Environmental Management Programme – Closure of Landfill Site – Hlabisa

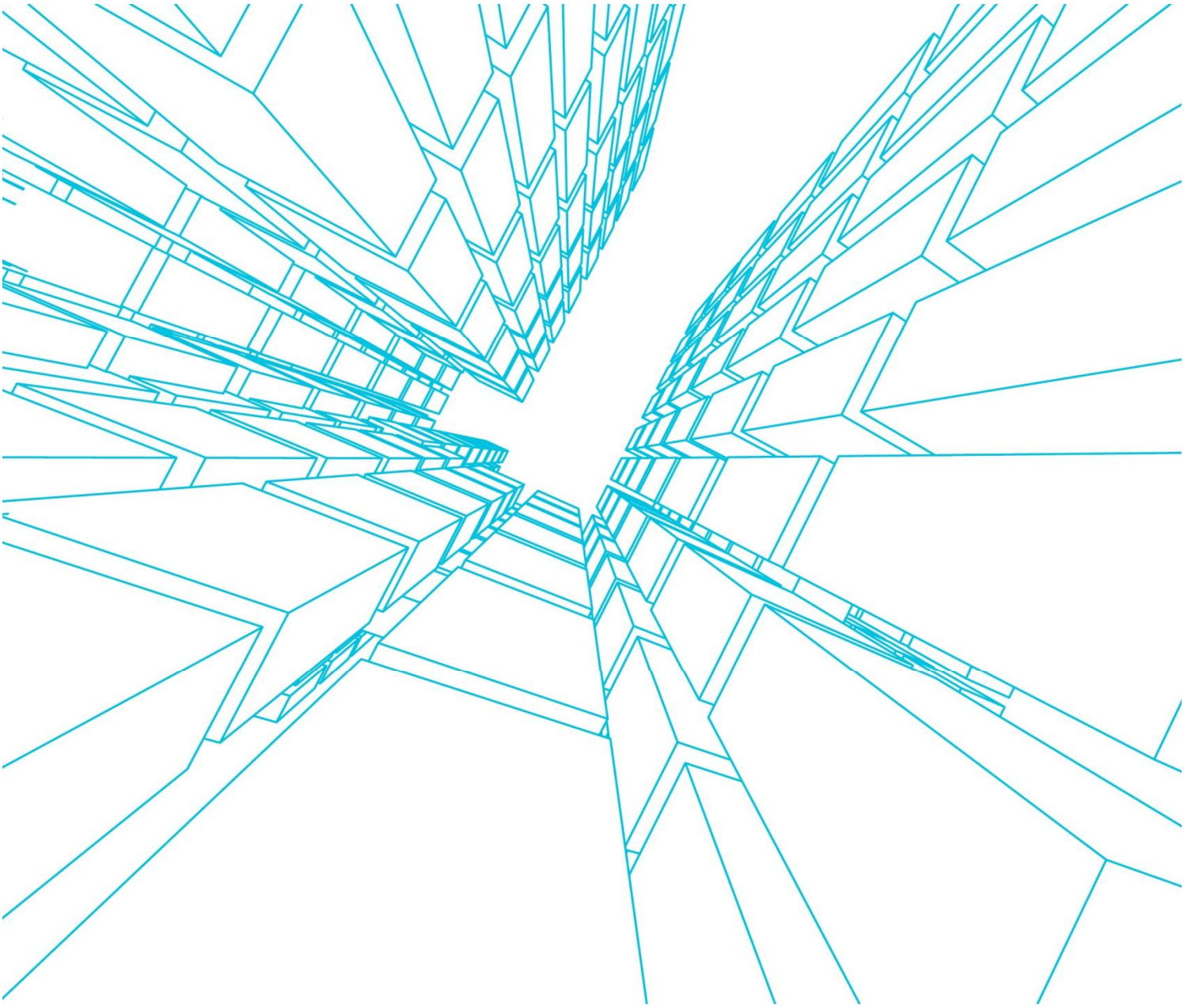

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Table 1-1: Terminology

Terminology	Explanation
Activity	Any action needed for the design, physical investigations and rehabilitation associated with the landfill site.
Alien species	A species occurring in an area outside of its historically known natural range as a result of intentional or accidental dispersal by human activities.
Builder's rubble	Includes pieces of masonry, bricks, concrete, etc. resulting from construction, repair and demolition operations, without reinforcing steel, uncontaminated with general waste and with a maximum particle size of 300-mm.
Bulky Waste	Includes items, such as large tree trunks, large concrete blocks, etc., for which the large size precludes or complicates their handling by normal collection, processing or disposal methods.
Cell	A cell which is designed and engineered to contain waste. It is underlain by a liner to prevent the waste or the leachate from the waste coming into contact with the environment.
Clean Garden Waste	Compostable waste derived from garden waste (for instance gardens, parks and similar), which has not been mixed with other waste categories. This may include clippings, pruning and other discarded plant material.
Closure	The act of terminating the operation of a landfill. Closure is preceded by rehabilitation and followed by end-use and post-closure monitoring.
Commercial Waste	Solid waste generated by stores, offices and other activities not involved in manufacturing.
Communication register	A register aimed at tracking all communication activities in the project.
Compaction	The process whereby the volume of waste is reduced, using a purpose built compactor or other suitable machine.
Compaction Density	The mass of a body of solid waste divided by the volume (after compaction) occupied by that same body of waste.
Compaction Ratio	The ratio of the volume of loose waste to the volume of the same waste after placement and compaction.
Compost	Organic waste that has undergone microbial degradation, to produce a contaminant- and nuisance free product of potential value as a soil conditioner.
Contaminated water	Water contaminated by pollutants from on-site or off-site activities; for example, runoff from un-rehabilitated parts of the waste body or runoff from waste management vehicle or plant wash areas. Contaminated water must be treated to ensure water released into the receiving environment meets minimum standards and guidelines. Treated water should be recycled where possible.
Cover Material	Soil or other suitable material like builders' rubble or clinker ash that is used for enclosing a body of compacted waste.
Daily Cell	A body of waste which has been placed between waste berms covered with soil, soil berms or builder's rubble berms compacted and enclosed by cover material. The size being determined by the mass of waste disposed of in a single day, as well as by the number of vehicles delivering waste.
Department of Water & Sanitation (DWS)	The authority responsible for water management.
Development Plan	A plan indicating the phasing of the development of a landfill from the landfill preparation, through the operation (which is usually divided into phases), to the final closure, rehabilitation and end-use. The phasing, and hence the Development Plan, forms part of the design.
Domestic Waste	Solid waste that originates in a residential environment.
Engineer	A suitably qualified duly appointed natural or juristic person or partnership or any other engineer appointed from time to time by the Owner, to act on its behalf with regards to certain aspects of the administration and execution of the work.
Environment	The surroundings in which humans exist and which comprise: • the land, water and atmosphere of the earth; • micro-organisms and vegetation and animal life; • any part or combination and interrelationships; and • the physical, chemical, aesthetic, historical, cultural and economic properties and conditions of the foregoing that can influence human health and well-being.
Environmental aspect	A product's or production process's environmental impact or important issues in

Terminology	Explanation
	the environment that an organisation should take into consideration.
Environmental Audit	Systematic, documented, regular and objective evaluation to see how well an organisation or facility is operating in terms of the Environmental Management Programme and is complying with statutory requirements and the organisation's Environmental Policy.
Environmental Authorisation (EA)	The authorisation by a competent environmental authority for commencement of listed activities in terms of the National Environmental Management Act and associated Specific Environmental Management Acts (SEMAs).
Environmental Control Officer (ECO)	An independent person, who is responsible for undertaking site inspections to audit and report on compliance with the environmental specifications contained within the Environmental Management Programme.
Environmental impact	Any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organisation's environmental aspects.
Environmental Impact Assessment (EIA)	The process of collecting, organising, analysing, interpreting and communicating information in accordance with the environmental legal requirements set out in GNR. No 982, GNR. 983, GNR. 984 and GNR 985 as published on 14 December 2014, promulgated in terms of Chapter 5 of the National Environmental Management Act, for the purposes of obtaining an Environmental Authorisation in accordance with Chapter 5 of the National Environmental Management Act.
Environmental Management Programme (EMPr)	A tool used to prescribe management mechanisms / methods for the prevention of undue or reasonably avoidable adverse environmental impacts and for the enhancement of the positive environmental benefits of a development.
Fauna	All species of animals found in a particular region or environment.
Fire Danger Index	A relative number denoting an evaluation of rate of spread, or suppression difficulty for specific combinations of fuel, fuel moisture and wind speed.
Fire hazard	The relative combination of fuel, oxygen and heat that will lead to the start and spread of a potential fire.
Flood line	The line or mark to which a flood could rise, every 50 (1:50 year flood line) or 100 (1:100 year flood line) years.
Flora	All species of vegetation found in a particular region or environment
General Waste	Waste that does not pose an immediate threat to man or the environment, i.e. house hold waste, builders' rubble, garden waste and certain dry industrial and commercial waste. It may, however, with decomposition, infiltration and percolation, produce leachate with an unacceptable pollution potential.
Groundwater	The water that fills the natural openings in below-surface rock or unconsolidated sands.
Hazardous waste	Waste that, because of its chemical reactivity, toxic, explosive, corrosive, radioactive or other characteristics, causes danger or is likely to cause danger to health or the environment.
Heritage resources	Any place or object of cultural, archaeological or paleontological significance in terms of the National Heritage Resources Act, 1999.
Induction training	The training provided to new / existing employees to (re)acquaint them with the company structure, their specific job requirements, practical and/or organisational issues and occupational health, safety and environmental considerations required on the project.
Industrial Waste	Non-toxic and non-hazardous solid waste resulting from industrial processes and manufacturing.
Interested and Affected Parties (I&APs)	Any person, group of persons or organisation interested in or affected by such operation or activity and any organ of state that may have jurisdiction over any aspect of the operation of activity.
Landfill (v)	To dispose of waste on land, whether by use of waste to fill in excavations or by creation of a landform above grade, where the term "fill" is used in the engineering sense.
Landfill (n)	The waste body created by landfilling. This may be above or below ground level, or both.
Landfill Gas	Typically malodorous gases generated during the decomposition of waste.
Landfill Operation Monitoring	The auditing and assessing of a waste disposal operation to determine whether it conforms to the Landfill design and to the Minimum Requirements.
Landfill Operator	The person, firm or company including the Landfill Operator's heirs, executors, administrators, trustees, judicial managers or liquidators, as the case may be,

Terminology	Explanation
	responsible for maintenance and operational standards at the landfill. Depending on the circumstances, the Landfill Operator may also be the Landfill Owner.
Landfill Owner	The Landfill Owner will be deemed to be the local municipality.
Land use	Characterised by the arrangements, activities and inputs people undertake in a certain land cover type to produce, change or maintain it. The definition of land use in this way establishes a direct link between the land cover and the actions of people in their environment.
Leachate	An aqueous solution with a high pollution potential, arising when water is permitted to percolate through decomposing waste. It contains final and intermediate products of decomposition, various solutes and waste residues. It may also contain carcinogens and / or pathogens (Sporadic / Significant).
Leachate Detection System	A system for detecting leachate at landfills. It comprises rudimentary liners, sloped towards 'finger drains' at the lowest point of the landfill.
Leachate Management	The collection and drainage of leachate to a point where it can be extracted for treatment. This requires a system of under-drains and liners and, in certain instances, is synonymous with containment.
Lift	A series of adjoining cells of the same height, and at the same level, in a landfill.
Mitigate	The implementation of practical measures to reduce adverse impacts, or to enhance beneficial impacts, of an action.
No-go area	An area where physical activities are prohibited.
Non-compliance	Failure to comply with the requirements of the EMPr.
Non-conformance Report	A report outlining a deviation from process, procedure or compliance specifications.
Plant	The apparatus, machinery and vehicles used for the construction, operation and maintenance of the landfill.
Pollution	Any change in the environment caused by substances and/or noise, malodours, dust or heat emitted from any activity, including the storage or treatment of waste or substances and the provision of services, where that change has an adverse effect on human health or well-being or on the composition, resilience and productivity of natural or managed ecosystems, or on materials useful to people, or that will have such an effect in the future
Potentially hazardous substance	A substance that can have a deleterious effect on the environment. Hazardous chemical substances are defined in the Regulations for Hazardous Chemical Substances, published in terms of the Occupational Health and Safety Act, 1993 (Act 85 of 1993).
Quality management system	A set of interrelated or interacting elements that organisations use to direct and control how quality policies are implemented and quality objectives are achieved.
Radioactive Waste	Waste with a specific activity of more than 74 bacquerels per gram (Bq/g) and total activity more than 3,7 kBq (0,1uCi). Disposal of radioactive wastes in a landfill is prohibited.
Red Data	A program by the International Union for Conservation of Nature (IUCN) for evaluating the conservation status of plant and animal species. This is represented as the Red List of Threatened Species.
Rehabilitation	To reinstate or restore to capacity or state similar or better than the state prior to the commencement of construction, operation and maintenance activities.
Resource recovery	Recycling of waste or the recovery of energy.
Response Action Plan	A plan intended to counter or minimise the adverse effects of any malfunction of a landfill design element with immediate effect.
Responsible Person	The Permit Holder or his / her legally appointed representative who takes responsibility for ensuring that all or some of the facets of any of the following are properly directed, guided and executed, in a professionally justifiable manner: investigatory work, design, preparation (construction), operation, closure and monitoring.
Safe Disposal	The process whereby spoilt foodstuff or condemned products may be disposed of on the landfill under supervision of the Environmental Health Officer and/or Landfill Supervisor.
Salvaging	The controlled and/or uncontrolled process of recovering any material, gas, compost, or other matter from the waste for benefit and for personal consumption.
Sanitary Landfilling	A method of disposing of waste on land without causing nuisances or hazards to

Terminology	Explanation
	public health or safety. Sanitary landfilling uses the principles of engineering to confine the waste to the smallest practical area, to reduce it to the smallest practical volume, and to cover it with a layer of earth at the conclusion of each day's operations or at such less frequent intervals as may be acceptable.
Sensitive receptors	Locations or areas that are likely to experience an impact greater than at other locations or areas; for example, schools and residential areas.
Ton	1000 kg
Waste	Means any substance, whether or not that substance can be reduced, re-used, recycled and recovered— (a) that is surplus, unwanted, rejected, discarded, abandoned or disposed of; (b) which the generator has no further use of for the purposes of production; (c) that must be treated or disposed of; or (d) that is identified as a waste by the Minister by notice in the Gazette, and includes waste generated by the mining, medical or other sector, but— (i) a by-product is not considered waste; and (ii) any portion of waste, once re-used, recycled and recovered, ceases to be waste.
Waste Body	This refers to the body of waste (and cover) that is contained in the landfill. Because it is subject to decomposition, it has the potential to generate leachate and must therefore be adequately separated from the water regime.
Waste minimisation	A programme that is intended to promote the reduced generation and disposal of waste.
Waste prevention	The prevention and avoidance of the production of waste.
Waste to Cover Ratio	The ratio of volume of compacted waste to volume of cover material used to cover the said volume of compacted waste.
Water resource	Includes a watercourse, surface water, estuary or aquifer.
Wetland	Means land, which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water and which, in normal circumstances, supports or would support vegetation typically adapted to live in saturated soil (as defined in the National Water Act).
Working Face	The active part of the landfill; where waste is deposited by incoming vehicles, then spread and compacted on the sloped face of the cell by a compactor. The width of the working face is determined by manoeuvring requirements of the vehicles depositing waste.

