UPDATED ENVIRONMENTAL MANAGEMENT PLAN FOR THE OPERATION AND MAINTENANCE OF THE LISELO SOLID WASTE MANAGEMENT SITE

January 2024

Katima Mulilo Town Council
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Project Title	**Updating of the Environmental Management Plan for the Operation and maintenance of the Liselo Solid Waste Management Site**
Version	January 2024
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Executive Summary

The Katima Mulilo Town Council Operate utilises a piece of land to the immediate south-east outside the townlands for waste management in the Liselo area, Zambezi Region. In 2021, the proponent instituted an environmental impact assessment (EIA) towards development of an environmental management plan (EMP), in compliance with national legislation as a listed activity. Subsequent to the submission of an application and the developed EMP to the office of the Environmental Commissioner (EC) in the Ministry of Environment, Tourism and Forestry (MEFT), an environmental clearance certificate (ECC) was issued for the period from 2021 and coming to expiry on the 28 February 2024.

Committed towards compliance to legislative requirements, the proponent appointed Namib Consulting to review waste management practices and update the EMP for the operation and maintenance of the Liselo Solid Waste Management Site.

The undertaken review took to examine the current operational practices to determine implementation of the approved EMP coming to expiry. The resultant outcomes indicate a limited implementation level of the EMP subject several prime factors among these are; the effects of Covid-19, lack of human and technical capacity, and inability to acquire suitable service providers for the management of the site.

Despite the above reasons for low implementation of the EMP approved for the expiring ECC, the proponent maintains commitment to improved waste management practices and operation of the solid waste site, and this review and update refocuses and pursues a practical approach with guidance of the national solid waste management strategy. Premised om the revised approach, an implementation plan for an updated EMP is developed in this report, that includes takes a more practical approach to adopting and implementing the waste management hierarchy through high order measures such as avoidance, reuse and recycle prior to the implementation of level or sink measures of treatment and disposal, however still in line with modern approach of landfilling.

It is therefore that devised mitigations measures are drawn and incorporate modern standard practice in waste management and are considered adequate if implemented towards revitalizing efforts to effectively improve operational and subsequently, improve the operation and management of the Liselo solid waste site.

The implementation of the recommended measures can mitigate adverse impacts to acceptable levels and thus pre-requisite. Cognizant of this, the Environmental Practitioner is confident of the ability of these measures to safeguard both environment and social receptors while also maintaining economic benefits where derivable. These can ensure that the site is utilised sustainably for extended years in future however with manageable adverse impacts. It is therefore recommended to the Environmental Commissioner to consider the issuance of the ECC to the proponent on conditions of implementation of this updated EMP to the fullest.

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Abbreviations

CBD	Central Business District
EC	Environmental Commissioner
ECO	Environmental Compliance Officer
ECC	Environmental Clearance Certificate
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
KMTC	Katima Mulilo Town Council
MEFT	Ministry of Environment Forestry and Tourism

1. Introduction

1.1 Background and Project Location

The Katima Mulilo Town Council (KMTC) also referred in this report as 'Proponent', acquired and makes use of an 8.2 hectares' portion of land in the Liselo area for solid waste management. The site is located some less than 10 kilometre south-west on the B8 highway, outside the boundaries of the town (see Figure 1:1). In 2021, the KMTC commissioned an environmental impact assessment (EIA) for the construction and operation of the landfill site. This led to the development of an environmental management plan (EMP) submitted to the Ministry of Environment Forestry and Tourism (MEFT) and subsequent environmental clearance by the Environmental Commissioner (EC). The issued environmental clearance certificate(ECC) in accordance with the Environmental Management Act (No. 7 of 2007) comes to expiry on the 28th of February 2024 and thus a need for renewal of the certificate to remain in compliance.

Premised on above background, Namib Consulting Services CC was appointed by the Proponent to carry out services related to the review of the EMP, towards renewal of the ECC.

