

RESTRICTED (ADMINISTRATION)

PUBLIC WORKS PROGRAMME

**ENVIRONMENTAL MONITORING AND
AUDIT MANUAL**

FOR

**HIGHWAY BETWEEN
SHAP PAT HEUNG INTERCHANGE AND
POK OI INTERCHANGE -
POK OI FLYOVER AND REMAINING WORKS**

EIA-1152/
BC

**Highways/New Territories Region
Highways Department
Hong Kong**


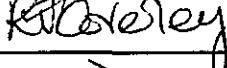
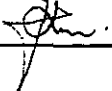
Binnie Consultants Limited

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ENVIRONMENTAL MONITORING AND AUDIT MANUAL

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1 INTRODUCTION

1.1 Purpose of the Manual

1.1.1 This Environmental Monitoring and Audit (EM&A) Manual is designated to guide the set up of an EM&A programme for the Highway between Shap Pat Heung Interchange and Pok Oi Interchange - Pok Oi Flyover and Remaining Works (the Project).

1.1.2 The purpose of this Manual is to ensure compliance with recommendations of the Environmental Impact Assessment (EIA) study, to assess the effectiveness of the recommended mitigation measures and to identify necessary additional remedial action.

1.1.3 This Manual outlines the EM&A programme for the Project works and provides systematic procedures for monitoring, auditing and minimising environmental impacts associated with the Project works.

1.1.4 Hong Kong environmental regulations for air, noise, waste and water quality, the *Hong Kong Planning Standards and Guidelines*, the *EPD Generic Environmental Monitoring and Audit Manual*, and recommendations in the EIA Report of the Project have served as environmental standards and guidelines in the preparation of this Manual.

1.1.5 This Manual contains the following:

- (a) duties of the Monitoring Team (MT)¹ with respect to the EM&A requirements during the Project;
- (b) organisation and construction programme of the Project;
- (c) project schedule and the synchronised EM&A programme to mitigate the environmental impacts;
- (d) Action and Limit levels;
- (e) event and action plans;
- (f) requirements of reviewing pollution sources and working procedures for noncompliance with the environmental criteria;
- (g) requirements of EM&A reports.

¹ Refer to Figure 1.7 and Section 1.8 of this Manual.

1.2 Background

Existing Road Network

- 1.2.1 The rapid growth of the towns in the New Territories and the closer ties with the mainland China since 1970 have given rise to a pressing need for improving roads in the New Territories. Since 1980, several trunk roads which form Routes 1 and 2 have been commissioned. Figure 1.1 shows the general layout of these trunk roads:
- (i) New Territories Circular Road (NTCR) which includes Tolo Highway between Sha Tin and Tai Po, and the trunk road from Tai Po to Au Tau via Fanling, Sheung Shui, Mai Po and Fairview Park.
 - (ii) Lok Ma Chau Border Link with its southern end connected to the NTCR near San Tin Village.
 - (iii) Tuen Mun-Yuen Long Eastern Corridor (Yuen Long Highway) from Tuen Mun to Long Tin Road in Yuen Long.
 - (iv) Yuen Long Southern Bypass (ie. part of Yuen Long Highway) which is to connect Castle Peak Road in the east at the Pok Oi Interchange to Yuen Long Eastern Corridor in the west. To date, only the section of Yuen Long Highway from its western junction with Tuen Mun Highway to the Shap Pat Heung Interchange has been completed. The Shap Pat Heung Interchange is currently connected to the Pok Oi Interchange by two district distributor roads, DR-1 and DR-2.
- 1.2.2 The commission of the completed section of Yuen Long Highway in November 1994 has enabled the trunk road traffic between Tuen Mun and San Tin Village to avoid the busy section of Castle Peak Road in Yuen Long Town. However, rapid growth of traffic volume in recent years and the rapid flow of traffic on the new highways in the North West New Territories have rendered the capacity of the old Au Tau Roundabout at the junction of Castle Peak Road and Kam Tin Road insufficient.
- 1.2.3 To ease traffic congestion along Route 2 (the NTCR and Yuen Long Highway), local widening along Castle Peak Road at approaches to the old roundabout and a temporary single lane Yuen Long-bound flyover were implemented in August 1996.

- 1.2.4 The Route 3 Country Park Section (CPS), including its links with the Pok Oi Interchange by two slip roads on the northern side of the Interchange, has been scheduled for commission in July 1998. Figure 1.2 shows the general layout of the roadworks to be constructed by the Route 3 Franchisee, Route 3 (CPS) Co. Ltd., at the Pok Oi Interchange.
- 1.2.5 Originally, the construction of the Yuen Long Highway (ie. 'the Highway') between Shap Pat Heung Interchange and Pok Oi Interchange was scheduled to start in early 1999 for completion in late 2001. However, with Route 3 CPS commissioned in mid 1998, this would mean that all the south-bound traffic heading for Yuen Long and Tuen Mun, and all the traffic along Yuen Long Highway heading for Route 3 CPS would have to pass through the existing roundabout at grade at the Pok Oi Interchange. This would inevitably lead to serious traffic congestion and major delays on the roads leading to the roundabout.²
- 1.2.6 The configuration of the Pok Oi Interchange is currently imposing a constraint to the achievement of Housing Branch's targets for housing in the Yuen Long area. This is because the approval of several major housing/residential developments in Yuen Long Town depends largely on whether the interchange is able to absorb additional traffic generated from these developments.
- 1.2.7 In view of the imminent completion of Route 3 CPS, the pressing housing demand and the projected undercapacity of the existing Pok Oi Interchange, Housing Branch, Transport Department and Highways Department have recognised the urgent need to complete part of the remaining section of Yuen Long Highway (ie. 'the Highway') between Shap Pat Heung Interchange and Pok Oi Interchange (see Figure 1.3).
- 1.2.8 The part of the programme that Housing Branch, Transport Department and Highways Department are considering advancing is the construction of a flyover over the existing roundabout at Pok Oi Interchange to provide a direct link between Route 3 CPS and the Yuen Long Highway. Implementation of the Pok Oi Flyover project is the most practicable means available to facilitate the free flow of traffic in the area.

² This is confirmed by recent traffic studies which indicate that the Design to Flow Capacity of Pok Oi Roundabout would increase to 2.37 in 2001.

1.3 Project Components

Pok Oi Flyover

- 1.3.1 The proposed works between SPH Interchange and Pok Oi Interchange - Pok Oi Flyover (Figure 1.4) include construction of a dual two-lane road linking Yuen Long Highway to Route 3 Au Tau Bypass via a dual two lane flyover at Pok Oi Interchange. In addition, two single two-lane temporary roads of about 200 m each will be constructed, connecting the trunk road to the existing district distributors of Yuen Long Highway.
- 1.3.2 The approach roads to the flyover will be formed on embankments, which includes the span of the flyover. These 550 m of road embankments are located inside the embankments of the district distributor roads formed under the Yuen Long Southern Bypass project and the Route 3 CPS project.
- 1.3.3 The flyover is to be formed on a piled foundation. Two alternative structures have been proposed: an asymmetric design using 37-37-37 m spans (total span 111 m) and a symmetrical design using 40-49-40 m spans (total span 129 m). The option to be adopted will be required to obtain approval by ACABAS.
- 1.3.4 Like the rest of Route 3 CPS and Yuen Long Highway, the flyover will be designed to accommodate a free flow of traffic with minimum braking and acceleration and for no stopping, except under emergency conditions.
- 1.3.5 Noise barriers will be installed on the embankment and flyover sections to protect local noise sensitive receivers.
- 1.3.6 The works also include the installation of all associated drainage, street lighting, traffic aids, landscaping and utilities.

Remaining Works

- 1.3.7 The Remaining Works involve the construction of the remaining approximately 1,100 metres of trunk road between the Pok Oi Flyover and SPH Interchange. This will include the construction of:
 - (a) two two-lane bridges of around 30 metres length at the SPH Interchange;
 - (b) a 25 metres long by 11 metres wide combined vehicular/pedestrian underpass at Sheung Yau Tin Tsuen;
 - (c) a 55 metres long by 4 metres wide pedestrian underpass at Tai Kei Leng;

- (d) a 35 metres long by 4 metres wide pedestrian underpass at Sheung Yau Tin Tsuen.

The layout of the Remaining Works is shown in Figure 1.4.

- 1.3.8 Most of the trunk road will be formed on embankments with a final level far lower than the existing distributor roads. The bridges at SPH Interchange will be some 6 metres lower than the existing roads RA1 and A1 and probably be formed on a piled foundation. Like the Pok Oi Flyover embankments, the location of the road embankment of the Remaining Works is bounded by the district distributors constructed under the Yuen Long Southern Bypass Contract.
- 1.3.9 All the proposed underpasses will be connected to underpasses underneath the existing district distributors. For efficient maintenance and for aesthetic reasons, the construction of the proposed underpasses will be similar to the existing structures. Depending on the underlying geology, either driven friction piles or raft footings will be used to form the foundations of the underpasses.
- 1.3.10 The works will also involve the removal of the two existing temporary roads between the Pok Oi Flyover and the district distributors, including the reversion of the two temporary road junctions, so as to enable the district distributors to resume their function solely as district distributors.
- 1.3.11 The works also include the installation of all associated drainage, street lighting, traffic aids, landscaping, utilities and the erection of noise barriers, if required.
- 1.3.12 The design of the Remaining Works was basically completed together with the Yuen Long Southern Bypass in 1990.

1.4 Concurrent Projects

- 1.4.1 The construction of Route 3 (Country Park Section) is scheduled for completion in July 1998. It has potential impacts on noise levels, construction dust levels and water quality (particularly suspended solids levels) in the Project area during implementation of the Project.
- 1.4.2 Yuen Long South Areas 12 and 14 are scheduled for substantial redevelopment. Planned facilities include a District Games Complex in Area 12³ and a wholesale market in the G/IC area adjacent to the Pok Oi Interchange.

³ Memo DRS to PM/NTN ref. (3) in RSD 9/HQ712/84(9) II dated 16 December 1996.

- 1.4.3 Town Planning Board (TPB) has approved a planning application for the Comprehensive Development Area (CDA) in Area 12. This development comprises commercial elements on a podium and 12 residential towers ranging from 24 to 36 storeys above the podium. Car parking is provided at ground level and two basement floors. The domestic and non-domestic Gross Floor Areas (GFA) are 175,790 sq.m and 40,000 sq.m respectively. 2,934 flats will be provided to accommodate 6,703 persons.
- 1.4.4 TPB has approved a Section 16 application for a proposed residential development at Yuen Long CDA 15. The proposed development consist of twelve 24-32 storey residential blocks to be constructed on a 15 m high podium above commercial facilities.
- 1.4.5 TPB has also approved a Section 16 application for a comprehensive residential development adjacent to Pok Oi Hospital. The development involves three 12-15 storey residential blocks containing a total of 95 flats for accommodation of 238 persons.
- 1.4.6 Environmental and engineering studies are currently underway for PWP 27CG - Yuen Long South Eastern Extension - Site Formation, Roads and Drainage works which covers works in Area 14. The site formation and infrastructure works are currently scheduled for construction between July 2000 and July 2004.
- 1.4.7 A number of properties south of the Yuen Long Highway will be resumed prior to the implementation of PWP Item No. 70CD - Yuen Long Bypass Floodway, which is scheduled for construction between March 2001 and March 2004. The floodway will act as a buffer between development to the south of floodway and traffic on the Yuen Long Highway.
- 1.4.8 The sensitive receivers for the operational phase of the Project are expected to be significantly different in terms of location and numbers from the sensitive receivers for the construction phase.
- 1.4.9 It is recommended that as an early task in the Detailed Design stage for the Pok Oi Flyover, the status of existing and proposed NSRs in the Study Area is reviewed: the design and installation of the temporary noise barriers detailed in the EIA Report can then, in consultation with EPD, be re-evaluated if necessary.

1.5 Construction Programme

1.5.1 This programme is for information of the Environmental Manager⁴ (EM) to get an initial idea of the projection of the works. The EM shall make reference to the actual works progress and programme during the construction stage to schedule the EM&A works, and the Contractor shall provide the respective information to the EM for formulating the EM&A schedule.

1.5.2 Figures 1.5 and 1.6 are the tentative works programme for the Project. The construction is expected to last for fourteen months from May 1997 to July 1998 and the Remaining Works are planned to be implemented during December 1996 to early 2002.

1.6 Environmental Impact Assessment (EIA)

Sensitive Receivers

1.6.1 The location of air and noise sensitive receivers which will be potentially affected by the construction and operation of the Project is indicated in Figures 2.1 and 3.1. All the proposed works lie within the existing Yuen Long Highway and Route 3 CPS road reserves.

1.6.2 Current sensitive receivers include: the Pok Oi Hospital; the villages of Yeung Uk Tsuen, Chuk San Tsuen, Kong Tau San Tsuen and Tai Kei Leng east of Yuen Long Highway; a number of dwellings near Ha Yau Tin Tsuen, Sheung Yau Tin Tsuen and Tai Kei Leng west of Yuen Long Highway; the Small Traders New Village, Wong Uk Tsuen and Tai Wai to the north of Castle Peak Road.

1.6.3 Future sensitive receivers include: the residential areas, schools and other developments planned for Areas 12, 14 and 15, Yuen Long and also the residential developments at Au Tau adjacent to Pok Oi Hospital.

Requirements of EIA

1.6.4 The requirements of the EIA Study for the Project are contained in Section 4.1 of the Environmental Impact Assessment (EIA) Study Brief of the Project. They are summarised below:

- (a) to carry out the necessary background studies to identify, collect and analyse existing information relevant to the EIA study;

⁴ Refer to Figure 1.7 and Section 1.8 of this Manual.

- (b) to carry out any necessary environmental survey, site investigations and baseline monitoring work to supplement background studies;
- (c) using predictive techniques such as mathematic modelling to quantify residual and cumulative environmental impacts arising from the Project works and to specify whether they are transient, long term or irreversible;
- (d) to propose short and long term mitigation measures to minimise any significant environmental impacts; and
- (e) to outline an EM&A programme to implement recommendations of the EIA Study.

Scope of the EIA

- 1.6.5 The EIA Study includes detailed investigation on construction and operational impacts of all possible key issues, namely: noise, air quality, construction site runoff, ecology and waste management.
- 1.6.6 Background studies on all possible key issues have been undertaken. Where necessary, environmental surveys, site investigations and baseline study have been carried out.
- 1.6.7 Sensitive receivers have been identified and potential short and long term impacts of the Project on sensitive receivers have been quantified using mathematical models where appropriate.
- 1.6.8 Assessment of the environmental impacts has been undertaken according to the *Hong Kong Planning Standards and Guidelines* and other statutory requirements.
- 1.6.9 Mitigation measures to reduce adverse impacts to acceptable levels have been proposed with consideration of practicality of enforcement, cost-effectiveness and compliance with environmental standards.
- 1.6.10 An EM&A programme has been set up to implement recommendations of the EIA.

Summary of Recommendations of the EIA

- 1.6.11 The EIA Report has concluded that the Project can be implemented with a minimum of impacts on the environment to the ultimate benefit of current and future residents in the Project area, provided recommendations of the EIA Report are carried out.

- 1.6.12 Construction dust has been identified as one of the major environmental concerns of the Project. EM&A for construction dust shall be undertaken at the most critical Air Sensitive Receivers (ASRs) during the whole construction period. Detailed requirements and systematic procedures for the EM&A are described in Section 2 of this Manual. Emission of other pollutants is concluded insignificant in air quality of the construction and operation period of the Project. No mitigation and EM&A will be required for vehicle emissions.
- 1.6.13 Noise has been identified as one of the major environmental concerns of the Project. EM&A for construction noise shall be undertaken at the most critical Noise Sensitive Receivers (NSRs) during the whole construction period. Detailed requirements and systematic procedures for the EM&A are described in Section 3 of this Manual. Operation noise will comply with the NCOs if mitigation measures recommended in the EIA are implemented and hence no EM&A will be required during the operation period of the Project.
- 1.6.14 Construction site runoff may cause adverse environmental impacts if not properly controlled. EM&A for construction site runoff shall be undertaken at all discharge points where construction site runoff enters the surface drainage system during the whole construction period. Detailed requirements and systematic procedures for the EM&A are described in Section 4 of this Manual. No EM&A will be required during the operation period of the Project.
- 1.6.15 Construction waste shall be controlled through implementation of the waste management system. Detailed requirements for the waste management are described in Section 5 of this Manual.
- 1.6.16 The EIA Report has also concluded that the construction works associated with the Pok Oi Flyover and Remaining Works will have little ecological impact. No mitigation and EM&A will be required for ecology during both the construction and operation of the Project works.

1.7 Environmental Monitoring and Audit Requirements

- 1.7.1 Monitoring can be defined as the systematic collection of data through a series of repetitive measurements.

- 1.7.2 Baseline monitoring refers to the measurement of environmental parameters during a representative period prior to the commencement of the Project works. The purpose of baseline monitoring is to examine the nature and range of "ambient" conditions. The baseline monitoring data are used to review and determine the standards (e.g. Action and Limit Levels)⁵ with which the impact monitoring results are compared.
- 1.7.3 For this Project, impact monitoring refers to the measurement of environmental parameters during the Project works and the identification of any changes in these parameters which may be attributed to the Project works so that proactive mitigation measures can be adopted to avoid the occurrence of adverse environmental impacts.
- 1.7.4 Environmental audit is intended to check methodically whether the activities of the Project comply with environmental requirements previously defined in the EIA. It also examines whether the necessary measures have been implemented to remedy any unacceptable environmental impacts. Environmental audit is a check to reassure management and regulatory agencies that the Project is constructed in an environmentally acceptable manner. It also enables a post project analysis to be carried out to examine the accuracy of the original environmental impact assessment. Environmental audit is an important tool to maintain and improve environmental performance of the Project.
- 1.7.5 The EM&A Programme consists of a schedule of monitoring and auditing of designated environmental parameters of the area under the influence of the Project works in order to:
- (a) where applicable, provide a baseline database of "ambient", or pre-Project conditions;
 - (b) follow up the recommendations of the EIA and the timely implementation of the identified mitigation measures;
 - (c) ensure that the contracts, licences, working method statements, works programmes and detailed design of the Project incorporate the recommendations of the EIA;
 - (d) monitor and interpret conditions with respect to acceptance criteria during construction in order to provide an early indication of noncompliance with the required environmental standards;

⁵ Refer to the following paragraph 1.8.5 (i).

- (e) identify additional remedial measures to be undertaken where unanticipated impacts arise;
- (f) provide data to determine the effectiveness of mitigation or control measures which are implemented through changes in working practice for exceedances of acceptance criteria;
- (g) provide a database of conditions during and prior to the construction period for the assessment of the extended effects of construction and for the post-Project audit;
- (h) assess compliance with contractual or legislative environmental standards;
- (i) assess the validity of the Action and Limit levels set for the event/action plans:

Action Levels - levels beyond which there is an indication of a deteriorating ambient environment for which a typical response would be more frequent monitoring. Appropriate remedial actions may be necessary to prevent exceedance of the Limit Level which would be unacceptable;

Limit Levels - statutory limits stipulated in the relevant pollution control ordinances, *Hong Kong Planning Standards and Guidelines* or Environmental quality Objectives established by EPD.

- (j) ensure that only acceptable environmental impact impinges upon nearby sensitive uses and receivers with the aim of minimising adverse impact upon the surrounding environs.

1.7.6 Air, noise and construction site runoff monitoring programmes shall be set up prior to the commencement of the construction works. Necessary baseline monitoring shall be undertaken before earth works begin. It has been recommended that a programme of monitoring and audit of construction noise, construction dust and site runoff is undertaken throughout the construction period.

