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Environmental Protection Department
The Government of the Hong Kong
Special Administrative Region

South East New Territories (SENT) Landfill Extension

Updated Environmental Monitoring & Audit Manual

March 2020

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South East New Territories (SENT) Landfill Extension

Environmental Certification Sheet
EP-308/2008/B and FEP-01/308/2008/B

Reference Document/Plan

Document/Plan to be Certified/Verified:	Updated Environmental Monitoring & Audit Manual for South East New Territories (SENT) Landfill Extension
Date of Report:	19 March 2020

Reference EP Condition

EP Condition:	Condition No. 3.1

The EM&A programme shall be implemented in accordance with the procedures and requirements as set out in the EM&A Manual. Any changes to the programme shall be justified by the ET leader and verified by the IEC as conforming to the information and requirements contained in the EM&A Manual before submission to the Director for approval.

ET Certification

I hereby certify that the above referenced document/plan complies with the above referenced condition of EP-308/2008/B and FEP-01/308/2008/B.

Frank Wan,
Environmental Team Leader:
(ERM Hong-Kong, Limited)

Date: 19 March 2020

IEC Verification

I hereby verify that the above referenced document/plan complies with the above referenced condition of EP-308/2008/B and FEP-01/308/2008/B.

W.K. Chiu,
Independent Environmental Checker:
(Meinhardt Infrastructure and Environment Limited)

Date: 19/3/2020

South East New Territories (SENT) Landfill Extension

Updated Environmental Monitoring & Audit Manual

Environmental Resources Management

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Summary:

This document presents the Updated Environmental Monitoring & Audit Manual for *South East New Territories (SENT) Landfill Extension*

Project No:

0465169

Date:
19 March 2020

Approved by:

Frank Wan
Partner

Revision	Description	By	Checked	Approved	Date
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CONTENTS

1 INTRODUCTION

1.1 PURPOSE OF THE MANUAL

1.1.1 Background

The *Environmental Impact Assessment (EIA) Report* and the associated *Environmental Monitoring and Audit (EM&A) Manual* for the construction, operation, restoration and aftercare of the South East New Territories Landfill Extension (SENTX) (hereafter referred to as "the Project") have been approved under the *Environmental Impact Assessment Ordinance (EIAO)* in May 2008 (Register No.: AEIAR-117/2008). Since then, the Hong Kong SAR Government has decided to reduce the scale of the design scheme of SENTX assessed in the approved *EIA Report* and SENTX will only receive construction waste. In line with the changes proposed by EPD, the landfill contractor for SENTX, Green Valley Landfill Limited (GVL), has developed a final scheme for SENTX (hereafter "the latest scheme") in 2016. This latest design complies with the requirements in the *Technical Memorandum of the Environmental Impact Assessment Process (EIAO-TM)* and the current Environmental Permit (EP-308/2008/B).

This updated EM&A Manual has taken into account the findings and recommendation of the approved *EIA Report* and with updates taken from the current EP and the latest design to reflect the necessary environmental monitoring and audit (EM&A) requirements associated with the construction, operation/ restoration and aftercare of the SENTX under the latest design.

This updated Manual has been prepared with reference to the approved *EM&A Manual* prepared in May 2008, the current EP, the latest design and the *EIAO-TM*. The purpose of the Manual is to provide information, guidance and instruction to personnel charged with environmental duties and those responsible for undertaking EM&A work during construction, operation/restoration and aftercare phases of the SENTX. It provides systematic procedures for the environmental monitoring and auditing of the potential environmental impacts that may arise from the Project.

1.2 PROJECT DESCRIPTION

1.2.1 Background

The existing waste disposal facility in the South-east New Territories is the SENT Landfill at Tseung Kwan O (TKO). The Hong Kong SAR Government has identified a 13 ha site at TKO Area 137 for the extension of the SENT Landfill (hereafter refer to "SENTX") (see *Figure 1.2a*).

Under the latest design, the SENTX has a net void capacity of about 6.5 Mm^3 and provides an additional lifespan of about 6 years, commencing operation

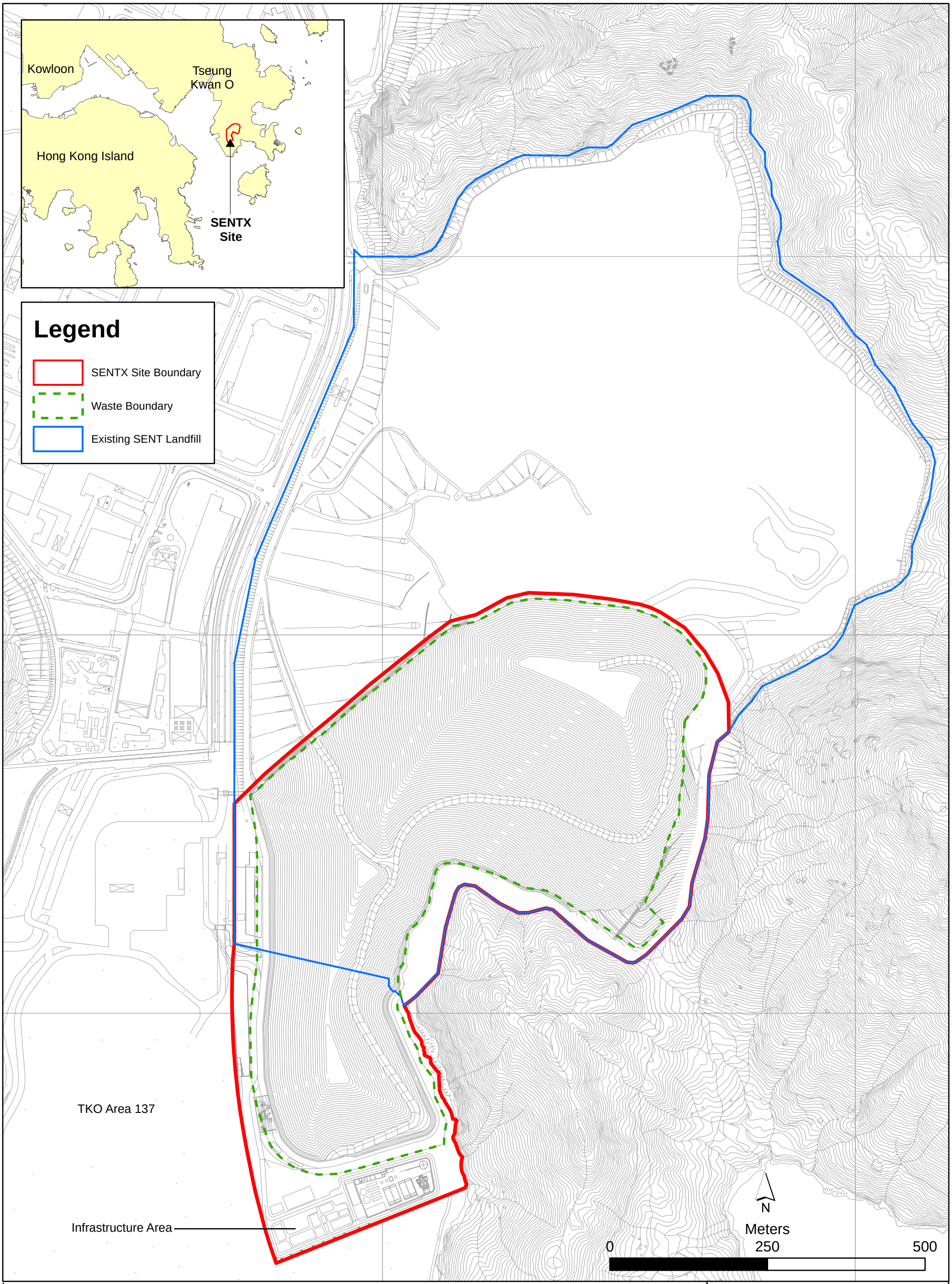

Figure 1.2a

Layout Plan of SENTX (GVL Scheme)

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Date: 12/8/2016

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upon exhaustion of the SENT Landfill. The SENTX will receive construction waste only.

The design, construction, operation, restoration and aftercare of the SENTX shall comply with the requirement stipulated in the EP (EP-308/2008/B).

1.2.2 The Project

The SENTX is a piggyback landfill, occupying the southern part of the existing SENT Landfill (including its infrastructure area) and 13 ha of TKO Area 137. A layout plan of the SENTX is shown in *Figure 1.2a*. The key elements of the construction, operation/restoration and aftercare of the SENTX are described below.

Construction of SENTX

Construction works will commerce about two years prior to the operation of the SENTX. The major construction works includes:

- Site formation at the TKO Area 137 and the existing infrastructure area at SENT Landfill;
- Construction of surface and groundwater drainage systems;
- Construction of the leachate containment and collection systems;
- Construction of new leachate and landfill gas treatment facilities, site offices, maintenance yards at the new infrastructure area;
- Construction of new pipelines to transfer the leachate and landfill gas collected from the existing SENT Landfill to the treatment facilities at the new infrastructure area;
- Construction of the site access and new waste reception facilities; and
- Demolition of the facilities at the existing SENT Landfill infrastructure area.

Operation and Restoration of SENTX

The leachate and landfill treatment facilities will be commissioned and the first phase of the SENTX will start operation upon exhaustion of the SENT Landfill. Construction of the leachate containment and collection system for the subsequent phases will continue while the first phase of the SENTX is in operation. The areas that reach the finished profile will be progressively restored and landscaped.

Aftercare of SENTX

Upon the completion of final filling and restoration, the aftercare of the SENTX will begin and last for 30 years. Regular site maintenance, collection and treatment of landfill gas and leachate will be undertaken during the

aftercare period to ensure that the landfill complies with the required environmental performance requirements and is safe. The restored landfill may then be developed for various passive beneficial uses (eg open spaces, walking trails, etc).

An EM&A programme will be implemented throughout the construction, operation/restoration and aftercare phases of the SENTX.

Implementation Programme

The key implementation of milestone of the Project is indicatively summarised in *Table 1.2a*.

Table 1.2a Estimated Key Dates of Implementation Programme

Key Stage of the Project	Indicative Date
Start construction	31 December 2018
Commissioning of new infrastructure facilities	2020
Demolition of existing infrastructure facilities	2021
Start waste intake at SENTX	2021 or upon exhaustion of SENT Landfill
Stop taking waste at SENTX	2027
End of aftercare for SENTX	2057

1.3 OBJECTIVES OF THE EM&A PROGRAMME

The potential environmental impacts associated with the Project have been assessed and described in the approved *EIA Report*. Mitigation measures are required to comply with the environmental criteria. The updated mitigation measures associated with the latest design and their implementation requirements are presented in the Implementation Schedule (see *Annex A)*. An EM&A programme will be implemented to assess the effectiveness of measures and to confirm that there will be no adverse environmental impacts during all phases of the Project. Regular site audits will be undertaken during the construction and operation/restoration phases to check whether good site practices are properly implemented to prevent adverse environmental impacts. Any activities that have a potential to cause adverse environmental impacts are identified before the adverse impacts occurred. *Ad hoc* visits to the impacted sites should also be undertaken in response to any complaints or reported non-compliance with environmental standards in order to enable prompt actions are taken to address the impacts.

This updated EM&A Manual provides details of the updated EM&A requirements associated with the latest design (SENTX only accept construction waste). The main objectives of the EM&A programme are to:

- verify the environmental impacts predicted in the *EIA Report* taking account of latest design;

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

1.4 SCOPE OF THE EM&A PROGRAMME

Table 1.4a summarises the requirements at various phases of the Project.

Table 1.4a Summary of EM&A Requirements

Parameter	EM&A Phase		
	Construction	**Operation/ Restoration**	**Aftercare**
Dust	✓	✓	✓ **(b)**
Ambient Volatile Organic Compounds (VOC), Ammonia and Hydrogen Sulphide (H_2S)	✓ (a)	✓	✓
Stack emissions from Flares and Thermal Oxidizers		✓	✓ **(d)** **(flares only)**
Odour		✓	✓ **(b)**
Surface Water	✓	✓	✓
Groundwater	✓ (a)	✓	✓
Leachate		✓	✓
Landfill Gas	✓ (a)	✓	✓
Noise	✓	✓	✓ **(b)**
Waste Management (c)	✓	✓	
Ecology (c)	✓	✓	✓
Landscape and Visual (c)	✓	✓	✓

Notes:

(a) The monitoring of VOCs, ammonia, H_2S, groundwater and landfill gas during construction would act as baseline monitoring for operation impact

(b) The monitoring and audit of dust, odour and noise in aftercare phase will only be required when there are major maintenance / maintenance works requiring excavation of waste.

(c) EM&A scope include audit works only.

(d) Since the leachate quantity will be significantly decreased during aftercare phase, therefore, SBR/MBR tanks should be sufficient to treat the leachate to meet the required standards without the need to operate the thermal oxidiser. Hence, stack emission monitoring will only be conducted at flares only if the thermal oxidiser is no longer in use.

The scope of the EM&A programme is to:

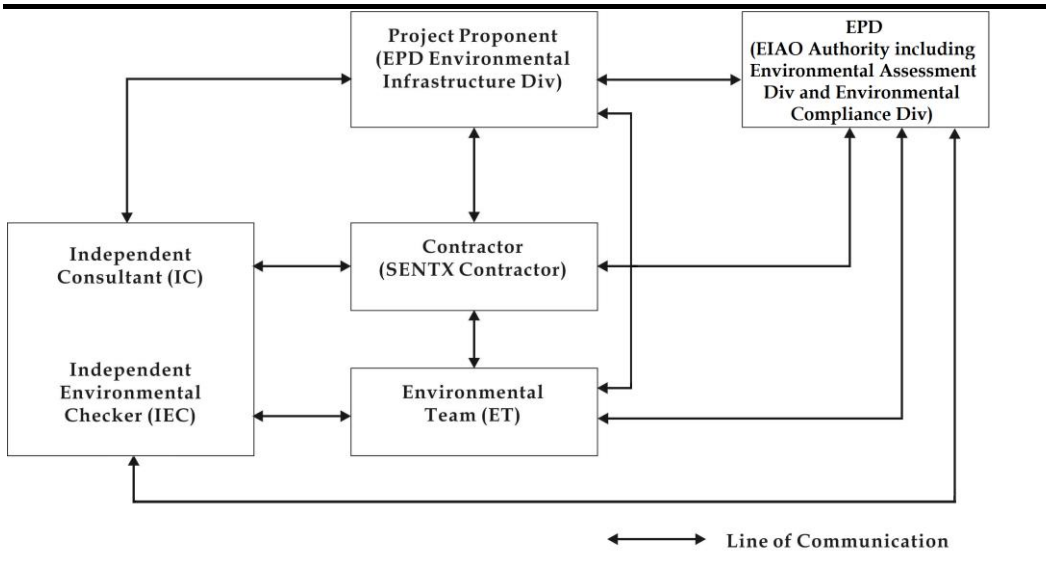
- implement regular monitoring and site audit requirements and undertake additional or *ad hoc* monitoring if non-compliance identified;
- evaluate and interpret all environmental monitoring data on a regular basis to provide an early indication should any of the environmental control measures or practices fail to achieve the required performance standards, and to verify the environmental impacts predicted in the *EIA Report* taking account of the latest design;
- liaise with, and provide environmental advice (as requested or when otherwise necessary) to construction/operation site staff on the comprehension and consequences of the environmental audit;
- identify and resolve environmental issues that may arise from the Project;
- investigate environmental complaints associated with the Project;
- check and evaluate the Contractor's overall environmental performance, and the effectiveness of the remedial actions; and
- prepare and submit EM&A reports which summarise project monitoring and auditing data, with full interpretation illustrating the acceptability or otherwise of any environmental impacts and identification or assessment of the implementation status of agreed mitigation measures.

1.5 ORGANISATION AND STRUCTURE OF THE EM&A PROGRAMME

1.5.1 Project Organisation

The proposed organisation of the personnel involved in the EM&A process is illustrated in *Figure 1.5a.*

Figure 1.5a Organisation Chart



The roles and responsibilities of the various parties are summarised below:

- **Project Proponent:** Environmental Infrastructure Division, EPD

- **Independent Consultants (IC)**: The IC should be responsible for overseeing the Project undertaken by the Contractor and for ensuring that the Project is undertaken by the Contractor in accordance with the specification and contractual requirements. The responsibilities for the IC include the following:

  - Verify and check the Contractor's activities and ensure that the requirements in the Contract Specifications, including the implementation and operation of the environmental mitigation measures and other aspects of the EM&A programme are fully complied with (1).

- **Contractor**: The landfill contractor should be responsible for carrying out design, construction, operation, restoration and aftercare of the SENTX.

  The Contractor should:

  - implement environmental controls and mitigation as set out in this EM&A Manual as well as any additional measures necessary for compliance with the environmental control standards;

  - assist the Project Proponent to establish an ET to undertake the monitoring and reporting of the EM&A requirements outlined in this EM&A Manual;

  - submit proposals on mitigation measures in case of exceedances of Action and Limit levels in accordance with the Event and Action Plans;

  - implement measures to reduce impact where Action and Limit levels are exceeded;

  - implement the corrective actions instructed by Project Proponent and advised by the ET;

  - participate in the site inspections undertaken by the ET and undertake any corrective actions advised by the ET; and

  - adhere to the procedures for carrying out complaint investigation.

- **Environmental Team (ET)**: The ET should be responsible for ensuring the implementation of the mitigation measures and EM&A requirements recommended in this EM&A Manual, and report to the Project Proponent

(1) It should be noted that under the SENTX contract, the IC and the IEC is the same company and the checking and verification of the environmental mitigation measures and other aspects of the EM&A programme will be carried by the IEC.

and the EPD (EIAO Authority) on all environmental aspects of the Project. The ET should be led and managed by the ET Leader (or sometimes called Environmental Manager). The ET Leader should have relevant education, training, knowledge, experience and professional qualifications. The ET Leader should possess at least 7 years of experience in EM&A and/or environmental management. The ET shall not be in any way an associated body of the Contractor or the IEC for the Project. The ET should:

- Monitor of the various environmental parameters as required by this or subsequent revisions to the Manual;
- assess the EM&A data and review the success of the EM&A programme determining the adequacy of the mitigation measures implemented and the validity of the predictions in the approved *EIA Report* taking account of the latest design;
- conduct site inspections to investigate and inspect the work equipment and methodologies with respect to pollution control and environmental mitigation, monitor compliance with environmental protection specifications, and to anticipate environmental issues that may require mitigation before the problem arises;
- compile the environmental monitoring data and report the status of the general site environmental conditions and the implementation of mitigation measures resulting from site inspections;
- review working programme and methodology, and comment as necessary;
- investigate and evaluate complaints, and identify corrective measures;
- advice on environmental improvement, awareness, enhancement matters, etc, on site;
- report on the environmental monitoring and audit results and the wider environmental issues and conditions to the Project Proponent and the EPD (EIAO Authority);
- adhere to the agreed protocols in the event of exceedances or complaints; and
- the ET Leader will keep a contemporaneous log-book and record each and every instance or circumstance or change of circumstances which may affect the findings of approved EIA Report (taking account of the latest design) and non-compliance with the EP.

- **Independent Environmental Checker (IEC)**: An IEC will be appointed, as part of the IC, who should verify the overall environmental performance of the Project. The IEC should be responsible for verifying

all environmental submissions required under the EM&A programme and EP to the EPD (EIAO Authority). The IEC should possess at least 7 years of experience in EM&A and/or environmental management. The IEC shall not be in any way an associated body of the Contractor or the ET for the Project.

The IEC should:

- audit the EM&A works performed by the ET (at least at monthly intervals);
- carry out random sample check and audit the monitoring activities and results (at least at monthly intervals);
- conduct site inspections and report the audit/site inspection results and other environmental performance reviews to the Project Proponent;
- review and verify the EM&A reports submitted by the ET;
- review the effectiveness of environmental mitigation measures and project environmental performance;
- check the mitigation measures recommended in this updated EM&A Manual, and ensure they are properly implemented in timely manner when required;
- review the proposal on mitigation measures submitted by the Contractor in accordance with the EAP; and
- adhere to the procedures for carrying out complaint investigation.

- **EPD**: The Authority under the *EIAO*, including the EPD Environmental Assessment Division and EPD Environmental Compliance Division. The EPD will be the authority to approve all submissions under the *EIAO*.

1.6 STRUCTURE OF THE EM&A MANUAL

The remainder of this updated EM&A Manual is set out as follows:

- *Section 2* sets out the EM&A general requirements;
- *Section 3* details the requirements for air quality monitoring;
- *Section 4* details the requirements for water quality and leachate monitoring;
- *Section 5* details the requirements for landfill gas monitoring;
- *Section 6* details the requirements for noise monitoring;

- *Section 7* details the requirements for waste management audit;
- *Section 8* details the requirements for ecological mitigation measures;
- *Section 9* details the requirements for landscape and visual impacts mitigation measures;
- *Section 10* describes the scope and frequency of site auditing;
- *Section 11* details the EM&A reporting requirements;
- *Annex A* contains the implementation schedule summarising all applicable mitigation measures in the approved *EIA Report* taking account of the latest design; and
- *Annex B* contains the monitoring and complaint log sheets.

This updated EM&A Manual is an evolving document that should be updated to maintain its relevance as the Project progresses. The primary focus for these updates will be to ensure the impacts predicted and the recommended mitigation measures remain consistent and appropriate to the manner in which the works are to be carried out. Any changes to the programme shall be justified by the ET Leader and verified by the IEC before submission to the EIAO Authority for approval.

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2 EM&A GENERAL REQUIREMENTS

2.1 INTRODUCTION

The general requirements of the EM&A programme are described in this *Section*. The scope of the programme is developed with reference to the findings and recommendations from the approved *EIA Report* taking account of the latest design.

2.2 EM&A

The potential environmental impacts and the implementation of the recommended mitigation measures for the construction, operation, restoration and aftercare of the SENTX should be monitored through the EM&A programme specified in this EM&A Manual.

The EM&A programme will include regular and ad hoc site inspections/ audits and environmental monitoring. The programme also include the mechanisms to review and assess the Contractor's environmental performance, ensuring that the recommended mitigation measures have been properly implemented, and that timely resolution of received complaints are managed and controlled in a manner consistent with the recommendations of the approved *EIA Report*.

2.2.1 *Environmental Monitoring*

Baseline monitoring and impact monitoring during the construction, operation, restoration and aftercare of the SENTX should be managed by the ET. The monitoring should be focused on the following aspects:

- dust and odour impacts on air sensitive receivers;
- ambient VOCs, ammonia & H_2S along the SENTX Site boundary;
- stack emissions from the flares of landfill gas treatment facilities and the thermal oxidisers of Leachate Treatment Plant (LTP);
- water quality impacts on groundwater and surface water;
- landfill gas concentration at the SENTX Site boundary; and
- effluent flow and quality from the LTP, and leachate level in the landfill;

These are discussed further in *Sections 3* to *10* of this EM&A Manual.

2.2.2 *Compliance with Action and Limit Levels*

The action and limit levels should be defined for environmental monitoring at designated monitoring locations exceeding which a prescribed response

should be required. Individual action and limit levels should be quantitatively defined for the respective environmental monitoring parameters according to the following basic principles:

Action Level

Action levels indicate deteriorating ambient environmental quality potentially due to the Project implementation. It acts as a sign to trigger stepped up monitoring and appropriate remedial actions in order to rectify any mal-practices or non-conformance of Project activities thereby preventing the deterioration of environmental quality and to resume the ambient environmental quality back to normal levels.

Limit Level

Limit levels are the statutory and/or contractual levels above which environmental conditions are considered unacceptable. If limit levels were exceeded, the relevant part of the works should not be continued without implementation of immediate remedial action, including a critical review of plant and working methods.

2.2.3 Event and Action Plans

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

2.2.4 Site Inspections/Audits

In addition to monitoring works as the means of assessing the ongoing environmental performance of the Project, the ET and IEC should undertake site inspections and audits of on-site practices and procedures. The primary objectives of the site inspection and audit programme are to ensure the good site practices and mitigation measures in this updated EM&A Manual are properly implemented and to assess the effectiveness of these measures.

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

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

2.2.5 *Enquiries, Complaints and Requests for Information*

Enquiries, complaints and requests for information can be expected from a wide range of individuals and organisations including members of the public, Government departments, the press and television media and community groups.

All enquiries concerning the environmental impacts of the Project, irrespective of how they are received, should be reported to the Project Proponent and IEC and directed to the Contractor and ET who should set up procedures for handling, investigation and storage of such information. The following steps should be followed:

(a) The ET should notify the IEC of the nature of the enquiry.

(b) An investigation should be initiated to determine the validity of the complaint and to identify the source(s) of the problem.

(c) The ET and the Contractor should undertake the following steps, as necessary:

- investigate and identify source(s) of the problem;
- if considered necessary by the IEC, undertake additional monitoring to verify the existence and severity of the alleged complaint;
- identify necessary remedial measures and implement as soon as possible;
- repeat the monitoring to verify effectiveness of mitigation measures; and
- repeat review procedures to identify further possible areas of improvement if the repeat monitoring results continue to substantiate the complaint.

(d) The outcome of the investigation and the actions taken should be documented on a complaint proforma (see *Annex B*) and should be verified by the IEC. A formal response to each complaint received should be prepared by the Contractor within a maximum of five working days and submitted to the IEC for review. The ET should submit the formal response to the Project Proponent for approval. The Project Proponent will notify the concerned person(s) of the findings of the complaint investigation and the actions taken, if required.

(e) All enquiries/complaints that trigger this process should be reported in the monthly EM&A reports, which should include results of investigations undertaken by the ET and the Contractor, and details of the measures taken, and additional monitoring results (if deemed necessary). It should be noted that the receipt of complaint or enquiry should not be, in itself, a sufficient reason to introduce additional mitigation measures.

In all cases the complainant will be notified of the findings of the investigation.

2.2.6 Reporting

With respect to the identified potential impacts and the nature and frequency of the EM&A to be undertaken, it is considered that real-time reporting of the monitoring data through a dedicated website is not applicable. However, the monitoring data should be uploaded to the Project website at regular interval to be agreed by the EPD (EIAO Authority), Contractor and the Project Proponent.

Monthly EM&A reports prepared by the ET should be certified by the ET Leader and verified by the IEC prior to submission to the Project Proponent and EPD (EIAO Authority). The monthly EM&A reports should be prepared and submitted within 10 working days of the end of each reporting month. Additional details on reporting protocols are presented in *Section 10*.

2.2.7 Cessation of EM&A

The ET will continue to manage the environmental monitoring and site inspection/audit until completion of the Project (i.e. until the completion of the aftercare period).

3 AIR QUALITY

3.1 INTRODUCTION

The general requirements, methodology, equipment, and mitigation measures for the monitoring and audit of potential air quality impacts associated with different phases of the Project are described in this *Section*. The air quality monitoring parameters includes:

- Dust;
- Ambient volatile organic compounds (VOCs), ammonia and hydrogen sulphide (H_2S);
- Odour;
- Emission from the thermal oxidiser of the LTP;
- Emission from LFG flares; and
- Emission from LFG generator.

The requirements of setting up a meteorological station are also described in this *Section*.

The mitigation measures recommended to control air quality impacts are summarised in *Annex A*.

3.2 DUST

3.2.1 Introduction

Monitoring of the Total Suspended Particulates (TSP) levels should be carried out to ensure that construction works and operation/ restoration of SENTX will not cause adverse dust impacts to the identified air sensitive receivers. During the aftercare phase, monitoring of dust should also be conducted when there are major maintenance works. Timely action should be taken to rectify the situation if an exceedance is detected.

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, any other special phenomena and work progress of the concerned site should be recorded. A sample data log sheet is shown in *Annex B*.

