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1.0 INTRODUCTION

This site management system relates to the non-hazardous waste management facility located at Ta' Zwejra L/O Maghtab, within the district of Naxxar.

1.1 Proposed Development

The proposed project comprises the development of an engineered facility for the disposal of non-hazardous wastes generated on the Maltese Islands during a period of 18 months in an area measuring some 41,000m². The estimated volume capacity is 500,000 cubic metres following the post settlement of wastes. With an 'after-compaction' density of 0.8 tonnes per cubic metre and with the current rate of waste input, the facility should accommodate 400,000 tonnes of wastes in a time frame of 18 months.

The facility will be developed in three phases consisting of three hydraulically independent cells. All the cells will be built as a typical, standard design fully contained engineered landfill on the basis of already developed and approved techniques through all the EU Member States.

The disposal of non-hazardous waste shall be followed by an intensive waste treatment programme. Research has shown that the decomposition of readily and moderately decomposable organic waste constituents can be accelerated into stabilised waste by the recirculation of leachates. The three cells of the Ta' Zwejra Waste Management Facility will be built with leachate recirculation for rapid degradation, stabilisation and partial recovery of wastes with engineered re-cultivation supported by controlled irrigation.

1.2 Site Management System

This document specifies the site management system that will govern the operation of the installation. The management system includes details of the following procedures:

- waste types and quantity for disposal;
- waste acceptance criteria and procedures;
- engineered containment system and site infrastructure;
- waste deposit and emplacement;
- management and monitoring of leachate, groundwater, surface water and landfill gas;
- amenity control measures for particulates, odour, dirt, litter birds, vermin and insects and noise;
- the use of raw materials and energy;
- accidents and their consequences;
- metrological monitoring; and
- site closure.

2.0 LANDFILL CLASSIFICATION

2.1 Introduction

The installation will be classified as a landfill for non-hazardous waste. The total capacity of the installation is approximately 500,000 m³ (post settlement). The expected density of waste after compaction of 0.8 tonnes per cubic metre will give a 400,000 tonnes available capacity which should effectively provide capacity for 18 months.

2.2 Waste Types and Quantities

2.2.1 *Wastes for Disposal*

The non-hazardous waste types that will be accepted for disposal at the installation are detailed within Appendix 1.

For each waste category, the following details are provided:-

- The full European Waste Catalogue (EWC) Code; and
- Description including physical nature.

2.2.2 *Wastes for Restoration*

The non-hazardous waste types that will be used at the installation for capping, engineering and restoration are detailed in Appendix 2.

For each waste category, the following details are provided:-

- The full European Waste Catalogue (EWC) Code; and
- Description including physical nature.

2.2.3 *Waste Quantity*

The maximum quantity of waste that will be deposited at the installation in any year is detailed in Table 2.1 below.

Table 2.1 Annual Waste Input Limits

Category	Limit (tonnes/year)	Comments
Non-hazardous waste	250,000 m ³	
Inert waste	Only as daily cover	<i>Will be kept to minimum in order to save on void space</i>
Total	250,000 m ³	

3.0 WASTE ACCEPTANCE

Acceptance of waste at the installation will be subject to the following requirements.

3.1 Waste Acceptance Criteria

3.1.1 *Prohibited Waste*

The following wastes shall be specifically prohibited from disposal at the installation:-

- Liquid waste;
- Hazardous wastes (including waste lubricating oils, batteries, asbestos, etc.)
- Waste which in the conditions of a landfill is explosive, corrosive, oxidising, highly flammable or flammable;
- Hospital and other clinical waste arising from medical or veterinary establishments, which are infectious;
- Chemical substances arising from research and development or teaching activities which are not identified and/or are new and whose effects on man and/or the environment are not known (e.g. laboratory residues); and
- Whole and shredded used tyres, excluding those used as engineering material.

3.1.2 *Gypsum Waste*

Unless it is demonstrated by risk assessment that the disposal of gypsum based materials with biodegradable waste will not give rise to risk of pollution of the environment or harm to human health, gypsum based materials will not be disposed of together with biodegradable waste.

3.1.3 *Non-Hazardous Waste*

Non-hazardous waste will be accepted at the installation. Non-hazardous waste is defined as waste which is not covered by Legal Notice 337 Waste Management (Permit and Control) Regulations, 2001.

3.1.4 *Municipal Waste*

Municipal waste can be accepted at landfills for non-hazardous waste without testing. However, waste characterisation will be undertaken to ensure that the production and handling of the waste does not result in a change to its characteristics, for example, by mixing with other materials or by producing a segregated hazardous fraction, which would require the waste to be reclassified as other than municipal waste.

3.1.5 *Inert Waste*

Inert waste, as defined by the Legal Notice 337 Waste Management (Permit and Control) Regulations, 2001 will not be accepted at the installation, except that quantity that may be required as daily cover.

3.2 Waste Acceptance Procedures

Prior to the acceptance of waste at the installation, the following waste acceptance procedures will be followed as appropriate:-

3.2.1 Level 1 Basic Characterisation Testing

Level 1 basic characterisation of wastes constitutes a thorough determination, according to standardised analysis and behaviour testing methods of the short and long term leaching behaviour and or characteristic properties of waste.

Other than in the prescribed circumstances outlined below, all wastes accepted at the installation will undergo basic characterisation testing by, or on behalf of, the waste holder before landfilling. Basic characterisation testing will be used to determine the following:-

- Source and origin of the waste;
- Information on the process producing the waste (description, and characteristics of raw materials and products);
- Description of waste treatment applied to the waste or reasons why treatment is not considered necessary;
- Data on composition of waste and leaching behaviour, where relevant;
- Appearance of the waste (smell, colour and physical form);
- The European Waste Catalogue code;
- Loading rate requirements; and
- Additional precautions to be taken at the landfill.

Key Variables

Basic characterisation will focus on identifying key variables, of which there are two types:

- Those parameters which dictate that a waste will always be directed to a particular class of landfill; and
- Those parameters which vary in a waste stream such that the waste is sometimes suitable for one class of landfill, and sometimes another.

Basic characterisation will normally be required where:-

- Wastes need to be analysed for a limited number of key variables, which may vary close to the landfill class limit values or the presence/absence of which affect the class of landfill; and
- A complete determination of composition and leaching is required, particularly if the waste is either a one-off, is from a very variable process, or has not undergone basic characterisation before.

All wastes being accepted for disposal at the installation will be subject to basic characterisation and compliance testing apart from in the following circumstances:

1. Where testing is not considered necessary due to the nature of the waste (e.g. municipal waste, glass, glass based fibrous materials, etc.). This exclusion would not apply where there is the possibility that the waste has been contaminated during previous use, production, storage or transport.
2. Where all necessary information required for the basic characterisation is already known (This will usually only apply to wastes that are regularly generated by a consistent process at the same installation).
3. Where testing is impractical or where appropriate testing procedures and acceptance criteria are unavailable.

3.2.2 Level 2 Compliance Testing

Level 2 compliance testing constitutes periodical testing by simpler standardised analysis and behaviour testing methods to determine whether the waste complies with the results of the basic characterisation, the acceptance criteria for the landfill class and the installation specific conditions of the permit. This test will focus on key variables and behaviour identified by basic characterisation, and will be carried out at least once a year for each waste stream.

The relevant parameters to be checked will be determined from the results of the basic characterisation. The parameters, and reasons for their selection, will be documented, and the results of the tests will be maintained at the installation.

Compliance testing can be dispensed with in the following circumstances:-

1. Where testing is not considered necessary due to the nature of the waste e.g. municipal waste, glass, glass based fibrous materials, concrete, bricks, tiles and ceramics, soils and stones including naturally occurring sand and clay). This exclusion would not apply where there is the possibility that the waste has been contaminated during previous use, production, storage or transport.
2. Where it is known that the waste cannot contain contaminants of concern.
3. Where testing is impractical or where appropriate testing procedures and acceptance criteria are unavailable.

The reasons for dispensing with the compliance testing will be justified and documented and regular checks carried out to ensure that the waste complies with its description and documentation.

The requirements for Level 1 and Level 2 testing depend upon the type of waste. For wastes that are regularly generated in the same process, where the input materials, and the process are well defined, and changes to the process are notified to the landfill operator, initial analyses may show that there is little variability in the waste, and there may be no further requirement for characterisation testing. Further deliveries may then only be subject to compliance testing. For wastes that are not regularly generated in the same process and installation, each batch may require the basic characterisation testing and consequently no compliance testing is needed.

3.2.3 *Level 3 On-Site Verification of Wastes*

Level 3 on-site verification constitutes rapid check methods to confirm that a waste is the same as that which has been subjected to compliance testing and that which is described in the documentation accompanying the waste. It may consist merely of a visual inspection of the waste before and/or after unloading.

A visual inspection to satisfy the Level 3 on-site verification requirements will be carried out on all wastes deposited at the installation. Preliminary verification, including checking of the paperwork and a visual inspection if possible, will take place before vehicles carrying waste are allowed to proceed to the disposal area and final checking is carried out at the point of discharge.

This visual inspection will have two purposes:-

- To confirm that the waste is permitted for disposal at the installation; and
- To confirm the waste is as described in the accompanying documentation.

In this respect, the person inspecting the waste will be looking for both visual and olfactory evidence of contaminants within the waste, which are either not declared on the Duty of Care transfer note, and/or are not permitted under the terms of the permit.

In cases where basic characterisation has identified that a waste may vary outside the limits applicable to a particular installation or class of landfill, and the variation cannot be detected by visual means, it will be necessary to supplement the visual testing by additional tests such as pH or short leaching tests. If the necessary tests cannot be carried out at the installation, the tests will be undertaken prior to delivery, and the necessary results provided in advance of the deposit of the waste at the installation.

3.3 Pre-Treatment of Wastes

By a date yet to be determined by MEPA, waste destined for disposal at the installation will be subject to pre-treatment unless treatment of the waste would not reduce its quantity or the hazard it presents to human health or the environment. The treatment requirement will also not apply to inert waste for which treatment is not technically feasible.

The majority of waste to be accepted at the landfill will comprise of municipal waste or similar commercial /industrial waste. It is anticipated that the treatment of these wastes will be primarily through segregation or sorting at source, where at least one of the components will not be directly landfilled.

Prior to the acceptance of a specific waste stream at the installation after the designated date, the producer will be asked to confirm that either the waste is pre-treated or that pre-treatment does not apply.

3.4 Technical Control and Assessment

Prior to the acceptance of any new or altered waste stream at the installation, the enquiry regarding waste acceptance will initially be assessed by the installation operator who will determine the following:-

- Whether the waste is on the list of permitted waste types authorised by the Waste Management permit; and
- If the waste is permitted by the permit, whether the waste requires basic characterisation (Level 1) or compliance (Level 2) testing prior to acceptance at the installation.

In the event that the waste does not require testing, the waste enquiry will be passed to the installation operator for quotation.

For waste that requires testing, a technical assessment will be carried out, and the following information will be obtained and recorded for each individual waste stream:-

- The waste category and European Waste Catalogue code;
- A detailed description of the waste including appearance (smell, colour and physical form);
- Source and origin of the waste;
- Information on the process producing the waste (description, and characteristics of raw materials and products);
- Description of waste treatment applied to the waste or reasons why treatment is not considered necessary;
- Chemical analytical data and characterisation testing on composition of waste and leaching behaviour, where relevant;
- Additional precautions and handling methods to be taken at the landfill;
- Any additional determinands to be included in the leachate/groundwater monitoring regimes at the installation as a consequence of the deposit;
- Loading rate requirements;
- Details of any additional checks or analyses to be carried out at the installation at the time of deposit;
- Frequency and quantity of arising; and
- Frequency of compliance (Level 2) testing.

In the event that initial information is insufficient to complete the assessment, the technical controller will gather additional information. This may include direct liaison with the waste producer with regard to the waste and method of production, reference to standard texts and to personal experience.

Final technical approval will be given when all necessary information has been obtained, and will take into account the following:-

- Analytical details, production processes, and materials handling data sheets, if available;
- Suitability for landfilling with reference to IPPC permit conditions, current guidance, and good practice;
- Health and safety and operational issues and the need for special handling; and
- Current operating conditions at the installation.

The technical assessment records will be maintained under review to ensure that basic characterisation and compliance testing is carried out at the intervals identified in the initial technical assessment.

3.5 Weighbridge Procedure

3.5.1 *Weighbridges*

The installation will have a total of two weighbridges, of which one will be located at the entrance of the facility i.e. the waste reception area. The second weighbridge will be located at the exit of the facility. All customers' vehicles will be weighed upon entry before discharging their load and prior to exit after discharging their load.

3.5.2 *Computerised Measurement System*

The weighbridge measurement equipment will be linked to a digital display unit inside the weighbridge office, from which the weighbridge operator can read the gross weight of vehicles. The system will also be linked automatically to the computer system.

The waste recording process will be carried out by the weighbridge operator on a computerised system comprising a keyboard, disk drive unit, visual display monitor and ticket printer.

3.5.3 *Customer Account and Waste Stream Numbers*

Prior to acceptance of waste at the installation, the customer will be allocated a customer account number, and an account will be opened when the customer's details are entered into the master computer.

3.5.4 *Vehicle Details*

If a new vehicle uses the installation, its details including registration number and vehicle description will be entered into the computer to complete the transaction. Vehicles to be used by the customer for some time will be set up on the computer system to allow the vehicle and contract details to show automatically when the weighbridge enters the vehicle registration.

3.5.5 Waste Identification/Verification

The weighbridge operator will then identify the type of waste by reference to the following information:-

- Duty of Care transfer note; and
- Verbal confirmation from the driver.

Where possible, the weighbridge operator will undertake a preliminary visual examination of the waste.

Non-Conforming Waste

Wastes that are identified at the weighbridge as non-conforming will be directed to the waste quarantine area for inspection. If the inspection confirms that the waste is non-conforming, MEPA, the waste carrier, and/or producer, and the internal company line management will be consulted. The load will remain on site until an agreed course of action has been agreed with all relevant parties.

Difficult Waste

These wastes once processed for correct paperwork will be directed to the waste quarantine area for verification, testing and sampling purposes.

3.5.6 Waste Rejection at Weighbridge

Incoming waste will be rejected at the weighbridge for a number of reasons including:-

- Incomplete or unsatisfactory documentation;
- Physical appearance not fitting description on transfer note;
- Burst sacks or inadequately contained load;
- Presence of free liquid in the waste;
- Waste not adequately pre-conditioned; and
- Adverse weather conditions at tipping face.

The site manager will be informed of any waste that is rejected at the weighbridge due to inaccurate documentation. He/she will then communicate with the customer, advising that the load has been rejected and the reasons why. The details will be entered in the installation logbook.

If the installation is unable to accept certain waste streams due to adverse weather conditions, customers will be notified by telephone, facsimile or e-mail giving the period of closure, providing as much notice as possible.

3.5.7 *Waste Quantity*

The waste quantity will be determined from the measurement of the gross weight of the vehicle (determined prior to waste deposit) minus the tare weight (determined following discharge). For suitable vehicles the tare weight will be stored to enable the computer to automatically calculate the net weight of the load.

3.5.8 *Ticket Issue*

The transaction will be regarded as complete when the driver signs the issued ticket to confirm that the specified information is correct. The ticket will be handed back to the weighbridge operator and a copy will be supplied to the driver.

In case of temporary computer failure, manual tickets will also be available at the weighbridge, for manually recording waste receipts.

3.5.9 *Waste Authorisation*

The weighbridge operator will consult the site manager where the waste does not conform to the information stored on the computer.

The site manager will determine if the waste is acceptable for disposal at the installation under the terms of the permit, and whether all necessary pre-treatment and characterisation testing has been satisfied. If there is any doubt, the waste will not be accepted and the weighbridge operator will advise the waste carrier accordingly. Alternatively, if the site manager agrees to accept the waste, the weighbridge operator will arrange for the load to be observed during discharge at the tipping area, in accordance with Section 5.2.10.

3.5.10 *Difficult Waste*

Difficult waste is generally defined as any waste, which by virtue of its chemical composition, stability, concentration, toxicity or physical characteristics is likely to cause harm to human health or pollution of the environment. The term 'harm' includes offence to any of man's senses.

Difficult wastes that may be accepted at the installation may include, but are not limited to the following:-

- Malodorous waste;
- Drummed waste; and
- Dusty waste.

Wastes that may be difficult will only be accepted if they are specifically listed as permitted waste types in Appendix 1.

Technical Assessment

All difficult waste will comply with the permit requirements with respect to maximum quantities, loading rates and limiting factors. All difficult wastes will undergo technical assessment to determine their suitability for disposal at the installation, and a copy of the assessment will be provided to the site manager prior to any deposit.

Advance Notification

Advance notification of delivery is required from the customer or carrier to enable special arrangements to be put in place for the receipt and disposal of these wastes. Normally one day's prior notification is required, however this requirement may be altered in special circumstances and subject to the site manager's approval.

Terms of Acceptance

The waste carrier shall be advised of the terms and conditions for acceptance of the difficult waste load, namely:

- The address and location of the designated disposal installation;
- The earliest date for the deposit and the requirement to book the waste in with the installation at least one day before;
- Conditions relating to the proposed method of disposal i.e. buried at the foot of the working face;
- Physical conditions for acceptance of the waste i.e. enclosed skip, waste contained in bags, dust to be pre-wetted; and
- A Duty of Care transfer note will need to be completed in accordance with instructions from MEPA.

On receipt of advanced notification the weighbridge operator will:

- Obtain details of the waste delivery from the customer;
- Advise the site manager of the proposed delivery; and
- Record the details in the installation log.

The site manager will be responsible for controlling the acceptance of difficult waste, determining the requirement for any additional checks and authorising its disposal. No difficult waste will be accepted at the installation without the approval of the site manager.

3.5.11 Records

Records relating to the acceptance of waste at the weighbridge, and their retention arrangements are summarised below:-

- Weighbridge tickets and manual tickets/disposal record sheets. These will be retained at the installation site office for 6 months.
- Duty of Care transfer notes. These will be retained for 5 years. For the first 2 years they will be retained at the installation to satisfy the requirements of the

Duty of Care requirements. Thereafter they will be retained for another 3 years at the installation operator's main office to satisfy tax requirements.

3.5.12 Sampling Plan

Wastes that have been identified as requiring testing at 3.2.1 (Level 1) will be sampled by a suitably qualified person to comply with 3.2.3 (Level 3). The samples will be retained for a period of 1 month, and the results of the analyses will be maintained at the installation.

3.6 Waste Storage and Handling Prior to Final Deposit

The drivers of all vehicles carrying wastes destined for disposal at the installation will report to the installation control or weighbridge office prior to unloading at the active landfilling area.

Restoration materials and engineering materials delivered to the installation which will not be immediately placed on the restored landform or within areas undergoing engineering will be stored within designated soil, clay or engineering materials storage locations prior to use.

Restoration materials will be stored and handled in accordance with the requirements of the planning consent, and engineering materials in accordance with the relevant Construction Quality Assurance Plan.

3.7 Final Inspection of Wastes at Working Face

On discharge of waste, a final visual inspection of all loads will be carried out by the installation operator, who will identify suspect or non-conforming materials which could have been hidden in the body of the waste container, a bulk vehicle or skip.

In the event that non-conforming material is identified in the load, the following action will be taken:-

- The site manager or next available superior level of management will be informed immediately by radio or other available means;
- Other waste and vehicles will be directed to another location on the working area, such that the suspect waste remains exposed;
- The site manager will examine the waste transfer note and any other documentation which provides details on the process or premises that produced the waste, to enable an appropriate assessment to be undertaken on inspection;
- The site manager will inspect the suspect waste taking all necessary safety precautions;
- If the site manager is satisfied that the description of the waste was appropriate, that there has been no contravention of the permit, or breach of contract, he/she will authorise the continuation of disposal;
- The details of the incident will be recorded in the installation log;
- If however, the site manager is not satisfied that the material conforms to the above requirements, he/she will contact MEPA, and if necessary seek

- assistance and advice from the Operations Unit; and
- The name of MEPA officer, the time of the call, and the action taken will be recorded in the installation log.

3.8 Rejection and Quarantine Procedures

The course of action to be taken with non-conforming waste will be dependant upon specific circumstances and will be agreed with MEPA.

- In any event, the following action will be taken: -
- The relevant MEPA officer(s) will be notified immediately;
- With the agreement of MEPA, and if the carrier's vehicle is still present, the waste will wherever possible be reloaded back onto the carrier's vehicle;
- If the material is reloaded onto the carrier's vehicle, the office of the carrier will be notified by telephone, and the details including time of call and contact name will be recorded in the installation log;
- If the carrier has departed the installation, and if it is considered safe to do so, the waste will be loaded into a container and placed in the quarantine area pending the outcome of further investigations;
- If the waste is of unknown composition, it will be isolated at the operational area pending further investigations. This will be achieved by the placement of cones or other barriers around the waste. Landfilling operations will be moved to ensure no person comes within close proximity of the waste;
- Further investigations may include contact with the carrier and the producer to seek to determine the likely composition of the waste. It may also include taking samples in order to determine the chemical composition of the waste. These investigations will be undertaken by the site manager, or other suitably qualified person under the supervision of the site manager;
- Following further investigations, the acceptability of the waste may be confirmed, and with the agreement of MEPA, the waste will be disposed of at the installation in accordance with the terms of the permit;
- If the waste is confirmed as not being permitted for disposal at the installation, the waste will be directed to an alternative licensed facility. If necessary, the waste will be repackaged, and in the case of 'Hazardous Waste' a Consignment note will be raised; and
- Wherever possible, rejected waste will be removed from the installation within 24 hours of the container becoming full, and within 5 days of receipt at the installation. However, sampling and analysis of wastes, and identification of suitable disposal facilities, may result in the waste being stored for a longer period prior to removal from the installation, in which case MEPA will be notified accordingly.

A record will be maintained in the installation log of the circumstances of the non-conformance, which will include the following details: -

- Date and time;
- Producer details;
- Carrier details;
- Duty of Care transfer note reference number;
- Description of waste;
- Volume of waste;
- European Waste Catalogue (EWC) code (if possible);
- Non conforming waste;
- Samples taken;
- Details of communication with MEPA (time, name of MEPA officer); and
- Actions agreed and taken.

3.9 Recording Methods

3.9.1 *Individual Waste Records*

For all wastes accepted at the installation a record will be maintained in the installation control office detailing the following: -

- Date of delivery;
- Waste quantity;
- Waste description and EWC classification code;
- Waste producer and/or carrier;
- Results of basic characterisation and compliance testing; and
- Method of pre-treatment including written confirmation from waste producer.

