

ENVIRONMENTAL MONITORING &
AUDITING MANUAL

Hongkong Electric Company Limited

Lamma Power Station Extension:
EM&A Manual (Construction Phase)

March 2001

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**LAMMA POWER STATION EXTENSION
ENVIRONMENTAL MONITORING & AUDIT PROGRAMME
AT CONSTRUCTION PHASE**

Report Title Lamma Power Station Extension - EM&A Manual
(Construction Phase)

Date 26 March 2001

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For and on behalf of Environmental Resources Management
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1 INTRODUCTION

1.1 PURPOSE OF THE MANUAL

The purpose of this Environmental Monitoring and Audit (EM&A) Manual (Construction Phase) is to provide information, guidance and instruction to personnel charged with environmental responsibilities and undertaking environmental monitoring and auditing work during the Construction Phase of the Lamma Power Station Extension (the Project). It provides systematic procedures for the monitoring and auditing of potential environmental impacts that may arise from the works.

1.2 BACKGROUND

1.2.1 Background to the Study

The Environmental Impact Assessment (EIA) Report for the Project, which was prepared in response to the *EIA Study Brief No. ESB-001/1998* issued to Hongkong Electric Company Limited (HEC) by the Environmental Protection Department (EPD), was completed in February 1999. The EIA Report was submitted to the Director of Environmental Protection (DEP) in accordance with the *Environmental Impact Assessment Ordinance (EIAO)* on 23 December 1998 and was approved by DEP on 5 May 1999.

The EIA Study concluded that unacceptable or insurmountable impacts were not expected from the proposed development, provided the recommended mitigation measures in the EIA Report are adopted and implemented.

1.2.2 Project Description

The Project involves the construction of a gas-fired power station employing combined cycled gas turbine technology, forming an extension to the existing Lamma Power station. The following outlines the key elements of the Project including the construction activities associated with the transmission system and submarine gas pipeline.

(a) The New Power Station

Reclamation

The Lamma Extension site, which is shown in *Figure 1.2a*, will be constructed entirely by reclamation in a depth of water of about 10 metres. The site platform will provide a usable area of about 22 hectares and will be connected to the south-west corner of the existing Lamma Power Station by means of bridge. A water channel will be retained to the north of the Lamma Extension to avoid blockage of cooling water intakes for the existing power station facilities. Dredging will be required to remove soft marine mud at the seawall

and part of the reclamation area so as to provide an appropriate foundation stratum.

Issues for the reclamation works will include potential water quality impacts associated with dredging, reclamation and altered flow regimes, mud disposal, and impacts on fisheries and the marine environment.

Construction of Combined Cycle Plant

Six 300 MW gas-fired combined cycle units will be constructed on the Lamma Extension. Each unit will consist of gas turbines, heat recovery steam generators (HRSGs), a steam turbine, generators and a flue gas stack of about 110 m.

Key issues during the construction phase including local construction noise and dust impacts have been assessed in the EIA report, although these are not considered to be significant because of the substantial distance of the construction site from sensitive receivers.

Gas Receiving Station

To receive natural gas delivered from a regional LNG terminal through a pipeline, a gas receiving station will be required. Received natural gas will be processed in the receiving station and subsequently delivered to the plant for combustion. Major components of the station include shut-off valves, pig receiver, filter, gas heaters, pressure regulator, metering device, stack and protection system to ensure safe operation.

The Project area for the construction of new power station and extent of reclamation are shown in *Figure 1.2a*.

(b) Transmission System

The electricity generated from the Lamma Extension Project will be transmitted via a new transmission system linking the Lamma Extension to load centres on Hong Kong Island as shown in *Figure 1.2b*.

Proposed Route

The proposed Stage 1 transmission route from Lamma Extension to Hong Kong South is as follows:

- *Lamma Extension to Landing Point N2*: Underground cables passing through the existing power station complex for about 1 km, followed by the formation of cable ducts in rock through the existing hillside north of the power station to submarine cable landing point N2 in Yung Shue Wan (approx. 250 m);
- *Landing Point N2 to Landing Point N4*: Submarine Cables (approx. 3.2 km) between landing points N2 in Yung Shue Wan and N4 at Pak Kok Shan Tsuen;

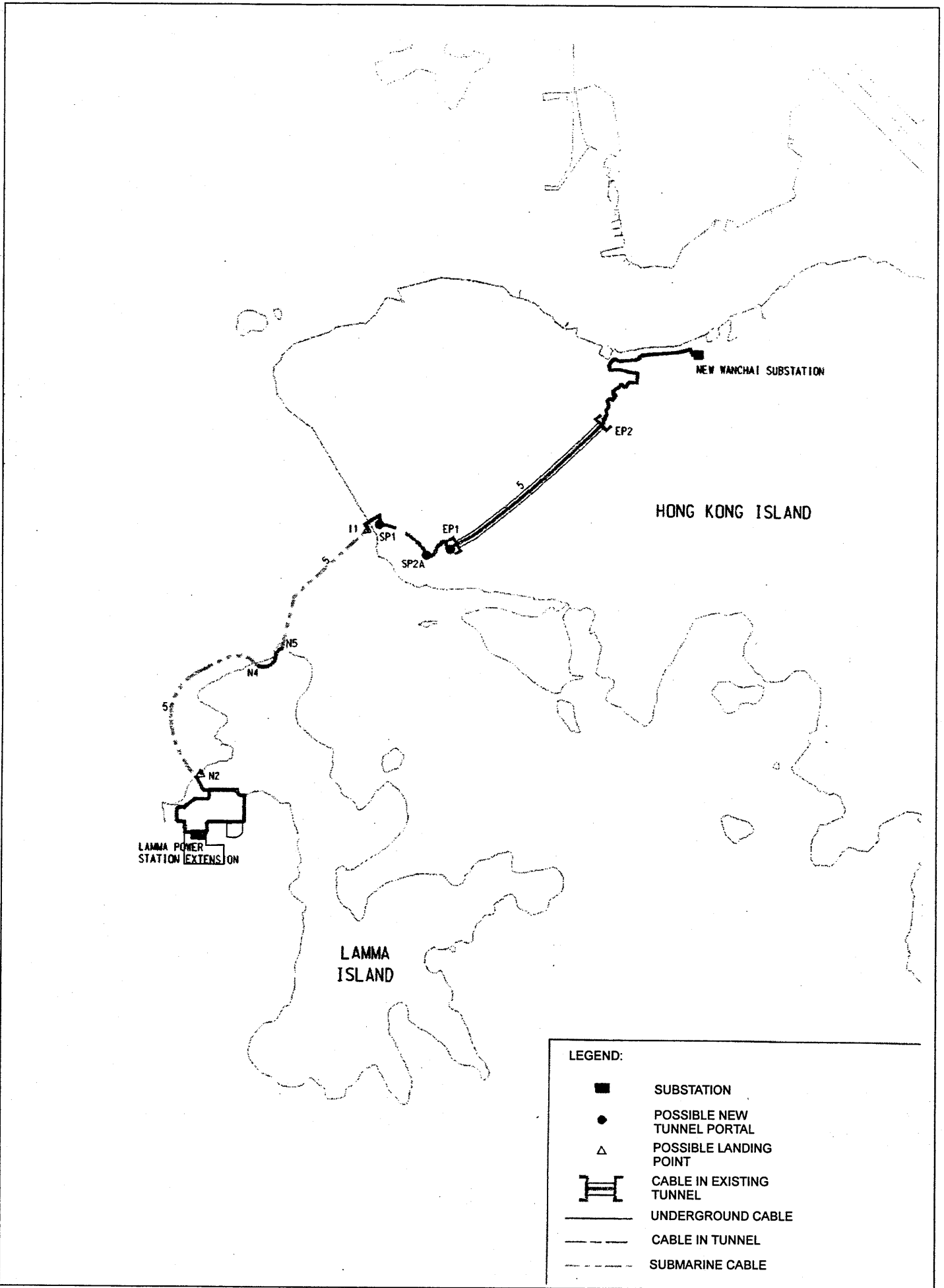


FIGURE 1.2b

PREFERRED TRANSMISSION ROUTE

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- *Landing Point N4 to Landing Point N5*: Land cables along the waterfront for approx. 260 m in a structural cable trough between cable landing points N4 & N5, crossing the Sandy Bay/Lamma water main in front of the new WSD pumphouse at Pak Kok Shan Tsuen; and
- *Landing Point N5 to Landing Point I1*: Submarine Cables (approx. 2.4 km) from landing point N5 at Pak Kok Peninsula to landing point I1 at the existing seawall of Telegraph Bay.

(c) Gas Pipeline

Natural gas for the new power station will be supplied via a submarine pipeline from a regional LNG terminal located at Cheng Tou Jiao in Shenzhen as shown in *Figure 1.2c*. As with the transmission cables, environmental impacts from the gas pipeline are only anticipated during the construction period.

Limited dredging will be required for laying of the submarine pipeline. For most of the pipeline route, a pipe jetting method will be used for laying of the pipeline under the seabed, which will not require the dredging of marine sediment. In areas where the pipeline crosses busy marine channels, the pipeline will be laid by jetting and covered by precast concrete slab. Dredging will only be necessary at the Lamma and Shenzhen approaches. As the sediment in the proposed Lamma approach is classified as Class A, the dredged sediment can be disposal of at designated marine dumping grounds.

"Class A dredged sediment [extracted from EPD's Technical Circular No. (TC) 1-1-92] - Uncontaminated material, for which no special dredging transport or disposal methods are required beyond those which would normally be applied for the purpose of ensuring compliance with EPD's Water Quality Objectives, or for protection of sensitive receptors near the dredging or disposal areas."

1.3

OBJECTIVES OF THE ENVIRONMENTAL MONITORING AND AUDIT PROGRAMME

The environmental impacts resulting from the construction of the Lamma Extension are specified in the Final EIA Report. The Report also specifies the mitigation measures that need to be implemented to ensure compliance with the required environmental criteria; these mitigation measures and their implementation requirements, are presented in the Implementation Schedule contained in *Annex B* of this Manual. In order to ensure that these mitigation measures are fully and effectively implemented, the EIA Report recommends that environmental monitoring should be carried out for noise, air, water and ecological monitoring during the construction phase. In addition, environmental audits for noise, air, water, ecological and waste management issues are also required.

This Manual provides specific details of the EM&A requirements that have been recommended to ensure compliance with the mitigation measures specified in the EIA Report.

The main objectives of this EM&A programme are:

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

1.4

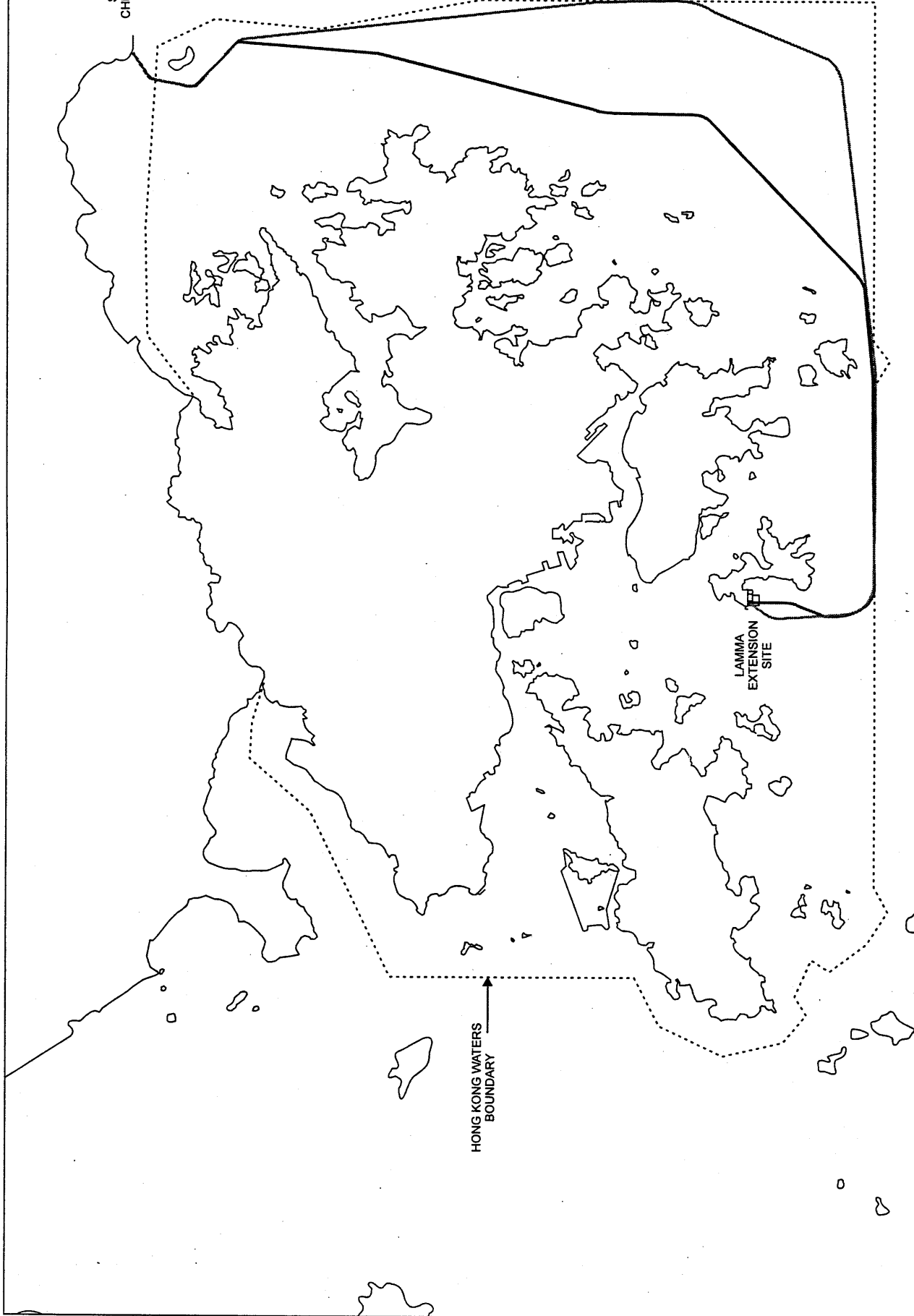
THE SCOPE OF THE ENVIRONMENTAL MONITORING AND AUDIT PROGRAMME

The scope of this EM&A programme is to:

- establish baseline noise, air and water quality levels at specified locations and review these baseline levels at specified period acceptable to the Authority;
- implement construction noise, air, water quality and ecological impact monitoring programmes;
- implement audit requirements to address noise, air, water quality, ecology, waste and landscape and visual issues;
- liaise with and provide environmental advice (as requested or when otherwise necessary) to construction site staff on the comprehension and consequences of the EM&A programme;
- identify and resolve environmental issues and other functions as they may arise from the works;
- check and quantify the Contractor's overall environmental performance, implement Event and Action Plans (EAPs), and recommend and



SHENZHEN
CHENGTOU JIAO



HONG KONG WATERS
BOUNDARY

LAMMA
EXTENSION
SITE

NOT TO SCALE



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----- PREFERRED GAS PIPELINE ROUTE
———— ALTERNATIVE GAS PIPELINE ROUTE

ROUTE OF GAS PIPELINE

FIGURE 1.2c

implement remedial actions to mitigate adverse environmental effects as they may arise from the works;

- conduct regular reviews of monitored impact data as the basis for assessing compliance with defined criteria and to ensure that necessary mitigation measures are identified, designed and implemented, and to undertake additional *ad hoc* monitoring and auditing as required by special circumstances;
- evaluate and interpret all environmental monitoring data to provide an early indication should any of the environmental control measures or practices fail to achieve the acceptable standards, and to verify the environmental impacts predicted in the EIA;
- manage and liaise with other individuals or parties concerning any other environmental issues deemed to be relevant to the construction process;
- conduct regular site audits of a formal or informal nature to assess:
 - the level of the Contractors' general environmental awareness,
 - the Contractors' implementation of the recommendations in the EIA Report,
 - the Contractors' performance as measured by the EM&A programme,
 - the need for specific mitigation measures to be implemented or the continued usage of those previously agreed; and
 - to advise the site staff of any identified potential environmental issues.
- submit regular EM&A reports which summarise project monitoring and auditing data, with full interpretation illustrating the acceptability or otherwise of any environmental impacts and identification or assessment of the implementation status of agreed mitigation measures.

1.5

STRUCTURE OF THE EM&A MANUAL (CONSTRUCTION PHASE)

Following this introductory Section, the remainder of the Manual is set out as follows:

- *Section 2* presents the organisation and structure for the management of the EM&A programme, outlines the various parties involved in the EM&A process, the notes and responsibilities of key individuals;
- *Section 3* presents the EIA findings and sets out the EM&A general requirements;
- *Section 4* details the requirements for baseline and impact monitoring for noise, and lists relevant monitoring equipment, locations, compliance and Event and Action Plans (EAPs);

- *Section 5* details the requirements for baseline and impact monitoring for air quality, and lists relevant monitoring equipment, locations, compliance and EAPs;
- *Section 6* details the requirements for baseline and impact monitoring for water quality, and lists relevant monitoring equipment, locations, compliance and EAPs;
- *Section 7* details the audit requirements with regard to waste management issues;
- *Section 8* details the audit procedures for the minimisation of landscape and visual impacts;
- *Section 9* details the EM&A programme for marine ecology;
- *Section 10* describes the scope and frequency of site auditing; and
- *Section 11* details the EM&A reporting requirements.

In addition, *Annex A* provides samples for EM&A Reporting Documentation, and *Annex B* presents the summary of mitigation measures recommended in the EIA Report in the form of an Implementation Schedule.

2.1

GENERAL

The construction of the Project requires that the Engineer to appoint an Environmental Team (ET) six months before the commencement of the construction of the Project. The roles of the ET are to conduct the monitoring and auditing works and to provide specialist advice to the Engineer on the undertaking and implementation of his environmental responsibilities.

The ET shall have previous relevant experience with managing similarly sized EM&A programmes and the Environmental Team Leader (ET Leader) shall be a recognised environmental professional, who has at least seven years relevant experience in environmental monitoring and auditing or environmental management.

To maintain strict control of the EM&A process, the Engineer shall appoint independent environmental consultants to act as an "Independent Environmental Checker" (IEC) at least two months before the commencement of construction of the project. The IEC is to verify and validate the environmental performance of the Contractor and the Environmental Team. The IEC shall have at least seven years' experience in EM&A or environmental management.

2.2

PROJECT ORGANISATION

An Environmental Management Committee (EMC) will be set up in HEC to oversee the EM&A programme for the Lamma Extension Project. The organisation and management structure for the EM&A programme is illustrated in *Figure 2.2a*. An Environmental Team will be employed to implement the environmental monitoring work as required by this EM&A Manual (Construction Phase).

The Chairman of the EMC (the "Environmental Manager") is the official contact person between EPD and HEC. The Environmental Manager shall be authorized to sign all submissions to the EPD in accordance with the requirements of the EM&A Manual (Construction Phase).

The Engineer of HEC shall appoint appropriate members of the Project and resident site staff to manage and supervise the work of the Contractor, the ET Leader and its various specialist teams and other professional delegates.

An Independent Environmental Checker (IEC) will be appointed by HEC to audit and verify the overall environmental performance of the construction site and assess the effectiveness of the ET.

The specific roles and responsibilities of the various parties involved in the EM&A process outlined above are further expanded upon in the following sections.

2.2.1

Contractor

Reporting to the Engineer, the Contractor shall:

- work within the scope of the construction contract and other tender conditions;
- provide assistance to the ET in conducting the required environmental monitoring;
- participate in the site inspections undertaken by the ET, as required, and undertake any corrective actions instructed by the Engineer;
- provide information/advice to the ET or IEC regarding works activities which may contribute, or be contributing to the generation of adverse environmental conditions;
- implement measures to reduce impact where Action and Limit levels are exceeded; and
- take responsibility and strictly adhere to the guidelines of the EM&A programme and complementary protocols developed by their project staff.