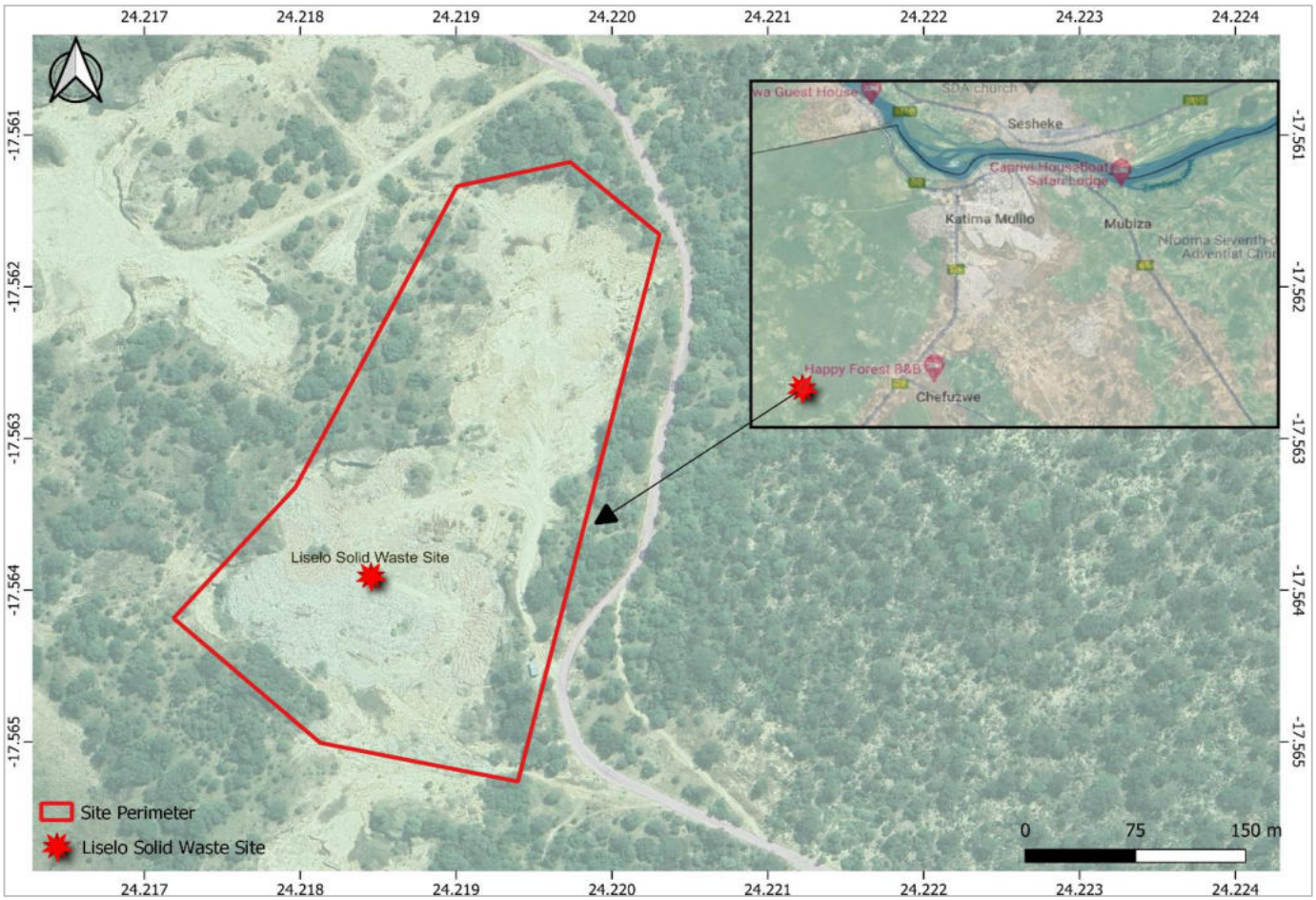

Figure 1:1 Locality of the Liselo waste management site

1.2 Objective and Scope

The objective of the assignment is to review the environmental management plan for the operation and management of the Liselo solid waste site. Therefore, the scope of the assignment involves;

i. Review the solid waste management operations of the KMTC in line with earlier approved EMP for the expiring ECC. Subsequently, this included;
   - Review the solid waste management operations across the waste management process chain.
   - Review adequacy of mitigations across the solid waste management process chain based on update practices and implementation level of the initial EMP.

- Consolidate all mitigations measures for solid waste management across the process chain into an updated EMP.

ii. Submit application to the MEFT for renewal of environmental clearance certificate based on the updated EMP based on improved waste management operational design.

2. Review of Solid Waste Operations

The review of waste management operations in the Katima Mulilo town and at the Liselo solid waste site were carried out by consultants, as these are precursors to the review and update of the EMP. Review carried out across the process chain from source-to-sink approach.

2.1 Town based operations

Town-based solid waste operations refers to methods of solid waste gathering and subsequent collection for transportation to the disposal or landfilling site. Solid waste gathering and collection were differentiated into residential, business and or industrial practices, however distinct merely on certain types of waste and quantities produced. Premised on this variation, town-based operations were examined as follows;

2.1.1 Waste assemblage at source

Household waste

Residential areas are associated with solid domestic waste or garbage. Organic component of that waste is inclusive of kitchen waste, vegetables, flowers, leaves, fruits. The toxic component to this waste is inclusive of: old medicines, paints, chemicals, bulbs, spray cans, fertilizer and pesticide containers, batteries, and shoe polish among others. Potential recyclable component of the waste is inclusive of paper in various forms, glass, metals, plastics in various forms. Moreover, other waste such as cloth further form part of the waste. These can be further classified into biodegradable and non-biodegradable and thus some implication on management.

Waste gathering for households in Katima Mulilo town varies somewhat between formal and informal settlements. In formal settlements, the use of waste or garbage containers is common in the two forms provided in Figure 2:1. Excess domestic waste is gathered in any additional material that may be shop available designated black plastics or dormant food packaging materials such as sacks.

In informal settlements, there is limited use of designated containers referred in Figure 2:1, however waste is gathered in various ways that are inclusive of sack packaging, black plastic bags, cages and or mere assembling numerous loosely knotted shopping bags.

Figure 2:1 Containers used for household waste collection

Business and Industrial waste

Solid domestic waste from industries and businesses is handled in parallel with household domestic waste for formal areas as earlier described. This waste is assembled in waste containers as depicted in Figure 1, however these containers may be multiple. In addition to these containers, businesses further setup other means to expand their holding capacity as in Figure 2:2.

Figure 2:2 Containers used for excess waste from businesses and industrial operations.

Industrial waste includes different kinds of materials like paper, plastic, wood, cardboard, packaging materials, scrap metals and other matter considered unusable. While much of plastics, paper and other un-harmful waste forms part of mainstream solid domestic waste. Other industrial waste such scrap metals and builders waste are ambiguously managed or assembled in their various forms.

Industrial waste further includes toxic waste such as chemicals, pesticides, and oil. In this category, toxic or hazardous medical waste can also be included. Except for medical waste that is handled by the state hospital as required, other chemicals, oils and other of toxic nature are also ambiguously managed like scrap matter.

2.1.2 Waste collection

Solid water collection from households, business and industry is carried out by a total of six (6) waste collector companies. Collection of solid waste for households is carried out once per week, while for the central business district (CBD) this is up to three or more times a week.

Solid waste collection at assemblage points for each household or and business or industry is loaded into trucks of varying sizes, with average capacity of six (6) tons. Each truck makes several rounds collecting at households or businesses. Loading are done manually by garbage loaders.

2.1.3 Transportation to the waste site

Waste collection trucks are filled at various capacities prior transporting for delivery to the dumping site. The average truck makes up to four trips a day to the waste site to offload waste. Nets are used to cover toppings of the trucks to prevent the loose materials flying of in the transportation process (Figure 2:3).

Figure 2:3 Waste collection truck covered with shade net.

2.2 Liselo Waste Site Operations

Notable developments to the site include the following;

i. A barrier fence has been erected around the site.
ii. An access gate to the site is manned by security for access control purposes.
iii. All permitted vehicles except recognized waste trucks, are recorded on accessing the site. Such details include the registration number, names of the driver, reasons for entry.
iv. An office building was constructed although still minimally utilised for that purpose.

v. Septic tank for collection of management sanitary waste for onsite personnel.
vi. Solar flood lights installed around the site.

