmental situation outside the site area which is likely to be affected, directly or indirectly, by the site activities. The EM shall make reference to the following information in conducting the inspection:

- the EIA recommendations on environmental protection and pollution control mitigation measures (refer *Annex B*);
- works progress and programme;
- individual works methodology proposals (which shall include proposal on associated pollution control measures);
- the contract specifications on environmental protection;
- the relevant environmental protection and pollution control laws; and
- previous site inspection results.

6.1.4 The Contractor shall update the EM with all relevant information of the construction contract for him to carry out the site inspections. The inspection results and its associated recommendations on improvements to the environmental protection and pollution control works shall be submitted to the ER and the Contractor within 24 hours, for reference and for taking immediate action. The Contractor shall follow the procedures and time-frame as stipulated in the environmental site inspection, deficiency and action reporting system formulated by the EM to report on any remedial measures subsequent to the site inspections.

- 6.1.5 Regular site inspections should also ensure that the work site boundaries are not exceeded and that no damage, especially of an ecological nature, is being caused to the surrounding areas.
- 6.1.6 Ad hoc site inspections shall also be carried out if significant environmental problems are identified. Inspections may also be required subsequent to receipt of an environmental complaint, or as part of the investigation work, as specified in Action Plan for environmental monitoring and audit.

6.2 Compliance with Legal and Contractual Requirements

- 6.2.1 There are contractual environmental protection and pollution control requirements as well as environmental protection and pollution control laws in Hong Kong which the construction activities shall comply with.
- 6.2.2 In order that the works are in compliance with the contractual requirements, all the works method statements submitted by the Contractor to the ER for approval shall be sent to EM for vetting to see whether sufficient environmental protection and pollution control measures have been included.
- 6.2.3 The EM shall also review the progress and programme of the works to check that relevant environmental laws have not been violated, and that the any foreseeable potential for violating the laws can be prevented.
- 6.2.4 The Contractor shall regularly copy relevant documents to the EM so that the checking work can be carried out. The document shall at least include the updated Work Progress Reports, the updated Works Programme, the application letters for different licence/permits under the environmental protection laws, and all the valid licence/permit. The site diary shall also be available for the EM's inspection upon his request.
- 6.2.5 After reviewing the document, the EM shall advise the ER and the Contractor of any non-compliance with the contractual and legislative requirements on environmental protection and pollution control for them to take follow-up actions. If the EM's review concludes that the current status on licence/permit application and any environmental protection and pollution control preparation works may not cope with the works programme or may result in potential violation of environmental protection and pollution control requirements by the works in due course, he shall also advise the Contractor and the ER accordingly.
- 6.2.6 Upon receipt of the advice, the Contractor shall undertake immediate action to remedial the situation. The ER shall follow up to ensure that appropriate action has been taken by the Contractor in order that the environmental protection and pollution control requirements are fulfilled.

6.3 Environmental Complaints

6.3.1 Complaints shall be referred to the EM for carrying out complaint investigation procedures. The EM shall undertake the following procedures upon receipt of the complaints:

- log complaint and date of receipt onto the complaint database;
- investigate the complain to determine its validity, and to assess whether the source of the problem is due to works activities;
- if a complaint is valid and due to works, identify mitigation measures;
- if mitigation measures are required, advise the Contractor accordingly;
- review the Contractor's response on the identified mitigation measures, and the updated situation;
- if the complaint is transferred from EPD, submit interim report to EPD on status of the complaint investigation and follow-up action within the time frame assigned by EPD;
- undertake additional monitoring and audit to verify the situation if necessary, and review that any valid reason for complaint does not recur;
- report the investigation results and the subsequent actions to the source of complaint for responding to complainant (If the source of complaint is EPD, the results should be reported within the time frame assigned by EPD); and
- record the complaint, investigation, the subsequent actions and the results in the monthly EM&A reports.

6.3.2 During the complaint investigation work, the Contractor and ER shall cooperate with the EM in providing all the necessary information and assistance for completion of the investigation. If mitigation measures are identified in the investigation, the Contractor shall promptly carry out the mitigation. The EM shall ensure that the measures have been carried out by the Contractor.

Annex A

Complaints Proforma

Table A1 Complaints Proforma

Trunk Road T7 in Ma On Shan	Sheet ____ of ____
Report Form for Complaints	Unit Reference: _____
RECIPIENT	
Name: _____	Location: _____ Tel: _____
COMPLAINANT	
Name: _____	Tel: _____
Address: _____	Fax: _____
COMPLAINT	
Type: Noise/Dust/Other	
Date: _____	Time: _____ Location: _____
Description: _____	
Copy fax to: _____	Original to: _____
Date: _____	Date: _____
REVIEW RESULTS	
Signed: _____ Date: _____	

RECOMMENDATIONS		
<div style="height: 150px; border: 1px solid black;"></div>		
Signed:		Date:
ATTACHMENTS:		
Copy to:		Date/Time:
PR Manager:		Date: Time:
Engineer Representative:	Date:	Time:
Environmental Manager:	Date:	Time:

Annex B

Mitigation Measures

Introduction

The mitigation measures recommended in the T7 EIA are included in this Annex as the basis of the monitoring and audit requirement for the EM&A Manual and should be incorporated into Contract Specifications. *Table B2* shows the environmental mitigation implementation schedule.

Noise

Locations of the relevant NSRs are depicted in *Figures 4.4a* and *b*.

Construction Phase

Noise emissions from construction sites can be minimised through good site practice, selecting quiet plant and quiet working methods and through the use of temporary barriers. The recommended set back distance is shown in *Figures B1a* and *B1b*.

Good Site Practice

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

- only well-maintained plant should be operated on-site and plant should be serviced regularly during the construction works;
- machines and plant that may be in intermittent use should be shut down between work periods or should be throttled down to a minimum;
- plant known to emit noise strongly in one direction, should, where possible, be orientated so that the noise is directed away from nearby NSRs;
- silencers or mufflers on construction equipment should be utilised and should be properly maintained during the construction works;
- mobile plant should be sited as far away from NSRs as possible; and
- material stockpiles and other structures should be effectively utilised, where practicable, to screen noise from on-site construction activities.

Selecting Quieter Plant and Working Methods

The Contractor may be able to obtain particular models of plant that are quieter than standard types given in the TM. The benefits achievable in this way will depend on the details of the Contractors' chosen methods of working, and it is considered too restrictive to specify that a Contractor has to use specific items of plant for the construction operations. It is therefore both preferable and practical to specify an overall plant noise performance specification to apply to the total sound power level of all plant on the site so that the Contractor is allowed some flexibility to select plant to suit his needs.

It should be noted that various types of silenced equipment can be found in Hong Kong. However, the EPD, when processing a CNP application, will apply the noise levels

contained in the relevant statutory TM unless the noise emission of a particular piece of equipment can be validated by certificate or demonstration.

Temporary Noise Barriers

In general, noise barriers located between noisy construction activities and NSRs could give up to 5 dB(A) reduction from screening (estimated in accordance with TM). It would be possible for the Contractor to provide barriers, in the form of site hoardings, to achieve this level of reduction. Certain types of PME, such as generators and compressors, can be completely enclosed giving a total noise reduction of 10 dB(A) or more. Movable vertical barriers that can be located close to noisy plant can also be very effective at screening NSRs from particular plant.

Road Construction

By considering the above methods of mitigation it is possible to develop a mitigation package, which can be adopted to minimise potential noise impacts.

Mitigation of Residual Impacts

Further mitigation has been developed on a more site specific basis and are summarised in *Tables B1a* and *B1b*.

Casting Yard

Noise from the casting yard can be mitigated through the use of quiet plant and temporary noise barriers. This will prevent impacts arising from the casting yard alone (outside 125 m) and will also reduce the radius of cumulative impacts zone to 150 m. Cumulative impacts are therefore anticipated to occur in only one area which is considered noise sensitive; that is the proposed railway depot and residential development at Lee On. At present the exact layout of this development is unknown therefore it is not possible to quantify the potential impacts. However, cumulative impacts will only occur during construction of either the interchange slip road or the section of T7 immediately south west of the development. Therefore, if necessary the percentage on-time of plant (for example the vibratory pokers) within the yard can be reduced to prevent cumulative impacts during these periods.

Tunnel Construction

Blasting used for the construction of the two tunnels in the interchange should be controlled within the appropriate guidance provided by the Mines and Quarries (M&Q) Division of the Civil Engineering Department (CED). While it is unlikely that noise impacts from blasting can be prevented altogether, it is possible to minimise potential impacts by adopting appropriate blasting techniques and through the implementation of a good public relations programme.

Table B1a - Site Specific Noise Mitigation - At Grade Sections

NSR	Site Clearance	Drainage ⁽¹⁾	Road Construction ⁽¹⁾	Paving
Ma On Shan Area 86B (Shing On THIA)	n/a	to be carried out separately with dumpertruck and crane operating with 50 % on-time	road levelling to be carried out separately with graders with 30 % on-time laying base and sub-base to be carried out separately with dumpertruck and roller at 50% on-time and compactor at 30 % on-time. Kerbing and and laying new surface to be carried out separately	none necessary
Proposed RailwayDepot and Residential Development ⁽⁴⁾	n/a	to be carried out separately	levelling road carried out separately laying base/sub-base to be carried out separately kerbing/laying new surface may be carried out simultaneously with compactor operating at 85 %	none necessary
Heng On Estate - Schools ⁽²⁾	no site clearance required within 100m therefore no further mitigation required	to be carried out separately on altered section of Ma On Shan Road	T7 Trunk Road levelling of road carried out separately Ma on Shan Road levelling road separately laying base/kerbing/newsurface all at 90% on-time except compactor at 35%	none necessary
Heng On Estate - Residential	scraper on-time 35%	none necessary	levelling of road carried out separately compactor on-time 85 %	none necessary
Development TPTL 146 and Cheung Muk Tau Village	n/a	to be carried out separately	levelling road carried out separately laying base/sub-base to be carried out separately kerbing/laying new surface may be carried out simultaneously with compactor operating at 85 %	none necessary

Notes:

(1) If a construction process is listed as to be carried out separately, no other construction activity should take place on the adjacent road section in order to prevent cumulative impacts.

