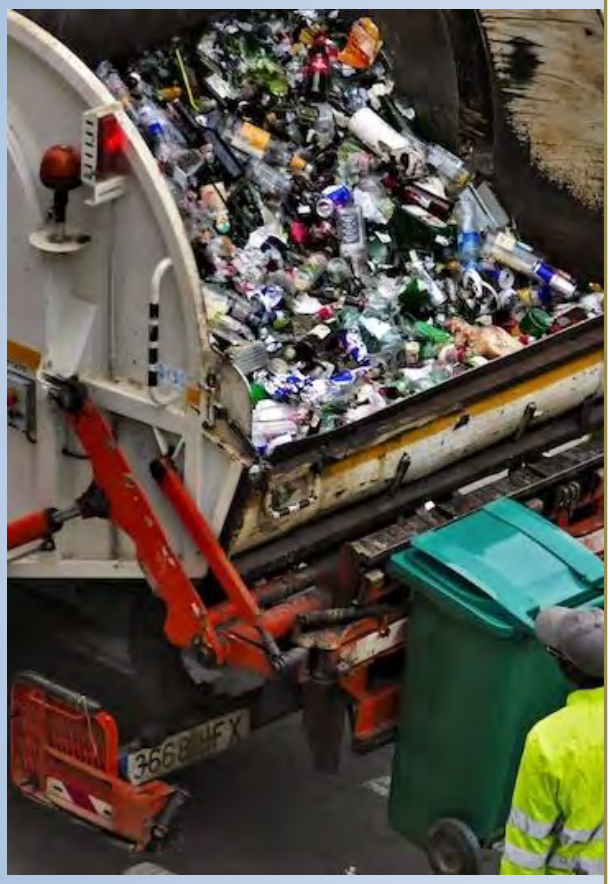
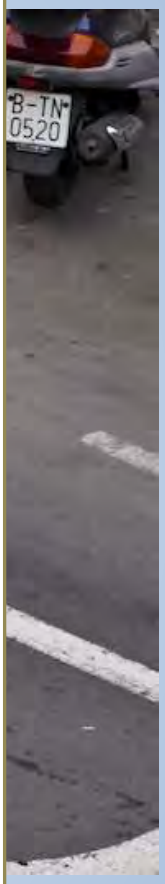
November 2022





ENVIRONMENTAL IMPACT ASSESSMENT

For The New Municipal Waste Disposal Site at Karibib, Erongo Region

ECT
ENVIRONAM CONSULTANTS TRADING

KARIBIB

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REPORT DATE:

03 November 2022

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Signature

EXECUTIVE SUMMARY

1. INTRODUCTION

Karibib is a town in the Erongo Region of western Namibia. It is situated, halfway between Windhoek and Swakopmund on the B2 Main Road. Karibib is the district capital of the Karibib Constituency, which includes the urban area of Usakos and surrounding private commercial farms. The town comprises of some 9,800 hectares of land and is governed by the Karibib Town Council while the surrounding rural areas (farm land) are governed by the Erongo Region Council.

The discovery of gold, marble and granite in the vicinity of Karibib has contributed positively to the local economic development of the town. The Navachab Gold Mine owned by QKR Namibia is located 10 km from Karibib and is the major employer in the town. Pressure on the town is caused by the increasing town population, the economic activities of the people and their social interactions. The town has a relatively small economic base which is very much reliant on the gold mine and the farming activities. There is hence a desperate need to diversify the economy of the town to attract investors and thus grow the town and the local economy.

The Karibib Town Council is in a fortunate position in that it has sufficient townlands available for future developments; accessibility and convenience to main centres and activities in Namibia. This accessibility combined with the availability of land makes the town a perfect destination for investment. The surrounding hinterland is also filled with tourism opportunities and natural attractions.

Urban and industrial developmental activities, however, disturb the natural ecosystem and have multiple direct and indirect environmental consequences. Waste management, being a prominent activity that accompanies any urban and industrial development, is a perpetual problem.

The Karibib Town Council (KTC) has resolved to initiate the process of identifying a new Municipal Waste Disposal Site, which will be formalised through an Environmental Impact Assessment and subsequent design and construction. The existing dumping site will then be closed. It is Council's intention to finalise the processes culminating into the new landfill site during the period of validity of the Environmental Clearance Certificate (ECC) for the existing dumping site. KTC has appointed Environam Consultants Trading (ECT) to carry out the assignment of conducting an Environmental Impact Assessment (EIA) for the selected site.

1.1 PROJECT LOCATION

This site is located on the southwestern quadrant of Karibib at coordinates lat: -21.994910°; lon: 15.831379° to the west of the C32 road (see Figure 1 below). The site is of a sufficient size of approximately 8 hectares with a potential for further expansion and justifies the expenditure

necessary to conduct further technical studies, develop, operate and maintain the site to the highest standards over an extended period.

Figure 1: Preferred Site D for New Waste Disposal Site

2. LEGISLATIVE FRAMEWORK

The principle environmental regulatory agency in Namibia is the Office of the Environmental Commissioner within the Directorate of Environmental Affairs of the Ministry of Environment, Forestry and Tourism. Most of the policies and legislative instruments have their basis in two clauses of the Namibian Constitution, i.e. Article 91 (c) and Article 95 (l); however, good environmental management finds recourse in multiple legal instruments. Table 2 provides a summary of the legal framework considered to be relevant to this development and the environmental assessment process.

3. ENGINEERING SERVICES

The infrastructure needs of the proposed project can be categorised into two broad classifications namely:

- Basic infrastructure that includes water supply, drainage, electricity, and roads.
- Environmental infrastructure that consists of solid waste management and landscaping.

Karibib town is supplied with electricity by ErongoRED from a 66kV overhead powerline, terminating at the Karibib 66/11kV, 2.5 MVA substation The current demand for Karibib

according to the bulk infrastructure masterplan is 1.65MVA, leaving the town with a reserve capacity of 0.85MVA (SPC, 2016).

The current sewage works are situated approximately 1.5km to the north of central town area on private land. The treatment works is in a fragile condition and the Council is busy investigating the possibility of (a) relocating the ponds and constructing a modern waste water treatment plant; or (b) upgrading the existing ponds to make provision for future demand (SPC, 2016).

Usab and most of the erven in Karibib Proper are connected to the sewage gravity flow system, with only a few erven that make use of septic tanks. The town has 1 existing pump station and it is recommended by consulting engineers that an additional 4 pump stations be installed for the future extensions planned (SPC, 2016).

Although a Namwater line and an ERONGORED power line can be found some distance to the north, the bulk service infrastructure as far as water, sewer, roads, electricity etc. will have to consider a decentralised approach due to the distance of the nearest bulk services, this will be designed by registered professional engineers to ensure quality and security of supply.

Access to the site is planned to be obtained from the C32 Road. According to the Roads Authority, access road onto the C32 should be applied for and build to the standards of the Roads Authority. The C32 is a building restriction road, therefore, the boundary of the landfill should not be closer than 100 m from the centre line of the road. Liaison in this regard should be done with the Roads Authority Usakos District Office.

4. PUBLIC PARTICIPATION PROCESS

In terms of Section 21 of the EIA Regulations a call for public consultation with all I&APs during the EIA process is required. This entails consultation with members of the public and providing them an opportunity to comment on the proposed project. The Public Consultation Process does not only incorporate the requirements of Namibia's legislation, but also takes account of national and international best practises. Please see Table 6 for the activities undertaken as part of the public participation process.

The comment period of the initial public participation process commenced on 12 August 2022 and ended on 30 August 2022. Minutes, comments and input received from various stakeholders are attached in Annexure D.

The second phase of the Public Consultation Process involved the lodging of the Draft Environmental Scoping Report (DESR) to all registered I&AP for comment. Registered and potential I&APs were informed of the availability of the DESR for public comment. An Executive Summary of the DESR was included in the communication that went out to the registered I&APs. I&APs were given time until 02 November 2022 to submit comments or raise any issues or concerns they may have with regard to the proposed project. No input or comments were received during this period.

5. POTENTIAL IMPACTS IDENTIFIED

The following impacts were identified:

- Public health and safety threats
- Air pollution
- Visual impacts
- Pollution of underground water resources
- Socio-economic impacts

6. CONCLUSION

The Karibib Town Council should take the overall responsibility to ensure that all recommended actions within the Draft EMP are properly implemented, monitored, evaluated, recorded and accordingly reported. All key role players such as the Council staff involved in the day-to-day operations of the waste disposal site; all waste contractors and service providers, and recyclers on site should be informed about the content of the Draft EMP and activities to be undertaken.

The Karibib Town Council should ensure compliance to Section 5 and Part VI of the EMA that deals with Waste and Environmental Plans respectively. Apart from legal compliance, adherence to the Draft EMP will result in a well-managed designated disposal site, which in turn will minimize operational costs and future potential negative impacts and threats to the environment and public.

It is important that continuous monitoring and evaluation takes place as required and that bi-annual reports are submitted to the Environmental Commissioner on a regular basis. Based on the assessment conducted and the accompanying EMP outlining the mitigation measures to be implemented it is our opinion that the Environmental Clearance Certificate for this activity be approved.

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1. INTRODUCTION

1.1. Background Information

Karibib is a town in the Erongo Region of western Namibia. It is situated, halfway between Windhoek and Swakopmund on the B2 Main Road. Karibib is the district capital of the Karibib Constituency, which includes the urban area of Usakos and surrounding private commercial farms. The town comprises of some 9,800 hectares of land and is governed by the Karibib Town Council while the surrounding rural areas (farm land) are governed by the Erongo Region Council.

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Urban and industrial developmental activities, however, disturb the natural ecosystem and have multiple direct and indirect environmental consequences. Waste management, being a prominent activity that accompanies any urban and industrial development, is a perpetual problem.

The storage, transportation, treatment and disposal of waste can be a very expensive exercise that requires a lot of input from all stakeholders. However, there is a call to reduce the costs associated with the management of waste. This can be done by implementing the Integrated Waste Management Hierarchy as shown in Figure 1-1 below, which encourages all stakeholders to at best avoid the production of waste; were the avoidance of waste is not possible, the amount of waste produced be minimized; then to reuse; and recycle waste before disposal or landfilling is contemplated.

The Karibib Town Council (KTC) has resolved to initiate the process of identifying a new Municipal Waste Disposal Site, which will be formalised through an Environmental Impact Assessment and subsequent design and construction. The existing dumping site will then be closed. It is Council's intention to finalise the processes culminating into the new landfill site during the period of validity of the Environmental Clearance Certificate (ECC) for the existing dumping site. KTC has appointed Environam Consultants Trading (ECT) to carry out the assignment of conducting an Environmental Impact Assessment (EIA) for the selected site.

Figure 1-1: Integrated Waste Management Hierarchy

1.2. Terms of Reference and Scope of Project

The scope of this project is limited to conducting an environmental impact assessment and applying for an Environmental Clearance Certificate for the New Municipal Waste Disposal Site at Karibib, Erongo Region and associated infrastructure. This includes consultations with client; site investigations and analysis; stakeholder consultations including a public meeting; impact analysis; mitigation formulation; scoping report writing; and draft Environmental Management Plan.

1.3. Assumptions and Limitations

In undertaking this investigation and compiling the Environmental Assessment, the following assumptions and limitations apply:

- Assumes the information provided by the proponent is accurate and discloses all information available.

- Various site alternatives were initially considered by the proponent, having taken due regard of the natural and environmental constraints, and the unique character and appeal of Karibib. The identified site presents the most feasible result.

1.4. The Practice of Landfilling

There are many potential environmental challenges associated with the land filling of waste. These problems are often long-term and include possible contamination of the groundwater and surface water regimes, the uncontrolled migration of landfill gas and the generation of odour, noise and visual nuisances. Generally, many of the problem associated with landfills occur as a result of poorly operated and managed facilities. Therefore, it is of immense importance to establish appropriate sites for waste disposal facilities such as landfills. To establish an appropriate landfill site with minimal environmental damage, an environmental impact assessment (EIA) is necessary as per section 5 of the Environmental Management Act 7 of 2007.

1.5. Current Landfilling

The present municipal dump site in Karibib, measuring around 8 hectares in size, is owned and operated by the Karibib Town Council for the past approximately 25 years. The site is located in the north-eastern part of Karibib about 2.5km east of the town's Central Business District (CBD) on the following coordinates Lat: -21.932858°; Long: 15.878400°. The site sits on what is planned as Usab Extension 3 (See Figure 1-2 below).

The municipal dumpsite, which accommodates all types of solid waste generated within the town of Karibib, was seemingly chosen on the basis of its then strategic distance from formal built-up residential areas and the CBD rather than on environmental, hydrological or related public health considerations as there is no background assessment information available on the establishment of the site. Illegal dumping is a challenge both in the residential areas as well as around the vicinity of the dumping site. Generally, residents start dumping along the path purposefully created to enter the dumping site. Children and adults engage in scavenging and collection of recyclables, which is sold to a private collector from Usakos area. However, there exist no official relationship between Council and recyclers.

