東業德勤測試顧問有限公司
ETS-TESTCONSULT LIMITED

Drainage Services Department

Contract No. DC/2003/01 Ngong Ping Sewage Treatment Plant, Truck Sewers and Effluent Export Pipeline

Environmental Monitoring and Audit Manual

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Environmental Monitoring and Audit Manual

Revision 2

March 2004

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1. INTRODUCTION

1.1 Purpose of the Manual

1.1.1 The purpose of this Environmental Monitoring and Audit (EM&A) Manual is to guide the set up of an EM&A programme to ensure compliance with the recommendations in the Environmental Permit – EP-157/2003 (Hereinafter referred to as 'the EP') and the EIA report (Register No.: AEIAR-065/2002) on 'Outlying Islands Sewerage Stage 1 Phase 1, Ngong Ping Sewage Treatment Works and Sewerage, Design and Construction Consultancy Assignment' to assess the effectiveness of the recommended mitigation measures and to identify any further need for additional mitigation measures or remedial action. This Manual outlines the monitoring and audit programme to be undertaken for the construction and operation of the Project. It aims to provide systematic procedures for monitoring, auditing and minimising of the environmental impacts associated with the construction and operation works.

1.1.2 Hong Kong environmental regulations for air quality, water quality, noise, and waste; the Hong Kong Planning Standards and Guidelines (HKPSG); and recommendations in the EIA report have served as environmental standards and guidelines in the preparation of this Manual.

1.1.3 This Manual contains the following:

a. duties of the Environmental Team (ET) and Independent Environmental Checker (IEC) with respect to the environmental monitoring and audit requirements during construction;

b. information on project organisation and programming of construction and operational activities for the project;

c. requirements with respect to the construction and operation schedule and the necessary environmental monitoring and audit programme to track the varying environmental impact;

d. definition of Action and Limit levels;

e. establishment of event and action plans;

f. requirements of reviewing pollution sources and working procedures required in the event of non-compliance of the environmental criteria; and

g. requirements of presentation of environmental monitoring and audit data and appropriate reporting procedures.

1.1.4 For the purpose of this Manual, the "Engineer" should refer to the Engineer as defined in the Contract and the Engineer's Representative (ER), in cases where the Engineer's powers have been delegated to the ER, in accordance with the Contract. The ET leader, who should be responsible for and in charge of the ET, should refer to the person delegated the role of executing the environmental monitoring and audit requirements.

1.2 Background of the Project

1.2.1 Master Plan (OI SMP) Study in December 1994 and drew up a SMP for Lantau Island, Cheung Chau, Lamma Island, Peng Chau and other smaller and less populated islands. The

SMP comprises provisions for upgrading and expanding the sewerage systems to cover unsewered areas.

1.2.2 This sewerage project is the Stage 1 works under the OI SMP and can be divided into 3 packages as follows:

- Package 1 – Ngong Ping STW with tertiary treatment
- Package 2 – Ngong Ping main trunk sewer and effluent export pipeline
- Package 3 – Ngong Ping village sewerage system

1.2.3 The general layout plan of the project is shown in **Drawing No. 23400/EN/098**.

1.2.4 The existing treatment facilities at Ngong Ping include grease traps and septic tanks, with discharge locally to soakaways. Following the opening of the Statue of Buddha in December 1993, the number of visitors to Ngong Ping increased significantly. The existing treatment and disposal facilities were found to be inadequate, with significant quantities of sewage being directly discharged into the local stream. It was under this setting that the recommendation to provide a local sewerage system and a centralised treatment system for Ngong Ping was put forward in the OI SMP in 1994.

1.2.5 The Cable Car system linking Tung Chung and Ngong Ping is being planned for commissioning in August 2005. It will certainly further increase the number of visitors in Ngong Ping. This sewerage project will be completed to tie in with the commissioning of the Cable Car project. The proposed Ngong Ping Cable Car Terminal is close to the Ngong Ping Sewage Treatment Works (STW) and is some 50m to the proposed STW site.

EIA Requirements

1.2.6 Since the project is a Designated Project under the Environmental Impact Assessment Ordinance (EIAO) by virtue of Section Q.1 of Schedule 2 under the Ordinance, the EIA study has to satisfy the EIAO requirements and to obtain an Environmental Permit for the Project.

1.3 Environmental Monitoring and Audit Requirements

1.3.1 The construction and operational phases impacts of the project are assessed and presented in the Final EIA Report issued in August 2002 as well as the Environmental Assessment (EA) Report for Tung Wan Option issued in December 2002. The EIA Report and the EA Report also specified the recommended environmental mitigation measures to minimise the potential adverse environmental impacts identified. An implementation schedule of the recommended environmental mitigation measures is prepared as part of the EIA Study and is contained in **Appendix A** of this Manual.

1.3.2 In order to ensure that the mitigation measures recommended in EIA Report and the EA Report are implemented fully and resulted in the expected effectiveness, this Manual defines the scope of EM&A requirements for the construction and operation of the Ngong Ping STW and Sewerage project to achieve satisfactory environmental performance. The EM&A requirements are prepared in accordance with the requirements stipulated in Annex 21 of the TM on EIA Process.

1.4 Project Organization

1.4.1 The project organisation and lines of communication with respect to environmental protection works are shown in **Figure 1.1**. The roles and responsibilities of the various parties involved are described in following sections.

Environmental Team (ET)

1.4.2 The ET leader and the ET should not be in any way an associated body of the Contractor. The ET should be led and managed by the ET leader. The ET leader should have relevant education, training, knowledge, experience and professional qualifications subject to approval of the ER's Representative and the Director of Environmental Protection (DEP).

1.4.3 Suitably qualified staff should be included in the ET, and resources for the implementation of the EM&A programme should be allocated in time under the Contract, to enable fulfilment of the project's EM&A requirements as specified in the EM&A Manual during construction and operation.

1.4.4 The ET leader and the ET are employed to conduct the EM&A programme and ensure the Contractor's compliance with the project's environmental performance requirements during construction and operation. The duties are:

a. sampling, analysis and statistical evaluation of monitoring parameters with reference to the EIA report recommendations and requirements;

b. environmental site surveillance;

c. audit of compliance with environmental protection, and pollution prevention and control regulations;

d. monitor the implementation of environmental mitigation measures;

e. monitor compliance with the environmental protection clauses/specifications in the Contract;

f. review construction and operation programme and comment as necessary;

g. review construction and operation methodology and comment as necessary;

h. complaint investigation, evaluation and identification of corrective measures;

i. liaison with Independent Environmental Checker (IEC) on all environmental performance matters, and timely submission of all relevant EM&A proforma for the approval by IEC;

j. advice to the Contractor on environment improvement, awareness, enhancement matters, etc;

k. timely submission of the EM&A report to the project proponent and the DEP, and

l. The ET Leader will keep a contemporaneous log-book each and every instance or circumstance or change of circumstances with may recommendations of the EIA Reports or the EP. The ET Leader will notify the IEC within one working day of the occurrence of any such instance or circumstance or change of circumstance. The ET Leader's log-book will be kept readily available for inspection by all persons assisting in supervision of the implementation of the EIA Reports recommendations.

Contractor

1.4.5 The term "Contractors" should be taken to mean all construction contractors, operators and sub-contractors, working on site at any one time. Besides reporting to the Engineer, the Contractors should:

a. work within the scope of the relevant contract and other tender conditions;

b. participate in the site inspections undertaken by the ET, as required, and undertake any correction actions instructed by the Engineer;

c. provide information/advice to the ET regarding works activities which may contribute, or be continuing to the generation of adverse environmental conditions;

d. implement measures to reduce impact whenever Action and Limit Levels are exceeded; and

e. take responsibility and strictly adhere to the guidelines of the EM&A programme and complementary protocols developed by their project staff.

Engineer or Engineer's Representative

1.4.6 The term Engineer, or Engineer's Representative (ER), refers to the organisation responsible for overseeing the construction works or operation of the Ngong Ping STW and Sewerage project and 'monitoring' the works undertaken by the various Contractors, and for ensuring that they are undertaken by the Contractors in accordance with the specification and contractual requirements. The ER should:

a. Monitor the Contractors' compliance with contract specifications, including the implementation and operation of environmental mitigation measures and ensure their effectiveness, and other aspects of the EM&A programme;

b. Comply with the agreed Event and Action Plan in the event of any exceedance;

c. Provide assistance to the ET as necessary in the implementation of the environmental monitoring and auditing programme; and

d. Instruct the Contractors to follow the agreed protocols or those in the Contract Specifications in the event of exceedances or complaints.

Independent Environmental Checker (IEC)

1.4.7 Given the potential public concern of the environmental performance of the proposed Ngong Ping STW and Sewerage project, the IEC can serve as an individual independent of the Contractors to audit the overall EM&A program and report to the ER and DSD directly.

1.4.8 The IEC should advise the ER on environmental issues related to the project. The role of the IEC should be independent from the management of construction and operation activities, but he/she should be empowered to audit the environmental performance of construction and operation.

1.4.9 The IEC should be employed prior to commencement of construction of Ngong Ping STW and Sewerage project. The IEC should have at least 7 years experience in EM&A or environmental management. The appointment of the IEC is subject to the approval of the ER.

1.4.10 The IEC should audit the overall EM&A programme including the implementation of all environmental mitigation measures, submissions relating to EM&A, and any other submission required under the this Manual.

1.4.11 In addition, the IEC should be responsible for verifying the environmental acceptability of permanent and temporary works, and relevant design plans.

1.4.12 The IEC should arrange and conduct monthly general site inspections of Ngong Ping STW and Sewerage project during the construction and operational periods.

1.4.13 The IEC should ensure the impact monitoring is conducted according to the prescribed schedule at the correct locations.

1.4.14 The IEC should report the findings of the site inspections and other environmental performance reviews to DSD and EPD.

1.4.15 Appropriate resources should also be allocated under the Contractor and the ER to fulfil their duties specified in this Manual.

1.4.16 The main duty of the IEC is to carry out environmental audit of the construction and operation of the Ngong Ping STW and Sewerage project; this should include, inter alia, the followings:

a. review and audit in an independent, objective and professional manner in all aspects of the EM&A programme;

b. validate and confirm the accuracy of monitoring results, monitoring equipment, monitoring locations, monitoring procedures and locations of sensitive receivers;

c. carry out random sample check and audit on monitoring data and sampling procedures, etc;

d. conduct random site inspection;

e. audit the EIA/Environmental Assessment recommendations and requirement against the status of implementation of environmental protection measures on site;

f. review the effectiveness of environmental mitigation measures and project environmental performance;

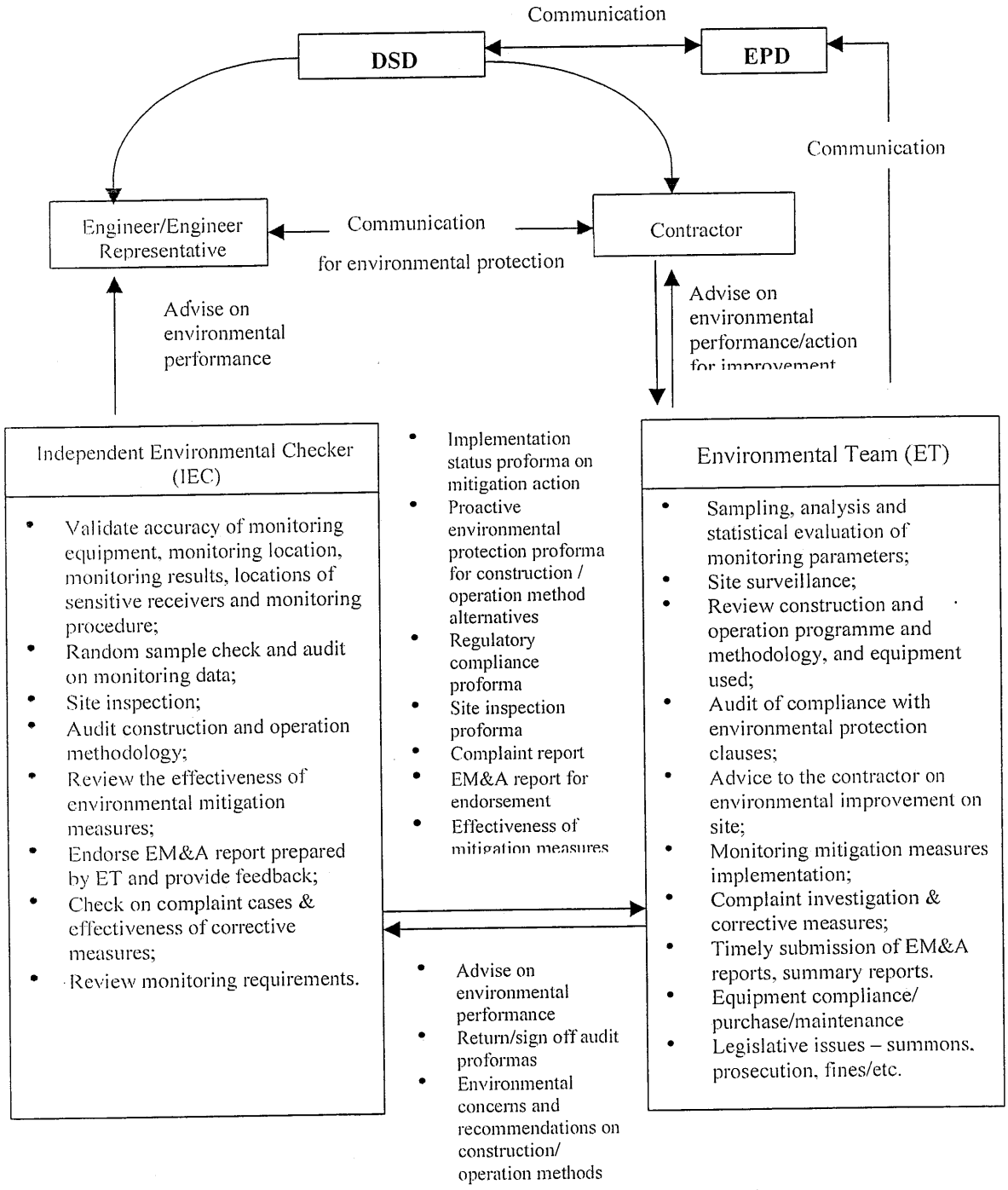
g. on a need basis, verify and certify the environmental acceptability of the permit holder's construction methodology (both temporary and permanent works), relevant design plans and submissions under the EP. Where necessary, the IEC shall seek the least impact alternative in consultation with Environmental Team (ET) leader and the permit holder;

h. verify the investigation results of complaint cases and the effectiveness of corrective measures;

i. verify EM&A report that has been certified by the ET leader;

j. feedback audit results to ET/Permit Holder according to Event/Action Plan in the EM&A manual.

Figure 1.1 Project Organisation (EM&A)



1.5 Construction Programme

1.5.1 The works of Package 1 and Package 2 will be carried out in two separate contracts with construction completed by July 2005. For Package 3, it will be implemented as a separate contract at a later stage as it depends on the progress of land resumption process. In addition, Package 3 work is not dependent on the commissioning of Cable Car project and is tentatively scheduled to be completed by April 2007, after commissioning of the Ngong Ping STW.

1.5.2 The updated construction programme is shown in Appendix C.

The project comprises the construction works for the Ngong Ping Sewage Treatment Works and the proposed scope includes:

- Construction of various structures of Ngong Ping Sewage Treatment Plant (NPSTP) including all other ancillary civil, pipe-laying geotechnical, building services, architectural and landscaping works in Portions A1, A2, A3 and landscaping works in Portion B1 excluding Establishment Works;
- Construction of all Electrical & Mechanical (E&M) works for NPSTP and flow monitoring chamber in Portions A3 and B4 respectively and any works other than those works under Sections I, III, VI, VII, VIII and IX of the Works excluding Establishment Works;
- Pipelaying works for trunk sewers to NPSTP as well as Effluent Export Pipeline from NPSTP along Ngong Ping Road and part of Shum Wat Road in Portion B1;
- Pipelaying works for Effluent Export Pipeline along part of Shum Wat Road and Keung Shan Road in Portion B2;
- Pipelaying works for Effluent Export Pipeline along part of Keung Shan Road in Portion B3;
- Pipelaying works for Effluent Export Pipeline along Shek Pik Reservoir Road in B4. All construction works for the flow monitoring chamber excluding E&M works in Portion B4;
- Pipelaying works for Effluent Export Pipeline along the existing pier at Tung Wan in Portion B5;
- Construction of Water Reuse Facilities including E&M works and all other ancillary civil, pipe-laying geotechnical, building services, architectural and landscaping works in Portion A3 and B1 excluding Establishment Works;Roadworks and pipeworks entrusted by Water Supplies Department along Ngong Ping Road in Portion B1.

1.5.3 The ET leader should make reference to the actual works progress and programme during the construction stage to schedule the EM&A works, and the Contractor should provide the respective information to the ET leader for formulating the EM&A schedule.

2. AIR QUALITY

2.1 Introduction

2.1.1 Dust impacts would be the major air quality impacts during the construction phase of the project. During operational phase of the project, there would be potential odour impacts associated with the operation of the sewage treatment plant. The following sections detailed the approaches, criteria and guidelines on monitoring and managing dust and odour impacts as well as the associated event and action plans and the recommended mitigation measures.

2.2 Construction Phase Dust Monitoring

General

2.2.1 Dust impacts would be the major air quality impacts during the construction phase of the project. It is necessary to monitor the dust generates from the construction activities after timely implementation of the dust mitigation measures listed in this Manual. The purpose of monitoring is to ascertain that the dust levels would comply with the 1-hour average and 24-hour average Total Suspended Particulate (TSP) criteria at the sensitive receivers, and that the recommended mitigation measures are effective in suppressing dust levels.

2.2.2 The objectives of the monitoring are:

a. To identify the extent of construction dust impacts on nearby sensitive receivers;

b. To determine the effectiveness of the recommended dust mitigation measures to control dust from construction activities;

c. To recommend further mitigation measures where necessary; and

d. To ascertain that the dust levels would comply with the 1-hour average and 24-hour average Total Suspended Particulates (TSP) criteria at nearby sensitive receivers as defined in this EM&A Manual.

Air Quality Parameters

2.2.3 Monitoring and audit of the TSP levels should be carried out by the ET Leader to ensure that any deteriorating air quality could be readily detected and timely and appropriate action undertaken to rectify the situation.

2.2.4 1-hour and 24-hour TSP levels should be measured to indicate the impacts of dust on air quality. The TSP levels should be measured by following the standard high volume sampling method as set out in the *Title 40 of the Code of Federal Regulations, Chapter 1 (Part 50), Appendix B*. Upon approval of the ER, 1-hour TSP levels can be measured by direct reading methods which are capable of producing comparable results as that by the high volume sampling method, to indicate short event impacts.

2.2.5 All relevant data including temperature, pressure, weather conditions, elapsed-time meter reading for the start and stop of the sampler, identification and weight of the filter paper, other local atmospheric factors affecting or affected by site conditions and work progress of the concerned site etc. should be recorded down in details. A sample data record sheet is shown in **Appendix B** for reference.

Monitoring Equipment

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

a. 0.6-1.7m^3/min (20-60 SCFM) adjustable flow range;

b. equipped with a timing/control device with +/- 5 minutes accuracy for 24 hours operation;

c. installed with elapsed-time meter with +/- 2 minutes accuracy for 24 hours operation;

d. capable of providing a minimum exposed area of 406cm^2 (63in^2);

e. flow control accuracy: +/- 2.5% deviation over 24-hour sampling period;

f. equipped with a shelter to protect the filter and sampler;

g. incorporated with an electronic mass flow rate controller or other equivalent devices;

h. equipped with a flow recorder for continuous monitoring;

i. provided with a peaked roof inlet;

j. incorporated with a manometer;

k. able to hold and seal the filter paper to the sampler housing at horizontal position;

l. easy to change the filter; and

m. capable of operating continuously for 24-hour period.

2.2.7 The ET Leader should be responsible for provision of the monitoring equipment. He/she should ensure that sufficient number of HVSs with an appropriate calibration kit are available for carrying out the baseline monitoring, regular impact monitoring and ad hoc monitoring. The HVSs should be equipped with an electronic mass flow controller and be calibrated against a traceable standard at regular intervals. All the equipment, calibration kit, filter papers, etc. should be clearly labelled.

2.2.8 Initial calibration of dust monitoring equipment should be conducted by the ET upon installation and thereafter at bi-monthly intervals. The transfer standard should be traceable to the internationally recognised primary standard and be calibrated annually. The calibration data should be properly documented for future reference by the concerned parties such as the IEC. All the data should be converted into standard temperature and pressure condition.

2.2.9 The flow-rate of the sampler before and after the sampling exercise with the filter in position should be verified to be constant and be recorded down in the data sheet (see **Appendix B**).

2.2.10 If the ET Leader proposes to use a direct reading dust meter to measure 1-hour TSP levels, he/she should submit sufficient information to the IEC to prove that the instrument is capable of achieving a comparable result as that of the HVS and may be used for the 1-hour sampling. The instrument should also be calibrated regularly, and the 1-hour sampling should be determined periodically by HVS to check the validity and accuracy of the results measured by direct reading method.

2.2.11 Wind data monitoring equipment should also be provided and set up at conspicuous locations for logging wind speed and wind direction near to the dust monitoring locations. The equipment installation location should be proposed by the ET Leader and agreed with the ER in consultation with the IEC. For installation and operation of wind data monitoring equipment, the following points should be observed:

a. the wind sensors should be installed on masts at an elevated level 10m above ground so that they are clear of obstructions or turbulence caused by the buildings;

b. the wind data should be captured by a data logger. The data recorded in the data logger should be downloaded periodically for analysis at least once a month;

c. the wind data monitoring equipment should be re-calibrated at least once every six months; and

d. wind direction should be divided into 16 sectors of 22.5 degrees each.

2.2.12 In exceptional situations, the ET Leader may propose alternative methods to obtain representative wind data upon approval from the ER and agreement from the IEC.

Laboratory Measurement / Analysis

2.2.13 A clean laboratory with constant temperature and humidity control and equipped with necessary measuring and conditioning instruments to handle the dust samples collected, should be available for sample analysis, and equipment calibration and maintenance. The laboratory should be HOKLAS accredited or other internationally accredited laboratory.

2.2.14 The IEC should conduct regular audit to the measurement performed by the laboratory so as to ensure the accuracy of measurement results. The ET Leader should provide the ER with one copy of the *Title 40 of the Code of Federal Regulations, Chapter 1 (Part 50), Appendix B* for his/her reference.

2.2.15 Filter paper of size 8"x10" should be labelled before sampling. It should be a clean filter paper with no pin holes, and should be conditioned in a humidity controlled chamber for over 24-hour and be pre-weighed before use for the sampling.

2.2.16 After sampling, the filter paper loaded with dust should be kept in a clean and tightly sealed plastic bag. The filter paper is then returned to the laboratory for reconditioning in the humidity-controlled chamber followed by accurate weighing by an electronic balance with a readout down to 0.1mg. The balance should be regularly calibrated against a traceable standard.

2.2.17 All the collected samples should be kept in a good condition for 6 months before disposal.

Monitoring Locations

2.2.18 Impact monitoring of dust shall be carried out at representative ASRs whenever there is ongoing construction work during construction phase of Ngong Ping STW and Sewerage project. Two dust monitoring stations are proposed to set up at as shown in **Drawing No. 23400/EN/094**.

2.2.19 Exact monitoring point for sensitive receivers shall be selected as close as is practical to the construction work boundary. The status and locations of dust sensitive receivers may change after issuing this Manual. If such cases exist, the ET Leader should propose updated monitoring locations and seek approval from ER and agreement from the IEC.

2.2.20 When alternative monitoring locations are proposed, the following criteria, as far as practicable, should be followed:

a. at the site boundary or such locations close to the major dust emission source;

b. close to the air sensitive receivers;

c. proper position/siting and orientation of the monitoring equipment; and

d. take into account the prevailing meteorological conditions.

2.2.21 The ET Leader should agree with the ER in consultation with the IEC the position of the HVS for installation of the monitoring equipment. When positioning the samplers, the following points should be noted:

a. a horizontal platform with appropriate support to secure the samplers against gusty wind should be provided;

b. no two samplers should be placed less than 2 meter apart;

c. the distance between the sampler and an obstacle, such as buildings, must be at least twice the height that the obstacle protrudes above the sampler;

d. a minimum of 2 metres of separation from walls, parapets and penthouses is required for rooftop samplers;

e. a minimum of 2 metre separation from any supporting structure, measured horizontally is required;

f. no furnace or incinerator flue is nearby;

g. airflow around the sampler is unrestricted;

h. the sampler is more than 20 metres from the dripline;

i. any wire fence and gate, to protect the sampler, should not cause any obstruction during monitoring;

j. permission must be obtained to set up the samplers and to obtain access to the monitoring stations; and

k. a secured supply of electricity is needed to operate the samplers.

