Comprehensive Environmental Management & Closure Plan (EMCP) & for the Existing Waste Dumping Site in the Rehoboth Town, Hardap Region

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LIST OF ABBREVIATIONS

Abbreviation	Meaning
DEAF	Department of Environmental Affairs and Forestry
EAP	Environmental Assessment Practitioner
ECC	Environmental Clearance Certificate
EDS	Excel Dynamic Solutions
EHO	Environmental Health Officer
EIA / EMA	Environmental Impact Assessment / Environmental Management Act
EMP	Environmental Management Plan
HDPE Liner	High Density Poly Ethylene (*a thermoplastic polymer from petroleum*)
MEFT	Ministry of Environment, Forestry and Tourism
PPE	Personal Protective Equipment
RTC	Rehoboth Town Council
SHE Officer	Safety, Health & Environmental Officer

1 INTRODUCTION

1.1 Project Background and Locality

Rehoboth Council (hereinafter referred to as The *Proponent*) through its contractor Frontier Multi Industries manages Town's dumping site (dumpsite) located about 7km south of the Town. The site is currently unlined and not cleared environmentally. The environmental clearance would also mean proper management of the dumping site and will be able to accommodate the increase in waste from the Town. The locality of the existing dumping site is shown on the map in Figure 1-1 below.

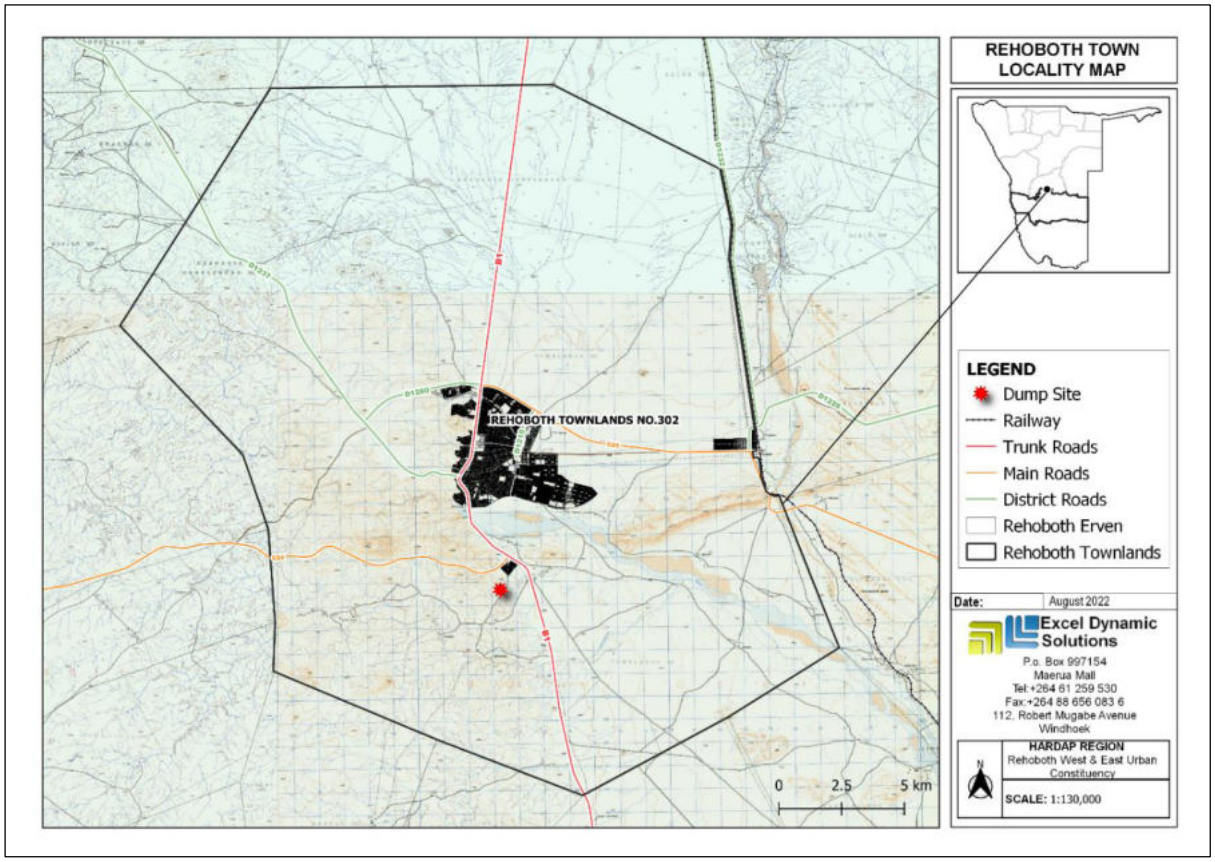

Figure 1-1: Locality map of the Rehoboth dumping site

1.2 The Coordinates of the Dumping Site

The GPS coordinates of the dumping site are provided in Table 1-1 below.

Table 1-1: GPS Coordinates of the Rehoboth Dumping Site

Point	Latitude	Longitude
A	23°21'52.43"S	17° 5'2.88"E
B	23°21'50.84"S	17° 5'8.99"E
C	23°21'53.39"S	17° 5'17.99"E
D	23°22'4.00"S	17° 5'12.93"E
E	23°22'0.92"S	17° 5'2.22"E

1.3 The Need for Environmental Clearance Certificate (ECC)

The Environmental Management Act (Act No. 7 of 2007) (EMA) and its 2012 EIA Regulations lists activities that must not be undertaken without an Environmental Clearance Certificate (ECC). The Rehoboth Town Dumping Site includes activities listed under the 2012 Regulations' Activity No.1 (a) and (b) as follows below,

''2. WASTE MANAGEMENT, TREAMENT, HANDLING AND DISPOSAL ACTIVITIES

- *2.1 The construction of facilities for waste sites, treatment of waste and disposal of waste."*

However, the dumping site has never been cleared environmentally (i.e., no ECC issued before). This could be attributed to the fact that like other similar local authorities' facilities in Namibia, have been established before the promulgation of the Environmental Management Act (EMA) No. of 7 of 2007 and its EIA regulations in 2012. The Rehoboth Town Dumping Site to be specific, is said to have been established over 30 years ago.

To ensure that the Site obtains full compliance with the environmental legislation and ensure environmental protection, an environmental clearance certificate must be issued by the Environmental Commissioner at the Ministry of Environment, Forestry and Tourism: Department of Environmental Affairs and Forestry (MEFT: DEAF).

Since the Site has already been in operation, and as per instruction from Office of the Environmental Commissioner to the Rehoboth Town Council, the ECC Application should be accompanied by a Draft Environmental Management Plan (EMP). The Draft EMP will then be evaluated by the Environmental Commissioner for consideration of the Site ECC.

1.4 The Need for Environmental Management & Closure Plan

Regulation 8(j) of the EIA Regulations (2012) requires that a draft Environmental Management Plan (EMP) shall be included as part of the Environmental Assessment (EA) scoping report

(please note that since the Dumping Site already in operation, there was no EA conducted nor scoping report for it). A '**Management Plan**' is defined as:

> *"…a plan that describes how activities that may have significant environments effects on the environment are to be mitigated, controlled and monitored."*

It is important to note that an EMP is a statutory document and a person who contravenes the provisions of this EMP may face imprisonment and/or a fine. This EMP is a living document and can be amended to adapt to address project changes and/or environmental conditions and feedback from compliance monitoring.

The purpose of this document is, therefore, to guide environmental management throughout the operational (and maintenance/upkeep), and closure (decommissioning) phases:

- **Operations and Maintenance (Upkeep/Upgrading):** the Dumping Site is operational (the solid waste is being disposed onsite) and maintenance is currently done by the Proponent through their contractors, where necessary.
- **Closure (Decommissioning)** – This is the stage at which the Dumping Site reaches capacity, and the Town Council ceases to dispose the solid waste (this could be due to relocation or siting of a new site). The Dumping Site would be decommissioned, and the Town Council will need to look for another site.

This EMP and Closure Plan thereto has been prepared for the management of potential impacts associated with the operations and the closure of the Dumping Site in the Town.

The description of the project activities is briefly provided under the next heading (Chapter 2).

2 THE DESCRIPTION OF PROJECT ACTIVITIES

This EMP was developed based on the site visit and assessment, consulted literature, information provided by the Proponent. The site visit was conducted on the 13th of July 2022. The activities currently undertaken onsite are presented under the following sections.

2.1 Operational and Maintenance (Upkeep)

The dumping of solid waste (domestic and building rubbles) is done by the Town Council through the waste removal and disposal contractor (Frontier Multi Industries) who was awarded the contract to manage waste in the Town (including the Dumping Site). The waste is also illegally dumped at the Site by the public. The contractor collects waste from the town, dump/dispose, level /compact, bulldoze, and burn it. The contractor's workers are onsite every day from 08h00 to 17h00. However, the Town Council do not have control of who enters the Site or waste dumping as there is no fence. There were some members of the public onsite, and they scavenge from the Dumping Site. Some of the photos taken on site regarding lack of site access control are shown in Figure 2-1 below.

Figure 2-1: Photos of the dumping site entrance taken in July 2022

Hazardous waste is not dumped on the Site by the Town Council. However, this may only apply to the waste dumped by the Council contractor, but the Town Council does not have control of what the public dumps onsite.

The dumped waste is burnt every 2 days in the week at around 15h00 to 16h00. During site visit there were visible signs of recently burnt waste (Figure 2-2).

Figure 2-2: The waste burning in the afternoon of 13 July 2022 during site visit

2.1.1 Resources, Services and Infrastructure

The required resources and services are and will continue to be provided by the Town Council throughout the Dumpsite. The following services are as follows:

A. Human Resources

The contractor managing the waste dumping has employed 24 people (drivers, general workers, litter pickers, site foreman). These people commute to Site from Town. Therefore, there is no onsite accommodation. Once upgraded, the Site will be provided with security personnel to look after the Dumpsite who will be working on shifts.

B. Equipment and Vehicles

There is one (1) Hydraulic compactor and Two (2) Open deck trucks of different sizes that are currently utilized to collect waste from the Town to the Site.

C. Water supply

There is currently no water supply onsite. Water would be required by Site workers, visitors and inspectors for ablution and drinking. Therefore, the Town Council will install water taps at the Dumpsite from its water supply line by setting up tanks.

D. Power supply

Currently, the Site is not equipped with electricity. This will be considered during the upgrading of the Site by availing through solar connection or generators.

E. Site accessibility

The site is accessible from the B1 via a well-maintained unpaved access road.

F. Site Security

The Dumping Site area does not have any fencing. There used to be a fence around the Site, but the fence has been vandalized over the years until there was nothing remaining. Due to this, the access to the Site area is open to everyone (unauthorized entry). Therefore, a new electric fence is planned for the Site to control access and protect the public from potential health and safety risks stemming from some waste onsite. There is also a plan to install a weighbridge at the Dumpsite.

G. Health and Safety:

The responsible personnel (workers) will be provided with appropriate Personal Protective Equipment (PPE). There will be one fully equipped first aid kit onsite and administering training provided to two or three of the workers onsite.

H. Potential Accidental Fire Outbreaks

The Site control room will be equipped with two fully serviced fire extinguishers to be kept at the security control room (at the entrance). For site fire outbreaks, the Site workers will be trained in basic fire response procedures while awaiting qualified and experienced firefighting personnel from the Town Council.

There has been an incident of fire outbreak when the waste was burnt in the evenings, and no one was around to monitor the fire. Therefore, improvements will be made going forward.

I. Waste management

The waste is currently poorly managed onsite. However, the following changes will be implemented onsite to improve operations:

- Solid waste: The Site office or control room will be equipped with secured waste bins for domestic waste for storage before disposing into the Dumpsite. The upgraded Site will also see the Waste Management Service delivery in informal settlements of the Town.
- Construction rubbles from the Town: these will be stored at a designated area onsite.
- Alternative waste usage: Implementation of the three R's (Reducing, Recycling, Reuse) Waste Management Hierarchy at the Site. Therefore, the Town Council is planning to establish a recycling centre onsite to minimize the accumulation of waste onsite.

- Hazardous waste: all the fuels and lubricants that may be used onsite during Site upgrade works will be properly handled and produced waste fuels will be stored in containers for disposal at the Town Council's hazardous waste management facility.
- Human waste (sewage): During site Upgrade, there will be provision for at least two portable toilets for the construction/upgrade workers. Ablution facilities (toilets and washroom) will be added onsite for the Site operations workers.

