



AGREEMENT NO. CE/38/95  
IMPROVEMENT TO KAM TIN ROAD, STAGE 1  
ENVIRONMENTAL IMPACT ASSESSMENT AND  
DRAINAGE IMPACT ASSESSMENT STUDIES

ENVIRONMENTAL IMPACT ASSESSMENT

FINAL REPORT

(VOLUME 2 OF 2)

ENVIRONMENTAL MONITORING AND AUDIT MANUAL

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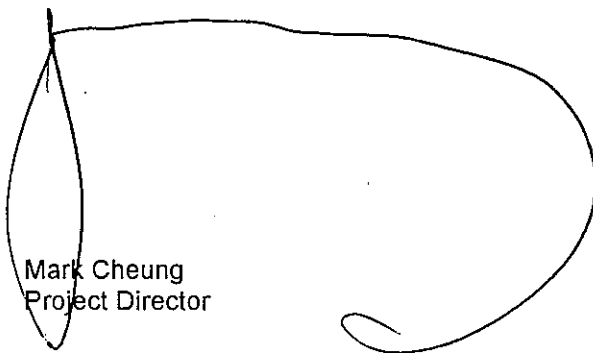
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Dear Sirs,

Agreement No. CE 38/95  
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Environmental Impact Assessment  
Final EIA Report, EM&A Manual and Executive Summary

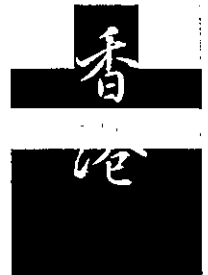
We enclose one set of the Final EIA Report, EM&A Manual and the Executive Summary for your retention and record.

Yours faithfully,  
For and on behalf of  
Babtie BMT (Hong Kong) Ltd. and  
Ho Tin & Associates Consulting Engineers Ltd.

  
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Project Director

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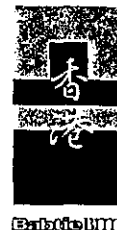
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**ENVIRONMENTAL IMPACT ASSESSMENT****FINAL REPORT**

(Volume 2 of 2)

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# Section 1

## Introduction

## 1. INTRODUCTION

### 1.1 BACKGROUND

The section of Kam Tin Road between Au Tau Roundabout and the proposed Kam Tin Bypass (western end) is to be improved to increase its capacity in order to cater for the increasing traffic demand arising from the rapid development of the North West New Territories areas, and to relieve the heavy traffic flow on Kam Tin Road upon the planned opening of Route 3 - Country Park Section in 1998 and Kam Tin Bypass in end 2001.

The stretch of Kam Tin Road for which improvement works are proposed is currently a single 2-lane carriageway with provision of narrow footpaths at discrete locations. The proposed improvement works, including widening/modification of road sections, provision of pedestrian/cyclist facilities and lay-bys, and construction of engineering and traffic management works, will upgrade the road to a dual 2-lane carriageway. Shown in Figure 1 is the works limit of Improvement to Kam Tin Road, Stage 1 (the Project).

An Environmental Impact Assessment (EIA) has been performed to address and evaluate the potential impacts associated with the implementation of Project. While results of the impact assessment and mitigation requirements for the Project are detailed in the EIA Report, this Environmental Monitoring and Audit (EM&A) Manual will form a separate stand alone document as part of the EIA Report, and will also include a practical guide that will be designed to assist the Engineer and the Contractor in fulfilling their requirements for environmental review.

### 1.2 THE PROPOSED PROJECT

#### 1.2.1 Road Improvement Works

The existing Kam Tin Road is to be improved to provide additional traffic capacity and at the same time to enhance safety through provision of wider continuous footpaths.

The project will upgrade the 1.1 km long Kam Tin Road between Au Tau Roundabout and Kam Tin River from a single carriageway to a dual 2-lane carriageway. The alignment of the upgraded Kam Tin Road in this section will follow approximately the existing alignment of Kam Tin Road.

In addition, a 2 m wide footpath with 3 m wide cycle track on the north side and 3.5 m wide footpath on the south side will be provided. There will be a 24 m long lay-bys for buses and general loading/unloading activities at appropriate locations (averaging 300 m apart).

### 1.2.2 Construction Activities and Schedule

Road works will consist of construction of flexible pavement comprising subbase, roadbase, basecourse and wearing course. Drainage for the carriageway will be provided by a gravity flow drainage system consisting of gullies, manholes, drain pipes, surface channels and possibly subsoil drains..

The existing traffic will be maintained during the construction period by adopting an appropriate temporary traffic diversion scheme. The sequence of construction will proceed generally in the following manner: (a) widening of carriageway while maintaining traffic in the existing Kam Tin Road, and (b) reconstruction of the existing Kam Tin Road while diverting the traffic to the widened carriageway.

A preliminary construction programme for the road widening works has been scheduled (also see Figure 2):

Months 1-2	Preliminaries, site clearance and mobilization
Months 3-12	Excavation
Months 6-15	Back filling and subbase
Months 12-18	Drainage and utilities
Months 12-15	Kerbing
Months 15-19	Road paving on widened portion
Months 17-20	Breaking of existing road surface
Months 20-26	Drainage and utilities
Months 22-26	Back filling and subbase
Months 23-27	Kerbing
Months 25-30	Road paving and road sign
Months 28-30	Footpath



## **Section 2**

### **Purpose of EM&A Manual**

## 2. PURPOSE OF EM&A MANUAL

### 2.1 EM&A OBJECTIVES

As part of the objectives of the EIA Study as stated in Section 3.1.1 of the Brief, an EM&A programme shall be developed to *design and specify the environmental monitoring and audit requirements necessary to ensure the implementation and the effectiveness of the environmental protection and pollution control measures adopted.*

Specifically, the EM&A Manual involves:

- Monitoring of the environmental performance of the Project and the effectiveness of mitigation measures.
- Verifying the environmental impacts predicted in the EIA.
- Determining Project compliance with regulatory requirements and Government policies.
- Taking remedial action if unexpected problems or unacceptable impacts arise.

### 2.2 EM&A REQUIREMENTS

The Environmental Protection Department (EPD) requires that monitoring is undertaken for the following stages of the Project:

- *Baseline Monitoring* refers to the measurements of environmental parameters such as existing noise levels and ecological elements, to determine the nature and ranges of natural variation and to establish, where appropriate, the nature of change. This information is useful for assessing the short and long term environment impacts of the Project activities.
- *Impact monitoring* involves the measurement of environmental parameters during the Project activities, in order to determine the impacts of the activities and the effectiveness of the mitigation measures proposed in the EIA Report, and any further remedial measures which are needed.
- *Compliance Monitoring* involves periodic sampling and/or continuous measurement of environmental parameters and the determination of their compliance with regulatory requirements and standards.

It is a further requirement of the EPD that the environmental monitoring programme is subject to environmental audit. The aim is to determine satisfactory compliance with the legislative requirements, ensure that no annoyance is caused to sensitive receivers and initiate the remedial action plan when required. This will require information on the statutory requirements for parameters of concern and monitoring data.

Each audit will consist of a review of the monitoring data and comparison with the relevant legislative requirements and environmental performance standards specified in the Contract Document.

The monitoring and audit requirements for the Project will be as follows:

- *Pre-Construction Phase* Including all baseline monitoring prior to any Project activity occurring on site.
- *Construction Phase* Including impact/compliance monitoring and audit during all construction activities.
- *Post-Project/Operational Phase* Including impact monitoring and audit after completion of Project and opening of road to traffic.

In addition, requirements stipulated in *EAD Operation Manual, Chapter 5, Environmental Monitoring & Audit of the Major Development Projects* (Appendices B and C) shall also be followed. An abstract on the operation manual is provided in Appendix A.

## **Section 3**

# **Environmental Impact Assessment**

### 3. ENVIRONMENTAL IMPACT ASSESSMENT

#### 3.1 SUMMARY OF IMPACT ASSESSMENT

##### 3.1.1 Identified NSRs

NSRs within the Study Area are low-rise developments. Locations of the identified NSRs are shown in Figures 3 and 4.

##### 3.1.2 Construction Phase

###### 3.1.2.1 Noise

With the exception of the noise sensitive receivers (NSRs) at Kam Tin Shi, most of the NSRs along Kam Tin Road will be subject to significant construction noise impacts. Mitigation measures are therefore required to reduce construction noise. For daytime construction activities, the effectiveness of amelioration measures will be confirmed in practice by the EM&A programme. For activities conducted during restricted hours, statutory requirements under the Noise control Ordinance (NCO) will be adhered to.

###### 3.1.2.2 Ecology

No severe direct ecological impacts are anticipated within the works limit and they can be mitigated. Indirect impacts such as polluted water and dust may affect the species and habitats outside the works boundary, and appropriate mitigation measures should be installed.

###### 3.1.2.3 Landscape/Visual Impact

The works would have a minimal impact on the overall landscape character of the area. High localised landscape impacts would result from the clearance of mature roadside trees. The potential loss of a number of inscribed stones would result in a high cultural impact.

Severe negative visual impacts are predicted for residents in Ko Po Tsuen during construction. Other residential areas and work places would experience negligible visual impacts. Pedestrians and cyclists along route would experience high negative visual impacts and motorists would experience low negative visual impacts during construction. Mitigation measures have been proposed to reduce landscape, cultural and visual impacts.



### 3.1.3 Post-Project/Operational Phase

#### 3.1.3.1 Noise

Operational impacts on the nearby NSRs, in particular those are located in the immediate vicinity of Kam Tin Road, will be significant. Noise mitigation structures will be provided and their effectiveness will be verified through the implementation of the EM&A programme.

#### 3.1.3.2 Ecology

There will not be any permanent loss of fish pond arising from this project, and no rare nor endangered species were discovered within the works boundary. The only direct impact is the removal of some roadside trees which can be compensated by landscape planting.

#### 3.1.3.3 Landscape/Visual Impact

Medium negative visual impacts are predicted at Ko Po Tsuen during the early operational phase and beneficial impacts in the longer term. Other residential areas and work places would experience negligible visual impacts. Pedestrians, cyclists and motorists would experience low negative impacts during the early operational phase. In the longer term the proposed environmental improvement measures would result in beneficial impacts for cyclists, pedestrians and motorists.

Mitigation proposals aim to provide a comprehensive landscape treatment for the road, which would be a significant environmental improvement for the whole area. Mitigation measures would reduce landscape, cultural and visual impacts to acceptable levels and negligible residual impacts are predicted as a result of the scheme.

## 3.2 RECOMMENDED MITIGATION MEASURES

### 3.2.1 Construction Phase

A summary of the mitigation measures recommended to be installed during the construction phase is indicated in Table 3.1.

**Table 3.1 Construction Mitigation Measures**

Aspect	Mitigation Measures
Noise	<ul style="list-style-type: none"> <li>• Install temporary noise barriers.</li> <li>• Locate noisy equipment and activities as far from NSRs as is practical.</li> <li>• Replace noisy plant or processes by quieter alternatives where possible.</li> <li>• Schedule noisy activities to minimize exposure of nearby NSRs to high levels of construction noise.</li> <li>• Turn off or throttle down idle equipment, and operate noisy equipment only when necessary.</li> <li>• Provide vibration isolation and/or acoustic enclosures to the power units of non-electric stationary plant and earth-moving plant.</li> <li>• Plan to avoid parallel conduction of noisy activities close to a given receiver.</li> <li>• Properly maintain and operate construction plant and the associated silencing measures.</li> </ul>
Ecology	<ul style="list-style-type: none"> <li>• Plant suitable native tree species along the widened Kam Tin Road.</li> <li>• Implement proper house-keeping procedures to prevent the discharge of polluted water into water bodies outside the works boundary and to minimize the emission of dust.</li> <li>• Take precautions not to alter the hydrology of the area.</li> </ul>
Landscape /Visual	<ul style="list-style-type: none"> <li>• Detailed alignment of road to reduce visual impacts and loss of existing trees and cultural artefacts.</li> <li>• Construction work areas to be restricted to a minimum and protective fencing used.</li> <li>• Erect hoarding to a safe minimum height at Ko Po Tsuen.</li> <li>• Minimise night-time working and lighting</li> </ul>

## 3.2.2 Post-Project/Operational Phase

A summary of the mitigation measures recommended to be implemented during the post-project/operational phase is shown in Table 3.2.