1.8 Project Organisation and Identification of Key Responsibilities

- 1.8.1 A Project organisation and lines of authority for the EM&A programme is presented on Figure 1.7. In this Manual, **the Engineer** refers to the Engineer as defined in the Contract and the Engineer's Representative (ER) in cases the Engineer's powers have been delegated to the ER in accordance with the Contract. The **EM** who is responsible for and in charge of the Environmental Team (ET) refers to the person delegated the role of executing the EM&A.
- 1.8.2 The Engineer shall be responsible for engaging an Environmental Team(s) (ET) and appointing an Environmental Manager (EM) from within the resident site staff. The EM shall not be in any way an associated body of the Contractor. The EM shall have relevant professional qualifications, or have sufficient relevant EM&A experience subject to approval of the ER and the EPD.
- 1.8.3 Appropriate staff shall be included in the MT to fulfil the EM&A duties specified in this manual.
- 1.8.4 The Engineer shall be responsible for:
- (a) ensuring that the EM&A programme is fully implemented in accordance with the requirements set out in the EIA Report and this Manual;
 - (b) ensuring that the Contractor is implementing environmental controls and mitigation as set out in the EIA Report and this Manual as well as any additional measures necessary for compliance with the environmental control standards;
 - (c) ensuring that the Contractor is implementing and enforcing event/action plans when exceedances of Action and Limit levels occur;
 - (d) reviewing the monitoring and audit reports submitted by the EM;
 - (e) implementing a 'stop work' action if repeated exceedance of target levels justifies this action.
- 1.8.5 The ER(s) have a key role to play with the EM&A programme, undertaking:
- (a) an engineering audit of environmental reports;
 - (b) site liaison;

- (c) implementing and enforcing event/action plans under the Contract when exceedances of Action Limit levels occur; and
- (d) ensuring that construction waste is controlled properly as stated in the Waste Management Section.

1.8.6 The EM shall be responsible for:

- (a) reviewing the EIA and the detailed designs to ensure EIA recommendations and any other measures identified during the reviews are incorporated into the designs;
- (b) ensuring that the contracts, licences and detailed designs of the Project incorporate the measures recommended in the EIA;
- (c) checking that timely implementation of mitigation measures identified in the EIA occurs;
- (d) examining Contractors' rolling works programmes, method statements, licence application and other relevant documentation so as to ensure the best practice would be implemented to generate no unacceptable impacts to the established guidelines/standards;
- (e) identifying any potential unanticipated impacts;
- (f) formulating any necessary remedial measures to be actioned for potential impacts;
- (g) liaising with the Engineer(s), and Contractors on environmental considerations both regularly and as necessary;
- (h) undertaking site visits both regularly and on ad hoc basis at a frequency appropriate to the intensity of the Project works. During the site inspections and the document review as stated in Section 6 of this manual, the EM shall pay special attention to the issues relating to waste management to check whether the Contractor has followed the relevant specifications and the procedures specified under the law of Hong Kong;
- (i) supervising the MT;
- (j) reviewing the monitoring data taking into account any factors which may influence this data;

- (k) interpreting the baseline and monitoring data with reference to Action and Limit levels;
- (l) ascertaining whether any extraneous activities unrelated to the construction work on the site may have influenced the data. Factors such as nearby construction works should be considered;
- (m) implementing event/action plans when exceedances of Action Limit levels occur;
- (o) liaising and consulting with all relevant parties during the implementation of event/action plans;
- (p) reviewing the EM&A programme after the collection and analysis of the baseline data and maintaining the EM&A programme in terms of parameters sites, sample sizes, frequency etc.;
- (q) improving the EM&A programme throughout the period of the Project works;
- (r) producing and circulating reports:
 - on a regular monthly basis;
 - when action plans are implemented;
 - when responding to environmental complaints; and
- (s) implementing and maintaining the complaints procedures.

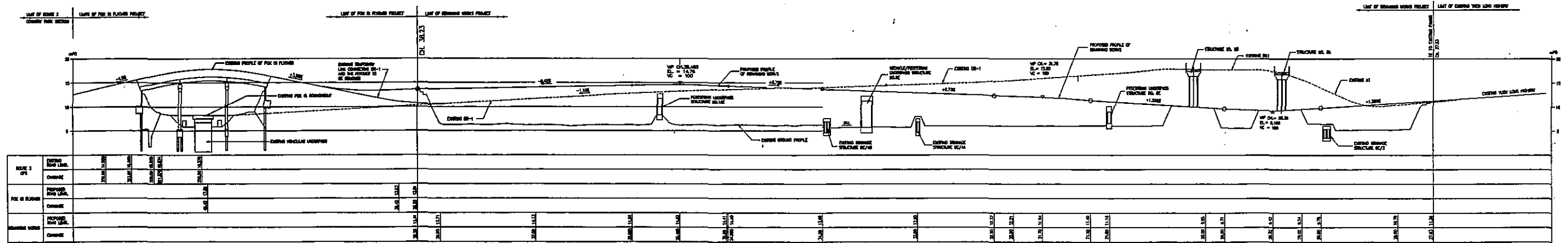
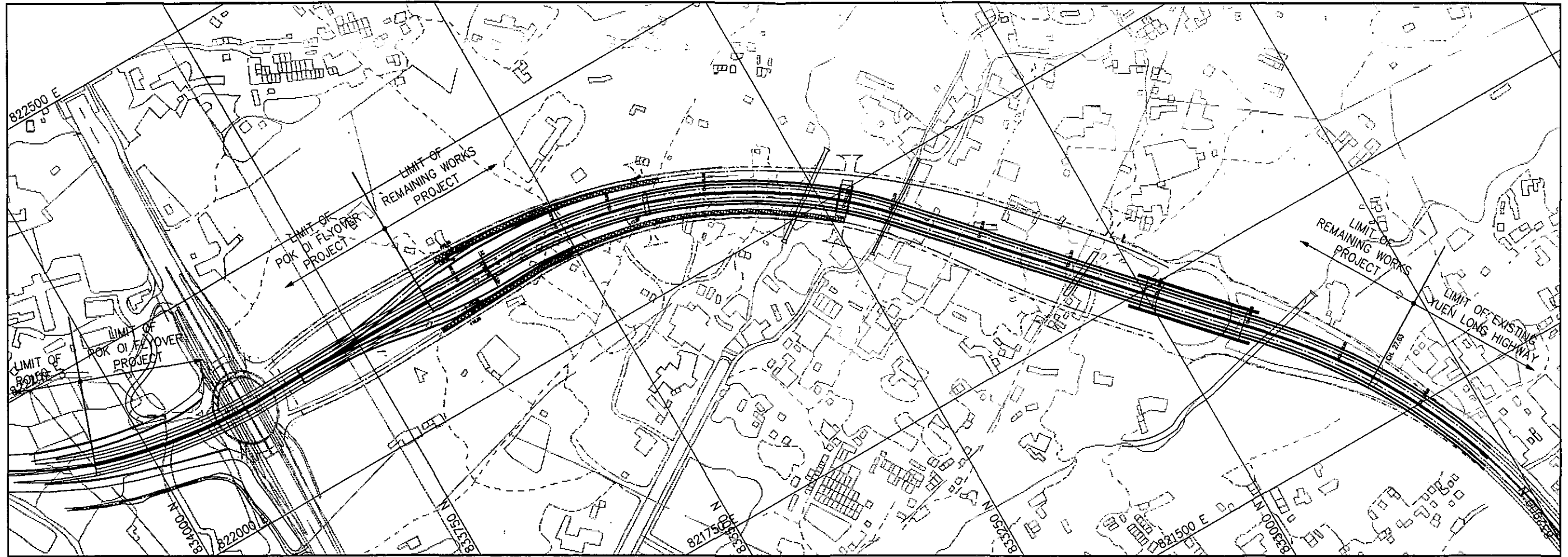
1.8.7 The Contractor(s) shall be responsible for:

- (a) implementing environmental controls and mitigation as set out in the EIA Report and this Manual as well as any additional measures necessary for compliance with the environmental control standards;
- (b) following any reasonable directions given by the Engineer or the Engineer Representative ER(s) particularly as the result of the implementation of event/action plans;
- (c) complying with all Ordinances, bye-laws, regulations and rules for the time being in force in Hong Kong governing the control of any form of pollution, including air, noise, water and waste pollution;

- (d) carrying out all works in such a manner as to cause little impacts as possible to environs and the Contractor shall be held responsible for any claims which may arise from such impacts.

1.8.8 The MT shall be responsible for:

- (a) collecting all the necessary data for the air and noise following the procedures outlined in this Manual;
- (b) recording activities at the site before or during the sampling period;
- (c) relevant information recording such as weather conditions at the time of sampling and data acquisition;
- (d) undertaking regular maintenance and calibration of equipment to ensure precision of the data acquired;
- (e) reporting to the EM any abnormality in monitoring process and any difficulties encountered; and
- (f) ensuring that monitoring results are reported timely to EM.



PROFILE
NO. 11-97

Contract Title :
HIGHWAY BETWEEN SHAP PAT
HEUNG INTERCHANGE AND POK OI
INTERCHANGE - POK OI FLYOVER
AND REMAINING WORKS


Title :

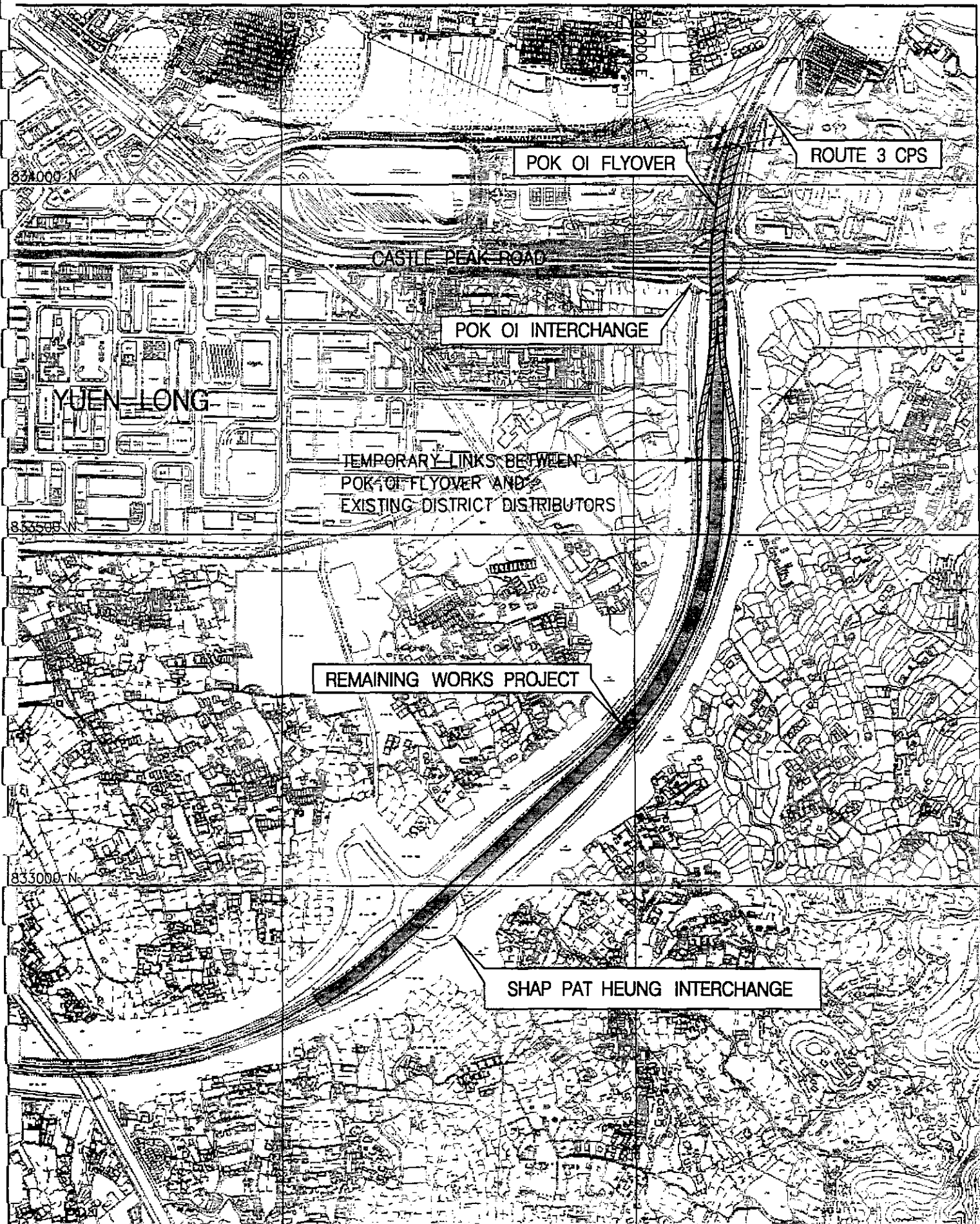
EM & A
PLAN AND PROFILES

BINNIE CONSULTANTS LIMITED
賓尼工程顧問有限公司
ENGINEERS AND SCIENTISTS

Figure No. 1.4	Revision 0
Reference	File Name 00320088.B04
Prepared	Checked
Date APR. 97	Scale N.T.S.



Figure No	1-1
Scale	N.T.S.
DATE	11/86
Contract title :	HIGHWAY BETWEEN SHAP HENG INTERCHANGE AND POK OI INTERCHANGE - POK OI FLYOVER
EM&A	
Drawing title :	MAJOR TRUNK ROADS IN THE NORTH WEST NEW TERRITORIES
 HKS CONSULTANTS LIMITED 賀尼 軒尼士工程顧問有限公司 HKS CONSULTING ENGINEERS	



Contract Title :
 HIGHWAY BETWEEN SHAP PAT
 HEUNG INTERCHANGE AND POK OI
 INTERCHANGE - POK OI FLYOVER
 AND REMAINING WORKS

Title :

EM & A
 EXTENT OF THE POK OI FLYOVER
 AND REMAINING WORKS PROJECT

Figure No. 1.3	Revision 0
Reference	File Name 00310088.B04
Prepared	Checked FNW
Date APR. 97	Scale N.T.S.

Client
Contact person:-----

Organisation:-----

Phone no:-----
Fax no:-----

Engineer	
Contact person:-----	

Organisation:-----	

Phone no:-----	
Fax no:-----	
Environmental Manager	Engineer's Representative(s)
Contact person:-----	Contact person:-----
-----	-----
Organisation:-----	Organisation:-----
-----	-----
Phone no:-----	Phone no:-----
Fax no:-----	Fax no:-----

Monitoring Team
Contact person:-----

Organisation:-----

Phone no:-----
Fax no:-----

Contractor(s)
Contact person:-----

Organisation:-----

Phone no:-----
Fax no:-----

Contract Title :
**HIGHWAY BETWEEN SHAP PAT
 HEUNG INTERCHANGE AND POK OI
 INTERCHANGE - POK OI FLYOVER
 AND REMAINING WORKS**

BINNIE CONSULTANTS LIMITED 賓尼
賓尼工程顧問有限公司
 ENGINEERS AND SCIENTISTS

Title : **EM&A**

**LINES OF AUTHORITY FOR
 EM & A PROGRAMME**

Figure No. 1.7	Revision
Reference	File Name
Prepared	Checked
Date APR. 97	Scale N.T.S.

2 AIR QUALITY

2.1 Requirements for the EM&A

2.1.1 The EIA Report has concluded that the construction dust is one of the major environmental concerns of the Project.

2.1.2 A total of 34 air sensitive receivers (ASRs) have been identified during the EIA study. Details of the ASRs are described in Table 2.1 whilst location of the ASRs is illustrated in Figure 2.1.

Table 2.1
Air Sensitive Receivers (ASRs) of the Project

ASRs	Description	mPD	No. of Storeys
ASR1	Village house at Yeung Uk Tsuen, Shap Pat Heung	4.6	1
ASR2	Village house at Yeung Uk Tsuen, Shap Pat Heung	6.8	2
ASR3	Village house between Yeung Uk Tsuen and Chuk San Tsuen, Shap Pat Heung	5.6	1
ASR4	Village house between Yeung Uk Tsuen and Chuk San Tsuen, Shap Pat Heung	6.8	2
ASR5	Village house between Yeung Uk Tsuen and Chuk San Tsuen, Shap Pat Heung, 2 storey building	6.8	1
ASR6	Village house at Ha Yau Tin Tsuen	5.2	3
ASR7	Home for the Aged at Pok Oi Hospital	5.5	6
ASR8	Proposed residential block 1 at CDA Area 15	5.5	24
ASR9	Proposed residential block 2 at CDA Area 15	5.5	24
ASR10	Proposed residential block 3 at CDA Area 15	5.5	24
ASR11	Proposed residential block 4 at CDA Area 15	5.5	24
ASR12	Proposed residential block 5 at CDA Area 12	5.0	23
ASR13	Proposed residential block 6 at CDA Area 12	5.0	23
ASR14	Village house at Small Traders Village	4.1	2
ASR15	Village house at Wong Uk Tsuen	4.1	3
ASR16	Village house at Small Traders Village	4.1	2
ASR17	Village house at Wong Uk Tsuen	4.1	3
ASR18	Village house at Chuk San Tsuen	6.8	2
ASR19	Village house at Chuk San Tsuen	6.8	2
ASR20	Village house at Chuk San Tsuen	6.8	1
ASR21	Village house at Chuk San Tsuen	7.9	1
ASR22	Village house at Kong Tau San Tsuen	7.3	3
ASR23	Village house at Kong Tau San Tsuen	8.0	3
ASR24	Village house at Tai Kei Leng	7.0	1
ASR25	Village house at Tai Kei Leng	7.0	1
ASR26	Village house at Tai Kei Leng	8.0	2

Table 2.1
Air Sensitive Receivers (ASRs) of the Project (cont'd)

ASRs	Description	mPD	No. of Storeys
ASR27	Village house at Ha Yau Tin Tsuen	6.0	2
ASR28	Village house at Ha Yau Tin Tsuen	6.0	1
ASR29	Village house at Tai Kei Leng	6.8	3
ASR30	Village house at Tai Kei Leng	5.0	3
ASR31	Village house at Tai Kei Leng	7.0	2
ASR32	Village house at Kong Tau San Tsuen	7.5	3
ASR33	Future residential building	5.0	12
ASR34	Future residential building	5.0	12

- 2.1.3 The EIA Report has also concluded that the air quality impacts arising from the Project works will mainly be from construction dust. The emissions from vehicles and plant used for the Project works will be within the AQOs limits and no EM&A and mitigation measures are required.
- 2.1.4 Table 2.2 shows the maximum 1-hr and 24-hr average TSP and RSP at selected ASRs with and without mitigation. It is obvious that without adequate mitigation measures, dust levels at ASRs during construction periods will most likely exceed the standards set out in the Air Quality Objectives. The transport of material by trucks travelling along haul roads will be the principal source of the excessive construction dust. Other sources include loading and unloading of construction materials, removal of topsoil and wind erosion of exposed areas.
- 2.1.5 Mitigation measures have been recommended to reduce the construction dust to an acceptable level. They are detailed in Section 2.8 of this section.
- 2.1.6 Air quality impacts during operation period have been estimated to be negligible. No mitigation and EM&A for air quality is required during the operation period.

Table 2.2
Predicted Maximum Hourly and Daily Particulate Concentrations ($\mu\text{g}/\text{m}^3$)*

ASR	Without Mitigation			With 95% Reduction of Dust Emission from Haul Roads		
	TSP		RSP	TSP		RSP
	Hourly	Daily	Daily	Hourly	Daily	Daily
1	3942	764	366	341	181	104
2	4944	995	470	391	193	109
5	4377	1058	499	363	196	111
6	2410	1106	520	267	198	112
7	1802	443	222	234	165	97
9	561	278	148	171	157	93
13	523	273	145	169	156	93
18	4380	1368	638	362	211	117
21	3564	1054	497	322	195	110
25	4324	1026	484	368	194	110
28	2424	1149	539	264	200	112
30	2612	953	451	274	191	108
34	523	266	142	169	156	93

* Background dust concentrations have been included.

2.2 Air Quality Parameters

2.2.1 Total Suspended Particulates (TSP) levels within the Project areas shall be monitored and audited by the MT to ensure that any deteriorating air quality can be timely detected and the situation can be timely rectified.

2.2.2 24-hour TSP levels shall be measured using the High Volume Sampler and method set out in the Title 40 of the Code of Federal Regulations, Chapter 1 (Part 50), Appendix B.

2.2.3 All relevant information including wind speed and wind direction, reading of the elapsed-time meter indicating the start and stop of the sampler, identification and weight of the filter paper, and other special phenomena and works occurred in the monitoring area shall be recorded in detail on the Data Sheet for TSP Monitoring (Figure 2.3).

2.3 Monitoring Equipment

2.3.1 Sufficient number of monitoring equipment with an appropriate calibration kit shall be available for carrying out the baseline monitoring, regular impact monitoring and ad hoc monitoring. All the equipment, calibration kit, filter papers, etc. shall be clearly labelled and properly maintained.

2.3.2 Initial calibration of dust monitoring equipment shall be conducted upon installation and thereafter once every two months. The standard used for calibration shall be traceable to the internationally recognised primary standard and be calibrated annually. The calibration data shall be properly documented for future reference. All the data should be converted into standard temperature and pressure condition.