2.2 Dumping Site Challenges and Observations by 13 July 2022

The following challenges are experienced by the Town Council and these are as follows:

- Littering and illegal refuse (waste) dumping: the light waste such as plastic and papers are blown away by the wind and could be seen trapped on the surrounding vegetation Figure 2-3. There is currently no proper waste storage nor fence to contain the waste inside the dumpsite. This causes a visual nuisance and concern to the surrounding farm animals consuming the plastics. There had been complaints from some neighboring farmers about the wind-blown plastic bags from the Site and these are consumed by farm animals such as sheep, cattle and goats.

Figure 2-3: The wind-blown waste trapped on the vegetation around the dumping site

- Vandalism: the site fence has been vandalized over the years and cut by the public to gain access to the Site for waste scavenging. Eventually, there is no fence remaining, and everyone can access the dumpsite anytime. However, there are signs that there was a fence around the Site.

- Waste scavenging: some members of the community gather at the site, wait for the waste disposal vehicles to offload the waste and search for whatever waste items they can use. This was observed during the site visit around 15h00 on the 13th of July 2022. Not only people that are scavenging on the waste but also local wild animals such as baboons due to lack of fencing - Figure 2-4.

Figure 2-4: Local communities and animals (baboons) scavenging on the waste at the Site

- Health and Safety: the community scavenges for waste items, but this could pose health and safety risks such as stumbling or stepping on unnoticed broken bottles, rotten food items, chemicals and other potential unhealthy items.

  Another major concern was children running after the slow moving the waste disposal trucks and bakkies to ride / hang on the waste skip bin / containers sides so that they could arrive first when the new waste is dumped so that they can collect (waste) items. There was a young toddler left under a hanging container shade (Figure 2-5) onsite while the parents go to collect items from the newly dumped waste for self-consumption.

Figure 2-5: A toddler left by his mother under the container shade while she is scavenging at the newly delivered waste by a pickup truck

- Groundwater pollution: the dumping site is not lined, therefore leachate seeps into the ground and could have been affecting groundwater over time (negative impact).
- Impact on surface water flow systems. According to the Town Council personnel, there used to be a visible stream on the north-western side of the dumpsite, but it has been since been filled up and potential surface water flow blocked by the piling of waste over the years. This has probably affected the ecological functions around the dumpsite.

Figure 2-6: The filled-up stream that used to be on the northwestern side of the dumpsite

- The population has increased, and therefore, an increase in waste generation, thus exerting pressure at the dumping site. The estimated population is currently at 45,000 (as per the Town Council information).
- There is no proper segregation of waste onsite. There are currently two random segregations that are building rubble and general waste as seen in Figure 2-7 below.

Figure 2-7: The segregation of waste at the Site

- Dumping site uncontrolled open fires: the waste burnt once or twice a week depending on the need. However, the fires are not fully controlled, left unattended nor monitored. Due to this, there had been a reported incidence of the Site fire that spread to the nearest vegetation.
- Lack of coordinated waste recycling: apart from uncoordinated and unregulated waste scavenging by people, there is no recycling practiced onsite.
- Lack of basic facilities (ablution and drinking water): There are no sanitary / ablution facilities for the Site workers (contractors) and visitors. There is no personnel shelter or shade onsite.

- Impact of population increase on waste management: there is an increase in squatter camps resulting in the increase of waste generation, and illegal waste dumping across the Town.
- Waste management data: There is no reliable data on waste management only estimates.

2.3 Site Improvements by 08 August 2022

Following the discussions and preliminary recommendations onsite on the 13th of July 2022, the Proponent had commenced with making the necessary changes onsite by compacting the waste and level the Site area. These are shown on the photos in Figure 2-8 and Figure 2-9 below.

Figure 2-8: A - Some of the visual improvements at the dumpsite by the Proponent in August 2022

Figure 2-9: B (Continued) - Visual improvements at the dumpsite by the Proponent in August 2022

2.4 Proposed Improvements and recommendations to the Town Council

Based on the site visit and observations above, the following improvements and recommendations were made by the EDS Consultants and these are also incorporated into the management and mitigation measures under Chapter 7.

- The dumpsite should be properly fenced off with a high steel pole wall (see Appendix 1) with sufficient warnings (in English, and Afrikaans languages)
- The waste should be properly sorted and disposed accordingly.
- Promote waste recycling such as bottles, garden refuse (garden manure) and plastic.
- The burning of waste should be done between 08h00 and 15h00 only and ensure that there is always someone to monitor the fire until it is completely put out before leaving the Site.
- Prohibit the entrance of children under the age of 18 into the dumpsite. The waste collection for re-use should be controlled and supervised by and done through designated site workers and proper procedures.
- Establish a security control gate to control the entrance into the dumpsite.
- Setting up ablution facilities for the site workers such as the security guards, waste sorters and disposal contractors.

The summary of legal requirements that govern the project activities are provided under the next chapter.

3 LEGAL FRAMEWORK: APPROVALS, LICENSES AND OR PERMITS

The project and its associated activities are governed by certain legislative and legal requirements that are necessary to consider and outlined herein. This is done in terms of institutional (local) and national perspective. Therefore, the summary of these relevant legal requirements and these that require permitting and licensing for certain project activities are presented under Table 3-1.

Table 3-1: The legal requirements and permits and licenses applicable to the project activities

Legislation/Policy/ Guideline	Relevant Provisions	Implications for this Project
Environmental Management Act EMA (No 7 of 2007) Environmental Impact Assessment (EIA) Regulations Government Notice 28-30 (Government Gazette 4878) of February 2012A **Regulated under the Ministry of Environment, Forestry and Tourism (MEFT)**	The Act and its 2012 EIA Regulations aims to ensure that the potential impacts of the development on the environment are carefully considered. The Act aims at promoting sustainable management of the environment and use of natural resources. The Environmental Management Act (EMA) is broad; it regulates land use development through environmental clearance certification and/or Environmental Impact Assessments. The Act provides for the clearance certification for ''***2.1 The construction of facilities for waste sites, treatment of waste and disposal of waste.*** *9.2 Any process or activity which requires a permit, license or other form of authorization, or the modification of or changes to existing facilities for any process or activity which requires an amendment of an existing permit, license, or authorization or which requires a new permit license or authorization in terms of a law governing the generation or release of emissions, pollution, effluent, or waste*" which is relevant to the Project.	The EMA should inform and guide this EMP development and its implementation for: **-**ECC Amendment/Transfer and Renewal: Should the Proponent consider amending/Transferring the Project activities - The ECC needs to be renewed every 3 years (at least 3 months prior to its expiry date). The applications as deem necessary should be made with the Department of Environmental Affairs and Forestry (DEAF) as follows: **Office of the Environmental Commissioner:** **Mr. Timoteus Mufeti** **Tel: 061 284 2701**

Legislation/Policy/ Guideline	Relevant Provisions	Implications for this Project
	For new projects, the Act requires that projects with significant environmental impacts are subject to an environmental assessment process (Section 27). Regardless to the dumping site, mitigation measures should be developed for implementation during operations.	
	Details requirements for public consultation within a given environmental assessment process (Government Notice No. 30 Section 21). The details the requirements for what should be included in an Environmental Scoping Report (Government Notice No. 30 S8) and an EIA Report (Government Notice No. 30 Section 15).	The Project is already in its operational phase. However, if necessary and required, constant consultations and engagements with the interested and affected parties (stakeholders) should be continued. In case of grievances raised by the neighbouring land users (such as farmers) to the Proponent, this should be addressed and resolved amicably.
Pollution Control and Waste Management Bill: **Regulated under the Ministry of Environment, Forestry and Tourism (MEFT)**	The bill aims to "prevent and regulate the discharge of pollutants to the air, water and land" Of particular reference to the Project is: Section 21 "(1) Subject to sub-section (4) and section 22, no person shall cause or permit the discharge of pollutants or waste into any water or watercourse." Section 55 "(1) No person may produce, collect, transport, sort, recover, treat, store, dispose of or otherwise manage waste in a manner that results in or creates a significant risk of harm to human health or the environment."	The Proponent and their workers should continue with the good waste management work (directly or indirectly) to ensure that the waste does not cause environmental threat and degradation. **No permit or license required.**

Legislation/Policy/ Guideline	Relevant Provisions	Implications for this Project
Forestry Act No. 12 of 2001 **Regulated under the Ministry of Environment, Forestry and Tourism (MEFT)**	The Act provides for the management and use of forests and related products / resources. It offers protection to any living tree, bush or shrub growing within 100 metres of a river, stream or watercourse on land that is not a surveyed erven of a local authority area. In such instances, a licence would be required to cut and remove any such vegetation. These provisions are only guidelines. The Project is in a desert environment where vegetation is scarce and of which some are sensitive species.	The Site is already disturbed from the Site establishment. However, there are shrubs and young trees of camelthorn on and around the dumping Site. Should there be a need to remove these trees (during Site upgrading or extension), **a permit should be obtained from the nearest MEFT' Forestry Office prior to removing the trees.**
Soil Conservation Act (No 76 of 1969) **Regulated under the Ministry of Agriculture, Water and Land Reform**	The Act makes provision for the prevention and control of soil erosion and the protection, improvement and conservation of soil, vegetation and water supply sources and resources, through directives declared by the Minister.	Duty of care must be applied to soil conservation and management measures must be included in the EMP. This is mainly aimed at soil disturbance through unnecessary creation of new tracks and pollution from project related activities.
The National Heritage Act (No. 27 of 2004) The National Monuments Act (No. 28 of 1969) **Regulated under the Ministry of Education, Arts and Culture**	The Act extends the protection of archaeological and historical sites to private and communal land and defines permit procedures regarding activities at such sites. The Act enables the proclamation of national monuments and protects archaeological sites.	Should heritage resources (e.g., artefacts, human remains/bones in the subsurface etc.) are discovered at some point on and /or around the site, these should be reported to the National Heritage Council of Namibia for relocation. **Contact: Mrs. Erica Ndalikokule (Director)** **Or Ms. Agnes Shiningayamwe (Regional Heritage Officer)** **Tel: 061 301 903**

Legislation/Policy/ Guideline	Relevant Provisions	Implications for this Project
Public Health Act (No. 36 of 1919): **Regulated under the Ministry of Health and Social Services**	Section 119 states that "no person shall cause a nuisance or shall suffer to exist on any land or premises owned or occupied by him or of which he is in charge any nuisance or other condition liable to be injurious or dangerous to health."	The Proponent and all its employees should ensure compliance with the provisions of these legal instruments. This includes the provision of health and safety measures, wearing of Personal Protective Equipment (PPE), Health & Safety Trainings, etc. This safety and health of the community around the dumping Site. This requires a complete upgrade of the Site to ensure that the unauthorized members of the public do not access the dumping site as it is the current situation onsite. **No permit or license required.**
Health and Safety Regulations GN 156/1997 (Government Gazette 1617): Regulated under the Ministry of Health and Social Services	Details various requirements regarding health and safety of labourers.	
Public and Environmental Health Act No. 1 of 2015: Regulated under the Ministry of Health and Social Services	To provide a framework for a structured uniform public and environmental health system in Namibia; and to provide for incidental matters.	
Road Traffic and Transport Act, No. 22 of 1999: Regulated under the Ministry of Works and Transport (Roads Authority of Namibia)	The Act provides for the establishment of the Transportation Commission of Namibia; for the control of traffic on public roads, the licensing of drivers, the registration and licensing of vehicles, the control and regulation of road transport across Namibia's borders; and for matters incidental thereto.	The Proponent should consider applying for a formal access road permit to the dumping site. This permit is to be applied from Roads Authority. **Contact: Mr Eugene de Paauw (Roads Authority – Specialist Road Legislation)** **Tel.: 061 284 7027**
Water Act 54 of 1956: Regulated under the Ministry of Agriculture, Water and Land Reform	The Water Resources Management Act 11 of 2013 is presently without regulations; therefore, the Water Act No 54 of 1956 is still in force: -Prohibits the pollution of water and implements the principle that a person disposing of effluent or waste has a duly of care to prevent pollution (S3 (k)). -Provides for control and protection of groundwater (S66 (1), (d (ii)).	The protection (both quality and quantity/abstraction) of water resources should be a priority.