2.2.2

Engineer or Engineer's Representative

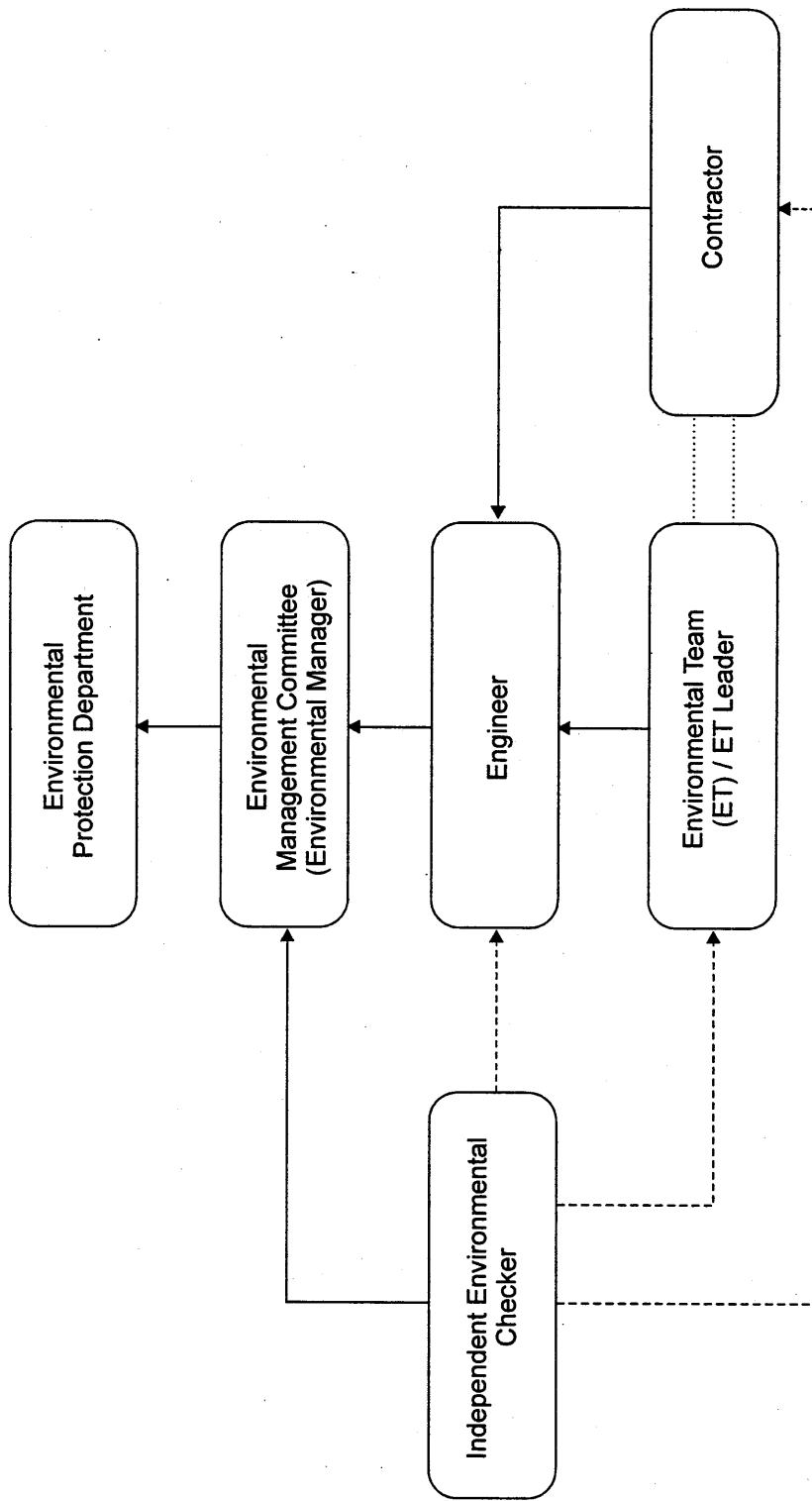
The Engineer or Engineers Representative (ER) shall:

- monitor the Contractor's compliance with contract specifications, including the effective implementation and operation of environmental mitigation measures and other aspects of the EM&A programme;
- engage an ET to undertake the monitoring, laboratory analysis and reporting of the environmental monitoring and audit requirements outlined in this Manual;
- comply with the agreed Event and Action Plans in the event of any exceedance;
- employ an Independent Environmental Checker IEC to audit the results of the EM&A works carried out by the ET; and
- instruct the Contractor to follow the agreed protocols or those in the Contract Specifications in the event of exceedances or complaints.

2.2.3

Environmental Team

The duties of the Environmental Team (ET) and Environmental Team Leader (ET Leader) are to:



- - - - Auditing
 ——— Reporting
 ······ Monitoring



Environmental Resources Management

ORGANIZATION OF ENVIRONMENTAL MONITORING & AUDITING PROGRAMME AT CONSTRUCTION PHASE

FIGURE 2.2a

- implement the EM&A programmes in accordance with the EM&A requirements as contained in this EM&A Manual;
- monitor the various environmental parameters as required by this or EM&A Manual (Construction Phase);
- prepare baseline and monthly EM&A reports for submission to the Authority;
- collect, analyse and statistically evaluate the EM&A monitoring data, with reference to the EIA Study recommendations, and to review the success of the EM&A programme by determining the adequacy of the mitigation measures implemented and the validity of the EIA predictions. Emphasis should be placed on identifying and resolving any adverse environmental impacts before they arise;
- conduct site inspections and investigate and inspect the Contractor's equipment and work methodologies with respect to pollution control and environmental mitigation, and to anticipate environmental issues that may require mitigation before the problem arises;
- audit the environmental monitoring data and report the status of the general site environmental conditions and the implementation of mitigation measures resulting from site inspections;
- certify the environmental acceptability of permanent and temporary works, relevant design, plans and submissions;
- monitor compliance with the environmental protection clauses / specifications in the Contract;
- regularly review the construction programme and construction methodology and comment as necessary;
- report on the environmental monitoring and audit results and the wider environmental issues (such as with compliance with environmental and pollution prevention and control regulations) and conditions to the Engineer;
- adhere to the agreed protocols (contained in this EM&A Manual and/or the Contract Specifications) in the event of exceedances or complaints. For complaints, this will comprise the investigation of all complaints, and the evaluation and identification of suitable corrective measures;
- liaise with the Independent Environmental Checker on all environmental issues performance matters, and the timely submission of relevant deliverables; and,
- advise the Contractor on environmental improvements, awareness, enhancement matters etc.

- certify if any necessary additional mitigation measures or alternative measures are required to be undertaken by the Contractor as the corrective actions to prevent adverse environmental impact arising from the construction activities.

2.2.4

Independent Environmental Checker

An Independent Environmental Checker (IEC) shall be appointed to independently audit and verify the overall environmental performance of the works and to assess the effectiveness of the ET in their duties. The IEC, who shall be independent from the management of the Project, shall advise the Engineer on the environmental issues related to the Project. The main objectives will be to:

- review and audit the overall EM&A programme including the implementation of all environmental mitigation measures, submissions relating to EM&A, and other submissions required under the Environmental Permit (EP);
- validate and confirm the accuracy of the monitoring results, monitoring equipment, monitoring locations, monitoring procedures, and locations of sensitive receivers;
- conduct random site inspections;
- review the effectiveness of environmental mitigation measures and project environmental performance;
- review and verify the monthly EM&A Report and the Baseline Reports prepared by the ET;
- verify the environmental acceptability of permanent and temporary works, and relevant design plans and submissions under EP;
- verify, if necessary, any additional mitigation measures or alternative measures to be undertaken by the Contractor as corrective actions to prevent adverse environmental impacts arising from the construction activities; and
- check complaint cases and the effectiveness of corrective measures implemented by the Contractor and the ET in case of Event & Action Plan.

2.3

CONSTRUCTION PROGRAMME

According to the latest project schedule, the construction programme would commence in early 2001, beginning with dredging and site formation work. The 1st new combined cycle unit would be in operation by June 2004. The rest five units will be constructed and operated in next 2 or 3-year intervals

depending on the system load growth as well as government approval. Throughout this period, many phases of construction will be carried out simultaneously in similar pattern as the 1st unit. *Table 2.3a* present the approximate timing and various activities of the construction programme, whilst *Figure 2.3a* presents this information graphically.

Table 2.3a *Tentative Construction Programme for the Lamma Power Station Extension Project*

Construction Activities	Programme Code	Duration
<u>Power Station</u>		
Site Formation	L9-L14	15/03/2001 - 15/03/2003
Piling & Civil Work	L9	15/01/2002 - 31/01/2003
Substructure & Superstructure	L9	15/10/2002 - 30/06/2004
E&M Erection	L9	01/01/2003 - 30/06/2004
<u>Submarine Gas Pipeline</u>		
Pipelaying	L9-L14	01/01/2003 - 31/08/2003
Jetting	L9-L14	01/09/2003 - 31/12/2003
Commissioning & Testing	L9-L14	01/01/2004 - 31/03/2004
<u>Transmission System</u>		
E&M Erection	L9 - L14	01/01/2002 - 30/04/2004

A revised construction programme is also attached in *Annex G* of this EM&A Manual.

As the implementation of the future gas fired units, viz L10 - L14 has yet to be endorsed, a review on the EM&A requirements will be conducted six months before work commencement of these units, taking into account the latest development programme stipulated in the Commissioning Schedule as submitted under Condition 4.3 of the Environmental Permit No. EP-071/2000/A issued under the EIA Ordinance.

3.1

INTRODUCTION

In this Section, the general requirements of the EM&A programme for the construction phase of the Lamma Extension Project are presented. The recommended mitigation measures and schedule for their implementation are detailed in *Annex B*.

The environmental issues associated with the construction phase of the Lamma Extension Project which were identified during the EIA process will be addressed through the monitoring and controls specified in the EM&A Manual (Construction Phase) and construction contract.

The predominant construction phase environmental issues of noise, dust and water pollution will be subject to EM&A; a broad description of the monitoring programme for these media is provided below. The monitoring of the effectiveness of the mitigation measures will be achieved through this process as well as through site inspections. The inspections will include within their scope, mechanisms to review and assess the Contractor's environmental performance, ensuring that the recommended mitigation measures have been properly implemented, and that the timely resolution of received complaints are managed and controlled in a manner consistent with the recommendations of the EIA.

3.1.1

Environmental Monitoring

The monitoring of environmental impacts shall be carried out by the Environmental Team; the monitoring work will comprise noise, air and water quality impacts at representative sensitive receivers or strategic locations in the vicinity of the works. The monitoring programme for the construction phase are presented in *Sections 4 to 6*. Marine ecological monitoring is also required during the construction and the specific requirements are presented in *Section 9*.

3.1.2

Action and Limit Levels

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

- *Action Levels*: beyond which there is a clear indication of a deteriorating ambient environment for which appropriate remedial actions are likely to be necessary to prevent environmental quality from falling outside the *Limit Levels*, which would be unacceptable; and
- *Limit Levels*: statutory and/or agreed contract limits stipulated in the relevant pollution control ordinances, the Hong Kong Planning Standards

and Guidelines (HKPSG) or *Environmental Quality Objectives* established by the EPD. If these are exceeded, works should not proceed without appropriate remedial action, including a critical review of plant and working methods.

3.1.3 *Event and Action Plans*

The purpose of the Event and Action Plans (EAPs) is to provide, in association with the monitoring and audit activities, procedures for ensuring that if any significant environmental incident (either accidental or through inadequate implementation of mitigation measures on the part of the Contractor) does occur, the cause will be quickly identified and remediated, and the risk of a similar event recurring is reduced. This also applies to the exceedances of A/L criteria identified in the EM&A programme.

3.1.4 *Site Inspections*

In addition to assessing the ongoing performance of the Contractor by means of noise, air, water quality and ecological monitoring, the ET shall undertake regular site inspections and audits of on-site practices and procedures. The primary objective of the inspection and audit programme will be to assess the effectiveness of the environmental controls established by the Contractor and the implementation of the environmental mitigation measures recommended in the EIA.

Whilst the audit and inspection programme will undoubtedly complement the monitoring activity with regard to the effectiveness of dust suppression, noise attenuation measures and water quality control, the criteria against which the audits shall be undertaken shall be derived from the clauses within the Contract Documents which seek to enforce the recommendations of the EIA and the established management systems.

The findings of site inspections and audits shall be made known to the Contractor at the time of the inspection to enable the rapid resolution of identified non-compliances. Non-compliances and the corrective actions undertaken shall also be reported in the monthly EM&A Reports.

Section 10 of this Manual presents details of the scope and frequency of on-site inspections and defines the range of issues that the audit protocols should be designed to address.

3.1.5 *Enquiries, Complaints and Requests for Information*

Enquiries, complaints and requests for information can be expected from a wide range of individuals and organisations including members of the public, Government departments, the press and television media and community groups. During the construction phase, the vast majority of such correspondence is likely to be received directly by the Engineer.

All enquiries concerning the environmental effects of the works, irrespective of how they are received, shall be reported to the Engineer and directed to the Contractor where necessary. The detailed complaints handling procedure is presented in Section 10.3.

3.1.6

Reporting

Monthly reports shall be prepared by the Environmental Team and verified by the Independent Environmental Checker. These shall be submitted to EPD through the Environmental Management Committee. The monthly reports shall be prepared and submitted within 2 weeks of the end of each calendar month. Additional details on reporting protocols are presented in *Section 11*.

3.1.7

Cessation of EM&A

The ET shall continue to carry out site inspections until the completion of the Construction works.

4 NOISE MONITORING

4.1 INTRODUCTION

In this section, the requirements, methodology, equipment, monitoring locations and mitigation measures for the monitoring and audit of noise impacts associated with the construction of the Lamma Extension Project are described.

4.2 MONITORING METHODOLOGY

Construction of Lamma Power Station Extension

The most critical NSR's will be used as representative indicators for other NSR's for monitoring of the construction noise impact from the Lamma Extension construction. With reference to the EIA report, the two critical NSR's are the Long Tsai Tsuen/Hung Shing Ye and the school within the village of Tai Wan San Tsuen. For the school, a lower noise limit level is applied due to educational institution.

Continuous noise alarm monitoring would be carried out to calculate the noise levels at these two critical NSRs for checking of any exceedance of limit levels as shown in *Tables 4.7a*.

The noise monitoring system will comprise two noise alarm stations at Ash Lagoon (roof top of decantrate pump house) and Ching Lam as shown in *Figure 4.4a*. The noise alarm station at Ash Lagoon is an additional one while the station at Ching Lam is the existing monitoring station as required by the EM&A programmes for Unit L7/8 and Ash Lagoon Operation. Based on standard acoustical principles and practices, the noise levels at the two critical NSRs will be calculated from the measured noise levels at the Ash Lagoon and Ching Lam. The details are described in *Annex C*.

The approach of using continuous noise monitoring data to predict the noise level at NSRs on a 24-hour basis instead of manual spot measurements is similar to that adopted in the current EM&A programmes for Units L7 & L8 and Ash Lagoon operation which has been endorsed by EPD.

In case of limit level exceedance at the critical NSRs, the data of the other existing noise monitoring stations in place (*viz.* Reservoir Area, Station Building Rooftop, Hung Shing Ye, etc.) will also be used for counter-checking.

Construction of Transmission System

Manual noise monitoring would be carried out at the Pak Kok Tsui residences for checking construction noise related to the transmission system.

Hand-held anemometer would be used to measure the wind speed during the monitoring. Noise measurements shall be made in accordance with standard acoustical principles and practices in relation to the weather conditions.

4.3

MONITORING EQUIPMENT

The sound level meters/analyzers used shall comply with International Electrotechnical Commission Publications 651:1979 (Type 1) and 804:1985 (Type 1).

The sound level meters/analyzers and calibrators shall be verified biennially and annually respectively by the manufacturer or accredited laboratory.

Construction of Lamma Power Station Extension

Monthly calibration of the noise measuring equipment shall be carried out.

Construction of Transmission System

The calibration procedures of manual noise monitoring shall follow the relevant Technical Memoranda under the *Noise Control Ordinance*.

4.4

MONITORING LOCATIONS AND SCHEDULE

Construction of Lamma Power Station Extension

It was suggested in the EIA report that an additional continuous noise alarm monitoring station be set up at Lamma Power Station, which should be closer to the site of Lamma Extension where construction noise clearly dominates the noise from the existing plant operations. With this in mind, the station at Ash Lagoon Pump House Rooftop is a preferred location as it is strategically situated on the line joining the site and the NSR at Long Tsai Tsuen/Hung Shing Ye.

The existing monitoring station at Ching Lam, on the boundary of power station, is close to the critical NSR at Tai Wan San Tsuen. Any noisy event arising from the Lamma Power Station Extension construction would be recorded at Ching Lam for predicting the noise level at Tai Wan San Tsuen first before going further to the other NSRs.

The locations of the two noise alarm stations at Ash Lagoon and Ching Lam are shown in the *Figure 4.4a*.

Construction of Transmission System

The location for manual noise monitoring would be at the nearest Pak Kok Tsui residences to cable landing points N4 and N5 as shown in *Figure 4.4b*.

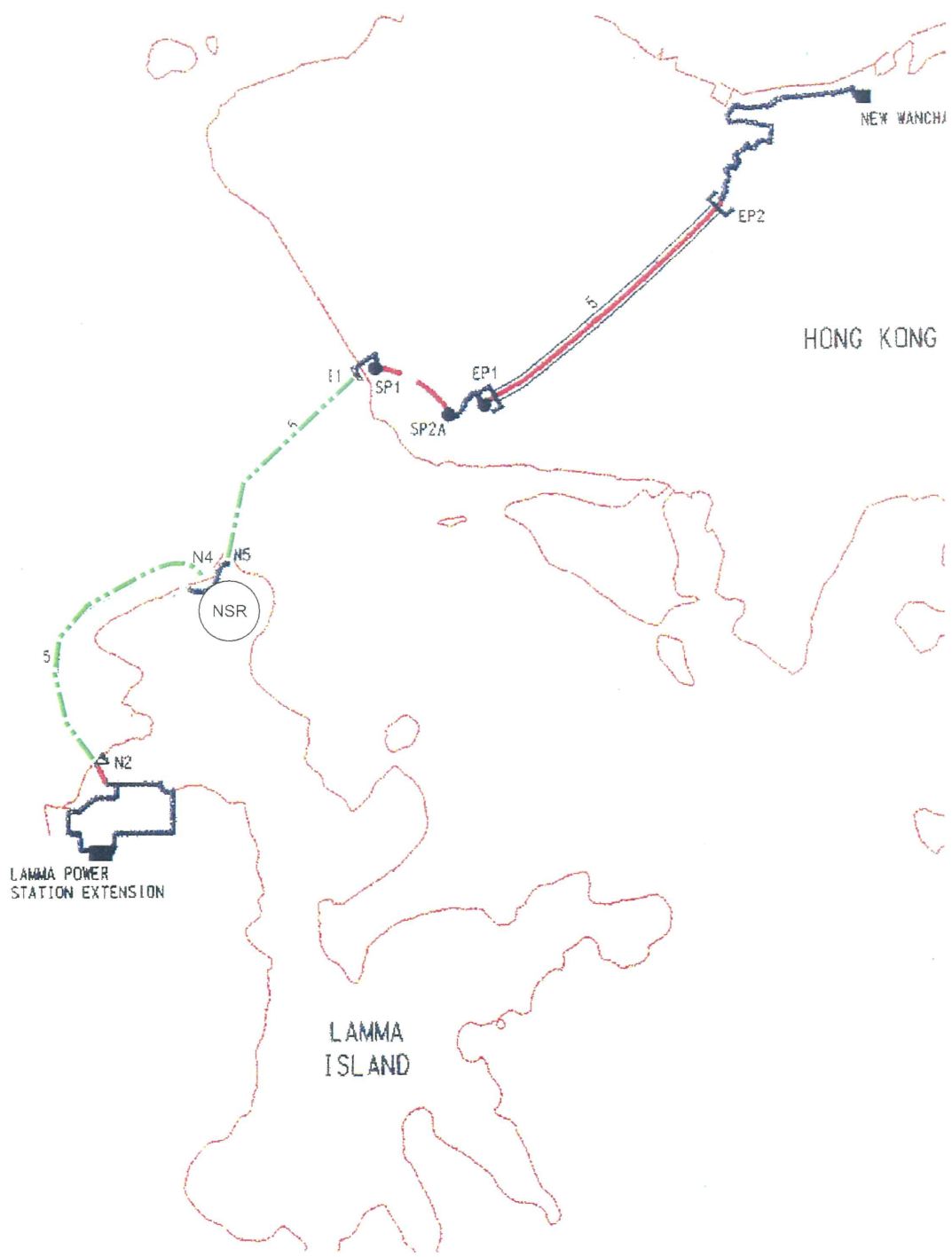


FIGURE 4.4b

LOCATION FOR NOISE MONITORING - CONSTRUCTION OF TRANSMISSION SYSTEM

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Environmental
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Management



4.5 **BASELINE MONITORING**

The baseline levels at the monitoring locations shall be determined prior to the commencement of the construction works of Lamma Power Station Extension and Transmission System.

Construction of Lamma Power Station Extension

For the existing monitoring station at Ching Lam, the 30-minute Leq's in the past 12 months can be regarded as the baseline level.

Baseline noise monitoring of six consecutive Leq (5 min) shall be carried out for 7 days at the new monitoring station at the Ash Lagoon.

Construction of Transmission System

Baseline noise monitoring of six consecutive Leq (5 min) for 7 days shall be carried out.

4.6 **IMPACT COMPLIANCE MONITORING**

The continuous noise alarm monitoring for the construction of Lamma Power Station Extension and the manual noise monitoring for the construction of the Transmission System would be carried out according to *Table 4.7a*.

4.7 **COMPLIANCE ASSESSMENT**

Action and Limit (A/L) Levels provide an appropriate framework for the interpretation of monitoring results. The noise impact monitoring data for construction noise other than percussive piling shall be checked against the agreed A/L levels as listed in *Table 4.7a* for construction noise other than percussive piling.