3.2.2 Monitoring Equipment

A high volume air sampler in compliance with the following specifications should be used for TSP monitoring:

- capable of collecting TSP in the range of 10 to 750 μg m^{-3};
- 0.6 to 1.7 m^3 min^{-1} (20-60 SCFM) adjustable flow range;
- equipped with a timing/control device with +/- 5 minutes accuracy for 24 hours operation;
- installed with elapsed-time meter with +/- 2 minutes accuracy for 24 hours operation;
- capable of providing a minimum exposed area of 406 cm^2 (63 in^2);
- flow control accuracy: +/- 2.5% deviation over 24-hr sampling period;
- equipped with a shelter to protect the filter and sampler;
- incorporated with an electronic mass flow rate controller or other equivalent devices calibrated against a traceable standard at regular intervals;
- equipped with a flow recorder for continuous monitoring;
- provided with a peaked roof inlet;
- equipped with a manometer;
- able to hold and seal the filter paper to the sampler housing in a horizontal position;
- easy to change the filter; and
- capable of operating continuously for 24-hr period.

The Contractor should be responsible for provision of the monitoring equipment, and should ensure that sufficient number of high volume air samplers and appropriate calibration kits are available for carrying out the baseline, impact and *ad hoc* monitoring. All the equipment, calibration kit, filter papers, etc. should be clearly labelled.

The Contractor should calibrate the dust monitoring equipment 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 concerned parties, such as the IEC. All the data should be converted into standard temperature and pressure condition.

The flow-rate of the sampler before and after the sampling exercise with the filter in position should be verified to be constant and recorded in the data sheet as described in *Section 3.2.1*.

Meteorological data should be obtained from the on-site meteorological monitoring station as described in *Section 3.9*.

3.2.3 Laboratory Measurement/ Analysis

A clean laboratory with constant temperature and humidity control and equipped with necessary measuring and conditioning instruments should be used for sample analysis and equipment calibration and maintenance. The laboratory should be HOKLAS accredited.

If a site laboratory (HOKLAS accredited) is set up or a non-HOKLAS accredited laboratory is hired for carrying out the laboratory analysis, the laboratory equipment should be fully justified by ET Leader, verified by IEC and approved by EPD (EIAO Authority). Measurement performed by the laboratory should be demonstrated to the satisfaction of the EPD (EIAO Authority) and the IEC. The IEC should conduct regular audits of the measurements performed by the laboratory to ensure the accuracy of the results. The ET should provide Contractor and the IEC with one copy each of the *Title 40 of the Code of Federal Regulations, Chapter 1 (Part 50), Appendix B* and *Appendix J* for reference.

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

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

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

3.2.4 Monitoring Locations

Construction Phase

High volume air samplers (HVSs) should be installed at the two designated locations at ASRs (i.e. DM1 and DM2) as shown in *Figure 3.2a.*

DM1 is located at TKO Fill Bank site boundary which is representative of the impact to the ASRs at the TKO industrial area including the nearest ASR TVB City.

DM2 is located at the existing TKO Fill Bank site office as TKO Fill Bank will continue to operate for the next 5 year during the construction phase of the SENTX; while the two planned ASRs which are the Construction & Demolition Material Handling Facility and the TKO Desalination Plant will not exist during construction phase of SENTX by 2021 according to the latest information available.

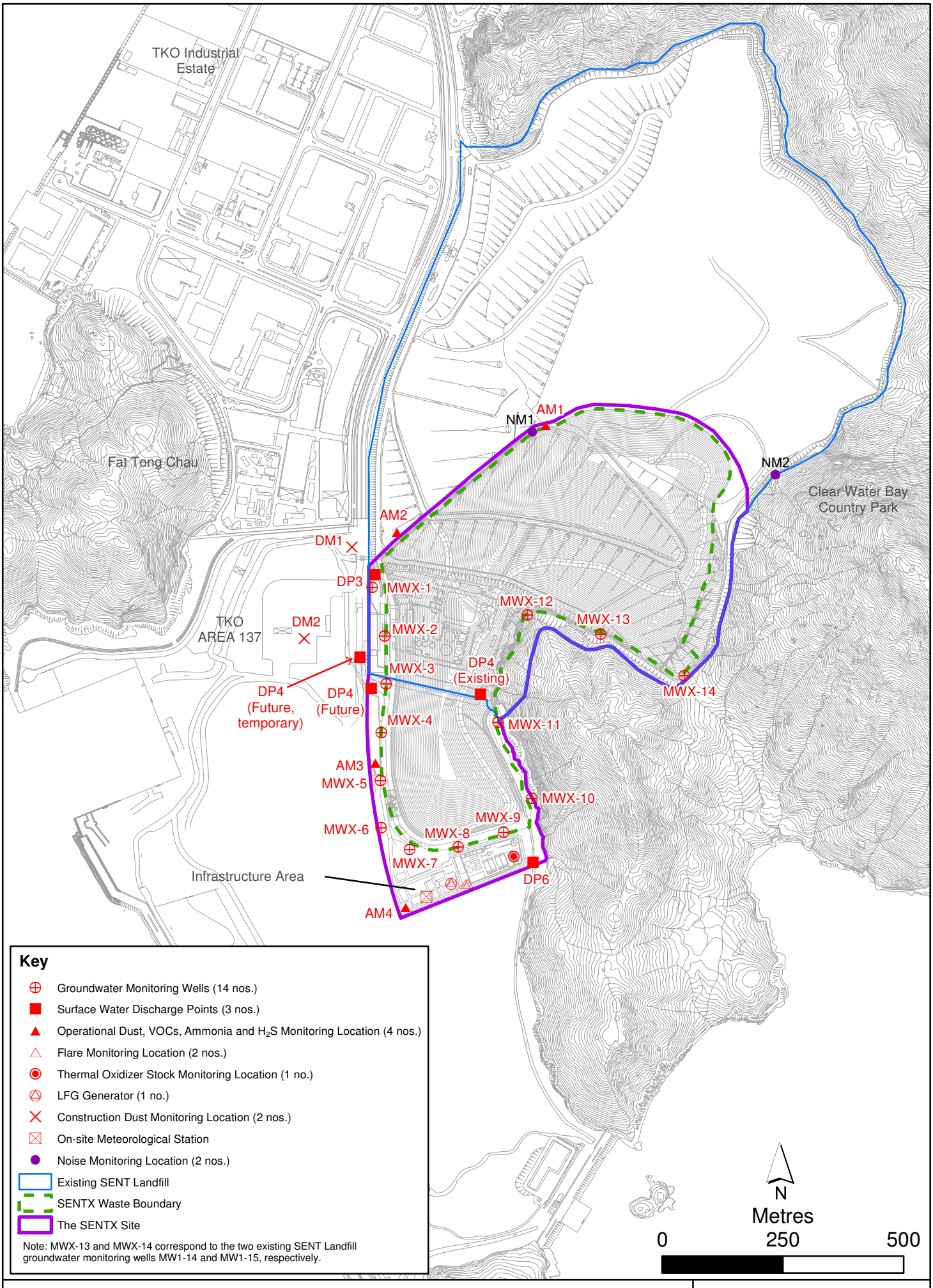

Figure 3.2a

Environmental Monitoring Locations

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Environmental Resources Management

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Operation/Restoration Phase

HVSs should be installed at the four designated locations along the site boundary (i.e. AM1, AM2, AM3 and AM4) as shown in *Figure 3.2a*. Should change of location is required after issuing this EM&A Manual, the proposed alternative monitoring locations should be fully justified by ET Leader, verified by IEC and approved by EPD (EIAO Authority).

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

- at the site boundary or such locations close to the major dust emission source(s);
- close to the ASRs; and
- taking into account the prevailing meteorological conditions.

The ET Leader should agree with the Contractor on the position of the HVSs for installation of the monitoring equipment. When positioning the samplers, the following points should be noted:

- a horizontal platform should be provided with appropriate support to secure the samplers against gusty wind;
- the distance between the sampler and an obstacle, such as buildings, should be at least twice the height that the obstacle protrudes above the sampler;
- a minimum of 2m separation from any supporting structure, measured horizontally is required;
- no furnaces or incineration flues or building vents are nearby;
- airflow around the sampler is unrestricted;
- the sampler is more than 20m from the drip line;
- any wire fence and gate, to protect the sampler, should not cause any obstruction during monitoring;
- permission must be obtained to set up the samplers and to obtain access to the monitoring stations; and
- a secured supply of electricity is needed to operate the samplers.

3.2.5 Baseline Monitoring

Construction Phase

24-hour TSP levels should be monitored at the two designated locations (i.e. DM1 and DM2), where there are two existing TSP monitoring stations

operating by the Civil Engineering and Development Department (CEDD). The recent 1 year historical data at a 6-day interval monitored by the two existing CEDD's monitoring stations prior to the commissioning of the construction works will be used to establish the baseline levels for construction phase. It is more representative to use the recent 1 year historical data, taking into account of the seasonal variation, to establish the baseline levels.

Operation/ Restoration & Aftercare Phases

24-hour TSP levels should be monitored at the four designated locations along the site boundary (i.e. AM1, AM2, AM3 and AM4) for at least 14 consecutive days prior to the commissioning of the operation phase to establish the baseline levels for operation phase. Prior to the commencement of the operation phase, earthworks and laying of liner should have been completed and the condition would be representative of the baseline condition prior to the operation phase. Prior to the commencement of the construction phase, AM3 and AM4 are located within the TKO Fill Bank area and the baseline monitoring results would be affected by the dusty activities in TKO Fill Bank which will not represent the baseline condition prior to the operation phase of the SENTX. In addition, in terms of technical feasibility, it is not practical to set up the HVSs at the four monitoring locations since there is no suitable horizontal platform or secured supply of electricity prior to the construction phase. Before commencing the baseline monitoring, the ET leader should inform the IEC and EIAO Authority of the monitoring programme such that the IEC can conduct on-site audit of the monitoring.

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

Ambient conditions may vary seasonally and should be reviewed at quarterly intervals. If the ET Leader considers that the ambient conditions have been changed and repeat of the baseline monitoring is required to be carried out for obtaining the updated baseline levels, the monitoring should be conducted at times when the Contractor's activities are not generating dust, at least in the proximity of the monitoring stations. Should changes 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 fully justified by ET Leader, verified by IEC and approved by EPD (EIAO Authority).

3.2.6 Impact Monitoring

Impact monitoring should be undertaken during the construction and operation/restoration of the SENTX, and during aftercare phase if there are major maintenance works.

Construction Phase

24-hour TSP levels should be measured at the two designated locations (i.e. DM1 and DM2) at least once every six days during the construction phase to monitor the dust impacts of construction works.

Operation/ Restoration & Aftercare Phases

During operation/restoration phase and aftercare period when there are major maintenance works, 24-hour TSP levels should be monitored at least once every six days at four designated locations along the site boundary (i.e. AM1, AM2, AM3 and AM4).

The specific time to start and stop the 24 hours monitoring should be clearly defined for each location and be strictly followed by the operator.

The parameters, locations and frequency of dust monitoring are summarized in *Table 3.2a.*

Table 3.2a Parameters, Locations and Frequency of Dust Monitoring

Phase	Location	Frequency	Parameter
Baseline monitoring	At two designated locations (i.e. DM1 and DM2)	Once every 6 days of the recent 1 year	• 24-hr TSP
	At four designated locations along the SENTX site boundary (i.e. AM1, AM2, AM3 and AM4)	At least 14 consecutive days prior to the commencement of the operation phase	• 24-hr TSP
Construction	At two designated locations (i.e. DM1 and DM2)	Once every 6 days	• 24-hr TSP
Operation/ Restoration	At four designated locations along the SENTX site boundary (i.e. AM1, AM2, AM3 and AM4)	Once every 6 days	• 24-hr TSP
Aftercare	At four designated locations along the SENTX site boundary (i.e. AM1, AM2, AM3 and AM4)	Once every 6 days when there are major maintenance works	• 24-hr TSP

3.2.7 Event and Action Limits for Dust

The baseline dust monitoring results and the Air Quality Objectives (AQOs) form the basis for determining the dust criteria for impact monitoring. The ET should compare the impact monitoring results with dust criteria. In case of non-compliance with the dust criteria, more frequent monitoring, as specified in the EAP (see *Section 3.6*), should be conducted. This additional monitoring should be continued until the non-compliance is rectified. Actions in accordance with the EAP (see *Section 3.7*) should be carried out in case non-compliance occurred.

Table 3.2b Action and Limit Levels for Dust

Parameter	Action Level	Limit Level
Construction Phase		
• 24-hr TSP Level	For baseline level ≤ 200 μg m^{-3}, Action level = (Baseline level *1.3 + Limit level)/2 For baseline level > 200 μg m^{-3}, Action level = Limit level	260 μg m^{-3}
Operation/Restoration Phase		
• 24-hr TSP Level	Action level = Limit level	260 μg m^{-3}
Aftercare Phase when there are major maintenance work		
• 24-hr TSP Level	Action level = Limit level	260 μg m^{-3}

3.3 AMBIENT VOCS, AMMONIA AND H_2S

3.3.1 Introduction

The general requirements, methodology, equipment, and mitigation measures for the monitoring and audit of ambient methane, VOCs, ammonia and H_2S associated with the operation, restoration and aftercare phases of the Project are described below. The sampling and analysis method should be prepared by the ET, in consultation with the IEC.

3.3.2 Sampling Equipment

The Contractor should be responsible for providing and maintaining a sufficient number of the following instruments for taking ambient air samples of VOCs, ammonia and H_2S.

Methane

The instruments should be able to capture ambient air into inert sample containers (e.g. low flow-rate pump and tedlar bags) for direct analysis using gas chromatography. If low flow-rate pump is used, it should be capable of maintaining a steady flow of air to collect the sample volume specified, and a rotameter of suitable range to measure flow rate during the sampling process.

VOCs

Samples for VOCs analysis should be collected using adsorption tubes containing a solid tenax/charcoal trapping medium or pressurised canisters fixed with a flow controller, which should be able to capture the suite of VOCs as shown in *Table 3.3b* for laboratory analysis.

Ammonia

The sampling instruments (e.g. low flow-rate pump and silica gel sampling tubes) should be able to collect samples for the laboratory analysis for measuring ammonia concentrations in between the range of 0.02 to 2 mg m^{-3}.

H_2S

Cadmium hydroxide solution was used as the absorbing solution to collect H_2S in air with mid-get impringer. The air sampling flow rate was set at 1.5 L/min.

3.3.3 Laboratory Measurement/Analysis

Air samples collected for laboratory analysis of should be transported to HOKLAS registered laboratories within 24 hours and analysed within 48 hours. The following analytical methods should be used:

- *Methane* – gas chromatography with thermal conductivity detection or non dispersion infrared spectroscopy or equivalent method approved by the IEC;
- *VOCs* – gas chromatography with mass selective detection or mass spectrophotometry or equivalent method approved by the IEC;
- *Ammonia* – NIOSH method S347 or equivalent method approved by the IEC; and
- *H_2S* –US NIOSH P&CAM Method 126 or equivalent method approved by the IEC.

The required detection limits for the methane, VOCs, ammonia and H_2S are detailed in *Table 3.3a.*

Table 3.3a Analytical Detection Limits for VOCs and Ammonia

Analytical Parameters	Detection Limit
Ammonia	0.02 mg m^{-3}
Methane	0.0025%
Methanethiol	27 ppb
Ethanethiol	1,400 ppb
Butanethiol	1,400 ppb
Trichloroethylene	0.6 ppb
Vinyl Chloride	2.0 ppb
Benzene	2.0 ppb
Methylene Chloride	1.0 ppb
Chloroform	0.8 ppb
1,2-dichloroethane	0.2 ppb
Carbon tetrachloride	0.2 ppb
Tetrachloroethylene	0.2 ppb
1,1,1- trichloroethane	0.5 ppb
1,2-dibromoethane	0.5 ppb
Toluene	0.5 mg m^{-3}
Carbon disulphide	0.5 mg m^{-3}
Propyl benzene	0.8 mg m^{-3}
Ethyl benzene	0.5 mg m^{-3}
Butyl benzene	1 mg m^{-3}
Xylenes	0.5 mg m^{-3}
Decanes	0.7 mg m^{-3}
Undecane	1.2 mg m^{-3}
Limonene	0.4 mg m^{-3}
Terpenes	0.8 mg m^{-3}
Ethanol	3.8 mg m^{-3}
Butan-2-ol	0.61 mg m^{-3}
Dimethylsulphide	0.2 mg m^{-3}
Methyl propionate	0.72 mg m^{-3}
Ethyl propionate	0.84 mg m^{-3}
Propyl propionate	0.95 mg m^{-3}
Butyl acetate	0.95 mg m^{-3}
Ethyl butanoate	0.95 mg m^{-3}
Dichlorobenzene	1 mg m^{-3}
Methyl butanoate	0.84 mg m^{-3}
Dipropyl ether	0.84 mg m^{-3}
Methanol	2.6 mg m^{-3}
Heptanes	0.82 mg m^{-3}
Octanes	0.93 mg m^{-3}
Nonanes	0.9 mg m^{-3}
Dichlorodifluoro-methane	0.6 mg m^{-3}
H_2S	1 ppb

3.3.4 Monitoring Parameter, Location and Frequency

Quarterly monitoring for a period of 12 months prior to waste filling should be conducted to establish the baseline ambient methane, VOCs, ammonia and H_2S concentrations prior to landfilling operation. Impact monitoring should be undertaken throughout the operation/restoration and aftercare phases of the SENTX and should not be conducted on rainy day. The monitoring frequency, locations, and parameters are summarised in *Table 3.3b*.

Table 3.3b Monitoring Parameters, Locations and Frequency of Ambient VOCs, Ammonia and H_2S Monitoring

Phase	Monitoring Locations	Monitoring Frequency	Parameters
Baseline Monitoring	4 locations along the SENTX Site Boundary (a)	Quarterly, for a period of 12 months prior to waste filling	• Methane • Ammonia • A suite of VOCs (b) • H_2S
Operation/ Restoration/ Aftercare	4 locations along the SENTX Site Boundary (a)	Quarterly, throughout operation/restoration and aftercare phases	• Methane • Ammonia • A suite of VOCs (b) • H_2S

Notes:

(a) See *Figure 3.2a* for the proposed locations.

(b) A suite of VOCs includes:

- Trichloroethylene
- Vinyl chloride
- Methylene chloride
- Chloroform
- 1,2-dichloroethane
- 1,1,1-trichloroethane
- Carbon tetrachloride
- Tetrachloroethylene
- 1,2-dibromoethane
- Benzene
- Toluene
- Carbon disulphide
- Propyl benzene
- Ethyl benzene
- Butyl benzene
- Xylenes
- Decanes
- Undecane
- Limonene
- Terpenes
- Ethanol
- Butan-2-ol
- Dimethylsulphide
- Methyl propionate
- Ethyl propionate
- Propyl propionate
- Butyl acetate
- Ethyl butanoate
- Dichlorobenzene
- Methyl butanoate
- Dipropyl ether
- Methanethiol
- Ethanethiol
- Butanethiol
- Methanol
- Heptanes
- Octanes
- Nonanes
- Dichlorodifluoro-methane
- Methane

3.3.5 Limit Levels for Methane, Ambient VOCs, Ammonia and H_2S Monitoring

Ambient methane, VOCs, ammonia and H_2S monitoring results will be evaluated against the limit levels. The limit levels at the SENTX boundary are defined as WHO/USEPA/CARB's ambient criteria if available or the odour thresholds or 1% of Workplace Exposure Limit (WEL) as stipulated in the "UK Health and Safety Executive (HSE) EH 40/2005 Workplace Exposure Limits", whichever is lower.

In case of exceedance of the limit levels, more frequent monitoring, as specified in the EAP (see *Section 3.8*) should be conducted. This additional monitoring should be continued until the non-compliance is rectified.

3.4 EMISSIONS OF THE THERMAL OXIDISER

3.4.1 Introduction

The performance of the thermal oxidiser should be monitored when the LTP is in operation. The purpose of the monitoring is to ensure the thermal oxidizer is operated under its design condition and emission limits.

3.4.2 Monitoring Parameter, Location and Frequency

Gas samples should be collected from the stack of the thermal oxidiser for laboratory analysis of the parameters at a frequency as described in *Table 3.4a*. In addition, the operating conditions of the thermal oxidiser should also be monitored continuously.

Table 3.4a Monitoring Parameters and Frequency of Stack of Thermal Oxidiser

Phase	Monitoring Frequency	Parameters
Operation/ Restoration	• Monthly for the first 12 months of operation and thereafter at quarterly intervals	Laboratory analysis for • NO_2 • CO • SO_2 • Benzene • Vinyl chloride In-situ analysis for • Exhaust gas velocity
	• Quarterly for the 1st year of operation (a)	Laboratory analysis for • Non-methane organic compounds
	• During commissioning and thereafter at quarterly intervals if any ammonia is detected during commissioning stage	Laboratory analysis for • ammonia
	• Continuously	• Gas combustion temperature • Exhaust temperature • Exhaust gas velocity (b)

Notes:

(a) The monitoring results will be reviewed towards the end of the first year of operation to determine if monitoring of this parameter can be terminated upon agreement by the EIAO Authority, IEC and Project Proponent.

(b) The exhaust gas velocity will be calculated based on the cross-section area of the stack and continuous monitored gas flow and combustion temperature data.

Under the combustion temperature of the thermal oxidiser, all ammonia will be destroyed. To confirm this design assumption, it is recommended that the ammonia concentration in the flue gas of the thermal oxidiser be monitored during the commissioning stage of the thermal oxidiser. If required, an emission standard will be set for ammonia for the thermal oxidiser based on the monitoring results and to be fully justified by ET Leader, verified by IEC and approved by EPD (EIAO Authority). If no ammonia is detected in the flue gas during the decommissioning stage, the monitoring of ammonia in the flue gas of the thermal oxidiser could be discontinued.

3.4.3 Monitoring Equipment

The Contractor should be responsible for providing and maintaining a sufficient number of the following monitoring equipment.

Air Sampling Equipment

The sampling equipment should be able to capture emission from the stack into inert sample containers for direct analysis on a gas chromatography in the laboratory. The method for the monitoring should be proposed by the ET and agreed with the Project Proponent in consultation with the IEC.

Gas Combustion Temperature, Exhaust Gas Temperature

A built-in monitoring system should be installed in the thermal oxidiser, which should be capable of continuous monitoring of gas combustion temperature and the exhaust gas temperature.

3.4.4 Laboratory Analysis

Gas samples should be transferred to the analytical laboratory within 24 hours of collection and analysed within 48 hours after collection.

Bulk gas samples should be analysed by gas chromatography for the parameters listed in *Table 3.4a* to detection limit of 0.0025% or lower unless other specified. The carrier gas to be used for the analysis should be helium, hydrogen or nitrogen with a minimum purity of 99.995%.

3.4.5 Impact Monitoring

The ET should carry out impact monitoring when the thermal oxidiser is in operation.

3.4.6 Performance Compliance

The limit levels for NO_2, CO, SO_2, benzene and vinyl chloride from the stack emission and gas combustion temperature presented in *Table 3.4b* should be met. The gas combustion temperature should also comply with the design parameters of the thermal oxidiser. These parameters have been updated as per the latest design and the air quality still complies with the prevailing AQOs. In case of non-compliance with the limit levels, more frequent monitoring and actions in accordance with the EAP (see *Table 3.8b*) should be carried out.

If ammonia is detected during the commissioning stage, an emission standard will be set for ammonia for the thermal oxidiser based on the monitoring results and to be fully justified by ET Leader, verified by IEC and approved by EPD (EIAO Authority).

Table 3.4b Limit Levels for Stack Emission of the Thermal Oxidiser

Parameter	Limit Level
NO_2	1.58 gs^{-1}
CO	0.53 gs^{-1}
SO_2	0.07 gs^{-1}
Benzene	3.01×10^{-2} gs^{-1}
Vinyl chloride	2.23×10^{-3} gs^{-1}
Gas combustion temperature	850°C (minimum)
Exhaust gas exit temperature	443K (minimum) (a)
Exhaust gas velocity	7.5 ms^{-1} (minimum) (a)

Note:
(a) Level under full load condition.

3.5 EMISSIONS OF LANDFILL GAS FLARE

3.5.1 Introduction

The performance of the landfill gas flares should be monitored when they are in operation. The purpose of the monitoring is to ensure the flares are operated in compliance with their design conditions and emissions standards.

3.5.2 Monitoring Parameter and Frequency

The operating conditions (i.e. gas combustion temperature and exhaust gas velocity) of the flare should be monitored continuously. Exhaust gas samples should be collected for laboratory analysis of NO_2, CO, SO_2, benzene and vinyl chloride. *Table 3.5a* summarised the monitoring parameters, locations and frequency of the emissions from the flares.

Table 3.5a Monitoring Parameters, Location and Frequency of Stack of the Flares

Phase	Monitoring Frequency	Parameters
Operation/ Restoration and aftercare	• Monthly for the first 12 months of operation and thereafter at quarterly intervals (a)	Laboratory analysis for • NO_2 • CO • SO_2 • Benzene • Vinyl chloride In-situ analysis for • Exhaust gas velocity
	• Quarterly for the 1st year of operation (b)	Laboratory analysis for • Non-methane organic compounds
	• Continuously	• Gas combustion temperature • Exhaust temperature • Exhaust gas velocity (c)

Notes:
(a) Reduction of monitoring frequency will be subject to the monitoring results to demonstrate environmentally acceptable performance.
(b) The monitoring results will be reviewed towards the end of the first year of operation to determine if monitoring of this parameter can be terminated upon agreement by the EIAO Authority, IEC and Project Proponent.
(c) Exhaust gas velocity will be calculated based on the cross-section area of the stack and

Phase	Monitoring Frequency	Parameters
	continuous monitored gas flow and combustion temperature data.	

3.5.3 Monitoring Equipment and Laboratory Analysis

The monitoring equipment and laboratory analysis requirements are the same as those for thermal oxidiser (see *Sections 3.4.3* and *3.4.4*)

3.5.4 Impact Monitoring

The Contractor should carry out impact monitoring when the flares are in operation.

3.5.5 Performance Compliance

The limit levels for NO_2, CO, SO_2, benzene and vinyl chloride from the stack emissions and gas combustion temperature presented in *Table 3.5b* should be met. The gas combustion temperature should also comply with the design parameters of the flares. These parameters have been updated as per the latest design and the air quality still comply with the prevailing AQOs. In case of non-compliance with the action levels, more frequent monitoring and actions in accordance with the EAP (see *Table 3.8b*) should be carried out.

Table 3.5b Limit Levels for Gas Flare Stack Emission

Parameter	Limit Level
NO_2	0.97 gs^{-1}
CO	2.43 gs^{-1}
SO_2	0.22 gs^{-1}
Benzene	4.14×10^{-4} gs^{-1}
Vinyl Chloride	2.60×10^{-4} gs^{-1}
Gas combustion temperature	815°C (minimum)
Exhaust gas exit temperature	923 K (minimum) [(a)]
Exhaust gas velocity	9.0 m s^{-1} (minimum) [(a)]

Note:
(a) Level under full load condition

3.6 EMISSIONS OF LFG GENERATOR

3.6.1 Introduction

The performance of the LFG generator should be monitored. The purpose of the monitoring is to ensure that the generators are operated in compliance with their design conditions and emissions standards.

3.6.2 Monitoring Parameter and Frequency

The operating conditions (ie gas combustion temperature and exhaust gas velocity) of the generator stack should be monitored continuously. Exhaust gas samples should be collected for laboratory analysis of NO_2, CO, SO_2,

benzene and vinyl chloride. *Table 3.6a* summarised the monitoring parameters, locations and frequency of the emissions from the generator stack.

Table 3.6a ***Parameter, Location and Frequency of Stack of the LFG Generator***

Phase	Monitoring Frequency	Parameters
Operation/ Restoration and aftercare	• Monthly for the first 12 months of operation and thereafter at quarterly intervals (a)	Laboratory analysis for • NO_2 • CO • SO_2 • Benzene • Vinyl chloride In-situ analysis for • Exhaust gas velocity
	• Quarterly for the 1st year of operation (b)	Laboratory analysis for • Non-methane organic compounds
	• Continuously	• Exhaust temperature • Exhaust gas velocity (c)

Notes:

(a) Reduction of monitoring frequency will be subject to the monitoring results to demonstrate environmentally acceptable performance.