Legislation/Policy/ Guideline	Relevant Provisions	Implications for this Project
	-Liability of clean-up costs after closure/abandonment of an activity (S3 (l)).	
Water Resources Management Act (No 11 of 2013): Regulated under the Ministry of Agriculture, Water and Land Reform	Ensure that the water resources of Namibia are managed, developed, used, conserved and protected in a manner consistent with, or conducive to, the fundamental principles set out in Section 66 - protection of aquifers, Subsection 1 (d) (iii) provide for preventing the contamination of the aquifer and water pollution control (Section 68).	
Atmospheric Pollution Prevention Ordinance (1976): Regulated under the Ministry of Health and Social Services	This ordinance provides for the prevention of air pollution and is affected by the Health Act 21 of 1988. Under this ordinance, the entire area of Namibia, apart from East Caprivi, is proclaimed as a controlled area for the purposes of section 4(1) (a) of the ordinance.	The project and related activities should be undertaken in such a way that they do not pollute or compromise the surrounding air quality.
Hazardous Substance Ordinance, No. 14 of 1974: Regulated under the Ministry of Health and Social Services	The ordinance provides for the control of toxic substances. It covers manufacture, sale, use, disposal and dumping as well as import and export. Although the environmental aspects are not explicitly stated, the ordinance provides for the importing, storage, and handling.	The Proponent should handle and manage the storage and use of hazardous substances on site so that they do not harm or compromise the site environment
Local Authorities Act No. 23 of 1992: Regulated under the Ministry of Urban and Rural Development	To provide for the determination, for purposes of local government, of local authority councils; the establishment of such local authority councils; and to define the powers, duties and functions of local authority councils; and to provide for incidental matters. This includes the management of waste.	The Rehoboth Town Council is the responsible Local Authority of the area, and the project Proponent. Regardless, they should ensure that the Site activities follow the Act and its Regulations, as relevant to the project.

Legislation/Policy/ Guideline	Relevant Provisions	Implications for this Project
Labour Act (No. 6 of 1992): Regulated under the Ministry of Labour, Industrial Relations and Employment Creation (MLIREC)	MLIERC is aimed at ensuring harmonious labour relations through promoting social justice, occupational health and safety and enhanced labour market services for the benefit of all Namibians. This ministry ensures effective implementation of the Labour Act No. 6 of 1992, specifically its Regulations, No. 156 Labour Act, 1992: Regulations relating to the health and safety of employees at work	The Proponent should ensure that the Site operations, and maintenance works, do not compromise the safety and welfare of workers. **No permit or license required.**

The dumping site is located in a specific biophysical and social environment. Understanding the existing environment would aid in identifying the sensitive or potentially affected features and how these can be protected by the development and implementation of mitigation or management measures. Therefore, the relevant features of this environment are presented under the next chapter.

4 ENVIRONMENTAL BASELINE: BIOPHYSICAL AND SOCIAL

The baseline current) environmental conditions of the site and surroundings are presented under the subheadings below. The information has been sourced from consulted literature (relevant books, reports, and websites) and observations made onsite by the Environmental Consultants in July and August 2022.

4.1 Climatic Conditions

4.1.1 Rainfall

The southern parts of the Hardap Region receive an average rainfall of 100 mm, increasing to 300 mm for the Rehoboth area further north. According to the 13-year period of rainfall data on the World Weather Online site (2022), the Rehoboth area received the highest rainfall in 2012, followed by 500mm in 2020 - Figure 4-1.

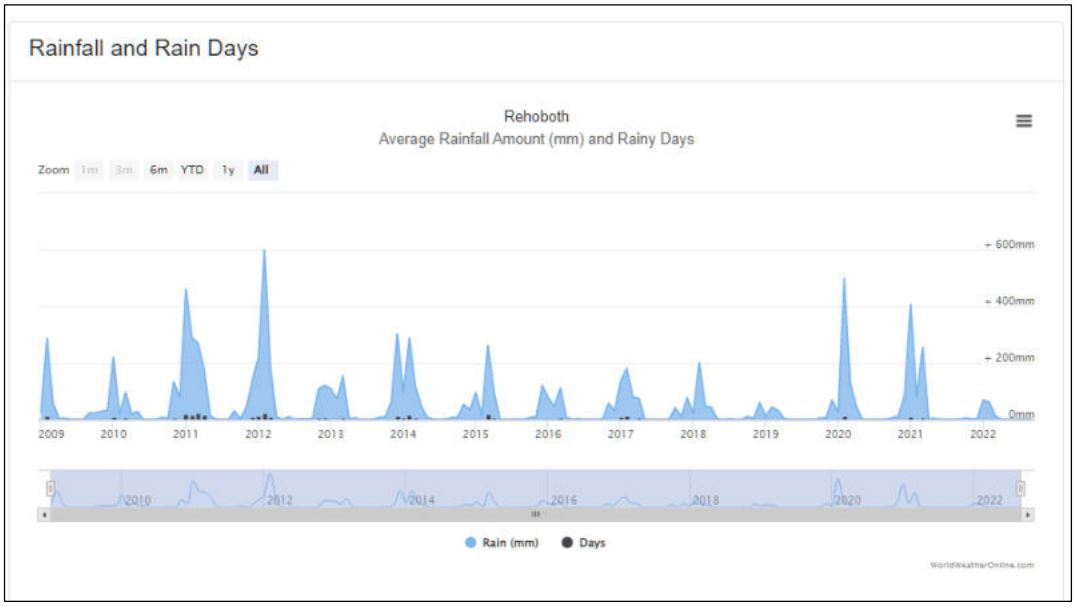

Figure 4-1: The average rainfall and rainy days for Rehoboth (World Weather online, 2022)

The average rainfall for the area is 180mm in February and 140mm and 130mm in January and March, respectively as shown in Figure 4-2.

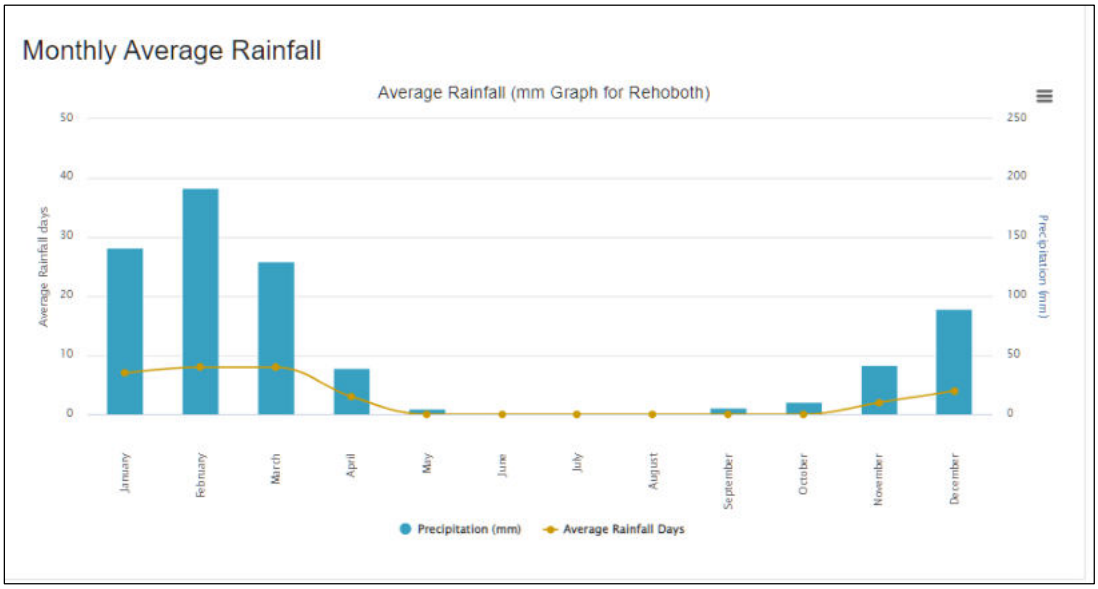

Figure 4-2: The monthly average rainfall for Rehoboth (World Weather online, 2022)

4.1.2 Temperature

Mendelsohn et al, (2002) indicated that the Rehoboth area has annual temperature of more than 22°C, minimum temperatures ranging between 4 and 6°C and maximum temperatures within the range of 34 to 36°C. According to World Weather Online (2022), the minimum, maximum and average temperature for Rehoboth area are 33°C, 4°C and 28°C, respectively (Figure 4-3). The monthly average high and low temperatures are 30°C and 6°C, respectively (Figure 4-4).

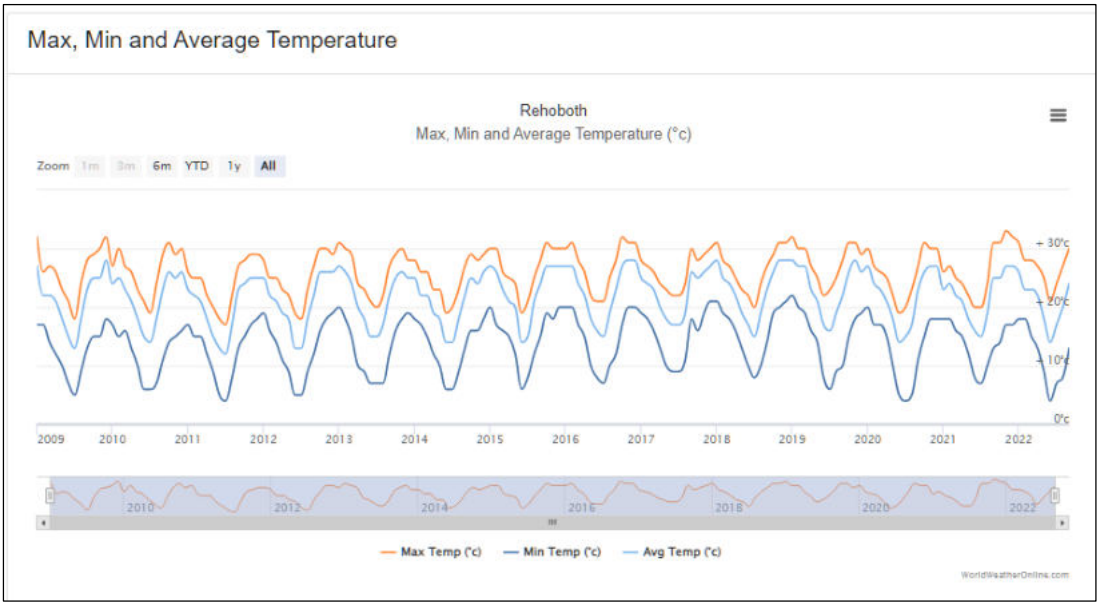

Figure 4-3: The maximum, minimum and average temperature for Rehoboth (World Weather online, 2022)

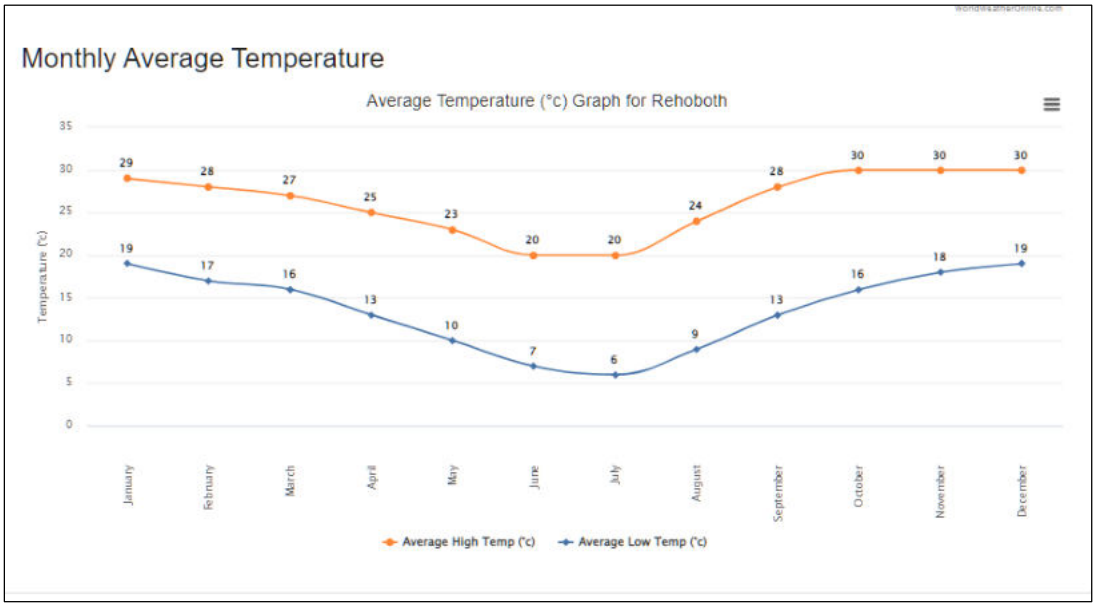

Figure 4-4: The monthly average temperature for Rehoboth (World Weather online, 2022)

4.1.3 Air Quality

According to IQ Air (2022), the current air pollution level around in and around Rehoboth area, air is moderate. The air quality index (AQI) is 89 US AQI, and the main pollutant is the atmospheric particulate matter (PM) 2.5. PM are microscopic solid or liquid matter suspended in the air with a diameter of 2.5 micrometres (µm) or less. The PM2.5 concentration in the Rehoboth is 30.2 µg/m³ which is currently 6 times the WHO annual air quality guideline value (IQ Air, 2022) of 5 µg/m³.