3.9.2 *Non-conforming Waste*

A record will be maintained of all non-conforming waste as detailed in Section 3.8.

4.0 ENGINEERED CONTAINMENT SYSTEM

4.1 Introduction

The installation has been designed on the principle of engineered containment, in order to contain, and manage, leachate and landfill gas produced by the degradation of the waste, and thereby prevent any adverse effects on the surrounding environment.

The engineering specifications have been derived from the hydrogeological, landfill gas and stability risk assessment process to ensure operations at the installation comply with the Waste Management (Landfill) Regulations, 2002.

4.2 Engineered Containment System Drawings

Illustrations and cross sections showing the engineered containment system design are presented as part of the IPPC application. The relevant drawings are listed in Table 4.1 below.

Table 4.1 Engineered Containment System Design Drawings

Drawing Title	Drawing Reference
Site Plan	ZW001/04
Phasing/volumes	ZW002/04
Geological setting	ZW003/04
Final landform	ZW004/04
Aquifer/groundwater flow	ZW005/04
Wind rose	ZW006/04
Cells cross-sections	ZW007/04
Monitoring points	ZW008/04
Gas Compound location/details	ZW009/04
Gas well cross section	ZW010/04
Containment engineering	ZW011/04
Capping details	ZW012/04

4.3 Engineered Containment System Specification

The specification of the different elements of the containment system is detailed within the IPPC permit application.

4.4 Landfill Phasing

The facility will be developed in three phases consisting of three hydraulically independent cells. Each cell will have its own leachate collection/extraction system and they will be physically connected to form an integral common base of the landfill.

4.5 Construction Quality Assurance

Strict third party Construction Quality Assurance (CQA) procedures will govern the construction of all elements of the engineered containment system.

Experienced contractors will carry out the works in accordance with detailed engineering specifications and method statements.

Installers of geomembrane will have third party accreditation for welding and installation. Following installation of geomembrane, a geophysical survey will be undertaken, and any identified defects will be repaired under CQA supervision and procedures.

A construction specific CQA plan will be adopted for each phase of containment construction, which will specify procedures to be followed during the installation, testing and sampling of all elements of the containment system.

A suitably qualified, third party engineer will monitor the application of all engineering specifications, method statements and detailed CQA procedures.

Upon completion of each phase of construction, a detailed validation report, based on an audit of the on-site procedures, will be prepared by the third party engineer and submitted to MEPA. The report will confirm that the specification and CQA procedures have been implemented and adhered to throughout the works.

5.0 WASTE DEPOSIT AND EMPLACEMENT

5.1 Introduction

This section describes the techniques and measures that will be employed at the installation during waste deposit and emplacement to ensure that impacts on the environment are minimised.

5.2 Management and Operational Techniques

5.2.1 *Vehicle Movements*

It will be the responsibility of the site manager to organise the working area in such a manner to allow the safe movement and discharge of vehicles and plant.

Appropriate signage will be used to direct traffic to the operational area.

The use of a banks man or marshall to direct traffic will be subject to a risk assessment.

5.2.2 *Towing of Vehicles*

If vehicles become bogged down and require assistance, other mobile plant will not push them. They will be recovered with a tow chain under the following conditions:-

- The chain will be attached by the vehicle driver, not the machine operator; and
- In the event that the vehicle does not have a recognised towing eye, the vehicle owner will be made aware, before moving the vehicle, of the possibility of damage occurring during towing.

5.2.3 *Selection, Inspection and Deposit of Initial Layer of Waste*

Only selected waste (comprising non-hazardous waste), which excludes large, bulky or sharp items will be used to form the initial lift of waste in each phase immediately above the liner system.

Vehicles delivering selected waste will be required to deposit their load at least 5 metres from the edge of the tipping face.

The selected waste will be subject to a minimal amount of compaction, and a rubber tyred-wheeled loading shovel shall be used for this purpose rather than a steel wheeled, compactor vehicle. The selected waste will be used to form a 'buffer' layer no less than 2 metres in depth.

The waste will be deposited from the access road in front of the mobile landfilling plant to create an operating surface. The leading edge of the tipping face will not be compacted or ramped down, but will be left in a near vertical state.

Mobile plant will operate only on the waste surface. Under no circumstances will mobile plant be permitted to operate on the basal containment system and leachate

drainage system.

If it is considered necessary to improve the running area during wet conditions, the compactor may be used to roll the top surface of the waste, and the operator will be instructed not to drive within 5 metres of the edge of the face. This will minimise the risk of the compactor teeth coming into contact with the liner should the leading edge of the tip face give way.

Daily cover for the top of the first layer of waste will be kept to a minimum and will comprise fine soils, so as not to hinder vehicle movements on the operational area. The face and flanks of the initial layer of waste will not be covered to avoid fouling and clogging of the leachate drainage blanket.

Selection and placement of the first layer of waste will be carried out under the supervision of a suitably trained and qualified member of staff, whose role will be to:-

- Visually inspect all waste to be used in the initial layer immediately following discharge;
- Identify any unsuitable materials, which may comprise large bulky or sharp items and ensure that such items are segregated and not placed in the initial waste lift;
- Observe the compaction and spreading activities to ensure that there is no damage to the lining system;
- Advise the site manager in the event of damage being observed; and
- Ensure that waste deposit operations cease immediately in the event of any damage occurring.

The site manager will be responsible for investigating any damage, and for liaising with the independent Construction Quality Assurance engineer and MEPA to ensure that appropriate remedial action is taken.

5.2.4 Waste Stability

The following operational techniques, to ensure stability of the waste mass, will be adopted at the site;

Waste Compaction

Waste will be levelled and compacted as soon as possible after discharge at the working area in order to minimise short-term settlement and to enhance stability of the waste mass.

Large Low Density Objects

All large, low-density objects will be crushed to ensure that voids do not develop in the landfill.

Height of Tipping Face

The maximum height of the tipping face after compaction will be **2.5** metres in order to avoid the deposit of uncompacted waste over high unstable faces.

Gradients

The maximum and minimum gradients and maximum heights for the working face, intermediate slopes and final slopes of the landform will be as specified in Table 5.1. These slopes have been derived from the Stability Risk Assessment (Document Reference ZWR 01/04) and will ensure stability of the deposited waste.

Table 5.1 Maximum and Minimum Slope Gradients

Feature	Maximum post-compaction height/m	Maximum Slope	Minimum Slope
Working Face:	2.5 m	45 deg	15 deg
Intermediate Slopes:	3 m	30 deg	15 deg
Final Slopes:	5 m	18 deg	12 deg

5.2.5 Prevention of Damage to Barriers, Liners, Leachate and Landfill Gas Management Systems

Action that will be taken during the deposit of waste to prevent damage to the basal barrier, lining system and leachate management system is described in Section 5.2.3.

The selected waste that is placed on the base of the site will be progressively extended up the sidewalls to protect the sidewall barrier and lining system. The selection, inspection and placement of these materials will be subject to the same procedures as outlined in Section 5.2.3.

In order to avoid inadvertent damage to leachate and gas extraction and monitoring wells, a layer of construction waste, which will act as a buffer against subsequent damage by mobile plant, will be placed around the wells to a distance of 1 metre.

5.2.5 Prevention of the Release of Particulate Matter, Litter and Odour

Measures that will be taken during the deposit of waste to prevent the release to the environment of particulate matter, litter and odour, are described in the following Sections of this management system:-

- Particulate Matter Section 14;
- Odour Section 15; and
- Litter Section 17.

5.2.6 Adverse Weather Conditions

Waste deposit operations in adverse weather conditions can give rise to litter and dust problems.

Control measures and techniques that will be implemented at the installation to minimise the impact of adverse weather conditions, including procedures to monitor meteorological conditions are described in the following sections of this management system:-

- Litter Section 17;
- Particulate Matter Section 14; and
- Meteorological Monitoring Section 23.

5.2.7 Selection and Inspection of Final Layer of Waste

In order to prevent damage to the final capping system, only selected waste (comprising municipal solid waste or similar) which excludes large and bulky or sharp items will be used to form the final lift of waste in each phase immediately below the final capping layer.

Selection and placement of the final layer of waste will be carried out under the supervision of a suitably trained and qualified member of staff, whose role will be to:-

- Visually inspect all waste to be used in the final layer immediately following discharge; and
- Identify any unsuitable materials, which may comprise large bulky or sharp items and ensure such items are segregated and not placed in the final waste lift.

5.2.8 Handling and Compaction Plant

In order to ensure that waste delivered to the installation can be handled, compacted and covered as required, the landfill will be equipped with the following items of mobile plant as appropriate to the waste deposit and emplacement operations:

- Hydraulic excavators e.g. CAT 320 (or similar);
- Cat D6 bulldozer; and
- Compactor e.g. Volvo L160 (or similar).
- Road lorries.

All operatives will undergo training appropriate to their role and the equipment to be used to ensure effective handling, compaction and covering procedures are adopted.

5.2.9 *General Waste Discharge and Emplacement Procedure*

Wastes accepted for disposal will be directed to the appropriate landfill phase and working area by a series of signs. Each landfill phase will be subdivided into smaller working areas.

On instructions from operatives in the disposal area, and where possible, waste delivery vehicles will reverse to the disposal face. The load will be discharged and the driver will inspect the vehicle for any loose waste caught up within or on it. If necessary, the vehicle will be cleaned by the driver and will then be returned to the haul road.

The deposited load will be subjected to a thorough inspection by the site plant operatives as the waste is spread, to ensure that the waste is permitted for disposal. Any unauthorised loads will be dealt with as described in Sections 3.7 and 3.8.

After placement of the initial layer of waste, subsequent lifts will be deposited in layers not exceeding 2.5 metres in height. Compaction will be achieved by spreading the waste in thin layers and by repeated passes of the landfill compactor. The surface of the waste will be graded to shed surface water and to prevent “ponding”.

Waste may either be deposited at the base of the working face and pushed up in thin layers, or deposited on top of the working face and pushed down in thin layers. This latter method is the preferred method as it allows difficult waste to be deposited ahead of the working face.

Suitable edge protection, i.e. bump banks, will be used if the edge of a phase, ramp or other area presents a hazard to vehicles and plant.

5.2.10 *Handling and Disposal of Difficult Waste*

All difficult waste loads will be taken to the specific phase designated for their disposal.

All difficult waste will be deposited under the working face in such a manner that it is completely covered by general waste i.e. household, commercial and other non difficult waste, as soon as practical following deposit.

The site manager or his representative will supervise the unloading and burial procedure dependent upon the nature of the waste.

5.2.11 *Handling and Disposal of Bulky Low Density Waste*

All bulky low-density items will be crushed or flattened prior to burial. This will avoid the presence of sub surface cavities which may give rise to unstable ground conditions during filling and eventually differential settlement of the restored surface.

5.2.12 Handling and Disposal of Malodorous Waste

Prior to the regular acceptance of any potentially malodorous waste at the installation, a trial load will be accepted in order to develop appropriate procedures to ensure that regular acceptance of the waste will not give rise to unacceptable odour releases. Following receipt of the trial load, specific handling procedures will be developed and requirements for the containment and pre-treatment of the waste agreed with the producer and carrier. This procedure will ensure that wastes that will give rise to unacceptable odours are prevented from being accepted at the installation.

Any malodorous waste accepted at the landfill will be subject to prior notification to ensure the necessary procedures are in place to ensure immediate burial and cover by other non-odorous materials. Malodorous waste will be placed within the body of the site so that it is located no less than 2 metres from the surface and flanks of the landfill by the end of the working day.

Wastes that may be potentially odorous include commercial or industrial wastes containing organic, biodegradable components.

Specific techniques that will be implemented at the installation to control and monitor odours are contained in Section 15.

5.2.13 Handling and Disposal of Dusty Waste

Dusty waste will only be accepted at the installation if it has been conditioned with water or otherwise contained to ensure that it does not give rise to an unacceptable release of dust upon discharge.

Dusty waste will be handled with care and immediately buried and covered with other wastes.

Specific techniques that will be implemented at the installation to control and monitor dust emissions are contained in Section 14.

5.2.14 Compaction

All deposited waste will be suitably compacted. Deposition will only take place at a rate at which the compactor can adequately cope. Each layer of waste will be compacted by 3-4 passes of the compaction equipment, to achieve a layer of waste thickness no more than 200mm thick by the second pass of the compactor.

5.2.15 Replacement Plant

In the event that the compactor becomes inoperative, a suitable alternative vehicle will be used. In the event that an alternative vehicle is not available, the deposition of waste will be suspended until compaction can be resumed.

5.2.16 Communication

The operatives at the active landfilling areas will be in direct radio contact with the installation control office. This will enable instructions to be given regarding particular loads of waste and to ensure appropriate precautions are taken during the disposal process.

5.2.17 Records

The installation log will be used to record any incidents that occur during the waste discharge and emplacement process, including action taken in relation to unauthorised waste.

5.2.18 Application of Daily and Intermediate Cover

Daily Cover

By the end of the working day a quantity of cover will be applied to the top, working flanks and working faces of the operational area (except the initial layer), sufficient to ensure that:-

- Windblown litter and debris are minimised;
- Vermin is prevented from entering the waste mass;
- Scavenging is prevented;
- Perched leachate problems are prevented; and
- The aesthetics of the site are addressed particularly with regard to the depth of landfilling, i.e. deeper less visually intrusive areas will need less cover than higher areas in direct view of surrounding land.

Daily cover will be progressively applied to the waste surface. This will be derived from suitable imported or on site materials such as:

- Inert materials including soils and hardcore;
- Compost; and
- Compost rejects.

A stockpile of cover materials will be maintained, as necessary, in the vicinity of the working face, in order to ensure that exposed waste can be covered at the end of each working day.

Intermediate Cover

In areas where landfilling operations will be temporarily suspended before final waste levels have been achieved, a layer of intermediate cover material will be applied.

5.2.19 Temporary Capping

Due to the nature of the landform to be created, it will be necessary to leave parts of some phases uncapped until landfilling has progressed sufficiently in neighbouring phases to enable final levels to be achieved. Under these circumstances temporary capping of the exposed wastes will be undertaken to minimise leachate generation in the phases concerned.

Temporary capping will comprise a layer of low permeability materials, a minimum of 300 mm thick or alternatively, a layer of lapped sheets of plastic membrane, weighted down by tyres, sand bags or small mounds of soil or clay.

Temporary capping will be installed at gradients sufficient to shed surface water from the landfill and to prevent water from ponding on the operational area. Care will be taken to prevent such surface water from infiltrating the landfilled wastes and to ensure that it is conducted to the surface water drainage system.

The temporary cap will be removed before waste disposal is reactivated in order to prevent perching of leachate or the development of failure planes.

5.2.20 Phase Sizing and Operational Area

Water balance calculations have been used to determine appropriate phase sizes and the need for sub-division of phases by the construction of a dividing intraphase bund to minimise the production of free leachate during the operational phase of the landfill.

Within each phase, the active operational area will be sufficient to accommodate the installation plant and delivery vehicles without giving rise to potentially dangerous situations, but will be contained in order to minimise the area of exposed waste which could give rise to litter, odour, dust and vermin infestation.

6.0 LEACHATE MANAGEMENT

6.1 Introduction

The objectives of the leachate management plan are;

- To control leachate generation within the landfill;
- To prevent the contamination of ground and surface waters by leachate migration;
- To maintain the level of leachate within the landfill below the maximum levels as may be specified in the permit;
- To achieve a stable biomass as early as possible. Leachate recirculation may be utilised during the early stages of phase development in order to accelerate stabilisation of the waste mass. A formal sub-cap recirculation system may also be developed in completed phases.

6.2 Design Principles/Risk Assessment

The minimisation of leachate generation and the control of leachate heads within specified maximum levels are integral elements of the risk management measures that have been incorporated into the site management system.

Consequently, phases have been designed and will be operated so as to minimise the generation of leachate within the landfill. In this respect each phase will be divided by an intraphase bund, which will serve to segregate clean rainfall from leachate, and hence minimise the volume of leachate requiring treatment and disposal. The phases will also incorporate a leachate extraction and collection system to facilitate the maintenance of leachate levels to within the prescribed parameters.

In order to determine the necessary specification for the leachate extraction and collection system, and ensure that the design will enable leachate to be maintained below permitted levels, a leachate risk assessment has been carried out. (Document Reference ZWR 02/04)

6.3 Water Balance Calculations

Water balance calculations (Document Reference ZWR 02/04 Appendix 1) have been developed in order to refine the phase design and to predict the volumes of leachate that may be produced at the landfill.

6.4 Engineered Leachate Extraction and Collection System Specification

The leachate extraction wells shall be located at the lowest point of each phase and will comprise of a telescopic shaft arrangement progressively increased in height as landfilling progresses. The leachate drainage blanket will consist of 500mm of clean aggregate with a minimum permeability of 1×10^{-3} m/s. The leachate drainage blanket will be installed to a minimum of 3m horizontally up the side slopes. At the top of final waste layer of all cells the system for leachate recirculation will be developed. The leachate re-circulation provides an essential method for joint treatment of waste and leachate itself. It is an approved technique where in the same time accelerating

the waste decomposition and reduction of leachate pollution potential.

6.5 System Inspection and Maintenance Procedures

The responsibility for system maintenance will lie with the site manager.

All of the equipment used within the leachate management system will be regularly inspected, where possible, maintained and repaired as necessary. Inspection and maintenance activities will include the following:-

- Daily inspection of drainage blanket and collection pipework during placement of initial lift of waste, to ensure that any damage is identified and remedial action taken;
- Daily inspection of leachate chambers for evidence of damage and the repair of damaged items within a timescale agreed with MEPA to ensure that the integrity of system is maintained;
- Removal of leachate abstraction pumps at intervals recommended by supplier, for cleaning inspection, maintenance and repair;
- Inspection of leachate carrier pipework for evidence of damage and leaks; and
- CCTV inspection and rodding/jetting of sub-waste pipework to maintain its carrying capacity.

In addition to the regular routine of maintenance, further assessment and repair, if required, would be triggered by the leachate monitoring action plan, which is described within Section 7.4.

6.6 Leachate Control Strategies

6.6.1 Phasing of Operations

Landfilling operations will be phased in order to minimise the generation of leachate.

6.6.2 Leachate Extraction

Prior to leachate levels exceeding the limits laid down in the permit, leachate will be removed by pumping. This will be achieved using submersible pumps installed within the leachate collection/extraction sumps and, if necessary, the leachate monitoring points.

6.6.3 Leachate Storage

Leachate removed from the sub-phases will be pumped to an enclosed leachate storage tank. The leachate storage tank will be designed and constructed to ensure there is no release of leachate, and will comprise of a suitably bunded or double-skinned tank.

6.6.4 *Leachate Recirculation*

In the early stages of a sub-phase's development, and in order to optimise stabilisation of the site, leachate will be recirculated within the active sub-phase. This will be achieved using a bowser to discharge the leachate at the active face, via a trench excavated into the waste, or a soak away linked to a system of radiating pipe work. Following completion and capping of a sub-phase leachate will be recirculated via a sub cap irrigation system comprising perforated pipes laid within coarse gravel soak away trenches within the unsaturated waste mass and accessed through the cap via a surface manhole.

Leachate recirculation will be undertaken in such a way as to avoid the spraying of leachate into the atmosphere, and will be carried out in a manner, which will not impact air quality around the site boundary or cause odours.

Care will be taken to avoid leachate breakouts, or perching of levels within the landfill.

Regular inspections will be carried out by site personnel to ensure leachate recirculation activities are not giving rise to blockages within pipe work, flooding, ponding and leachate breakout.

Prior to undertaking leachate level monitoring within sub-phases where leachate recirculation is taking place, pumping will cease for a period of 24 hours prior to readings being taken. If the leachate level exceeds the permitted levels, leachate recirculation will cease in that area.

The quality of recirculated leachate will also be monitored to ensure that recirculation does not result in changes to the leachate chemistry that may result in inhibition of the biodegradation processes.

Records will be maintained of the quantity of leachate recirculated within a sub-phase. The volumes will be determined either by reference to counters/flow meters on pumps or the number of bowser loads.

6.6.5 *Leachate Treatment Methods*

In the event that excess leachate is produced, consideration will be given to the following options: -

6.6.6 *Off-Site Leachate Treatment*

Leachate will be removed from the installation untreated, and will be transported to a suitable off site leachate treatment facility.

Prior to undertaking off-site disposal, details will be provided to MEPA of the treatment provided by the off-site facility. The details provided will include the following: -

- Treatment methods;

- Sewage treatment plant bypass (% of time sewage treatment plant is bypassed, an estimate of the increased annual load of metals and persistent substances which will result from by-passing, action to be taken in the event of bypass); and
- Actions to be taken to avoid events which may cause a release which could adversely affect sewage treatment works.

6.6.7 On-Site Leachate Treatment

On-site leachate treatment would consist of a leachate storage facility and treatment vessels, together with associated control facilities.

Design and construction details on the proposed facility will be submitted to MEPA prior to construction and will incorporate the following aspects:-

- Primary treatment methods (type of plant and performance parameters);
- Secondary treatment methods (type of plant and performance parameters);
- Tertiary treatment methods (type of plant and performance parameters); and
- Control of dissolved gas content.

Management procedures for the leachate treatment facility would be submitted to MEPA prior to operation.

6.7 Leachate Discharge and Disposal

If required, a number of methods for the disposal of leachate may be undertaken at the installation depending upon the stage of the site's development, the presence of leachate treatment facilities and the volume and chemical composition of the leachate.

The different disposal options can be summarised as follows:-

- Disposal of untreated leachate by tanker to an off-site facility;
- Disposal of treated leachate by tanker to an off-site facility;
- Discharge of untreated leachate via pipeline and consented sewer discharge point to waste water treatment works; and
- Discharge of treated leachate via pipeline and consented sewer discharge point to waste water treatment works.

6.8 Leachate Management Review

Management of leachate will be maintained under review by site management, to ensure that the leachate collection, treatment and disposal system will have sufficient capacity to handle the maximum predicted rate of leachate generation for the installation, and maintain leachate levels in each separately engineered sub-phase below the permit limit.

If the review process identifies potential shortfalls in the provision of leachate management facilities at the installation, action will be taken to enhance system

capability. This action may include the following: -

- Installation of additional leachate extraction wells;
- Increase in capacity of leachate pumping facilities;
- Installation of additional leachate re-circulation infrastructure;
- Installation of additional leachate storage facilities; and
- Development of permanent treatment facility.

7.0 LEACHATE MONITORING

7.1 Introduction

The leachate monitoring system will:

- Determine the head of leachate and quality of leachate in each phase;
- Help determine the stage of waste decomposition;
- Determine appropriate leachate management measures;
- Ensure that the assessment criteria and compliance limits are not exceeded; and
- Identify when relevant completion criteria are satisfied.