(b) The monitoring results will be reviewed towards the end of the first year of operation to determine if monitoring of this parameter can be terminated upon agreement by the EPD (EIAO Authority), IEC and Project Proponent.

(c) Continuous monitoring of exhaust gas velocity will be calculated based on the cross-section area of the stack and continuous monitored gas flow and combustion temperature data.

3.6.3 Monitoring Equipment and Laboratory Analysis

The monitoring equipment and laboratory analysis requirements are the same as those for thermal oxidiser (see *Sections 3.4.3* and *3.4.4*)

3.6.4 Impact Monitoring

The Contractor should carry out impact monitoring when the generator is in operation.

3.6.5 Performance Compliance

The limit levels for NO_2, CO, SO_2, benzene and vinyl chloride from the stack emissions as presented in *Table 3.6b* should be met. The gas combustion temperature should comply with the design parameters of the generator. These parameters have been updated as per the latest design and the air quality still complies with the prevailing AQOs. In case of non-compliance with the action levels, more frequent monitoring and actions in accordance with the EAP (see *Table 3.8b*) should be carried out.

Table 3.6b Limit Levels for LFG Generator Stack Emission

Parameter	Limit Level
NO_2	1.91 g s^{-1}
CO	2.48 g s^{-1}
SO_2	0.528 g s^{-1}
Benzene	2.47 x 10^{-4} g s^{-1}
Vinyl chloride	1.88 x 10^{-5} g s^{-1}
Gas combustion temperature	450°C (minimum)
Exhaust gas exit temperature	723K (minimum) (a)
Exhaust gas velocity	30.0 ms^{-1} (minimum) (a)

Note:
(a) Level under full load condition.

3.7 ODOUR

3.7.1 Introduction

The effectiveness of the odour mitigation measures should be monitored to ensure that the operation of the SENTX will not cause unacceptable odour impact on the ASRs. This *Section* describes the EM&A requirements with respect to odour control.

3.7.2 Odour Patrol

Odour patrol should be carried out during the operation/restoration phase. Odour patrol should commence once the SENTX starts receiving waste. During aftercare phase, when there are maintenance works that require excavation of waste, odour patrol should also be undertaken.

Daily odour patrol should be conducted jointly by the ET and the IEC who should have a specific sensitivity to a reference odour (i.e. on reference materials n-butanol with the concentration of 50ppm in nitrogen (v/v)). The odour intensity detected should be based on that determined by the IEC. The patrol frequency shall be 3 times per day and conducted daily during the first month of operation and reduce to weekly for another three months should odour not being detected in the first month and no valid odour complaint cases are received. The patrol frequency shall be reviewed after the 4-month patrol and reduce to monthly interval thereafter subject to the patrol findings and odour complaint record. Since 6 January 2016, the SENT Landfill has been receiving construction waste only, which is significantly less odorous and no substantiated odour complaint against SENT Landfill were received in 2016 and 2017. It is therefore considered appropriate to relax the monitoring frequency to monthly, which are made reference to the odour patrol requirement in other waste treatment facilities, including Sludge Treatment Facility, Organic Waste Treatment Facility Phase 1 and Integrated Waste Management Facilities Phase 1.

Each proposed change of odour frequency shall be justified by the ET Leader and verified by the IEC and will be subject to agreement with Project Proponent and EPD (EIAO Authority).

In addition, an independent party (who should be a trained personnel/ competent person as described in *Section 3.7.3*) should be appointed to undertake odour patrol together with the ET and the qualified panellist from the IEC at monthly interval. During these patrols, the odour intensity detected should be based on that determined by the independent third party.

The parameter, location and frequency of odour patrol are summarised in *Table 3.7a*.

Table 3.7a Parameter, Location and Frequency for Odour Patrol

Phase	Patrol Locations	Patrol Frequency [a]	Parameters
Operation/ Restoration	Patrol along the SENTX Site Boundary	Period 1 - First month of operation Daily, three times a day in the morning, afternoon and evening/night (between 18:00 and 22:00 hrs) conducted by the ET and the IEC Three times per week on different days conducted by an independent third party together with the ET and IEC [b] Period 2 - Three months following period 1 [c] Weekly conducted by the ET and the IEC Once every two weeks conducted by an independent third party together with the ET and IEC [b] Period 3 - Throughout operation following period 2 [c] Monthly conducted by the ET and the IEC Quarterly conducted by an independent third party together with the ET and IEC [b]	Odour Intensity (see *Table 3.7b*)
Aftercare	Patrol along the SENTX Site Boundary	Weekly or at least once [c] when there are maintenance works required excavation of waste	Odour Intensity (see *Table 3.7b*)

Notes:

(a) Reduction of monitoring frequency will be subject to the monitoring results to demonstrate environmentally acceptable performance.

(b) Patrol shall be scheduled so that they are carried out together with the patrols to be carried out jointly by the ET and the IEC.

(c) Commencement of each period will be justified by the ET Leader and verified by the IEC and will be subject to agreement with the EPD (EIAO Authority) and Project Proponent.

(d) At least once during the maintenance work if the work lasts less than a week.

Odour patrol should be carried out along the SENTX Site boundary. The odour intensities detected should be categorised as in *Table 3.7b*.

Table 3.7b Odour Intensity Level

Class	Odour Intensity	Description
0	Not Detected	No odour perceived or an odour so weak that it cannot be easily characterised or described.
1	Slight	Identified odour, slight
2	Moderate	Identified odour, moderate
3	Strong	Identified odour, strong
4	Extreme	Severe odour

Odour patrol should be conducted by trained personnel / competent persons patrolling and sniffing along the SENTX Site boundary to detect any odour. The trained personnel / competent persons shall:

- Have their individual odour threshold of n-butanol in nitrogen gas in the range of 20 to 80 ppb/v required by the Europoean Standard Method (EN 13725);
- Be free from any respiratory diseases;
- Not be allowed to smoke, eat, drink (except water) or use chewing gum or sweets 30 minutes before and during the odour patrol; and
- Take great care not to cause any interference with their own perception or that of others by lack of personal hygiene or the use of perfumes, deodorants, body lotions or cosmetics.

The trained personnel/competent persons shall use their noise (olfactory sensors) to sniff odours along the patrol route. The main odour emission sources and the areas to be affected by the odour nuisance shall be identified.

3.7.3 Odour Compliance

Odour Complaint

When a complaint is received regarding odour nuisance, a complaint log (see *Annex B*) should be completed within 24 hours and kept with the Contractor. The form should include but not be limited to the following:

- Date and time of the complaint;
- Name and contact information of the complainant;
- Location of where the odour nuisance occurred;
- Characteristics of the odour;
- Odour strength;
- Meteorological conditions including temperature, wind speed, wind direction relative humidity at the time of the complaint; and

- Operation activities carried out at the SENTX at the time the nuisance occurred.

Action and Limit Levels for Odour Patrol

Table 3.7c shows the action and limit levels to be used. When the action and limit levels are triggered, investigation should be carried out to identify the cause of exceedance and actions in accordance with the EAP (see *Table 3.8b*) should be taken.

Table 3.7c Action and Limit Levels for Odour

Parameter	Action Level	Limit Level
Perceived odour intensity and odour complaints	• Odour intensity ≥ Class 2 recorded; or • One documented complaint received	• Odour intensity ≥ Class 3 recorded on 2 consecutive patrol [(a) (b)]

Notes:
(a) i.e. either Class 3-strong or Class 4-extreme odour intensity.
(b) The exceedances of the odour intensity do not need to be recorded at the same location.

3.8 EVENT AND ACTION PLAN

3.8.1 Construction Phase

In case of non-compliance with the dust criteria mentioned in the above sections, more frequent monitoring, as specified in *Table 3.8a* should be conducted within 24 hours after the result is obtained. This additional monitoring should be continued until the dust levels fall within the compliance level.

3.8.2 Operation/Restoration and Aftercare Phase

The ET should take the following actions during operation/restoration and aftercare phases of the SENTX when action/limit levels are exceeded:

- Inform the IEC, Contractor and Project Proponent of the exceedence and any known circumstances associated with the exceedance within 24 hours;
- Investigate the cause of exceedance; and
- Implement the EAP as shown in *Table 3.8b*.

Table 3.8a Event and Action Plan for Dust Monitoring During Construction Phase

	Action		
Event	**ET**	**IEC**	**Contractor**
Action Level			
Exceedance for one sample	• Identify the source(s) and investigate the cause(s) of exceedance • Prepare Notification of Exceedance within 24 hours • Inform Contractor, IEC and Project Proponent whether the cause of exceedance is due to the Project • Repeat measurement to confirm finding if exceedance is due to the Project • Increase monitoring frequency to daily if exceedance is due to the Project and continue until the monitoring results reduce to below action level	• Verify the Notification of Exceedance • Check monitoring data submitted by ET • Check Contractor's working methods	• Rectify any unacceptable practice • Amend working methods if appropriate
Exceedance for two or more consecutive samples	• Identify the source(s) and investigate the cause(s) of exceedance • Prepare Notification of Exceedance within 24 hours • Inform Contractor, IEC and Project Proponent whether the cause of exceedance is due to the Project • Discuss with Contractor and IEC for remedial measures required • Ensure remedial measures are properly implemented • If exceedance continues, arrange meeting with Contractor & IEC • Continue monitoring at daily intervals if exceedance is due to the Project • If no exceedance for 3 consecutive days, cease additional monitoring	• Verify the Notification of Exceedance • Check monitoring data submitted by ET • Check Contractor's working methods • Discuss with ET and Contractor on proposed remedial measures • Review proposals on remedial measures • Audit the implementation of the remedial measures • Audit the effectiveness of the implemented remedial measures	• Submit proposals for remedial measures to IEC • Implement the agreed proposals • Amend proposal if appropriate

Event	Action		
	ET	**IEC**	**Contractor**
Limit Level			
Exceedance for one sample	• Identify the source(s) and investigate the cause(s) of exceedance • Prepare Notification of Exceedance within 24 hours • Inform Contractor, IEC, Project Proponent and EPD (EIAO Authority) whether the cause of exceedance is due to the Project • Discuss with Contractor and IEC for remedial measures required • Ensure remedial measures are properly implemented • Repeat measurement to confirm finding if exceedance is due to the Project • Increase monitoring frequency to daily if exceedance is due to the Project and continue until the monitoring results reduce to below limit level	• Verify the Notification of Exceedance • Check monitoring data submitted by ET • Check Contractor's working methods • Discuss with ET and Contractor on proposed remedial measures • Review proposals on remedial measures • Audit the implementation of the remedial measures • Audit the effectiveness of the implemented remedial measures	• Take immediate action to avoid further exceedance • Submit proposals for remedial measures to IEC • Implement the agreed proposals • Amend proposal if appropriate
Exceedance for two or more consecutive samples	• Identify source(s) and investigate the cause(s) of exceedance • Prepare Notification of Exceedance within 24 hours • Inform Contractor, IEC, Project Proponent and EPD (EIAO Authority) the causes & actions taken for the exceedances • Discuss with Contractor and IEC for remedial measures required • Ensure remedial measures are properly implemented • Continue monitoring at daily intervals if exceedance is due to the Project • If no exceedance for 3 consecutive days, cease additional monitoring	• Verify the Notification of Exceedance • Check monitoring data submitted by ET • Check Contractor's working methods • Discuss with ET and Contractor on proposed remedial measures • Review proposals on remedial measures • Audit the implementation of the remedial measures • Audit the effectiveness of the implemented remedial measures	• If exceedance due to the Project continues, consider what portion of the work is responsible and stop that portion of work until the exceedance is abated • Take immediate action to avoid further exceedance • Submit proposals for remedial measures to IEC • Implement the agreed proposals • Resubmit proposals if problem still not under control

Table 3.8b Event and Action *for Air Quality Monitoring During Operation/Restoration and Aftercare Phases*

Event	Action		
	ET	**IEC**	**Contractor**
Exceedance of Action/Limit Level for dust monitoring	• Identify the source(s) and investigate the cause(s) of exceedance • Prepare the Notification of Exceedance within 24 hours • Inform Contractor, IEC, Project Proponent and EPD (EIAO Authority) whether the cause of exceedance is due to the Project • Discuss with Contractor and IEC for remedial measures • Ensure remedial measures are properly implemented • Assess effectiveness of Contractor's remedial measures and keep the Project Proponent and IEC informed of the results • Repeat measurement to confirm finding if exceedance is due to the Project • Increase monitoring frequency to daily and continue until the monitoring results reduce to below action level	• Verify the Notification of Exceedance • Check monitoring data submitted by ET • Check Contractor's working methods • Discuss with ET and Contractor on proposed remedial measures • Review proposals on remedial measures • Audit the implementation of the remedial measures • Audit the effectiveness of the implemented remedial measures	• Take immediate action to avoid further exceedance • Submit proposals for remedial measures to IEC • Implement the agreed proposals • Amend proposal if appropriate
Exceedance of Action Level for odour	• Identify source(s) and investigate the cause(s) of exceedance or complaint • Prepare the odour complaint form or the Notification of Exceedance within 24 hours • Inform Contractor, IEC and Project Proponent whether the cause of exceedance is due to the Project • Discuss with Contractor and IEC for remedial measures • Ensure remedial measures are properly implemented • Increase monitoring frequency to daily until odour not being detected for three consecutive days	• Verify the Notification of Exceedance • Check monitoring data submitted by ET • Check Contractor's working methods • Discuss with ET and Contractor on proposed remedial measures • Review proposals on remedial measures • Audit the implementation of the remedial measures • Audit the effectiveness of the implemented remedial measures	• Rectify any unacceptable practice • Amend working methods as required • Implement amended working methods, if necessary

Event	Action		
	ET	**IEC**	**Contractor**
Exceedance of Limit Level for odour	• Identify source(s) and investigate the cause(s) of exceedance or complaint • Prepare the odour complaint form or the Notification of Exceedance within 24 hours • Inform Contractor, IEC, Project Proponent and EPD (EIAO Authority) whether the cause of exceedance is due to the Project • Discuss with Contractor and IEC for remedial measures • Ensure remedial measures are properly implemented • Assess effectiveness of Contractor's remedial measures and keep the Project Proponent and IEC informed of the results	• Verify the Notification of Exceedance • Check with Contractor on the operating activities and implementation of odour mitigation measures • Discuss with ET and Contractor on proposed remedial measures • Review proposals on remedial measures • Audit the implementation of the remedial measures • Audit the effectiveness of the implemented remedial measures	• Rectify any unacceptable practice • Submit proposals for remedial measures to IEC within 3 working days of notification • Implement the agreed proposal or amend working methods as required • Resubmit proposals if problem still not under control
Exceedance of Limit Level for ambient VOCs, ammonia and H_2S at the monitoring locations	• Identify the source(s) and investigate the cause(s) of exceedance • Prepare the Notification of Exceedance within 24 hours • Inform Contractor, IEC, Project Proponent and EPD (EIAO Authority) whether the cause of exceedance is due to the Project • Discuss with Contractor and IEC for remedial measures • Ensure remedial measures are properly implemented • Assess effectiveness of Contractor's remedial measures and keep the Project Proponent and IEC informed of the results • Repeat measurement to confirm finding if exceedance is due to the Project • Increase monitoring frequency to monthly and continue until the monitoring results reduce to below limit level	• Verify the Notification of Exceedance • Check with Contractor on the operating activities and implementation of landfill gas control measures • Discuss with ET and Contractor on proposed remedial measures • Review proposals on remedial measures • Audit the implementation of the remedial measures • Audit the effectiveness of the implemented remedial measures	• Rectify any unacceptable practice • Amend working methods as required • Implement amended working methods, if necessary

Event	Action		
	ET	IEC	Contractor
Exceedance of Limit Level of stack emission of the thermal oxidizer, flares and generator	• Identify source(s) and investigate the cause(s) of exceedance • Prepare the Notification of Exceedance within 24 hours • Inform Contractor, IEC, Project Proponent and EPD (EIAO Authority) whether the cause of exceedance is due to the Project • Discuss with Contractor and IEC for remedial measures • Ensure remedial measures are properly implemented • Assess effectiveness of Contractor's remedial measures and keep the Project Proponent and IEC informed of the results • Repeat measurement to confirm finding if exceedance is due to the Project • Increase monitoring frequency to monthly when there are two consecutive exceedances and continue until the monitoring results reduce to below limit level	• Verify the Notification of Exceedance • Check with Contractor on the operation performance of the stack • Discuss with ET and Contractor on proposed remedial measures • Review proposals on remedial measures • Audit the implementation of the remedial measures • Audit the effectiveness of the implemented remedial measures	• Rectify any unacceptable performance • Amend design as required • Implement amended design, if necessary

3.9 METEOROLOGICAL DATA

3.9.1 Introduction

The potential environmental impacts of the SENTX in many cases can be influenced by the weather conditions. Meteorological data should be collected and used to support the interpretation of environmental monitoring results and to assess the sufficiency of the landfill operational control by establishing on-site meteorological monitoring station.

3.9.2 Measurement Parameters and Location

General meteorological data should be gathered to establish background information. It should be capable for continuously monitoring throughout the construction, operation/ restoration phase and aftercare phases.

The location of meteorological monitoring station should be proposed by the ET, in consultation with the IEC. It should be constructed in a location that can collect representative data and not be influenced by the landfill operation. The supporting mast should be built as far from the laboratory and LTP as practicable to eliminate the possibility of interference due to turbulence generated in the vicinity of the buildings. The measurement details are listed in *Table 3.8a*.

Table 3.8a Measurement of Meteorological Data

Phase	Monitoring Frequency	Parameters
Construction/ Operation/ Restoration and Aftercare	Continuously	• Wind Speed • Wind Direction • Air Temperature • Barometric Pressure • Rainfall • Relative Humidity

3.9.3 Monitoring Equipment

The meteorological station should comprise the following equipment:

- Control module;
- Temperature and relative humidity probe with radiation shield;
- Rain gauge;
- Wind direction gauge;
- Wind speed monitor;
- Barometer;
- Supporting mast with sufficient height; and
- Weather-proof box which enclosed all control and logging equipment.

For installation and operation of wind data monitoring equipment, the following points should be observed:

- the wind sensors should be installed on masts at least 10m above ground so that they are clear of obstructions or turbulence caused by the buildings;

- the wind data should be captured by a data logger to be down-loaded for processing at least once a month; and

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

The supporting mast should be securely erected to minimise movement. The mast should be vertical and that the wind direction vane is correctly aligned and the alignment of the vane should be checked regularly.

In exceptional situations, the ET may propose alternative methods to obtain representative wind data which the proposal should be justified by ET Leader, agreed with IEC and approved by EPD (EIAO Authority).

All equipment should be calibrated before it is mounted to the meteorological station. They should be calibrated at least once a year with data from the Hong Kong Observatory or other sources approved by the EPD (EIAO Authority).

3.9.4 Data Logging and Management

A control module should be capable for controlling the measurement and data logging of the meteorological data at a specified time interval. The control module should be configured to sample wind speed and direction every minute and log the hourly average. Temperature readings should be logged every 10 minutes. Relatively humidity and total rainfall are logged every hour. Barometric pressure tendencies should be logged on an hourly basis.

The meteorological information should be relayed to and stored on the Contractor's computer system. This information should be reviewed on a weekly basis to ensure the data is reasonable and as a means of indicating any malfunction of the equipment and transfer process.

4 WATER QUALITY

4.1 INTRODUCTION

This *Section* describes the monitoring and audit requirements with respect to water quality during the construction, operation/restoration and aftercare phases of the SENTX.

The mitigation measures recommended to control water quality impacts are summarised in *Annex A*.

4.2 SURFACE WATER

Monitoring of surface water shall be carried out during the construction, operation/restoration and aftercare phases of the SENTX to ensure that the SENTX will not cause adverse water quality impact.

4.2.1 Monitoring Parameters, Locations and Frequency

The quality of the surface water discharged from all surface water discharge points (see *Figure 3.2a)* should be monitored during the construction, operation/restoration and aftercare of the SENTX. The monitoring frequency and parameters are presented in *Table 4.2a*.

Table 4.2a Surface Water Monitoring Parameters and Frequency

Phase	Monitoring Locations [a]	Monitoring Frequency	Parameters	
Baseline	Surface water discharge points DP3 and DP4	3 days per week for 4 consecutive weeks [b]	• pH • Electrical conductivity (EC) • DO • SS • COD • BOD_5 • TOC • Ammoniacal–nitrogen • Nitrate-nitrogen • Nitrite–nitrogen • TKN • TN • Phosphate • Sulphate • Sulphide • Carbonate • Oil & Grease	• Bicarbonate • Chloride • Sodium • Potassium • Calcium • Magnesium • Nickel • Manganese • Chromium • Cadmium • Copper • Lead • Iron • Zinc • Mercury • Boron
Construction	Surface water discharge points DP3, DP4 and DP6	Weekly	• pH • DO • SS	

Phase	Monitoring Locations [a]	Monitoring Frequency	Parameters
Operation/ Restoration/ Aftercare	Surface water discharge points DP3, DP4 and DP6	Monthly	Same as the baseline monitoring

Notes:

(a) The current DP4 for SENT Landfill will be relocated to a new position for SENTX, as shown in *Figure 3.2a*. Although the location is different, the catchment of the new DP4 location is similar to the existing catchment. Hence, it is still recommended that baseline monitoring shall be taken at the current DP4 location. As the catchment of the new DP6 will be from the hillside, similar to the current DP4 catchment, the baseline data will be used to set the action and limit level for DP6.

(b) If no flow is recorded during the monitoring period, ongoing monitoring data from the SENT Landfill contract for at least 12 months prior to SENTX construction shall be referenced.

4.2.2 Monitoring Equipment

The measurements of pH, EC and DO should be undertaken *in situ*. The following equipment should be used. The use of similar equipment is subject to prior approval from the IEC.

pH Meter

A portable pH meter capable of measuring a range between 0.0 and 14.0 (eg Orion Model 250A or an approved similar instrument) should be used to measure pH on site.

Electrical Conductivity Meter

A portable EC meter capable to show four significant figures should be provided to measure the EC on site.

Dissolved Oxygen Meter

A portable, weatherproof DO meter capable of measuring DO levels in the range of 0 – 20 mg L^{-1} and 0 – 200% saturation; and a temperature of 0 – 45 degrees Celsius should be used (eg YSI model 59 meter, YSI 5739 probe, YSI 5795A submersible stirrer with reel and cable or similar approved equipment). Spare electrodes and cables should be provided during the on-site monitoring.

Water Sampling Equipment

Samples should be obtained from the surface water body using an open mouthed vessel with a lip (for pouring into sample containers). A glass or polyethylene vessel is used according to the container type.

Water Sample Containers

The types and size of containers to be used for storage of water samples for laboratory analysis will depend upon the parameters to be analysed. The

laboratory should be consulted with the appropriate types of container to be used. All bottles should be fitted with a screw cap with inert plastic liner.

In situ monitoring instruments should be checked, calibrated and certified by a laboratory accredited under HOKLAS or other international accreditation scheme before use, and subsequently re-calibrated at 3 monthly intervals. Responses of sensors and electrodes should be checked with certified standard solutions before each use. Calibration for DO meter shall be carried out before measurement according to the instruction manual of the equipment model which is considered adequate for the type of DO meter employed.

For the on-site calibration of field equipment, the requirements of the BS 1427:1993, "Guide to Field and on-site test methods for the analysis of waters" should be observed.

4.2.3 Laboratory Measurement / Analysis

Analysis of surface water samples should be carried out by HOKLAS accredited laboratory. The analyses should follow the standard methods as described in American Public Health Association (APHA) "Standard Methods for the Examination of Water and Wastewater, 19th Edition" or "Annual Book of American Society for Testing and Materials Standards, Vol 11.01 & 11.02" or equivalent methods approved by the EPD (EIAO Authority). The SS determination should follow TSS-SM25400 or equivalent methods subject to approval of the EIAO Authority.

If a site laboratory (HOKLAS accredited) is set up or a non-HOKLAS accredited laboratory is hired for carrying out the laboratory analysis, the laboratory equipment, analytical procedures, and quality control should be fully justified by ET Leader, verified by IEC and approved by EPD (EIAO Authority). The analysis should be witnessed by the IEC.

The detection limits for each parameter are shown in *Table 4.2b***.** The analysis works should be undertaken within 24 hours after collection of the water samples.

Table 4.2b Analytical Detection Limit for Specific Analytical Parameters for Surface Water

Parameter	**Analytical Detection Limit (mg $L^{-1)}$**
COD	2
BOD_5	2
Total Organic Carbon	1
Sodium	0.05
Potassium	0.05
Calcium	0.05
Magnesium	0.05
Carbonate	1
Bicarbonate	1
Nickel	0.001

Parameter	Analytical Detection Limit (mg L^{-1})
Manganese	0.001
Nitrate-nitrogen	0.01
Nitrite-nitrogen	0.01
Sulphate	1
Phosphate	0.01
Chloride	1
Sulphide	0.1
Chromium	0.001
Cadmium	0.0002
Copper	0.001
Lead	0.001
pH	0.1
Electrical Conductivity	1
Iron	0.04
Zinc	0.01
Ammoniacal – nitrogen	0.1
Suspended Solids	1
Dissolved Oxygen	0.1
Oil & Grease	5
Mercury	0.002
Boron	0.01
TKN	0.1
Total Nitrogen	0.1

4.2.4 Baseline Monitoring

Baseline conditions for water quality should be established and agreed with the EPD (EIAO Authority) prior to the commencement of construction works and shall be reviewed after full restoration of SENT Landfill. The purpose of the baseline monitoring is to establish ambient conditions prior to the commencement of the construction works and to demonstrate the suitability of the proposed impact, control and reference monitoring stations. The baseline conditions should be established by measuring referencing the water quality parameters listed in *Table 4.2a*. The measurement should be taken at the designated surface water discharge points for 3 days per week for 4 consecutive weeks prior to commencement of the works. The interval between two sets of monitoring should not be less than 36 hours. If no flow is recorded during the baseline monitoring period, the ongoing monitoring data of DP3 and DP4 (at least 12 months prior to SENTX construction) shall be referenced.

There should not be any construction activities, as far as practicable, in the vicinity of the monitoring points during the baseline monitoring.

In exceptional cases when insufficient baseline monitoring data or questionable results are obtained, the ET Leader should seek approval from the IEC and EPD (EIAO Authority) on an appropriate set of data to be used as baseline reference.

Baseline monitoring schedule should be submitted to IEC and EPD (EIAO Authority) at least one week before the commencement of the monitoring.

4.2.5 Impact Monitoring

During the construction, operation/restoration and aftercare phases of the SENTX, surface water monitoring should be undertaken according to the parameters, frequencies, and duration described in *Table 4.2a.*

4.2.6 Compliance Requirements

Action and Limit Levels for Surface Water (Construction Phase)

The surface water quality criteria during construction phase are shown in *Table 4.2c*. Any noticeable change to water quality should be investigated and remedial actions should be undertaken to minimise the impacts.

Table 4.2c Action/Limit Levels for Surface Water Quality (Construction Phase)

Parameters	Action Level	Limit Level
DO	< 5%-ile of baseline data	< 1%-ile of baseline data
Suspended Solids	> 95%-ile of baseline data	> 99%-ile of baseline data
pH	> 95%-ile of baseline data	> 99%-ile of baseline data

Limit Levels for Surface Water Quality (Operation/ Restoration and Aftercare Phases)

Water quality monitoring will be assessed against the limit levels for COD and ammoniacal-nitrogen during operation, restoration and aftercare phases (see *Table 4.2d*). For any action level triggered, the ET will review potential cause of the exceedance and assess whether the cause is attributed to the activities of the SENT Landfill or SENTX in accordance with *Table 4.5a*. The Contractor should provide information on the activities or works being carried at the SENT Landfill and SENTX during the period when the surface water monitoring is carried out.

Table 4.2d Limit Level for Surface Water Quality (Operation/Restoration and Aftercare Phases)

Parameter	Limit Level (mg L^{-1}) [(a)]
Ammoniacal–nitrogen	> 0.5 or 95%-ile of baseline data [(b)]
COD	> 30 or 95%-ile of baseline data [(b)]
Suspended Solids	> 20 or 95%-ile of baseline data [(b)]

Notes:

(a) The limit levels specified for other parameters in *Table 10a of the Technical Memorandum Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters* should also be followed

(b) If the concentration of ammoniacal-nitrogen, COD and SS exceeds the respective limit level during baseline monitoring, the 95%-ile should be use as a limit level during impact monitoring.