Table 1-2: Acronyms

Acronym	Explanation
DEA	Department of Environmental Affairs
DWS	Department of Water & Sanitation
EA	Environmental Authorisation
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
I&APs	Interested and Affected Parties
IWMPs	Integrated Waste Management Plans
KPI	Key Performance Indicator
MSDS	Material Safety Data Sheet
NCR	Non-Compliance Report
NEMA	The National Environmental Management Act, 1998 (Act No.107 of 1998)
NEMWA	The National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008)
NHRA	National Heritage Resources Act, 1999 (Act No. 25 of 1999)
NWMS	National Waste Management Strategy
QMS	Quality Management System
SAHRA	South African Heritage Resources Agency
TEM	Transport, earthmoving and materials handling equipment

1. PURPOSE AND SCOPE OF THE ENVIRONMENTAL MANAGEMENT PROGRAMME FOR CLOSURE

1.1 Introduction

The Environmental Management Programme (EMPr) for the closure of the landfill is designed as an environmental management tool used to prescribe management mechanisms / methods for the prevention of undue or reasonably avoidable adverse environmental impacts and for the enhancement of the positive environmental benefits during the closure process.

The plan has been developed to take cognisance of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) requirements for bestowing a 'Duty of Care' on those who cause, have caused or may in future cause pollution or degradation of the environment, as per Section 28 (1) of NEMA. Section 28 (1) has been amended to include significant pollution or degradation that occurred before the commencement of NEMA, that arises or is likely to arise at a different time from the actual activity that caused the contamination or that arises through an act or activity of a person that results in a change to pre-existing contamination. An EMPr is a stand-alone document that is typically used to guide and regulate environmental performance through all stages of development, including planning, design, construction, operation, closure, rehabilitation and post closure monitoring.

In furtherance to the EMPr, the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) (NEMWA) also sets out key requirements for integrated waste management through the development of integrated waste management plans (IWMPs). The IWMPs allow waste generators and managers to implement measures to ensure waste is managed in a sustainable manner. Local and District Municipalities are required to compile and implement IWMPs to allow for effective sector planning, thereby ensuring waste management is undertaken in a sustainable and well planned manner. The outcomes of which, allow for improved planning and budgeting at municipal level.

The objectives (Chapter 2 of NEMWA) of afore-mentioned outcomes are to protect health, well-being and the environment by implementing the following NEMWA measures:

- Minimising natural resource consumption;
- Minimisation and avoidance of waste generation;
- Reduction, re-use, recovery and recycling of waste;
- Treating and safely disposing of waste;
- Ecological degradation and pollution prevention;
- Securing ecologically sustainable development while promoting justifiable economic and social development;
- Ensuring the promotion of effective waste delivery services;
- To undertake remediation of land where contamination (may) present(s) a significant risk of harm to health or the environment; and,
- To achieve integrated waste management reporting and planning.

This EMPr is not intended to provide site specific management and mitigation directives.

1.2 Details of the Authors

As per the requirements of the NEMA, the details and expertise levels of the persons who prepared the EMPr are provided below.

Table 1-1: Authors' Details

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Expertise to carry out review of EMPr	Mike has a BSc degree in Limnology. He is professional limnologist with over 30 years' experience on multi-disciplinary projects in the fields of environmental management, water resource management, waste management, community development programmes, spatial planning and project management.
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Qualifications	MSc Conservation Biology
Expertise to carry out preparation of EMPr	Vici has an MSc in Conservation Biology and a BSc degree in Zoology. She is a professional Environmental Assessment Practitioner (EAP) with over 9 years' experience in the environmental management field. She has compiled and reviewed numerous Environmental Management Programmes in support of various Environmental Authorisation application processes.

1.3 Project Description

The existing Hlabisa Landfill is located in a rural and hilly area, at the edge of the small town of Hlabisa. The landfill is located on Portion 812 of the Farm Hlabisa (SG21 Digit code: N0GU01420000081200000) and is accessed from an unnamed road that branches off the D1907 Road, which intersects with the A2143 Road 685 m south-eastwards. The landfill covers an area of approximately 11 100.16 m². (Figure 1, Appendix A).

The existing unlicensed Hlabisa Landfill is operated by the Hlabisa LM, the applicant for the proposed WML. The landfill is unlicenced. The site is earmarked for closure but will operate for a period of 5 years after which it will be decommissioned and closed. Although no record keeping of the influx of waste is being done, the Hlabisa LM estimates that the site receives 12 tons of domestic waste per day and 2 tons of hazardous waste per month. The site stands on top of a hill where it gets windy, and there is a significant amount of windblown litter against the fence. Despite being fenced, cattle are entering and grazing on the site. On the day of the site visit there was a fire on the site, which poses a risk to the cattle and to the residents living nearby across the valley. The landfill is surrounded by natural shrubland and grassland. A watercourse flows in a north-west to south-east direction in the valley that is located less than 100 metres south-west of the site, and towards which the site slopes.

The operation, closure and rehabilitation activities will comply with the Minimum Requirements for Waste Disposal by Landfill (Second Edition, 1998). The site will operate for a maximum of 5 years after licencing. Detailed closure design activities will commence 12 months prior to the WML expiring in order that approved decommissioning activities commence prior to the WML expiring.

- Operation
  - Immediate rehabilitation actions and environmental management measures as outlined in the Environmental Management Programme (EMPr) including:
    - Leachate collection;
    - Storm water management;
    - Erosion control works;
    - Monitoring boreholes;
    - Waste Classification at Gate;
    - Waste Compaction;
    - Covering of waste; and,
  - Management of the site according to the Minimum Requirements for Waste Disposal by Landfill (1998), including:
    - Maintenance of access roads to the Landfill;
    - Access control;
    - Maintenance of site roads and controlling of traffic within the site;
    - Control of nuisances, such as dust, odour and noise;

    - Construction and maintenance of site drainage, including storm water, contaminated runoff and leachate control;
    - Continuous surface and groundwater monitoring; and,
    - Record keeping.
- Closure:
    - Placement of a “no dumping” notice at the site after five (5) years of operation since the issuing of the WML; and,
    - Closing and locking the gate to the site so that no illegal dumping can take place.
- Stormwater:
    - Design of stormwater management infrastructure to comply with Government Notice 704 of the National Water Act, 1998 (Act No. 36 of 1998).
- Final Cover:
    - The final capping system includes 300mm compacted clay, a geomembrane, a ballast layer, a drainage layer and 200mm topsoil;
    - The final capping system must be designed by a Professional Engineer and must to include a gas collection system;
    - The site will then, immediately following capping with topsoil, be seeded with a mixture of indigenous grasses;
    - Vegetation establishment must be monitored post decommissioning to ensure successful rehabilitation; and,
    - Surface and groundwater monitoring to ensure no water pollution as a result of the landfill is occurring.

Closure activities should commence before the WML expires and should be completed within 12 months.

The GPS co-ordinates for the site are
(S) 28º08’35.89” “
(E) 31º51’’51.09 “

1.3.1 Closure Authorisation Process

The application for closure required the submission of a basic assessment report to the competent authority, thereby ensuring compliance to section 24(5) of NEMA.

A pre-requisite for authorisation from the competent authority is the inclusion of a rehabilitation plan indicating best environmental management practises to be implemented during site closure.

2. BACKGROUND TO THE ENVIRONMENTAL MANAGEMENT PROGRAMME FOR CLOSURE

2.1 Purpose of this EMPr

The purpose of an EMPr is to provide an acceptable environmental framework and action plan to manage and control potential environmental impacts resulting from the closure and conversion of the waste disposal facility. This EMPr is based on the principles of the NEMA. Such principles are:

- To avoid, minimise or correct the disturbance of ecosystems and loss of biodiversity;
- To avoid or minimise or correct pollution and degradation of the environment;
- To avoid or minimise waste and re-use or re-cycle waste where possible, disposing of it in a responsible manner;
- To apply a risk-averse and cautious approach; and,
- To anticipate and to prevent negative impacts on the environment and on people’s environmental rights. Where they cannot be prevented, such impacts must be minimised and remedied.

The EMPr provides guidelines and directions to ensure that the closure and conversion activities for the landfill are undertaken in such a way as to avoid, where possible, impacts on the biophysical and social environment.

2.2 Nature of the EMPr

The EMPr is a legally required document to ensure that compliance with the requirements of reasonable protection of the environment as imposed by NEMA, in particular Section 28, which refers to duty of care. The EIA Regulations, 2014, are used as a guideline for the content of the EMPr. The mitigation measures required in terms of Section 28, subsection (1) may include measures to –

- Inform and educate employees about the environmental risks of their work and the manner in which their tasks must be performed to avoid causing significant pollution or degradation of the environment;
- Cease, modify or control any act, activity or process causing the pollution or degradation;
- Contain or prevent the movement of pollutants or the cause of degradation;
- Eliminate any source of the pollution or degradation; or
- Remedy the effects of the pollution or degradation.

This EMPr, as a standalone document, shall be used to guide and regulate environmental performance during the closure of the waste disposal facility. It contains the following elements:

- Goal setting and performance measurement;
- Compliance management;
- An assessment and management system;
- Community relations;
- Roles, responsibilities and accountabilities;
- Risk management;
- Emergency preparedness and response; and,
- Incident reporting and investigation.

To achieve these environmental management requirements, a defined and implementable system must be in place. This system comprises the “what” and the “how”.

- The “what”: The EMPr indicates to the Landfill Supervisor what is required by setting objectives with measurable targets in place for the successful management of the scheme.
- The “how”: The Landfill Supervisor is required to formulate procedures and/or guideline documents in compliance with its Quality Management System (QMS) on how the objectives will be met.

2.3 The Continuous Improvement Approach

The approach adopted for this EMPr is derived from the Deming Cycle, a cycle of continuous improvement that entails the reiterative actions of plan, do, check and act.

2.3.1 Plan

Achieving the targets depends on compliance with this EMPr and the legislative requirements that underpin it.

2.3.2 Do

Throughout the life cycle of the waste disposal site, the Landfill Supervisor will be required implement management practices to ensure implementation of this EMPr. Such practices should include and evaluate at least the following for the project:

- Location and extent of associated infrastructure;
- Associated activities, such as the transportation of people and equipment;
- Materials and equipment to be used;
- Management actions;
- Human resources used;
- Monitoring activities;
- Emergency / disaster incident and reaction procedures; and
- Rehabilitation procedures for the impacted environment.

Including these information topics into procedures and/or guideline documents will ensure that aspect-specific environmental management (based on this EMPr) forms an integral part of the closure of the site. It is, therefore, important to integrate the environmental management requirements into the day-to-day activities by way of set procedures that are set out in its QMS.

The incorporation of the "how" and "what" will ensure that the Landfill Supervisor understands what is required of it and that it allows systems to be put in place to ensure that the execution of the requirements is monitored. The Landfill Supervisor should also develop a programme for monitoring aspect-specific indicators in terms of the targets provided in the EMPr.

2.3.3 Check

A system of assessing monitoring results has been developed (Section 4.2) to check environmental management performance. Continuous assessment facilitates proactive management of environmental issues. Mitigation measures can then be successfully implemented on an on-going basis to keep environmental indicators within their target thresholds. Moreover, the assessment system also enables the assessment of the efficacy of the EMPr. Regular auditing of environmental performance is prescribed to prove and preserve accountability in a legislative context.

2.3.4 Act

The assessments and monitoring of the results and findings of the regular audits must be documented within a reporting system. Precautionary mitigation measures and corrective actions will be prescribed and instructions will be given in order to implement these in the field. The Landfill Supervisor shall in terms of the requirements of the QMS comply with the timeframes for dealing with implementing corrective actions:

- Acknowledge the finding – within 1 day of being informed of the finding.
- Rectify/mitigate finding – within 3 days of finding being raised.
- Respond in writing on "close out" of finding – within 5 days of finding being raised.

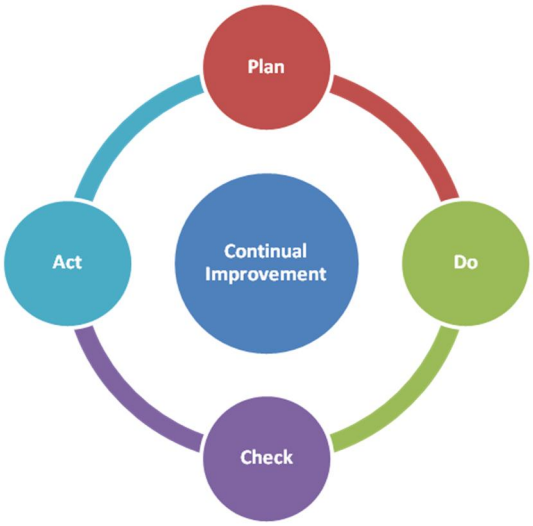

Figure 2-1: The Continual Improvement Cycle

The findings of monitoring and auditing programmes can also be used to update the EMPr. Although the EMPr is a specific document, it is dynamic and should be updated regularly to address changing requirements, legislation, technologies, etc.

3. LEGAL REQUIREMENTS

The site closure and conversion must be implemented within the framework of NEMA and other relevant environmentally related legislation as well as the project specific conditions of the EA. Please refer to Table 3-1below.