2.2.1 Offloading

Inside the waste site, collector trucks operators search for suitable points within the site to offload waste. There are no demarcated areas for offloading waste or any demarcation for different types of waste, thus waste is offloaded haphazardly. A small section of the area is utilised for disposal and burning of confiscated expired food products from shops.

2.2.2 Waste sorting

Some minimal sorting of waste takes place onsite for recyclables, mainly plastics in various forms. Beside these limited efforts, no other forms of waste sorting or separation occurs onsite. All waste aboard the trucks is offloaded and deposited at found suitable spot within the site.

2.2.3 Onsite waste treatment

The site was planned for landfilling of weekly deposited waste, however, occasional shifting of waste is carried out randomly with purpose of creating space for further disposals, without any compaction or plan for covering (i.e. landfilling) as was envisaged.

3. EMP Implementation Status

3.1 Review of EMP Implementation

Section 2 of the report elaborates the present practices of waste management in the Katima Mulilo Town. The developed 2021 environmental management plan for the construction and operation of the Liselo solid waste site hinges on improvement to these waste management practices towards modern approaches. Therefore, the EMP was developed with the guidance of the National Solid Waste Management Strategy. The strategy encourages planning and improving solid waste management in line with the principles of waste management hierarchy. The EMP therefore, aimed at adopting measures inclusive of source reduction, recycling, reuse and composting, and finally towards treatment and disposal as least preferable (Figure 3:1). Table 3:1 below therefore review the progress made towards implementation of the 2021 EMP through the various states of construction and operation of the Liselo Solid Waste Site.

Figure 3:1 The waste management hierarchy

Table 3:1 Review results of the 2021 EMP for the construction and operation of the Liselo Solid Waste Site.

No	Phase	Aspect/Impact	Management Objective	Management/Mitigation Action	Frequency	Indicator	Responsible	Review Status
1.		Clearing of sensitive/protected vegetation	Minimal removal of protected plant species	○ Identify healthy protected trees and mark them to avoid removal ○ Fence perimeter path to consider the location of healthy protected trees to avoid their removal. ○ Ensure that all trees marked for avoidance are known to site workers.	Throughout construction phase	Marked trees	ECO	**The fence perimeter was constructed away from the location of most mature and growing Acacia trees that are of protected status. Subsequently, minimal trees were removed in the construction of the fence.**
2		Site surroundings littered with construction waste	The surroundings are kept free of any litter	○ Designate specific points for disposal of construction waste materials and other unusable substances brought to site. ○ Place signage on disposal points for visibility. ○ Good housekeeping practices are required. ○ All loose materials and packaging from all site activities collected and disposed at specific designated points. ○ All contractors and their workers to be inducted of the required good housing keeping practices. ○ Assign responsibility to monitor housekeeping practices.	Daily clean-up of generated waste to disposal points Once off induction of construction teams on required practices. Weekly walkabouts	Designated disposal points. Site clear of any signs of litter and well maintained	ECO/Site Manager	**These mitigation measures were not achieved.**
3	**Construction Phase**	Dust generation	Extent of dust spread kept minimal	○ Activities with high dust generation potential to be avoided under high windy conditions. ○ Roads leading into the site to be sprayed using a water tank during dry periods of the year. ○ Vehicular speed inside the site be reduced to maximum of 40km/h. ○ Avoid unnecessary movement of construction vehicle ○ Construction work limited to normal working hours (7am to 5pm).	Continuous aligning of operations with weather conditions Weekly watering of roads in drier times. Site inspections of operations	Site records Speed regulating signage.	Site Manager/ECO	**These measures were unachievable**

4		Noise and vibrations	Restrict noise and vibration to working hours.	○ Restrict working time to normal working hours (7am to 17h00) ○ Regular servicing of vehicles and machines to remove excessive noises	Continuous	Site operational records	Site Manager	**These measures were unachievable**
5		Release of noxious gases into the environment	Reduce the release of noxious gases into the atmosphere	○ Regular servicing of vehicles to minimize the release of noxious gases. ○ No unnecessary operation of machines/vehicles.	Continuous	Service records	Site Manager/ECO	**These measures were unachievable**
		Accidental leakage or spill of oils/fuels onto soils/groundwater	Preservation of groundwater resources from pollution	○ Use of trays when fuelling to prevent spillages to the ground. ○ Fuelling activities to be monitored by experienced persons onsite. ○ Vehicles be checked regularly in the morning for signs of leakages/drippings and effect corrective action where necessary. ○ Any fuels and oils brought to site must be locked away and register for access kept.	Throughout the phases	Site drip trays Site Incident reports Site operational records	Site Manager/ECO	**These measures were unachievable**
6		Health and Safety of construction workers	Preservation of the safety and health of the workers	○ Provision of Personal Protective Equipment (PPE) such as safety shoes, gloves, goggles and overalls to all employees; ○ No employee must be allowed in working areas without necessary PPE ○ Operations should be restricted between 07H00 to 17H00. ○ All contractors required to ensure they conduct basic first aid and safety awareness training for its employees. ○ Site movement to minimized and controlled ○ Signage be placed where heavy machines will be actively working ○ No authorized persons should be allowed onsite. ○ Any persons authorized but unfamiliar with operations to be accompanied.	Continually	Records of awareness or trainings General caution signage	Site Manager/ECO	**These measures were unachievable**
7		Covering of the hand dug well water source	Continued access to water for livestock and nearby communities	○ Provide alterative drinking water point for dependent nearby community and livestock.	Once off	Established water point	PR	**The open well within the site was adequately sealed off.**
8		Potential pollution of groundwater from	Preservation of groundwater resources from pollution	○ Use of mobile ablution facilities in the initial phase.	Weekly monitoring of empting of holding tanks	Mobile ablution facilities onsite.	Site Manager/ECO	**These measures were unachievable**