Baseline Monitoring

2.2.22 The ET Leader should carry out baseline monitoring at all of the designated monitoring locations for at least 14 consecutive days prior to the commissioning of the construction works to obtain daily 24-hour TSP samples. 1-hour sampling should also be done at least 3 times per day while the highest dust impact is expected. Before commencing the baseline monitoring, the ET Leader should inform the IEC of the baseline monitoring programme such that the IEC can conduct on-site audit to ensure accuracy of the baseline monitoring results.

2.2.23 During the baseline monitoring, there should not be any construction or dust generation activities in the vicinity of the monitoring stations.

2.2.24 In case the baseline monitoring cannot be carried out at the designated monitoring locations during the baseline monitoring period, the ET Leader should carry out the monitoring at alternative locations which can effectively represent the baseline conditions at the impact monitoring locations. The alternative baseline monitoring locations should be approved by the ER and agreed with IEC.

2.2.25 In exceptional case, when insufficient baseline monitoring data or questionable results are obtained, the ET Leader should liaise with the IEC and EPD to agree on an appropriate set of data to be used as a baseline reference and submit to ER for approval.

2.2.26 Ambient conditions may vary seasonally and should be reviewed at three monthly intervals. If the ET leader considers that the ambient conditions have been changed and a repeat of the baseline monitoring is required to be carried out for obtaining the updated baseline levels, the monitoring should be at times when the contractor's activities are not generating dust, at least in the proximity of the monitoring stations. Should change in ambient conditions be determined, the baseline levels and, in turn, the air quality criteria, should be revised. The revised baseline levels and air quality criteria should be agreed with the IEC and EPD.

Impact Monitoring

2.2.27 The ET Leader should carry out impact monitoring during construction phase of Ngong Ping STW and Sewerage project. For regular impact monitoring, the sampling frequency of at least once in every six-days, should be strictly observed at all the monitoring stations for 24-hour TSP monitoring. For 1-hour TSP monitoring, the sampling frequency of at least three times in every six-days should be undertaken when the highest dust impact occurs. Before commencing the impact monitoring, the ET Leader should inform the IEC of the impact monitoring programme such that the IEC can conduct on-site audit to ensure accuracy of the impact monitoring results.

2.2.28 The specific time to start and stop the 24-hour TSP monitoring should be clearly defined for each location and be strictly followed by the field operator.

2.2.29 In case of non-compliance with the air quality criteria, more frequent monitoring exercise, as specified in the Action Plan in Section 2.2 of this Manual, should be conducted within 24 hours after the result is obtained. This additional monitoring should be continued until the excessive dust emission or the deterioration in air quality is rectified.

2.3 Event and Action Plan for Construction Phase Air Quality

2.3.1 The baseline monitoring results form the basis for determining the air quality criteria for the impact monitoring. The ET Leader should compare the impact monitoring results with air quality criteria set up for 24-hour TSP and 1-hour TSP. **Table 2.1** shows the air quality criteria, namely Action and Limit levels to be used. Should non-compliance of the air quality criteria occurs, the ET Leader, ER, and Contractor should undertake relevant actions in accordance with the Action Plan as stated **Table 2.2**.

Table 2.1 Action and Limit Levels for Air Quality (Dust)

Parameters	Action	Limit
24 Hour TSP Level in $\mu g/m^3$	For baseline level < $200/m^3$, Action Level = (Baseline level * 1.3 + Limit level)/2 For baseline level > 200 $\mu g/m^3$, Action level = Limit level	260
1 Hour TSP Level in $\mu g/m^3$	For baseline level < $384/m^3$, Action Level = (Baseline level * 1.3 + Limit level)/2 For baseline level > 384 $\mu g/m^3$, Action level = Limit level	500

Table 2.2 Event/Action Plan for Air Quality (Dust)

EVENT	ACTION			
	ET	IEC	ER	CONTRACTOR
Action Level being exceeded for one sample	1. Identify source; 2. Inform IEC and ER; 3. Repeat measurement to confirm finding; 4. Increase monitoring frequency to daily	1. Check monitoring data submitted by ET; 2. Check Contractor's working method.	1. Notify Contractor.	1. Rectify any unacceptable practice; 2. Amend working methods if appropriate.
Action Level being exceeded for two or more consecutive samples	1. Identify source; 2. Inform IEC and ER; 3. Repeat measurements to confirm findings' 4. Increase monitoring frequency to daily; 5. Discuss with IEC and Contractor on remedial actions required; 6. If exceedance continues, arrange meeting with IEC and ER; 7. If exceedance stops, cease additional monitoring.	1. Check monitoring data submitted by ET; 2. Check Contractor's working method; 3. Discuss with ET and Contractor on possible remedial measures; 4. Advise the ER on the effectiveness of the proposed remedial measures; 5. Supervise implementation of remedial measures.	1. Confirm receipt of notification of failure in writing; 2. Notify Contractor; 3. Ensure remedial measures are properly implemented.	1. Submit proposals for remedial actions to IEC within 3 working days of notification; 2. Implement the agreed proposals; 3. Amend proposal if appropriate.
Limit Level being exceeded for one sample	1. Identify source; 2. Inform EAT, ER and EPD; 3. Repeat measurement to confirm finding; 4. Increase monitoring frequency to daily; 5. Assess effectiveness of 6. Contractor's remedial actions; 7. Keep EPD and ER informed of the results.	1. Checking monitoring data submitted by EMT and Contractor's method; 2. Discuss with Contractor on the possible mitigation measures; 3. Review the proposed mitigation measures submitted by Contractor and advise the ER accordingly.	1. Confirm receipt of notification of failure in writing; 2. Notify Contractor; 3. Check monitoring data and Contractor's working methods; 4. Discuss with ENPO and Contractor potential remedial actions; 5. Ensure remedial actions properly implemented.	1. Take immediate action to avoid further exceedance; 2. Submit proposals for remedial actions to ER within 3 working days of notification; 3. Implement the agreed proposals; 4. Amend proposal if appropriate.
Limit Level being exceeded for two or more consecutive samples	1. Identify source; 2. Inform ER and EPD the causes & actions taken for the exceedances; 3. Repeat measurement to confirm findings; 4. Increase monitoring frequency to daily; 5. Investigate the causes of exceedance 6. Arrange meeting with EPD and ER to discuss the remedial actions to be taken; 7. Assess effectiveness of Contractor's remedial actions and keep EPD and ER informed of the results; 8. If exceedance stops, cease additional monitoring.	1. Checking monitoring data submitted by EMT and Contractor's method; 2. Discuss with Contractor on the possible mitigation measures; 3. Review the proposed mitigation measures submitted by Contractor and advise the ER accordingly; 4. Supervise the implementation of mitigation measures.	1. Confirm receipt of notification of failure in writing; 2. Notify Contractor; 3. Carry out analysis of Contractor's working procedures to determine possible mitigation to be implemented; 4. Discuss amongst ENPO and the Contractor potential remedial actions; 5. Review Contractor's remedial actions whenever necessary to assure their effectiveness; 6. If exceedance continues, consider what portion of the work is responsible and instruct the Contractor to stop that portion of work until the exceedance is abated.	1. Take immediate action to avoid further exceedance; 2. Submit proposals for remedial actions to ER within 3 working days of notification; 3. Implement the agreed proposals; 4. Resubmit proposals if problem still not resolved; 5. Stop the relevant portion of works as determined by the ER until the exceedance is abated.

2.4 Mitigation Measures During Construction Phase

2.4.1 The EIA Report has recommended dust control mitigation measures to minimise the impacts. The Contractor should be responsible for the design and implementation of these measures. If the recommended mitigation measures are not sufficient to restore the air quality to acceptable levels upon the advice of ET, the Contractor should liaise with the ET on some other mitigation measures, propose to ER for approval, and implement the mitigation measures.

2.4.2 In order to ensure that dust emission is minimised during the construction phase of the project, relevant dust control requirements set out in the *Air Pollution Control (Construction Dust) Regulation* should be met. The Contractors are required to adopt dust reduction measures when carrying out construction works. In particular, the mitigation measures listed below should be adopted where applicable. With the implementation of effective dust control measures, adverse dust impacts from the construction works of the project is not expected.

2.4.3 The EIA Report has recommended dust control and mitigation measures. The Contractor shall be responsible for the design and implementation of these measures.

2.4.4 Recommended dust mitigation measures to minimise dust and the effects of dust on sensitive receivers during construction of the project shall be adopted and are detailed as follows:

2.4.5 In order to ensure that dust emission is minimised during the construction phase of the project, relevant dust control requirements set out in the *Air Pollution Control (Construction Dust) Regulation* should be met. The site agent of the Contractor is required to adopt dust reduction measures while carrying out construction works. In particular, the mitigation measures listed below should be adopted where applicable. With the implementation of effective dust control measures, adverse dust impacts from the construction works of the project is not expected.

Site clearance and demolition of existing structures

- The working area for the uprooting of trees, shrubs, or vegetation or for the removal of boulders, poles, pillars or temporary or permanent structures should be sprayed with water or a dust suppression chemical immediately before, during and immediately after the operation so as to maintain the entire surface wet;
- All demolished items (including trees, shrubs, vegetation, boulders, poles, pillars, structures, debris, rubbish and other items arising from site clearance) that may dislodge dust particles should be covered entirely by impervious sheeting or placed in an area sheltered on the top and the 3 sides within a day of demolition;

Site boundary and entrance

- Vehicle washing facilities including a high pressure water jet should be provided at every discernible or designated vehicle exit point;
- The area where vehicle washing takes place and the section of the road between the washing facilities and the exit point should be paved with concrete, bituminous materials or hardcores;
- Where a site boundary adjoins a road, street, service and or other area accessible to the public, hoarding of not less than 2.4m from ground level should be provided along the entire length of that portion of the site boundary except for a site entrance or exit;

Access road

- Every main haul road (i.e. any course inside a construction site having a vehicle passing rate of higher than 4 in any 30 minutes) should be paved with concrete, bituminous materials, hardcores or metal plates, and kept clear of dusty materials; or sprayed with water or a dust suppression chemical so as to maintain the entire road surface wet;
- The portion of any road leading only to a construction site that is within 30m of a discernible or designated vehicle entrance or exit should be kept clear of dusty materials;

Use of vehicle

- Immediately before leaving a construction site, every vehicle should be washed to remove any dusty materials from its body and wheels;
- Where a vehicle leaving a construction site is carrying a load of dusty materials, the load should be covered entirely by clean impervious sheeting to ensure that the dusty materials do not leak from the vehicle;

Excavation and earth moving

- The working area of any excavation or earth moving operation should be sprayed with water or a dusty suppression chemical immediately before, during and immediately after the operation so as to maintain the entire surface wet;
- Exposed earth shall be properly treated by compaction, turfing, hydroseeding, vegetation planting or sealing with latex, vinyl, bitumen, shotcrete or other suitable surface stabilizer within 6 months after the last construction activity on the construction site or part of the construction site where the exposed earth lies;

Stockpiling of dusty materials

- Any stockpile of dusty material should be either covered entirely by impervious sheeting; placed in an area sheltered on the top and the 3 sides; or sprayed with water or a dust suppression chemical so as to maintain the entire surface wet.

2.4.6 If the above measures are not sufficient to restore the air quality to acceptable levels upon the advise of ET Leader, the Contractor should liaise with the ET Leader on some other mitigation measures, propose to ER for approval, and implement the mitigation measures.

2.5 Operational Phase Odour Monitoring

General

2.5.1 Initially, H_2S measurements and odour panel tests should be carried out at the site boundary and at nearby air sensitive receivers (ASRs). The purpose is to determine the correlation between H_2S concentrations and odour units obtained from the odour panel tests. Once such correlation is established, H_2S monitoring will be continued and H_2S concentrations measured will be converted to equivalent odour units.

Monitoring Methodology

2.5.2 Monitoring and audit of the odour level should be carried out by the ET during the course of the odour generating activities to ensure that odour levels at the ASRs meet the requirements and timely action would be undertaken to rectify any exceedances.

2.5.3 According to Annex 4 of the EIAO-TM, an odour concentration as a result of odour emission of 5 OU m^{-3} or above based on an averaging time of 5 seconds at an ASR is considered an odour nuisance.

2.5.4 Hydrogen sulphide (H_2S) is one of the main components of odour emissions. Since ambient H_2S concentration can be readily monitored at the ASRs, it can serve as a surrogate indicator for STW odours in addition to odour measurement using olfactometry techniques.

2.5.5 Prior to the operation of the odour generating activities, H_2S measurements and odour panel tests should be carried out at the site boundary and at nearby ASRs. The purpose is to establish the averaged baseline H_2S concentration conditions at each measurement position at the site boundary and at nearby ASRs. These baseline H_2S concentrations will be used to establish the action levels of the odour EM&A program.

2.5.6 In addition, H_2S measurements and odour panel tests should be carried out at the site boundary, at nearby ASRs, and at the exhaust of the centralised deodourisation unit in order to determine the correlation between H_2S concentrations and odour units obtained from the odour panel tests. Once such correlation is established, only H_2S monitoring should be continued and H_2S concentrations measured should be converted to equivalent odour units. The correlation is used to check whether the mitigation measures can reduce the odour concentration to meet the odour criteria.

2.5.7 After the establishment of the correlation, only measurements of H_2S concentrations at the site boundary, at nearby ASRs, and at the exhaust of the centralised deodourisation unit are required during the operational phase of the STW. This is to indicate whether the odour concentrations are higher or lower than the baseline condition, and within the odour criteria.

2.5.8 Apart from the baseline and impact odour monitoring, regular odour patrolling in the vicinity of the STW should also be conducted in a monthly interval during the operational phase to ensure that prompt actions would be taken whenever any excessive odour emissions are detected. The findings of the odour patrol should be properly recorded. If necessary, such as during initial operation stage or upon receipt of odour complaint, the regular odour patrolling should be carried out more frequently.

Monitoring Parameters

2.5.9 15-min H_2S concentration (in parts per billion or in parts per million) should be measured at the site boundary, at nearby ASRs, and at the exhaust of the centralised deodourisation unit using the equipment described below. Meteorological conditions including temperature, wind speed, wind direction and relative humidity should also be measured at the time of the monitoring.

2.5.10 For olfactometry analysis, air samples should also be collected for a period of 15-min at the selected locations in order to provide sufficient volume for olfactometric analysis. Odour concentrations should be expressed as OUm^{-3}.

Monitoring Equipment and Methods

Hydrogen Sulphide Monitoring

2.5.11 Concentrations of H_2S should be recorded using a Jerome H_2S Analyzers which utilises a gold film sensor for the detection of hydrogen sulphide. The instrument is controlled by

microprocessor, ensuring rapid accurate analyses, and should be fitted with the following accessories:

- Data logger (to allow the instrument to operate unattended);
- Interface cable and interface software; and
- Data download and graphics service.

2.5.12 The instrument is capable of measuring H_2S concentrations in the range 1ppb ($1.4\mu gm^{-3}$) to 50 ppm (70 mg m^{-3}) to an accuracy of ±6%. If the H_2S concentrations at the site boundary or at the exhaust of the centralised deodourisation unit are too high to be measured by this equipment, wet chemical method should be considered to analysis the H_2S concentrations of the collected air samples in the laboratory. Meteorological information including wind speed, wind direction and temperature should be retrieved from the meteorological monitoring station.

Olfactometry Analysis

2.5.13 The odour concentration should be measured by a force-choice dynamic olfactometer in accordance with the Dutch National Standard Method (NVN2820).

2.5.14 Large plastic bags of 40 litres are usually used to collect air samples. To avoid adsorption onto or chemical reaction with the bag surface, bags and connection tubing in contact with odour-laden gas should be made of inert material, e.g. poly-tetra fluro-ethylene (PTFE) or Tedlar.

2.5.15 During the sampling, weather condition including wind direction, wind speed and temperature should be recorded. The collected samples should be transported to an odour laboratory as soon as possible and shall be analyzed within 24 hours. Qualified odour panelists should be selected and those participating in the odour testings should be screened by using a 50ppm of certified n-butanol standard gas.

Laboratory Analysis and QA/QC

Basic Principle of Odour Measurement

2.5.16 The odour concentration of a gaseous sample is measured using dynamic olfactometry with a panel of human assessors being the sensor. The odour panel normally composes of 6 to 8 persons. The odour concentration is measured by determining the dilution factor required to reach the detection threshold. The odour concentration at the detection threshold is 1 odour unit (OUm^{-3}), which has a probability of 50% being detected under the conditions of the test. The odour concentration of the examined sample is then expressed in terms of multiples of one OUm^{-3} of neutral gas at standard conditions.

Panel Selection and Control

2.5.17 In order to ensure repeatability of the sensor, composed of individual panel members, their olfactory sensitivity should be within a narrow bandwidth. To achieve this aim, assessors with a specific sensitivity to a reference odour are selected to be panel members. The screening is on reference materials n-butanol with the concentration of 50ppm in nitrogen (v/v).

2.5.18 At least ten individual thresholds for the reference gas are collected for selection purposes. These data are collected in at least three sessions on separate days with a pause of at least one day between sessions. To become a panel member, the data collected for that assessor must comply with the following criteria:

- The geometric mean of the individual thresholds must fall between 20 and 80 ppb, when n-butanol standard gas is used; and
- A measuring history for each panel member is continuously recorded and their performance is compared with the selection criteria. If the panel member does not comply, he/she is excluded from all further measurements.

2.5.19 In order to control the quality of the results produced by panel members:

- Panel members must not eat or smoke for one hour prior to the session;
- Panel members should be in the odour room 15 minutes before measurements;
- Panel members should not use perfumes, after-shave lotions or any other fragrant essences before the session;
- Panel member should not attend a session if he/she has a cold, influenza or any other health problem, which will affect his/her nose;
- No panel member should be involved for more than 4 hours of odour testing. Within this period at least 2 ten minutes breaks for olfactory rest should be taken; and
- The odour panel should be housed in a room that is constructed of odour-free materials and is equipped with ventilation system to prevent build-up of odour in the room.

Instrument Calibration

2.5.20 Regular calibration of the olfactometer should be performed to check the accuracy and repeatability of its dilution settings and to establish its calibration history. The calibration may be performed using carbon monoxide as a tracer gas and a carbon monoxide monitor. The accuracy and repeatability of the olfactometer are calculated from two carbon monoxide concentrations with one measured at the sniffing port of the olfactometer and one being the certified carbon monoxide concentration.

Monitoring Locations

Monitoring Locations at ASRs

2.5.21 Odour sampling or H_2S measurements should be carried out at representative ASRs nearest to the odour sources, in particular the exhaust point of the deodourisation unit. The ET Leader should propose monitoring locations and seek approval from the ER.

2.5.22 Odour sampling or H_2S measurements should be taken outside the premises of the identified ASRs and these locations should preferably not be influenced by other nearby odour sources.

Monitoring Locations at Site Boundary

2.5.23 Odour sampling or H_2S measurements should be undertaken at the site boundary downwind of the exhaust point of the deodourisation unit and the covered odour sources. The selected locations should be determined by the ET Leader and agreed with ER and EPD.

Monitoring Location at the Exhaust of the Centralised Deodourisation Unit

2.5.24 H_2S measurements should be undertaken regularly at the exhaust point of the centralised deodourisation unit. The selected location should be determined by the ET Leader and agreed with ER and EPD.

Baseline Monitoring

2.5.25 Odour and H_2S monitoring should be taken prior to the operation of the odour generating activities in order to establish baseline odour and H_2S concentrations and to set up the Action and Limit levels. These will be compared with the results obtained during the impact monitoring stage.

2.5.26 Odour baseline monitoring should consist of both odour sampling and H_2S measurement. Sampling at the site boundary and at selected ASRs using olfactometry and an H_2S analyser should be carried out simultaneously using the equipment and methodology described above. The purpose is to establish both the correlations between odour level (OUm^{-3}) and H_2S concentration, and the averaged baseline H_2S concentration condition for each measurement position at the site boundary and at ASRs.

2.5.27 A 15-min sample should be collected every 3 hours for a duration of 24 hours at each of the monitoring locations. The purpose of sampling in 3-hour intervals and to cover a duration of a whole day is to capture the different atmospheric conditions at different time periods. If there is insufficient monitoring equipment or monitoring personnel, sampling/monitoring can be spread to 3 to 4 consecutive days as long as the different monitoring periods and each of monitoring locations are covered. Pairwise monitoring at ASRs and at site boundary should be carried out simultaneously. However, as the variation of odour concentration at site boundary should be less significant, timing of sampling or monitoring at the site boundary should be more flexible so as to accommodate the available resources for the monitoring programme.

2.5.28 In exceptional cases, when insufficient baseline monitoring data or questionable results are obtained, the ET Leader should liaise with EPD to agree on an appropriate set of data to be used as the baseline.

Impact Monitoring

2.5.29 The ET Leader should carry out the odour monitoring at all the designated monitoring locations during operation of the odour generating activities.

The First Set of Odour Monitoring

2.5.30 The first set of odour monitoring at the site boundary, at selected ASRs, and at the exhaust of the centralised deodourisation unit should consist of both odour sampling and H_2S measurement. Sampling at these locations using olfactometry and an H_2S analyser should be carried out simultaneously using the equipment and methodology described above. The purpose is to establish the correlations between odour level (OUm^{-3}) and H_2S concentration for each measurement position. Sample should be collected according to those described at S.2.5.27 above.

2.5.31 As the first set of odour sampling/monitoring is fundamentally to establish the correlation between OUm^{-3} and H_2S, the timing of this event should be selected during the summer period, as far as possible, to capture the highest odour concentrations. Once the correlation

between H_2S concentrations and odour units is established, H_2S monitoring should be continued during the subsequent odour monitoring and H_2S concentrations measured should be converted to equivalent odour units. The degree of correlation should be constantly reviewed in order to ascertain that the most realistic correlation factor be used.

Subsequent Odour Monitoring

2.5.32 The subsequent odour impact monitoring should provide a continuation of the H_2S monitoring at the site boundary, at selected ASRs and at the exhaust point of the centralised deodourisation unit. Impact monitoring should be carried out every 3 months. If necessary, such as during initial operation stage or upon receipt of odour complaint, the subsequent odour impact monitoring should be carried out more frequently.

2.5.33 The same monitoring regime as the baseline monitoring should be followed, except that odour sampling and analysis by olfactometry is not required in the subsequent odour impact monitoring.

2.6 Event and Action Plan for Operational Phase Air Quality

2.6.1 The baseline monitoring results form the basis for determining the odour criteria for the impact monitoring. The ET Leader should compare the impact monitoring results with the odour criteria shown in **Table 2.3**, namely Action and Limit Levels. Should a non-compliance of the odour criteria occur, the relevant parties should undertake the relevant actions in accordance with the Event/Action Plan in **Table 2.4**.

Table 2.3 Action and Limit Levels for Operational Phase Odour Monitoring

Location of Monitoring	Parameters	Action Level	Limit Level
At the site boundary and at ASRs.	Odour level (expressed as equivalent H_2S concentration)	For baseline level (BL) $\leq$ 3.84 OUm^{-3} measured at the site boundary and at ASRs, action level AL = (BLx1.3 + LL)/2; for BL > 3.84 OUm^{-3} at the site boundary and at ASRs, AL = LL	Limit level (LL) = odour criteria of 5 OUm^{-3} at the site boundary and at ASRs.
At the exhaust of the centralised deodourisation unit	H_2S concentration in ppb/ppm, flowrate of exhaust in m^3/s and temperature of exhaust (°C)	AL = LL/2 = 25 $\mu g/s$ of H_2S.	LL = 50 $\mu g/s$ of H_2S.

Table 2.4 Event/Action Plan for Odour Monitoring

Event	Action			
	ET	IEC	ER	Operator
Exceedance of Action Level for one or more samples at site boundary or ASRs or exhaust of centralised deodourisation unit	• Identify source/ reason of exceedance; • Inform IEC and ER; • Repeat measurement to confirm finding.	• Check with Contractor and Operator on the operating activities and implementation of odour mitigation measures; • Discuss with ET and Operator on the possible remedial actions; • Advise the ER on the effectiveness of the proposed remedial measures; • Supervise implementation of remedial measures.	• Confirm receipt of notification of exceedance in writing; • Notify Operator; • Ensure remedial actions properly implemented.	• Carry out investigation to identify the source/reason of exceedance or complaints. Investigation shall be completed within 1 week; • Rectify any unacceptable practice; • Amend working methods as required; • Inform ET and EPD if the cause of exceedance is considered to be caused by the project; • Implement amended working methods.
Exceedance of Limit Level for one or more samples at site boundary or ASRs or exhaust of centralised deodourisation unit	• Notify IEC, ER, Operator and EPD; • Identify source of odour; • Increase monitoring frequency; • Carry out analysis of the operating activities and implementation of odour mitigation measures to determine possible mitigation to be implemented • Arrange meeting with IEC and ER to discuss the remedial actions to be taken; • Assess effectiveness of the remedial actions and keep IEC, EPD and ER informed of the results; • Carry out odour measurement using dynamic olfactometry after implementation of remedial measures to confirm their effectiveness.	• Discuss amongst ET, ER and the Operator on the potential remedial actions; • Review the proposed remedial actions whenever necessary to assure their effectiveness and advise the ER accordingly; • Supervise implementation of remedial measures.	• Confirm receipt of notification of exceedance in writing; • Notify Contractor and Operator; • In consultation with the ET, agree with the Operator on the remedial measures to be implemented; • Ensure remedial measures properly implemented; • If exceedance continues, consider what portion of the work is responsible and instruct the Operator to stop that portion of work until the exceedance is abated.	• Carry out investigation to identify the source/reason of exceedance. Investigation shall be completed within 1 week; • Rectify any unacceptable practice; • Amend working methods as required; • Inform ET and EPD; • Formulate remedial actions; • Ensure amended working methods and remedial actions properly implemented; • If exceedance continues, consider what portion of the work is responsible and stop that portion of work until the exceedance is abated.