4.1.4 Wind Direction and Speed

The predominant wind in the Rehoboth area is blowing from South-West (SW) to North-East (NE) (Meteoblue, 2022) at a speed ranging between 19 and 28 kilometers per hour as shown in Figure 4-5 (left-had side). The strong winds (with a speed greater than 28km/h) occur mainly in the months of August, September, and October as shown in the chart (Figure 4-5 right-hand side).

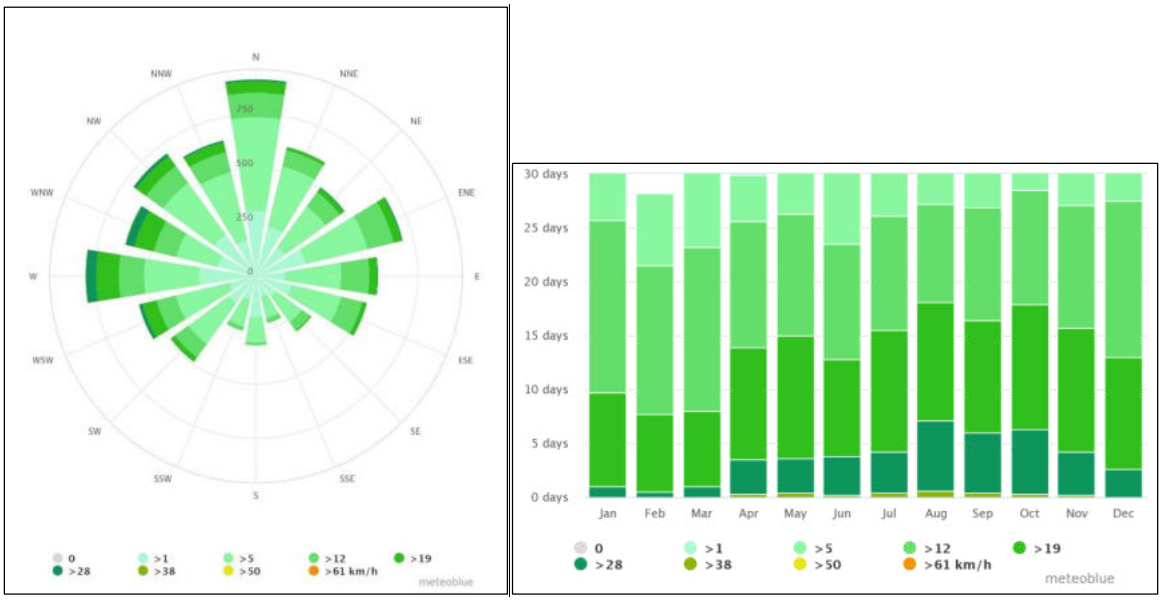

Figure 4-5: The wind speed and chart for Rehoboth (World Weather online, 2022)

4.2 Topography

Rehoboth lies on an elevation of 1,385m of which the physiography is characterized by rugged, stony hills, mountainous areas and sand-filled valleys (Rehoboth Town Council, 2005). The elevation ranges from 1,375 to 1,543m above mean sea level (mamsl) as shown on the topography map in Figure 4-6.

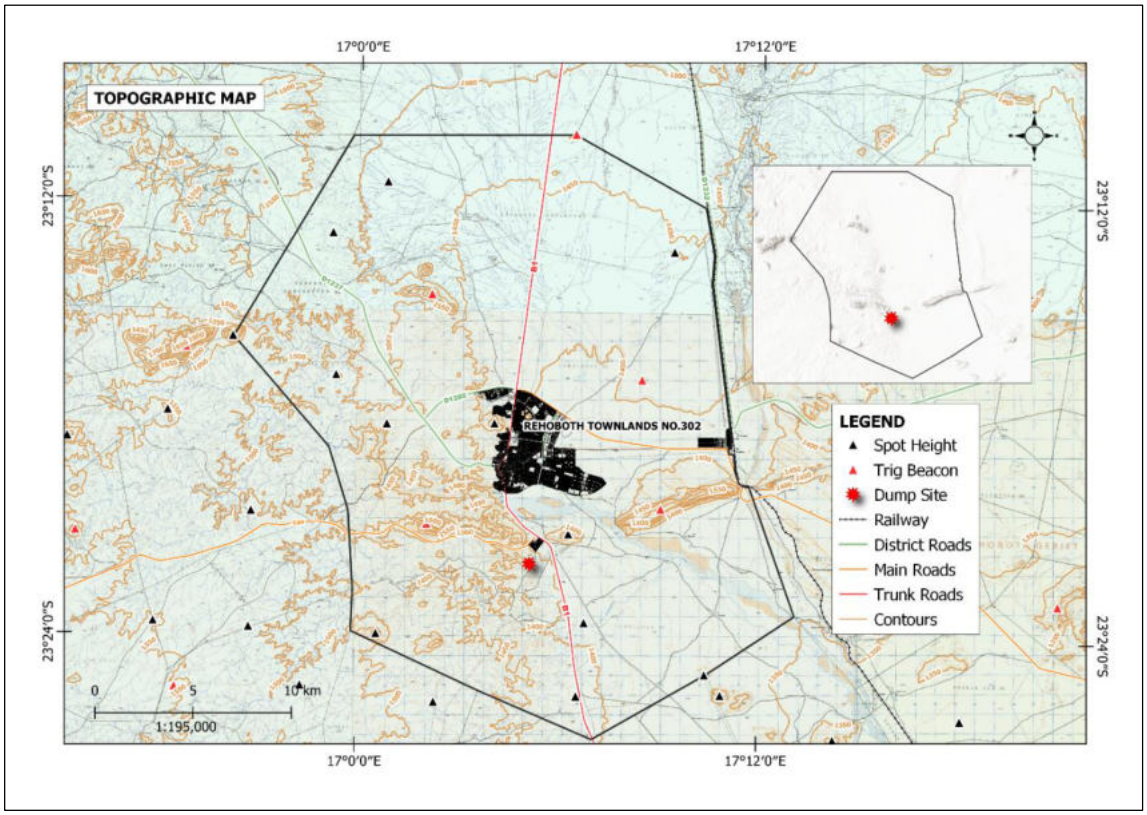

Figure 4-6: The topography map of Rehoboth and surroundings

4.3 Geology and Soils

Geologically, Rehoboth is situated in unconsolidated to semi-consolidated sand and gravel, locally calcrete. The dumping site is on a schist a shown in the geological map below (Figure 4-7).

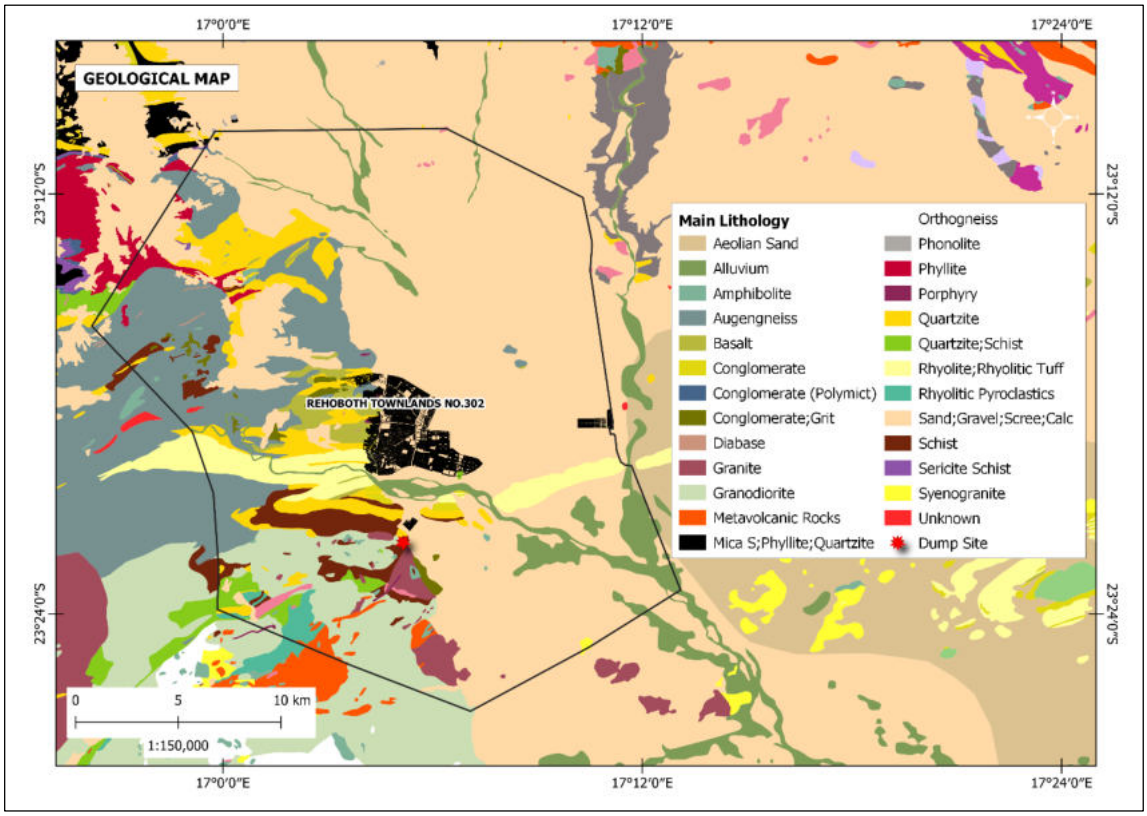

Figure 4-7: The geology of Rehoboth and surroundings

The soils in the region can be classified into three groups: Aeolian sands, Calereousus soils; and Lithosols. The town of Rehoboth is dominated by leptosols. These soil types typically form in actively eroding landscapes, especially in the hilly or undulating areas. The leptosols are shallowest soils and contain high content of gravel. As a result, their water holding capacity is low and vegetation in areas in which they occur is often subject to drought (Mendelsohn et. al, 2002).

The site soils are highly influenced by the dumpsite activities over time, which makes it difficult to identify the natural soil type. However, according to the mapped information, the dominant soil type had been eutric regosols and eutric leptosols as shown in Figure 4-8.