		wastewater generated		○ Weekly pumping of effluent and transportation to the towns wastewater facilities for proper handling and treatment.				
9		Waste separation at source	Reduce the volume of waste to the landfill site by early provision of opportunities reuse and recycling	○ Provision of different waste separation containers for public spaces. ○ Initiate a public awareness program on waste separation for schools and the public. ○ Identify an environmental youth group and support in addressing environmental topics including problems of waste. ○ Initiate demonstration projects at council premises on waste separation practices. ○ Engage businesses with large premises for placement of waste separation demonstration containers. ○ Place notices of penalties for illegal dumping or littering in hotspot areas. ○ Identify area for placement of skip containers for domestic rubble and garden waste. ○ Acquire skip containers for waste separation.	Continuous	Availability of waste separation containers/drums in public areas and public institutions such as schools.	ECO	**These mitigation measures are unimplemented.**
11		Differentiated loading of waste at source by contractors	Reduce the quantities of waste landfilled through improved handling and treatment.	○ Induction of contractors on procedures required for waste handling at loading points. ○ Monitor contractors regularly to comply with measures initiated to separate waste at source. ○ Dedicate a contractor towards rubble and garden waste collection with appropriate trucks. ○ Reuse of clean rubble waste as fill material for some depressed surfaces or roads. ○ Contracts of waste contractors to induce clauses on required waste handling practices.	Annual induction of employees and every new recruit Weekly inspection of contractor loading practices	Induction records (list of attendees, date of induction, signatures and contact details) Inspection reports	ECO Contractors	**These mitigation measures are unimplemented.**
12	**Operation Phase**	Securing of waste with nets during transportation	Prevent littering of the landscape	○ Maintain current practices of all waste trucks to have mesh/nets or cage to secure all waste when transported from town to landfill site. ○ Inspect waste trucks for securing of waste when transported to site.	Continuous securing of loaded waste Weekly inspection of contractor trucks	Inspection reports	ECO Contractors	**The use of nets for securing waste during transportation to the waste site well maintained by the waste contractors.**

13		Waste offloaded in appropriate demarcated areas	Site utilization in accordance to approved plan.	○ Place signage of the various areas for offloading different type of waste. ○ Waste contractors should be inducted on site utilization layout ○ Weekly inspection of the site to ensure compliance.	Weekly site visits	All waste in marked areas accordingly	ECO	**These mitigation measures are unimplemented.**
14		Recyclable materials removed from general cell	Reduce quantities of waste for landfilling.	○ Initiate waste picking and sorting activity at the landfill site. ○ Acquire waste pickers and sorters of recyclables and reusable materials and package them. ○ Engage local waste recyclers to explore possibilities and interests in waste collected and packaged at site.	Continuous	Picking and sorting of waste onsite	PR/ECO/Site Workers	**The Proponent gave permission to a local individual to operate picking and sorting of plastic waste for purpose of gathering and packaging to recycling facilities. Intermittent picking and sorting of plastic occur onsite though at a sluggish pace.**
15		Health and safety of workers	Preservation of the safety and health of the workers	○ Provision of Personal Protective Equipment (PPE) such as safety shoes, gloves, eye wear and overalls to all employees; ○ Conduct first aid and safety awareness training for contractors ○ Schedule inspections and audit of the practices of the contractors for compliance.	Continually Every 2 years	First aid training records PPE	Contractors	**These measures were unachievable**
16		Onsite waste weighing and subsequent offloading.	Provide data for process improvements	○ Construct platform at the gate for weighbridge ○ Acquire mobile weighbridge unit for installation at the site. ○ Assign responsibility of weighing and recording information associated with waste vehicles to the site. ○ All waste carrying vehicles pass through the weighbridge for weighing. ○ Regular auditing of the records for compliance to required record system.	Continually weigh incoming waste vehicles	Site records	Site Manager/ECO	**Although efforts were initiated for acquisition of a weighting scale, this has not been achieved.**
17		Opportunities for locals in picking and sorting of waste	Ensure site utilization activities benefits local communities	○ Priority be given to locals for non-qualifying job opportunities in waste picking and sorting of recyclables. ○ Where qualifying positions are available, locals be given advantage.	Continuous throughout site life span	Liselo locals as part of waste pickers and sorters	PR	**These measures were unachievable.**
18		Flying litter in surroundings area of the landfill site	The surrounding landscape is free of litter	○ A compactor or other earth moving machine be stationed at site to shift and gather waste offloaded, compact on daily basis to prevent flying into adjacent land.	Daily compaction and covering Monthly manual litter removal around the site	Minimal flying litter in the surrounding	Site Manager	**These measures were unachievable as no compaction and landfilling or covering takes place. However, due to the nature of the site, a depression, there is minimal flying waste to**

				○ All litter that gathers around the fencing perimeter should be regularly cleaned through manual removal				**the adjacent trees. These can be easily removed with implementation of the measures.**
19		Increase in vermin, flies and pests in the surrounding area	Reduce vermin numbers to site and adjacent landscape	○ Adequate daily covering of landfilled waste on general waste cell.	Daily compaction and covering of general waste cell	Compacting machine onsite	PR/Site Manager	**These measures were unachievable.**
20		Luring of scavengers to the site to collect food and other reusable and recyclables	Avoid social disturbance to the local community	○ Access to the site be controlled by lockable gate. ○ Place 24-hour security personnel to control access and record all authorized entries to the site. ○ Job opportunities reserved for locals to limit immigration into the area	○ Continuous access control	Control gate to site	Site Manager	**Perimeter fence was constructed around the site.** **Site access is controlled by 24-hr presence of security personnel.** **Authorised entry to the site are recorded.**
21		Luring aggressive wild animals to the site	Minimise the presence of wild animals into the area	○ Daily compacting and covering of the general waste cell. ○ Regular sighting (observation) and recording of wild animals in the area ○ Conduct nearby community visits to determine eminent concerns that may arise and device measures to address where possible.	Daily compaction and covering.	Records of any animal sightings	Site Manager ECO	**No reported incidents of wild animals were reported.** **Other measures were unachievable.**
22		Leachate generation to subsurface environment	Preserve baseline conditions of the groundwater resources of the area	○ Ensure construction of base layering of general waste cells as per design requirements. ○ Drilling of boreholes up and down gradient of the site. ○ Quarterly borehole water quality sampling and testing ○ Inclusion of identified private water points for water quality sampling and testing. ○ Analysis of results and interpretation of any deviation from baseline conditions. ○ Regular reporting to the regulatory authority of the results of the monitoring system.	Once off during construction Quarterly groundwater monitoring programme and reporting	Quarterly reports Monitoring programme	ECO	**These measures were unachievable.**
23		Generation of Odour	Limits the spread the odour	○ Daily compacting and adequate covering with sand/clay material	Daily compacting and covering	Site observations	Contractor	**These measures were unachievable.**
24		Accidental spillage of oils or fuels infiltrating to groundwater		○ Use drip trays when refuelling of earth moving vehicles onsite ○ Daily inspection of vehicles for signs of leakages and or spills and keep record	Daily machine inspections.	Drip trays available onsite Record of daily inspections	Contractor	**These measures were unachievable.**