2.3.3 The flow-rates of the sampler with the filter in position shall be determined and recorded before and after sampling. They shall be constant when used for the dust monitoring.

2.3.4 Some environmental team may prefer to a real time dust meter to measure 1-hr TSP levels. The EM shall provide sufficient information to prove that the instrument is capable of achieving a comparable result as that of the HVS. The instrument shall be regularly calibrated and cross checked by the calibrated HVS and the validated SOP¹.

2.3.5 The high volume sampler (HVS) used for 24-hour TSP monitoring shall be:

- (a) equipped with a pump with adjustable flow range of 0.6 - 1.7 m³/min;
- (b) equipped with a timing/control device accurate to ± 5 minutes for 24 hours operation;
- (c) installed with an elapsed-time meter accurate to ± 2 minutes for 24 hours operation;

¹ Refer to Chapter 2.4.7 of this Section.

- (d) capable of providing a minimum exposed area of 406 cm² (63 in²);
- (e) incorporated with a flow control precise to $\pm 2.5\%$ deviation over 24-hour sampling period;
- (f) equipped with shelter to protect the filter and sampler;
- (g) incorporated with an electronic mass flow rate controller or other equivalent devices, and be calibrated against a traceable standard at regular intervals;
- (h) equipped with a flow recorder for continuous monitoring;
- (i) provided with a peaked roof inlet;
- (j) incorporated with a manometer;
- (k) able to hold and seal the filter paper to the sampler housing at horizontal position;
- (l) easy to change filters;
- (m) capable of operating continuously for 24-hour period.

2.3.6 Wind monitoring equipment shall be provided and set up at a conspicuous location near to the dust monitoring locations for logging wind speed and wind direction. The location of equipment installation shall be proposed by the EM and agreed with the ER.

2.3.7 The following points shall be observed for the installation and operation of wind monitoring equipment:

- (a) the wind sensors shall be installed on masts at an elevated level 10 m above ground so that they are clear of obstructions or turbulence caused by buildings;
- (b) the wind data shall be captured by a data logger and be downloaded to a computer for processing at least once a month;
- (c) the wind monitoring equipment shall be calibrated at least once every six months;
- (d) wind direction shall be divided into 16 sectors of 22.5 degrees each.

2.3.8 In exceptional situations, the EM may propose alternative methods to obtain representative wind data upon agreement with the ER and approval from the EPD.

2.4 Laboratory Measurement

2.4.1 Determination of 24-hr TSP requires laboratory work for desiccating and weighing of filter papers. A clean laboratory with constant temperature and humidity control shall be available. The laboratory should be accredited under Hong Kong Accreditation Scheme (HOKLAS) for solids determination.

2.4.2 The laboratory shall be equipped with an electronic balance accurate to ± 0.1 mg for weighing filter papers. The balance shall be regularly calibrated against standards which are traceable to internationally recognised standards or certified by a HOKLAS accredited calibration laboratory.

2.4.3 A desiccator capable of maintaining constant relative humidity of not higher than 50% shall be available for filter paper conditioning.

2.4.4 The EM may prefer to a site laboratory or employing a non-HOKLAS accredited laboratory for carrying out the laboratory analysis, the laboratory equipment shall be approved and the measurement procedures shall be witnessed by the ER. The EM shall provide the ER with one copy of the Title 40 of the Code of Federal Regulations, Chapter 1 (Part 50), Appendix B for his reference.

2.4.5 Filter papers of size 8" x 10" shall be used for sampling. Each filter paper shall be verified to be clean with no pin holes. It shall be labelled and conditioned in the desiccator for over 24-hr and pre-weighed prior to use for the sampling.

2.4.6 Standard Operation Procedure (SOP) for 24-hr TSP measurement shall be prepared. It shall include necessary requirements set out in this section and validated equations for result calculation. The SOP shall be validated prior to use. All 24-hr TSP measurements shall follow the validated SOP.

2.4.7 After sampling, the filter paper loaded with dust sample shall be transferred to a clean and tightly sealed plastic bag. It shall be delivered to the laboratory for desiccation and weighing. The TSP result shall be calculated using the validated equation set out in the SOP.

2.4.8 All the dust samples and the completed TSP Monitoring Data Sheets shall be kept for at least 6 months after the results are reported.

2.5 Monitoring Locations

2.5.1 The dust monitoring locations for construction of Pok Oi Flyover and Remaining Works are shown on Figure 2.2. The status and location of dust sensitive receivers may change after issuing this manual. If such cases exist, the EM shall propose updated monitoring locations, following the criteria, as far as practicable, as stated below:

- (a) at the site boundary or such locations close to the major dust emission source;
- (b) close to the ASRs; and
- (c) taking into account predictions made in the EIA and the prevailing meteorological conditions.

2.5.2 The following points shall be noted when positioning the samplers:

- (a) a secure supply of electricity is needed to operate the samplers;
- (b) a horizontal platform with appropriate supporting to secure the samplers against gusty wind shall be provided;
- (c) the distance between any two samplers shall not be less than 2 metres;
- (d) the distance between the samplers and an obstacle such as buildings shall be at least twice the height of the obstacle protruding above the samplers;
- (e) for rooftop sampler, separation of at least 2 metres from walls, parapets and penthouses is required;
- (f) a minimum separation of 2 metres from any supporting structure measured horizontally is required;
- (g) no furnace or incinerator flues is nearby;
- (h) the airflow around the sampler is unrestricted;
- (i) the sampler is more than 20 metres from the dripline;
- (j) any wire fence or gate used to protect the sampler should not cause any obstruction during monitoring;

- (k) permission shall be obtained to set up the samplers and to obtain access to the monitoring stations.

2.6 Baseline Monitoring

- 2.6.1 Baseline monitoring shall be carried out at all of the designated monitoring locations for at least 14 consecutive days prior to the commencement of the Project to obtain daily 24-hr TSP samples.
- 2.6.2 During the baseline monitoring, there should not be any construction or dust generating activities in the vicinity of the monitoring locations.
- 2.6.3 In case the baseline monitoring cannot be carried out at the designated monitoring locations during the baseline monitoring period, monitoring at alternative locations which can effectively represent the baseline conditions at the impact monitoring locations shall be carried out. The alternative baseline monitoring locations shall be agreed with the ER and the EPD.
- 2.6.4 In exceptional case, when insufficient baseline monitoring data or questionable results are obtained, the EM shall liaise with EPD to agree on an appropriate set of data to be used as a baseline reference.
- 2.6.5 Baseline conditions may vary seasonally and shall be reviewed once every three months. If the EM considers that the baseline conditions have been changed and a repeat of the baseline monitoring is necessary, the monitoring should be at times when the contractor's activities are not generating dust, at least in the proximity of the monitoring locations. Should change in baseline conditions be verified, the baseline levels and in turn the Action and Limit levels should be revised. The revised baseline levels and air quality criteria should be agreed with the EPD.

2.7 Impact Monitoring

- 2.7.1 Impact monitoring shall be carried out at all the monitoring locations for 24-hour TSP as shown on Figure 2.2 during the course of the Project. The sampling frequency shall be once every six days.
- 2.7.2 The specific time to start and stop the HVS shall be clearly defined for each location and be strictly followed by the operator.
- 2.7.3 In case of noncompliance with the air quality criteria, more frequent monitoring as specified in the Action Plan in Section 2.8 shall be conducted within 24 hours after the result is obtained. This additional monitoring shall be continued until the noncompliance is rectified.

2.8 Event and Action Plan

2.8.1 The baseline monitoring results form important part of the basis of the air quality criteria for the impact monitoring. The impact monitoring results shall be compared with the air quality criteria set up for 24-hour TSP. Table 2.3 shows the air quality criteria, namely Action and Limit levels. Should noncompliance with the air quality criteria occurs, the EM, the ER and the Contractor shall undertake the corresponding action in accordance with the Action Plan illustrated in Table 2.4.

Table 2.3
Action and Limit Levels for Air Quality²

Parameters	Action Levels	Limit Level
24 Hour TSP Level in $\mu\text{g}/\text{m}^3$	For baseline level $< 108 \mu\text{g}/\text{m}^3$, Action level = average of baseline level plus 30% and Limit level For baseline level $> 108 \mu\text{g}/\text{m}^3$ and baseline level $< 154 \mu\text{g}/\text{m}^3$, Action level = $200 \mu\text{g}/\text{m}^3$ For baseline level $> 154 \mu\text{g}/\text{m}^3$, Action level = 130% of baseline level	260

² Refer to EPD Generic Environmental Monitoring and Audit Manual, May 1996.

Table 2.4
Actions in the Event of Exceedance of Action/Limit Levels

Event	Actions		
	EMT	ER	Contractor
Action Level			
Exceedance for one sample	<ol style="list-style-type: none"> 1. Identify source 2. Inform ER 3. Repeat measurement to confirm finding 4. Increase monitoring frequency to daily 	<ol style="list-style-type: none"> 1. Notify Contractor 2. Check monitoring data and Contractor's working methods 	<ol style="list-style-type: none"> 1. Rectify any unacceptable practice 2. Amend working methods if appropriate
Exceedance for two or more consecutive samples	<ol style="list-style-type: none"> 1. Identify source 2. Inform ER 3. Repeat measurements to confirm findings 4. Increase monitoring frequency to daily 5. Discuss with ER for remedial actions required 6. If exceedance continues, arrange meeting with ER 7. If exceedance stops, cease additional monitoring 	<ol style="list-style-type: none"> 1. Confirm receipt of notification of failure in writing 2. Notify Contractor 3. Check monitoring data and Contractor's working methods 4. Discuss with EM and Contractor on potential remedial actions 5. Ensure remedial actions are properly implemented 	<ol style="list-style-type: none"> 1. Submit proposals for remedial actions to ER within 3 working days of notification 2. Implement the agreed proposals 3. Amend proposal if appropriate
Limit Level			
Exceedance for one sample	<ol style="list-style-type: none"> 1. Identify source 2. Inform ER and EPD 3. Repeat measurement to confirm finding 4. Increase monitoring frequency to daily 5. Assess effectiveness of Contractor's remedial actions and keep EPD and ER informed of the results 	<ol style="list-style-type: none"> 1. Confirm receipt of notification of failure in writing 2. Notify Contractor 3. Check monitoring data and Contractor's working methods 4. Discuss with EM and Contractor the potential remedial actions 5. Ensure remedial actions are properly implemented 	<ol style="list-style-type: none"> 1. Take immediate action to avoid further exceedance 2. Submit proposals for remedial actions to ER within 3 working days of notification 3. Implement the agreed proposals 4. Amend proposal if appropriate
Exceedance for two or more consecutive samples	<ol style="list-style-type: none"> 1. Identify source 2. Inform ER and EPD the causes & actions taken for the exceedances 3. Repeat measurement to confirm findings 4. Increase monitoring frequency to daily 5. Investigate the causes of exceedance 6. Arrange meeting with EPD and ER to discuss the remedial actions to be taken 7. Assess effectiveness of Contractor's remedial actions and keep EPD and ER informed of the results 8. If exceedance stops, cease additional monitoring 	<ol style="list-style-type: none"> 1. Confirm receipt of notification of failure in writing 2. Notify Contractor 3. Carry out analysis of Contractor's working procedures to determine possible mitigation to be implemented 4. Discuss amongst EM and the Contractor the potential remedial actions 5. Review Contractor's remedial actions whenever necessary to assure their effectiveness 6. 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 	<ol style="list-style-type: none"> 1. Take immediate action to avoid further exceedance 2. Submit proposals for remedial actions to ER within 3 working days of notification 3. Implement the agreed proposals 4. Resubmit proposals if problem still not under control 5. Stop the relevant portion of works as determined by the ER until the exceedance is abated

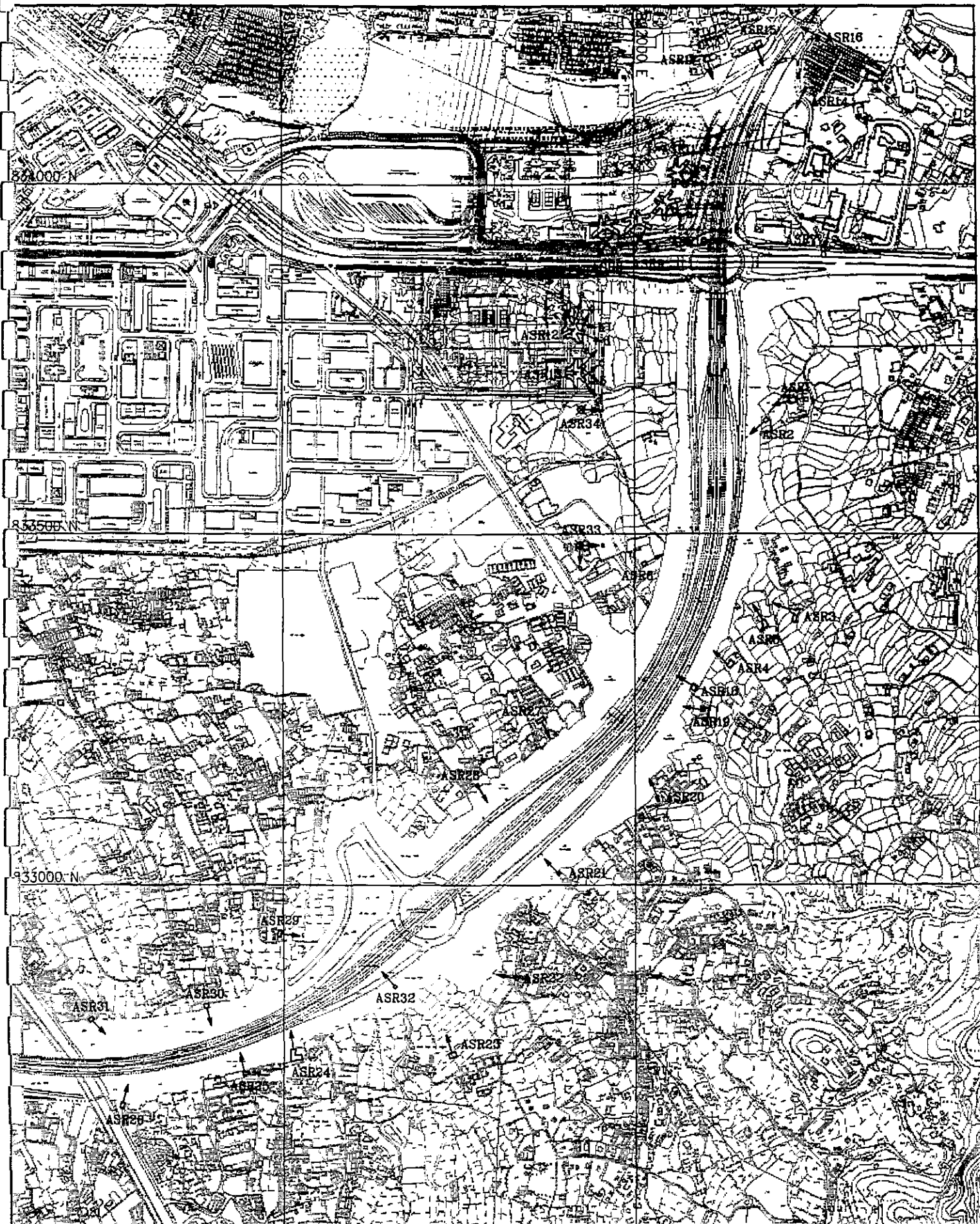
2.9 Dust Mitigation Measures to be Implemented by the Contractor

2.9.1 The EIA Report has concluded that without mitigation the construction dust levels at ASRs will most likely exceed the 24-hr TSP limit of $260 \mu\text{g}/\text{m}^3$. The EIA Report has also recommended mitigation measures to reduce the construction dust to an acceptable level. The Contractor shall be responsible for implementation of the mitigation measures recommended in the EIA:

- (a) Effective water sprays shall be used during the delivery and handling of all raw sand and aggregate and other construction materials particularly when dampening stored materials during dry and windy weather when dust is most likely to emanate from the operation.
- (b) Watering of exposed surfaces shall be undertaken at least twice daily and be exercised as many as possible depending on the circumstances.
- (c) Stockpiles of sand and aggregate shall be enclosed on three sides with walls extending above the pile and 2 metres beyond the front of the pile, if the size of each stockpile is greater than 20 m^3 .
- (d) Chemical wetting agents shall only be used on completed cuts and fills to reduce wind erosion.
- (e) Areas within the construction site where there is a regular movement of vehicles shall have an approved hard surface and be kept clear of loose surface material.
- (f) Should the conveyor system be used, the contractors shall implement the following precaution measures. Conveyor belts shall be fitted with windboards, and conveyor transfer points and hopper discharge areas shall be enclosed to minimize dust emission. All conveyors under the contractor's control and construction materials which have the potential to create dust shall be fully enclosed and fitted with belt cleaners.
- (g) Where dusty materials are being discharged to vehicle from a conveying system at a fixed transfer point, a three-sided roofed enclosure with a flexible curtain across the entry shall be provided. Exhaust fans shall be provided for this enclosure and vented to a suitable fabric filter system.
- (h) The Contractor shall impose speed restriction for all motorized vehicles travelling in the construction site. The recommended maximum speed limit is 20 km per hour. The Contractor shall confine haulage and delivery vehicles to designated roadways within the site.

- (i) Construction working areas shall be minimised to a practicable size.
- (j) The contractors shall ensure that no earth, rock, debris or any other materials arising from the activities of plant or vehicles are deposited on public or private land.
- (k) The Contractor shall ensure that all the vehicles leaving the construction site have passed through wheel washing facilities as stipulated in paragraph 5.8.4 of this Manual.
- (l) The Contractor shall remove all deposited spoil, debris, silt or any other materials immediately and restore the affected land or seabed and areas.
- (m) If spoil cannot be immediately transported out of the site, it shall be stockpiled in sheltered areas.
- (n) All site vehicle and plants shall be inspected regularly to ensure that they are operating efficiently and all exhausts shall be directed vertically upwards or directed away from ground to avoid emission nuisance.

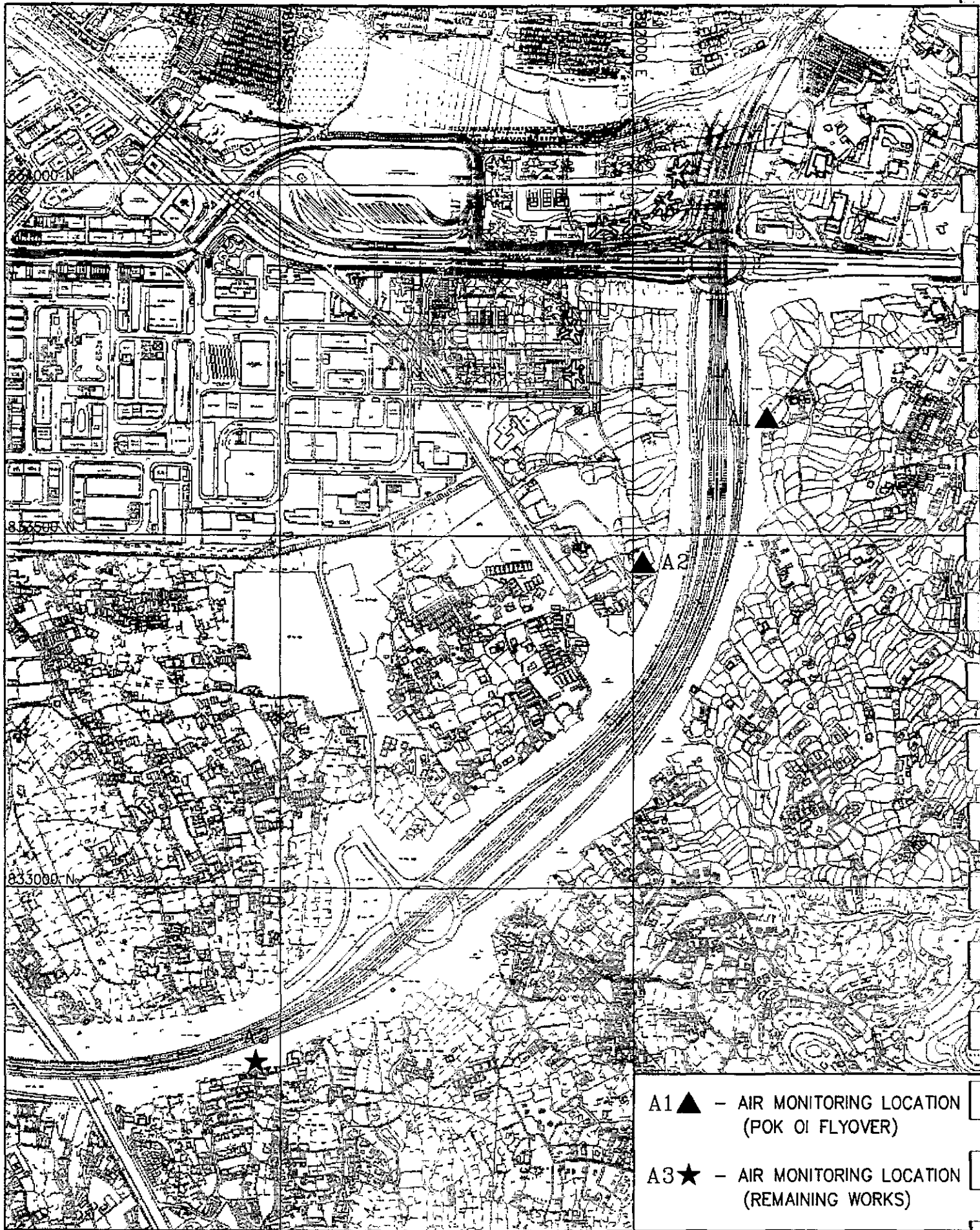
2.9.2 If the above measures are not sufficient to restore the air quality to acceptable levels, upon advice of the EM, the Contractor shall propose to ER some other mitigation measures for approval, and implement the mitigation measures.