4.8 **EVENT AND ACTION PLAN**

All the impact monitoring results should be checked against the Action and Limit levels set out in *Tables 4.7a*. Actions required in the event of exceedance of any of the levels are summarised in *Table 4.8a*.

4.9 **MITIGATION MEASURES**

The EIA has recommended noise control and mitigation measures during the construction phases of the Project. These are outlined in the Implementation Schedule (*Annex B*). In the event of exceedances or complaints, the ET and Contractor shall be responsible for reviewing the effectiveness of these measures and for proposing, designing and implementing alternative measures as appropriate.

Table 4.7a Monitoring Frequency and Action & Limit Levels of Construction Noise (Other than Percussive Piling)

Parameters	Frequency	Action	Limit	Proposed Action
1. Noise Levels at the NSRs at Long Tsai Tsuen/Hung Shing Ye and school within the village of Tai Wan San Tsuen predicted by the noise alarm monitoring system (Annex C)	Continuous	When one or more documented complaints are received	<p>a. 75 dB(A) in $L_{Aeq,30 \text{ min}}$ (07:00-19:00 hrs on normal weekdays) (Note 2)</p> <p>b. Subject to statutory control under the Noise Control Ordinance (07:00-23:00 hrs on holidays and 19:00-23:00 hrs on all other days)</p> <p>c. Subject to statutory control under the Noise Control Ordinance (23:00-07:00 hrs of next day)</p>	In case of exceedances of respective AL levels, action as outlined in Section 4.8 should be taken.
2. Manual noise monitoring at the nearest Pak Kok Tsui residences to cable landing points N4 and N5 (Note 1)	Twice per week (period a) and once per week (periods b-c)			

Note:

- One set of measurements shall include one $L_{Aeq,30 \text{ min}}$ for period a or three consecutive $L_{Aeq,5 \text{ min}}$, for periods b and c.
- For educational institution, the limit level shall be 70 dB(A), reduced to 65 dB(A) during examination periods.

Table 4.8a *Event and Action Plans - Construction Noise*

Exceedance Action Level	ET Leader	IEC	Engineer	Contractor
	Undertake noise measurement/check monitoring data to establish validity of complaint.	Review the analysed results submitted by the ET.	Notify Contractor of the complaint if proven.	Submit proposals for remedial actions to Engineer.
	If the complaint is valid, inform Engineer and IEC verbally.	Review the remedial measures proposed by the Contractor and advise the Engineer and ET accordingly.	Check Contractor's working methods and advise IEC and ET accordingly.	Amend proposals if required by the Engineer.
	Identify the source(s) of the noise.	Verify the implementation of the remedial measures.	Remind the Contractor of his contractual obligations and discuss remedial actions.	Implement the remedial actions immediately upon instruction from the Engineer.
	Discuss remedial actions required with Contractor and Engineer.		Keep the Contractor informed of the efficacy of remedial actions.	Liaise with the Engineer to optimise the effectiveness of the agreed mitigation.
	Increase manual monitoring frequency to assess efficacy of remedial measures.			
	If exceedance continues, review implementation of appropriate mitigation measures.			
Limit Level	Repeat manual measurement/check monitoring data to confirm findings.	Agree potential remedial actions with Engineer, ET and Contractor.	Notify Contractor of exceedance.	Take immediate action to avoid further exceedance.
	Identify the source(s) of the impact. If the exceedance is found to be valid and due to the Construction works, verbally advise the Contractor, Engineer and IEC, and inform the EPD of the exceedance, as soon as practicable.	Review Contractor's remedial actions / measures to ensure their effectiveness and advise the Engineer and ET accordingly.	Check Contractor's working methods and advise IEC and ET accordingly.	Submit proposals for remedial actions to Engineer.
	Discuss remedial actions required with Engineer.	Verify the implementation of the remedial measures	Discuss with Contractor the remedial actions to be implemented.	Amend proposals if required by the Engineer.
	Increase manual monitoring frequency to assess efficacy of remedial measures.		Keep the Contractor informed of the efficacy of remedial actions.	Implement remedial actions immediately upon instruction from the Engineer.
			If the exceedance continues, consider what portion of the work is responsible and instruct the Contractor to stop the portion of work until the exceedance is abated	If the exceedance continues, consider what portion of the work is responsible and, as instructed by the Engineer, stop the portion of work until the exceedance is abated

5 AIR QUALITY MONITORING

5.1 INTRODUCTION

In this section, the requirements, methodology, equipment, monitoring locations, criteria and protocols for the monitoring and audit of air quality impacts during the construction of the Lamma Extension Project are presented.

5.2 METHODOLOGY AND CRITERIA

Dust monitoring, in terms of total suspended particulate (TSP), will be undertaken in accordance with the methodology and procedures stipulated in *USEPA Standard Method, CFR Part 50, Appendix B, Reference Method for the Determination of Suspended Particulate Matter in the Atmosphere (High-Volume Method)*.

5.3 MONITORING EQUIPMENT

Unless otherwise approved by EPD, the high volume sampler will be referenced in the *USEPA Standard Method 40, CFR Part 50, Appendix B*.

Same as the current Quality Assurance (QA) procedures established for Unit L7/8 EM&A operation endorsed by EPD, equipment should be calibrated at monthly intervals. Deviation from the calibrated flow rate should be noted and appropriate adjustments made.

Staff members of ET responsible for monitoring should undergo appropriate training to ensure correct sampling and handling procedures. Exposed filters should be handled carefully to avoid errors through sample loss.

Normal gravimetric analysis of filters is required on oven dried filters or equivalent. Appropriate laboratory protocols for gravimetric determinations should be followed. Procedures for routine calibration and QA for TSP measurements are given in *Annex D*.

5.4 MONITORING LOCATIONS

Routine dust monitoring during construction is to be carried out by ET at two sites within Lamma Power Station (AM1 and AM2) and one at Tai Yuen Village (AM4) as shown in *Figure 5.4a*. The former two dust monitoring stations are required by the existing Specified Processes Licence (L-7-002) under the Air Pollution Control Ordinance while the latter one at Tai Yuen Village by the Environmental Monitoring & Auditing Programme for Unit L7/8 operation agreed with EPD.

High Volume Air Samplers (HVAS) are employed for the dust monitoring stations within the boundaries of Lamma Power Station. However, taking into account the possible noise nuisance from HVAS to the nearby neighbourhood, a mini-volume air sampler approved by EPD, is installed in the monitoring station at Tai Yuen Village.

All the existing dust monitoring stations within the boundaries of Lamma Power Station consist of one set of TEOM model 1400a real time dust monitor and a HVAS. TEOM real time dust monitor is widely employed by EPD for ambient dust monitoring in Hong Kong. Considering that time is required to condition the TSP filters before weighing, HEC has voluntarily installed the real time dust monitors for providing an indicative signal to determine whether repeat sampling by HVAS is required. The 1-hour indicative TSP data given by the TEOM can also be used for proactive dust control as well as for investigation in case of complaints.

For the present EM&A programme for the construction of the Lamma Extension Project, it is suggested that the three existing dust monitoring stations be used together with one additional monitoring station at the roof top of Ash Lagoon Decantrate Tower (AM3), which is strategically situated on the line joining the site and the sensitive receivers at Hung Shing Ye as shown in *Figure 5.4a*. Any pollution source arising from the Lamma Extension will trigger the AL level at the new dust monitoring station first before going further to the sensitive receivers at Hung Shing Ye. The new dust monitoring station will consist of a TEOM and a HVAS or its equivalence providing 1-hour and 24-Hour TSP measurements respectively.

5.5 *METEOROLOGICAL MONITORING*

Following the current EM&A practice for Unit L7/8 operation, the meteorological information obtained from Hong Kong Observatory (viz. wind speed, wind direction and relative humidity) would be used to correlate with the 24-hour TSP data.

5.6 *BASELINE MONITORING*

Baseline levels for both 24-hour and 1-hour TSP sampling should be determined before the commencement of the construction work for Lamma Extension. Action levels shall be derived based on the criteria in *Table 5.6a*.

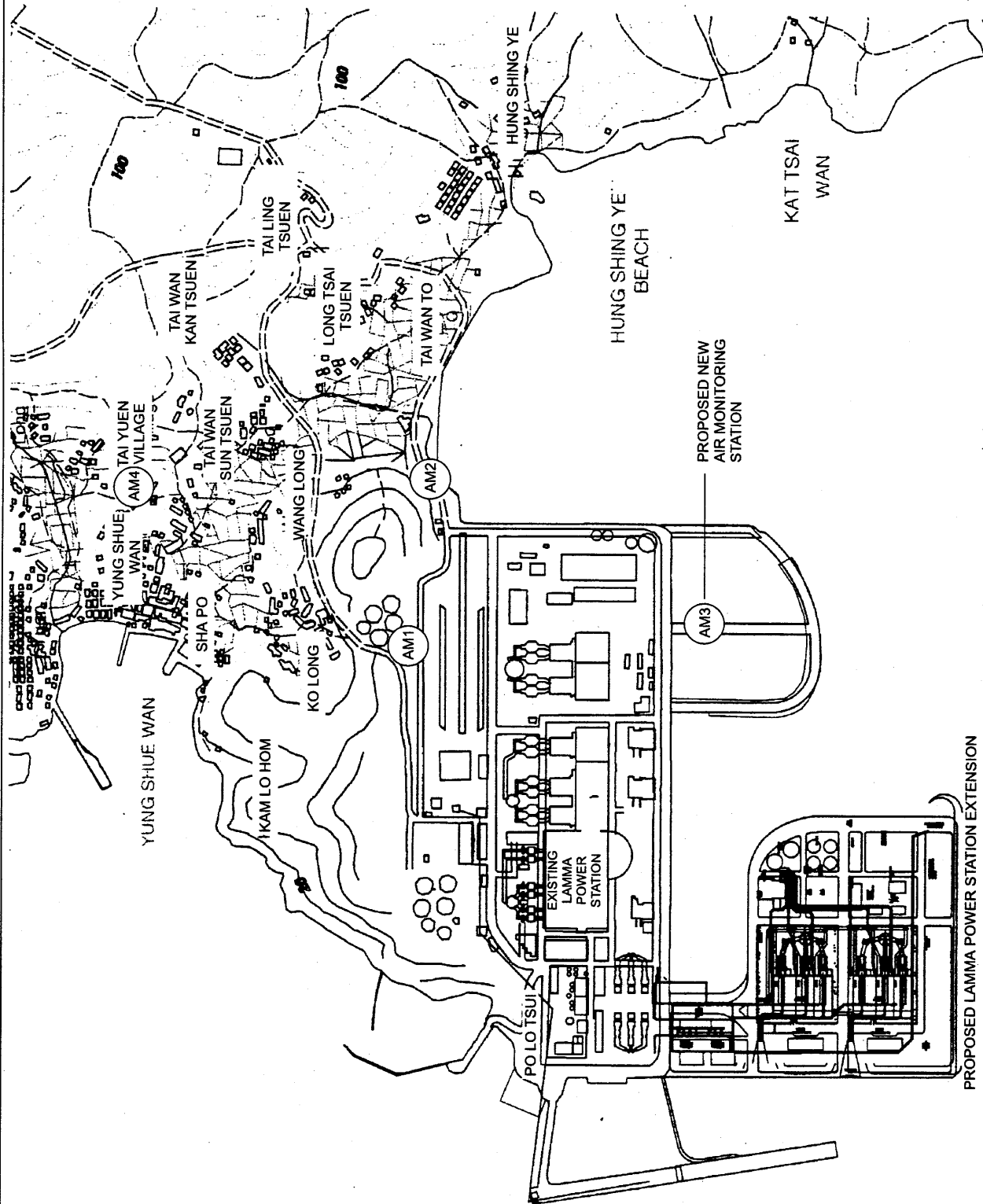
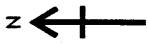


FIGURE 5.4a

LOCATIONS OF AIR QUALITY MONITORING STATION - LAMMA POWER STATION EXTENSION CONSTRUCTION

Table 5.6a Action and Limit Levels for TSP

Parameters	Action	Limit
24-hour TSP level in $\mu\text{g}/\text{m}^3$	For Baseline < 200 $\mu\text{g}/\text{m}^3$, Action level = (130% x baseline + the Limit Level)/2 For Baseline > 200 $\mu\text{g}/\text{m}^3$, Action level = Limit level	260
1-hour TSP level in $\mu\text{g}/\text{m}^3$	For Baseline < 384 $\mu\text{g}/\text{m}^3$, Action level = (130% x baseline + the Limit Level)/2 For Baseline > 384 $\mu\text{g}/\text{m}^3$, Action level = Limit level	500

As previously mentioned, a comprehensive monitoring system for dust emission from the existing coal-fired generating units at Lamma Power Station is stipulated in both the existing Specified Processes Licence and EM&A requirements for Unit L7/8 Operation. Hence, the results of the dust monitoring in the first quarter of 2000 can be regarded as the baseline monitoring for determination of the appropriate Action level.

5.7 IMPACT MONITORING

The frequency of 24-hour TSP monitoring at AM1 to AM4 is once every six days for impact monitoring. 1-hour TSP measurement at AM1 to AM3 shall be conducted at least three times every six days when the highest dust impacts are likely to occur. In the event of a non-compliance with the air quality criteria, or the receipt of complaints, more frequent monitoring exercises shall be conducted, within 24 hours after the result are obtained, as specified in the Event and Action Plan.

5.8 COMPLIANCE ASSESSMENT

The air quality monitoring data shall be checked against the A/L levels given in Table 5.8a. The derivation of Action Level is presented in Annex E.

Table 5.8a Specific Action in Response of Exceedance of AL Level (Air Emission)

Source of Emission	Parameters to be monitored	Frequency	Concentration not to be exceeded	Action	Limit	Proposed Action
Construction Dust	Particulate Ambient TSP (24-Hour)	Once every six days	260 $\mu\text{g}/\text{m}^3$	190	260	In case of exceedance of respective AL levels, actions as outlined in section 5.9 should be taken.
	Particulate Ambient TSP (1-Hour)	Three times every six days	500 $\mu\text{g}/\text{m}^3$	340	500	In case of exceedance of respective AL levels, actions as outlined in section 5.9 should be taken.

EVENT AND ACTION PLANS

All the impact monitoring results should be checked against the Action and Limit levels set out in *Table 5.8a*. Actions required in the event of exceedance of any of the levels are summarized in *Table 5.9a*.

Table 5.9a Event and Action Plans for Air Quality

Event	Monitoring		Action	
	ET Leader	IEC	Engineer	Contractor
Action Level				
Exceedance of one sample	Identify source Inform Engineer and IEC verbally Repeat measurement to confirm finding	Check monitoring data submitted by ET and advise Engineer.	Notify Contractor Checking monitoring data and contractor's working methods	Rectify any unacceptable practice amend any working methods if appropriate
Exceedance of two or more consecutive samples	Identify source Inform Engineer and IEC verbally Repeat measurement to confirm finding Increase monitoring frequency Discuss with Engineer and Contractor on remedial actions required If exceedance continues, arrange meeting with Engineer If exceedance stops, discontinue additional monitoring	Check monitoring data submitted by ET and advise Engineer. Provide feedback to the Engineer on the remedial actions proposed by the ET / Contractor Advise Engineer on the effectiveness of the proposed remedial measures Verify the implementation of the remedial measures	Confirm receipt of notification of failure in writing Notify contractor Checking monitoring data and contractor's working methods Discuss proposed remedial actions with the ET and Contractor Ensure remedial actions properly implemented	Submit proposals for remedial actions to Engineer within 3 working days of notifications Implement the agreed proposals Amend proposal if appropriate
Limit level				
Exceedance of one sample	Repeat measurement to confirm finding. Identify the source(s) of the impact. If the exceedance is found to be valid and due to the Construction works, verbally advise the Contractor, Engineer and IEC, and inform the EPD of the exceedance, as soon as practicable. Increase monitoring frequency to daily Assess the effectiveness of the contractor's remedial actions and keep Engineer, IEC and EPD informed of the results	Check monitoring data submitted by ET and advise Engineer Provide feedback to the Engineer on the remedial actions proposed by the ET / Contractor Advise Engineer on the effectiveness of the proposed remedial measures Verify the implementation of the remedial measures	Confirm receipt of notification of failure in writing Notify Contractor Checking monitoring data and Contractor's working method Discuss with ET and Contractor on remedial actions to be provided Ensure remedial measures properly implemented	Take immediate action to avoid further exceedance Submit proposals for remedial actions to Engineer within 3 working days of notifications Implement the agreed proposals Amend proposal if appropriate

Event	Monitoring		Action	
	ET Leader	IEC	Engineer	Contractor
Exceedance of two or more consecutive samples	<p>Identify source</p> <p>If the exceedance is found to be valid and due to the construction works, verbally advise the Contractor, Engineer and IEC, and inform the EPD of the exceedance as soon as practicable.</p> <p>Repeat measurement to confirm finding</p> <p>Increase monitoring frequency to daily</p> <p>Carry out analysis of Contractor's working procedures to determine possible mitigation to be implemented</p> <p>Arrange meeting with Engineer and Contractor to discuss the remedial actions to be taken</p> <p>If exceedance stops, discontinue additional monitoring</p>	<p>Provide feedback to the Engineer on the remedial actions proposed by the ET / Contractor</p> <p>Advise Engineer on the effectiveness of the proposed remedial measures</p> <p>Verify the implementation of the remedial measures</p>	<p>Confirm receipt of notification of failure in writing</p> <p>Checking monitoring data and Contractor's working methods</p> <p>Notify Contractor</p> <p>Discuss proposed remedial actions with ET and Contractor</p> <p>Ensure remedial measures properly implemented</p> <p>If exceedance continues, consider what portion of the work is responsible and instruct the Contractor to stop the portion of work until the exceedance is abated</p>	<p>Take immediate action to avoid further exceedance</p> <p>Submit proposals for remedial actions to Engineer within 3 working days of notifications</p> <p>Implement the agreed proposals</p> <p>Resubmit proposals if problem still not under control</p> <p>Stop the relevant portion of works as determined by the Engineer until the exceedance is abated</p>

MITIGATION MEASURES

The EIA has recommended air quality control and mitigation measures during the construction phases of the Project. These are outlined in the Implementation Schedule (*Annex B*). In the event of exceedances or complaints, the ET and Contractor shall be responsible for reviewing the effectiveness of these measures and for proposing, designing and implementing alternative measures as appropriate.

6 WATER QUALITY MONITORING

6.1 INTRODUCTION

In this section, the requirements, methodology, equipment, monitoring locations and mitigation measures for the monitoring and audit of water quality impacts from the construction of the Project are presented.

6.2 METHODOLOGY AND CRITERIA

Based on the recommendation in the EIA report, marine water quality monitoring shall be carried out to ensure that any deteriorating water quality is readily detected and that timely action is taken to rectify the situation. The appropriate water quality mitigation measures are outlined in the Implementation Schedule (in *Annex B* of this EM&A Manual (Construction Phase)).

6.3 WATER QUALITY MONITORING

The objectives of the water quality monitoring programme are as follows:

- to determine the effectiveness of the operational controls and mitigation measures employed, and the need for supplementary mitigation measures; and
- to check compliance with relevant WQOs;

Parameters to be measured *in situ* are:

- Dissolved oxygen (DO) (% saturation);
- Dissolved oxygen (DO) (in mgL⁻¹);
- Temperature (°C);
- Turbidity (NTU);
- Salinity (ppt);
- pH; and
- Water depth (m).

Parameters to be measured in the laboratory are:

- suspended solids (mg L⁻¹);
- total inorganic nitrogen (mg L⁻¹); and
- un-ionised ammonia (mg L⁻¹).

In addition to the water quality parameters, other relevant data shall also be measured and recorded as follows:

- monitoring location/position;
- measuring depth;
- time;
- weather conditions,
- sea conditions (where appropriate);
- tidal stage (where appropriate);
- special phenomena and work activities at the construction site.

A sample monitoring record sheet shown in *Annex A*.

6.4

MONITORING EQUIPMENT

For water quality monitoring, the following equipment shall be used to carry out the monitoring:

(a) Dissolved Oxygen and Temperature Measuring Equipment

The instrument shall be a portable, weatherproof dissolved oxygen measuring instrument complete with cable, sensor, comprehensive operation manuals, and shall be operable from a DC power source. It shall be capable of measuring:

- dissolved oxygen levels in the range of 0 - 20 mg L⁻¹ and 0 - 200% saturation; and
- a temperature of 0 - 45 degrees Celsius.

It shall have a membrane electrode with automatic temperature compensation complete with a cable of not less than 25 m in length. Sufficient stocks of spare electrodes and cables shall be available for replacement where necessary. (For example, YSI model 59 metre, YSI 5739 probe, YSI 5795A submersible stirrer with reel and cable or an approved similar instrument).