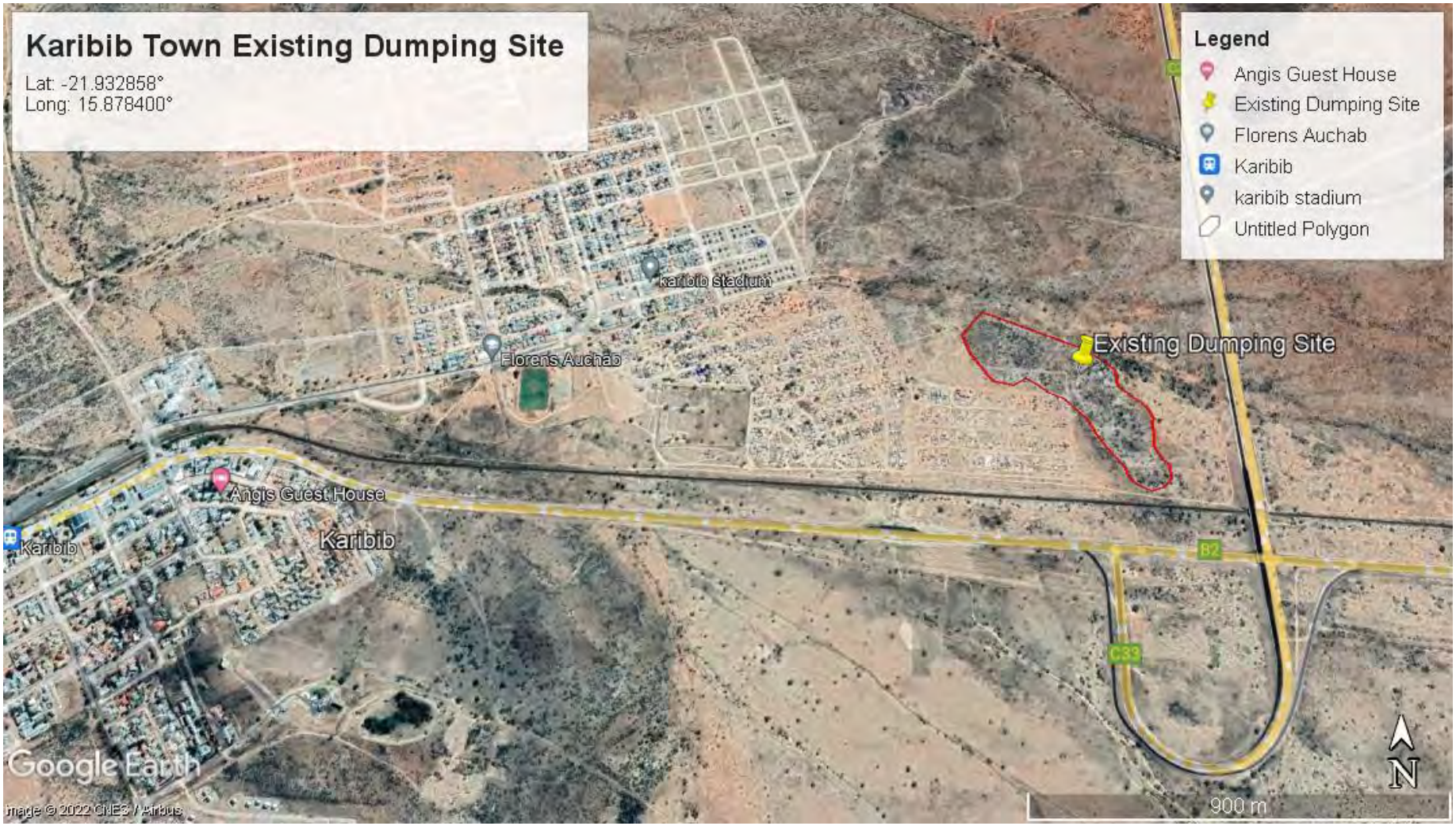

Figure 1-2: Location of the existing Karibib municipal dumpsite

1.6. Content of Environmental Scoping Report

In terms of Section 8 of the gazetted EIA Regulations a Scoping Report must contain specific content. Table 1 below delineate, for the purpose of ease reference, where this content is found in the Environmental Scoping Report (ESR).

Table 1: Contents of the Scoping / Environmental Assessment Report

Section	Description	Section of ESR/ Annexure
8 (a)	The curriculum vitae of the EAPs who prepared the report;	Refer to Annexure E
8 (b)	A description of the proposed activity;	Refer to Chapter 4
8 (c)	A description of the site on which the activity is to be undertaken and the location of the activity on the site;	Refer to Chapter 3
8 (d)	A description of the environment that may be affected by the proposed activity and the manner in which the geographical, physical, biological, social, economic and cultural aspects of the environment may be affected by the proposed listed activity;	Refer to Chapter 3
8 (e)	An identification of laws and guidelines that have been considered in the preparation of the scoping report;	Refer to Chapter 2
8 (f)	Details of the public consultation process conducted in terms of regulation 7(1) in connection with the application, including	Refer to Chapter 5
	(i) the steps that were taken to notify potentially interested and affected parties of the proposed application	Refer to Chapter 5

Section	Description	Section of ESR/ Annexure
	(ii) proof that notice boards, advertisements and notices notifying potentially interested and affected parties of the proposed application have been displayed, placed or given;	Refer to Annexures A and B for site notices and advertisements respectively.
	(iii) a list of all persons, organisations and organs of state that were registered in terms of regulation 22 as interested and affected parties in relation to the application;	Refer to Annexure D
	(iv) a summary of the issues raised by interested and affected parties, the date of receipt of and the response of the EAP to those issues;	Refer to Annexure D
8 (g)	A description of the need and desirability of the proposed listed activity and any identified alternatives to the proposed activity that are feasible and reasonable, including the advantages and disadvantages that the proposed activity or alternatives have on the environment and on the community that may be affected by the activity;	Refer to Chapter 4
8 (h)	A description and assessment of the significance of any significant effects, including cumulative effects, that may occur as a result of the undertaking of the activity or identified alternatives or as a result of any construction, erection or decommissioning	Refer to Chapter 7

Section	Description	Section of ESR/ Annexure
	associated with the undertaking of the proposed listed activity;	
8 (i)	terms of reference for the detailed assessment;	Refer to Chapter 1
8 (j)	An environmental management plan	Refer to Annexure F

2. LEGAL, POLICY AND INSTITUTIONAL FRAMEWORK

The principle environmental regulatory agency in Namibia is the Office of the Environmental Commissioner in the Directorate of Environmental Affairs of the Ministry of Environment, Forestry and Tourism (MEFT). Most of the policies and legislative instruments have their basis in two clauses of the Namibian Constitution, i.e., Article 91 (c) and Article 95 (l). However, good environmental management finds recourse in multiple legal instruments. Table 2 below provides a summary of the legal framework considered to be relevant to this development and the environmental assessment process.

Table 2: Legislation Applicable to the Proposed Development

LEGISLATION/POLICIES	RELEVANT PROVISIONS	RELEVANCE TO PROJECT
The Constitution of the Republic of Namibia as Amended	Article 91 (c) provides for duty to guard against "the degradation and destruction of ecosystems and failure to protect the beauty and character of Namibia." Article 95(l) deals with the "maintenance of ecosystems, essential ecological processes and biological diversity" and sustainable use of the country's natural resources.	Sustainable development should be at the forefront of this development.

LEGISLATION/POLICIES	RELEVANT PROVISIONS	RELEVANCE TO PROJECT
Environmental Management Act No. 7 of 2007 (EMA)	Section 2 outlines the objective of the Act and the means to achieve that. Section 3 details the principles of Environmental Management	The development should be informed by the EMA.
EIA Regulations GN 28, 29, and 30 of EMA (2012)	GN 29 Identifies and lists certain activities that cannot be undertaken without an environmental clearance certificate. GN 30 provides the regulations governing the environmental assessment (EA) process.	Activity 2.1 The construction of facilities for waste sites, treatment of waste and disposal of waste. Activity 2.3 The import, processing, use and recycling, temporary storage, transit or export of waste. Activity 9.2 Any process or activity which requires a permit, license or other form of authorisation, or the modification of or changes to existing facilities for any process or activity which requires an amendment of an existing permit, licence or authorisation or which requires a new permit, licence or authorisation in terms of a law governing the generation or release of emissions, pollution, effluent or waste.

LEGISLATION/POLICIES	RELEVANT PROVISIONS	RELEVANCE TO PROJECT
Convention on Biological Diversity (1992)	Article 1 lists the conservation of biological diversity amongst the objectives of the convention.	The project should consider the impact it will have on the biodiversity of the area.
Draft Procedures and Guidelines for conducting EIAs and compiling EMPs (2008)	Part 1, Stage 8 of the guidelines states that if a proposal is likely to affect people, certain guidelines should be considered by the proponent in the scoping process.	The EA process should incorporate the aspects outlined in the guidelines.
Namibia Vision 2030	Vision 2030 states that the solitude, silence and natural beauty that many areas in Namibia provide are becoming sought after commodities and must be regarded as valuable natural assets.	Care should be taken that the development does not lead to the degradation of the natural beauty of the area.
Water Act No. 54 of 1956	Section 23(1) deals with the prohibition of pollution of underground and surface water bodies.	The pollution of water resources should be avoided during construction and operation of the development.
The Ministry of Environment and Tourism (MET) Policy on HIV & AIDS	MET has recently developed a policy on HIV and AIDS. In *addition,* it has also initiated a programme aimed at mainstreaming HIV and gender issues into environmental impact assessments.	The proponent and its contractor have to adhere to the guidelines provided to manage the aspects of HIV/AIDS. Experience with construction projects has shown that a significant risk is created when construction workers interact with local communities.

LEGISLATION/POLICIES	RELEVANT PROVISIONS	RELEVANCE TO PROJECT
Township and Division of Land Ordinance 11 of 1963	The Townships and Division of Land Ordinance regulates subdivisions of portions of land falling within a proclaimed Local Authority area.	In terms of Section 19 such applications are to be submitted to the Townships Board
Local Authorities Act No. 23 of 1992	The Local Authorities Act prescribes the manner in which a town or municipality should be managed by the Town or Municipal Council.	The development has to comply with the provisions of the Local Authorities Act
Labour Act no 11 of 2007	Chapter 2 details the fundamental rights and protections. Chapter 3 deals with the basic conditions of employment.	Given the employment opportunities presented by the development, compliance with the labour law is essential.
Public Health Act no 36 of 1919	Section 119 prohibits persons from causing nuisance.	Contractors and Council are to comply with these legal requirements.
Nature Conservation Ordinance no 4 of 1975	Chapter 6 provides for legislation regarding the protection of indigenous plants	Indigenous and protected plants have to be managed within the legal confines.
Atmospheric Pollution Prevention Ordinance (No. 11 of 1976).	The Ordinance objective is to provide for the prevention of the pollution of the atmosphere, and for matters incidental thereto.	All activities on the site will have to take due consideration of the provisions of this legislation.

LEGISLATION/POLICIES	RELEVANT PROVISIONS	RELEVANCE TO PROJECT
Roads Ordinance 17 of 1972	This Ordinance consolidates the laws relating to roads.	The provisions of this legislation have to be taken into consideration in as far as access to the development site is concerned.
Roads Authority Act, 1999	Section 16(5) of this Act places a duty on the Roads Authority to ensure a safe road system.	Some functions of the Roads Ordinance 17 of 1972 have been assigned to the Roads Authority.
Pollution Control and Waste Management Bill	This bill aims to promote sustainable development and to prevent and regulate the discharge of pollutants into the environment.	Once this bill is enacted it will make provision for the establishment of an appropriate framework for integrated pollution prevention and control.
National Solid Waste Management Strategy	Objective 4 of Phase 2 requires the proper management of municipal waste disposal.	Task 2.4.1 specifically addresses the implementation of waste disposal standards at local authorities.

In addition to national policies and legislation, Namibia has signed many inter-national treaties and conventions aimed at protecting the global environment and managing waste. The following are particularly important for environmental and waste management in Karibib:

- The Stockholm Declaration on the Human Environment;
- The Convention on Biological Diversity;
- The United Nations Convention to Combat Desertification;
- The United Nations Framework Convention on Climate Change, and
- The United Nations Millennium Development Goals (MDGs).

This waste management project is both premised on and follows national policies, legislation and multilateral agreements with particular emphasis on the Environmental Management Act, 2007 (Act No. 7 of 2007), which states that " … *a person may not discard or cause to be discarded waste or dispose of it in any other manner, except at a disposal site declared or approved by the Minister in terms of this section; or in a manner or by means of a facility or method and subject to such conditions as the Minister may prescribe*."

This EA process will be undertaken in accordance with the EIA Regulations. A Flow Diagram (refer to Figure 2-1 below) provides an outline of the EIA process to be followed.