Table 3.2 Post-Project/Operation Mitigation Measures

Aspect	Mitigation Measures
Noise	<ul style="list-style-type: none"> <li>Provision of 3m high noise barriers and 5.7m high inverted-L barriers to protect NSRs at "Kam Fung Terrace" and Ko Po Tsuen.</li> <li>Consideration for indirect technical measures to redress the residual impact.</li> </ul>
Ecology	<ul style="list-style-type: none"> <li>Planting of suitable tree species along the widened Kam Tin Road.</li> <li>Reinstatement and return of the affected fish pond to the owner after completion of the works.</li> </ul>
Landscape /Visual	<ul style="list-style-type: none"> <li>New replacement tree planting.</li> <li>Dense tree and shrub planting to screen views to the road from sensitive receivers.</li> <li>Raised amenity areas to provide visual and physical separation of pedestrians, cyclists and vehicular traffic.</li> <li>Noise barriers to be sensitively designed and planting used to help ameliorate their appearance.</li> <li>Environmental improvements to the roadside including a paved area in front of Ko Po Tsuen.</li> </ul>

## **Section 4**

# **EM&A Organisation and Management**

#### **4. EM&A ORGANIZATION AND MANAGEMENT**

##### **4.1 ORGANIZATION AND MANAGEMENT STRUCTURE**

A number of parties will take part in the implementation of the EM&A programme, namely (a) Client Department, i.e. Highways Department (HyD) and its representatives, (b) EM&A Section of EPD, (c) Engineer, (d) Independent Environmental Auditor, (e) Contractor, and (f) Environmental Sub-Contractor. The organization and management structure for the EM&A programme is illustrated in Figure 5.

##### **4.2 RESPONSIBILITIES AND LINES OF COMMUNICATION**

The principal responsibilities of each project team member are outlined in the followings:

###### **4.2.1 Client Department**

- Overall management of the Project including EM&A programme.
- Communication with EPD over decisions/actions on non-compliances.

###### **4.2.2 EM&A Section of EPD**

- Overall review and approval of the EM&A programme.
- Advice on regulatory policies and environmental requirements.

###### **4.2.3 Engineer**

- Ensuring the Contractor has implemented the mitigation measures recommended in the EIA.
- Approving the appointment of the Environmental Sub-Contractor.
- Ensuring the Contractor carries out the environmental monitoring programme.
- Ensuring the Contractor undertakes any remedial measures necessary to address unanticipated or unacceptable impacts arising during construction of the Project.
- Liaising with the Independent Environmental Auditor.
- Ensuring smooth circulation of all project-related environmental information to all concerned parties.
- Reviewing monitoring and audit reports.
- Notifying EPD of exceedances of environmental quality performance limits.
- Initiating the action plans in the event of non-compliances.



#### 4.2.4 Independent Environmental Auditor

- Undertaking analysis of the monitoring results.
- Performing audits of the EM&A activities.
- Preparing audit reports.
- Undertaking site inspections on issues related to EM&A.
- Making recommendations and suggestions to the Engineer for improving environmental performance at the site.
- Liaising and consulting with all relevant parties during the implementation of the Event/Action Plans.
- Modifying, if necessary, the EM&A programme in consultation with the Engineer, EPD and other concerned parties.
- Producing reports on implementation of action plans and responses to public complaints.

#### 4.2.5 Contractor

- Undertaking construction in compliance with the EM&A requirements.
- Implementing mitigation and improvement measures as necessary and as instructed by the Engineer.
- Appointing the Independent Environmental Auditor (the Auditor).
- Appointing and supervising the Environmental Sub-Contractor for conduction of monitoring works.
- Preparing and submitting monitoring reports to the Engineer.
- Reporting to the Engineer on any abnormalities, difficulties and extraneous activities (unrelated to the construction of the Project) observed/recorded during the monitoring process.

#### 4.2.6 Environmental Sub-Contractor

- Performing all monitoring and sampling tasks as specified or directed.
- Recording all necessary field data during monitoring and sampling.
- Undertaking maintenance and calibration of monitoring and sampling equipment.
- Compiling and submitting monitoring results and reports to the Contractor.
- Reporting to the Contractor on any abnormalities, difficulties and extraneous activities (unrelated to the construction of the Project) observed/recorded during the monitoring process.

Shown in Figures 5 and 6 are the lines of communication between the concerned parties, and EM&A procedures respectively.

Prior to commencement of construction, the Contractor should submit to the Engineer a detailed monitoring and audit programme for construction and operation. The programme must be approved by EPD before work commencing on site. The Contractor should undertake the monitoring and recording of environmental issues in order to assess the impacts of the Project activities and compliance against agreed environmental quality performance limits. Details of the specific monitoring parameters and the required frequency of sampling are provided in the following sections.

## **Section 5**

# **Construction EM&A Programme**

## **5. CONSTRUCTION EM&A PROGRAMME**

### **5.1 PURPOSES**

The construction monitoring and audit programme will be used to verify the predictions of environmental impact developed during the design stage and to ensure that unforeseen impacts are detected during the construction stage. This will allow corrective measures to be implemented before irrecoverable damages occur. The objectives of the programme are as follows:

- To provide a database of environmental data against which to determine any short term or long term environmental impacts as a result of the construction activities.
- To confirm the assumptions made in the design of the Project and particularly the effectiveness of the mitigation measures.
- To provide an indication whether the environmental control measures are effective in maintaining the required standards.
- To provide data to enable the environmental audits to be carried out.

To achieve these aims the environmental monitoring will be carried out in two stages, namely pre-project (baseline monitoring) and during construction (impact/compliance monitoring).

### **5.2 NOISE**

#### **5.2.1 Monitoring Methodology and Equipment**

##### **5.2.1.1 Monitoring Methodology**

Noise measurements shall be undertaken in accordance with the procedures and methodologies specified, in the order of precedence, in the Noise Control Ordinance (NCO), EPD's requirements, the Engineer's instructions, and this EM&A Manual. Standard acoustical principles and practices shall be followed in the measurement and analysis of the noise being monitored.

Noise monitoring shall be undertaken at the designated and/or agreed locations. Unless otherwise accepted by the Engineer and EPD, the measurement point for noise monitoring conducted outside a building shall be at 1 m from the exterior of the sensitive facade. Where a measurement is to be made of noise being received at a place other than a building, the measurement shall be at a position 1.2 m above the ground in the free-field.

Noise monitoring shall be carried out at a time appropriate for the activities on site or as directed by the Engineer. Where construction is to be carried out during restricted hours, noise monitoring shall follow the conditions and terms specified in the Construction Noise Permit. Noise measurements shall not be made: (a) when other intrusive noise sources other than Influencing Factors are apparent at the measurement point, or (b) in the presence of fog, rain, or excessive steady/gusty winds.

All noise measurements shall be rounded to the nearest whole dB(A), with values of 0.5 or more being rounded upwards.

#### **5.2.1.2 Monitoring Equipment**

Sound level meters used for noise monitoring shall comply with International Electrotechnical Commission Publications (IECP) 651:1979 (Type 1) and 804:1985 (Type 1), and other noise measuring and analysis instrumentation shall be of comparable professional quality.

All monitoring equipment shall be maintained in calibration at all times. Recalibration shall be carried out in accordance with the requirements stated in this Manual or those recommended by the manufacturer, whichever is more stringent. Noise monitoring equipment shall be calibrated at least annually by the manufacturer or an accredited laboratory.

Calibration shall be made prior to and after each set of measurements, and the results of the calibration recorded on the appropriate field data sheet. Measurements will be considered as valid only if the calibration levels before and after the noise measurement agree to within 1 dB(A). Routine calibration equipment and procedures shall comply with IECP 942.

All noise measurement equipment and accessories shall be used with great care and maintained in accordance with the manufacturer's recommendations.

#### **5.2.2 Monitoring Locations and Schedule**

##### **5.2.2.1 Monitoring Locations**

Noise monitoring is suggested to be undertaken at the following locations:

- MS-A Village house adjacent to access road to the electrical sub-station.
- MS-B Village house at Ko Po San Tsuen
- MS-C Village house at Ko Po Tsuen
- MS-D Kam Tin Mung Yuen Public School



For baseline monitoring, noise measurements will be made at MS-B, C and D. Impact and/or compliance noise monitoring shall be conducted, on a routine basis and when required, at the 3 closest monitoring stations (chosen from MS-A to D) within 200 m of the active portion of site. Monitoring at other locations may be required by the Engineer in case of non-compliances or upon receipt of complaints. Additional noise monitoring locations shall be agreed with EPD and the Engineer if works carried out during restricted hours are necessary.

Figure 7 shows the locations of the suggested noise monitoring stations.

#### 5.2.2.2 Baseline Monitoring

Noise monitoring shall be carried out prior to the commissioning of the construction work for a period of at least 2 weeks, with measurement to be taken on a daily basis. There should not be any construction activities in the vicinity of the stations during the baseline monitoring.

#### 5.2.2.3 Impact/Compliance Monitoring

Noise monitoring shall be carried out at the chosen monitoring station(s) every 6 days during normal construction hours. Noise measurements shall be conducted over a 30-minute period to give 6 consecutive  $L_{eq}(5 \text{ min})$  readings. The  $L_{eq}(30 \text{ min})$  reading shall be determined from the  $L_{eq}(5 \text{ min})$  readings within the noise meter.

The frequency of monitoring shall be increased: (a) in case of non-compliances, (b) upon receipt of complaints, or (c) when works are carried out during restricted hours. Furthermore, the effectiveness of mitigation measures should be ensured by checking that any silenced construction equipment is properly used and maintained, any mitigation measures such as noise barriers are properly positioned and maintained, and good site practice is observed.

A summary of the construction noise monitoring programme is provided in Table 5.1.

**Table 5.1 Summary of Construction Noise Monitoring Programme**

Item	Baseline Monitoring	Impact/Compliance Monitoring
Monitoring Stations	MS-B, C and D	3 closest monitoring stations of MS-A to D within 200 m of the active portion of site
Frequency/Duration	Daily basis for a 2-week period prior to construction works	Every 6 days during normal construction hours
Parameters	$L_{10}$ , $L_{eq}$ and $L_{90}$	$L_{eq}$ (30 min) reading derived from 6 consecutive $L_{eq}$ (5 min) readings
Additional Monitoring	Nil	<ul style="list-style-type: none"> <li>· In case of non-compliances</li> <li>· Upon receipt of complaints</li> <li>· During restricted hours</li> <li>· Test of mitigation measures</li> </ul>

### 5.2.3 Environmental Quality Performance Limits

Three environmental quality performance limits will be used for the environmental audit, as described in Table 5.2.

The trigger, action and target (TAT) levels for construction noise pollution are shown in Table 5.3.

**Table 5.2 Environmental Quality Performance Limits**

Level	Indication and Response
Trigger Level	The level beyond which there is an indication of a deteriorating ambient environmental quality for which a typical response could be more frequent monitoring.
Action Level	The level beyond which appropriate remedial actions may be necessary to prevent the environmental quality from going beyond the Target Limit, which would be unacceptable.
Target level	The level stipulated in relevant pollution control ordinances, the HKPSG, or other appropriate criteria established by EPD for a particular project, beyond which the works should not proceed without appropriate remedial action, including a critical review of plant and work methods.