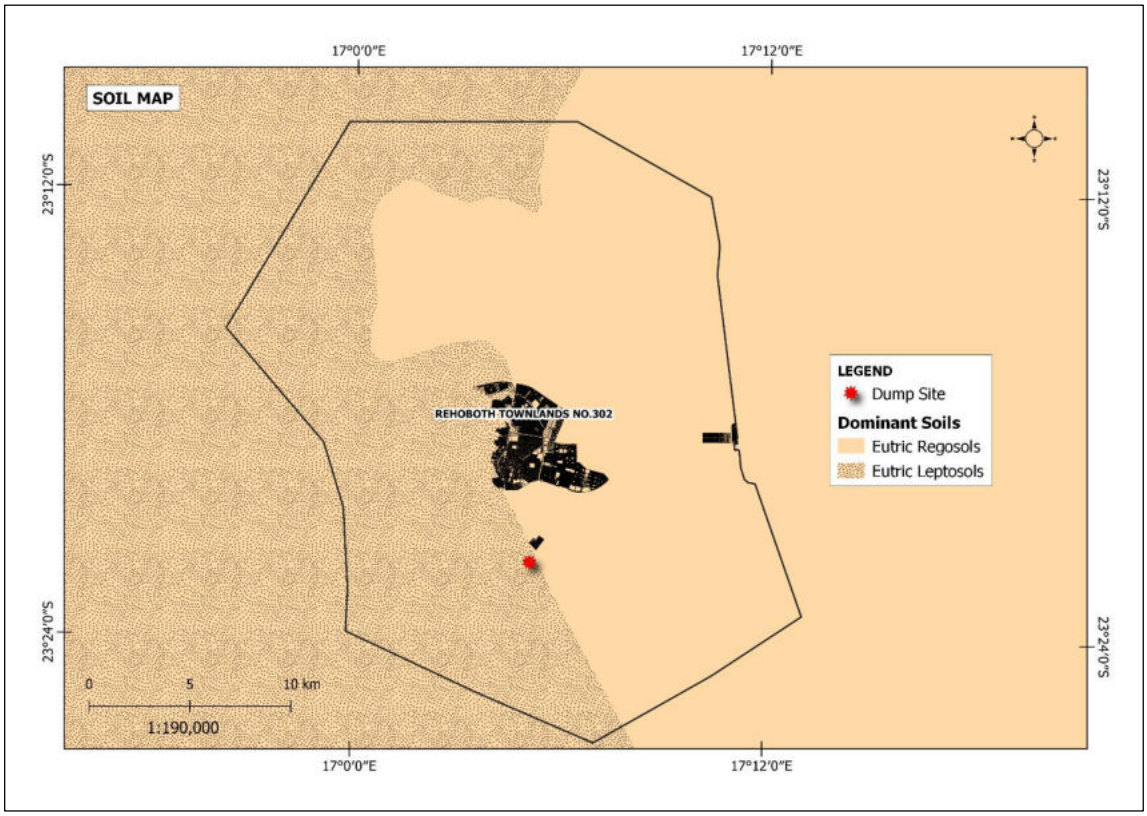

Figure 4-8: The dominant soil map of Rehoboth and surroundings

4.4 Water Resources: Hydrology and Hydrogeology

The Town of Rehoboth does not have permanent nor long-term river flows, as the inland of Namibia only have ephemeral rivers. The main ephemeral rivers within and in the surroundings of Rehoboth include the Kalknaute, Swartmodder (south of the dumping site) and Oanob rivers as shown in the map in Figure 4-9.

In terms of groundwater, the project site is characterized by rocks with low groundwater potential as shown in Figure 4-9.

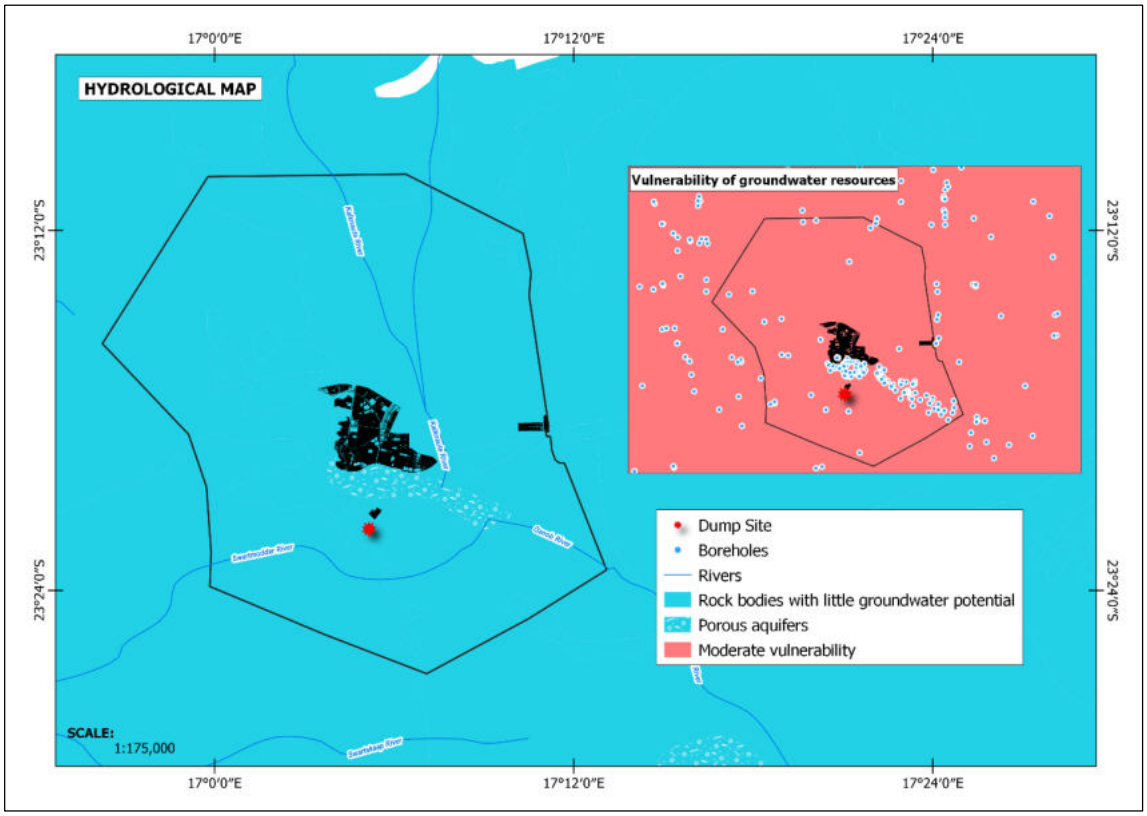

Figure 4-9: The hydrological and hydrogeological map of the Rehoboth area

4.5 Fauna

Within proximity of the Site, there are farms with livestock such as goats, sheep, cattle and other animals from farms that reportedly graze around the dumpsite sometimes. The map of the livestock density (kg per hectare (kg/Ha)) in the area is shown in Figure 4-10, with the dumping site vicinity indicating the density being between 20 and 39. However, no livestock was not seen during site visit.

On Wildlife, there is a seldom occurrence of wildlife, but the only wildlife observed during site visit were baboons, also trying to scavenge from the dumpsite.

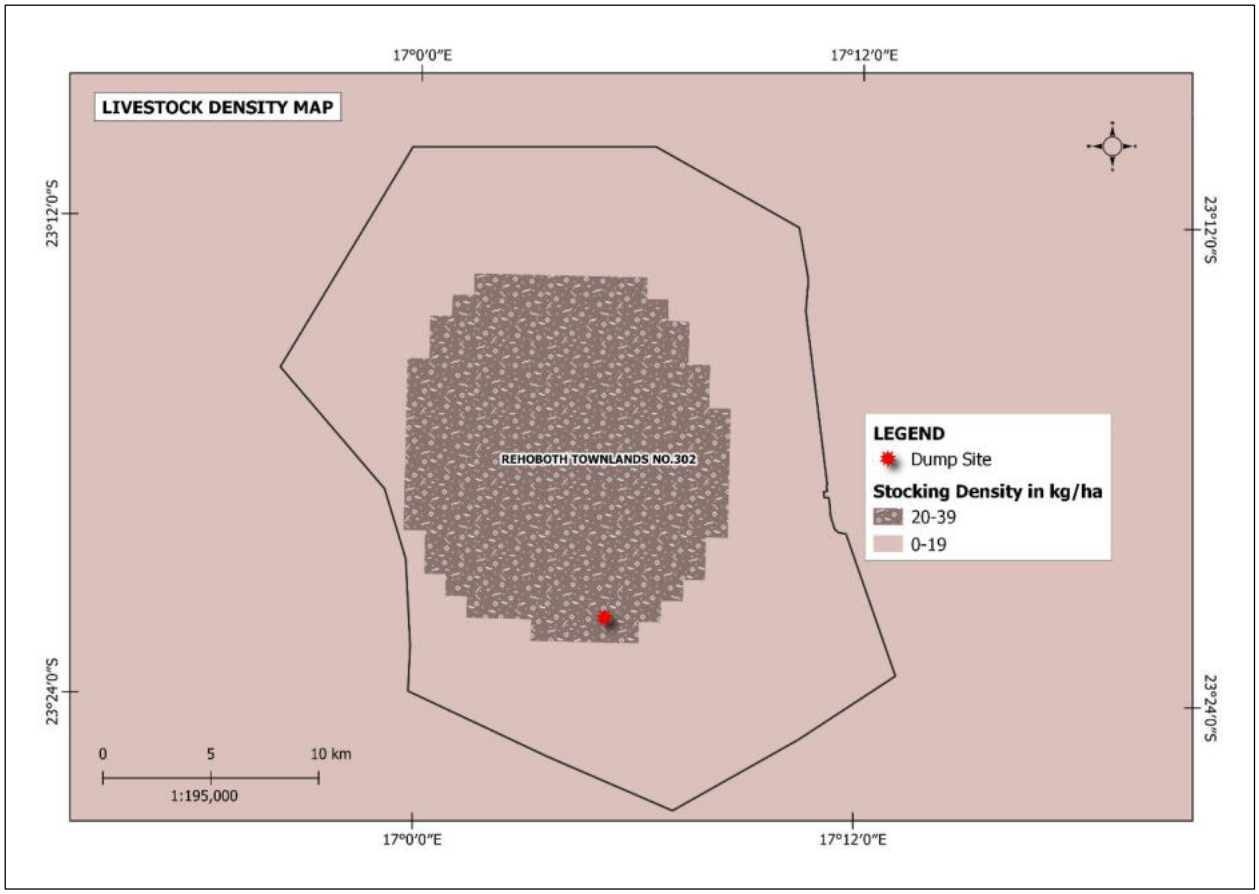

Figure 4-10: The livestock density map of the Rehoboth area

4.6 Flora

The town of Rehoboth is dominated by magnificent and beautiful old camelthorn trees. These trees are very characteristic of the Kalahari and often line the drainage lines in the Namib where their ancient, beautifully gnarled trunks testify to their remarkable endurance under harsh conditions. Seedlings of this tree immediately form a deep tap root and live roots of a certain tree in Namibia have been found at a depth of 46m. Consequently, they can tap deep groundwater and survive under very arid conditions (Hoffmann, 2014).

The dominant vegetation on and around the dumping site and Rehoboth at large are dwarf shrub savanna and mixed tree and shrub savanna - Figure 4-11. The dumpsite area has a medium to densely grass cover, shrubs and young trees of the camelthorn species (*Vachellia erioloba*, and *reficiens*).

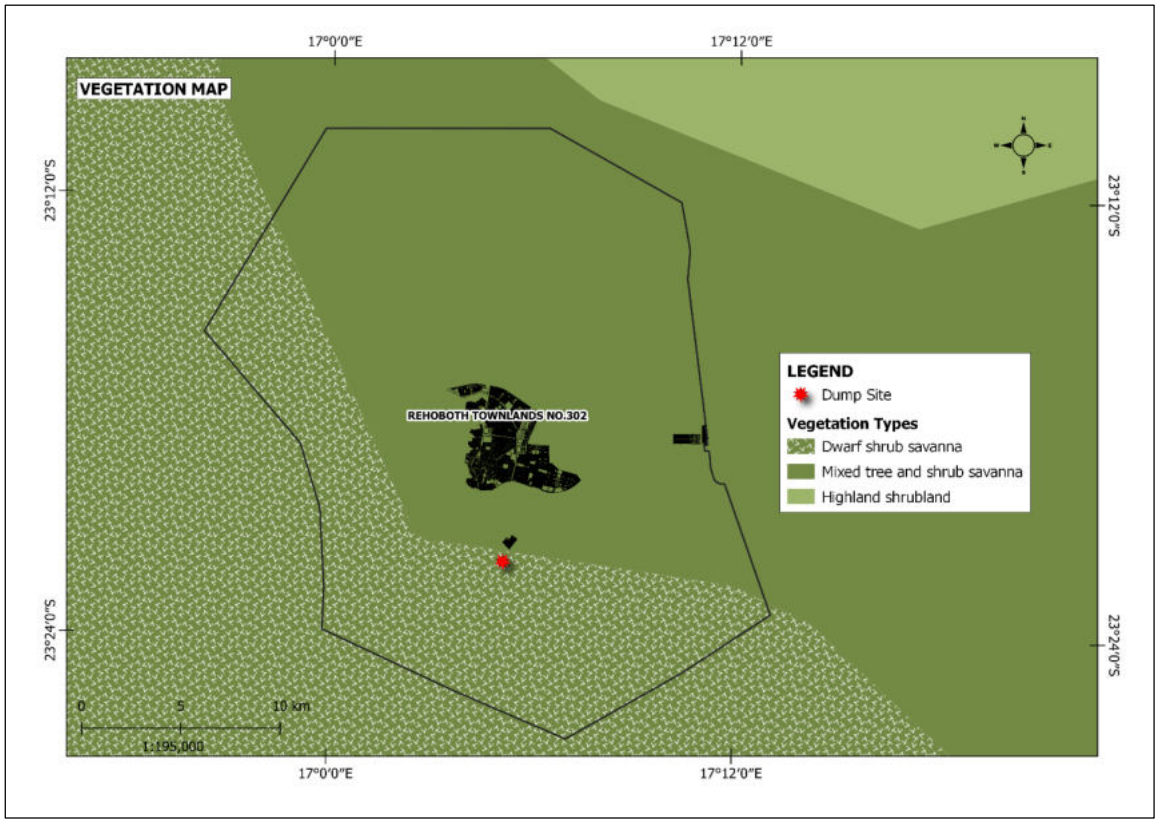

Figure 4-11: The vegetation type map of the Rehoboth area

4.7 Social and Economy

4.7.1 Demography

Based on 2011 Namibia Population and Housing Census, the population of the three Rehoboth Constituencies; Rehoboth Rural, Rehoboth West and Rehoboth East was 7,300, 18,000 and 11,200, respectively, which amounts to 36,500 of the total population of Hardap Region which was 79,000. The population densities for these Constituencies were 25, 34.3 and 1.6, respectively.