		Generation of smoke into surrounding area	Minimise the spread of smoke to adjacent landscape	○ No open burning of waste to be allowed prior acquiring an incineration unit ○ Schedule incineration for few days (2-3) a week spaced with up to 2 days in-between to avoid continuous smoke retention in the atmosphere. ○ Incineration of waste to be monitored frequently by the health/environmental officer ○ Limit incineration on windy days and months of the year	Weekly site inspections	Incineration schedule. No signs of open burning on waste cells	Site Manager	**There is minimal burning of waste onsite for mainly expired food waste from retailers.** **Other measures were unachievable.**
25		Landfilling as per operation design recommended	Maintain the approved approach to landfilling	○ The landfilling process to align with the cell recommended approach. ○ Regular Inspection of the landfilling approach.	Daily landfilling Weekly inspections	Site observations	Site Manager/ECO	**These measures were unachievable.**
26		Opportunities in guarding of site	Local benefit form site utilization	○ Priority be given to locals for non-qualifying job opportunities in waste picking and recycling ○ Where qualifying positions are available, locals be given advantage	Lifespan of site utilization	Site guarding contacted to locals of the area	PR	**The security personnel are from a security company of the local area. The guards onsite are from the area. Three (3) of the four (5) guards are women.**
27		Potential pollution of groundwater from wastewater generated	Preservation of groundwater resources from pollution	○ Weekly monitoring of the septic tank levels ○ Pumping of septic effluent and transportation to the town's wastewater facilities for proper handling and treatment.	Weekly monitoring of septic tanks Monthly review of the operations	Records of pumping and transportation	Site Manager/ECO	**Septic tank was constructed for managing wastewater and provide sanitary facilities for onsite personnel. The structure are recent and minimally utilised.**
28		Town residents visitors do not interfere and or disrupt site operations.	All visitors align to required site requirements	○ No town residents to be allowed access site to dispose waste until prior approval is provided. ○ No commercial agencies allowed to dispose waste at site without making prior arrangement and agreement with site proponent. ○ All waste coming into the facility should be weighed and guided to appropriate area. ○ Avail drop-off waste skips at the gate area for residents and nearby communities. ○ Keep a register of waste brought to site	Continuous	Records of visitors to site	Site Manager	**Site access control has been achieved and is in operation.** **Other measures were unachievable.**

3.2 EMP Review Outcomes

In interpreting the results of Table 3:1, it is differentiated in the review that 'unachievable measures' 'were reliant on certain precursor enablers. On the other hand, 'unimplemented'' refers to measures that have the likelihood of being implemented despite enablers being limited or lacking. The results therefore indicate that that the Proponent was able to partly implement several of the EMP recommended measures, however, a substantial number of measures from the construction into the operation phase remained unimplemented and some unachievable. This status is subject to several challenges pronounced as leading causes, later described in detail.

3.3 Challenges to EMP Implementation.

Premised on the review outcomes, the low implementation level of the EMP was acknowledged and reasoned as a result of several challenges that undermined the commitments to achieve the intended objectives. These challenges are attributed to review outcomes stated as unimplemented and unachievable.

3.3.1 Challenges leading unimplemented measures

Limited human capacity

The environmental health section unit under the Department of Community and Local Economic Development administers the waste management services of the town. The structure of the division/section comprises, an environmental health officer and an assistant. These are responsible for delivering a range of services including business fitness registration process, involving inspection of premises, regular inspection of food retail compliance, including coordinating waste management activities. Subsequently, the present human resource capacity of the section is insufficient to provide necessary focus on the implementation of the EMP.

The role of an environmental compliance officer (ECO) was well acknowledged as critical by the Proponent as recommended in the EMP. However, such has not been achievable, as this requires conformity with legislative requirements to structural amendments for a local authority and more so, necessary financial provisions for such structural amendments. Subsequently such had led inability to take up this process towards appointment of an ECO.

Limited technical capacity

Waste management is among specialised fields and requires appropriate knowledge level and experience for adequate attention. While the KMCT has adequate capacity of specialised fields that address various services relating to water, electricity and wastewater among others, there is pertinent limited in-house technical capacity towards solid waste management. Although the environmental health officer retains some understanding of the field, this is at a limited level and provide a comprehensive approach that addresses the entire spectrum of solid waste management process chain.

Limited financial capacity

A comprehensive implementation approach to the EMP requires sound financial provision. The KMCT like other local authorities face dire financial challenges to adequately provide for a comprehensive implementation approach to solid waste management and other services. This remains a predicament in maintaining and improving operation, more so for waste management.

3.3.2 Challenges leading to unachievable measures

Impacts of COVID-19 Pandemic

On the 17 of March 2020, the Government of Republic of Namibia declared a state of emergency in proclamation 7 of 2020. It this led a deviant approach to operations across sectors including for local authorities. Furthermore, it was required to adopt a divergent resource allocation approach towards, prioritizing area aimed at lessening the impacts of the pandemic. Subsequently, these undermined many areas including devoting resources both human and financial towards fluent implementation of waste management operations and thus undermining the implementation of the EMP.

Inability to appoint a landfill site waste contractor

The KMTC strived over the implementation period of the EMP to appoint a contractor to undertake the construction and operation of the Liselo waste site. Through the procurement process towards appointment of a contractor, notices for submission of expression of the interest for the work were ran in 2022 during the month of April and again in 2023 over the month of January. Subsequent processes failed to lead to an appointment of a contractor due to various reasons among these either lack of technical capacity required for the implementation or assurance of availability of the required machinery for the implementation.

The role of the appointed contactor was critical to ensure towards meeting the construction and operational requirements in the EMP. However, the failure to appoint undermined the Proponents ability to achieve the desire goal and thus comprehensively implement the EMP towards compliance with legislative requirements of the issued ECC.