Contract Title :
 HIGHWAY BETWEEN SHAP PAT
 HEUNG INTERCHANGE AND POK OI
 INTERCHANGE - POK OI FLYOVER
 AND REMAINING WORKS

Title :
 EM & A
 LOCATION OF AIR
 SENSITIVE RECEIVERS
 (ASRs)

Figure No.	Revision
2.1	0
Reference	File Name
	00130088.B04
Prepared	Checked
	FNW
Date	Scale
APR. 97	N.T.S.



- A1 ▲ - AIR MONITORING LOCATION (POK OF FLYOVER)
- A3 ★ - AIR MONITORING LOCATION (REMAINING WORKS)

Contract Title :
 HIGHWAY BETWEEN SHAP PAT
 HEUNG INTERCHANGE AND POK OI
 INTERCHANGE - POK OI FLYOVER
 AND REMAINING WORKS

Title :
 EM & A
 AIR MONITORING LOCATIONS

Figure No. 2.2	Revision 0
Reference	File Name 0014.0088.B04
Prepared	Checked FNW
Date APR. 97	Scale N.T.S.

Figure 2.3 TSP Monitoring Data Record Sheet

Monitoring Location		
Details of Location		
Sampler Identification		
Date & Time of Sampling		
Elapsed-time Meter Reading	Start (min.)	
	Stop (min.)	
Total Sampling Time (min.)		
Weather Conditions		
Site Conditions		
Initial Flow Rate, Qsi	Pi (mmHg)	
	Ti (°C)	
	Hi (in.)	
	Qsi (Std. m ³)	
Final Flow Rate, Qsf	Pf (mmHg)	
	Tf (°C)	
	Hf (in.)	
	Qsf (Std. m ³)	
Average Flow Rate (Std. m ³)		
Total Volume (Std. m ³)		
Filter Identification No.		
Initial Wt. of Filter (g)		
Final Wt. of Filter (g)		
Measured TSP Level (µg/m ³)		

	<u>Name & Designation</u>	<u>Signature</u>	<u>Date</u>
Field Operator :	_____	_____	_____
Laboratory Staff :	_____	_____	_____
Checked by :	_____	_____	_____

Contract Title :
HIGHWAY BETWEEN SHAP PAT
HEUNG INTERCHANGE AND POK OI
INTERCHANGE - POK OI FLYOVER
AND REMAINING WORKS

Title : **EM&A**

TSP Monitoring Data Record Sheet

Figure No. 2.3	Revision
Reference	File Name
Prepared	Checked
Date APR. 97	Scale N.T.S.

3 NOISE

3.1 Requirements for EM&A

3.1.1 The EIA Report has concluded that the noise impact is one of the major environmental concerns of the Project.

3.1.2 A total of 34 noise sensitive receivers (NSRs) have been identified during the EIA study. Details of the NSRs are described in Table 3.1 whilst location of the NSRs is presented on Figure 3.1.

Table 3.1
Noise Sensitive Receivers (NSRs)

NSRs	Description	mPD	No. of Storeys
NSR1	Village house at Yeung Uk Tsuen, Shap Pat Heung	4.6	1
NSR2	Village house at Yeung Uk Tsuen, Shap Pat Heung	6.8	2
NSR3	Village house between Yeung Uk Tsuen and Chuk San Tsuen, Shap Pat Heung	5.6	1
NSR4	Village house between Yeung Uk Tsuen and Chuk San Tsuen, Shap Pat Heung	6.8	2
NSR5	Village house between Yeung Uk Tsuen and Chuk San Tsuen, Shap Pat Heung, 2 storey building	6.8	1
NSR6	Village house at Ha Yau Tin Tsuen	5.2	3
NSR7	Home for the Aged at Pok Oi Hospital	5.5	6
NSR8	Proposed residential block 1 at CDA Area 15	5.5	24
NSR9	Proposed residential block 2 at CDA Area 15	5.5	24
NSR10	Proposed residential block 3 at CDA Area 15	5.5	24
NSR11	Proposed residential block 4 at CDA Area 15	5.5	24
NSR12	Proposed residential block 5 at CDA Area 12	5.0	23
NSR13	Proposed residential block 6 at CDA Area 12	5.0	23
NSR14	Village house at Small Traders Village	4.1	2
NSR15	Village house at Wong Uk Tsuen	4.1	3
NSR16	Village house at Small Traders Village	4.1	2
NSR17	Village house at Wong Uk Tsuen	4.1	3
NSR18	Village house at Chuk San Tsuen	6.8	2
NSR19	Village house at Chuk San Tsuen	6.8	2
NSR20	Village house at Chuk San Tsuen	6.8	1
NSR21	Village house at Chuk San Tsuen	7.9	1
NSR22	Village house at Kong Tau San Tsuen	7.3	3
NSR23	Village house at Kong Tau San Tsuen	8.0	3
NSR24	Village house at Tai Kei Leng	7.0	1
NSR25	Village house at Tai Kei Leng	7.0	1

Table 3.1
Noise Sensitive Receivers (NSRs) (cont'd)

NSRs	Description	mPD	No. of Storeys
NSR26	Village house at Tai Kei Leng	8.0	2
NSR27	Village house at Ha Yau Tin Tsuen	6.0	2
NSR28	Village house at Ha Yau Tin Tsuen	6.0	1
NSR29	Village house at Tai Kei Leng	6.8	3
NSR30	Village house at Tai Kei Leng	5.0	3
NSR31	Village house at Tai Kei Leng	7.0	2
NSR32	Village house at Kong Tau San Tsuen	7.5	3
NSR33	Future residential building	5.0	12
NSR34	Future residential building	5.0	12

3.1.3 The EIA Report has also concluded that the construction noise during construction of Pok Oi Flyover and the Remaining Works will mainly be associated with piling, operation of powered mechanical equipment and the movements of construction vehicles. Tables 3.2-3.5 show construction equipment likely to be used during different construction periods and the acoustic information related to the equipments.

Table 3.2
SWLs of the Construction Equipment during Piling Period

Equipment	No.	Sound Power Level (SWL) dB(A)	Total Sound Power Level (SWL) dB(A)
Percussive Piling Rig	2	116.0	119.0
The Total Sound Power Level (SWL)			119.0 dB(A)

Table 3.3
SWLs of the Construction Equipment during Site Formation Period

Equipment	No.	Sound Power Level (SWL) dB(A)	Total Sound Power Level (SWL) dB(A)
Air compressor (silenced type)	1	100.0	100.0
Excavator (tracked)	1	112.0	112.0
Bulldozer	1	115.0	115.0
Generator (silenced type)	1	100.0	100.0
Water Pump (electric)	1	88.0	88.0
Dumper	1	106.0	106.0
The Combined Total Sound Power Level (SWL)			117.3 dB(A)

Table 3.4
SWLs of the Construction Equipment during Superstructure Period

Equipment	No.	Sound Power Level (SWL) dB(A)	Total Sound Power Level (SWL) dB(A)
Air compressor (silenced type)	1	100.0	100.0
Generator (silenced type)	1	100.0	100.0
Crane Lorry	1	112.0	112.0
Water Pump (electric)	2	88.0	91.0
Concrete Lorry Mixer	1	109.0	109.0
Concrete Pump	1	109.0	109.0
Poker (hand-held)	2	113.0	116.0
Saw (circular, wood)	1	108.0	108.0
The Combined Total Sound Power Level (SWL)			119.0 dB(A)

Table 3.5
SWLS of the Construction Equipment
during Pavement & Utility Installation Period

Equipment	No.	Sound Power Level (SWL) dB(A)	Total Sound Power Level (SWL) dB(A)
Air compressor (silenced type)	1	100.0	100.0
Bulldozer	1	115.0	115.0
Dump truck	1	117.0	117.0
Generator (silenced type)	1	100.0	100.0
Crane Lorry	1	112.0	112.0
Concrete Lorry Mixer	1	109.0	109.0
Asphalt Paver	1	109.0	109.0
Vibratory Roller	1	108.0	108.0
Power rammer (petrol)	1	108.0	108.0
The Combined Total Sound Power Level (SWL)			121.1 dB(A)

3.1.4 Without mitigation, the noise levels at some of the NSRs are predicted to exceed the EPD recommended Acceptable Noise Level (ANL) of 75 dB(A) during the construction period of the Project.

3.1.5 However, most of the NSRs exposed to the unacceptable noise levels are 2 storey buildings and are much lower than the proposed flyover and viaduct. They are fully or partially screened by the existing Yuen Long Southern Bypass embankment, resulting in a reduction of the noise impacts at the NSRs by 5 dB(A).

3.1.6 The implementation of the recommended mitigation measures will further reduce the noise impacts at the NSRs by 6 dB(A).

3.1.7 Tables 3.6 and 3.7 show the predicted noise impacts with and without mitigation.

Table 3.6
Predicted Noise Impact (Pok Oi Flyover)

NSR	Predicted Noise Level dB(A)	Mitigation Measures Correction dB(A)	Acceptable Noise Level (ANL) dB(A)	Mitigated Noise Levels dB(A)
<i>Site Formation Period</i>				
NSR1	75.2 dB(A)	11.0 dB(A)	75.0 dB(A)	64.2 dB(A)
NSR2	81.7 dB(A)	11.0 dB(A)	75.0 dB(A)	70.7 dB(A)
NSR3	78.0 dB(A)	11.0 dB(A)	75.0 dB(A)	67.0 dB(A)
NSR4	75.2 dB(A)	11.0 dB(A)	75.0 dB(A)	64.2 dB(A)
NSR5	81.2 dB(A)	11.0 dB(A)	75.0 dB(A)	70.2 dB(A)
NSR6	77.3 dB(A)	11.0 dB(A)	75.0 dB(A)	66.3 dB(A)
<i>Pavement & Utility Installation Period</i>				
NSR1	79.0 dB(A)	11.0 dB(A)	75.0 dB(A)	68.0 dB(A)
NSR2	85.5 dB(A)	11.0 dB(A)	75.0 dB(A)	74.5 dB(A)
NSR3	81.8 dB(A)	11.0 dB(A)	75.0 dB(A)	70.8 dB(A)
NSR4	79.0 dB(A)	11.0 dB(A)	75.0 dB(A)	68.0 dB(A)
NSR5	85.0 dB(A)	11.0 dB(A)	75.0 dB(A)	74.0 dB(A)
NSR6	81.1 dB(A)	11.0 dB(A)	75.0 dB(A)	70.1 dB(A)

Table 3.7
Predicted Noise Impact (Remaining Works)

NSR	Predicted Noise Level dB(A)	Mitigation Measures Correction dB(A)	Acceptable Noise Level (ANL) dB(A)	Mitigated Noise Levels dB(A)
Site Formation Period				
NSR18	81.4 dB(A)	11.0 dB(A)	75.0 dB(A)	70.4 dB(A)
NSR19	77.0 dB(A)	11.0 dB(A)	75.0 dB(A)	66.0 dB(A)
NSR21	75.2 dB(A)	11.0 dB(A)	75.0 dB(A)	64.2 dB(A)
NSR24	75.4 dB(A)	11.0 dB(A)	75.0 dB(A)	64.4 dB(A)
NSR28	75.4 dB(A)	11.0 dB(A)	75.0 dB(A)	64.4 dB(A)
Superstructure Period (vehicle/pedestrian underpass structure no. 9E)				
NSR19	77.7 dB(A)	11.0 dB(A)	75.0 dB(A)	66.7 dB(A)
Pavement & Utility Installation Period				
NSR18	85.2 dB(A)	11.0 dB(A)	75.0 dB(A)	74.2 dB(A)
NSR19	80.8 dB(A)	11.0 dB(A)	75.0 dB(A)	69.8 dB(A)
NSR20	77.4 dB(A)	11.0 dB(A)	75.0 dB(A)	66.4 dB(A)
NSR21	79.0 dB(A)	11.0 dB(A)	75.0 dB(A)	68.0 dB(A)
NSR24	79.2 dB(A)	11.0 dB(A)	75.0 dB(A)	68.2 dB(A)
NSR27	78.5 dB(A)	11.0 dB(A)	75.0 dB(A)	67.5 dB(A)
NSR28	79.2 dB(A)	11.0 dB(A)	75.0 dB(A)	68.2 dB(A)
NSR29	76.6 dB(A)	11.0 dB(A)	75.0 dB(A)	65.6 dB(A)

3.1.8 With implementation of the recommended mitigation measures, the noise levels at the NSRs during operation period of the Project can be reduced to an acceptable level. No EM&A will be required during the operation period of the Project.

3.1.9 Mitigation measures are detailed in Chapter 3.8 of this section.

3.2 Noise Parameters

- 3.2.1 A-weighted equivalent continuous sound pressure level (Leq) shall be monitored and audited by the MT to ensure compliance with the criteria of the Noise Control Ordinance (NCO). Leq (30 min) shall be measured during the time period between 0700-1900 hours on normal weekdays. For other time periods, Leq (5 min) shall be measured for comparison with the NCO criteria.
- 3.2.2 All relevant information including date, time and locations of the monitoring, weather condition, calibration and measurement data, and other special phenomena and works occurred in the monitoring locations shall be recorded in detail on the Noise Monitoring Field Record Sheet (Figure 3.4).

3.3 Monitoring Equipment

- 3.3.1 Sufficient number of noise equipment and associated calibration kit and accessories shall be available for carrying out the baseline monitoring, regular impact monitoring and ad hoc monitoring. All the equipment and associated instrumentation shall be clearly labelled and properly maintained.
- 3.3.2 The sound level meters used for noise monitoring shall comply with the International Electrotechnical Commission Publications 651: 1979 (Type 1) and 804: 1985 (Type 1).
- 3.3.3 The sound level meters shall be calibrated immediately before each noise measurement using an acoustic calibrator which generates a known sound pressure level at a known frequency. The sound level meters shall be checked after each measurement using the same acoustic calibrator. Measurements shall be accepted as valid only if the calibration levels before and after the noise measurement agree to within 1.0 dB.
- 3.3.4 Noise measurements should not be made in the presence of fog, rain, wind with a steady speed exceeding 5 ms^{-1} or wind with gusts exceeding 10 ms^{-1} . The wind speed shall be checked with a portable wind speed meter capable of measuring the wind speed in m/s.
- 3.3.5 Standard Operation Procedure (SOP) for noise monitoring shall be prepared. It shall be validated prior to use. All noise measurement shall follow the validated SOP.

3.4 Monitoring Locations

- 3.4.1 The noise monitoring locations for construction of Pok Oi Flyover and Remaining Works are shown on Figures 3.2 and 3.3 respectively. The status and locations of noise sensitive receivers may change after issuing this manual. If such cases exist, the EM shall propose updated monitoring locations which are:
- (a) close to the major site activities where adverse noise impacts are likely to occur;
 - (b) close to the NSRs which include any domestic premises, hotel, hostel, temporary housing accommodation, hospital, medical clinic, educational institution, place of public worship, library, court of law, performing art centre;
- 3.4.2 When monitoring noise level at locations in the vicinity of the sensitive receivers, care should be taken to minimise disturbance to the occupants.
- 3.4.3 The noise level metres shall be set at 1.2 m above the ground level.
- 3.4.4 Normal requirements for the distance between the noise level meter and the exterior facade of the sensitive receiver building is 1 m.
- 3.4.5 Where the normal requirement is found impracticable, an alternative position may be selected. A correction shall be made to the result of the noise measurement at the alternative position. For reference, a correction of +3 dB(A) shall be made to the field free measurement.
- 3.4.6 The EM shall agree with the ER on the monitoring position and the corrections adopted. Once the positions for the monitoring stations are chosen, the baseline monitoring and the impact monitoring shall be carried out at the same positions.

3.5 Baseline Monitoring

- 3.5.1 The baseline noise monitoring shall be carried out at the noise monitoring location as shown on Figures 3.2 and 3.3 for a period of two weeks prior to the commencement of the construction works. A schedule on the baseline monitoring shall be submitted to the ER before the monitoring starts.
- 3.5.2 There shall not be any construction activities in the vicinity of the noise monitoring locations during the baseline monitoring.

3.5.3 In exceptional cases, when insufficient baseline monitoring data or questionable results are obtained, the EM shall propose an appropriate set of data to be used as a baseline reference and submit to the ER.

3.6 Impact Monitoring

3.6.1 Noise monitoring shall be carried out once per week between 0700-1900 on normal weekdays at all the designated monitoring locations as shown on Figures 3.2 and 3.3.

3.6.2 For the monitoring locations close to schools, the noise measurement, besides normal monitoring, shall be carried out during the school examination periods. The EM shall liaise with the school personnel and the Examination Authority to ascertain the exact dates and times of all examination periods during the course of the Project.

3.6.3 In case of noncompliance with the construction noise criteria, more frequent monitoring as specified in the Action Plan in Section 3.7 shall be carried out. The additional monitoring shall be continued until the recorded noise levels are rectified or proved to be irrelevant to the construction activities.

3.7 Event and Action Plan

3.7.1 The Action and Limit levels for construction noise are defined in Table 3.8. Should noncompliance with the criteria occurs, action in accordance with the Action Plan in Table 3.9, shall be carried out.

Table 3.8
Action and Limit⁽¹⁾ Levels for Noise Measured at NSRs during Construction

Period	Weekdays ⁽²⁾	Evenings	Night-time
	0700 to 1900 hours	1900 to 2300 hours Sundays and General Holidays	2300 to 0700 hours
	$L_{Aeq(30\ min)}$ (dB(A))	$L_{Aeq(5\ min)}$ (dB(A))	$L_{Aeq(5\ min)}$ (dB(A))
Action Level	Baseline + 5 dB(A)	Baseline + 5 dB(A)	Baseline + 5 dB(A)
Limit Level	75 ⁽⁴⁾	45 ⁽³⁾	30 ⁽³⁾

Notes:

- (1) Limit levels may be adjusted according to the baseline data collected.
- (2) At schools AL levels are 5 dB(A) lower, 10 dB(A) lower during examinations.
- (3) *Technical Memorandum on Noise from Construction Work other than Percussive Piling* issued under the *Noise Control Ordinance*. The finalisation of target levels is subject to the Area Rating of the NSR to be determined by EPD. Area Rating 'B' is suggested, as most of the NSRs are high rise

buildings without any nearby Influencing Factors. If the following equipment or processes were in use then the levels will be 15 dB lower:

- . bulldozer
- . hand held breakers
- . vibrator concrete poker
- . dump truck
- . concrete lorry mixer
- . hammering
- . any process concerning scaffolding or formwork making.

(4) EPD Internal Guideline.