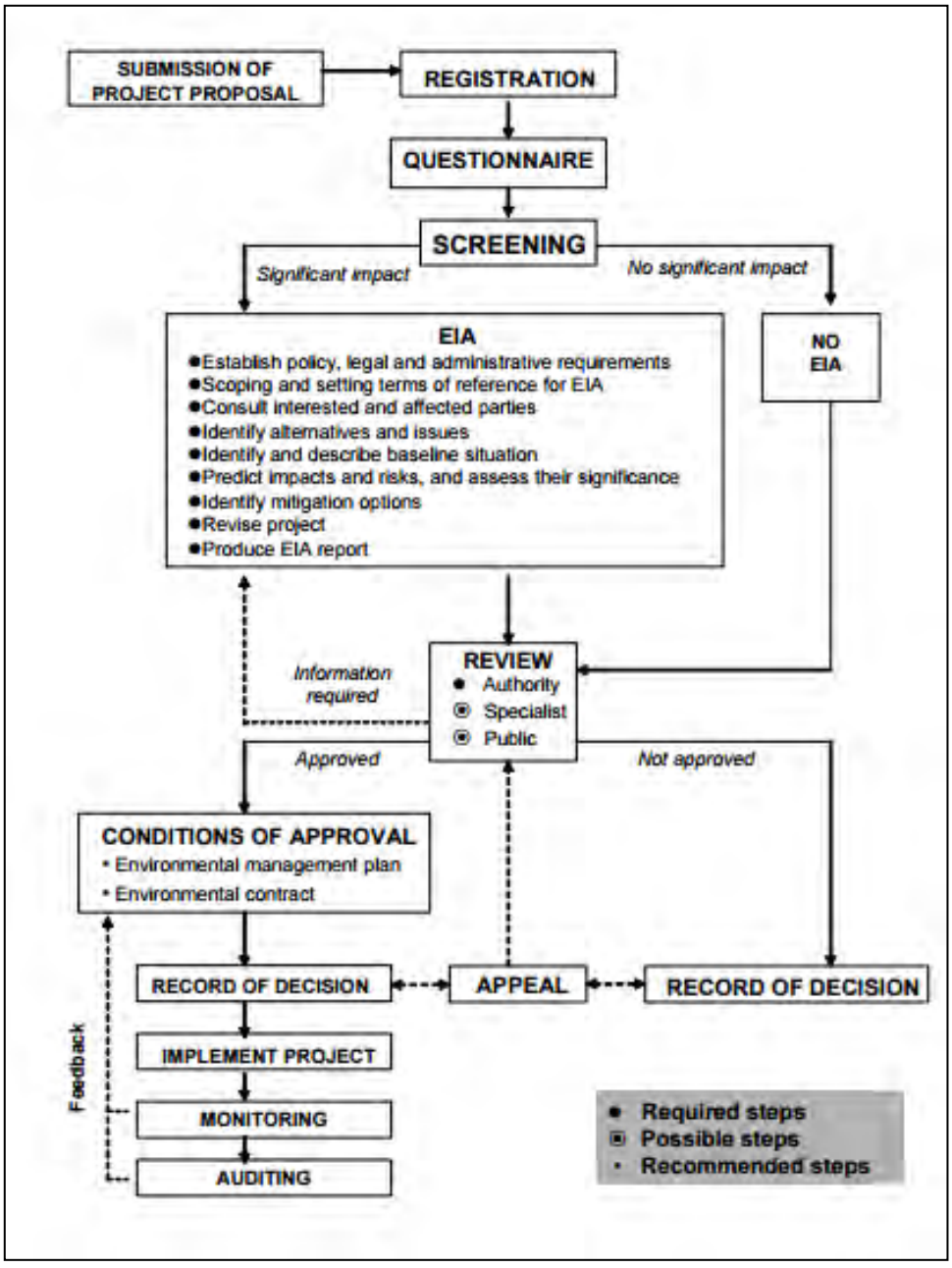

Figure 2-1: EIA Flowchart for Namibia (SELH, 2012)

3. ENVIRONMENTAL BASELINE DESCRIPTION

3.1. Social Environment

3.1.1. Socio-Economic Context

The statistics shown in Table 3 below are derived from the 2011 Namibia Population and Housing Census (NSA, 2011) and is presented from a constituency perspective:

Table 3: Statistics of Karibib Constituency

KARIBIB CONSTITUENCY	
Population	13,320
Females	6,412
Males	6,908
Private Households	3,471
Population under 5 years	13%
Population aged 5 to 14 years	20%
Population aged 15 to 59 years	60%
Population aged 60 years and above	7%
Female: male ratio	100:108
Literacy rate of 15 years old and above	92%
Head of household - Females	42%
Head of household - Males	58%
People above 15 years who have never attended school	12%
People above 15 years who are currently attending school	10%
People above 15 years who have left school	76%
People with disability	4%
People aged 15 years and up who belong to the labour force	76%
Population employed	59%

KARIBIB CONSTITUENCY	
Homemakers	8%
Students	43%
Retired, too old etc.	49%
Income from pension	13%
Income from business and non-farming activities	9%
Income from farming	6%
Income from cash remittance	7%
Wages and salaries	58%

3.1.2. Archaeological and Heritage Context

There are a few sites of heritage and archaeological importance within the Karibib area which are declared as national monuments. They are listed in Table 4 below:

Table 4: Declared Heritage Sites (NHCN, 2016; Namibian.org, 2016)

Site Name	Site Type	General Information
Proviantamt	Building	• Located on western border of Karibib. • Arched wooden windows, face-brick work, corrugated iron roof. • Erected in 1911 as quartermaster's stores by "Schutstruppe". • Office and additional rooms erected in 1907. • Mamormerke uses it as offices • Gazetted on 15/05/1986.

Site Name	Site Type	General Information
Hälbich Buildings	Building	• 4 buildings shop (built in 1899), residence combined commercial section and living quarter, storehouse (1900-1907). • Large semi-detached, cast-iron lattice-work structure serving as fence on the corner of Main and Third Streets. • Hälbich and Co oldest trading company in Namibia. • Gazetted on 01/04/1986
Kubas Station Building	Building	• One of 24 stops built along the route of the first narrow-gauge railway between Swakopmund and Windhoek. • Built in 1900 • The outer walls were made of broken marble mined near the station. • The inner walls were cement bricks and the floor was part wood, part cement. • The ceiling was made from wooden planks and the verandah was made from wood and zinc. • Proclaimed on 15 June 1983.

Site Name	Site Type	General Information
Hotel Zum Grünen Kranz	Building	• One of six hotels built in the German colonial period in Karibib. • The front of the building is adorned with a set of unusual pillars with connecting arches that meet a low stoep wall. • Some of the original interior furnishings were imported from as far away as Canada. • Proclaimed a national monument on 15th May 1986.
Haus Woll	Building	• Alongside Karibib's main road. • Constructed from granite stone and marble. • Proclaimed on 15 May 1986.

3.2. Bio-Physical Environment

3.2.1. Climate

The town of Karibib is situated in a semi-desert climate, with low rainfall, high evaporation and high day time temperatures. Evaporation rates are between 2,330 and 2,440mm per year, with frost being extremely rare in this area. Karibib has very hot summers and milder winters. The average annual temperature for Karibib is more than 22.3 ºC, with an average maximum temperature of between 34 and 36 ºC, and an average winter month minimum of between 25ºC and 28ºC (SPC, 2016). See the climate graph in Figure 3-1 and the temperature graph in Figure 3-2 below.

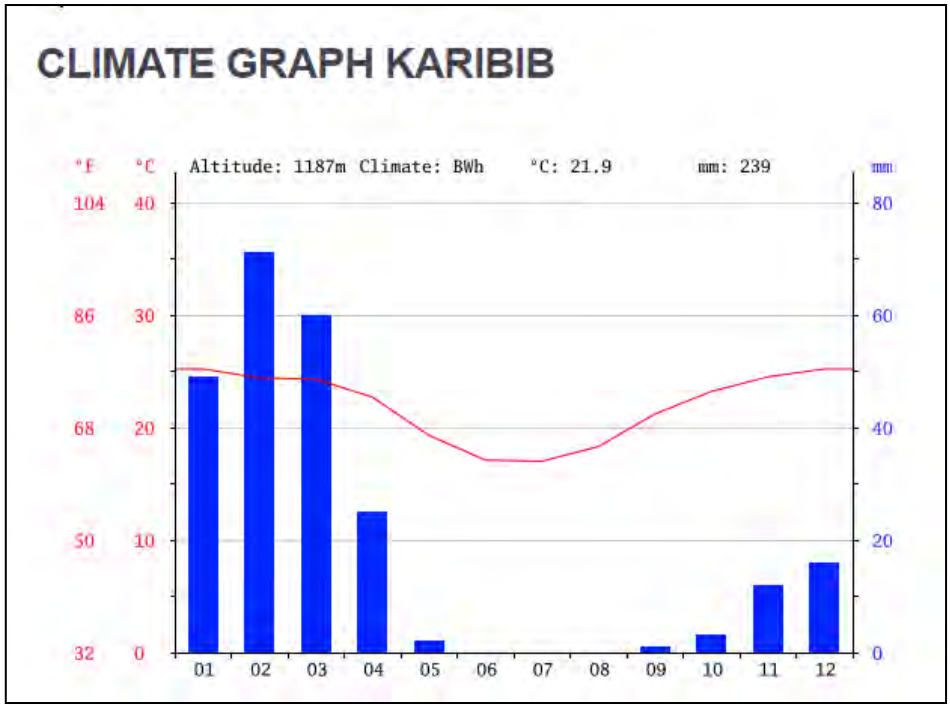

Figure 3-1: Average monthly temperature and rainfall for Karibib (Climate-data, 2022)

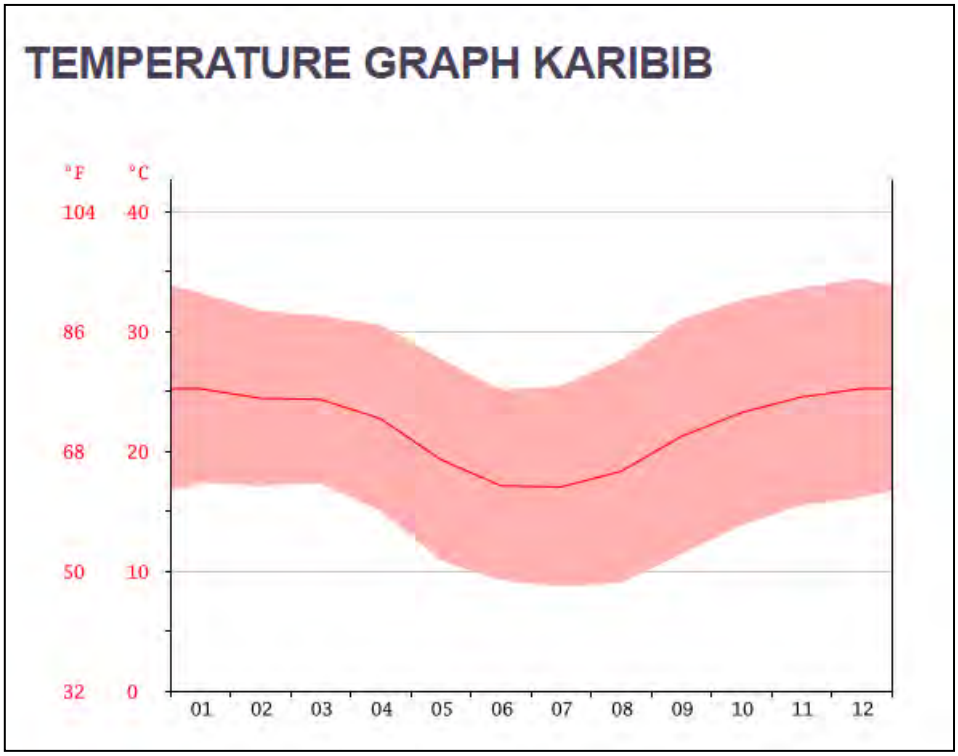

Figure 3-2: Temperature graph for Karibib (Climate-data, 2022)

3.2.2. Topography, Geology and Hydrogeology

Like most part of the country, Karibib and the Erongo Region area have no surface water and rely on underground water. The town of Karibib, and a large part of the Erongo Region,

falls within the Erongo water basin. The Erongo basin has two important water catchment areas, that is the Omaruru catchment and the Swakop catchment area into which the three major rivers of the Omaruru, the Khan and the Swakop Rivers are major ephemeral rivers that only flow in high rainy seasons for a short duration. Karibib town falls within the Swakop catchment area (SPC, 2016).

The town of Karibib is located in an area which has a moderate productive aquifer. Water is supplied to Karibib by NamWater. Water is sourced from the Swakoppoort Dam and channelled with a pipeline to the water treatment plant at Karibib. The Swakoppoort Dam, situated approximately 50 km west of Okahandja, has a capacity of 63.489 Mm^3 and has a surface area of 7.80km^2 when it is full. The Karibib water treatment plant has a capacity of 216m^3/ h and was constructed in 1989. Accessibility to water for households for cooking and drinking in the Karibib Constituency is lower than the regional average, with 89% of the households having access to safe water compared to the 96.3% of regional households (SPC, 2016).

The Council is also addressing the future supply of water within the town by considering the upgrade of dormant boreholes within the townlands of Karibib. These boreholes can then be utilised by the town in future to augment the water supply (SPC, 2016).

3.2.3. Terrestrial Ecology

Karibib lies within the Tree-and-shrub Savanna Biome, the largest biome in Namibia characterised by large, open expanses of grasslands dotted with Acacia trees. It is specifically located in the Acacia Tree-and-shrub Savanna sub-biome. The vegetation structure in the sub-biome consists of 'large, open expanses of grasslands dotted with Acacia trees. The trees are tallest in areas of deeper sands in the east, with plant growth becoming progressively shrubby further west where the soils are shallower and the landscape is more "hilly and rocky". The vegetation structure of the area is sparse shrubland that stretches from the south-east to the north-west of Namibia (Mendelsohn, et al, 2002). The vegetation in the proposed development area consists mainly of Acacia species and grasslands. Figure 3-3 below provides a view of the general area and surrounds of the proposed development site. Table 5 below delineate the animal species diversity of the Karibib area:

Table 5: Species diversity (Mendelsohn et al., 2003)

Fauna	No. of Species (Country Total)	No. of Species (Karibib Area)	Remarks
Bird	658	171-200	The diversity of habitats is important to bird diversity.
Frog	50	8-11	The diversity of frogs follows patterns of rainfall.
Mammal	217	61-75	
Reptile	258	71-80	Namibia has one of the richest lizard faunas in Africa
Scorpion	56	18-21	

3.3. Surrounding Land Use

The surrounding land use of the proposed site consists mainly of undeveloped land in all directions. To the north-east the C32 road can be found.

Figure 3-3: General area of the EIA site

3.4. Physical Environment

The infrastructure needs of the proposed project can be categorised into two broad classifications namely:

- Basic infrastructure that includes water supply, drainage, electricity, and roads.

- Environmental infrastructure that consists of solid waste management and landscaping.

Karibib town is supplied with electricity by ErongoRED from a 66kV overhead powerline, terminating at the Karibib 66/11kV, 2.5 MVA substation The current demand for Karibib according to the bulk infrastructure masterplan is 1.65MVA, leaving the town with a reserve capacity of 0.85MVA (SPC, 2016).