(2) The criterion for schools is 70 dB(A). Three schools in this area will lie within the potential impacts zone. However, two of the schools are already insulated against noise therefore further mitigation is only required for the primary school.

(3) The exact layout of this development is unknown at this stage.

(4) Movable barriers should also be used to further protect the lower level floors.

Table B1b - Site Specific Noise Mitigation - Elevated Sections

NSR	Site Clearance ⁽¹⁾	Bored Piling ⁽¹⁾	Pile Capping ⁽¹⁾	Superstructure Construction In-Situ
Heng On Estate - Residential	scraper on-time 35%	none necessary	none necessary	none necessary
Kam Ying Court	scraper separately or scraper at 25% and bulldozer/loader operating with 55% on-time	to be carried out separately	to be carried out separately	limit plant to 1 mixer truck and 1 vibratory poker cranes and winches at 55% on-time
Development ST11/446(3)	Scraper operating separately with a 20% on-time	to be carried out separately	to be carried out separately	Crane and winches operating with 70% on-time
Notes:				
(1) If a construction process is listed as to be carried out separately, no other construction activity should take place on the adjacent road section in order to prevent cumulative impacts.				
(2) The criterion for schools is 70 dB(A). Three schools in this area will lie within the potential impacts zone. However, two of the schools are already insulated against noise therefore further mitigation is only required for the primary school.				
(3) The exact layout of this development is unknown at this stage.				
(4) Movable barriers should also be used to further protect the lower level floors.				

Operational Phase

For almost the entire length of T7, NSRs lie on only one side of the roadway, therefore the noise barriers required may be of reflective type. There will however be two exceptions where absorptive barriers will be necessary to prevent potential noise impacts at properties directly opposite the barrier. These are: the barrier along the westbound carriageway immediately north of Cheung Muk Tau; and a section of the barrier along the slip road leading from the T7 Interchange to the Sai Sha Road roundabout. The mitigation measures required are illustrated in *Figures B2a* and *B2b*, with typical cross-sections of the noise barriers and semi-enclosure provided in *Figures B3a* and *B3b*.

Development at GIC Site Currently Occupied by Shing On THA

It is proposed that a 5m high cantilever noise barrier is provided alongside the northern edge of the western bound carriageway of the T7 adjacent to the boundary of this GIC site. This barrier will adequately protect NSRs (N01 and N02) within this proposed development from noise impacts associated with T7.

Heng on Estate and Yiu On Estate

Roadside noise barriers have been proposed to prevent cumulative noise impacts arising at residential and educational properties within Heng On Estate (N3, N6, N7, N8 and N12). The mitigation includes a 5m cantilever barrier alongside the altered section of the Ma On Shan Road and a roadside barrier, approximately 830m long, of at least 5m in height, alongside the T7 alignment. For the initial 250m section of this barrier, which extends in a northeasterly direction from the intersection of T7 and the existing Ma On Shan Road immediately south of Heng Fung House, a 5m cantilever barrier will be required.

Residual impacts of up to 5dB(A) are likely to arise at each of the five NSRs considered. These, however, will be a result of road traffic on existing roads as the contribution from T7 will be 8 to 23 dB(A) below the existing road contributions. Since existing roads will dominate the noise climate in this area, any further mitigation along T7 or its slip roads would be ineffective. Therefore no further mitigation has been considered.

Kam Ying Court

If unmitigated, properties within Kam Yiu House (N19), in the western end of Kam Ying Court, will experience the greatest noise impacts (up to 10dB(A)) resulting from T7. Because of the proximity of the road and the relative heights of the road and Kam Yiu House, roadside barriers will not be sufficient to prevent noise impacts. It is therefore recommended that a semi-enclosure (150m in length) is provided to mitigate against traffic noise in this area. Other NSRs within this residential development (N20, N21, N22, and N23) are also likely to experience noise impacts if no mitigation is applied to T7. These NSRs are located much further away from T7 and therefore 4m high roadside noise barriers will be sufficient. The provision of the mitigation discussed will adequately protect NSRs within this development, as a result no residual impacts are anticipated. This semi-enclosure will also prevent T7 from contributing to noise impacts at N16.

Saddle Ridge Gardens and Lee On Estate

It is proposed that the 4m high noise barrier which has been proposed alongside the T7 alignment to mitigate noise impacts within Kam Ying Court is extended to protect NSRs within Saddle Ridge Gardens and Lee On Estate (N24, N25 and N28). The entire length of barrier required would be approximately 950m. The proposed mitigation will prevent noise impacts arising at Lee On Estate. Residual impacts of up to 7 dB(A) are, however, anticipated at N25. These residual impacts are a result of traffic using existing roads, the contributions from which will be between 9 to 15 dB(A) greater than those from T7. Therefore, since any further mitigation applied to T7 would be ineffective, no further mitigation has been considered.

Proposed Residential Development above the Railway Depot at Lee On

It is proposed that a 5m cantilever barrier located alongside the slip road approaching the Sai Sha Road to prevent potential noise impacts at NSRs within this residential development (N30 and N31). This mitigation will be sufficient to prevent noise impacts arising at N30 although residual impacts of up to 1dB(A) are predicted at the 20th floor of NSR 31. In order to achieve further reduction in noise levels at this NSR, a taller barrier would be required along the slip road. This option is however precluded by engineering constraints (for example, loading limits). The mitigation which has been proposed is therefore considered the best practicable. No further mitigation has been considered for this development.

Cheung Muk Tau and Proposed Development at TPTL145

A 2m high, approximately 350m long, roadside noise barrier has been proposed along the southern end of the eastern bound carriageway of T7 adjacent to Cheung Muk Tau Village to protect NSRs within Cheung Muk Tau Village and the proposed development TPTL145 (N33, N34 and N41).

A small section of the T7 Interchange, to the east of Cheung Muk Tau will travel through two short tunnels. While this may cause the noise emissions from the section of roads within the tunnels to be significantly reduced, increased noise levels may be experienced at the tunnel portals as, in general, these present the only method of escape for the noise built up within the tunnel. There may be an increase in noise level at the tunnel portals which likely to be directional in nature. Therefore, in order to protect Cheung Muk Tau NSRs from noise generated within the tunnels, it is recommended that an absorptive noise barrier is provided at the eastern tunnel portals, along the outside of the northern bound carriageway leading to the Sai Sha Road.

The mitigation proposed will adequately protect NSRs within Cheung Muk Tau Village from noise impacts although residual noise impacts of up to 1 dB(A) are predicted at N41. These residual impacts are dominated by existing roads the contributions from which are likely to be 11 and 17 dB(A) greater than those from T7. Therefore any further mitigation applied to T7 is likely to be ineffective consequently, no further mitigation has been considered.

Proposed Residential Development TPTL146

A 4.5m boundary noise barrier has been included in the layout for this development. This barrier will adequately protect the majority of NSRs within this development (N36) from impacts associated with T7. Residual noise impacts of up to 3 dB(A) are however likely at

upper floors of N35. Further reductions in noise levels would require mitigation of the main carriageways of T7 immediately south of N35. The provision of noise barriers in this area would restrict sight lines for merging traffic. This option is precluded by safety issues therefore no further mitigation is considered.

Proposed Residential Development STTL446

It is proposed that a 5m cantilever barrier is erected alongside a 180m section of the T7 alignment at the interchange to mitigate against noise from the main carriageways of T7. The layout of this proposed development includes a 5m and 2m barrier alongside the site boundary. However, the results of the noise modelling indicate that a 5m cantilever barrier alongside the slip road leading from T7 to the Sai Sha Road would be more beneficial. Therefore in order to provide the maximum protection possible to this NSR, as well as to provide continuity, it is recommended that the boundary barrier is omitted from the this proposed development and is replaced by a continuous 5m cantilever barrier alongside the slip road.

Even with the mitigation proposed above, criteria exceedances of up to 3dB(A) are likely at twenty floors of N40. In order to achieve further reduction in noise levels at this NSR, a taller barrier or semi-enclosure would be required along the slip road. This option is however precluded by engineering constraints (for example, loading limits). The mitigation which has been proposed is therefore considered the best practicable. No further mitigation has been considered for this development.

Air Quality

The following dust control measures should be incorporated into the Contract Specification and duly implemented as part of good construction practice:

- water sprays should be used during the handling of fill material at active cuts, excavation and fill sites where dust is likely to be created;
- dropping heights for excavated materials should be controlled to a minimum practicable height to minimise the fugitive dust arising from unloading;
- during transportation by truck, materials should not be loaded to a level higher than the side and tail boards, and should be dampened or covered before transport;
- effective water sprays should be used on the site at potential dust emission sources such as unpaved areas, haul roads should be watered regularly to maintain a high moisture level; and
- wheel washing facilities should also be installed and used by all vehicles leaving the site.

Whilst adverse impacts are not anticipated during blasting, the following measures should still be implemented:

- wire mesh, gunny sack and sandbags should be used on top of the blast area on each shot to preventing flying rocks and reduce fugitive dust generation;
- the surface of the blast area should be watered to increase its moisture content;
- dust filters should be placed around the portals; and
- a blast door fitted at the portals could further contain dust debris from the tunnelling works.

The set back distance of T7 has been designed to comply with the HKPSG and even with the proposed noise barriers in place, air quality levels at the ASRs are predicted to comply with the AQOs and no additional mitigation measures are required.

To ensure compliance with the TAQG, monitoring of air quality within the tunnel is recommended. Moreover, sufficient ventilation capacity will be allowed to ensure that the TAQG would be maintained.