Table 3-1: Legislation applicable to waste management

Legislation	Sections	Relates to
The Constitution, 1996 (Act No. 108 of 1996)	Chapter 2	Bill of Rights
	Section 24	Environmental rights
	Section 25	Rights in property
	Section 32	Administrative justice
	Section 33	Access to information
National Environmental Management Act, 1998 (Act No. 107 of 1998) as amended[1]	Section 2	Defines the strategic environmental management goals, principles and objectives of the government. Applies throughout the country to the actions of all organs of state that may significantly affect the environment.
	Section 24	Provides for the prohibition, restriction and control of activities which are likely to have a detrimental effect on the environment.
	Section 28	Duty of care and remediation of environmental damage. The scheme owner has a general duty to care for the environment and to institute such measures as may be needed to demonstrate such care. The duty of care has been amended to include significant pollution or degradation that occurred before the commencement of the NEMA that arises or is likely to arise at a different time from the actual activity that caused the contamination or that arises through an act or activity of a person that results in a change to pre-existing contamination.
	Section 30	Control of emergency incidents. Responsible person's duties relating to reporting and remediation actions regarding emergency incidents. A criminal sanction may be imposed on the responsible person for failure to comply with the reporting requirements and obligations to address any emergency incidents.
Environment Conservation Act, 1989 (Act No. 73 of 1989) and regulations	The Act has been substantially repealed by the NEMA. However, there are certain regulations under the Act which are still in operation, such as the National Noise Control Regulations.	
National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) (NEMWA)[2]	Section 16	General duty in terms of waste management
	Section 17	Reduction, re-use, recycling and recovery of waste
	Section 26	Prohibition of unauthorised disposal of waste
	Section 27	Littering
National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA)	Sections 65-69	These sections deal with restricted activities involving alien species, restricted activities involving certain alien species totally prohibited, and duty of care relating to alien species.
	Sections 71 and 73	These sections deal with restricted activities involving listed invasive species and duty of care relating to listed invasive species.
National Environmental	Section 32	Control of dust

[1] The NEMA 2014 EIA regulations may be relevant for certain construction and maintenance such as those that may need to take place in or close to water resources.

[2] The Listed Activities in terms of the Waste Act should be included as R718 of GG32368 of 3 July 2009 as, depending on throughput, the effluent treatment plants may require waste licenses.

Legislation	Sections	Relates to
Management: Air Quality Act, 2004 (Act No. 39 of 2004)[3]	Section 34	Control of noise
	Section 35	Control of offensive odours
	Schedule 2	Ambient air quality standards
Fertilisers, Farm Feeds, Agricultural Remedies and Stock Remedies Act, 1947 (Act No. 36 of 1947) and regulations	Sections 3 to 10	Control of the use of registered pesticides, herbicides (weed killers) and fertilisers. Special precautions must be taken to prevent workers from being exposed to chemical substances in this regard. Workers handling these remedies must also be registered in terms of the Act.
Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) and regulations	Section 5, 6	Implementation of control measures for alien and invasive plant species
National Heritage Resources Act, 1999 (Act No. 25 of 1999)	Section 35	No person may, without a permit issued by the responsible heritage resources authority, destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or paleontological site.
	Section 36	No person may, without a permit issued by the South African Heritage Resource Agency (SAHRA) or a provincial heritage resources authority, destroy, damage, alter, exhume, remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority. "Grave" is widely defined in the Act to include the contents, headstone or other marker of such a place, and any other structure on or associated with such place.
	Section 38	This section provides for Heritage Impact Assessments (HIA), which are not covered under the NEMA. The HIA will be approved by the authorising body of the provincial directorate of environmental affairs, which is required to take the provincial heritage resources authorities' comments into account prior to making a decision on the HIA.
Occupational Health and Safety Act, 1993 (Act No. 85 of 1993) and regulations	General Administration Regulations GN R1449 (Section 7)	Material Safety Data Sheets must be made available at the request of any interested or affected party.
	Section 8	General duties of employers to their employees
	Section 9	General duties of employers and self-employed persons to persons other than their employees
National Water Act, 1998 (Act No. 36 of 1998) and regulations	Section 19	Prevention of and remedying the effects of pollution of a water body
	Section 20	Control of emergency incidents
	Chapter 4	Use of water and licensing
Hazardous Substances Act, 1973 (Act No. 15 of 1973) and regulations	Provides for the definition, classification, use, operation, modification, disposal or dumping of hazardous substances.	
Minimum requirements for storage, handling and disposal of hazardous waste, DWAF guidelines, 1998	Section 10	Temporary hazardous waste storage: time, volume and other requirements
National Road Traffic Act,	Section 54	Transportation of dangerous goods

[3] The National Ambient Air Quality Standards have been published and replace the SANS codes, R1210, GG 32816 of 24 December 2009.

Legislation	Sections	Relates to
Act 1996 (Act No. 93 of 1996) and regulations		
Fencing Act, 1963 (Act No. 31 of 1963)	Section 17	Any person erecting a boundary fence may clean any bush along the line of the fence up to 1.5 metres on each side thereof and remove any tree standing in the immediate line of the fence. However, this provision must be read in conjunction with the environmental legal provisions relevant to the protection of flora.
National Veld and Forest Fires Act, 1998 (Act No. 101 of 1998)	Chapter 2	Promotes and regulates the formation of fire protection associations which aim to manage and coordinate fire protection and fire services in an area.
	Chapter 4, 5	Organisations are required to make and maintain firebreaks and fire-fighting equipment and personnel should there be a risk that a fire may start or spread from the premises.
DEA Integrated Environmental Management	DEA Integrated Environmental Management Information Series (2004): Environmental Management Plans: DEA Guideline on compiling EMPrs.	
SANS 1929	Ambient air quality – limits for common pollutants[4]	
SANS 10103	The measurement and rating of environmental noise with respect to land use, health, annoyance and to speech communication.	
National Waste Policy	Provides for the identification of and governance arrangements for priority initiatives and measures for performance assessment. The National Waste Management Strategy (NWMS) seeks to systematically improve waste management in South Africa. Therefore, as a legislative requirement of the NEMWA, the NWMS seeks to ensure sustainable design, resource efficiency and waste prevention practices are implemented (DEA, NWMS Draft, 2010).	

4. EMPr ORGANISATION, RESPONSIBILITY AND AUTHORITY

4.1 Roles and responsibilities

This section describes the key functionaries in the planning, implementation and monitoring of the EMPr.

4.1.1 Duties and Powers of the Municipal Manager

The Municipal Manager is ultimately responsible for:

- Ensuring compliance with all the environmental requirements of the EMPr;
- Ensuring that the EMPr has been made available to the staff, suppliers as well as subcontractors;
- Reviewing all reports by the Landfill Supervisor; and,
- Ensuring rectification on non-compliance issues raised by the Landfill Supervisor.

4.1.2 Duties and Powers of the Landfill Supervisor

The Landfill Supervisor is ultimately responsible for:

- Ensuring that the EMPr has been made available to appointed Contractors, for review and distribution to its suppliers as well as subcontractors, and that the Contractor acknowledges and accepts the contents therein, also on behalf of any parties reporting to the Contractor;
- Ensuring compliance with all the environmental requirements of the EMPr;
- Assessing the Contractor's environmental performance during project life-cycle in consultation with the ECO, to whom a brief monthly statement of environmental performance will be submitted;
- Maintaining a register of complaints and queries made by members of the public; and,

[4] Replaced by R1210

- Oversee response by the task specific contractor to any project-related complaints from the public.

4.1.3 Duties and Powers of the Environmental Control Officer

The closure related activities must be monitored by an independent Environmental Control Officer (ECO). The ECO must be well versed in environmental matters and have a minimum of two years of relevant on-site construction related experience. The ECO should have a relevant environmental degree or other relevant tertiary qualification. The ECO's responsibilities include:

- Report on compliance with all the environmental requirements set in the EMPr (photographs will be taken of any transgressions and will be presented to the Landfill Supervisor, who will be responsible for ensuring rectification of non-compliance issues);
- Be familiar with relevant legislation and regulations;
- Brief the various Landfill Supervisor's / Contractor's foremen about the requirements of the EMPr for at least one hour (where after environmental training will be provided by the Environmental Officer to the workforce);
- Undertaking weekly site visits;
- Advise the Landfill Supervisor about the interpretation, implementation and enforcement of the EMPr;
- Attend site meetings, as and where required;
- Oversee implementation of corrective action with regard to the EMPr;
- Issue a list of transgressions / non-conformance reports to the Landfill Supervisor at monthly intervals for dissemination to the various responsible parties; and,
- Undertake monthly audits of adherence to the EMPr.

The ECO is responsible for providing an independent evaluation of compliance with the EMPr and not for enforcement of conditions of the EMPr. The Applicant is responsible for enforcement of the conditions of the EMPr. The ECO provides feedback to the Landfill Supervisor who, in turn, reports to the Municipal Manager, as required. Issues of non-compliance raised by the ECO must be taken up by the Landfill Supervisor and resolved with the construction teams in a timely manner. The ECO will remain employed for the full duration of the closure phase.

4.1.4 Duties of the Contractor

All Contractors (including staff, suppliers, sub-contractors and casual labour) are ultimately responsible for:

- Task specific activities for the duration of their appointment (so will Sub-Contractors and contract workers);
- Ensuring work conducted is done within the framework of the EA, EMPr and applicable legislation;
- Ensure that all suppliers and Sub-Contractors have a copy of and are fully conversant with the contents of the EMPr;
- Providing Method Statements setting out, in detail, how management actions contained in the EMPr will be implemented;
- Monitoring task specific impacts upon the surrounding environment as per the Environmental Monitoring Method Statement; and,
- Submitting environmental monitoring data to the Landfill Supervisor on a monthly basis.

The Contractor(s) must arrange for all his/her employees and those of his/her sub-contractors to be made aware of the requirements of the EMPr to ensure:

- A basic understanding of the key environmental features of the work site and environments; and,
- Familiarity with the requirements of this EMPr.

Suppliers, sub-contractors with their employees and casual labour must comply with all the requirements of this EMPr and supporting documents in terms of NEMA Section 28 Duty of Care. The absence of specific reference to the supplier, the sub-contractor or casual labour in any specification does not imply that the supplier, sub-contractor, casual labour is not bound by this EMPr.

The Contractor shall clearly describe the overall methodology proposed for the task specific related activities in particular method statements. All method statements must take environmental requirements into account.

5. SUMMARY OF IMPACTS / ASPECTS

As the site is to operate for 5 years prior to decommissioning, environmental aspects identified, as well as aspects generally associated with operations have been identified in the table below.

Table 5-1: Summary of impacts which can be expected during operations

System Element	Nature of Impact	Mitigation
Aesthetics	Change in visual landscape due to infrastructure development and associated activities	• Litter to be removed daily from fence • Site management to ensure cells are covered daily • No fires allowed
Air Quality	Dust generation and related maintenance of ancillary infrastructure	• All reasonable measures should be taken to minimise air emissions in the form of smoke, dust and gases from vehicles/ equipment used on site. • No fires are allowed. • The Landfill Supervisor shall implement measures to restrict the generation of dust during rehabilitation activities. • The Landfill Supervisor shall control dust from spoil dumps or stockpiles by ensuring that they are kept covered or must have a suitable dust palliative applied (such as water or commercial dust suppressants) to prevent windborne dust pollution.
	Gaseous emissions from active landfill cells (odour, health impacting substances);	• Daily cover of cells • Acceptance of permissible waste only at entrance • Access control to prevent informal recovery and cattle grazing disturbing covered areas
Heritage	Loss of artefacts due to landfill cell development and associated activities	Landfill supervisor to ensure any heritage finds during construction activities for new cells is brought to the attention of Amafa
Hydrological and Ecological	Erosion and/or siltation due to excavation, removal of vegetation	• Precautionary measures must be taken to prevent any form of pollution. • Accidental pollution incidents shall be reported to the Municipal Manager immediately after they occur and shall be cleaned up (to the satisfaction of the ECO) by the Landfill Supervisor or a nominated clean-up organisation. • Vehicle and plant maintenance shall be confined to the areas demarcated for this purpose. Should any amount of fuel, oil, transmission or hydraulic fluids be spilled onto the soils, the Municipal Manager or ECO shall be informed immediately. Tests must be conducted to determine the extent of soil contamination as soon as a spillage occurs. The polluted soil shall be rehabilitated or remediated to the satisfaction of the ECO. • On-site stormwater management shall be to the satisfaction of the ECO. • Any spillage of waste, caused by any party during the closure activities, shall be cleaned up immediately and appropriately disposed of.
	Contamination of water resources from leakage of leachate	
Noise	Noise impacts to local receivers	• Servicing of all vehicles and machinery to ensure good working order; and, • Use of silencers and mufflers on potentially noisy equipment
Vermin and Vector	Increased vermin and vector species in area	Daily cover of cells to: • Reduce flies • Reduce vermin Fencing to prevent cattle from entering the site.

System Element	Nature of Impact	Mitigation
Health and Safety	Health and safety incidents to workers during closure and rehabilitation activities.	• Safety training of staff is required to minimize accidents • All staff are required to wear the required Personal Protective Equipment (PPE) at all times.
Health and Safety	Movement of operational vehicles and equipment or danger associated with open areas (trenches, unstable ground etc.) may lead to potential safety impacts to the public if not demarcated as no go zones.	• The site must have access control. The public will not be allowed near the working areas. • On site vehicles will be fitted with reversing horn. • Staff on site will wear PPE and reflective clothing. • Open excavations will be marked with danger tape.

All closure activities will be limited to the landfill site, lay-down areas and site office / yard. All activities outside these areas need to be approved by the landfill Supervisor prior to the commencement of works.

All interactions between the Landfill Supervisor and I&APs will be via the Municipal Manager. The Landfill Supervisor may not enter into agreements with I&APs or undertake work on private property in lieu of favours, payment or any other means where either party may benefit from the activities / permissions of the other party. The identification and summarisation of impacts and risks associated with decommissioning related activities are set out in this section.