**Table 5.3 Trigger, Action and Target Levels for Construction Noise Monitoring**

Level	Indication and Response
Trigger Level	This level acts as an "early warning" of deterioration, so that closer monitoring of noise levels may be initiated, possible sources of the noise may be identified, and early mitigation measures enacted to prevent further deterioration. This level may be defined as receipt of one independent complaint (directed either to EPD or the Engineer).
Action Level	Achievement of this level indicates that noise levels have increased from the Trigger Level, and that corrective action is required before conditions further deteriorate and relevant standards are not met. This level may be defined as receipt of more than one independent complaint in a two-week period.
Target level	This is the upper limit, or maximum permissible level that will still comply with the appropriate regulation. In the absence of statutory controls to limit daytime (07:00-19:00 hours) construction noise, a limit of 75 dB(A) shall be used, with a limit of 70 dB(A) and 65 dB(A) for schools during normal school days and during examination respectively, as the Target Level. Exceedance of the Target Level is generally not permitted.

#### 5.2.4 Event/Action Plan

Whenever monitoring indicates that a particular parameter has exceed its trigger, action or target level, the Engineer shall initiate a programme of action, i.e. the Event/Action Plan. The Event/Action Plan for noise exceedance are detailed in Table 5.4 and included as flow diagram in Figure 8.

### 5.3 ECOLOGY

#### 5.3.1 Baseline

A baseline ecological study of flora and fauna was completed during the environmental impact assessment stage and the results are presented in the EIA report.

#### 5.3.2 Construction

It is recommended that the following monitoring and audit programme to be carried out during the construction phase:

- Monitoring and auditing the use of Ko Po Tsuen Egrettry and/or other active egrettries adjacent to the works areas along the road corridor by egrets and herons monthly during the nesting season, in view of its proximity to the works site.
- Monitoring and auditing the success of the landscape planting, in terms of health, survival and growth of vegetation, by landscape contractor every 6 months.

Table 5.4 Action Plan for Construction Noise Exceedance

Event	Action by Engineer	Action by Contractor
One independent complaint received	<ul style="list-style-type: none"> <li>Investigate complaint.</li> <li>Notify Contractor.</li> </ul>	<ul style="list-style-type: none"> <li>Investigate noisy operations.</li> </ul>
More than one independent complaint received in a 2-week period	<ul style="list-style-type: none"> <li>Investigate complaint.</li> <li>Notify Contractor.</li> <li>Require Contractor to propose measures to reduce noise.</li> </ul>	<ul style="list-style-type: none"> <li>Review noise source and working method.</li> <li>Increase frequency of monitoring.</li> <li>Submit noise mitigation proposals to the Engineer.</li> <li>Implement noise mitigation measures.</li> <li>Perform noise monitoring after implementation of noise mitigation measures.</li> </ul>
Target Level exceeded	<ul style="list-style-type: none"> <li>Investigate noise problems.</li> <li>Notify Contractor.</li> <li>Require Contractor to propose measures to reduce noise.</li> </ul>	<ul style="list-style-type: none"> <li>Review noise source and working method.</li> <li>Increase frequency of monitoring.</li> <li>Submit noise mitigation proposals to the Engineer.</li> <li>Implement noise mitigation measures.</li> <li>Perform noise monitoring after implementation of noise mitigation measures.</li> </ul>



## 5.4 LANDSCAPE/VISUAL

### 5.4.1 Baseline

A study of the existing landscape and sensitive receivers was completed during the environmental assessment stage and the results are presented in the EIA report. A detailed tree survey is recommended prior to the detailed design of the works, as part of the necessary tree felling application.

### 5.4.2 Construction

The contractor will be responsible for implementing the EM&A programme during the construction, and the organisation and management will be as described in Section 4.

The following monitoring and audit programmes are to be carried out during the construction phase :

- . Monitoring and auditing the effectiveness of the proposed mitigation measures in reducing visual impacts on Ko Po Tsuen, cyclists, pedestrians and motorists.
- . Monitoring and auditing the effectiveness of the proposed mitigation measures in retaining existing vegetation and cultural artefacts.

## **Section 6**

# **Post-Project/Operation EM&A Programme**

## 6. POST-PROJECT/OPERATION EM&A PROGRAMME

### 6.1 PURPOSES

The post-project/operation monitoring and audit programme will be used to verify the predictions of environmental impact developed during the design stage and to ensure that unforeseen impacts are detected during the early post-project/operational stage. This will allow corrective measures to be implemented before irrecoverable damages occur. The objectives of programme are as follows:

- To provide a database of environmental data against which to determine any short or long term environmental impacts as a result of the post-project/operational activities.
- To confirm the assumptions made in the design of the Project and particularly the effectiveness of the permanent mitigation measures.
- To provide data to enable the environmental audits to be carried out and to review the requirements for any on-going monitoring programme.

To achieve these aims the environmental monitoring will be carried out on project completion and early operational stages.

### 6.2 NOISE

The Contractor should be responsible for implementing the post-project/operation EM&A programme for noise on project completion. The EM&A organization and management structure will be as that described in Section 4, and the monitoring methodology and equipment used shall generally follow that detailed in Section 5.2.1.

The noise monitoring will be undertaken to verify the performance, in terms of noise reduction achieved, of the proposed noise screening structures. The monitoring locations, schedule and parameter are shown in Table 6.1.

**Table 6.1 Summary of Post-Project/Operation Noise Monitoring Programme**

Item	Description
Monitoring Stations	MS-B, C and D
Frequency/Duration	<ul style="list-style-type: none"> <li>· Upon completion of each set of noise mitigation structures.</li> <li>· 6 and 12 months after full opening of the road to traffic.</li> </ul>
Parameters	L <sub>10</sub> (peak hour)
Additional Monitoring	<ul style="list-style-type: none"> <li>· When any of the noise screening structures do not achieve the required noise reduction.</li> <li>· After remedial works are taken.</li> </ul>

### 6.3 ECOLOGY

The Contractor should be responsible for implementing the post-project/operation EM&A programme for ecology, and the organization and management will be as that described in Section 4.

The post-project/operation monitoring and audit programme for ecology will run for one year after the completion of the Project and will cover the followings:

- Monitoring and auditing the use of Ko Po Tsuen Egret and/or other active egrets adjacent to the works areas along the road corridor by egrets and herons monthly during the nesting season, in view of its proximity to the works site.
- Monitoring and auditing the success of the landscape planting, in terms of health, survival and growth of vegetation, by landscape contractor every 6 months.

### 6.4 LANDSCAPE/VISUAL

The contractor will be responsible for implementing the post project EM&A programme, and the organisation and management will be as described in Section 4.

The post-project/operation monitoring and audit programme will last for 1 year after the completion of the project and will cover the following :

- Monitoring and auditing the success of the landscape planting, in terms of health, survival and growth of vegetation every 6 months.
- Monitoring and auditing the success of the mitigation planting as above, in reducing visual impacts on Ko Po Tsuen, cyclists, pedestrians and motorists.

## **Section 7**

# **Contingency Plan**

## 7. CONTINGENCY PLAN

Contingency plan should be proposed and submitted by the Contractor to cater for the eventualities described in Table 7.1. Any changes in the monitoring schedule due to unforeseen circumstances should be reported to EPD and the Engineer immediately. The originally agreed monitoring should be resumed as soon as practicable.

**Table 7.1 Requirements of Contingency Plan**

Issue	Requirements
Delay in equipment delivery of set-up	<ul style="list-style-type: none"> <li>Make all efforts to acquire, prepare and install the monitoring equipment before the start of the monitoring programme.</li> <li>Inform EPD and the Engineer on the revised start date for the particular environmental parameter in case of delay in equipment installation.</li> <li>Proceed the monitoring programme for those parameters not affected by the delay.</li> </ul>
Prolonged non-availability of key personnel	<ul style="list-style-type: none"> <li>Fill in the position within 1 week of the commencement of the period of non-availability of any key monitoring personnel for longer than 2 weeks.</li> <li>Assign other equally qualified personnel to take up the responsibilities of the individual in question in the interim period.</li> </ul>
Failure or theft of equipment	<ul style="list-style-type: none"> <li>Obtain the back-up monitoring equipment or have the equipment repaired within 1 week of equipment failure or theft.</li> </ul>
Adverse weather conditions	<ul style="list-style-type: none"> <li>Propose and implement make-up monitoring schedule as soon as weather conditions permit.</li> </ul>

## **Section 8**

# **Environmental Complaints & Responses**



## 8. ENVIRONMENTAL COMPLAINTS AND RESPONSES

In the event of any complaints, EPD will liaise with HyD and the Engineer and the latter would be responsible for ensuring the implementation of necessary remedial measures and actions, in accordance with the complaints handling procedures outlined in Figure 9.

In particular, the followings procedures and actions shall be observed:

- Record all complaints including complainants, details and dates of receipt onto the complaint database.
- Investigate the complaint to determine its validity, and to assess whether the source of the problem is due to recurring works/activities.
- Identify the problem, and determine and implement suitable mitigation measures if complaint is valid.
- Undertake additional monitoring and audit to verify the situation as necessary, and address the issue in the progress report.
- Record the monitoring data, results of the investigation and remedial actions taken onto the database.
- Notify the complainants on the results of complaint investigation and, where applicable, remedial measures implemented.

## **Section 9**

# **Records and Reporting**

## 9. RECORDS AND REPORTING

### 9.1 DATA RECORDING

The Contractor should record the results of the monitoring on standard field data sheets and report to the Engineer on a monthly basis (also see Section 9.2 below). The data will then be input into a computer database which serves as a systematic method of recording, storing and retrieving data. The database will be so designed such that the data can easily be referenced in the event of complaints or non-compliances.

The Contractor's monitoring personnel should, whenever applicable, register the following minimum information on a field record sheet:

- Details on project name, monitoring staff, monitoring location/station, date of measurement and monitoring period.
- Details on equipment used, including type and make of equipment, model/serial number, equipment settings and calibration status.
- Monitoring results for each environmental parameters.
- Other relevant non-quantitative information/observations relevant to the interpretation of the monitoring results, including weather conditions, site conditions and activities, and presence of abnormalities and extraneous activities.

The field records shall be reviewed by a competent personnel of the Contractor within 24 hours.

A set of sample field data record sheets for noise monitoring is attached in Appendix B.

### 9.2 REPORTING

The Contractor shall prepare monthly summary records of monitoring data. At monthly intervals, and not more than 6 calendar days after the end of the month to which the data refer, the Contractor should submit duplicate copies of a summary monitoring report in both printed and electronic form to the Engineer.

The Engineer, upon receipt of the monthly monitoring report prepared by the Contractor, shall forward the report to the Auditor for review and audit. A monthly Environmental Monitoring and Audit Report (EM&A Report) will be prepared by the Auditor within 14 calendar days of the end of each month, with the first report due in the month after construction commences.

The EM&A Report, together with a disk containing all the monitored data, will be submitted to both EPD (EM&A Section) and the Engineer. The format of the database will be agreed with EPD prior to the issuance of the first report.

Each EM&A Report will contain the information as shown in Table 9.1. While under normal situations, non-compliances and remedial actions will be addressed in the EM&A Reports, they would also need to be dealt with on a day to day basis through the issue of action plans and site instructions.

Table 9.1 Contents of Monthly EM&amp;A Reports

Issue	No.	Item
General	1	An executive summary.
	2	Brief project background information including project programme, organization and management structure.
Monitoring	1	A summary of EM&A requirements including: (a) all monitoring parameters, (b) environmental quality performance limits (trigger/action/target levels), (c) Event/Action Plans, (d) recommended environmental mitigation measures, and (e) environmental requirements in Contract Documents.
	2	Drawings showing environmental sensitive receivers/elements and locations of the monitoring stations.
	3	All monitoring results (in both hard and diskette copies) and other relevant information including: (a) monitoring methodologies, (b) equipment used and calibration details, (c) parameters monitored, (d) monitoring locations/positions, (e) monitoring time, frequency, duration and period, (f) weather conditions during monitoring, (g) site activities during monitoring, and (h) other factors that might affect the monitoring results.
	4	A summary of non-compliances (exceedances) of the environmental quality performance limits (trigger/action/target levels).
	5	A review of the reasons for the non-compliances including review of pollution sources and works procedures/methodologies.
	6	A description of the actions taken in the event of non-compliances and any follow-up procedures related to earlier non-compliances.
	7	A record of all complaints (written or verbal) received including nature and location of complaint, liaison and consultation undertaken, actions and follow-up procedures taken.
	8	A forecast of the works programme and monitoring schedule for the coming month.
	9	Comments and conclusions for the month.