Water Quality

Construction Phase

Although many of the impacts described above would be localised and temporary, further increases in SS levels within the harbour could lead to adverse impacts. A number of mitigation measures are recommended to minimise the magnitude and extent of such impacts, and these are detailed below. Good site management and housekeeping practices in accordance with the *Practice Note for Professional Persons - Construction Site Drainage, EPD, 1994* (ProPECC PN 1/94) will be required to ensure that implemented mitigation measures are effective. In particular, the Tolo harbour WQOs should not be breached, and care should be taken to ensure that annual median levels of SS do not exceed 20 mg l⁻¹, and that DO levels do not fall below 4 mg l⁻¹ at any time as a result of the work.

The following mitigation measures are recommended:

- the boundaries of critical areas of earthworks should be marked and surrounded by dykes or embankments for flood protection; accidental release of soil, debris or solid waste into streams should be prevented by installing boards at the site boundary, and silt fences and straw bales should be placed along stream banks;
- temporary ditches or drainage trenches should be provided, to the satisfaction of DSD with hydraulics designs complying with DSD's Stormwater Drainage and Sewerage Manuals, to collect all runoff from the construction site, permanent drainage channels should be installed early in the course of construction, and should incorporate sediment basins or traps and baffles to enhance deposition rates;
- temporary diversions of streams should, to the satisfaction of DSD and in compliance with DSD's Stormwater Drainage and Sewerage Manuals, ensure that there is no reduction in the hydraulic capacity of the watercourse, and should allow the water to discharge without overflow, erosion or washout, any watercourses which are temporarily affected should be quickly and properly reinstated to their original conditions after the completion of construction works;
- all drainage pipes and culverts (temporary and permanent) should be adequately designed and maintained to facilitate a controlled release of storm water during heavy rainfalls, without causing flooding;
- all run-off should be discharged via a sediment trap or retention pond; sediment traps should be regularly cleaned and maintained by the contractor, and should be inspected daily;
- all traps (both temporary and permanent) should incorporate oil and grease removal facilities in areas where there is a high risk of oil or grease pollution;
- oil interceptors should be installed for maintenance workshop and storage areas, in compliance with EPD regulations, these should be emptied regularly and should have a by-pass to prevent flushing during periods of heavy rain;

- slope exposure during the wet season should be minimised through avoiding primary earthworks during the wet season and adopting, wherever possible, a construction sequence which reduces exposed areas through maintaining short work faces;
- dry cement material delivered to the working site should be stored in sealed water-proof containers or bags, any cement that is unused should be temporarily stored in a warehouse and removed from the site at the end of construction work, spent cement mix or other unused paving materials should be collected in a separate collection system for either cleaning and reuse or disposal to landfill;
- open stockpiling of construction material should be avoided;
- hydro-seeding is recommended, wherever practical, to minimise exposed soil areas and reduce the potential for increased siltation and contamination of runoff;
- disposal of any solid materials, litter or wastes to the streams or drainage channels should be prohibited;
- all fuel tanks and storage areas should be locked and sited on sealed areas, within bunds of a capacity equal to 110% of the storage capacity of the largest tank, or 20% of the total volume stored (whichever is larger);
- on-site portable toilets or septic tanks should be provided for the construction workforce, sewage should be collected by a reputable sewage collector for disposal at an appropriate sewage treatment works;
- site runoff and drainage should be minimized and controlled in accordance with ProPECC PN 1/94, to ensure compliance with the WCZ effluent discharge standards; and
- a section of road between the wheel washing bay and the public road should be paved, with backfall, to prevent wash water or other site runoff from entering public road drains, sand and grit from wheel washing water should be settled out and removed before the water is discharged into storm drains;

Operational Phase

Despite the low risk of watercourse contamination resulting from the operation of the road, a number of mitigation measures could be introduced to protect the water quality of the Tolo Harbour and Channel WCZ. These include the following:

- all road runoff should be collected and discharged via a stormwater drainage system;
- oil and grit interceptors should be incorporated in areas where spills are likely to remove any oil, grease and sediment before being diverted to the public stormwater drainage system, contents of the oil interceptors should be transferred to an appropriate disposal facility on a regular basis, particularly in the wet season; and
- silt traps or sedimentation tanks should be installed to remove suspended solids, which may contain heavy metals such as lead and zinc, from the drainage runoff, silt

traps, as well as oil interceptors, should be regularly cleaned and maintained in good working condition.

Regular inspection, cleaning and maintenance of sediment traps and oil interceptors will be required to ensure minimal impacts. No other water quality monitoring requirements are anticipated.

Waste Management

The Contractor should incorporate the following recommendations into a comprehensive on-site waste management plan. Such a management plan should incorporate site specific factors, such as the designation of areas for the segregation and temporary storage of reusable and recyclable materials.

Waste Management Hierarchy

The various waste management options can be categorised in terms of preference from an environmental viewpoint. The options considered to be more preferable have the least impacts and are more sustainable in the longer term. Hence, the hierarchy is as follows:

- avoidance and minimisation, ie not generating waste through changing or improving practices and design;
- reuse of materials, thus avoiding disposal (generally with only limited reprocessing);
- recovery and recycling, thus avoiding disposal (although reprocessing may be required); and
- treatment and disposal, according to relevant laws, guidelines and good practice.

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

This hierarchy should be used to evaluate waste management options, thus allowing maximum waste reduction and often reducing costs. For example, by reducing or eliminating over-ordering of construction materials, waste is avoided and costs are reduced both in terms of purchasing of raw materials and in disposing of wastes.

Excavated Inert Materials

The 200,000 m³ of excavated materials are not considered likely to cause adverse impacts with respect to their disposal, since they will be reused on-site as far as possible. If any surplus uncontaminated inert materials do arise then they may be delivered to public dumps and fill sites. The nearest public dump site identified is the Pak Shek Kok Reclamation Public Dump site, with capacity of more than 3,000,000 m³ and operates from July 1997 to July 2004.

The main concern will be proper segregation, to avoid possible contamination, thereby allowing disposal at public dumps or fill sites.

Construction and Demolition Waste

It is considered that the generation rates of demolition wastes will be relatively low. In order to minimise waste arisings and keep environmental impacts within acceptable levels, the mitigation measures described below should be adopted.

Careful design, planning and good site management can minimise over-ordering and generation of waste materials such as concrete, mortars and cement grouts. If feasible, any noise barriers used at each site should be designed so that they are reusable, after they have been dismantled and removed, thereby not generating construction waste. The design of

formwork should maximise the use of standard wooden panels so that high reuse levels can be achieved. Alternatives such as steel formwork or plastic facing should be considered to increase the potential for reuse.

The Contractor should recycle as much of the construction waste as possible on-site. Proper segregation of wastes on site will increase the feasibility that certain components of the waste can be recycled by specialised contractors. Concrete and masonry, for example, can be crushed and used as fill and steel reinforcing bar can be used by scrap steel mills. Different areas of the work sites can be designated for such segregation and storage depending on site specific conditions.

The handling and disposal of bentonite slurries should be undertaken in accordance with the *Practice Note For Professional Persons, Construction Site Drainage, Professional Persons Consultative Committee, 1994 (ProPECC PN 1/94)*.

In accordance with the *New Disposal Arrangements for Construction Waste, Environmental Protection Department and Civil Engineering Department, 1992*, disposal of construction waste can either be at a specified landfill, or at a public dump, with the latter being the preferred option. Construction and demolition wastes currently comprise approximately 35% of waste inputs to landfills. In order to maximise landfill life, Government policy discourages the disposal of construction waste at landfill, if it contains more than 20% inert material (by volume). Inert wastes are directed to reclamation areas, where they have the added benefit of offsetting the need for removal of materials from terrestrial borrow areas for reclamation purposes.

If landfill disposal has to be used, the wastes will most likely be delivered to the NENT Landfill.

At present, Government is developing a charging policy for the disposal of waste to landfill. When it is implemented, this will provide additional incentive to reduce the volume of waste generated and to ensure proper segregation to allow free disposal of inert material to public dump.

Chemical Waste

For those processes which generate chemical waste, it may be possible to find alternatives which generate reduced quantities or even no chemical waste, or less dangerous types of chemical waste. However, most of the chemical waste which will arise from the construction of Trunk Road T7 will be from the maintenance of plant and equipment and there are, therefore, unlikely to be any alternatives which will reduce the quantities of waste.

Chemical waste that is produced, as defined by *Schedule 1 of the Waste Disposal (Chemical Waste) (General) Regulation*, should be handled in accordance with the *Code of Practice on the Packaging, Handling and Storage of Chemical Wastes* as follows.

Containers used for the storage of chemical wastes should:

- be suitable for the substance they are holding, resistant to corrosion, maintained in a good condition, and securely closed;

- have a capacity of less than 450 l unless the specifications have been approved by the EPD; and
- display a label in English and Chinese in accordance with instructions prescribed in Schedule 2 of the Regulations.

The storage area for chemical wastes should:

- be clearly labelled and used solely for the storage of chemical waste;
- be enclosed on at least 3 sides;
- have an impermeable floor and bunding, of capacity to accommodate 110% of the volume of the largest container or 20% by volume of the chemical waste stored in that area, whichever is the greatest;
- have adequate ventilation;
- be covered to prevent rainfall entering (water collected within the bund must be tested and disposed as chemical waste if necessary); and
- be arranged so that incompatible materials are adequately separated.

Disposal of chemical waste should:

- be via a licensed waste collector; and
- be to a facility licensed to receive chemical waste, such as the Chemical Waste Treatment Facility which also offers a chemical waste collection service and can supply the necessary storage containers; or
- be to a reuser of the waste, under approval from the EPD.

The Centre for Environmental Technology operates a Waste Exchange Scheme which can assist in finding receivers or buyers. In terms of the wastes likely to be generated during the construction of Trunk Road T7, it may be possible to sell (or give) used oils and acids to recycling companies, although this will be dependent on sufficient volumes generated.