Table 5-2: Summary of Closure Impacts

Impact	Nature of Impact	Mitigation
Noise generation	Noise generated as a result of machinery used and personnel required to implement the closure/ decommissioning activities on site.	• Servicing of all vehicles and machinery to ensure good working order; and, • Use of silencers and mufflers on potentially noisy equipment.
Air Emissions	Emissions from vehicles and equipment on site fitted with exhausts may cause a temporary decrease in air quality within the immediate surroundings. Similarly, dust generated during closure and rehabilitation activities may negatively impact on the surrounding areas ambient air quality.	• All reasonable measures should be taken to minimise air emissions in the form of smoke, dust and gases from vehicles/ equipment used on site. • No fires are allowed. • The Landfill Supervisor shall implement measures to restrict the generation of dust during rehabilitation activities. • The Landfill Supervisor shall control dust from spoil dumps or stockpiles by ensuring that they are kept covered or must have a suitable dust palliative applied (such as water or commercial dust suppressants) to prevent windborne dust pollution.
Health and Safety	Health and safety incidents to workers during closure and rehabilitation activities.	• Safety training of staff is required to minimize accidents. • All staff are required to wear the required Personal Protective Equipment (PPE) at all times.
Health and Safety	Movement of operational vehicles and equipment or danger associated with open areas (trenches, unstable ground etc.) may lead to potential safety impacts to the public if not demarcated as no go zones.	• The site must have access control. The public will not be allowed near the working areas. • On site vehicles will be fitted with reversing horn. • Staff on site will wear PPE and reflective clothing. • Open excavations will be marked with danger tape.
Water and Soil Pollution	Contamination of soils and surface water due to hydrocarbon spills from vehicles/ equipment used during rehabilitation.	• Precautionary measures must be taken to prevent any form of pollution. • Accidental pollution incidents shall be reported to the Municipal Manager immediately after they occur and shall be cleaned up (to the satisfaction of the ECO) by the Landfill Supervisor or a nominated clean-up organisation. • Vehicle and plant maintenance shall be confined to the areas demarcated for this purpose. Should any amount of fuel, oil, transmission or hydraulic fluids be spilled onto the soils, the Municipal Manager or ECO shall be informed

Impact	Nature of Impact	Mitigation
		immediately. Tests must be conducted to determine the extent of soil contamination as soon as a spillage occurs. The polluted soil shall be rehabilitated or remediated to the satisfaction of the ECO. • On-site stormwater management shall be to the satisfaction of the ECO. • Any spillage of waste, caused by any party during the closure activities, shall be cleaned up immediately and appropriately disposed of.
Illegal Dumping	Night-time and / or weekend fly tipping (illegal dumping) may result in dumping of unacceptable waste streams increasing environmental, health and safety impacts and risks including: • Changes in the expected composition of leachate from the waste disposal facility resulting in the pollution of soil and water resources. • Changes in expected landfill gas emissions resulting in flammability, toxicity, asphyxiation and other hazards as well as objectionable odour negatively impacting on on-site personnel (and other on-site persons) health and safety. • The increase for the landfill footprint in instances of uncontrolled dumping of wastes.	• All existing fencing shall be maintained to prevent access for illegal dumping. • The local community shall be informed of the site closure and made aware of alternatives through public meetings, the placement of notices in local newspapers, etc. • The Municipal Manager shall ensure placement of signage close to the road informing the public of site closure and providing details on alternative disposal sites or facilities. • Maintain security at the site for a short period after closure to prevent potential illegal dumping and / or vandalism. • Placement of skips near the community residential areas / notices informing community members of the waste transfer station for use to safety dispose of their waste.
Surface and groundwater pollution	Surface and groundwater water pollution may occur after closure if the engineering design/ instructions are not correctly implemented on site.	• A professional engineer must provide detailed closure drawings and oversee and sign off on the closure of the landfill. • Maintenance of the site is ongoing until vegetation establishment has been completed. • The installation of stormwater management measures, such as intercept drains and conservancy tanks, must be regularly checked for damage and proper functioning. • Water collected in the conservancy tank (if applicable) must be analyzed for potential contamination. • A monitoring borehole is required downstream of the landfill site. • Water Levels should be measured monthly and the readings recorded against time and date • Water samples should be taken at least every 6 months, preferably in April and October (end of summer and winter) and the samples sent to a reputable lab for analysis. Field readings such as pH, temperature, EC, etc. should also be measured at the time of sampling and recorded against date and time.
Alien vegetation	Alien plant species may establish on site post closure/ decommissioning of the landfill site. This may interfere with the capping layer making it less able to control the ingress of water, resulting in leachate.	• Maintenance of the site is ongoing until indigenous vegetation has successful established on site. • Any alien plants identified must be removed from site and destroyed. • Care must be taken not to control indigenous species.

Impact	Nature of Impact	Mitigation
Loss of habitat and indigenous vegetation	Activities conducted for the closure of the landfill may lead to the loss of natural habitats and indigenous species.	• Clean up the surrounding areas and move the litter into an approved landfill area. • Vehicle movement must be restricted to the fenced area and the road to the landfill and should not disturb additional vegetation and habitat. • Rehabilitation activities should focus on clearing the litter from the area outside the landfill and establishing a soil cover over the litter on site.

6. ENVIRONMENTAL DOCUMENTATION, REPORTING AND COMPLIANCE

6.1 Documentation

The following documentation must be kept on the project site for the full duration of closure and conversion:

- Environmental Management Programme;
- Environmental Authorisation/s (e.g. Waste Management License);
- Environmental monitoring reports;
- Environmental incident book;
- Communications Register;
- Register of audits; and,
- Non-conformance reports.

6.2 Responsibility Matrix and Organogram

The Landfill Supervisor has in terms of its environmental management system, a Responsibility Matrix and Organogram. This shall be displayed in an appropriate location. This identifies responsible parties, their contact details, and highlights their roles and responsibilities. This document must be updated on a regular basis to ensure that information is correct.

6.3 Environmental Inspections and Audits

Audits will be conducted to monitor compliance with the EMPr. Photographic records will support the visual assessment. External auditing may take place at unspecified times.

6.4 Non-Conformance Report

The Non-Conformance Report (NCR) process shall be in terms of the Landfill Site's environmental management system.
The following information is typically recorded in the NCR:

- Details of non-conformance;
- Any plant or equipment involved;
- Any chemicals or hazardous substances involved;
- Work procedures not followed;
- Any other physical aspects;
- Nature of the risk;
- Actions agreed to by all parties following consultation that should adequately address the identified non-conformance. This may take the form of specific control measures and should take the hierarchy of controls into account. This must accompany the NCR for filing purposes;
- The agreed timeframe by which corrective actions should be completed;
- The Landfill Site representative should verify that the agreed actions have been taken on or soon after the agreed completion date. Where the actions are complete, the Landfill Site representative should sign the Close-Out portion of the Non-Conformance Form and file it; and,
- The measures put in place to prevent any future reoccurrence of the problem.

6.5 Environmental Emergency Response

The Landfill Site environmental emergency procedures must ensure that there will be an appropriate response to unexpected or accidental actions or incidents that could cause environmental impacts. Such incidents may include:

- Accidental discharges to water (i.e. into a water resource) and land;
- Accidental spillage of hazardous substances (typically oil, petrol, and diesel);
- Accidental toxic emissions into the air; and,
- Specific environmental and ecosystem effects from accidental releases or incidents.

The Environmental Emergency Response Plan is separate to the Health and Safety Plan as it is aimed at responding to environmental incidents and must ensure to include the following:

- All employees shall be adequately trained in terms of incidents and emergency situations;
- Details of the organisation (manpower) and responsibilities, accountability and liability of personnel;
- A list of key personnel and contact numbers;
- Details of emergency services (e.g. the fire department, spill clean-up services) shall be listed;
- Internal and external communication plans, including prescribed reporting procedures;
- Actions to be taken in the event of different types of emergencies;
- Incident recording, progress reporting and remediation measures to be implemented;
- Information on hazardous materials, including the potential impact associated with each, and measures to be taken in the event of accidental release; and,
- Preventative measures to be taken in future.

6.6 Communications Register

All complaints or communications that are received from I&APs or any other stakeholder must be recorded in a Communications Register. These complaints and communications will be investigated and a response to the Complainant, I&APs or stakeholder will be given within 10 days. The Communications Register shall include the following information:

- Record the time and date of the complaint/communication;
- A detailed description of the complaint/communication;
- Findings from investigation into the cause of the problem;
- Action and resources used to correct the problem;
- Action taken to prevent a reoccurrence of the problem;
- Photographic evidence of the problem (where possible);
- A written response to the Complainant indicating rectification of the problem; and,
- Information regarding the relevant authority that was contacted or notified in writing (person, time and date).

6.7 Good Housekeeping

The Landfill Site is to practice good housekeeping throughout the closure and conversion life-cycle. This should eliminate disputes about responsibility and facilitate efficiency. Records of such actions taken to ensure the maintenance and management of housekeeping must be recorded.

6.8 Management of Environmental Requirements

The Landfill Supervisor shall record and report upon environmental management measures undertaken to mitigate assessed impacts upon the environment.

6.9 Management and Control

The Landfill Supervisor is to implement environmental management in terms of its environmental management system
Appropriate measures shall include:

- Appointment of necessary resources to monitor and manage environmental requirements;
- Implement aspect specific method statements to deal with emergency situations;
- Provision of adequate emergency response equipment to mitigate and manage an incident or emergency; and,
- Provision of specific training related to implementation of environmental management requirements.

6.10 Recording and reporting

The Landfill Supervisor shall maintain detailed records of parameters monitored. These detailed records shall demonstrate the effectiveness of the management actions implemented to mitigate potential impacts.

The Landfill Supervisor shall compile a database/report of management works implemented in terms of and at the frequencies stipulated by the environmental management system requirements.

6.11 Monitoring

The Landfill Supervisor shall compile an Environmental Monitoring procedure which details the scope, nature, process, schedule and templates for environmental monitoring. The procedure shall in be in line with the environmental management system requirements.

The monitoring results shall be used to determine the effectiveness of the management programme.
All complaints, compliments or other comments relating to environmental management parameters are to be recorded in the site issues register for inclusion in the project issues register held by the Landfill Supervisor.

Monitoring results and the associated required management and mitigation actions for the coming monitoring period are to be presented in the monitoring section of the Monthly Report. The Landfill Supervisor shall monitor and maintain the following on an on-going basis, if applicable:

- Re-growth of alien invasive vegetation;
- Storm water systems;
- Topsoil and backfill volumes;
- Access road condition;
- Noise;
- Erosion prevention;
- Landscaping requirements;
- Spoil management; and
- KPI monitoring schedule.

7. TRAINING AND INDUCTION OF EMPLOYEES

The Landfill Supervisor is to take responsibility for the management of staff on the Landfill Site during operations and supervise them closely at all times. The onus is on him to make sure that all staff and Sub-Contractors fully comprehend the contents of the EMPr. The environmental awareness training programmes should, therefore, be targeted at the two levels of employment: management and labour. Environmental awareness training programmes need to be formulated for these levels and must comprise:

- A record of all names, positions and duties of staff to be trained;
- A framework for the training programmes;
- A summarised version of the training course(s);
- An agenda for the delivery of the training courses.
- such programmes will set out the training requirements, which need to be conducted prior to any construction works occurring and will include:
- Acceptable behaviour with regard to flora and fauna;
- Maintenance of equipment to prevent the accidental discharge or spill of fuel, oil, lubricants, cement, mortar and other chemicals;
- Responsible handling of chemicals and spills;
- Environmental emergency procedures and incident reporting; and,
- General code of conduct towards I&APs.

8. ASPECT AND ACTIVITIES MATRIX

Environmental aspects identified, as well as aspects generally associated with landfill closure upgrade activities have been identified and listed in the following table. The Landfill Supervisor will be required to check which aspects may be affected and to put measures in place to mitigate or reduce the impacts on each aspect.

Table 8-1: Environmental Specifications – General

Activity /Issue	Action required
General	
Site Offices	Fires will not be allowed on the site. The site will be kept clean, neat and tidy at all times and all materials are to be stored in a neat and organised manner. Should existing buildings be used, these should be maintained at all times. The Municipal Manager will supply at the very least chemical toilets. These shall be secured to prevent them from being knocked or blown over. The use of the natural bush for ablution purposes is strictly prohibited. Should water and electricity supply not be available on site, the Landfill Supervisor is to supply generators and water tanks. Water from mains supply must be agreed to with the Municipal Manager Deviation from the existing access roads must be planned to limit disturbance of the environment (maximum 3m in width and following the contours), including birds, animals, reptiles and their habitat as much as possible, and must have the approval of the ECO and the landowner. All route deviations must be approved by the Municipal Manager and ECO.
Safety and Security at the Sites	Access to the site must be restricted and guarded. The site must be secured to reduce opportunities for criminal activity. Trenches and potential hazardous areas must be demarcated and clearly marked. No firearms (except security personnel), alcohol or drugs are allowed on site. Trespassing on private properties that adjoin the site is forbidden.
Training and Induction	The Landfill Supervisor must ensure that all people involved in the closure (including sub-contractors and casual labour) are aware of and familiar with the environmental requirements. The Landfill Supervisor is responsible for providing the site foreman with at least one hour of environmental training and for ensuring that the foreman will be able to adequately pass the information on to staff. Topics of this training must include: • The meaning of environment; • Acceptable behaviour with regard to flora and fauna; • Management and minimisation of waste; • Maintenance of equipment to prevent the accidental discharge or spill of fuel, oil, lubricants and other chemicals; • Responsible handling of chemicals and spills; and, • Emergency procedures and incident reporting. The Landfill Supervisor must monitor the performance of the workers to ensure that the topics that were covered during their training and induction have been understood and are being followed. Environmental awareness posters should be used on site. If required, the ECO and/or a translator may be requested to explain aspects of environmental or social behaviour that are unclear on site. The Landfill Supervisor must ensure that all staff on site have undergone basic fire-fighting and spill management training prior to arrival on site.
Complaints Register	Any complaints received will be investigated and a response will be given to the complainant within 7 days. Complaints received from the community must be recorded in the Complaints Register. The complaint will be brought to the attention of the Municipal Manager, who will respond accordingly. Detailed information has to be recorded, including: • The name and contact details of the complainant (if not anonymous); • The date, time and nature of the complaint; • The response and investigation undertaken; and, • Which actions were taken and who the name of the person responsible for the action. The Landfill Supervisor shall assist the Municipal Manager in responding to queries and complaints from the public pertaining to site establishment and activities by: • Documenting the details of such communications and submitting the information to the

Activity /Issue	Action required
General	
	Municipal Manager for inclusion in the complaints register; • Bringing any such matters to the attention of the Municipal Manager as soon they arise; • Taking any remedial action as instructed by the Municipal Manager or the ECO; and discussing such matters at the site meetings. The Landfill Supervisor shall make selected staff available for any formal consultation with affected parties for explaining the process and answering such parties' questions.
Emergency Response	An emergency response and contingency plan must be in place to limit the extent of any actions that may result in significant environmental damage. Such actions include: Establishment of procedures and policies to ensure that an incident does not recur. Development, review and testing of an emergency and contingency plan. Emergency organisation (manpower) and responsibilities, accountability and liability: • A list of key personnel. • Details of emergency services applicable (e.g. the fire department and spill clean-up services). • Internal and external communication plans, including prescribed reporting procedures where required by legislation. • Actions to be taken in the event of different types of emergencies. • Appropriate training of all staff will with regard to emergency responses. • Incidents will be reported immediately to the responsible person. • Documentation of all incidents in the environmental incident register. • Recording of detailed information, including: o The name and contact details of the complainant (if not anonymous). o The date, time, location and nature of the complaint. o The response and investigation undertaken. o Which actions were taken and who was responsible for the action. o Information regarding the relevant authority that was contacted or notified in writing (person, time and date).
Demarcated Areas and Fencing	Routes for temporary access shall be located within the approved demarcated areas and vehicle movement shall be confined to these roads. Movement of vehicles outside the designated working areas shall not be permitted without authorisation from the ECO.
Storage of Fuel and other Materials	Once the Landfill Supervisor has been appointed, the following actions will be undertaken: • An emergency response plan will be prepared. • Fuel, lubricants, transmission, and hydraulic fluids shall only be stored in designated areas. • Areas made available for fuelling or greasing equipment and vehicles must be clearly demarcated. A drip tray must be used to prevent soil pollution. No fuelling, greasing or filling of oils may take place outside these demarcated areas. • The Landfill Supervisor must provide adequate and approved facilities for the storage and recycling of used oil and contaminated hydrocarbons. Such facilities must be designed and sited with the intention of preventing the pollution of the surrounding area and environment. • The Landfill Supervisor shall provide spill response kits and enough of the correct type of drip trays to prevent, contain and mop up any spill envisaged on site.
Control of Damage to Plants and Animals	In principle, the ideal is to minimise damage to natural habitats within the designated area. In practice, however, it is sometimes unavoidable, in which case the aim is to rehabilitate the disturbed land according to the EMPr and the ECO's instructions. <u>Destruction and Removal of Plants:</u> No indigenous shrubs and/or trees shall be cut down by the Landfill Supervisor, unless authorised by the ECO in consultation with the specialist ecologist. Removal, damage, or disturbance of any plant outside the designated area is not permitted. Special care shall be taken not to disturb or destroy riverine vegetation.