Table 3.9
Event/Action Plan for Construction Noise

Event	Action	
	EM or ER	Contractor
Action Level	<ol style="list-style-type: none"> 1. Notify Contractor 2. Analyse investigation 3. Require Contractor to propose measures for the analysed noise problem 4. Increase monitoring frequency to check mitigation effectiveness 	<ol style="list-style-type: none"> 1. Submit noise mitigation proposals to Environmental Manager/Engineer's Representative 2. Implement noise mitigation proposals
Limit Level	<ol style="list-style-type: none"> 1. Notify Contractor 2. Notify EPD 3. Require contractor to implement mitigation measures. Increase monitoring frequency to check mitigation effectiveness 	<ol style="list-style-type: none"> 1. Implement mitigation measures 2. Prove to Environmental Manager/ER effectiveness of measures applied

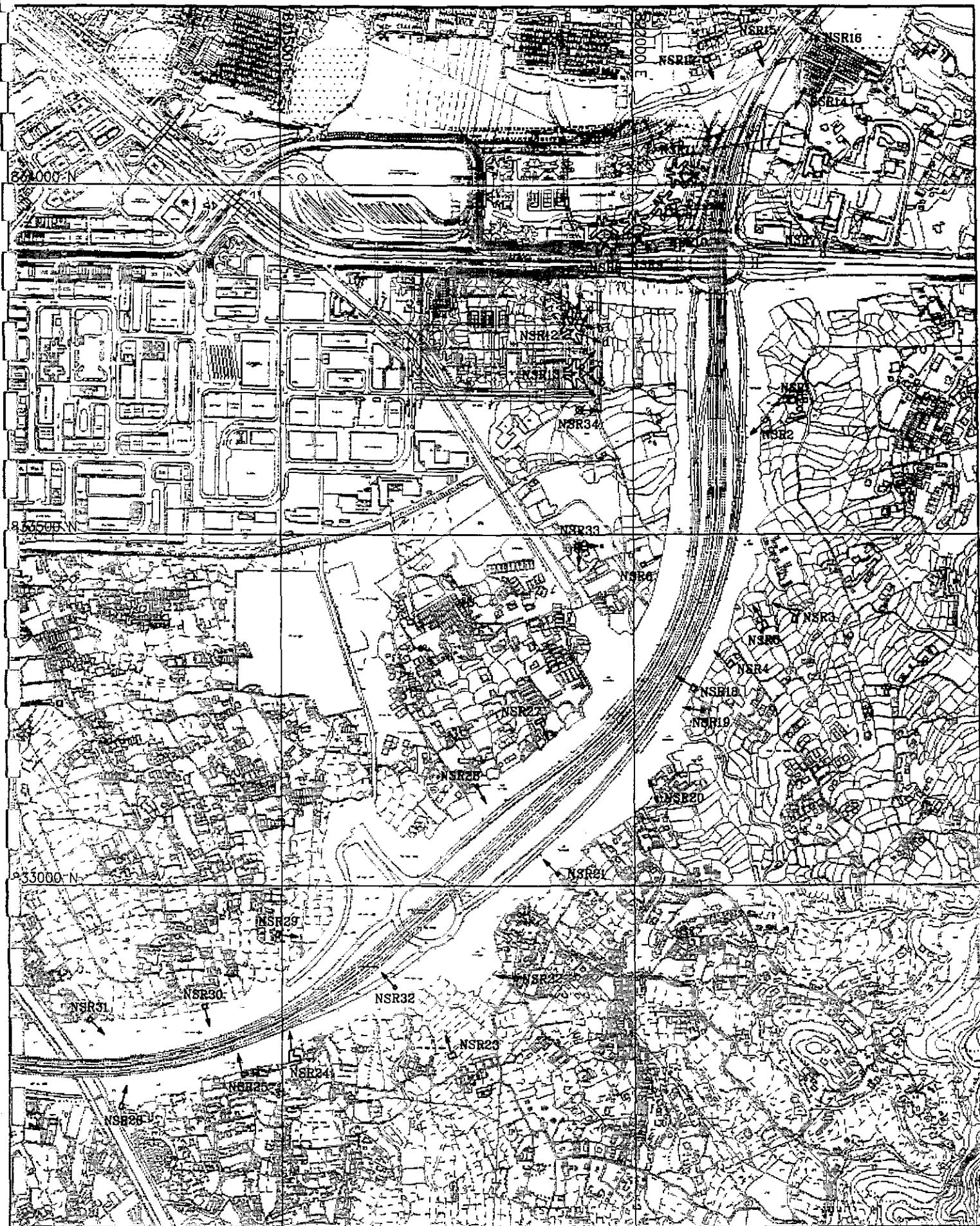
3.8 Noise Mitigation Measures to be Implemented by the Contractor

3.8.1 The Contractor shall consider noise as an environmental constraint during the implementation of the Project works.

3.8.2 The Contractor shall comply with the *Noise Control Ordinance (NCO) (Cap 400)* and any regulations made under the NCO, including restrictions placed on noise from construction work and the requirements to seek Construction Noise Permits. Before commencement of any works requiring Construction Noise Permits, the Contractor shall obtain such permits and display them appropriately.

3.8.3 In addition, the Contractor shall implement the following mitigation measures:

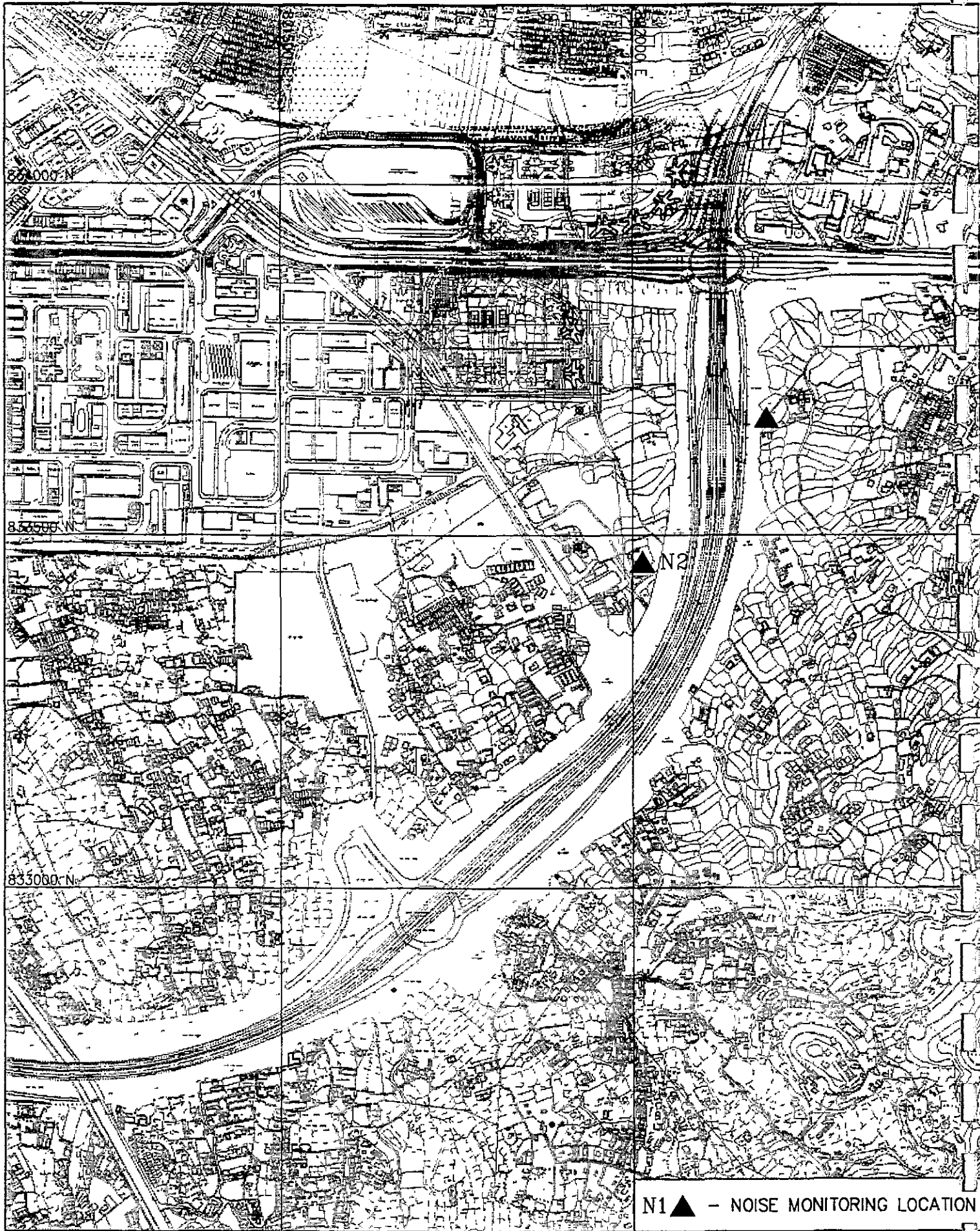
- (a) to erect temporary noise barriers along the road as illustrated in Figure 3.5;
- (b) to install permanent acoustic barriers along the road as shown on Figure 3.6;
- (c) to use, where applicable, partial or full acoustic enclosures for the engine of the noisy equipment;
- (d) to maintain all the construction plant and equipment in a good condition;
- (e) to choose silenced equipment and quieter working processes;
- (f) to turn off all idle equipment which are not currently in use;
- (g) to arrange all noisy equipment and activities as far away as possible from nearby NSRs;
- (h) to plan all the construction activities properly to avoid parallel operation of several sets of equipment and to minimise the numbers of noisy equipment.

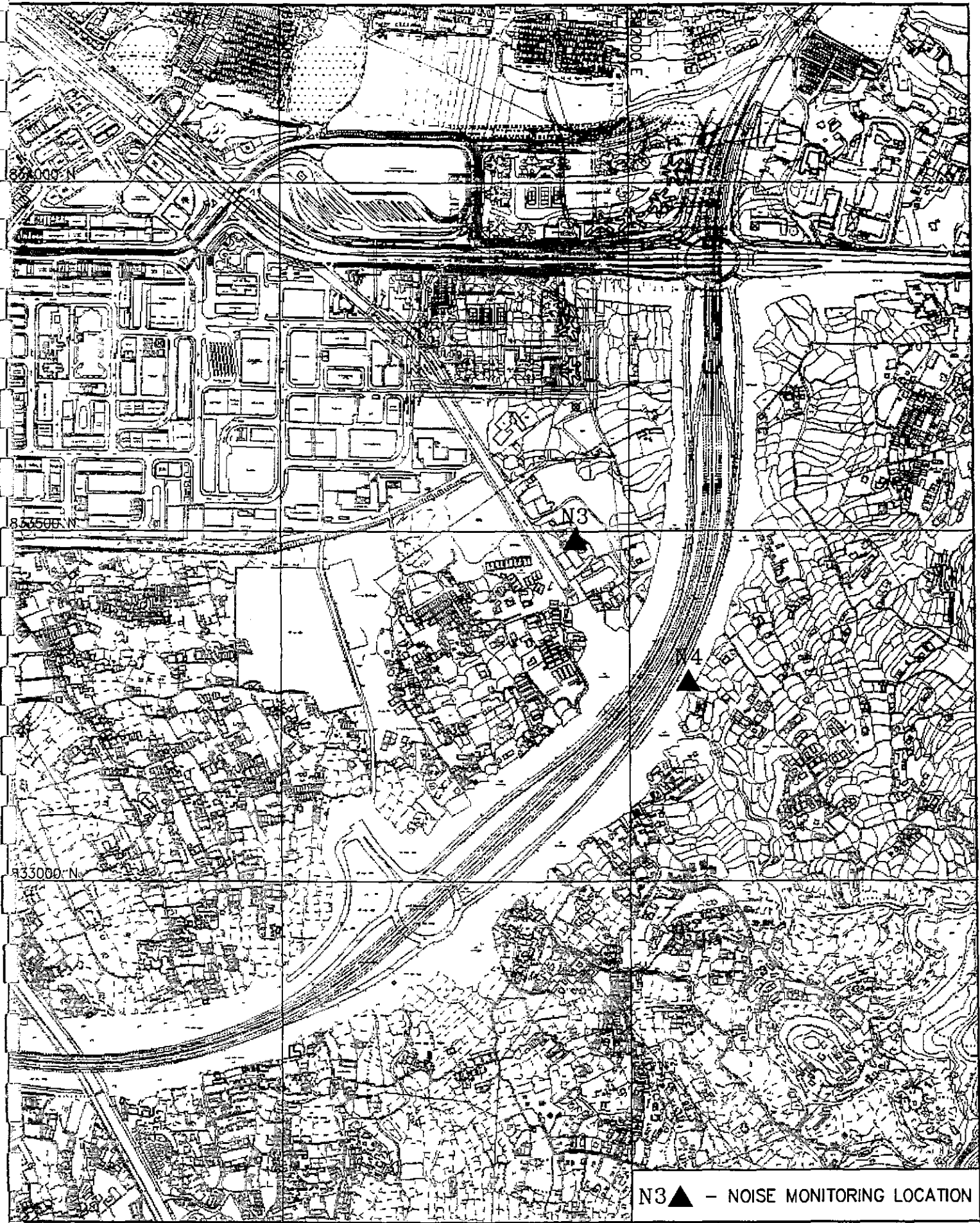


Contract Title :
 HIGHWAY BETWEEN SHAP PAT
 HEUNG INTERCHANGE AND POK OI
 INTERCHANGE - POK OI FLYOVER
 AND REMAINING WORKS

Title :
 EM & A
 LOCATION OF NOISE
 SENSITIVE RECEIVERS
 (NSRs)

Figure No. 3.1	Revision 0
Reference	File Name 00150088.B04
Prepared	Checked FNW
Date APR. 97	Scale N.T.S.





Contract Title :
 HIGHWAY BETWEEN SHAP PAT
 HEUNG INTERCHANGE AND POK OI
 INTERCHANGE - POK OI FLYOVER
 AND REMAINING WORKS

Title :
 EM & A
 NOISE MONITORING LOCATIONS
 (REMAINING WORKS, UP TO 2011)

Figure No. 3.3	Revision 0
Reference	File Name 00170088.B04
Prepared	Checked FNW
Date APR. 97	Scale N.T.S.

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 ENGINEERS AND SCIENTISTS

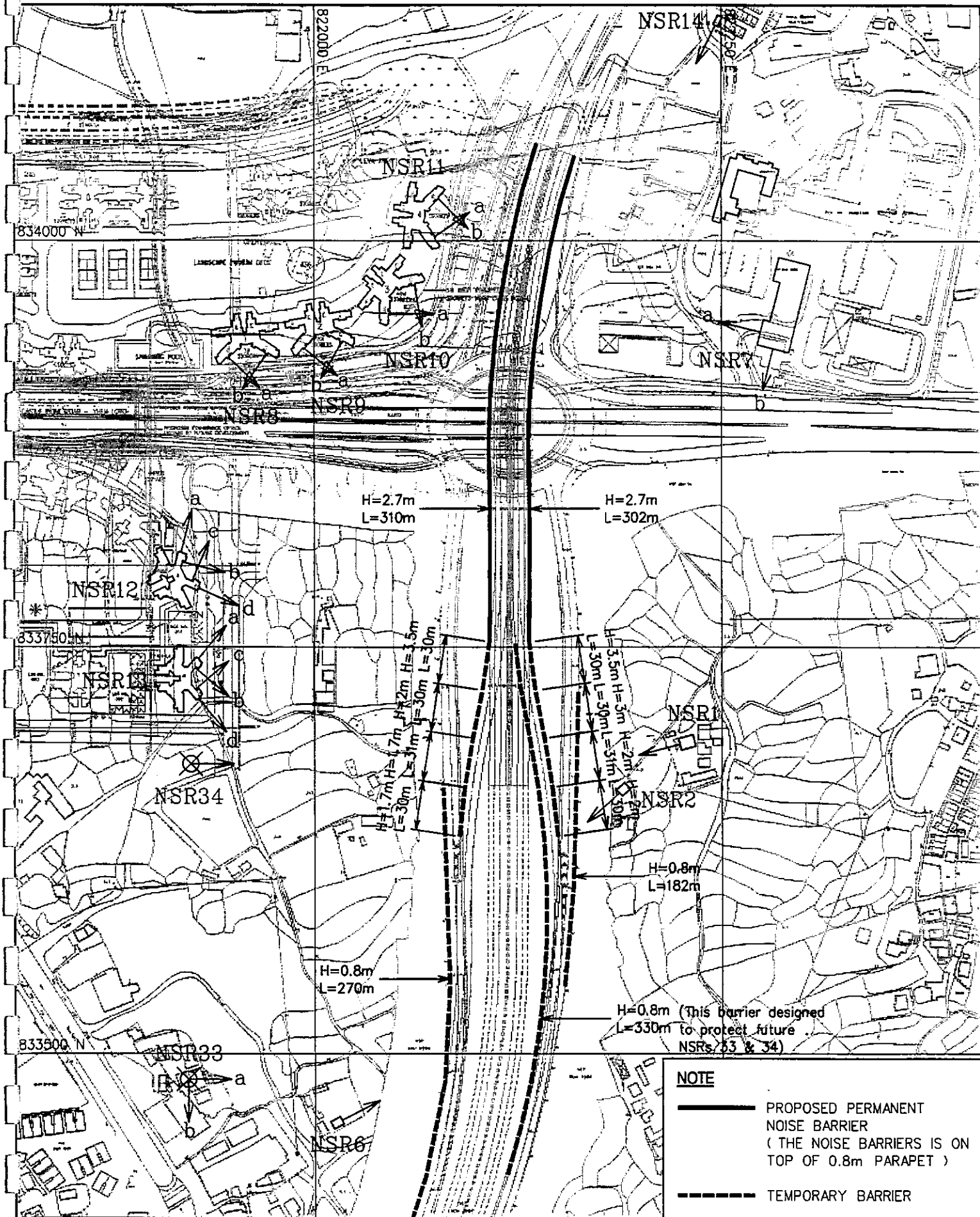
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Figure 3.4 Noise Monitoring Field Record Sheet

Monitoring Location		
Description of Location		
Date of Monitoring		
Measurement Start Time (hh:mm)		
Measurement Time Length (min.)		
Noise Meter Model/Identification		
Calibrator Model/Identification		
Measurement Results	L ₉₀ (dB(A))	
	L ₁₀ (dB(A))	
	Leq (dB(A))	
Major Construction Noise Source(s) During Monitoring		
Other Noise Source(s) During Monitoring		
Remarks		

	<u>Name & Designation</u>	<u>Signature</u>	<u>Date</u>
Recorded By :	_____	_____	_____
Checked By :	_____	_____	_____

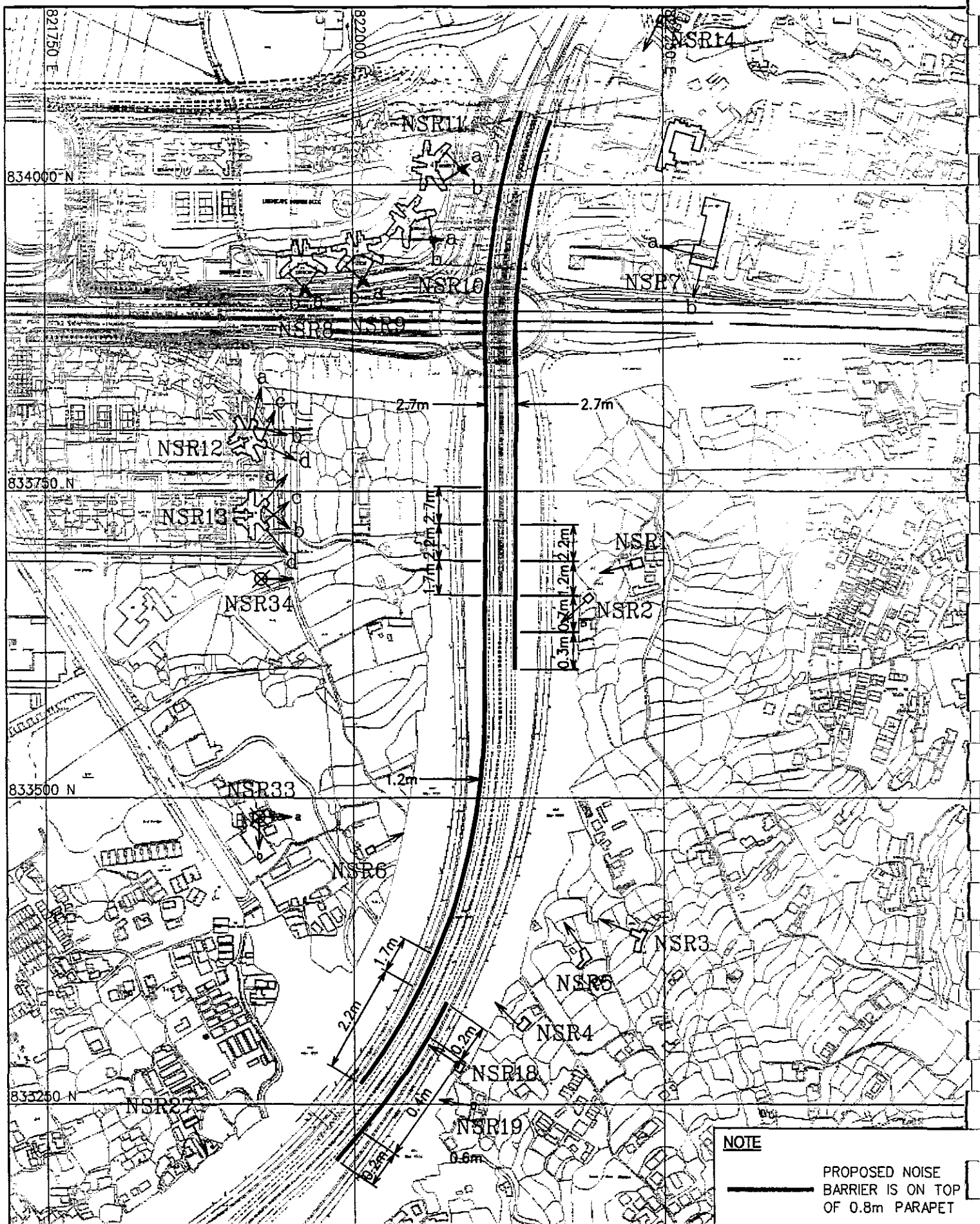
Contract Title : HIGHWAY BETWEEN SHAP PAT HEUNG INTERCHANGE AND POK OI INTERCHANGE - POK OI FLYOVER AND REMAINING WORKS	Title : <div style="text-align: center; font-size: 1.2em; font-weight: bold;">EM&A</div>	Figure No. 3.4	Revision
		Reference	File Name
		Prepared	Checked
		Date APR. 97	Scale N.T.S.