General Refuse

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

General refuse is generated largely by food service activities on site, so reusable rather than disposable dishware should be used if feasible. Aluminium cans are often recovered from the waste stream by individual collectors if they are segregated or easily accessible, so separate labelled bins for their deposit should be provided if feasible.

Office wastes can be reduced through recycling of paper if volumes are large enough to warrant collection. Participation in a local collection scheme should be considered if one is available.

Terrestrial Ecology

The key ecological impact, as identified in this assessment, will result from the direct loss of the woodland habitats. With reference to the TM, the general policy for mitigating impacts on important habitats and wildlife, in the order of priority, are avoidance of impact to the maximum extent such as adopting suitable alternatives, and any unavoidable impact shall be minimised by taking appropriate and practicable measures such as transplanting or relocating important specimens.

Since it is understood that the feasibility and practicability for any alternative alignment is limited because of the constraints of the Ma On Shan Country Park and the Water Services Department facilities, the "moderate" direct impact on the woodland habitats is thus unavoidable. However, such impact could be mitigated on-site through advance/compensatory tree replanting along both sides of the proposed alignment during or after completion of the construction process, particularly over the temporary work area where wasteland can be planted, and the fringe between the T7 alignment and the Ma On Shan Country Park (see the following section on *Landscape/Townscape and Visual*). Plant species selected should be similar to the scrubland-woodland mosaic nearby, or other native grass, herbs, shrub and tree species that bear fruits preferred by birds and/or palatable to larval or adult butterflies. A tree survey should also be conducted before the work so as to fulfill the requirement of the WBTC 24/94 and PELBTC 3/94.

Other measures that could mitigate adverse impacts, as well as avoid any adverse ecological impact to the surrounding environment due to uncontrolled construction activities, are recommended below:

- the woodland area to be encroached upon by the roadwork should be well-defined and minimised as far as possible;
- any damage that may occur to trees in the adjacent area should be treated with surgery;
- the exact location of haul routes, storage and works areas, etc. should be selected to avoid ecologically sensitive areas as far as possible or otherwise minimise disturbance;
- if there is any loss of surrounding woodland because of the temporary land take, the area should be returned to its original status after completion of the project by on-site tree replanting;
- fences should be erected along the boundary of construction sites before the commencement of works to prevent tipping, vehicle movements, and encroachment of personnel into adjacent wooded areas;
- regular checks should be made to ensure that the work site boundaries are not exceeded and that no damage is being caused to the surrounding areas;
- the use of burning during construction should be avoided, or such use if unavoidable should be carried out under close supervision; and

- wild and uncontrolled open fires should be strictly prohibited within the work site boundary, and sufficient fire fighting equipment should be provided at frequent intervals along the alignment.

Landscape/Townscape and Visual

The scheme proposes to construct a road through the vegetated lower slopes of the Hunch Backs. As such, it is introducing a major hard element through the area which will be a major landscape and visual feature. The two options for the northern interchange will be considered separately, and subsequent, to the mitigation measures for the section from Ma On Shan Road to Lee On Estate.

Mitigation Measures Between Shing On THA and T7 Interchange

The mitigation measures for the section between Shing On THA and up to the northern interchange are as follows:

- dense tree and shrub planting on both sides of the road should be implemented. This will provide a visual screen helping to obscure the road from the Primary High Rise Residential VSRs. However, it must be accepted that mitigating the visual impacts to Kam Ying Court are limited due to its proximity and elevation. The planting will also replace any buffer zone lost during works and help to segregate the road from the surrounding landscape.
- tree and shrub species to be used will reflect those existing on the adjacent hillside and will include:

<u>Nurse Species</u>	<i>Acacia mangium</i>
	<i>Causarina stricta</i>
	<i>Eucalyptus citriodora</i>

<u>Secondary Species</u>	<i>Eriobotrya fragrans</i>
	<i>Ficus microcarpa</i>
	<i>Fraxinus retusa</i>
	<i>Litsea glutinosa</i>
	<i>Mallotus paniculatus</i>
	<i>Sapium discolor</i>
	<i>Symplocos decora</i>
	<i>Schima superba</i>
	<i>Viburnum odoratissimum</i>

<u>Shrub Species</u>	<i>Dalbergia hencei</i>
	<i>Gordonia axillaris</i>
	<i>Litsea rotundifolia</i>
	<i>Rhus sp.</i>

- re-instatement of the public pedestrian access between Ma On Shan and The Hunch Backs on completion of works is recommended. Alternative public pedestrian access should be maintained during construction works.
- consideration of noise barrier design to create elements that are integrated within the scheme and the surrounding landscape.
- dense tree and shrub planting on any new cut slopes to create a landscape buffer zone and visual screen.

- consideration of the design of, and hard materials finishes to, all elevated sections of road.

Mitigation Measures for the T7 Interchange

Mitigation measures for the northern interchange are as follows:

Overland Option

- it must be accepted that the formation of an eighty metre slope cut in rock limits measures to mitigation both its landscape and visual impact. However, the introduction of dense tree, shrub and climber planting to the rockface and engineered benches will alleviate some of the impact caused.
- dense tree and shrub planting adjacent to the road and within the access slip roads and interchange areas including the casting yard casting yard.
- consideration of the design of, and hard materials finishes to, any elevated structures and noise barriers.

Tunnel Option

- in the context that the tunnel will be constructed by excavation and backfilling, consideration will be given to the formation of levels and contours of the backfill material to be sympathetic to those in the surrounding hillside. Dense tree and shrub planting will replace the vegetated landscape buffer zone and visual feature of the hill or,
- in the context that the tunnel will be constructed by boring dense tree and buffer planting will be replaced in those areas lost.
- dense tree and shrub planting adjacent to the road and access slip road, including the casting yard, to create a landscape buffer zone and visual screen to the scheme.
- consideration of the design of, and hard materials finishes to, any elevated structures, including noise barriers.

In total, it is expected that some 6.5ha of land will be potentially available for soft landscape including those areas in the quarry and on new slopes.

Table B2 *Environmental Mitigation Implementation Schedule*

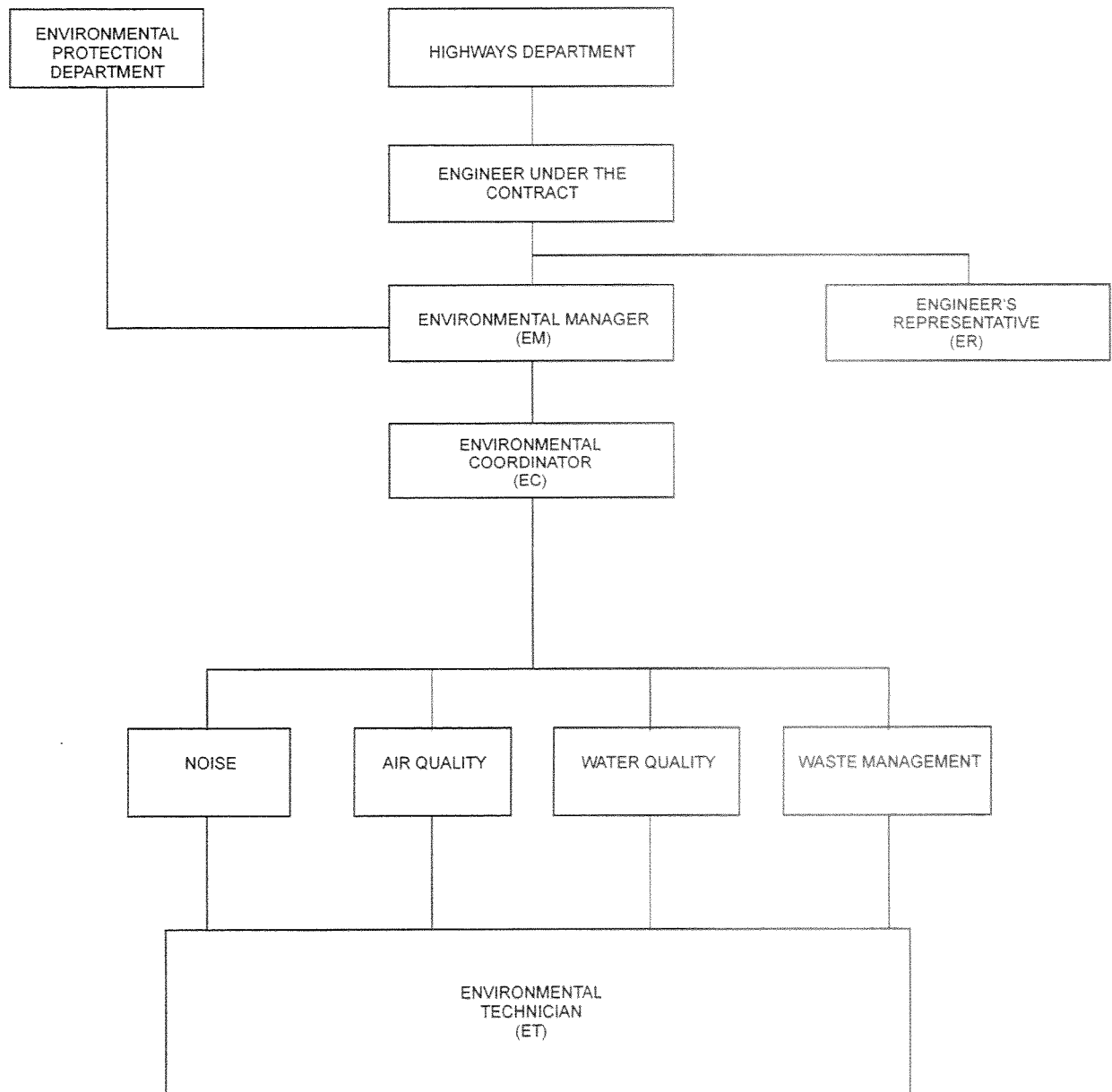
Phase	Parameter	Location	Mitigation	Responsibility
Construction	Noise	all work sites	<ul style="list-style-type: none">• good site practice• use of quiet plant and working methods• temporary noise barriers & operational restrictions on specific items of plant (refer to <i>Tables B1a and B1b</i>)	• TDD
		casting yard	<ul style="list-style-type: none">• quiet plant• temporary barriers• reduction of operation time of plant, if necessary	
		T7 interchange	<ul style="list-style-type: none">• appropriate blasting techniques• implementation of a good public relations programme	
	Air Quality	all work sites	<ul style="list-style-type: none">• regular use of effective water sprays during handling of fill material at active cuts, excavation and fill sites, and at unpaved areas and haul roads• minimise dropping heights for unloading of excavated materials• during transportation by truck, materials loaded to a level no higher than the side and tail boards, and should be dampened or covered before transport• installation and use of wheel washing facilities at site exits• use of wire mesh, gunny sack and sandbags on blast area on each shot• watering of blast area surface• dust filters should be placed around the portals• a blast door fitted at the portals	• TDD
	Water Quality	all work sites	<ul style="list-style-type: none">• appropriate sewerage control measures and good site practice	• TDD