The current sewage works are situated approximately 1.5km to the north of central town area on private land. The treatment works is in a fragile condition and the Council is busy investigating the possibility of (a) relocating the ponds and constructing a modern waste water treatment plant; or (b) upgrading the existing ponds to make provision for future demand (SPC, 2016).

Usab and most of the erven in Karibib Proper are connected to the sewage gravity flow system, with only a few erven that make use of septic tanks. The town has 1 existing pump station and it is recommended by consulting engineers that an additional 4 pump stations be installed for the future extensions planned (SPC, 2016).

Although a Namwater line and an ERONGORED power line can be found some distance to the north, the bulk service infrastructure as far as water, sewer, roads, electricity etc. will have to consider a decentralised approach due to the distance of the nearest bulk services, this will be designed by registered professional engineers to ensure quality and security of supply.

Access to the site is planned to be obtained from the C32 Road. According to the Roads Authority, access road onto the C32 should be applied for and build to the standards of the Roads Authority. The C32 is a building restriction road, therefore, the boundary of the landfill should not be closer than 100 m from the centre line of the road. Liaison in this regard should be done with the Roads Authority Usakos District Office.

4. PUBLIC PARTICIPATION PROCESS

4.1. Public Participation Phase 1

In terms of Section 21 of the EIA Regulations a call for public consultation with all I&APs during the EIA process is required. This entails consultation with members of the public and providing them an opportunity to comment on the proposed project. The Public Consultation Process does not only incorporate the requirements of Namibia's legislation, but also takes

account of national and international best practises. Please see Table 6 below for the activities undertaken as part of the public participation process.

Table 6: Table of Public Consultation Activities

ACTIVITY	REMARKS
Placement of site notices/posters in Karibib	See Annexure A
Placing advertisements in two newspapers for two consecutive weeks, namely Windhoek Observer and Confidente	See Annexure B
Written notice to Interested and Affected Parties via Email	See Annexure D
Public meeting in Karibib, Usab Community Hall	23/08/2022

The comment period of the initial public participation process commenced on 12 August 2022 and ended on 30 August 2022. Minutes, comments and input received from various stakeholders are attached in Annexure D.

4.2. Public Consultation Process Phase 2

The second phase of the Public Consultation Process involved the lodging of the Draft Environmental Scoping Report (DESR) to all registered I&AP for comment. Registered and potential I&APs were informed of the availability of the DESR for public comment. An Executive Summary of the DESR was included in the communication that went out to the registered I&APs. I&APs were given time until 02 November 2022 to submit comments or raise any issues or concerns they may have with regard to the proposed project. No input or comments were received during this period.

5. COMPARATIVE ASSESSMENT OF DISPOSAL SITES

5.1. Identifying the site

An exercise was undertaken to assist and advise the Karibib Town Council In identifying a suitable location for the disposal site. This chapter provides an overview of the methodology applied to determine the best site. This methodology presents a tool for evaluation and ranking of alternative waste disposal facilities against a range of criteria reflecting specific local considerations in determining the optimum location for a municipal landfill site. The

methodology has been adapted to suit local conditions, environmental constraints and priorities.

The Karibib Town Council initially proposed two (2) potential sites for consideration by the Consultant. However, an additional two (2) potential sites were identified during the "Inception Phase", one of the 2 being the existing dumpsite in Karibib (see Figure 5-1). Each site was physically visited and roughly mapped to illustrate its location and geographical context as below.

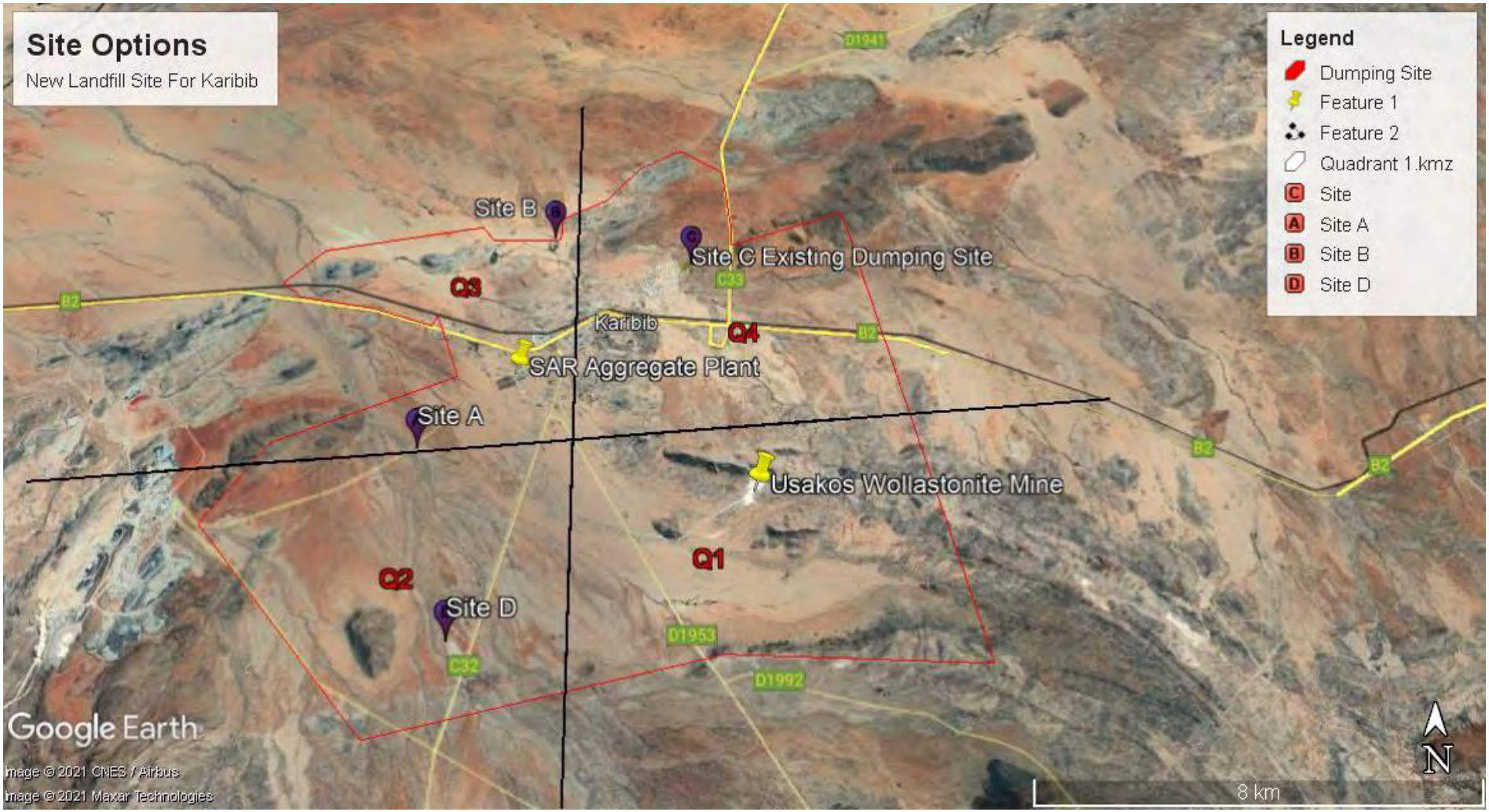

Figure 5-1: Four potential sites for consideration

All these 4 sites were then subjected to a screening, evaluation and ranking exercise taking into account a range of technical, cost and environmental criteria as well as giving due weight to accessibility to all stakeholders; suitability to the current prevailing circumstances; council and community feasibility, and public acceptability.

5.2. Criteria for Site Selection

The consulting team identified 15 criteria and allocated a relative weight to each criterion. A relative weight for each criterion was established, considering the importance and relevance to the specific local conditions. Criteria were assigned a weighting factor of 1.0 (for lower level of importance/significance), 1.5 (for medium level) and 2.0 (for high level) as per Table 7 below.

Table 7: Site Selection Criteria (criteria and relative weights as adjusted to the local Karibib conditions)

List of Criteria	Relative
1. LAND AVAILABILITY & OWNERSHIP	2.0
2. VICINITY OF SETTLEMENT AREA	2.0
3. CURRENT LAND USE & ZONING	2.0
4. AVAILABILITY OF INFRASTRUCTURE & SERVICES	2.0
5. FLOODING OCCURRENCE	2.0
6. HAUL DISTANCE	1.5
7. UNIQUE NATURAL AND CULTURAL TREASURES	1.5
8. PROXIMITY TO SENSITIVE WATER RESOURCES	1.5
9. COVER MATERIAL AVAILABILITY	1.5
10. TRANSPORTATION AND ACCESS LINKS	1.5
11. METEOROLOGY (WIND CONDITIONS)	1.0
12. HYDROLOGY AND HYDROGEOLOGY	1.0
13. LOCAL ECOLOGICAL CONDITION	1.0
14. TOPOGRAPHY	1.0
15. SOIL AND LAND STABILITY CONDITIONS	1.0

The criteria considered in the site assessment and site selection are outlined below. These criteria were generally the basis for overall comparison of sites and for selection of the preferred site, subject to statutory procedures. Justification of criteria adopted were as follows:

5.2.1. Land Availability & Ownership (Relative Weight Factor 2.0)

One of the most critical factors determining the feasibility of a landfill is the extent of ownership and available land area. In order to gain full benefit in economies of scale, and justify capital investment in waste collection and treatment systems, larger sites are preferable to smaller ones.

5.2.2. Vicinity of Settlement Area (Relative Weight Factor 2.0)

Landfill sites are often very unpopular with residents, this is because they impact the natural landscape: they smell, they are visually intrusive and become a bacteria breeding ground. The smell and vermin that accompany landfills can also lower property prices. In addition, due to the increase in vermin, flies, dust, smoke, traffic, noise, and pollution surrounding landfills, the health and well-being of communities becomes a concern. Waste and particularly the waste disposal site, in any sense, is seen as socially unacceptable in particular because of previous waste dumping experiences. The "not in my backyard (NIMBY)" attitude is prevalent in society among all social classes in every town. Based on such public perception, treatment and disposal of waste should be carried out in sparsely populated areas. Due to increasing population density, high demand for habitable land and spreading human settlements, availability of land area completely devoid of human settlement is becoming very limited. Taking such constraints into consideration, the project team agreed that the distance of the potential site from the nearest major settlement should preferably be at least 500 meters, ranking the sites which are a greater distance as more appropriate.

5.2.3. Current Land Use (Relative Weight Factor 1.5)

Ideally, a waste disposal facility should be on non-productive land devoid of economic value. It would be economically detrimental to select land with a high potential for economic development. However, circumstances may compel the selection of land with potential for future development. Abandoned quarries and /or scrubland are more suitable than productive agricultural land for development as landfill sites. Karibib's land use is mainly urban and the surrounding areas predominantly agricultural and mining.

5.2.4. Availability of Infrastructure (Relative Weight Factor 1.0)

The site selection process took account of the services that would be necessary to develop and operate a landfill to the required standards. For example, water supply (including on-site storage), proximity to sewerage system and suitable wastewater treatment, power supply and telephone connections were considered as this would be advantageous in reducing the capital costs. Although important, the team has considered this criterion and assigned a less relative weight to it considering the economic situation of Council.

5.2.5. Flooding Occurrence (Relative Weight Factor 1.0)

Inundation and flooding due to continued rainy spells occur at nearly all sites at varying frequencies, depending on the rainfall intensity, duration of rainfall, the topography and the porosity of underlying strata. Although topographically acceptable sites with impermeable strata are desirable (protection of groundwater and/or soil/land), formation of rain water ponds during heavy rains in some climates would not be possible to avoid. These factors will affect the capital cost of the proposed disposal site, as well as the operations and management of the site after construction.

5.2.6. Haul Distance (Relative Weight Factor 1.5)

The greater the haul distance from the centre of waste source, the greater the cost per unit amount to the waste generator (or their municipality) who will be using the services of the facility. Transfer stations can, however, often be used to cost-effectively haul waste over greater distances. As cost and affordability are critical issues taking into consideration the economic base of the Karibib community, haul distance was initially assigned a weight of 2.0 but revised to 1.5 in favour of ecological considerations.

5.2.7. Unique Natural and Cultural Treasures (Relative Weight Factor 2.0)

Unique natural habitats and cultural/historical/religious monuments are considered integral units of any civilization/society. The society's identity is partly dependent upon these features. Therefore, it is essential that a high degree of social sensitiveness is allocated to such features. The team was very aware of this fact and the relative weight assigned to this criterion was 2.0. taking into consideration the rich historical background of Karibib such as the Declared Heritage Sites namely: Proviantamt, Hälbich Buildings, Kubas Station Building, Hotel Zum Grünen Kranz, and Haus Woll. When selecting a site for treatment and disposal facility, the proximity/presence of such features was considered accordingly. Potential landfill sites should further be assessed in relation to potential impacts on archaeological heritage sites and monuments in the area should be recognized. In addition

to recorded sites and monuments, there is the potential for previously unknown features or monuments hidden beneath the soil surface.

5.2.8. Proximity to Sensitive Water Resources (Relative Weight Factor 2.0)

Regardless of the level of containment technology applied to a landfill site, there is always some risk of water resources contamination from the release of leachate. As such, it is desirable to locate a landfill as far away from sensitive ground and surface water resources as possible. Karibib area has no surface water and rely on underground water. The town of Karibib, and a large part of the Erongo Region, falls within the Erongo water basin. The Erongo basin has two important water catchment areas, that is the Karibib catchment and the Swakop catchment area into which the three major rivers drain. These are the Karibib, the Khan and the Swakop Rivers, they are major ephemeral rivers that only flow in high rainy seasons for a short duration. Karibib town falls within the Swakop catchment area (KUSP, 2016). Potential effects due to landfill siting can thus effects water quality, quantity and aquatic ecology (habitat loss, disturbance or alteration).