2.7 Mitigation Measures During Operational Phase

2.7.1 In order to mitigate the potential odour impacts from the proposed Ngong Ping STW to an acceptable level, it is recommended that all the major odour sources within the proposed STW namely the inlet work, the sequencing batch reactors, the sludge thickeners, and the emergency storage tank should all be constructed as underground facilities to minimise direct emission of odour to the atmosphere.

2.7.2 Other components of the STW will be constructed as above ground structures. All odour emissions from the underground/above ground facilities mentioned above will be contained by building structures and ventilated to a centralised deodourisation unit. Based on the findings of the EIA study, the H_2S removal efficiency of the deodourisation unit should be 99.5% or better and the H_2S emission rate at the exhaust end of the deodourisation unit should not be more than 50 μg/s. The exhaust height and exit velocity of the treated air should not be less than 5m and 10m/s respectively. A backup deodorization unit should be provided to cater for the situation during maintenance or breakdown of the deodorization unit.

2.7.3 All the sludge generated from the STW will be dewatered onsite to more than 30% dry solids content before transporting to the designated landfill site for disposal and will be stored in covered container along the transporting route to avoid the possible odour impact on nearby sensitive receivers. The transportation of the sludge by sea to the disposal location is recommended, as far as practicable, in order to reduce potential air quality impacts from road transportation."

3. NOISE

3.1 Introduction

3.1.1 The EIA Report and the EA Report point out that there is a need for both construction and operational phase EM&A. The EM&A requirements for construction noise are described in Sections 3.2 to 3.8 while the specific mitigation measures for operational phase are given in Section 3.9.

3.2 Noise Parameters

3.2.1 Monitoring and audit of noise levels should be carried out by the ET to ensure that any unacceptable noise impacts could be readily detected and timely and appropriate action be undertaken to rectify the situation.

3.2.2 The construction noise level shall be measured in terms of the A-weighted equivalent continuous sound pressure level (Leq). Leq(30 min) shall be used as the monitoring parameter for the time period between 0700-1900 hours on normal weekdays. For all other time periods, Leq(5 min) shall be employed for comparison with the NCO criteria.

3.2.3 As supplementary information for data auditing, statistical results such as L_{10} and L_{90} shall also be obtained for reference. A sample data record sheet is shown in **Appendix B** for reference.

3.3 Monitoring Equipment

3.3.1 As referred to in the Technical Memorandum (TM) issued under the Noise Control Ordinance (NCO), sound level meters in compliance with the *International Electrotechnical Commission Publications 651: 1979 (Type 1) and 804: 1985 (Type 1)* specifications shall be used for carrying out the noise monitoring. Immediately prior to and following each noise measurement the accuracy of the sound level meter shall be checked using an acoustic calibrator generating a known sound pressure level at a known frequency. Measurements may be accepted as valid only if the calibration level from before and after the noise measurement agree to within 1.0 dB.

3.3.2 Noise measurements should not be made in the presence of fog, rain, wind with a steady speed exceeding 5 m/s or wind with gusts exceeding 10 m/s. The wind speed shall be checked with a portable wind speed meter capable of measuring the wind speed in m/s.

3.3.3 The ET Leader should be responsible for the provision of the monitoring equipment. He/she should ensure that sufficient noise measuring equipment and associated instrumentation are available for carrying out the baseline monitoring, regular impact monitoring and ad hoc monitoring. All the equipment and associated instrumentation should be clearly labelled. The equipment installation location should be proposed by the ET Leader and agreed with the ER and EPD in consultation with the IEC.

3.4 Monitoring Locations

3.4.1 One noise monitoring station is proposed to set up at Lin Chi Monastery during construction phase. The location of the proposed noise monitoring stations is shown in **Drawing No. 23400/EN/094**

3.4.2 The status and locations of noise sensitive receivers (NSRs) may change after issuing this Manual. If such cases exist, the ET Leader should propose updated monitoring locations and seek approval from ER and agreement from the IEC and EPD of the proposal.

3.4.3 When alternative noise monitoring locations are proposed, the monitoring locations should be chosen based on the following criteria:

a. at locations close to the major site activities which are likely to have noise impacts, with proper position/siting and orientation of the monitoring equipment ensured;

b. close to the noise sensitive receivers (any domestic premises, hotel, hostel, temporary housing accommodation, hospital, medical clinic, educational institution, place of public worship, library, court of law, performing art centre should be considered as noise sensitive receiver); and

c. for monitoring locations located in the vicinity of the sensitive receivers, care should be taken to cause minimal disturbance to the occupants during monitoring.

3.4.4 The monitoring station should normally be at a point 1m from the exterior of the sensitive receivers building facade and be at a position 1.2m above the ground. If there is problem with access to the normal monitoring position, an alternative position may be chosen, and a correction to the measurements should be made. For reference, a correction of +3dB(A) should be made to the free field measurements. The ET Leader should agree with the IEC on the monitoring position and the corrections adopted. Once the positions for the monitoring stations are chosen, the baseline monitoring and the impact monitoring should be carried out at the same positions.

3.5 Baseline Monitoring

3.5.1 The ET Leader should carry out baseline noise monitoring prior to the commencement of the construction works. The baseline monitoring should be carried out daily for a period of at least two weeks. A schedule on the baseline monitoring should be submitted to the ER for approval before the monitoring starts.

3.5.2 During the baseline monitoring, there should not be any construction activities in the vicinity of the monitoring stations.

3.5.3 In exceptional cases, when insufficient baseline monitoring data or questionable results are obtained, the ET Leader should liaise with EPD and in consultation with ER to agree on an appropriate set of data to be used as a baseline reference.

3.6 Impact Monitoring

3.6.1 Noise monitoring should be carried out at all the designated monitoring stations for the construction phase. Given that the operating hours during construction and operational phases of the project will be restricted and no noise-generating activities would be expected during

1900 to 0700 hours all days or any time on Sundays or general holidays, noise monitoring will only be carried out during 0700 to 1900 hours on normal weekdays.

3.6.2 The monitoring frequency should depend on the scale of construction and operation activities. As an initial guide for both construction and operational phases, one set of measurements between 0700 to 1900 hours on normal weekdays should be carried out for each station on a per week basis when noise-generating activities are underway. One set of measurements should at least include 6 consecutive Leq(5 min) results (i.e. a minimum of 30 minutes).

Construction noise monitoring

3.6.3 Construction noise monitoring shall be carried out at all the designated monitoring station. It was assumed in the EIA Report that no night-time work would be carried out under the proposed construction programme. However, the monitoring frequency shall depend on the scale of the construction and the actual timing of activities. The following is an initial guide on the regular monitoring frequency for each station on a per week basis when noise generating activities are underway:

a. one set of measurements between 0700-1900 hours on normal weekdays;

b. one set of measurements between 1900-2300 hours (if there is construction work);

c. one set of measurements between 2300-0700 hours of next day (if there is construction work); and

d. one set of measurements between 0700-1900 hours on holidays (if there is construction work).

3.6.4 For the measurements (b), (c) & (d) above, one set of measurements shall at least include three consecutive Leq(5 min) results and shall only be carried out when there are construction activities scheduled during those periods.

3.7 Event and Action Plan for Noise

3.7.1 Since the monitoring would be carried out near site boundary, the ET should predict the noise levels at the nearest NSRs using standard acoustic principles on the basis of the measured noise levels from monitoring. The predicted noise levels should then be compared with the action and limit levels in **Tables 3.1.**

3.7.2 The Action and Limit levels for noise are defined in **Table 3.1**. Should non-compliance of the criteria occur, action in accordance with the Action Plan in **Table 3.2** should be carried out.

Table 3.1 Action and Limit Levels for Construction Noise

Time Period	Action Level	Limit Level
0700-1900 hrs on normal weekdays	When one documented complaint is received	75* dB(A)
0700-2300 hrs on holidays; and 1900-2300 hrs on all other days		60/65/70** dB(A)
2300-0700 hrs of next day		45/50/55** dB(A)

* reduce to 70 dB(A) for schools and 65 dB(A) during school examination periods.
** to be selected based on Area Sensitivity Rating.

Table 3.2 Event/Action Plan for Construction Noise

EVENT	ACTION			
	ET	IEC	ER	CONTRACTOR
Action level	1. Notify IEC and Contractor; 2. Carry out investigation; 3. Report the results of investigation to the IEC and Contractor; 4. Discuss with the Contractor and formulate remedial measures ; 5. Increase monitoring frequency to check the effectiveness of mitigation measures.	1. Review the analysed results submitted by the ET; 2. Review the proposed remedial measures by the Contractor and advise the ER accordingly; 3. Supervise the implementation of remedial measures.	1. Confirm receipt of notification in writing; 2. Notify Contractor; 3. Require Contractor to propose remedial measures for the analysed noise problem; 4. Ensure mitigation measures are properly implemented.	1. Submit noise mitigation proposal to IEC; 2. Implement noise mitigation proposals.
Limit level	1. Notify IEC, ER, EPD & Contractor; 2. Identify source; 3. Repeat measurement to confirm findings; 4. Increase monitoring frequency; 5. Carry out analysis of Contractor's working procedures to determine possible mitigation to be implemented; 6. Inform IEC, ER and EPD the causes and actions taken for the exceedances; 7. Assess the effectiveness of Contractor's remedial actions and keep IEC, EPD and ER informed of the results; 8. If exceedance stops, cease additional monitoring.	1. Discuss amongst ER, ET, and Contractor on the potential remedial actions; 2. Review Contractor's remedial actions whenever necessary to assure their effectiveness and advise the ER accordingly; 3. Supervise the implementation of remedial measures.	1. Confirm receipt of notification in writing; 2. Notify Contractor; 3. Require Contractor to propose remedial measures for the analysed noise problem; 4. Ensure mitigation measures are properly implemented; 5. If exceedances continue, consider what portion of the work is responsible and instruct the Contractor to stop that portion of work until the exceedance is abated.	1. Undertake immediate action to avoid further exceedance; 2. Submit proposals for remedial actions to IEC within 3 working days of notification; 3. Implement the agreed proposals; 4. Resubmit proposals if problem still not under control; 5. Stop the relevant portion of works as determined by ER, until the exceedance is abated.

3.8 Mitigation Measures for Construction Noise Control

3.8.1 The EIA report has recommended construction noise control and mitigation measures. The Contractor should be responsible for the design and implementation of these measures under the supervision of the Engineer and the Environmental Team.

3.8.2 Noise emissions from construction sites during construction phase could be minimised by adopting good site practice, selecting quiet plant, using quiet working methods and installing temporary barriers.

Proposed Construction Phase Mitigation Measures

Use of Quiet Plant

3.8.3 The use of quiet plant was identified to be a feasible solution to tackle the adverse impacts associated with construction works. The Contractor should obtain particular models of plant that are quieter than standard types given in the GW-TM. The benefits achievable in this way would depend on the details of the Contractor's chosen methods of working, and it would be too restrictive to specify that a Contractor has to use specific items of plant for the construction operations. It is therefore both preferable and practical to specify an overall plant noise performance specification to apply to the total SWL of all plants on the site so that the Contractor is allowed some flexibility to select plant items to suit his needs. It should be noted that various types of silenced equipment could be found in Hong Kong. However, the Authority, when processing a CNP application, will apply the noise levels contained in the relevant statutory TMs unless the noise emission of a particular piece of equipment can be validated by a certificate or through a demonstration.

3.8.4 Quiet PME is defined as PME whose actual SWL is less than the value specified in the GW-TM for the same item of plant. Reference can be made to the *British Standard BS5228: Part 1:1997 Control on Construction and Open Sites*.

Using Temporary and Movable Noise Barriers

3.8.5 Movable barriers that can be located close to noisy plant can be very effective at screening NSRs from particular items of plant or noisy operations. Movable barriers of 3 to 5m height with a small cantilevered upper portion and skid footing can be located within a few metres of stationary plant and within about 5m or more of mobile equipment such as an excavator and mobile crane etc., such that the line of slight to the NSR is blocked by the barriers. It would be possible for the Contractor to provide purpose-built noise barriers or screens constructed of appropriate material (minimum superficial density of 7 kg/m^2) located close to operating PME, in order to reduce the noise impact to the surrounding sensitive uses. Certain types of PME, such as generators and compressors, can be completely screened by portable barriers giving a total noise reduction of 10 dB(A) or more.

3.8.6 For this assessment, it was estimated that movable noise barriers can achieve a 10 dB(A) noise reduction for stationary plant and 5 dB(A) for movable plant.

Reducing the Numbers of Plants Operating in Critical Areas Close to NSRs

3.8.7 In general the number of plant should be left to the choice of the Contractor so that in combination with the selection of quiet plant, any further reduction in the total plant noise level, or the site specific maximum sound power levels, as described above, can be achieved. It would be appropriate to restrict the number of operating PME within certain parts of the site that are very close to the NSRs in order to reduce the level of noise impacts. This method could be more effective for activities associated with foundation work, pile construction and excavation activities in which a large number of PME are anticipated, but not all of them would be utilised at the same time.

Good Site Practice

3.8.8 The following good site practice should be adopted during the construction phase:

- The contractor should site noisy equipment and activities as far from sensitive receivers as practical. Also, temporary site offices (and other similar structures) should be located, as far as is possible, such that sensitive receivers are screened by these structures from the line of sight of the construction areas.
- Intermittent noisy activities should be scheduled to minimise exposure of nearby NSRs to high levels of construction noise. For example, noisy activities could be scheduled at times coinciding with periods when the schools are likely to be unoccupied. Prolonged operation of noisy equipment close to the schools should be avoided.
- Idle equipment should be turned off or throttled down. Noisy equipment should be properly maintained and used no more often than is necessary.
- Construction activities should be planned so that parallel operation of several sets of equipment close to a given receiver is avoided.
- Where possible, the numbers of concurrently operating items of plant should be reduced through sensitive programming.
- Construction plant should be properly maintained and operated. Construction equipment often has silencing measures built in or added on, e.g. compressor panels, and mufflers. Silencing measures should be properly maintained and utilised.

Specific Mitigation Measures

3.8.9 The proposed mitigation measures for construction noise are arranged in an increasing level of efforts. Since the actual activities in the construction sites may vary at local site level, the level of mitigation measures adopted should also be determined with reference to the findings of the EM&A programme. The following are mitigation levels:

Mitigation Level 1 Use of quiet plant and working methods.

Mitigation Level 2 Use of quiet plant and working methods and Use of movable and temporary noise barriers.

Mitigation Level 3 Use of manual construction methods in very limited space within Ngong Ping Village like narrow alleys.

Adopt administrative measures to inform and, if necessary, liaise with the village and staff quarter residents on the construction schedule and work locations before the start of any construction work within the village.

3.8.10 The number of PME used on site should be reviewed from time to time to avoid excessive or dummy PME located too close to NSRs. Good site practice should be followed through the construction phase.

3.8.11 For construction activities of Ngong Ping STW, mitigation level 1 with the use of quiet plant is recommended. For construction of effluent export pipeline, village sewerage and the two local pump chambers, mitigation level 2 with the use of quiet plant and use of movable temporary noise barrier is recommended. For construction of village sewerage, mitigation level 3 with the use of manual construction methods are recommended in those narrow alleys which are less than 4 m away from the nearest NSR where it may not be practical to use noise barriers. It is also recommended that the contractor should inform and, if necessary, liaise with the residents in Ngong Ping village and Shek Pik Prison on the construction schedule and work locations before the start of any construction work within the village.

3.9 Operational Phase Mitigation Measures for Noise Control

3.9.1 In order to meet both the daytime/evening and night-time noise limits, mitigation measures as suggested as follows should be applied.

1. Building Envelope/Enclosure

The building envelope holding noisy equipment should be made of suitable materials (e.g. concrete) and design capable of achieving a reduction of 20 dB(A). It should be a complete enclosure with minimal openings for which these openings should not be facing any NSRs in the east or south. The building materials should be of surface density of 25kg/m^2 or higher. If necessary, it should be internally lined with 50mm thick sound absorbing material (e.g. fibre glass). Ventilation should not be overlooked as most equipment, such as motors, requires an adequate air supply either to prevent overheating or to enable them to function efficiently. A silenced ventilation system incorporating silencers at the air intakes and discharge openings should be employed.

2. Layout of Building Structures

It would be beneficial if building structures e.g. plant office capable of screening noisy components could be located in the east side of the site to act as noise screening structures.

3.9.2 The two local pump chambers will be fully enclosed as underground facilities to minimize the noise emissions.

3.9.3 If the above measures are not sufficient to restore the noise quality to acceptable levels upon the advise of ET Leader, the Contractor should liaise with the ET Leader on some other mitigation measures, propose to ER for approval, and implement the mitigation measures.

4. WATER QUALITY

4.1 Introduction

4.1.1 Water quality impacts arising from the carrying out of construction and operational activities would be minimised by implementation of suitable mitigation measures and through good management practices. Contractual documents for the Ngong Ping STW and Sewerage project should incorporate the mitigation measures for water pollution control as recommended in the EIA and the EA Report.

4.1.2 Site audits should be implemented to ensure that the mitigation measures recommended in the EIA report are fully implemented during the construction and operational phases of the Ngong Ping STW and Sewerage project.

4.2 Monitoring Equipment

Dissolved oxygen and temperature measuring equipment

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

- a dissolved oxygen level in the range of 0-20 mg/l and 0-200% saturation; and
- a temperature of 0-45 degree Celsius.

4.2.2 It should have a membrane electrode with automatic temperature compensation complete with a cable. Sufficient stocks of spare electrodes and cables should be available for replacement where necessary. (e.g. YSI model 59 meter, YSI 5739 probe, YSI 5795A submersible stirrer with reel and cable or an approved similar instrument).

4.2.3 Should salinity compensation not be built-in in the DO equipment, in-situ salinity should be measured to calibrate the DO equipment prior to each DO measurement.

Turbidity Measurement Instrument

4.2.4 The instrument should be a portable, weatherproof turbidity-measuring instrument complete with comprehensive operation manual. The equipment should use a DC power source. It should have a photoelectric sensor capable of measuring turbidity between 0-1000 NTU (e.g. Hach model 2100P or an approved similar instrument).

Salinity

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

Water Depth Detector

4.2.6 A portable, battery-operated echo sounder should be used for the determination of water depth at each designated monitoring station. This unit can either be handheld or affixed to the bottom of the work boat, if the same vessel is to be used throughout the monitoring programme.

Water Sampling Equipment

4.2.7 A transparent PVC or glass cylinder, which has a volume of not less than 2 litres and can be sealed at both ends with cups, should be used for collection of water samples at various depths. The water sampler should be equipped with a positive latching system. During water sampling, a messenger is released to trigger the closure of the water sampler at suitable water depth. .

4.2.8 All in-situ monitoring instruments should be checked, calibrated and certified by a laboratory accredited under HOKLAS or any other international accreditation scheme before use, and subsequently re-calibrated at 3 monthly intervals throughout all stages of the water quality monitoring. Responses of sensors and electrodes should be checked with certified standard solutions before each use. Wet bulb calibration for a DO meter should be carried out before measurement at each monitoring location.

4.2.9 For the on site calibration of field equipment, the BS 127:1993, *Guide to Field and On-Site Test Methods for the Analysis of Water* should be observed.

4.2.10 Sufficient stocks of spare parts should be maintained for replacements when necessary. Backup monitoring equipment shall also be made available so that monitoring can proceed uninterrupted even when some equipment is under maintenance, calibration, etc.

4.3 Laboratory Measurement / Analysis

4.3.1 Water samples should be analysed in a HOKLAS or other international accredited laboratory for SS, TIN, NH_3-N, BOD and *E. coli*. Water samples of about 2 litres should be collected at the monitoring stations for carrying out the laboratory analysis. The analysis should commence within 24 hours after collection of the water samples.

4.3.2 Detailed testing methods, pre-treatment procedures, instrument use, Quality Assurance/Quality Control (QA/QC) details (such as blank, spike recovery, number of duplicate samples per batch, etc.), detection limits and accuracy should be submitted to DEP for approval prior to the commencement of monitoring programme. The QA/QC results should be reported. EPD may also request the laboratory to carry out analysis of known standards provided by EPD for quality assurance. Additional duplicate samples may be required by EPD for inter laboratory calibration. Remaining samples after analysis should be kept by the laboratory for 3 months in case repeat analysis is required. If in-house or non-standard methods are proposed, details of the method verification may also be required to submit to DEP. In any circumstance, the sample testing should have comprehensive quality assurance and quality control programmes. The laboratory should prepare to demonstrate the programmes to DEP or his representatives when requested.

4.4 Operational Phase Mitigation Measures and Effluent Sampling

Mitigation Measures Associated with Emergency Situations

4.4.1 In view of the sensitivity of the area, several special precautionary measures will be adopted:

- Ductile iron pipe will be used for all the Ngong Ping village sewers and effluent pipeline for its robustness, because the area is within the water gathering ground. Sealed pipe joints with hatchboxes along the pipeline will also be adopted;

- The maximum distance between manholes would be limited to 60 m to facilitate over-pumping operations during sewer inspection or maintenance. This would also facilitate flow diversion in case of emergency situation during pipe leakage;
- Standby units, emergency power generation and emergency storage facilities will be provided at Ngong Ping STW to avoid the need for emergency discharges. It is proposed to construct an emergency storage tank to temporary store both the raw sewage from Ngong Ping sewerage catchment and the effluent of STW to cater for the STW breakdown and bursting of effluent pipe. Furthermore, it is also proposed that the size of the emergency storage tank will be large enough to store 72hr. Sewage/effluent flow (48 hours peak day and 24 hours average day i.e. 2 x 2956 + 1524 = 7436m^3) in ultimate stage. Thus, the volume of the emergency storage tank is about 7600m^3 and the size is about 50m(L) x 40m(W) x 3.8m (D).
- The effluent will be treated to standards listed in Table 1.2 of the EIA Report such that the impact to local water quality in the unlikely event of pipe leakage will be small. As a result of the high quality effluent and steep gradient, there would be minimal chance of effluent pipeline blockage.
- Installation of 150mm diameter borehole with 100mm diameter slotted iron sleeve for water pollution monitoring, around the STW site at suitable location.
- The drainage of any high contamination risk areas such as the DG store will be physically separated from the drainage system of the STW site.
- 150mm diameter bore holes will also be installed along the section of export pipeline carrying a high risk of contamination of the water gathering ground.

4.4.2 Careful monitoring of the export pipeline should be carried out to protect the highly sensitive environment at Ngong Ping. Routine flow monitoring will be carried out at both the upstream end (STW) and downstream of the water gathering ground and country park to ensure early detection of any major leakage. Flowmeter will be installed in the flowmeter chamber inside STP, i.e. the upstream of the effluent export pipeline, and at Tung Wan, i.e. the downstream of the effluent export pipeline, respectively. Any major leakage along the effluent export pipeline can be detected by the difference in the flow measured at the flowmeters installed at upstream and downstream. An emergency plan listing the procedures to be followed in the event that pipe leakage is suspected or identified is given in **Table 4.2**. Temporary diversion of effluent to the emergency storage tank at the STW could be arranged to provide no-flow condition for the repair of the effluent pipeline.

4.4.3 The above measures proposed to mitigate the water quality impacts should be embodied into the detailed design drawings, specifications and contract documents. Designs should be checked to ensure that the measures have been fully incorporated.

Table 4.2 Emergency Plan for Pipe Leakage

1. If possible leakage is detected from routine flow monitoring, carry out investigation to determine the reason of such detection and identify the location of any leakage.
2. If pipe leakage is confirmed, inform EPD and WSD;
3. Determine possible remedial measures such as temporary flow diversion and pipe repairing work;
4. Ensure remedial actions are properly implemented;
5. Assess effectiveness of the remedial actions and keep EPD and WSD informed of the results;
6. If leakage continues, consider what portion of the work is responsible and reassess the remedial actions;
7. Arrange meeting with EPD and WSD to discuss the required remedial actions if necessary and ensure all necessary remedial actions are properly implemented until the leakage is abated.