(b) Turbidity Measurement Equipment

Turbidity within the water shall be measured in-situ by the nephelometric method. The instrument shall be a portable, weatherproof turbidity-measuring unit complete with cable, sensor and comprehensive operation manuals. The equipment shall be operated from a DC power source, it shall have a photoelectric sensor capable of measuring turbidity between 0 - 1000 NTU and shall be complete with a cable with at least 25 m in length (Hach 2100P or an approved similar instrument).

(c) Water Depth Gauge

A portable, battery-operated echo sounder approved by the authority shall be used for the determination of water depth at each designated monitoring station. This unit shall either be hand-held or affixed to the bottom of the

work boat if the same vessel is to be used throughout the monitoring programme.

(d) *Salinity Measurement Instrument*

A portable salinometer capable of measuring salinity in the range of 0 - 40 ppt shall be provided for measuring salinity of the water at each monitoring location.

(e) *pH Measuring Instrument*

A portable pH meter shall be provided for measuring pH of the water at each monitoring location.

(f) *Water Sampling Equipment*

A water sampler, consisting of a transparent PVC or glass cylinder of not less than two litres which can be effectively sealed with cups at both ends, shall be used (Kahlsico Water Sampler 13SWB203 or an approved similar instrument). The water sampler shall have a positive latching system to keep it open and prevent premature closure until released by a messenger when the sampler is at the selected water depth.

Water samples for SS, TIN and ammonia measurements shall be collected in high density polythene bottles, packed in ice (cooled to 4 °C without being frozen), and delivered to a HOKLAS laboratory as soon as possible after collection.

(g) *Positioning Device*

A hand-held or boat-fixed type Global Positioning System (GPS) Receiver shall be used during monitoring to ensure the monitoring vessel is at the correct location before taking measurements.

6.5

TESTING PROTOCOLS

- (a) All measuring equipment shall be checked, calibrated and maintained at intervals as recommended by the equipment manufacturers throughout all stages of the monitoring programme.
- (b) Sufficient stocks of spare parts shall be maintained for replacements when necessary. Backup monitoring equipment shall also be made available so that monitoring can proceed uninterrupted even when equipment is under maintenance or calibration.

6.6

LABORATORY ANALYSIS

All laboratory work shall be carried out in a HOKLAS accredited laboratory. Water samples of about 1,000 mL shall be collected at the monitoring and control stations for carrying out the laboratory determinations. The

determination work shall start within 24 hours after collection of the water samples. The analyses shall follow the standard methods according to *Table 6.6a* and as described in APHA *Standard Methods for the Examination of Water and Wastewater, 19th Edition*, unless otherwise specified.

Table 6.6a *Analytical Methods to be Applied to Marine Water Quality Samples*

Determinant	Standard Method
Suspended solids	APHA 17e 2540D
Total inorganic nitrogen	APHA 18ed 4500 - NO ₂ B & NO ₃ E+ APHA 17ed 4500 - NH ₃ B, E
Unionised ammonia	APHA 17ed 4500 - NH ₃ B, E

6.6.1 *Quality Assurance and Quality Control*

Field Logs

Field logs are maintained for all survey works, noting the date of the survey, equipment used, survey date personnel and a record of all activities and observations. Field logs are retained for the duration of the Project and archived on completion.

In-situ measured data is digitally recorded from the instruments and converted into Microsoft Excel format. Both soft-copy on disk and hardcopy are retained for records. Any deviation from the standard procedures shall be noted in the log and the reason for the deviation recorded. In addition, field logs shall contain notes of events or activities in the vicinity of the monitoring location which might give rise to anomalous values being measured.

Sampling

All samples will be assigned with a unique code which shall be attached to the sample container or written directly on the container.

Measurement Procedures

All in-situ monitoring equipment shall be checked and calibrated throughout all stages of the monitoring, or as required per the manufacturers specification. Certificate(s) of Calibration specifying the instrument being functional for the designed purpose will be attached to the monitoring reports. Response of sensors and electrodes will be checked with certified standard solutions before each use. Wet bulb calibration for a dissolved oxygen meter will be carried out before measurement at each monitoring location.

Transport of Samples

All samples transferred from one sub-contractor to another are accompanied by Chain of Custody (COC) sheets. Missing or damaged samples are notified to ET following logging of the samples into the laboratory QA system. Sample of the COC form can be found in *Annex F*.

Laboratory Testing

Quality assurance is provided during the processing of sampling and the subsequent analytical procedures. The laboratory operates its own in-house Quality Assurance and Quality Control Procedures in which all methods used are referenced or fully documented.

In addition to the laboratory's own Quality Assurance and Quality Control Procedures, "blind" duplicate samples of marine waters shall be submitted on a routine basis for analysis alongside the normal samples. The sample code for the "blind" duplicates should not be identifiable by the laboratory. Approximately one "blind" duplicate should be submitted for every ten standard samples. Samples to be duplicated on any one sampling occasion should be selected at random. As a means of identifying any systematic errors, the testing regime shall also include, as a minimum, the analyse of the following :

- laboratory blanks;
- batch duplicates;
- matrix spikes;
- laboratory standards; and,
- certified reference materials.

All water testing parameters should be analyzed using method based on the "Standard Methods for the Analysis of Water of Wastewater" APHA or other international methods accepted by EPD.

Table 6.6b *Detection Limits of Suspended Solid, Total Inorganic Nitrogen and Ammoniacal Nitrogen*

	Detection Limit
Suspended Solid	1.0 mg/L
Total Inorganic Nitrogen	0.01 mg/L
Ammoniacal Nitrogen	0.01 mg/L

6.7 *MARINE WATER QUALITY MONITORING LOCATIONS*

6.7.1 *Construction of Power Station*

The water quality monitoring stations are shown in *Figure 6.7a*. Seven Sensitive Receiver (SR) Stations as recommended in the EIA report have been chosen on the basis of their proximity to the dredging and filling operations and thus the greatest potential for water quality impacts, as detailed in *Table 6.7a*. The monitoring locations are:

- SR1 representing the sub tidal assemblages at Pak Kok (north Lamma coastline);
- SR2 representing the sub tidal assemblages at Shek Kok Tsui (north west Lamma coastline);
- SR3 representing the existing power station intakes (only for SS measurement);

- SR4 representing Hung Shing Ye beach;
- SR5 representing Lo So Shing beach; and
- SR6 representing the north western part of the proposed South Lamma Marine Park; and
- SR7 representing Ha Mei Tsui in the proposed South Lamma Marine Park.

Table 6.7a *Locations of Marine Water Quality Monitoring Stations - Power Station*

Station	Easting	Northing
SR1	830 224	811 528
SR2	829 004	810 903
SR3	829 194	808 600
SR4	830 119	808 650
SR5	830 386	807 189
SR6	829 977	805 758
SR7	829 566	804 545

As detailed in *Table 6.7b*, five Control Stations as recommended in the EIA report have been selected, namely C1, C2, C3, C4 and C5, to facilitate comparison of the water quality of the SR stations with ambient water quality conditions. Details of the control stations are as follows:

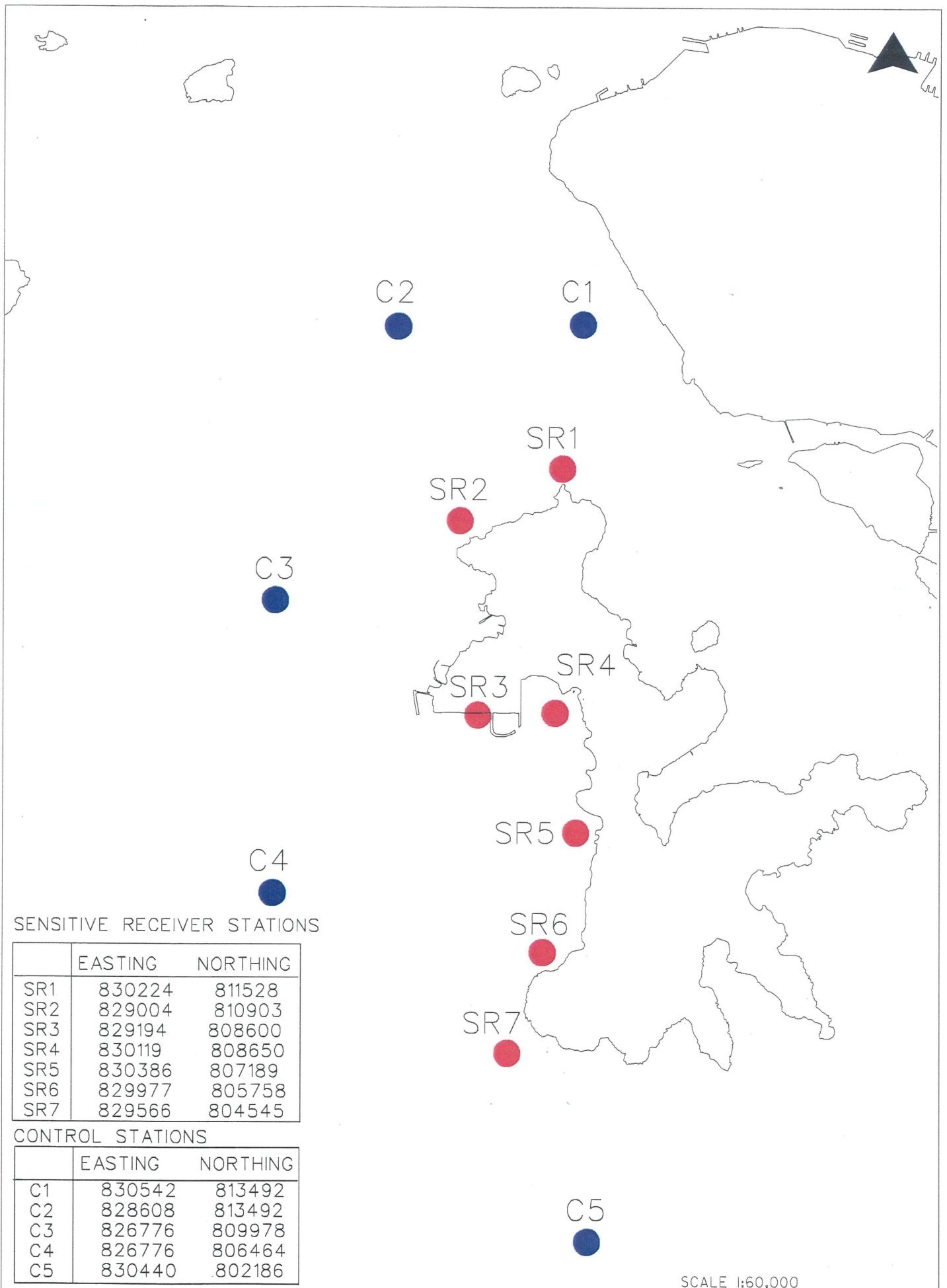
- Stations C1, C2 and C3 are designated to monitor the ambient water quality in relation to other activities with potential water quality impacts in the Study Area (ie CT9 sand dredging, backfilling of the South Tsing Yi borrow area and CT9 mud dredging). As these projects have been confirmed and contracts have been awarded, they are considered as concurrent projects with the construction of the Lamma Power Extension.
- Stations, C4 and C5, are located in areas not affected by other projects and which lie within the path of water body movements affecting the SRs but are outside the predicted influence of the reclamation works.
- Monitoring data from these Control Stations can be used as upstream and downstream controls for the SR stations. Locations of control stations shall be subject to change depending on the location and timing of dredging and other marine works projects in the Study Area. Any proposal for changes to the locations of control/impact stations shall be subject to EPD approval.

Table 6.7b *Locations of Marine Water Quality Control Stations - Power Station*

Station	Easting	Northing
C1	830 542	813 492
C2	828 608	813 492
C3	826 776	809 978
C4	826 776	806 464
C5	830 440	802 186

The locations of water quality monitoring are depicted in *Figure 6.7a*.

Water quality monitoring results from SR stations should be compared to baseline monitoring results, control stations' results and EPD's Water Quality Objectives (WQO) for the Southern Water Control Zone (SWCZ) and the



SENSITIVE RECEIVER STATIONS

	EASTING	NORTHING
SR1	830224	811528
SR2	829004	810903
SR3	829194	808600
SR4	830119	808650
SR5	830386	807189
SR6	829977	805758
SR7	829566	804545

CONTROL STATIONS

	EASTING	NORTHING
C1	830542	813492
C2	828608	813492
C3	826776	809978
C4	826776	806464
C5	830440	802186

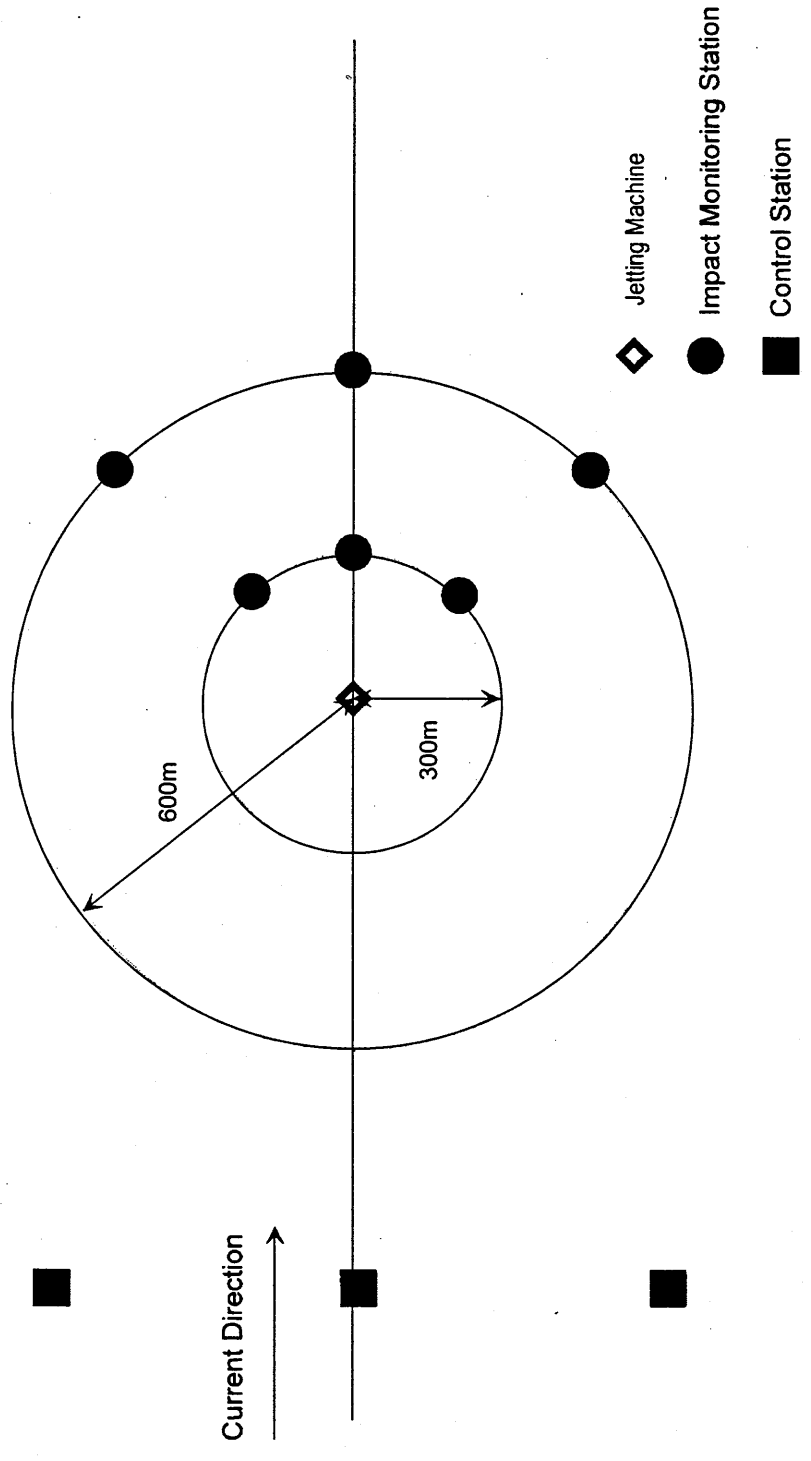
SCALE 1:60,000

FIGURE 6.7a

LOCATIONS OF WATER QUALITY MONITORING STATIONS

**Environmental
Resources
Management**





INDICATIVE LOCATIONS OF MONITORING STATIONS FOR PIPELINE LAYING USING JETTING

FIGURE 6.7b

Western Buffer Water Control Zone (WBWCZ). The standards stated in the WQOs are as follows:

- *Suspended Solids (SS)*: SS should not be raised above ambient levels by an excess of 30% nor cause the accumulation of SS which may adversely affect aquatic communities.
- *Dissolved Oxygen (DO)*: DO within 2m of the bottom should not be less than 2 mg/L for 90% of the samples; depth averaged DO should not be less than 4 mg/L for 90% of the samples during the whole year.
- *Ammonia (NH₃-N)*: The unionised ammoniacal nitrogen level should not be more than 0.021 mg L⁻¹, calculated as the annual average (arithmetic mean).
- *Nutrients (TIN)*: Nutrients will not be present in quantities that cause excessive algal growth TIN should not exceed 0.1 mg L⁻¹ for the SWCZ and 0.4 mg L⁻¹ for the WBWCZ expressed as annual water column average.

6.7.2

Construction Activities of Gas Pipeline

It has been identified in the EIA that the relevant WQO for the Southern Waters and Mirs Bay WCZs, in which the gas pipeline is to be laid is only Suspended Solids (SS). Hence SS will be the only monitoring parameter for the construction of the gas pipeline. The standard stated for SS in the WQOs is as follows:

- *Suspended Solids (SS)*: SS should not be raised above ambient levels by an excess of 30% nor cause the accumulation of SS which may adversely affect aquatic communities.


→ Water quality monitoring is to be employed during the laying of the gas pipeline. Monitoring will only be required for the jetting operations, and this monitoring will be carried out for the first two weeks of the construction programme. Monitoring for SS and dissolved oxygen will be carried out at Ping Chau and Southern Lamma when jetting operation is conducted in the vicinity of these two ecological sensitive areas. Further monitoring after the initial two weeks will be carried out if unacceptable impacts are revealed.

Monitoring will be carried out as jetting progresses along the pipeline route, and should be designed to demonstrate the localised nature of the impacts from jetting. Control stations are to be positioned upstream of the jetting machine during monitoring at the impact stations, which should be at least 1km upstream of the jetting machine. An indicative layout for the monitoring programme is shown in *Figure 6.7b*. In addition to the above described monitoring requirement, monitoring for SS and dissolved oxygen should also be carried out at the Po Toi FCZ and the control stations when jetting passes within 1km of the FCZ. The Action / Limit levels shall be as specified in *Table 6.11a*, however, it should be noted that, since it is impractical to undertake baseline monitoring for a continuously moving linear activity such as the

→ jetting operations associated with the pipeline construction, the levels shall be related to Control Station data.

When alternative monitoring locations are proposed, they should be chosen taking into regard the following criteria:

- at locations close to and preferably at the boundary of the mixing zone of the major site activities as indicated in the EIA Report, which are likely to have water quality impacts;
- close to sensitive receptors which are directly or likely to be affected;
- for monitoring locations located in the vicinity of the sensitive receivers, care should be taken to cause minimal disturbance during monitoring;
- at two or more control stations which shall be at locations representative of the project site in its undisturbed condition. Control stations should be outside the area of influence of the works and, as far as practicable, not affected by any other works.

→  A review will be carried out six months prior to the commencement of construction work to see if there are any changes in circumstances which may affect the EM&A requirements for the construction of the gas pipeline.

6.8

BASELINE MONITORING

Baseline conditions of various water quality parameters will be established prior to the commencement of the works. Baseline monitoring will be performed at all designated Control and SR stations, 3-days per week, at mid-flood and mid-ebb tides, for at least 4 consecutive weeks prior to the commencement of the reclamation works.

The locations for baseline monitoring for the construction of power station should be the same as those for impact monitoring. Baseline monitoring for the jetting of the gas pipeline will not be required.

Details of the monitoring parameters for construction of the power station are stated in *Section 6.3*. The monitoring should be carried out following the requirements presented in *Section 6.10*.

6.9

IMPACT MONITORING

Water quality impact monitoring would be required only during the reclamation works and pipeline construction.

→ Impact monitoring for sea water quality at SR and Control Stations should be performed on three days per week, at mid-flood and mid-ebb tides. Details of the monitoring parameters for construction of Power Station are stated in *Section 6.3*. For construction activities related to the Gas Pipeline, only SS and DO will apply. The monitoring should be carried out following the requirements presented in *Section 6.10*.

Within the first three months of impact monitoring, the sampling frequency, parameters and locations of control/impact monitoring will be reviewed taking account of the experience gained and the actual environmental conditions at that time.

Except with the prior consent of the DEP, the EPD's agreement shall be gained one month prior to implementing any changes that are proposed to the scheduled water quality monitoring programme.

6.10

MONITORING REQUIREMENTS

The following requirement should be followed for both the baseline and impact monitoring.