Table 9.1  
(Con't)

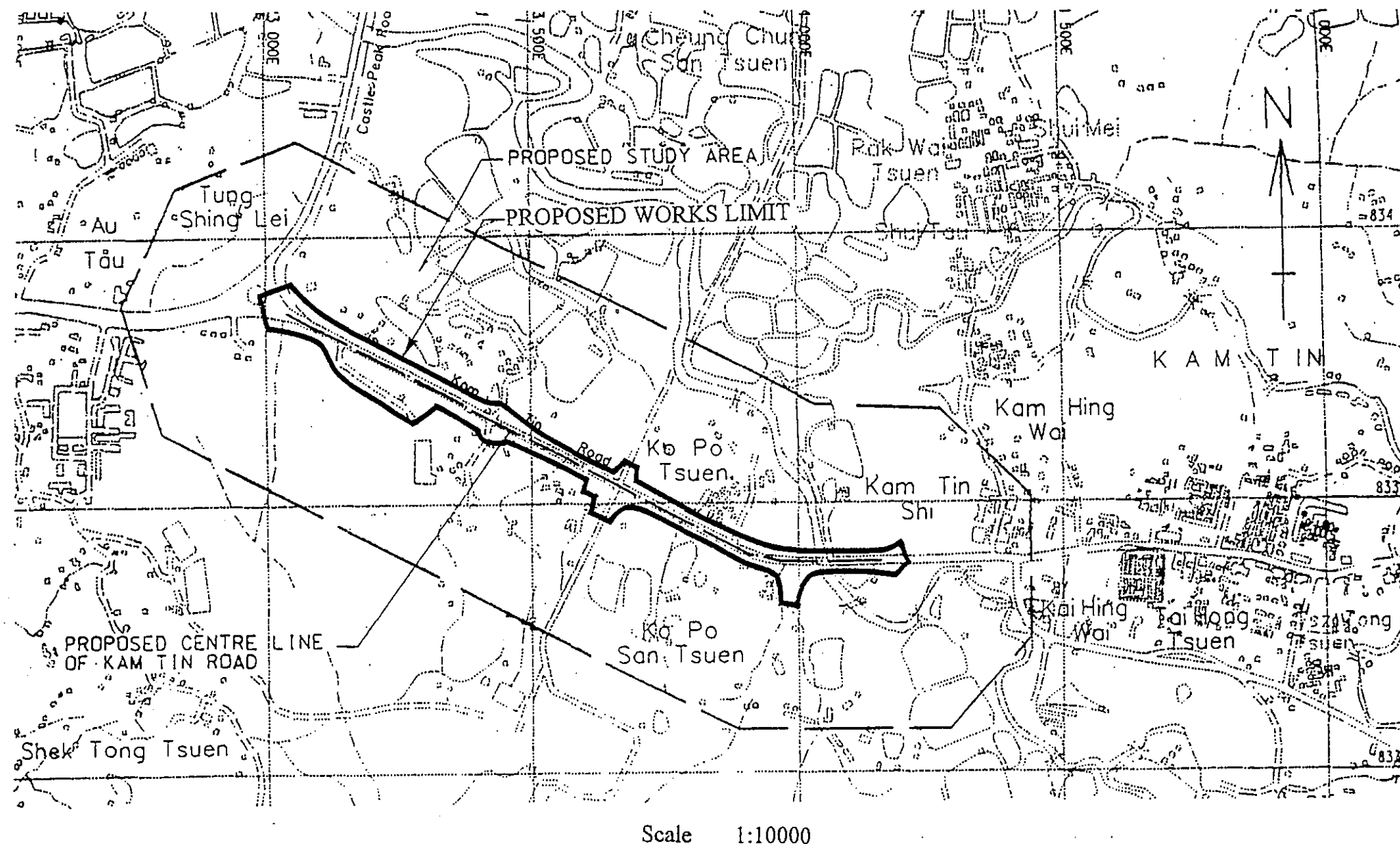
Issue	No.	Item
Audit	1	A summary on the checking and validating the monitoring results.
	2	An analysis and interpretation of the monitoring results to establish an environmental profile at the time of audit.
	3	A summary of on-site inspections and investigations to identify sources and cause of non-compliances and unacceptable impacts.
	4	A review on whether the Contractor fulfills the contractual and statutory requirements, licensing conditions, etc. relating to protection of environment.
	5	A review on whether all mitigation measures are properly and effectively implemented, and the anticipated protection/mitigation achieved.
	6	An assessment of the accuracy of environmental impact predictions by comparing the predicted impacts with the actual impacts measured.
	7	An assessment of the effectiveness of the environmental management system, practices and procedures.
	8	An identification of any remedial measures in case of non-compliances and improvements in management, control and operations if environmental objectives are not achieved.
	9	An identification of any environmental problems/impacts which may be encountered in the near future and the associated resolutions.
	10	An investigation of complaints received and the actions taken.
	11	A review of the overall monitoring philosophy, in terms of procedures, location of monitoring stations, monitoring frequencies, parameters measured, test methods, acceptance criteria, etc.

## Figures

**List of Figures**

- Figure 1 Works Limit of Proposed Road Improvement Works
- Figure 2 Preliminary Construction Programme
- Figure 3 Noise Sensitive Receivers and Representative Sensitive Facades (Sheet 1 of 2)
- Figure 4 Noise Sensitive Receivers and Representative Sensitive Facades (Sheet 2 of 2)
- Figure 5 EM&A Organization and Management Structure
- Figure 6 EM&A Procedures
- Figure 7 Noise Monitoring Stations
- Figure 8 Event/Action Plan for Noise Exceedance
- Figure 9 Complaints Handling Procedures

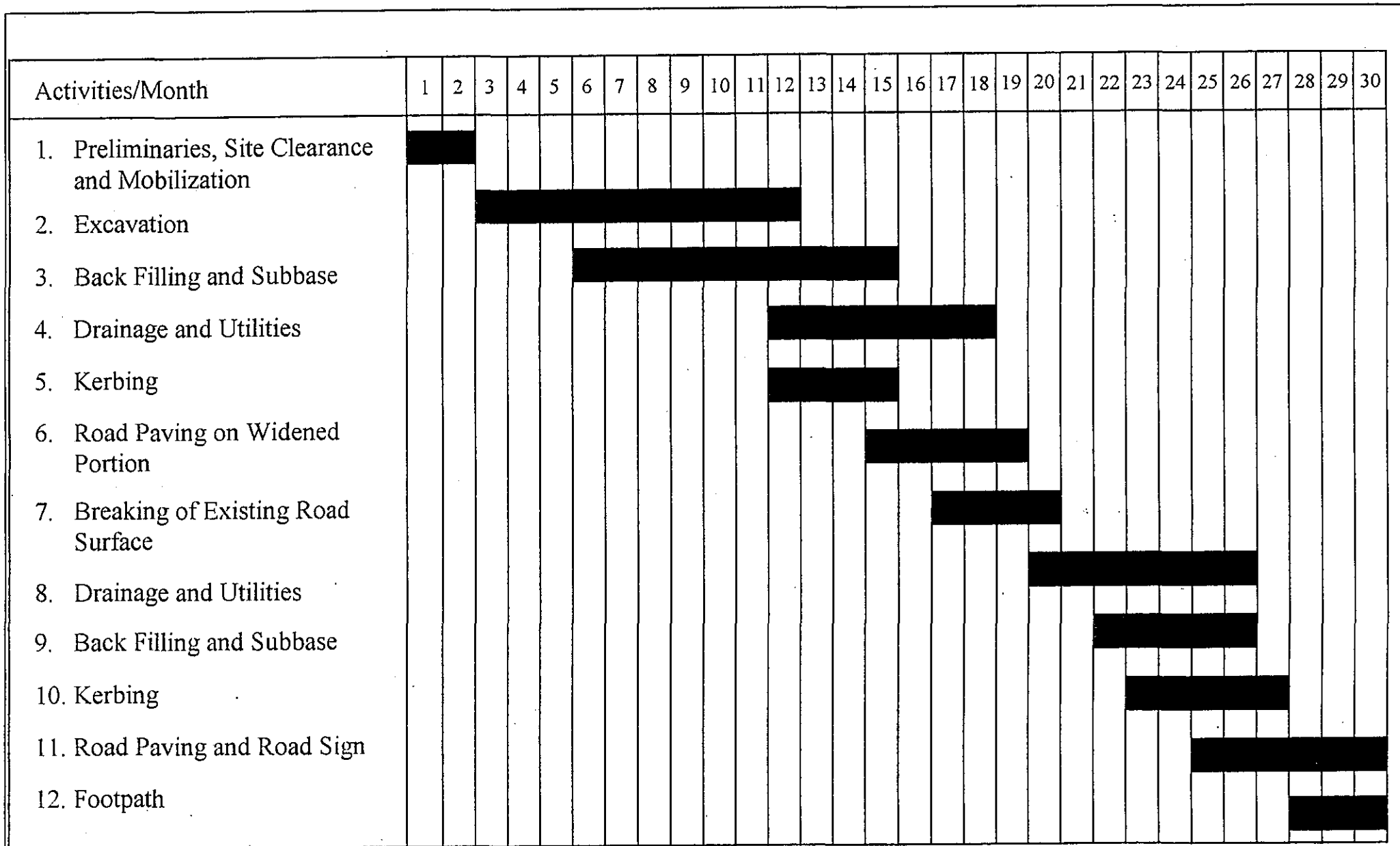




WORKS LIMIT OF PROPOSED ROAD IMPROVEMENT WORKS

FIGURE 1

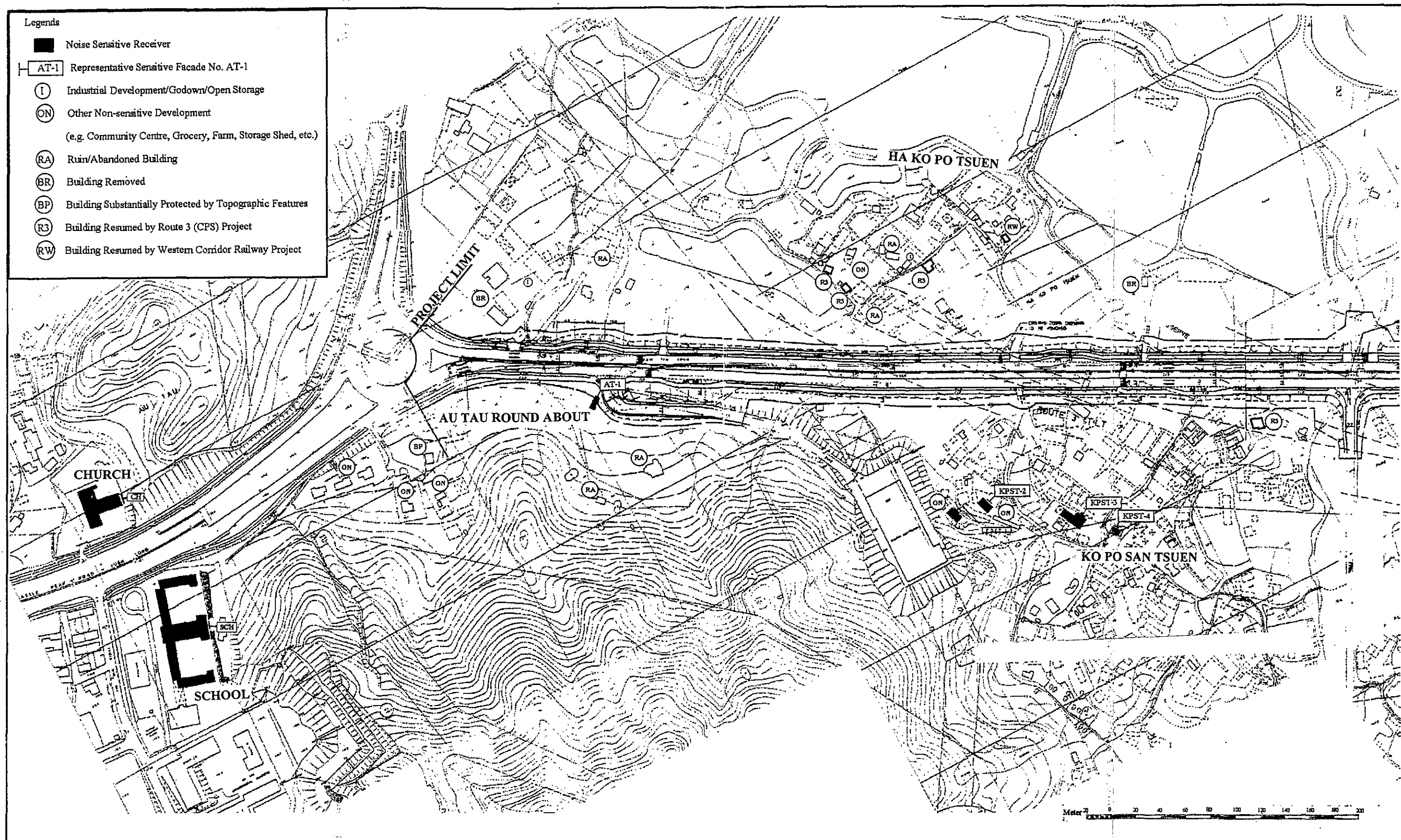
BABTIE BMT (HONG KONG) LTD.  
HO TIN & ASSOCIATES CONSULTING ENGINEERS LTD.