Effluent Quality Monitoring at Ngong Ping STW

4.4.4 The predicted water quality results are based on the minimum effluent discharge standards as presented in **Table 1.2** of the EIA report. To ensure the effectiveness of the proposed treatment process, monitoring of effluent quality in terms of pH, BOD, SS, TIN, NH_3-N, and *E. coli* is recommended.

4.4.5 It is proposed to monitor the effluent at the outlet chamber of the disinfection unit. The samples should be taken from 1m below the surface to ensure that the surface scum is not included in the sample. Monitoring equipment and laboratory analysis of effluent samples should follow the requirements given in Sections 4.2 and 4.3 of this Manual. A valid discharge licence should be obtained from EPD prior to the discharge of effluent from the project. The monitoring frequency and parameters specified in the discharge licence should be fully considered during the monitoring. The ET should seek approval from the DEP on all the monitoring requirements.

4.4.6 A valid discharge licence should be obtained from EPD prior to the discharge of effluent from the project. The effluent results reflect whether the effluent quality is in compliance with the discharge licence requirements. In case of non-compliance, suitable actions should be undertaken to notify the plant operator for the non-compliance and identify the sources of exceedance. The operating conditions of the treatment systems should be investigated. Corrective and remedial actions should be implemented to improve the effluent quality. The monitoring team should also increase monitoring frequency until the effluent quality is in compliance with the discharge licence requirements.

4.4.7 The non-compliance and propose preventive measures should be documented.

4.5 Construction Phase Mitigation Measures for Water Quality Control

4.5.1 Measures to reduce water quality impacts due to:

- construction site runoff;
- sewage from workforce;
- accidental spillage of chemicals and;
- wastewater from various construction activities, including groundwater collected from excavations;
- Prevention of contamination of the water gathering ground.

Construction Site Runoff and Wastewater from Construction Activities

4.5.2 To minimise the potential water quality impacts from construction site runoff and various construction activities, the practices outlined in *ProPECC PN 1/94 Construction Site Drainage* should be adopted. It is recommended to install perimeter channels in the works areas to intercept runoff at site boundary prior to the commencement of any earthwork. To prevent storm runoff from washing across exposed soil surfaces, intercepting channels should be provided. Drainage channels are also required to convey site runoff to sand/silt traps and oil interceptors. Provision of regular cleaning and maintenance can ensure the normal operation of these facilities throughout the construction period. The recommendation to install perimeter drains to collect site runoff and to properly treat the runoff by settlement tank/treatment system shall apply to all sites including those for mainlaying works.

4.5.3 A discharge licence needs to be applied from DEP for discharging effluent from the construction site. The discharge quality is required to meet the requirements specified in the discharge licence. As project location is an environmentally sensitive area, all the runoff and

wastewater generated from the works areas within the water gathering ground should be treated so that it satisfies with all the standards listed in the Technical Memorandum for Group A inland waters. In addition, substances listed in Clause 8.4 of the Technical Memorandum shall not be discharged into the water gathering ground. A wastewater treatment system should be provided for removal of suspended solids and to adjust pH prior to final discharge. Suitable coagulants and neutralising chemicals should be used to enhance the efficiency of the treatment system. Reuse and recycling of the treated effluent can minimise water consumption and reduce the effluent discharge volume. The beneficial uses of the treated effluent may include dust suppression, wheel washing and general cleaning. It is anticipated that the wastewater generated from the works areas would be in small quantity. Monitoring of the quality of treated effluent discharged from the works areas should be carried out as part of the EM&A programme. The monitoring frequency and parameters specified in the discharge licence should be fully considered during the monitoring. Compliance audits as discussed in Section 4.10.5 should also be performed. It is recommended that random samples should also be collected by EPD/DSD to verify the results obtained by the ET. The ET should submit detailed effluent sampling programme for water quality control during construction phase to EPD and WSD for approval prior to commencement of the construction works.

4.5.4 The construction programme should be properly planned to minimise soil excavation, if any, in rainy seasons. This prevents soil erosion from exposed soil surfaces. Any exposed soil surfaces should also be properly protected to minimise dust emission. Hydroseeding could be applied to protect exposed slope surfaces, if any. No earth, building materials, soil and other materials should be allowed to be stockpiled on site within the water gathering ground. All surplus spoil should be removed from the water gathering ground as soon as practicable. All mud and debris should be removed from any waterworks access roads and associated drainage systems within the water gathering ground. In areas outside the water gathering ground where a large amount of exposed soils exist, earth bunds or sand bags should be provided. Exposed stockpiles should be covered with tarpaulin or impervious sheets at all time. The stockpiles of materials should be placed in the locations away from any stream courses so as to avoid releasing materials into the water bodies. Final surfaces of earthworks should be compacted and protected by permanent work. It is suggested that haul roads should be paved with concrete and the temporary access roads are protected using crushed stone or gravel, wherever practicable. Wheel washing facilities should be provided at all site exits to ensure that earth, mud and debris would not be carried out of the works areas by vehicles

4.5.5 Good site practices should be adopted to clean the rubbish and litter on the construction sites so as to prevent the rubbish and litter from dropping into the nearby environment. It is recommended to clean the construction sites on a regular basis.

Sewage from Workforce

4.5.6 To avoid introducing additional pollution loads into the nearby waters, it is recommended to provide chemical toilets in the works areas. Provision of temporary toilet facilities within the water gathering ground is subject to the approval of the Director of Water Supplies. All waste should be cleared away daily and disposed outside the water gathering ground. The toilet facilities should not be less than 30 m from any watercourse.

4.5.7 All canteens/kitchens should be located outside the water gathering ground. Wastewater generated from kitchens, if any, should be collected in a temporary storage tank. A licensed waste collector should be deployed to clean the chemical toilets and temporary storage tank on a regular basis. The collected sewage and wastewater could then be transported to the sewage treatment plants for disposal.

4.5.8 Storage of oils/chemicals/waste within the water gathering ground should be limited to absolute minimum volume and are to be removed from sites at the earliest opportunity. No storage and discharge of flammable or toxic solvents, petroleum oil or tar and other toxic substances should be allowed within the water gathering ground. Any construction plant which causes pollution to catchwater or water gathering ground due to leakage of oil or fuel should be removed off site immediately. Any soil contaminated with fuel leaked from the plant should be removed off site and the voids arising from removal of contaminated soil should be replaced by suitable material to the approval of the Director of Water Supplies. Any chemicals to be used including disinfectants and deodorants within the water gathering ground should be subject to the approval of the Director of Water Supplies.

4.5.9 Notices should be posted at conspicuous locations to remind the workers not to discharge any sewage or wastewater into the nearby environment during the construction phase of the project. Implementation of environmental audit on the construction site can provide an effective control of any malpractices and can achieve continual improvement of environmental performance on site. It is anticipated that sewage generation during the construction phase of the project would not cause water pollution problem after undertaking all required measures. Construction programme should be properly planned to minimise soil excavation, if any, in rainy seasons, so as to prevent soil erosion from exposed soil surfaces.

Accidental Spillage of Chemicals

4.5.10 It is required to register as a chemical waste producer if chemical wastes would be produced from the construction activities. The Waste Disposal Ordinance (Cap 354) and its subsidiary regulations in particular the Waste Disposal (Chemical Waste) (General) Regulation should be observed and complied with for control of chemical wastes.

4.5.11 Any service shop and minor maintenance facilities should be located outside the water gathering ground and should be on hard standings within a bunded area, and sumps and oil interceptors should be provided. Maintenance of vehicles and equipment involving activities with potential for leakage and spillage should only be undertaken with the areas appropriately equipped to control these discharges. Any soil contaminated with chemicals/oils shall be removed from site and the void created shall be filled with suitable materials. Washing the chemicals away is not acceptable as they will contaminate the water gathering ground.

4.5.12 Disposal of chemical wastes should be carried out in compliance with the Waste Disposal Ordinance. The *Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes* published under the Waste Disposal Ordinance details the requirements to deal with chemical wastes. General requirements are given as follows:

- Suitable containers should be used to hold the chemical wastes to avoid leakage or spillage during storage, handling and transport.
- Chemical waste containers should be suitably labelled to notify and warn the personnel who are handling the wastes to avoid accidents.
- Storage area should be selected at a safe location on site and adequate space should be allocated to the storage area.

4.5.13 Detailed emergency plans and clean up procedures should be developed and approved before the commencement of the construction work to deal with accidental spillage of chemicals. Leakage and spillage of chemicals should be contained and cleaned up immediately so as to minimise the impact to the water quality. The emergency plans should include the procedures for:

- Spill prevention and precaution;
- Response actions; and
- Spill clean up and disposal

4.5.14 Spill prevention and precaution cover the following areas:

- Good housekeeping practices;
- Chemical storage precaution; and
- Chemical transfer and transport precaution

4.5.15 Detailed response actions should be clearly stated in the emergency plans and training on implementation of the response actions should be provided to the staff. A detailed emergency call-out procedure should be formulated and a number of departments such as EPD, FSD, WSD, TD and Police may need to be informed in case of accidental spillage of chemicals within the water gathering ground. The emergency plan and clean up procedures are given in **Table 4.3** as below. The emergency plans should also include a list of contact persons/parties and their phone numbers in the event of an accident. Detailed emergency plans and clean up procedures should be approved by DSD/WSD before the commencement of the construction work.

Table 4.3 Emergency Plan for Accidental Spillage of Chemicals

1. Spill Prevention and Precaution

GENERAL PRECAUTION

- ❑ Any service shop and minor maintenance facilities should be located outside the water gathering ground and should be on hard standings within a bunded area, and sumps and oil interceptors should be provided.
- ❑ Maintenance of vehicles and equipment involving activities with potential for leakage and spillage should only be undertaken with the areas appropriately equipped to control these discharges.
- ❑ Any soil contaminated with chemicals/oils shall be removed from site and the void created shall be filled with suitable materials. Washing the chemicals away is not acceptable as they will contaminate the water gathering ground.
- ❑ Storage of oils/chemicals/waste within the water gathering ground should be limited to absolute minimum volume and are to be removed from sites at the earliest opportunity. No storage and discharge of flammable or toxic solvents, petroleum oil or tar and other toxic substances should be allowed within the water gathering ground.
- ❑ Any construction plant which causes pollution to catchwater or water gathering ground due to leakage of oil or fuel should be removed off site immediately.
- ❑ Any chemicals to be used including disinfectants and deodorants within the water gathering ground should be subject to the approval of the Director of Water Supplies.
- ❑ Suitable containers should be used to hold the chemical wastes to avoid leakage or spillage during storage, handling and transport.
- ❑ Chemical waste containers should be suitably labelled to notify and warn the personnel who are handling the wastes to avoid accidents.
- ❑ Storage area should be selected at a safe location on site and adequate space should be allocated to the storage area.
- ❑ Avoid disorder and storage of unnecessary materials in working areas.
- ❑ Prevent obstructions and tripping hazards.
- ❑ Lock all dangerous goods and chemical stores.

STORAGE PRECAUTIONS

- ❑ Use solid and impermeable enclosure walls or storage shelves.
- ❑ Reduce the danger of falling of stacked containers.
- ❑ Provide tightly closed lips to avoid leakage of chemical wastes to further reduce the danger of container falling.

- ❑ Store compatible chemical wastes in the same storage area.
- ❑ Inspect the storage area to detect if any leaking or defective containers on a regular basis.
- ❑ Check the conditions of the storage containers regularly.
- ❑ Identify and provide suitable notices in storage area.
- ❑ Store large and heavy containers on the floor as far as possible or avoid storage of these containers higher than 2 feet from the floor.
- ❑ Keep chemical waste containers below eye level.
- ❑ Provide adequate space for handling of the containers.
- ❑ Maintain a log of chemical wastes.
- ❑ Separate incompatible chemicals from each other.

TRANSFER AND TRANSPORT PRECAUTIONS

- ❑ Consider the size of the container to avoid overfilling.
- ❑ Use pumps to transfer chemical wastes instead of simple pouring.
- ❑ Provide containment structure to hold the chemical wastes when leakage or spillage of chemical waste occurs.
- ❑ Use suitable carriers to transfer the chemical waste containers from one location to another.
- ❑ Employ licensed waste collectors to be responsible for chemical waste transport.

2. Responses Action

Workers should be aware of emergency telephone numbers and locations of spill kits. The response actions to an accident would include the following steps:

- ❑ Keep untrained personnel away from the spillage area or evacuate all personnel and call the emergency service if the spills are highly toxic and volatile.
- ❑ Allow only trained persons who have equipped with protective clothing and equipment to enter the spillage area for clean up.
- ❑ Transfer the spills back into containers using suitable equipment wherever practicable.
- ❑ Use suitable absorbing materials to clean up the spills and dispose the absorbing materials as chemical wastes.
- ❑ Use suitable solvent to clean the spillage area after removing the spills.
- ❑ Inform Environmental Protection Department, Fire Services Department and Police in the case where the spillage of chemicals would cause serious contamination of an area or risk of pollution. Inform Water Services Department in the case where the spillage of chemicals would cause contamination of the water gathering ground.
- ❑ Prepare necessary protective devices, safety equipment, containers and clean up materials for emergency use.
- ❑ Train staff to handle the spillage of chemicals.
- ❑ Evaluate the potential hazard of the chemical wastes.

3. Spill Clean Up and Disposal

- ❑ Control the leakage of the chemical wastes and absorb the spills using suitable absorbing materials
- ❑ Use acidic or alkaline solution for neutralisation wherever appropriate
- ❑ Take special precautions for flammable wastes and wastes in powder form
- ❑ Keep and label the clean up wastes
- ❑ Clean the spillage area and equipment used in the response actions
- ❑ Dispose the clean up wastes as chemical wastes
- ❑ Safety equipment and personal protective equipment for handling of chemical wastes would be similar to that for handling of chemicals.

The equipment includes:

- ❑ Fire extinguishers
- ❑ Brush, dustpan, mop and bucket
- ❑ Dry sand tissue and toweling
- ❑ Containers including plaster bags, drums, etc
- ❑ Absorbing materials
- ❑ Pumps

- ❑ Sampling devices

Personal protective equipment:

- ❑ Safety helmet and goggles
- ❑ Gloves which can resist chemical reaction
- ❑ Protective boot and clothing
- ❑ Respirators and gas masks
- ❑ First-aid kits
- ❑ Face visor

Groundwater Monitoring

4.5.16 To have an early detection of groundwater contamination during operation of the sewage treatment plant, it is proposed to monitor the groundwater quality on monthly basis. Water samples will be taken from the installed borehores inside the Ngong Ping Sewage Treatment Plant and the Effluent Export Pipeline (Location of boreholes shown on Drawing No.: 23400/T/140-143). The frequency of monitoring will be reviewed after a period of time and may be increased or decreased if necessary.

4.5.17 The following parameters of groundwater quality will be analysed:

- Biochemical Oxygen Demand (BOD_5)
- Ammonia nitrogen (NH_3^+-N)
- Nitrate + Nitrite Nitrogen
- E-coli
- PH
- Turbidity
- Total phosphates
- Oil & Grease
- Synthetic Detergents

4.5.18 DSD will take up the groundwater quality monitoring work for both the Ngong Ping Sewage Treatment Plant and the Effluent Export Pipeline. All results should be made available to WSD and EPD upon completion of analysis.

Prevention of Contamination of the water gathering ground

4.5.19 For prevention of contamination of the water gathering ground, mitigation measures shall be implemented during the construction phase

4.5.20 The mitigation measures to prevent the contamination of the water gathering ground are as below:

- The provision of leakage containment system for the section of pipeline in the close proximity of the reservoir;
- No earth, building materials, soil and other materials should be allowed to be stockpiled on site within the water gathering ground.
- All surplus spoil should be removed from the water gathering ground as soon as practicable.
- All mud and debris should be removed from any waterworks access roads and associated drainage systems within the water gathering ground.

- In areas outside the water gathering ground where a large amount of exposed soils exist, earth bunds or sand bags should be provided.
- Exposed stockpiles should be covered with tarpaulin or impervious sheets at all time. The stockpiles of materials should be placed in the locations away from any stream courses so as to avoid releasing materials into the water bodies.
- Final surfaces of earthworks should be compacted and protected by permanent work. Haul roads should be paved with concrete and the temporary access roads are protected using crushed stone or gravel, wherever practicable.
- Wheel washing facilities should be provided at all site exits to ensure that earth, mud and debris would not be carried out of the works areas by vehicles.
- To avoid introducing additional pollution loads into the nearby waters, it is recommended to provide chemical toilets in the works areas. Provision of temporary toilet facilities within the water gathering ground is subject to the approval of the Director of Water Supplies. All waste should be cleared away daily and disposed outside the water gathering ground. The toilet facilities should not be less than 30 m from any watercourse.
- All canteens/kitchens should be located outside the water gathering ground. Wastewater generated from kitchens, if any, should be collected in a temporary storage tank. A licensed waste collector should be deployed to clean the chemical toilets and temporary storage tank on a regular basis. The collected sewage and wastewater could then be transported to the sewage treatment plants for disposal.
- Notices should be posted at conspicuous locations to remind the workers not to discharge any sewage or wastewater into the nearby environment during the construction phase of the project.
- Any service shop and minor maintenance facilities should be located outside the water gathering ground and should be on hard standings within a bunded area, and sumps and oil interceptors should be provided. Maintenance of vehicles and equipment involving activities with potential for leakage and spillage should only be undertaken with the areas appropriately equipped to control these discharges. Any soil contaminated with chemicals/oils shall be removed from site and the void created shall be filled with suitable materials. Washing the chemicals away is not acceptable as they will contaminate the water gathering ground.
- Storage of oils/chemicals/waste within the water gathering ground should be limited to absolute minimum volume and are to be removed from sites at the earliest opportunity. No storage and discharge of flammable or toxic solvents, petroleum oil or tar and other toxic substances should be allowed within the water gathering ground. Any construction plant which causes pollution to catchwater or water gathering ground due to leakage of oil or fuel should be removed off site immediately. Any soil contaminated with fuel leaked from the plant should be removed off site and the voids arising from removal of contaminated soil should be replaced by suitable material to the approval of the Director of Water Supplies. Any chemicals to be used including disinfectants and deodorants within the water gathering ground should be subject to the approval of the Director of Water Supplies.
- It is required to register as a chemical waste producer if chemical wastes would be produced from the construction activities. The Waste Disposal Ordinance (Cap 354) and its subsidiary regulations in particular the Waste Disposal (Chemical Waste) (General) Regulation should be observed and complied with for control of chemical wastes.
- Disposal of chemical wastes should be carried out in compliance with the Waste Disposal Ordinance. The *Code of Practice on the Packaging, Labelling and Storage of Chemical*

Wastes published under the Waste Disposal Ordinance details the requirements to deal with chemical wastes. General requirements are given as follows:

- Suitable containers should be used to hold the chemical wastes to avoid leakage or spillage during storage, handling and transport. Chemical waste containers should be suitably labelled to notify and warn the personnel who are handling the wastes to avoid accidents.
- Storage area should be selected at a safe location on site and adequate space should be allocated to the storage area.

- A detailed emergency plan and clean up procedures should be developed and approved by EPD/WSD before commencement of construction work to deal with accidental spillage of chemicals.

4.6 Construction Site Audits

4.6.1 Implementation of regular site audits is to ensure that the recommended mitigation measures are to be properly undertaken during construction phase of the project. It can also provide an effective control of any malpractices and therefore achieve continual improvement of environmental performance on site.

4.6.2 The ET is responsible for carrying out the regular site audits. Site audits would include site inspections, compliance and conformance audits and environmental complaints.

Site Inspections

4.6.3 A programme for site inspections should be established defining the frequency, procedures and actions to be undertaken during the carrying out of site inspections. Site inspections should be based on the mitigation measures for water pollution control recommended in the EIA report. In the event that the recommended mitigation measures are not fully or properly implemented, deficiency should be recorded and reported to the site management. Suitable actions are to be carried out to:

- Investigate the problems and the causes;
- Issue action notes to the Contractor which is responsible for the works;
- Implement remedial and corrective actions immediately;
- Re-inspect the site conditions upon completion of the remedial and corrective actions; and
- Record the event and discuss with the Contractor for preventive actions.

4.6.4 The ET should liaise closely with the Contractor to obtain information on the adopted working methods. Submission of method statements for the construction activities by the Contractor could help the ET to accurately address the potential water quality impacts that may arise. Alternative working methods could be suggested to the Contractor in order to avoid adverse water quality impacts.

Compliance and Conformance Audits

4.6.5 Monitoring of effluent quality is required during the construction phase of the project. The monitoring should be carried out at the pre-determined discharge point. Compliance audits are to be undertaken to ensure that a valid discharge licence has been issued by EPD prior to the discharge of effluent from the project site. In addition, the monitoring frequency and parameters specified in the discharge licence should be fully considered during the monitoring. The audit results reflect whether the effluent quality is in compliance with the

discharge licence requirements. In case of non-compliance, suitable actions should be undertaken to:

- Notify the site management for the non-compliance;
- Identify the sources of pollution;
- Check the implementation status of the recommended mitigation measures;
- Investigate the operating conditions of the on-site treatment systems;
- Implement corrective and remedial actions to improve the effluent quality;
- Increase monitoring frequency until the effluent quality is in compliance with the discharge licence requirements; and
- Record the non-compliance and propose preventive measures.

4.6.6 Conformance audits are to ensure that the works carried out by the Contractor meet the statutory regulations and water pollution control requirements specified in the contractual documents. The Contractor should be responsible for design and implementation of the recommended mitigation measures. The ET should:

- Check the contractual documents which define the roles of the Contractor in water pollution control;
- Recommend necessary improvement works to the mitigation measures designed and undertaken by the Contractor;
- Evaluate the effectiveness of mitigation measures performed by the Contractor;
- Carry out ad hoc inspections of the Contractor's performance on water pollution control;
- Report to the site management for any non-conformance works; and
- Initiate actions to remedy any non-conformance works.

4.6.7 Good housekeeping on site is essential to the protection of water pollution. It is recommended to conduct audits to ensure that all the recommended elements are fully incorporated in the management system. It is recommended that pre-set checklists could be used to check the overall performance.

Environmental Complaints

4.6.8 A complaint hotline may be provided to the public for reporting of any unsatisfactory environmental conditions that could be created by the project. Procedures for complaint investigation should be developed in advance of commencement of the construction works. When a complaint on water pollution is received, the ET should:

- Record the date and time of receipt, and name and contact telephone number of the complainant;
- Report the complaint to the site management and initiate the investigation according to the information provided by the complainant;
- Discuss with the Contractor to verify the complaint and to identify the possible sources of pollution;
- Check the effectiveness and adequacy of relevant mitigation measures if the complaint is valid;

- Implement necessary corrective and remedial actions;
- Monitor the situation and take necessary follow-up action; and
- Inform the complainant the investigation results and actions taken for remedial works.

Continual Improvement

4.6.9 Implementation of mitigation measures safeguards the aquatic environments in the vicinity of the project site and is one of the important components for improvement of water pollution control. This component needs to be integrated with other components to form an integral system for achieving water pollution control. These include:

- commitment to control water pollution;
- good planning;
- staff training;
- checking and corrective actions; and
- management review.

4.6.10 The integral system should be implemented in a systematic manner. Continual improvement of water pollution control would be achieved through the implementation of the integral system.

5. LANDSCAPE AND VISUAL

5.1.1 The EIA has recommended that environmental monitoring of landscape and visual resources be undertaken during the design, construction and operational phases of the project. The design, implementation and maintenance of landscape mitigation measures is a key aspect of this and should be checked to ensure that they are fully realised and that potential conflicts between the proposed landscape measures and any other project works and operational requirements are resolved at the earliest possible date and without compromise to the intention of the mitigation measures. In addition, implementation of the mitigation measures recommended by the EIA will be monitored through the site audit programme.

Mitigation Measures

5.1.2 Landscape and Visual Assessment of the EIA recommends a series of mitigation measures to ameliorate the landscape and visual impacts of the project. There will be no off-site mitigation measures during the construction stage for the Ngong Ping STW site. These measures include the following:

- minimising the extent of the works;
- protection and retention of existing woodland trees;
- sensitive design of site hoarding;
- advance planting and visual screening;
- grassing and woodland planting of soil slopes and disturbed areas; and
- sensitive design of the superstructures, the selection of building material shall be considered earlier at the design stage.