7.2 Location Design and Construction of Monitoring Points

Each landfill sub-phase will be provided with 1 leachate extraction well and 1 leachate monitoring well.

The design and construction of the leachate extraction and monitoring wells is illustrated in Drawing No. ZW011/04.

7.3 Monitoring Measurements and Schedules

7.3.1 *Leachate Level Monitoring*

The leachate level compliance points, frequency of monitoring will be in accordance with the regulatory specification in Section XXX of the IPPC Permit application.

7.3.2 *Leachate Quality Monitoring*

The leachate quality sampling points, determinands, and frequency of monitoring will be in accordance with the regulatory specification in Section XXX of the IPPC permit application.

The leachate monitoring programme and results will be subject to annual review by the installation operator throughout the operational and post-closure aftercare period of the installation. Sampling frequencies and determinands may therefore be modified and adjusted as appropriate, with additional determinands being considered to reflect the deposit of certain waste streams at the site.

If stable conditions are present (leachate levels or quality) the frequency and/or number of determinands may be reduced in consultation with MEPA.

7.4 Assessment and Compliance Limits and Contingency Action Plan

7.4.1 Assessment and Compliance Limits

Assessment levels and compliance limits for leachate level and quality are as specified in the regulatory specification in Section XXX of the IPPC permit application.

In the event that assessment levels and compliance limits are exceeded at the designated monitoring locations, the various actions that may be appropriate are detailed in Table 7.1.

Table 7.1: Leachate Contingency Action Plan

Appropriate Contingency Actions	Following a Breach of a	
	Assessment Level	Compliance Limit
Advise site management	✓	✓
Advise the Installation operator's Environmental Manager	✓	✓
Advise MEPA	✓	✓
Confirm by repeat sampling and analysis	✓	✓
Review existing monitoring information	✓	✓
Review site management and operations, and implement actions to prevent future breach of assessment levels	✓	
Review the assumptions incorporated into the conceptual site model	✓	✓
Review existing hydrogeological risk assessment, control and trigger levels*	✓	✓
If risks are unacceptable, set in place procedures for implementing corrective measures in consultation with or required by MEPA		✓

*This should include a re-evaluation of whether the baseline conditions have changed since the last hydrogeological risk assessment.

In the event of elevated leachate levels rates of extraction will be increased and pumping will be carried out from leachate monitoring points as necessary. Consideration will be given to the need to install additional leachate extraction wells.

7.5 Monitoring Methodology

Monitoring will be carried out by the monitoring technician, in accordance with the procedure outlined below: -

7.5.1 Pre-Monitoring Checks

Prior to undertaking leachate monitoring, checks will be carried out to determine: -

- The number of samples and analytical requirements;
- The size, type and number of bottles that are required, and any fixative or

- preservative requirements;
- That all equipment is clean and in good working order;
- That all necessary equipment is available including keys; and
- Bailers and dip tapes used for leachate sampling will be marked 'leachate only'; and will not be used for any other purpose.

7.5.2 *On-Site Records*

A record will be made of the following: -

- Name of technician;
- Date of sampling;
- Sampling equipment and method used;
- On-site weather conditions;
- Observations including vegetation die-back, leachate outbreaks, surface water ponding, damage to security fencing, or accumulations of wind blown litter;
- Damage to manhole/headworks of leachate extraction and monitoring points;
- The specific reference number of the leachate extraction/monitoring point and the number of the top ring; and
- Depth to top of leachate and depth to the base of the extraction/monitoring point.

7.5.3 *Monitoring Procedure*

The following procedures will be implemented: -

- An electronic dip tape or equivalent monitoring method will be used to record the depth to the top of the leachate, and the depth to the base of the extraction/monitoring point from the top of the cover.
- Samples of leachate will be obtained using a teflon bailer, stainless steel sample cup or other suitable equipment used only for the sampling of leachate;
- The sampling equipment will be flushed out between sample locations;
- Those sample bottles not containing preservative will be flushed out with the sample;
- Other than for bottles containing fixative, the sample bottle will be filled to the brim to exclude air, the top will be secured firmly, and it will be clearly labelled with the location code and date; and
- Samples will be transferred immediately to cool boxes containing ice packs, and taken to the laboratory at the earliest opportunity.

7.6 *Data Management and Reporting*

The leachate level will be calculated in relation to m OD, and the depth of leachate above the phase base. The recorded ring numbers will be checked against the previous months records. In the event of any discrepancy, clarification will be obtained from the site manager.

The site manager will be informed by the monitoring technician of any results in excess of the trigger levels or any problems recorded as part of the visual inspection.

The leachate level and quality monitoring results will be entered into a database, and the data will be submitted to MEPA for review at an agreed frequency. Copies of the leachate quality data will also be sent to the landfill electronically or hard copy and kept on file.

Results and analysis of the data will also be included within an annual environmental monitoring report, which will be submitted to MEPA.

7.7 Quality Assurance

Leachate monitoring and sampling at the installation will be undertaken in accordance with the procedure outlined in Section 7.5.

Suitably qualified personnel will undertake leachate monitoring. A suitably accredited laboratory will carry out leachate quality analysis of samples. A major ion balance will be undertaken routinely and reported by the analytical laboratory as part of laboratory quality control procedures. Monitoring equipment will be serviced and maintained in line with the manufacturers' recommendations. Copies of field logs will be kept on file at the installation site office.

Should any of the leachate monitoring points become damaged to such an extent that the leachate levels cannot be recorded, they will be either repaired or replaced within a timescale agreed with MEPA. The nature and location of any replacement, as well as the methods to be used, would be approved by MEPA prior to any works being undertaken.

8.0 SURFACE WATER MANAGEMENT

8.1 Introduction

The surface water management plan will control the collection and disposal of surface water so as to prevent pollution of the environment and downstream flooding. By controlling waters from precipitation and surface run-off from entering the waste body, the system will also serve to minimise the production of leachate.

8.2 Risk Assessment/Precipitation and Flood Risk Calculations

To ensure that the surface water collection, drainage and discharge system will have sufficient capacity to handle the maximum predicted rate of rainfall for the installation, and hence ensure that the installation will not give rise to an unacceptable risk to surface waters, a detailed emergency flood plan was developed. A network of drainage trenches and channels lined with low permeable material and where appropriate with geo-textile filtration liner will be constructed.

The assessment included the estimation of surface water run off and sizing of attenuation/balancing pond/s to accommodate a 1:100 year return period flood event.

Risks to surface water was accessed through water balance calculations and is enclosed as Appendix 1 of the Hydrogeological Risk Assessment (Document Reference ZWR 02/04).

8.3 Detailed Design and CQA

The outline design principles for the surface water management system are provided in Section 8.4 below. However, the detailed design of the surface water management system will be undertaken following a detailed topographical survey to determine appropriate gradients and alignments. The detailed design specification will be submitted with a CQA plan to MEPA for approval in advance of construction and will incorporate the following aspects:

- Engineered or mechanical control systems; and
- Pipework configuration and alignment.

The surface water management system will be constructed in accordance with third party CQA principles.

8.4 Control Strategies

The control strategies that will be adopted to effectively manage surface water at the installation can be summarised as follows:-

- Phasing of operations and restoration to facilitate the segregation of surface water from leachate;
- The use of water balance calculations to optimise the size of operational phases;
- The development of engineered drainage systems outside the contained

- landfill area;
- The use of surface water segregation sumps and bunds during installation operations;
- The use of perimeter ditches and drains to control and capture surface water run off; and
- Construction of attenuation and settlement lagoons to permit settlement of surface water prior to discharge and prevent flooding during rainfall events.

8.5 Operational and Management Procedures

8.5.1 Engineered Drainage Systems

Areas of the installation benefiting from an engineered drainage system are identified on Drawing No. ZW 011/04. Hard surfaced areas will incorporate the following: -

- Main installation access road;
- Installation control area (including the installation control office where waste acceptance procedures will be carried out (pre-disposal Level 3 on-site verification/visual inspection, document examination and processing, and maintenance of records));
- Quarantine area (where possible non-conforming waste may be stored pending further investigations); and
- Car parking area.

In addition to an impervious surface, these areas will benefit from sealed construction joints and containment kerbing.

Hard surfaced areas will be subject to an inspection and maintenance programme, which will ensure the continued integrity of the surface.

8.5.2 Water Balance Calculations

In order to control the volumes of surface water entering operational landfill phases, and seek to minimise the production of significant volumes of leachate during the operational phase, water balance calculations have been used to determine appropriate phase size.

The water balance calculation is enclosed as Appendix 1 of the Hydrogeological Risk Assessment (Document Reference ZWR 02/04).

8.5.3 Surface Water Sumps and Segregation Bunds

Within the main operating areas, a series of temporary sumps and bunds will be employed to gather incident rainfall. A temporary bund will be placed around active landfilling areas to prevent incident rainfall draining from the unprepared areas of the installation from coming into contact with waste.

The sumps will provide primary settlement of suspended solids within the runoff, prior to secondary attenuation and infiltration into the limestone bedrock.

8.5.4 *Perimeter Ditches and Drains*

The landfill development will include a perimeter network of open ditches and channels that will capture and control any surface water runoff generated from the capped and restored landfill slopes and which will transport it to retention/infiltration ponds, where upon surface water will infiltrate into the limestone bedrock.

8.5.5 *Contour Drains*

Depending upon the gradient of the perimeter drains, it may be necessary to construct drains within the restoration profile across the contour lines to intercept run off and divert it away from low points on the perimeter of the installation towards the discharge retention/infiltration ponds.

8.5.6 *Retention/Infiltration Ponds*

In addition to the perimeter and contour ditches, retention/infiltration ponds will be constructed with a water storage retention volume sufficient to attenuate runoff from the installation during 1:100 year rainfall events.

8.5.7 *Surface Water Treatment and Discharge*

Surface water will be treated and discharged from the site as follows: -

- Surface water arising on the hard surfaced access road, installation control area, and car parking area will be discharged via an interceptor before joining the surface water drainage system.
- Surface water run off from restored areas of the installation, and areas which have not been subject to landfilling, will discharge via perimeter drains and retention/infiltration ponds.

Surface water, which has been in contact with waste will be treated as leachate and disposed of in accordance with the principles contained in Section 6.

8.5.8 *Progressive Restoration*

In addition to the above mitigating measures, the site will be progressively restored. The revegetation of the proposed landfill will significantly reduce the rate of runoff.

8.5.9 *System Monitoring/Inspection and Maintenance*

Monitoring technicians and site operatives will monitor the efficiency of the surface water management scheme.

The monitoring technicians will carry out checks each time the perimeter gas and groundwater monitoring boreholes are monitored. They will make observations, and report evidence of contamination, excessive sedimentation or any other factors that may compromise the efficiency of the system to the site manager or his deputy prior to leaving the site.

The checks carried out by the technicians will be supplemented during the operational phase by routine weekly checks by operational personnel.

In order to maintain the effectiveness of the surface water system, appropriate action will be taken within 7 days of defects being observed to remove any obstructions to flow. This may involve the regrading of drainage ditches, or desilting of the retention/infiltration ponds.

8.5.10 Action Plan

In the event of suspected or confirmed contamination of surface water, MEPA will be informed immediately, the outlet to the discharge point will be blocked and contingency measures put in place if necessary to remove the contaminated water by pumping from the ponds for off site disposal. Sand bags or other similar equipment will be maintained at the installation for the purpose of blocking the outlet. The suspected contamination will be confirmed by analysis, and the necessary actions agreed with MEPA.

The maintenance and monitoring procedures and action plan outlined above will be maintained throughout the pre-operational, operational and aftercare phases of the installation.

9.0 SURFACE WATER MONITORING

9.1 Monitoring Locations

The surface water monitoring locations are illustrated in Drawing ZW008/04.

9.2 Monitoring Measurements and Schedules

The surface water sampling points, monitoring schedules, and frequency of monitoring to be undertaken are detailed in Table 9.1.

Table 9.1 Surface Water Monitoring Regime

Sampling Location	Frequency	Measurement and Analytical Suite
Upstream	To be determined by MEPA	pH, TOC, phenols, heavy metals, fluoride, oils/hydrocarbon
Downstream	To be determined by MEPA	pH, TOC, phenols, heavy metals, fluoride, oils/hydrocarbon

The surface water monitoring programme and results will be subject to annual review throughout the operational and post-closure aftercare period of the installation unless as agreed otherwise with MEPA. Sampling frequencies and determinands will be reviewed and will be modified and adjusted as appropriate.

9.3 Assessment and Compliance Limits and Contingency Action Plan

9.3.1 *Assessment and Compliance Limits*

Assessment and compliance limits will form the basis for assessing surface water monitoring data in relation to the installation.

Assessment limits will be set to draw attention of site management and the MEPA to the development of adverse, or unexpected, trends in the monitoring data. Such trends may result from failure of installation engineering or management or may be due to natural or non-landfill related reasons. Assessment limits will be treated primarily as an early warning system to enable appropriate investigative or corrective measures to be implemented, particularly where there is potential for a compliance level to be breached.

Assessment limits will be set to: -

- Identify unambiguous adverse trends which are indicative of leachate impacts;
- Allow for variation in natural water quality from baseline conditions; and
- Give sufficient time to take corrective or remedial action before compliance levels are breached.

Compliance limits are regulatory standards. They are defined as criteria at which significant adverse environmental effects and/or breaches of legislation have occurred. Such effects would be consistent with the surface water having been

polluted.

The assessment and compliance limits that will apply at the installation are as detailed within the IPPC Permit application.

9.3.2 Contingency Action Plan

In the event that surface water assessment or compliance limits are exceeded at the designated monitoring locations, the various actions that will be taken are detailed in Table 9.2.

Table 9.2: Contingency Action Plan

Appropriate Contingency Actions	Following a Breach of	
	Assessment Level	Compliance Level
Advise site management	✓	✓
Advise the installation operator's environmental manager	✓	✓
Advise MEPA	✓	✓
Confirm by repeat sampling and analysis	✓	✓
Review existing monitoring information	✓	✓
Review site management and operations, and implement actions to prevent future failure of an assessment level	✓	

9.4 Monitoring Methodology

Monitoring will be carried out by the monitoring technician, in accordance with the procedure outlined below.

9.4.1 9.4.1 Pre-Monitoring Checks

Prior to undertaking surface water monitoring, checks will be carried out to determine: -

- The number of samples and analytical requirements;
- The size, type and number of bottles that are required, and any fixative or preservative requirements;
- That all equipment is clean and in good working order; and
- That all necessary equipment is available including keys.

9.4.2 *On-Site Records*

A record will be made of the following: -

- Name of technician;
- Date of sampling;
- Sampling equipment and method used;
- On-site weather conditions; and
- Observations including vegetation die-back, leachate outbreaks, surface water ponding, damage to security fencing, or accumulations of wind blown litter;

9.4.3 *Monitoring Procedure*

- Samples of surface water will be obtained using a stainless steel bucket or sampling can, or by directly filling the sample bottle;
- Those sample bottles not containing preservative will be flushed out with the sample;
- Other than for bottles containing fixative, the sample bottle will be filled to the brim to exclude air, the top will be secured firmly, and it will be clearly labelled with the location code and date; and
- Samples will be transferred immediately to cool boxes containing ice packs, and taken to the laboratory at the earliest opportunity.

9.5 Data Management and Reporting

Comparison of monitoring data with assessment levels will be carried out each time monitoring data are collected. The monitoring frequency will be increased if there appears to be a trend, which could lead to the compliance levels being breached, or when there is a rapidly rising trend towards this point. When an adverse trend or breach of an assessment level is indicated by the monitoring results, appropriate contingency actions will be implemented as detailed in Table 9.1.

The surface water quality monitoring results will be entered into a database, and the data will be submitted to MEPA for review on an agreed frequency.

Results and analysis of the data will also be included within an annual environmental monitoring report, which will be submitted to MEPA.

9.6 Quality Assurance

9.6.1 *Monitoring and Analysis*

Surface water monitoring and sampling at the installation will be undertaken in accordance with the monitoring procedure outlined in Section 9.4.

Suitably trained personnel will undertake surface water monitoring.

A suitably accredited laboratory will carry out surface water quality analysis of samples.

Monitoring equipment will be serviced and maintained in line with the manufacturers' recommendations. Monitoring equipment will be cleaned following each monitoring exercise.

10.0 GROUNDWATER MONITORING

10.1 Introduction

Monitoring of groundwater quality is an “essential precaution” as required by the Groundwater Regulations.

This procedure outlines the measures that will be taken at the installation to monitor groundwater quality and levels.

10.2 Location Design and Construction of Monitoring Points

Groundwater will be monitored at the locations shown on Drawing No. ZW008/04.

Borehole logs illustrating the construction and design of the monitoring boreholes are provided in the Hydrogeological Risk Assessment (Document Reference ZWR 02/04).

The monitoring installations will be fitted with a removable sealed cap, which can be removed to enable samples to be obtained and level monitoring undertaken. All boreholes will be secured with lockable steel headworks fitted into a concrete surround. The steel headwork will be marked with the monitoring location reference number.

10.3 Monitoring Measurements and Schedules

The groundwater sampling points, monitoring schedules, and frequency of monitoring to be undertaken are detailed in Table 10.1.

Table 10.1 Groundwater Monitoring Regime

Sampling Location	Frequency	Measurement and Analytical Suite
Upstream	To be determined in conjunction with MEPA/MRA	pH, TOC, phenols, heavy metals, fluoride, oil/hydrocarbons
Downstream	To be determined in conjunction with MEPA/MRA	pH, TOC, phenols, heavy metals, fluoride, oil/hydrocarbons

The groundwater monitoring programme and results will be subject to annual review throughout the operational and post-closure aftercare period of the installation. Sampling frequencies and determinands will be modified and adjusted as appropriate, with additional determinands being considered to reflect the deposit of certain waste streams at the site.

If stable conditions are present, the frequency and/or number of determinands may be reduced in consultation with MEPA/MRA.

10.4 Control and Trigger Levels and Contingency Action Plan

10.4.1 Control and trigger levels

Control and trigger levels will form the basis for assessing groundwater monitoring data at the installation.

Control levels are specific assessment criteria relating to groundwater or other relevant parameters and will be used to determine whether the landfill is performing as designed. They are levels that are intended to draw attention of site management and MEPA to the development of adverse, or unexpected, trends in the monitoring data. Such trends may result from failure of installation engineering or management, or from variations between actual conditions and those assumed within the conceptual model. Control levels will be treated primarily as an early warning system to enable appropriate investigative or corrective measures to be implemented, particularly where there is potential for a trigger level to be breached.

Control levels will be used therefore to:

- Highlight variations between the conceptual model (i.e. assumed behaviour) and observed conditions;
- Identify unambiguous adverse trends which are indicative of leachate impacts;
- Allow for variation in natural water quality from baseline conditions; and
- Give sufficient time to take corrective or remedial action before trigger levels are breached.

Trigger levels are specific compliance levels, or regulatory standards. They are defined as criteria at which significant adverse environmental effects and/or breaches of legislation have occurred. Such effects would be consistent with the groundwater having been polluted.

Groundwater control and trigger levels have been derived from the Hydrogeological Risk Assessment, and a description of the derivation of these levels together with supporting justification can be found in the Hydrogeological Risk Assessment report (Document Reference ZWR 02/04).

The control and trigger levels that will apply at the installation are as detailed within the IPPC Permit application.

10.4.2 Contingency Action Plan

In the event that control and trigger levels are exceeded in the designated monitoring boreholes, the various actions that will be taken are detailed in Table 10.2.

Table 10.2: Contingency Action Plan

Appropriate Contingency Actions	Following a Breach of a	
	Control Level	Trigger Level
Advise site management	✓	✓
Advise the installation operator's environmental manager	✓	✓
Advise MEPA	✓	✓
Confirm by repeat sampling and analysis	✓	✓
Review existing monitoring information	✓	✓
Review site management and operations, and implement actions to prevent future failure of a control level	✓	
Review the assumptions incorporated into the conceptual site model	✓	✓
Review existing hydrogeological risk assessment, control and trigger levels*	✓	✓
If risks are unacceptable set in place procedures for implementing corrective measures in consultation with or required by MEPA		✓

*This should include a re-evaluation of whether the baseline conditions have changed since the last hydrogeological risk assessment.

10.5 Monitoring Methodology

Monitoring will be carried out by the monitoring technician, in accordance with the procedure outlined below:-

10.5.1 Pre-Monitoring Checks

Prior to undertaking groundwater monitoring, checks will be carried out to determine:-

- The number of samples and analytical requirements;
- The size, type and number of bottles that are required, and any fixative or preservative requirements;
- That all equipment is clean and in good working order; and
- That all necessary equipment is available including keys.

10.5.2 On-Site Records

A record will be made of the following: -

- Name of technician;
- Date of sampling;
- Sampling equipment and method used;
- On-site weather conditions;
- Observations including vegetation die-back, leachate outbreaks, surface water ponding, damage to security fencing, or accumulations of wind blown litter; and
- Damage to borehole headworks or caps.

10.5.3 Monitoring Procedure

- The borehole cap will be removed and the depth to groundwater and depth to the base of the borehole from the cover level or any other agreed datum will be measured using an electronic dip tape or other suitable equipment;
- The depth of the water column will be calculated by subtracting the dip to the water from the dip to the base of the borehole;
- The volume of water will be calculated by multiplying the depth of the water column by the borehole diameter to derive the well volume;
- A submersible pump, inertial pump or bailer will be used to purge the borehole into a graduated bucket;
- The borehole will be purged by 3 well volumes or until it is dry, whichever is the sooner;
- The volume of water removed will be recorded;
- The borehole cap will be replaced;
- Those sample bottles not containing preservative will be flushed out with the sample;
- The sample bottle will be filled to the brim to exclude air, the top will be secured firmly, and it will be clearly labelled with the location code and date;
- Care will be taken to avoid cross contamination between samples. The pump head and hosing will be kept off the ground, and the equipment will be purged of any residual water, before progressing to the next sample location;
- Dirty equipment will not be put down the borehole; and
- Samples will be transferred immediately to cool boxes containing ice packs, and taken to the laboratory at the earliest opportunity.

10.5.4 Data Management and Reporting

Comparison of monitoring data with control levels will be carried out each time monitoring data are collected. The monitoring frequency will be increased if there appears to be a trend indicating that the trigger levels may be breached, or when there is a rapidly rising trend towards this point. When an adverse trend or breach of a control level is indicated by the monitoring results, appropriate contingency actions will be implemented.

The groundwater level and quality monitoring results will be entered into a database, and the data will be submitted to MEPA for review on an agreed frequency.