PRELIMINARY CONSTRUCTION PROGRAMME

FIGURE 2

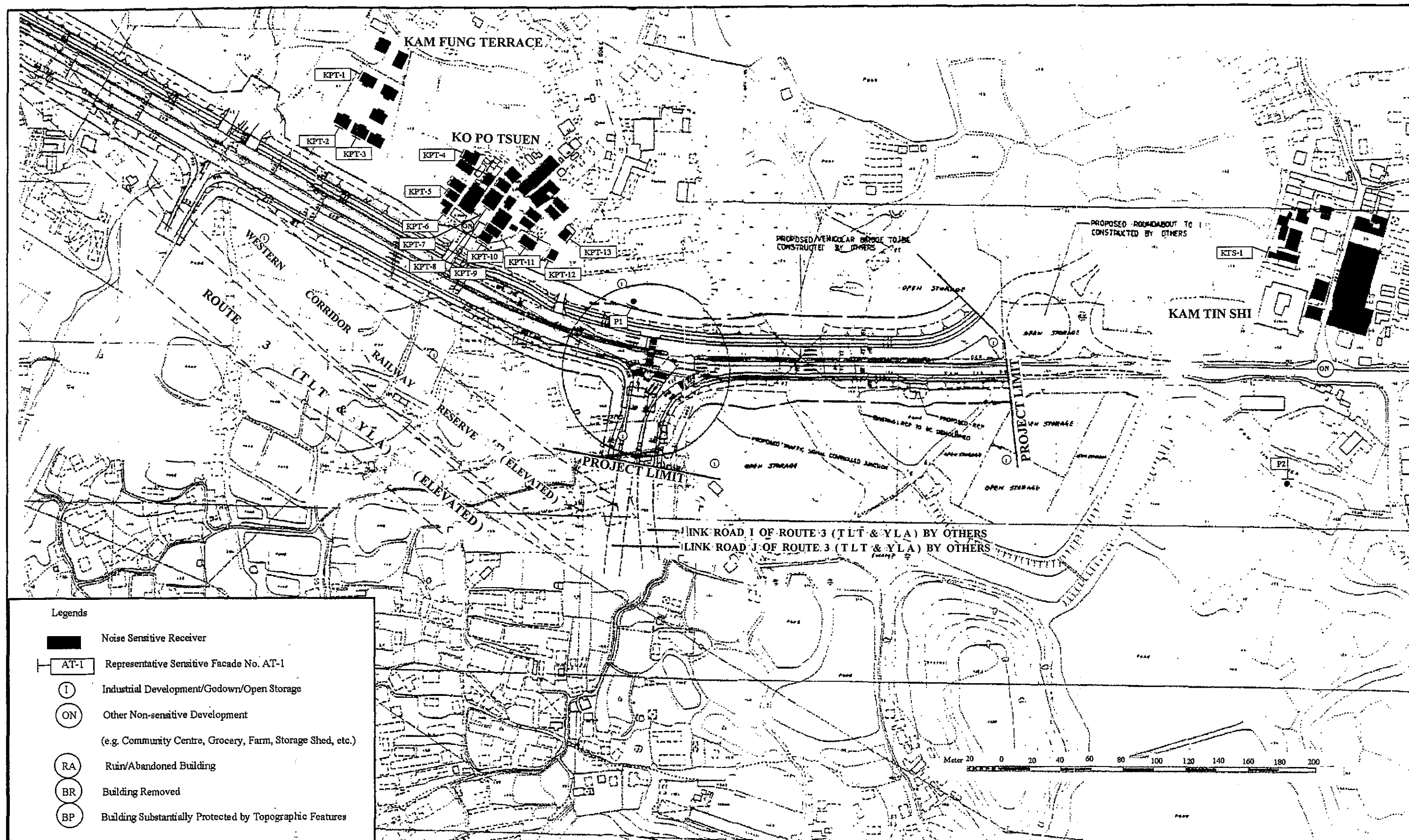
BABTIE BMT (HONG KONG) LTD.  
HO TIN & ASSOCIATES CONSULTING ENGINEERS LTD.



NOISE SENSITIVE RECEIVERS AND  
REPRESENTATIVE SENSITIVE FACADES  
(SHEET 1 OF 2)

FIGURE 3

BABTIE BMT (HONG KONG) LTD.  
HO TIN & ASSOCIATES CONSULTING ENGINEERS LTD.



NOISE SENSITIVE RECEIVERS AND  
REPRESENTATIVE SENSITIVE FACADES  
(SHEET 2 OF 2)

FIGURE 4

BABTIE BMT (HONG KONG) LTD.  
HO TIN & ASSOCIATES CONSULTING ENGINEERS LTD.

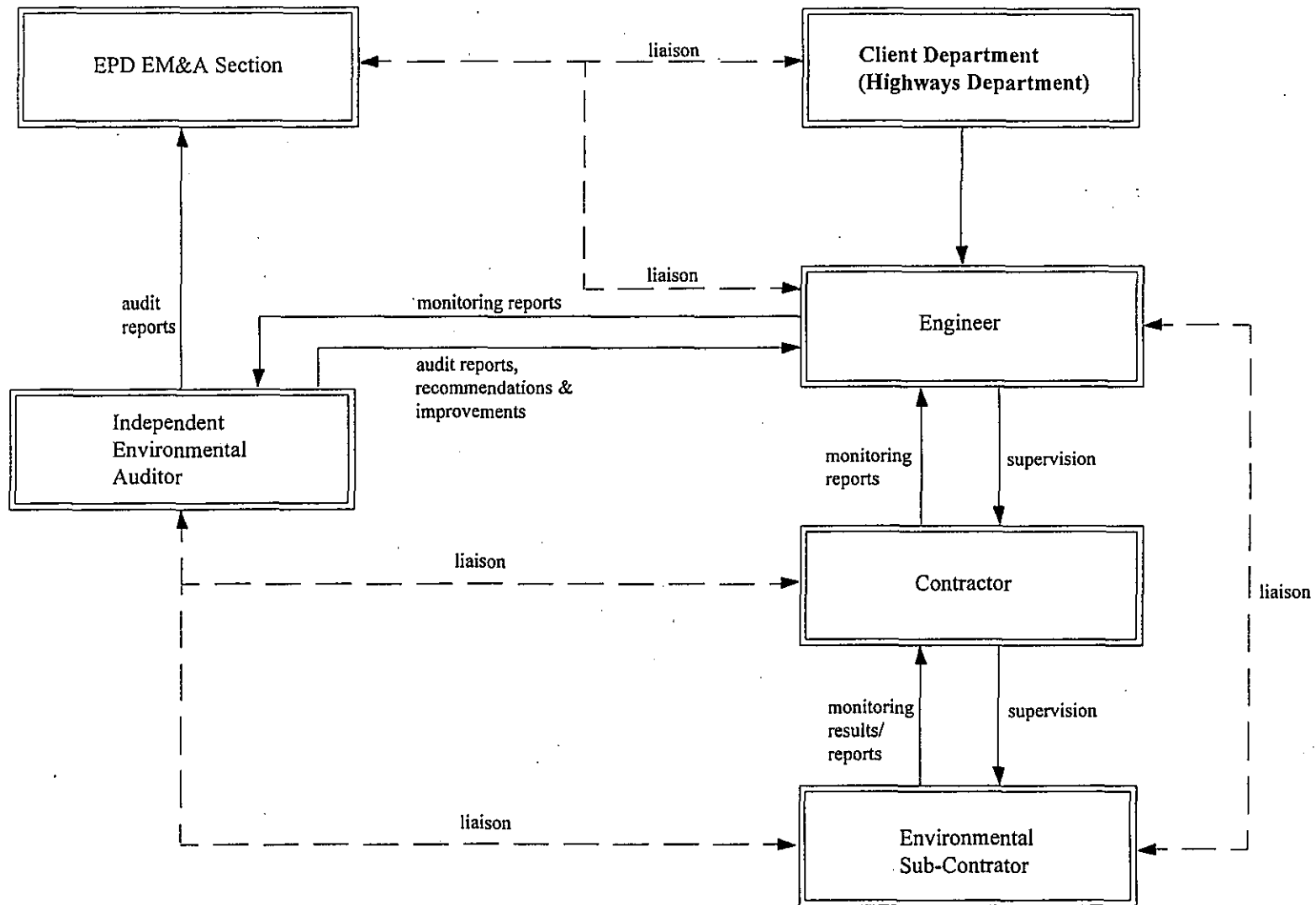
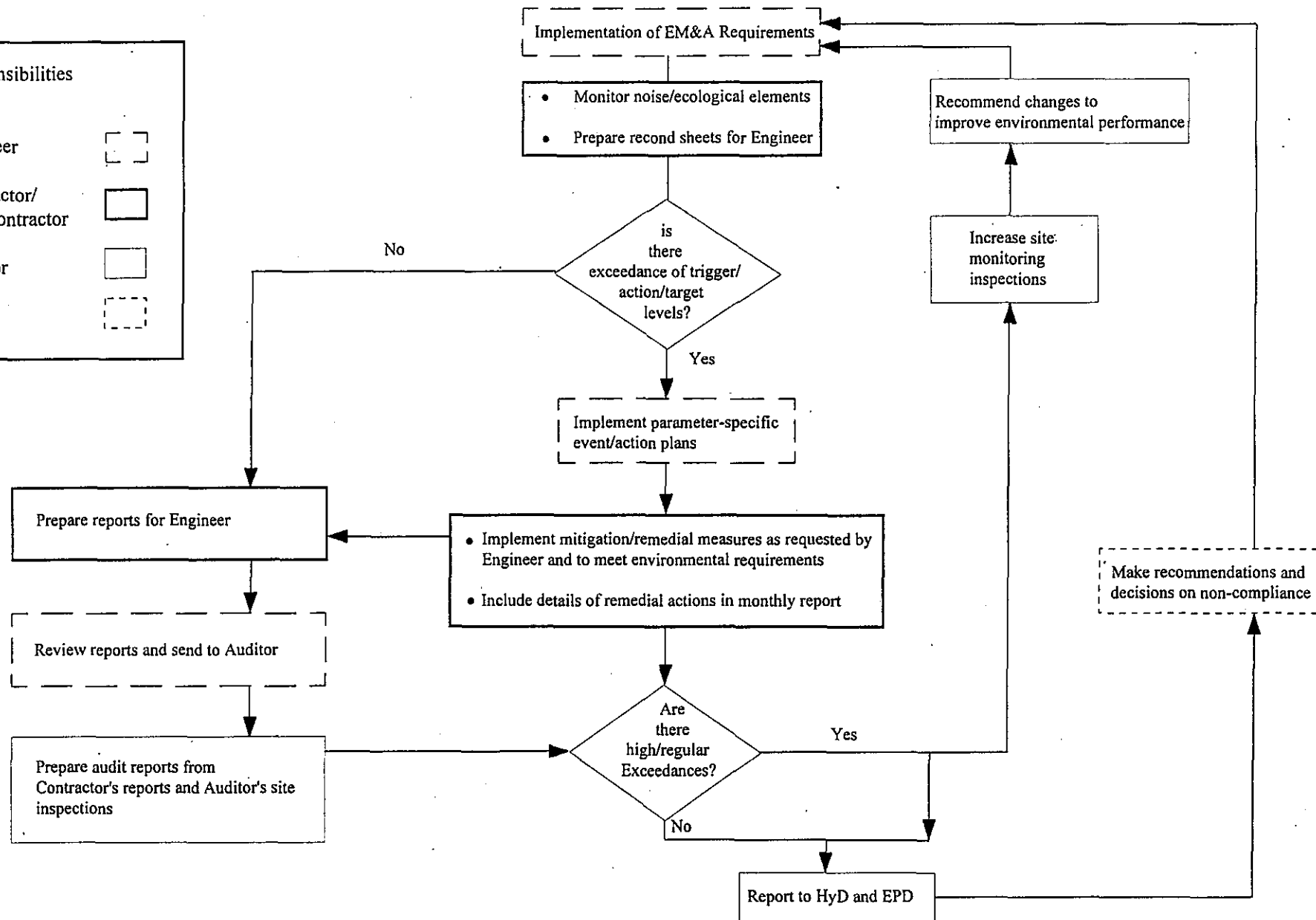