- a) Sampling should take place under non-exceptional conditions with respect to the tides, weather and season. Construction works will normally be halted when typhoon signal No.3 or above or the black rainstorm signal is hoisted and therefore no sampling should be carried out.
- b) A replicate sample for each analysis should be kept in accordance with the international standard procedure and methods.
- c) The interval between two sets of monitoring shall not be less than 36 hours except where there are exceedances of Action and/or Limit levels, in which case the monitoring frequency will be increased.
- d) All measurements shall be carried out at three water depths, namely, 1 m below water surface, mid-water depth, and 1 m above sea bed as appropriate to the derivation of Action and Limit levels. If the water depth is less than 6 m, the mid-depth measurement may be omitted. If the depth is less than 3 m, only the mid-depth measurement needs to be taken. There shall not be any marine construction activities in the vicinity of the stations during the baseline monitoring. All parameters should be measured on each monitoring day.
- e) When the difference in value between the first and second measurement of on-site parameters is more than 25% of the value of the first reading, the reading shall be discarded and further readings shall be taken.

6.11

COMPLIANCE ASSESSMENT

Water quality monitoring results will be evaluated against Action and Limit levels as shown in *Table 6.11a*. Exceedances of the Action and Limit Levels may, as necessary, result in changes to the monitoring and dredging operations, potentially involving increased monitoring and implementation of appropriate mitigation measures.

Table 6.11a Action and Limit levels for Water Quality

Parameters	Action	Limit
DO in mg/ L (Surface, Middle and Bottom).	<u>Surface and Middle</u> 5%-ile of baseline data for surface and middle layer.	<u>Surface and Middle</u> For non-FCZ stations the limit level shall be 4 mg/L whereas for FCZ stations the limit level shall be 5 mg/L or 1%-ile of baseline data for surface and middle layers.
	<u>Bottom</u> 5%-ile of baseline data for bottom layer.	<u>Bottom</u> 2 mg/L or 1%-ile of baseline data for bottom layer.
SS in mg/L (depth-averaged)	95%-ile of baseline data or 120% upstream control station's SS at the same tide of the same day. No Action Level is applied to SR3.	99%-ile of baseline, or 130% of upstream control station's SS at the same tide of the same day. For SR3, the SS Limit Level is 100 mg/L
Turbidity (Tby) in NTU (depth-averaged)	95%-ile of baseline data or 120% of upstream control station's Tby at the same tide on the same day	99%-ile of baseline data or 130% of upstream control station's Turbidity at the same tide on the same day
NH ₃ -N in mg/L (depth averaged)	95%-ile of baseline data.	99%-ile of baseline data or 0.021 mg/L for unionised ammoniacal nitrogen, whichever is greater.
TIN in mg/L (depth averaged)	95%-ile of baseline data.	99%-ile of baseline data or 0.1 mg/L whichever is greater. (Note: as SR1 and C1 are located within the Western Buffer rather than the Southern Waters Control Zone, the limit levels are 99%-ile of baseline data or 0.4 mg/L whichever is greater.)

Notes:

- "Depth-averaged" is calculated by taking the arithmetic means of reading of all three depths;
- For DO, non-compliance of the water quality limits occurs when monitoring result is lower than the limits.
- For SS and Tby, non-compliance of the water quality limits occurs when monitoring result is higher than the limits.
- All the figures given in the table subject to revision pending results of the baseline monitoring and subsequent approval by EPD.
- Whichever of the two criteria is greater, except DO which will take the lower of the two criteria, shall be used as the Action and Limit levels. Subject to approval from EPD.
- Unionised ammoniacal nitrogen shall be calculated from the monitored ammoniacal nitrogen based on temperature, pH and salinity which are routinely monitored. Reference should be made to the following literary sources for information on the conversion equation for unionised ammonia:
 - a) Bower C.E and Bidwell J.P (1978) Ionisation of ammonia equilibrium calculations: effect of pH and salinity. J. Fish Res Board Can, Vol.35 pp.1012-1016
 - b) Emerson K, Russo R.C & et al (1975). Aqueous ammonia equilibrium calculations: effect of pH and temperature. J.Fish. Res. Board Can Vol.32, pp.2379-2383.
- For pipeline construction the Action and Limit levels will relate only to the Control Station data.

6.12

EVENT AND ACTION PLANS

Should the monitoring results of the water quality parameters at any designated monitoring stations indicate that the water quality criteria have

been exceeded, the actions in accordance with the Event and Action Plans in *Table 6.12a* shall be carried out.

6.13 ***MITIGATION MEASURES***

Details of all the recommended mitigation measures are included within the Implementation Schedule (in *Annex B* of this EM&A Manual (Construction Phase)).

6.14 ***AUDITING REQUIREMENTS***

In order to ensure that water resources are adequately protected it will be necessary to undertake audits to ensure the effective implementation of the recommended mitigation measures and to ensure compliance with the EIA report's assumptions and recommendations.

Table 6.12a Event and Action Plans for Water Quality

Exceedance	ET Leader	IEC	Engineer	Contractor
Action level exceeded on one sampling day	Verbally inform the Contractor, and IEC. Repeat in-situ measurement to confirm findings; Identify source(s) of impact; Check monitoring data, all plant, equipment and Contractor's working methods; Discuss mitigation measures with Engineer and Contractor; Repeat measurement on next day of exceedance.	Provide feedback to the Engineer on the remedial actions proposed by the ET / Contractor Advise Engineer on the effectiveness of the proposed remedial measures Verify the implementation of the remedial measures	Discuss with Contractor the proposed mitigation measures; Make agreement on the mitigation measures to be implemented; Assess the effectiveness of the implemented mitigation measures.	Inform the Engineer and confirm notification of the non-compliance in writing; Rectify unacceptable practice; Check all plant and equipment; Consider changes of working methods; Propose and discuss mitigation measures with Engineer; Implement the agreed mitigation measures.
Action level exceeded on more than one consecutive sampling day	Repeat in-situ measurements to confirm findings; Identify source(s) of impact; Inform Contractor and IEC; Check monitoring data, all plant, equipment and Contractor's working methods; Discuss mitigation measure with Engineer and Contractor; Ensure mitigation measures are implemented; Prepare to increase the monitoring frequency to daily; Repeat measurement on next day of exceedance.	Provide feedback to the Engineer on the remedial actions proposed by the ET / Contractor Advise Engineer on the effectiveness of the proposed remedial measures Verify the implementation of the remedial measures	Discuss with ET and Contractor on the proposed mitigation measures; Make agreement on the mitigation measures to be implemented; Assess the effectiveness of the implemented mitigation measures.	Inform the Engineer and confirm notification of the non-compliance in writing; Rectify unacceptable practice; Check all plant and equipment; Consider changes of working methods; Propose mitigation measures to Engineer within 3 working days and discuss with ET and Engineer; Implement the agreed mitigation measures.

Exceedance	ET Leader	IEC	Engineer	Contractor
Limit level exceeded on one sampling day	Verbally inform the Contractor, IEC and the EPD of the exceedance; Repeat in-situ measurement to confirm findings; Identify source(s) of impact; Check monitoring data, all plant, equipment and Contractor's working methods; Discuss mitigation measure with Engineer and Contractor; Ensure mitigation measures are implemented; Increase the monitoring frequency to daily until no exceedance of Limit level.	Provide feedback to the Engineer on the remedial actions proposed by the ET / Contractor Advise Engineer on the effectiveness of the proposed remedial measures Verify the implementation of the remedial measures	Discuss with Contractor on the proposed mitigation measures; Request Contractor to critically review the working methods; Make agreement on the mitigation measures to be implemented; Assess the effectiveness of the implemented mitigation measures.	Inform the Engineer and confirm notification of the non-compliance in writing; Rectify unacceptable practice; Check all plant and equipment; Consider changes of working methods; Propose mitigation measures to Engineer within 3 working days and discuss with Engineer; Implement the agreed mitigation measures.
Limit level exceeded by more than one consecutive sampling day	Repeat in-situ measurement to confirm findings; Identify source(s) of impact; Inform Contractor, IEC and EPD; Check monitoring data, all plant, equipment and Contractor's working methods; Discuss mitigation measure with Engineer and Contractor; Ensure mitigation measures are implemented; Increase the monitoring frequency to daily until no exceedance of Limit level for two consecutive days.	Provide feedback to the Engineer on the remedial actions proposed by the ET / Contractor Advise Engineer on the effectiveness of the proposed remedial measures Verify the implementation of the remedial measures	Discuss with Contractor on the proposed mitigation measures; Request Contractor to critically review the working methods; Make agreement on the mitigation measures to be implemented; Assess the effectiveness of the implemented mitigation measures; Consider and instruct, if necessary, the Contractor to slow down or to stop all or part of the marine works until no exceedance of the Limit Level.	Inform the Engineer and confirm notification of the non-compliance in writing; Rectify unacceptable practice; Check all plant and equipment; Consider changes of working methods; Propose mitigation measures to Engineer within 3 working days and discuss with Engineer; Implement the agreed mitigation measures.. As directed by the Engineer, to slow down or to stop all or part of the marine work

7.1

INTRODUCTION

The Contractor is responsible for waste control within the construction site, removal of waste material produced by the site and the implementation of any mitigation measures to avoid or minimise potential adverse impacts associated with waste arising from the construction of the Project and the associated developments. The Contractor should incorporate these recommendations into an on-site Waste Management Plan to be prepared by the Contractor for the construction works. The Waste Management Plan should incorporate site specific factors, such as arrangement for avoidance, reuse, recovery, recycling, storage, collection, treatment and disposal of different categories of waste to be generated from the construction activities and shall take into account the recommendation of the EIA report. Such a management plan shall include the designation of areas for segregation and temporary storage of reusable and recyclable materials.

It is the Contractor's responsibility to ensure that only approved licensed waste collectors are used and that appropriate measures to minimise adverse impacts, including windblown litter and dust from the transportation of these wastes are employed. In addition, the Contractor must ensure that all the necessary waste disposal permits are obtained.

7.2

EM&A RECOMMENDATIONS

In order to ensure that the Contractor has implemented the recommendations of the EIA, the ET shall conduct site audits of each of the waste streams, to determine if wastes are being managed in accordance with the approved procedures and the site waste management plan. The scope of the waste management audits is presented below.

7.2.1

Objectives of the Waste Audit

The aims of the waste management audit will include, but are not limited to, the following:

- ensuring that the wastes arising from works are handled, stored, collected, transferred and disposed of in an environmentally acceptable manner and comply with the relevant requirements under the *Waste Disposal Ordinance (WDO)* and its regulations;
- ensuring that the Contractor properly implements the appropriate environmental protection and waste pollution control mitigation measures, as outlined in *Section 7.3* and the Implementation Schedule (*Annex B*) to minimise and control the potential for waste impacts;
- ensuring the effective implementation of the Contractor's and waste management plan;

- to monitor the disposal of construction and demolition material and solid wastes at public filling facilities and landfills, and to control fly-tipping, a trip-ticket system should be included as one of the contractual requirements during the EM&A programme. The ET should be responsible for auditing the result of the system; and
- to encourage the reuse and recycling of materials.

7.2.2 *Methodology and Criteria*

The Contractor should ensure that the necessary waste disposal permits or licences are obtained from appropriate authorities in accordance with the various Ordinances. A Waste Management Plan should be submitted to EPD three months prior to the commencement of the construction. The ET should also regularly inspect and audit the waste management practices on site with reference to the recommendations given in *Section 7.3* and the Implementation Schedule contained in *Annex B*.

- *Waste Disposal Ordinance (Cap 354);*
- *Waste Disposal (Chemical Waste) (General) Regulation (Cap 354);*
- *Land (Miscellaneous Provisions) Ordinance (Cap 28);*
- *Public Health and Municipal Services Ordinance (Cap 132) - Public Cleansing and Prevention of Nuisances (Urban Council) and (Regional Council) By-law;* and
- the storage, handling and disposal of chemical waste should be audited with reference to the requirements of the *Code of Practice on the Package, Labelling and Storage of Chemical Wastes* published by the EPD.

7.3 WASTE MITIGATION MEASURES

When handling the waste material, the following procedures and measures shall be implemented.

7.3.1 *Waste Management Hierarchy*

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

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

The Waste Disposal Authority and the EPD, should be consulted on the final disposal of wastes, if necessary.

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

7.3.2 *Excavated Materials*

Excavated materials are not considered likely to cause adverse impacts with respect to their disposal, since the amount is expected to be minimal. If any surplus uncontaminated inert materials do arise then they may be delivered to public filling areas or other reclamation sites. Excavated materials should be segregated from other wastes to avoid possible contamination, thereby allowing reuse at public filling areas.

7.3.3 *Construction and Demolition (C&D) Waste*

In order to minimise waste arisings and keep environmental impacts within acceptable levels, the mitigation measures described below should be adopted.

Careful design, planning and good site management can minimise over ordering and generation of waste materials such as concrete, mortars and cement grouts. If feasible, the noise enclosures used at each site should be designed so that they are reusable, after they have been dismantled and removed, thereby not generating construction waste. The design of formwork should maximise the use of standard wooden panels so that high reuse levels can be achieved. Alternatives such as steel formwork or plastic facing should be considered to increase the potential for reuse.

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

The requirements for the handling and disposal of bentonite slurries should follow the *Practice Note For Professional Persons, Construction Site Drainage, Professional Persons Consultative Committee, 1994 (ProPECC PN 1/94)*.

C&D materials should be segregated on site into different waste and material types. Where site conditions allowed, different types of wastes should be segregated and stored in different containers, skips or stockpiles to enhance reuse or recycling of materials and their proper disposal. Wherever possible, materials should be reused or recycled with the remaining inert materials before being disposed of at public filling areas. Waste containing putrescible materials should be disposed of at landfill.

In order to minimise the impacts of the demolition works these wastes must be cleared as quickly as possible after demolition. The demolition and clearance works should therefore be undertaken simultaneously.

7.3.4

Chemical Waste

For those processes which generate chemical waste, it may be possible to find alternatives which generate reduced quantities or even no chemical waste, or less dangerous types of chemical waste.

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

- be suitable for the substance they are holding, resistant to corrosion, maintained in a good condition, and securely closed;
- have a capacity of less than 450 L unless the specifications have been approved by the EPD; and
- display a label in English and Chinese in accordance with instructions prescribed in Schedule 2 of the Regulations.

The storage area for chemical wastes should:

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

Disposal of chemical waste should be:

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

The Centre for Environmental Technology operates a Waste Exchange Scheme which can assist in finding receivers or buyers.

7.3.5

General Refuse

General refuse generated on-site should be stored in enclosed bins or compaction units separate from construction and chemical wastes. A

reputable waste collector should be employed by the contractor to remove general refuse from the site, separately from construction and chemical wastes, as frequent as practicable to minimise odour pest and litter impacts. The burning of refuse on construction sites is prohibited by law.

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

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

7.4

REPORTING

The monthly EM&A reports shall contain the results of the waste management practices being implemented on site. This shall follow the detailed waste management procedures as outlined in the Waste Management Plan.

8.1

GENERAL

The proposed Lamma Extension Project is located on a man-made reclamation which is flat and rectangular in shape. Sitting on this flat platform, the Extension itself has also a regular layout with very large scale buildings and structures. The whole development which stands as an island separate from the existing power station is, therefore, in contrast with the natural setting across the water. It would be recommended that a more natural land-form is introduced to break up the regular and flat appearance of the site. The following key mitigation measures are recommended.

New Power Station

- a) Use of rubble mound seawall along south and west edges of the reclamation to provide a more natural look.
- b) Break the mass of main building by varying the height/division into smaller units.
- c) Plant trees and vegetation for screening.
- d) Adopt colour scheme to blend the buildings into the scenery.

Transmission System

- a) In order to minimise the visual impact of the landing points, the exposed sides of the platforms and the cable slipway should be screened with irregularly arranged boulders of varying sizes to mimic the natural coastline features. The horizontal platform surface should be finished with natural materials such as stone pavings or tiles.
- b) The cable trough in between Landing Points N4 and N5 is about 5.5 m wide and 260 m long. The walkway that is formed above the cable trough should be shielded by boulders (or, where practicable, shrub planting) from potential viewers from the area and horizontal surfaces be finished with natural materials such as stone paving.
- c) Appropriate compensatory landscaping should be provided for any disruption to existing vegetation to blend in with the surrounding setting.
- d) As a planning gain, parts of the landing points N4 and N5 and the cable trough between the landing points can be used for amenity and recreational purposes. Some low maintenance fixtures, matching with the natural environment, will be built or placed on the landing points for public use.

Details of the other recommended mitigation measures are included in the Implementation Schedule (in *Annex B* of this EM&A Manual (Construction Phase)).

HEC shall deposit with EPD three sets of Landscape Plan no later than three months before the commencement of the landscape work of the Project. The Plan shall include an explanatory statement and drawings in 1:1000 scale or other appropriate scale outlining the visual and landscape mitigation measures.

9.1 INTRODUCTION

This section presents the objectives, requirements, methodology, equipment and monitoring locations for the monitoring and audit of potential impacts to marine ecological resources from the construction of the Project. Based on the findings of this ecological monitoring a *Habitat Compensation and Enhancement Programme* can be implemented. This programme is discussed in the following sections.

As the EIA has predicted that no unacceptable impacts to fisheries resources or fishing operations will occur as a result of the construction of the Project, no Environmental Monitoring and Audit procedures have been deemed necessary.

9.2 ECOLOGICAL MONITORING AND AUDIT REQUIREMENTS

According to the EIAO TM *Section 8.3* an EM&A programme would be required in a situation where the project involves mitigation measures of which the effectiveness may require a long period to establish and/or, according to *Annex 20, Section 8* if there are any uncertainties regarding the scale of impacts. Both of these sections of the TM are applicable in this situation as the effectiveness of providing rubble mound seawalls for the recolonisation of soft corals and gorgonians will take time to evaluate, and also because the severity of the impact of elevated SS levels on the soft corals and gorgonians adjacent to the reclamation site is uncertain.

The dredging operations include constraints which act as appropriate mitigation measures to control environmental impacts to within acceptable levels. Actual impacts from construction activities will be monitored through impacts to water quality as discussed in *Section 6*. Monitoring and audit activities designed to detect and mitigate any unacceptable impacts to water quality will also serve to protect against unacceptable impacts to marine ecological resources. The water quality monitoring programme provides management actions and supplemental mitigation measures to be employed should impacts arise, thereby ensuring the environmental acceptability of the project.

In order to determine both the severity of the impact to soft corals and gorgonians and the extent of recolonisation of the area once the construction works have been completed, ecological monitoring of the potentially affected habitats is recommended. Following the ecological monitoring programme, a *Habitat Compensation and Enhancement Programme* can be initiated, with the scale of this programme dependant on the findings of ecological monitoring. The following section presents the objectives, methodology and rationale for the ecological monitoring.

The objectives of the ecological monitoring programme are as follows:

- to determine the severity of impacts arising from construction activities on soft corals and gorgonians located adjacent to the proposed extension site;
- to determine the rate and effectiveness of colonisation of the rubble mound seawall by soft coral and gorgonian assemblages; and
- to determine the rate and effectiveness of recolonisation of existing habitats indirectly impacted during construction by soft coral and gorgonian assemblages.

Ecological monitoring will consist of subtidal surveys prior to the dredging and reclamation works for the power station extension and for a period after reclamation works have ceased. These surveys will assess the health of the corals which have been identified in the EIA on or in the vicinity of the existing rubble mound seawalls of the ash lagoon. Monitoring of the benthos around the proposed power station extension will not be conducted as these habitats have been deemed as being of low ecological value and have been predicted to return to pre-dredging and reclamation conditions within a short period or time following completion of the construction activities.

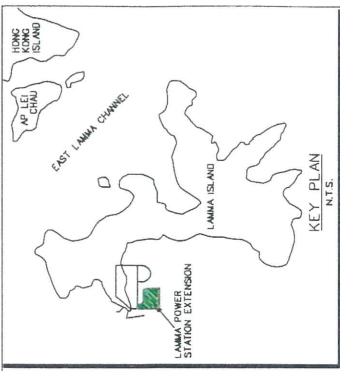
Specific requirements of the ecological monitoring programme are presented below in the following sub-sections.