Activity /Issue	Action required
General	
	Gathering of firewood shall not be permitted. Disturbance of Animals: No animals (birds, reptiles, amphibians, insects or mammals) that reside within or adjacent to the site shall be killed or unnecessarily disturbed.
Control of Pollution	As a minimum requirement, all waste emissions (hazardous, airborne, liquid and solid) from the site shall be kept within the limits of standards set in terms of relevant national and local pollution legislation and regulations. General No waste of a solid, liquid or gaseous nature shall be emitted from the site without approval from the Municipal Manager and ECO. Precautionary measures must be taken to prevent any form of pollution. Accidental pollution incidents shall be reported to the Municipal Manager immediately after they occur and shall be cleaned up (to the satisfaction of the ECO) by the Landfill Supervisor or a nominated clean-up organisation. Soil Vehicle and plant maintenance shall be confined to the areas demarcated for this purpose. Should any amount of fuel, oil, transmission or hydraulic fluids be spilled onto the soils, the Municipal Manager or ECO shall be informed immediately. Tests must be conducted to determine the extent of soil contamination as soon as a spillage occurs. The polluted soil shall be rehabilitated or remediated to the satisfaction of the ECO. Water Water containing waste shall be prevented from entering water sources either by seepage or natural flow. On-site stormwater management shall be to the satisfaction of the Municipal Manager. Air All reasonable measures should be taken to minimise air emissions in the form of smoke, dust and gases.
Management of Waste	In practice, all wastes arising from closure activities are to be handled, transported and disposed of in accordance with the relevant regulations. All efforts shall be made to minimise, reclaim or recycle waste and, failing that, to dispose of it in a manner that is licensed by the competent authority for that purpose. Sanitation The Landfill Supervisor shall provide adequate sanitation facilities in the form of chemical toilets at the site camp and at the site for staff and visitors. The use of the surrounding veld as a toilet facility is not permitted under any circumstance. Wastewater Wastewater is water that is contaminated by humans through their actions. All wastewater runoff from disturbed areas shall be collected in settlement ponds. Solid Waste Solid waste refers to all construction waste (such as rubble, cement bags, waste cement, timber, cans, other containers, wires and nails), household and office waste. Solid waste shall be collected and stored in demarcated, fenced areas in skips and/or bins. The fenced areas or containers shall be designed to be weather and rodent proof and should be strategically and conspicuously placed throughout the site. Wherever possible, solid waste that is recyclable shall be recycled. Hazardous Wastes Hazardous wastes are wastes that are proven to be toxic, corrosive, explosive, flammable, carcinogenic,

Activity /Issue	Action required
General	
	radioactive, poisonous or as determined by the Hazardous Substances Act (Act 15 of 1973) as amended. The discharge of hazardous chemicals (such as hydraulic fluid, degreaser and drilling fluid), as declared under the Hazardous Substances Act as amended, on the site or into the river is prohibited. Potentially hazardous raw and waste materials shall be handled and stored on site in containers with tight lids that must be sealed and must be disposed of at an appropriately permitted hazardous waste disposal site. Such containers must not be used for purposes other than those they were originally designed for. The following hazardous waste products shall be disposed of at a waste disposal site approved by the ECO: • Diesel and petroleum; • Oil and lubricants; The Landfill Supervisor must maintain a hazardous material register.
Control of Disturbance to Neighbours and/or Affected Parties	<u>Noise</u> All noise levels must be controlled at the source. All employees must be given the necessary ear protection. Noise emanating from operational and rehabilitation activities must not be "disturbing noise"; that is, the sound level from the site measured at the nearest dwelling must not exceed the ambient noise level by 7dBA or more. Appropriate directional and intensity settings should be maintained on hooters and sirens, if applicable. Silencer units on plant and vehicles shall be maintained in good working order. Where required, the Landfill Supervisor shall provide noise attenuation measures in the form of cladding and earth berms between sources of on-site noise and neighbours and/or affected property owners. A speed restriction of 10km/h shall be imposed on all vehicles to limit additional noise that could be generated by these vehicles. <u>Dust</u> The Landfill Supervisor shall implement measures to restrict the generation of dust during operation, rehabilitation and other related activities. Roads and working areas shall be maintained regularly and this may include spraying water or the application of dust palliatives. Water used for this purpose shall be used in quantities that are small enough not to generate run-off and cause soil erosion. The Landfill Supervisor shall control dust from spoil dumps as specified above. Stockpiles of soil must be kept covered or must have a suitable dust palliative applied, such as water or commercial dust suppressants, to prevent windborne pollution. <u>Social Interaction and Disruption</u> The Landfill Supervisor's activities and movement of staff shall be restricted to designated areas only. The Landfill Supervisor and site staff may not interact directly with adjacent landowners but only through the Municipal Manager, who will contact property owners to obtain permission. The Landfill Supervisor's staff shall wear identity cards (with the employee's photograph displayed on the card) to make identification possible at all times. Any temporary staff employed by the Landfill Supervisor or sub-contractor shall also comply with this clause. <u>Traffic Control</u> All reasonable precautions must be taken during operational and rehabilitation activities to avoid severely interrupting the traffic flow on existing roads.

9. Engineering Operation Methods for the Hlabisa Landfill

9.1 Aim and Objectives

The aim is to provide guidelines for interim Operation of the existing communal landfill site. The Hlabisa landfill site is un-licenced and pre-dates the Minimum Requirements for Waste Disposal by Landfill (DWAF, 1998). Consequently the planning, engineering and operations were not implemented at the sites.

The site is to be closed within 5 years of licencing but operations on site must comply with current legislated practices. The required actions required for each activity during operations is presented in Table 9-1 below.

Table 9-1: Operation & Maintenance Guidelines

Activity /Issue	Action required
Operation And Maintenance	
Waste quantities	The landfill shall be limited to waste quantities as authorised by the relevant authority.
Waste types	The landfill shall only accept waste for which it is authorised to receive.
Charges for disposal	It is intended by the Municipal Manager that the tariff structure for disposal of waste by outside parties be revised annually. Where considered justified, the Municipal Manager reserves the right to grant special disposal tariffs to any of the landfill users. Having revised the disposal tariffs, the tariffs will be updated and the Landfill Supervisor will adhere strictly to the prescribed schedule. A notice board with the applicable disposal tariffs, to be erected at the Landfill entrance, will be updated annually.
Operating Hours	The landfill operating hours should be displayed or made available to the public and should include specific times for public holidays and closure periods.
Landfill Supervisor	A full-time Landfill Supervisor will be provided to manage the Landfill. The experience and qualifications of the Landfill supervisor will comply with the Minimum Requirements for Waste Disposal by Landfill, 1998, as issued by the Department of Water Affairs and Forestry. The Landfill Supervisor will be contactable for 24 hours a day in the event of any emergencies or serious problems that may arise on the Landfill.
Meetings and landfill inspections	The Landfill Supervisor, the Municipal Manager, the Engineer as well as other Contractors that may be actively involved on the Landfill at the time, will meet at approximately monthly intervals as the Committee of Control (C.O.C.). The Engineer will make arrangements for the C.O.C meetings and will also be responsible for the minutes of the meetings. The C.O.C. meetings will be conducted to discuss all matters relating to the operation of the Landfill and to review and up-date the overall plan of operation. Decisions made, agreed upon and recorded in the minutes of these meetings will be binding on the parties. It is however to be noted that the C.O.C. does not have executive powers and that certain decisions affecting the Landfill Supervisor may need to be approved by the Municipal Manager. Periodic (initially six-monthly) Landfill audits will be undertaken by external auditors appointed by the Municipal Manager, in the company of the Landfill Supervisor. During this exercise a specially designed pro forma will be filled out, which will numerically assess important aspects of the operation. This, together with appropriate recommendations, will be submitted to the Municipal Manager, the Engineer and the Landfill Supervisor. These inspections may or may not be conducted in conjunction with the monthly meetings. The frequency of meetings and audits will be increased if operational standards are not acceptable. At the discretion of the Municipal Manager and based on the standard of operation, such periodic Landfill audits can later be reduced to annual inspections. Any member of the C.O.C. will have unimpeded access to the Landfill, provided that they report to security before entering the operational part of the Landfill.
Salvage Rights	Although certain salvage operations may be undertaken, scavenging amongst the waste at the working face will be prevented. The only exception to this rule is the compulsory removal from waste disposal area of steel objects that can cause punctures in tyres of vehicles delivering waste as well as the removal and stacking of tyres disposed of as part of the general waste stream. Salvaging may in future include formalised materials sorting and recovery, composting, landfill gas recovery and any other operation of a similar nature.
Operation of the landfill	The operation of the Landfill will involve the following major functions, which will be undertaken in accordance with the Minimum Requirements for Waste Disposal by Landfill, 1998, as well as the Environmental Management Programme. • Maintenance of access roads to the Landfill

Activity /Issue	Action required
Operation And Maintenance	
	• Access control • Maintenance of Site roads and controlling of traffic within the Site • Control of nuisances • Construction and maintenance of Site drainage, including storm water-, contaminated runoff- and leachate control • Record keeping The principles regarding the above are discussed below, with a view to providing a clear concept of what is anticipated in terms of the landfill operation. In addition to the major functions dealt with below, numerous other aspects are included for information. **Maintenance of access roads to the Landfill** The entrance to the Site will be kept in a clean and neat state. This includes removal of all mud and refuse deposited on the road in the vicinity of the Site entrance (particularly during wet weather) and the picking of all windblown or scattered refuse and litter emanating from the waste delivery and disposal operation. This activity will be performed daily. **Access control** Access control will at all times be performed in a responsible manner, thus ensuring that only vehicles with waste loads permitted for disposal on the Waste Disposal Site, in accordance with the Minimum Requirements for Waste Disposal by Landfill, 1998, will be allowed on the Landfill. **Control of nuisances** The Landfill Supervisor will take all reasonable measures to operate the Landfill so as to reduce and, where possible, prevent nuisances such as: • odour; • dust (by means of watering Site roads), • flies and rodents (by applying sanitary landfill procedures of compaction and covering, as well as by providing fly bait and fly traps at the waste disposal working face, public disposal area, etc. Rat traps or natural rodent control measures will be implemented to prevent poisoning of birds in the area); • noise (by ensuring that all plant silencers, etc. are in good working order and by limiting the operations to the prescribed hours.); • windblown litter (by applying sanitary landfill procedures of waste compaction and daily covering, as well as using litter catch nets where required. Litter that has been scattered in the area will be collected and disposed of on a daily basis); and • no scavenging will be allowed on the Landfill workface. The removal of sharp steel objects from the workface that could cause punctures to waste collection vehicle tyres as well as tyres disposed of with the general waste, will however be the only exceptions and removal thereof from the disposable waste stream a requirement. **Construction and maintenance of Site drainage, including storm water, contaminated run-off and leachate control** Undue contact between waste and storm water will be prevented, so as to minimise the volume of contaminated run-off and leachate generated on the Landfill. Two drainage systems will therefore be operated on Site; one for clean storm water and uncontaminated run-off from rehabilitated parts of the Landfill, and the other for polluted runoff from the operational part of the waste body that is to be directed into a contaminated water containment pond. <u>Uncontaminated storm water</u> A system of berms and cut-off drains will be constructed around the perimeter of the Site to prevent clean water from entering the Landfill area. The object of the drainage system is to divert clean storm water, as well as unpolluted run-off from rehabilitated areas, around one or both sides of the waste body. Once portions of the landfill have been rehabilitated, such runoff will be classified as unpolluted. Continued maintenance of this system is intended to keep it free draining. As new phases of the landfill are developed, the storm water system will be extended by excavating and preparing further trenches. Erosion protection will be provided where required.

Activity /Issue	Action required
Operation And Maintenance	
	Should water be accumulating in the daily cover material borrow pit, it is to be drained / pumped from the excavations as soon as possible to prevent it from hampering cover material excavations. **Record keeping** Detailed daily records will be kept of the following operational aspects and these will be available for inspection by the Landfill Supervisor: • mass of each waste load delivered; • category and composition of each waste load; • source of the waste; • process from which waste originated; • vehicle registration number; • driver details; • time and date of delivery; • account number; • verification tests performed on incoming waste loads; • volume of cover placed per day; • complaints lodged; • incidents / accidents; • landfill protocol violations; • breakdowns and stoppages; • rainfall figures with full weather station data including minimum and maximum temperatures, rainfall, wind speed and wind direction; and • monthly and annual reports will be prepared, highlighting the major activities, events, statistics, etc. The format of the monthly and annual reports will be discussed with the Engineer prior to finalisation of the reports. A Site Instruction Book will also be kept on the Landfill. All consumables for record keeping, invoices, associated computer equipment, peripherals and the supply of a suitable extra heavy duty printer will be available on the Landfill. All consumables for record keeping, invoices, associated computer equipment, peripherals and the supply of all suitable equipment should be made available on the Landfill.
Maintenance of the Landfill	All aspects of the Landfill will be maintained in order to ensure its smooth and efficient operation and to prevent undue deterioration of any item. Included in the maintenance of the Landfill are: **Scattered waste** To keep the Site and its surrounds neat and clean by removing all windblown or scattered litter emanating directly or indirectly from the Landfill operation on a daily basis. As a first step, the Landfill Supervisor will take all actions required to prevent the spreading of windblown litter. **Buildings** The buildings and structures will all be maintained on an on-going basis. This will include, but not be limited to the following: • General housekeeping to ensure that all buildings are maintained and kept clean inside and outside as well as all areas surrounding the buildings • Upkeep and maintenance of gardens and landscaped areas, as it may apply • Ensuring clean and hygienic conditions in all ablution facilities as well as kitchen/dining areas **Access road** All temporary and permanent Site roads will be maintained (i.e. those roads providing access to various waste management facilities). This work will include the watering of unpaved road surfaces to prevent dust nuisances; grading and filling of potholes; resurfacing of roads with selected graded material or building rubble free from reinforcing and with particle size less than 100-mm; as well as any other repair work required to ensure that all-weather access to the Landfill workface is provided in a safe and usable condition.