FIGURE 5

EM&A ORGANISATION AND MANAGEMENT STRUCTURE

BABTIE BMT (HONG KONG)LTD.  
HO TIN & ASSOCIATES CONSULTING ENGINEERS LTD.

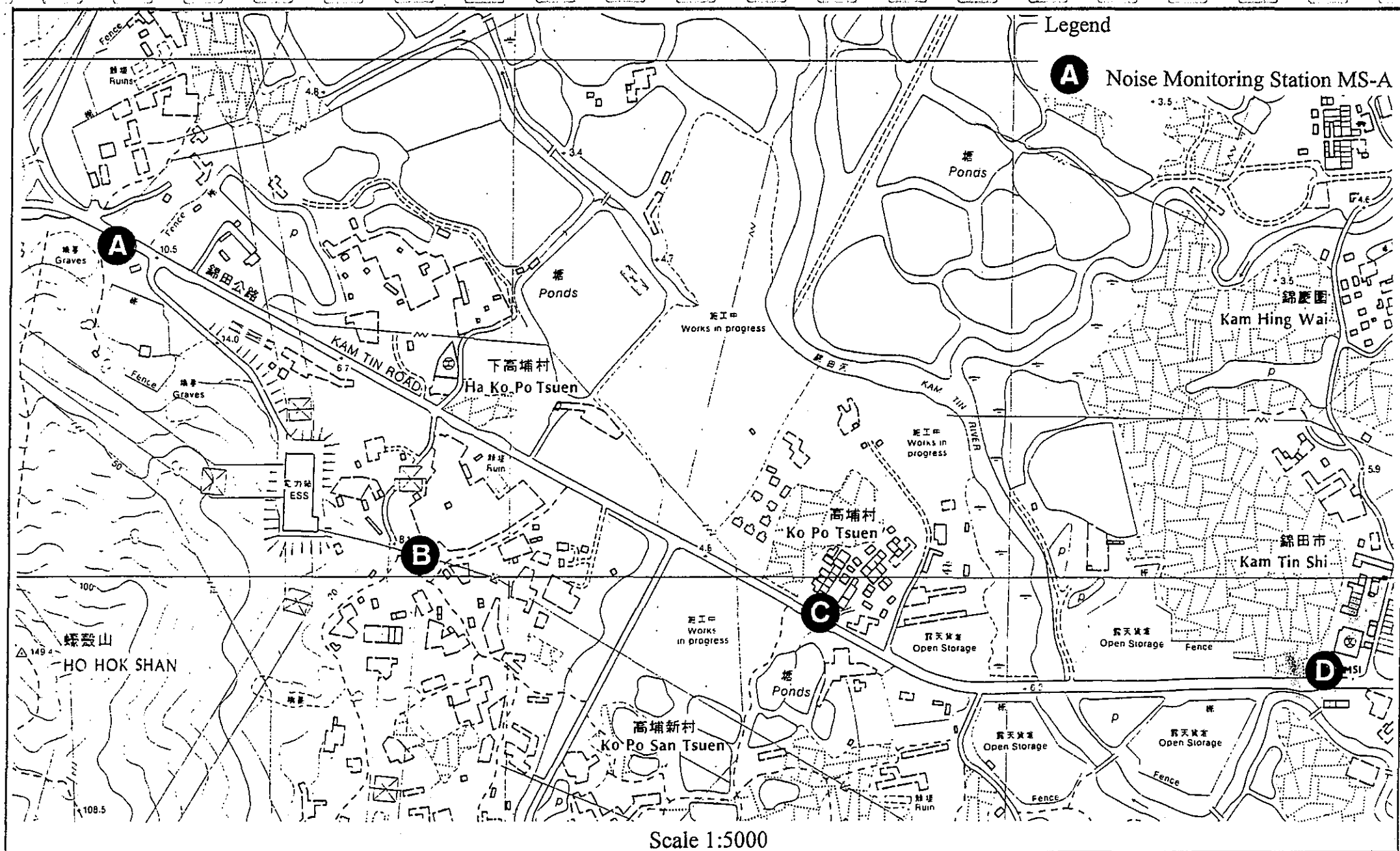
Responsibilities	
Engineer	[ ]
Contractor/ Sub-Contractor	[ ]
Auditor	[ ]
EPD	[ ]



EM&A PROCEDURES

FIGURE 6

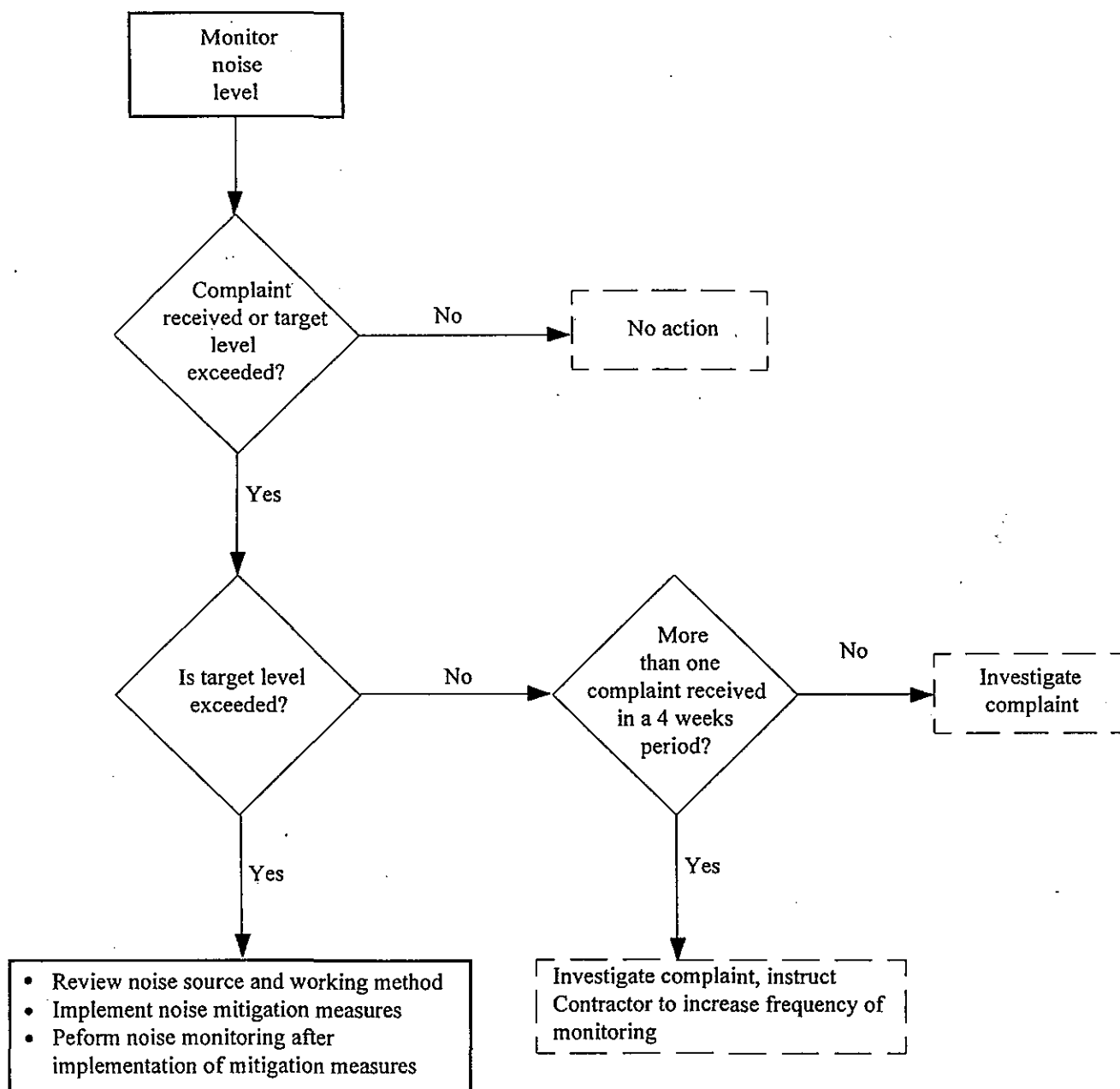
BABTIE BMT (HONG KONG) LTD.  
HO TIN & ASSOCIATES CONSULTING ENGINEERS LTD.



NOISE MONITORING STATIONS

FIGURE 7

BABTIE BMT (HONG KONG) LTD.  
HO TIN & ASSOCIATES CONSULTING ENGINEERS LTD.