Baseline Survey

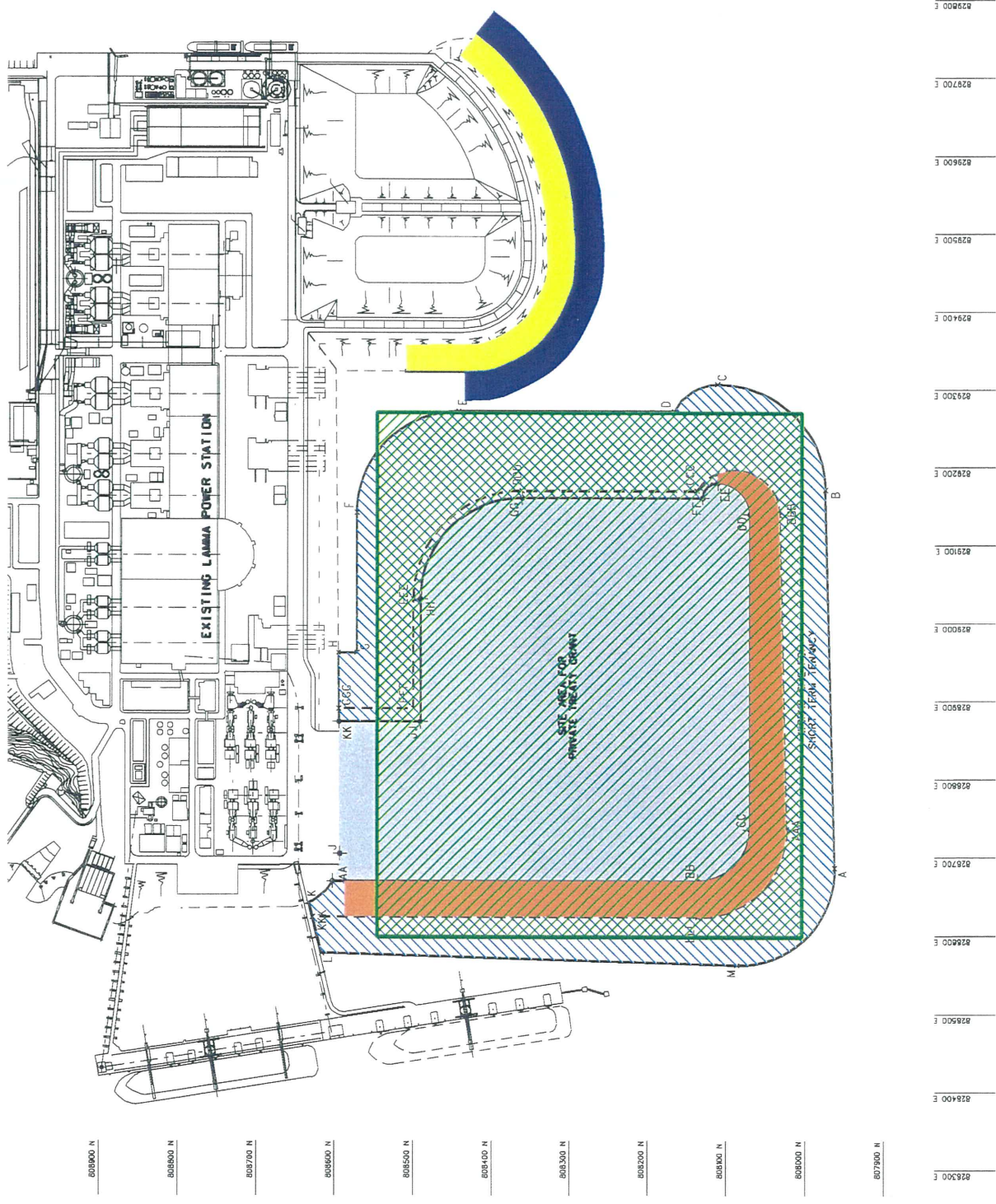
Subtidal surveys using a remotely operated vehicle (ROV) have been conducted as part of this EIA which has resulted in the compilation of an extensive database on the abundance and diversity of the soft coral and gorgonian assemblages in the vicinity of the power station. It was recommended that a ROV should be used for the baseline survey and the exact methodology presented in the EIA was to be followed. However, as the ROV that was used to conduct the original survey as part of the EIA is no longer available, a revised methodology for a baseline dive survey using SCUBA is presented below. The survey should be conducted before construction works begin.

Methodology

Quantitative dive surveys will be undertaken within three zones as indicated in *Figure 9.4a*. These zones have been termed Reclamation Site Zone, Ash Lagoon Seawall Zone and Ash Lagoon Base Zone. Within the Reclamation Site Zone ten randomly placed 100m transects will be surveyed, whereas, within the Ash Lagoon Seawall Zone and Ash Lagoon Base Zone, five



- ASH LAGOON BASE ZONE
(BASELINE AND POST CONSTRUCTION MONITORING)
- ASH LAGOON SEAWALL ZONE
(BASELINE AND POST CONSTRUCTION MONITORING)
- RECLAMATION SITE ZONE
(BASELINE MONITORING)
- RECLAMATION SITE SEAWALL ZONE
(POST CONSTRUCTION MONITORING)
- RECLAMATION SITE
- WORKS SITE
- SEAWALL TOE



SCALE 1:8000

FIGURE 9.4c LOCATION OF BASELINE AND POST CONSTRUCTION MONITORING DIVE SURVEY SITES



permanent marked 100m transects will be surveyed. Each transect within the Ash Lagoon Seawall Zone will be ensured to be placed on the seawall.

A measuring tape will be laid down in the middle of each transect and an area 0.5m wide either side of the tape will be surveyed for its entire length. This will result in a "belt" transect. Photographs of representative coral species located within the belt transect will be taken using a Nikonos V underwater camera (or equivalent) equipped with a 15 mm wide angle lens and a SB 103 strobe light (or equivalent).

Video transects will also be recorded at each site. Each transect will be filmed at approximately 50 cm above the transect tape and at a constant speed in compliance with standard protocols for coral surveys (no more than 10 metres per minute). Each video transect will record a 50 cm swath of seabed. The video camera will be held perpendicular to the substrate to minimise parallax error and to keep the substrate in focus. In addition, the video camera will be used to provide a landscape view of the survey area and provide a permanent record of the site inspected by the surveyors.

Data on colony abundance of corals, both scleractinian and octocorals, will be extracted from both the video transects and the belt transects. Counts will be made for each site and the locations of the corals along the transects noted. Wherever possible, corals will be identified to species level by coral specialists using regional texts and will be accompanied by a brief description of their morphology.

The results will be presented in two forms, as detailed below, and will provide comprehensive information on the baseline conditions:

- *Percentage Cover Estimates*: these values will be calculated using the video footage and the fixed point sampling method to estimate the coverage of coral species on the seabed surface.
- *Total number of colonies*: this method will record the number of colonies of each coral species within the entire belt transect. This measure is unlike the first as it will record all species observed instead of the cover of those occurring on a set number of fixed frames. As a result more coral species may potentially be identified under the second method than the first.

Reporting

Using the information obtained following the methodology of the baseline survey described above, a *Baseline Survey Report* should be produced. This data will serve the purpose of a baseline with which the severity of impacts and rate of colonisation can be gauged and the scale of the *Habitat Compensation and Enhancement Programme* to be implemented.

9.4.2

Post-Construction Monitoring

As soon as possible upon the completion of the construction works for the proposed power station extension, an Initial Survey should be conducted in

order to assess the immediate impacts of the construction works on the corals and other organisms of interest identified in the EIA and re-examined in the Baseline Survey. This Initial Survey should employ the use of SCUBA and should follow the same methodology as the Baseline Survey. Both the Ash Lagoon Seawall Zone and the Ash Lagoon Base Zone should be re-surveyed, with five permanently marked 100m transects in each. In addition, a new zone, located on the newly constructed southern and western rubble mound seawalls of the reclamation site, should also be surveyed (*Figure 9.4a*). Within this zone, termed the Reclamation Site Seawall Zone, ten 100m transects should be surveyed. The same information on coral abundance as that obtained from the baseline survey should be collected from these surveys.

Following the Initial Survey, each zone should be re-visited every six months for a period of two years. As a result, a total of four post-construction surveys should be conducted at each zone, including the Initial Survey. This monitoring will be used to assess the extent of recolonisation of corals adjacent to the reclamation site, and the extent of colonisation on the rubble mound seawalls.

Reporting

Following the above reconnaissance survey to investigate the immediate impacts of the construction works on the marine ecology, an *Initial Survey Report* should be produced. This report should detail any colonisation on the newly constructed rubble mound seawalls as well as a comparison of the results of the Baseline Survey with the findings of the Initial Survey.

A *Monitoring Report* should then be produced following each follow-up survey detailing the extent of recolonisation at each of the sites surveyed. The final of these *Monitoring Reports* should be issued as the *Ecological Monitoring and Audit Report on Marine Ecological Resources*. This report should comprehensively detail the findings of the monitoring programme describing the overall extent of impacts of the construction of the proposed power station extension as well as the extent of the recolonisation of the rubble mound seawalls by soft corals and gorgonians. All findings should be based on not only the findings of the Baseline Survey, the Initial Survey and the follow-up surveys, but should also make reference to the findings of the EIA and any such useful historical data.

9.5

HABITAT COMPENSATION AND ENHANCEMENT PROGRAMME

In order to mitigate against potential impacts to marine ecological resources, a *Habitat Compensation and Enhancement Programme* has been presented in the EIA. This programme proposed that a minimum of 400m³ ⁽¹⁾ of Artificial Reefs (ARs) were to be deployed in Hong Kong waters at a site (or sites) to be decided upon consultation with the Director of the Agriculture, Fisheries and

(1) Information from the AFCD's Artificial Reef Deployment Study has reported that Japanese researchers have claimed that for ARs to be effective in enhancing marine resources they should have a minimum volume of 400 m³. The Study also determined that the stocking density of ARs should be no less than 1,500m³ km². ERM - Hong Kong, Ltd (1999) *Artificial Reef Deployment Study*. Final Report to the Agriculture, Fisheries and Conservation Department.

Conservation Department. The exact amount of ARs should be decided through consultation with the Agriculture, Fisheries and Conservation Department and the Environmental Protection Department and should be directly correlated to the severity of impacts and extent of recolonisation of soft corals and gorgonians onto the rubble mound and ash lagoon seawalls. The extent of this impact and amount of recolonisation will be based on the findings presented in the *Ecological Monitoring and Audit Report on Marine Ecological Resources*.

10.1

SITE INSPECTIONS

Site inspections provide a direct means to track and ensure the enforcement of specified environmental protection and pollution control measures. The inspections should be undertaken routinely by the ET to ensure that appropriate environmental protection and pollution control mitigation measures are properly implemented. Additionally, the ET shall be responsible for defining the scope of the inspections, detailing any deficiencies that are identified, and reporting any necessary action or mitigation measures that were implemented as a result of the inspection.

Site inspections shall be carried out once per week. The areas of inspection should include the general environmental conditions in the vicinity of the site and pollution control and mitigation measures within the site; it should also review the environmental conditions outside the site area which are likely to be affected, directly or indirectly, by site activities. The ET shall make reference to the following information in conducting the inspections:

- the environmental protection and pollution control mitigation measures included in this EM&A Manual (Construction Phase);
- ongoing results of the EM&A programme;
- works progress and programme;
- individual works method statements which shall include proposals on associated pollution control measures;
- the relevant environmental protection and pollution control laws; and
- previous site inspection results.

The ET inspection results and their associated recommendations on improvements to the environmental protection and pollution control works shall be submitted to the Engineer and the IEC within 24 hours, for reference and for taking immediate action. They shall also be presented, along with the remedial actions taken, in the monthly EM&A report. The Contractor shall follow the procedures and time-frames stipulated in the environmental site inspection for the implementation of mitigation proposals and the resolution of deficiencies in the Contractor's EMS. An action reporting system shall be formulated and implemented to report on any remedial measures implemented subsequent to the site inspections.

Ad hoc site inspections shall also be carried out by the ET Leader if significant environmental problems are identified. Inspections may also be required subsequent to receipt of an environmental complaint, or as part of the associated investigation work.

In addition to the ET's inspections, the IEC shall also conduct random site inspections in order to verify the Contractor's environmental performance and the appropriate implementation of the required practices and mitigation measures. These inspections will also be an important source of data

collection to allow the IEC to undertake an up-to-date and informed review of the information and data contained within the monthly EM&A Reports.

10.2

COMPLIANCE WITH LEGAL AND CONTRACTUAL REQUIREMENTS

The Contractor shall comply with environmental protection and pollution control requirements stipulated in this EM&A Manual (Construction Phase) as well as Hong Kong environmental protection and pollution control laws.

The ET Leader shall review the progress and programme of the works to check that relevant environmental laws have not been violated, and that any foreseeable potential for violating the laws can be prevented.

The Contractor shall also regularly copy relevant documents to the ET Leader so that the checking work can be carried out. The relevant documents are expected to include the updated Work Progress Reports, the updated Works Programme, the application letters for different licences/permits under the environmental protection laws, and all the valid licences/permit. The site diary shall also be available, upon request, to the ET Leader during his site inspection.

After reviewing the documentation, the ET Leader shall advise the Engineer and the Contractor of any non-compliance with the contractual and legislative requirements on environmental protection and pollution control for them to take follow-up actions. If the ET Leader's review concludes that the current status on licence/permit application and any environmental protection and pollution control preparation works is incompatible with the works programme or may result in potential violation of environmental protection and pollution control requirements by the works in due course, he shall also advise the Contractor and the Engineer accordingly.

Upon receipt of the advice, the Contractor shall undertake immediate action to remedy the situation. The Engineer shall follow up to ensure that appropriate action has been taken by the Contractor in order that the environmental protection and pollution control requirements are fulfilled.

10.3

ENVIRONMENTAL COMPLAINTS

A formal procedure for handling complaints on environmental matters is required to ensure that appropriate actions will be taken to handle the complaints properly. The procedure shall also be consistent with the well-established corporate procedures within HEC for handling environmental complaints against the existing Lamma Power Station to avoid confusion and complicating the issue. A flow chart outlining the complaints handling procedure is shown in *Figure 10.3a* and briefly described below.

Complaints can be received via various channels and can generally be classified as verbal and written complaints. These may be received directly

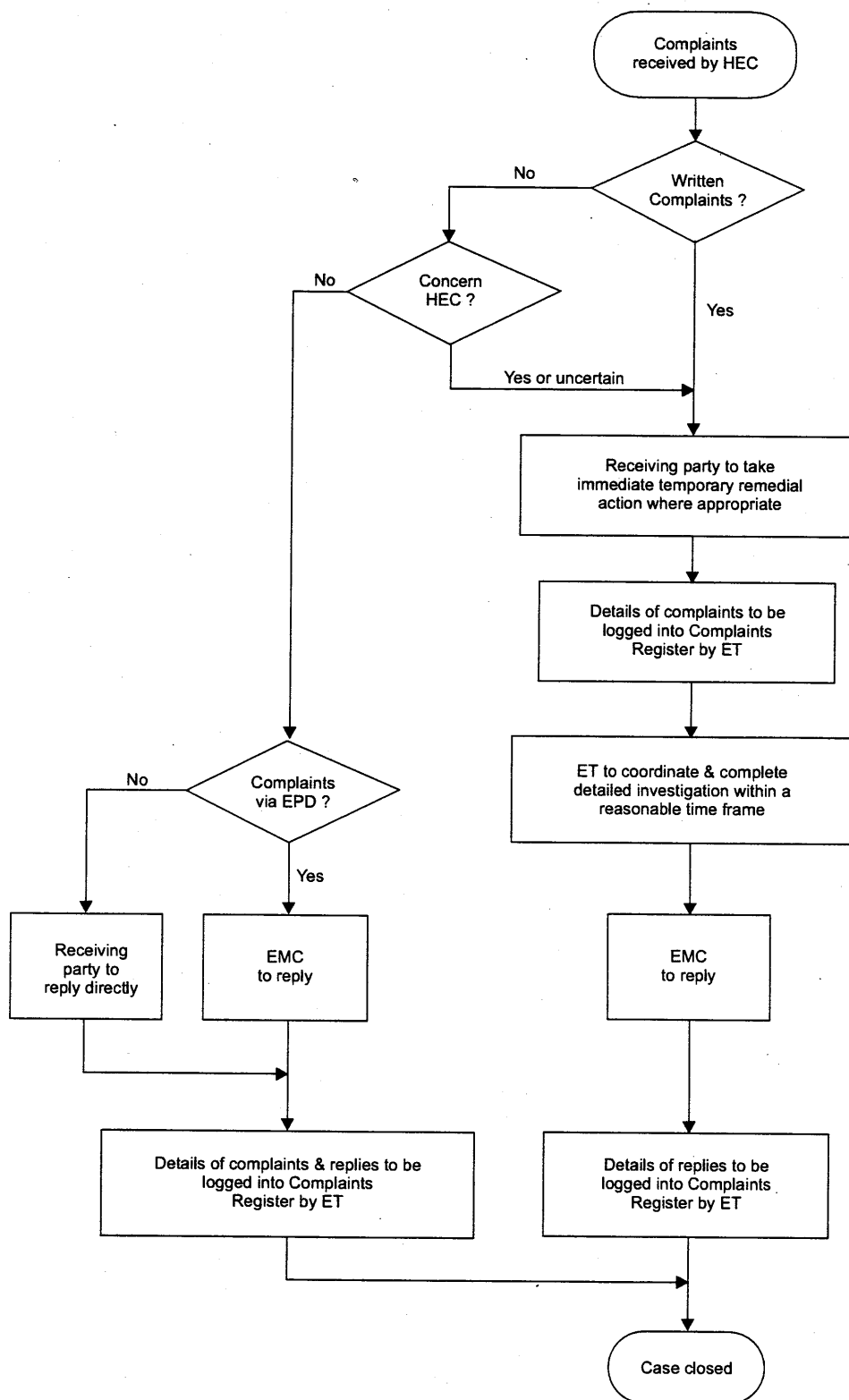


FIGURE 10.3a

COMPLAINTS HANDLING PROCEDURE

FILE: C2037m
DATE: 15/05/00

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from the public (such as the local residents) or via Environmental Protection Department (EPD).

Details of complaints shall be logged into a complaints register by the ET. Information to be recorded shall include the name, address & contact number of the complainant and also the date, time & nature of the complaint. See *Annex A* for a sample Complaints Reporting Form.

When a verbal complaint is received which obviously does not concern HEC, the party receiving the complaint shall directly reply to the complainant accordingly unless it is lodged via EPD in which case it shall be referred to the EMC for a formal reply.

Any verbal complaint which may concern HEC or written complaint shall be referred to the ET who shall then coordinate a detailed investigation. Where appropriate, the party receiving the complaint shall also take immediate temporary remedial action to alleviate the problem or prevent it from deteriorating. After the investigation is completed, the EMC shall be informed to reply to the complainant accordingly.

Replies to written complaints shall be formal in writing signed by the nominated Responsible Officer. In all replies, whether verbal or written, the complainant shall be informed of the investigation results and the subsequent remedial actions taken. When the investigation reveals that the complaint is not justified, the complainant shall also be informed, together with the reasons for arriving at such a conclusion. The details of the replies shall be referred to the ET for logging into the complaints register.

When a complaint is referred to the ET for a detailed investigation, the ET shall:-

- a) Where necessary arrange a verbal or written acknowledgement to the complainant advising that an investigation is under way.
- b) Coordinate an investigation to determine the validity of the complaint and to identify the source of the problem.
- c) Arrange monitoring to verify the existence and severity of the complaint if necessary.
- d) Propose mitigation measures if necessary.
- e) Arrange additional monitoring, audit and inspections as necessary to verify the status and effectiveness of the mitigation measures.
- f) Arrange interim replies to the complainant if necessary.
- g) Record the relevant information in the complaints register.
- h) Log the details of the complaint and report the actions taken to investigate, resolve and respond to the complaint in the monthly EM&A Report.

During the complaint investigation work, the Engineer and Contractor shall cooperate with the ET in providing all necessary information and assistance. If mitigation measures are necessary, the Engineer shall ensure that the measures are promptly carried out by the Contractor.

A pending-complaint review system (such as regular evaluation in routine Working Committee Meetings) shall be operated to ensure timely follow-up of outstanding complaints.

The normal contact telephone and fax numbers at HEC for complaints are:-

Party	Attention	Telephone	Fax
Generation Division	Chief Operations Engineer	2982 6205	2982 1654
Projects Division	Site Manager	2982 6317	2982 1623
D,P&IT Division	Senior Environmental Engineer	2814 3663	2814 6179
Public Affairs Department	Deputy Public Affairs Manager	2843 3287	2521 1580
System Control Department	Customer Emergency Services Centre (24 hours)	2555 4999	2555 6637

11 REPORTING

11.1 INTRODUCTION

The primary reporting function, undertaken within the EM&A programme, will be the issuance of formal exceedance notifications, corrective actions and ongoing feedback between the ET Leader, the Contractor and the Engineer. Reporting will be driven by the results of the monitoring and audit programme and will be recorded through written correspondence, site inspections and minutes and notes of meetings.

In addition, periodic reviews of the EM&A process and subsequent revisions to the EM&A Manual (Construction Phase), as appropriate, will be prepared and circulated to relevant personnel within the Contractor's Project Team as a means of gauging site staff and contractor performance. The periodic reviews will comprise Monthly Reports; these reports will be copied to the EPD for comment. The exact details of the frequency, distribution and time frame for submission shall be agreed with the EPD prior to the commencement of the works.