5.1.3 The measures for both the construction and operation stage as recommended in the EIA are summarised in **Tables 5.1** and **5.2** below:

Table 5.1 Proposed Construction Stage Mitigation Measures

No.	Mitigation Measure
CM 1	Retention and protection of existing woodland trees to include minimisation the extent excavation for temporary and permanent works and necessary physical measures to prevent access into areas outside the limit of works. Regular checks should be carried out to ensure that the work site boundaries are not exceeded, hoarding is properly maintained and that no damage is being caused to the these areas.
CM 2	Decorative hoarding along publicly assessable boundaries of the site
CM 3	Topsoil stripped and stored for re-use in the construction of the soft landscape works
CM 4	Grass Hydroseeding of slopes as soon as they are complete
CM 5	Control of night-time lighting

Table 5.2 Proposed Operation Stage Mitigation Measures

ID No.	Mitigation Measure
OM 1	Grass hydroseeding and planting of native shrub and trees to provide green backdrop to the development, and to blend the slope into the surrounding natural slopes, and to compensate for grass and shrubs and trees lost during construction
OM 2	Grass hydroseeding (with groundcover) on top of the underground structures within STW site
OM 3	Grass hydroseeding and tree and shrub planting to screen elevated structures along the souutheastern boundary of STW site, to provide visual interest, and to provide shade and shelter.
OM 4	Sensitive architectural and chromatic treatment of the elevated structures
OM 5	Night Lighting should be designed to minimise glare to all receivers

Design Phase Audit

5.1.4 The landscape measures proposed to mitigate the landscape and visual impacts of the scheme should be embodied into the detailed landscape design drawings, specifications and contract documents. Designs should be checked to ensure that the measures have been fully incorporated and that potential conflicts with civil engineering, geo-technical, structural, underground utility and operational requirements have been resolved prior to construction.

5.1.5 Monitoring of design works against the recommendations of the landscape and visual impact assessments within the EIA should be undertaken as and when the designs are produced to ensure that they fulfil the intentions of the mitigation measures.

5.1.6 The landscape auditor shall review the designs as and when they are prepared and liaise with the landscape architect and design engineer to ensure all measures have been incorporated in the design in a format that can be specified to the Contractor for implementation. In the event of non-conformity, the Event/Action plan as detailed in Table 5.3 below should be followed.

Table 5.3 Event / Action Plan for Design Phase

Action Level	Landscape Auditor	Project Engineer (PE)
Non Conformity (with Design Standards and Specification)	• Identify Source • Inform PE • Discuss remedial actions with PE • Verify remedial actions when complete.	• Discuss remedial actions with Landscape Auditor • Ensure remedial designs are fully incorporated

Baseline Monitoring

5.1.7 Baseline monitoring for the landscape and visual resources will comprise a vegetation survey of the entire selected route undertaken on an 'area' basis. Representative vegetation types will be identified along with typical species composition. An assessment of landscape character will be made against which future change can be monitored. The landscape resources and elements of particular concern are to be noted.

Construction and Operational Phase Audit

5.1.8 A specialist Landscape Sub-Contractor should be employed by the Contractor for the implementation of landscape construction works and subsequent maintenance operations during the 12-month establishment period. The planting will be conducted during the construction contract with the establishment works being undertaken within the first operational year of the project.

5.1.9 All measures undertaken by both the Contractor and the specialist Landscape Sub-Contractor during the construction phase and first year of the operational phase shall be audited by the ER on a regular basis to ensure compliance with the intended aims of the measures. Site inspections should be undertaken at least once every two weeks throughout the construction period and once every two months during the operational phase. The broad scope of the audit is detailed below but should also be undertaken with reference to the more specific checklist provided in **Table 5.4**.

- the extent of the agreed works areas should be regularly checked during the construction phase. Any trespass by the Contractor outside the limit of the works, including any damage to existing trees and woodland shall be noted;
- the progress of the engineering works should be regularly reviewed on site to identify the earliest practical opportunities for the landscape works to be undertaken;
- all existing trees and vegetation within the study area which are not directly affected by the works are retained and protected;
- the methods of protecting existing vegetation proposed by the Contractor are acceptable and enforced;
- all landscaping works are carried out in accordance with the specifications;
- the planting of new trees, shrubs, groundcover, climbers, ferns, grasses and other plans, together with the replanting of any transplanted trees are carried out properly and within the right season;
- all necessary horticultural operations and replacement planting are undertaken throughout the Establishment Period to ensure the healthy establishment and growth of both transplanted trees and all newly established plants.

Table 5.4 Construction/Operational Phase Audit Checklist

Area of Works	Items to be Monitored
Transplanting of trees	identification and demarcation of trees / vegetation to be transplanted, monitoring of extent of pruning / lifting works to minimise damage, timing of operations, implementation of all stages of preparatory and translocation works, and maintenance of transplanted vegetation, etc.
Clearance of existing vegetation	identification and demarcation of trees / vegetation to be cleared, checking of extent of works to minimise damage, monitoring of adjacent areas against possible incursion, physical damage, fire, pollution, surface erosion, etc.
Decorative treatment of site hoarding	implementation and maintenance, to ensure compliance with agreed designs.
Protection of all trees and woodland blocks to be retained	identification and demarcation of trees / vegetation to be retained, erection of physical protection (e.g. fencing), monitoring against possible incursion, physical damage, fire, pollution, surface erosion, etc.

Area of Works	Items to be Monitored
Advance planting	monitoring of implementation and maintenance of planting, and against possible incursion, physical damage, fire, pollution, surface erosion, etc.
Plant supply	monitoring of operations relating to the supply of specialist plant material (including the collecting, germination and growth of plants from seed) to ensure that plants will be available in time to be used within the construction works.
Soiling, planting, etc.	monitoring of implementation and maintenance of soiling and planting works and against possible incursion, physical damage, fire, pollution, surface erosion, etc.
Architectural treatment of building structures and other engineering works.	implementation and maintenance of mitigation measures, to ensure compliance with agreed designs.
Establishment Works	monitoring of implementation of maintenance operations during Establishment Period

5.1.10 In the event of non-compliance the responsibilities of the relevant parties is detailed in the Event /Action plan provided on Table 5.5.

Table 5.5 Event / Action Plan for Construction/Operational Phase

Action Level	ER	Contractor
Non-conformity on one occasion	1. Identify Source 2. Notify Contractor 3. Discuss remedial actions with the Contractor 4. Ensure remedial measures are properly implemented	1. Amend working methods 2. Rectify damage and undertake any necessary replacement
Repeated Non-conformity	1. Identify Source 2. Notify the Contractor 3. Increase monitoring frequency 4. Discuss remedial actions with the Contractor 5. Ensure remedial measures are properly implemented 6. If exceedance stops, cease additional monitoring	1. Amend working methods 2. Rectify damage and undertake any necessary replacement

6. WASTE MANAGEMENT

6.1.1 Implementation of the mitigation measures recommended by the EIA (as attached in **Appendix A** of this Manual) should be monitored through the site audit programme as described in Section 9 of this Manual.

6.1.2 A Waste Management Plan (WMP) should be developed to describe in details the followings:

- The arrangements for avoidance, reuse, recovery and recycling, collection, treatment and disposal of different categories of waste to be generated from the construction activities;
- The recommended mitigation measures on waste management under the description of WMP;
- The disposal location(s) of all surplus excavated spoil and other waste; and
- The trip-ticket system.etc.

All measures recommended in the WMP should be fully and properly implemented. Types and quantities of all wastes, spoil, excavated materials, etc., arising from the Project during construction and their management and disposal arrangements including the disposal locations should be reported in the monthly report.

7. ECOLOGY

7.1.1 Implementation of the mitigation measures recommended by the EIA (as attached in **Appendix A** of this Manual) should be monitored through the site audit programme as described in Section 9 of this Manual.

8. CULTURAL HERITAGE

8.1.1 Implementation of the mitigation measures recommended by the EIA (as attached in Appendix A of this Manual) should be monitored through the site audit programme as described in Section 9 of this Manual.

9. SITE ENVIRONMENTAL AUDIT

9.1 Site Surveillance

9.1.1 Site surveillance provides a direct means to assess the project's environmental protection and pollution control measures are in compliance with the contract specifications. It should be undertaken regularly and routinely by the ET to inspect the construction activities of the Ngong Ping STW and Sewerage project in order to ensure that appropriate environmental protection and pollution control mitigation measures are properly implemented in accordance with EIA recommendations. With well-defined pollution control and impact mitigation specifications and a well-established efficient and remedial action reporting system, site inspection is an effective "tool" to ensure acceptable environmental performance on the site.

9.1.2 The ET Leader is responsible for formulation of the environmental site inspection, deficiency and remedial action reporting system, and for carrying out the site inspection works. He/she should in consultation with the IEC, prepare a procedure for the site inspection, deficiency and remedial action reporting requirements; and submit to the Contractor for agreement and to the ER for approval, within 21 days of the commencement of the contract.

9.1.3 Regular site inspections should be carried out at least once per week for all work areas during both construction and operational phases of Ngong Ping STW and Sewerage project. The inspections should cover the environmental situation, pollution control and mitigation measures within the site. They should also review the environmental situation outside the site area which is likely to be affected, directly or indirectly, by the site activities. The ET Leader should make reference to the following information in conducting the inspection:

- the EIA recommendations and requirements on environmental protection and pollution control mitigation measures;
- works progress, programme, site/aerial photos and site plans;
- individual works methodology proposals (which should include proposals on associated pollution control measures);
- the contract specifications on environmental protection and pollution prevention control;
- the relevant environmental protection and pollution control laws, ProPECC Notes; and
- previous site inspection results.

9.1.4 The Contractor should update the ET Leader with all relevant information of the contract for him/her to carry out the site inspections. The inspection report results and its recommendations for any necessary improvements in the project's environmental performance should be submitted, in a site inspection proforma, to the IEC and the Contractor within 24 hours, for reference and the taking of immediate remedial action. The Contractor should follow the procedures and time-frame as stipulated in the environmental site inspection, deficiency and remedial action reporting system which is formulated by the ET Leader to report on any remedial measures subsequent to the site inspections.

9.1.5 *Ad hoc* site inspections should also be carried out by the ET and/or IEC if major unacceptable or unforeseen environmental problems are identified. Inspections may also be required subsequent to receipt of an environmental complaint, or as part of the investigation work, as specified in the Action Plan for environmental monitoring and audit.

9.2 Compliance with Legal and Contractual Requirements

9.2.1 There are contractual environmental protection and pollution control requirements as well as environmental protection and pollution prevent and control laws in Hong Kong that the construction and operation of Ngong Ping STW and Sewerage project should comply with.

9.2.2 In order that the works are in compliance with the contractual requirements, all the works method statements submitted by the Contractor to the ER for approval should be sent to the ET Leader for vetting to see whether sufficient environmental protection and pollution control measures have been included.

9.2.3 The ET Leader should also 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.

9.2.4 The Contractor should regularly copy relevant documents to the ET Leader so that the checking of the project's environmental performance could be carried out effectively. The documents to be submitted by the Contractor should at least include the updated Work Progress Reports, the Works Programme, application for any necessary licence/permits under relevant environmental protection laws, and all the valid licence/permits received to date. The site diary should also be available for the ET Leader's inspection upon his/her request.

9.2.5 After reviewing the document, the ET Leader should advise the Contractor of any non-compliance with the project contractual and legislative requirements on environmental protection and pollution control for them to take follow-up and appropriate remedial actions. If the ET Leader's review concludes that the current status on licence/permit application and any planned environmental protection and pollution control works may not cope with the works programme, or may result in potential violation of environmental protection and pollution control requirements, the ET leader should also advise the Contractor and the ER accordingly. The review should be copied to IEC for any follow-up action.

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

9.3 Environmental Complaints

9.3.1 Complaints should be referred to the ET Leader for carrying out complaint investigation procedures. The ET Leader should undertake the following procedures upon receipt of the complaints:

a. log complaint and date of receipt onto the complaint database and inform the IEC immediately;

b. investigate the complaint to determine its validity, and to assess whether the source of the problem is due to works activities;

c. if a complaint is valid and due to project works, identify mitigation measures and in consultation with the IEC;

d. if mitigation measures are required, advise the Contractor accordingly;

e. review the Contractor's implementation of the identified and required mitigation measures, and the current situation;

f. if the complaint is transferred from EPD, submit interim report to EPD on status of the complaint investigation and follow-up action within the time frame assigned by EPD;

g. undertake additional monitoring and audit to verify the complaint if necessary, and ensure that any valid reason for complaint does not recur through proposed amendments to work methods, procedures, machines and/or equipment, etc.;

h. report the investigation results and the subsequent actions to the complainant (if the source of complaint is identified through EPD, the results should be reported within the time frame assigned by EPD); and

i. log a record of the complaint, investigation, the subsequent actions and the results in the monthly EM&A reports.

9.3.2 During the complaint investigation work, the Contractor and the ER should cooperate with the ET Leader in providing all the necessary information and assistance for completion of the investigation. If mitigation measures (in consultation with the IEC) are required following the investigation, the Contractor should promptly carry out the measures. The ER should ensure that the measures have been carried out by the Contractor.

9.3.3 A flow chart of the complaint response procedures is shown in **Figure 9.1**.

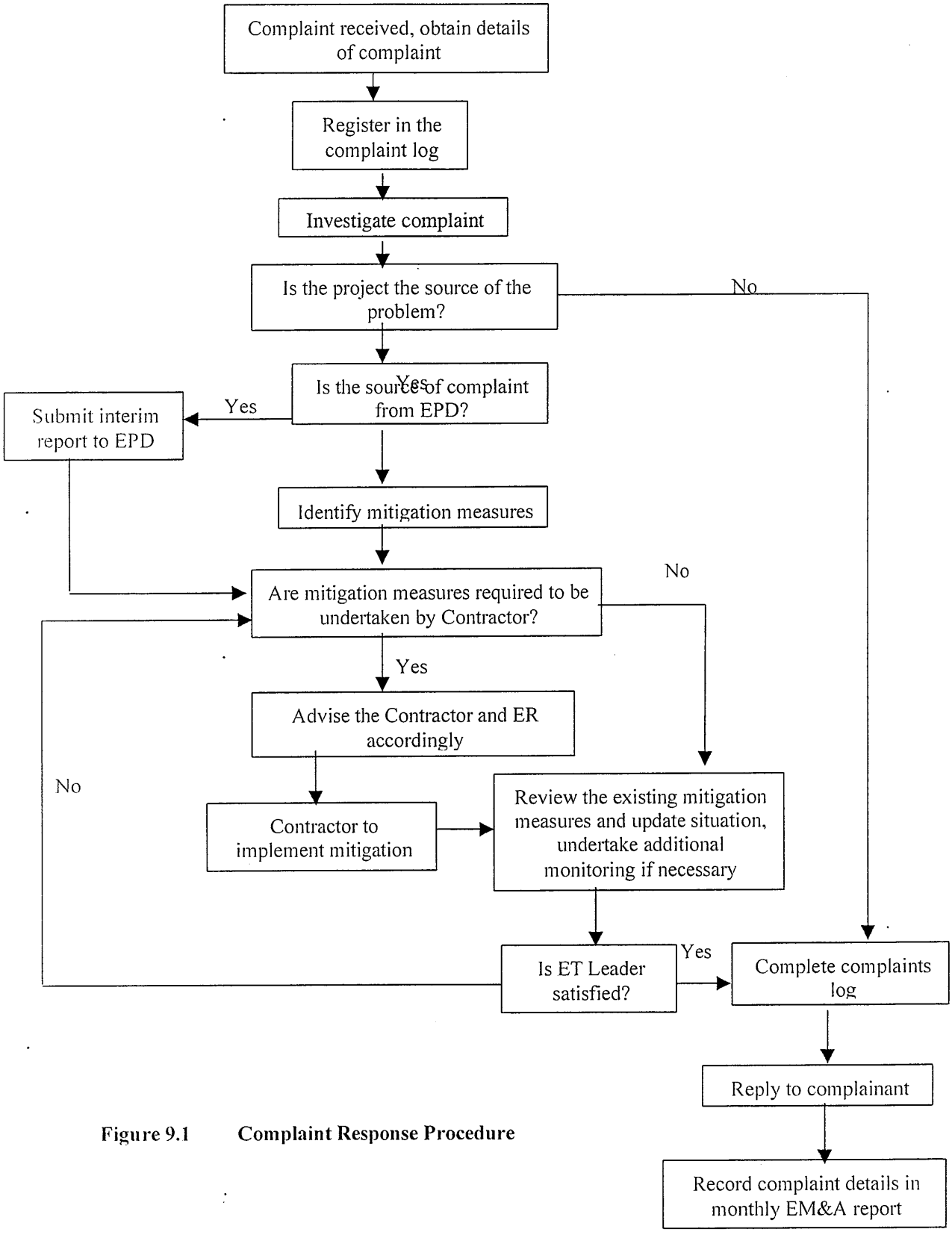


Figure 9.1 Complaint Response Procedure

10. REPORTING

10.1 General

10.1.1 The use of an electronic communication and data recording system for the EM&A programme would facilitate the rapid and effective communication of the site environmental status, as well as serving as a management tool for the Contractors. Reporting of monitoring data for the Project through a dedicated internet website is recommended. This can achieve real-time monitoring and notify the Engineer any exceedance of the pre-set environmental quality so as to trigger immediate remedial actions, thus increasing the efficiency in resolving the environmental problems. The system will also track the actions undertaken by relevant parties. The system could also function as a database for the entry of all recorded monitoring and audit information.

10.1.2 In addition, the system could:

- automatically issues Notifications of Exceedances and track their completion;
- instigate Event and Action Plans and track their completion;
- store details of complaints;
- store details of licenses, permits and notify forthcoming expiry dates;
- store construction / operation activity details and other relevant site information and link these to the EM&A Implementation Schedule; and
- allow retrieval of electronic versions of the EM&A Manual and other documents.

10.1.3 The following reporting requirements based upon a paper-documented approach. However, the same information can be provided in an electronic medium upon agreeing the format with the ER and EPD. This would enable a transition from a paper/historic and reactive approach to an electronic/real time proactive approach.

10.1.4 For the operational phase marine water quality monitoring, one baseline monitoring report and four quarterly summary reports for the marine water quality monitoring should be prepared with appropriate statistical analyses to show the water quality changes before and after the commissioning of NPSTW. The last quarterly report shall conclude whether or not the findings are in line with the EIA predictions and whether the effluent discharge is causing any adverse impacts on the receiving environs and, if so what respects.

10.2 Baseline Monitoring Report

10.2.1 The ET leader should prepare and submit a Baseline Environmental Monitoring Report within 10 working days of completion of the baseline monitoring. Copies of the Baseline Environmental Monitoring Report should be submitted to each of the four parties: the Contractor, the IEC, the ER and the EPD. The ET leader should liaise with the relevant parties on the exact number of copies they want. The format and content of the report and the representation of baseline monitoring data should be in a format to the satisfaction of EPD.

10.2.2 The baseline monitoring report should include, but not limited to the following:

a. up to half a page executive summary;
b. brief project background information;
c. drawings showing locations of the baseline monitoring stations;

d. an updated construction programme with milestones of environmental protection/mitigation activities annotated;

e. monitoring results (in both hard and diskette copies) together with the following information:

- monitoring methodology;
- name of laboratory and types of equipment used and calibration details;
- parameters monitored;
- monitoring locations (and depth);
- monitoring date, time, frequency and duration;
- QA/QC results and detection limits.

f. details on influencing factors, including:

- major activities, if any, being carried out on the site during the period;
- weather conditions during the period;
- other factors which might affect the results;

g. determination of the Action and Limit Levels (AL Levels) for each monitoring parameter and statistical analysis of the baseline data; the analysis should conclude if there is any statistical difference between control and impact stations for the parameters monitored;

h. revisions for inclusion in the EM&A Manual; and

i. comments and conclusions.

10.3 EM&A Reports

10.3.1 The results and findings of all EM&A work required in this Manual should be recorded in the monthly EM&A reports prepared by the ET leader. The EM&A report should be prepared by ER and endorsed by the IEC and submitted within 10 working days of the end of each reporting month, with the first report due in the month after construction commences. A maximum of 4 copies of each monthly EM&A report should be submitted to each of the four parties: the Contractor, the IEC, the ER and the EPD. The submission of the first monthly report and subsequent monthly reports should follow the requirement in the Section 5 of the EP. Before submission of the first EM&A report, the ET leader should liaise with the parties on the exact number of copies and format of the monthly reports in both hard copy and electronic medium requirement.

10.3.2 The ET leader should review the number and location of monitoring stations and parameters to monitor every 6 months or on an as needed basis in order to cater for the changes in surrounding environment and nature of works in progress.

First Monthly EM&A Report

10.3.3 The first monthly EM&A report should include at least but not be limited to the following:

a. Executive summary in 1-2 pages

- .breaches of AL Levels;
- complaint log;
- notifications of any summons and successful prosecutions;
- reporting changes; and

- future key issues.

b. Basic project information

- project organisation including key personnel contact names and telephone numbers;
- construction programme with fine tuning of construction activities showing the interrelationship with environmental protection/mitigation measures for the month;
- management structure; and
- works undertaken during the month.

c. Environmental status

- works undertaken during the month with illustrations showing location of works; and
- drawing showing the project area, any environmental sensitive receivers and the locations of the monitoring and control stations.

d. Summary of EM&A requirements

- all monitoring parameters;
- environmental quality performance limits (Action and Limit levels);
- Event / Action Plans;
- environmental mitigation measures, as recommended in the Final EIA; and
- environmental requirements in contract documents.

e. Implementation status

- Advice on the implementation status of environmental protection and pollution control/mitigation measures, as recommended in the Final EIA, summarised in the updated implementation schedule.

f. Monitoring results

- To provide monitoring results (in both hard and diskette copies) together with the following information:
- monitoring methodology;
- name of laboratory and types of equipment used and calibration details;
- parameters monitored;
- monitoring locations (and depth);
- monitoring date, time, frequency, and duration;
- weather conditions during the period;
- graphical plots of the monitored parameters in the month annotated against;
- the major activities being carried out on site during the period;
- weather conditions that may affect the results and other factors which might affect the monitoring results; and
- QA/QC results and detection limits.

g. Report on non-compliance, complaints, notifications of summons and successful prosecutions

- record of all non-compliance (exceedances) of the environmental quality performance limits (Action and Limit Levels);
- record of all complaints received (written or verbal) for each media, including locations and nature of complaints investigation, liaison and consultation undertaken, actions and follow-up procedures taken, results and summary;
- record of all notifications of summons and successful prosecutions for breaches of the current environmental protection/pollution control legislations, including ocations and nature of the breaches, investigation, follow-up actions taken, results and summary;
- review of the reasons for and the implications of non-compliance, complaints, summons and prosecutions including review of pollution sources and working procedures; and
- a description of the actions taken in the event of non-compliance and deficiency reporting and any follow-up procedures related to earlier non-compliance.

h. Others

- an account of the future key issues as reviewed from the works programme and work method statements;
- advice on the solid and liquid waste management status; and
- submission of implementation status proforma, proactive environmental protection proforma, regulatory compliance proforma, data recovery schedule and complaint log summarizing the EM&A of the period.

Subsequent EM&A Reports

10.3.4 The subsequent monthly EM&A reports should include the following:

a. Executive summary (1-2 pages)

- breaches of AL levels;
- complaint log;
- notifications of any summons and successful prosecutions;
- reporting changes; and
- future key issues.

b. Environmental status

- construction / operation programme with fine tuning of construction / operation activities showing the interrelationship with environmental protection/mitigation measures for the month;
- works undertaken during the month with illustrations including key personnel contact names and telephone numbers; and
- drawing showing the project area, any environmental sensitive receivers and the locations of the monitoring and control stations.

c. Implementation status

- Advice on the implementation status of environmental protection and pollution control/mitigation measures, as recommended in the Final EIA, summarised in the updated implementation schedule.