Results and analysis of the data will also be included within an annual environmental monitoring report, which will be submitted to MEPA.

10.6 Quality Assurance

10.6.1 Construction Quality Assurance

All groundwater monitoring point construction works will be subject to a Construction Quality Assurance plan agreed with MEPA.

Drill arisings and monitoring well installation will be supervised by an appropriately qualified geologist / hydrogeologist.

Should any of the groundwater monitoring points become damaged to such an extent that the levels cannot be recorded or samples obtained, they will be either repaired or replaced within a timescale agreed with MEPA. The nature and location of any replacement, as well as the drilling methods to be used, would be approved by MEPA prior to any works being undertaken.

10.6.2 Monitoring Quality Assurance

Groundwater monitoring and sampling at the site will be undertaken in accordance with the monitoring procedure outlined in Section 10.5.

Suitably trained personnel will undertake groundwater monitoring.

A suitably accredited laboratory will carry out groundwater quality analysis of samples.

A major ion balance will be undertaken routinely and reported by the analytical laboratory as part of laboratory quality control procedures.

Monitoring equipment will be serviced and maintained in line with the manufacturers' recommendations. Monitoring equipment will be cleaned after each monitoring exercise.

11.0 LANDFILL GAS MANAGEMENT

11.1 Introduction

A gas management system will be installed at the installation for the long-term control of landfill gas to prevent migration beyond the landfill and to minimise uncontrolled emissions of landfill gases to the atmosphere.

The system will comprise of a series of gas extraction wells installed in a grid pattern across the landfill, linked via sub surface pipe work to a gas flare. The long-term objective will be to utilise the gas for energy generation.

11.2 Landfill Gas Risk Assessment

A landfill gas risk assessment (Document Reference ZWR 03/04) has been used to derive the necessary mitigation measures that will be required at the installation to ensure that risks associated with the generation of gas are acceptable.

11.3 Landfill Gas Generation Assessment

As part of the gas risk assessment, gas production calculations for the life of the installation have been undertaken.

The gas generation model estimates that landfill gas generation.

11.4 Landfill Gas Emergency Plan

In view of the potentially hazardous nature of landfill gas, an Emergency Plan has been developed to outline the action that will be taken in the event of landfill gas migration giving rise to potentially dangerous situations.

In the event that landfill gas is detected in buildings at concentrations in excess of 20% of the lower explosive limit (LEL) above background levels, the alarm will be raised by fixed gas alarms or by monitoring personnel. The following measures will be taken: -

- All buildings, cabins or other potentially confined spaces will be evacuated;
- Electrical switches and buttons will not be operated;
- If it is safe to do so, any possible sources of ignition will be isolated and locked off. For example, fuses from electrical systems will be removed;
- All windows and doors in buildings within the installation will be opened to ventilate the area and landfill gas levels should be determined immediately;
- The site manager/site supervisor will be informed immediately;
- The weighbridge will be alerted and entry of vehicles via the main site entrance will be prevented;
- The environmental monitoring manager and the installations operator's safety health and environment manager will be advised of the situation;
- Buildings will not be entered until it is safe to do so;
- The gas call out number will be contacted;

- If the area of migration is adjacent to nearby buildings the gas extraction field will be adjusted to increase suction in that area;
- Perimeter monitoring boreholes will be monitored at an increased frequency;
- If migration continues, the local emergency services and the Environmental Health Department will be called, and a joint monitoring exercise will be carried out on properties at risk;
- If local residents need to be evacuated, the Police will be contacted; and
- The site manager will note down any actions taken and inform MEPA at the earliest opportunity.

11.5 Collection Efficiency

The landfill gas extraction system will be designed to have an overall collection efficiency of 80%.

11.6 System Capacity

The capacity of the utilisation and flaring plant that will be installed are summarised in Table 11.1 above. This demonstrates that the plant will have sufficient capacity to handle the maximum gas generation predicted by the gas generation model.

11.7 Design and Construction Quality Assurance (CQA)

11.7.1 Design

All elements of the proposed control systems will be designed and assessed in accordance with recognised standards and methodologies, and these processes will be documented to provide an adequate audit trail.

The design will consider the following aspects: -

- Performance required to achieve necessary standards;
- The context i.e. whether they are temporary or permanent systems;
- The design life;
- The purpose and environment in which they are situated;
- Selection of materials and products;
- Compatibility of the installed elements of the control system in terms of the phased development of the site e.g. appropriate sizing of gas extraction plant;
- Operational and maintenance requirements; and
- Health and safety issues.

11.7.2 Construction Quality Assurance

During the construction of each phase of the landfill gas management system, a Construction Quality Assurance Plan will be followed. This CQA plan will specify procedures for the installation, testing and sampling of all elements of the landfill gas management system and will be submitted to MEPA in advance of construction.

The CQA Plan will incorporate the following: -

- Roles and responsibilities;
- Quality assurance principles;
- As built documentation; and
- Provision for the preparation of a validation report.

A suitably qualified engineer will control the application of all engineering specifications and detailed CQA procedures.

The records of Landfill Gas Management System CQA, including all in-situ and laboratory testing, maintenance and repair will be formulated into reports and submitted to MEPA.

Factors that will provide the necessary assurance for the quality of the gas system include: -

- The use of suitably experienced and competent contractors;
- Surveying gas well positions to determine available depth of waste;
- Collection and analysis of joint records on the gas pipe work;
- Pressure testing of the entire system; and
- Provision of as-built drawings.

11.7.3 Gas System Design and Specification

The various elements of the landfill gas management system are described below: -

11.7.4 Engineered Containment system

The site will be developed with an engineered basal, sidewall and capping containment system, which will provide the primary protection against the migration of landfill gas.

11.7.5 Gas Extraction Wells

Gas extraction wells will be installed within each sub-phase following capping operations. They will be drilled vertically into the landfill at surveyed locations and will be installed on a triangular grid at approximately 30 metre intervals. The boreholes will be drilled at a diameter of 160mm, and the wells will terminate above the basal liner at a distance equivalent to approximately 20% of the waste depth. This will ensure that settlement of the waste will not cause excessive damage to the wells or the landfill basal sealing liner.

A typical section of a gas extraction well is illustrated on Drawing No. ZW010/04

11.7.6 Metering Stations/Manifolds

Metering stations/manifolds will be installed at intervals across the gas field, with each typically being connected to 10 to 12 wells. The metering stations/manifolds will be located above ground and will be contained within a fenced enclosure.

11.7.7 Connection Pipe-work and Configuration

The gas wells will be linked via sub surface HDPE pipe work laid in graded trenches to a depth of between 0.5 and 1.5 metres. Wherever possible the pipe work will be laid to a fall to encourage drainage of condensate to a low point. The pipe work will be protected from deformation due to loading stresses by a layer of bedding material.

The pipework will be sized to take account of the volume and rate of gas abstraction and configuration of the abstraction wells, to maintain suction pressure loss at acceptable levels and ensure effective gas abstraction is achievable throughout the gas field.

The manifolds will be linked via a main gas line to transport gas to the flare or utilisation equipment.

11.7.8 Control Systems

Valves

Control valves will be located at appropriate locations throughout the gas collection system to permit isolation of sections for monitoring, instrumentation, repair or modifications. The location of control valves will be determined by the landfill phase layout. They will allow regulation of vacuum to, and flow rates from, different parts of the site, to accommodate temporal and spatial variations in gas production.

Telemetry

The gas utilisation plant will incorporate an engine management system which will be linked to a central station to permit remote monitoring of the facility 24 hours a day.

Alarm Systems

In the event of problems with the utilisation plant or the flare unit, the telemetry unit will automatically alarm a 24 hour manned central station.

Interlock

Interlock systems will be incorporated within the gas management system to provide additional process control capability.

11.7.9 Dewatering Facilities

Landfill gas is extracted at temperatures often in the region of 40 to 50°C, and is saturated with water vapour. As the gas is conveyed through the collection pipe network, it cools, and landfill gas condensate forms.

Dewatering facilities will therefore be constructed at strategic low points within the system to avoid blockages caused by accumulation of condensate within the pipe work. The condensate will be discharged into the landfill or via the site leachate management system.

Dewatering facilities may comprise either of pumped condensate knockout pots or condensate dewatering legs installed in the low points of the system.

11.7.10 Gas Pre-treatment


Gas pre-treatment or cleanup is a multi-stage operation that can help reduce environmental emissions and reduce engine maintenance costs. Pre-treatment processes fall into two groups: primary pre-treatment processes are aimed at dewatering and particulate removal, whereas secondary pre-treatment processes are aimed at the removal of a percentage of specific components of the supply gas for example halogens, sulphur or siloxane compounds.

The gas pre-treatment technologies that will be undertaken at the installation are summarised within Table 11.1.

Table 11.1 Gas Pre-treatment Technologies

Technology	Comment
Water/condensate knockout	The flare will be equipped with this technology
Liquid water capture	The flare will be equipped with this technology
Foam removal	
Vapour reduction	
Contaminated water management	
Particulate filtration	
Hydrogen sulphide pre-treatment	
Halogenated organics pre-treatment	
Siloxane pre-treatment	

11.7.11 Gas Flare

A permanent gas flare will be provided at the installation. It will be located within the environmental management compound, situated to the north of the main access into the western quarry. 

Prior to the selection of the flare, detailed estimates of gas generation rate and treatment options shall be undertaken. However, the gas flare will be of an enclosed design. This will permit a homogenous temperature distribution across the combustion chamber. The flare will be lined with refractory material on the interior and the flare will be contained within a unit. Dimensions cannot be precisely estimated at this stage but shall be 0.75-1.0m in diameter and 3.5m in height.

The design specification for the flare will be as detailed in Table 11.2 below

Table 11.2 Gas Flare Design Specification

Feature	Specification	Yes/No/Comment
Manufacturer		Unknown at this stage
Model		Unknown at this stage
Design capacity	200-1000m ³ hr ⁻¹	
Turndown range		Unknown at this stage
Combustion control		Unknown at this stage
Retention time	0.3 Secs	
Minimum temperature	1000 ⁰ C	
Flame detector		This technology will accompany the flare.
Automatic flame temperature control		This technology will accompany the flare.
Slam shut valve		This technology will accompany the flare.
Flame arrestor on flare feed line		This technology will accompany the flare.
Flame arrestor on any other point		

The combustion air supply will be controlled so as to achieve a minimum temperature and retention time of 1,000°C and 0.3 seconds respectively during all operational conditions.

Emissions from the flare will comply with the appropriate European emission standards. The flare will be maintained in accordance with the manufacturer's recommendations, to ensure continued effective operation. Full maintenance records will be maintained.

11.7.12 Utilisation Plant

If the site generates enough landfill gas and it is considered commercially viable, a gas utilisation plant will be provided at the installation. It will consist of an acoustically insulated and containerised generating set. The set shall house a landfill gas driven prime mover and alternator set with engine management and remote monitoring facilities.

The objective is for the landfill gas to be used to generate power. As the site is developed, gas generation rates will be kept under review, with the objective of installing power generation equipment when it is feasible to do so.

Details on the proposed engine specification and power generation plant will be submitted to MEPA in advance of installation.

11.7.13 Temporary and Emergency Provisions

In the event of generator shut down, for planned maintenance or an unplanned event, the excess gas will automatically flow to the flare, with no disruption to flow rate or applied vacuum to the field.

In the event of a power failure, both the flare and generator will shut down. However, on the resumption of installation supplies, the gas plant will restart automatically. The generators will be linked via telemetry to a central location and will be capable of being started remotely.

11.8 System Operation

11.8.1 Operations Manual

The landfill gas management system will be subject to an operational, preventative maintenance and servicing programme in accordance with the manufacturer's recommendations.

Procedures detailing all the operational and maintenance requirements for the permanent gas flare and utilisation plant will be contained within the operational manual, which will be retained within the gas management compound.

The operational manual will include the following aspects: -

- System description (construction, process and operational parameters) including full as built drawings, together with a record of all subsequent changes;
- Commissioning measurement data;
- Operating instructions;
- Commissioning into service and out of service procedures;
- Specification for routine operational monitoring;
- Register of all routine adjustments;
- Record of all non-routine incidents; and
- Health and safety instructions for routine operation and further guidance on procedures to adopt in the event of an accident or emergency.

The monitoring, inspection and maintenance programme will include the following: -

- Detailed inspection programme with inventories and frequencies (including responsibilities for monitoring, inspection and maintenance, daily, weekly and monthly requirements, documentation and recording procedures, procedures for implementing corrective actions);
- Register of fault conditions and corrective actions taken to overcome faults;

- Details of routine repairs and replacements;
- Review requirements for fault conditions and repairs; and
- Inventory of replacement parts and contact details for relevant suppliers and manufacturers.

Personnel responsible for the operation and maintenance of the gas management system will be fully conversant with the operational procedures and safety and maintenance programmes.

The integrity of the gas system will also be subject to routine monitoring and any identified problems affecting the operation of the system will be remedied to ensure continued effective control of landfill gas.

11.8.2 Start up and Shut Down Procedures

The procedures will incorporate the gas engine manufacturers start-up and shutdown procedures to ensure maximum reliability of the gas engine.

The gas engine will be started up and shutdown using fully documented Start Up and Shutdown Procedures. These procedures will include the actions required by the operator to ensure the engine is commissioned safely, and is left in a safe condition (i.e. gas free and isolated) when shutdown. The procedures will endeavour to ensure that the environmental impact of start-up and shutdown is minimised. The procedures will be integrated with the gas bypass procedure to ensure release of unburnt gas is minimised.

11.8.3 Engine By Pass Procedures

In the case that the gas engine is shutdown, for example for routine maintenance, then the engine by pass procedure will be used, in conjunction with the shutdown and start-up procedures. The by pass procedure will ensure that gas bypassing the engine is fully burnt in a safe manner, in the flare which is designed for the gas flow rates usually handled by the gas engine. The procedure covers the safe ignition and extinguishing of the flare at the beginning and end of the by pass activity. It will also cover the monitoring of the flare to ensure the flame out is detected and that the gas is incinerated in conditions that ensure full combustion.

11.8.4 Routine Operational Procedures

The results of the routine monitoring for gas quality, flow and pressure will be used to adjust and 'balance' the gas system, in order to optimise the extraction and control of the gas. This will be achieved by manually adjusting the control valves and the suction that is applied to individual wells or groups of wells, and thereby ensure equilibrium with gas generation rates within the site.

11.8.5 *Prioritising Migration Control*

The extraction system will be designed and configured to enable individual parts of the gas field to be isolated and controlled. This enables appropriate adjustments to be made to individual wells or groups of wells to ensure migration control is optimised.

11.8.6 *Collection and Control during Low Methane Generation*

During the early stages of the landfill development, and during the post closure aftercare period, there may be insufficient gas to support continual combustion. In these circumstances, the results of the routine system monitoring, which will provide data on the gas flows and concentrations within the different parts of the site, will be used to determine the most appropriate operational regime both in respect of the suction applied to the wells and the operational sequence of the flare, with the objective of ensuring that extraction and flaring of gas is optimised.

Additional control measures such as optimising methane oxidation in the restoration soils may also be considered during periods of low methane generation.

11.9 System Maintenance

11.10 *Planned and Unplanned Maintenance*

The various components of the landfill gas management system will be subject to a maintenance programme in accordance with the manufacturer's instructions.

Gas Collection System

The gas pipelines, wellheads, manifolds and condensate knockout systems shall be checked by the monitoring technicians for the following: -

- Wellhead damage including damage to security padlocks;
- Settlement, which may affect wellhead connections and pipework falls;
- Condensate, which may block pipelines or restrict flow;
- Integrity of couplings and connections;
- Pipework damage and leaks; and
- Functioning of condensate pumping systems.

The requirement for unplanned remedial work or replacement wells will be identified during the routine inspection programme outlined above.

Gas Flare

The gas plant equipment will be subject to a visual inspection at least weekly to check that all systems are functioning according to the manufacturers specification.

This visual inspection will include the following: -

- Check all instrumentation;
- Listen for early signs of bearing or motor failure on fans;

- Check ignition systems;
- Check joints and pipework for signs of damage, leaks or fatigue;
- Check condensate pumping system;
- Check flame for signs of surging and flame colour; and
- Check performance indicators such as differential pressure and flow

These inspections will be used to indicate potential problems between services, and any signs of malfunction will be reported immediately and arrangements made for repairs to be carried out.

In addition to the above, approved contractors will service the gas flare on a six monthly basis in accordance with the manufacturers recommendations. Servicing of the gas plant will be carried out with minimal interruption to its operation.

Gas Utilisation Plant

The engine suppliers will service the gas utilisation plant. The servicing will allow for planned and unplanned maintenance activities, with the degree of servicing reflecting the hours of operation of the generator.

The requirement for unplanned maintenance will be identified through the 24 hour feedback from the telemetry system, and the weekly monitoring carried out by the gas field technician.

11.11 System Monitoring

11.11.1 Flow, Pressure and Composition

The gas collection system will be monitored for gas flow rate, gas quality and pressure.

The entire gas field will be monitored once a month, with the gas plant and manifold outlets being monitored on a weekly basis during normal operations.

In the event of abnormal operating conditions, additional monitoring will be carried as required until normal operating conditions are re-established.

This monitoring will be carried out throughout the operational and post closure stages of the installation.

11.11.2 Meteorological Monitoring

Meteorological monitoring will be carried out at the installation, and will be used where necessary to assist in the management of gas.

11.12 Action Plan

11.12.1 Air Ingress

Air ingress into the system can be caused by a number of different failure scenarios,

such as damage to a wellhead caused by settlement or vandalism, or failure of a manifold component.

In the event of such damage being observed, immediate action would be taken to make temporary repairs using sealing tape, pending more permanent repairs, which would be undertaken following isolation of the wellhead or manifold.

11.12.2 Leaks

The integrity of the gas system will also be subject to routine monitoring and any identified problems affecting the operation of the system will be remedied to ensure continued effective control of landfill gas.

Again the priority would be to undertake temporary repairs immediately using sealing tape if possible pending more permanent replacements or resealing of components.

11.13 Data Management and Recording

Records of the design, specification, operation, inspection, maintenance and monitoring of the gas system will be maintained. Specifically, the following records will be maintained:

- Records of all inspections carried out on the system;
- Planned and unplanned maintenance and servicing;
- Records of monitoring for gas composition, flow and volume; and
- Telemetry records.

These records will comprise both hard copy data sheets, and electronic records of system operation. All records will be available for inspection by MEPA on request.

An installation log will also be maintained in the control room and will be used to record all visits, significant alterations to the gas field extraction regime, and unusual occurrences.

12.0 GAS MONITORING

12.1 Introduction

The gas monitoring plan will ensure that: -

- Gas quality and quantity from each section of the installation is identified and controlled;
- Perimeter monitoring is adequate to cover the pathways of migration to identified off-site receptors;
- High permeability sections of the cap can be located;
- Leaks in the gas collection system will be identified;
- Enable the volumes of landfill gas being sent for utilisation/flaring to be quantified;
- Ingress of air into installation can be detected;
- Adequate balancing of gas collection system;
- Borehole performance will be maintained to design specification;
- Concentration and composition of trace gases can be determined; and
- Quality and quantity of emissions from flares and utilisation plant can be determined.

12.2 Locations, Design and Construction of Monitoring Points

12.2.1 *In Waste Boreholes and Wells*

Monitoring of landfill gas inside the installation will be carried out at the individual gas extraction wellheads/metering stations, which will be installed at intervals across the gas field.

12.2.2 *Perimeter Boreholes*

A number of external landfill gas monitoring locations will be established. Gas monitoring boreholes will be installed to a minimum depth of 2 metres below the base of the landfill.

The monitoring boreholes will be fitted with a gas tight cap that will be equipped with a gas-sampling tap suitable for connection to the sampling equipment to be used at the site. All boreholes will be secured with lockable steel headworks fitted into a concrete surround. The borehole number will be marked on the headworks.

12.3 Monitoring Measurements and Schedules

12.3.1 Internal Gas Monitoring

Landfill gas monitoring will be carried out using a portable infra-red gas analyser for the following determinands: -

- Methane (% by vol.);
- Carbon Dioxide (% by vol.);
- Oxygen (% by vol.);
- Temperature ($^{\circ}\text{C}$); and
- Carbon Monoxide (% by vol.).

In addition, monitoring for trace component compounds will be undertaken as described in Section 12.3.2.

During the operational and aftercare phases of the landfill, routine gas monitoring of the gas extraction system and extraction plant will be carried out on a regular basis. As a minimum, monitoring of the manifold outlets and gas plant will be carried out on a monthly basis. However, if there are prolonged periods where there is no off-site gas migration, as detected in the exterior monitoring wells, the extent and frequency of the monitoring will be altered from this regime in consultation with MEPA. Conversely if perimeter monitoring suggests that off-site gas migration could potentially present a hazard, the frequency and extent will be increased proportionally.

12.3.2 Monitoring of Trace Components

The gas will be monitored for priority trace components, unless site-specific risk assessments indicate that additional or alternative compounds should be included.

The monitoring of priority trace components will be carried out on at least an annual basis, when the gas collection system is at or near steady state conditions. However, in the event of significant changes to the gas management system or waste composition, additional monitoring will be considered.

The sampling location will be selected in order to ensure it is representative of the gas being generated at the installation. It is anticipated that the sample will be obtained from the main line carrying gas to the engines or flares. However, if it is considered that this location will not provide a representative sample, an alternative sampling location will be proposed and agreed with MEPA.

In order to confirm that the proposed sampling point is appropriate and that it will provide a representative sample, a measurement of bulk gas concentrations will be made prior to undertaking sampling for trace components.

The sampling method and analytical method* for each of the trace compounds is as prescribed in Table 12.1.