Activity /Issue	Action required
Operation And Maintenance	
	Berms and storm water drainage canals All berms and storm water canals will be maintained in good condition and free from any blockages to effectively perform its intended function. Silt accumulating in the storm water drains will be removed at regular intervals. Where required, temporary berms and storm water drainage channels will be provided to ensure the safe and sound operation of the Landfill. **Fences, gates and access control boom** All fences, gates and locks will be kept in good order and any damage caused to it will be repaired. All alien bushes or trees growing on- or in close proximity of the line of security fences will be removed and the roots killed. **Rehabilitated and landscaped areas** All trees and shrubs planted onsite will be watered until such time as they are well enough established not to require further watering. Any erosion furrows and subsidence's which form on intermediate or finally rehabilitated disposal areas shall be filled and re-grassed where applicable. **Road-markings** All road markings on the paved access roads will be maintained.
Notice boards	A weatherproof notice board will be erected at an approved location indicating hours of opening, type of waste that can be received and contact numbers of waste management section. All notice boards, including the tariff board, will be updated to ensure that the information displayed remains relevant. The boards will be maintained in good repair.
Violation of Site Protocol	A record and the details of the occurrence of all vehicles violating the site protocol will be kept. Vehicles may, depending on the violation and the number of written warnings issued, be "blacklisted" from being allowed to dispose of waste at the Waste Landfill Site for a period to be determined by the Landfill Supervisor. A report of the violation will be handed to the vehicle driver and distributed to the driver's direct supervisor and the Municipal Manager. Types of incidences considered to be a violation, are in accordance with site rules, which will be displayed on site
Procedure for rejection of waste loads	Should any waste load delivered to the Landfill not meet the Landfill license conditions in terms of its waste classification, the Landfill Supervisor shall refuse the waste load. Such waste includes: • Asbestos waste; • Hazardous waste; • Medical waste; and, • Infected animal carcasses.
Rehabilitation of the site and immediate surrounds	The following is proposed for the once-off rehabilitation of the landfill: • Fencing o Erect a concrete palisade fence around the landfill including a lockable gate. Other types of fences are easily vandalised and stolen. Although concrete palisade fencing can also be vandalised or stolen, it has proved most effective in applications of this nature. • Infrastructure o Construct a lockable guardhouse with a gate and access control and appoint personnel to man the facility. Access control is required to monitor the types and volumes of waste being dumped at the site and to indicate to the driver of the vehicle, where to dispose of the waste. Install ablution facilities or porta-toilet with maintenance contract. o Install potable water tank and replenish daily. o Install solar powered security light at entrance. • Rehabilitation of site o Determine the extent of the previous waste disposal activities on site. Dig test pits of approximately 2m deep around the site to determine the locations and extend of previous

Activity /Issue	Action required
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	disposal areas. Survey the site to determine the waste volumes currently on site; o Any new incoming waste must be directed to the trench where the waste is consolidated; o Consolidate all the waste material in one area of the site, preferably the current trench or pit, using a Tractor Loader Backhoe (TLB) and a tipper/front end loader. An existing trench should be used if possible, otherwise a cell should be excavated. It is strongly recommended that a TLB be purchased and dedicated to work at the landfill. Keep clean builders rubble aside as this can be used as cover material. o Spread all the waste material on site into the trench in 300mm layers and compact the waste. The bucket of the TLB could be used to compact the waste. Cover the waste with 150mm of clean excavated soil or builder's rubble for every 1m of waste and compact. Continue with this process until all the waste on site is in the trench or the trench is filled up to an acceptable height above ground level (normally between 3m and 5m depending on the size of the pit). o A leachate cut-off trench must be installed downstream of all the waste trenches on site in order to intercept the leachate coming from the unlined cells; o Construct stormwater berms around the east, north and west perimeter of the site to diver clean water around the site; o Once all the waste has been consolidated, daily operations should include daily covering and compaction of the waste the 150mm clean soil o The last waste layer in the cell should have at least 300mm ground cover with slopes of 1:3 down to natural ground level. o Stockpile any excavated material near the cell or trench to use as cover material. Ensure that there is enough space for vehicles to manoeuvre when they come to dump the waste. o If the excavation of the cells reveals that the water table at the site is shallower than anticipated, the cell excavations should not continue. Consult the advice of a suitably qualified Professional Engineer to determine the best disposal solution for the site. The base of the cell will have to be lined with a class B liner according to the latest Norms and Standards for waste disposal. This would be in the form of an excavated shallow cell with adequate drainage. Compact the layers of the cell in accordance with the information in the Minimum Requirements document or in accordance with the instructions of the Design Engineer. This is to minimise the migration of contaminants to into the groundwater. o If there is a significant amount of leachate remaining on the natural ground level after the waste has been moved, the leachate and the contaminated soil should be collected in an approved container (plastic double walled or a steel drum) and sent it to a laboratory for waste classification tests. Seek advice from a professional engineer in the case of significant leachate generation. o Cap the pit at the end of the 5 years of the specified operational lifetime. o The capping layer should include a gas venting system. o The capping design must be designed by and signed off by a Professional Engineer. • Litter picking o Appoint unskilled casual labour from surrounding communities to pick up the windblown litter surrounding the landfill. Provide gloves and masks. Provide a container or collection point where litter can be stored. Alternatively use Municipal workers for this task. • Signage o Erect a sign post at the gate indicating the operating times of the landfill site as well as the types of waste accepted at the landfill site.
Heritage Sites	Should a find of heritage importance be unearthed during construction of additional cells in the interim 5 year operational period, then construction activities will stop immediately at the site of discovery. The area will be fenced off with a radius of 20m around the unearthed item, demarcated as a no-go area and access will be prohibited. Should there a risk of the find being violated, whether intentionally or inadvertently, the Contractor

Activity /Issue	Action required
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	shall be required to appoint a guard to enforce the no-go area policy. The ECO and Municipal Manager shall be notified immediately. The ECO will contact an archaeologist to undertake further studies and determine the importance of such a find. All related activities will be undertaken by the archaeologist, or under his/her supervision, to ensure no unnecessary damage takes place on the site. During this period, work will not take place in the demarcated area. Work will be continued further along the site at a distance which is clearly well out of the area that may be affected by the findings. Should the findings be clearly limited to a particular area the ECO and Municipal Manager, in consultation with the archaeologist, will be free to determine what can reasonably be deemed a safe no-work distance, which will be kept clear of activities. Work will only recommence on the written consent of the archaeologist and/or the Amafa, KZN. Finds containing human remains shall immediately be reported by the Municipal Manager to the South African Police Services (SAPS). All parties concerned shall respect the potentially sensitive and confidential nature of the heritage resource, particularly human remains. Under no circumstances shall any artefacts be removed, destroyed or interfered with by anyone on site. The Contractor and workers shall be advised of the penalties associated with the unlawful removal of cultural, historical, archaeological or paleontological artefacts, as set out in Section 51(1) of the NHRA.
Engineering works	The following are engineering works that are important at the Hlabisa Landfill Site: • Leachate collection o In order to minimise the contamination of groundwater by the leachate in the waste cells, construct a drainage trench (Figure 9-1) downstream of the waste cell. The drainage channel should be deeper than the waste cell by up to 1m. Install a HDPE perforated drainage pipe in the trench and cover the pipe with a geotextile bidim material to prevent blockage of the pipe perforations. Backfill the drainage trench with the excavated soil and compact. The pipe must have a minimum 2% slope and drain towards an underground conservancy tank. o The tank must be drained when it is 75% full. The conservancy tank has a vent open to the atmosphere that can be used to test the level of leachate in the tank. Rainwater on top of cells will seep through the waste and will drain through the leachate collection system into the conservancy tank. This water should be drained into the conservancy tank and should not go into the environment. o During planning and when installing the leachate collection system, care should be taken to ensure that the leachate channel have a slope towards the leachate collection tank.

Activity /Issue	Action required
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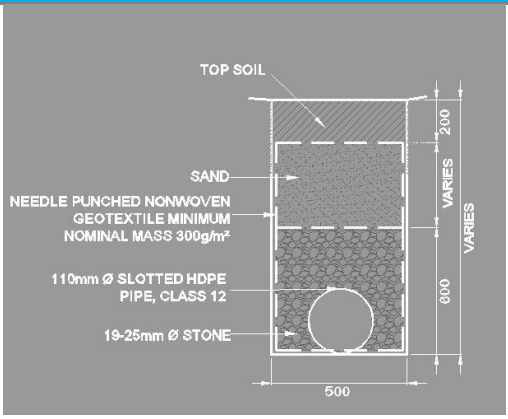

Figure 9-1: Leachate cut-off trench

- Storm water Management
  - Using material from the excavated cell, construct a berm upstream of the cell to divert the stormwater from the waste. Water should be kept out of the waste cell.
- Erosion control works
  - Repair existing erosion areas by stabilising with rock and shaping to maximise run-off.
- Boreholes

A monitoring borehole is required downstream of the landfill site. The monitoring protocol is as follows:

  - Water Levels should be measured at least monthly and the readings recorded against time and date
  - Water samples should be taken at least every 6 months, preferably in April and October (end of summer and winter) and the samples sent to a reputable lab for analysis. Field readings such as pH, temperature, EC, etc. should also be measured at the time of sampling and recorded against date and time.
  - Chemical constituents to test for should include Ca, Na, Mg, Fe, K, SO_4, HCO_3, Cl, NH_4, NO_2, NO_3, F, PO_4, Si, as well as physical readings such as pH, temperature, EC, DO, Redox Potential.
  - The monitoring data should be kept in a safe place and be available to the Department on request.
  - A monitoring report done by a geohydrologist should be compiled at the end of the 18 months, using the monitoring data collected. This report will then be evaluated to determine whether further monitoring may be needed.
  - In the event of contamination/pollution being found, the department should be notified as soon as possible and a remediation plan be provided for approval. Potential receptors are to be identified immediately and action taken to ensure that there is no health risk.
  - The precautionary principle applies, as it is very difficult if not impossible to remediate groundwater once it has been polluted.

- Waste Classification at Gate
  - Waste can only be accepted at the Landfill which is accordance with the Waste Licenses.
  - Waste not in accordance with the license must be refused and diverted to an appropriate facility.
  - Should the waste be acceptable, record keeping of the incoming waste types and quantities must be as accurate as possible.
    - According to the regulations contained in Government Gazette of 23 August 2013, the waste manager must keep record of the following:
      - Name, address and contact details.
      - Date of receipt.
      - Quantity of waste received by weight (ton) and volume (m^3) if possible.

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	• Type of waste management applied (recycled, re-use, recovery, treatment, disposal) • Any discrepancies in information between the different holders of the waste (related to the quantity of the waste, type, classification, physical and chemical properties) • Waste management reporting description and code in terms of the National Waste Information Regulations, 2012. • Details on waste diverted to anther waste facility, and details of the facility. • Certification and declaration of receipt and final arrangement of the waste. o A compliance check list can assist the landfill operator in complying with the permit conditions. Internal audits also assure that the operator is following the check list and that the site is meeting the permit conditions. The facility should be audited on an annual basis. • Compaction o Compaction must be done daily. Compaction of waste is done by passing heavy equipment over deposited waste. This reduces voids in the waste, thus reducing the chances of channelling which promotes the rapid infiltration and migration of any leachate formed. It also reduces the risk of fires, discourages vermin, controls litter, reduces the amount of cover required and increases site life. o For landfill sites were compaction rollers cannot be purchased, hand rollers or filled drums can be used to get some degree of compaction. o Should the site receive mostly garden refuse and builder's rubble, the garden waste should ideally be chipped and converted to compost. If the Municipality cannot afford a chipper for permanent use on site, the possibility of using external contractors to convert the garden waste into compost, needs to be investigated. • Cover application o Daily cover of the working face of the landfill is required. The application of soil or other suitable cover to compact waste reduces litter and the risk of fire, but its main purpose is to eliminate odour. It also reduces scavenging and generally improves aesthetics. The sanitary landfill definition specifies daily cover or covering after the waste has been placed (if the waste is not dumped on a daily basis). . o A minimum thickness of 100mm of compacted soil is required after 300mm waste has been placed. This thickness will need to be increased in the case of poor quality cover. o The material to be used for cover may be on-site soil or builders' rubble of manageable sizes. With the approval of the Provincial Authority, ash or other artificial covering can be used. o Always keep an emergency stock pile for at least one week's cover. o When cover material is not available on site, the material needs to be obtained from external sources like construction sites, cemeteries etc. • Surface water Management o Separation of clean and dirty water circuits requires regular maintenance o The storm water system installed must be inspected and cleaned weekly. o Ponding on the landfill must be avoided and if it occurs, the area must be re-shaped to maximise run-off
Storm Water Management System	Storm water management and drainage planning are critical components on waste management sites during operations and after closure of the site. Therefore the storm water management infrastructure should be designed to comply with Government Notice 704 of the National Water Act of 1998. <u>Objectives</u> The design focuses on mitigating potential adverse effects of inadequate storm water management at the

<table>
<tr><th>Activity /Issue</th><th>Action required</th></tr>
<tr><td colspan="2">Operation And Maintenance</td></tr>
<tr><td></td><td>site. The objectives of a Storm Water Management Plan (SWMP) can be summarised as:

• to protect water resources from pollution by separating and collecting all storm water that has a poor quality into dirty water ‘storage’ facilities for treatment before discharging into the environment or reuse within the site operations where applicable.
• to ensure that all storm water management infrastructure is designed to handle a 1 in 50 year storm event and is not adversely affected by a 1 in 100 year storm event.
• to maintain downstream water quantity and quality requirements by ensuring that the maximum volume of clean water runoff is diverted directly to the natural watercourses and the minimum amount of clean storm water is contaminated and thus enhancing the overall catchment yield.
All the storm water that falls on part of the landfill cell which is not operational (and probably capped) will not be allowed to get mixed with the dirty water and will be diverted to natural water courses around the site.

In addition to meeting the fore mentioned objectives, the storm water management system will ensure that:-

• contaminated areas will be minimized and remain isolated from clean areas
• clean storm water may be reused in the site operations
• seepage losses from waste management facilities are minimized and overflows are prevented.

<u>Classification of Areas according to land use</u>

Good storm water management is based on separating clean and dirty water and therefore incorporates the fundamental principle of pollution prevention. The site should be divided into dirty and clean areas. The storm water that fall on these areas shall be classified as dirty storm water and clean storm water respectively.