If monitoring indicates that a particular parameter has exceeded the limit level, the EAP as shown in *Table 4.5a* should be implemented.

4.3 GROUNDWATER

4.3.1 Monitoring Parameters, Locations and Frequency

Groundwater level and quality of the perimeter groundwater monitoring wells (including five up-gradient wells and nine down-gradient wells, as shown in *Figure 3.2a)* should be monitored to establish the baseline conditions. Monitoring should be continued throughout operation/restoration and aftercare phases.

The monitoring parameters, locations and frequency of groundwater at different phases of the Project are shown in *Table 4.3a*.

Table 4.3a Groundwater Monitoring Parameters, Locations and Frequency

Phase	Monitoring Locations	Monitoring Frequency	Parameters	
Baseline monitoring (prior to operation of the SENTX)	All groundwater monitoring wells	Monthly, for a period of 12 months prior to waste filling	• Water level • pH • EC • COD • BOD_5 • TOC • Ammoniacal–nitrogen • Nitrate-nitrogen • Nitrite – nitrogen • TKN • TN • Sulphate • Sulphide • Carbonate • Bicarbonate • Phosphate	• Chloride • Sodium • Potassium • Calcium • Magnesium • Nickel • Manganese • Chromium • Cadmium • Copper • Lead • Iron • Zinc • Mercury • Boron
Operation / Restoration/ Aftercare	All groundwater monitoring wells	Monthly	Same as the baseline monitoring	

4.3.2 Monitoring Wells and Equipment

Monitoring Wells

The Contractor should be responsible for construction of the perimeter groundwater monitoring wells at least 12 months before the operation of the SENTX so that baseline groundwater monitoring can be undertaken. The monitoring wells should be constructed in accordance with the engineering design and should minimise the potential contamination of groundwater by various construction activities.

Groundwater Level Measurement

A portable dip meter with 5mm accuracy should be used for measurement of groundwater level at each well. The dip meter should have an audio and /

or visual indicator of water level. The dip meter should be calibrated at least once a month.

Groundwater Sampling Pump and Sample Filtration

A bladder pump with Teflon sampling tube should be used for purging and taking of groundwater sample from the monitoring well. Pump that is dedicated to individual well and have adjustable discharge rates to allow low flows for sampling accuracy and high flows for purging efficiency should be considered. Filtered groundwater samples will be taken during baseline monitoring, operation/restoration and aftercare phases.

Filtered groundwater samples should be collected by filtering in the field through a 0.45 μm membrane prior to storage and analysis. An in-line filter system connected to the tubing of the sampling pump can be used for that purpose. In case non-disposal filter equipment are used, decontaminated between sampling locations should be conducted.

The specifications of equipment for *in situ* measurement of pH and EC are described in *Section 4.2.3.*

4.3.3 Laboratory Measurement / Analysis

Analysis of groundwater samples should be carried out by a HOKLAS accredited laboratory. The analyses should follow the standard methods as described in American Public Health Association (APHA) "Standard Methods for the Examination of Water and Wastewater, 19th Edition" or "Annual Book of American Society for Testing and Materials Standards, Vol 11.01 & 11.02" or equivalent method as approved by the EPD (EIAO Authority).

If a site laboratory (HOKLAS accredited) is set up or a non-HOKLAS accredited laboratory is hired for carrying out the laboratory analysis, the laboratory equipment, analytical procedures, and quality control should be fully justified by ET Leader, verified by IEC and approved by EPD (EIAO Authority). The analysis should be witnessed by the IEC. The analytical detection limits of each parameter are shown in *Table 4.3b*.

Table 4.3b ***Analytical Detection Limit for Specific Analytical Parameters for Groundwater***

Parameter	Analytical Detection Limit (mg L^{-1})	
	Water	Saline Water (a)
COD	2	10
BOD_5	2	2
Total Organic Carbon	1	1
Sodium	0.05	0.5
Potassium	0.05	0.2
Calcium	0.05	0.5
Magnesium	0.05	0.5
Carbonate	1	1
Bicarbonate	1	1
Nickel	0.001	0.01
Manganese	0.001	0.01
Nitrate-nitrogen	0.01	0.01
Nitrite-nitrogen	0.01	0.01
Sulphate	1	1
Chloride	1	1
Sulphide	0.1	0.1
Chromium	0.001	0.01
Cadmium	0.0002	0.001
Copper	0.001	0.01
Lead	0.001	0.01
pH	0.1	0.1
Electrical Conductivity	1	1
Iron	0.04	0.04
Zinc	0.01	0.01
Phosphate	0.01	0.01
Ammoniacal–nitrogen	0.1	0.1
Mercury	0.0002	0.0002
Boron	0.01	0.01
TKN	0.1	0.1
Total Nitrogen	0.1	0.1

Note:
(a) Detection limits for down gradient wells with saline water.

4.3.4 Groundwater Quality Compliance

Groundwater quality monitoring should be evaluated against limit levels for COD and ammoniacal-nitrogen (see *Table 4.3c*).

Table 4.3c Limit Levels for Groundwater Monitoring Parameters

Parameter	Limit Level (mg L^{-1})
Ammoniacal–nitrogen	5 or 95%-tile of baseline data [(a)]
COD	30 or 95%-tile of baseline data [(a)]

Note:

(a) If the concentration of ammoniacal-nitrogen and COD exceeds the respective limit level during baseline monitoring, the 95%-ile should be use as a limit level during impact monitoring. Should this be the case, the limit level will be well specific.

If the impact monitoring indicates that the concentration of either ammoniacal-nitrogen or COD has exceeded the limit level, the EAP as shown in *Table 4.5a* should be implemented.

4.4 LEACHATE

4.4.1 Introduction

The SENTX will be designed to minimise leachate production and contain leachate within the landfill. Leachate collected will be treated at the on-site LTP prior to discharge to the foul sewer leading to Tseung Kwan O Sewage Treatment Works (TKO STW).

Environmental monitoring related to leachate management will include monitoring leachate levels within the landfill, and leachate and effluent quality.

4.4.2 Monitoring Parameter, Location and Frequency

Leachate will be generated once the SENTX starts to receive waste and will continue to be generated for a considerable period after the landfill is restored. Leachate monitoring should therefore be carried out during the operation/ restoration and aftercare phases of the SENTX. *Table 4.4a* summarises the proposed locations, parameters and frequency of leachate/effluent monitoring during operation/restoration and aftercare phases.

Table 4.4a Summary of Leachate/Effluent Monitoring Requirements

Phase	Location	Frequency	Parameter
Operation / restoration/ Aftercare	Leachate levels above the basal liner	Continuous	Leachate Levels
	Effluent discharged from LTP	Daily for the first 3 months upon full operation of the LTP at wet season (Apr to Sep) and dry season (Oct to Mar), respectively and reduce to monthly thereafter subject to the monitoring results of the first 3 months for each season and agreement with the EIAO Authority, IEC and IC. (a)	*On-site Measurements*: • Volume • pH • Temperature *Laboratory analysis:* • Suspended Solids • COD • BOD_5 • TOC • Ammoniacal–nitrogen • Nitrate-nitrogen • Nitrite–nitrogen • Total Nitrogen • Sulphate • Phosphate • Oil & Grease • Alkalinity • Chloride • Calcium • Potassium • Magnesium • Iron • Zinc • Copper • Chromium • Nickel • Cadmium • Boron

Note:
(a) Reduction of monitoring frequency will be subject to the monitoring results to demonstrate environmentally acceptable performance.

Leachate levels above the basal liner should be measured continuously to ensure that the leachate head complies with the performance requirements and hence minimise the potential for off-site migration of leachate.

Prior to discharge of the treated effluent from the LTP to the foul sewer leading to the TKO STW, effluent sample should be taken and analysed to ensure that it complies with the standards stipulated in the effluent discharge license issued under the *Water Pollution Control Ordinance* (hereafter "the discharge license). The sampling point should be at the effluent discharge point or the effluent holding tank of the LTP.

4.4.3 Monitoring Equipment

It is recommended that different sets of monitoring equipment such as collection vessel, sampling pump and tubes, and field meters (e.g. probes for

pH and EC meters) should be used for leachate and groundwater/surface water quality monitoring.

Leachate Levels

Leachate levels above the basal liner should be monitored continuously by pairs of pressure transducers installed on the two side slope risers fitted at each of the seven leachate collection sumps. These are set to automatically alarm if the leachate levels reach the defined levels. The device should be capable of accurately and precisely measuring leachate levels between 0.01 and 2.5m.

Sample Containers

The types and size of containers to be used for storage of effluent samples for laboratory analysis will depend upon the analytical parameter and should be in accordance with the specific requirements of the specialist analytical laboratory. Separate samples should be collected for the analysis of heavy metal (250 mL minimum), sulphides (100 mL minimum) and other determinants (1 litre minimum). All bottles should be fitted with inert plastic inserts and have a screw cap. For samples taken for sulphide analysis, 2 ml of 0.5 molar zinc acetate and 2 mL of 0.75 molar sodium carbonate should be added per 100 mL of sample as a preservative.

Field Monitoring Equipment

The specification of equipment for taking *in situ* measurements of pH and temperature should be referred to *Section 4.2.3.* Handling and calibration requirements of the *in situ* monitoring equipment and sample preservation prior to laboratory analysis can also refer to *Section 4.2.3.*

4.4.4 Laboratory Measurement / Analysis

Analysis of effluent samples should be carried out by a HOKLAS accredited laboratory. The analyses should follow the standard methods as described in APHA "Standard Methods for the Examination of Water and Wastewater, 19th Edition" or equivalent method as approved by the IEC and EPD (EIAO Authority).

If a site laboratory (HOKLAS accredited) is set up or a non-HOKLAS accredited laboratory is hired for carrying out the laboratory analysis, the laboratory equipment, analytical procedures, and quality control should be fully justified by ET Leader, verified by IEC and approved by EPD (EIAO Authority). The analysis should be witnessed by the IEC. The analytical detection limits of each parameter are shown in *Table 4.4b.*

Table 4.4b *Analytical Detection Limit for Specific Analytical Parameters for Treated Effluent from the LTP*

Parameter	Analytical Detection Limit (mg L^{-1})
COD	2
BOD_5	2
Total Organic Carbon	1
Potassium	0.2
Calcium	0.5
Magnesium	0.5
Nitrate-nitrogen	0.1
Nitrite-nitrogen	0.1
Chloride	1
pH	0.1
Iron	0.04
Zinc	0.01
Alkalinity	1
Total Nitrogen	0.1
Ammoniacal – nitrogen	0.1
Suspended Solids	1
Oil & Grease	5
Sulphate	5
Copper	0.01
Chromium	0.01
Nickel	0.001
Cadmium	0.001
Phosphate	0.01
Boron	0.1

4.4.5 Compliance Requirements

The Contractor is required to apply for a discharge license for discharge of treated effluent into public sewer under the *Water Pollution Control Ordinance*. The discharge license will state the discharge limits for the key parameters. The Contractor is required to ensure the quality of the treated effluent complies with the limits stipulated in the discharge license.

The leachate level at any point within the landfill should not exceed a limit level of 1 m above the primary liner of the leachate containment system.

If the impact monitoring indicates that particular parameters have exceeded the limit levels, the EAP (see *Table 4.5b*) should be implemented.

4.5 EVENT AND ACTION PLAN FOR WATER QUALITY MONITORING

4.5.1 Construction Phase

If the surface water quality monitoring indicates any non-compliance with the action/limit levels, the actions stipulated in the EAP (see *Table 4.5a*) should be

implemented. Any noticeable change to surface water quality should be recorded in the EM&A reports and should be investigated. Remedial actions should be undertaken to minimise the impacts.

4.5.2 Operation/Restoration and Aftercare Phases

If the water quality monitoring result indicates exceedance of the limit levels, the actions stipulated in *Table 4.5b* should be taken.

Table 4.5a Event and Action Plan for Surface Water Quality During Construction Phase

Event	Action		
	ET	IEC	Contractor
Action Level being exceeded by one sampling day	• Repeat *in situ* measurement to confirm findings • Identify the source(s) and investigate the cause(s) of exceedance • Prepare Notification of Exceedance within 24 hours • Inform Contractor, IEC and Project Proponent whether the cause of exceedance is due to the Project • Repeat measurement on the next day of exceedance if exceedance is due to the Project	• Verify the Notification of Exceedance • Check monitoring data submitted by ET • Check Contractor's working methods	• Rectify any unacceptable practice • Amend working methods if appropriate
Action Level being exceeded by two consecutive sampling days	• Repeat *in situ* measurement to confirm findings • Identify the source(s) and investigate the cause(s) of exceedance • Prepare Notification of Exceedance within 24 hours • Inform Contractor, IEC and Project Proponent whether the cause of exceedance is due to the Project • Discuss with Contractor and IEC for remedial measures required • Ensure remedial measures are properly implemented • Increase the monitoring frequency to daily if exceedance is due to the Project and continue until no exceedance of Action Level	• Verify the Notification of Exceedance • Check monitoring data submitted by ET • Check Contractor's working methods • Discuss with ET Leader and Contractor on proposed remedial measures • Review proposals on remedial measures • Audit the implementation of the remedial measures • Audit the effectiveness of the implemented remedial measures	• Submit proposals for remedial measures to IEC • Implement the agreed proposals • Amend proposal if appropriate

Event	Action		
	ET	IEC	Contractor
Limit Level being exceeded by two consecutive sampling days	• Repeat *in situ* measurement to confirm findings • Identify source(s) of impact and cause(s) of exceedance • Prepare the Notification of Exceedance within 24 hours • Inform Contractor, IEC, Project Proponent and EPD (EIAO Authority) whether the cause of exceedance is due to the Project • Discuss with Contractor and IEC for remedial measures required • Ensure remedial measures are properly implemented • Increase the monitoring frequency to daily if exceedance is due to the Project until no exceedance of Limit Level	• Verify the Notification of Exceedance • Check monitoring data submitted by ET • Check Contractor's working methods • Discuss with ET and Contractor on proposed remedial measures • Review proposals on remedial measures • Audit the implementation of the remedial measures • Audit the effectiveness of the implemented remedial measures	• Critically review the working methods • Rectify unacceptable practice • Check all plant and equipment • Consider changes of working methods • Discuss with the ET and IEC and propose mitigation measures to the IEC • Implement the agreed mitigation measures
Limit Level being exceeded by more than two consecutive sampling days	• Repeat *in situ* measurement to confirm findings • Identify source(s) of impact and cause(s) of exceedance • Prepare the Notification of Exceedance within 24 hours • Inform Contractor, IEC, Project Proponent and EPD (EIAO Authority) whether the cause of exceedance is due to the Project • Check monitoring data, all plant, equipment and Contractor's working methods • Discuss with Contractor and IEC for remedial measures required • Ensure mitigation measures are implemented • Increase the monitoring frequency to daily if exceedance is due to the Project until no exceedance of Limit Level for two consecutive days	• Verify the Notification of Exceedance • Check monitoring data submitted by ET • Check Contractor's working methods • Discuss with ET and Contractor on proposed remedial measures • Review proposals on remedial measures • Audit the implementation of the remedial measures • Audit the effectiveness of the implemented remedial measures	• Critically review the working methods • Rectify unacceptable practice • Check all plant and equipment • Consider changes of working methods • Discuss with the ET and IEC and propose mitigation measures • Implement the agreed mitigation measures • As directed by the Project Proponent, slow down or stop all or part of the construction activities

Table 4.5b Event and Action Plan for Water Quality Monitoring During Operation/Restoration and Aftercare Phases

Event	Action		
	ET	**IEC**	**Contractor**
Exceedance of Limit Level for surface water monitoring	• Identify source(s) of impact and investigate the cause(s) of exceedance • Prepare Notification of Exceedance within 24 hours • Inform Contractor, IEC, Project Proponent and EPD (EIAO Authority) whether the cause of exceedance is due to the Project • Discuss with Contractor and IEC for remedial measures required • Ensure remedial measures are properly implemented • Repeat measurement to confirm finding if exceedance is due to the Project • Increase monitoring frequency to weekly if exceedance is due to the Project until no exceedance of Limit Level	• Verify the Notification of Exceedance • Check monitoring data submitted by ET • Check Contractor's working methods • Discuss with ET and Contractor on proposed remedial measures • Review proposals on remedial measures • Audit the implementation of the remedial measures • Audit the effectiveness of the implemented remedial measures	• Take immediate action to avoid further exceedance • Submit proposals for remedial measures to IEC • Implement the agreed proposals • Amend proposal if appropriate
Exceedance of Limit Level for groundwater monitoring	• Identify source(s) of impact and investigate the cause(s) of exceedance • Prepare Notification of Exceedance within 24 hours • Inform Contractor, IEC, Project Proponent and EPD (EIAO Authority) whether the cause of exceedance is due to the Project • Discuss with Contractor and IEC for remedial measures required • Ensure remedial measures are properly implemented • Repeat measurement to confirm finding if exceedance is due to the Project • Increase monitoring frequency to weekly at monitoring well if exceedance is due to the Project until no exceedance of Limit Level	• Verify the Notification of Exceedance • Check monitoring data submitted by ET • Check Contractor's working methods • Discuss with ET and Contractor on proposed remedial measures • Review proposals on remedial measures • Audit the implementation of the remedial measures • Audit the effectiveness of the implemented remedial measures	• Divert groundwater collected at the collection sumps to the leachate treatment plant • Submit proposals for remedial measures to IEC • Rectify any unacceptable practice or design • Amend working methods as required • Implement amended working methods, if necessary

Event	Action		
	ET	IEC	Contractor
Exceedance of Limit Level for leachate level	• Investigate the cause(s) of exceedance • Prepare Notification of Exceedance within 24 hours • Inform Contractor, IEC, Project Proponent and EPD (EIAO Authority) whether the cause of exceedance is due to the Project • Discuss with Contractor and IEC for remedial measures required • Ensure remedial measures are properly implemented	• Verify the Notification of Exceedance • Check with Contractor on the operating activities and performance of the leachate collection system • Discuss with ET and Contractor on proposed remedial measures • Review proposals on remedial measures • Audit the implementation of the remedial measures • Audit the effectiveness of the implemented remedial measures	• Check the performance of the leachate collection system • Rectify any unacceptable practice; • Amend leachate collection design if required • Implement amended leachate collection system, if necessary
Exceedance of Limit Level of effluent discharge from LTP	• Investigate the cause(s) of exceedance • Prepare Notification of Exceedance within 24 hours • Inform Contractor, IEC, Project Proponent and EPD (EIAO Authority) whether the cause of exceedance is due to the Project • Discuss with Contractor and IEC for remedial measures required • Ensure remedial measures are properly implemented • Repeat measurement to confirm finding if exceedance is due to the Project • Increase monitoring frequency to weekly until no exceedance of Limit Level	• Verify the Notification of Exceedance • Check with Contractor on the operation performance of the LTP • Discuss with ET and Contractor on proposed remedial measures • Review proposals on remedial measures • Audit the implementation of the remedial measures • Audit the effectiveness of the implemented remedial measures	• Rectify any unacceptable performance • Carry out remedial measures or amend design as required • Implement amended design, if necessary

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5 LANDFILL GAS

5.1 INTRODUCTION

Potential landfill gas hazards to developments in the vicinity of a landfill site will depend on the effectiveness of the landfill gas management system of the SENTX; the nature of the migration pathways and types of the developments. The *Section* describes the landfill gas monitoring requirements for the SENTX.

5.2 METHODOLOGY AND CRITERIA

The landfill gas monitoring programme includes *in situ* measurement and gas sampling for laboratory testing to ensure the landfill gas control systems are effective in preventing migration of landfill gas off Site. The monitoring locations should include the perimeter of the waste boundary (monitoring wells), area between the SENTX Site boundary and the waste boundary (surface emission), occupied on-site building, service voids, utilities pit and manholes in the vicinity of the SENTX (build-up of landfill gas). The gaseous composition at the landfill gas flares should also be monitor to ensure the landfill gas treatment system is operating at optimal efficiency and no adverse environmental impacts are associated with its operation. Details of the emission monitoring requirement for flare emissions are described in *Section 3.6*.

5.3 MONITORING PARAMETERS, LOCATIONS AND FREQUENCY

For the purpose of establishing the baseline condition at the boundary of the SENTX Site and thus the Action Level for the operation/restoration and aftercare phases, it is recommended that gas in the perimeter landfill gas monitoring wells be monitored at monthly intervals for a period of 12 months prior to commencement of waste filling. These monitoring wells should be monitored for the presence of landfill gas throughout the operation/restoration and aftercare phases. Bulk gas samples should also be taken from at least 2 of the perimeters landfill gas monitoring wells at quarterly basis for laboratory analysis of its composition.

A total of 36 landfill gas monitoring wells (24 are new wells and 12 are existing wells for SENT Landfill) is proposed and their locations are shown in *Figure 5.3a*. The spacing of the new landfill gas monitoring wells along the western and southern boundaries of the SENTX is approximately 50m and the spacing of the monitoring wells along the eastern boundary is about 100m. The permanent gas monitoring systems with alarms should be installed and operated in all occupied on-site buildings.

The parameters, locations and frequency of landfill gas monitoring for various phases of the SENTX are summarized in *Table 5.3a*.

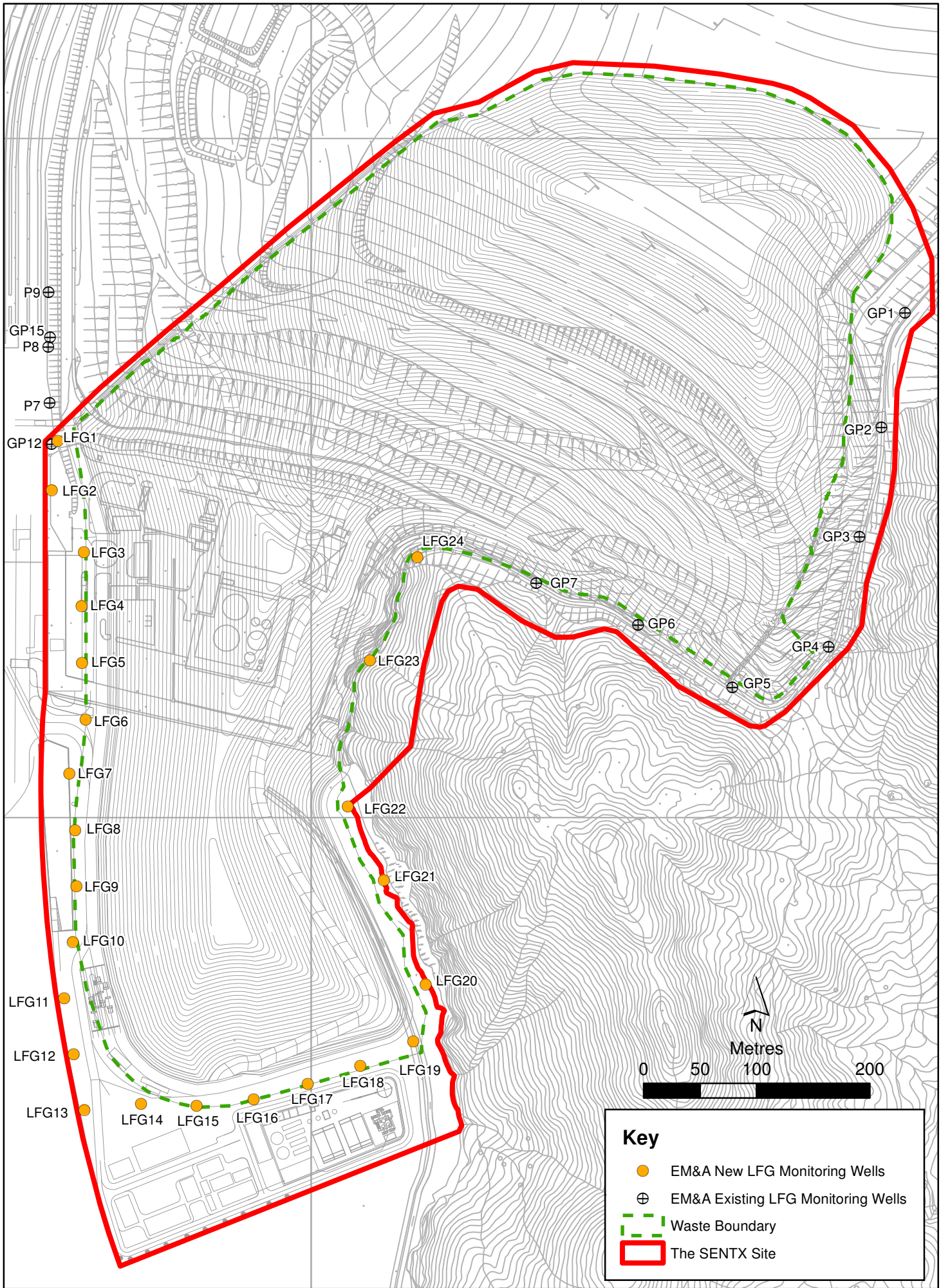

Figure 5.3a

Location of Landfill Gas Monitoring Wells

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Date: 20/11/2019

Environmental Resources Management

ERM

Table 5.3a Parameters, Locations and Frequency of Landfill Gas Monitoring

Phase	Monitoring Location	Monitoring Frequency	Monitoring Parameters
Baseline Monitoring	All perimeter LFG monitoring wells	Monthly, for a period of 12 months prior to waste filling	• Methane • Carbon dioxide • Oxygen • Atmospheric pressure
Operation / Restoration/ Aftercare	Perimeter LFG monitoring wells	Monthly	• Methane • Carbon dioxide • Oxygen • Atmospheric pressure
	Permanent gas monitoring system in all occupied on-site buildings	Continuous	• Methane (or flammable gas) by permanent gas monitoring system
	Areas between the SENTX Site boundary and the waste boundary and location of vegetation stress	Quarterly	• Flammable gas emitted from the ground surface [(a)]
	Bulk gas sampling at least 2 of the perimeters LFG monitoring wells (for laboratory analysis by gas chromatography)	Quarterly	• Methane • Carbon dioxide • Oxygen • Nitrogen • Other flammable gas • Carbon monoxide
	Service voids, utilities and manholes along the Site boundary and within the SENTX Site	Monthly	• Carbon dioxide • Oxygen • Methane

Note:
(a) To be calibrated with methane gas

5.4 MONITORING EQUIPMENT

5.4.1 Portable Equipment

Surface Emissions of Flammable Gases

The instrument should be able to measures flammable gas concentration (calibrated with methane gas) in the range of 1 to 10,000 ppm. The instrument should be intrinsically safe if used in confined area. The surface gas emission survey should be conducted at a slow pace with the inlet tube of the meter probe a few centimeters above ground surface.

Carbon dioxide, Methane, Oxygen and Gas Pressure

The instruments should be of a robust and weatherproof design and able to monitor the above parameters in landfill gas monitoring wells, probes, piezometer and gas well heads.

Dipmeter

A portable dipmeter should be used to monitor the water level in the gas monitoring wells, probes or piezometers.

Bulk Landfill Gas

Sampling containers, such as Tedlar bags, stainless steel gas cylinders or glass gas bombs should be used for landfill gas sampling with suitable gas sampling pump. The sampling tube through which the gas is withdrawn from the gas monitoring wells, probes, piezometers or well heads into the sampling containers should be made of inert materials. A drying tube should be used to minimize the moisture content of the gas sample. The gas samples should be taken prior to field measurement of that landfill gas monitoring well, probes, piezometers or well heads.

5.4.2 Permanent Monitoring System

Permanent Landfill Gas Monitoring System Inside Buildings

The detection system should consist of the following components:

- detector heads located within all occupied site buildings and located close to below ground utilities, other confined spaces, or other areas where gas ingress or gas accumulation may occur. The detectors should have a pre-set alarm levels for methane at 20% lower explosive limit (LEL, equivalent to 1% methane gas (v/v) and are fitted with audible alarms.