5.2.9. Cover Material Availability (Relative Weight Factor 1.0)

The use of fill material to cover emplaced waste is a fundamental aspect of landfilling. The availability of suitable cover for the duration of the landfilling operation is essential. This includes daily cover material and cover for final restoration. Cover material is, however, more cost-effectively applied at a site where there is a ready supply of local materials. Although to some extent construction and demolition waste and/ or composted organic waste can be used as cover material, there is often a requirement for imported materials. A local readily available supply of cover material is therefore extremely beneficial to cost-effective landfilling.

5.2.10. Transportation and Access Links (Relative Weight Factor 1.0)

Haulage routes need to be able to accommodate additional vehicle movements without increasing traffic congestion. In addition, transporting waste along heavily congested roads can significantly affect the economics of waste disposal. Roads need to be of sufficient standard to cater for two-way heavy goods vehicle flows. Although most roads can cater for waste collection vehicles, wider roads with better standards of surfacing are often required for the larger haulage vehicles. Good transportation links to a landfill site are advantageous in cost and environmental terms. Waste disposal sites are seldom located along high ways or main roads. The greater the requirement for construction of access roads, the higher the development cost of a landfill. Also, the greater would be the capital cost, operations and management of such a facility. An access road less than 500 metres

may be considered economical while access roads longer than 2.5km would involve much higher costs, and may be prohibitive.

Aesthetic concerns would be advisable for good planning, and landfill sites should be accessible under any conditions. Access to the site should be as direct as possible to ensure that people are not tempted to dump their rubbish before getting to the landfill, and to minimize waste spillage from vehicles. A minimum buffer distance of 100 meters from the centre line should be maintained to ensure that landfill operations are adequately screened from the nearest main road.

5.2.11. Meteorology (Relative Weight Factor 1.5)

At site selection stage, consideration should be given to meteorological factors and information should be obtained from relevant sources on aspects of precipitation and evapotranspiration for the areas in question. The annual rainfall is an important factor as all new sites must collect and contain any leachate generated. Wind strength and wind patterns must also be examined and windbreaks considered to avoid blowing or flying debris/litter.

5.2.12. Hydrology and Hydrogeology (Relative Weight Factor 1.5)

Amongst the most significant considerations in landfill site selection is the possibility of surface and ground water pollution. It is also undesirable to allow surface and ground waters to enter a landfill site, as allowing this will lead to generation of greater quantities of leachate. External water flows, therefore need to be managed. Hence, the greater the need for management the higher the engineering costs associated with the landfill. For these reasons it is more appropriate to locate a landfill in an area with lower rainfall, and surface/groundwater flows.

5.2.13. Local Ecological Conditions (Relative Weight Factor 2.0)

This criterion examines the state of the environment of each site. The team ranked possibility of reclamation; the level of degradation; previous usage; unique examples of flora and fauna; and the presence of wildlife habitat. The higher the level of existing degradation of the local environment, the higher the level of acceptability of the site for the location of a landfill.

This criterion was initially assigned a weight of 1.5 but increased to 2.0 because of our constitutional obligation to: "*maintenance of ecosystems, essential ecological processes and biological diversity of Namibia and utilization of natural resources on a sustainable basis for the benefit of all Namibians both present and future.*" A study of the ecology of

potential sites thus considered if there were any relevant designations (e.g. Special Areas of Conservation, Special Protection Areas, Natural Heritage Area, or area of special interest); any rare species of plants and /or animals occurring; any particular features of habitats (terrestrial and aquatic) which should be protected, and any records of protected plants at the sites. Development of landfill sites means the loss of approximately 30 - 300 species per hectare. Changes also occur in local/indigenous species with some mammals and birds being replaced by species that feed on refuse such as rats and crows. Vegetation changes also occur regardless of the duration of landfill site as some plant species are replaced by others.

5.2.14. Topography (Relative Weight Factor 1.0)

Topography refers to the physical features of the land surface, or the terrain. The topography of the site area is an important factor to indicate potential cost in the development of the area. 'Land-fill' projects (such as quarries of valleys) tend to be cheaper than 'land-raise' projects (filling waste on flat land). This is due to the fact that proportionally a greater depth of waste can be accommodated at a land-fill project for a given unit site area. Site preparation and lining costs therefore tend to be lower for land-fills that for land-raises. All these features such as steep slopes, watershed and depressions are represented on maps by means of contour lines which offer an advantage for landfill development with respect to visual screening and noise attenuation.

5.2.15. Soil and Land Stability Conditions (Relative Weight Factor 1.5)

The aim of this criterion is to examine the structure of the top medium through which underlying strata could be polluted. For example, hard rock with a network of fractures in a quarry disposal site may cause pollution of underlying strata unless adequately protected. On the other hand, a clay lined surface or a clay pit would significantly mitigate pollution due to its very low permeability. Media like laterite, sandy/gravel and sandy clay have permeability of varying magnitudes which lie between those of clay and fissured rock. Equally, the stability of some slopes may cause much concern if no attempt has been made to conserve the land by adopting good land conservation measures. During rainy seasons, erosion could be a significant factor. All such suspect areas need to be identified and carefully categorized. This criterion was considered important, and thus given a relatively medium weight.

5.3. The Site Assessment and Scoring Process

Investigation or assessment of potential landfill sites is an essential part of the overall site selection process with the purpose of determining the most suitable site or sites for landfill development. All the 4 sites were simultaneously subjected to both the assessment and site scoring phases in parallel and overlapping. The project team also decided not to reject any site too early even if it does seem to be located in exclusionary areas or not appearing to fully meet all criteria at face value. This involved desk studies; walk-over surveys using a checklist; site investigations through physical visits, and constraint mapping using selection and scoring criteria.

Using information from the above mentioned, the detailed comparative assessment investigations and the siting criteria scoring allowed decision making in technical, environmental and financial terms based on:

- The likely degree of impact to each site;
- The site suitability in terms of technical and environmental factors; and
- The conceptual design, estimated cost of the landfill development, and operational techniques that could overcome initial reservation for each site.

Each site was considered in terms of positive and negative implications with regard to siting scoring criteria. Positive aspects included good local road access, location on a poor aquifer, good quality natural screening, and other considerations likely to assist the acceptable integration of a landfill site into a particular area. Typical negative aspects included poor access to suburb routes, proximity to ecologically sensitivity areas, high population density and other features which would make landfill siting difficult to substantiate or defend.

Each criterion was multiplied by one of the three sub-criteria, giving the investigating team the opportunity to analyse, rank accordingly; and select a score which characterizes the site. Sub-criteria were assigned a "relative positive impact" ranking of:

- 5 if the possibility of a negative impact materializing is very low either because of design or historic experience (likelihood <1%);
- 3 if the likelihood of a negative impact materializing is moderate and <25%, and
- 1 if it is certain that a negative impact will materialize regardless of any preventative measure.

For example, the best conditions for the location of the respective site are assigned a mark of 10 (criteria's relative weight 2.0 X sub-criteria's rank 5) while the lowest acceptable conditions are assigned a mark of 1 (criteria's relative weight 1.0 X sub-criteria's rank 1). In context of the specific weightings given to the 15 criteria in the assessment, the best site could win 112.5 points while the worst would be awarded with only 22.5 points.

It is unlikely that any site will be favourable in relation to all siting criteria. Therefore, the decision-making process and the selection of the preferred site becomes a balance of trade-offs based on the judgement of the project team involved. The Table 8 below depicts the final scores as awarded during this exercise.

Table 8: Final Scores

CRITERIA ID	CRITERIA	WEIGHT	SUB CRITERION WEIGHT SITE A	SUB CRITERION WEIGHT SITE B	SUB CRITERION WEIGHT SITE C	SUB CRITERION WEIGHT SITE D	TOTAL WEIGHT SITE A	TOTAL WEIGHT SITE B	TOTAL WEIGHT SITE C	TOTAL WEIGHT SITE D
1	LAND AVAILABILITY & OWNERSHIP	2.00	5.00	1.00	3.00	5.00	10	2	6	10
2	VICINITY OF SETTLEMENT AREA	2.00	5.00	3.00	1.00	5.00	10	6	2	10
3	CURRENT LAND USE & ZONING	2.00	5.00	3.00	1.00	5.00	10	6	2	10
4	AVAILABILITY OF INFRASTRUCTURE &	2.00	1.00	3.00	5.00	1.00	2	6	10	2
5	FLOODING OCCURRENCE	2.00	5.00	3.00	5.00	5.00	10	6	10	10
6	HAUL DISTANCE	1.50	1.00	5.00	5.00	1.00	1.5	7.5	7.5	1.5
7	UNIQUE NATURAL AND CULTURAL	1.50	5.00	1.00	5.00	5.00	7.5	1.5	7.5	7.5
8	PROXIMITY TO SENSITIVE WATER	1.50	1.00	1.00	1.00	5.00	1.5	1.5	1.5	7.5
9	COVER MATERIAL AVAILABILITY	1.50	3.00	3.00	3.00	3.00	4.5	4.5	4.5	4.5
10	TRANSPORTATION AND ACCESS LINKS	1.50	5.00	3.00	5.00	1.00	7.5	4.5	7.5	1.5
11	METEOROLOGY (WIND CONDITIONS)	1.00	5.00	1.00	1.00	5.00	5	1	1	5
12	HYDROLOGY AND HYDROGEOLOGY	1.00	1.00	5.00	5.00	5.00	1	5	5	5
13	LOCAL ECOLOGICAL CONDITION	1.00	3.00	3.00	5.00	5.00	3	3	5	5
14	TOPOGRAPHY	1.00	5.00	5.00	5.00	5.00	5	5	5	5
15	SOIL AND LAND STABILITY	1.00	5.00	5.00	3.00	3.00	5	5	3	3
	TOTAL SCORE	22.50	55.00	45.00	53.00	59.00	83.5	64.5	77.5	87.5

Individual assessment scoring for each criterion can be found in Appendix A. The methodology, as a qualitative tool for rapid assessment, provides a relative comparison, which is useful as a decision support tool for evaluating a long-list of sites. Although rapid, the project team also considered relatively more detailed specific comparisons of environmental, technical and cost implications during the entire site selection process. It is important to emphasize that neither the assessment process nor the final site scoring lend themselves to precise mathematical determination.

5.4. The Proposed Landfill Site

The highest scoring and thus recommended disposal site has been identified to be Site D taking into consideration compliance to legislative, environmental impacts, public health and acceptance, meteorological and weather aspects as well as municipal capabilities. This site is located on the southwestern quadrant of Karibib (Q2) at coordinates lat: -21.994910^{o}; lon 15.831379^{o}. The site is of a sufficient size of approximately 8 hectares with a potential for further expansion and justifies the expenditure necessary to conduct further technical studies, develop, operate and maintain the site to the highest standards over an extended period. Note satellite map of Site D area in Figure 5-2 below.

Figure 5-2: Preferred Site D for New Waste Disposal Site

Once again, it is unlikely that any site will be favourable in relation to all siting criteria. Therefore, the decision-making process and the selection of the preferred site should be guided by the individual allocated scores with the principal aim of the overall site selection process from an environmental perspective to select a landfill site, which will safeguard public health, have minimal impact on the environment, and provide for safe disposal of waste.

Section 5(2)-(3) of the Environmental Management Act states that the Ministry of Environment, Forestry and Tourism (MEFT) may, by notice in the Gazette or by regulation, declare a site to be a disposal site, and where a waste disposal site already exists, the Minister may approve that site as such. A landfill site is thus only deemed to be "selected and approved" when statutory procedures have been successfully completed, and hence the application to the MEFT for the granting of an environmental clearance certificate for the establishment of a waste disposal site at Site D should be carried out.

5.5. Proposed Operational and Management Plan

This landfill should not be designed for the routine disposal of industrial or hazardous waste, used oil, or other special wastes but for Municipal Solid Waste (MSW). The treatment and disposal of these other types of waste should be considered as per recommendations made in this report. If this landfill site is consistently pushed beyond its design limits, like any other engineered system, it will fail. Such failure can have dire consequences for human health and the environment as the landfill then degrades into a potentially toxic open dump.

Apart from the actual landfilling area and its expansion, other designated areas for the disposal of marketable recyclables, tyres, construction and demolition debris, used oil and grease sludges, fabrics and textiles, repairable waste items, hazardous and industrial waste, garden waste and putrescibles should be considered during the landfill site design phase. In addition, provision should be made for MSW facilities such as a weighbridge, equipment store and staff rooms, vehicle fleet garages, administrative building, parking and washing bay, recycling stalls, operators' room and stores, public disposal area, hazardous waste disposal pond, incinerator, electrical substation, sewage effluent reticulation, security etc.

Access to the landfill site must be controlled in order to prevent unauthorized vehicular traffic and illegal dumping of waste. Security should be considered and attention should be paid to natural barriers or suitability for artificial barriers if fencing is unaffordable. In such case screening around landfill site can be accomplished through construction or the erection of any readily available berms, planting, or enhancement of existing vegetation.

Daily cover material (and cover for final restoration) should be permeable to aid rainfall penetration and assist waste degradation. It must also be suitable to reduce localized odour at the tipping face and reduce nuisance associated with insects and vermin. Issues such as water pollution, litter, vermin, flies, dust, odour, fire, traffic and noise should be controlled and their effect further minimized by modern engineering and design, good operating practices and effective management.

Landfill site developers should consider how local community involvement during construction can be facilitated and how liaison might be maintained during subsequent landfill operation. Where there are downstream advantages, these should be identified and communicated to the local community. Council should thus extend its Public Private Partnership agreement with unemployed individuals or groups of waste pickers to provide management, operational and access control services at the site.