4.7.2 Economic Activities

The Rehoboth Town covers a surface area of 54,000 ha and enjoys a strategic location on the national highway, untapped natural resources, including tourism and eco-tourism potential, low cost for land and business properties. There are more than 190 registered businesses and two financial institutions such as First National Bank and Standard Bank. There are seven Primary Schools, two Senior Secondary Schools and one Technical Secondary School in Rehoboth.

Region has tourist potential. The main tourism activities around and in the Town are Acacia forest, Oanob Lake Resort, Namibia Wild Life Resorts (Hot Water Springs) and Rehoboth Museum. The main tourist destinations on a regional level are Naukluft Park and Sossus Vlei. These developments in the region have positive spin-offs for the economy in the form of new employment opportunities and increased revenue streams and foreign exchange earnings. Efforts would continue the part of the government to encourage the private sector to invest in the region in order to revive economic activities and create the much-needed employment opportunities in towns and settlements in the region (Rehoboth Town Council, 2005).

4.7.3 Services and Infrastructure

The Town of Rehoboth is well-equipped with services and infrastructure to aid in running the Town. The services include trunk, main and district roads. The main tarred road is the B1 connecting Rehoboth to Windhoek and Mariental and then to the rest of the country. There are tarred street roads in the Town as well as surrounding gravel roads (district roads) connecting the Town to nearby settlements and farms. Other services and infrastructures such as railways, aerodromes, water meters and powerlines are shown on the map in Figure 4-12.

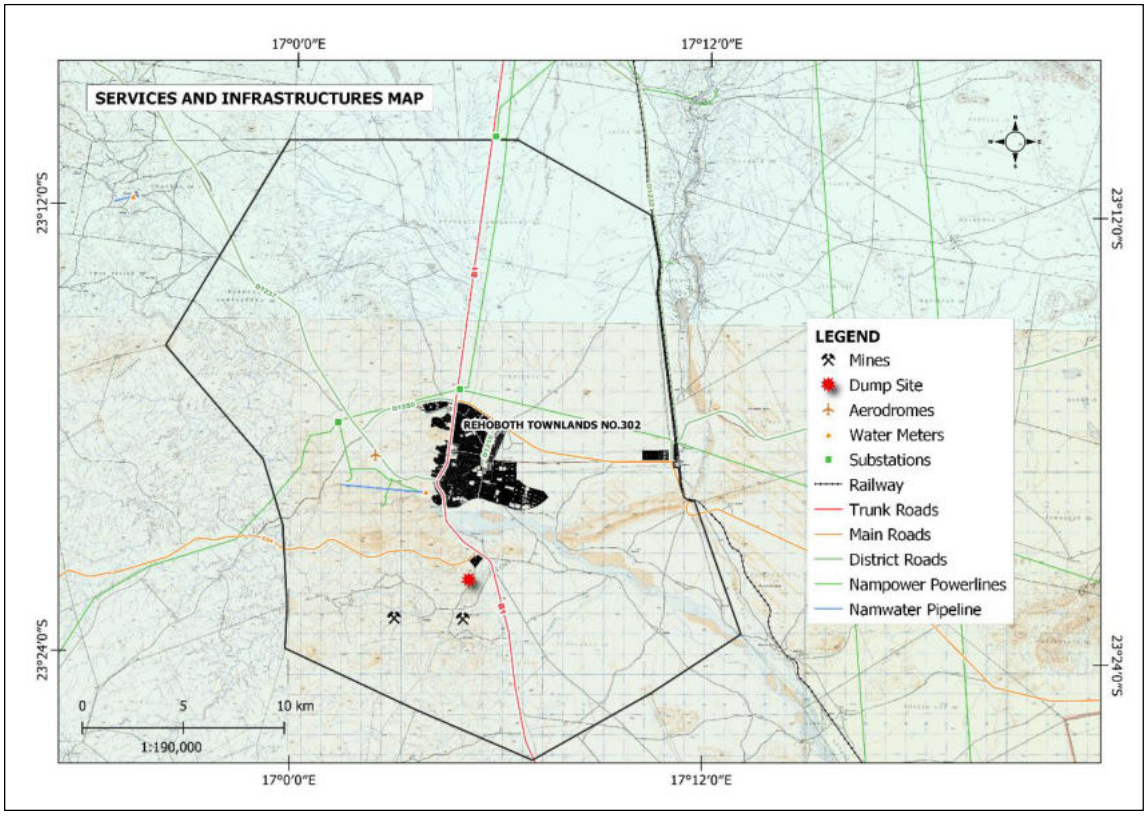

Figure 4-12: The services and infrastructure map of Rehoboth and surroundings areas

4.7.4 Waste Management

The Town's waste is managed as follows:

- Solid and domestic waste: stored on a household level and disposed of at the existing dumping site (by an external waste removal contractor).
- Sewage: in formal houses, the sewage is managed through the municipal sewer reticulation line to a sewage management facility (oxidation ponds).
- Hazardous waste: the waste is managed and handled at a hazardous waste treatment facility.

4.7.5 Surrounding Land Uses

The site is bordered to the north by the Rehoboth Town and B1. To the east is also the B1 and commercial farms that also continue to the south and west.

4.7.6 Archaeology and Heritage Resources

There were no recorded nor observed archaeological or heritage resources onsite. However, there are some archaeological site mapped some kilometers to the southeastern side of the dumping site. However, the absence of surface findings does not mean an absence of subsurface resources that may be uncovered during earthworks of the site upgrading. The archaeological map of the recorded sites are shown in Figure 4-13.

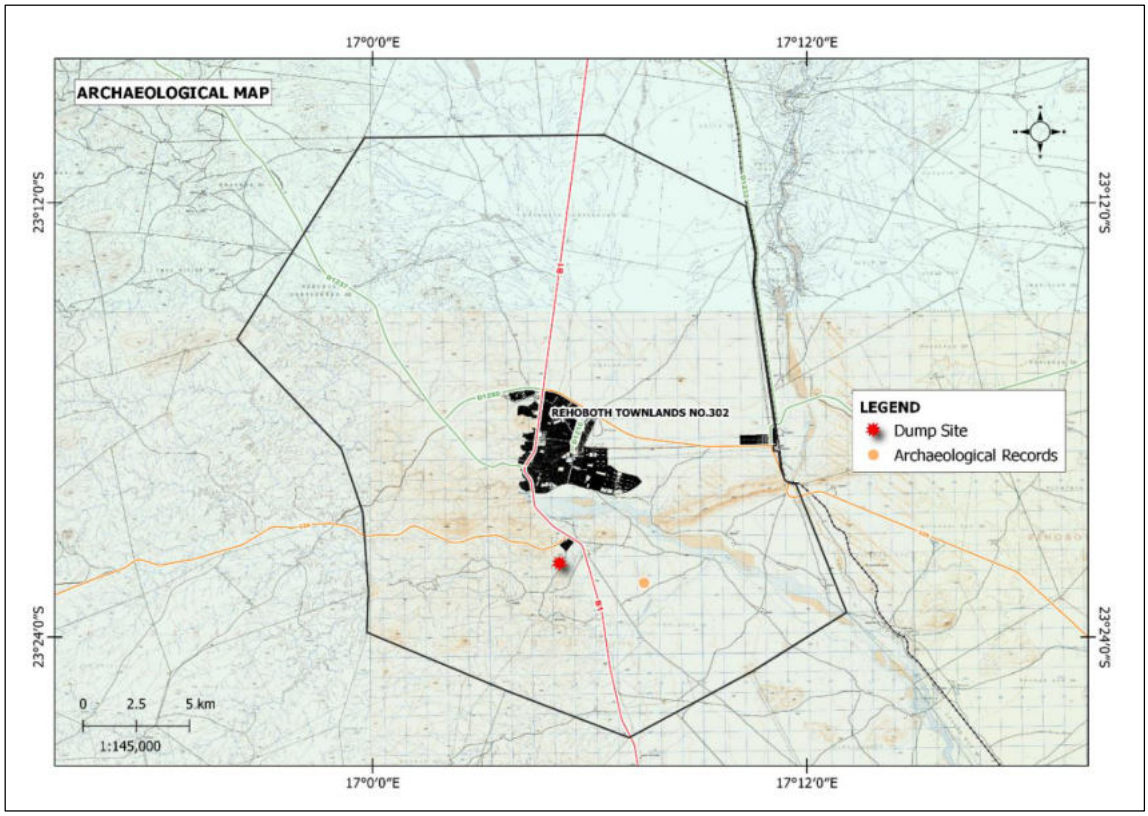

Figure 4-13: The archaeological map of Rehoboth and surroundings areas

For the successful implementation of this EMP, the roles and responsibilities need to be assigned to different parties at the Rehoboth Town Council (and contractors appointed by the Town Council to undertake works at the dumping site or associated activities). Although the Town Council holds overall responsibility of implementing the EMP, individual parties operating under the Town Council holds the responsibility of implementing specific measures (as entirely individually or collectively), therefore, the EMP roles and responsibilities are provided under the next chapter.

5 EMP IMPLEMENTATION: ROLES & RESPONSIBILITIES

The Rehoboth Town Council, as the project Proponent has the overall responsible for the implementation of the EMP and the associated Closure Plan. The roles and responsibilities of all delegates/parties involved in the effective implementation of this EMP are set in Table 5-1.

Table 5-1: The list of responsible parties and their roles in implementing the EMP & Closure Plan

Role (Person and or Institution)	Responsibilities
The Proponent (Rehoboth Town Council)	-Managing the implementation of this EMP and updating and maintaining it when necessary. -Management and monitoring of individuals and/ or equipment on-site in terms of compliance with this EMP and issuing fines for contravening EMP provisions.
Safety, Health & Environmental (SHE) Officer / Environmental Health Officer (EHO)	-Conducting site inspections of all areas with respect to the implementation of this EMP (monitor and audit the implementation of the EMP). -Advising the Proponent on the removal of person(s) and/or equipment not complying with the provisions of this EMP. -Undertaking an annual review of the EMP and recommending additions and/or changes to this document.
Site Operator	-Collaborate with the ECO to ensure the implementation of the EMP, especially on the technical aspects regarding the dumping site upgrading and operations.
Site Upgrading Contractor	-Collaborate with the SHE Officer/EHO and Site Operator to ensure the implementation of the EMP, especially on the technical aspects regarding the upgrading of the dumping site.

6 ENVIRONMENTAL MANAGEMENT AND MITIGATION MEASURES

6.1 Identification of Key Impacts

The key potential impacts associated with the dumping site upgrading and operations are as follows:

Positive impacts

-Improved local public and environment health through a better and environmentally managed dumping site.

-Improvement for the town's planning regarding future solid waste management.

-Employment and business opportunities: creation of jobs to the locals (temporary work for the site upgrading works, and permanent / contractual work for dumping site operations and maintenance).

Potential Negative impacts

-Soil disturbance during site fencing and installing the needed services.

-Groundwater pollution from infiltration of dissolved waste into surrounding soils and eventually water resources systems.

Potential Negative impacts (Continued)

-Surface water pollution: During heavy rains, rainwater may carry wastes from the dumping site to nearby river systems.

General environmental pollution through mishandling of project related waste during operational phase.

-Air pollution by potential dust on untarred roads during waste offloading/disposal.

-Visual impact due to the presence of the piling waste heaps over time when the town expands towards the dumpsite or located close to roads and waste blown by wind on surrounding vegetation.

-Health and safety: improper handling of site materials and equipment may cause health and safety risks.