Contract Title :
 HIGHWAY BETWEEN SHAP PAT
 HEUNG INTERCHANGE AND POK OI
 INTERCHANGE - POK OI FLYOVER
 AND REMAINING WORKS

Title :
 EM & A
 LOCATION AND HEIGHTS OF
 NOISE BARRIERS FOR POK OI
 FLYOVER PROJECT

Figure No. 3.5	Revision 0
Reference	File Name 00250088.B04
Prepared WKY	Checked YWL
Date APR. 97	Scale N.T.S.



NOTE

— PROPOSED NOISE BARRIER IS ON TOP OF 0.8m PARAPET

Contract Title :
 HIGHWAY BETWEEN SHAP PAT
 HEUNG INTERCHANGE AND POK OI
 INTERCHANGE - POK OI FLYOVER
 AND REMAINING WORKS

Title :
 EM & A
 LOCATION AND HEIGHTS OF NOISE
 BARRIERS FOR POK OI FLYOVER
 & REMAINING WORKS PROJECT

Figure No.	Revision
3.6	0
Reference	File Name
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Date	Scale
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4 WATER QUALITY

4.1 Requirements of EM&A

4.1.1 The Project site is located in Deep Bay Water Control Zone where wetlands of international importance especially as waterfowl habitat (Ramsar, 1971) are included. Deep Bay is eligible for protection under the Bonn Convention on the Conservation of Migratory Species of Wild Animals (WWF, 1993). Five Sites of Special Scientific Interest (SSSI) have also been designated in the area on ecological grounds.

4.1.2 All unsuitable materials have already been removed from the Project site under an earlier contract. However, the remaining construction works will result in adverse impacts on the local surface water system if the mitigation measures recommended in the EIA Report and this Manual are not implemented.

4.1.3 Potential sources of environmental impacts on water quality will be from direct discharge of sewage, oil or other pollutants and uncontrolled construction site runoff and drainage to the local drainage system.

4.2 Water Quality Parameters

4.2.1 The EIA report has recommended the water quality parameters to be monitored during the Project works and all future development works. The parameters as well as the rationale and methodology for the parameters are summarised in Table 4.1.

Table 4.1
Rationale and Methodology for Water Quality Parameters

Parameters	Rationale	Method Reference
1. Dissolved Oxygen (DO)	<p>DO is a key water quality parameter in water pollution and waste treatment process control. It indicates ability of a water body to support a well balanced aquatic fauna.</p> <p>Sufficient DO in water is required for protection of aesthetic quality of water as well as maintenance of fish and other aquatic life. Insufficient DO develops septic conditions, causing malodorous emission resulted from anaerobic decomposition of organic and other oxygen-demanding matters present in water. Insufficient DO also adversely affects aquatic insects and other animals upon which fish and waterbirds feed, causing eventually loss of the ecological balance.</p> <p>A minimum DO level of 4 mg/l is set as limit level in this EM&A.</p> <p>DO could be reduced by the pollutants in site run-off.</p>	<p>Standard Methods for the Examination of Water and Waste Water 17th Edition (APHA, AWWA, WEF) 4500-0 G</p>
2. Turbidity	<p>Turbidity is an expression of the optical property that causes light to be scattered and absorbed rather than transmitted in straight lines. Optically black particles increase turbidity.</p> <p>Turbidity in water may be caused by suspended matter such as clay, silt, finely divided organic and inorganic matter, soluble organic compounds, plankton and other microscopic organisms as are likely in site runoff.</p> <p>Turbidity is a measure of clarity which indicates the condition and productivity of a water body. It may be used as a quick reference to the amount of total suspended solids (TSS) in water, although the correlation of turbidity with TSS is difficult because the size, shape and reflective index of the particulates affect the light-scattering properties of the suspension.</p>	<p>Standard Methods for the Examination of Water and Waste Water 17th Edition (APHA, AWWA, WEF) 2130</p>

Table 4.1
Rationale and Methodology for Water Quality Parameters (cont'd)

Parameters	Rationale	Method Reference
3. Temperature	<p>Water temperature regulates to some extent the metabolism and ability to survive and reproduce effectively of aquatic life.</p> <p>Temperature also affects the self-purification phenomenon in water bodies and henceforth affects the aesthetic and sanitary qualities of the water bodies. Increased temperatures accelerate biodegradation of organic matters both in water and in bottom deposits, demanding more dissolved oxygen. This is exacerbated by the fact that oxygen becomes less soluble as water temperature increases. Increased temperatures also increase the odour of water because of the increased volatility of odour-causing compounds.</p> <p>Temperature affects many chemical equilibriums, therefore, it is used in calculation of various laboratory studies and chemical operations. In this EM&A, interpretation of monitoring results of some water quality parameters such as pH, DO etc. require temperature data.</p> <p>In conclusion, "Temperature, a catalyst, a depressant, an activator, a restrictor, a stimulator, a controller, a killer, is one of the most important and most influential water quality characteristics to life in water." (FWPCAC (1967))</p>	<p>Standard Methods for the Examination of Water and Waste Water 17th Edition (APHA, AWWA, WEF) 2550</p>

Table 4.1
Rationale and Methodology for Water Quality Parameters (cont'd)

Parameters	Rationale	Method Reference
4. pH	<p>pH is a measure of hydrogen ion activity in water. The mathematical expression of pH is:</p> $\text{pH} = -\log_{10} [\text{H}^+], \text{ where } [\text{H}^+] \text{ is the activity of hydrogen ion}$ <p>The pH value of natural waters is a measure of acid-base equilibrium of various dissolved compounds, salts or gases. It does not indicate the ability of a water to neutralized additions of acids or bases due to the 'buffering capacity' of the water. However, it affects the degree of dissociation of weak acids and bases, causing variation of toxicity of many compounds, typical examples of which being toxicity of cyanides, sulphides and ammonia. In the case of ammonia, the chemical equilibrium is shifted towards an increased concentration of toxic un-ionized ammonia as pH is increased.</p> <p>pH is raised by concrete washings.</p>	<p>Standard Methods for the Examination of Water and Waste Water 17th Edition (APHA, AWWA, WEF) 4500-H⁺</p>
5. Total Suspended Solids (TSS)	<p>Water high in TSS may aesthetically be unsatisfactory for many purposes such as bathing. More significantly, TSS affects fish and fish food populations. Being components of TSS, clay, silt and other settleable particulates blanket the bottom of water bodies, damaging invertebrate populations and blocking gravel spawning beds. The organic parts of TSS remove dissolved oxygen from overlying water, causing another adverse effect to aquatic life (refer to DO).</p> <p>High TSS levels can occur in runoff from site formation works, removal of material, concrete washings. etc.</p>	<p>Standard Methods for the Examination of Water and Waste Water 17th Edition (APHA, AWWA, WEF) 2540D</p>

- 4.2.2 Samples collected for TSS should be transported to the laboratory upon collection and preserved immediately upon arrival at the laboratory. Remaining samples should be kept until analytical results are confirmed or maximum storage times are reached, whichever is shorter. In the event of noncompliance, extra analyses can be checked on the remaining preserved sample.
- 4.2.3 Sample presentation and maximum storage times shall be in accordance with Standard Methods for the Examination of Water and Wastewater, APHA-AWWA-WEF.
- 4.2.4 All laboratory measurement shall be carried out in a laboratory accredited under Hong Kong Laboratory Accreditation Scheme (HOKLAS) or other international accredited laboratory. All methodology shall follow that set out in the *Standard Methods for the Examination of Water and Wastewater*, APHA-AWWA-WEF. Results should be made available to the EM and ER as soon as possible.
- 4.2.5 If a site laboratory is set up or a non-HOKLAS and non-international accredited laboratory is hired for carrying out the laboratory analysis, the laboratory equipment, analytical procedures, and quality control shall be approved by the DEP. All the analysis shall be witnessed by the ER. The EM shall provide the ER with one copy of the relevant chapters of the "Standard Methods of the Examination of Water and Wastewater" updated edition and any other relevant document for his reference.

4.3 Monitoring Equipment

Dissolved Oxygen/Temperature Meter

- 4.3.1 The instrument shall be a portable, weatherproof dissolved oxygen measuring instrument complete with cable, sensor, comprehensive operation manuals, and be operable from a DC power source. It shall have a membrane electrode with automatic temperature compensation complete with a cable of sufficient length. It shall be capable of measuring:
- (i) a dissolved oxygen level in the range of 0-20 mg/L and 0-200% saturation; and
 - (ii) a temperature of 0-45 degree Celsius.

Turbidity Meter

- 4.3.2 A portable turbidity-measuring instrument operating on a nephelometric principle. It shall contain a photoelectric sensor(s) and come with comprehensive operation manuals. The equipment shall be operable from a DC power source. It shall have a photoelectric sensor capable of measuring turbidity at least between 0-200 NTU and shall be calibrated using a set of secondary turbidity standards in each range the equipment can measure (Hach 2100P Turbidimeter or similar approved).

Suspended Solids

- 4.3.3 A drying oven capable of maintaining a temperature within 103° - 105° shall be available for drying filter papers in the processes of TSS determination. The oven shall be maintained and calibrated according to the requirements of the quality system of the HOKLAS or the equivalent.
- 4.3.4 A desiccator capable of maintaining a relative humidity below 50% shall be used for cooling and equilibrating the filter papers before weighing.
- 4.3.5 An electronic balance readable to not less than 0.1 mg (i.e. 0.0001 g) shall be available for weighing filter papers. The balance shall be maintained and calibrated according to the requirements of the quality system of the HOKLAS or the equivalent.
- 4.3.6 High density polythene or glass bottles shall be used for sample container.
- 4.3.7 Glass fibre filter paper recommended in the APHA 2540D shall be used for TSS determination.

pH Meter

- 4.3.8 The instrument shall consist of a potentiometer, a glass electrode, a reference electrode and a temperature-compensating device. It shall be readable to 0.1 pH in a range of 0 to 14. Standard buffer solutions of at least pH 7 and pH 10 shall be used for calibration of the instrument before and after use. Details of the method are given in APHA, 17th ed. 4500-H⁺B. Temperature of measurement shall always be reported with pH results.

Salinity

- 4.3.9 A portable salinity meter should be used. Calibration against at least two concentrations of salt solution (including blank) should be carried out each time the instrument is used.

Thermometer

- 4.3.10 A certified mercury-in-glass thermometer with an accuracy of at least 0.5 degree Celsius shall be used for measuring the ambient (air) temperature.
- 4.3.11 All in-situ monitoring instruments shall be checked, calibrated and certified by an approved laboratory, preferably HOKLAS accredited, before use on the Works. The instruments shall be subsequently re-calibrated at 3 month intervals throughout all stages of the water quality monitoring. Responses of sensors and electrodes should be checked with certified standard solutions before each use.
- 4.3.12 A set of backup equipment must be available to ensure that if any of the monitoring equipment is sent for repair or re-calibration, the monitoring programme can continue uninterruptedly. In addition, sufficient stocks of spare parts and consumables for the equipment such as electrodes, membranes and cable shall be maintained.

4.4 Monitoring Locations

- 4.4.1 Water quality monitoring shall be carried out at all points where construction site runoff enters the surface drainage system. The two main points shown on Figures 4.1 and 4.2 are the monitoring locations for the Construction of Pok Oi Flyover. Figure 4.3 shows monitoring locations for the Remaining Works. The EM shall propose monitoring locations in liaison with the ER and seek approval from the DEP.

4.5 Baseline Monitoring

- 4.5.1 No baseline monitoring is recommended.

4.6 Impact Monitoring

- 4.6.1 Water quality monitoring should be taken once a week and more frequently during heavy rain, as agreed between the EM and the ER.
- 4.6.2 A Standard Operation Procedure for monitoring of each parameter shall be prepared and validated prior to commencement of the monitoring. Monitoring data sheets shall also be prepared for each parameter. All monitoring shall follow strictly the validated SOP.

4.6.3 All monitoring information including date and time, weather conditions, operator, identification and description of the monitoring locations, works, progress and construction activities, sample ID, method, analytical data and calculation etc. shall be recorded in the monitoring data sheet as shown on Figure 4.4.

4.7 Event and Action Plan for Water Quality

DO, TSS and Turbidity

4.7.1 The water quality criteria, namely Action and Limit levels are shown in Table 4.2. Should the monitoring results of the water quality parameters at any designated monitoring stations indicate that the water quality criteria are exceeded, the actions in accordance with the Action Plan in Table 4.3 shall be carried out.

Table 4.2
Action and Limit Levels for Water Quality¹

Parameter	Action Levels	Limit Levels
pH ²	≥ 8.5	≥ 9.0
DO in mg/l ³	1%-ile of baseline ⁴ data, or midway between 5%-ile of baseline data and Limit levels	< 4 mg/l
SS in mg/l ³	> 95%-ile of baseline data and 120% of upstream control station's SS at the same tide of the same day	> 99%-ile of baseline, 130% of upstream control station's SS at the same tide of the same day
Turbidity (Tby) in NTU ³	> 95%-ile of baseline data and 120% of upstream control station's Tby at the same tide of the same day	> 99%-ile of baseline and 130% of upstream control station's Tby at the same tide of the same day

- Notes:
1. These Action and Limit levels may be adjusted following the collection and audit of baseline data.
 2. Action and Limit levels are set at levels recommended in Water Quality Objectives (Deep Bay Water Control Zone).
 3. Action and Limit levels are set at levels recommended in EPD Generic Environmental Monitoring and Audit Manual (May 1996).

Table 4.3
Actions in the Event of Exceedance of Action/Limit Levels

Event	Actions		
	EM	ER	Contractor
Action Level			
Water: Action level being exceeded by one sampling day	<ol style="list-style-type: none"> 1. Repeat in-situ measurement to confirm findings; 2. Identify source(s) of impact; 3. Inform contractor and EPD; 4. Check monitoring data, all plant, equipment and Contractor's working methods; 5. Discuss mitigation measures with ER and Contractor; 6. Repeat measurement on next day of exceedance. 	<ol style="list-style-type: none"> 1. Discuss with EM and Contractor on the proposed mitigation measures; 2. Make agreement on the mitigation measures to be implemented; 3. Assess the effectiveness of the implemented mitigation measures. 	<ol style="list-style-type: none"> 1. Inform the Engineer and confirm notification of the noncompliance in writing; 2. Rectify unacceptable practice; 3. Check all plant and equipment; consider changes of working methods; 4. Propose mitigation measures to ER and discuss with EM and ER; 5. Implement the agreed mitigation measures.
Water: Action level being exceeded by more than two consecutive sampling days	<ol style="list-style-type: none"> 1. Repeat in-situ measurement to confirm findings; 2. Identify source(s) of impact; 3. Inform contractor and EPD; 4. Check monitoring data, all plant, equipment and Contractor's working methods; 5. Discuss mitigation measures with ER and Contractor; 6. Ensure mitigation measures are implemented; 7. Prepare to increase the monitoring frequency to daily; 8. Repeat measurement on next day of exceedance. 	<ol style="list-style-type: none"> 1. Discuss with EM and Contractor on the proposed mitigation measures; 2. Make agreement on the mitigation measures to be implemented; 3. Assess the effectiveness of the implemented mitigation measures. 	<ol style="list-style-type: none"> 1. Inform the Engineer and confirm notification of the noncompliance in writing; 2. Rectify unacceptable practice; 3. Check all plant and equipment; consider changes of working methods; 4. Propose mitigation measures to ER within 3 working days and discuss with EM and ER; 5. Implement the agreed mitigation measures.
Water: Limit level being exceeded by one sample at any monitoring station	<ol style="list-style-type: none"> 1. Repeat in-situ measurement to confirm findings; 2. Identify source(s) of impact; 3. Inform contractor and EPD; 4. Check monitoring data, all plant, equipment and Contractor's working methods; 5. Discuss mitigation measures with ER and Contractor; 6. Ensure mitigation measures are implemented; 7. Increase the monitoring frequency to daily until no exceedance of Action level. 	<ol style="list-style-type: none"> 1. Discuss with EM and Contractor on the proposed mitigation measures; 2. Request Contractor to critically review the working methods; 3. Make agreement on the mitigation measures to be implemented; 4. Assess the effectiveness of the implemented mitigation measures. 	<ol style="list-style-type: none"> 1. Inform the Engineer and confirm notification of the noncompliance in writing; 2. Rectify unacceptable practice; 3. Check all plant and equipment; consider changes of working methods; 4. Propose mitigation measures to ER within 3 working days and discuss with EM and ER; 5. Implement the agreed mitigation measures.
Water: Limit level being exceeded by more than two consecutive samples at any monitoring station	<ol style="list-style-type: none"> 1. Repeat in-situ measurement to confirm findings; 2. Identify source(s) of impact; 3. Inform contractor and EPD; 4. Check monitoring data, all plant, equipment and Contractor's working methods; 5. Discuss mitigation measures with ER and Contractor; 6. Ensure mitigation measures are implemented; 7. Increase the monitoring frequency to daily until no exceedance of Action level for two consecutive days. 	<ol style="list-style-type: none"> 1. Discuss with EM and Contractor on the proposed mitigation measures; 2. Request Contractor to critically review the working methods; 3. Make agreement on the mitigation measures to be implemented; 4. Assess the effectiveness of the implemented mitigation measures; 5. Consider and instruct, if necessary, the Contractor to slow down or to stop all or part of the work until no exceedance of Limit level. 	<ol style="list-style-type: none"> 1. Inform the Engineer and confirm notification of the noncompliance in writing; 2. Rectify unacceptable practice; 3. Check all plant and equipment; consider changes of working methods; 4. Propose mitigation measures to ER within 3 working days and discuss with EM and ER; 5. Implement the agreed mitigation measures; 6. As directed by the Engineer, to slow down or to stop all or part of the work or construction activities.