An integrated planning approach is required to ensure that all spheres of waste management are addressed, and thus to improve waste management in the entire town of Karibib. It is also very crucial to ensure that all the initiatives and plans are self-sustaining. This project's overarching objective is to improve on the current waste management practices in Karibib by promoting a holistic approach to waste management in line with the "Integrated Waste Management Policy" of Karibib Town Council.

5.5.1. Recycling

The Karibib community has a lot of potential to engage in profitable recycling ventures. For recycling to be a viable option of waste management in town, concerted effort is required to ensure that all recyclables are deposited at a central place, the proposed new waste disposal site in this case. Big recycling companies in Namibia such as "Rent-A-Drum" and "Scrap & Skins" have indicated their willingness to collect and buy recyclables if the Karibib residents become organized and accumulate viable quantities.

As such, it is recommended that the proposed recycling stalls at the waste disposal site become the centre of the community recycling activities. Residents who want to recover recyclables from the waste that will be delivered at the waste disposal site will be allocated stalls and they will be required to comply with the waste disposal site operational guidelines to avoid disorder.

Lodges and other institutions such as schools are encouraged to sort their waste at source were possible to make recycling easier. A recycling station such as the one shown on Figure 5-3 below can be a cost-effective way to encourage recycling at source. This station is operated by depositing waste in the corresponding bags and once the bags are full, the

recyclers are then called to empty them. This makes it cost effective as the costs of transportation and sorting at the waste disposal site are eliminated.

Figure 5-3: Example of a Recycling Station

5.5.2. Disposal

It is recommended that all waste generated in the Karibib and surrounding areas that cannot be recycled must be disposed of at the proposed new waste disposal site to avoid negative impacts on the environment and public health. This will minimise littering and dumping at undesignated sites.

5.5.3. Awareness Raising

Awareness raising campaigns are a key component of this exercise that needs to be embarked upon through a properly designed outreach programme. There is a strong need to ensure that the contents and objectives of this exercise are fully communicated to the residents of Karibib, Taxi Drivers and Tour Guides. It is recommended that awareness campaigns are carried out by all relevant stakeholders. The initial campaigns should be carried out concurrently with clean-up campaigns. Existing community gatherings should also be used to raise awareness on waste management in town. Information to be communicated to the residents should, amongst others, include the promotion of the use of the new waste disposal site, the importance of disposing waste in the designated storage facilities and promote reduction, reuse and recycling of waste.

Various levels of funding will be required to ensure the realisation and successful implementation of this plan. Initial funding for the design, Environmental Impact Assessment (EIA) and construction of the site will be provided by KTC. It is also recommended that KTC engages with key stakeholders in the vicinity such as big businesses, mines, industrial players etc. to solicit support for resources to ensure the project is successfully implemented.

After the establishment of the new waste disposal site other sources of funding will be required to cover operational expenses mainly salaries of staff working at the site. Other funds will be used for ad hoc maintenance of the waste disposal site such as fixing of the fence and removal of vegetation along the periphery fence to reduce fire risk. Various funding options are proposed for thorough consideration by the Karibib Town Council. One or a combination of the following options can be pursued to cover the operational expenses of the waste disposal site.

- Navachab Gold Mine: The mine is a significant employer in the town and by extension a contributor to the consumption patterns of the town's residents. It is therefore a role-player and has an obligation to support the town in its efforts to address the waste management challenge. An opportunity exists for the mine to make use of the new landfill site for the disposal of waste generated on site.
- Other mines and industries: the other mines in an around Karibib as well as the number of industries that make use of the waste disposal site such as Best Cheers, NAMAGRA etc. can allocate funds from their income for the management of the waste disposal site.
- Ministry of Environment, Forestry and Tourism: This waste disposal site will significantly contribute to the improvement of tourism in the area as it will lead to a reduction of littering in the area. It will therefore make sense for the ministry to contribute some funds towards the operation of the site.
- Income from recycling stalls: recycling stalls to be constructed at the waste disposal site can be rented out to recyclers at a minimal fee and the funds can be used for operational costs. This will however only be used to supplement the main source of funding.
- Advertisements: Lodges and other business can display or advertise their respective ventures on the waste storage drums and or facilities at a minimal fee and the funds can also be used for operational costs. This will however also only be used to supplement the main source of funding.

- Environmental Investment Fund: The EIF through it's various facilities can also be approached to consider providing assistance to the KTC towards the implementation of the new site.

All relevant Interested and Affected Parties (I&APs) need to formally (have agreements in place were necessary) commit to this plan to ensure that the responsibilities allocated to them are fully implemented. However, there is a need to have one dedicated stakeholder that will have the overall responsibility of ensuring that this plan is fully implemented. It is recommended that the KTC convenes a Project Committee that will be the body to carry out the above and will also be responsible for monitoring and evaluation of the implementation of the plan.

It is further recommended to adhere to the Karibib Town Council "Integrated Waste Management Policy".

Table 9 below provides a guide of the various actions that need to be considered for implementation to successfully achieve the recommended improvements on the waste management practices of the Town Council. The plan also lists stakeholders that are responsible for the implementation of the specific action. It is very important to set dates by when the specific tasks will be completed. Actual activities will be identified, discussed and adopted during the suggested "Main Brainstorming Workshop", which will serve as a tool to initiate and monitor progress in the implementation of recommendations.

Table 9: Implementation Activities

ACTION	DESCRIPTION	RESPONSIBLE	TIMEFRAME
EIA	Appoint consultants to conduct EIA for the waste disposal site.	KTC	
Design and construction of waste disposal site	Appoint consultants to design the waste disposal site and construct the waste disposal site.	KTC	
Determine waste transportation options	Organise a "*Main Brainstorming Workshop*" to determine the most appropriate option for waste transportation from the recommended options.	KTC	

ACTION	DESCRIPTION	RESPONSIBLE	TIMEFRAME
	Appoint transportation contractors if this is the best option.	KTC	
	Allocate dedicated vehicle for waste transportation if this is the best option.	KTC	
Install waste receptacles for the storage of waste from the community.	Organise a survey to determine the location and number of receptacles to be placed in the town.	KTC	
	Determine financial implications and source funding.	KTC	
	Procure, distribute and allocate receptacles at the selected locations.	KTC	
Raise awareness on waste management in the town	Source and appoint an Outreach consultant that will develop and facilitate the entire awareness programme that will include among others the activities below.	KTC	
	Organise community meetings to inform them about this plan and the proposed waste management practices (including the new waste disposal site).	Outreach Consultant with assistance from KTC	
	Develop radio programmes, posters and leaflets on good waste management practices in town, translate into local languages and disseminate in the town.	KTC	
	Organise corporate social contributing clean-up campaigns in littering hotspots and inform residents on best waste management practices.	KTC	
Appointment of waste disposal site operators	Identify, appoint and train community members who will operate the waste disposal site.	KTC	

ACTION	DESCRIPTION	RESPONSIBLE	TIMEFRAME
	Secure an exchange program with institutions (e.g., municipalities) that operate a similar waste disposal site for in-service training of the operators.	KTC	
Funding for operations of waste disposal site	Secure sustainable source funding to pay for operational expenses of the waste disposal site.	KTC	
	Approach all relevant stakeholders to see how they can contribute to the operations of waste disposal site.	KTC	
Select waste collectors	Select community members who will be allocated recycling stalls at the waste disposal site. Preference should be given to women, previously disadvantaged individual and those communities in which the waste disposal site is located.	KTC	
	Link waste collectors with recycling companies that will buy and transport their recyclables.	KTC	
Promote recycling in the town	Provide name and contact details of interested Recycling Companies to KTC.	KTC	
	Enter into agreements with companies that will buy and transport recyclables from waste collectors at the waste disposal site and from source. Follow up on companies that have indicated willingness to collect and transport recyclables from the landscape.	KTC	
	Install recycling stations at strategic spots (e.g., lodges, shops and institutions) to promote separation of waste at source.	KTC	

5.6. Recommended Site

It was recommended and approved that Council select Site D as the optimal site for the construction of a new landfill site. It should however be noted that further activities have to be undertaken such as the EIA, which has just been concluded, and technical studies (geo-hydrology) to conclusively confirm the suitability of this site prior to landfill design and construction.

It is also further recommended that Site A which was ranked second best be considered as an alternative should further investigation reveal the non-viability of the preferred site for one or the other reason (e.g., cost, technical etc.).

It is recommended for Council to consider an integrated MSWM system that may prioritize its waste management options according to the waste hierarchy i.e., waste minimization, materials recovery/recycling, composting, incineration, and landfilling. All these components of an integrated approach can improve landfill operations and extend the life of the facility. The drafting and or improvement of legislative and guiding documents such as *Solid Waste Management Regulations* and an *Integrated Waste Management Plan* may add value to Council's endeavours in this regard.

Finally, and as detailed in this entire report, many factors affect what should be considered a sound waste management practice in a particular situation. Decision makers need to assess how the specific, prevailing background conditions constrain the choices available. It is unlikely that all of the following points will be important in any one instance, but the list of conditions that help to determine what constitutes sound practice include:

- Level of development
    - economic development, including relative cost of capital, labour, and other resources;
    - technological development;
    - and human resource development, in the MSW field and in the society as a whole.

Other conditions are:

- Natural conditions
    - physical conditions, such as topography, soil characteristics, type and proximity of bodies of water; climate temperature, rainfall, propensity for thermal inversions, and winds;

- specific environmental sensitivities of the town as well as conditions primarily affected by human activities
- waste characteristics density, moisture content, combustibility, recyclability, and inclusion of hazardous waste in MSW;
- towns' characteristics, size, population density, and infrastructure development),
- and *social and political considerations* (degree to which decisions are constrained by political considerations, and the nature of those constraints; degree of importance assigned to community involvement - including that of women and the poor - in carrying out MSWM activities; and social and cultural practices).

These background conditions can occur in a huge number of combinations. This means, once again, that decision-making has to be informed by a particular situation. Solid waste management should always be an agenda item during Council's strategic planning exercises as it offers an opportunity to turn things around and deliver sustainable improvements to local waste management practices. Strategic planning is necessary to ensure that municipal waste services keep pace with demand, are appropriate to needs, and are cost-effective.

A piecemeal solution may be all that is possible in a particular situation, but the goal should be to develop Council's administrative, technical, and financial capacity required to implement solutions that can be sustainable in the long term.

As per the description of the current operations of the dumpsite above, the key environmental and public health impacts emanating from the existing dumpsite are summarized below:

- Public health and safety threats

Current operations at the existing site can seriously affect the health of those still residing close to the site as well as people operating at the site such as personnel, recyclers and scavengers. There is currently no access control at the site and this implies that anyone can access the site. This can be dangerous as even children with no parental guidance were observed at the site and can be injured by sharp objects such as broken bottles and uncontrolled vehicular traffic. The health of recyclers and scavengers on the site are also at risk as they are able to collect and consume food products that could be trapped within general household wastes. The site can also lead to an outbreak of diseases as the current conditions on the site are conducive to the breeding of vectors such as rodents.

- Air pollution

Currently waste at the site is burned indiscriminately and illegally by community members and scavengers. This smoke affects the air quality and well-being of nearby residents and site users and recyclers as well as scavengers. Numerous complaints continue to be received from residents in the surrounding areas. Organic waste usually produces bad rotting smells because waste is not systematically buried and covered.

- Visual impacts

The current operations at the dumpsite affect the aesthetic value of the surrounding area. This is mainly due to the unorganized manner in which the waste is dumped at the site. Another issue that is negatively contributing to the aesthetic value of the surrounding is the non-existence of the fence around the site which was stolen by community members and thus resulting in waste such as papers and plastics to be blown into the surrounding environment.

- Pollution of underground water resources

The dumpsite has a significant potential of polluting underground water resources in the same catchment area and downstream. The surface run-off water from the landfill site and its drainage path may pollute the area and this may cause significant risks.

- Socio-economic impacts

It is a common trend nowadays to promote economic activities at a disposal site. Such activities include the recycling of waste and creation of employment opportunities (e.g., security, caretakers, recyclers etc.) as a result. Currently there are unformalized small scales recycling activities thus not maximizing the potential recycling economic. In addition, formalized and controlled recycling at the site will ensure that the recyclers are not subjected to conditions that threaten their health and safety. The Karibib Municipality can also generate income from the site (e.g., establishment of waste disposal tariffs for businesses) which can help to sustain the Municipality's operational and maintenance measures.

6. RECOMMENDED MANAGEMENT ACTIONS

6.1. Disposal Site Infrastructure Layout Plan

The site infrastructure layout plan below is recommended in order to meet the Karibib Municipality's organizational effectiveness, namely suitability of the layout to the current situation; acceptability of the layout by the majority of stakeholders and feasibility to the Karibib Municipality and its social economic-base in constructing and maintaining the infrastructure. This proposed layout plan will serve as a major mitigation measure in addressing the negative environmental and public health impacts emanating from the disposal site.