Table 12.1 Sampling and Analytical Methods for Landfill Gas Trace Compounds

Significant Trace Component	Sampling Method	Analytical Method **
Chloroethane	Dual solid sorbent	ATD-GC-MS
Chloroethane (vinyl chloride)	Dual solid sorbent	ATD-GC-MS
Benzene	Dual solid sorbent	ATD-GC-MS
2-butoxy ethanol	Dual solid sorbent	ATD-GC-MS
Arsenic (as As)	Solid sorbent	ICP-MS/AAS
1,1-dichloroethane	Dual solid sorbent	ATD-GC-MS
Trichloroethene	Dual solid sorbent	ATD-GC-MS
Tetrachloromethane	Dual solid sorbent	ATD-GC-MS
Methanal (formaldehyde)	Reactive sorbent	HPLC
Hydrogen sulphide	Direct on site measurement of raw gas	Hand-held instrument
1,2-dichloroethene	Dual solid sorbent	ATD-GC-MS
Carbon disulphide	Dual solid sorbent	ATD-GC-MS
Methanethiol	Dual solid sorbent	ATD-GC-MS
Butyric acid	Solid sorbent	GC-FID
Ethanal (acetaldehyde)	Reactive sorbent	HPLC
Ethyl butyrate	Dual solid sorbent	ATD-GC-MS
1-propanethiol	Dual solid sorbent	ATD-GC-MS
Dimethyl disulphide	Dual solid sorbent	ATD-GC-MS
Ethanethiol	Dual solid sorbent	ATD-GC-MS
1-pentene	Dual solid sorbent	ATD-GC-MS
1-butanethiol	Dual solid sorbent	ATD-GC-MS
Dimethyl sulphide	Dual solid sorbent	ATD-GC-MS
1,3-butadiene	Dual solid sorbent	ATD-GC-MS
Furan	Dual solid sorbent	ATD-GC-MS
Mercury (as Hg)	Solid sorbent	ICP-MS/CV-AAS

*Taken from UK Environment Agency 'Guidance for Monitoring Trace Components in Landfill Gas'

**Abbreviations and units are as follows:-

AAS, Atomic Absorption Spectroscopy

ATD, Automated Thermal Desorption

CV-AAS, Cold Vapour Atomic Absorption Spectroscopy

GC-FID, Gas Chromatography with Flame Ionisation Detection

GC-MS, Gas Chromatography with detection by Mass Spectrometry

HPLC, High Pressure Liquid Chromatography

ICP-MS, Inductively Coupled Plasma-Mass Spectrometry

The results of the trace gas data will be summarised and submitted to MEPA together with the annual environmental monitoring report.

12.3.3 Perimeter Gas Monitoring

The monitoring locations, frequency and measurements undertaken on perimeter gas monitoring boreholes are as detailed in Table 12.2.

Table 12.2 Perimeter Gas Monitoring Regime

Sampling Location	Frequency	Measurement and Analytical Suite
Several locations	Monthly	Methane, carbon dioxide, oxygen, hydrogen sulphide, etc.

If gas migration is identified then the action plan presented within Section 12.4.2 will be followed and gas monitoring may take place on a more frequent basis than proposed above. The monitoring frequency will be subject to regular review and may be subject to change in consultation with MEPA.

12.3.4 Gas Flare Monitoring

Emissions from the enclosed gas flare will be subject to a programme of monitoring. Gas flare emissions monitoring will be carried out on at least an annual basis, for the following determinands: -

- Nitrogen oxides (NO_x);
- Carbon Monoxide (CO);
- Total Volatile Organic Compounds (VOC's); and
- Non-Methane Volatile Organic Compounds (NMVOCs).

12.3.5 Utilisation Plant Monitoring

The following principles will be adopted for the monitoring of landfill gas engines:

- Discharges will be vertically upwards and unimpeded by cowls or any other fixture on top of the stack;
- Sampling sockets will be fitted to all new installations;
- Crankcase emissions will be managed to minimise their release to the environment;
- Continuous monitoring will be undertaken for methane concentration and flow in the inlet gas; and
- Continuous monitoring will be undertaken for NO_x and CO in the emissions.

A summary of the parameters to be monitored, the test reference method, sampling and analytical technique, and testing frequency are provided in Table 12.3.

Table 12.3 Gas Engine Emission Testing Requirements

Emission	Reference Method*	Sampling & Analytical Technique	Testing Frequency
Nitrogen Oxides	ISO 10849:1996	Extractive sampling and chemiluminescence	Annually
Carbon Monoxide	ISO 12039:2001	Extractive sampling and Non-Dispersive Infra Red analysis (NDIR)	Annually
Organic Total Volatile Compounds	BS 12619:1999 ^a EN BS 13526:2002 ^b EN	Extractive sampling and FID analysis	Annually
Non-Methane Volatile Organic Compounds	BS 13649:2002 EN	Extractive sampling onto sorbant, extraction by CS ₂ analysis by GC with appropriate detector.	Annually

a At sites with low total VOC concentrations

b At sites with low to moderate total VOC concentrations

* Alternative methods will only be used if they are demonstrated as fit for purpose, to the satisfaction of MEPA

12.3.6 Surface Emissions

The monitoring of gas emissions from the surface of the landfill will be undertaken to determine the rate at which gas is escaping from the capped surface of the landfill and is used to: -

- Minimise the uncontrolled release of landfill gas and its impact on global warming; and
- Check the integrity of the gas management system and the capping system.

Surface emissions monitoring will be undertaken on an annual basis during both the operational and post closure stage of the landfill. The methodology for undertaking surface emissions monitoring is as detailed in Table 12.4 below.

Table 12.4 Methodology for Undertaking Surface Emissions Monitoring

Stage	Comments
Desk Study	The desk study will be used to define the history of waste disposal activities at the installation, and details of the installation of any capping and gas control measures.
Walkover Survey	This will be used to identify any zones of relatively high or low methane emission concentrations.
Detailed FID (flame ionisation detector) surface scanning	The identified zones will be traversed in a systematic manner using a portable FID, held as close to the landfill as possible.
Flux survey design	The results of the desk study and surface scanning will be used to divide the site into monitoring zones, based on a survey grid.
Flux Survey	Flux boxes will be placed at designated locations across the capped area of the site and sealed against the ground.
Processing and interpretation of results	Measurements obtained from the flux boxes will be used to calculate emission rates for specific zones or the whole site.
Assessing compliance with emission limits	The results will be compared with appropriate emission limits.
Reporting and definition of remedial actions	The results will be submitted to MEPA, and where necessary appropriate remedial actions will be defined and undertaken.

12.3.7 Aerial Emissions/Air Quality

It is considered that the requirement to undertake aerial emissions/air quality monitoring will be determined by the potentially odorous nature of landfill gas and also by the presence of particulates in both landfill gas and emissions from combustion plants.

Principles that will be adopted with respect to such monitoring are outlined in the odour management plan (Section 15) and the particulate management plan (Section 14) respectively.

12.3.8 Off-Site Monitoring/Receptor Monitoring

It is considered that off site monitoring and receptor monitoring will only be undertaken in response to complaints of odour, particulate emissions, or as part of the action plan relating to the detection of landfill gas in perimeter monitoring boreholes.

12.4 Assessment and Compliance Limits and Contingency Action Plan

12.4.1 Assessment and Compliance Limits

The assessment and compliance limits that will apply to the monitoring of internal and external gas concentrations at the installation are detailed within Table 12.5.

Table 12.5 Perimeter Landfill Gas Assessment and Compliance Limits

Substance	Control Level, detection limit and accuracy	Trigger Level, detection limit and accuracy	Frequency of monitoring

Emission limits that will apply to the landfill gas flare and gas utilisation equipment will be set in agreement with MEPA.

12.4.2 12.4.2 Contingency Action Plan

The landfill gas monitoring action plan will be followed in the event of:-

- Abnormal changes in monitoring data;
- Operational problems or failure of the control system;
- Reported events (e.g. odour complaints);
- Migration and release of landfill gas; and
- Impact on local air quality.

The landfill gas monitoring action plan that will be followed in the event of any of the circumstances identified above is as follows:

- Methane concentrations in the zero to 1% above background levels range are considered to show normal variability and routine monitoring will be maintained;
- If methane concentrations exceed 1% above background levels then action will be taken to regularise the situation.
- The site manager will be informed immediately before the technician leaves the installation and MEPA will be informed at the earliest opportunity;
- The details of the compliance level breaches will be forwarded to the installation operator's environmental manager and gas manager for immediate action;
- The affected borehole(s) will be re-monitored to verify the results and establish that the compliance level has been exceeded. If it is established that the compliance level has actually been exceeded, then the monitoring frequency will be increased within the affected and adjacent boreholes;
- An assessment will be made as to whether there were any properties immediately at risk from gas migration. Emergency procedures will be implemented if gas concentrations were found to be above trigger levels inside

the building(s);

- An assessment will be made of the possible causes of the increase in methane levels, e.g.:-
 - Gas plant failure;
 - Vandalism or tampering to the extraction system by unauthorised persons;
 - Fluctuations in leachate and/or groundwater levels;
 - Rapid drop in atmospheric pressure; and
 - Snow, frost, heavy rain.
- The previous monitoring results for the site will be checked;
- The gas extraction system will be adjusted, where appropriate, in order to increase the extraction of gas adjacent to the affected area;
- The extraction system will be checked for well failures, damaged pipework, condensate blockages;
- The surrounding area will be checked for signs of gas or leachate escaping or vegetation die back.
- If, after four weeks, gas levels are showing no signs of stabilising the following will be considered: -
 - Review of the landfill gas risk assessment;
 - Sampling of gases for laboratory analysis to verify source;
 - Installation of additional boreholes; and
 - Installation of additional gas extraction wells or capacity.

Routine gas monitoring would recommence once methane levels had stabilised.

12.5 Monitoring Techniques

Monitoring of perimeter and internal gas monitoring points will be carried out in accordance with the procedure outlined below: -

12.5.1 Equipment and Maintenance

- Gas monitoring will be carried out using a portable infra-red gas analyser, capable of reading methane, carbon dioxide, oxygen and atmospheric pressure; and
- The instruments will be serviced in accordance with the manufacturers recommendations.

12.5.2 Pre-Monitoring Checks

Prior to undertaking gas monitoring, the following checks will be carried out: -

- In-line hydrophobic filters will be checked and replaced if necessary;
- Battery life will be checked to ensure there is sufficient charge to carry out the monitoring;
- The calibration status of the instrument will be checked; and
- Once per week, test gas will be used to check the accuracy of the instrument, the results of which will be recorded.

12.5.3 On-Site Records

A record will be made of the following: -

- Name of technician;
- Date of sampling;
- Atmospheric pressure and trend;
- Instrument type and serial number;
- On-site weather conditions;
- Observations including vegetation die-back, leachate outbreaks, surface water ponding, damage to security fencing, or accumulations of wind blown litter;
- Damage to borehole headworks, caps or taps; and
- For internal gas monitoring, the position of the valve between open and closed will be recorded.

12.5.4 Monitoring Procedure

- The sample tube will be attached to the sample tap;
- The tap will be opened and the analyser pump will be switched on;
- When constant readings are achieved, the data will be recorded on the logger;
- Borehole pressure readings will be taken at gas extraction wells;
- The gas tap will be closed, the tube will be removed, and the pump will be allowed to run to flush out any residual gas before taking the next sample;
- If water level data is required, the borehole cap will be removed and, an electronic dip tape will be used to measure the water level relative to the cover level or other agreed datum point; and
- The borehole cap will be replaced.

Monitoring of gas flares, gas utilisation plant, and surface emissions will be carried out in accordance with the methods and procedures agreed with MEPA.

12.6 Data Management and Reporting Procedures

12.6.1 Recording and Maintenance of Data

Following each landfill gas monitoring exercise, a hard copy of the landfill gas monitoring results will be kept on file at the site.

The gas monitoring results will be entered into a database. This information will include: -

- Borehole identification;
- Date;
- Gas concentration;
- Barometric pressure; and
- Units.

12.6.2 Reporting to MEPA

Results of landfill gas monitoring will be submitted to MEPA at intervals that will be agreed with MEPA.

An annual environmental monitoring report will be compiled which includes both raw and aggregated data, charts and trends. The report will demonstrate compliance with the conditions of the permit, and will provide an interpretation of the data, including exception reports to highlight where deviations have occurred.

Details of reporting procedures to be carried out in the event that compliance levels are exceeded are included in the Action Plan outlined in Section 12.4.2.

12.6.3 Recording Complaints

All complaints regarding landfill gas will be recorded within the installation log, and will include the following details: -

- Complaints received including address of complainant;
- Nature of problem including date, time, duration, prevailing weather conditions and cause of the problem;
- Details on the corrective action taken, and any subsequent changes to monitoring and operational procedures; and
- An evaluation of the effectiveness of the techniques used.

12.7 Quality Assurance

12.7.1 Construction Quality Assurance

Should any well, headworks or monitoring connection point become damaged they will be repaired or replaced within 28 days to ensure that the integrity and operating efficiency of the system is not impaired.

Where new boreholes are installed, the borehole logs and as-built installation details will be forwarded to MEPA and shall provide the following information: -

- Borehole identification;
- Date of drilling/installation;
- Geological strata descriptions;
- Groundwater level (and any perched water levels);
- Design of the borehole if more than one type is being used on the site;
- Depth of borehole (m) and level of the bottom of the borehole in m OD;
- The surveyed height of the top of the borehole in m OD, and the surveyed ground level at the point if it differs; and
- The National Grid Reference of the borehole (10 figure).

12.7.2 Monitoring Quality Assurance

Suitably trained and experienced personnel will undertake gas monitoring.

The gas monitoring equipment will be calibrated, serviced and maintained in line with the manufacturer's recommendations. Calibration certificates will be kept on file at the operations department.

Laboratory analysis of gas will be utilised when necessary to identify gas source or to validate results.

The area adjacent to the boreholes will be kept clear and free from any vegetation, which could potentially prevent adequate area for sampling or monitoring.

Landfill gas monitoring at the site will be undertaken in accordance with the monitoring procedure outlined in Section 12.5.

13.0 INSTALLATION INFRASTRUCTURE

13.1 Introduction

This section describes the infrastructure that will be provided at the installation. In addition to providing details for each element of the infrastructure, the principles that will be adopted during the design and construction process to ensure that risk to air, land and water are minimised, are also detailed.

13.2 Security Measures and Standards

In order to minimise the risk of problems arising as a result of inadequate security, the following measures will be implemented at the installation.

13.2.1 Building Security

The installation control office will have the benefit of a security alarm to discourage intruders. Windows will also be fitted with bars and /or shutters to prevent damage by vandals.

13.2.2 Lighting

The main installation control area, environmental management compound and plant storage area will have security lighting to discourage unauthorised visitors during the hours of darkness.

13.2.3 Fencing

The installation will have the benefit of security fencing which will extend around the perimeter of the installation. There will also be a separate fence and gates around the environmental management compound.

13.2.4 Security Gates

Security gates, which span the full width of the access road, will be provided at the entrance to the installation. The gates will be locked outside operational hours to deter unauthorised vehicular and pedestrian access.

13.2.5 Warning Notices

Notices warning against unauthorised access (and alerting potential trespassers to on site hazards) will be erected at the installation entrance and adjacent to the footpath, and will be repeated as necessary at locations around the perimeter.

13.2.6 Security Systems

The installation will have the benefit of a security system comprising either electronic alarms or security guards, which will be activated/in place outside operational hours.

13.2.7 Authorised Access System

All visitors will be required to register their presence by signing in the visitors book on entry to the installation, and again on exit. This will minimise the risk of unauthorised visitors being present on site.

13.2.8 Inspection

The site manager or his/her nominated deputy, will inspect gates and fencing weekly, to identify deterioration and damage, and the need for any repairs.

13.2.9 Maintenance and Repair

The fencing and gates will be maintained and repaired when required to ensure their continued integrity. In the event that damage is sustained, a temporary repair will be made within 24 hours until permanent repairs can be effected.

13.2.10 Action Plan

In the event of a breach of security at the installation, the following course of action will be followed.

Unauthorised Access

The route of access will be determined, and consideration given to the following measures as appropriate: -

- Repair of gates or fencing;
- Replacement of gates or fencing with more secure design;
- Erection of warning signs; and
- Installation or implementation of additional security measures for example security cameras, more frequent patrols.

Unauthorised Tipping

The following actions will be taken in the event of unauthorised tipping: -

- The material will be examined for evidence of ownership;
- MEPA will be informed;
- With the agreement of MEPA, the material will be removed and disposed of correctly;
- If appropriate, additional warning signs will be erected; and
- Additional security measures will be considered.

Records

A record relating to the management and monitoring of security will be maintained. It will include the following details: -

- Records of the inspections and maintenance of security fencing and gates;
- A record of all breaches of security and incidents of fly tipping, and investigations of these breaches of security; and
- Details of the action taken to replace or repair security equipment, and investigate fly tipping, including any subsequent changes to operational procedures.

13.3 Sub-Surface Structures

Installation and operation of sub-surface structures such as drains, pipework, sumps and storage vessels will be subject to the following criteria: -

- The source, direction and destination of all drains, ditches and subsurface pipework will be recorded;
- All sumps and storage vessels will be identified;
- Systems will be designed where appropriate to provide secondary containment or leak detection, and minimise leakage; and
- Sub surface structures will be subject to an inspection and maintenance programme, which will include pressure tests, leak tests, material thickness checks or CCTV. These checks will be undertaken at maximum 3 yearly intervals and the results will be forwarded to MEPA.

13.4 Installation Surfacing

All areas of the installation (excluding the landfill containment areas) where there is potential for activities to pollute the ground or controlled waters will be hard surfaced.

To ensure appropriate standards are achieved, all hard surfaced areas will be designed to take account of the following requirements: -

- Capacities;
- Thickness;
- Falls;
- Material of construction;
- Hydraulic conductivity;
- Strength/reinforcement; and
- Resistance to chemical attack.

Construction of the surfacing will be subject to Construction Quality Assurance procedures, and thereafter regular inspection and maintenance.

Hard surfaced areas incorporate the following: -

- Main installation access road;
- Waste reception/installation control area (including the installation control office where waste acceptance procedures will be carried out (pre-disposal Level 3 on-site verification/visual inspection, document examination and processing, and maintenance of records));
- Waste storage/quarantine area (where possible non-conforming waste may be

- stored pending further investigations);
- Fuel storage area; and
- Car parking area.

In addition to the impervious surface these areas will benefit from sealed construction joints. They will also have the benefit of containment kerbing and a sealed drainage system.

Hard surfaced areas will be subject to an inspection and maintenance programme, which will ensure the continued integrity of the surface.

13.5 Bunds

Bunds or other means of containment will be provided for all tanks containing liquid whose spillage could be harmful to the environment.

The bunds will possess the following features: -

- Impermeability and resistance to the stored materials;
- A capacity of 110% of the largest tank or 25% of the total tankage whichever is the greater;
- No outlet and drain to a blind collection point, which does not penetrate or compromise the structure of the bund and which will be emptied using a vacuum device;
- Fill points within the bund or provide alternative containment;
- Pipework routed within the bund, with no penetration of contained surfaces; and
- Designed to catch leaks from tanks or fittings.

Bunds will be subject to regular visual inspections at weekly intervals and the results will be entered in the installation log. Where the structural integrity of bunds is in doubt, water testing will be undertaken.

The contents of the bunds will be pumped out or otherwise removed under manual supervision and control after checking for contamination.

13.6 Infrastructure

The following infrastructure will be provided at the installation.

13.6.1 13.6.1 Notices and Signs

A large, clearly marked notice board of durable, weather resistant design will be maintained at the entrance to the installation. The notice board will show the following: -

- The name of the installation;
- The name, address and telephone number of the permit holder;
- The IPPC permit reference number;
- The hours of operation;
- The address and telephone number of MEPA office responsible for monitoring the installation;
- An emergency out-of-hours telephone number for the permit holder; and
- An emergency telephone number for MEPA.

The notice board will be maintained in a legible condition throughout the duration of operations.

13.6.2 Access Road

An access road to the installation entrance already exists.

13.6.3 Installation Roads

Traffic will gain access through the existing access road to the waste reception area.

13.6.4 Weighbridges and Weighbridge Offices

Weighbridges will be installed at the gates of the installation. All vehicles arriving at the facility to deposit waste will use a weighbridge. A clerk/weighbridge operator will be stationed in the office to administer incoming loads of waste.

The weighbridge office will be used for the safe storage of Duty of Care documentation, the installation log, and environmental monitoring records. The offices will be open during operational hours and will be equipped with a telephone and supplied with mains electricity.

In addition to the weighbridge office, installation offices containing mess facilities will be provided.

13.6.5 Plant Compound

A secure compound surrounded by security fencing will be provided for the storage of plant and equipment outside operational hours.

13.6.6 Wheel Washes

Wheel washes, incorporating high pressure sprays will be provided at the end of the surfaced haul roads.

The wheel washes will be operated and maintained in accordance with the manufacturer's recommendations in order to optimise operational efficiency. Water use will be restricted to the amount necessary to ensure effective operation, but will be recycled in order to minimise water consumption.

13.6.7 Parking

Provision will be made for landfill personnel and visitors to park their vehicles adjacent to the site offices in the waste reception areas.

13.6.8 Fuel Storage

Fuel for landfill plant will be stored in an above ground storage tank(s). To conform to the design principles outlined in Section 13.5, the tank will be provided with a means of secondary containment to retain accidental spillages and this will be maintained to ensure that it is capable of storing 110% of the capacity of the tank.

13.6.9 Lighting

During the summer months, supplementary lighting to illuminate operational areas will not be necessary. In the winter, lighting will be made available as necessary; to ensure that safe working conditions are maintained.

During the hours of darkness, mobile lighting rigs will be placed on or near the operational areas. These shall be positioned to allow for safe operation of vehicles and plant and for visual inspection of wastes.

The weighbridge area will be provided with permanent security lighting and this will provide enough illumination for any inspection carried out at this point.

13.6.10 Quarantine/Isolation Area

A quarantine/isolation area for the temporary storage of inappropriate wastes or waste loads discovered to be on fire will be located within the installation control area.

The quarantine area will be a contained area, benefiting from an impermeable pavement, and sealed drainage system.

14.0 PARTICULATE MATTER MANAGEMENT AND MONITORING

14.1 Operational Measures

14.1.1 Management Responsibility

The site manager will have responsibility for ensuring that nuisances and hazards arising from the installation due to dust are minimised.

14.1.2 Vehicle Speed Limits

To minimise the emissions of dust arising from the use of installation roads, speed limits of 20 km/h will be imposed for all vehicles using unsurfaced haul roads,

14.1.3 Sweeping of Access Road and Highway

The main access road will be swept with a mechanical road sweeper as and when conditions dictate to minimise emissions of dust.

14.1.4 Spraying of Roads and Operational Areas

During dry conditions, a water bowser will be used to spray the installation roads and the operational area, prior to and during vehicle movements.

14.1.5 Static Water Sprays

In particularly sensitive locations or during adverse weather conditions, consideration will be given to the operation of static water sprays, which will provide continuous protection against dust.

14.1.6 Seeding of Earth Bunds, Stockpiles and Surfaces

If necessary, bare earth surfaces will be seeded to provide protection against wind erosion and associated dust emissions.

14.1.7 Acceptance of Dusty and Friable Waste

Dusty and friable waste which could cause a potential dust problem during and immediately following its deposit will only be accepted if the waste is bagged, otherwise contained, or has been conditioned with water prior to delivery.