Phase	Parameter	Location	Mitigation	Responsibility
Construction	Waste Management	all work sites	<ul style="list-style-type: none"> • appropriate waste management hierarchy • on-site reuse and proper segregation of excavated inert materials • minimise over-ordering and generation of waste materials • appropriate storage and disposal of chemical waste • enclosed storage of general refuse 	<ul style="list-style-type: none"> • TDD
	Terrestrial Ecology	along T7 alignment	<ul style="list-style-type: none"> • advance/compensatory tree planting along both sides of the alignment • minimise the woodland area to be encroached upon • surgery of any damaged trees • the exact location of haul routes, storage and works areas, etc. should be selected to avoid ecologically sensitive areas or minimise disturbance; • loss of surrounding woodland due to temporary land take should be returned to its original status by on-site tree replanting, • erecting fences along the boundary of construction sites before works commence • regular checks to ensure the work site boundaries are not exceeded and that no damage is being caused to the surrounding areas; • avoid burning, or if necessary should be carried out under close supervision • prohibiting open fires within the work site boundary • provision of sufficient fire fighting equipment at frequent intervals along the alignment. 	<ul style="list-style-type: none"> • TDD

Phase	Parameter	Location	Mitigation	Responsibility
Construction	Landscape & Visual	along T7 alignment	<ul style="list-style-type: none"> • dense tree and shrub planting on both sides of the alignment • re-instatement of the public pedestrian access between Ma On Shan and The Hunch Backs on completion of works (alternative public pedestrian access maintained during construction works) • noise barrier design to create elements that are integrated with the surrounding landscape. • dense tree and shrub planting on any new cut slopes to create a landscape buffer zone and visual screen • protective measures for retaining existing trees • consideration of the design of, and hard materials finishes to, all elevated sections of road 	<ul style="list-style-type: none"> • TDD/Contractor
		T7 interchange	<ul style="list-style-type: none"> • for tunnel option, consideration given to the formation of levels and contours of the backfill material sympathetic to those in the surrounding hillside • dense tree and shrub planting to replace the vegetated landscape buffer zone and visual feature of the hill • dense tree and shrub planting adjacent to the road and access slip road, including the casting yard, to create a landscape buffer zone and visual screen to the scheme • protective measures for retaining existing trees • consideration of the design of, and hard materials finishes to, any elevated structures, including noise barriers 	

Phase	Parameter	Location	Mitigation	Responsibility
Operation	Noise	along T7 alignment	<ul style="list-style-type: none"> low road noise surface and noise barriers 	<ul style="list-style-type: none"> TDD/ Contractor (design & construction)
		Shing On T11A	<ul style="list-style-type: none"> 5m high cantilever noise barrier along the northern edge of the west bound carriageway 	<ul style="list-style-type: none"> HyD (maintenance)
		Heng On Estate and Yiu On Estate	<ul style="list-style-type: none"> 5m cantilever barrier along the altered section of Ma On Shan Road 	
			<ul style="list-style-type: none"> 5m cantilever alongside T7 alignment extending 250m north east of the intersection of Ma On Shan Road and T7. 	
			<ul style="list-style-type: none"> 5m barrier approximately 590m in length, alongside the T7 alignment in the vicinity of northern area of Heng On Estate, Yiu On Estate and Park Belvedere 	
		Kam Ying Court	<ul style="list-style-type: none"> semi-enclosure approximately 150m in length east of Kam Yiu House 	
			<ul style="list-style-type: none"> 4m high cantilever barriers along the T7 alignment east of the remaining area of Kam Ying Court 	
		Saddle Ridge Gardens & Lee On Estate	<ul style="list-style-type: none"> 4m high barrier along T7 alignment 	
		Proposed Residential Development above the Railway Depot at Lee On	<ul style="list-style-type: none"> 5m high cantilever barrier along the slip road leading from T7 to Sai Sha Road 	
		Cheung Muk Tau and proposed Residential TPTL 145	<ul style="list-style-type: none"> 3m high roadside barrier along southern end of the east bound carriageway of T7 adjacent to Cheung Muk Tau Village 	
			<ul style="list-style-type: none"> absorptive noise barrier along T7 at the eastern tunnel portals 	

Phase	Parameter	Location	Mitigation	Responsibility
Operation	Noise	Proposed Residential STTL 446	<ul style="list-style-type: none"> 5m cantilever barrier alongside the silroad leading from T7 to Sai Sha Road 5m cantilever barrier along the T7 alignment at the T7 interchange 	<ul style="list-style-type: none"> TDD/ Contractor (design & construction) HyD (maintenance)
	Air Quality	T7 interchange tunnels	<ul style="list-style-type: none"> sufficient ventilation capacity to allow for compliance with the TAQG 	<ul style="list-style-type: none"> TDD (design & construction) EMSD (operation & maintenance)
	Water Quality	along T7 alignment	<ul style="list-style-type: none"> road runoff collected and discharged via a stormwater drainage system oil and grit interceptors should be incorporated in areas where spills are likely, before being diverted to the public stormwater drainage system contents of the oil interceptors should be transferred to an appropriate disposal facility on a regular basis, particularly in the wet season silt traps or sedimentation tanks installed and regularly maintained to remove suspended solids 	<ul style="list-style-type: none"> TDD (design & construction) HyD (maintenance)
Operation	Landscape & Visual	along T7 alignment	<ul style="list-style-type: none"> dense tree and shrub planting on both sides of the alignment 	<ul style="list-style-type: none"> TDD (design & construction) HyD/RSD (maintenance)



STRUCTURE AND ORGANISATION OF ENVIRONMENTAL TEAM

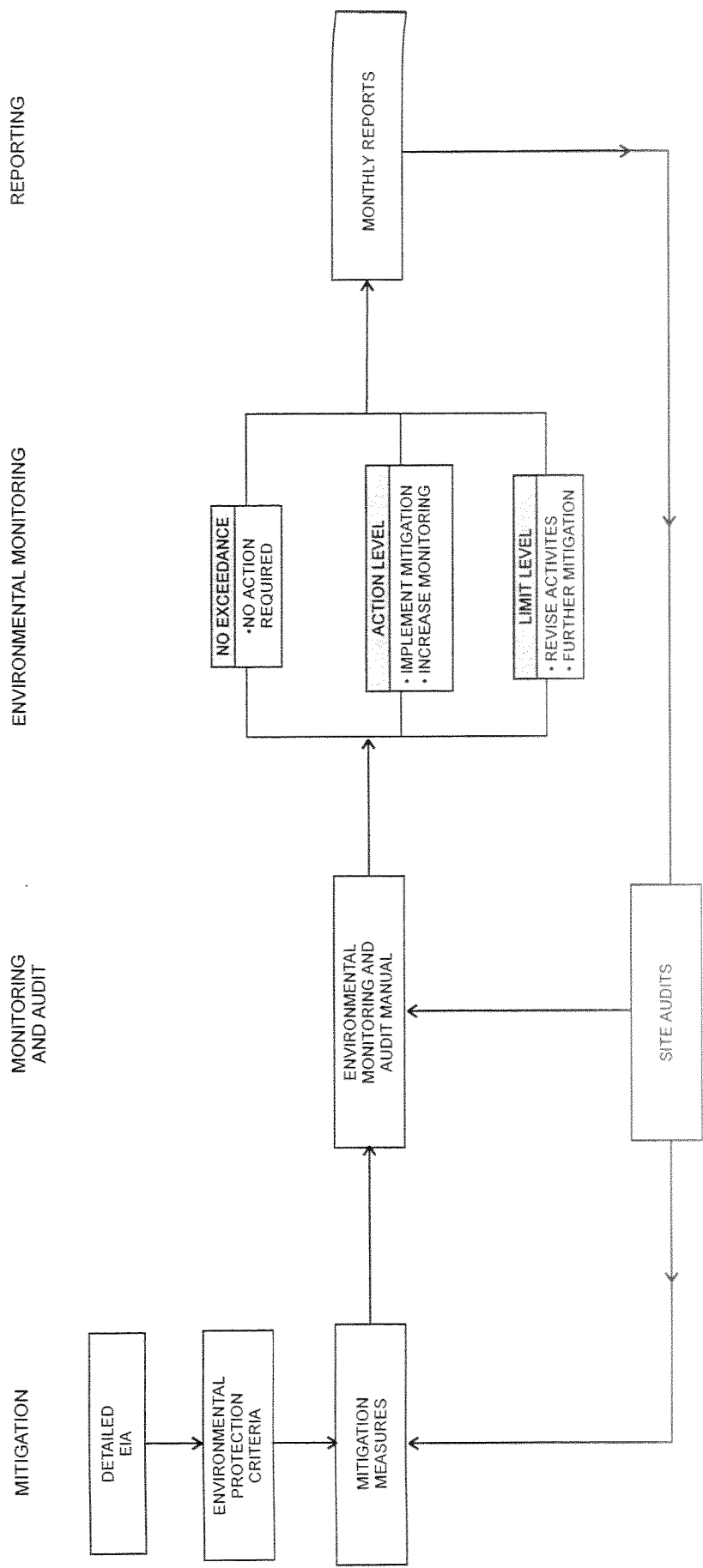
FIGURE No.