4.8 Water Quality Mitigation Measures to be Implemented by the Contractor

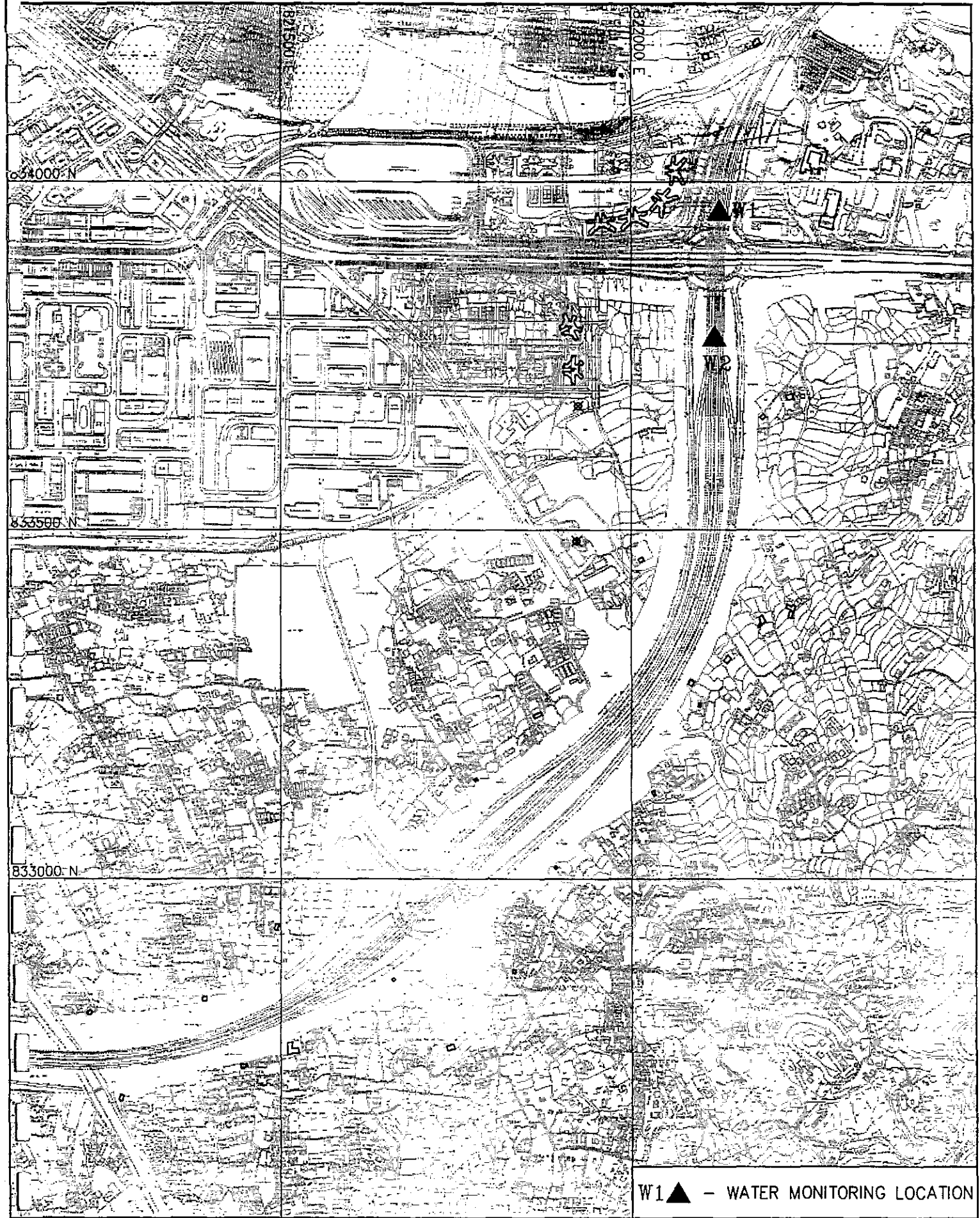
- 4.8.1 The Contractor shall be aware of and comply with the *Buildings Ordinance*, the *Water Pollution Control Ordinance* and the *Technical Memorandum Standards for Effluent Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters*.
- 4.8.2 The Contractor shall not discharge directly or indirectly (by runoff) any effluent or foul or contaminated water or cooling or hot water without the prior consent of the Engineer and the EM to the drainage system.
- 4.8.3 Construction site runoff shall be discharged into storm drains via sand/silt removal facilities such as sand traps, silt traps and sediment basins.
- 4.8.4 The Contractor shall not permit any sewage and waste water to flow from the site onto any adjoining land or allow any waste matter to be deposited anywhere within the site or onto any adjoining land. The Contractor shall collect, remove and dispose of such wastewater according to the regulatory requirements set out in the documents stated in 4.8.1.
- 4.8.5 The Contractor shall be liable for any damages caused to adjoining area through his failure to comply with the previous clause 4.8.4.
- 4.8.6 Silt removal facilities, channels and manholes shall be maintained and the deposited silt and grit shall be removed regularly, at the onset of, and after each rainstorm to ensure that these facilities are functioning properly at all times. Disposal of material shall be carried out properly and with the knowledge and approval of the ER and EM.
- 4.8.7 Open stockpiles of construction materials (e.g. aggregates, sand and fill material) on site shall be protected from erosion during rainstorms. Measures shall be taken to prevent the washing away of construction materials, soil, silt or debris into any drainage system.
- 4.8.8 Discharge of surface runoff into foul sewers shall be prevented in order not to unduly overload the foul sewerage system.

4.8.9 Precautions to be taken at any time of year when rainstorms are likely, actions to be taken when a rainstorm is imminent or forecast and actions to be taken during or after rainstorms are summarized in the following:

- (1) Precautions to be taken at any time of year when rainstorms are likely
 - (a) Silt removal facilities, channels and manholes should be maintained and the deposited silt and grit should be removed regularly.
 - (b) Temporary access roads should be protected by crushed stone or gravel.
 - (c) Intercepting channels should be provided (e.g. along the crest/edge of excavation) to prevent storm runoff from washing across exposed soil surfaces.
- (2) Actions to be taken when a rainstorm is imminent or forecast
 - (a) Silt removal facilities, channels and manholes should be checked to ensure that they can function properly.
 - (b) Open stockpiles of construction materials (e.g. aggregates, sand and fill materials) on Site should be surrounded by suitable bunds and temporary channels.
- (3) Actions to be taken during or after rainstorms
 - (a) Silt removal facilities, channels and manholes should be checked and maintained to ensure satisfactory working conditions. Attention should be given to safety when carrying out this work.

4.8.10 All vehicles and plant shall be cleaned before they leave the site to ensure no earth, mud, debris and the like is deposited on roads. A wheelwash shall be provided at every exit and the washwater shall be maintained regularly. The wastewater from wheelwash shall be settled before discharging into the site drainage system. The section of construction road between the wheelwash and the public road shall be paved to reduce vehicle tracking of soil and to prevent site runoff from entering public road drains.

- 4.8.11 Erosion of any stockpile of spoil or fill materials shall be prevented. A separate settlement system for a large stockpile will be provided as necessary to collect contaminated surface water prior to release to the drainage system of the works area.
- 4.8.12 All compounds in works areas shall be located on areas of hardstanding with provision of drainage channels and settlement ponds where necessary to allow interception and controlled release of settled/treated water; and provision of bunding for all potentially hazardous materials on site including fuels. The Contractor shall establish emergency procedures in the event of any spills of hazardous materials.
- 4.8.13 If any office, works area canteen or toilet facilities are erected, foul water effluent should be directed to a foul sewer or to a sewage treatment facility either directly or indirectly by means of pumping or other means approved by the Engineer.
- 4.8.14 Wastewater generated from the washing down of mixer trucks and drum mixers and similar equipment should wherever practicable be recycled. The discharge of wastewater should be kept to a minimum.
- 4.8.15 Any waters entering the storm drains must have a pH less than 8.5. Under normal circumstances, surplus wastewater may be discharged into foul sewers after treatment in silt removal and pH adjustment facilities (to within the pH range of 6 to 9). Disposal of wastewater into storm drains will require more elaborate treatment. Surface runoff should be segregated from the concrete batching plant and casting yard area as much as possible, and diverted to the stormwater drainage system. Surface runoff contaminated by materials in a concrete batching plant or casting yard should be adequately treated before disposal into stormwater drains.

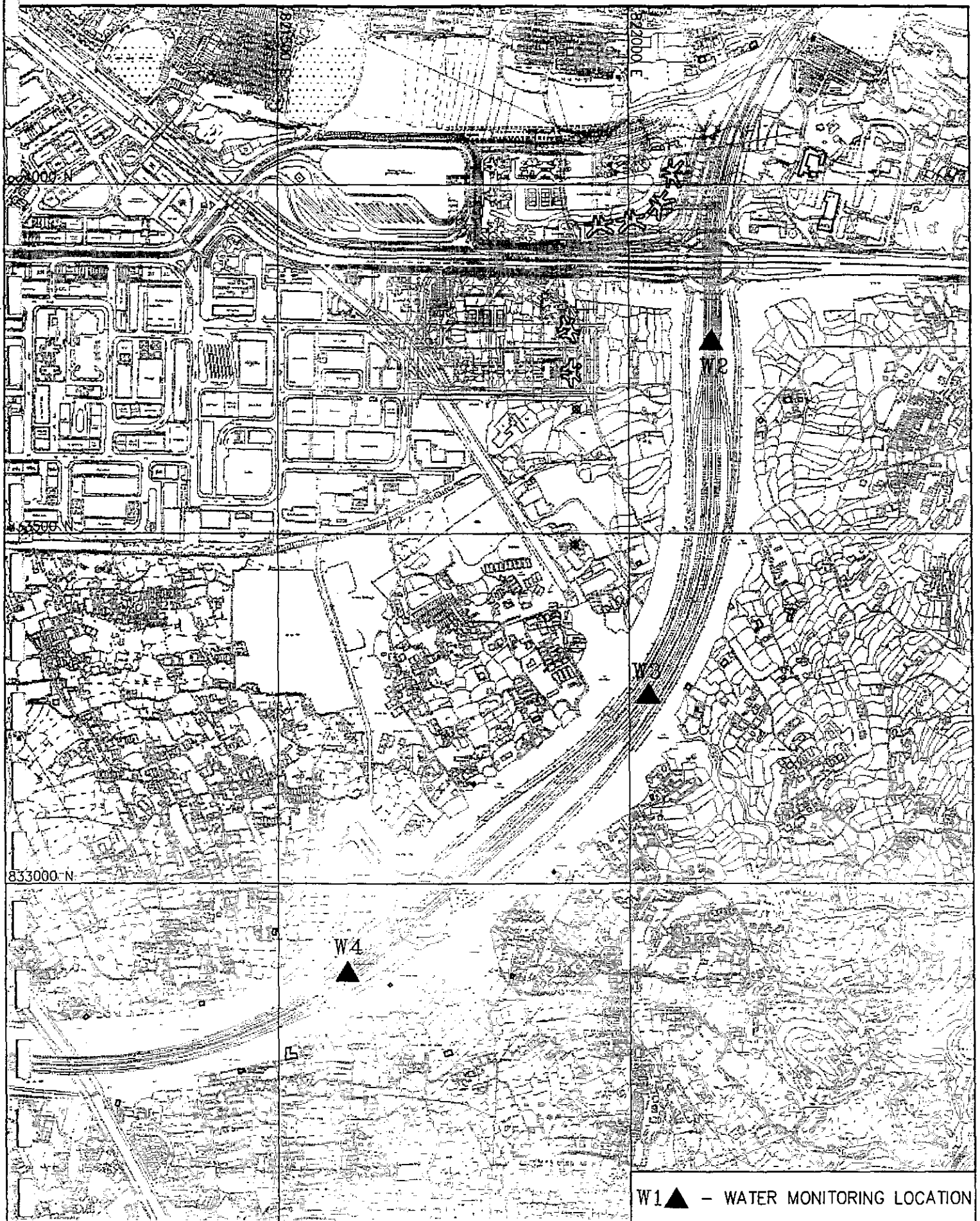


Contract Title :
 HIGHWAY BETWEEN SHAP PAT
 HEUNG INTERCHANGE AND POK OI
 INTERCHANGE - POK OI FLYOVER
 AND REMAINING WORKS

Title :

EM & A
 WATER MONITORING LOCATIONS
 (POK OI FLYOVER)

Figure No. 4.1	Revision 0
Reference	File Name 00190088.B04
Prepared	Checked FNW
Date APR. 97	Scale N.T.S.



Contract Title :
 HIGHWAY BETWEEN SHAP PAT
 HEUNG INTERCHANGE AND POK OI
 INTERCHANGE - POK OI FLYOVER
 AND REMAINING WORKS

Title :
 EM & A
 WATER MONITORING LOCATIONS
 (REMAINING WORKS)

Figure No. 4.3	Revision 0
Reference	File Name 00200088.B04
Prepared	Checked FNW
Date APR. 97	Scale N.T.S.

 BINNIE CONSULTANTS LIMITED
 寶尼工程顧問有限公司 寶尼
 ENGINEERS AND SCIENTISTS

Figure 4.4 Water Quality Monitoring Data Record Sheet

Location			
Date			
Start Time (hh:mm)			
Weather			
Sea Conditions			
Tidal Mode			
Water Depth (m)			
Monitoring Depth	Surface	Middle	Bottom
Salinity			
Temperature (°C)			
DO Saturation (%)			
DO (mg/l)			
Turbidity (NTU)			
SS Sample Identification			
SS (mg/l)			
Observed Construction Activities	<100m from location		
	>100m from location		
Other Observations			

Name & Designation

Signature

Date

Recorded By : _____

Checked By : _____

Note: The SS results are to be filled up once they are available from the laboratory.

Contract Title :
HIGHWAY BETWEEN SHAP PAT
HEUNG INTERCHANGE AND POK OI
INTERCHANGE - POK OI FLYOVER
AND REMAINING WORKS

Title : **EM&A**

Water Quality Monitoring Data Record Sheet

Figure No. **4.4**

Revision

Reference

File Name

Prepared

Checked

Date

APR. 97

Scale

N.T.S.

5 WASTE MANAGEMENT

5.1 Overall Responsibilities of the Contractor

- 5.1.1 The overall principles of construction waste management are to reduce waste generation and to reuse and recycle construction waste.
- 5.1.2 The Contractor is responsible for implementation of the waste management schemes including reduction, reuse, recycle and disposal of the waste material produced from the site. The Contractor is also responsible for implementation of any mitigation measure to minimise waste or redress problems arising from the construction waste of the Project.
- 5.1.3 The Contractor shall pay attention to the *Waste Disposal Ordinance*, the *Dumping at Sea Ordinance*, the *Public Health and Municipal Services Ordinance* and the *Waste Disposal (Chemical Waste) (General Regulation)*, and carry out appropriate waste management work.
- 5.1.4 The Contractor shall refer to the relevant booklets issued by the EPD to obtain relevant licence/permit such as the effluent discharge licence, the chemical waste producer registration, etc.

5.2 Types of Construction Waste

- 5.2.1 Construction waste from the Project works may include:
- (a) excavated materials, such as contaminated mud, soft materials and organic clay from the site formation, cutting trenches and foundations;
 - (b) concrete waste;
 - (c) wooden waste;
 - (d) steel waste;
 - (e) chemical waste;
 - (f) liquid waste;
 - (g) municipal waste;
 - (h) site clearance waste.

5.3 Excavated Material

- 5.3.1 The Contractor shall dispose of unsuitable excavated material (i.e. contaminated mud, organic clay and vegetation) in accordance with *WBTC 6/92, Fill Management* and *WBTC 22/92, Marine Disposal of Dredged Mud*. The Contractor will normally be required to produce analytical reports on the heavy metal content of the material, and occasionally of toxic organic pollutants such as PAHs and PCBs.
- 5.3.2 Under the *Dumping at Sea Ordinance [Cap 466] 1995*, the Contractor shall obtain a dumping licence for the disposal of contaminated sediment. The Contractor is normally required to produce analytical reports on the heavy metal content of the sediment for the application of the licence.

5.4 Concrete Waste

- 5.4.1 Concrete is the major construction material to be used in the Project works, e.g. installation of the permanent stormwater drainage culverts, flyovers and other infrastructure works. The volume of concrete waste is estimated to be approximately 3-5% of the concrete used. The old house and building demolition will be another source of concrete waste. The Contractor should sort out dry concrete waste from the other wastes and recycle or reuse it. If inevitable, the concrete waste shall be disposed of at the public dump ground e.g. Tseung Kwan O.

5.5 Wooden Waste

- 5.5.1 Wood is widely used as formwork for concrete structures erection of site boundaries and scaffolding etc. The Contractor shall not incinerate wooden waste on-site unless a permit from EPD has been obtained.
- 5.5.2 The Contractor should separate used wooden materials from other wastes and reuse them as much as possible. Those which cannot be reused should also be sorted and stored separately from other wastes for collection by private contractors for local reuse or export to overseas. If inevitable, the wooden waste shall be disposed of at landfill.

5.6 Steel Waste

- 5.6.1 The Contractor may consider to use woods instead of metal for fencing to reduce steel waste.
- 5.6.2 The Contractor should reuse steel shutters as much as possible.
- 5.6.3 All steel waste should be separated from other wastes for collection by private contractors for recycling.

5.7 Chemical Waste

- 5.7.1 The Contractor shall be aware of the *Waste Disposal (Chemical Waste) (General) Regulation*. Where the construction processes produce chemical waste which is subject to stringent disposal routes, the Contractor should register with EPD as a Chemical Waste Producer.
- 5.7.2 The major chemical waste arising from the construction sites are likely to be oils, lubricants, paints and solvents. Oil waste may be in the form of raw waste, or as sundries such as spent oil filters, or materials used to absorb oil leaks.
- 5.7.3 The Contractor shall prevent leakage and spillage of fuel and lubricating oil to avoid contamination of the construction site. All compounds in works areas shall be located on areas of hardstanding with provision of drainage channels and interceptors to allow separation of oils from water and release of separated water. Oils accumulated in interceptors shall be regularly removed to prevent oils and grease from overflowing into the surface water drainage system. The interceptor shall also have a bypass to drain heavy rains. Oil and fuel bunkers should be bunded to accommodate oils from accidental spillages or breaches of tanks. Waste collected from any grease traps should be collected and disposed of by a licensed contractor. The Contractor shall prepare a spill action plan and keep suitable clean-up materials such as emulsifier and absorbent etc., on site.
- 5.7.4 Any construction plant which is likely to leak oil should have inert absorbent e.g. sand, placed under it. The absorbent should be replaced on a regular basis and the contaminated absorbent should be stored in a designated secure place.

- 5.7.5 Lubricants and waste oils are likely to be generated from the maintenance of vehicles and mechanical equipment. Used lubricants shall be collected and stored in individual containers which are properly labelled. The containers should be stored in a designated secure place. If possible such waste should be sent to oil recycling companies for recycling.
- 5.7.6 Chemical wastes should be treated at the Chemical Waste Treatment Centre by licensed contractor.
- 5.7.7 Some paints and solvents are also classified as chemical waste and, if used on site, will be subject to the stringent requirements of the *Waste Disposal (Chemical Waste) (General) Regulation*. Empty paint cans should be recycled or collected as waste. Any dry paint waste should be swept up and collected in containers for disposal.

5.8 Liquid Wastes

- 5.8.1 The Contractor shall comply with the *TM on Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters*. Advice on the handling and disposal of construction site discharges including site runoff and contaminated wastewaters is provided in the *ProPECC Paper (PN1/94), Construction Site Drainage*.
- 5.8.2 Discharges from construction site may contain high pH and suspended solids. Site runoff shall be tilted and treated before discharged to surface water. Landtake under stockpiles or open working areas such as the road upgrading works shall be minimised. Stockpiles shall be fenced, bunded and treated to reduce erosion and ingress of solids to surface runoff. The surface runoff should be collected and settled. Solids accumulated in the sand traps, settlement tanks, manholes, and streambeds shall be removed and disposed of regularly.
- 5.8.3 Refuse emanating from the works and floating in the surface waters should be collected using refuse booms and disposed of appropriately.
- 5.8.4 The Contractor shall provide a wheelwash at each exit. All vehicles leaving the construction site shall pass through the wheelwash. The Contractor shall regularly clean the wheelwash and remove accumulated sediment. Routine maintenance of the wheelwash may produce a large volume of wastewater which contain excessive suspended solids causing contamination of local streams and water courses. These wastewaters shall be directed into settlement ponds and the settled supernatant should be reused on Site.

5.8.5 The Contractor shall ensure that disposal of sewage generated from the construction site complies with the standards set out in the *TM on Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters*. Sewage is characterised by high BOD, suspended solids, nutrients and bacteria. Domestic sewage generated from the site toilets, washing facilities and any temporary canteen provided for construction workers shall be collected separately and disposed of appropriately.

5.9 Municipal Waste

5.9.1 The Contractor shall provide adequate temporary refuse collection stations to collect municipal waste regularly. The Contractor shall contain the waste in black refuse bags and disposed of at an approved landfill as required by the Regional Services Department (RSD).

5.10 Site Clearance

5.10.1 Site clearance waste includes used materials such as packaging materials, used wooden blocks and boards, debris etc. The Contractor should sort out the site clearance waste into paper, wood, cans, tyres, glass, plastics, steel etc., and reuse or recycle them as much as possible. If inevitably, non-inert materials such as soil, sand, concrete, rubble etc should be disposed of at public dumps. Construction waste with only a small amount of inert material (not more than 20% by volume) will be allowed for disposal at landfill. In the case of reinforced concrete, steel rods should be separated from concrete rubble by mechanical means and recycled. If inevitable, the steel rods shall be disposed of appropriately.