The impacts will be mitigated by the implementation of measures provided under the next section.

6.2 Environmental Management and Mitigation Measures for the Dumpsite

The management actions provided under this section are aimed at avoiding the above-listed potential negative impacts, where possible. Where it is impossible to avoid the impacts, mitigation measures are provided to reduce the impacts' significance. The measures recommended (Table 6-1 and Table 6-2).

Table 6-1: The Environmental management and mitigation measures for the Site Upgrading

Aspect	Impact	Management and Mitigation Measure(s)	Key Performance Indicator (KPI)	Implementation Responsibility
Site Improvement / Upgrading Mitigation Measures				
Dumping site wall design	Utilization of unsuitable materials such as precast	-The dumping site wall should be constructed with steel pole to ensure that the site is protected from vandalism and unauthorized access – please refer to an example of a better and strong/vandalism & theft resistance dumping site wall **(Oshakati Town Council site - Appendix 1)** -The materials for the wall should be well designed and installed (height-wise)	-The site walls materials are not mesh wire (vulnerable to vandalism and theft)	-Proponent
Site infrastructures and services	Lack of necessary infrastructure	-The design should include the security control gate, water supply, ablution facilities, parking areas, and night lighting. -The roads to the site should properly upgraded and maintenance done regularly.	-All the infrastructures and services are included in the site upgrade layout/plan	-Proponent (Planning & Design Engineer))
Stormwater Management	The stagnation of rainwater and possible overtopping during rainwater (site damage and flooding)	-Stormwater management systems should be designed and incorporated into the dumpsite upgrading plan to ensure that the rainwater is collected and diverted to specific rainwater collection area (point) and not idle on site. -A runoff diversion ditch must be constructed and maintained.	-Stormwater discharge systems are incorporated into the upgrade plan and installed onsite.	-Proponent -Planning & Design Engineer
Employment opportunities	Conflicts from unfair practices of labour recruitment	-The locals should be given preference for works (skilled, semi and unskilled, where possible). -Equal opportunities should be given to women and men, where possible.	-There is a fair recruitment process -Locals are given preference for the work	-Proponent (Human Resources Department)

Aspect	Impact	Management and Mitigation Measure(s)	Key Performance Indicator (KPI)	Implementation Responsibility
Goods and services procurement	The procurement of goods and service from outsiders over local business may lead to conflicts and overlooking local suppliers	-The procurement of works for site upgrade works should follow a fair and transparent process. -Procurements for goods and services should be open only to local and Namibian companies with strong local participation. -The business opportunities such as bulk waste disposal and site maintenance should be given to local companies	-Site upgrading goods and services are procured from Rehoboth -Local businesses are considered for procurement opportunities	-Proponent (Procurement Department)

Table 6-2: The Environmental management and mitigation measures for the Operational and Maintenance of the Dumping Site

Aspect	Impact	Management and Mitigation Measure(s)	Key Performance Indicator (KPI)	Implementation Responsibility
Continued Operational and Maintenance Mitigation Measures				
EMP implementation and training	Lack of EMP awareness and implications thereof	-EMP trainings should be provided to all site personnel. -All site personnel should be aware of necessary health, safety, and environmental considerations. -The implementation of this EMP should be monitored. The site should be inspected, and a compliance audit done throughout the project activities (bi-annually). -Implement EMP non-compliance penalty system onsite.	-Compliance monitoring conducted bi-annually and should be recorded. -The ECC is renewed every 3 years -Bi-annual reports -Records of EMP training conducted.	-SHE Officer
Soils	Physical soil / land disturbance and loss of	-The topsoil that was stripped from certain site areas should returned to its initial position, should be returned.	-No stockpiled soils after completion of works -No new erosion gullies.	-SHE Officer

Aspect	Impact	Management and Mitigation Measure(s)	Key Performance Indicator (KPI)	Implementation Responsibility
	topsoil during site upgrade	-Site soils should not be disturbed, if not needed or related to the actual construction works. -All site maintenance trenches should be backfilled, and areas rehabilitated upon completion of works		
Site Fire outbreaks	Accidental fire outbreaks risks	-Warning signs of ‘*’No Smoking”* and ‘*’No throwing of live cigarettes or firewood inside the dumping site/No open fires”* should be clearly written (in English and Afrikaans) and pasted at dumping site entrance. -The site should be equipped with at least two fire extinguishers at the security gate and should be serviced accordingly. The personnel should be trained on how to use extinguishers (basic fire firefighting skills). -No open fires should be created onsite. -The contact details of fire services should be readily and visibly displayed at the entrance office/security control. -All personnel must be sensitised about responsible fire protection measures and good housekeeping such as the removal of flammable materials (e.g., rubbish, dry vegetation, and hydrocarbon-soaked soil) onsite. -The burning of waste onsite should be done between 8am and 15h00 to ensure that there is someone onsite to monitor the fire until it is completely put out before leaving the site, i.e., no open fire should be left onsite unattended.	-No open fires by site personnel or visitors -Fire extinguishers are readily available and up to date with service	-Proponent -SHE Officer -Site Operator
Site safety and security	Compromising site security and safety	-A high steel pole wall should be constructed around the site (as proposed under the site upgrading above). -A modern security gate and security control point should be installed at the site entrance.	-The site wall and security measures are in place	-Proponent -Site Upgrading Contractor

Aspect	Impact	Management and Mitigation Measure(s)	Key Performance Indicator (KPI)	Implementation Responsibility
		-The site should be equipped with 24-hour security surveillance in case of opportunistic activities such as theft and vandalism.		
Occupational and community health and safety	Project related injuries and other health and safety related issues on personnel and locals	-Project personnel should be inducted provided on the health & safety measures, including the risks of mishandling equipment, materials on site. -The contact details of ambulance and other extensive health care services should be readily and visibly displayed onsite for the site personnel. -A fully furnished first aid kit should always be onsite and ensure that 2 or 3 site personnel are trained on administering first aid. -Employees and visitors should be properly equipped with adequate personal protective equipment (PPE) such as coveralls, gloves, safety boots, earplugs, or safety glasses (depending on the job undertaken onsite or sites visited, etc.) -Heavy vehicle, equipment and machinery at or to site should be properly secured to prevent any harm or injury to the Proponent's personnel. -An emergency preparedness plan should be compiled, and all personnel appropriately trained. -Personnel should not be allowed to drink alcohol prior to and during working hours nor allowed on site when under the influence of alcohol (leading to health & safety risks). -The scavenging of waste by community members should be prohibited as certain waste items could pose health and safety risks such as stumbling on unnoticed broken	-Comprehensive health and safety plan for all project activities compiled. -Occupational Health and Safety Personnel -Health and Safety Trainings -Fully equipped first aid kit onsite -Trained workers to administer first aid	Proponent -SHE Officer -Site Upgrading Contractor

Aspect	Impact	Management and Mitigation Measure(s)	Key Performance Indicator (KPI)	Implementation Responsibility
		bottles, rotten food items, chemicals and other potential unhealthy items contained in waste. - Prohibit the entrance of children under the age of 18 into the dumpsite. The waste collection for re-use and recycling should be supervised and done through a designated site workers and following proper procedures.		
Water Resources Use	Over-utilization of water resources	-Project water storage tanks should be inspected daily to ensure that there is no leakage, resulting in wasted water. -Water conservation awareness and saving measures training should be provided to all the project workers so that they understand the importance of conserving water and become accountable.	-No water leakages from site water storage tanks -Water is recycled where possible	-SHE Officer -Site Upgrading Contractor
Soils and water resources	Soils and water resources pollution	-Particularly during site upgrading, spill control preventive measures should be in place on site to management soil pollution. -During site upgrade, for site areas that will be used for the storage of hazardous waste, consider using an HDPE liner or natural clay liner to eliminate the risk of possible leakage/leachate. -Sensitized personnel on the impacts of soil pollution. -Project machines and equipment should be equipped with drip trays to contain possible oil spills. -Polluted soil should be removed immediately and disposed of at an approved and appropriately classified hazardous waste treatment facility. -Refuelling of vehicles should be done offsite (at filling stations in Town).	-No complaints of pollutants on the soils due to project activities -No visible oil spills on the ground or pollution spots. -Sufficient waste containers provided onsite -Non-permeable material are used on areas where hydrocarbons and potential pollutants are utilized during upgrade works.	-SHE Officer

Aspect	Impact	Management and Mitigation Measure(s)	Key Performance Indicator (KPI)	Implementation Responsibility
		-Washing of equipment contaminated hydrocarbons, as well as the washing and servicing of vehicles should take place at a dedicated area offsite.		
Biodiversity	Loss Fauna and Flora	-Avoid the killing or hunting of animals (birds, reptiles, mammals (such as baboons)) encountered onsite. -Environmental awareness on importance of biodiversity preservation should be provided to personnel.	-No killing or disturbance of biodiversity	-SHE Officer -Site Operator -Site Upgrading Contractor
Road use and safety	Increase in vehicular traffic flow	-The transportation of materials to and from site should be limited to once a week only. -Ensure that the access roads are frequently maintained and have sufficient road signs. -Drivers should possess valid and appropriate driving licenses and adhere to road safety rules. -Drivers should drive 40km/hour and be on the lookout for people and local animals on the roadsides -Drivers should not be allowed to operate vehicles while under the influence of alcohol. -The deliveries of waste to the site should be done during weekdays between the hours of 8am and 5pm.	-No complaints from members of the public regarding vehicular traffic issues related to the project activities. -All vehicle drivers are appropriately licensed and possession of valid driving licenses.	-Proponent -SHE Officer -Site Upgrading Contractor -Site Operator
Archaeology and heritage	Accidental disturbance of archaeological or heritage objects	-During site upgrading, the contractor should be sensitized to exercise and recognize Heritage "Chance Finds Procedure (CFP)" – Appendix 2. -Adhere to the provisions of Section 55 of the National Heritage Act in event significant heritage and culture features are discovered while conducting site works.	-Preservation of all artefacts and objects that are discovered on and around the project site during earthworks	-Site Upgrading Contractor -Site Operator -SHE Officer

Aspect	Impact	Management and Mitigation Measure(s)	Key Performance Indicator (KPI)	Implementation Responsibility
		-When the removing topsoil and subsoil on the site for site upgrade works, the site should be monitored for subsurface archaeological materials.		
Littering and waste management (general waste and sanitation)	Environmental Pollution	-Personnel should be sensitized to dispose of waste in a responsible manner and not to litter. -Ensure that there are no wastes left or disposed of outside the site. -No waste may be buried on site. -Maintain separate areas for different wastes waste onsite. -Encourage the recycling of waste such as bottles, garden refuse and plastic by setting up a recycling centre at the dumping site. -Educate people on the importance of re-usable household waste and encourage recycling of waste.	-No visible litter within and around the site area owing to the Project -Provision of sufficient waste storage containers -Waste management awareness	-Site Upgrading Contractor -Site Operator -SHE Officer
	Wastewater (sewage)	-Ensure that there are sufficient toilets (septic tank system) for the construction phase and flushing toilets for the operational phase. -Sewage and wastewater generated onsite during construction should be properly contained for transportation to the Town's sewage treatment facility -Open defecation on /around the site is strictly prohibited.	-Adequate toilet and basic ablution facilities on site.	-Proponent
Air Quality	Dust generation, fumes (poor air quality)	-Vehicles should only be driven at the authorized site speed of 40km per hour to avoid dust generation.	-No complaints from the public about vehicle emissions and dust generation. -Visible efforts to curb dust	-Site Operator -SHE Officer -Site Upgrading Contractor

Aspect	Impact	Management and Mitigation Measure(s)	Key Performance Indicator (KPI)	Implementation Responsibility
		-The heavy vehicles and fumes generating equipment (during site upgrade and maintenance) should not be left idling when not in use. -Avoid heavy trenching during windy times of the day during site upgrading period.		
Noise	Nuisance	-Noise from operations' vehicles and equipment on the sites should be at acceptable levels. -The site upgrading activities should not be carried out during the night or before 08h00 in the morning and should be carried out during weekdays only. -Working hours for site upgrade works should be restricted to between 8am and 5pm to avoid noise. -Site workers and contractors should be equipped with PPE such as earplugs to reduce exposure to excessive noise during site upgrading.	-No complaints from local communities such as neighbours about excessive noise from site -Noise protective equipment for workers	-Site Upgrading Contractor -SHE Officer
Visual	Visual nuisance due to the waste heap built-up	-Consider compacting waste to prevent a built-up of a waste heap onsite. -All the available options to improve the aesthetic of the site should be considered to enhance for a better appeal.	Visual impact is addressed	-Proponent -Site Operator

7 ENVIRONMENTAL REHABILITATION AND CLOSURE

7.1 General Overview of Dumpsite Rehabilitation

Before rehabilitating an existing dumpsite, the following need to be taken into consideration and implemented. This will entail the:

- Backfilling of dumpsite depressions with suitable cover material compacted to minimize seepage,
- Landscaping and sloping to prevent water ponding over footprint of old dumpsite,
- Revegetation (this would also depend on the planned post-use of the closed dumpsite), and
- Construction of shallow cut of shallow cut off trench around perimeter of rehabilitated site to avoid ingress of runoff into contaminated area, and
- The removal of perimeter fences.