- A central control penal which should alert site personnel when the gas concentration at any detector reaches the alarm level.

5.5 LABORATORY MEASUREMENT/ANALYSIS

Bulk gas sample should be transferred to the analytical laboratory within 24 hours and analysed within 48 hours after collection.

Bulk gas samples should be analysis by gas chromatography for the parameters listed in *Table 5.3a* to detection limit of 0.0025% or lower unless other specified. The carrier gas to be used during the analyses should be helium, hydrogen or nitrogen with a minimum purity of 99.995%.

The results of field monitoring and laboratory analyses of bulk samples should be checked to see if the gas concentrations measured by both methods are within the same order of magnitude. If two sets of data are not comparable, the sampling procedures should be checked and if deemed

necessary, to repeat the monitoring and recalibrate the portable monitoring instruments.

5.6 COMPLIANCE REQUIREMENTS

5.6.1 Limit Levels for Landfill Gas

The Limit Levels for landfill gas constituents of the SENTX are shown in *Table 5.6a.*

Table 5.6a Limit Levels for Landfill Gas Constituents

Location	Parameter	Limit Level
All perimeter landfill gas monitoring wells	Methane	1% by volume
	Carbon Dioxide	1.5% by volume above background [(a)]
Permanent gas monitoring system	Methane (or flammable gas)	1% by volume (20% LEL)
Area between the SENTX Site boundary and the waste boundary (surface emission)	Flammable gas	30 ppm
Service voids, utilities pits and manholes and location of vegetation stress	Methane (or flammable gas)	1% by volume

Note:
(a) Background concentrations established in baseline monitoring

5.6.2 Event/Action Plan

Should the monitoring results of the landfill gas parameters at any designated monitoring point indicate that the action levels in *Table 5.6a* are exceeded, the actions described in the EAP (see *Table 5.6b*) should be implemented.

Table 5.6b Event/Action Plan for Landfill Gas Monitoring

Event	Action		
	ET	IEC	Contractor
Limit Level being exceeded for field monitoring at the perimeter monitoring wells	• Investigate the cause(s) of exceedance • Prepare the Notification of Exceedance within 24 hours • Check monitoring data, all plant, equipment and the Contractor's working methods • Inform Contractor, IEC, Project Proponent and EPD (EIAO Authority) whether the cause of exceedance is due to the Project • Discuss with Contractor and IEC for remedial measures required • Ensure remedial measures are properly implemented • Increase the monitoring frequency to daily if exceedance is due to the Project for monitoring wells in the areas where there is development within 250m of the SENTX Site Boundary and to weekly for other monitoring wells, until no exceedance of limit level	• Verify the Notification of Exceedance • Discuss with ET and Contractor on proposed remedial measures • Review proposals on remedial measures • Audit the implementation of the remedial measures • Audit the effectiveness of the implemented remedial measures	• Repeat field measurement to confirm findings • Check the performance of landfill gas management system • Rectify unacceptable practice • Discuss with the ET and IEC and submit proposals for remedial measures to IEC • Implement the agreed proposals • Amend proposal if appropriate
Limit Level being exceeded for the bulk gas sampling at the perimeter monitoring wells	• Check and compare the results of field monitoring and laboratory analyse of bulk samples • If the results of field monitoring also show exceedance, the action(s) for limit level being exceeded for field monitoring would have been triggered • If the results of field monitoring does not show exceedance, the sampling procedures should be checked and if deems necessary, to repeat the monitoring and recalibrate the portable monitoring instruments • Notify the above findings to Contractor and IEC	• Verify the findings by ET	• Nil

Event	Action		
	ET	IEC	Contractor
Limit Level being exceeded at the permanent gas monitoring system	• Investigate the cause(s) of exceedance • Prepare the Notification of Exceedance within 24 hours • Check the methane gas level at the perimeter monitoring wells, manholes or utilities duct • Check monitoring data, all plant, equipment and the Contractor's working methods • Inform Contractor, IEC, Project Proponent and EPD (EIAO Authority) whether the cause of exceedance is due to the Project • Discuss with Contractor and IEC for remedial measures required • Ensure remedial measures are properly implemented	• Verify the Notification of Exceedance • Discuss with ET and Contractor on proposed remedial measures • Review proposals on remedial measures • Audit the implementation of the remedial measures • Audit the effectiveness of the implemented remedial measures	• Evacuate all staff in the concerned building • Open the doors and window of all rooms on the ground floor • Do not allow staff to go back to the room if methane level is higher than 1% gas • Check the performance of the landfill gas management system • Rectify unacceptable practice • Consider changes of working methods • Discuss with the ET and IEC and submit proposals for remedial measures to IEC • Implement the agreed proposals • Amend proposal if appropriate
Limit Level being exceeded during surface emission monitoring	• Repeat the measurement to confirm findings • Investigate the cause(s) of exceedance • Prepare the Notification of Exceedance within 24 hours • Check monitoring data, all plant, equipment and the Contractor's working methods • Inform Contractor, IEC, Project Proponent and EPD (EIAO Authority) whether the cause of exceedance is due to the Project • Discuss with Contractor and IEC for remedial measures required • Ensure remedial measures are properly implemented • Increase the monitoring frequency to monthly if exceedance is due to the Project until no exceedance of limit level	• Verify the Notification of Exceedance • Discuss with ET and Contractor on proposed remedial measures • Review proposals on remedial measures • Audit the implementation of the remedial measures • Audit the effectiveness of the implemented remedial measures	• Check landfill gas management system • Rectify unacceptable practice • Consider changes of working methods • Discuss with the ET and IEC and submit proposals for remedial measures to IEC • Implement the agreed proposals • Amend proposal if appropriate

Event	Action		
	ET	IEC	Contractor
Limit Level being exceeded at the service voids, utilities pits, manholes and location of vegetation stress	• Repeat the measurement to confirm findings • Investigate the cause(s) of exceedance • Prepare the Notification of Exceedance within 24 hours • Check monitoring data, all plant, equipment and the Contractor's working methods • Inform Contractor, IEC, Project Proponent and EPD (EIAO Authority) whether the cause of exceedance is due to the Project • Discuss with Contractor and IEC for remedial measures required • Ensure remedial measures are properly implemented • Increase the monitoring frequency to weekly if exceedance is due to the Project until no exceedance of limit level	• Verify the Notification of Exceedance • Discuss with ET and Contractor on proposed remedial measures • Review proposals on remedial measures • Audit the implementation of the remedial measures • the effectiveness of the implemented remedial measures	• Check landfill gas management system • Rectify unacceptable practice • Discuss with the ET and IEC and submit proposals for remedial measures to IEC • Implement the agreed proposals • Amend proposal if appropriate

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6 NOISE

6.1 INTRODUCTION

The mitigation measures and general requirements, methodology and equipment for monitoring and audit of noise impacts associated with the Project are described in this *Section*.

6.2 METHODOLOGY AND CRITERIA

Although no adverse impacts are predicted at the Noise Sensitive Receivers (NSRs), it is still recommended to undertake noise monitoring near the SENTX Site boundary during construction, operation/restoration phase of the SENTX to ensure the noise criteria at the NSRs can be met. Noise monitoring is not considered necessary during the aftercare phase. However, if there are major construction works to be carried out on site during the aftercare period, noise should be monitored at weekly basis during this period.

The noise level should be measured in terms of the A-weighted equivalent continuous sound pressure level (L_{eq}) for a period of 30 minutes between 07:00 and 19:00 hours on normal weekdays.

6.2.1 *Construction Phase*

Whilst the *Noise Control Ordinance* (NCO) does not provide the statutory control of construction activities occurring on weekdays during normal working hours (ie Monday to Saturday inclusive 07:00-19:00 hours), a day-time standard of 75dB(A) $L_{eq,\ 30\ minute}$ stipulated in Annex 5 of the *Technical Memorandum on Environmental Impact Assessment Process* (*EIAO-TM*) should be used as the construction noise limit.

It is not anticipated that construction works will be carried out during the restricted hours (ie 19:00 to 07:00 hours). However, when construction works within the restricted hours is needed, a Construction Noise Permit (CNP) is required under the *NCO* and the Contractor should comply with the standards promulgated in *Technical Memorandum on Noise from Construction Work other than Percussive Piling (GW-TM)*.

6.2.2 *Operational Phase*

The standard stipulated in the *Technical Memorandum on Noise From Places Other than Domestic Premises, Public Places or Construction Sites* (*IND-TM*) should be complied with.

6.3 *MONITORING EQUIPMENT*

The Contractor should be responsible for providing and maintaining a sufficient number of sound level meters for the baseline, impact and *ad hoc* monitoring. The ET Leader should ensure the equipment is kept in a good state of repair in accordance with the manufacturer's recommendations and maintained in proper working order with sufficient spare equipment available in the event of breakdown to maintain the planned monitoring programme.

Sound level meters and calibrators should comply with the *International Electrotechnical Commission (IEC) Publication 651 : 1979 (Type 1) and 804 : 1985 (Type 1)* specification as stated in the *GW-TM* and *IND-TM*. The sound level meters should be supplied and used with the manufacturers recommended wind shield.

The calibration of the sound level meters should be carried out in accordance with the manufacturer's requirements. Sound level meters should be calibrated using a portable calibrator before and after each measurement. The calibration levels should be noted with the measurement results and where the difference between the calibration levels is greater than 1 dB(A) the measurement will be repeated. The sound level meters, including the calibrators, should be verified by the manufacturers once every two years. Calibrated hand-held anemometers capable of measuring the wind speed in m s^{-1} should also be supplied for the measurement of wind speeds during noise monitoring periods. The anemometers should be used and calibrated in accordance with the manufactures recommendations.

Noise measurements should not be made in the presence of fog, rain, wind with a steady speed exceeding 5 m s^{-1} or wind with gusts exceeding 10 m s^{-1}. The wind speed should be checked with the hand-held anemometers.

6.4 *MONITORING LOCATIONS*

As the NSRs are located at more than 1.6km away from the SENTX, it is not considered appropriate to carry out monitoring at the NSRs as the monitoring results is likely to be dominated by other noise sources near the NSRs. Two locations along and at around 100m from the SENTX Site boundary have therefore been selected for conducting the monitoring, as shown in *Figure 3.2a*. Noise levels at NM1 should be monitored during construction and the first 3 years of operation, while NM2 should be monitored during the next 3 years of operation until the completion of the Restoration phase.

6.5 *BASELINE MONITORING*

The Contractor should carry out baseline noise monitoring prior to the commencement of the construction works. The baseline monitoring should be measured for a continuous period of at least 14 consecutive days at a minimum logging interval of 30 minutes for day-time between 07:00 and 19:00 hours of normal weekdays. The L_{eq}, L_{10} and L_{90} should be recorded at the

specified interval. A schedule on the baseline monitoring should be submitted to the IEC and EPD (EIAO Authority) for information before the monitoring starts.

There should not be any construction activities in the vicinity of the monitoring locations during the baseline monitoring. In case there is insufficient baseline monitoring data or questionable results are obtained, the ET Leader should liaise with the IEC and EPD (EIAO Authority) to agree on an appropriate set of data to be used as a baseline reference and submit to EPD (EIAO Authority) for information.

6.6 IMPACT MONITORING

Noise monitoring should be undertaken during the construction and operation/restoration phases to ensure compliance with the acceptable noise level. Noise monitoring should be undertaken weekly at the monitoring locations to obtain one set of 30-minute measurement between 07:00 and 19:00 hours on normal weekdays.

Weekly site audits should be conducted throughout the construction and operation/restoration phases to ensure that the proposed mitigation measures are implemented properly and that the plant inventory used on site is consistent with the assumptions used in the approved *EIA Report* taking account of the latest design .

6.7 EVENT AND ACTION PLAN

The action and limit levels for construction and operation noise are defined in *Table 6.7a*. If non-compliance occurred, actions as stated in *Table 6.7b* should be undertaken.

Table 6.7a Action and Limit Levels for Noise

Time Period	Action Level [a]	Limit Level [b]
Construction Noise:		
07:00 – 19:00 hrs on normal weekdays	When one documented complaint is received from any one of the noise sensitive receivers or 75 dB(A) recorded at the monitoring station	75 dB(A) at NSRs
Operational Noise:		
07:00 – 19:00 hrs on all days	When one documented complaint is received from any one of the NSRs or 75 dB(A) recorded at the monitoring station	65 dB(A) at NSRs [c]
19:00 – 23:00 hrs on all days		65 dB(A) at NSRs [c]
23:00 – 07:00 hrs on all days		55 dB(A) at NSRs [c]

Notes:

(a) 75dB(A) along and at about 100m from the SENTX site boundary was set as the Action Level.

(b) Limits specified in the GW-TM and IND-TM for construction and operational noise, respectively.

(c) Limit Level only apply to operational noise without road traffic and construction activities noise.

Table 6.7b Event and Action Plan for Construction and Operational Noise Monitoring

Event	Action		
	ET	**IEC**	**Contractor**
Action Level	• Identify the source(s) and investigate the cause(s) of exceedance and complaint • Prepare Notification of Exceedance within 24 hours • Inform Contractor, IEC and Project Proponent whether the cause of exceedance is due to the Project • Discuss with Contractor and IEC for remedial measures required • Ensure remedial measures are properly implemented • Have additional monitoring if exceedance is due to the Project. If exceedance stops, cease additional monitoring	• Verify the Notification of Exceedance • Check monitoring data submitted by ET • Discuss with ET and Contractor on proposed remedial measures • Review proposals on remedial measures • Audit the implementation of the remedial measures • Audit the effectiveness of the implemented remedial measures	• Submit proposals for remedial measures to IEC • Implement the agreed proposals
Limit Level	• Identify the source(s) and investigate the cause(s) of exceedance and complaint • Prepare Notification of Exceedance within 24 hours • Inform Contractor, IEC, Project Proponent and EPD (EIAO Authority) whether the cause of exceedance is due to the Project • Analyse the operation of SENTX and investigate the causes of exceedance • Provide interim report to Contractor, IEC, Project Proponent and EPD (EIAO Authority) the causes of the exceedances • Discuss with Contractor and IEC for remedial measures required • Ensure remedial measures are properly implemented • Report the remedial measures implemented and the additional monitoring results to Contactor, IEC, Project Proponent and EPD (EIAO Authority) • Have additional monitoring if exceedance is due to the Project. If exceedance stops, cease additional monitoring	• Verify the Notification of Exceedance • Check monitoring data submitted by ET • Discuss with ET and Contractor on proposed remedial measures • Review proposals on remedial measures • Audit the implementation of the remedial measures • Audit the effectiveness of the implemented remedial measures	• Take immediate measures to avoid further exceedance • Submit proposals for remedial measures to IEC within 3 working days of notification • Implement the agreed proposals • Resubmit proposals if problem still not under control • Stop the relevant activity of works as determined by the Project Proponent until the exceedance is abated

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7 WASTE MANAGEMENT

7.1 GENERAL

Construction and demolition waste, chemical wastes and general refuse will be generated during the construction, operation/restoration and aftercare phases of the SENTX. With the implementation of the good site practices, the handling, collection, transportation and disposal of the wastes arising from the SENTX will not cause adverse environmental impacts with respect to the criteria specified in the *EIAO-TM*.

The good site practices are further described below and the Contractor should ensure that all the necessary waste disposal permits or licences are obtained prior to the commencement of the construction works.

7.2 MITIGATION MEASURES

7.2.1 *Construction Waste*

Wherever practicable, the excavated materials and inert construction waste generated from site clearance and construction and demolition of site infrastructure should be segregated from other wastes to avoid contamination, and reused on-site for the site formation works and during operation to reduce the amount of construction waste to be disposed off-site.

The contractor should open a billing account with the EPD in accordance with the *Waste Disposal (Charges for Disposal of Construction Waste) Regulation*. Every load of construction waste or public fill to be transferred to the Government disposal facilities such as public fill reception facilities, sorting facilities and landfills will require a valid "chit".

A trip-ticket system should also be established in accordance with *Development Bureau Technical Circular (Works) No. 6/2010* to monitor the disposal of construction waste at the SENT Landfill, and public fill to the public fill reception or sorting facilities. The trip-ticket system should be included as one of the contractual requirements and implemented by the Contractor.

7.2.2 *Chemical Waste*

The Contractor should be registered as a chemical waste producer with the EPD. Chemical waste should be handled in accordance with the *Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes.*

7.2.3 *Sludge*

In case off-site disposal is required, the sludge generated from the LTP during operation/ restoration phase should be transported to another waste disposal facility, e.g. other landfills or the Sludge Treatment Facility using enclosed

containers. The LTP will continue to operate during the aftercare phase and the sludge generated should be dewatered (> 30% dry solids) and transported to another waste disposal facility, e.g. other landfills or the Sludge Treatment Facility for off-site disposal, if required.

7.2.4 Sewage

An adequate number of portable toilets should be provided at the Site during construction phase. The sludge collected from the portable toilets should be disposed of at the appropriate STW. Sewage generated during the operation/restoration and aftercare phases should be diverted to the LTP for treatment or to public sewer, if available.

7.2.5 General Refuse

General refuse should be stored in enclosed bins separately from construction and chemical wastes. The general refuse should be delivered to other approved waste transfer /disposal facilities, e.g. refuse transfer station or landfill on a daily basis during the construction, operation/restoration and aftercare phases.

7.2.6 Staff Training

At the commencement of the construction works, training should be provided to workers on the concepts of site cleanliness and on appropriate waste management procedures, including waste reduction, reuse and recycling. Refreshment courses should be held one a regular basis (eg once a year).

7.3 SITE AUDIT/INSPECTION

Weekly site audits of the waste management practices should be carried out during the construction and operation/restoration phases to determine if wastes are being managed in accordance with the good site practices described in this update EM&A Manual. The audits should examine all aspects of waste management including waste generation, storage, recycling, transport and disposal.

8 ECOLOGY

8.1 INTRODUCTION

This *Section* describes the monitoring and audit requirements with respect to ecology during the construction, operation, restoration and aftercare phases of the SENTX.

The mitigation measures recommended to further reduce the potential impacts and disturbance to the surrounding habitats are summarised in *Annex A*.

8.2 MITIGATION MEASURES

8.2.1 *Measures for Controlling Construction Site Runoff*

The following measures for controlling site runoff will be implemented to avoid potential water quality impacts.

- Exposed soil areas should be minimised to reduce the contamination of runoff and erosion;
- To prevent stormwater runoff from washing across exposed soil surfaces, perimeter channels should be constructed in advance of site formation works and earthworks and intercepting channels should be provided for example along the edge of excavation;
- Silt removal facilities, channels and manholes should be maintained and the deposited silt and grit should be removed regularly to ensure they are functioning properly at all times;
- Temporary covers such as tarpaulin should also be provided to minimise the generation of high suspended solids runoff;
- The surface runoff contained any oil and grease will pass through the oil interceptors; and
- Control measures, including implementation of excavation schedules, lining and covering of excavated stockpiles will be implemented to minimise contaminated stormwater run-off from the SENTX Site.

8.2.2 *Good Construction Site Practice*

The following good construction site practice will be implemented to avoid ecological impacts.

- Erect fences along the boundary of the SENTX Site before the commencement of construction works to prevent vehicle movements, and encroachment of personnel, onto adjacent areas;

- Regularly check the work site boundaries to ensure that they are not breached and that damage does not occur to surrounding areas;

8.2.3 Measures for Controlling Migration of Leachate

Leachate should be contained within the SENTX Site by the proposed leachate containment system and collected by the leachate collection system to prevent potential migration of leachate to habitats in the vicinity. The implementation details of monitoring the management of leachate are described in *Section 4 - Water Quality Monitoring*.

8.2.4 Measures for Controlling Migration of Landfill Gas

Stress to vegetation due to off-site migration of landfill gas should be prevented by proper management (e.g. gas abstraction and flaring, and landfill gas monitoring) of the landfill gas generated from the SENTX. Ignition fires should be prohibited within the boundary of the SENTX Site. Further details of monitoring requirement for surface emission and off-site migration of landfill gas are described in *Section 5 - Landfill Gas Monitoring*.

8.3 COMPENSATION

The following compensation planting is recommended as the mitigation measures for the impacted habitats due to the SENTX.

- Provision of 6 ha of mixed woodland planting to compensate the loss of shrubland; and

- Provision of a mosaic of grassland and shrubland in the remaining areas of the SENTX Site.

The mixture of grassland, shrubland and woodland habitats are recommended to diversify the habitats for supporting various wildlife in particular butterflies, birds and herpetofauna and blend into the adjacent environment.

It is recommended that indigenous plant species of shallow root system, softwood in nature and adaptive to sea shore habitat (such as *Gordonia axillaris, Phyllanthus emblica, Celtis sinensis* and *Macaranga tanarius*) should be used for the restoration of the SENTX. Taking consideration of the relative poor substrate and the difficulties of establishment of some native trees in Hong Kong, it is recommended to include approximately 20% of non-native tree species in the compensatory woodland. The non-native tree species can serve as a nurse species to facilitate the establishment of the native tree species and it can be replaced by established native tree species progressively. Plant species can also make reference to food plants of butterfly species (in particularly butterfly species of conservation interests recorded within the CWBCP) such as *Ischaemum aristatum, Microstegium ciliatum, Miscanthus floridulus, Miscanthus floridulus, Ficus superba, Phoenix hanceana* and *Zanthoxylum nitidum*.

It is also recommended that a trial nursery for native plant species be set up in advance during the construction phase in order to fine tune the planting matrix and management intensity of the recommended indigenous tree species. It should be noted that native shrubs and tree species had been used for restoration of the existing SENT Landfill, native plant species that could not successfully be established on the existing SENT Landfill should be reviewed before the preparation of the compensatory planting list. Special care and intensive management of native plant should be implemented in order to ensure proper establishment of the native plants.

8.4 ENVIRONMENTAL MONITORING AND AUDIT

The implementation of the ecological mitigations and compensation planting should be checked by the ET as part of the EM&A procedures during the construction, operation/restoration and aftercare phases.

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9 LANDSCAPE AND VISUAL

9.1 INTRODUCTION

It is recommended that EM&A for landscape and visual resources is undertaken during the design, construction, operation and restoration/ aftercare phases of the SENTX. The design, implementation and maintenance of landscape mitigation measures is a key aspect of this should be checked to ensure that they are fully realised and that potential conflicts between the proposed landscape measures and any other the SENTX works and operational requirements are resolved at the earliest possible time and without compromise to the intention of the mitigation measures. In addition, implementation of the mitigation measures should be monitored through the regular site inspection/audit programme.

9.2 MITIGATION MEASURES

A series of mitigation measures recommended to ameliorate the landscape and visual impacts during the construction, operation/restoration and aftercare phases of the SENTX are summarised in the *Annex A*.

9.3 DESIGN PHASE AUDIT

The landscape measures proposed in the *EIA Report* with updates from the current EP and the latest design to mitigate the landscape and visual impacts of the SENTX should be embodied into the detailed landscape design drawings and contract documents including the protection of existing trees, the transplanting of existing trees and landscape restoration proposals, notably the phasing of restoration, final grading profiles and the planting of new trees and shrubs. Designs should be checked to ensure that the measures are fully incorporated and that potential conflicts with civil engineering, geotechnical, structural, drainage, underground utility and operational requirements are resolved prior to construction and operation/ restoration of the SENTX.

The design phase EM&A requirements for landscape and visual resources comprise the audit of the detailed landscaping designs and specifications to be prepared during the detailed design together with ensuring that the design is sensitive to landscape and visual impacts and that landscape resources are retained as far as practicable. Monitoring of design works against the recommendations of the landscape and visual impact assessments of the *EIA Report* with updates from the current EP and the latest design should be undertaken when the designs are produced to ensure that they fulfill the intentions of mitigation measures.

The design phase audit should be carried out by a Registered Landscape Architect and checks should be made at two points in time: namely:

- First draft of Detailed Design Drawings; and
- Draft Construction Drawings.

The design phase audit should be carried out in accordance with the list of issues that are addressed in design drawings and mitigation measures as described in this updated EM&A Manual.

9.3.1 Non-Conformity in the Design Phase

The landscape auditor should review the designs 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 a non-conformity, the EAP as detailed in *Table 9.3a* should be followed.

Table 9.3a Event and Action Plan for Design Phase

Action Level	Landscape Auditor from the ET	Independent Consultant (IC)	Project Landscape Architect (PLA) from the Contractor
Non Conformity (with Design Standards and Specification)	• Identify Source • Inform Project Proponent and PLA • Discuss remedial actions with Project Proponent and PLA • Verify remedial actions when complete	• Notify PLA • Discuss remedial actions with PLA • Ensure remedial designs are fully incorporated	• Amend designs • Discuss remedial actions with Project Proponent

9.3.2 Baseline Monitoring

Baseline monitoring for the landscape and visual resources will comprise checking and updating of:

- The landscape resources identified in the *EIA Report* taking account of the latest design and elements of particular concern are to be re-checked and any changes identified;
- Any Tree Survey Report prepared;
- Habitat maps in the *EIA Report* taking account of the latest design; and
- Landscape and visual impact assessments included in the *EIA Report* taking account of the latest design, to include updated photos of each landscape character area (LCA) and landscape resources (LR) which have changed.

9.4 CONSTRUCTION PHASE AUDIT

A specialist Landscape Sub-Contractor (on the Government's Approved List) should be employed by the Contractor for the implementation of landscape works and subsequent maintenance operations during the construction phase. All landscape works carried out in this phase should have a two-year establishment period.

All measures should be audited by a Registered Landscape Architect, as a member of the ET, on a regular basis to ensure compliance with the intended aims of the measures. Site inspections should be undertaken monthly throughout the construction period and once every two months during the establishment period for these landscape works. The broad scope of audit is detailed below.

- The extent of the agreed works area should be regularly checked during the construction phase. Any trespass by the Contractor outside the limit of the works, including any damage to existing slopes, trees and woodland should 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;
- The methods of protecting existing vegetation proposed by the Contractor are acceptable and enforced;
- Preparation, lifting transport and re-planting operations for any transplanted trees;
- All landscaping works are carried out in accordance with the *EIA Report* taking account of the latest design and with specifications;
- The planting of new trees, shrubs, groundcover, climbers, ferns, grasses and other plants, together with the replanting of any transplanted trees are carried out properly and within the right season; and
- All necessary horticultural operations and replacement planting are undertaken throughout the restoration / establishment period to ensure the healthy establishment and growth of both transplanted trees and all newly establishment plants.

9.5 OPERATION/RESTORATION PHASE AUDIT

All measures undertaken by both the Contractor during the operational/ restoration phase should be audited by a Registered Landscape Architect, as a member of the ET, on a regular basis to ensure compliance with the intended aims of the measures. Site inspections should be undertaken once a month throughout the operation/restoration period. The broad scope of audit is detailed below. Operational/restoration phase audits should be carried out

throughout the operational/restoration period and thus only the items below concerning this period are relevant to the operational/restoration phase.

- The extent of the agreed works area should be regularly checked during the operation/restoration phases. Any trespass by the Contractor outside the limit of the works, including any damage to existing trees and woodland should 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.

- The methods of protecting existing vegetation proposed by the Contractor are acceptable and enforced.

9.6 AFTERCARE PHASE AUDIT

A specialist Landscape Sub-Contractor (on the Government's approved list) should be employed by the Contractor for the implementation of landscape works and subsequent maintenance operations during the aftercare phase. It is proposed that landscape restoration take place in a minimum of six phases. Thus, restoration and establishment works will be undertaken concurrently for different phases of the landscape restoration. The intention is to provide 30 years of establishment period for any planting works.

All measures undertaken by both the Contractor and the specialist Landscape Sub-Contractor during the operational phase and for 30 years after completion of operation should be audited by a Registered Landscape Architect, as a member of the ET, on a regular basis to ensure compliance with the intended aims of the measures. Site inspections should be undertaken once every six months during the aftercare phase. Items to be checked during the aftercare phase should include:

- All landscaping works are carried out in accordance with the *EIA Report* taking account of the latest design and with specifications.