- Advice on the status of submissions as required in the EP.

d. Monitoring results

- To provide monitoring results (in both hard and diskette copies) together with the following information:
- monitoring methodology;
- name of laboratory and types of equipment used and calibration details
- parameters monitored;
- monitoring locations (and depth);
- monitoring date, time, frequency, and duration;
- weather conditions during the period;
- graphical plots of the monitored parameters in the month annotated against;
- the major activities being carried out on site during the period;
- weather conditions that may affect the results and other factors which might affect the monitoring results; and
- QA/QC results and detection limits.

e. Report of non-compliance, complaints, notifications of summons and successful prosecutions

- record of all non-compliance (exceedances) of the environmental quality performance limits (Action and Limit Levels);
- record of all complaints received (written or verbal) for each media, including locations and nature of complaints investigation, liaison and consultation undertaken, actions and follow-up procedures taken, results and summary;
- record of all notifications of summons and successful prosecutions for breaches of the current environmental protection/pollution control legislations, including locations and nature of breaches, investigation, follow-up actions taken, results and summary;
- review of the reasons for and the implications of non-compliance, complaints, summons and prosecutions including review of pollution sources and working procedures; and
- a description of the actions taken in the event of non-compliance and deficiency reporting and any follow-up procedures related to earlier non-compliance.

f. Others

- an account of the future key issues as reviewed from the works programme and work method statements; and
- advice on the solid and liquid waste management status, including types and quantities of all wastes, spoil, excavated materials, etc., arising from the Project during construction and their management and disposal arrangements including the disposal locations.

g. Appendix

- AL levels

- graphical plots of trends of monitored parameters at key stations over the past four reporting periods for representative monitoring stations annotated against the following:

  i. major activities being carried out on site during the period;

  ii. weather conditions during the period; and

  iii. any other factors which might affect the monitoring results

  - monitoring schedule for the present and next reporting period
  - cumulative statistics on complaints, notifications of summons and successful prosecutions
  - outstanding issues and deficiencies

Quarterly EM&A Summary Reports

10.3.5 The quarterly EM&A summary report which should generally be around 5 pages (including about 3 of text and tables and 2 of figures) should contain at least the following listed information. Apart from these, the first quarterly summary report should also confirm that the monitoring work is proving effective and that it is generating data with the necessary statistical power to categorically identify or confirm the absence of impact attributable to the works:

a. up to half a page executive summary;

b. basic project information including a synopsis of the project organisation, programme, contacts of key management, and a synopsis of work undertaken during the quarter;

c. a brief summary of EM&A requirements including:

   - monitoring parameters;
   - environmental quality performance limits (Action and Limit levels); and
   - environmental mitigation measures, as recommended in the Final EIA;

d. advice on the implementation status of environmental protection and pollution control/mitigation measures, as recommended in the Final EIA, summarised in the updated implementation schedule;

e. drawings showing the project area, any environmental sensitive receivers and the locations of the monitoring and control stations;

f. graphical plots of the trends of monitored parameters over the past 4 months (the last month of the previous quarter and the present quarter) for representative monitoring stations annotated against;

   - the major activities being carried out on site during the period;
   - weather conditions during the period; and
   - any other factors which might affect the monitoring results;

g. advice on the solid and liquid waste management status;

h. a summary of non-compliance (exceedances) of the environmental quality performance limits (Action and Limit levels);

i. a brief review of the reasons for and the implications of non-compliance including review of pollution sources and working procedures;

j. a summary description of the actions taken in the event of non-compliance and any follow-up procedures related to earlier non-compliance;

k. a summary record of all complaints received (written or verbal) for each media, liaison and consultation undertaken, actions and follow-up procedures taken;

l. comments (e.g. effectiveness and efficiency of the mitigation measures), recommendations (e.g. any improvement in the EM&A programme) and conclusions for the quarter; and

m. proponents' contacts and any hotline telephone number for the public to make enquiries.

Final EM&A Summary Report

10.3.6 The termination of EM&A programme should be determined on the following basis:

a. completion of construction and operation activities and insignificant environmental impacts of the remaining outstanding activities;

b. trends analysis to demonstrate the narrow down of monitoring exceedances due to construction activities and the return of ambient environmental conditions in comparison with baseline data; and

c. no environmental complaint and prosecution involved.

10.3.7 The proposed termination may be required to consult related local community such as District Board and the proposal should be endorsed by the IEC, ER and the project proponent prior to Final approval from the Director of Environmental Protection.

10.3.8 The Final EM&A summary report should include, inter alia, the following:

a. an executive summary;

b. basic project information including a synopsis of the project organisation, programme, contacts of key management, and a synopsis of work undertaken during the entire construction period;

c. a brief summary of EM&A requirements including:

- monitoring parameters;
- environmental quality performance limits (Action and Limit levels); and
- environmental mitigation measures, as recommended in the Final EIA;

d. advice on the implementation status of environmental protection and pollution control/mitigation measures, as recommended in the Final EIA, summarised in the updated implementation status proforma;

e. drawings showing the project area, any environmental sensitive receivers and the locations of the monitoring and control stations;

f. graphical plots of the trends of monitored parameters over the construction and operation period for representative monitoring stations annotated against;

- the major activities being carried out on site during the period;
- weather conditions during the period; and

- any other factors which might affect the monitoring results;
- the return of ambient environmental conditions in comparison with baseline data;

g. compare and contrast the EM&A data with the Final EIA predictions and annotate with explanation for any discrepancies;

h. provide clear-cut decisions on the environmental acceptability of the project with reference to the specific impact hypothesis;

i. advice on the solid and liquid waste management status;

j. a summary of non-compliance (exceedances) of the environmental quality performance limits (Action and Limit levels);

k. a brief review of the reasons for and the implications of non-compliance including review of pollution sources and working procedures;

l. a summary description of the actions taken in the event of non-compliance and any follow-up procedures related to earlier non-compliance;

m. a summary record of all complaints received (written or verbal) for each media, liaison and consultation undertaken, actions and follow-up procedures taken;

n. review the monitoring methodology adopted and with the benefit of hindsight, comment on its effectiveness (including cost effectiveness);

o. a summary record of notifications of summons and successful prosecutions for breaches of the current environmental protection/pollution control legislations, locations and nature of breaches, investigation, follow-up actions taken and results;

p. review the practicality and effectiveness of the Final EIA process and EM&A programme (e.g. effectiveness and efficiency of mitigation measures), recommend any improvement in the EM&A programme; and

q. a conclusion to state the return of ambient and/or the predicted scenario as per Final EIA findings.

10.4 Documentation

10.4.1 All documentation is required to be filed in a traceable and systematically manner. Site document, such as, monitoring field records, laboratory analysis records, meeting minutes, correspondences etc., should be cross-referenced by the ET leader and be ready for inspection upon request. All EM&A results and findings should be documented in the EM&A reports prepared by the ET and endorsed by the IEC prior to disseminate to the Contractor, ER and the DEP.

10.4.2 All documentation to the DEP should be in paper form and/or electronic form (in the format in agreement with the DEP) upon request. All documents and data should be kept for at least one year after the completion of the contract. All submissions namely reports, data, and correspondences, etc., to the DEP should be liable to use freely for the purposes of communicating environmental data and the owner of information should claim no copyright. Any request to treat all or part of a submission in confidence would be respected, but if no such request is made it would be assumed that the submission is not intended to be confidential.

10.5 Electronic Reporting of EM&A Information

10.5.1 The electronic reporting of EM&A information should follow Section 6.1 to 6.3 of the EP.

10.6 Interim Notifications of Environmental Quality Limit Exceedances

10.6.1 With reference to Event/Action Plans in this Manual, when the environmental quality limits are exceeded, the ET leader should immediately notify the ER and EPD, as appropriate. The notification should be followed up with advice to EPD on the results of the investigation, proposed action and success of the action taken, with any necessary follow-up proposals. A sample template for the interim notifications is shown in **Appendix B**.

APPENDIX A

Implementation Schedule for Recommended Mitigation Measures

Appendix A Implementation Schedule of Recommended Mitigation Measures

EIA Ref.	EM&A Log Ref	Recommended Mitigation Measures	Objectives of the Recommended Measure & Main Concerns to address	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
Air Quality Mitigation Measures							
S3.6.1	S2.4	In order to ensure that dust emission is minimized during the construction phase of the project, relevant dust control requirements set out in the *Air Pollution Control (Construction Dust) Regulation* should be met. The site agent of the Contractor is required to adopt dust reduction measures while carrying out construction works. In particular, the mitigation measures listed below should be adopted where applicable. With the implementation of effective dust control measures, adverse dust impacts from the construction works of the project is not expected. Site clearance and demolition of existing structures • The working area for the uprooting of trees, shrubs, or vegetation or for the removal of boulders, poles, pillars or temporary or permanent structures should be sprayed with water or a dust suppression chemical immediately before, during and immediately after the operation so as to maintain the entire surface wet; • All demolished items (including trees, shrubs, vegetation, boulders, poles, pillars, structures, debris, rubbish and other items arising from site clearance) that may dislodge dust particles should be covered entirely by impervious sheeting or placed in an area sheltered on the top and the 3 sides within a day of demolition; Site boundary and entrance • Vehicle washing facilities including a high pressure water jet should be provided at every discernible or designated vehicle exit point;	Dust control	Contractor	All construction sites	Construction stage (Jan 03 to Apr 07)	EIAO, APCO, Air Pollution Control (Construction Dust) Regulation
S3.6.1	S2.4	• The area where vehicle washing takes place and the section of the road between the washing facilities and the exit point should be paved with concrete, bituminous materials or hardcores; • Where a site boundary adjoins a road, street, service and or other area accessible to the public, hoarding of not less than 2.4m from ground level should be provided along the entire length of that portion of the site boundary except for a site entrance or exit; Access road • Every main haul road (i.e. any course inside a construction site	Dust control	Contractor	All construction sites	Construction stage (Jan 03 to Apr 07)	EIAO, APCO, Air Pollution Control (Construction Dust) Regulation

EIA Ref.	EM&A Log Ref	Recommended Mitigation Measures	Objectives of the Recommended Measure & Main Concerns to address	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
		having a vehicle passing rate of higher than 4 in any 30 minutes) should be paved with concrete, bituminous materials, hardcores or metal plates, and kept clear of dusty materials; or sprayed with water or a dust suppression chemical so as to maintain the entire road surface wet; • The portion of any road leading only to a construction site that is within 30m of a discernible or designated vehicle entrance or exit should be kept clear of dusty materials; Use of vehicle • Immediately before leaving a construction site, every vehicle should be washed to remove any dusty materials from its body and wheels; • Where a vehicle leaving a construction site is carrying a load of dusty materials, the load should be covered entirely by clean impervious sheeting to ensure that the dusty materials do not leak from the vehicle;					
S3.6.1	S2.4	Excavation and earth moving • The working area of any excavation or earth moving operation should be sprayed with water or a dusty suppression chemical immediately before, during and immediately after the operation so as to maintain the entire surface wet; • Exposed earth shall be properly treated by compaction, turfing, hydroseeding, vegetation planting or sealing with latex, vinyl, bitumen, shotcrete or other suitable surface stabilizer within 6 months after the last construction activity on the construction site or part of the construction site where the exposed earth lies; Stockpiling of dusty materials • Any stockpile of dusty material should be either covered entirely by impervious sheeting; placed in an area sheltered on the top and the 3 sides; or sprayed with water or a dust suppression chemical so as to maintain the entire surface wet.	Dust control	Contractor	All construction sites	Construction stage (Jan 03 to Apr 07)	EIAO, APCO, Air Pollution Control (Construction Dust) Regulation
-	S2.2.22	Baseline dust monitoring at two stations for at least 14 consecutive days prior to the commissioning of the construction works to obtain daily 24-hour TSP samples. 1-hour sampling should also be done at least 3 times per day while the highest dust impact is expected.	Dust control	Contractor/ET	Stations A1 and A2 (Ref: Drawing No. 23400/EN/094)	Before the commencement of construction works	EIAO, APCO, Air Pollution Control (Construction Dust) Regulation
-	S2.2.27	24-hour TSP monitoring at two stations at a frequency of at least once in every six days during the construction period. For 1-hour TSP monitoring, the sampling frequency of at least three times in every six	Dust control	Contractor/ET	Stations A1 and A2 (Ref: Drawing No.	Construction stage (Jan 03 to Apr 07)	EIAO, APCO, Air Pollution Control (Construction Dust)

EIA Ref.	EM&A Log Ref	Recommended Mitigation Measures	Objectives of the Recommended Measure & Main Concerns to address	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
		days should be undertaken when the highest dust impact occurs.			23400/EN/094)		Regulation
S3.6.4	S2.7	All the sludge generated from the STW will be dewatered onsite to more than 30% dry solids content before transporting to the designated landfill site for disposal and will be stored in covered container along the transporting route to avoid the possible odour impact on nearby sensitive receivers. The transportation of the sludge by sea to the disposal location is recommended, as far as practicable, in order to reduce potential air quality impacts from road transportation.	Odour control	DSD	Ngong Ping STW	Operational stage	EIAO, APCO
S3.6.2, S3.6.3	S2.7	In order to mitigate the potential odour impacts from the proposed Ngong Ping STW to an acceptable level, it is recommended that all the major odour sources within the proposed STW namely the inlet work, the sequencing batch reactors, the sludge thickeners, and the emergency storage tank should all be constructed as underground facilities to minimise direct emission of odour to the atmosphere. Other components of the STW will be constructed as above ground structures. All odour emissions from the underground/above ground facilities mentioned above will be contained by building structures and ventilated to a centralised deodourisation unit. Based on the findings of the EIA study, the H_2S removal efficiency of the deodourisation unit should be 99.5% or better and the H_2S emission rate at the exhaust end of the deodourisation unit should not be more than 50 µg/s. A backup deodorization unit should be provided to cater for the situation during maintenance or breakdown of the deodorization unit.	Odour control	DSD	Ngong Ping STW	Operational stage	EIAO, APCO
-	S2.5	Odour baseline monitoring which consist of both odour sampling and H2S measurement at the site boundary and at selected ASRs. A 15-min sample should be collected every 3 hours for a duration of 24 hours at each of the monitoring locations.	Odour control	DSD/ET	Ngong Ping STW	Before the operation of Ngong Ping STW	EIAO, APCO
-	S2.5	The first set of odour impact monitoring at the site boundary, at selected ASRs, and at the exhaust of the centralised deodourisation unit should consist of both odour sampling and H2S measurement. The subsequent odour impact monitoring should provide a continuation of the H2S monitoring at the site boundary, at selected ASRs and at the exhaust point of the centralised deodourisation unit. Impact monitoring should be carried out every 3 months.	Odour control	DSD/ET	Ngong Ping STW	Operational stage	EIAO, APCO

EIA Ref.	EM&A Log Ref	Recommended Mitigation Measures	Objectives of the Recommended Measure & Main Concerns to address	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
Noise Mitigation Measures							
S4.5.2, S4.5.3	S3.8.3, S3.8.4	*Use of Quiet Plant* The Contractor should obtain particular models of plant that are quieter than standard types given in the GW-TM. Reference can be made to the *British Standard BS5228: Part 1:1997 Control on Construction and Open Sites*.	Noise control	Contractor	All construction sites	Construction stage (Mar 03 to Apr 07)	EIAO, NCO
S4.5.4	S3.8.5	*Using Temporary and Movable Noise Barriers* Movable barriers of 3 to 5 m height with a small cantilevered upper portion and skid footing can be located within a few metres of stationary plant and within about 5 m or more of mobile equipment such as an excavator and mobile crane etc., such that the line of slight to the NSR is blocked by the barriers. It would be possible for the Contractor to provide purpose-built noise barriers or screens constructed of appropriate material (minimum superficial density of 7 kg/m^2) located close to operating PME, in order to reduce the noise impact to the surrounding sensitive uses. Certain types of PME, such as generators and compressors, can be completely screened by portable barriers giving a total noise reduction of 10 dB(A) or more.	Noise control	Contractor	All construction sites	Construction stage (Mar 03 to Apr 07)	EIAO, NCO
S4.5.6	S3.8.7	*Reducing the Numbers of Plants Operating in Critical Areas Close to NSRs* It would be appropriate to restrict the number of operating PME within certain parts of the site that are very close to the NSRs in order to reduce the level of noise impacts.	Noise control	Contractor	All construction sites	Construction stage (Mar 03 to Apr 07)	EIAO, NCO
S4.5.7	S3.8.8	*Good Site Practice* The following good site practice should be adopted during the construction phase: ▪ The contractor should site noisy equipment and activities as far from sensitive receivers as practical. Also, temporary site offices (and other similar structures) should be located, as far as is possible, such that sensitive receivers are screened by these structures from the line of sight of the construction areas. ▪ Intermittent noisy activities should be scheduled to minimise	Noise control	Contractor	All construction sites	Construction stage (Mar 03 to Apr 07)	EIAO, NCO

EIA Ref.	EM&A Log Ref	Recommended Mitigation Measures	Objectives of the Recommended Measure & Main Concerns to address	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
		exposure of nearby NSRs to high levels of construction noise. For example, noisy activities could be scheduled at times coinciding with periods when the schools are likely to be unoccupied. Prolonged operation of noisy equipment close to the schools should be avoided. ▪ Idle equipment should be turned off or throttled down. Noisy equipment should be properly maintained and used no more often than is necessary. ▪ Construction activities should be planned so that parallel operation of several sets of equipment close to a given receiver is avoided. ▪ Where possible, the numbers of concurrently operating items of plant should be reduced through sensitive programming. ▪ Construction plant should be properly maintained and operated. Construction equipment often has silencing measures built in or added on, e.g. compressor panels, and mufflers. Silencing measures should be properly maintained and utilised.					
S4.5.8 to S4.5.10	S3.8.9 to S3.8.11	***Specific Mitigation Measures*** For construction activities of Ngong Ping STW, mitigation level 1 with the use of quiet plant is recommended. For construction of effluent export pipeline, village sewerage and the two local pump chambers, mitigation level 2 with the use of quiet plant and use of movable temporary noise barrier is recommended. For construction of village sewerage and effluent export in front of prison's staff quarters, mitigation level 3 with the use of manual construction methods are recommended in those narrow alleys which are less than 4 m away from the nearest NSR. It is also recommended that the contractor should inform and, if necessary, liaise with the residents in Ngong Ping village and Shek Pik Prison on the construction schedule and work locations before the start of any construction work within the village.	Noise control	Contractor	All construction sites	Construction stage (Mar 03 to Apr 07)	EIAO, NCO
S4.5.12	S3.9.1	In order to meet both the daytime/evening and night-time noise limits during operational phase of the project, mitigation measures as suggested in the following should be adopted: *Building Envelope/Enclosure* The building envelope holding noisy equipment should be made of suitable materials (e.g. concrete) and design capable of achieving a reduction of 20 dB(A). It should be a complete enclosure with	Noise control	DSD	Ngong Ping STW	Design and operational stage	EIAO

EIA Ref.	EM&A Log Ref	Recommended Mitigation Measures	Objectives of the Recommended Measure & Main Concerns to address	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
		minimal openings for which these openings should not be facing any NSRs in the east or south. The building materials should be of surface density of 25kg/m^2 or higher. Ventilation should not be overlooked as most equipment, such as motors, requires an adequate air supply either to prevent overheating or to enable them to function efficiently. A silenced ventilation system incorporating silencers at the air intakes and discharge openings should be employed. *Layout of Building Structures* It would be beneficial if building structures e.g. plant office capable of screening noisy components could be located in the east side of the site to act as noise screening structures.					
S4.5.13	S3.9.2	The two local pump chambers will be fully enclosed as underground facilities to minimize the noise emissions.	Noise control	DSD	Pump chambers at Ngong Ping Village	Design and operational stage	EIAO
-	S3.5	Baseline noise monitoring should be carried out daily for a period of at least two weeks. At least one set of measurements should be collected on each monitoring day at each monitoring station. The noise level shall be measured in terms of the A-weighted equivalent continuous sound pressure level (Leq). One set of measurements should at least include 6 consecutive Leq(5 min) results (i.e. a minimum of 30 minutes). Leq(30 min) shall be used as the monitoring parameter for the time period between 0700-1900 hours on normal weekdays. For all other time periods, Leq(5 min) shall be employed for comparison with the NCO criteria.	Noise control	Contractor/ET	Two noise monitoring stations as shown in Drawing No. 23400/EN/094	Before the commencement of construction works	EIAO, NCO
-	S3.6	Impact noise monitoring should be carried out at all the designated monitoring stations for the construction phase. The monitoring frequency should depend on the scale of construction and operation activities. As an initial guide, one set of measurements between 0700 to 1900 hours on normal weekdays should be carried out for each station on a per week basis when noise-generating activities are underway. One set of measurements should at least include 6 consecutive Leq(5 min) results (i.e. a minimum of 30 minutes). Leq(30 min) shall be used as the monitoring parameter for the time period between 0700-1900 hours on normal weekdays. For all other time periods, Leq(5 min) shall be employed for comparison with the NCO criteria.	Noise control	Contractor/ET	Two noise monitoring stations as shown in Drawing No. 23400/EN/094	Construction stage (Mar 03 to Apr 07)	EIAO, NCO

EIA Ref.	EM&A Log Ref	Recommended Mitigation Measures	Objectives of the Recommended Measure & Main Concerns to address	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
Water Quality Mitigation Measures							
S5.4.5	S4.5	The practices outlined in *ProPECC PN 1/94 Construction Site Drainage* should be adopted to minimise the potential water quality impacts from construction site runoff and various construction activities. The recommendation to install perimeter drains to collect site runoff and to properly treat the runoff by settlement tank/treatment system shall apply to all sites including those for mainlaying works.	Water quality control	Contractor	All construction sites	Construction stage (Jan 03 to Apr 07)	WDO, WPCO, PN1/94
S5.4.6	S4.5	A discharge licence should be applied from EPD for discharging effluent from the construction site. The discharge quality is required to meet the requirements specified in the discharge licence. As project location is an environmentally sensitive area, all the runoff and wastewater generated from the works areas within the water gathering ground should be treated so that it satisfies with all the standards listed in the Technical Memorandum for Group A inland waters. In addition, substances listed in Clause 8.4 of the Technical Memorandum shall not discharge into the water gathering ground. Monitoring of the discharge quality of treated effluent should be part of the environmental monitoring and audit programme. Detailed effluent sampling programme for water quality control during construction phase should be submitted to EPD and WSD for approval prior to commencement of the construction works.	Water quality control	Contractor	All construction sites	Construction stage (Jan 03 to Apr 07)	WDO, WPCO, PN1/94
S5.4.7	S4.5	The construction programme should be properly planned to minimise soil excavation, if any, in rainy seasons. Any exposed soil surfaces should also be properly protected to minimise dust emission. Hydroseeding could be applied to protect exposed slope surfaces, if any.	Water quality control	Contractor	All construction sites	Construction stage (Jan 03 to Apr 07)	WDO, WPCO, PN1/94
S5.4.7	S4.5	The provision of leakage containment system for the section of pipeline in the close proximity of the reservoir.	Water quality control	Contractor	All construction sites	Construction stage (Jan 03 to Apr 07)	WDO, WPCO, PN1/94
S5.4.7	S4.5	No earth, building materials, soil and other materials should be allowed to be stockpiled on site within the water gathering ground. All surplus spoil should be removed from the water gathering ground as soon as practicable. All mud and debris should be removed from any waterworks access roads and associated drainage systems within the water gathering ground. In areas outside the water gathering ground	Water quality control	Contractor	All construction sites	Construction stage (Jan 03 to Apr 07)	WDO, WPCO, PN1/94

EIA Ref.	EM&A Log Ref	Recommended Mitigation Measures	Objectives of the Recommended Measure & Main Concerns to address	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
		where a large amount of exposed soils exist, earth bunds or sand bags should be provided. Exposed stockpiles should be covered with tarpaulin or impervious sheets at all time. The stockpiles of materials should be placed in the locations away from any stream courses so as to avoid releasing materials into the water bodies. Final surfaces of earthworks should be compacted and protected by permanent work. Haul roads should be paved with concrete and the temporary access roads are protected using crushed stone or gravel, wherever practicable. Wheel washing facilities should be provided at all site exits to ensure that earth, mud and debris would not be carried out of the works areas by vehicles					
S5.4.8	S4.5	Good site practices should be adopted to clean the rubbish and litter on the construction sites so as to prevent the rubbish and litter from dropping into the nearby environment. Construction sites should be cleaned on a regular basis.	Water quality control	Contractor	All construction sites	Construction stage (Jan 03 to Apr 07)	WDO, WPCO, PN1/94
S5.4.9	S4.5	To avoid introducing additional pollution loads into the nearby waters, it is recommended to provide chemical toilets in the works areas. Provision of temporary toilet facilities within the water gathering ground is subject to the approval of the Director of Water Supplies. All waste should be cleared away daily and disposed outside the water gathering ground. The toilet facilities should not be less than 30 m from any watercourse.	Water quality control	Contractor	All construction sites	Construction stage (Jan 03 to Apr 07)	WDO, WPCO, PN1/94
S5.4.10	S4.5	All canteens/kitchens should be located outside the water gathering ground. Wastewater generated from kitchens, if any, should be collected in a temporary storage tank. A licensed waste collector should be deployed to clean the chemical toilets and temporary storage tank on a regular basis. The collected sewage and wastewater could then be transported to the sewage treatment plants for disposal.	Water quality control	Contractor	All construction sites	Construction stage (Jan 03 to Apr 07)	WDO, WPCO, PN1/94
S5.4.11	S4.5	Notices should be posted at conspicuous locations to remind the workers not to discharge any sewage or wastewater into the nearby environment during the construction phase of the project.	Water quality control	Contractor	All construction sites	Construction stage (Jan 03 to Apr 07)	WDO, WPCO, PN1/94
S5.4.14	S4.5	It is required to register as a chemical waste producer if chemical wastes would be produced from the construction activities. The Waste	Water quality control	Contractor	All construction sites	Construction stage (Jan 03 to Apr 07)	WDO, WPCO, PN1/94