14.1.8 Filling Direction and Sequence

In order to minimise the escape of dust from operational areas and minimise the impact of any escape that may occur, consideration will be given to the strength and direction of the prevailing wind, and the proximity of receptors when planning the sequence and direction of filling.

14.1.9 Sheetting of Vehicles

All vehicles using the installation will be instructed to ensure that their loads are adequately sheeted or otherwise contained. All loads of secondary aggregates or soils leaving the installation will also be sheeted.

To avoid the escape of dust from vehicles whilst they are traversing site roads, they will not be permitted to unsheet (other than for the purposes of waste inspection) other than at the designated unsheeting area, which will be located immediately adjacent to the active landfilling area.

14.1.10 Landfill Construction Work

Engineering works carried out, as part of the installation construction activities can be a potential source of dust, particularly bulk excavation and earthmoving activities. Procedures to minimise the environmental impacts of these activities with respect to dust emissions, will be incorporated within the contract documentation.

14.2 Dust Monitoring Plan

14.2.1 Monitoring of Meteorological Conditions

The site manager will use the Meteorological Office weather forecast to predict weather conditions such as prolonged dry, hot spells, which may give rise to high levels of dust, and ensure the necessary precautionary measures are in place.

14.2.1 Visual Monitoring

All personnel employed on site will undertake visual monitoring for dust throughout the working day. Any problem that is observed will be reported to the site manager (or the next level of management if they are unavailable), who will be responsible for investigating the cause and implementing any necessary remedial action.

14.2.2 Quantitative Monitoring

Additional quantitative monitoring at the landfilling area, the installation boundary or at sensitive receptors will only be carried out in circumstances where complaints have been received, corrective action has not resolved the problem, and where such monitoring will assist in determining the source/cause and what further action may be appropriate.

14.3 Dust Action Plan

If significant volumes of dust are being noted at the installation during routine visual monitoring, the following action will be taken:

14.3.1 Dust Generation during Vehicle Movements

- Take action to ensure that vehicles are obeying the speed limits;
- Organise additional road sweeping; and
- Consider erecting static water sprays in strategic locations.

14.3.2 Dust Generation during Waste Emplacement and Covering

- Establish cause of emissions;
- If problem is caused by a particular waste type, cease accepting the relevant waste until a suitable method statement detailing how the waste will be handled, has been prepared and implemented; and
- If dust is caused by general compaction and covering operations, arrange for area to be sprayed with water.

14.3.3 Dust Generation during Landfill Construction

- Establish cause of the problem and implement revised procedures to minimise emissions. This may involve the use of water sprays during excavation activities or the temporary relocation of work away from receptors pending a change in wind direction or other weather conditions.

14.3.4 Records

A record relating to the management and monitoring of dust will be maintained. It will include the following details: -

- A record of all dust events including date, time, and cause of the problem;
- A record of all complaints; and
- Details on the corrective action taken and any subsequent changes to operational procedures.

15.0 ODOUR MANAGEMENT AND MONITORING

15.1 Introduction

The main sources of odours at waste management facilities are likely to arise from the following: -

- Biodegradable waste that has been stored for significant periods prior to delivery e.g. wastes from transfer stations;
- Malodorous waste, e.g. animal processing wastes;
- Old waste, which is partially degraded, and is disturbed by digging or drilling;
- Landfill gas and leachate, containing compounds with low odour thresholds, e.g. organo-sulphur compounds, aromatic hydrocarbons, esters and carboxylic acids; and
- Restoration activities involving the spreading of agricultural or sewage sludges.

This procedure describes the techniques and measures that will be adopted to minimise the escape of odorous emissions from the installation.

15.2 Risk Assessment

The measures necessary to control odour have been considered in the context of the installation setting and the proposed operations that will be carried out.

Those waste streams that represent a high risk in respect of odour have been identified as follows: -

- Animal and plant tissue waste;
- Fleshings and lime split waste;
- Sludges from on-site effluent treatment;
- Organic matter from natural products (for example grease, wax);
- Sludges from physico/chemical treatment;
- Screenings;
- Edible oil and fat, including grease and oil mixture from oil/water separation containing only edible oil and fats;
- Solid waste from primary filtration and screenings;
- Septic tank sludge and waste from sewage cleaning;
- Non-composted fraction of animal, vegetable, municipal and similar waste;
- Off-specification compost;
- Materials unsuitable for consumption or processing;
- Biodegradable waste, including kitchen and canteen waste;
- Street-cleaning residues and detergents;
- Mixed municipal waste, including waste from markets;
- De-inking sludges from paper recycling ;
- Sludges from on-site effluent treatment;
- Absorbents, filter materials, wiping cloths and protective clothing;
- Solid wastes and sludges from soil remediation, including dredging spoil;
- Sludges from treatment of urban waste water and water clarification;

- Sludges from biological and other treatment of industrial waste water;
- Sludges from washing, cleaning, peeling, centrifuging and separation; and
- Waste from washing, cleaning and mechanical reduction of raw materials.

As a result, an odour management plan has been developed for the installation to ensure that the risk from these hazards is tolerable. The management plan will be implemented to ensure action is related to the meteorological conditions and the location of sensitive receptors.

15.3 Operational Measures

15.3.1 Management Responsibility

The site manager will have responsibility for ensuring that nuisances and hazards arising from the installation due to odour are minimised.

15.3.2 Liaison with Neighbours

If at any time an action that is likely to cause temporary odour is being considered e.g. application of sewage sludge for restoration, then before such action is taken the area manager or operations manager will be informed. Neighbours who may be affected will be contacted in advance to advise them of the operation being undertaken, and that any odour will be of a temporary nature.

15.3.3 Waste Storage and Transport

For biodegradable potentially odorous waste, the site manager will liaise with the waste producers and transport contractors, with a view to minimising the storage and transport periods for waste being delivered to the site.

15.3.4 Installation Trials

Activities which are known to present a potential odour risk, e.g. the spreading of sewage sludge for restoration purposes, will only be undertaken after small scale trials have been carried out to assess the odour impact, and will only be undertaken when the prevailing wind direction is away from sensitive receptors.

15.3.5 Location of Gas and Leachate Infrastructure

As far as possible gas and leachate infrastructure will not be located in close proximity to sensitive receptors.

15.3.6 Plant and Equipment

Sufficient plant and equipment will be maintained at the landfilling area to ensure that all delivered waste can be adequately and progressively placed, compacted and covered.

These operational procedures will ensure that only a small area of waste is exposed at any one time, thereby minimising the risk of odour emissions from imported waste.

15.3.7 Provision of Cover Materials

The site manager will ensure that adequate supplies of daily and intermediate cover material are available at the installation.

15.3.8 Compaction of Waste

The process of progressively compacting the waste during the day using mobile compaction equipment will assist in the prevention of odours.

15.3.9 Application of Daily and Intermediate Cover

A layer of cover material will be applied to deposited waste at the end of the working day and this will assist in controlling odour from recently deposited waste.

The application of additional intermediate cover over areas where landfilling will be temporarily suspended will provide additional protection.

15.3.10 Progressive Capping of Completed Areas

Completed areas of the installation will be capped promptly.

15.3.11 Avoiding Disturbance to Previously Emplaced Waste

Wherever possible, measures will be taken to ensure that previously emplaced waste is not disturbed, exposed or moved.

In the event that it is excavated, e.g. during the installation of gas and leachate monitoring and extraction wells, it will be removed and buried at the earliest opportunity.

15.3.12 Pre-Booking of Odorous Waste

Wastes identified as being difficult due to their odorous nature, will be required to book in the day before.

15.3.13 Pre-Treatment of Odorous Waste

Discussions will be held with the producer of the waste, prior to the acceptance of odorous waste at the installation, to ensure pre-treatment of the waste to reduce its odour potential is undertaken prior to delivery.

15.3.14 Disposal of High Odour Risk Waste Streams

The management practices in place at the installation include the pre-vetting of odorous waste and consideration of the distance to sensitive receptors. Therefore, the criteria that will be adopted for the closure of the installation to high risk waste streams are not considered necessary.

The weighbridge operator will advise the plant operatives of the arrival of any high odour risk waste so that appropriate preparations to receive the waste can be made at the operational area.

High odour risk waste will be deposited in front of the working face and will be covered immediately by other non-malodorous waste materials.

15.3.15 Emergency Tipping Area

The criteria for using an emergency tipping area will be dependant upon the height of the landfilling area, its proximity to sensitive receptors, and prevailing weather conditions.

15.3.16 Landfill Gas Management

As filling progresses, a gas extraction system will be installed progressively in the parts of the installation that have been capped and restored.

This active extraction system will be operated during the operational and post closure period. It will be maintained regularly to ensure its continued integrity and will therefore minimise potential odorous emissions caused by the uncontrolled venting of landfill gas.

Gas collected by the extraction system will be flared where practicable or alternatively be utilised in a power generation plant.

15.3.17 Leachate Management

All leachate extraction wells and monitoring points will be provided with a cap to minimise potentially odorous emissions.

15.3.18 Odour Management Sprays

If considered necessary, odour management sprays containing either a masking or neutralising agent may be utilised around sensitive areas of the installation.

However, their use will be monitored closely to ensure their effectiveness and avoid the use of compounds that are considered more offensive than the smell they are being used to mask.

15.4 Monitoring Plan

15.4.1 Monitoring of Meteorological Conditions

Meteorological forecasts and weather conditions (including atmospheric pressure, and wind speed and direction) will be monitored routinely to enable potential odour problems to be predicted and necessary remedial action, such as modifications to the method of working or the use of deodorising sprays, to be implemented.

15.4.2 Regular Inspection/Olfactory Monitoring

All installation personnel will be responsible for reporting any odour problems immediately to the site manager or the next level of management if the manager is not available.

The manager will ensure that regular weekly inspections are made of the installation and its perimeter in order to identify any sources of odour and to establish whether any odours are discernable at the perimeter of the installation. Particular attention will be paid to the active landfilling area, to areas where gas and leachate are actively being managed, and the perimeter of the installation, which is close to sensitive receptors.

In the event that odour is detected at the installation boundary, additional monitoring will be undertaken at the sensitive receptors.

The site manager, his/her appointed deputy, and the environmental monitoring technicians will carry out the odour monitoring. The role of the technicians, who are not based at the installation, will be essentially to confirm the findings of the inspections carried out by installation personnel and thereby minimise the potential impacts of odour fatigue.

15.4.3 Monitoring of Gas System

The integrity of the gas system will also be monitored on a regular basis. This will include checks on gas abstraction rates, integrity of pipework, and other infrastructure.

15.4.4 Air Samples

Collection and analysis of air to determine the nature of any odours will only be undertaken if it is necessary to investigate complaints and to establish the source of odour.

15.5 Action Plan

In the event that odour is found to be causing a problem at the installation, as determined by off-site complaints or during routine on-site monitoring, action will be taken to determine the source, and the following courses of action as detailed below shall be taken.

15.5.1 Malodorous Waste

Acceptance of the specific waste type will be put on hold pending further investigations.

The following actions will be considered: -

- Discuss with the waste producer the possibilities of containing the waste in bags or other receptacles prior to landfill disposal;
- Alter the operational procedures to ensure the waste is immediately buried and covered with other waste;
- Consider the transfer of disposal operations to the emergency tipping area;
- Utilise odour-masking sprays to hide the offensive smell; and
- Terminate the acceptance of the malodorous waste at the installation.

15.5.2 Inadequate Cover or Capping

- Additional cover will be applied to the problem area and if the area is awaiting capping, this will be carried out as soon as practicable; and
- Utilise odour-masking sprays pending completion of remedial work.

15.5.3 Inadequate Gas Control

Remedial action could involve one or more of the following: -

- Installation of additional gas wells;
- A comprehensive audit on the gas system to ensure its integrity and effectiveness;
- Repairs to or replacement of any malfunctioning infrastructure for example pipelines, wellheads, dewatering pots, flare; and
- Utilise odour-masking sprays pending completion of remedial work.

15.5.4 Leachate Wells/Monitoring Points

The following actions will be considered: -

- Additional seals may be applied to problematic wells and monitoring points;
- Alternative methods of leachate pumping and recirculation, which reduce exposure of the leachate to the atmosphere, will be considered; and
- Utilise odour-masking sprays pending completion of remedial work.

15.5.5 Disturbed Waste

Action will be taken to bury the waste or terminate drilling or excavation operations until favourable conditions prevail.

15.5.6 Records

A daily record relating to the management and monitoring of odour will be maintained. It will include the following details: -

- The results of inspections and olfactory monitoring carried out by installation personnel;
- Weather conditions including atmospheric pressure, wind speed and wind direction;
- Problems including date, time, duration, prevailing weather conditions and cause of the problem;
- Complaints received including address of complainant;
- Details of the corrective action taken, and any subsequent changes to operational procedures; and
- An evaluation of the effectiveness of the techniques used.

16.0 DIRT AND MUD MANAGEMENT AND MONITORING

16.1 Introduction

As a result of vehicles having to travel across temporary unsurfaced roads to gain access to operational areas of the installation, there is potential for dirt and mud to be exported from the installation onto surrounding highways and land.

This procedure describes the techniques and measures that will be used to prevent dirt and mud escaping from the installation onto surrounding land.

16.2 Risk Assessment

The measures necessary to control dirt and mud have been considered in the context of the installation setting and the proposed operations that will be carried out.

As a result, a dirt and mud management plan has been developed for the installation to ensure that the risk from these hazards is tolerable. The management plan will be implemented to ensure action is related to the meteorological conditions and the location of sensitive receptors.

16.3 Operational Measures

16.3.1 Management Responsibility

The site manager will have responsibility for ensuring that nuisances and hazards arising from the landfill due to dirt and mud are minimised.

16.3.2 Hard Surfaced Access Road

A hard surfaced access road will be provided from the installation entrance to the wheel wash facilities.

The hard surfaced road will act to minimise the potential for carriage of mud onto the surrounding land and public highways.

16.3.3 Subsidiary Installation Roads

Subsidiary installation roads will be constructed from hardcore or other suitable material to provide sufficient run off for vehicles using the installation prior to the wheel wash facilities.

16.3.4 Wheel Washes

Wheel washes will be provided in the western and eastern quarries waste reception area adjacent to the surfaced road. The wheel washes will be maintained in accordance with the manufacturers instructions, and the water will be recirculated where possible.

All vehicles exiting the installation when deemed necessary by the site manager will use a wheel wash. The use of the equipment will be supervised by a landfill operative

to ensure it is used correctly.

16.3.5 Road Sweeping

A road sweeper will be hired at a minimum of a weekly basis and more frequently if necessary. The sweeper will be used to sweep the main access road, other hard surfaced areas in the installation and the highway outside the installation, to maintain them in a clean condition.

16.4 Monitoring Measures

16.4.1 Daily Inspection

The site manager will ensure that daily inspections are made of the wheel cleaning facilities, the installation road, and the highway outside the installation to ensure the continued effectiveness of the mud prevention measures. In addition, the sensitive receptors identified in the risk assessment will be included within the inspections.

16.5 Action Plan

In the event that mud and dirt is found to be escaping onto surrounding land, public roads, or sensitive receptors, the following action will be taken: -

- Investigations will be made of the cause of the problems;
- Action will be prioritised according to the meteorological conditions and the location of sensitive receptors;
- If appropriate, a road sweeper will be hired to sweep the access road, and the surrounding highway within 24 hours of the problem notification;
- If necessary action will be taken to clean the wheel wash;
- If it is found that vehicles are not using the wheel cleaning equipment correctly, action will be taken to provide additional instruction and supervision; and
- Persistent misuse of the wheel cleaning equipment may lead to the vehicle being banned from using the installation.

Due to the use of hard surfaced access roads, wheel cleaning facilities, and management techniques that will be employed at the installation, it is not envisaged that closure of the installation as a result of mud deposition will be necessary.

16.5.1 Records

A daily record relating to the management and monitoring of mud and dirt will be maintained. It will include the following details: -

- The results of inspections and monitoring carried out by site personnel;
- Problems including date, time, duration, and cause of the problem;
- Complaints received including address of complainant;
- Details on the corrective action taken, and any subsequent changes to operational procedures; and

- An evaluation of the effectiveness of the techniques used.

17.0 LITTER MANAGEMENT AND MONITORING

17.1 Introduction

Litter could be fugitive from the installation under some of the following conditions: -

- Landfilling of waste during high winds;
- Inadequate compaction of the waste;
- Input exceeding plant capability;
- Unsheeted loads; and
- Inadequate or ill positioned litter screens.

17.2 Risk Assessment

The measures necessary to control litter have been considered in the context of the installation setting and the proposed operations that will be carried out.

Those waste streams that represent a high risk in respect of litter have been identified as follows: -

- Mechanically separated rejects from pulping of waste paper and cardboard;
- Waste from sorting of paper and cardboard destined for recycling;
- Waste plastic and plastic packaging;
- Paper and cardboard packaging;
- Wooden packaging;
- Composite packaging;
- Metallic packaging;
- Textile packaging; and
- Mixed municipal waste and waste from markets.

As a result, a litter management plan has been developed for the installation to ensure that the risk from these hazards is tolerable. The management plan will be implemented to ensure action is related to the meteorological conditions and the location of sensitive receptors.

17.3 Operational Measures

17.3.1 Management Responsibility

The site manager will have responsibility for ensuring that nuisances and hazards arising from the landfill due to litter are minimised.

17.3.2 Additional Personnel

If deemed necessary from the inspections and ongoing monitoring of the installation, additional temporary personnel will be employed to collect litter.

17.3.3 Plant and Equipment

Sufficient plant and equipment will be maintained at the landfilling area to ensure that all delivered waste can be adequately and progressively placed, compacted and covered.

17.3.4 Supplies of Litter Fencing

A supply of litter netting and associated materials will be maintained at the installation sufficient to accommodate the erection of fencing round new operational areas and to repair existing litter fencing, as and when required.

17.3.5 Provision of Cover Materials

The site manager will ensure there are adequate supplies of daily and intermediate cover material available at the installation.

17.3.6 Filling Direction and Sequence

When planning the sequence and direction of filling, in order to minimise the escape of litter from operational areas and minimise the impact of any escape that may occur, consideration will be given to the strength and direction of the prevailing wind and the proximity of receptors.

17.3.7 Sheeting of Vehicles

To avoid litter problems on the adjacent highway caused by items falling or being blown from vehicles carrying waste, all vehicles using the installation will be instructed to ensure that their loads are adequately sheeted or otherwise contained.

Should vehicles arrive at the installation unsheeted, the customer may be refused access to the installation. Unsheeted loads would only be accepted in exceptional circumstances.

To avoid the escape of materials from vehicles whilst they are traversing installation roads, they will not be permitted to unsheet (other than for the purposes of waste inspection) other than at the designated unsheeting area, which will be located immediately adjacent to the active landfilling area.

17.3.8 Cleaning of Vehicles

To avoid the escape of residual materials that may be adhered to the waste vehicles after waste discharge, drivers will be instructed to ensure the full discharge of a vehicle, and to examine their vehicles to ensure there is no residual waste, prior to exiting the installation.

17.3.9 Emergency Tipping Area

Wherever practicable and necessary, an emergency tipping area will be provided in a protected and sheltered area of the installation for the receipt of lightweight wastes such as paper when winds are prevalent and potentially problematic.

The criteria that will be used to determine when the emergency tipping area should be used are dependant upon the height and location of the landfilling area with respect to the sensitive receptors.

17.3.10 Compaction of Waste

The process of progressively compacting the waste during the day using mobile compaction equipment will immobilise the waste immediately after deposit and help prevent its escape from the landfilling area.

17.3.11 Daily Covering of Waste

A layer of cover material will be applied to deposited waste at the end of the working day and this will assist in preventing materials escaping from the operational area.

17.3.12 Mobile Litter Screens

Strategically placed mobile litter screens will be provided when necessary, located close to the tipping area or on the nearest downwind crest to minimise escape from the operational area.

17.3.13 Temporary Banks and Bunds

Consideration will be given to the construction of temporary banks and bunds placed immediately adjacent to the operational area to provide an immediate barrier to the migration of litter.

17.3.14 Semi-Permanent/Permanent Litter Fencing

Semi-permanent catch nets will be erected around operational areas prior to landfilling commencing in any phase.

17.3.15 Perimeter Fencing

The fencing that is located around the perimeter of the installation will provide a final barrier to the escape of litter.

17.3.16 Restrictions on Waste Types and Installation Closure

In the event of particularly adverse weather conditions giving rise to litter problems which can only be alleviated by controlling the waste stream, the site manager will liaise with the operations department to divert the waste away from the installation.

In extreme circumstances it may be appropriate to consider closure of the installation

to all wastes. A decision to close the installation will be made in consultation with the regional manager. In these circumstances, regular clients must be advised of closure and alternative installations.

The criteria that will be used to determine closure of the installation to the high litter risk waste streams will depend upon the height and precise location of operations with respect to natural barriers and sensitive receptors.

17.3.17 Containment of High Litter Risk Waste Streams

Waste streams, which are considered to pose a high risk with regard to litter, will be bagged, baled or otherwise treated to ensure that their acceptance does not pose an unacceptable risk.

17.3.18 Litter Collection

Regular and diligent litter collection patrols will be employed as and when required and at least weekly to collect any litter that does escape from operational areas. In the event that litter escapes from the confines of the installation, immediate action will be taken to undertake clean up as soon as practicable.

17.4 Monitoring Techniques

17.4.1 Monitoring of Meteorological Conditions

The site manager will consult with the Meteorological Office weather forecast on a daily basis, in order to be aware of potentially adverse weather conditions and to ensure that the necessary precautionary measures are in place.

17.4.2 Daily Inspection

The site manager will ensure that daily inspections are made of the installation, its perimeter, adjoining roads and properties, and any other sensitive receptors. If necessary clean up will be arranged as soon as possible. Within the installation particular attention will be paid to areas that are prone to accumulations of debris such as ditches, haul roads and water bodies.

17.5 Action Plan

Litter escaping from the deposition area but remaining within the installation boundary will be collected within 7 days and will be returned to the deposition area.

In the event that litter is found to be escaping from the operational areas of the installation, the site manager will consult with the local weather forecast to establish the likely strength and duration of the adverse wind conditions.

Depending upon the current and anticipated severity and duration of the adverse conditions, the following actions will be undertaken and/or considered: -

- Litter picking personnel will be deployed to collect fugitive litter within 24

- hours of its escape from the installation;
- Mobile litter fencing will be deployed to accommodate prevailing wind direction and location of receptors;
- Operations will be transferred to the emergency landfilling area;
- Additional temporary litter picking personnel will be employed if necessary;
- Additional litter fencing will be erected; and
- The installation will be closed to selected waste or in extreme circumstances all waste inputs.