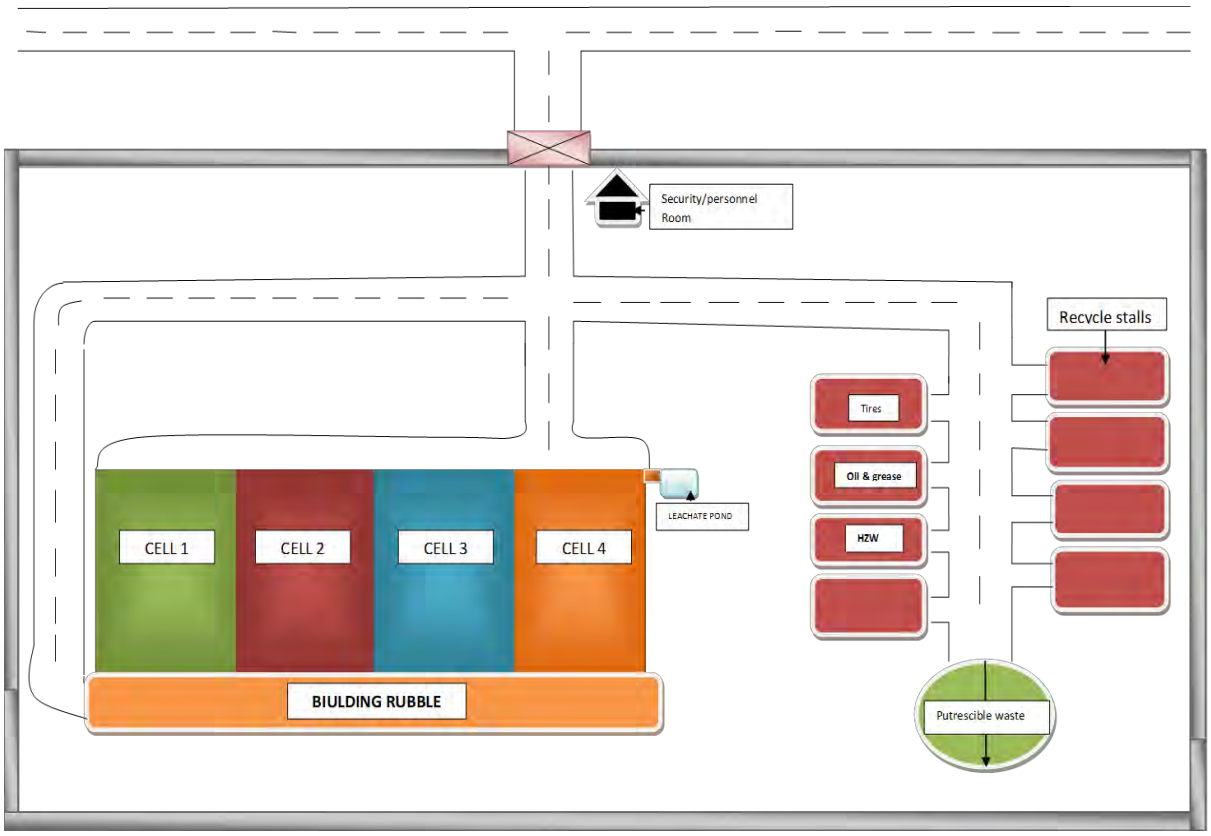

Figure 6-1: Simplified drawing of the disposal site layout plan

6.1.1. Buffer and Access Road

Signage should be strategically placed to provide direction to customers and the public to the public entrance of the disposal site. A two-way access road to the disposal site must be constructed and maintained through regular grading for all-weather conditions to ensure that waste trucks and site vehicles will drive over hard-surfaced roads. The ends of the internal roads must be constructed relatively wide to allow waste trucks and site vehicles enough manoeuvring space in turning around. A buffer zone to the property boundary should

be at least 100 meters from the centre of the C32 road of which the 5-15 meters closest to the property boundary must be reserved for natural or landscaped screening (berms or vegetative screens).

6.1.2. Entrance Control Facilities

Controlled access should be constructed together with a new fence, security gate and lifting barrier as well as a "non-authorized entrance" signage. The name and contact details of the disposal site operator as well as operation hours should be displayed at the site entrance. A site office for the site contractor/security should be positioned such that vehicles approaching, leaving and using the site are able to speak to the security officer. The operator/security should control traffic entering by means of a lifting barrier. It is also recommended that water and electricity be availed to the security/contractor's office and all other site's facilities were possible.

6.1.3. Weighbridge

An accurate record of waste inputs is essential for effective waste management and the installation of an on-site weighbridge, as a long-term option, will be the best means of providing such data. However, due to the importance of waste quantification, it is recommended that the "Typical Daily Waste Composition Recording Sheet" – note Appendix B - be used as a template to be completed by site contractor/security at the access control point/site office. Further note Section 6.2.3 below on Measuring and Recordkeeping.

6.1.4. Emplacement Cells

Approximately 4 emplacement cell types are recommended for logistical and practical emplacement, compaction and possible daily covering of waste, where this waste is stockpiled and compacted into a one 2-3 meters high cell for storage and coverage.

Signage within the facility should provide the public with direction to the respective offloading working areas.

6.1.5. Recycling Stalls

Three to four (3-4) shaded recycling stalls should be constructed to enable litter pickers/recyclers to sort through the waste without interfering with the waste offloading operation in a safer and more hygienic set-up. Income can be generated for the lease of these stalls. Signage within the facility will provide direction for public to the reuse - recycling stalls. This will increase the lifespan of the disposal site.

6.2. Daily Operations and Maintenance

Again, suitability, acceptability and feasibility were the main guiding principles that were considered in order for the Karibib Town Council to meet its organizational effectiveness in implementing this EMP. The recommended human resources organogram depicted in Figure 6-2 below and respective responsibilities; the daily operational and maintenance plan below will serve as mitigation measures in addressing potential negative environmental and public health impacts emanating from the site.

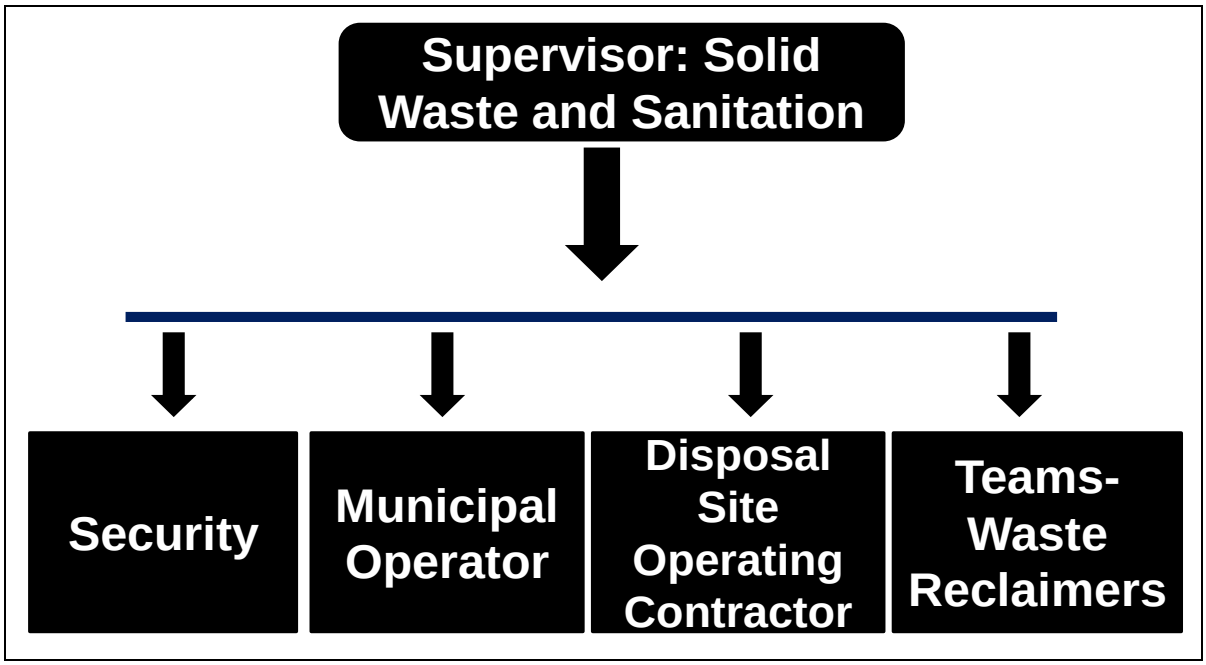

Figure 6-2: Minimum recommended human resource requirement

6.2.1. Manpower and Key Performance Areas

The minimum manpower recommended for a well-managed site is:

Supervisor: Solid Waste & Sanitation (SSWS) - The present municipal employed SSWS will have the overall responsibility in ensuring the implementation and adherence to this Draft EMP and in accordance with the required legal requirements and relevant national policies, plans and programmes. The SSWS will thus be accountable to the Council for the effective and efficient management and operation of the site in terms of the SSWS job description.

Disposal Site Operating Contractor (DSOC) - The DSOC will be coordinating and supervising the overall operations at the disposal site. This will include activities such as regulating and controlling gate access into and out of site; recording and keeping records of waste types and quantities entering and leaving the disposal site; cleaning, inspecting and reporting

defects and conditions of the disposal site fence; reporting non-compliances and making improvement suggestions to the SSWS. The DSOC will directly be accounting and reporting to the SSWS.

Currently there are no formal arrangement in existence between Council and any entity for these activities. It is recommended that caretaking arrangements with an identified service provider be considered and utilized, adding the above mentioned DSOC requirements, as part of a contract agreement with such service provider.

Security Guard and Traffic Controller (SGTC) - The SGTC will be controlling legal and illegal access/entries to the disposal site; patrolling the disposal site and fence; directing and guiding vehicles to respective disposal areas and cells; prevention (and were possible regulation) of waste burning, and reporting any non-conformities or defects to the DSOC but mainly to the SSWS. The SGTC will directly be accounting and reporting to the SSWS. *It is recommended that security services arrangements with the Waste Recyclers/Reclaimers be considered and utilized.*

Municipal Earth Moving Equipment Operator (MEMEO) - The establishment, maintenance and covering of emplacement cells will be performed by the MEMEO on instructions of the SSWS as per present arrangements and MEMEO job description. The MEMEO will thus directly be accounting and reporting to the SSWS.

Waste Reclaimers – It is recommended that the Karibib Town Council assists the present scavengers on site to organize themselves into recognized Waste Reclaimers and to create a conducive environment for these Waste Reclaimers to trade with recycling companies in town. These Waste Reclaimers will aid Council in guarding and controlling or reporting irregularities in order to safeguard their socio-economic interests. The Waste Reclaimers will be performing recycling activities on site on instructions of the SSWS and will thus directly be accounting and reporting to the SSWS.

6.2.2. Access Control and Maintenance

Access should be controlled to minimize unauthorized human and animal presence, vehicular traffic as well as unauthorized and illegal dumping and burning within the disposal site by:

- Preventing unauthorized entrance. The site should have dedicated and trained staff on-site during and after operating hours. The gates are to be locked to prevent unauthorized access during non-operating hours. Properly designed and maintained public waste disposal and/or recyclable material bins situated outside the main gate may be provided for after-hours use.
- Visually inspecting and recording types and quantities of waste loads entering and leaving the site.
- Directing vehicles to respective emplacement and offloading areas.
- Inspecting perimeter fence and gates for damages. Reporting and or making repairs were necessary.
- Inspecting access roads, entrance areas and perimeter fence for loose trash, and weekly clean-ups as necessary.
- Inspecting site access road for damage from vehicle traffic, erosion, or excessive mud accumulation. Maintaining entrance and internal roads as needed by grading at least on a monthly basis.
- Scavenging of food waste is to be prevented. The salvaging/reclaiming of recyclable or re-usable wastes should be encouraged by providing areas and facilities for separation of recyclable or reusable materials.
- Open burning of typical domestic garbage and waste at the disposal site is strictly prohibited. Open burning of other combustibles should generally be discouraged. Where justifiable, controlled burning may be allowed in consultation and approval by the SSWS.

6.2.3. Measuring and Recordkeeping

It is good practice to accurately record the quantities of waste both on entry and exit from the site, recording and keeping of waste inputs is essential for effective waste management. It should be noted that quantities of waste being generated in any developing town such as Karibib is expected to grow. It is thus important to measure daily and seasonal waste streams data variations as well as the generation rate of municipal solid waste at varying points in the chain through representative surveys of households and at any transfer, recycling, treatment and disposal sites. This will enable the Karibib Town Council's solid waste management services to cope with all situations and to feed data into the current municipal Draft Waste Management Plan.

Records of waste deliveries to the site should be kept, showing who delivered the waste, of what type, how much, and when. These records are particularly important if the municipality decides to charge waste generators for their waste services and such records will equally be vital to the re-design or upgrading of the existing site or for the design of a new landfill site when required. Manual waste estimations and recording is recommended (note Appendix B for a typical daily waste recording sheet for appropriate editing and usage) while a decision on the construction of the weighbridge is been considered and planned for as a long-term option.

6.2.4. Emplacement and Co-Disposal

It is recommended that operations at the site be conducted in a manner that allows the prompt and efficient emplacement and offloading of waste through measures such as:

- Vehicles transporting solid waste arriving at the waste disposal site will be directed to an offloading area by on-site personnel and or signage.
- The approach to the offloading area will be wide enough to safely offload at least two vehicles side-by-side.
- Two emplacement cells will be utilized daily – one for offloading and collection of recyclables while the second cell is being maintained for proper placement, thickness compaction and coverage.
- Waste should be disposed of and covered in thin bands up to 3.0m which should be build up into a layer about 2m deep. This reduces the likelihood of instability and settlement problems in the future.
- Compacted waste should be covered with excavated soil or similar inert material (alternatives such as construction and demolition material and ash) to deter flies and other insects from breeding in waste; to reduce the attraction of birds to wastes; to suppress odours and dust as well as reducing wind-blown waste and improving the surface roads for waste vehicles.
- Inspection of all site signs for damage, general location, and accuracy of posted information and correcting on date of discovery were possible.
- Inspecting for proper placement, thickness, slope, settlement, erosion and compaction. Emplacement cell's maintenance will be ongoing throughout post closure care period.
- Deliberate and controlled co-disposal of a range of industrial/hazardous waste and municipal/household waste is recommended where the State Hospital incineration cannot be utilized.

6.2.5. Reuse and Recycling

Waste burning should not be permitted. Fires can cause hollows in the waste, encouraging instability, and could ignite pockets of landfill gas, causing explosions. If not quickly extinguished, fires can become deep seated and smoulder for many years. It is thus recommended to reuse or recycle waste instead of burning.