- The planting of new trees, shrubs, groundcover, climbers, ferns, grasses and other plants, 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 restoration/establishment period to ensure the healthy establishment and growth of both transplanted trees and all newly establishment plants.

9.6.1 Non-Conformity in the Operational/Restoration and Aftercare Phases

In the event of non-compliance the responsibilities of the relevant parties are described in *Table 9.6a*.

Table 9.6a Event and Action Plan for Operational/Restoration and Aftercare Phases

Action level	ET	IEC	Contractor
Non-conformity on one occasion	• Identify source and cause of non-conformity • Inform the IEC and the Contractor • Discuss remedial measures with the IEC and the Contractor • Ensure remedial measures are properly implemented • Monitor remedial measures until rectification has been completed	• Check monitoring report • Check the Contractor's working method • Discuss with ET and Contractor on proposed remedial measures • Review proposals on remedial measures • Audit the implementation of the remedial measures • Audit the effectiveness of the implemented remedial measures	• Propose remedial measures • Amend working methods • Rectify damage and undertake any necessary replacement
Repeated Non-conformity	• Identify source and cause of non-conformity • Inform the IEC and the Contractor • Discuss remedial measures with the IEC and the Contractor • Ensure remedial measures are properly implemented • Monitor remedial measures until rectification has been completed • Increase monitoring frequency. If exceedance stops, cease additional monitoring	• Check monitoring report • Check the Contractor's working method • Discuss with ET and Contractor on proposed remedial measures • Review proposals on remedial measures • Audit the implementation of the remedial measures • Audit the effectiveness of the implemented remedial measures	• Propose remedial measures • Amend working methods • Rectify damage and undertake any necessary replacement

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10 SITE ENVIRONMENTAL AUDIT

10.1 SITE INSPECTION

Site inspections provide a direct means to track and ensure the enforcement of specified environmental protection and pollution control measures. The inspections should be undertaken on a weekly basis by the ET, Contractor and the IEC during the construction and operation/restoration phases and quarterly during the aftercare phase to ensure that appropriate environmental protection and pollution control mitigation measures are properly implemented. Additionally, the ET will be responsible for defining the scope of the inspections, detailing any deficiencies that are identified, and reporting any necessary action or mitigation measures that were implemented as a result of the inspection; the results of the inspections should be made available to the Contractor.

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

- the approved *EIA Report*, updates from the current EP and the latest design (GVL Design) and EM&A recommendations on environmental protection and pollution control mitigation measures;
- ongoing results of the EM&A programme;
- works progress and programme;
- individual works method statements which will include proposals on associated pollution control measures; and
- relevant environmental protection and pollution control laws.

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

Ad hoc site inspections should also be carried out by the ET and IEC if significant environmental problems are identified. Inspections may also be

required subsequent to receipt of an environmental complaint, or as part of the associated investigation work.

10.2 ENVIRONMENTAL MANAGEMENT PLAN

The Contractor is required to define mechanisms for achieving environmental performance targets for the construction and operation of the SENTX. A systematic Environmental Management Plan (EMP) should be developed and implemented by the Contractor in accordance with the *ETWB TC(W) No. 19/2005 Environmental Management on Construction Sites* to ensure effective implementation of the applicable mitigation measures, monitoring and remedial requirements presented in the approved *EIA Report* with updates from the current EP and the latest design, this updated *EM&A Manual* and implementation schedule (*Annex A*). A primary reason for adopting the EMP approach is to make sure that the Contractor are fully aware of their environmental responsibilities and to ensure commitment to achieving specified standards.

The EMP approach is grounded on the principle that the Contractor should define the means by which the environmental requirements of the EIA process, and the contractual documentation should be met. The IEC should audit the implementation status of the EMP and advise the necessary remedial action as required. Such remedial actions should be enforced through contractual requirements. The EMP should be certified by the ET Leader and verified by the IEC. The EMP should be subject to continuous review to ensure that it contains sufficient provision to provide environmental protection.

10.3 COMPLIANCE WITH LEGAL AND CONTRACTUAL REQUIREMENTS

There will be contractual environmental protection and pollution control requirements as well as Hong Kong's environmental protection and pollution control laws which the construction activities will comply with.

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

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

After reviewing the documentation, the ET should advise IEC, IC, Project Proponent, EPD (EIAO Authority) and Contractor of any non-compliance with the contractual and legislative requirements on environmental protection

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

Upon receipt of the advice, the Contractor should undertake immediate action(s) to remedy the situation. The ET, IEC and IC should follow up to ensure the appropriate actions have been taken by the Contractor in order that the environmental protection and pollution control requirements are fulfilled.

10.4 ENVIRONMENTAL COMPLAINTS

The complaints handling procedure should be as follows:

The ET should undertake the following procedures upon receipt of a complaint:

- log complaint and date of receipt into the complaint database and inform the Contractor, IEC and Project Proponent immediately;
- investigate the complaint jointly with the Contractor and the IEC and discuss with the Contractor and IEC to determine its validity and to assess whether the source of the issue is due to construction or landfill activities;
- if a complaint is considered valid due to the construction or landfill activities, the ET should identify mitigation measures in consultation with the Contractor, and submitted to the IEC for review. The IEC should report the results to the Project Proponent;
- if mitigation measures are required, the ET should advise the Contractor accordingly;
- review the Contractor's response on the identified mitigation measures and the updated situation;
- if the complaint is transferred from EPD (Regional Office), an interim report should be submitted to EPD (Regional Office) on the status of the complaint investigation and follow-up action within the time frame assigned by EPD (Regional Office);
- undertake additional monitoring and audit to verify the situation if necessary and ensure that any valid reason for complaint does not recur;
- report the investigation results and the subsequent actions on the source of the complaint for responding to complainant. If the source of complaint is EPD (Regional Office), the results should be reported within the time frame assigned by EPD (Regional Office); and

- record the complaint, investigation, the subsequent actions and the results in the monthly EM&A reports.

During the complaint investigation work, the ET and Contractor should cooperate with the IEC in providing the necessary information and assistance for completion of the investigation. If mitigation measures are identified in the investigation, the Contractor should promptly carry out the mitigation measures. The proposed mitigation measures will be justified by ET Leader, agreed with IEC and approved by EPD (EIAO Authority) and the ET and IEC should check that the measures have been carried out by the Contractor.

10.5 LOG-BOOK

The ET Leader should keep a contemporaneous log-book of each and every instance or circumstance or change of circumstances which may affect the findings of the environmental impact assessment and non-compliance with the EP. The ET Leader should 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 should be kept readily available for inspection by persons (such as IEC and Contractor) assisting in supervision of the implementation of the applicable recommendations of the approved *EIA Report* taking account of the latest design and the conditions set out in the EP, or by EPD (EIAO Authority) or his authorised officers.

11 REPORTING

11.1 GENERAL

Reports can be provided in an electronic medium upon agreeing the format with the Contractor, IEC, Project Proponent and the EPD (EIAO Authority). All the monitoring data should also be submitted on diskettes or CD Rom.

11.2 BASELINE MONITORING REPORT

The ET shall prepare and submit a *Baseline Monitoring Report* before the commencement of construction and before the commencement of operation. The *Baseline Monitoring Report* shall be certified by the ET Leader and verified by the IEC and submitted within 10 days of completion of the baseline monitoring and laboratory testing. The *Baseline Monitoring Report* will be submitted to the Contractor, IEC, Project Proponent and the EPD (EIAO Authority). The *Baseline Monitoring Report* will include at least the following:

(a) up to half a page executive summary;

(b) brief project background information;

(c) drawings showing locations of the baseline monitoring stations;

(d) an updated construction programme;

(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;
- monitoring date, time, frequency and duration; and
- quality assurance (QA) / quality control (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; and

- other factors which might affect results;

(g) determination of the Action and Limit Levels (A/L levels) for each monitoring parameter and statistical analysis of the baseline data;

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

(i) comments and conclusions.

11.3 MONTHLY EM&A REPORTS

The results and findings of all EM&A works required in this updated EM&A Manual should be recorded in the monthly EM&A Reports and be prepared by the ET, certified by the ET Leader and verified by the IEC. The reports will be submitted to the Contractor, IEC, Project Proponent and the EPD (EIAO Authority) within 10 working days of the end of each reporting month, with the first report due in the month after construction works commence. The ET should liaise with the relevant parties to confirm the exact number and format of monthly reports in both hard copy and electronic format. The report should include, but not be limited to, the following elements:

11.3.1 First Monthly EM&A Report

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

(a) Executive Summary (1-2 pages);

- Exceedances of A/L Levels;
- Complaint Log;
- Notifications of any summons and successful prosecutions;
- Reporting Changes;
- 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 inter-relationship with environmental protection/ mitigation measures for the month; and
- Works undertaken during the month.

(c) Environmental Status

- Works undertaken during the month with illustrations (such as

location of works); and

- Drawing showing the Project area, any environmental sensitive receivers.

(d) Summary of EM&A requirements including:

- Environmental mitigation measures, as stated in the current EP and recommended in this updated EM&A Manual;
- Environmental monitoring requirements and contractual requirements;

(e) Implementation Status

Advice on the implementation status of environmental protection and pollution control/mitigation measures, as stated in the current EP and recommended in this updated EM&A Manual, summarised in the updated implementation schedule.

(f) Site Audit Report

(g) Monitoring results (in both hard and diskette copies) together with the following information:

- Monitoring methodology;
- Name of laboratory and equipment used and calibration details;
- Parameters monitored;
- Monitoring locations (and depth); and
- Monitoring date, time, frequency, and duration.

(h) Report on Complaints, Notifications of Summons and Successful Prosecutions

- 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 notifications of summons and successful prosecutions for breaches of the current environmental protection/pollution control legislation's, including locations 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

- Description of the actions taken in the event of non-compliance and deficiency reporting and any follow-up procedures related to earlier non-compliance.

(i) Others

- An account of the future key issues as reviewed from the works programme and work method statements; and
- Submission of implementation status proforma, proactive environmental protection proforma, regulatory compliance proforma, site inspection proforma, data recovery schedule and complaint log summarising the EM&A of the period.

11.3.2 Subsequent Monthly EM&A Reports

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

(a) Executive Summary (1-2 pages)

- Exceedances of Action/Limit Levels;
- Complaint Log
- Notifications of any summons and successful prosecutions;
- Reporting Changes
- Future key issues

(b) Environmental Status

- Construction Programme with fine tuning of construction activities showing the inter-relationship 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.

(c) Implementation Status

Advice on the implementation status of environmental protection and pollution control/mitigation measures, as stated in the current EP and recommended in this updated EM&A Manual, summarised in the updated implementation schedule.

(d) Monitoring results (in both hard and diskette copies) together with the following information:

- Monitoring methodology;
- Name of laboratory and equipment used and calibration details;
- Parameters monitored;
- Monitoring locations (and depth); and
- Monitoring date, time, frequency, and duration.

(e) Report on Complaints, Notifications of Summons and Successful Prosecutions

- 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 notifications of summons and successful prosecutions for breaches of the current environmental protection/pollution control legislation's, including locations 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
- 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.

(g) Appendix

- Supporting documents
- Outstanding issues and deficiencies.

11.4 QUARTERLY EM&A SUMMARY REPORTS

The quarterly EM&A summary report shall be prepared by the ET, certified by the ET Leader and verified by the IEC. The quarterly EM&A summary report should contain the following listed information:

(a) Executive summary (up to half page);

(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 stated in the current EP and recommended in this updated EM&A Manual;

(d) Advice on the implementation status of environmental protection and pollution control/mitigation measures, as stated in the current EP and recommended in this updated EM&A Manual, 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) A summary record of notifications of summons and successful prosecutions for breaches of the current environmental protection/pollution control legislations, locations and nature of the breaches, investigation, follow-up actions taken and results;

(m) 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

(n) Project Proponents' contacts and any hotline telephone number for the public to make enquiries.

11.5 ANNUAL EM&A REVIEW REPORT

The *Annual EM&A Review Report* shall be prepared by the ET, certified by the ET Leader and verified by the IEC. The *Annual EM&A Review Report* should contain the following listed information:

(a) Executive summary (up to half page);

(b) Drawings showing the Project area, environmental sensitive receivers and monitoring and control stations;

(c) Basic project information including a synopsis of the project organisation, programme, contacts of key management, and a synopsis of work undertaken during the year;

(d) A brief summary of EM&A requirements including:

- Monitoring parameters;
- Environmental quality performance limits (Action and Limit levels); and
- Environmental mitigation measures, as stated in the current EP and recommended in this updated EM&A Manual;

(e) Summary of the implementation status of environmental protection and pollution control/mitigation measures, as stated in the current EP and recommended in this updated EM&A Manual, summarised in the updated implementation schedule;

(f) Graphical plots of the trends of monitored parameters over the past year 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) A summary of non-compliance (exceedances) of the environmental quality performance limits (A/L levels);

(h) A brief review of the reasons for and the implications of non-compliance including review of pollution sources and working procedures;

(i) A summary description of the actions taken in the event of non-compliance and any follow-up procedures related to earlier non-compliance;

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

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

(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) Project Proponents' contacts and any hotline telephone number for the public to make enquiries.

11.6 FINAL EM&A SUMMARY REPORT

The EM&A programme will be terminated upon the completion of the construction works and specified operation and aftercare phase monitoring period so that the potential to cause significant environmental impacts is ceased and concluded.

The final EM&A summary report shall be prepared by the ET, certified by the ET Leader and verified by the IEC. The final EM&A summary report shall include, *inter alia*, the following:

(a) An executive summary;

(b) Drawings showing the project area, any environmental sensitive receivers;

(c) Basic project information including a synopsis of the project organisation, programme, contracts of key management, and a synopsis of work undertaken during the entire construction period;

(d) A brief summary of EM&A requirements including: environmental mitigation measures, as stated in the current EP and recommended in this updated EM&A Manual;

(e) Advice on the implementation status of environmental protection and pollution control/mitigation measures, as stated in the current EP and recommended in this updated EM&A Manual summarised in the updated implementation schedule;

(f) Provide clear-cut decisions on the environmental acceptability of the

Project with reference to the specific impact hypothesis;

(g) A summary description of the actions taken in the event of non-compliance and any follow-up procedures related to earlier non-compliance;

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

(i) A summary record of notification of summons and successful prosecutions for breaches of the current environmental protection/ pollution control legislation's, locations and nature of the breaches, investigation, follow-up actions taken and results;

(j) Review the practicality and effectiveness of the EIA process and EM&A programme (eg effectiveness and efficiency of the mitigation measures) recommend any improvement in the EM&A programme; and

(k) A conclusion to state the return of ambient and/or the predicted scenario as per findings of the approved *EIA Report* and updates associated with the latest design.

11.7 DATA KEEPING

Documentation such as the monitoring field records, site inspection forms, etc. are not required to be included in the *EM&A Reports* for submission. However, such documents should be well kept by the ET Leader and should be available for the inspection of the IEC, Project Proponent and the EIAO Authority upon request. All relevant information should be clearly and systematically recorded in the documents. The monitoring data should also be recorded in electronic format. All the documents and data should be kept for at least five years after completion of the SENTX contract.

Annex A

Implementation Schedule

A1 IMPLEMENTATION SCHEDULE

A1.1 INTRODUCTION

This *Annex* summarises all the mitigation measures recommended in the approved *EIA Report* taking account of the latest design and presents them in the form of an Implementation Schedule in accordance with the requirements of Section 3.4.10.3 of the *EIA Study Brief No. ESB-119/2004*.

The Implementation Schedule has the following column headings:

EIA Ref

This denotes the section number or reference from the approved *EIA Report* Main text.

EM&A Ref

This denotes the sequential number of each of the recommended mitigation measures specified in the Implementation Schedule.

Recommended Mitigation Measures

This denotes the recommended mitigation measures, courses of action or subsequent deliverables that are to be adopted, undertaken or delivered to avoid, reduce or ameliorate predicted environmental impacts.

Objectives of the Recommended Measure and Main Concerns to be Addressed

This denotes the objectives of the recommended mitigation measures and main concerns to address.

Location

This indicates the spatial area in which the recommended mitigation measures are to be implemented together with details of the programming or timing of their implementation.

Who to Implement the Measure

This denotes where the responsibility lies for the implementation of the recommended mitigation measures.

When to Implement the Measure

This denotes the stage at which the recommended mitigation measures are to be implemented either during the Design, Construction, Operation/ Restoration or Aftercare phases.

What Requirements or Standards for the Measure to Achieve

This defines the controlling legislation that is required to be complied with.

Table A1.1a Implementation Schedule

EIA Ref.	EM&A Ref	Environmental Protection Measures	Objectives of the Recommended Measure & Main Concerns to address	Location of the Measures	Who to implement the measure?	When to implement the measure? (1) D	C	O/R	A	What requirements or standards for the measure to achieve?	Remarks and Justification
Air Quality – Construction Phase											
4.8.1	AQ1	<u>Blasting</u> • The area within 30m of the blasting area will be wetted prior to blasting. • Blasting will not be carried out when the strong wind signal or tropical cyclone warning signal No. 3 or higher is hoisted, unless this is with the express prior permission of the Commissioner of Mines. • loose material and stones in the Site will be removed prior to the blast operation • During blasting, blast nets, screens and other protective covers will be used to prevent the projection of flying fragments and material resulting from blasting	To minimise potential dust nuisance	Blasting area and 30m of blasting area	SENTX Contractor		✓			*Air Pollution Control (Construction Dust) Regulations*	Not Applicable. Blasting is not required in the latest landfill design
4.8.1	AQ2	<u>Rock Drilling</u> • Watering will be carried out at the rock drilling activities to avoid fugitive dust emissions.	To minimise potential dust nuisance	Rock drilling area	SENTX Contractor		✓			*Air Pollution Control (Construction Dust) Regulations*	Not Applicable. Rock drilling is not required in the latest landfill design

(1) D=Design; C=Construction; O/R=Operation/Restoration; A=Aftercare

EIA Ref.	EM&A Ref	Environmental Protection Measures	Objectives of the Recommended Measure & Main Concerns to address	Location of the Measures	Who to implement the measure?	When to implement the measure? (1) D	C	O/R	A	What requirements or standards for the measure to achieve?	Remarks and Justification
4.8.1	AQ3	<u>Site Access Road</u> • The main haul road will be kept clear of dusty materials or sprayed with water. • The main haul road will be paved with aggregate or gravel. • Vehicle speed will be limited to 10kph.	To minimise potential dust nuisance	Main haul road	SENTX Contractor		✓			*Air Pollution Control (Construction Dust) Regulations* *HKAQO and EIAO-TM Annex 4*	-
4.8.1	AQ4	<u>Stockpiling of Dusty Materials</u> • Any stockpile of dusty materials will be covered entirely by impervious sheeting or placed in an area sheltered on the top and three sides or sprayed with water so as to ensure that the entire surface is wet.	To minimise potential dust nuisance	All construction works area	SENTX Contractor		✓			*Air Pollution Control (Construction Dust) Regulations* *HKAQO and EIAO-TM Annex 4*	-
4.8.1	AQ5	<u>Loading, unloading or transfer of dusty materials</u> • All dusty materials will be sprayed with water immediately prior to any loading, unloading or transfer operation so as to maintain the dusty material wet.	To minimise potential dust nuisance	All construction works area	SENTX Contractor		✓			*Air Pollution Control (Construction Dust) Regulations* *HKAQO and EIAO-TM Annex 4*	-
4.8.1	AQ6	<u>Site Boundary and Entrance</u> • Where a site boundary adjoins a road, street, service lane or other area accessible to the public, hoarding of height not less than 2.4m from	To minimise potential dust nuisance	Site boundary and entrance	SENTX Contractor		✓			*Air Pollution Control (Construction Dust) Regulations* *HKAQO and EIAO-*	-

EIA Ref.	EM&A Ref	Environmental Protection Measures	Objectives of the Recommended Measure & Main Concerns to address	Location of the Measures	Who to implement the measure?	When to implement the measure? (1) D	C	O/R	A	What requirements or standards for the measure to achieve?	Remarks and Justification
		ground level will be provided along the entire length of that portion of the site boundary except for the site entrance or exit.								*TM Annex 4*	
4.8.1	AQ7	<u>Excavation Works</u> • Working area of any excavation or earth moving operation will be sprayed with water immediately before, during and immediately after the operation so as to ensure that the entire surface is wet.	To minimise potential dust nuisance	All construction works area	SENTX Contractor		✓			*Air Pollution Control (Construction Dust) Regulations* *HKAQO and EIAO-TM Annex 4*	-
4.8.1	AQ8	<u>Building Demolition</u> • The area where the demolition works are planned to take place will be sprayed with water immediately prior to, during and immediately after the demolition activities. • Any dusty materials remaining after a stockpile is removed will be wetted with water and cleared from the surface of roads or street.	To minimise potential dust nuisance	All construction works area	SENTX Contractor		✓			*Air Pollution Control (Construction Dust) Regulations* *HKAQO and EIAO-TM Annex 4*	-
4.8.1	AQ9	<u>Construction of the Superstructure of Building</u> • Effective dust screens, sheeting or netting will be provided to enclose the scaffolding from the ground level up to the highest level of the scaffolding.	To minimise potential dust nuisance	All construction works area	SENTX Contractor		✓			*Air Pollution Control (Construction Dust) Regulations* *HKAQO and EIAO-TM Annex 4*	-

EIA Ref.	EM&A Ref	Environmental Protection Measures	Objectives of the Recommended Measure & Main Concerns to address	Location of the Measures	Who to implement the measure?	When to implement the measure? (1) D	C	O/R	A	What requirements or standards for the measure to achieve?	Remarks and Justification
4.8.1	AQ10	Should a stone crushing plant be needed on site, the control measures recommended in the *Best Practicable Means Requirement for Mineral Works (Stone Crushing Plants) BPM 11/1* should be implemented.	To minimise potential dust nuisance	Stone crushing plant/ construction phase	SENTX Contractor		✓			*Best Practicable Means Requirement for Mineral Works (Stone Crushing Plants) BPM 11/1*	Not Applicable. Stone crushing plant is not required in the latest landfill design
4.8.1	AQ11	Good site practices such as regular maintenance and checking of the diesel powered mechanical equipment will be adopted to avoid any black smoke emissions and to minimize gaseous emissions.	To minimise potential dust nuisance	All construction works area	SENTX Contractor		✓			*HKAQO and EIAO-TM Annex 4*	-
4.10.1	AQ12	Dust monitoring once every 6 days	Ensure the dust generated from the project meets the air quality requirement	At monitoring locations shown in *Figure 3.2a*	SENTX Contractor		✓			*HKAQO and EIAO-TM Annex 4*	-
Air Quality – Operation, Restoration and Aftercare Phases											
4.8.2	AQ13	<u>Odour</u> • Enclosing the weighbridge area	To minimise odour nuisance	Weighbridge area	SENTX Contractor	✓		✓		*EIAO-TM Annex 4*	Not Applicable. As SENTX will receive construction waste only which is significantly less odorous, enclosing the weighbridge area is not necessary
4.8.2	AQ14	• Providing a vehicle washing facility before the exit of SENTX and	To minimise odour nuisance	Vehicle washing	SENTX Contractor	✓		✓		*EIAO-TM Annex 4*	-

EIA Ref.	EM&A Ref	Environmental Protection Measures	Objectives of the Recommended Measure & Main Concerns to address	Location of the Measures	Who to implement the measure?	When to implement the measure? (1) D	C	O/R	A	What requirements or standards for the measure to achieve?	Remarks and Justification
		providing sufficient signage to remind RCV drivers to pass through the facility before leaving SENTX		facility							
4.8.2	AQ15	• Reminding the RCV drivers to empty the liquor collection sump and close the valve before leaving the tipping face	To minimise odour nuisance	Tipping face	SENTX Contractor			✓		*EIAO-TM Annex 4*	Not Applicable. As SENTX will receive construction waste only, which is relatively dry, the amount of liquor generated is expected to minimal
4.8.2	AQ16	• Washing down the area where spillage of RCV liquor is discovered promptly	To minimise odour nuisance	SENTX Site	SENTX Contractor			✓		*EIAO-TM Annex 4*	Not Applicable. As SENTX will receive construction waste only, which is relatively dry, the amount of liquor generated is expected to minimal.
4.8.2	AQ17	• Reminding operators to properly maintain their RCVs and ensure that liquor does not leak from the vehicles	To minimise odour nuisance	SENTX Site	SENTX Contractor			✓		*EIAO-TM Annex 4*	Not Applicable. As SENTX will receive construction waste only, which is relatively dry, the amount of liquor generated is expected to minimal.
4.8.2	AQ18	• Installation of landfill gas control	To minimise odour	SENTX Site	SENTX	✓		✓	✓	*EIAO-TM Annex 4*	-

EIA Ref.	EM&A Ref	Environmental Protection Measures	Objectives of the Recommended Measure & Main Concerns to address	Location of the Measures	Who to implement the measure?	When to implement the measure? (1) D	C	O/R	A	What requirements or standards for the measure to achieve?	Remarks and Justification
		system to enhance collection of landfill gas from the waste mass and hence minimise odour associated with fugitive landfill gas emissions	nuisance		Contractor						
4.8.2	AQ19	• Progressive restoration of the areas which reach the finished profile (a final capping system including an impermeable liner will be put in place) and installation of a permanent landfill gas extraction system	To minimise odour nuisance	SENTX Site	SENTX Contractor	✓		✓	✓	*EIAO-TM Annex 4*	-
4.8.2	AQ20	• Installing deodorizers along the site boundary adjacent to the ASRs	To minimise odour nuisance	SENTX Site boundary	SENTX Contractor			✓	✓	*EIAO-TM Annex 4*	Not Applicable. As SENTX will receive construction waste only which is significantly less odorous, installation of deodorizers is not necessary.
4.8.2	AQ21	• Erecting a vertical barrier, wall or structure softened by planting rows of trees/shrubs or landscape feature along the site boundary, particularly in the areas near the ASRs	To minimise odour nuisance	SENTX Site boundary	SENTX Contractor	✓		✓	✓	*EIAO-TM Annex 4*	-
4.8.2 and SENTX latest design	AQ22	• Maintaining the size of the active tipping face not greater than 1,200 m^2	To minimise odour nuisance	Active tipping face	SENTX Contractor			✓		*EIAO-TM Annex 4*	-

EIA Ref.	EM&A Ref	Environmental Protection Measures	Objectives of the Recommended Measure & Main Concerns to address	Location of the Measures	Who to implement the measure?	When to implement the measure? (1) D	C	O/R	A	What requirements or standards for the measure to achieve?	Remarks and Justification
4.8.2	AQ23	• Promptly covering the MSW with soil or selected inert materials to control odour emissions	To minimise odour nuisance	Active tipping face	SENTX Contractor			✓		*EIAO-TM Annex 4*	Not Applicable. SENTX will not receive MSW.
4.8.2	AQ24	• Maintaining the size of the special waste trench not greater than 6m (l) × 2.5m (w)	To minimise odour nuisance	Special waste trench	SENTX Contractor			✓		*EIAO-TM Annex 4*	Not Applicable. SENTX will not have any special waste trench.
4.8.2 and SENTX latest design	AQ25	• Covering daily covered area with a tarpaulin sheet or 300mm of soil after the landfill operating hours	To minimise odour nuisance	Daily covered area	SENTX Contractor			✓		*EIAO-TM Annex 4*	-
4.8.2	AQ26	• Covering special waste trench with 600 mm of soil and an impervious liner after 5 pm	To minimise odour nuisance	Special waste trench	SENTX Contractor			✓		*EIAO-TM Annex 4*	Not Applicable. SENTX will not have any special waste trench.
4.8.2	AQ27	• Covering the non-active tipping face with 600mm of soil and an impermeable liner (on top of the intermediate cover), which will not only control odour emissions from landfilled waste but also enhance landfill gas extraction by the landfill gas extraction system	To minimise odour nuisance	Intermediate cover	SENTX Contractor			✓		*EIAO-TM Annex 4*	-
4.8.2	AQ28	• Applying deodorizers or odour suppression agents to control odour emissions from the active tipping face and special waste trench, if any,	To minimise odour nuisance	Active tipping face and special waste	SENTX Contractor			✓		*EIAO-TM Annex 4*	Not Applicable. As SENTX will receive construction waste only which is