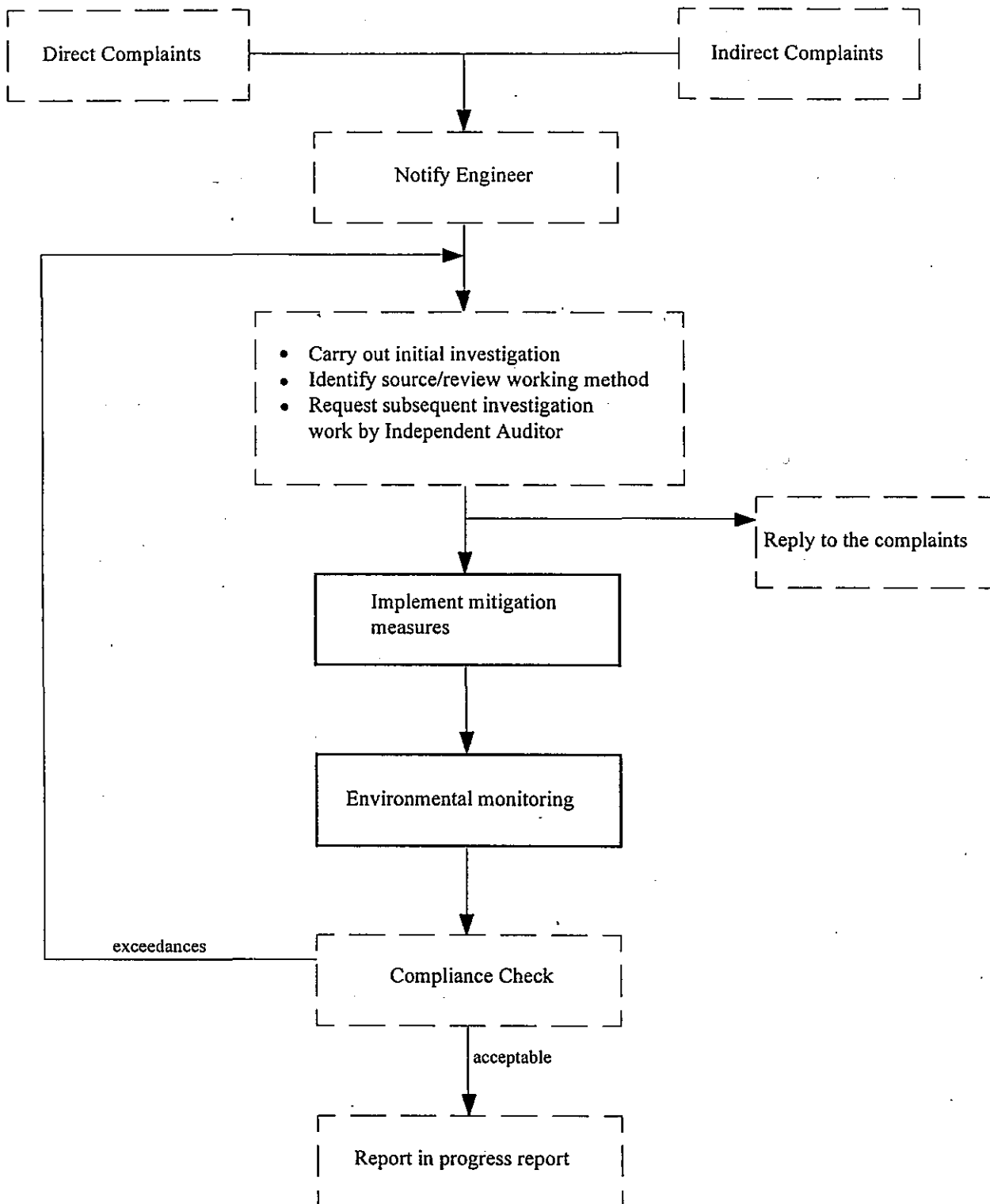
Responsibilities	
Engineer	<input type="checkbox"/>
Contrator/ Sub-Contractor	<input type="checkbox"/>

EVENT/ACTION PLAN  
FOR NOISE EXCEEDANCE

FIGURE 8

BABTIE BMT (HONG KONG)LTD.  
HO TIN & ASSOCIATES CONSULTING ENGINEERS LTD.





Responsibilities	
Engineer	<div style="border: 1px dashed black; width: 40px; height: 15px;"></div>
Contrator/ Sub-Contractor	<div style="border: 1px solid black; width: 40px; height: 15px;"></div>

**Appendix A Abstract on EAD Operation Manual**

Appendix A is an abstract on *EAD Operation Manual, Chapter 5, Environmental Monitoring & Audit of the Major Development Projects* (Appendices B and C) prepared by the Environmental Protection Department. This appendix contains the following relevant sections of the operation manual:

Appendix B Engineer's Guidelines for Implementation of EM&A Programmes

Appendix C A Selection from the EM&A Protocols

**Engineer's Guidelines for Implementation  
of Environmental Monitoring and Audit (EM&A) Programmes**

1. Prior to commencement of works the Engineer shall review the Environmental Impact Assessment study final report for the project in question and ensure that he and his environmental monitoring and audit (EM&A) team review and perform in accordance with the requirements set out in the EM&A Manual, agreed with the EPD.
2. The Engineer shall incorporate agreed pollution control contract clauses into tender and contract documents.
3. **EM&A Manual:** The Manual shall be a stand-alone document and shall be reviewed and revised as necessary during the EM&A programme. The Manual should include the following:
  - (a) project background including organisation and programme;
  - (b) purpose of the manual;
  - (c) an implementation schedule, summarizing all recommended environmental mitigation measures with reference to the programme for their implementation. The measures should include those identified at detailed design, contract preparation, construction, and operation stages of the project;
  - (d) drawings showing all environmentally sensitive receivers;
  - (e) an EM&A programme for the construction of the project including:
    - responsibility for EM&A work;
    - EM&A organisation and management structure;
    - EM&A methodology;
    - equipment to be used and calibration required;
    - locations, parameters, frequency and duration for baseline, impact and compliance monitoring;
    - environmental quality performance limits (Trigger, Action and Target levels);
    - Event-Action plans and decision audit flow charts;
    - procedures for reviewing the monitoring results;
    - compliance audit procedures and follow-up;
  - (f) implementation programme and impact prediction review procedures;
  - (g) site inspection, deficiency and action reporting procedures;
  - (h) complaint/consultation procedures, and
  - (i) baseline, monthly, quarterly and any other reporting format and procedures;

4. Prior to contract commencement, the Engineer shall establish an independent EM&A team which shall be responsible for the implementation and execution of the agreed EM&A programme. The EM&A team may form part of the resident site staff, but should be independent of the contractor for the construction phase of the project. Consideration should be given to set up an EM&A team for the post-project and operational stages, if such monitoring works are required.
5. The Engineer (his EM&A team) should acquire the stipulated environmental monitoring equipment through an appropriate means.

[Note: In many cases the Engineer would rely on the contractor responsible for the construction works to provide the monitoring equipment. This approach often has the drawback of delaying the commencement of the EM&A programme and making it very difficult to acquire sufficient background information before work begins. Therefore, as far as possible, equipment shall be ready for use about 6 weeks before contract commencement by the Proponent, the Engineer, an independent laboratory or any other means acceptable to the Proponent.]

6. The Engineer shall recover, if not already available, the baseline environmental profile of the works area through baseline monitoring as specified in the agreed EM&A Manual.
7. **Baseline Monitoring Report:** The baseline monitoring report should include at least the following:
  - (a) up to half a page executive summary;
  - (b) brief project background information;
  - (c) drawings showing locations of the baseline monitoring stations;
  - (d) monitoring results (in both hard and diskette copies) together with the following information:
    - monitoring methodology;
    - equipment used and calibration details;
    - parameters monitored;
    - monitoring locations (and depth);
    - monitoring data, time, frequency and duration;
  - (e) details on influencing factors, including:
    - major activities, if any, being carried out on the site during the period;
    - weather conditions during the period;
    - other factors which might affect the results;
  - (f) determination of the Trigger, Action and Target Levels for each monitoring parameter;

- (g) revisions for inclusion in the EM&A Manual; and
  - (h) comments and conclusions.
8. The Engineer (his EM&A team) shall carry out or supervise his laboratory or Contractor to carry out regular monitoring as stipulated in the agreed EM&A Manual, and shall audit the monitoring results. The Engineer shall also inspect the work sites regularly and initiate appropriate actions as per the agreed Event/Action Plan contained in the EM&A Manual.
9. **Compliance Audit:** Compliance audits shall be conducted in conjunction with the environmental monitoring programme as specified in the EM&A Manual. Compliance audits shall include:
- (a) inspection and validation of the monitoring procedures and results;
  - (b) organisation and presentation of the monitoring data;
  - (c) analysis and interpretation of the monitoring results to establish an environmental profile at the time of audit;
  - (d) verification that the monitoring results are in compliance with established environmental quality limits (trigger/action/target levels and/or any regulatory requirements) and documentation of any exceedances;
  - (e) on-site inspections and investigations to identify sources and causes of non-compliance and unacceptable impacts;
  - (f) Inspections to ensure the Contractor fulfils the contractual and statutory requirements, licensing conditions etc., relating to protection of environment. Such inspections may or may not involve sampling for analysis which is not covered by the regular monitoring. [Note: Should noncompliance associated with the works be proven through sampling and testing, the Contractor shall be liable for all such expenses incurred.]
  - (g) inspection to ensure that all environmental mitigation measures are properly and effectively implemented, and review the adequacy of the implemented measures;
  - (h) comparison of impact predictions with the actual impacts measured to assess the accuracy of predictions;
  - (i) assessment of the environmental management systems, practices and procedures;
  - (j) identification of remedial measures if noncompliance and improvements in management, control and operations of environmental objectives are not achieved;

- (k) identification of potential environmental problems or impacts associated with the programme works and the works method statement and identify solutions to avert or minimise these impacts;
  - (l) investigation of complaints from residents/sensitive receivers and actions taken when the complaints are received; and
  - (m) a review of the overall monitoring philosophy, in terms of procedure, location of monitoring stations, frequency, parameters measured, test methods, acceptable criteria, etc.
10. **Monthly EM&A Reports:** The results and findings of each audit should be documented in monthly EM&A reports prepared by the Engineer (his EM&A team). Monthly EM&A reports shall include at least the following:
- (\*: Where applicable, items which have already been included in the EM&A Manual need not be repeated in each monthly EM&A report unless there are substantial amendments.)
- (a) 1-2 pages executive summary;
  - (b)\* basic project information including a synopsis of the project organisation, programme and management structure, and the work undertaken during the month;
  - (c)\* a brief summary of EM&A requirements including:
    - all monitoring parameters;
    - environmental quality performance limits (Trigger, Action and Target levels);
    - Event-Action Plans;
    - environmental mitigation measures, as recommended in the project EIA study final report;
    - environmental requirements in contract documents.
  - (d) advice on the implementation status of environmental protection and pollution control [mitigation] measures, as recommended in the project EIA study report, summarised in the updated implementation schedule;
  - (e)\* drawings showing the project area, any environmental sensitive receivers and the locations of the monitoring and control stations;
  - (f) monitoring results (in both hard and diskette copies) together with the following information:
    - monitoring methodology
    - equipment used and calibration details
    - parameters monitored
    - monitoring locations (and depth)

- monitoring date, time, frequency, and duration;
  - (g) graphical plots of trends of monitored parameters over the past four reporting periods for representative monitoring stations annotated against the following:
    - major activities being carried out on site during the period;
    - weather conditions during the period; and
    - any other factors which might affect the monitoring results;
  - (h) advice on the solid and liquid waste management status;
  - (i) a summary of noncompliance (exceedances) of the environmental quality performance limits (Trigger/Action/Target levels) [see e.g. in Table 1];
  - (j) a review of the reasons for and the implications of noncompliance including review of pollution sources and working procedures;
  - (k) a description of the actions taken in the event of noncompliance and deficiency reporting and any follow-up procedures related to earlier noncompliance;
  - (l) a summary record of all complaints received (written and verbal) for each media, including the locations and nature of complaints, liaison and consultation undertaken, actions and follow-up procedures taken and summary of complaints [see e.g. in Table 2];
  - (m) a forecast of the works programme, impact predictions and monitoring schedule for the next three months; and
  - (n) comments, recommendations and conclusions for the month.
11. **Quarterly EM&A Reports:** The quarterly EM&A summary report which should generally be around 5 pages (including about 3 of text and tables and 2 of figures) should contain at least the following information:
- (a) up to half a page executive summary;
  - (b) basic project information including a synopsis of the project organisation, programme, contacts of key management, and a synopsis of work undertaken during the quarter;
  - (c) a brief summary of EM&A requirements including:
    - monitoring parameters;
    - environmental quality performance limits (Trigger, Action and Target levels); and
    - environmental mitigation measures, as recommended in the project EIA study report;

- (d) advice on the implementation status of environmental protection and pollution control [mitigation] measures, as recommended in the project EIA study report, summarised in the updated implementation schedule;
  - (e) drawings showing the project area, any environmental sensitive receivers and the locations of the monitoring and control stations;
  - (f) graphical plots of trends of monitored parameters over the past 4 months (the last month of the previous quarter and the present quarter) for representative monitoring stations annotated against the following:
    - the major activities being carried out on site during the period;
    - weather conditions during the period; and
    - any other factors which might affect the monitoring results;
  - (g) advice on the solid and liquid waste management status;
  - (h) a summary of noncompliance (exceedances) of the environmental quality performance limits (Trigger/Action/Target levels) [see e.g. in Table 1];
  - (i) a brief review of the reasons for and the implications of noncompliance including review of pollution sources and working procedures;
  - (j) a summary description of the actions taken in the event of noncompliance and any follow-up procedures related to earlier noncompliance;
  - (k) a summary record of all complaints received (written and verbal) for each media, including the locations and nature of complaints, liaison and consultation undertaken, actions and follow-up procedures taken and summary of complaints [see e.g. in Table 2];
  - (l) comments, recommendations and conclusions for the quarter; and
  - (m) proponents' contacts and any hotline telephone number for the public to make enquiries.
12. The Engineer shall liaise with respective organisations and parties in the case that complaints are received, and to investigate the complaints and initiate appropriate actions as deemed necessary.
13. The Engineer shall continue the monitoring and auditing programme to the end of the agreed period. Meanwhile, there may be a need for ad hoc liaison meetings between the Proponent, the Engineer, the EM&A team, and the EPD. There may also be a need for briefings and presentations to the Advisory Council on the Environment, District Boards and other interested parties.