<u>Storm Water Management Infrastructure</u>

The table below shows some elements that may be incorporated into the storm water management systems on sites and the respective purposes.

Table 9-2: Elements of the storm water management system.
<table><tr><td>Element</td><td>Supply</td><td>Convey</td><td>Store/other</td></tr><tr><td>Storm water drains</td><td></td><td>√</td><td></td></tr><tr><td>Diversion Berms</td><td></td><td>√</td><td></td></tr></table>
<u>Design of the Elements</u>

The storm water flowing towards the site will be collected away from the waste facilities in drains or will be diverted by berms to the downstream side of the facilities. After capping of the landfill all the water falling on top of the landfill is considered clean therefore it can be released directly to the water courses downstream of the landfill.

The Hlabisa landfill site is located on the sloped terrain. It is therefore advised that stormwater berms be constructed at the uphill side of the site to divert clean stormwater abound the site.</td></tr>
<tr><td>Landfill Management Actions</td><td>There are a number of Landfill Management Actions that must be implemented as part of the overall operation of the landfill.

• Responsible Personnel
o Training must be provided to responsible personnel on the waste management and landfill</td></tr>
</table>

Activity /Issue	Action required
Operation And Maintenance	
	operation practises, as general lack of knowledge by the employees adds to the current problems experienced. It is advised that the responsible personnel register with the Institute of Waste Management of Southern Africa (IWMSA) and use the minimum requirements document (Minimum Requirements of Water Affairs and Forestry Document) daily. Attendance of seminars and courses offered by the IWMSA or regulatory waste bodies are also strongly recommended. • Burning of waste o Burning of waste takes place at many small landfills in South Africa, to reduce the volume of waste and its attraction to vermin and livestock. The burning of waste is considered unacceptable, however, because of the aesthetics, odours, and the potential of health dangers from air pollution. On account of these adverse impacts, therefore, the Department prohibits the burning of waste. o Possible exceptions to this Minimum requirement would be small general landfill in rural areas, provided that they are at least a 1000m downwind of residential areas. In such cases special permission to burn must be obtained. Where burning is permitted, proper procedures must be followed to protect the public health and safety, and to prevent the degradation of the environment. Efficient burning to obtain complete combustion without smouldering would therefore be a minimum requirement and all relevant occupational health and safety requirements would have to be met. o Accidental fires on landfills while burning must be extinguished immediately. Appropriate operational procedures, involving the spreading and smouldering of burning waste, rather than the application of water must be implemented. • Litter o It is a minimum requirement that all litter be contained within the site. This may be achieved by the principals of compaction and cover. On sites characterized by high winds, however, movable litter fences are a minimum requirement. Windblown litter must be picked up and removed from fences on a daily basis. • Odours o Odours must be combatted by good cover application and maintenance. • Dust o Unsurfaced roads and ungrassed or unpaved areas, which give rise to dust problems, must be regularly watered to restrict duct levels which do not pose a nuisance to workers or users of the facility. • Waste reclamation o Reclamation on the landfill is not permitted. Reclamation at landfill sites can endanger the health and safety of the reclaimers. o Pickers, children and domestic animals are not allowed onto any landfill site for safety reasons. • Vandalism and Theft o Vandalism and theft on a landfill site is a common occurrence. Access control and proper security measures are required on landfill sites. Regular inspections of the perimeter of the landfill and immediate repairs of the fencing must be undertaken. • Monitoring Compliance check list o A compliance check list must be drawn up and used to ensure the landfill operator is complying with the permit conditions. Quarterly Internal audits are required to ensure that the operator is following the check list and the site meeting the permit conditions. The current landfill has a variety of negative impacts on the environment. Standards and requirements are in place in South Africa to limit these impacts and it is the duty of the landfill operator to implement these measures. Municipalities often have a significant challenge in this regard because of budget constraints resulting in a lack of equipment or personnel. However, these short comings do not change the duty of care requirements for the operation of landfills.

Activity /Issue	Action required
Operation And Maintenance	
	Most of the environmental impacts are because of general waste management practices not being adhered to. The people surrounding the landfill are exposed to health hazards due to the waste not being managed properly. Uncovered waste results in windblown litter, landfill fires, ground water and air pollution, negative aesthetics etc. Food for waste programme o The municipality can encourage the community to take part in the food for waste or similar programme. o The Food for Waste programme is a special Public Works Programme of the Department of Public Works through which three objectives are pursued: (1) Increasing the waste collection capacity of municipalities thereby reducing the amount of un-serviced areas; (2) creating job localised opportunities for unemployed people from poor households; and (3) reducing poverty and hunger through providing food parcels to compensate for labour. o The beneficiaries of the programme should preferably be non-working individuals from the most vulnerable sections of disadvantaged communities who do not receive any social security income. o The food for waste programme can help in cleaning the area surrounding the landfill site from windblown litter and dumping outside the perimeters of the landfill site. • Material recycling facility o If there are currently informal recyclers on the landfill site, the municipality may consider putting a programme in place for the informal recyclers. A certain area on the entrance to the site could be identified where these informal recycles can still do recycling, but in a more controlled and hygienic way. o The informal recyclers allowed on the landfill site should register themselves and get a permit from the waste manager. They should be provided with Personal Protective Equipment (PPE). Permit conditions can include the following: ▪ Do not eat anything found on the site ▪ Do not burn anything on the site ▪ Do not allow children and animals on the site ▪ You are only allowed on site with in working hours ▪ Wear PPE at all times ▪ Obey the rules on the site enforced by the Security Guards o Payment is based on the waste volumes collected.
Composting Systems	Composting systems will reduce the amount of waste that is being landfilled and will benefit the surrounding communities through job creation and giving them the opportunity to have a product to sell Typical waste that can be used for composting is garden waste, food waste, manures and fruit waste. Below is a discussion of compost methods that can typically be used at communal landfill sites: **Minimal Technology** • Static piles require minimum technology. A compost pile is fairly simple to imagine. Starting at a minimum size of about one cubic meter to generate and retain heat, compost piles have been known to become quite large. Static piles have no forces aeration. The output that one can expect from this type of composting technique is a lower grade compost or a soil conditioner. • This type of composting is inexpensive and if the piles are turned every few weeks, relatively few day of equipment is needed. • The time period for this kind if composting is 18-24 months. Less skilled labour is required as this is fairly easy to operate and manage.

Activity /Issue	Action required
Operation And Maintenance	
	Low Technology • Compost bins or barrels refer to an aerated bin containing layers of carbons, kitchen scraps and soil left to decompose. • Windrow – As the volume of materials increases it becomes prudent to make additional piles, often side by side, until you have a long row. A windrow is an elongated compost pile. Materials need to be physically turned in order to introduce air into the process • Vermicomposting refers to the controlled degradation, or composting, of organic wastes, primarily by earthworm consumption. The output that can be expected from low technology composting is compost or a soil conditioner. The advantages is moderate cost, labour intensive, ability to use a front end loader and other generic types of equipment and the product is generally of a satisfactory quality. The time period for this type of composting is 9 – 12 months.

10. Engineering Closure Methods for the Hlabisa Landfill

10.1 Aim and Objectives

The aim is to provide guidelines for closure of the existing communal landfill sites. The Hlabisa landfill site is un-licenced and pre-date the Minimum Requirements for Waste Disposal by Landfill (DWAF, 1998). Consequently the planning, engineering and operations were not implemented at the site.

All waste disposal facilities need to be closed and rehabilitated after their intended design life. Closure plans are best developed before a landfill is put into service, but in this case, no proposed closure plan was ever prepared. Thus a rehabilitation plan is required to close the site and to monitor the effectiveness of the closure into the future.

The Department of Water Affairs and Forestry (DWAF), Minimum Requirements for Waste Disposal by Landfill (Second Edition, 1998); Table 12; summarizes the requirements for the closure of a landfill site. In terms of the Minimum Requirements, the closure and end use plan must include the following:

- Evaluation of the current status of the landfill.
- Comparison of the current status of the landfill with the closure design including end use requirements.
- Recommendations for upgrading the existing condition of the landfill to that desired.
- Detailed plans for management, monitoring, inspection and maintenance of the site once it has been closed.

10.2 Identification of End Land Use

There are many different options and alternatives for end use of landfills including agricultural use, ecological uses, recreational and amenity uses etc. The choice of the desired end use is typically influenced by a number of factors including:

- Type of waste and associated operational constraints;
- Size, location and access;
- The development plan or framework;
- The aspirations of local residents, interest groups, etc;
- Scheme economics; and,
- Long-term management requirements.

10.3 Conceptual Closure Design and Proposals for Rehabilitation

The Closure design and proposals for rehabilitation made under this section of the Report address the requirements as per the Minimum Requirements for Waste Disposal by Landfill (Second Edition, 1998).

The following recommendations are made in order to prevent or reduce the impact of the landfill on the geohydrology by:

- Minimising the ingress of rain and storm water into the waste material at the landfill site, by placing an impervious cover over the waste at the site and that any leachates and run-off water be collected in lined ponds. This will keep the waste deposited at the site historically, as dry as possible reducing the chances of pollutants originating from this site.
- It is recommended that the site be isolated and that no further development or dumping of additional waste of any kind be carried out.

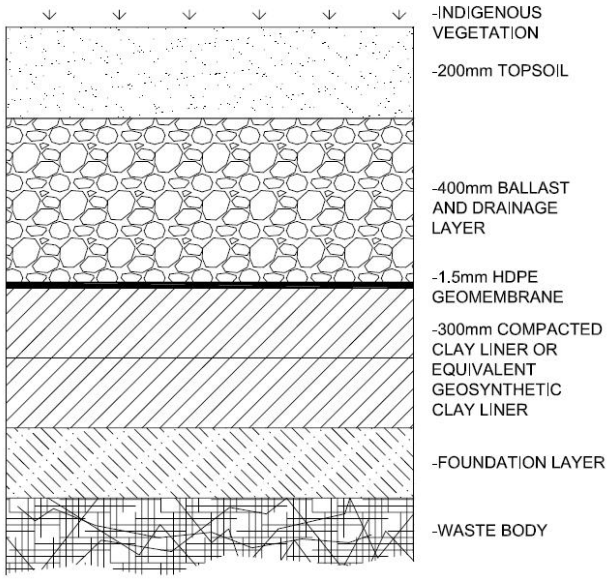
10.4 Requirements for Closure Design

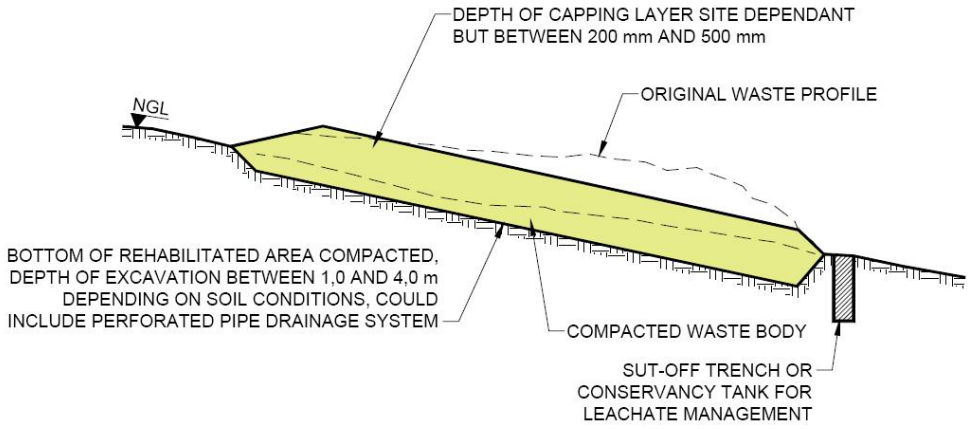
The final closure design:

- Ensures that any identified pollution risk is mitigated and managed. Pollution control is the primary function of the closure design;
- Reduces the infiltration of precipitation into the landfill to control leachate generation;
- Separates the waste in the landfill from its surrounding environment; and
- Minimises fugitive emissions of landfill gas through the surface of the cap.

Table 10-1: Engineering Specifications – Closure Design

Activity /Issue	Action required
Closure	
Closure Methodology	The following steps are envisaged in the Hlabisa closure plan: • If the site will be operational for a few years before final closure, it is advised that the landfill site be operated according to the Operation and Maintenance guidelines as set out in Table 9-1. • For final capping layer or must be placed on the last cover layer of the cell. • Grass the topsoil with the hydroseed mix prescribed.
Surveying	The site must be surveyed by a professional land surveyor to determine the shape of the waste body, the general sloping of the ground within the site, the boundary of the property concerned and location of site infrastructure. The survey informs the infrastructure that has to be in place and the way it fits into the terrain. An exercise to quantify the amount of waste within the landfill cells and the remaining airspace can also be done via survey data and DTM modelling.
Geometrics of the Landfill cell	Final Elevation It is best practice to limit final height to that of the background topographical features; however in this scenario there are no significant features in close proximity to be considered. A final height of at least 2m above the natural ground level or the existing waste body is proposed in order to cater for settlement. A cover will protect the rehabilitated waste body from water ingress and to allow natural vegetation to establish without compromising the integrity of the capping design. Slope and Grading The plateau of the final landfill cells must be graded to 2 - 3% slope to encourage flow of water at the plateau whilst discouraging ponding at the top of the landfill. Side slopes of a maximum of 1:3 slopes will be adopted to ensure stability of the landfill cells. This gentle slope also encourages the growth of vegetation which will act as a cover, improving the aesthetics of the site in the post closure period. The growth of vegetation will also reduce erosion of the side slopes. However, the final shape must be approved by the regulating authority.
Final Cover and Capping	Capping The final covering and capping of the site must be undertaken at the end of the specified operational

Activity /Issue	Action required
Closure	
	lifetime (5 years) and must conform to the applicable legislation. Before final capping, the waste must be compacted and shaped in such a way as to promote run-off and to prevent any ponding of water on the landfill site. Filling and landscaping may be necessary to achieve a dome shaped landscape. This is essential in order to prevent any pooled water from seeping through the capping layer and in to waste below. The capping needs to be impervious in order to prevent any further contaminants leaching into the ground water. A capping or final cover system is made up of a series of elements. The capping system is designed to maximise run-off, while minimising infiltration and preventing ponding of water on the landfill. Cover requirements, and hence the number and sequence of components, will vary with the class of landfill under consideration. For the site in question, a 300mm compacted clay layer, 1,5mm geomembrane, 400mm ballast and drainage layer and a 200mm thick layer of local topsoil planted with local grasses and shrubs to be applicable as a final capping. The topsoil layer must be lightly compacted after spreading. Figure 10-1 below shows a typical section of the conceptual capping for the landfill site. The compacted clay layers could be replaced by a suitable Geosynthetic equivalent depending on the approval of the Engineer. The current sand capping layer can be used as the foundation layer required in the capping design. Allowance should be made in the capping design for gas venting.  **Figure 10-1: Typical capping detail for the Hlabisa landfill site.** The capping system is subjected to a detailed engineering design by a Professional Engineer. During the detail design of the capping system, attention should be given to the Factor of Safety against