In the event that litter escapes from the installation boundary, immediate action will be taken to organise litter collection and retrieval. Priorities for clearing litter will be related to the meteorological conditions and any sensitive receptors that may be affected.

17.5.1 Records

A daily record relating to the management and monitoring of litter will be maintained. It will include the following details: -

- The results of inspections and monitoring carried out by installation personnel;
- Wind speed and direction;
- Problems including date, time, duration, prevailing weather conditions and cause of the problem;
- Complaints received including address of complainant;
- Corrective action taken;
- Details on the corrective action taken and any subsequent changes to operational procedures; and
- An evaluation of the effectiveness of the techniques used.

18.0 BIRDS, VERMIN AND INSECTS MANAGEMENT

18.1 Introduction

This section describes the techniques and measures that will be used to prevent and control birds, vermin and insects. The main pests that require control at landfill installations are rats and flies, as the waste can provide ideal conditions for the breeding of such species.

18.2 Risk Assessment

The measures necessary to control birds, vermin and insects have been considered in the context of the installation setting and the proposed operations that will be carried out.

Those waste streams that represent a high risk in respect of birds, vermin and insects have been identified as follows: -

- Animal and plant tissue waste;
- Sludges from on-site effluent treatment;
- Organic matter from natural products (for example grease, wax);
- Screenings;
- Waste from desanding;
- Grease and oil mixture from oil/water separation containing only edible oil and fats;
- Solid waste from primary filtration and screenings;
- Septic tank sludge and waste from sewage cleaning;
- Non-composted fraction of municipal or similar waste;
- Off-specification compost;
- Materials unsuitable for consumption or processing;
- Biodegradable waste, including kitchen and canteen waste;
- Edible oil and fat;
- Street-cleaning residues;
- Mixed municipal waste, including waste from markets;
- Sludges from washing, cleaning, peeling, centrifuging and separation; and
- Waste from washing, cleaning and mechanical reduction of raw materials.

As a result, a bird, vermin and insect management plan has been developed for the installation to ensure that the risk from these hazards is tolerable. The management plan will be implemented to ensure action is related to the meteorological conditions and the location of sensitive receptors.

18.3 Operational Techniques

18.3.1 Management Responsibility

The site manager in consultation with the regional manager will have responsibility for ensuring that nuisances and hazards arising from the installation due to birds vermin and insects are minimised.

18.3.2 Plant and Equipment

Sufficient plant and equipment will be maintained at the operational area to ensure that all delivered waste can be adequately and progressively placed, compacted and covered.

These operational procedures will ensure that only a small area of waste is exposed at any one time and that a high waste density is achieved, thereby reducing the opportunities for rats to feed on and shelter within the waste mass, and reduce the probability of flies emerging from eggs present within the waste.

18.3.3 Provision of Cover Materials

The site manager will ensure there are adequate supplies of daily and intermediate cover material available at the installation.

18.3.4 High Risk Waste Streams

For those waste streams that have been identified as a high risk within the risk assessment, the following additional measures will be taken: -

- Prior to acceptance of the waste at the installation, the producer of the waste will be contacted to ensure all practicable measures are taken prior to delivery to minimise the risk associated with birds, vermin and flies; and
- In the event of problems developing, raised either by complaints or as monitored by installation staff, which cannot be remedied by immediate action, the installation will cease to accept the problematic waste stream until further measures have been agreed with the producer to prevent problems from re-occurring.

18.3.5 Restricted Operational Area

The installation will be operated in a cellular manner, with operations being restricted to a relatively small area. This factor combined with the high levels of operational activity within this area will serve to discourage birds and other scavengers from the installation.

18.3.6 Compaction of Waste

The process of progressively compacting the waste during the day using mobile compaction equipment will minimise the risk of infestation by vermin and insects.

18.3.7 Application of Daily and Intermediate Cover

A layer of cover material will be applied to deposited waste at the end of the working day and this will assist in preventing vermin and insect infestation and scavenging by birds.

The application of additional intermediate cover over areas where landfilling will be temporarily suspended will provide additional protection, particularly against birds that are liable to scavenge through daily cover materials.

18.3.8 Capping of Completed Areas

Completed areas of the installation will be capped promptly, and this will provide further protection against pest infestation and scavenging.

18.3.9 Avoiding Disturbance to Previously Emplaced Waste

Wherever possible, measures will be taken to ensure that previously emplaced waste is not disturbed, exposed or moved.

18.3.10 Bird Abatement Techniques

In the event that scavenging birds give rise to problems at the installation bird abatement techniques will be considered

Selection of the most appropriate technique/s will be dependant upon a number of factors e.g. preference will be given to passive techniques to minimise disturbance to neighbours. Consideration will be given to the presence of protected bird species in the vicinity of the installation, prior to utilising falconry/birds of prey. Techniques can also be rendered ineffective due to habituation and therefore a combination of different techniques will be used to ensure their individual effectiveness.

18.4 Monitoring Techniques

18.4.1 Regular Inspection

The site manager will ensure that regular weekly inspections are made of the installation, for visual evidence of infestation by birds, vermin and insects. Particular attention will be paid to operational areas where the presence of recently deposited waste is likely to attract birds and vermin. Sewers, culverts and drains that are considered to be vulnerable areas, will be included within the scope of the inspections. Locations in close proximity to the identified receptors will also be prioritised.

Active baiting will also be undertaken at strategic locations around the installation, and the baiting sites will be examined during the regular inspections.

In the event that problems are identified, action will be taken to remedy the problem as outlined in the birds, vermin and insect action plan.

18.4.2 Specialist Contractor

A specialist pest control contractor will inspect the installation at quarterly intervals. The contractor will be responsible for carrying out any necessary remedial action to address any identified problems with respect to vermin or insects. The contractor will also be available on call out to respond to any problems identified during the regular inspections carried out by installation personnel.

The specialist contractor will have all necessary permits, training and protective clothing that may be necessary to ensure the work is carried out in a safe manner.

18.5 Action Plan

In the event that birds, vermin or insects are found to be scavenging from or infesting the installation, and causing annoyance either within the installation, or complaints are received from outside the installation, the following action will be taken within 24 hours.

18.5.1 Birds

Taking into account the severity of the problem, the proximity of receptors and whether any complaints have been received, the site manager will determine the most appropriate technique/s to adopt.

Remedial action will be taken without delay, and the effectiveness of the techniques will be kept under review and appropriate modifications implemented, if required.

18.5.2 Vermin and Insects

If problems are detected during the routine inspections of the installation, appropriate remedial action will be taken within 24 hours. This may involve the application of insecticide spray at the working area by suitably trained staff using either backpacks or tractor mounted sprayers. Precautions will be taken to ensure that the insecticide is applied in a manner that will avoid contamination of surface water runoff or leachate collection systems.

In the event that remedial action does not successfully mitigate the problems and complaints continue to be received, consideration will be given to closing the installation to the problematic waste stream.

18.5.3 *Records*

A record relating to the management and monitoring of birds, vermin and insects will be maintained. It will include the following details: -

- Inspections carried out by installation personnel;
- Problems including date, time, and cause of the problem;
- Complaints;
- Visits by the specialist pest control contractor;
- Details on the corrective action taken, and any subsequent changes to operational procedures; and
- The effectiveness of bird control techniques.

19.0 NOISE AND VIBRATION

19.1 Introduction

Owing to the nature of the operations carried out at the installation, there will be emissions of noise from the installation. The main sources of noise are considered to be as follows: -

- Vehicles using the installation;
- Reversing beepers;
- Mobile plant, e.g. excavators, compactors, bulldozers, dump trucks;
- Fixed plant, e.g. pumps, generators, gas flares, leachate treatment equipment; and
- Audible bird scaring equipment.

The generation of vibration as a result of operations at the installation should not be significant.

This procedure outlines the management techniques that will be used at the installation to minimise emissions of noise.

19.2 Risk Assessment

The measures necessary to control noise have been considered in the context of the installation setting, the proximity of sensitive receptors and the proposed operations that will be carried out.

As a result, a noise management plan has been developed for the installation to ensure that the risk from these hazards is tolerable. The management plan will be implemented to ensure action is related to the location of sensitive receptors.

19.3 Operational Techniques

19.3.1 Management Responsibility

The site manager will have responsibility for ensuring that nuisances and hazards arising from the landfill due to noise are minimised.

19.3.2 Liaison with Neighbours

Regular liaison will be maintained with neighbours to ensure they are notified in advance of activities, which may give rise to increased noise levels.

19.3.3 Training

All installation personnel will be trained in the need to minimise installation noise, and will be responsible for monitoring and reporting excessive noise when carrying out their everyday roles.

19.3.4 Operational Hours

In order to minimise disturbance to neighbours, waste disposal operations involving the use of mobile plant and equipment and the importation of waste will not be carried on outside permitted operational hours.

19.3.5 Engineering Works

Contract documentation governing engineering works will incorporate specific responsibility for minimising emissions of noise during the work.

19.3.6 Noise Suppression Equipment

Consideration will be given to the fitting of noise suppression kits on items of plant and equipment.

19.3.7 Selection of Plant and Equipment

During the selection process for new plant and equipment, consideration will be given to the need to meet all legislation and standards on noise levels and to minimise levels of noise from selected equipment.

If older items of plant are found to give rise to unacceptable noise levels, consideration will be given to their replacement with quieter designs.

19.3.8 Siting of Plant and Equipment

When siting noisy equipment consideration will be given to the proximity of receptors and also the prevailing wind direction.

19.3.9 Maintenance of Plant and Equipment

All plant and equipment in use at the installation will be regularly maintained to minimise noise resulting from inefficient operation of pumps, generators and engines.

19.3.10 Modification to Plant and Equipment

If an item of plant is found to generate unacceptable noise levels, consideration will be given to modifying the equipment to incorporate noise suppression equipment.

19.3.11 Reversing Alarms

In the event that reversing alarms are found to give rise to complaints, alternative alarms or technology will be investigated.

19.3.12 Sound Barriers

If noise levels are unacceptable in the vicinity of receptors, sound bunds and barriers may be constructed around operational areas and acoustic screening erected around fixed plant. For temporary plant, portable acoustic screens or straw bale, enclosures will be considered if necessary.

19.3.13 Speed Limits

The imposition of a speed limit of 20 km/h for vehicles delivering waste to the installation will reduce noise associated with high engine speeds.

19.3.14 Vehicle Circulation Routes

Vehicles using the installation will travel across designated routes that have been designed and located so as to minimise nuisance and hazard to both internal installation users and, receptors located outside the installation boundary.

19.3.15 Road Maintenance

The regular maintenance of roads to prevent the development of potholes will significantly reduce the noise generated particularly by empty vehicles exiting the installation.

19.3.16 Audible Bird Scaring Equipment

Preference will be given to the use of passive methods of bird control. However, in the event it is found necessary to utilise audible techniques they will be located and operated so as to minimise the impacts of the noise.

19.4 Monitoring Techniques

19.4.1 Monitoring of Meteorological Conditions

Wind speed and direction will be routinely monitored and in certain circumstances i.e. when landfilling close to receptors, this will enable potential noise problems to be predicted and necessary remedial action, such as modifications to the method of working, to be planned and implemented.

19.4.2 Regular Inspection/Monitoring

The site manager will ensure that regular inspections are made of the installation and its perimeter in order to identify any unacceptable or unexpected sources of noise and to establish whether noise is discernable at the perimeter of the installation. Particular attention will be paid to the active landfilling area, to areas where gas and leachate is actively being managed and the perimeter of the installation, which is close to sensitive receptors.

19.4.3 Quantitative Noise Monitoring

Quantitative noise monitoring will be carried out if it is identified that problems are being caused and to demonstrate conformance with any noise levels imposed by the planning consent. The monitoring will be carried out either within the installation at the noise source, on the boundary of the installation, or at specific receptor locations. The monitoring will be carried out using an integrated sound level meter, at sensitive locations around the perimeter of the installation. The monitoring will be carried out in agreement with MEPA.

19.5 Action Plan

If a noise problem is noticed or a complaint received by installation personnel, it will be immediately reported to the site manager or the next level of management if they are unavailable. The source of the problem will then be investigated and appropriate corrective action will be taken.

In the event that noise derived from the site is perceived beyond the installation boundary and gives rise to complaints, action will be taken without delay. The remedial action will be related to the meteorological conditions and the high sensitivity receptors. The following remedial action may be appropriate: -

- Relocate landfilling operations pending change in wind direction;
- Relocate plant and equipment to less sensitive locations;
- Construct or erect acoustic bunds, barriers or screens;
- Replace noisy plant and equipment with quieter models;
- Undertake maintenance on equipment that will reduce noise levels; and
- Modify plant to incorporate noise suppression equipment.

19.5.1 Records

A record relating to the management and monitoring of noise will be maintained. It will include the following details: -

- The results of inspections and monitoring carried out by installation personnel;
- Wind speed and direction;
- Problems including date, time, duration, prevailing weather conditions and cause of the problem;
- Complaints received including address of complainant;
- Details on the corrective action taken, and any subsequent changes to operational procedures; and
- An evaluation of the effectiveness of the techniques used.

20.0 RAW AND AUXILIARY MATERIALS

20.1 Introduction

This section describes the selection and minimisation of the raw and auxiliary materials that are used in the operation of the installation.

20.2 Principal Raw Materials

20.2.1 *Engineering Materials*

The primary materials that will be used to engineer the installation are as follows: -

- Geo-synthetic Clay Liner (GCL) as a low permeable mineral liner ($k=1 \times 10^{-11}$ m/s)
- High density polyethylene (HDPE) for the basal and sidewall lining systems;
- layer of shredded tyres as a drainage and protection bedding
- Geotextile to protect HDPE basal liner;
- Geotextile for leachate/surface water filtration & separation
- Gravel for leachate drainage blanket;
- Concrete and/or tarmacadam and associated materials for construction of main access road and hard standing areas;
- Aggregate for construction and maintenance of installation roads; and
- High and medium density polyethylene for construction of leachate drains, landfill gas pipelines, well components and monitoring installations.
- enriched composting material for top soil re-cultivation

The use of these specific materials will be a requirement of the permit, and their primary role will be to protect the environment. The quantity of material to be used will also be a requirement of the permit. They are considered to be fundamentally inert and therefore their environmental impact is considered negligible. The consideration of alternatives is not therefore appropriate or necessary.

20.2.2 *Fuels*

Fuels utilised at the installation will include: -

- Gas oil/diesel; and
- Lubricating oils.

The use of fuels at the installation will be optimised through an annual review and inventory of energy use.

Specific fuels to be used will be those recommended by the plant manufacturer, bearing in mind the need to minimise environmental impacts.

20.2.3 *Amenity Control Chemicals*

A number of chemicals may be used at the installation, which will primarily be associated with control of amenity impacts, these will possibly include: -

- Pesticides to control insect and vermin infestation;
- Herbicide for amenity management; and
- Odour control chemicals.

The compounds to be used will be as recommended by specialist suppliers, in order to optimise the effectiveness of the treatment and the biodegradability of the selected materials.

The quantity of such chemicals will be the minimum necessary to achieve successful control of amenity impacts.

20.2.4 *Process Control Chemicals*

Successful operation of the leachate treatment plant may require the use of additives to optimise the treatment process, these may include: -

- Alkali for pH adjustment;
- Phosphorous for nutrient addition; and
- Anti foaming additives.

The quantity of such materials will be dependant upon the composition of the leachate that requires treatment, and the necessary quality of the final effluent.

The materials to be used will be those recommended by the designer of the treatment facility. In addition to the effectiveness of the compounds, their potential impact on receiving waters, and their biodegradability will also be considered.

20.3 *Material Inventory*

A full inventory of materials used at the installation will be available from the following sources.

20.3.1 *Control of Substances Hazardous to Health (COSHH) Records*

This document will contain details of all those substances used at the installation, which are considered to present a hazard to health. It will contain product safety data sheets, which will include details of the chemical composition of the chemicals, the associated hazards and recommended measures to control exposure.

20.3.2 *Construction Quality Assurance Reports*

The construction quality assurance reports will contain details on all the engineering materials, which were utilised during the construction of the various elements of the installation, including where applicable chemical composition and quantities used.

20.4 Material Selection

20.4.1 Engineering Materials

Selection of engineering materials will be governed primarily by the quality assurance requirements to ensure long term performance and protection of the environment.

Where prescriptive quality assurance and performance specifications do not apply, e.g. in the construction of temporary installation roads, the use of recycled materials will be optimised.

20.4.2 Fuel

All fuels used at the installation will conform to relevant standards on polluting emissions.

20.4.3 Amenity and Process Control Chemicals

Wherever possible materials will be selected that will minimise the impact of the activities on the environment. Consideration will be given to such factors as degradability, bioaccumulation potential and toxicity.

20.4.4 Substitution Principle

Alternative raw materials will be evaluated for their environmental impact and where there is no overriding quality requirement, substitution will be considered.

20.4.5 Product Awareness

The ongoing programme of professional and technical development for all installation personnel will ensure awareness of new developments in product availability and their implications.

20.5 Material Input Minimisation

20.5.1 Raw and Auxiliary Material Minimisation

As the majority of raw and auxiliary materials used at the installation are required to minimise the impact of the activities on the environment, any attempts to minimise their use may compromise the control and abatement systems and may not be appropriate. However wherever possible and where such systems will not be compromised, alternative materials will be considered, e.g. the use of suitable inert waste for the construction of installation roads.

20.5.2 Review Procedure

In order to ensure the use of raw materials is evaluated, raw material use will be reviewed on an annual basis. The review will consider any opportunities for reduction in use and will provide an action plan for improvements.

21.0 ENERGY

21.1 Introduction

The waste management sector is not considered to be a significant energy user and therefore the opportunity for significant energy efficiency is limited. However, the following section provides details on the proposed measures for energy efficiency that will be adopted at the installation.

21.2 Energy Consumption Audit

In order to optimise the efficiency of energy usage at the installation, an audit of energy usage will be undertaken on an annual basis. This will provide a breakdown of energy consumption at the installation.

The audit will identify energy use by source for the different installation operations. Sources of energy to be evaluated will include electricity and diesel.

The results of the audit will be evaluated and used to identify potential measures for improving energy efficiency.

21.3 Energy Efficiency Plan

21.3.1 Plant and Equipment Selection

The selection process for new plant and equipment will include an evaluation of its energy efficiency.

21.3.2 Maintenance

All plant and equipment in use at the installation will be subject to regular maintenance to ensure they continue to operate at optimum energy efficiency, and that fuel consumption does not increase due to inefficient engine performance.

A record of fuel consumption will be maintained and will be used to identify the need for unplanned maintenance. These records will also be reviewed as part of the annual energy consumption audit.

21.3.3 Insulation and Containment Measures

The installation control office will incorporate insulation and other design features such as self-closing doors and energy efficient lighting systems that will minimise heat loss and electricity usage, and therefore reduce energy consumption.

21.3.4 Training in Energy Efficient Practices and Housekeeping

All staff employed at the installation will undergo awareness training in energy efficient practices such as the need to ensure electric lights are not left switched on when they are not required, and the engines of mobile plant are not left running when not in use.

21.3.5 Indirect Consumption

Measures will be taken to minimise indirect energy consumption by optimising the use of vehicles delivering and removing materials from the installation.

21.3.6 Landfill Gas Utilisation

Where viable, recoverable landfill gas generated at the installation together with gas collected through the rehabilitation of the former Maghtab waste deposit site will be used for power generation; therefore the installation will in these circumstances become a net producer of energy.

22.0 ACCIDENTS AND THEIR CONSEQUENCES

22.1 Introduction

This section considers those aspects of the installation operations that may pose a risk of accidents that may have environmental consequences.

The following categories of potential hazard/accident have been identified as being relevant to the installation: -

- Flood;
- Fire;
- Explosion;
- Major breach of installation liner; and
- Spillage and leakage.

Action plans have been devised for each potential identifiable accident scenario.

22.2 Flood

Given the elevation of the site, the installation is not located within a flood plain area. It is therefore considered that the likelihood of the installation flooding is low.

Notwithstanding this, if appropriate, perimeter ditches will be installed around the perimeter of the installation to intercept water from surrounding higher land, and divert it away from the installation.

As part of the surface water risk assessment, run off calculations have been carried out to determine the appropriate size for attenuation lagoons to prevent flooding of adjacent land.

22.2.1 Action Plan

In the event of flooding, the following action may be taken: -

- If the installation is in imminent danger of flooding or a flood alert has been issued, all electrical supplies in the affected area will be isolated;
- If possible all stocks of chemicals and fuel will be removed from the at risk area;
- All leachate collection systems at risk will be isolated and sealed off;
- All plant will be removed from the area at risk;
- If spillage has occurred, MEPA will be contacted immediately, and action will be taken to contain the spill using appropriate equipment, such as oil absorbent booms;
- If the spillage cannot be contained, senior management will be contacted and specialist help will be obtained;
- Personnel will not attempt to enter a flooded area until a risk assessment has been undertaken or the flood has subsided; and
- Personnel will follow instructions issued by supervisors, managers or other

competent persons.

Samples of floodwater will be obtained to determine whether it is contaminated. If the floodwater is not contaminated, it will be pumped to surface water. If contamination is shown to be present, MEPA will be consulted before removal.

Following remedial action to clear the floodwater, an approved contractor will check all affected electrical supplies.

22.3 Fire

Waste management installations can represent a potential fire risk for a number of reasons: -

- Installation buildings contain electrical appliances and other sources of ignition along with materials that would readily burn;
- Many waste materials that are delivered to the installation will support combustion;
- Some loads are liable to be delivered in a hot condition;
- Maintenance activities on plant and equipment can represent a potential fire risk if necessary precautions are not taken; and
- Underground fires, due to smouldering loads or spontaneous combustion have been known to occur at landfill installations.

22.3.1 Management Responsibility

The site manager will have responsibility for ensuring that nuisances and hazards arising from the landfill due to fire are minimised.

22.3.2 Training

All employees will undergo training relevant to their role in fire prevention, use of fire extinguishers, and emergency procedures.

22.3.3 Smoking Policy

Smoking will only be permitted at designated areas and specifically not at the operational areas on the installation.

22.3.4 Fire Protection Equipment

Where appropriate plant will be fitted with automated fire protection equipment.

22.3.5 Hot Work Permitting System

A formal permit to work system will be in place to ensure appropriate precautions are taken and approval obtained prior to any hot work being carried out on installation plant and equipment.

22.3.6 Acceptance of Hot Loads

A number of waste streams have the potential to arrive at the installation in a hot condition and can therefore present a potential fire risk. Typical examples are foundry sand, slags from smelting works and loads that have previously been on fire.

All potentially hot loads will be identified on arrival at the installation, and will be subject to quarantine procedures.