5.11 Reuse or Recycling Facilities

5.11.1 Where appropriate, the Contractor should establish an efficient waste collection and reuse or recycling facilities to achieve objectives of the construction waste management. The system should encourage reuse and recycle of waste materials, and proper inevitable disposal of them. Table 4.1 illustrates potential reuse or recycle and disposal options of various types of construction wastes.

Table 5.1
Potential Reuse or Recycle and Disposal Option of Construction Wastes

Waste type	Works generating waste	Volumes lost as waste	Potential re-use or recycling	Disposal Options
Fill material	Site Formation	None	Material balance in deficit for site formation, and excess fill material produced during piling activities will be used to balance the deficit	No disposal considered - all fill will be used
	Construction of buildings	None		
Concrete	Road building	3-5%	Needs to be separated; re-useable material needs to be crushed	To public dump
	Construction of buildings			
Wood formwork, fencing	Road building	20%	Used as lower grade shuttering or fencing on-site or other sites	To public dump
	Construction of buildings			
Reinforcing steel, steel cable and shutters	Road building	1%	Most material can be re-used after cleaning	To public dump
	Construction of buildings			
Chemical waste	General site activities	Small amounts	Recycling/disposal firms will collect chemicals or waste oil, or refill oil containers	Chemical waste, including paints disposed of to treatment facility - REQUIRES LICENCE. Oil can be removed for recycling or soaked up by sand for disposal to landfill. Grease trap waste collected and disposed of to licensed contractor.
Oil waste				
Grease trap waste				
Wheel wash waste	Vehicle use during general works	Total volume when replaced	Recycling through filter until replacement of water is required	Onto sand area where natural filtration occurs, and oils can be retained before landfill disposal.
Domestic waste	General site activities	Putrescible waste, wet paper, fabrics	Cans, bottles, dry paper	To landfill

6 SITE ENVIRONMENTAL AUDIT

6.1 Site Inspections

6.1.1 Inspection of construction sites and activities is a direct means to assess if the Project works are undertaken in such a manner that adverse impacts on the environment are minimised to an acceptable levels. It is also an effective tool to trigger and enforce the environmental protection requirements on the construction site.

6.1.2 A formal site inspection shall be carried out at least once a month by the EM. The EM shall submit to the ER and Contractor a proposal on the site inspection and the deficiency and action reporting procedures within 21 days of the commencement of the Project works.

6.1.3 During the site inspections, the EM shall review the on-site environmental situation including pollution control and mitigation measures within the Project areas. The EM should also observe the off-site environmental situation to ascertain that any adverse impacts directly or indirectly arising from the Project works have been minimised to acceptable levels.

6.1.4 When conducting site inspections, the EM shall make reference to:

- (a) the EIA recommendations on environmental protection and pollution control mitigation measures;
- (b) the contract specifications on environmental protection;
- (c) the relevant environmental and pollution control laws;
- (d) the works progress and programme to determine if the current activities match closely with proposed activities;
- (e) work methodologies submitted by the contractors to match with existing practices to assess adequacy of the associated pollution control; and
- (f) previous site inspection results.

6.1.5 The Contractor shall update the EM with all relevant information of the construction contract for the EM to carry out site environmental audit.

6.1.6 The EM shall submit results of each site inspection to the ER and Contractor within 24 hours upon completion of the inspection for reference and immediate action, including details of recommended actions to be taken where deficiencies are recorded. The Contractor shall follow the procedures and time-frame as stipulated in the proposal on the site inspection and the deficiency and action reporting procedures and report on any remedial measures subsequent to the site inspections.

6.1.7 Ad hoc site inspections shall be carried out if significant environmental problems are identified. The ad hoc site inspections may also be required as part of the investigation work of the handling of an environmental complaint or the Action Plan for the EM&A.

6.2 Compliance with Legal and Contractual Requirements

6.2.1 In addition to the law of environmental protection and pollution control, construction activities shall also comply with contractual requirements of environmental protection and pollution control.

6.2.2 All the works method statements submitted by the Contractor to the ER for approval shall be vetted by the EM to ensure that sufficient measures for environmental protection and pollution control has been included.

6.2.3 The EM shall also check the progress and programme of the works if relevant environmental laws have not been violated, and if any foreseeable potential violations of the laws can be prevented.

6.2.4 The EM shall carry out document review regularly. The Contractor shall regularly provide copies of at least the following documents to the EM:

- (a) the updated Work Progress Reports;
- (b) the updated Works Programme;
- (c) the application letters for different licence/permits under the environmental protection laws;
- (d) all the valid licence/permit; and
- (e) the site diary upon request.

6.2.5 If any noncompliance with the contractual and legislative requirements on environmental protection and pollution control is detected from the document review, the EM shall advise the ER and the Contractor of the corrective actions for them to follow-up. The EM shall also advise the Contractor and the ER accordingly if the document review concludes that the current status on licence/permit application and any preparation works of environmental protection

and pollution control may not cope with the progress and programme of the works, or may result in potential violation of the requirements for environmental protection and pollution control in due course.

- 6.2.6 Upon receipt of the advice, the Contractor shall undertake immediate action to remediate the situation. The ER shall 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 Complaint

- 6.3.1 All complaints need sensitive handling. Environmental complaints shall be directed to the EM who shall be responsible for the implementation of complaints procedures. A flowchart of the handling of environmental complaints is given on Figure 6.1.

- 6.3.2 Each complaint shall be logged onto the Complaint Log to record details of the complaint:

- (a) data and time of receipt of complaint;
- (b) name, telephone or fax number, and address of complainant;
- (c) nature of the complaint;
- (d) site situations as observed by complainant;
- (e) communications made;
- (f) results of investigations and records of actions taken.

- 6.3.3 Each complainant shall be acknowledged receipt of the complaint as soon as possible in writing.

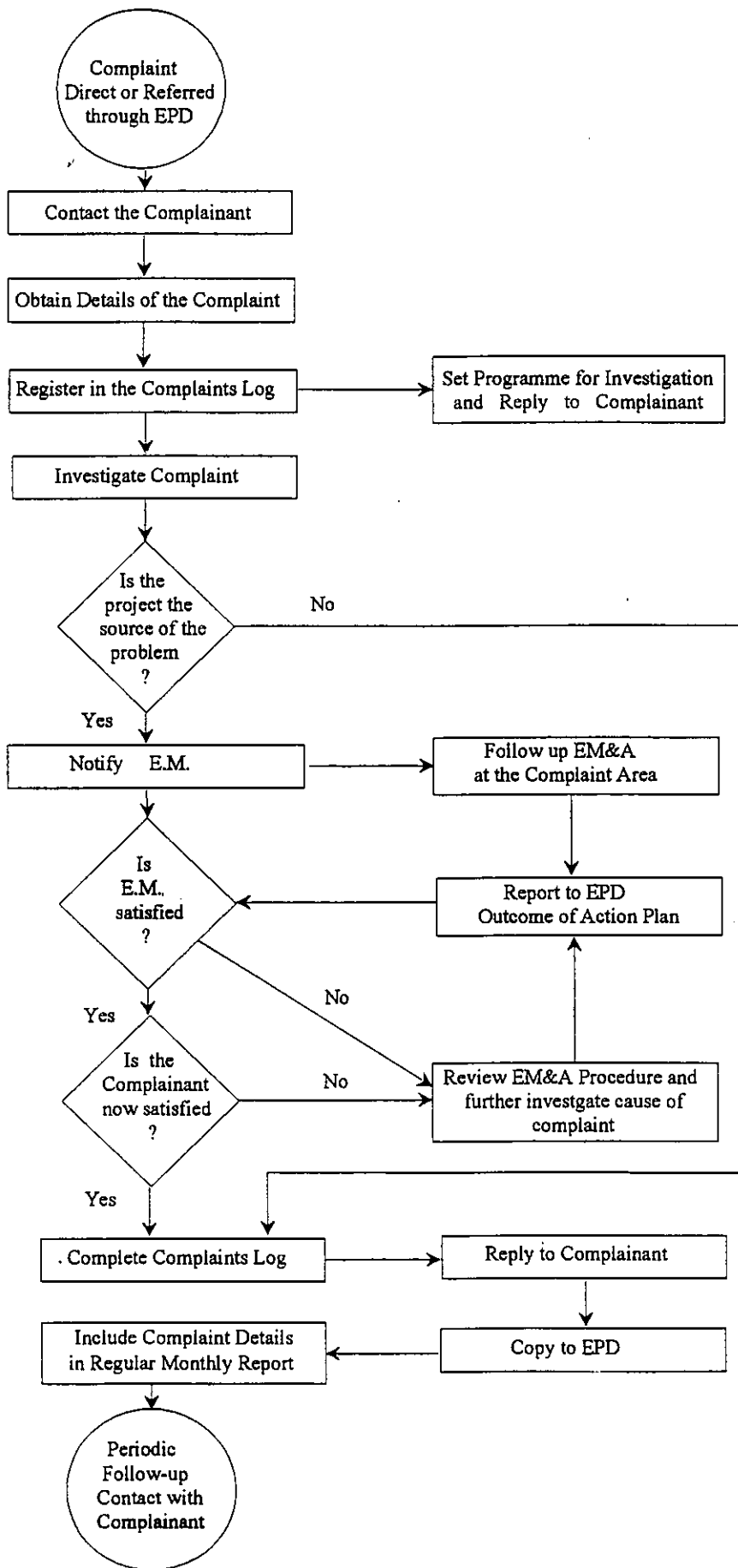
- 6.3.4 Each complaint shall be investigated to determine its validity and to assess whether the source of the problem is due to the Project works.

- 6.3.5 The EM shall identify appropriate mitigation measures if they are verified to be valid and due to the Project works. The EM shall also advise the Contractor accordingly on the required mitigation measures.

- 6.3.6 The EM shall inform the complainant of any findings and subsequent actions, if any. The EM may also need to contact the complainant after mitigation measures have been introduced to ensure their sufficiency.

- 6.3.7 The EM shall recommend additional monitoring if appropriate.

- 6.3.8 The EM shall review the Contractor's response on the recommended mitigation measures and the updated situation of the environmental complaint to ensure that recurrent of any error detected during complaint investigation is avoided.
- 6.3.9 If the complaint is transferred from the EPD, the EM shall submit interim report on the status of the complaint investigation and follow-up actions to the EPD within three working days upon receipt of the complaint.
- 6.3.10 The EM shall record all the environmental complaints, the investigation, the subsequent actions and the results in the monthly EM&A reports.
- 6.3.11 During the complaint investigation, 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 ER shall ensure that the measures have been carried out by the Contractor.



Contract Title :
HIGHWAY BETWEEN SHAP PAT
HEUNG INTERCHANGE AND POK OI
INTERCHANGE - POK OI FLYOVER
AND REMAINING WORKS

 BINNIE CONSULTANTS LIMITED
寶尼工程顧問有限公司
ENGINEERS AND SCIENTISTS

Title : **EM&A**

**ACTION FLOW CHART FOR HANDLING
COMPLAINTS OF EM & A PROGRAMME**

Figure No.	6.1	Revision	
Reference		File Name	
Prepared	FNW	Checked	
Date	APR. 97	Scale	N.T.S.

7 REPORTING

7.1 Lines of Communication for Reporting Function

7.1.1 Lines of Communication for the Reporting Function is illustrated on Figure 7.1.

7.2 Baseline Monitoring Report

7.2.1 The EM shall prepare and submit a Baseline Environmental Monitoring Report to the Contractor, the ER and the EPD within 10 working days of completion of the baseline monitoring.

7.2.2 The baseline monitoring report shall 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:
 - (i) monitoring methodology;
 - (ii) equipment used and calibration details;
 - (iii) parameters monitored;
 - (iv) monitoring locations;
 - (v) monitoring data, time, frequency and duration;
- (e) details on influencing factors, including:
 - (i) major activities, if any, being carried out on the site during the period;
 - (ii) weather conditions during the period;
 - (iii) other factors which might affect the results;
- (f) determination of the Action and Limit Levels for each monitoring parameter and statistical analysis of the baseline data;
- (g) revisions for inclusion in the EM&A Manual; and
- (h) comments and conclusions.

7.3 Monthly EM&A Reports

7.3.1 The results and findings of all EM&A work required in the Manual shall be recorded in the monthly EM&A reports.

7.3.2 The EM shall prepare and submit to the Contractor, the ER and the EPD the monthly EM&A report within 10 working days of the end of each reporting month, with the first report due in the month after construction commences.

7.3.3 Before submission of the first EM&A report, the EM shall liaise with the Contractor, the ER and the EPD on the exact number of copies and format of the monthly reports in both hard copy and electronic medium requirement.

First Monthly EM&A Report

7.3.4 The first monthly EM&A report shall include at least the following:

- (a) 1 to 2 page 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:
 - (i) all monitoring parameters;
 - (ii) environmental quality performance limits (Action and Limit levels);
 - (iii) Event-Action Plans;
 - (iv) environmental mitigation measures, as recommended in the project EIA study final report;
 - (v) environmental requirements in contract documents;
- (d) advice on the implementation status of mitigation measures of environmental protection and pollution control as recommended in the EIA Report and in updated implementation schedule;
- (e) drawings showing the project area, environmental sensitive receivers and the locations of the monitoring;

- (f) monitoring results (in both hard and diskette copies) together with the following information:
 - (i) monitoring methodology;
 - (ii) equipment used and calibration details;
 - (iii) parameters monitored;
 - (iv) monitoring locations;
 - (v) monitoring date, time, frequency, and duration;

- (g) graphical plots of trends of monitored parameters over the past four reporting periods for representative monitoring locations annotated against the following:
 - (i) major activities being carried out on site during the period;
 - (ii) weather conditions during the period; and
 - (iii) any other factors which might affect the monitoring results;

- (h) advice on the waste management status;

- (i) a summary of noncompliance with the environmental quality performance limits (Action and Limit levels);

- (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 or verbal) for each media, including locations and nature of complaints, liaison and consultation undertaken, actions and follow-up procedures taken and summary of complaints;

- (m) an account of the future key issues as reviewed from the works programme and works method statements.

Subsequent EM&A Reports

7.3.5 The subsequent monthly EM&A report shall include the following:

- (a) Title Page

- (b) Executive Summary (1-2 pages)
 - (i) Breaches of Action and Limit levels
 - (ii) Complaint Log
 - (iii) Reporting Changes
 - (iv) Future key issues
- (c) Contents Page
- (d) Environmental Status
 - (i) Drawing showing the project area, any environmental sensitive receivers and the locations of the monitoring
 - (ii) Summary of noncompliance with the environmental quality performance limits
 - (iii) Summary of complaints
- (e) Environmental Issues and Actions
 - (i) Review of issues carried forward and any follow-up procedures related to earlier noncompliance (complaints and deficiencies)
 - (ii) Description of the actions taken in the event of noncompliance and deficiency reporting
 - (iii) Recommendations (should be specific and target the appropriate party for action)
 - (iv) Implementation status of the mitigation measures and the corresponding effectiveness of the measures
- (f) Future Key Issues
- (g) Appendix
 - (i) Action and Limit levels
 - (ii) Graphical plots of trends of monitored parameters at key locations over the past four reporting periods for representative monitoring locations 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
 - (iii) Monitoring schedule for the present and next reporting period
 - (iv) Cumulative complaints statistics
 - (v) Details of complaints, outstanding issues and deficiencies

7.4 Quarterly EM&A Summary Reports

7.4.1 The quarterly EM&A summary report shall be prepared by the EM. It should generally consist of about 3 pages of text and tables and 2 pages of figures. It 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:
 - (i) monitoring parameters;
 - (ii) environmental quality performance limits (Action and Limit levels); and
 - (iii) environmental mitigation measures as recommended in the EIA Report;
- (d) advice on the implementation status of mitigation measures of environmental protection and pollution control as recommended in the EIA Report and in the updated implementation schedule;
- (e) drawings showing the project area, any environmental sensitive receivers and the monitoring locations;
- (f) graphical plots of the trends of monitoring parameters over the past 4 months (the last month of the previous quarter and the present quarter) for representative monitoring stations annotated against:
 - (i) the major activities being carried out on site during the period;
 - (ii) weather conditions during the period; and
 - (iii) any other factors which might affect the monitoring results;
- (g) advice on the waste management status;
- (h) a summary of noncompliance with the environmental quality performance limits (Action Limit levels);
- (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 or verbal) for each media, liaison and consultation undertaken, actions and follow-up procedures taken;
- (l) comments (e.g. effectiveness and efficiency of the mitigation measures), recommendations (e.g. any improvement in the EM&A programme) and conclusions for the quarter; and
- (m) proponents' contacts and any hotline telephone number for the public to make enquiries.

7.5 Data Keeping

7.5.1 The site document such as the monitoring field record, laboratory analysis records, site inspection forms, etc. are not required to be included in the monthly EM&A reports for submission. However, the document shall be properly updated and maintained by the EM and be ready for inspection upon request. All relevant information shall be clearly and systematically recorded in the document. The monitoring data shall also be recorded in magnetic media form, and the software copy can be available upon request. All the document and data shall be kept for at least one year after completion of the construction contract.

7.6 Interim Notifications of Environmental Quality Limit Exceedances

7.6.1 When noncompliance with the environmental quality limits occurs, the EM shall immediately notify the ER and the EPD, as appropriate. The notification shall be followed up with advice to EPD on the results of the investigation, proposed action and success of the action taken, with any necessary follow-up proposals. A sample template for the interim notifications is shown in Figure 7.2.

Monitoring Team
Contact person: _____
Organisation: _____
Phone no: _____
Fax no: _____

Contractor(s)
Contact person: _____
Organisation: _____
Phone no: _____
Fax no: _____

Environmental Manager	Engineer's Representative(s)
Contact person: _____	Contact person: _____
Organisation: _____	Organisation: _____
Phone no: _____	Phone no: _____
Fax no: _____	Fax no: _____
Engineer	
Contact person: _____	
Organisation: _____	
Phone no: _____	
Fax no: _____	

EPD
Contact person: _____
Organisation: _____
Phone no: _____
Fax no: _____

Client
Contact person: _____
Organisation: _____
Phone no: _____
Fax no: _____

Contract Title :
**HIGHWAY BETWEEN SHAP PAT
 HEUNG INTERCHANGE AND POK OI
 INTERCHANGE - POK OI FLYOVER
 AND REMAINING WORKS**

BENNE CONSULTANTS LIMITED 賓尼
賓尼工程顧問有限公司
 ENGINEERS AND SCIENTISTS

Title : **EM&A**

**LINES OF COMMUNICATION FOR
 REPORTING FUNCTION FOR
 EM & A PROGRAMME**

Figure No. 7.1	Revision
Reference	File Name
Prepared FNW	Checked
Date APR. 97	Scale N.T.S.

Incident Report on Action Level or Limit Level Non-compliance

Project	
Date	
Time	
Monitoring Location	
Parameter	
Action & Limit Levels	
Measured Level	
Possible reason for Action or Limit Level Non-compliance	
Actions taken / to be taken	
Remarks	

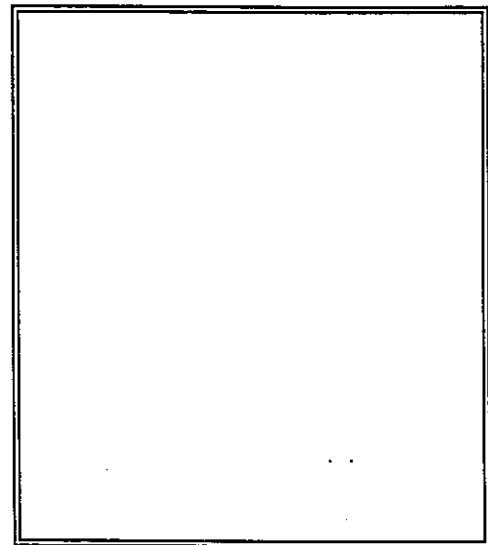
Location Plan

Prepared by : _____

Designation : _____

Signature : _____

Checked by : _____



Contract Title : HIGHWAY BETWEEN SHAP PAT HEUNG INTERCHANGE AND POK OI INTERCHANGE - POK OI FLYOVER AND REMAINING WORKS	Title : EM&A Interim Notifications of Environmental Quality Limit Exceedances	Figure No. 7.2	Revision
		Reference	File Name
		Prepared	Checked
		Date APR. 97	Scale N.T.S.