Activity /Issue	Action required
Closure	
	sliding of the soil cover on top of the geomembrane (the veneer system). In **Figure 10-2** the correct profile for a landfill on a sloped terrain can be seen.  **Figure 10-2**: Waste disposal profile on a sloped terrain
Soil Remediation	Fertilising: Soil analysis tests on the top 75 mm of prepared surface shall be performed prior to revegetation/seeding to determine the required fertiliser levels for vegetative cover. These levels should be in line with the following used for dry land production of pasture grasses: Nitrogen at 70kg/ha-1, Potassium at 40kg/ha-1 and Phosphorus at 20kg/ha-1. The fertiliser application rate will be dependent on the fertiliser mix and application rates as identified during soil analysis. These requirements will be determined from findings following tests done on adjacent lands or prior to decommissioning and rehabilitation activities commencing. Fertilisers shall contain both macro and micro elements.
Hydro seeding	Seed acquisition: Seed shall be purchased from a South African National Seed Organization (SANSOR) accredited dealer. Seed used for rehabilitation shall not be older than one season. Purchased seed must be of the correct species and of known origin, dried and packed, conforming to all legal requirements for seed. Proof of compliance must be provided to the Municipal Manager prior to commencement of works. Hydro seeding/Conventional Seeding: The Municipal Manager shall appoint a reputable hydro seeding/conventional seeding company to undertake the hydro seeding/conventional seeding. The appointed Contractor shall ensure that an approved hydro seeding machine is used capable of dispensing a uniform solution of seed, anti-erosion compound, fertiliser and water. The seed mix required for re-vegetation will be dispensed at a rate of not less than 20 kilolitres of water per hectare. This mixture will comprise a selection of species that are indigenous and locally occurring, and capable of growing under natural conditions. Hydro seeding/conventional seeding shall only be carried out after the first good rains (minimum of 5 mm) have fallen during the summer rainfall period. All hydro seeding/conventional seeding activities

Activity /Issue	Action required
Closure	
	shall be completed one month before the end of the growing season. The grass cover requirements at the end of the growing seasons following the rehabilitation work and hydro seeding are: • 60% cover of the approved seed mix species diversity after the first growing season. • 80% cover of the approved seed mix species diversity after the second growing season. The appointed Contractor shall be held liable during the Defects Notification Period applicable to rehabilitation will commence when the 60% grass cover is achieved and end when 80% grass cover is achieved.
Alien Vegetation Control	The rehabilitated areas shall be maintained weed and invader plant free. An active programme must be implemented to ensure no further spread of these plants in adjacent areas occurs. Control of weeds and invader plants must be done in accordance with accepted control measures implementable for each species. All weeds and invader plants shall be controlled before the setting of seeds. All such material must be removed to a registered landfill site. The transportation of such material must not result in the spread of weeds and invader plant species along public or private roads.
Reinstatement of Infrastructure	Fences: All existing fencing removed or damaged during the decommissioning of the site must be replaced with new fencing of the same or upgraded standard. The Municipal Manager must ensure all fence lines and gates are protected from damage as a result of activities associated with the decommissioning and rehabilitation phase. Access to the site must be restricted to prevent illegal access and dumping.
Prevention of Further Illegal Dumping	Fencing: All existing fencing shall be repaired and maintained to prevent access for illegal dumping. Signage: The Municipal Manager shall ensure placement of signage close to the road informing the public of site closure and conversion and providing details on alternative transfer sites. Security: Maintain security at the site for a short period after closure to prevent potential illegal dumping and / or vandalism.

11. TIMEFRAMES FOR REHABILITATION

Rehabilitation works shall proceed after the first good rains (minimum of 5 mm) have fallen during the rainfall period. All hydro seeding/conventional seeding activities shall be completed one month before the end of the growing season.

12. POST CLOSURE AND CONVERSION MONITORING, INSPECTIONS AND MAINTENANCE

The appointed Contractor will be responsible for environmental control on site during rehabilitation and the maintenance period. During rehabilitation, activities will be monitored and recorded by an ECO and audited against the EMPr. Photographic records of the site will support the visual assessment. Monitoring and incident information will be communicated to the Municipal Manager. Any complaints will be recorded and investigated.
After rehabilitation, the site needs to be inspected and monitored to ensure that the rehabilitation activities have been successful and maintained. The monitoring actions are:

- Inspection of all erosion and sediment control devices on a regular basis, particularly after heavy rains.
- Inspection of the site to check for soils compaction and contamination.
- Water control bunds, drains, ponds and channels will be checked regularly and after each heavy rainfall to ensure they are functioning correctly.
- General housekeeping will be examined regularly to ensure stormwater runoff does not contain refuse or contaminants.
- Noise generated on site will be subjectively assessed during site inspections.
- An audit (summer) of rehabilitated areas will be undertaken to record species composition and cover.
- Ongoing assessment of unsuccessful areas and erosion, stability and drainage re-establishment.
- Regular visual assessment of all storage containers and areas for capacity, potential for recycling and evidence of spillage, among other criteria.
- Adequacy of bunding will be assessed.
- Records of spills will be examined in the environmental incident register.
- Staff will be questioned regarding their understanding of chemical management.

Incident reports will be checked to ensure that appropriate follow-up actions were taken.

The specifications made under this section address the requirements as per the Minimum Requirements for Waste Disposal by Landfill (Second Edition, 1998).

Table 12-1: Engineering Specifications – Post Closure Monitoring

Activity /Issue	Action required
Rehabilitation	
On-going Monitoring	Ground water monitoring • Generally no monitoring of ground water is required for communal landfills and small sites in low rainfall areas. The following specifications are made in terms of the on-going water monitoring on for small sites in high rainfall areas: • It is recommended to sink boreholes to complement the existing monitoring network, where boreholes are not present or where the drilling of boreholes are not possible, a competent Engineer needs to be consulted in order to decide on an alternative solution • Future water table measurements and sampling should be analysed by the same accredited laboratory to avoid variations in results attributable to analytical techniques which can mask variations over time. • Static water tables and the water chemistry of all boreholes must be monitored at three monthly intervals. Once stable trends have been established, the interval can be extended to a longer period in consultation with the relevant authorities. • Monitoring shall be done bi-annually and annually for the elements shown in Table 12-2 below.

Activity /Issue	Action required
Rehabilitation	

Table 12-2: Elements to be Monitored

BI-ANNUALLY	ANNUALLY
Alkalinity (Total Alkalinity)	Calcium (Ca)
Ammonia (NH_3-N)	Fluoride (F)
Chemical Oxygen Demand(COD)	Magnesium (Mg)
Chlorides(Cl)	Sodium (Na)
Electrical Conductivity (EC)	Sulphate (SO_4)
Nitrate (NO_3-N)	
pH	
Potassium (K)	
Total Dissolved Solids (TDS)	

- Additional parameters may be added once a full suite of Metals, VOCs, and SVOCs, has been analysed during the TCLP and risk assessment study has been done.
- Changes of monitoring intervals can only be instituted once stable trends for certain elements can be established.
- Subsequent to measuring the water tables and collecting the water samples, the boreholes should be pumped empty or if this is not possible a volume equal to the column of water in the borehole should be pumped out of it to prevent re- analyses of stagnant water in the borehole.
- It is recommended that stable isotopes oxygen-18 and deuterium as well as tritium analysis be done during the initial monitoring events to gather more information about groundwater interconnection and recharge dynamics.
- The results of the monitoring program should be submitted to the Department of Water Affairs before they are included in the annual audit report.
- Monthly inspections (for a period of 18 months) of the conservancy tank are required to estimate the amount of leachate being generated.
- A water quality analysis must be done on the water in the conservancy tank every three months for a period of 18 months.

<u>Site Inspections, maintenance and management</u>

The following specifications are important in order to meet the requirements on-going site inspections, maintenance and management.

- The fence must be regularly inspected so that no further development or dumping of additional waste of any kind can be carried out after the closure of the site.
- The security of the site should be maintained at all times to prevent illegal access and dumping.
- The site must be inspected at 3 monthly intervals. Once the stability of the site has been established, the inspection interval can be extended in consultation with the Department.
- Inspection of the cover integrity must include the following: the presence of any depressions, evidence of ponding, evidence of erosion.
- Any breach in cover integrity needs to be reported, the cause identified and the situation restored by infilling.
- Any areas of subsidence must be filled.

Activity /Issue	Action required
Rehabilitation	
	• Evidence of ponding or poor drainage must be corrected. • Fires need to be identified, exposed and covered with soil. • The vegetation that has been established on the landfill needs to be maintained in order to prevent erosion. • Alien vegetation must be removed. • Leachate in the conservancy tank should also be monitored at regular intervals (initially quarterly) and the results reported to the KZN DEDTEA and DWS and a professional engineer who will decide whether further work is required.

13. CONCLUSION

The activities set out in this EMPr will effectively manage any current and residual impacts on the closure of Hlabisa Landfill. It must be further noted that:

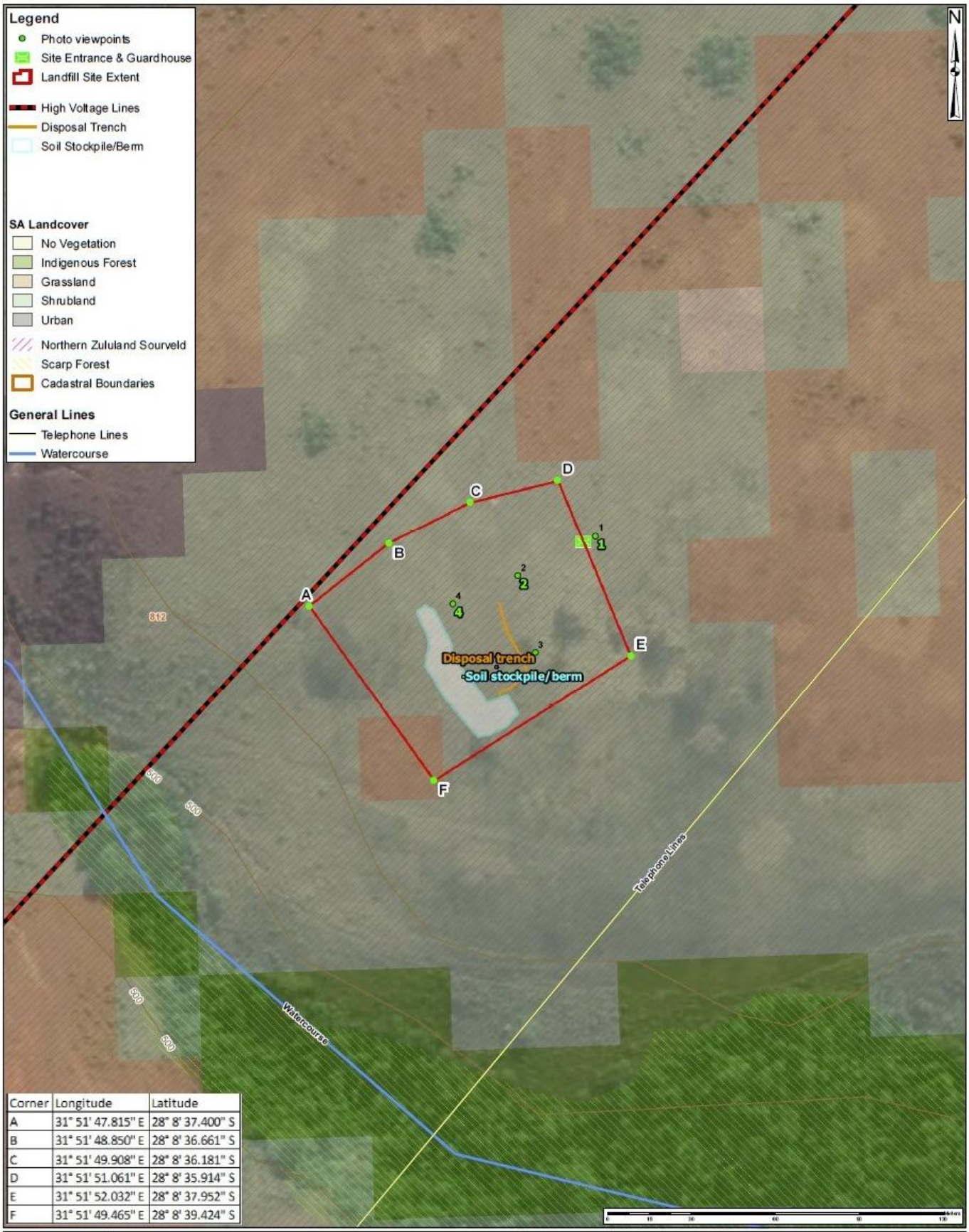
- A professional engineer must sign off on the construction works to confirm that it complied with the engineering design requirements;
- Detailed closure design activities will commence 12 months prior to the WML expiring in order that approved decommissioning activities commence prior to the WML expiring.
- Ongoing management on site must be maintained and waste must be immediately diverted from site to the nearest licenced landfill; and
- On-site monitoring must continue until the KZN DEDTEA and the Municipality are satisfied that no further potential environmental impacts are identified.

14. REFERENCES

- AECOM, 2015. Basic Assessment Report. Closure License Application for the Hlabisa Landfill Facility

APPENDIX A

SITE PLAN



Corner	Longitude	Latitude
A	31° 51' 47.815" E	28° 8' 37.400" S
B	31° 51' 48.850" E	28° 8' 36.661" S
C	31° 51' 49.908" E	28° 8' 36.181" S
D	31° 51' 51.061" E	28° 8' 35.914" S
E	31° 51' 52.032" E	28° 8' 37.952" S
F	31° 51' 49.465" E	28° 8' 39.424" S

Project Title:	DEA Waste Licenses 2015	Scale 1:1 200 (When page size is A3 portrait)	Figure
Map Title:	Site Plan of Hlabisa Landfill	Projection: Transverse Mercator; Datum: Hartebeesthoek 1994; Central Meridian: 31.0; Compiled By: GA Maree; GIS QC By: TBD; Approved By: J Hayes; Date Saved: 2015/11/26; Project Number: 60437185; Map Ref: EnviroConsolidated.mxd; Revision: 00 DDP Ref.: 9 of 13	CD:NGI Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community © OpenStreetMap & contributors NFEPA, SANBI, 2011. Vegetation, SANBI 2012. CBA, SANBI BGIS. Land Cover, GeoTerraImage (GTI) 2013.

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