2.1a

SCALE:

DATE:

Oct 97



**Trunk Road T7 in Ma On Shan
Environmental Impact Assessment**

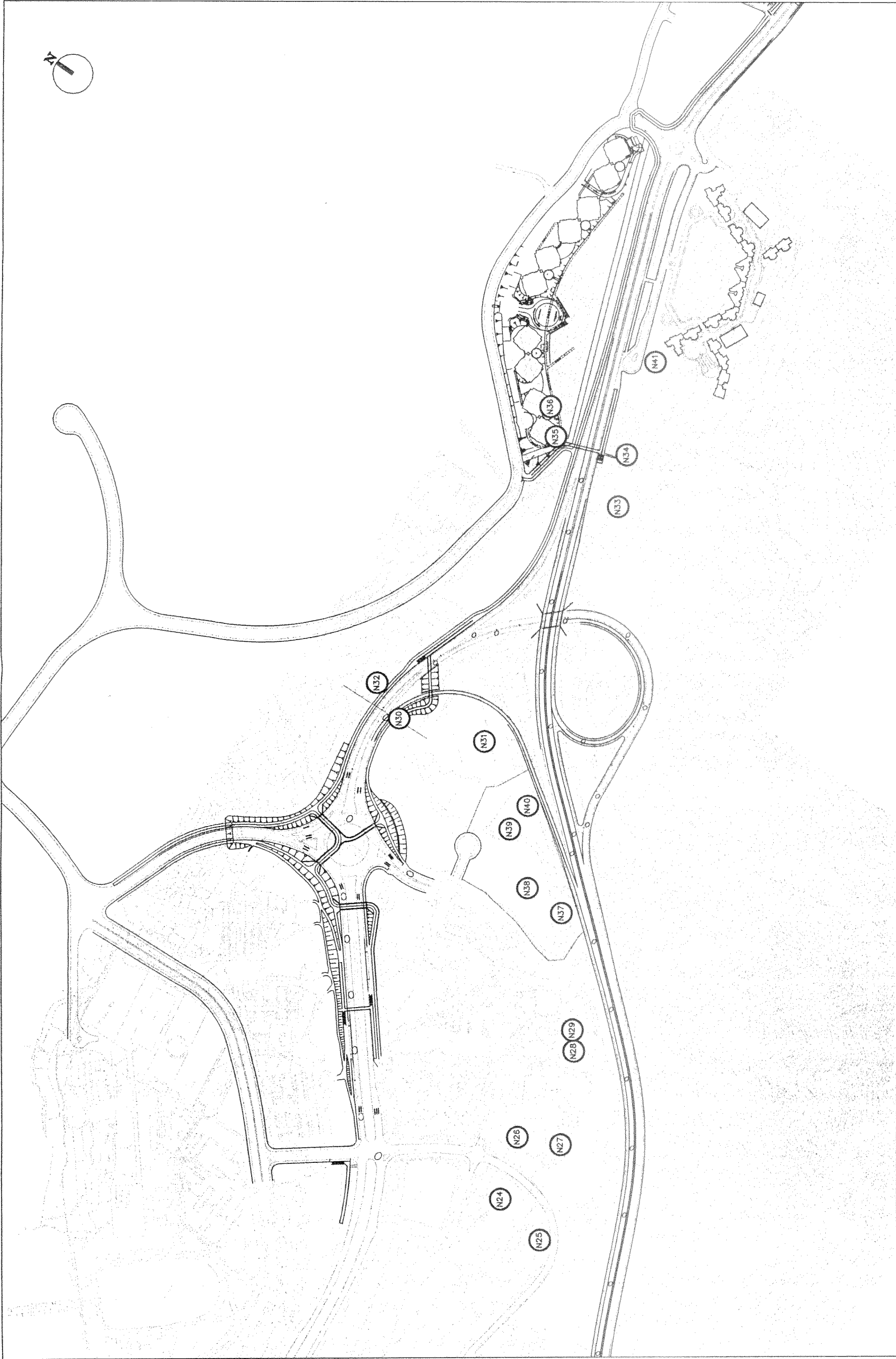
**ENVIRONMENTAL MONITORING
& AUDIT MANUAL**

February 1998

Maunsell Consultants Asia Ltd.
in association with
ERM (Hong Kong) Ltd.
Hassell Ltd.



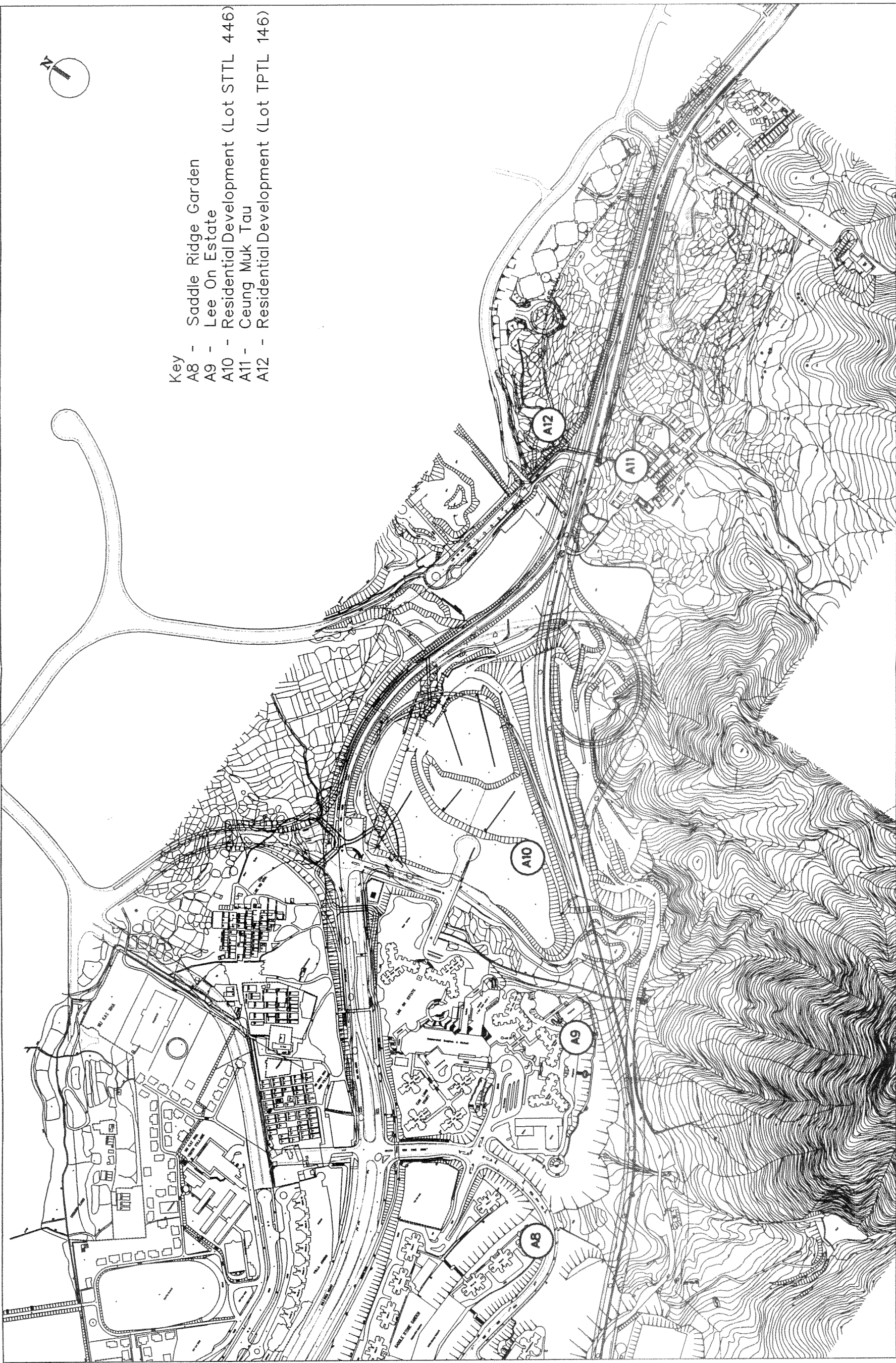
LOCATION OF NOISE SENSITIVE RECEIVERS		FIGURE NO.: 4.4a		Maunsell	
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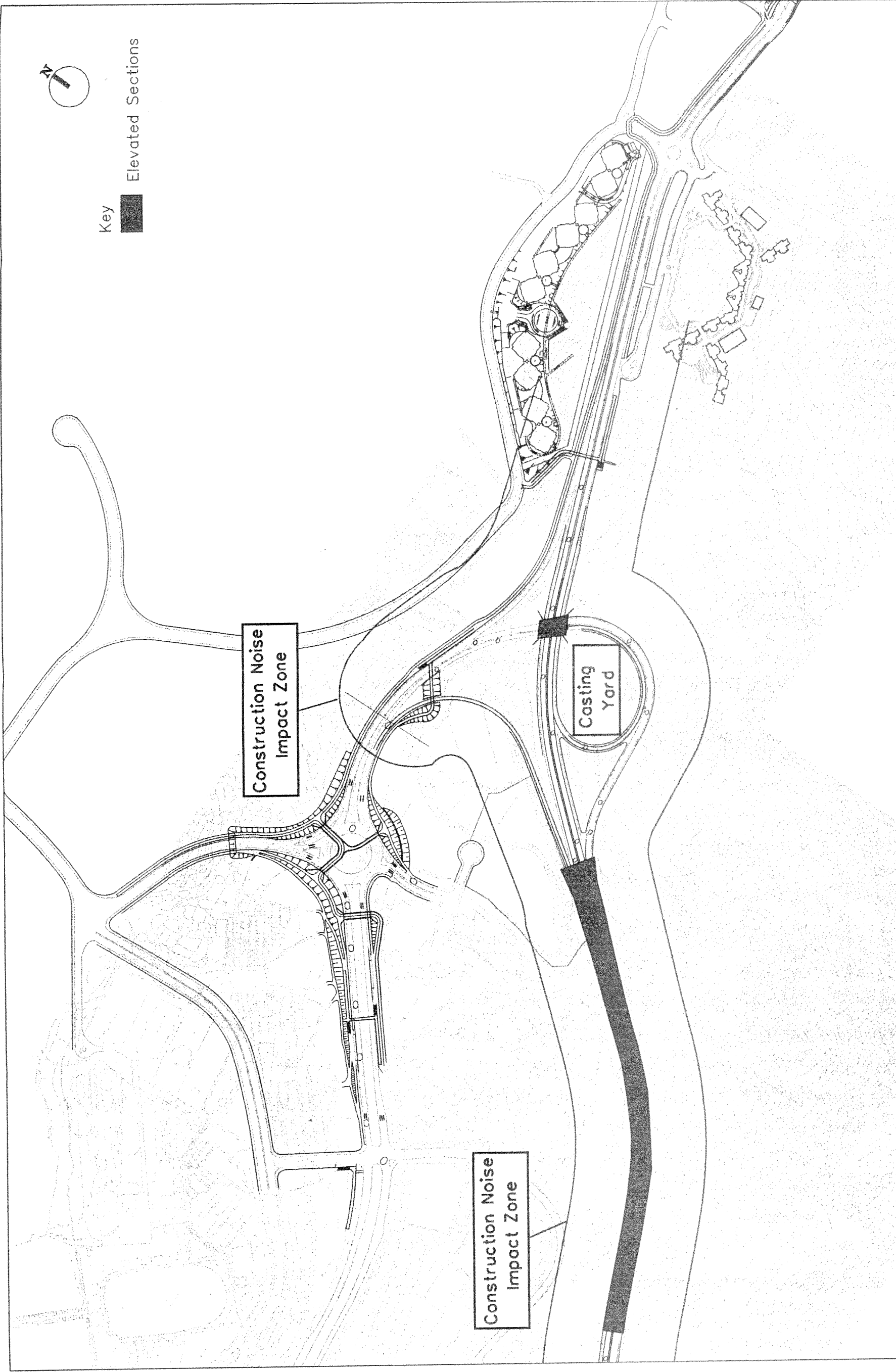
LOCATION OF NOISE SENSITIVE RECEIVERS		FIGURE NO. : 4.4b		Maunsoill	
		SCALE : 1 : 5500	DATE : 6/2/98		