Table 1 Summary of Compliance/Exceedances of Criteria Levels

Environmental Parameter	Jul 94			Aug 94			Sept 94		
	Total	Action	Target	Total	Action	Target	Total	Action	Target
Air	13	0	0	5	0	0	15	0	0
Noise	248	0	0	253	0	0	243	0	0
DO Surface	320	0	0	448	0	0	408	0	0
DO Bottom	160	0	0	224	0	0	206	0	0
Turbidity	747	105	26	702	112	33	614	83	15

Total = Number of monitoring events undertaken

Action = Number of monitoring events exceeding the Action Level

Target = Number of monitoring events exceeding the Target Level

Table 2      Summary of Complaints

Environmental Parameter	Cumulative No. Brought Forward	No. of Complaint			Cumulative No.
		Jul 94	Aug 94	Sept 94	
Air	0	0	0	0	0
Noise	3	0	0	0	3
Water	0	0	0	0	0
Waste	0	0	0	0	0
Total	3	0	0	0	3

## A Selection from the EM&A Protocols

### Box 1. Standard Air, Water and Noise Monitoring Requirements

#### (1) Introduction

- (i) The objective of the following notes is to provide guidance to staff on typical monitoring requirements for air, water and noise and respective specifications with respect to the following:

- monitoring equipment
- selection of monitoring site
- positioning of samples
- calibration requirements
- data collection
- laboratory measurement/analysis
- monitoring requirements
- Trigger/Action/Target levels

- (ii) These requirements and specifications are prepared primarily based on the needs of the EM&A programme for construction. Nevertheless, these requirements represent good practices (e.g. the equipment requirements) which may also be considered for general monitoring works.

- (iii) It should be noted that these kind of monitoring requirements and specifications should in fact come from the respective environmental consultants for various EIA studies and should form part of the EIA recommendations. In another word, these notes are to facilitate our staff in (a) guiding the consultants to draft up EIA recommendations and thus an EM&A Manual; and (b) checking if the consultants' recommendations and proposals are up to our requirements.

- (iv) Therefore, these guidance notes should be read in conjunction with relevant EIA recommendations and other environmental specifications for the particular project, which stipulate the responsibilities of various parties in relation to EM&A and environmental protection works.

- (v) These EM&A requirements and specifications are intended to be incorporated into the EM&A Manual, which is to be agreed between the project proponent and EPD.

- (vi) The project proponent should assign an environmental team and supervisor to assume the overall responsibility for the EM&A programme. It is much preferable for the project proponent to employ an environmental consultant, independent from the Engineer and particularly the Contractor for that particular contract, to carry out the EM&A programme.

- (vii) However in many cases, the project proponent would prefer to delegate his EM&A responsibility to the Engineer responsible for the tender preparation and contract management. In that case, the EM&A requirements described in these guidelines should be specified in respective consultancy agreements between the Engineer and the project proponent. The Engineer should employ an environmental team and supervisor who should not be directly involved in supervision of construction works throughout the contract period.

(2) Air Quality Monitoring

*[This section is not applicable to this Project and is thus omitted]*

(3) Water Quality Monitoring

*[This section is not applicable to this Project and is thus omitted]*

(4) Noise Monitoring

4.1 Monitoring equipment

The sound level meter shall comply with the International Electrotechnical Commission Publications 651:1979 (Type 1) and 804:1985 (Type 1) specifications, as referred to in the Technical Memoranda to the Noise Control Ordinance.

4.2 Selection of the monitoring site<sup>1</sup>

- (i) Locations of monitoring stations should be defined according to the recommendation in the EIA study, Final Report and EM&A Manual and any other locations considered necessary, in agreement with the EPD.
- (ii) The monitoring locations should be chosen based on the following criteria:
- (a) at locations close to the major site activities which are likely to have noise impacts;
  - (b) close to the sensitive receptors (N.B. For the purpose of this section, any domestic premises, hotel, hostel, temporary housing accommodation, hospital, medical clinic, educational institution, place of public worship, library, court of law, performing art centre should be considered as noise sensitive receiver);
  - (c) for monitoring locations located in the vicinity of the sensitive receptors, care should be taken to cause minimal disturbance to the inhabitant during monitoring.

4.3 Positioning of sampler

- (i) Where a measurement is to be carried out at a building, the monitoring station should normally be at a point 1 m from the exterior of the building facade but may also be at any point considered to be appropriate by EPD.

- (ii) Where a measurement is to be made of noise being received at a place other than a building, the monitoring station should be at a position 1.2 m above the ground, at a particular point considered appropriate by EPD.

(Note: <sup>1</sup> EPD should have the right to impose additional requirements or change the monitoring station, where necessary.)

#### 4.4 Calibration requirements

The sound level meter should be calibrated in accordance with the International Electrotechnical Commission Publications 651:1979 (Type 1) and 804:1985 (Type 1) specifications, as referred to in the Technical Memoranda to the Noise Control Ordinance. The measurement should be discarded if the calibrations before and after do not agree to within 1 dB(A), then repeated until the calibrations before and after agree to within 1 dB(A).

#### 4.5 Data collection

- (i) The following data should be provided in the monitoring record sheet:
- (a) measured noise level
  - (b) background noise level
- (ii) The following provides an initial guide on regular monitoring frequency for each representative receiver on a per week basis when noise generating activities are underway:
- (a) one measurement between 0700-1900 hours on normal weekdays;
  - (b) one measurement between 1900-2300 hours;
  - (c) one measurement between 2300-0700 hours of next day; and
  - (d) one measurement between 0700-1900 hours on holidays.
- (iii) The following requirements should be complied in carrying out the noise measurements:
- (a) The noise level shall be measured at 1m from the most affected external facade of the nearby noise sensitive receivers during any 30 minute period.
  - (b) During school examination periods, the noise level shall be measured at 1m from the most affected facade of the nearby schools over any 30 minute period. Liaison with the schools and the Examination Authority should be maintained (by the project proponent or his engineer) to ascertain the exact dates and times of all examination periods during the course of the contract.

#### 4.6 Laboratory measurement/analysis

No laboratory measurement/analysis is needed for noise monitoring.

#### 4.7 Monitoring requirements

##### (i) Baseline Monitoring

- (a) The baseline monitoring should be carried out prior to the commissioning of the construction work for a period of at least 2 weeks, with measurement to be taken on a daily basis.
- (b) There should not be any construction activities in the vicinity of the stations during the baseline monitoring.
- (c) Reference should be made to a set of baseline monitoring data which should have been available in the EIA study at one or more of the most representative location(s), for the concerned project.
- (d) In case no monitoring data or reliable results are available, the EPD using its knowledge of the ambient noise condition in the project area have the right to assign a new set of data to be used as the baseline reference condition.

##### (ii) Impact monitoring

For impact monitoring, the measurement frequency at least once per week should be strictly observed at all monitoring stations.

##### (iii) Compliance monitoring

In case of non-compliance with the recommended noise level, more frequent noise monitoring as specified in the Event and Action Plan should be carried out. This additional monitoring should be continued until the recorded noise levels are rectified.

Table 1 Typical Event and Action Plan for Air, Water and Noise Monitoring (During Construction)

EVENT		ACTIONS		
		ENVIRONMENTAL TEAM LEADER	ENGINEER'S REPRESENTATIVE (RE)	CONTRACTOR
TRIGGER LIMIT				
Noise	When a complaint is received	1. Notify Contractor 2. Conduct Measurement 3. Investigate noisy operations		
ACTION LIMIT				
Noise	When more than one complaint are received within 2 weeks on the same event or at the same location	1. Notify Contractor 2. Analyze investigation 3. Require Contractor to propose measures for the analyzed noise 4. Increase monitoring frequency to check mitigation effectiveness		1. Submit noise mitigation proposals to Environmental Team Leader/Engineer's Representative 2. Implement noise mitigation proposals
TARGET LIMIT				
Noise	Non-statutory - 75* dB(A) exceeded between 0700-1900 hrs on normal weekdays	1. Notify Contractor 2. Notify EPD# 3. Require contractor to implement mitigation measures increase on effectiveness		1. Implement mitigation measures 2. Prove to Environmental Team Leader/-
	Statutory - 60/65/70** dB(A) exceeded between 0700-2300 hrs on holidays and 1900-2300 hrs on all Statutory other days; 45/50/55** dB(A) exceeded between 2300-0700 hrs of the next day			

\* reduce to 70 dB(A) for schools and 55 dB(A) during school examination periods.

\*\* to be selected based on Area Sensitivity Rating.

# only applicable to projects of significant scale.

## 4.8 Trigger, Action and Target Levels

The Trigger/Action/Target levels are defined as follows:

	Trigger	Action	Target
0700-1900 hrs on normal weekdays	When a complaint is received	When more than one complaints are received within 2 weeks' time on the same event/location	75* dB(A)
0700-2300 hrs on holidays; and 1900-2300 hrs on all other days	When a complaint is received	When more than one complaints are received within 2 weeks' time on the same event/location	60/65/70** dB(A)
2300-0700 hrs of next day	When a complaint is received	When more than one complaints are received within 2 weeks' time on the same event/location	45/50/55** dB(A)

\* reduce to 70 dB(A) for schools and 65 dB(A) during school examination periods.

\*\* to be selected based on Area Sensitivity Rating.



## Appendix B Sample field Data Record Sheets

## DATA SHEET FOR NOISE MONITORING

Project No. : \_\_\_\_\_ Date of measurement : \_\_\_\_\_  
 Performed by : \_\_\_\_\_ Location : \_\_\_\_\_  
 Type of SLM : \_\_\_\_\_  
 Serial No. : \_\_\_\_\_ Weather Conditions : \_\_\_\_\_  
 Measurement Period : \_\_\_\_\_

### Calibration Record:

Type of Calibrator : \_\_\_\_\_  
 Serial No. : \_\_\_\_\_

	Noise Level (dBA)
Before	
After	

### Results:

Time	L <sub>10</sub>	L <sub>50</sub>	L <sub>90</sub>	L <sub>eq</sub>	L <sub>max</sub>	Remarks

Checked by : \_\_\_\_\_

Date : \_\_\_\_\_

## **DATA SHEET FOR NOISE MONITORING**

Project No. : \_\_\_\_\_ Date of measurement : \_\_\_\_\_  
 Performed by : \_\_\_\_\_ Location : \_\_\_\_\_  
 Type of SLM : \_\_\_\_\_  
 Serial No. : \_\_\_\_\_ Weather Conditions : \_\_\_\_\_  
 Measurement Period : \_\_\_\_\_

### **Calibration Record:**

Type of Calibrator : \_\_\_\_\_  
 Serial No. : \_\_\_\_\_

	Noise Level (dBA)
Before	
After	

### **Results:**

Time	$L_{eq}$ (5 min)	$L_{max}$	Remarks
Logarithmic Average			

Checked by : \_\_\_\_\_  
 Date : \_\_\_\_\_