4. Revised Operational Design

4.1 Introduction

Acknowledging inadequacies during the validity period of the ECC, the Proponent commits towards practical efforts to effective and efficient waste management operations for the Katima Mulilo Town, in line with the National Solid Waste Management Strategy. This approach seeks to address potential laborious areas identified during the validly period of the expiring ECC, while aiming to ensure comprehensive implementation of a revised Environmental and Social Management Plan.

4.2 Revised Waste Management Objectives

The purpose of the revised waste management plan is to improve present operational practices and design of the Liselo Landfill site to address potential adverse effects on human health, the environment and aesthetics.

4.3 Revised Implementation plan

The implementation plan for the operation and maintenance of the Liselo Landfill Site is updated in Table 4:1 below towards renewal of the environmental clearance certificate.

4.3.1 Identification of potential impacts from current operation

Based on the revised waste management process chain across town and waste site based operations, here to be referred as upstream (town-based) and downstream (i.e. waste site based) the following areas are identified as still needing focused attention to address.

(a) Upstream

The areas present eventual adverse impacts to operations

i. There are no initiatives aimed towards application of the waste management hierarchy principles.
ii. There is some ambiguousness to business and or industrial waste management
iii. There is unawareness by waste contractors of the desired waste management practices across the process chain.
iv. There is potential neglect of the safety and health of garbage handlers in collector trucks.
v. Lack of efforts towards prompting the public from waste illegal waste disposal and management of waste assemblage points (i.e. through signage).

(b) Midstream

i. Unclear practices and procedures for transportation of waste by households, business and industry, as well as waste from operations or activities outside the Katima Mulilo townlands (i.e. potential waste from surrounding villages, commercial facilities such as tourism operations).
ii. Uphold the waste transportation protocol for waste collecting trucks

(c) Downstream

The areas present eventual adverse impacts to operations

i. There remains inability to account for waste flows into the site.
ii. There is no site management and thus haphazard approach to waste disposal
iii. The current approach to waste picking and sorting of plastics for recycling remains inadequate and is exclusive to other recyclables.
iv. Undifferentiated disposal and lack of alternative treatments methods for waste undermines longevity of the site
v. Un-designed disposal surfaces and lack of environmental monitoring of subsurface resources undermines detectability of any potential risks to subsurface resources.
vi. Inability to implement the landfilling approach to site management
vii. Site access to town residents to dispose transported waste and that from activities individuals or operations outside townlands.

Taking the above aspects in consideration towards improving the waste management approach and operations across up-, mid- and downstream spectrum for Katima Mulilo Town, the 2021 Environmental Management Plan is revised in Table 4:1.

Table 4:1 Updated implementation plan for the operation and maintenance of the Liselo Solid Waste Site.

No	Aspect	Impact/Risk	Management Objective	Management/Mitigation Action	Frequency	Indicator	Responsible	Cost/Budget
				Upstream				
1	There are no initiatives aimed towards application of the waste management hierarchy principles.	Minimal opportunities for improved waste handling and treatment throughout the process chain	Public awareness on waste management and bylaws related to waste management.	Initiate and implement a public awareness program on waste separation for the public through local available broadcasting or publication media.	Monthly	Program schedule	ECO	Operational activity
				Compile information materials on waste management for the public.	Once off and yearly review	Information brochures	ECO	Operational activity
			Provide opportunities for improved waste handling at earliest practical.					
			Demonstrate feasibility of waste management in line with principles of waste management hierarchy	Initiate a demonstration projects at council premises on waste separation practices.	Once of	Availability of separation containers onsite	ECO	N3, 000.00
2	There is some ambiguousness to business and or industrial waste management	inconsiderate handling and preparation of waste and subsequent Illegal waste disposals	Measures and procedure for management of peculiar waste are clear.	Draft clear procedures for handling of commercial or industrial waste management, based waste regulations.	Once off	Information brochures	ECO	Operational activity
			Acknowledge improved practices to foster continuous effort efforts to waste management.	Initiate a waste management appraisals system for commercial entities to recognize efforts towards improvements.	Once off	Draft proposal	ECO	Operational activity
				Implement the developed waste appraisal system	continuous	Industry aware of the appraisal system	ECO	Operational activity
			Illegal waste placement and disposal of construction waste (i.e. builders rubble) across town are minimized.	Identify and designate specific points for disposal of construction waste and other related materials.	Once off	Designated points around the town	ECO	Operational activity
				Place signage on demarcated disposal points indicating do's and don'ts.	Once off	Signage on sites	Assistant to ECO	N15 000.00
				Random spot monitoring of waste assemblage and serve notices of non-compliance to institutions to improve.	Continuous	Issued non-compliance	Assistant to ECO	Operational activity
				Engage businesses with large premises for placement of waste separation demonstration containers.	Once off	Erected waster separation containers onsite	Manager	Operational activity

					Regular monitoring of the site			
3	There is unawareness by waste contractors of the desired waste management practices across the process chain.	Misalignment towards effecting the adopted and desired waste management approach	Waste contractors are aware and understand the purpose of the adopted waste management approach.	All waste contractor and their workers are inducted on the waste management approach adopted.	Bi-annual	Register of training and training material	ECO	Operational activity
				Incorporate specific clauses of the expected waste management practices in procurement process for waste contractors.	Contract annuals	Requirements of waste management in procurement documents and contracts.	Manager	Operational activity
4	There is potential neglect of the safety and health of garbage handlers in collector trucks.	Safety and health of waste handlers is compromised.	The safety and health of the waste collectors is maintained at all times.	Waste contractors to provide proof on provision of personal protective equipment (PPE) or gears to the workers on appointment.	Annual	Proof of purchase of materials	ECO	Operational activity
				Waste contractors to adequately acquire and provide required PPE required for daily operations.	Continuous	Waste collectors are observed with full PPE	Assistant to ECO	To be budgeted by Contractors
				Waste collector workers to make use of provided PPE at all times in daily operations.	Continuous	Waste collectors are observed with full PPE	Assistant to ECO	Operational activity
5	Lack of efforts towards prompting the public from waste illegal waste disposal and management of waste assemblage points (i.e. through signage).	unabated waste dumping with resultant safety and health effects.	Waste hotspot areas are identified and measures are put in place to curb illegal waste dumping.	Identify hotspot area of illegal disposing of waste by households.	Once off Bi-monthly monitoring	Hotspot areas are identified.	ECO Assistant to ECO	Operational activity
				Demarcate conspicuous areas for communal waste assemblage	Once off and as necessary for new areas	Designated areas or spots for waste assemblage.	ECO	Operational activity
				Place signage to warn against use of un-designated spots for communal waste assemblage.	Once off	Signage place on hotspot areas	Assistant to ECO	N15 000.00
				Identify conspicuous points for piloting placement of waste separation.	Once off Regular monitoring of the sites	Waste separation containers.	Assistant to ECO	Operational activity
Midstream								
6	Unclear practices and procedures for transportation of waste	Undermine the desired water	Side stream waste flow procedures are clear to	Establish and compile clear procedures prescribing the steps required for qualifying waste transportation to	Once off	Information brochures	ECO	Operational activity