11.2 BASELINE MONITORING REPORT

The ET Leader shall prepare and submit a Baseline Environmental Monitoring Report at least 2 weeks before the commencement of any major construction works that would affect the monitoring results. Copies of the Baseline Report shall be submitted to all parties for agreement; including the Engineer, IEC and the EPD. Two hard copies and one soft copy of the Baseline Monitoring Report shall be submitted to EPD. The submissions shall be certified by the ET leader and verified by the IEC. The report will be supported by the baseline monitoring data in electronic format, along with information covering the monitoring locations and conditions, equipment and protocols.

11.3 MONTHLY EM&A REPORTS

Monthly EM&A Reports shall be prepared and certified by the ET Leader. The reports shall be verified by the IEC and submitted to the EPD one hard copy and one soft copy via the EMC within 2 weeks of the end of each month after works commence. The ET Leader shall liaise with the relevant parties to confirm the format of monthly reports in both hard copy and electronic format. The report shall include the following elements:

- Executive Summary highlighting breaches of agreed criteria, complaints log, summons, reporting changes and future key issues;
- brief background to the project and figure showing its location;
- basic project information (e.g. project organisation, programme, management structure, current permits and licences);
- brief account of construction activities;

- monitoring results (hard and diskette copies) together with details of methodology, parameters, locations, dates, times, weather conditions and other influencing factors;
- interpretation of the significance of the monitoring results and explanation of the influencing factors;
- graphical plots of monitored trends over the past four reporting periods;
- description of recommendations and / or actions taken, or outstanding, in the event of non-compliances, complaints, notifications of Summons, prosecutions, and site inspections and audits;
- review of the implementation status and effectiveness of environmental protection works in relation to non-compliances and deficiencies and the mitigation measures recommended in the EIA;
- summary of site inspections undertaken, findings and remedial actions taken and/or further actions required;
- summary of complaints, results of investigations and follow-up actions;
- future key issues and steps taken to combat them; and
- provide a regular update to confirm that there will be no delay in LNG supply and therefore the new generation units will still be fuelled by LNG only in 2004.

11.4

ELECTRONIC REPORTING OF EM&A INFORMATION

To facilitate public inspection of the Baseline Monitoring Report and monthly EM&A Reports via the EIAO Internet Website and at the EIAO Register Office, electronic copies of these Reports shall be prepared in Hyper Text Markup Language (HTML) (version 4.0 or later) and in Portable Document Format (PDF version 4.0 or later), unless otherwise agreed by EPD and shall be submitted at the same time as the hard copies to EPD. For the HTML version, a content page capable of providing hyperlink to each section and sub-section of these Reports shall be included in the beginning of the document. Hyperlinks to all figures, drawings and tables in these Reports shall be provided in the main text from where the respective references are made. All graphics in these Reports shall be in interlaced GIF format unless otherwise agreed by EPD. The content of the electronic copies of these Reports must be the same as the hard copies.

All environmental monitoring data in the Baseline Monitoring and the monthly EM&A shall be made available to the public via internet access in the form of a website, in the shortest possible time and in no event later than two weeks after the relevant environmental monitoring data are collected or become available, unless otherwise agreed with EPD. HEC shall notify EPD in writing within six weeks after the commencement of works the internet address where the environmental monitoring data are to be placed. The internet address and the relevant environmental monitoring data shall be made available to the public via the EIAO Internet Website and the EIAO Register Office.

The internet website shall enable user friendly public access to the monitoring data and with features capable of:

- i) providing access to environmental monitoring data collected since the commencement of works;
- ii) searching by date;
- iii) searching by types of monitoring data (air quality, water quality and noise etc); and
- iv) hyperlinks to relevant monitoring data after searching.

11.5

DATA KEEPING

All documents and records, in both paper and electronic format, pertaining to this EM&A programme will be retained by the ET Leader as part of the Project files and will be subject to appropriate data handling procedures. All documents and data shall be kept until 1 year after the completion of all construction contracts of the Project.

11.6

INTERIM NOTIFICATION OF ENVIRONMENTAL QUALITY LIMIT EXCEEDANCES

Interim notifications of exceedances of Limit levels will be reported both verbally and in writing to the EPD as soon as practicable. The Monthly Reports will contain all available details concerning exceedances and complaints, their causes and those steps taken to control impacts and prevent their recurrence.

Annex A

Reporting Documentation

Lamma Extension Project Environmental Monitoring Report

Air Quality Monitoring (Environmental Monitoring Report)

Site: Lamma Power Station Extension

Month: MMMM-YYYY

Date	TSP Concentration ($\mu\text{g}/\text{m}^3$)				Weather Information (from Hong Kong Observatory)		
	Reservoir (AM1)	East Gate (AM2)	Ash Lagoon (AM3)	Tai Yuen Village (AM4)	Mean Wind Speed (km/hr)	Prevailing Wind Dir. ($^{\circ}$)	Mean R. H. (%)

Remark:

(1) The monitoring stations, Reservoir & East Gate & Ash Lagoon, are located within Lamma Power Station.

	TSP ($\mu\text{g}/\text{m}^3$)
Action Level	190
Limit Level	260

Calibration: Calibration at site as per attached

Equipment Used:

Reservoir, East Gate & Ash Lagoon : High Volume Air Sampler or equivalent
Tai Yuen Village : MiniVOL Portable Sampler

Monthly Manual Noise Monitoring Report

Noise Monitoring Report

Site:

Measurement Location:

Measurement Parameter:

Noise Equipment Used:

Remarks

Date	Time	Measured Noise Level (dB(A))	Average Noise Level (dB(A))	Notional Background Noise Level (dB(A))	Corrected Noise Level (dB(A))	Limit Noise Level (dB(A))	Wind Speed (m/s)	Remark
DD/MM/YYYY	hh:mm- hh:mm	xx.x	xx.x	xx	xx	xx	x.x	
DD/MM/YYYY	hh:mm- hh:mm	xx.x	xx.x	xx	xx	xx	x.x	
DD/MM/YYYY	hh:mm- hh:mm	xx.x	xx.x	xx	xx	xx	x.x	
DD/MM/YYYY	hh:mm- hh:mm	xx.x	xx.x	xx	xx	xx	x.x	
DD/MM/YYYY	hh:mm- hh:mm	xx.x	xx.x	xx	xx	xx	x.x	
DD/MM/YYYY	hh:mm- hh:mm	xx.x	xx.x	xx	xx	xx	x.x	
DD/MM/YYYY	hh:mm- hh:mm	xx.x	xx.x	xx	xx	xx	x.x	
DD/MM/YYYY	hh:mm- hh:mm	xx.x	xx.x	xx	xx	xx	x.x	
DD/MM/YYYY	hh:mm- hh:mm	xx.x	xx.x	xx	xx	xx	x.x	
DD/MM/YYYY	hh:mm- hh:mm	xx.x	xx.x	xx	xx	xx	x.x	
DD/MM/YYYY	hh:mm- hh:mm	xx.x	xx.x	xx	xx	xx	x.x	
DD/MM/YYYY	hh:mm- hh:mm	xx.x	xx.x	xx	xx	xx	x.x	
DD/MM/YYYY	hh:mm- hh:mm	xx.x	xx.x	xx	xx	xx	x.x	
DD/MM/YYYY	hh:mm- hh:mm	xx.x	xx.x	xx	xx	xx	x.x	
DD/MM/YYYY	hh:mm- hh:mm	xx.x	xx.x	xx	xx	xx	x.x	

Note:

Monthly Continuous Noise Monitoring Report

Noise Monitoring Report

Site:

Measurement Location:

Measurement Parameter:

Noise Equipment Used:

Remarks

Date	Time	Calculated Noise Level at NSR at Long Tsai Tsuen/Hung Shing Ye (dB(A))		Limit Noise Level (dB(A))	Calculated Noise Level at NSR at school within Tai Wan San Tsuen (dB(A))		Limit Noise Level (dB(A))	Remark
		Max	Avg		Max	Avg		
DD/MM/YYYY	hh:mm- hh:mm	xx	xx	xx	xx	xx	xx	
DD/MM/YYYY	hh:mm- hh:mm	xx	xx	xx	xx	xx	xx	
DD/MM/YYYY	hh:mm- hh:mm	xx	xx	xx	xx	xx	xx	
DD/MM/YYYY	hh:mm- hh:mm	xx	xx	xx	xx	xx	xx	
DD/MM/YYYY	hh:mm- hh:mm	xx	xx	xx	xx	xx	xx	
DD/MM/YYYY	hh:mm- hh:mm	xx	xx	xx	xx	xx	xx	
DD/MM/YYYY	hh:mm- hh:mm	xx	xx	xx	xx	xx	xx	
DD/MM/YYYY	hh:mm- hh:mm	xx	xx	xx	xx	xx	xx	
DD/MM/YYYY	hh:mm- hh:mm	xx	xx	xx	xx	xx	xx	
DD/MM/YYYY	hh:mm- hh:mm	xx	xx	xx	xx	xx	xx	
DD/MM/YYYY	hh:mm- hh:mm	xx	xx	xx	xx	xx	xx	
DD/MM/YYYY	hh:mm- hh:mm	xx	xx	xx	xx	xx	xx	
DD/MM/YYYY	hh:mm- hh:mm	xx	xx	xx	xx	xx	xx	

Note:

Seawater Quality Monitoring On-Site Results

Project Code : _____ Our Ref. : _____ Page No. : _____

Sampling Date : _____ Sampling Site : _____

Equipment : _____ Time for Mid-flood / mid-ebb : _____

Monitoring Location	Sample Code	Measurement		Water Depth(m)	Measuring Depth (m)	DO (mg/L)		DO (%)		pH		Temp (°C)		Salinity (ppt)		Turbidity (NTU)		Weather Condition	Other Observation
		Date	Time			1st trial	2nd trial	1st trial	2nd trial	1st trial	2nd trial	1st trial	2nd trial	1st trial	2nd trial				
SR1					Top														
					Middle														
					Bottom														
SR2					Top														
					Middle														
					Bottom														
SR3					Top														
					Middle														
					Bottom														
SR4					Top														
					Middle														
					Bottom														
SR5					Top														
					Middle														
					Bottom														
SR6					Top														
					Middle														
					Bottom														
SR7					Top														
					Middle														
					Bottom														

Prepared by : _____ Checked by : _____

Seawater Quality Monitoring On-Site Results

Project Code : _____ Our Ref. : _____ Page No. : _____
 Sampling Date : _____ Tide : _____ Sampling Site : _____
 Equipment : _____ Time for Mid-flood / mid-ebb : _____

Monitoring Location	Sample Code	Measurement		Water Depth (m)	Measuring Depth (m)	DO (mg/L)		DO (%)		pH		Temp (°C)		Salinity (ppt)		Turbidity (NTU)		Weather Condition	Other Observation
		Date	Time			1st trial	2nd trial	1st trial	2nd trial	1st trial	2nd trial	1st trial	2nd trial	1st trial	2nd trial	1st trial	2nd trial		
C1					Top														
					Middle														
					Bottom														
C2					Top														
					Middle														
					Bottom														
C3					Top														
					Middle														
					Bottom														
C4					Top														
					Middle														
					Bottom														
C5					Top														
					Middle														
					Bottom														

Prepared by : _____

Checked by : _____

Seawater Quality Monitoring Laboratory Results

Project Code: _____

Sampling Site: _____

Sampling Date: _____

Page : _____

Monitoring Location	Sampling Code	Measuring Depth (m)	SS (mg/L)	NH3-N (mg/L)	(NO2, NO3 + NH3)-N (mg/L)
SR1		Top			
		Middle			
		Bottom			
SR2		Top			
		Middle			
		Bottom			
SR3		Top			
		Middle			
		Bottom			
SR4		Top			
		Middle			
		Bottom			
SR5		Top			
		Middle			
		Bottom			
SR6		Top			
		Middle			
		Bottom			
SR7		Top			
		Middle			
		Bottom			
C1		Top			
		Middle			
		Bottom			
C2		Top			
		Middle			
		Bottom			
C3		Top			
		Middle			
		Bottom			
C4		Top			
		Middle			
		Bottom			
C5		Top			
		Middle			
		Bottom			

Prepared by : _____

Checked by : _____

Reporting Form for Environmental Complaints	Sheet of Ref:
<u>Received By</u>	
Div./Dept./Contractor:	Contact Person/Tel.:
Receiving Channel:	Date/Time Received:
<u>Complainant</u>	
Name/Tel.:	Fax.:
Address:	
<u>Acknowledged By</u>	
Div./Dept./Contractor:	Contact Person/Tel.:
Remarks:	Date/Time Acknowledged:
<u>Details of Complaint</u>	
Nature:	Date/Time of Concern:
Description:	
Immediate Actions Taken:	
Recommended Follow-up Actions/Remarks:	
<u>Reported By</u>	
Div./Dept.:	Contact Person/Tel.:
Signature:	Date/Time:
<u>Note</u>	
The completed form should be copied to the persons below for necessary follow-up actions to be taken:-	
1. The ET Leader (Attn.:	Div./Dept.:)
2. The Engineer (Attn.:	Div./Dept.:)
3. PA Manager (Attn.:	Div./Dept.:)

Annex B

Implementation Schedule

ANNEX B: IMPLEMENTATION SCHEDULE

B.1. POWER STATION (PART B OF EIA REPORT)

Table B1 Construction Phase Mitigation Measures and their Implementation

EIA Ref.	EM&A Log Ref.	Mitigation Measures	Implementation	Implementation Agent	Relevant Legislation & Guidelines
4.9.2	A1	<p>AIR QUALITY</p> <p>For general construction works, the dust control measures stipulated under the Air Pollution Control (Construction Dust) Regulation shall be complied with, such as:</p> <ul style="list-style-type: none"> the haul roads shall be sprayed with water to keep the entire road surface wet. the load carried by vehicle shall be covered by impervious sheeting to ensure no leakage of dusty materials from the vehicle. the heights from which fill materials are dropped shall be controlled to a practical level to minimise the fugitive dust arising from unloading. 	To be implemented throughout the full duration of the construction phase	HEC/Contractor	Air Pollution Control (Construction Dust) Regulation
4.9.2	A2	<p>For the concrete batching plant, the following control measures are recommended:</p> <ul style="list-style-type: none"> loading, unloading, handling, transfer or storage or any dusty materials shall be carried out in a totally enclosed system. The materials which may generate airborne dust emissions shall be wetted by water spray system. All receiving hoppers shall be enclosed on three sides up to 3m above unloading point. All conveyor transfer points shall be totally enclosed. 	To be implemented throughout the full duration of the construction phase	HEC/Contractor	Best Practicable Means Requirements for Cement Works (Concrete Batching Plant)
5.4.2	B1	<p>WATER QUALITY</p> <p>The following configurations and maximum rates of dredging shall be allowed:</p>			

EIA Ref.	EM&A Log Ref.	Mitigation Measures	Implementation	Implementation Agent	Relevant Legislation & Guidelines
		<ul style="list-style-type: none"> 3 large grab dredgers and 1 small grab dredger operating concurrently, each with rates of working of 12,000 m³ day⁻¹ and 8,000 m³ day⁻¹ respectively. During the flood phase of the tidal cycle the total number of large dredgers working shall be reduced by one, while during the ebb phase of the tidal cycle no reductions in the total number of dredgers shall be required. 	During reclamation works phase	HEC/Contractor	Water Pollution Control Ordinance
		<ul style="list-style-type: none"> 1 trailer dredger with a rate of working of 8,000 m³ day⁻¹, and 2 large grab dredgers, each with rates of working of 12,000 m³ day⁻¹ 	During reclamation works phase	HEC/Contractor	Water Pollution Control Ordinance
5.4.2	B2	Silt curtains shall be installed on the eastern, southern and north western sides of the reclamation site during dredging for the reclamation construction. This is a required mitigation measure for the construction works and shall be implemented prior to the commencement of bulk dredging.	Prior to the commencement of dredging	HEC/Contractor	Water Pollution Control Ordinance
5.4.2	B3	As a necessary operational constraint combined bulk dredging and sand filling for site formation shall not be permitted at any time. In addition, sand filling for site platform shall take place behind constructed sea walls which pierce the water surface.	During site platform formation	HEC/Contractor	Water Pollution Control Ordinance
5.4.2	B4	HEC shall ensure design to divert all storm drains away from Hung Shing Ye Bay.	During design stage	HEC/Contractor	Water Pollution Control Ordinance
5.4.2	B5	Sand fill for the rubble mound seawalls shall be placed by controlled pumping down the trailer arm.	During seawall construction	HEC/Contractor	Water Pollution Control Ordinance
5.4.2	B6	EM&A shall confirm the acceptability of any impacts during construction and should any unacceptable impacts be found then one or more of the following mitigation measures shall be implemented: <ul style="list-style-type: none"> reducing the number of dredgers working at any one time; reducing the rate of working of the dredgers; temporary suspension of operations; phasing of the works so that dredging / filling is only undertaken at certain stages of the tidal cycle. 	In the event of an exceedance identified by the EM&A programme	HEC	Water Pollution Control Ordinance

EIA Ref.	EM&A Log Ref.	Mitigation Measures	Implementation	Implementation Agent	Relevant Legislation & Guidelines
5.4.2	B7	<p>In addition to the above specific measures the following general working procedures shall be adopted.</p> <ul style="list-style-type: none"> • fully-enclosed, watertight grabs shall be used to minimise loss of sediment during the raising of loaded grabs through the water column; • the descent speed of grabs shall be controlled to minimise the seabed impact speed and to reduce the volume of over dredging; • barges shall be loaded carefully to avoid splashing of material; • all barges used for the transport of dredged materials shall be fitted with tight bottom seals in order to prevent leakage of material during loading and transport; • all barges shall be filled to a level which ensures that material does not spill over during loading and transport to the disposal site and that adequate freeboard is maintained to ensure that the decks are not washed by wave action; • the speed of trailer dredgers shall be controlled to prevent propeller wash from stirring up the sea bed sediments; • "rainbowing" sand fill from trailer dredgers shall not be permitted; and • the works shall cause no visible foam, oil, grease or litter or other objectionable matter to be present in the water within and adjacent to the dredging site and along the route to the disposal site. 	During reclamation works phase	HEC/Contractor	Water Pollution Control Ordinance
5.4.2	B8	<p>Cumulative impacts shall be assessed through EM&A. Co-ordination with the EM&A consultants for other projects to determine if any exceedances are caused by the other projects or by HEC's activities. Should monitoring results indicate exceedances at sensitive receivers due to HEC's activities, then the above described mitigation measures shall be implemented until impacts reduce to acceptable levels.</p>	During reclamation works phase	HEC/Contractor	Water Pollution Control Ordinance
6.6.1	C1	<p>NOISE General noise mitigation measures shall be employed at all work sites throughout the construction phase.</p>	To be implemented throughout the full duration of the construction phase	HEC/Contractor	Noise Control Ordinance
6.6.1.	C2	<p>Mitigate against general construction noise during Sunday's and public holidays, either at source with portable noise barriers, or by rescheduling of some PMEs to less sensitive time periods.</p>	Sunday's & Public Holidays	HEC/Contractor	Noise Control Ordinance

TABLE B1 - 3

EIA Ref.	EM&A Log Ref.	Mitigation Measures	Implementation	Implementation Agent	Relevant Legislation & Guidelines
6.6.1	C3	Mitigate against night time noise from dredging equipment, with silencers or mufflers.	Night time	HEC/Contractor	Noise Control Ordinance
Part G	D1	<p>LANDSCAPE & VISUAL IMPACTS</p> <p>The following mitigation measures shall be allowed for landscape and visual improvement:</p> <ul style="list-style-type: none"> • Use rubble mound seawall along south and west edges of the reclamation to provide a more natural look. • Break the mass of main buildings by varying the height/division into smaller units. • Plant trees and vegetation for screening. • Adopt colour scheme to blend the buildings into the scenery. 	To be implemented throughout the full duration of the construction phase	HEC/Contractor	
8.5	E1	<p>WASTE MANAGEMENT</p> <p>HEC to submit a Waste Management Plan for the construction phase to EPD. The Plan shall be verified by the IEC and shall describe the arrangements for avoidance, reuse, recovery and recycling, storage, collection, treatment and disposal of different categories of waste to be generated from the construction activities and shall take into account the recommendations of the EIA report.</p>	Three months prior to the commencement of the construction works	HEC/Contractor	
8.5.2	E2	<p><i>Dredging Waste</i></p> <p>All vessels for marine transportation of dredged sediment shall be fitted with tight fitting seals to their bottom openings to prevent leakage of materials. In addition, loading of barges and hoppers shall be controlled to prevent splashing of dredged material into the surrounding water, and barges or hoppers should under no circumstances be filled to a level which shall cause the overflowing of materials or polluted water during loading or transportation</p>	Throughout the construction phase	HEC/Contractor	
Part G	E3	<p><i>Storage, Collection and Transport of Waste</i></p> <ul style="list-style-type: none"> • Minimise windblown litter and dust during transportation by either covering trucks or transporting wastes in enclosed containers. • Obtain the necessary waste disposal permits from the appropriate authorities, if they are required, in accordance with the Waste Disposal Ordinance (Cap.354), Waste Disposal (Chemical Waste) (General) Regulation (Cap.354), the Crown 	Throughout the construction phase	HEC/Contractor	Regulated under the Ordinances and Administrative Rules cited.