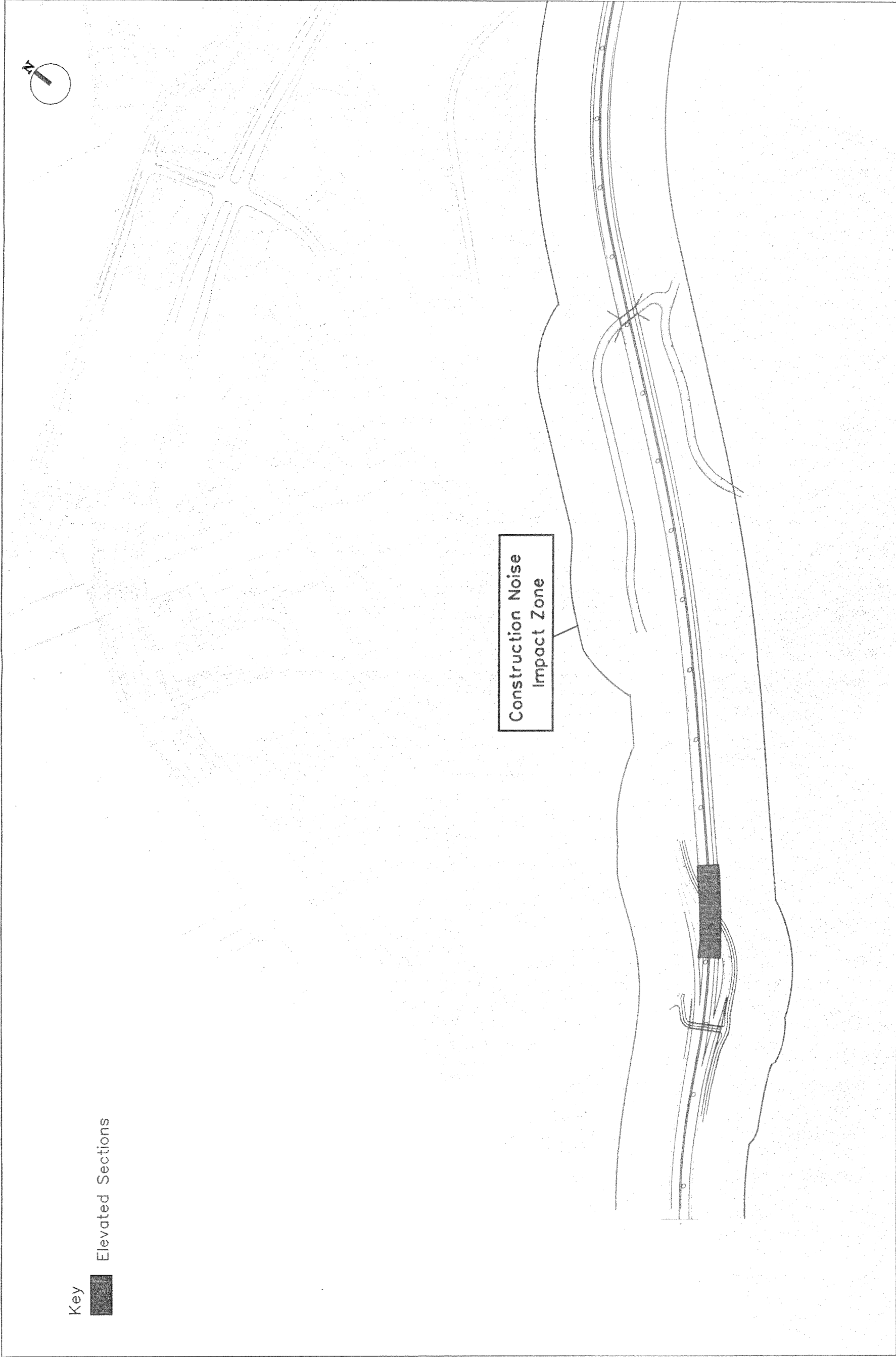
LOCATION OF AIR SENSITIVE RECEIVERS		FIGURE NO.:	5.1a	Maunsell	
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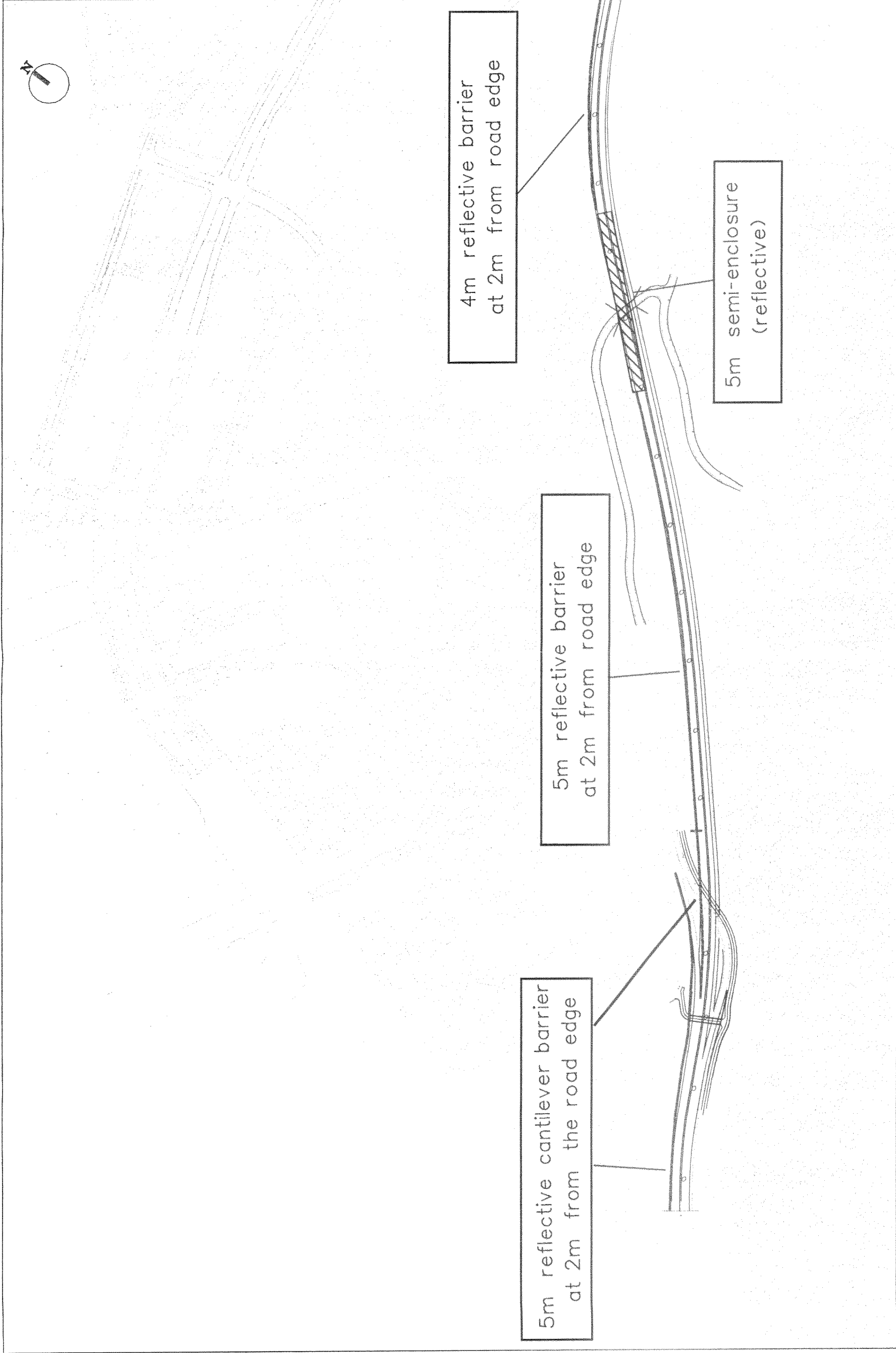
LOCATION OF AIR SENSITIVE RECEIVERS	FIGURE NO.:		5.1b	
	SCALE :	1 : 5500	DATE :	23/6/97
	Maunsell			