EIA Ref.	EM&A Ref	Environmental Protection Measures	Objectives of the Recommended Measure & Main Concerns to address	Location of the Measures	Who to implement the measure?	When to implement the measure? (1) D	C	O/R	A	What requirements or standards for the measure to achieve?	Remarks and Justification
		through spraying or fogging equipment		trench							significantly less odorous, installation of deodorizers is not necessary. Moreover, SENTX will not have any special waste trench.
4.8.2	AQ29	• Providing a mobile cover with retractable or suitable opening to cover up the opening of the special waste trench except during waste deposition and a suitable odour removal unit. The mobile cover should be equipped with powered extraction and suitable odour removal unit for purifying the trapped gas inside the trench before release into the atmosphere	To minimise odour nuisance	Special waste trench	SENTX Contractor			✓		*EIAO-TM Annex 4*	Not Applicable. SENTX will not have any special waste trench.
4.8.2 and SENTX latest design	AQ30	• Providing a thermal oxidizer for the leachate treatment plant	To minimise odour nuisance as a result of breakdown of thermal oxidizer	Leachate treatment plant	SENTX Contractor	✓		✓	✓	*EIAO-TM Annex 4*	-
4.8.2 and SENTX latest design	AQ31	• Enclosing all the leachate storage and treatment tanks (except for the Sequential Batch Reactor (SBR) or Membrane Bioreactor (MBR) tanks) and diverting the exhaust air from these tanks to a thermal oxidizer or flare to avoid potential odour	To minimise odour nuisance	Leachate treatment plant	SENTX Contractor	✓		✓	✓	*EIAO-TM Annex 4*	-

EIA Ref.	EM&A Ref	Environmental Protection Measures	Objectives of the Recommended Measure & Main Concerns to address	Location of the Measures	Who to implement the measure?	When to implement the measure? (1) D	C	O/R	A	What requirements or standards for the measure to achieve?	Remarks and Justification
		emissions from the LTP									
4.8.2	AQ32	• Rescheduling of waste filling activities on-site by avoiding waste filling activities carrying out at the northern area of the site in the summer months between July to November	To minimise odour nuisance	SENTX Site	SENTX Contractor			✓		*EIAO-TM Annex 4*	Not Applicable. As SENTX will receive construction waste only which is significantly less odorous, rescheduling of waste filling activities is not necessary.
4.8.2 and SENTX latest design	AQ33	<u>Dust, Gaseous Emission and LFG including Volatile Organic Compounds (VOCs)</u> • Keeping the main haul road to the waste filling area wet by regular watering ;	To minimise dust nuisance	SENTX Site	SENTX Contractor			✓		*HKAQO and EIAO-TM Annex 4*	-
4.8.2	AQ34	• Compacting the exposed daily and intermediate covered areas well to avoid fugitive dust emission;	To minimise dust nuisance	SENTX Site	SENTX Contractor			✓		*HKAQO and EIAO-TM Annex 4*	-
4.8.2	AQ35	• Limiting the vehicle speed within SENTX site boundary;	To minimise dust nuisance	SENTX Site	SENTX Contractor			✓		*HKAQO and EIAO-TM Annex 4*	-
4.8.2	AQ36	• Providing vehicle washing bay to avoid vehicles carrying dust to public roads;	To minimise dust nuisance	SENTX Site	SENTX Contractor			✓		*HKAQO and EIAO-TM Annex 4*	-
4.8.2	AQ37	• Switching off the engine when the	To minimise gaseous	SENTX Site	SENTX			✓	✓	-	-

EIA Ref.	EM&A Ref	Environmental Protection Measures	Objectives of the Recommended Measure & Main Concerns to address	Location of the Measures	Who to implement the measure?	When to implement the measure? (1) D	C	O/R	A	What requirements or standards for the measure to achieve?	Remarks and Justification
		diesel-driven equipment is idling;	emissions		Contractor						
4.8.2	AQ38	• Maintaining the construction equipment properly to avoid any black smoke emissions;	To minimise gaseous emissions	SENTX Site	SENTX Contractor			✓	✓	-	-
4.8.2	AQ39	Providing sufficient underground landfill gas collection system to capture the landfill gas generated as much as possible; and	To minimise gaseous emissions, including LFG and VOCs	SENTX Site	SENTX Contractor			✓	✓	*EIAO-TM Annex 4*	-
4.8.2	AQ40	Periodic inspections of the final cover should be undertaken to ensure that the capping layer is in good conditions at all times.	To minimise gaseous emissions, including LFG and VOCs	SENTX Site	SENTX Contractor			✓	✓	*EIAO-TM Annex 4*	-
4.10.2	AQ41	Monitoring of ambient TSP once every 6 days	Ensure the dust emission from the project meets the dust requirement	At monitoring locations shown in *Figure 11.3a*	SENTX Contractor		✓	✓		*HKAQO* and *EIAO-TM Annex 4*	-
4.10.2	AQ42	Monitoring of ambient VOCs, ammonia and H_2S, quarterly	Ensure the gaseous emission from the project meets the air quality requirement	At monitoring locations shown in *Figure 11.3a*	SENTX Contractor			✓	✓	Odour thresholds or 1% of Occupational Exposure Limit (OEL) as stipulated in the "*UK Health and Safety Executive (HSE) EH 40/05 Occupational Exposure Limits*", whichever is lower.	-
4.10.2 and SENTX	AQ43	Monitoring of parameters for thermal oxidizer, flares and generator in	Ensure the gaseous emission from the	At the flares and thermal	SENTX			✓	✓	Emission Limits	-

EIA Ref.	EM&A Ref	Environmental Protection Measures	Objectives of the Recommended Measure & Main Concerns to address	Location of the Measures	Who to implement the measure?	When to implement the measure? (1) D	C	O/R	A	What requirements or standards for the measure to achieve?	Remarks and Justification
latest design		accordance with requirements stated in Tables 3.4a, 3.5a and 3.6a of the EM&A Manual respectively.	project meets the air quality requirement	oxidizer stacks when they are in operation	Contractor				(1)	specified in Contract	
4.10.2	AQ44	To confirm design assumption of ammonia, it is recommended that the ammonia concentration in the flue gas of the thermal oxidiser be monitored during the commissioning stage of the thermal oxidiser. If required, an emission standard will be set for ammonia for the thermal oxidiser based on the monitoring results. If no ammonia is detected in the flue gas during the decommissioning stage, the monitoring of ammonia in the flue gas of the thermal oxidiser could be discontinued.	Ensure the gaseous emission from the project meets the air quality requirement	At the thermal oxidizer stack during commissioning. If ammonia is detected during commissioning stage, the monitoring will continue.	SENTX Contractor			✓		Emission Limits determined during commissioning stage	-
4.10.2 and SENTX latest design	AQ45	Odour patrol in accordance with requirements stated in Table 3.7a of the EM&A Manual.	Ensure the odour emission from the project meets the odour requirement	Along SENTX Site boundary	SENTX Contractor			✓		*EIAO-TM Annex 4*	-
4.10.2	AQ46	Monitoring of meteorological station, continuously	Collect site specific meteorological data	At meteorological station shown in	SENTX Contractor		✓	✓	✓	-	-

(1) For LFG flare and LFG generator only.

EIA Ref.	EM&A Ref	Environmental Protection Measures	Objectives of the Recommended Measure & Main Concerns to address	Location of the Measures	Who to implement the measure?	When to implement the measure? (1) D C O/R A	What requirements or standards for the measure to achieve?	Remarks and Justification
				Figure 11.3a				
Noise – Construction Phase								
5.7.1	N1	Adopt good site practice listed below: • Only well-maintained plant will be operated on-site and plant should be serviced regularly during the construction program;	To minimise potential construction noise nuisance.	All construction works area	SENTX Contractor	✓	*Noise Control Ordinance (NCO) and EIAO-TM Annex 5*	-
		• Silencers or mufflers on construction equipment should be utilized and will be properly maintained during the construction program;					-	-
		• Mobile plant, if any, will be sited as far from NSRs as possible;					-	-
		• Machines and plant (such as trucks) that may be in intermittent use will be shut down between work periods or should be throttled down to a minimum;					-	-
		• Plant known to emit noise strongly in one direction will, wherever possible, be orientated so that the noise is directed away from the nearby NSRs; and					-	-
		• Material stockpiles and other structures will be effectively utilised, wherever practicable, in screening					-	-

EIA Ref.	EM&A Ref	Environmental Protection Measures	Objectives of the Recommended Measure & Main Concerns to address	Location of the Measures	Who to implement the measure?	When to implement the measure? (1) D	C	O/R	A	What requirements or standards for the measure to achieve?	Remarks and Justification
		noise from on-site construction activities.									
5.8	N2	Weekly noise monitoring	Ensure noise generated from the project meets the criteria	At monitoring locations shown in *Figure 6.4a*	SENTX Contractor		✓			*Noise Control Ordinance (NCO) and EIAO-TM Annex 5*	-
Noise – Operation/Restoration Phase											
5.7.2	N3	Adopt good site practice listed below: • Choose quieter PME;	To minimise potential operational noise nuisance.	Within the SENTX Site	SENTX Contractor			✓		*Noise Control Ordinance (NCO) and EIAO-TM Annex 5*	-
		• Include noise levels specification when ordering new plant items;								-	-
		• Locate fixed plant items or noise emission points away from the NSRs as far as practicable;								-	-
		• Locate noisy machines in completely enclosed plant rooms or buildings; and								-	-
		• Develop and implement a regularly scheduled plant maintenance programme so that plant items are properly operated and serviced. The programme should be implemented by properly trained personnel.								-	-
5.8	N4	Weekly noise monitoring	Ensure noise generated from the project meets the	At monitoring locations shown in	SENTX Contractor			✓		*Noise Control Ordinance (NCO) and EIAO-TM Annex 5*	-

EIA Ref.	EM&A Ref	Environmental Protection Measures	Objectives of the Recommended Measure & Main Concerns to address	Location of the Measures	Who to implement the measure?	When to implement the measure? (1) D	C	O/R	A	What requirements or standards for the measure to achieve?	Remarks and Justification
			criteria	*Figure 6.4a*							
Water Quality – Construction Phase											
6.8.1	WQ1	<u>Construction Runoff</u>									-
		• Exposed soil areas will be minimised to reduce the contamination of runoff and erosion.	To minimise potential water quality impacts arising from the construction works	All construction works area	SENTX Contractor		✓			*ProPECC PN 1/94* *EIAO-TM Annex 6*	
6.8.1	WQ2	• Perimeter channels will be constructed in advance of site formation works and earthworks and intercepting channels will be provided for example along the edge of excavation.	To minimise potential water quality impacts arising from the construction works	All construction works area	SENTX Contractor	✓	✓			*ProPECC PN 1/94* *Water Pollution Control Ordinance (WPCO)* *EIAO-TM Annex 6*	-
6.8.1	WQ3	• Silt removal facilities, channels and manholes will be maintained and the deposited silt and grit should be removed regularly to ensure they are functioning properly at all times.	To minimise potential water quality impacts arising from the construction works	All construction works area	SENTX Contractor		✓			*ProPECC PN 1/94* *WPCO* *EIAO-TM Annex 6*	-
6.8.1	WQ4	• Temporary covers such as tarpaulin will also be provided to minimise the generation of high SS runoff.	To minimise potential water quality impacts arising from the construction works	All construction works area	SENTX Contractor		✓			*ProPECC PN 1/94* *WPCO*	-
6.8.1	WQ5	• The surface runoff contained any oil and grease will pass through the oil interceptors.	To minimise potential water quality impacts arising from the construction works	All construction works area	SENTX Contractor		✓			*ProPECC PN 1/94* *WPCO* *EIAO-TM Annex 6*	-

EIA Ref.	EM&A Ref	Environmental Protection Measures	Objectives of the Recommended Measure & Main Concerns to address	Location of the Measures	Who to implement the measure?	When to implement the measure? (1) D	C	O/R	A	What requirements or standards for the measure to achieve?	Remarks and Justification
6.8.1	WQ6	• All sewer and drains will be sealed to prevent building debris, soil etc from entering public sewers/drains before commencing any demolition works	To minimise potential water quality impacts arising from the demolition works	Infrastructure area at existing SENT Landfill	SENTX Contractor		✓			*ProPECC PN 1/94* *WPCO* *EIAO-TM Annex 6*	-
6.8.1	WQ7	• During the excavation works for the twin drainage tunnels, the recycle water for cooling the cutter head of the TBM will be conveyed to the sedimentation tanks for treatment and most of the treated water will be reused, where applicable and as much as possible, in the boring operations.	To minimise potential water quality impacts arising from the tunnel works	Tunnel boring sites	SENTX Contractor		✓			*ProPECC PN 1/94* *WPCO* *EIAO-TM Annex 6*	Not Applicable. Excavation of drainage tunnels is not required in the latest landfill design.
6.8.1	WQ8	• The fuel and waste lubricant oil from the on-site maintenance of machinery and equipment will be collected by a licensed chemical waste collector.	To minimise potential water quality impacts arising from improper handling of fuel and oil	SENTX Site	SENTX Contractor		✓			*ProPECC PN 1/94* *WPCO* *Waste Disposal Ordinance (WDO)*	-
6.8.1	WQ9	• Implementation of excavation schedules, lining and covering of excavated stockpiles	To minimise contaminated stormwater run-off from the SENTX Site	All construction works	SENTX Contractor		✓			*ProPECC PN 1/94* *WPCO* *EIAO-TM Annex 6*	-
6.13	WQ10	• Monitoring of surface water quality will be conducted on a regular basis as stated in the EM&A Manual.	To minimise potential water quality impacts on surface water arising from the construction works	SENTX Site	SENTX Contractor		✓			*WPCO* *Water-TM*	-
6.8.2	WQ11	<u>Sewage Effluents</u>									-
		• Sufficient chemical toilets will be provided for the construction	To minimise potential water quality impacts	SENTX Site	SENTX Contractor		✓			*WPCO*	

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		workforce.	arising from the sewage effluents								
6.8.2	WQ12	• Untreated sewage will not be allowed to discharge into the surrounding water body.	To minimise potential water quality impacts arising from the sewage effluents	SENTX Site	SENTX Contractor		✓			*WPCO* *WDO*	-
6.8.2	WQ13	• A licensed waste collector will be employed to clean the chemical toilets on a regular basis.	To minimise potential water quality impacts arising from the sewage effluents	SENTX Site	SENTX Contractor		✓			*WPCO* *WDO*	-
Water Quality – Operation/Restoration and Aftercare Phases											
6.9.1	WQ14	<u>Surface Water Management</u>								*WPCO*	-
		• Inspections of the drainage system, sand traps, settlement ponds and surface water channels will be performed regularly to identify areas necessary for maintenance, cleaning or repair.	To minimise potential water quality impacts on surface water arising from the landfill operations.	SENTX Site	SENTX Contractor			✓		*Technical Memorandum Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Inshore Waters (Water-TM)* *EIAO-TM Annex 6*	
6.9.1	WQ15	• Regular maintenance and replacement, if required, of the HDPE liner will be conducted to prevent degradation from affecting the performance of the capping system.	To minimise potential water quality impacts on surface water arising from the landfill operations.	SENTX Site	SENTX Contractor			✓		*WPCO* *Water-TM* *EIAO-TM Annex 6*	-
6.9.1	WQ16	• Monitoring of surface water quality will be conducted on a regular basis as	To minimise potential water quality impacts	SENTX Site	SENTX Contractor			✓	✓	*WPCO* *Water-TM*	-

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		stated in the EM&A Manual.	on surface water arising from the landfill operations.								
6.9.2 and SENTX latest design	WQ17	<u>Groundwater Management</u> • The groundwater management facilities including the groundwater monitoring wells will be inspected regularly during routine groundwater monitoring programme.	To minimise potential water quality impacts on groundwater arising from the landfill operations.	SENTX Site	SENTX Contractor			✓	✓	*WPCO* *Water-TM* *EIAO-TM Annex 6*	-
6.9.2	WQ18	• Monitoring of groundwater water quality will be conducted on a regular basis as stated in the EM&A Manual.	To minimise potential water quality impacts on groundwater arising from the landfill operations.	SENTX Site	SENTX Contractor			✓	✓	*WPCO* *Water-TM* *EIAO-TM Annex 6*	-
SENTX latest design	WQ19	<u>Sewage</u> • All sewage from the operation staff will be diverted to the LTP for treatment or public sewer, if available.	To ensure proper handling of sewage	SENTX Site	SENTX Contractor			✓	✓	-	-
6.9.3	WQ20	<u>Leachate Management</u> • The leachate pump houses and related ancillary equipment will be inspected regularly and repairs, if necessary.	To minimise potential water quality impacts on surrounding water bodies arising from the landfill operations.	Leachate pump houses and related ancillary equipment	SENTX Contractor			✓	✓	*WPCO* *Water-TM* *EIAO-TM Annex 6*	-
6.9.3	WQ21	• For equipment such as pumps that require routine scheduled maintenance, the maintenance will be	To minimise potential water quality impacts on surrounding water	Leachate pumps	SENTX Contractor			✓	✓	*WPCO* *Water-TM*	-

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		performed following manufacturer's recommended frequency.	bodies arising from the landfill operations.								
6.9.3	WQ22	• Preventive maintenance will be implemented so that the possibility for forced shutdown during wet season will be kept to minimal.	To minimise potential water quality impacts on surrounding water bodies arising from the landfill operations.	Leachate treatment plant	SENTX Contractor			✓	✓	*WPCO* *Water-TM* *EIAO-TM Annex 6*	-
6.9.3	WQ23	• Emergency procedures or a contingency plan will be established when the LTP is malfunctioned.	To minimise potential water quality impacts on surrounding water bodies arising from the landfill operations.	Leachate treatment plant	SENTX Contractor			✓	✓	*WPCO* *Water-TM* *EIAO-TM Annex 6*	-
6.9.3 and SENTX latest design	WQ24	• There will be sufficient redundancy in the system to handle the leachate flow even if one treatment train is down for maintenance. The leachate may be required to temporarily store within the landfill if the leachate storage lagoon are full and leachate cannot be transported to the LTP for treatment.	To minimise potential water quality impacts on surrounding water bodies arising from the landfill operations.	Leachate treatment plant	SENTX Contractor			✓	✓	*WPCO* *Water-TM* *EIAO-TM Annex 6*	-
6.13	WQ25	• Monitor the quality of effluent discharged from the LTP	To ensure discharge quality comply with WPCO requirement	Leachate treatment plant discharge point	SENTX Contractor			✓	✓	*WPCO* *Water-TM*	-
6.10.1	WQ26	<u>Potential Leakage of Leachate</u>									-

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		• Regular groundwater quality monitoring will be carried out to monitor the performance of the leachate containment system.	To minimise potential water quality impacts on surrounding water bodies arising from the landfill operations.	SENTX Site	SENTX Contractor			✓	✓	*WPCO* *Water-TM*	
6.10.1	WQ27	• Maintenance and replacement of the capping system should be carried out, if necessary, to prevent control infiltration and leachate seepage from any damaged cap.	To minimise potential water quality impacts on surrounding water bodies arising from the leachate leakage.	SENTX Site	SENTX Contractor			✓	✓	*WPCO* *Water-TM* *EIAO-TM Annex 6*	-
6.10.1	WQ28	• Maintaining control of the leachate level through extraction	To minimise potential water quality impacts on surrounding water bodies arising from surface breakout of leachate.	SENTX Site	SENTX Contractor			✓	✓	*WPCO* *Water-TM* *EIAO-TM Annex 6*	-
Waste Management – Construction Phase											
7.6.1	WM1	All the necessary waste disposal permits are obtained prior to the commencement of construction work.	To ensure compliance with relevant statutory requirements	Before construction works commence	SENTX Contractor	✓	✓			*WDO*	-
7.6.1	WM2	<u>Management of Waste Disposal</u>									-
		The construction contractor will open a billing account with the EPD. Every construction waste or public fill load to be transferred to the Government waste disposal facilities such as public fill	To ensure that adverse environmental impacts are prevented	SENTX Site	SENTX Contractor		✓			*WDO* *Waste Disposal (Charges for Disposal of Construction Waste) Regulation;*	

EIA Ref.	EM&A Ref	Environmental Protection Measures	Objectives of the Recommended Measure & Main Concerns to address	Location of the Measures	Who to implement the measure?	When to implement the measure? (1) D	C	O/R	A	What requirements or standards for the measure to achieve?	Remarks and Justification
		reception facilities, sorting facilities, landfills will required a valid "chit" which contains the information of the account holder to facilitate waste transaction recording and billing to the waste producer. A trip-ticket system will also be established to monitor the disposal of construction waste at the SENT Landfill and to control fly-tipping. The trip-ticket system will be included as one of the contractual requirements and implemented by the contractor. A recording system for the amount of waste generated, recycled and disposed of (including the disposal sites) will be established.								*Works Bureau Technical Circular No.31/2004; and* *Annex 5 and Annex 6 of Appendix G of ETWBTC No. 19/2005)*	
7.6.1	WM3	<u>Measures for the Reduction of Construction Waste Generation</u>									-
		Inert and non-inert construction waste will be segregated and stored in different containers or skips to facilitate reuse or recycling of the inert waste and proper disposal of the non-inert construction waste. Specific areas of the work site will be designated for such segregation and storage if immediate use is not practicable.	To reduce construction waste generation	SENTX Site	SENTX Contractor		✓			*WDO* *EIAO-TM Annex 7*	
7.6.1	WM4	<u>Chemical Waste</u>									-
		The construction contractor will register	To ensure proper	SENTX Site	SENTX		✓			*WDO*	

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		as a chemical waste producer with the EPD. Chemical waste will be handled in accordance with the *Code of Practice on the Packaging, Handling and Storage of Chemical Wastes.*	handling of chemical waste		Contractor					*Code of Practice on the Packaging, Handling and Storage of Chemical Wastes*	
7.6.1	WM5	<u>Sewage</u>									-
		An adequate number of portable toilets will be provided at the site to ensure that sewage from site staff is properly collected. The portable toilets will be desludged and maintained regularly by a specialist contractor.	To ensure proper handling of sewage	SENTX Site	SENTX Contractor		✓			*WDO* *EIAO-TM Annex 7*	
7.6.1 and SENTX latest design	WM6	<u>General Refuse</u>									-
		General refuse will be stored in enclosed bins separately from construction and chemical wastes. The general refuse will be delivered to a transfer station or other landfill, separately from construction and chemical wastes, on a daily basis to reduce odour, pest and litter impacts. Recycling bins will be provided at strategic locations to facilitate recovery of aluminium can and waste paper from the SENTX Site. Materials recovered will be sold for recycling.	To ensure proper handling of general refuse	SENTX Site	SENTX Contractor		✓			*WDO* *EIAO-TM Annex 7*	
7.6.1	WM7	<u>Staff Training</u>									-
		At the commencement of the	To ensure that	SENTX Site	SENTX		✓				

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		construction works, training will be provided to workers on the concepts of site cleanliness and on appropriate waste management procedures, including waste reduction, reuse and recycling.	adverse environmental impacts are prevented		Contractor						
7.8	WM8	<u>Environmental Monitoring & Audit Requirements</u> Weekly audits of the waste management practices will be carried out during the construction phase. The audits examine all aspects of waste management including waste generation, storage, recycling, transport and disposal.	To ensure that adverse environmental impacts are prevented	SENTX Site	SENTX Contractor		✓			*WDO*	-
Waste Management – Operation/Restoration Phase											
7.6.2 and SENTX latest design	WM9	<u>Sludge</u> In case off-site disposal is required, the Contractor will ensure that sludge generated from the LTP will be delivered in closed container to other waste disposal facility e.g. other landfills or a sludge treatment facility, for proper disposal on a daily basis.	To ensure proper handling of sludge	SENTX Site	SENTX Contractor			✓		*WDO* *EIAO-TM Annex 7*	-
7.6.2	WM10	<u>Chemical Waste</u> The construction contractor will register as a chemical waste producer with the EPD. Chemical waste will be handled	To ensure proper handling of chemical waste	SENTX Site	SENTX Contractor			✓		*WDO* *EIAO-TM Annex 7*	-

EIA Ref.	EM&A Ref	Environmental Protection Measures	Objectives of the Recommended Measure & Main Concerns to address	Location of the Measures	Who to implement the measure?	When to implement the measure? (1) D	C	O/R	A	What requirements or standards for the measure to achieve?	Remarks and Justification
		in accordance with the *Code of Practice on the Packaging, Handling and Storage of Chemical Wastes.*								*Code of Practice on the Packaging, Handling and Storage of Chemical Wastes*	
7.6.2	WM11	<u>Sewage</u> All sewage from the operation staff will be diverted to the LTP for treatment or public sewer, if available.	To ensure proper handling of sewage	SENTX Site	SENTX Contractor			✓		*WDO* *EIAO-TM Annex 7*	Moved to mitigation measure under water quality WQ19. It is a measure for water quality rather than waste management.
7.6.2 and SENTX latest design	WM12	<u>General Refuse</u> General refuse will be stored in enclosed bins and disposed of at other landfills or transfer station on a daily basis to reduce odour, pest and litter impacts. Recycling bins will be provided at strategic locations to facilitate recovery of aluminium can and waste paper from the SENTX Site. Materials recovered will be sold for recycling.	To ensure proper handling of general refuse	SENTX Site	SENTX Contractor			✓		*WDO* *EIAO-TM Annex 7*	-
Waste Management – Aftercare Phase											
7.6.3	WM13	*Sludge* The Contractor will ensure that all dewatered sludge (>30% dry solids) generated from the LTP be transported to a waste disposal facility eg other landfills or sludge treatment facility, if required,	To ensure proper handling of sludge	Infrastructure area	SENTX Contractor				✓	*WDO* *EIAO-TM Annex 7*	-

EIA Ref.	EM&A Ref	Environmental Protection Measures	Objectives of the Recommended Measure & Main Concerns to address	Location of the Measures	Who to implement the measure?	When to implement the measure? (1) D	C	O/R	A	What requirements or standards for the measure to achieve?	Remarks and Justification
		for proper disposal on a daily basis.									
7.6.3	WM14	*Sewage*									
		All sewage from the aftercare staff will be treated at the LTP or directed to the public sewer, if available.	To ensure proper handling of sewage	Infrastructure area	SENTX Contractor				✓	*WDO* *EIAO-TM Annex 7*	Moved to mitigation measure under water quality WQ19. It is a measure for water quality rather than waste management.
7.6.3	WM15	*General Refuse*									-
		General refuse will be stored in enclosed bins and disposed of at a waste disposal facility eg other landfills or transfer stations on a daily basis to reduce odour, pest and litter impacts. Recycling bins will be provided at strategic locations to facilitate recovery of aluminium can and waste paper from the SENTX Site. Materials recovered will be sold for recycling.	To ensure proper handling of general refuse	SENTX Site	SENTX Contractor				✓	*WDO* *EIAO-TM Annex 7*	
Landfill Gas Hazards – Design and Construction Phase											
8.6.2 and SENTX latest design	LFG1	Precautionary measures to be adopted by the contractors at the Project site and the adjacent development site within the landfill consultation zone are outlined in Paragraphs 8.3 to 8.49 of EPD's *Landfill Gas Hazard Assessment Guidance Notes (the Guidance Note*). Those precautionary	To protect workers from landfill gas risk	All construction works area	SENTX Contractor		✓			*Paragraphs 8.3 to 8.49 of EPD's Landfill Gas Hazards Assessment Guidance Note* *EIAO-TM Annex 7*	-