EIA Ref.	EM&A Log Ref	Recommended Mitigation Measures	Objectives of the Recommended Measure & Main Concerns to address	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
		Disposal Ordinance (Cap 354) and its subsidiary regulations in particular the Waste Disposal (Chemical Waste) (General) Regulation should be observed and complied with for control of chemical wastes.					
S5.4.15	S4.5	Any service shop and minor maintenance facilities should be located outside the water gathering ground and should be on hard standings within a bunded area, and sumps and oil interceptors should be provided. Maintenance of vehicles and equipment involving activities with potential for leakage and spillage should only be undertaken with the areas appropriately equipped to control these discharges. Any soil contaminated with chemicals/oils shall be removed from site and the void created shall be filled with suitable materials. Washing the chemicals away is not acceptable as they will contaminate the water gathering ground.	Water quality control	Contractor	All construction sites	Construction stage (Jan 03 to Apr 07)	WDO, WPCO, PN1/94
S5.4.16	S4.5	Storage of oils/chemicals/waste within the water gathering ground should be limited to absolute minimum volume and are to be removed from sites at the earliest opportunity. No storage and discharge of flammable or toxic solvents, petroleum oil or tar and other toxic substances should be allowed within the water gathering ground. Any construction plant which causes pollution to catchwater or water gathering ground due to leakage of oil or fuel should be removed off site immediately. Any soil contaminated with fuel leaked from the plant should be removed off site and the voids arising from removal of contaminated soil should be replaced by suitable material to the approval of the Director of Water Supplies. Any chemicals to be used including disinfectants and deodorants within the water gathering ground should be subject to the approval of the Director of Water Supplies.	Water quality control	Contractor	All construction sites	Construction stage (Jan 03 to Apr 07)	WDO, WPCO, PN1/94
S5.4.17	S4.5	Disposal of chemical wastes should be carried out in compliance with the Waste Disposal Ordinance. The *Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes* published under the Waste Disposal Ordinance details the requirements to deal with chemical wastes. General requirements are given as follows: ▪ Suitable containers should be used to hold the chemical wastes to avoid leakage or spillage during storage, handling and transport. Chemical waste containers should be suitably labelled to notify and warn the personnel who are handling the wastes to avoid accidents.	Water quality control	Contractor	All construction sites	Construction stage (Jan 03 to Apr 07)	WDO, WPCO, PN1/94

EIA Ref.	EM&A Log Ref	Recommended Mitigation Measures	Objectives of the Recommended Measure & Main Concerns to address	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
		▪ Storage area should be selected at a safe location on site and adequate space should be allocated to the storage area.					
S5.4.18-S5.4.21	S4.5	A detailed emergency plan and clean up procedures should be developed and approved by EPD/WSD before commencement of construction work to deal with accidental spillage of chemicals.	Water quality control	Contractor	All construction sites	Construction stage (Jan 03 to Apr 07)	WDO, WPCO, PN1/94
S5.5.1	S4.4.1	▪ Ductile iron pipe should be used for all the Ngong Ping village sewers and effluent pipeline for its robustness, because the area is within the water gathering ground. Sealed pipe joints with hatchboxes along the pipeline should be adopted. ▪ Maximum distance between manholes should be limited to 60 m to facilitate over-pumping operations during sewer inspection or maintenance. This would also facilitate flow diversion in case of emergency situation during pipe leakage. ▪ The drainage of any high contamination risk areas such as the DG store will be physically separated from the drainage system of the STW site. ▪ Installation of 150mm diameter borehole with 100mm diameter slotted iron sleeve for water pollution monitoring, around the STW site at suitable location. ▪ 150mm diameter bore holes will be installed along the section of export pipeline carrying a high risk of contamination of the water gathering ground. ▪	Water quality control	DSD	Ngong Ping sewerage system	Design and operational stages	EIAO
S5.5.1	S4.8	Standby units, emergency power generation and emergency storage facilities should be provided at Ngong Ping STW to avoid the need for emergency discharges. An emergency storage tank should be constructed to temporary store both the raw sewage from Ngong Ping sewerage catchment and the effluent of STW to cater for the STW breakdown and bursting of effluent pipe. Furthermore, it is also proposed that the size of the emergency storage tank will be large enough to store 72hr. Sewage/effluent flow (48 hours peak day and 24 hours average day i.e. 2 x 2956 + 1524 = 7436m^3) in ultimate stage. Thus, the volume of the emergency storage tank is about 7600m^3 and the size is about 50m(L) x 40m(W) x 3.8m (D).	Water quality control	DSD	Ngong Ping STW	Design and operational stages	EIAO

EIA Ref.	EM&A Log Ref	Recommended Mitigation Measures	Objectives of the Recommended Measure & Main Concerns to address	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
S5.5.2	S4.8	Routine flow monitoring should be carried out at both the upstream end (STW) and downstream of the water gathering ground and country park to ensure early detection of any major leakage. An Action Plan should be prepared and should be followed in the event that pipe leakage is suspected or identified. Temporary diversion of effluent to the emergency storage tank at the STW could be arranged to provide no-flow condition for the repair of the effluent pipeline.	Water quality control	DSD	Ngong Ping sewerage system	Design and operational stages	EIAO
S5.6.108	S4.8	Effluent should be monitored at the outlet chamber of the disinfection unit.	Water quality control	DSD	Ngong Ping STW	Operational stages (upon commissioning of Ngong Ping STW)	EIAO
--	S4.5.16 to S4.5.18	Groundwater Monitoring To avoid the groundwater pollution from excavations, it is proposed to monitor the groundwater quality on monthly basis. The frequency of monitoring will be reviewed after a period of time and may be increased or decreased if necessary. The following parameters of groundwater quality will be analysed: ▪ Biochemical Oxygen Demand (BOD_5) ▪ Ammonia nitrogen (NH_3^+-N) ▪ Nitrate + Nitrite Nitrogen ▪ E-coli ▪ PH ▪ Turbidity ▪ Total phosphates ▪ Oil & Grease ▪ Synthetic Detergents DSD will take up the groundwater quality monitoring work for both the Ngong Ping Sewage Treatment Plant and the Effluent Export Pipeline. All results should be made available to WSD and EPD upon completion of analysis.	Water quality control	DSD	Ngong Ping STW	Construction stage (Jan 03 to Apr 07)	EIAO

EIA Ref.	EM&A Log Ref	Recommended Mitigation Measures	Objectives of the Recommended Measure & Main Concerns to address	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
Waste Management							
S6.5.1	S6	A proper Waste Management Plan (WMP) should be submitted to Engineer for approval and implemented. Where waste generation is unavoidable then the potential for recycling or reuse should be explored and opportunities taken. If wastes cannot be recycled, recommendations for appropriate disposal routes should be provided in the WMP. A method statement for stockpiling and transportation of the excavated material and other construction wastes should also be included in the WMP and approved before the commencement of construction. All mitigation measures arising from the approved WMP shall be fully implemented.	Waste minimization and control	Contractor	All construction sites	Construction stage (Jan 03 to Apr 07)	WDO, WBTC 29/2000
S6.5.2	S6	Excavated material to be generated from construction works to be re-used on-site as far as practicable to reduce off-site disposal.	Waste minimization and control	DSD/ Contractor	All construction sites	Design and construction stages	WDO, WRFP, WBTC 2/93, 2/93B, 5/98, 25/99, 25/99A, 25/99C, 4/98, 4/98A, 19/99, 12/2000
		Segregation and storage of different types of waste in different containers, skips or stockpiles to enhance reuse or recycling of materials and their proper disposal.	Waste minimization and control	Contractor	All construction sites	Construction stage (Jan 03 to Apr 07)	
		To encourage collection of aluminium cans by individual collectors, separate labelled bins should be provided to segregate this waste from other general refuse generated by the workforce.					
		Any unused chemicals or those with remaining functional capacity should be recycled.					
		Prior to disposal of C&D waste, recyclable materials should be salvaged for reuse (such as wood and metal) and inert waste utilised as public fill to minimise the quantity of waste to be disposed of to landfill.					
		Proper storage and site practices to minimise the potential for damage or contamination of construction materials.					
S6.5.2	S6	Plan and stock construction materials carefully to minimise amount of waste generated and avoid unnecessary generation of waste.	Waste minimization and control	Contractor	All construction sites	Construction stage (Jan 03 to Apr 07)	WDO, WRFP, WBTC 2/93, 2/93B, 5/98, 25/99, 25/99A, 25/99C, 4/98, 4/98A, 19/99, 12/2000

EIA Ref.	EM&A Log Ref	Recommended Mitigation Measures	Objectives of the Recommended Measure & Main Concerns to address	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
S6.5.3	S6	Nomination of approved personnel, such as a site manager, to be responsible for good site practices, arrangements for collection and effective disposal to an appropriate facility, of all wastes generated at the site. Training of site personnel in proper waste management and chemical handling procedures. Provision of sufficient waste disposal points and regular collection for disposal. Appropriate measures should be employed to minimise windblown litter and dust during transportation of waste by either covering trucks or by transporting wastes in enclosed containers. The Storage of oils/chemicals/waste within the boundary of the water gathering ground should be limited to the absolute minimum volume and are to be removed from sites at the earliest opportunity.	Waste minimization and control	Contractor	All construction sites	Construction stage (Jan 03 to Apr 07)	WDO, WPCO, PN1/94
S6.5.3	S6	Separation of chemical wastes for special handling and appropriate treatment at the Chemical Waste Treatment Facility. Regular cleaning and maintenance programme for drainage systems, silt traps, sumps and oil interceptors. Any mud and debris should be removed from any waterworks access roads and associated drainage systems within the water gathering ground.	Waste minimization and control	Contractor	All construction sites	Construction stage (Mar 03 to Apr 07)	WDO, WPCO, PN1/94
S6.5.4	S6	In order to monitor the disposal of C&D material and solid wastes at public filling areas and landfills, and to control fly-tipping, a trip-ticket system should be included as one of the contractual requirements. If surplus excavated spoil would be reused in land formation projects, the sites for such land formation projects must be clearly identified with written agreement from the relevant third party before such disposal. Assessment of potential environmental impact of such disposal has to be conducted and the above information has to be submitted to EPD for approval before action is taken.	Waste minimization and control	Contractor	All construction sites	Construction stage (Jan 03 to Apr 07)	WBTC No. 5/99, 5/99A
S6.5.5	S6	A recording system for the amount of wastes generated, recycled and disposed (including the disposal sites) should be proposed. Quantities could be determined by weighing each load or other suitable methods.	Waste minimization and control	Contractor	All construction sites	Construction stage (Jan 03 to Apr 07)	WDO
S6.5.7	S6	A collection area should be provided where waste can be stored and loaded prior to removal from site. An enclosed and covered area is preferred to reduce the occurrence of 'wind blown' light material. If an open area is unavoidable for the storage or loading/unloading of	Waste minimization and control	Contractor	All construction sites	Construction stage (Jan 03 to Apr 07)	WDO, WPCO, PN1/94

EIA Ref.	EM&A Log Ref	Recommended Mitigation Measures	Objectives of the Recommended Measure & Main Concerns to address	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
		wastes, then the area should be bunded and all the polluted surface run-off collected within this area should be diverted into wastewater treatment system. The collection area for waste should be sited away from the Country Park and ecological sensitive areas.					
S6.5.8	S6	Suitable collection sites around site offices and canteen will be required. For environmental hygiene reasons and to minimize odor, refuse should not be stored for a period exceeding 48 hours, however, removal every 24 hours is preferable.	Waste minimization and control	Contractor	All construction sites	Construction stage (Jan 03 to Apr 07)	WDO
S6.5.8	S6	No canteen should be provided within the water gathering ground.	Waste minimization and control	Contractor	All construction sites	Construction stage (Jan 03 to Apr 07)	WDO
S6.5.9	S6	Provision of temporary toilet facilities within the water gathering ground should be subject to the approval of Director of Water Supplies. All waste should be cleared away daily and disposed outside the water gathering ground. The toilet facilities should not be less than 30 m from any watercourses.	Waste minimization and control	Contractor	All construction sites	Construction stage (Jan 03 to Apr 07)	WDO
S6.5.10	S6	It is required to register as a chemical waste producer if chemical wastes would be produced from the construction activities. The Waste Disposal Ordinance (Cap 354) and its subsidiary regulations in particular the Waste Disposal (Chemical Waste) (General) Regulation should be observed and complied with for control of chemical wastes. After use, chemical wastes (e.g. cleaning fluids, solvents, lubrication oil and fuel) should be handled according to the *Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes*. Spent chemicals should be stored and collected by an approved operator for disposal at the Chemical Waste Treatment Facility or other licensed facility in accordance with the Chemical Waste (General) Regulation.	Waste minimization and control	Contractor	All construction sites	Construction stage (Jan 03 to Apr 07)	WDO
S6.5.11	S6	Any service shop and minor maintenance facilities should be located outside the water gathering ground and should be on hard standings within a bunded area, and sumps and oil interceptors should be provided. Maintenance of vehicles and equipment involving activities with potential for leakage and spillage should only be undertaken with the areas appropriately equipped to control these discharges. No storage and discharge of flammable or toxic solvents, petroleum oil or tar and other toxic substances shall be allowed within the water	Waste minimization and control	Contractor	All construction sites	Construction stage (Mar 03 to Apr 07)	WDO, WPCO, PN1/94

EIA Ref.	EM&A Log Ref	Recommended Mitigation Measures	Objectives of the Recommended Measure & Main Concerns to address	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
		gathering ground. Any chemicals to be used including disinfectants and deodorants within the water gathering ground should be subject to the approval of the Director of Water Supplies.					
S6.5.12 - S6.5.13	S6	No earth, building materials, soil and other materials should be stockpiled within the water gathering ground. All surplus spoil should be removed from the water gathering ground as soon as practicable. Any soil contaminated with fuel leaked from plant should be removed from the water gathering ground and the voids arising from removal of contaminated soil should be replaced by suitable material to the approval of the Director of Water Supplies.	Waste minimization and control	Contractor	All construction sites	Construction stage (Jan 03 to Apr 07)	APCO, NCO, WDO, WPCO, PN1/94
S6.5.12	S6	Stockpiles of excavated spoil outside the water gathering ground should be covered to minimise run-off during heavy rainstorms and should be located to minimise visual impacts and nuisance related to noise and dust. Stockpiles of excavated spoil should be covered to minimise run-off during heavy rainstorms. Appropriate haul routes should be designated. Elevated levels of suspended solids in surface water should be prevented through appropriate bunding, interceptors, and direction of run-off into settling ponds.	Waste minimization and control	Contractor	All construction sites	Construction stage (Jan 03 to Apr 07)	APCO, NCO, WDO, WPCO, PN1/94
S6.4.1	S6	The sludge generated from Ngong Ping STW should be dewatered to more than 30% dry solids and transported to the landfills.	Waste minimization and control	DSD	Ngong Ping STW	Operational stage	WDO
S6.4.2 - S6.4.4	S6	The operators of future UV disinfection plant should work with the supplier/manufacturer on recycling and reuse of the defective UV lamps as far as possible. Should the disposal of UV lamps be unavoidable, the operators should identify the content of the UV lamp and confirm with EPD whether the UV lamps should be disposed of as chemical waste. If so, the handling and disposal should follow the Chemical Waste (General) Regulation. In handling the UV lamps, cautions should be exerted to avoid breakage of lamps and release of contaminants.	Waste minimization and control	DSD	Ngong Ping STW	Operational stage	WDO, WRFP
S6.4.5 - S6.4.6	S6	Unless the spent fluids from the wet scrubber system are treated on-site to meet the discharge standards stipulated in the TM under WPCO, they should be handled and disposed of according to the requirements under the Chemical Waste (General) Regulation.	Waste minimization and control	DSD	Ngong Ping STW	Operational stage	WDO, WPCO

EIA Ref.	EM&A Log Ref	Recommended Mitigation Measures	Objectives of the Recommended Measure & Main Concerns to address	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
Landscape and Visual Mitigation Measures							
S 7.7 & Dwg No. 23400/EN /043	S5	Retention and protection of existing woodland trees (CM1)	To mitigate landscape and visual impacts	Contractor	All construction sites	Throughout construction period	EIAO / A Guide to Tree Planting and Maintenance in Urban Hong Kong / WBTC No. 14/2002
S 7.7 & Dwg No. 23400/EN /043	S5	Decorative hoarding along publicly assessable boundaries of the site (CM2)	To mitigate landscape and visual impacts	Contractor	Public areas	Throughout construction period	EIAO
Sec. 7.7 & Dwg No. 23400/EN /043	S5	Topsoil stripped and stored for re-use in the construction of the soft landscape works (CM3)	To mitigate landscape and visual impacts	Contractor	All construction sites	Throughout construction period	EIAO
S 7.7 & Dwg No. 23400/EN /043	S5	Grass Hydroseeding of slopes as soon as they are complete (CM4)	To mitigate landscape and visual impacts	Contractor	Newly formed cut slopes	As soon as they are formed	EIAO / A Guide to Tree Planting and Maintenance in Urban Hong Kong / GEO Publication 1/2000 / WBTC No. 14/2002
S 7.7 & Dwg No. 23400/EN /043	S5	Control of night-time lighting	To mitigate landscape and visual impacts	Contractor	All construction sites	Throughout construction period	EIAO
S 7.11 & Dwg No. 23400/EN /044	S5	Grass hydroseeding and planting of native shrubs and trees to provide green backdrop to the development, and to blend the slope into the surrounding natural slopes, and to compensate for grass and shrubs and trees lost during construction (OM1)	To mitigate landscape and visual impacts	Contractor	Newly formed cut slopes, and boundary areas	As soon as possible	EIAO / A Guide to Tree Planting and Maintenance in Urban Hong Kong / GEO Publication 1/2000 / WBTC No. 14/2002
S 7.11 & Dwg No. 23400/EN /044	S5	Grass hydroseeding (with groundcover) on top of the underground structures within STW site (OM2)	To mitigate landscape and visual impacts	Contractor	On top of underground structures as shown Landscape Proposal	As soon as possible	EIAO / A Guide to Tree Planting and Maintenance in Urban Hong Kong / WBTC No. 14/2002

EIA Ref.	EM&A Log Ref	Recommended Mitigation Measures	Objectives of the Recommended Measure & Main Concerns to address	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
S 7.11 & Dwg No. 23400/EN /044	S5	Grass hydroseeding and tree and shrub planting to screen elevated structures along the souutheastern boundary of STW site, to provide visual interest, and to provide shade and shelter (OM3).	To mitigate landscape and visual impacts	Contractor	Roadside area as shown on Landscape Proposal	As soon as possible	EIAO / A Guide to Tree Planting and Maintenance in Urban Hong Kong / WBTC No. 14/2002
S 7.11, 7.12 & Dwg No. 23400/EN /044	S5	Sensitive architectural and chromatic treatment of the elevated structures (OM4)	To mitigate landscape and visual impacts	Contractor	STW site	During structural construction	EIAO
S 7.11, 7.12 & Dwg No. 23400/EN /044	S5	Night Lighting should be designed to minimise glare to all receivers (OM5)	Contractor	Contractor	All areas within STW site	Throughout construction period	TMEIA
Cultural Heritage Mitigation Measures							
S10.8.2	S8	The entire construction workforce should be informed of the locations of the identified sites of cultural heritage and special attention should be given during the entire process of project construction to avoid any damage to these cultural remains. Construction sites which are close to these cultural remains should be posted with notices at conspicuous locations to remind the workers not to make any disturbance to these cultural remains. It is recommended to avoid the use of mechanical equipment in any works area which is less then 5 m away from the boundary of the identified sites of cultural heritage.	To avoid any damage to historic ruins	Contractor	All construction sites	Construction stage (Jan 03 to Apr 07)	Antiquities and Monuments Ordinance
Ecological Mitigation Measures							
S8.5.7	S7	Special attention should be paid to the stream in which Romer's Tree Frog has been observed breeding (Drawing No. 23400/EN/067a). It is recommended that earthworks near this stream should not be carried out during the breeding season of Romer's Tree Frog (March to September).	Protect ecological sensitive receivers	Contractor	Breeding stream of Romer's Tree Frog (Ref: Drawing No. 23400/EN/067a)	Construction stage (Jan 03 to Apr 07)	EIAO
S8.6	S7	Prevention of surface runoff entering streams or estuary	Control of site runoff	Contractor	Any works area approaching streams or estuary	Construction stage (Jan 03 to Apr 07)	PN 1/94, WPCO

APPENDIX B

Sample Forms for EM&A Programme

Sample Template for Interim Notifications of Environmental Quality Limits Exceedances

~~Incident Report on Action Level or Limit Level Non-compliance~~

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

Location Plan

Prepared by: _____

Designation: _____

Signature: _____

Date: _____

Data Sheet for TSP Monitoring

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

	Name & Designation	Signature	Date
Field Operator :	_____	_____	_____
Laboratory Staff :	_____	_____	_____
Checked By :	_____	_____	_____

Sample of Odour Complaint Registration Form

Subject	Description
Name of Complainant:	
Complainant's Contact Information	
Tel:	
Fax:	
Address:	
Location of Odour Nuisance:	
Date of Odour Nuisance:	
Time of Odour Nuisance:	
Type of Odour Nuisance:	
Extent of Odour Strength:	Highly Offensive/Offensive/Slightly Offensive/ Continuously Detectable/Intermittently Detectable/
Meteorological Conditions:	
Temperature:	
Wind Speed:	
Relative Humidity:	
Wind Direction:	
SPS Operation Condition: Details of Operation Conditions:	Normal/Abnormal

Noise Monitoring Field Record Sheet

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

		Name & Designation	Signature	Date
Recorded By	:	_____	_____	_____
Checked By	:	_____	_____	_____

Effluent Quality Monitoring Data Record Sheet

Location	
Date	
Start Time (hh:mm)	
Weather	
Sea Conditions	
Tidal Mode	
Water Depth (m)	
Monitoring Depth	1m below the surface
pH	
Salinity (mg/l)	
Temperature (°C)	
BOD_5 (mg/l)	
COD (mg/l)	
Turbidity (NTU)	
SS (mg/l)	
NH_3-N (mg/l)	
TIN (mg/l)	
TIP (mg/l)	
E.coli (pfu/100ml)	
Observations	

	Name & Designation	Signature	Date
Recorded By :	_____	_____	_____
Checked By :	_____	_____	_____

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

Marine Water Quality Monitoring Data Record Sheet

Location				
Date				
Start Time (hh:mm)				
Weather				
Sea Conditions				
Tidal Mode				
Water Depth (m)				
Monitoring Depth		Surface	Middle	Bottom
pH				
Salinity (mg/l)				
Temperature (^{o}C)				
DO Saturation (%)				
DO (mg/l)				
BOD_5 (mg/l)				
Turbidity (NTU)				
SS (mg/l)				
NH_3-N (mg/l)				
TIN (mg/l)				
E.coli (pfu/100ml)				
Observed Construction Activities	<100m from location			
	>100m from location			
Other Observations				

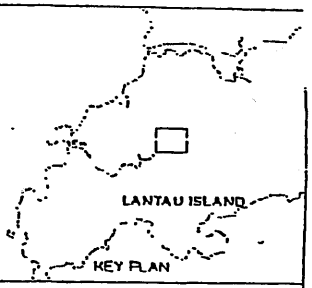
	Name & Designation	Signature	Date
Recorded By :	_____	_____	_____
Checked By :	_____	_____	_____