EIA Ref.	EM&A Log Ref.	Mitigation Measures	Implementation	Implementation Agent	Relevant Legislation & Guidelines
		<p>Land Ordinance (Cap 28), Dumping at Sea Ordinance (Cap 466) and Work Branch Technical Circular No. 22/92, Marine Disposal of Dredged Mud.</p> <ul style="list-style-type: none"> • Disposal of waste at Licensed sites; • Develop procedures such as a ticketing system to facilitate tracking of marine mud and chemical waste, and to ensure that illegal disposal does not occur; • Segregate and sort the waste materials into 3 categories: <ul style="list-style-type: none"> • public fill (e.g. concrete and rubble) for re-use on-site or disposal at a public filling area; • re-use and/or recycling waste (e.g. steel and other metals); • waste which cannot be re-used and/or recycled (e.g. wood, glass and plastic) for landfill disposal. • The sorting process shall be carefully monitored to avoid missing of the 3 categories. Different types of wastes shall be stockpiled and stored in different containers or skips to enhance re-use or recycling of materials and their proper disposal. • Maintain records of the quantities of wastes generated and disposed off-site for each category of waste. 			<p><i>Waste Disposal Ordinance and subsidiary legislation.</i></p> <p><i>Waste Disposal Ordinance and subsidiary legislation.</i></p>
Part G	E4	Chemical waste that is produced, as defined by Schedule 1 of the Waste Disposal (Chemical Waste) (General) Regulation, shall be handled in accordance with the Code of Practice on the Packaging, Handling and Storage of Chemical Wastes	Throughout the construction phase	HEC/Contractor	<i>Waste Disposal Ordinance and subsidiary legislation.</i>
9.5	F1	<p>LAND CONTAMINATION</p> <p>No land Contamination mitigation measures are required during the construction phase.</p>			

EIA Ref.	EM&A Log Ref.	Mitigation Measures	Implementation	Implementation Agent	Relevant Legislation & Guidelines
10.4.1	G1	MARINE ECOLOGY All percussive piling works shall be conducted on reclaimed land to avoid noise impact to marine mammals	During construction phase	HEC/Contractor	
10.6.2	G2	All construction related vessels shall approach the extension site from the north and via the East Lamma Channel to avoid disturbance to the finless porpoise	During Construction phase	HEC/Contractor	
10.7	G3	Rubble mound seawall to the south and west edges of the reclamation to enhance recolonisation of marine organisms	During Construction Phase	HEC/Contractor	
10.7	G4	Artificial Reefs of a volume not less than 400 m ³ shall be deployed in a location to be decided upon consultation with the Director of Agriculture and Fisheries to serve the purpose of an Additional Habitat Enhancement Measure.	A period of two years after construction of the extension rubble mound seawalls	HEC	
11.9	H1	FISHERIES No Fisheries-specific mitigation measures are required during the construction phase.			
12.8	I1	RISK ASSESSMENT No risk mitigation measures are required during the construction phase.			

ANNEX B: IMPLEMENTATION SCHEDULE

B.2. TRANSMISSION SYSTEM(PART C OF EIA REPORT)

Table B2 Construction Phase Mitigation Measures and their Implementation

EIA Ref.	EM&A Log Ref.	Mitigation Measures	Implementation	Implementation Agent	Relevant Legislation & Guidelines
AIR QUALITY					
4.6	J1	To mitigate potential construction related dust impacts, the dust control measures stipulated under the <i>Air Pollution Control (Construction Dust) Regulation</i> shall be complied with, such as : <ul style="list-style-type: none"> all debris or materials shall be either covered or stored in a debris sheltered collection area; prior to any material handling, all dusty material shall be sprayed with water. 	Throughout the construction phase of the land portion of transmission route	HEC/Contractor	<i>Air Pollution Control (Construction Dust) Regulation</i>
WATER QUALITY					
5.4.4	K1	No mitigation measures were considered necessary.	-	-	-
NOISE					
6.5	L1	N4-N5 <i>Cable Route</i> Selection and use of quiet PMEs, or use of modest source noise controls with standard PMEs	To be implemented throughout the full duration of the construction phase	HEC/Contractor	<i>Noise Control Ordinance</i>
6.5	L2	N5 <i>Landing Point</i> Selection and use of quiet PMEs (particularly the barge-mounted crane), or use of comparably effective source noise controls with the PMEs;	To be implemented throughout the full duration of the construction phase	HEC/Contractor	<i>Noise Control Ordinance</i>

EIA Ref.	EM&A Log Ref.	Mitigation Measures	Implementation	Implementation Agent	Relevant Legislation & Guidelines
6.5	L3	For non-percussive piling - use of equipment with a SWL of 113 dB(A) or less if there is no programme overlap of the piling with the site formation works, otherwise offsetting source noise controls shall be required.	To be implemented throughout the full duration of the construction phase	HEC/Contractor	Noise Control Ordinance
6.5	L4	For percussive piling - use of equipment with a SWL of 115 dB(A) or less, otherwise offsetting source noise controls shall be required.	To be implemented throughout the full duration of the construction phase	HEC/Contractor	Noise Control Ordinance
6.5	L5	If non-percussive piling and site formation activities are to be carried out simultaneously then careful equipment selection and source controls shall be required for both activities to reduce each by approximately 3dB(A).	To be implemented throughout the full duration of the construction phase	HEC/Contractor	Noise Control Ordinance
MARINE ECOLOGY					
7.5	M1	Construction of rubble mound seawalls for the landing and launching points at Lamma Island.	To be implemented throughout the full duration of the construction phase	HEC/Contractor	
FISHERIES					
	N1	No fisheries-specific mitigation measures are required during the construction phase			
TERRESTRIAL ECOLOGY					
The following mitigation measures shall be implemented to protect the important plant species and minimising disturbance to the surrounding environment through good construction practice, as recommended below:					
9.6	O1	Avoidance of impact on the uncommon and rare plant species <i>Celtis biondii</i> , <i>Pteris dispar</i> and <i>Arádia pusilla</i> , and the restricted plants <i>Vitis balansana</i> , <i>Pterospermum heterophyllum</i> and <i>Rhapis excelsa</i> , by locating the landing points N4 & N5 and the connecting cable trough in areas outside where these plant species are located (Figures 9.4b & 9.4c, Part C, Volume 2), as well as close monitoring of the construction activity.	Prior to and during the construction works	HEC/Contractor	

EIA Ref.	EM&A Log Ref.	Mitigation Measures	Implementation	Implementation Agent	Relevant Legislation & Guidelines
9.6	O2	The erection of fences along the boundary of construction sites before the commencement of works to prevent tipping, vehicle movements, and encroachment of personnel into adjacent wooded areas, particularly where the rare, uncommon and restricted plant species are located.	Prior to and during the construction works	HEC/ Contractor	
9.6	O3	Regular checking to ensure that the work site boundaries are not exceeded and that no damage occurs to surrounding areas.	To be implemented throughout the full duration of the construction phase	HEC/ Contractor	
9.6	O4	The prohibition and prevention of open fires within the work site boundary during construction and provision of temporary fire fighting equipment in the work area during construction.	To be implemented throughout the full duration of the construction phase	HEC/ Contractor	<i>Air Pollution Control Ordinance</i>
LANDSCAPE AND VISUAL IMPACT					
10.3	P1	The visual impact of the Cable Landing Point I1 is considered negligible as it would have similar appearance as the existing sea wall and therefore no mitigation is required.	To be implemented throughout the full duration of the construction phase	HEC/ Contractor	
10.3	P2	The proposed landing points N2, N4 and N5, the following landscaping mitigation measures are recommended to minimise the potential impacts: <ul style="list-style-type: none"> Although the size of the landing points varies (N2 is 26 x 70 m, N4 is 27 x 65 m and N5 is 33 x 56 m), each has a finished platform level at +6.00 mPD. With the Low Water Level at +1.00 mPD, the platforms shall be a maximum of some 5 m above the water level at low tide. In order to minimise the visual impact of the landing points, the exposed sides of the platforms and the cable slipways shall be screened with irregularly arranged boulders of varying sizes to mimic the natural coastline features. The horizontal platform surface shall be finished with natural materials such as stone pavings or tiles. The cable trough in between Landing Points N4 and N5 is 5.5 m wide and 260 m long. The walkway that is formed above the cable trough shall be shielded by boulders (or, where practicable, shrub planting) from potential viewers from the sea and horizontal surfaces be finished with natural materials such as stone paving. 	To be implemented throughout the full duration of the construction phase	HEC/ Contractor	

Table B2 - 3

- Appropriate compensatory landscaping shall be provided for any disruption to existing vegetation to blend in with the surrounding setting.
- As a planning gain, parts of the landing points N4 and N5 and the cable trough between the landing points can be used for amenity and recreational purposes. Some low maintenance fixtures, matching with the natural environment, shall be built or placed on the landing points for public use. HEC shall resolve any management and maintenance requirements of the proposed mitigation measures during the processing stage of wayleave agreements. If required by Government, HEC commit to bear the management and maintenance responsibilities of these facilities.

ANNEX B: IMPLEMENTATION SCHEDULE

B.3 GAS PIPELINE (PART D OF EIA REPORT)

Table B3 Construction Phase Mitigation Measures and their Implementation

EIA Ref.	EM&A Log Ref.	Mitigation Measures	Implementation	Implementation Agent	Relevant Legislation & Guidelines
AIR QUALITY					
Part G	Q1	For the fuel gas supply system, equipment shall be chosen and measures taken, so as to prevent CH ₄ leakage from the system. In accordance with this recommendation, HEC shall be implementing the following: <ul style="list-style-type: none"> • corrosion-preventing coatings on the pipeline; • welded pipe joints; and • laying of pipeline below sea bed such that it is well protected from potential damages by marine activities. 	3 months prior to commissioning of the first 300MW unit	HEC	
Part G	Q2	HEC shall submit to EPD for review, a report of the above actions before the commissioning of the first 300 MW gas-fired unit.			
WATER QUALITY - CONSTRUCTION					
4.4.5	R1	The following rates of dredging for the trenches at the Shenzhen and Lamma approaches and the rate of progress of the jetting shall be adopted: <ul style="list-style-type: none"> • a single small grab dredger with a maximum daily rate of working of 2,400 m³ • maximum forward speed of the jetting machine should be 1 km per day 	During reclamation works and jetting phases	HEC/ Contractor	Water Pollution Control Ordinance
4.4.5	R2	No further mitigation measures were considered necessary, however if unacceptable impacts were to be found in the course of the EM&A programme for the pipeline jetting, then the following measures shall be implemented: <ul style="list-style-type: none"> • reducing the speed of the water jetting machine; and • temporary suspension of the works. 	In the event of exceedances identified by the EM&A programme.	HEC/ Contractor	Water Pollution Control Ordinance

ELA Ref.	EM&A Log Ref.	Mitigation Measures	Implementation Agent	Implementation Agent	Relevant Legislation & Guidelines
MARINE ECOLOGICAL IMPACTS					
5.7	S1	It is recommended that to avoid disruption to the <i>Neophocaena phocaenoides</i> population in the southwestern coastal waters of Lamma Island that works associated with the pipeline jetting do not occur during Spring off the coast of southwest Lamma.	HEC	During the establishment of the pipeline laying programme	
FISHERIES					
6.5	T1	No fisheries-specific mitigation measures are required during the construction phase.			
HAZARDS					
Part G	U1	Detailed quantitative risk study shall be conducted in accordance with the requirements in the <i>Gas Safety Ordinance (Cap. 51)</i> to satisfy EMSD's requirements which shall ensure adequate design of the pipeline to protect against third party damage and safe operation of the pipeline system.	HEC	Prior to pipeline commissioning	<i>Gas Safety Ordinance (Cap. 51)</i>
Part G	U2	HEC shall review their existing safety management system against current best practice.	HEC	During design, construction and operational phases	

Annex C

Continuous Noise Alarm Monitoring

CONTINUOUS NOISE ALARM MONITORING

Monitoring Approach

The noise monitoring system will consist of two noise alarm stations at Ash Lagoon (roof top of decantrate pump house) and Ching Lam. The noise alarm station at Ash Lagoon is an additional one while the station at Ching Lam is the existing one for the EM&A programmes for Unit L7/8 and Ash Lagoon Operation.

The measured noise levels (MNL's) will be collected at the noise alarm stations at Ash Lagoon and Ching Lam. The notional background noise levels (viz. baseline noise data at Ash Lagoon and Ching Lam) shall be applied to the corresponding MNL's in 30-min or 5-min L_{Aeq} .

The noise level after notional background correction at Ash Lagoon would be used to calculate the noise level at the critical NSR, Long Tsai Tsuen/Hung Shing Ye while that collected at both Ching Lam and Ash Lagoon be adopted to predict the noise levels at the NSR, the school within the village of Tai Wan San Tsuen, taking the smaller one as the calculated noise level at NSR. This is to discard the data affected by local noisy events (e.g. vehicle noise, bird noise, etc.). No facade reflection and tonality corrections would be applied. The calculated noise levels would then be checked against the corresponding limiting noise levels for any exceedance.

Features

The features of continuous noise alarm monitoring are as follows:-

- a. During the construction work at Lamma Extension, 30-min L_{Aeq} shall be measured at 07:00-19:00 hrs on normal weekdays. In the meantime, 5-min L_{Aeq} shall also be measured at 07:00-23:00 hrs on holidays & 19:00-23:00 hrs on all other days and 23:00-07:00 hrs of next day.
- b. Adverse meteorological conditions would affect the noise measurements, e.g. strong wind, heavy rain and thunder. A wind speed sensor has been installed at Station Building Rooftop. The wind speed signal shall be used to determine whether the data from the Ash Lagoon and Ching Lam noise alarm stations are affected. The computer shall be programmed to discard the instantaneous data in case the instantaneous wind speed exceeds 10 m/s.

The 30-min/5-min L_{Aeq} shall be considered valid only if the amount of valid data is equal to or above 70%.

There are presently no signal for inhibition of data which may be affected by thunder or heavy rain but they are usually associated with strong winds. If winds are not strong enough to cause data to be inhibited, noisy thunder and rain would have to be manually correlated with these alarms/events. If a noise alarm is raised, Generation Operations (on-duty

round the clock), would record the incident with a remark that it is caused by thunder storm or heavy rain in the area.

Calculated Noise Levels at the NSR's

A single notional noise source centre for Lamma Extension construction site is assumed for the calculated noise level at the NSR's at Long Tsai Tsuen/Hung Shing Ye and the school in Tai Wan San Tsuen.

Noise alarm shall be raised in the central control room if the calculated noise level at Long Tsai Tsuen/Hung Shing Ye exceeds the corresponding limit levels or the calculated noise levels at the school in Tai Wan San Tsuen, based on noise levels collected at Ching Lam as well as at Ash Lagoon, both exceed the corresponding limit levels.

$$\text{Calculated Noise Level} = \text{SPL}_{ALM} + 10 \times \log \left(\frac{d_{ALM}}{d_{NSR}} \right)^2 - BA - \text{AtmA } \text{dB(A)}$$

Where SPL_{ALM} = noise level at Ash Lagoon/Ching Lam noise alarm station after notional background correction

d_{NSR} = distance between the single notional noise source centre and the NSR

d_{ALM} = distance between the single notional noise source centre and the noise alarm station

BA = barrier attenuation difference (to be reviewed, if required)

AtmA = atmospheric absorption difference

The barrier attenuation difference and atmospheric absorption difference for calculating noise level at the NSR at Long Tsai Tsuen/Hung Shing Ye from Ash Lagoon monitoring station is assumed to be 5 dB(A) and 2 dB(A) respectively. And that at the school within the village of Tai Wan San Tsuen from Ash Lagoon and Ching Lam monitoring stations are assumed to be 10 dB(A) and 2 dB(A) & 10 dB(A) and 1 dB(A) respectively.

Sample Report Format

A sample format of the noise monitoring report is shown in the *Annex A* for reference.

Annex D

Total Suspended Particulate
(TSP) Monitoring

The following measures should be adopted to achieve good quality assurance in TSP measurement:

- i) Calibration of Equipment
- ii) Preventive Maintenance of Equipment
- iii) Elimination of Inherent Sources of Error
- iv) Documentation

Calibration of Equipment

Analytical Balance

The analytical balance used should be calibrated frequently using a set of standard weights covering the range normally encountered in weighing filters. The sensitivity of the analytical balance will be 0.01 mg.

High Volume Air Sampler (HVAS)

The HVAS should be calibrated by a top loading calibrator once a month to ensure that a constant total sampler flow is maintained.

Preventive Maintenance of Equipment

Sampler Motor

Motor brushes should be replaced after 500-600 hours of operation and the motor should be replaced normally after two or three motor brush replacements. Calibration of the HVAS should be carried out whenever the above replacement work has been done.

Faceplate Gasket

A worn faceplate gasket is characterised by a gradual blending of the interface between the collected particulates and the clean filter border. The faceplate gasket should be replaced when any decrease in the sharpness of this interface is noticed.

Elimination of Inherent Sources of Error

Airflow Variation

The weight of material collected on the filter represents the sum of the product of the instantaneous flow rate multiplied by the instantaneous particle concentration. Therefore, dividing this weight by the average flow rate over the sampling period yields the true particulate matter concentration only when the flow rate is constant over the period. The sampler is equipped with an automatic flow controller that maintains a constant flow during the sampling period. Furthermore, a continuous flow recorder is available to check if there is any airflow variation during the sampling period. If any flow

variation in the chart paper is observed, the sampling filter paper should be discarded.

Filter Handling

The pre/post sampling filter before weighing should be equilibrated in the conditioning environment at room temperature and RH < 50% for at least 24 hours. The filter should be handled very carefully between the pre-sampling and post-sampling weighings to avoid errors due to loss of fibres or particles from the filter. Any physical damage of the filter should be checked after sampling.

Non Sampled Particulate Matter

Particulate matter may be deposited on the filter by wind during periods when the sampler is inoperative. In order to minimise errors from this source, the following measures should be taken as far as practicable:

- a. GMW-8550 SAMPLE SAVER to cover the filter when the sampler is not sampling. Retrieval of filter would be scheduled on the next working day after sampling.
- b. Cleaning the filter paper holder and its immediate surroundings to be carried out each time during the installation of pre-sampling filter.

Timing Errors

Samplers are normally controlled by clock timers set to start and stop the sampler at midnight. Errors in the nominal 1440 min sampling period may result from a power interruption during the sampling period. A continuous flow recorder is used to provide indications of the sampler run time and any power interruption during the sampling period. Any TSP measurement without a complete sampling cycle should be discarded and sampling will be repeated.

Documentation

All the information such as the calibration results, the TSP measurement, conditions of the monitoring sites and identification for filters should be kept in the records for future reference and analysis.

Annex E

Derivation of Action Level

Derivation of Action level for 24-hour TSP Level

In the first quarter of 2000, the average for 24-hour TSP level at Reservoir, East Gate and Tai Yuen Village are $85 \mu\text{g m}^{-3}$, $89 \mu\text{g m}^{-3}$ and $80 \mu\text{g m}^{-3}$ respectively. Taking the highest TSP level recorded at East gate, the Action level for 24-hour TSP is found to be:

$$(1.3 \times 89 + 260) \mu\text{g m}^{-3} / 2 = 187.9 \mu\text{g m}^{-3} = 190 \mu\text{g m}^{-3}$$

Derivation of Action Level for 1-hour TSP Level

Similarly, 42 sets of 1-hour TSP data (viz. three times per day for 14 days) collected at day time at Reservoir and East Gate in March 2000 were taken to determine the action level. These periods were considered to be the highest dust impact. The average of these data was $130 \mu\text{g}/\text{m}^3$. Therefore, the Action level for 1-hour TSP is found to be:

$$(1.3 \times 130 + 500) \mu\text{g m}^{-3} / 2 = 334.5 \mu\text{g m}^{-3} = 340 \mu\text{g m}^{-3}$$

Annex F

Chain of Custody Form

Annex F Chain of Custody Form

**Sample Chain-of-Custody (Sample)
(Sample Delivery)**

Sampling Code : _____ Record No. : _____

Page : ___ of ___

Project : _____ Sampling Date : _____
 Type of Sample : _____ Total No. of Sample : _____
 Sample Storage Condition : _____
 Sample Transported from : _____ to _____ by : _____

Sample Code	Sample Vol. (L)	Container Material	Sample Container Condition	Remarks	Checked by

Delivery Date : _____ Receiving Date : _____
 Delivery Time : _____ Receiving Time : _____
 From : _____ To : _____
 Relinquished By : _____ Receiving By : _____

Note * : Please Refer to Sample Chain-of-Custody - Sample Description for Testing Parameter of Each Sample.

Annex G

Construction Programme

Construction Programme for the Lamma Power Station Extension Project
 (Based on work commencement on 15/02/2001)