EIA Ref.	EM&A Ref	Environmental Protection Measures	Objectives of the Recommended Measure & Main Concerns to address	Location of the Measures	Who to implement the measure?	When to implement the measure? (1) D	C	O/R	A	What requirements or standards for the measure to achieve?	Remarks and Justification
		measures applicable to the SENTX will be confirmed in the detailed Qualitative Landfill Gas Hazard Assessment to be submitted by the contractor.									
8.6.2	LFG2	Monitoring will be undertaken when construction works are carried out in confined space within the consultation zone with reference to the monitoring requirements and procedures specified in Paragraphs 8.23 to 8.28 of EPD's *Guidance Note* will be followed. In the event of the trigger levels being exceeded, it is recommended that a person, such as the Safety Officer, is nominated, with deputies, to be responsible for dealing with any emergency which may occur due to landfill gas. In an emergency situation, the nominated person, or his deputies, shall have the necessary authority and shall ensure that the confined space is evacuated and the necessary works implemented for reducing the concentrations of gas. The appropriate organisations shall be contact.	To protect workers from landfill gas risk	Confined space within the construction works area	SENTX Contractor		✓				-
8.6.3	LFG3	The design of the landfill gas management system and the landfill gas precautionary measures to be adopted on-site will be done by a landfill gas specialist consultant appointed by the SENTX contractor, who has	To minimise landfill gas hazards by appropriate design	SENTX Site	SENTX Contractor	✓				*EIAO-TM Annex 7*	-

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		comprehensive knowledge on landfill characteristics, potential landfill gas hazards and appropriate precautionary measures to minimise hazards. Moreover, the landfill gas management system and landfill gas precautionary measures will be checked and certified by a qualified independent consultant. During the detailed design stage, a review of this preliminary qualitative risk assessment will be carried out, a detailed qualitative landfill gas risk assessment will be prepared and the report together with the detailed design of gas protection measures will be submitted to EPD for vetting.									
8.6.3	LFG4	Implementation of engineering measures according to Contract Specification requirements. These measures will include the placement of liner and installation of landfill gas management system to contain, manage and control landfill gas.	To protect workers from landfill gas risk	SENTX Site	SENTX Contractor	✓	✓	✓	✓	*EIAO-TM Annex 7*	-
8.6.3	LFG5	Engineering measures to significant engineering measures will be required in the design of the SENTX to protect the staff working in the infrastructure area. These measures include a combination of passive and active systems (examples are recommended in EPD's *Guidance Notes*).	To protect workers from landfill gas risk	Infrastructure Area	SENTX Contractor	✓	✓			*EPD's Landfill Gas Hazards Assessment Guidance Note* *EIAO-TM Annex 7*	-

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		Landfill gas monitoring boreholes will be installed at the edge of the waste slope between the waste and the new infrastructure area to monitor the migration of landfill gas, if any.									
8.6.3	LFG6	For future developments in TKOIE and TKO Area 137 which fall into the Landfill Consultation Zone of the SENTX, the project proponents should strictly follow the recommendations in the HKPSG and the *ProPECC PN 3/96* to carry out landfill gas hazard assessment for the developments and design/implement suitable precautionary and protection measures to render the development as safe as practicable. These precautionary measures may include passive gas control e.g. provision of barriers to the movement of landfill gas.	To protect workers and future site operator from landfill gas risk	Future Development within the SENTX Consultation Zone in TKO Area 137	Developers/ operators of the future development site within the SENTX Consultation Zone in TKO Area 137	✓	✓			*Landfill Gas Hazards Assessment Guidance Note* *ProPECC PN 3/96* *EIAO-TM Annex 7*	-
Landfill Gas Hazards – Operation, Restoration and Aftercare Phases											
8.6.4	LFG7	To train and ensure staff to take appropriate precautions at all times when entering enclosed spaces or plant rooms. Undertake regular monitoring of landfill gas at the perimeter boreholes to detect if there are any signs of off-site landfill gas migration. Prepare and implement emergency plan in case off-	To protect workers from landfill gas risk	SENTX Site	SENTX Contractor			✓	✓	*Landfill Gas Hazards Assessment Guidance Note*	-

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		site landfill gas migration is detected. A permanent gas monitoring system with alarm will be installed and operated in all occupied on-site buildings.									
8.7 and SENTX latest design	LFG8	<u>Environmental Monitoring & Audit Requirements</u> Undertake regular monitoring of landfill gas within the SENTX and along the SENTX boundary as required by the Contract Specification.	To protect workers from landfill gas risk	Within the SENTX and along the SENTX boundary	SENTX Contractor			✓	✓	*Landfill Gas Hazards Assessment Guidance Note*	-
Ecology – Construction Phase											
9.10.2	EC1	Measures to control construction runoff: • Exposed soil areas will be minimised to reduce the contamination of runoff and erosion;	To minimise potential water quality impacts affecting ecological resources	All construction works area	SENTX Contractor		✓			*EIAO-TM Annex 16* *ProPECC PN 1/94* *Water Pollution Control Ordinance (WPCO)* *EIAO-TM Annex 6*	-
		• To prevent stormwater runoff from washing across exposed soil surfaces, perimeter channels will be constructed in advance of site formation works and earthworks and intercepting channels will be provided for example along the edge of excavation;								-	-

EIA Ref.	EM&A Ref	Environmental Protection Measures	Objectives of the Recommended Measure & Main Concerns to address	Location of the Measures	Who to implement the measure?	When to implement the measure? (1) D	C	O/R	A	What requirements or standards for the measure to achieve?	Remarks and Justification
		• Silt removal facilities, channels and manholes will be maintained and the deposited silt and grit will be removed regularly to ensure they are functioning properly at all times;								-	-
		• Temporary covers such as tarpaulin will also be provided to minimise the generation of high suspended solids runoff;								-	-
		• The surface runoff contained any oil and grease will pass through the oil interceptors; and,								-	-
		• Control measures, including implementation of excavation schedules, lining and covering of excavated stockpiles will be implemented to minimise contaminated stormwater run-off from the SENTX site.								-	-
9.10.2 and SENTX latest design	EC2	<u>Good Construction Practice</u>:								*EIAO-TM Annex 16*	-
		• Fences along the boundary of the SENTX Site will be erected before the commencement of works to prevent vehicle movements, and encroachment of personnel, onto adjacent areas.	To minimise potential ecological impacts arising from the Project	SENTX Site	SENTX Contractor		✓				
		• The work site boundaries will be									

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		regularly checked to ensure that they are not breached and that damage does not occur to surrounding areas.									
Ecology – Operation, Restoration and Aftercare Phases											
9.10.2	EC3	<u>Measures for Controlling Leakage of Landfill Leachate</u> Leachate will be contained within the SENTX Site by the proposed impermeable leachate containment system and collected by the installation of drainage system to prevent potential migration of leachate to habitats in the vicinity.	To minimise potential water quality impact affecting the ecological resources	SENTX Site	SENTX Contractor			✓	✓	*EIAO-TM Annex 16* *WPCO* *Water-TM* *EIAO-TM Annex 6*	-
9.10.2	EC4	<u>Measures for Controlling Migration of Landfill Gas</u> Disturbance to habitat in the vicinity and associated wildlife due to migration of landfill gas will be prevented by proper management of the landfill gas generated from the SENTX. Ignition fires will be prohibited to occur within the boundary of the SENTX Site. Surface emission and off-site migration of landfill gas will be regularly monitored.	To minimise potential landfill gas migration affecting ecological resources	SENTX Site	SENTX Contractor			✓	✓	*EIAO-TM Annex 16*	-
9.10.3 and SENTX latest design	EC5	The following compensation planting is recommended as the mitigation measures for the habitat affected due to the SENTX:	Compensation of habitat loss due to the Project	SENTX Site	SENTX Contractor			✓	✓	*EIAO-TM Annex 16*	-

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		• Provision of 6 ha of mixed woodland planting to compensate the loss of shrubland; and • Provision of a mosaic of grassland and shrubland in the remaining areas of the SENTX Site. Compensatory planting and restoration of the SENTX can be implemented progressively according to the filling plan of SENTX.									
9.10.3	EC6	The mixture of grassland, shrubland and woodland habitats are recommended to diversify the habitats for supporting various wildlife in particular butterflies, birds and herpetofauna and blend into the existing undisturbed ecological environment.	To diversify habitats	SENTX Site	SENTX Contractor			✓	✓	*EIAO-TM Annex 16*	-
9.10.3	EC7	Indigenous plant species of shallow root system, softwood in nature and adaptive to sea shore habitat are recommended to be used in the restoration plan, which can establish well in coastal area with exposure to strong wind and salt spray, with sand soil base. Taking consideration of the relative poor substrate and the difficulties of establishment of some native trees in Hong Kong, it is recommended to include approximately 20% of non-native tree species in the compensatory	To enhance ecological value of the habitats	SENTX Site	SENTX Contractor			✓	✓	*EIAO-TM Annex 16*	-

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		woodland. The non-native tree species can serve as a nurse species to facilitate the establishment of the native tree species, especially the shading, and it can be replaced by established native tree species progressively. Plant species can also make reference to food plants of butterfly species (in particularly butterfly species of conservation interests recorded within the CWBCP).									
9.10.3	EC8	It is also recommended that a trial nursery for native plant species be set up to fine tone the planting matrix and management intensity of the recommended indigenous tree species for the restoration of the SENTX. It should be noted that native shrubs and tree species had been used for restoration of the existing SENT Landfill, native plant species that could not successfully be established on the existing SENT Landfill should be reviewed before the preparation of the compensatory planting list. Special care and intensive management of native plant should be implemented in order to ensure proper establishment of the native plants.	To select the most suitable indigenous tree species for the SENTX	SENTX Site	SENTX Contractor	✓		✓	✓	*EIAO-TM Annex 16*	-
9.12.1	EC9	<u>Environmental Monitoring & Audit Requirements</u> The implementation of the ecological mitigation measures should be checked	To ensure that adverse ecological impacts are prevented	SENTX	SENTX Contractor		✓	✓	✓	*EIAO-TM Annex 16*	-

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		as part of the environmental monitoring and audit procedures during the construction period.									
Landscape and Visual – Construction Phase											
10.6.5	LV1	CM1 - The construction area and area allowed for the contractor's office, leachate treatment plant and laboratory areas will be minimised to a practical minimum, to avoid impacts on adjacent landscape.	To minimise the landscape and visual impacts	SENTX Site	SENTX Contractor		✓			*EIAO-TM Annex 18 and ETWBC 3/2006*	-
10.6.5	LV2	CM2 - Topsoil, where identified, will be stripped and stored for re-use in the construction of the soft landscape works, where practical. The Contract Specification will include storage and reuse of topsoil as appropriate.	To minimise the landscape and visual impacts	All construction works area	SENTX Contractor		✓			*EIAO-TM Annex 18*	-
10.6.5	LV3	CM3 - All existing trees at the edges of the landfill will be carefully protected during construction. Detailed Tree Protection Specification will be provided in the Contract Specification. Under this Specification, the Contractor will be required to submit, for approval, a detailed working method statement for the protection of trees prior to undertaking any works adjacent to all retained trees, including trees in Contractor's works areas.	To minimise the landscape and visual impacts	Potential impacted area	SENTX Contractor		✓			*EIAO-TM Annex 18 and ETWBC 3/2006*	-
10.6.5	LV4	CM4 - Trees unavoidably affected by the	To minimise the	Potential	SENTX	✓	✓			*EIAO-TM Annex 18 and ETWBC 3/2006*	-

EIA Ref.	EM&A Ref	Environmental Protection Measures	Objectives of the Recommended Measure & Main Concerns to address	Location of the Measures	Who to implement the measure?	When to implement the measure? (1) D	C	O/R	A	What requirements or standards for the measure to achieve?	Remarks and Justification
		works will be transplanted, where necessary and practical. A detailed Tree Transplanting Specification will be provided in the Contract Specification, if applicable. Sufficient time for necessary tree root and crown preparation periods will be allowed in the project programme.	landscape and visual impacts	impacted area	Contractor						
10.6.5 and SENTX latest design	LV5	CM5 - Within 3 months of taking possession of the SENTX Site, the Contractor will plant advance screen planting of native species at Light Standard size at 1.5m centres along the High Junk Peak Trail so as to screen views of the Works from the trail. Tree planting locations will be agreed with AFCD. Works will be completed within 9 months of taking possession of the SENTX Site.	To minimise the landscape and visual impacts	At High Junk Peak Hiking Trail	SENTX Contractor		✓			*EIAO-TM Annex 18*	
10.6.5	LV6	CM6 - The Contractor's office, leachate treatment plant and laboratory will be given an aesthetic treatment in earth tones to reduce their visual impact and albedo and blend them into the surrounding landscape.	To minimise the landscape and visual impacts	Infrastructure area	SENTX Contractor	✓	✓			*EIAO-TM Annex 18*	-
10.6.5	LV7	CM7 - The Contractor's office, leachate treatment plant and laboratory will be surrounded by a minimum of 5m wide and 0.75m high earth bund on the west and south sides planted with a dense screen of tree and shrub vegetation.	To minimise the landscape and visual impacts	Infrastructure area	SENTX Contractor	✓	✓			*EIAO-TM Annex 18 and ETWBC 7/2002*	-

EIA Ref.	EM&A Ref	Environmental Protection Measures	Objectives of the Recommended Measure & Main Concerns to address	Location of the Measures	Who to implement the measure?	When to implement the measure? (1) D	C	O/R	A	What requirements or standards for the measure to achieve?	Remarks and Justification
		Additional tree planting will be provided in unused spaces with thin infrastructure site, along access roads and in and around car parks. This will be supplemented with shrub planting, where appropriate.									
10.6.5	LV8	CM8 - Planting trials will be carried out in an on-site nursery prior to implementation of the first phase of restoration to establish the best planting matrix and management intensity of the recommended plant materials for the restoration.	To minimise the landscape and visual impacts	SENTX Site	SENTX Contractor		✓			*EIAO-TM Annex 18*	-
11.4.1 and SENTX latest design	LV9	During the preparation of the detailed landscape design plan, the design submission will be audited against the recommendation proposed in the *ER Report* by the Registered Landscape Architect from the ET.	To ensure the implementation of mitigation measures proposed in this EIA Report	SENTX Site	SENTX Contractor/ET	✓	✓			*EIAO-TM Annex 18*	-
Landscape and Visual – Operation/Restoration Phase											
10.6.5 and SENTX latest design	LV10	OM1 - Landfill materials will be covered with general fill material or tarpaulin sheet on a daily basis to reduce visual impact.	To minimise the landscape and visual impacts	Tipping area	SENTX Contractor			✓		*EIAO-TM Annex 18*	-
10.6.5 and SENTX latest design	LV11	OM2 - Filling and restoration will be phased during the course of operations in a minimum of 4 phases, the restoration of each phase to commence immediately on the completion of filling in that phase.	To minimise the landscape and visual impacts	Tipping area	SENTX Contractor			✓		*EIAO-TM Annex 18*	-

EIA Ref.	EM&A Ref	Environmental Protection Measures	Objectives of the Recommended Measure & Main Concerns to address	Location of the Measures	Who to implement the measure?	When to implement the measure? (1) D	C	O/R	A	What requirements or standards for the measure to achieve?	Remarks and Justification
10.6.5	LV12	OM3 - Catch fences will be erected at the perimeter of the waste boundary, to ensure that all waste stays within the site and is not blown into surrounding areas.	To minimise the landscape and visual impacts	Tipping area	SENTX Contractor			✓		*EIAO-TM Annex 18*	-
10.6.5	LV13	OM4 - All night-time lighting will be reduced to a practical minimum both in terms of number of units and lux level and will be hooded and directional.	To minimise the landscape and visual impacts	Tipping area	SENTX Contractor			✓		*EIAO-TM Annex 18*	-
11.4.2 and SENTX latest design	LV14	The condition of the restoration plantation will be audited at monthly intervals by a Registered Landscape Architect from the ET.	To check the restoration plantation	SENTX Site	SENTX Contractor/ET			✓		*EIAO-TM Annex 18*	-
Landscape and Visual – Aftercare Phase											
10.6.5	LV15	AM1 - The SENTX will be restored to resemble a natural hillside/ upland landscape as far as possible.	To minimise the landscape and visual impacts	SENTX Site	SENTX Contractor	✓		✓	✓	*EIAO-TM Annex 18*	-
10.6.5	LV16	AM2 - Final restoration earthworks grading will provide both vertical and horizontal variation to simulate as far as practicable, natural terrain.	To minimise the landscape and visual impacts	SENTX Site	SENTX Contractor	✓		✓	✓	*EIAO-TM Annex 18*	-
10.6.5	LV17	AM3 - Compensatory Tree Planting for all felled trees will be provided to the satisfaction of relevant Government departments. Required numbers and locations of compensatory trees will be determined and agreed separately with Government during the Tree Felling Application process under ETWB-WBTC	To minimise the landscape and visual impacts	Potential impacted area	SENTX Contractor	✓		✓	✓	*EIAO-TM Annex 18 and ETWBC 3/2006*	-

EIA Ref.	EM&A Ref	Environmental Protection Measures	Objectives of the Recommended Measure & Main Concerns to address	Location of the Measures	Who to implement the measure?	When to implement the measure? (1) D	C	O/R	A	What requirements or standards for the measure to achieve?	Remarks and Justification
		3/2006.									
10.6.5 and SENTX latest design	LV18	AM4 - The restored SENTX will be substantially vegetated so as to mimic the patterns of natural vegetation on surrounding hills. At least 17.9 ha of the area of the SENTX will be planted with woodland mix planting at no less than 1.2m spacings. 80% of all plants planted should be native species. The remainder of the site should be planted as a grassland / shrub mosaic.	To minimise the landscape and visual impacts	SENTX Site	SENTX Contractor	✓		✓	✓	*EIAO-TM Annex 18*	-
10.6.5	LV19	AM5 - Drainage channels will be treated with stone pitching or coloured pigment in an earth tone and will not be untreated concrete.	To minimise the landscape and visual impacts	SENTX Site	SENTX Contractor	✓		✓	✓	*EIAO-TM Annex 18*	-
10.6.5	LV20	AM6 - Soil mix in accordance with the Government's General Specification for Engineering Works will be used in the restoration works. In areas of tree planting, soil mix will not be less than 1.2m deep. In areas of scrub planting and grassland, it should not be less than 600mm deep.	To minimise the landscape and visual impacts	SENTX Site	SENTX Contractor	✓		✓	✓	*EIAO-TM Annex 18*	-
10.6.5	LV21	AM7 - All above ground structures, including gas wells and flares will be sensitively designed in a manner that responds to the existing and planned urban context, and minimises potential adverse landscape and visual impacts.	To minimise the landscape and visual impacts	SENTX Site	SENTX Contractor	✓		✓	✓	*EIAO-TM Annex 18*	-
10.6.5	LV22	AM8 - Permanent access and	To minimise the	SENTX Site	SENTX	✓		✓	✓	*EIAO-TM Annex 18*	-

EIA Ref.	EM&A Ref	Environmental Protection Measures	Objectives of the Recommended Measure & Main Concerns to address	Location of the Measures	Who to implement the measure?	When to implement the measure? (1) D	C	O/R	A	What requirements or standards for the measure to achieve?	Remarks and Justification
		maintenance tracks will not have an unfinished concrete surface. Acceptable finish materials might include granite, or concrete blocks in an earth tone colour.	landscape and visual impacts		Contractor						
11.4.3 and SENTX latest design	LV23	The restoration plantation will be audited quarterly by the Registered Landscape Architect from the ET	To check the restoration plantation	SENTX Site	SENTX Contractor and ET				✓	*EIAO-TM Annex 18*	-

Annex B

Monitoring and Complaint Proforma

Data Sheet for TSP Monitoring

Monitoring Location		
Details of Location		
Sampler Identification		
Date & Time of Sampling		
Elapsed-time Start (min.)		
Meter Reading Stop (min.)		
Total Sampling Time (min.)		
Weather Conditions		
Site Conditions		
Initial Flow Rate	Pi (mmHg)	
	Ti (^{o}C)	
	Hi (in.)	
	Qsi (Std. m^3)	
Final Flow Rate	Pf (mmHg)	
	Tf (^{o}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 (ug/m^3)		

	Name & Designation	Signature	Date
Field Operator:			
Laboratory Staff:			
Checked by:			

Data Sheet for Ambient VOCs, Ammonia & H_2S Monitoring

Monitoring Location	
Details of Location	
Sampler Identification	
Date & Time of Sampling	
Weather	Sunny / Fine / Overcast / Shower / Rain
Ambient Temperature	^oC
Wind Speed	
Wind Direction	
Wind from the Project Area	Yes / No

Parameter	Value	Parameter	Value
Ammonia		Methane	
Trichloroethylene		Ethanol	
Vinyl chloride		Butan-2-ol	
Methylene chloride		Dimethylsulphide	
Chloroform		Methyl propionate	
1,2-dichloroethane		Ethyl propionate	
1,1,1-trichloroethane		Propyl propionate	
Carbon tetrachloride		Butyl acetate	
Tetrachloroethylene		Ethyl butanoate	
1,2-dibromoethane		Dichlorobenzene	
Benzene		Methyl butanoate	
Toluene		Dipropyl ether	
Carbon disulphide		Methanethiol	
Propyl benzene		Ethanethiol	
Ethyl benzene		Butanethiol	
Butyl benzene		Methanol	
Xylenes		Heptanes	
Decanes		Octanes	
Undecane		Nonanes	
Limonene		Dichlorodifluoromethane	
Terpenes		Hydrogen Sulphide	

Name & Designation Signature Date

Field Operator:

Laboratory Staff:

Checked by:

Data Sheet for Odour Monitoring

Date	
Time	
Monitoring Location	
Description of Location	
Site Conditions	

Weather	Sunny / Fine / Overcast / Shower / Rain
Ambient Temperature	^{o}C
Wind Speed	
Wind Direction	
Wind from the Project Area	Yes / No

Odour Characteristic	
Odour Level (0-4) *	0 / 1 / 2 / 3 / 4
Major Odour Sources	SENT: Others:
Remarks	

Note: *

0	Not Detected	No odour perceived or an odour so weak that it cannot be easily characterized or described
1	Slight	Identifiable odour, slight
2	Moderate	Identifiable odour, moderate
3	Strong	Identifiable, strong
4	Extreme	Severe odour

Name & Designation Signature Date

Recorded by:

Checked by:

Data Sheet for Thermal Oxidizer / LFG Flare / LFG Generator Monitoring

Monitoring Location	
Details of Location	
Sampler Identification	
Date & Time of Sampling	

Performance Parameter	Value
Gas Combustion Temperature	
Exhaust Gas Temperature	
Exhaust Gas Velocity	
Exhaust Gas Retention Time	

Parameter	Value	
NO_2		$g\ s^{-1}$
CO		$g\ s^{-1}$
SO_2		$g\ s^{-1}$
Benzene		$g\ s^{-1}$
Vinyl chloride		$g\ s^{-1}$
NMOCs		$mg\ m^{-3}$ / ppm

Name & Designation Signature Date

Field Operator:

Laboratory Staff:

Checked by:

Surface Water Quality Monitoring Data Sheet – In-situ Monitoring

Location		Surface	Middle	Bottom
Monitoring Station				
Date				
Weather				
Sea Condition				
Tide Mode				
Start Time	(hh:mm)			
Water Depth	(m)			
PH				
Temperature	(^{o}C)			
Salinity	(ppt)			
Turbidity	(NTU)			
Electricity Conductivity				
Sample Identification				
DO	(mg/l)			
DO Saturation	(%)			
Other Observations				

Name & Designation Signature Date

Recorded by:

Checked by:

Surface Water Quality Monitoring Data Sheet – Laboratory Testing

Location	
Monitoring Station	
Date	
Time	
Weather	

Parameters	Value	Parameters	Value
SS		Sodium	
COD		Potassium	
BOD		Calcium	
TOC		Magnesium	
Ammonia–nitrogen		Nickel	
Nitrate-nitrogen (N)		Manganese	
Nitrite – nitrogen (N)		Chromium	
Phosphate		Cadmium	
Sulphate		Copper	
Sulphide		Lead	
Carbonate		Iron	
Bicarbonate		Zinc	
Chloride			

Name & Designation Signature Date

Field Operator:

Laboratory Staff:

Checked by:

Groundwater Monitoring Data Sheet – In-situ Monitoring

Monitoring Hole Reference No.	
Time	
Depth to water below monitoring hole datum	
Monitoring hole datum level*	
Groundwater level*	
General weather conditions	
Equipments	
pH	
Electricity conductivity	
Comments	

* With reference to Principle Datum

	Name & Designation	Signature	Date
Recorded by:			
Checked by:			

Ground Water Quality Monitoring Data Sheet – Laboratory Testing

Monitoring Station	
Date	
Time	
Weather	

Parameters	Value	Parameters	Value
BOD		Sodium	
COD		Potassium	
TOC		Calcium	
Ammonia-nitrogen		Magnesium	
Nitrate-nitrogen (N)		Nickel	
Nitrate-nitrogen		Manganese	
Nitrite – nitrogen		Chromium	
Sulphate		Cadmium	
Sulphide		Copper	
Carbonate		Lead	
Chloride		Iron	

	Name & Designation	Signature	Date
Field Operator:			
Laboratory Staff:			
Checked by:			

Effluent Monitoring Data Sheet – In-situ Monitoring

Effluent from Leachate Treatment Plant

pH	
Electricity conductivity	
Temperature (Leachate)	
Temperature (Air)	
Sampling Device	
Sample Colour	
Sample Clarity	
Comments	

Name & Designation Signature Date

Field Operator:

Checked by:

Effluent Monitoring Data Sheet – Laboratory Testing of Effluent from LTP

Monitoring Station	
Date	
Time	
Weather	

Parameters	Value	Parameters	Value
COD		Iron	
BOD		Zinc	
TOC		Alkalinity	
Ammonia–nitrogen		Chloride	
Nitrate-nitrogen		Calcium	
Nitrite–nitrogen		Potassium	
Total Nitrogen		Magnesium	

	Name & Designation	Signature	Date
Field Operator:			
Laboratory Staff:			
Checked by:			

Noise Monitoring Field Data 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:

Sample Template for Interim Notifications of Environmental Quality Limits Exceedances

Incidental Report on Action Level or Limit Level Non-compliance

Project	
Date	
Time and Tidal status if relevant	
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: _____

Landfill Gas Monitoring –Field Measurement Recording Sheet

Name of site:
Date of measurement:

Sampling equipment used:	Dates calibrated

Sample location	Date of measurement	Sampling time	Monitoring wells / Surface Gas Emission						
			Weather condition	Balance gas (%)	Flammable gas (methane %)	Carbon dioxide (%)	Oxygen (%)	Temp (°C)	Remark

Name & Designation Signature Date

Field Operator:

Laboratory Staff:

Checked by:

Landfill Gas Monitoring – Permanent Gas Detection System Field Data Sheet of Alarm System Activation

Date	
Time	
Building	
Detector Head No.	
Fault	

Methane Concentration	
Action Taken	

Name & Designation Signature Date

Field Operator:

Laboratory Staff:

Checked by:

Complaint Log

Ref:

Log Ref	Date	Location	Complainant/ Date of Contact	Details of Complaint	Investigation / Mitigation Action	File Closed

Filed by Environmental Team Leader:

Date:

Implementation Status Proforma

Ref:

Ref**	Environmental Protection Measures*	Implementation Status

* All recommendations and requirements resulted during the Course of EIA Process, including ACE and/or accepted public comment to the proposed projects.
** EIA Ref/ EM&A Log Ref/ Design Document Ref

Signed by Environmental Team Leader:

Date:

Audited by Independent Environmental Checker:

Date:

Regulatory Compliance Proforma

Ref:

Ref**	Environmental Licence / Permit*	Control Area / Facility / Location	Effective Date

* Name of Applicant, Business Corporation, relevant regulation and remark of license/permit conditions

** File reference of the license/permittee

Recorded by Environmental Team Leader:

Audited by Independent Environmental Checker:

Date:

Date:

Site Inspection Proforma

Ref:

Date	Location	Requirement Ref.*	Observation / Deficiency	Mitigation Action ** (Responsible Agency)	Date*** of Confirmation

* EIA Ref/EM&A Log Ref/Design Document Ref/Environmental Protection Contract Clause
** Specific Environmental Mitigation Measures should be stated, such as, equipment, process, system, practices or technologies
*** The required completed date to confirm the specified Environmental Protection Action

Recorded by Environmental Team Leader:

Date:

Audited by Independent Environmental Checker:

Date