The improper management of waste at facilities such as open dumpsites have an environmental and health impact. According to Joseph and Visvanathan (2001)[1], there are several major risks and impacts of the dumpsites on the environment, and these include:

- The leachate generated because of decomposition of waste contaminates surface and groundwater sources which become unfit for human consumption.
- Air pollution from open burning, fire hazards and explosions cause public health risks as well as add to the emission of greenhouse gases (methane and carbon dioxide).
- Scattering of wastes by wind and scavenging by birds, animals and waste pickers creates aesthetic nuisance.
- Malodour emanating due to the degradation of the waste in the dumpsite restricts land use development as it decreases the economic and social values in surrounding areas. The absence of daily cover on the dumped waste attracts the animal and human scavengers alike.

[1] Joseph, K., and Visvanathan, C. 2011. https://www.nswai.org/docs/Dumpsite_Rehabilitation.pdf

The environmental and health impact of dumpsites can be reduced by dumpsite rehabilitation. Joseph and Visvanathan (2001) further indicated that this can be defined as a process by which disposed wastes in an existing dumpsite is excavated and either reused or disposed in an environmentally friendly manner. Excavated waste may require to be moved or relocated to higher portions of the site or placed in appropriate areas to enable an adequate gradient for the closed site. Dumpsite rehabilitation projects are initiated due to one of the following reasons:

- Presence of marketable material in the dumpsite that can be excavated for sale or use,
- Reduction in the closure and post operation monitoring costs of the site,
- Stipulated requirement by the owner/regulator of the landfill to close and rehabilitate the site, and
- Presence of toxic wastes within the dump site that poses public health risks.

The basic requirements for closing an open dumpsite include providing final soil cover, vegetation layer, drainage control system, leachate and gas management systems, monitoring systems and site security (aftercare programme). The closure of dumpsites typically requires re-gradation of site slopes, capping of landfill with impermeable cover, placement of leachate collection and treatment systems, installation of landfill gas collection and flaring system and aesthetic landscaping of the closed dumpsite. If landfill gas volumes are significant, then a landfill gas utilization project by way of power generation/direct supply to neighboring community for use as fuel may be installed. As appropriate, waste materials may be moved or relocated to higher portions of the site or placed in appropriate areas to help sloping of the closed site. It is important to promote surface water drainage from landfill areas to prevent it from infiltration and further percolation through the garbage and the soil underneath, thus creating ground and surface water degradation.

Rehabilitation actions will be aimed at both reduction and stabilisation of the risks associated with the accumulated waste, i.e. leachate control, landfill gas removal, and nuisance reduction (odour, wind scatter, birds, scavengers, pests, etc.). The general transition to dumpsite closure will include the following works: shaping the main capping, topsoil application, grass sowing (and possibly bush planting), gas collection and removal, and leachate management (Joseph et al (2005)[2],)

[2] Joseph, K., Esakku, S., Nagendran, R. and Visvanathan, C. 2005. A Decision-Making Tool for Dumpsite Rehabilitation in Developing Countries. https://www.academia.edu/75965746/Dumpsite_rehabilitation_Manual

The rehabilitation measures of the existing Town Council dumpsite are provided under the next subsection.

7.2 Scope of Planned activities: Safe Closure of the Existing Dumpsite

7.2.1 Environmental Rehabilitation Plan for the Existing Waste Dumpsite

The Town Council is planning to decommission the existing waste dumpsite in the Town. Therefore, to ensure that the site does not continue to be a nuisance to the environment, residents and even travellers of the Town, a rehabilitation Plan in a form of rehabilitation management measures has been developed. These are presented in Table 7-1. The proposed uses of the rehabilitated (post-closure) dumpsite are also provided in the same table. The implementation of the Rehabilitation Plan (measures) is entirely the responsibility of the Rehoboth Town Council.

According to Joseph et al (2005)[3], before the dumpsite stops receiving wastes, it is important that a final closure plan is prepared, approved, and available for implementation. The main components of the closure plan include, but are not limited, to the following:

- Stabilization, landscaping and sloping of landform slopes,
- Final cover,
- Drainage control systems,
- Fire control,
- Prevention of further illegal dumping,
- Resettlement action plan (if necessary)
- Security,
- Leachate and gas management systems (this could be expensive for RTC), and
- Feasibility studies for beneficial end use options

Given the above, it is therefore crucial for the Town Council to make provision for both financial and technical resources for site rehabilitation in the financial budget.

[3] Joseph, K., Esakku, S., Nagendran, R. and Visvanathan, C. 2005. A Decision-Making Tool for Dumpsite Rehabilitation in Developing Countries. https://www.academia.edu/75965746/Dumpsite_rehabilitation_Manual

Table 7-1: The Environmental Rehabilitation Measures and Post-Closure Uses of the Existing Waste Dumpsite

Aspect	Mitigation Measure(s)	Completion criteria
Contaminated soils	-A Soil Scientist should be appointed to undertake a full Soil Contamination Assessment (including sampling) to ascertain the extent of pollution onsite and thus, recommending site specific remediation measures. -A Geochemical Assessment and Waste Characterization should be done for the site. -Removal of visibly contaminated soils to depth of 1m for offsite cleaning and clean it up and retuned to where it was taken.	-Sign-off by a Soil Scientist upon completion of the rehabilitation/remediation of contaminated soils to ensure successful exercise and safety of site soils -The soil is cleaned and returned onsite, and the site can be safely utilized post-closure.
Stockpiled soils, disturbed areas and trench-looking like site depressions	-The stockpiled soils should be levelled into visible uneven site depressions and trenches. -Site trenches and pits / holes should be backfilled.	-The site soils are levelled, and depressions backfilled, and the site can be used for other uses.
Existing piles of wastes	-The waste should be sorted. What can be re-used and recycle should be handled as such. -Waste that cannot be re-used or recycled should be carefully handled and transported to the new waste dumpsite once it is constructed and ready for operations.	-The waste is handled and managed better by preparing for re-use, recycling and proper disposal at the future dumpsite. -The site is made safe for the next use.
Dumpsite slope edges and stability	-A Geotechnical Engineer (Engineering geologist) should be contracted to undertake a geotechnical assessment of the dumpsite and make the necessary, recommendations and action regarding ultimate landform slopes, type of cover material to be used and how those should be compacted to minimize runoff ingress. -A simple method for stabilization of the steep side slopes of the dumpsite is to reprofile and regrade them to gentle slope of 4 (horizontal): 1 (vertical).	-A geotechnical and construction materials investigation completed over the site as well as on existing nearby borrow sources by a qualified and experienced Engineering geologist. Such report shall contain recommendations of safe final slopes, type and sources for cover material, compaction requirements.

Aspect	Mitigation Measure(s)	Completion criteria
	-The slope of waste filled portions is a primary concern as adequate gradient is required to promote surface water runoff without ponding or waterlogging or erosion of the final cover. ***!!!!Closed dumpsites are not suitable for buildings or permanent structures without extensive site engineering or improvement.***	
Surface infrastructure and structures	**Service infrastructure to be removed** -All infrastructures and structures that will no longer be required for the post-closure should be dismantled and removed from site. These structures include fences and gates. -All access roads that may have been created for the site should be temporary close, pending post-closure use of the site.	-All other infrastructure decommissioned to ground level and removed from site
''When disposal operations have ceased and final cover or capping has been applied to the waste, the dumpsite is considered as "closed". It is important to ensure that illegal dumping does not continue at any closed dumpsite.''		
POSSIBLE POST-USES OF THE EXISTING WASTE DUMPSITE		
-The uses for a closed dumpsite after thorough rehabilitation and remediation are limited to: o **Recreational uses** such as golf courses, public parks, fields, and walking or biking trails for public use. These uses are relatively easy to construct and maintain because the waste decomposition does not adversely affect recreational facilities like they do with buildings. o **Structures:** construction of commercial or industrial buildings to repurpose the land for such uses, but any structure, including pavement, built atop a landfill has increased engineering problems associated with it, especially if the structure is large. Hence, this option is not deemed suitable. If structures are to be placed on this site proper ground improvement must be done prior, and foundation designs should be tailored accordingly. Only lightly loaded structures must be considered o **Renewable Energy source site**: The closed dumpsite can be converted into a solar plant park to produce solar energy that can supplement the town's energy demand, and **Agriculture:** for agricultural use due to the large open area on top of a dumpsite.		

8 Environmental Monitoring

To ensure that the implementation of recommended environmental management and mitigation measures is working and produces the desired results (to minimize and or eliminate adverse impacts), implementation of measures will need to be monitored and reported on. Monitoring is crucial as it helps with early identification of new adverse impacts that would arise during project operations/implementation and timely development of mitigation measures for implementation.

The Bi-annual environmental monitoring reports should be compiled by the Proponent's availed resources (Environmental Health or SHE Officer) and submitted to the DEAF for archiving on a bi-annual basis (every 6 months throughout the project) as required by the Environmental Commissioner on the conditions to be attached to the ECC. The reports should be audited annually by an Independent Environmental Consultant and prior to applying for an ECC renewal.

9 LIST OF REFERENCES

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APPENDIX 1: EXAMPLE OF THE RECOMMENDED DUMPING SITE WALL (AS SEEN WITH THE OSHAKATI TOWN COUNCIL)

Oshakati Town Council solid waste dumping site entrance

Oshakati Town Council solid waste dumping site entrance and eastern side wall

APPENDIX 2: CHANCE FINDS PROCEDURE (AFTER KINAHAN, 2020)

Areas of proposed project are subject to heritage survey and assessment at the planning stage. These surveys are based on surface indications alone, and it is therefore possible that sites or items of heritage significance will be found during development work. The procedure set out here covers the reporting and management of such finds.

Scope: The "*chance finds*" procedure covers the actions to be taken from the discovery of a heritage site or item to its investigation and assessment by a trained archaeologist or other appropriately qualified person.

Compliance: The "chance finds" procedure is intended to ensure compliance with relevant provisions of the National Heritage Act (27 of 2004), especially Section 55 (4): "*a person who discovers any archaeological …. object ……must as soon as practicable report the discovery to the Council*". The procedure of reporting set out below must be observed so that heritage remains reported to the NHC are correctly identified in the field.
Manager/Supervisor must report the finding to the following competent authorities:

- National Heritage Council of Namibia (Head Office: +264 61 244 375 / Technical Office +264 61 301 903)
- National Museum (+264 61 276 800),
- National Forensic Laboratory (+264 61 240 461).

Archaeological material must NOT be touched. Tempering with the materials is an offence under the heritage act and punishable upon conviction by the law.

Responsibility:

Operator:	To exercise due caution if archaeological remains are found
Foreman:	To secure site and advise management timeously
Superintendent:	To determine safe working boundary and request inspection
Archaeologist:	To inspect, identify, advise management, and recover remains

Procedure:

Action by person identifying archaeological or heritage material:

a) If operating machinery or equipment stop work

b) Identify the site with flag tape

c) Determine GPS position if possible

d) Report findings to foreman

Action by foreman

a) Report findings, site location and actions taken to superintendent

b) Cease any works in immediate vicinity

Action by superintendent

a) Visit site and determine whether work can proceed without damage to findings

b) Determine and mark exclusion boundary

c) Site location and details to be added to project GIS for field confirmation by archaeologist

Action by Archaeologist

a) Inspect site and confirm addition to project GIS

b) Advise NHC and request written permission to remove findings from work area

c) Recovery, packaging and labelling of findings for transfer to National Museum

In the event of discovering human remains

a) Actions as above

b) Field inspection by archaeologist to confirm that remains are human

c) Advise and liaise with NHC and Police

d) Recovery of remains and removal to National Museum or National Forensic Laboratory, as directed.