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

APPENDIX C

Construction Programme of the Project

DRAWINGS



Legend

- Dust monitoring station
- Noise monitoring station

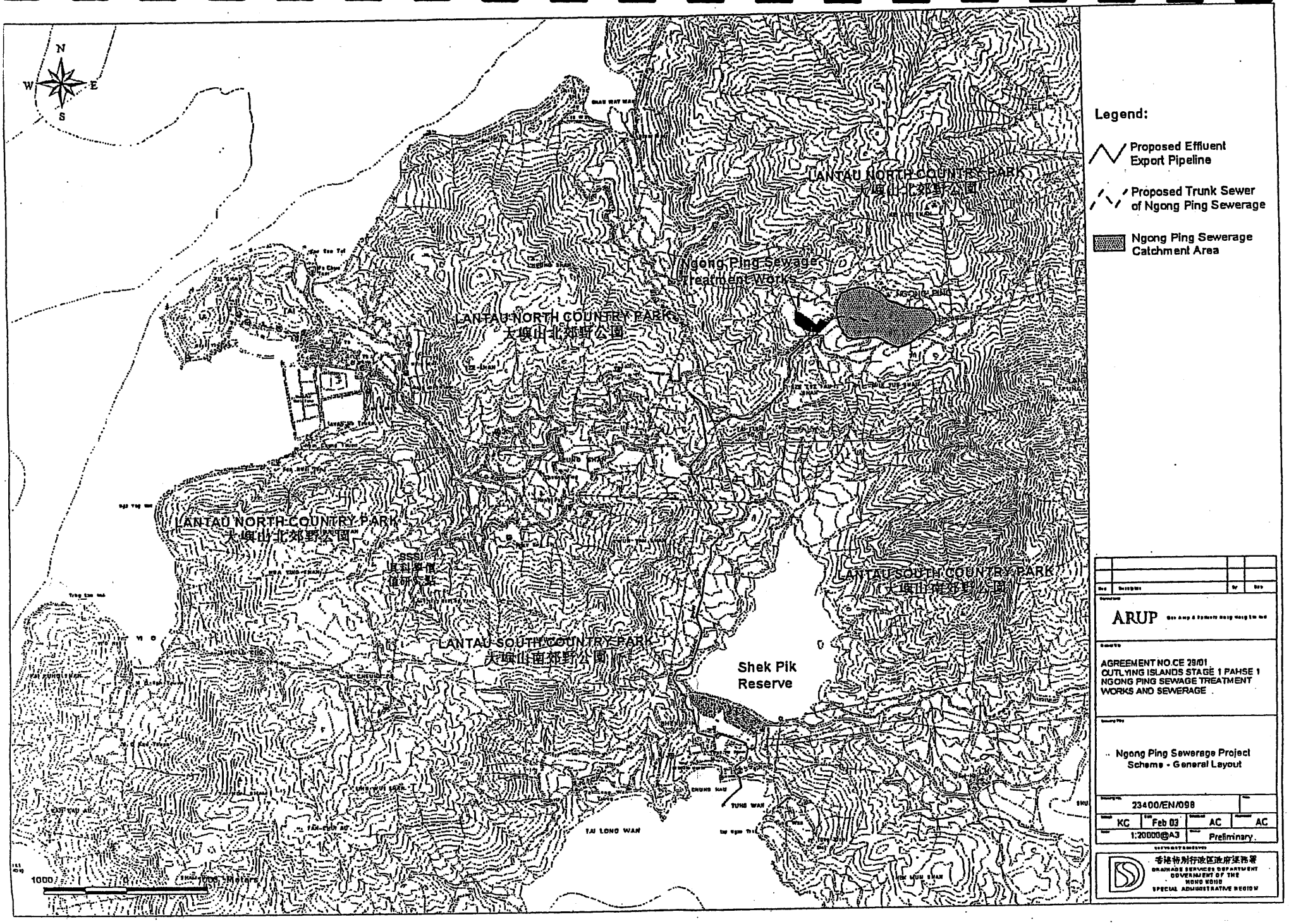
ARUP

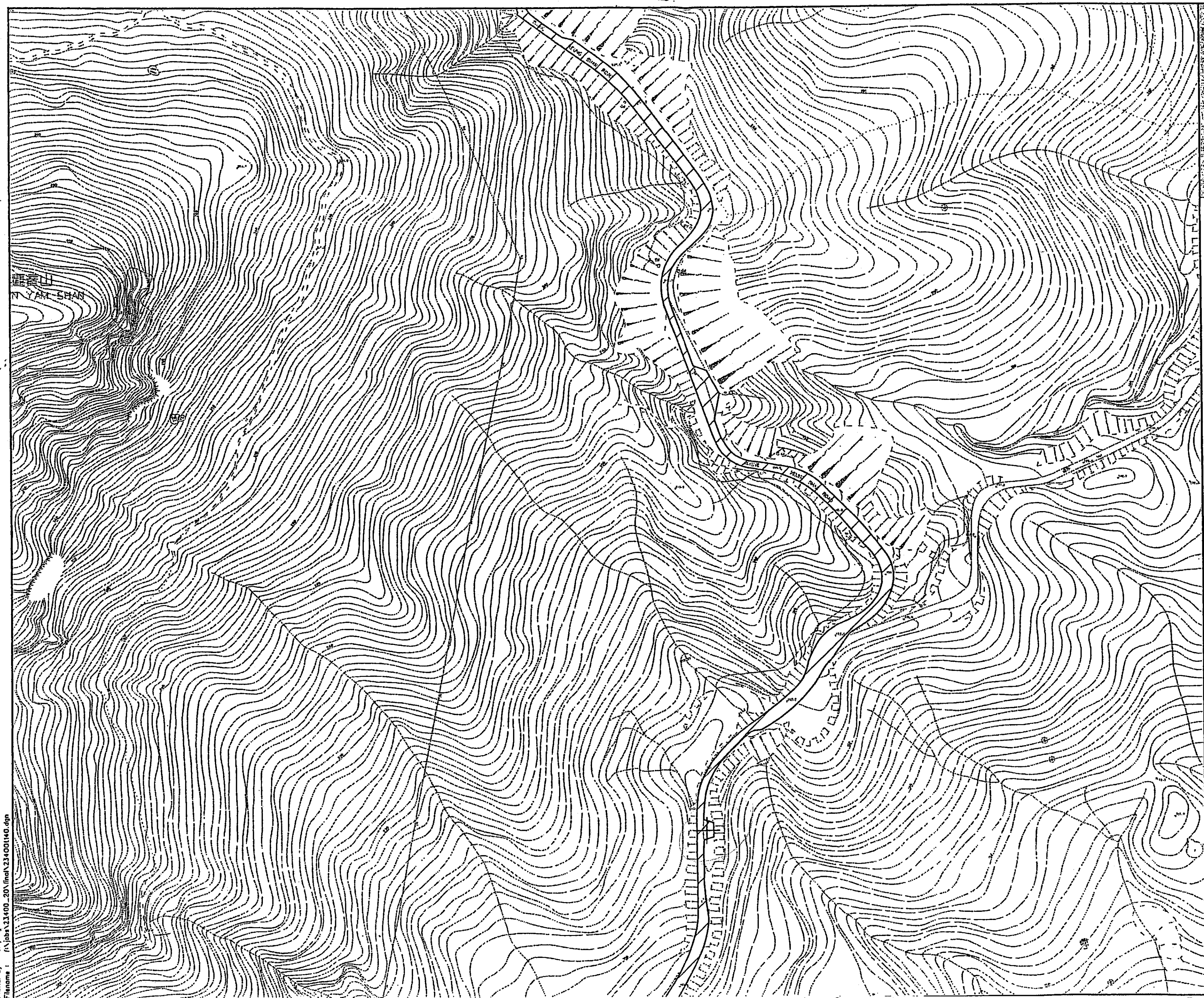
AGREEMENT NO.CE 29/01
OUTLYING ISLANDS STAGE 1 PAHSE 1
NGONG PING SEWAGE TREATMENT WORKS AND SEWERAGE

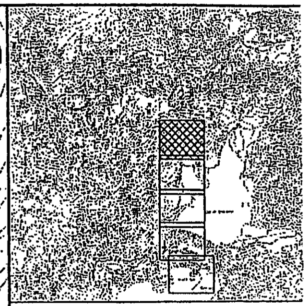
Locations of Noise and Dust Monitoring Stations

23408/EN/094			
JS	Mar 02	PP	AC
1:4,000@A3		Preliminary	

DRAINAGE SERVICES DEPARTMENT
GOVERNMENT OF THE HONG KONG SPECIAL ADMINISTRATIVE REGION


N
W
E
S
LANTAU NORTH COUNTRY PARK
大嶼山北郊野公園
Ngong Ping Sewage Treatment Works
LANTAU NORTH COUNTRY PARK
大嶼山北郊野公園
LANTAU NORTH COUNTRY PARK
大嶼山北郊野公園
SSSI
LANTAU SOUTH COUNTRY PARK
大嶼山南郊野公園
LANTAU SOUTH COUNTRY PARK
大嶼山南郊野公園
Shek Pik Reserve
TUNG WAN
TAI LONG WAN
1000
0
1000 Meters
Legend:
Proposed Effluent Export Pipeline
Proposed Trunk Sewer of Ngong Ping Sewerage
Ngong Ping Sewerage Catchment Area
ARUP
AGREEMENT NO.CE 29/01
OUTLYING ISLANDS STAGE 1 PAHSE 1
NGONG PING SEWAGE TREATMENT WORKS AND SEWERAGE
Ngong Ping Sewerage Project
Scheme - General Layout
23400/EN/098
KC
Feb 03
AC
AC
1:20000@A3
Preliminary
香港特別行政區政府渠務署
DRAINAGE SERVICES DEPARTMENT
GOVERNMENT OF THE
HONG KONG
SPECIAL ADMINISTRATIVE REGION





KEY PLAN

LENGENDS:

+ WATER MONITORING BOREHOLE

WORKS SITE

NOTES:

1. EXACT LOCATION OF WATER MONITORING BOREHOLE TO BE DETERMINED ON SITE

2. REFER DRAWING NO. 23400/T/144 FOR INSTALLATION DETAILS

Rev	Description	By	Date
A	TENDER ISSUE	DKL	04/0.

Consultants

ARUP Ove Arup & Partners Hong Kong Limited

Project title

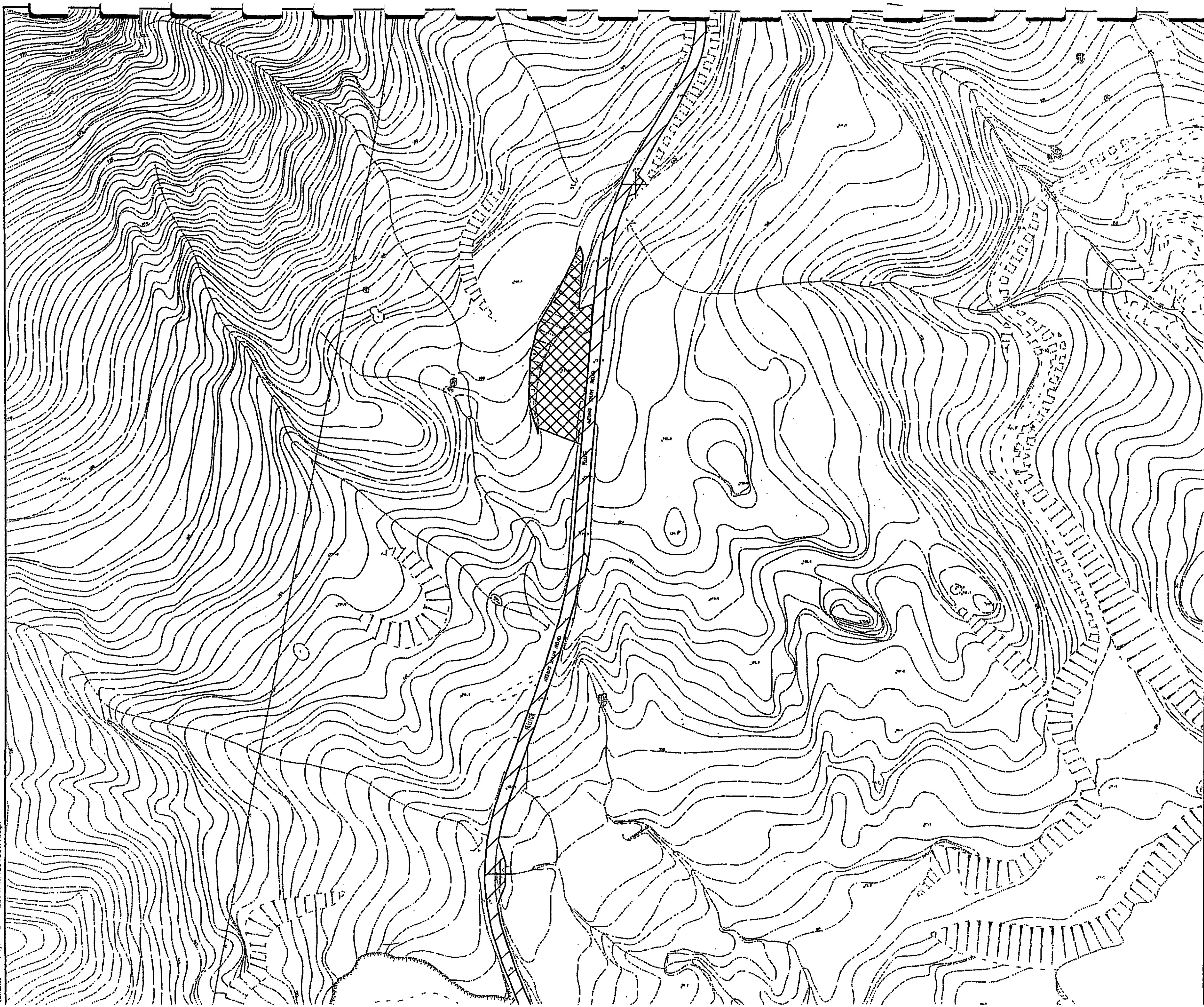
CONTRACT NO. DC/2003/01
NGONG PING SEWAGE TREATMENT PLANT, TRUNK SEWERS AND EFFLUENT EXPORT PIPELINE

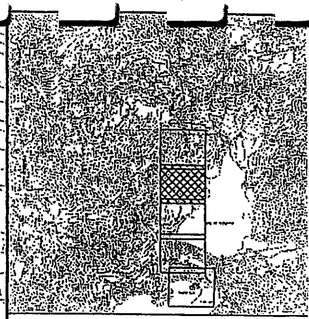
Drawing title

WATER MONITORING BOREHOLES
(SHEET 1 OF 4)

Drawing no.	23400/T/140		Rev. A
Drawn TSN	Date NOV 02	Checked DKL	Approved YWY
Scale 1:1000 (A1) 1:2000 (A3)		Status TENDER	

香港特別行政區政府渠務署
DRAINAGE SERVICES DEPARTMENT
GOVERNMENT OF THE HONG KONG SPECIAL ADMINISTRATIVE REGION





KEY PLAN

LENGENDS:

WATER MONITORING BOREHOLE

WORKS SITE

NOTES:

1. EXACT LOCATION OF WATER MONITORING BOREHOLE TO BE DETERMINED ON SITE

2. REFER DRAWING NO. 23400/T/14A FOR INSTALLATION DETAILS

Rev	Description	By	Date
A	TENDER ISSUE	DW	04/03

Consultants

ARUP Ove Arup & Partners Hong Kong Limited

Project title

CONTRACT NO. DC/2003/01
NGONG PING SEWAGE TREATMENT PLANT, TRUNK SEWERS AND EFFLUENT EXPORT PIPELINE

Drawing title

WATER MONITORING BOREHOLES (SHEET 2 OF 4)

Drawing no. 23400/T/141			Rev. A
Drawn TSN	Date NOV 02	Checked DW	Approved YWY
Scale 1:1000 (A1) 1:2000 (A3)		Status TENDER	

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DRAINAGE SERVICES DEPARTMENT
GOVERNMENT OF THE HONG KONG SPECIAL ADMINISTRATIVE REGION

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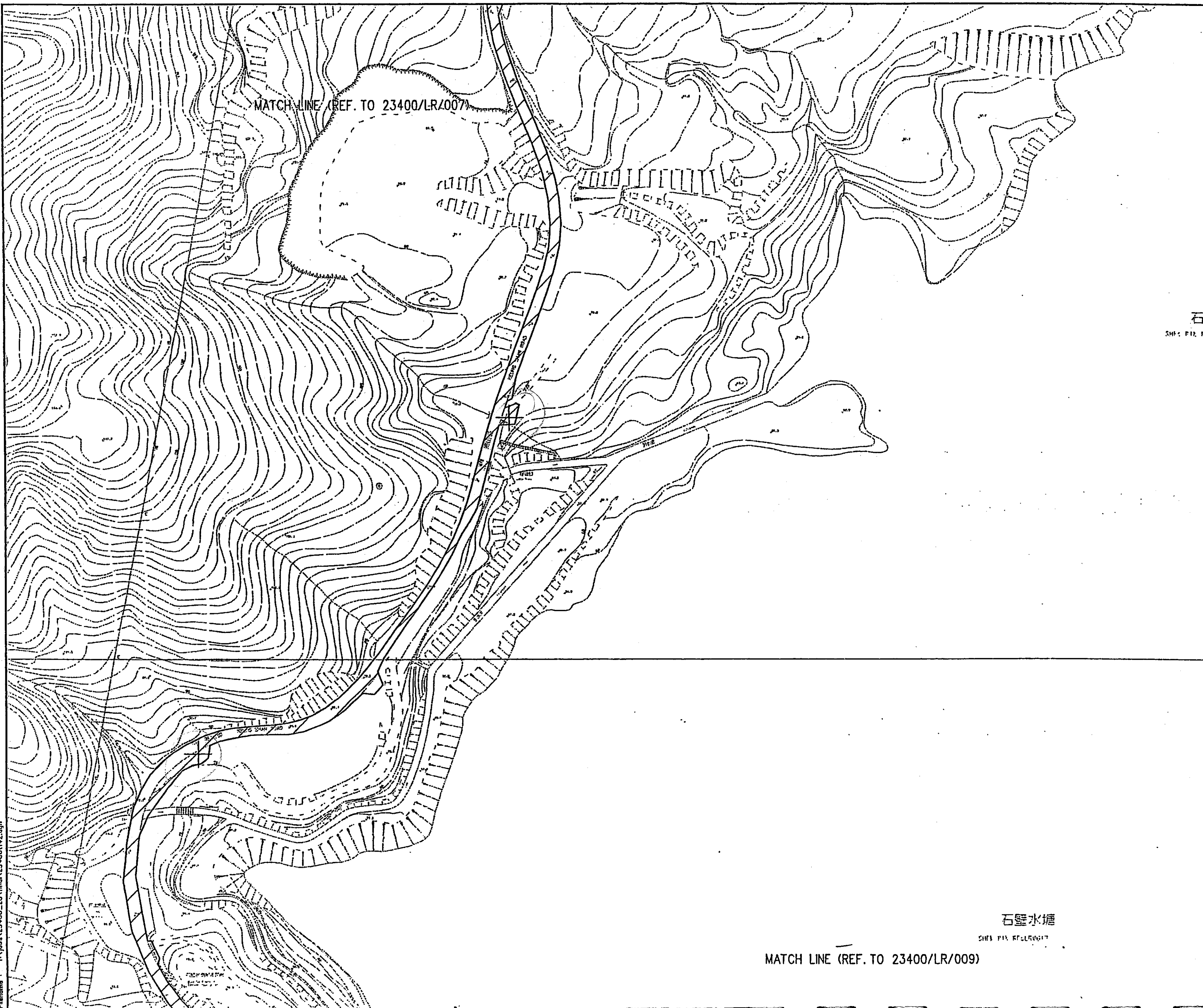
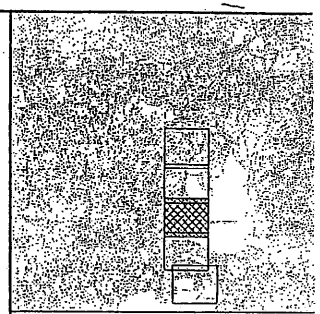




KEY PLAN

LENGENDS:

+ WATER MONITORING BOREHOLE

NOTES:

1. EXACT LOCATION OF WATER MONITORING BOREHOLE TO BE DETERMINED ON SITE

2. REFER DRAWING NO. 23400/T/144 FOR INSTALLATION DETAILS

Rev	Description	By	Date
A	TENDER ISSUE		04/03

Consultants

ARUP Ove Arup & Partners Hong Kong Limited

Project title

CONTRACT NO. DC/2003/01
NGONG PING SEWAGE TREATMENT PLANT, TRUNK SEWERS AND EFFLUENT EXPORT PIPELINE

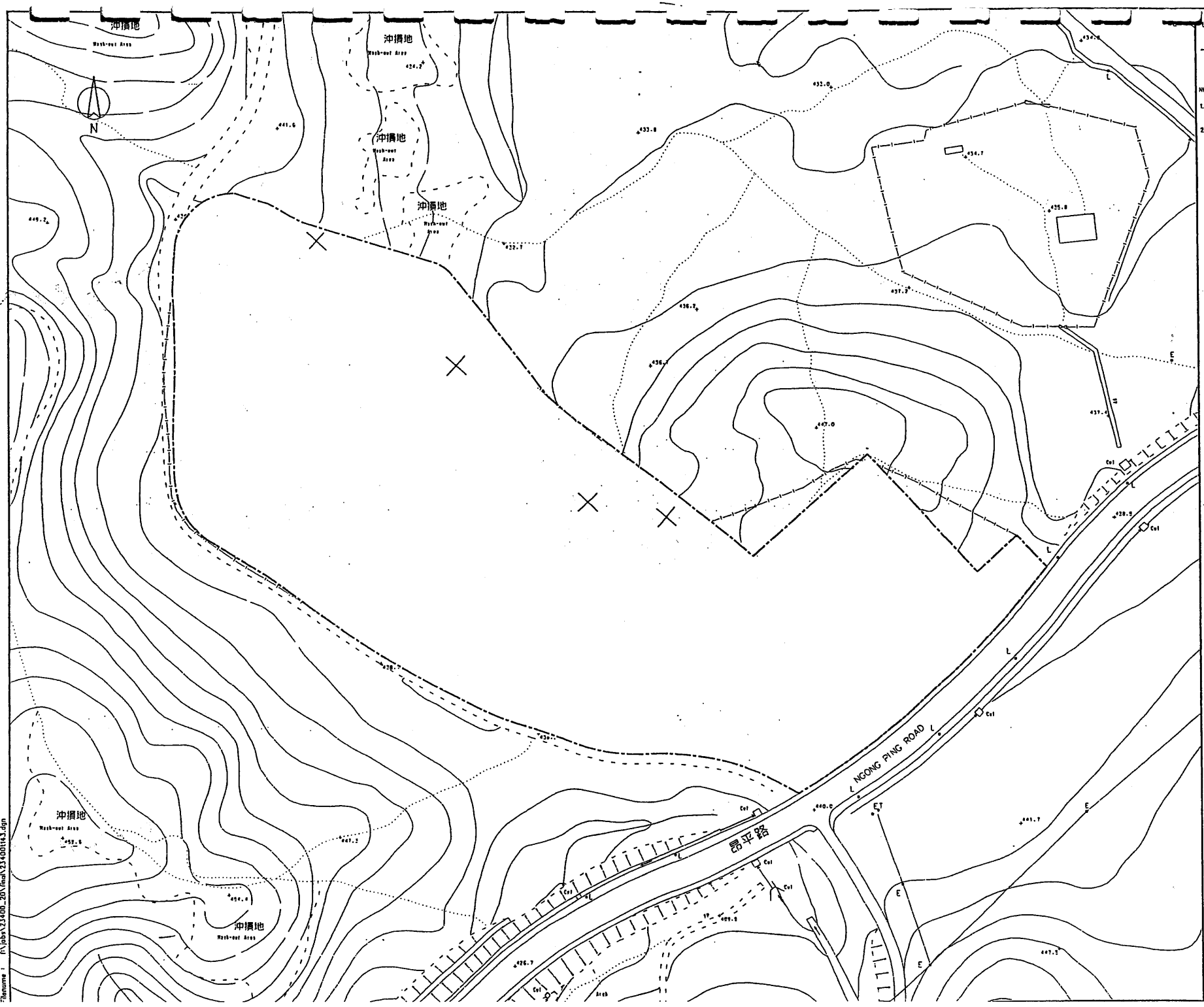
Drawing title

WATER MONITORING BOREHOLES (SHEET 3 OF 4)

Drawing no.	23400/T/142	Rev.	A
Drawn TSN	Date NOV 02	Checked	Approved
Scale 1:1000 (A1) 1:2000 (A3)		Status TENDER	

香港特別行政區政府渠務署
DRAINAGE SERVICES DEPARTMENT
GOVERNMENT OF THE HONG KONG SPECIAL ADMINISTRATIVE REGION

Filename : (r:\jobs\23400_20\final\23400t142.dgn



LEGENDS:

WATER MONITORING BOREHOLE

NOTES:

1. EXACT LOCATION OF WATER MONITORING BOREHOLE TO BE DETERMINED ON SITE
2. REFER DRAWING NO. 23400/T/144 FOR INSTALLATION DETAILS

Rev	Description	By	Date
A	TENDER ISSUE	CWL	04/03

Consultants

ARUP Ove Arup & Partners Hong Kong Limited

Project title

CONTRACT NO. DC/2003/01
NGONG PING SEWAGE TREATMENT PLANT, TRUNK SEWERS AND EFFLUENT EXPORT PIPELINE

Drawing title

WATER MONITORING BOREHOLES (SHEET 4 OF 4)

Drawing no.			Rev.
23400/T/143			A
Drawn: TSN	Date: NOV 02	Checked: CWL	Approved: YWY
Scale: 1:500 AT A1, 1:1000 AT A3		Status: TENDER	

香港特別行政區政府渠務署
DRAINAGE SERVICES DEPARTMENT
GOVERNMENT OF THE HONG KONG SPECIAL ADMINISTRATIVE REGION

Plotted by : ai-yung kwok@03/03/2003
Filename : f:\jobs\23400_20\final\234001143.dgn