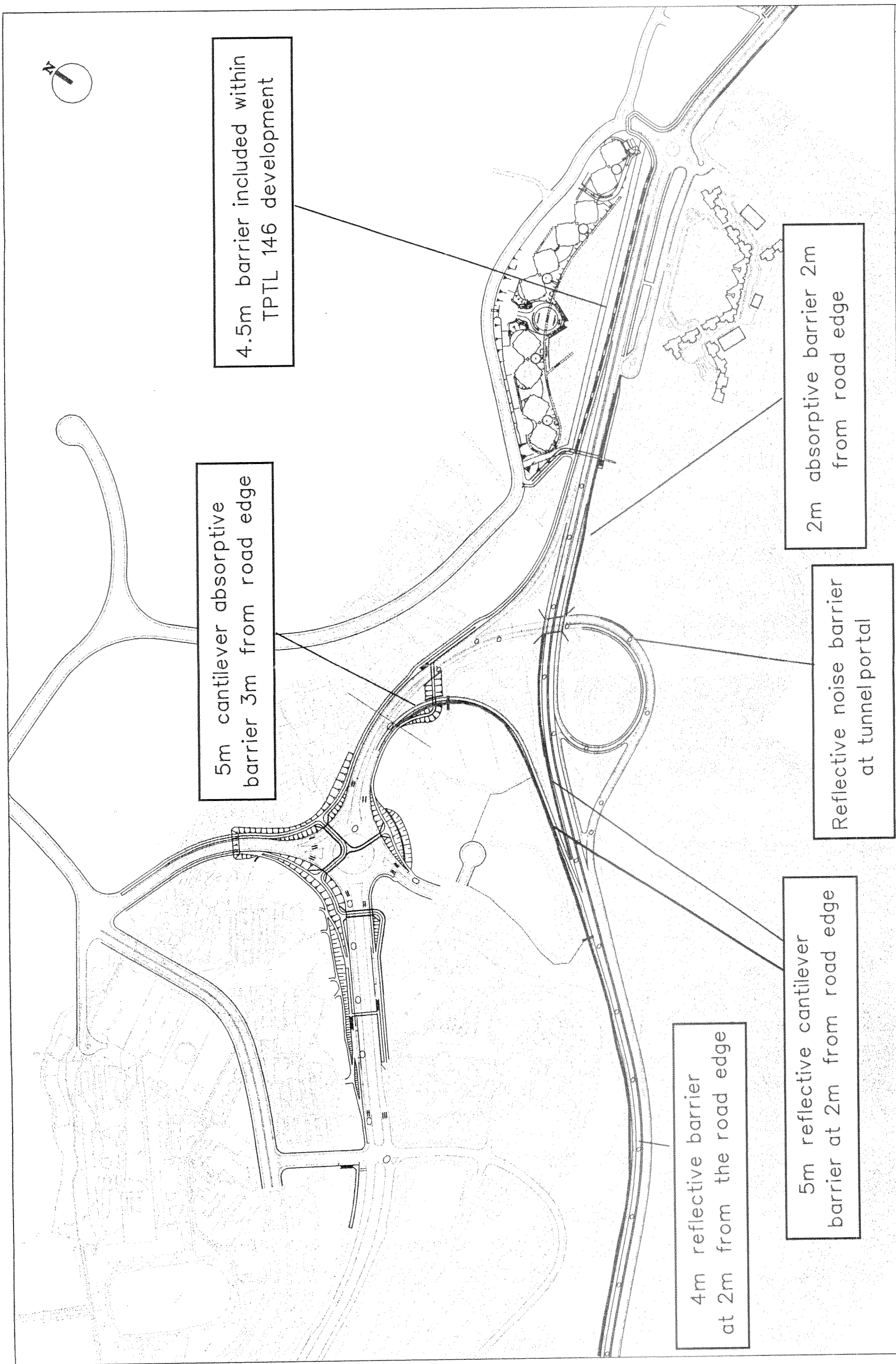
CONSTRUCTION NOISE IMPACTS			FIGURE NO.:	B1a	Maunsoill
SCALE :		1 : 5500	DATE :		18/11/97



CONSTRUCTION NOISE IMPACTS			Maunsell
FIGURE NO.:		B1b	
SCALE :	1 : 5500	DATE :	18/11/97



LOCATION OF NOISE BARRIERS		Maunsell	
FIGURE NO.:		B2a	
SCALE :	1 : 5500	DATE :	06/02/98



LOCATION OF NOISE BARRIERS			Maunsell	
FIGURE NO.:		B2b		
SCALE :		1:5500	DATE :	
			06/02/98	

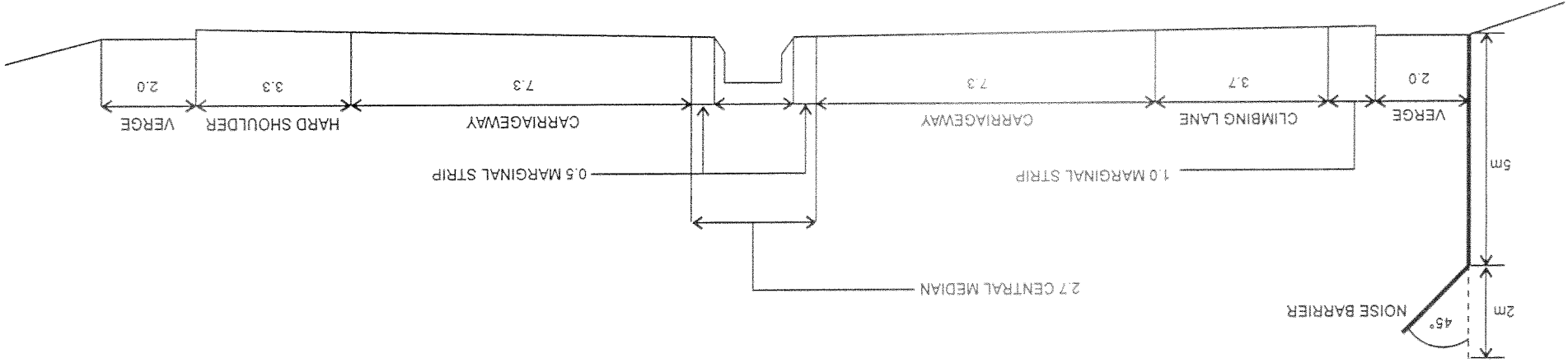
TYPICAL SECTION OF TRUNK ROAD T7
5m CANTILEVER BARRIER EQUIVALENT TO 7m VERTICAL BARRIER 2m FROM THE OUTER CARRIAGEWAY

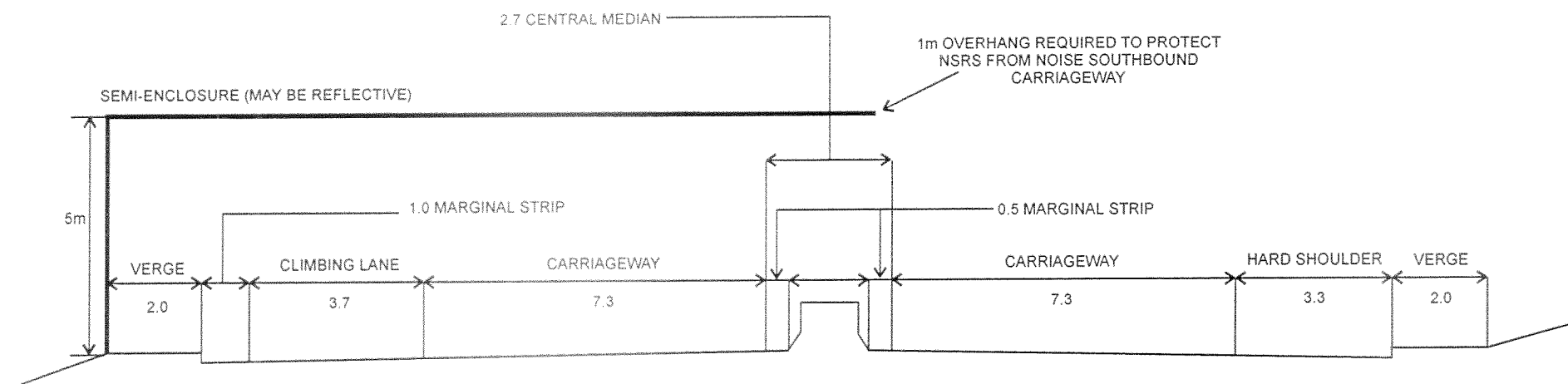
FIGURE NO. B3a

SCALE:

DATE: Oct 97

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TYPICAL SECTION OF TRUNK ROAD T7
SEMI-ENCLOSURE SOUTH OF KAM YING COURT

FIGURE No.

B3b

SCALE:

DATE:

Oct 97