22.3.7 Quarantine Bay

Hot loads identified by the weighbridge operator will be placed in a quarantine area and monitored until such time as they no longer present a potential fire risk, after which they will be landfilled.

22.3.8 Fire Fighting Equipment

Fire extinguishers will be provided in the installation buildings and will be used if it is appropriate and safe to do so, in the event that fire is discovered in the building.

22.3.9 Landfill Gas Management System

The landfill gas management system will be monitored regularly and adjusted where necessary to ensure that air is not entering the system.

22.3.10 Smoke and Fire Alarms

Smoke and fire alarms will be fitted in the installation offices.

22.3.11 Monitoring

All operatives will remain vigilant regarding the breakout of fire at the site, and the emergency procedure and action plan outlined below will be followed if fire is observed.

Monitoring for underground fires will be routinely carried out during the regular monitoring of the landfill gas management system.

22.3.12 Fire Action Plan

Fire within Installation Buildings

The following courses of action will be taken if a fire is discovered within an installation buildings: -

- The person discovering the fire will raise the alarm and evacuate and isolate the area;
- The site manager will be contacted immediately;
- If the fire can be controlled without endangering personnel, appropriate fire extinguishers or other fire fighting equipment i.e. fire suppression equipment

- on plant, will be used;
- If the fire cannot be safely tackled using appropriate fire extinguishers the emergency services will be notified;
- If it is safe to do so, all electrical supplies will be isolated and made safe in the area of the fire;
- If necessary the site manager will inform the weighbridge to prevent further entry of vehicles into the installation;
- The site manager or his deputy will check for all visitors, contractors and staff to ensure everyone is accounted for;
- The site manager or his deputy will direct the emergency services to any casualties;
- The site manager will send a report of the incident to the operations manager and MEPA;
- All used fire extinguishers will be returned to the supplier for refilling or replacement; and
- All personnel will follow instructions provided by managers or other competent person.

Fire at the Operational Area

In the event of fire discovered in the operational area the following actions will be taken: -

- The site manager and MEPA will be informed immediately;
- If deemed necessary by the site manager, the Emergency Services will be called;
- All tipping operations will be suspended and all vehicles in the vicinity of the fire will be evacuated if it is safe to do so;
- Using available mobile plant with a bucket or blade the fire will be smothered with inert material working from the outside edge of the fire towards the centre;
- A second machine and operator will be available on standby;
- Under no circumstances will a machine be driven into the centre of a fire, as this will endanger both driver and machine;
- If the fire continues to burn below the surface, the burning material will be isolated by digging it out and spreading it on top of inert material, after which it will again be smothered;
- The site manager or his deputy will check for all visitors, contractors and staff to ensure everyone is accounted for;
- The site manager or his deputy will direct the emergency services to any casualties;
- The site manager will send a report of the incident to the operations manager and MEPA; and
- The area will continue to be monitored to ensure that all burning material has been fully and permanently extinguished.

In addition to the above steps, any gas extraction in the area will be isolated to prevent oxygen being pulled into the waste mass.

Underground Fire

In the event that an underground fire is suspected, the following possible courses of action will be considered in consultation with MEPA: -

- Excavation of the burning material;
- Turning off gas extraction wells in the vicinity of the fire;
- Ensuring all leachate extraction wells are sealed to prevent oxygen entering the installation; and
- Discharge of water or leachate via boreholes or wells constructed to the appropriate depth.

Records

A fire log will be maintained. It will include the following details: -

- Records of the maintenance of fire extinguishers;
- A record of all incidents of fire including date, time, nature and cause of the fire; and
- Details on the action taken to extinguish the fire, and any subsequent changes to operational and emergency procedures.

MEPA will be advised of all incidents of fire as soon as practicable.

22.4 Explosion

22.4.1 Gas Extraction System

The main risk of explosion at the installation is associated with the operation of the landfill gas collection and extraction system.

A continuous monitoring and recording system will be installed in all sensitive areas. Special attention will be given to the enclosed areas where possible human presence is envisaged.

The system will be able to produce audible alarm when explosion level of gas is reached.

The gas system will be designed to meet all relevant Construction Standards. The plant will contain explosion prevention features and the cable and connection standards will be to appropriate certified standards.

In the event of an explosion, the action taken by installation personnel would be the same as that taken in the event of fire.

22.4.2 Explosive Waste Materials

Action Plan

In the event that explosive materials are discovered within the waste or in a skip, the following action would be taken: -

- Evacuate area and keep clear;
- Contact emergency services and state nature of emergency;
- Follow all instructions given; and
- Contact supervisor/line manager immediately.

22.5 Major Breach of Installation Liner

22.5.1 Stability Risk Assessment

A major breach of the installation liner could be caused by instability of the substrata, or of the engineered lining system.

The stability of both these elements has been assessed in a quantitative manner in the stability risk assessment (Document Reference ZWR 01/04), and all necessary precautions incorporated within the design of the installation to ensure that the risk of a breach in the lining system as a result of instability in the substrata or the engineered lining system is low.

22.5.2 Monitoring

Notwithstanding this, visual inspection will be carried out on a weekly basis for evidence of the following: -

- Evidence of cracks in temporary waste slopes caused by movement of the waste mass;
- Evidence of instability or movement in the lining system;
- Evidence of differential settlement causing depressions in the restored landform, cracks in the capping system, or damage to the drainage system; and
- Evidence of sudden drop in leachate levels.

Topographical surveys will be carried out at annual intervals to monitor the following aspects: -

- Settlement of the waste mass (to monitor settlement against design assumptions); and
- Stability of temporary and permanent slopes (to identify any requirements for remedial action and/or revisions to design for future phases).

22.5.3 Action Plan

In the event that stability or settlement problems are discovered, appropriate remedial action will be taken as detailed below: -

Liner Breach

- Leachate will be pumped from the affected sub-phase to minimise heads;
- The liner will be inspected by an independent engineer to assess the need for any remedial action, which will be agreed with MEPA; and

- Revisions to liner design to provide additional resistance to slippage or damage will be considered for future phases and agreed with MEPA.

Instability of Waste Mass

If there is visual evidence of movement within the waste mass, or evidence from the regular topographical surveys, an independent engineer will review the situation, and appropriate remedial action will be taken in agreement with MEPA.

The action taken will depend upon the severity of the movement, the timescales over which the unstable mass will remain unsupported and the consequences of failure.

Action taken may include one or more of the following: -

- The situation will continue to be monitored through regular visual inspections and topographical surveys;
- Prohibit operations at the base of the slope, which may place operatives at potential risk;
- Adjustment to phasing of landfill operations to provide additional support to the waste mass as soon as possible;
- Engineering work to reduce the gradient of the slope and reduce the risk of failure; and
- Revised design for future phases to reduce slope gradients and/or height of slopes and reduce time period over which temporary slopes remain unprotected.

Differential Settlement

Remedial action taken will depend upon the severity of the differential settlement and whether it has affected the integrity of the cap, and may include some or all of the following actions: -

- Surcharging affected areas with additional restoration soils to produce a landform with appropriate falls;
- Localised removal of capping layers, surcharging with waste or soils, and replacement of cap under appropriate CQA procedures;
- Replacement of drainage channels to ensure continued integrity of surface water drainage; and
- Review of design to accommodate predicted differential settlement by locally strengthening cap, providing additional thickness of capping materials, or incorporating irregular edges and boundaries to compensate for predicted settlement differentials.

Records

Records will be maintained as follows: -

- The results of visual inspections and topographical surveys;

- Stability problems including date, nature and suspected cause of the problem; and
- Details on the corrective action taken, and any subsequent changes to installation design or operational procedures.

22.6 Spillage and Leakage

Spillage and leakage can occur during refuelling of vehicles, fuel deliveries, vehicle servicing, vehicle breakdowns, accidents and/or damage to tanks and bunds.

In order to prevent spillages and leaks of potentially polluting materials and minimise the impact of any spillages that do occur, the following measures will be implemented at the installation.

22.6.1 Unloading Procedure

All polluting materials delivered to site will be unloaded by suitably qualified employees from the delivery company, and overseen by a designated installation operative.

22.6.2 Storage Vessels

All potentially polluting materials shall be stored within tanks constructed to, meet the required pollution control standards.

22.6.3 Bunding

All storage tanks will be located within an area bunded to contain 110% of the volume of the largest vessel contained within the bund, or 25% of the aggregated total capacity, whichever is the greater.

22.6.4 Inspection

All bunded tanks will be inspected at regular intervals by the site manager or his/her designated deputy to ensure the continued integrity of the tanks, and identify the requirement for any remedial action.

Any minor spillages or rainwater that has accumulated within the bund will be removed at regular intervals to ensure the capacity of the bund is maintained.

22.6.5 Absorbent Materials

A supply of materials suitable for absorbing and containing any minor spillage will be maintained at the installation.

Suitable materials include the following: -

- Sand and earth;
- Proprietary absorbants; and
- Sealing.

22.6.6 Spill Containment Equipment

Materials suitable for containing spills including sealing devices and substances for damaged containers, drain seals and booms, and overdrums will be maintained at the installation.

22.6.7 Leachate Treatment Plant

Any leachate treatment plant will be designed to minimise the risk of spillage and leakage and will incorporate the following features: -

- Engineered containment system;
- Level controls within storage and treatment vessels; and
- Visual alarms.

Full details on the design of the plant, including measures to prevent spillage and leakage will be supplied to MEPA in advance of construction.

22.6.8 Monitoring Techniques

All installation personnel will be tasked with monitoring for evidence of spillage and leakage, during their day-to-day routine. The condition of bunds and tanks will also be inspected on a daily basis.

Any evidence of spillage or leakage will be reported to the site manager or his deputy for appropriate remedial action

22.6.9 Leaks and Spillage Action Plan

In the event of spillage of polluting materials, immediate action will be taken to contain the spillage.

The spillage will be reported to the site manager, who will assess the situation and decide on the most appropriate course of action.

The action taken will depend upon the size of the spillage, the location of the spillage in relation to sensitive receptors and the nature of the spilled material.

Action taken may include some or all of the following: -

- If possible the leak will be stopped;
- If it safe to do so, the cause of the spill or leak will be isolated, and/or moved to a bunded area;
- If the spillage is small, spill granules will be used immediately to prevent the spill spreading. The area will be cleared and all contaminated material will be sent to an appropriately licenced site for disposal;
- If the spill is larger, inert materials such as clay or sand will be used to make a containment bund and specialist help will be sought to assist in clean up;
- If any spillage enters a flowing watercourse, MEPA will be contacted immediately, and appropriate action will be taken to contain the spill by using

for example oil absorbent booms;

- If the spillage cannot be contained using approved materials, MEPA and senior management will be contacted immediately and specialist help obtained;
- If a vehicle is found to be leaking, it should be moved to a position where the spillage can be contained i.e. quarantine area, or other hard surfaced area, if it is safe to do so; and
- All personnel will follow instructions provided by managers or other competent person.

23.0 METEOROLOGICAL MONITORING

23.1 Introduction

The monitoring of meteorological conditions will be an important management tool in ensuring the impacts arising from the operations at the installation are minimised. Meteorological data are relevant to interpreting other monitoring data, for instance:

- How representative gas/pollutant measurements are;
- Whether monitoring is being carried out at times of gas ingress or egress which is determined by changes in atmospheric pressure;
- Which sources are contributing to ambient pollution concentrations;
- Emission rates associated with measured ambient concentrations;
- Modelled impacts on downwind receptors; and
- Any special factors causing particular events.

Meteorological data will enable the site manager or his deputy to make a qualitative assessment of the on-site conditions and put in place necessary precautions in order to prevent problems such as aerial emissions beyond the site boundary.

23.2 On-Site Meteorological Station

An integrated weather station will be installed at the facility. This will permit the continual recording of weather conditions with accompanying data analysis and display.

23.3 Meteorological Office Data

In addition to the data obtained from the weather station located at the installation, weather reports will be obtained from the Meteorological Office, which provide a 5 day forecast of weather conditions including pressure movements and surface winds.

Evaporation records can also be obtained from the Meteorological Office if required.

23.4 Monitoring Measurements and Schedules

The determinands that will be measured by the on-site meteorological station are as follows:-

- Temperature (°C);
- Wind speed (mph);
- Wind Direction (0 - 360°);
- Rainfall(mm);
- Barometric Pressure(mb); and
- Humidity(%).

23.5 Data Management and Reporting

The weather station will be linked to a computer, which allows the monitoring data to be displayed and downloaded as required.

The data will be retained at the installation and a back up copy of the data will be kept in the operations department. A summary will be included in the Annual Environmental Monitoring Report.

24.0 LANDFILL BODY MONITORING

Measures will be taken to record the structure and composition of the landfill body as detailed below.

24.1 Structure and Composition

The structure and composition of the landfill body will be recorded on at least an annual basis and will include the following aspects.

24.1.1 Surface Occupied by Waste

The surface area of the landfill, which is covered by waste, will be measured and recorded.

24.1.2 Waste Levels

Waste levels will be measured to monitor the progress of landfilling in active sub-phases, and ensure landfilling is undertaken to the approved restoration profile.

24.1.3 Volume and Composition of Waste

The survey of the site and the waste input records for the installation will be used to determine the volume of waste present within the installation, and the overall composition of the waste in respect to the different waste categories which are permitted.

24.1.4 Methods of Depositing

Plant and equipment used to deposit waste, and methods used, including number of passes of compaction plant, height of waste lifts, and depths of cover, will be recorded. This will allow potential impacts on void use associated with such operational practices to be evaluated in the future.

24.1.5 Time and Duration of Depositing

Records will be maintained of operational hours and periods of closure that have occurred during the reporting period.

24.1.6 Remaining Capacity

The remaining capacity of the site will be determined using survey data, and approved restoration contours.

24.1.7 Settlement

Survey information from specific locations within the restored areas of the site, will be used, together with historical information to determine settlement of the waste mass.

24.2 Monitoring Frequency

Landfill body monitoring will be carried out at yearly intervals during the operational phase of the landfill. During the aftercare phase, settlement will continue to be monitored at annual intervals.

24.3 Monitoring Methods

Ground control will be established for each survey, and will be checked as appropriate to ensure continued accuracy.

Surveys will be carried out to an accuracy of +/- 20mm.

A recognised computer software package will be used for all volume and area calculations.

24.4 Data Management and Recording

All data collected during the surveys will be stored electronically, and used to generate paper plans as required by operational personnel.

25.0 SITE CLOSURE, AFTERCARE AND COMPLETION

25.1 Introduction

This section describes the measures that will be taken on definitive cessation of activities, to avoid any pollution risk, and return the installation to a satisfactory state. The plan is divided into 6 subsections, which address specific requirements of the overall aftercare management of the installation, namely: -

- Definite closure plan;
- Access and site security plan;
- Restoration plan;
- Post closure monitoring plan;
- Post closure maintenance plan; and
- Site completion plan.

25.1.1 *The Definition of Closure*

A requirement of the IPPC regime is that when an installation closes, the operator should apply to surrender the permit in order to end regulation under IPPC. However, with regards to landfill developments, the surrender of the IPPC permit will not be coincidental with the cessation of waste disposal operations owing to the ongoing potential for the installation to cause pollution and/or harm.

With regards to landfills, there are therefore two stages to the closure process. Stage 1 is the 'definite closure' of the landfill, which is the point at which the site stops taking waste, while Stage 2, or 'landfill completion', is the later point when aftercare maintenance and monitoring is completed to such a level that the installation is unlikely to cause pollution to the environment or harm to human health.

25.1.2 *Design Considerations*

To facilitate the ease and security of installation closure, consideration will be given during the design process to the following: -

- Provision for the draining and decontamination of tanks, lagoons and pipework prior to dismantling;
- Ease of dismantling and removal of installation infrastructure;
- Wherever practicable, use of construction materials that are readily recyclable, and insulation that can be removed without causing a dust hazard;
- The need to design above ground infrastructure e.g. gas extraction wells which are compatible with the proposed after use of the installation.

25.1.3 *Financial Provision*

During the operational period of the installation, the price charged for the disposal of waste will cover the estimated costs of the closure and aftercare of the installation for the predicted period over which the installation is likely to present a hazard.

25.1.4 *Definite Closure Plan*

Definite closure will occur when the installation stops taking waste. The actions that will be taken at this point are set out below.

25.1.5 *Final Waste Levels and Settlement Surveys*

Surveys will be undertaken as required to ensure that final pre-settlement waste levels are achieved in accordance with the approved restoration plan.

Throughout the aftercare period, settlement surveys will be undertaken on an annual basis.

25.1.6 *Communication*

MEPA will be informed in writing of the date of cessation of waste inputs to the installation. This will enable MEPA to make arrangements to inspect the site, approve the closure, and agree the actions that will need to occur following closure.

All waste contractors will be informed of the impending closure of the installation so that alternative disposal options can be determined.

25.1.7 *Capping*

All waste phases will be capped in accordance with the approved specification.

25.1.8 *Environmental Management and Monitoring Systems*

All environmental management and monitoring systems for landfill gas, leachate, surface water and groundwater will be present in all of the phases at the point of 'definite closure' and will be maintained and protected from damage so that they operate in an effective manner until the point of installation completion. If necessary infrastructure will be replaced to ensure their continued suitability for use throughout the aftercare phase.

Gas treatment, utilisation plant and flares will be operated, maintained and replaced such that they remain suitable for use throughout the aftercare phase.

Leachate extraction, recirculation, treatment and disposal systems will be operated, maintained and where necessary replaced such that they remain suitable for use throughout the aftercare phase.

25.2 *Access and Site Security Plan*

Following 'definite closure', an audit will be carried out of security provisions to ensure that the installation is left in a secure condition, unauthorised access is avoided, and illegal dumping is discouraged.

Installation security will be maintained through the use of perimeter fencing and lockable gates to prevent unauthorised access to the installation after closure. Fencing

and gates around the Environmental Management Compound will also be maintained throughout the aftercare period.

To ensure maintenance of security at the installation, inspections of the fencing and gates will be carried out on at least a 2 weekly basis, and any damage will be repaired as soon as practicable. This may necessitate the completion of temporary repairs pending permanent repairs. Temporary repairs will be carried out within 24 hours of the damage being observed. Maintenance and repair will be carried out where damage or deterioration is observed either during the routine inspection programme or as reported by a third party such as a local resident and only where the observed damage affects the integrity of the security provision.

25.3 Restoration Plan

The proposed restoration scheme seeks to maximise the potential contribution that the installation can make to improving landscape quality, ecological enhancement and public access.

25.3.1 *Stability of Landform*

The short and long-term stability of the proposed landform has been considered during the design and operation of the facility and assessed in a quantitative manner in the stability assessment (Ref: XXX).

25.3.2 *Access for Monitoring and Maintenance*

The proposed after use and restoration does not conflict with the requirements to ensure continued access for monitoring and maintenance of environmental monitoring and management systems, including the requirement to replace gas extraction boreholes.

25.3.3 *Progressive Restoration*

The installation will be progressively restored in accordance with the approved restoration plan. This provides for the creation of a sympathetic landform in keeping with the topography of the surrounding area, and will minimise the visual impact of the development. The controlled irrigation system will be installed on the final layer of top soil to support development of vegetation.

25.3.4 *Restoration Aftercare*

On completion of restoration, the installation will be managed in accordance with a 5 year aftercare plan to be agreed with the local planning authority. This would involve the implementation of schemes, which would provide the management regimes needed for the development and maintenance of the proposed habitats.

25.4 Post Closure Monitoring Plan

Prior to the 'definite closure' of the installation, the environmental monitoring programme will be reviewed, and a post closure environmental monitoring plan will be submitted to MEPA detailing the scope and frequency of the proposed environmental monitoring and reporting during the post closure period. This post closure monitoring plan will also incorporate installation completion objectives for agreement with MEPA.

Notwithstanding this, all post closure monitoring will continue to be carried out in accordance with the procedures and methods adopted during the operational phase, as modified to reflect new guidance and requirements, specifically: -

- All environmental monitoring and recording of landfill gas, leachate, groundwater and surface water will continue to be carried out in accordance with procedures and methods undertaken throughout the operational phase. Monitoring results for landfill gas, leachate and groundwater and surface water will continue to be recorded and sent to MEPA;
- All environmental monitoring records will be kept on file at the installation's Operations Department; and
- Post closure settlement surveys will be carried out on an annual basis.

25.5 Post Closure Maintenance Plan

25.5.1 *Inspection Programme*

To ensure all necessary maintenance is carried out during the aftercare period, a regular two weekly inspection programme will be implemented. The scope of the inspection programme will be as follows: -

- Inspection of fencing and gates;
- Inspection of 'above ground' components of landfill including monitoring boreholes, pipework, wellheads;
- Inspection of public access features, i.e. public right of way;
- Inspection of leachate treatment and landfill gas plant; and
- Inspection of landfill topography for signs of differential settlement.

25.5.2 *Maintenance Programme*

All plant and equipment utilised during the post closure period will be maintained in accordance with the manufacturers requirements. The plant and equipment that will be subject to this maintenance is as follows: -

- Fencing and gates;
- Monitoring boreholes (gas, leachate, groundwater);
- Landfill gas infrastructure (wells, pipework);
- Landfill gas plant (power generation equipment, gas flare); and
- Leachate pumping and treatment plant equipment.

In addition to the planned maintenance programme, unplanned maintenance will be carried out in response to unexpected damage identified during the course of the routine inspection programme.

In addition, the restored landform will be maintained as required to remedy any differential settlement that may jeopardize the integrity of the capping or drainage system.

25.6 Installation Completion Plan

Installation completion will occur when the landfill is unlikely to cause pollution to the environment, harm to human health or detriment to the amenities of the locality, and when MEPA is satisfied that the installation has been returned to a satisfactory condition.

The methodology that will be followed to determine this point, as well as the actions that will be carried out following completion are set out below.

25.6.1 Methodology to Determine Installation Completion

The methodology for determining installation completion will be in accordance with MEPA guidance applicable at the time of completion.

The methodology will consist of the completion of a risk-based assessment that provides a structured and defensible basis for determining whether the installation is likely to cause a hazard to the environment as a result of the activities carried out on the permitted area of land.

A report will be prepared for the site and submitted to MEPA in support of an application for 'permit surrender'. The report will consist of an identification of relevant completion criteria, an assessment and interpretation of the environmental monitoring data and a justification that the condition of the land is unlikely to cause an environmental hazard.

25.6.2 Following Installation Completion

Following installation completion, the entire remaining infrastructure that is present above ground surface will be decommissioned and removed off-site. This will include items relating to the landfill gas and leachate management systems and associated security provisions.

In addition, the environmental monitoring of the installation will cease, and installation security arrangements will be modified accordingly.