	by households, business and industry, as well as waste from operations or activities outside the Katima Mulilo townlands (i.e. potential waste from surrounding villages, commercial facilities such as tourism operations).	management approach	residents and other potential	municipal waste site. Further these shall be transferred into readily available information materials for residents and other interested parties. Further prescribe measures for safe transfer of waste to the designated site.				
		Concealing of waste for illegal disposal in undesignated areas	Awareness of required waste conduct to waste management.	Provide awareness of required conduct in initiated awareness programs.	In line with monthly program for awareness.	Inclusion on awareness program	ECO	Operational activity
7	Uphold the waste transportation protocol for waste collecting trucks	Littering of transportation routes to waste site.	Securing of waste during transportation to the waste site	Maintain practice of covering waste trucks with nets with transportation of waste to site.	Continuous	Waste trucks are observed covered during transportation	Contractors	To be budgeted by Contractors
	Downstream							
8	There remains inability to account for waste flows into the site.	Undermine the waste management approach adopted.	A practical mechanisms of waste inflows recording is designed and implemented.	Investigate practical waste measurement and accounting system that can be applied towards records of inflows.	Once off	A proposal document	ECO	Operational activity
				Implement a feasible waste accounting system devised.	Continuous	Records of waste accounting	Assistant to ECO	Operational activity
9	There is no site management and thus haphazard approach to waste disposal	Haphazard approach to utilization of the site.	Site management protocols and associated structures are established.	Explore various alternatives and implement a feasible option to address required technical capacity and availability of equipment towards site management.	Continuous	A proposal; document on the approach.	ECO	Operational activity
10	The current approach to waste picking and sorting of plastics for recycling remains inadequate and is exclusive to other recyclables.	Minimal effect to improving the waste management approach	Current measure towards waste recycling and capacity are reviewed.	Re-engage current recycling agent to establish challenges and process chain for their activities to establish opportunities.	Once off	Minutes of the engagements	Manager ECO	Operational activity
			Improve and expand the potential capacity of waste recycling	Initiate additional measures to support current recycling agent or other alternatives to expand capacity.	Once off	Proposal document	ECO	Operational activity
				Monitoring the implementation of waste recycling initiatives	Continuous	Onsite waste recycling is observable	ECO	Operational activity
11	Undifferentiated disposal and lack of alternative treatments	Haphazard approach to	Alterative waste treatment methods are implemented.	Review site outlook and reconfigure practical demarcation of areas as per waste cell model approach.	Once off	Reconfigured site layout.	ECO	

	methods for waste undermines longevity of the site	utilization of the site.		Demarcate and identify specific areas as per reconfiguration.	Once off and as required	Identification of sites	ECO Assistant to ECO	N15 000.00
				Provide induction to waste collectors on required approach to offloading of waste on daily basis.	Bi-annual	Induction registers and material	ECO	Operational activity
				Site supervision of waste disposal practices by waste truck operators	Weekly	Orderly placement of waste by waste collection contractors	ECO	Operational activity
				Investigate waste volume reduction measures towards compaction	Once off	Proposal document	ECO	Operational activity
				Implementation of devised waste reduction the piling of waste.	Continuous	Orderly placement of waste by waste collection contractors	ECO	Operational activity
				Landfilling with earth material is implemented. This will prepare new areas for waste cells in future.	Bi-weekly	Cell application of coverings	ECO	To be budgeted by a site Contractor
				Consider a practical incineration structure and approach towards waste volume reduction.	Once off	Proposal structure for the site	ECO	Operational activity
				Implement an incineration structure for waste reduction.	Continuous	incineration structure onsite	Contractor	To be budgeted by a site Contractor
12	Un-designed disposal surfaces and lack of environmental monitoring of subsurface resources undermines detectability of any potential risks to subsurface resources.	Potential risk contamination are undetected earliest for redresses such can lead to regulatory compliance and liability	Site waste placement and treatment is improved	No excavating of surfaces for material shall take place from undesignated area of the waste pit.	Continuous	No signs of excavation of prohibited areas	Assistant to ECO	Operational activity
			Environmental monitoring of subsurface resources is initiated and implemented.	Drilling of a minimum of two boreholes to detect for sampling purposes and Incorporate at least two additional surrounding community boreholes for sampling purposes.	Once off	Boreholes sites	Manager	N120 000.00
				Sampling and testing of water samples from boreholes for quality	Quarterly	Water quality results	ECO	Provided in monitoring plan
13	Site access to town residents to dispose transported waste and that from activities individuals or operations outside townlands	Concealing of waste for illegal disposal in undesignated areas	Site access protocols established and clear	Design sign boards for placement at the waste site providing required conduct for waste use of the site.	Once off	Signage onsite	ECO Assistant to ECO	N$ 8 000.00
			Stakeholder awareness of site protocols.	Include procedures on waste site use protocols for town residents and other stakeholders.	Once off	Information signage onsite	ECO Assistant to ECO	Not applicable.

5. Administration of the EMP

5.1 Roles and Responsibilities

5.1.1 The Ministry of Environment and Tourism

The Environmental Management Act (No. 7 of 2007) empowers the Environmental Commissioner in the MEFT as the designated authority responsible for approval of ESMP's. Once approved, an ESMP is a legally binding document and carries the obligation for implementation by the Proponent to the latter. The Environmental Commissioner has the authority to enforce legal action where non-compliance perpetuates despite carrying out inspections and issuance of compliance orders.

5.1.2 The proponent

The Proponent is custodian of the entire EMP and oversees its implementation. The role requires a supervisory designation with ability to lobby necessary resources and allocate of these resources towards implementation of the EMP. Such is achieved through continuous interaction with the key stakeholder and further with the technical staff to achieve the overall goal of effective and efficient delivery of solid waste management services.

Premised on the given requirements, in behalf of the proponent, the manager for community services and economic development is designated with custodianship of the EMP and all responsibilities to its implementation. The Manager is assisted by the Environmental Compliance Officer.

5.1.3 Environmental Compliance Officer

The Environmental Compliance Officer (ECO) as an implementing level under the Manager, requires an understanding of the field of environmental management including specific subject area of solid waste management. The role of ECO remains designated within the current structure to the environmental health officer. Responsibilities ascribed to the ECO are;

i. Coordination of the entire solid waste management system and processes to ensure implementation of the EMP. Such shall include establish protocols and standards that govern waste management within the town and the waste site.
ii. Establishing and maintaining an information record system for the entire waste management system.
iii. Liaise with relevant authorities and contractors regarding required compliance
iv. Conduct scheduled environmental and social audits of various parameters established in EMP and reporting.
v. Providing recommendations for remedial action in the event of any non-compliances.
vi. Assist in the assessment and review of contractor's performance
vii. Ensure that contractors, subcontractors and workers and even official visitors to the site are aware of the environmental and health and safety conduct required.
viii. Ensure that the site is utilised as per set out layout plan
ix. Develop training and awareness programs on waste management
x. Engage media, and public institutions and publicise environmental information related to waste in and around the town.

5.1.4 Environmental Consultant

The Environmental Consultant is contracted to undertake the review and development of a revised EMP, premised on revised operation practices, submit an application to the authority for renewal of the environmental clearance certificate. While the obligations of the consultant are towards renewal of environmental and social clearance. It is further expected expand to providing intermittent technical support in the implementation of the EMP.

5.1.5 Contractor/Subcontractors

Contractors and subcontractors comprise those that will provide a certain service to the proponent that may be managing in part or whole of the entire waste management process.

5.2 Environmental Monitoring and Reporting

Table 5:1 below presents the environmental and social monitoring requirements in the implementation of the plan.

Table 5:1 Environmental and social monitoring plan

Aspect	Objective	Indicator	Fregquncey	Responsible	Annual Cost (N$)
Groundwater sampling and quality testing	Detect variation in water quality of the surrounding area	Water quality results	Quarterly	ECO	30,000
Waste compaction and landfilling	Alignment with the landfilling approach required		Monthly	ECO	NA
Application of waste burning	Burning technique is beneficially applied in waste management		Monthly	ECO	NA
Septic tank holding volumes.	Minimise potential pollution and health hazard	Inspection reports	Monthly	ECO	NA
Integrity of the fence	Prevent illegal access to the site.	Quarterly reports	Quarterly	ECO	NA
Regulatory reporting on implementation of the EMP	Compliance to reporting requirements	Progress reports	Bi-annual	ECO	NA

5.3 Redress of Non-compliance

As a legally binding document, incidents involving deviation or non-compliance by contractor that trigger contract terms and conditions shall be addressed by the procurement processes in line with applicable procurement protocols. In terms of the noncompliance to the projects environmental and social (E& S) requirements, these comprise the following:

i. Undertake an act that has social or environmental impacts without having obtained necessary authorization or licenses or clearances.
ii. Not implementing necessary measures specified towards addressing an environmental or social impact emanating from an activity under the project.

Procedure for handling non-compliance to E & S requirements shall involve the following steps, administered through the ECO:

i. Each incident observed or reported shall be in documentary form (i.e. incident report) and where possible photographic evidence be acquired.
ii. Timely communication and instruction for the contractor to halt non-compliance and thus lessening aggravation of subsequent impact.
iii. Scrutinize the submitted incident to determine cause and extent of non-compliance
iv. Establish and advance required corrective actions to mitigate future occurrence.
v. Timely communication where such has immediate contractual implications. and report to the Manager.

The following levels of addressing compliance shall be implemented;

Level 1: A written notice to the contractor on the incident reported or observed. The contractor shall provide proof of implementing measures for corrective action towards redressing the reported incident.

Level 2: A second written warning on repeat of a similar or other E&S requirements. The contractor shall further provide proof of implementing measures for corrective action towards redressing the reported incident.

Level 3: Notice shall be served of the occurrence of the third breach of E&S requirements. After investigations and determined that this remains negligence that associates to prior incidents, the manager shall be notified and a report submitted for contractual management, including potential forfeit of the contract.

6. Capacity Development Plan

A human resource capacity development has been developed in Table 6:1 below to address knowledge requirements towards effective implementation of the EMP.

Table 6:1 Capacity development plan

Type of capacity development	Target	Estimate Cost (N$)	Frequency
Waste management and Landfill management training	ECO	50 000.00	Once off and refresher where possible
Operational Requirement for waste management for KMTC	Waste contractors	Operational	Bi-annual Regular Induction of new waste collectors

7. Conclusion and Recommendations

Conclusion

This EMP document is an operational document aimed at improving waste management operation process chain for the Katima Miulilo Town Council. The development of the EMP has considered the waste management hierarchy principles as advocated by the National Solid Waste Management Strategy towards improving practices across the process chain from upstream to downstream activities. Standard practices in waste management have been considered with measures incorporated in the development of the document. It is therefore that this document can be considered sufficient functional tools towards operation of the Liselo Landfill Site to achieve desired management objectives.

The Proponent through the established structures, shall be liable for the implementation of the EMP and to achieve required level of implementation. Non-compliance shall be subject to legislative requirements and subsequent applicable processes by the Environmental Commissioner.

Recommendation

The Environmental Assessment Practitioner recommends to the Environmental Commissioner, for consideration of the revised environmental management plan as adequate for renewal of the environmental clearance towards revised operation of the Liselo Solid Waste Site.