Marketable recyclables: A Usakos-based company is currently active at the existing dumping site where it purchases recyclable waste from the waste pickers. It is recommended for the Karibib Town Council to enter into a formal agreement with this company and or other recycling companies, with unemployed individuals or groups of waste pickers to provide formal collection services in search for the recovery of such recyclables at source, and at the disposal site as a job creation venture. The present unemployed waste reclaimers should be organized into specialized groups with a permit to operate at the disposal site. They can sell their bottles, plastics, cardboard, and paper to the company (and other recycling companies) at their assigned recycling stalls - at the disposal site and or other allocated council areas. The extent to which these transactions occur will depend on the availability of marketable end uses for the materials.

Special waste: such as tyres should be recycled as rethreads, for use on carts, to make shoes, flower pots, gardening, road demarcation, playground equipment, animal feeding troughs and for a number of other domestic, farming, agricultural and industrial articles.

Construction and Demolition Debris (CDD) should be reused as covering material during waste emplacement, and for the filling of low-lying areas subject to regular flooding. Wood, nails, bricks, and other materials of direct use should also be reclaimed from CDD for use in a number of minor DIY construction projects. The rate of recycling of CDD, especially bricks and wood (for the manufacturing of furniture and as firewood), has already been established country-wide. Similarly, to the marketable recyclables, unemployed community members should be organized into tyres and CDD specialized groups with a permit to operate at the disposal site as job creation ventures.

Used oil and grease should be recycled as an industrial lubricant or fuel through the establishment of a deposit system to increase the rate of oil recycling. It is suggested to identify companies, within the Erongo Region (e.g., Wesco Group, a factory for the regeneration of used oil operating in Walvis Bay) that are collecting used oil for refining and reuse purposes.

Again, the establishment of agreements with such companies will promote the recycling of used oil across and within the entire Karibib district. It is worthwhile to consider providing

waste reclaimers with rag-pulling equipment to shred, clean, and reknit fabrics and textiles as all-purpose utility cloths for resale. This is equally applicable to repairable waste items such as electrical equipment, utensils, bicycles, radios and many other items at designated recycling centres/stations.

Composting: Urban demand for compost has not been established. Additionally, the technology works better with a well-segregated MSW stream, which may be the case with garden refuse in Karibib. In general, even though the organic content of the MSW in Karibib may exceed 40% (wet basis), centralized composting is encouraged in the short to medium term consideration.

Incineration: The construction of an incinerator by Council should remain a non-option for the short to medium term taking into consideration the availability of State Hospital incinerators, which Council should be able to utilize once the need arise. In addition, high costs relative to other municipal solid waste management options, a limited infrastructure, human, mechanical and institutional resources, and the composition of the waste stream itself, suggest that incineration is an inappropriate technology for Council for the short to medium term. Organisations such as The African Expert Federation can be approached to assess the feasibility of establishing a Waste-to-Energy facility in Karibib.

6.2.6. Continuous Site Rehabilitation

Weekly cover application is essential and required in every disposal site operation. The weekly cover application will minimize negative effects of the site operation such as odours nuisance, wind-blown waste and vector populations. It might also avoid landfill fires, minimize contamination of surface runoff, and improve aesthetics of the site operation. The availability of soil or other inert matter material as cover material is of importance for the weekly coverage of the waste. Instead of transporting soil or other inert material to the disposal site over longer distances (which is expensive), unutilized compost or demolition waste should be used as alternative daily cover material. This can be considered as "best available practice" to operate the site, especially when insufficient soil cover material or lack of financial resources is experienced.

Final cover application: The Karibib Municipality is recommended that after a single emplacement cell has reached its final capacity the waste need to be covered first by an intermediate cover layer, which is sensitive to settlements of the disposal site surface. The functions of this intermediate cover layer (e.g., 50 cm of soil or compost) are the prevention of erosion by wind and water; the reduction of water infiltration, and gas emissions (at least partial oxidation of methane generated); to promote vegetation, and for aesthetic issues.

The intensive natural dense vegetation cover (in order to prevent erosion) will servers as the final capping of the disposal site.

Ground water monitoring boreholes: It is important to monitor the potential for groundwater pollution by drilling monitoring boreholes for the collection of samples to analyse water quality. This should be done on a regular basis, i.e., a minimum of 6 months or less.

Post-closure care: The site needs to be managed and controlled in order to avoid adverse effects on humans and the environment after the closure of this disposal site. This post-closure care (or site aftercare) has to be prolonged as long as landfill emissions present a hazard to human health and the environment, which post-closure care is estimated to be in the range of several decades to centuries. In addition, the status of different elements should also be observed, such as final cover integrity, natural drainage system - monitoring boreholes, vegetation growth, slope, etc. Post-closure care may not be necessary taking into consideration national efforts in the establishment of Waste-to-Energy facilities in all in the 14 regions in Namibia.

6.2.7. Draft EMP Database System and Review Process

The database system is a critical component of this Draft EMP, as the management plan refers to any operational records and reports, design information and monitoring reports, which are the site records for the disposal site. The site records should be referenced on a regular basis. The format of the database system should facilitate ease of reference to the site records and incorporate a process for identifying documents, and should include the provision for document identification numbers and provision for issue dates and authors as a minimum. Daily recording sheets and monthly site inspection reporting and reports will be included in the database system to identify the process to be used in reviewing the Draft EMP. The system should be used to clearly demonstrate that the identified actions and outcomes at site operation stage, are met or not met.

The review period for the Draft EMP for this disposal site shall be each year or as otherwise specified in the Environmental Clearance Certificate (ECC). Given the ongoing records keeping, monitoring and reporting associated with the disposal site, the review of the Draft EMP should demonstrate that the sufficiency of the operational, layout design and daily monitoring and reporting systems for the current development stage of the site has been addressed. The review process should be established to ensure continual improvement in the management and operation of the disposal site.

Upon approval of the Environmental Clearance Certificate for this activity, bi-annual reports have to be submitted to the Environmental Commissioner.

The Draft EMP review process (for example, a checklist system) will assist in identifying the outcomes from site investigations, operational reporting and/or monitoring programs and so on, for incorporation in upcoming management plan as appropriate. This could take the form of regular monitoring exercises/inspection once every quarter. As a result, the outcome of the Draft EMP review process is that only specific sections of the management plan may be subject to revision and submission to the Environmental Commissioner for approval in terms of Part VI of the Environmental Management Act, No 7 of 2007.

7. CONSLUSION

The Karibib Town Council should take the overall responsibility to ensure that all recommended actions within the Draft EMP are properly implemented, monitored, evaluated, recorded and accordingly reported. All key role players such as the Council staff involved in the day-to-day operations of the waste disposal site; all waste contractors and service providers, and recyclers on site should be informed about the content of the Draft EMP and activities to be undertaken.

The Karibib Town Council should ensure compliance to Section 5 and Part VI of the EMA that deals with Waste and Environmental Plans respectively. Apart from legal compliance, adherence to the Draft EMP will result in a well-managed designated disposal site, which in turn will minimize operational costs and future potential negative impacts and threats to the environment and public.

It is important that continuous monitoring and evaluation takes place as required and that bi-annual reports are submitted to the Environmental Commissioner on a regular basis. Based on the assessment conducted and the accompanying EMP outlining the mitigation measures to be implemented it is our opinion that the Environmental Clearance Certificate for this activity be approved.

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APPENDIX A - INDIVIDUAL ASSESSMENT FOR EACH CRITERION

1. Land Availability & Ownership (Relative Weight Factor 2.0)

In terms of land availability, Site B is large enough but falls outside of the Karibib Townlands and is on privately owned Farmland, although the owner has indicated willingness to negotiate with Council to release some of the land for Council's use. For these reasons site B scores the least with a sub criterion weight of 1. Site C, the existing dumping site, is located within Karibib Townlands on a Council-owned land, and presents an existing footprint large enough to accommodate a landfill site. However, it leaves very little room for expansion in future. Site C scores a higher sub criterion weight than Site B with a 3. Sites A and D are both ideal in this category in that they are located on large vast Council-owned land within the Karibib Townlands that could be utilized for the siting of a landfill site and possible future extension. Sites A and D are therefore allocated a sub criterion weight of 5 each.

2. Vicinity of Settlement Area (Relative Weight Factor 2.0)

Distance from the residential are a key determinant, Sites A & D are furthest from the built-up areas hence these sites scored the highest sub criterion weight of 5. This means that, the possibility of a negative impact materializing is very low making them the most suitable sites. Site B could also be considered due to its sub criterion weight of 3, indicating that the likelihood of a negative impact materializing is moderate. On the contrary, Site C with a sub criterion weight of 1 is the least suitable because this area is in close proximity to the settlement area hence it is certain that a negative impact will materialize regardless of any preventative measure.

3. Current Land Use (Relative Weight Factor 1.5)

Site C is located on a Private Open Space zoned erf in Usab Extension 3, surrounded by a number of Institutional zoned properties. There are also existing and planned residential properties in the immediate surrounds of the site. Site C and surrounds have potential high economic value, and is therefore allocated a 1. No productive activity was observed at Site B, although it is on farmland with potential for farming activities, the adjacent sewage ponds present a potential negative impact to the level of productive activities that can be undertaken in the area. Site B is given a score of 3. Both Sites A and D, are abandoned quarries and are ideal for conversion to an activity such as landfilling and are equally allocated sub criterion weights of 5 each.

4. Availability of Infrastructure (Relative Weight Factor 1.0)

For this category, Site C is ideally located in terms of proximity to infrastructure services as it is located in an area with existing and planned mixed-use developments. Site C is therefore allocated a 5, with site B a 3, while Sites A and D being the furthest from existing bulk infrastructure services each score a 1. It should however be noted that services can be developed on a decentralized basis and do not have to be pulled from existing services that are further away.

5. Flooding Occurrence (Relative Weight Factor 1.0)

Karibib is relatively dry with an annual average rainfall of 224mm recorded between 1967 and 1983 and 180mm between 1980 to 2002 and between 2008 and 2010, 215mm (KUSP, 2016). Like most part of the country, Karibib area has no surface water and rely on underground water. While generally the sites are not prone to inundation, it was noted that during periods of overflow of the sewage ponds the are in the vicinity of Site B has been known to be affected. Therefore, we scored Site B a 3 with the rest of the site allocated a 5.

6. Haul Distance (Relative Weight Factor 1.5)

Sites A and D being the furthest account for a higher haul distance and given a sub criterion weight of 1 each with Sites B and C allocated a 5 each due to their close proximity to the suburbs and locations serviced, and subsequent low haul distance.

7. Unique Natural and Cultural Treasures (Relative Weight Factor 2.0)

It is important to preserve the natural and cultural heritage because it enhances our identity as people. Based on the above mentioned, Sites A, C and D scored a sub criterion weight of 5 because no observation or reports of unique natural and cultural treasures were recorded, making them the most favourable sites. The development of a municipal landfill can be considered on these sites because the possibility of a negative impact materializing is very low. On the contrary, Site B scored a sub criterion weight of 1, this was based on the first hand information obtained, that the local residents believe that the surrounding area of this site is an ancestral land which serves great value in their culture. Site B is also of great concern because it is in close proximity to the sewage ponds.

8. Proximity to Sensitive Water Resources (Relative Weight Factor 2.0)

Site D is located in an area with minimum vegetation cover and stunted vegetation growth indicative of low drainage density, hence a sub criterion weight score of 5, while site A in contrast has a more prominent vegetation cover of taller and bigger shrubs and trees, therefore it is allocated a score of 1. Sites B and C are given a sub criterion weight of 1 for the same reasons as Site A.

9. Cover Material Availability (Relative Weight Factor 1.0)

Availability of cover material for all sites is not in abundance in the immediate surrounds, but can be considered to be moderate. Over the long-term the site will have have to rely on ex-situ importation of cover material. Karibib provides a lot of options in obtaining suitable material, from construction activities as well as mining and industrial activities in the general area. Marble dust for example is being touted as an effective liner additive material. It can also be used as an effective stabilizing material. All sites are scored 3 in this criterion.

10. Transportation and Access Links (Relative Weight Factor 1.0)

In this regard, Sites A & C scored a sub criterion weight of 5. This was because they are nearer to the road making them the most suitable in terms of transportation and access links to the suggested landfill site. While site B with the sub criterion weight of 3 is the second suitable. Although the access road is close, it is not properly maintained, thus the likelihood of a negative impact materializing is moderate. However, site D with the sub criterion score of 1 is the least favourable distance to the landfill site because it's far from road network making it difficult to access the landfill, therefore influencing the costs associated with transportation. Regardless of site C scoring a sub criterion weight of 5, it's not favourable because it renders an aesthetically unpleasant view and residents have been dumped their waste indiscriminately alongside the road without permission.

11. Meteorology (Relative Weight Factor 1.5)

Karibib's average annual rainfall is around 239 mm. The evaporation is between 2,330 and 2,440 mm per year and greatly exceeds precipitation. The information available on wind directions in Karibib indicates that the predominant day-time wind is north-east, while at night-time the prevailing wind is southeast and south-southeast. During winter time the prevailing winds are from the northeast and east (east winds) while in summer and spring time the prevailing winds are from the northwest north-westerly directions.

For the purpose of this assessment, we have divided the townlands in four quadrants, i.e. Q1-Q4, grouped in the following directions: Q1 = South-East; Q2 = South-West; Q3 = North-West; and Q4 = North-East. Considering the prevailing winds, it is clear that Q2 presents the favorable locality for this criterion. Site D falls in Q2; Site A at the borders of Q2 and Q3; Site B is in Q3; and Site C is in Q4. Therefore, Sites A and D were allocated a sub criterion weight of 5 each, while Sites B and C are scored at 1 each.

12. Hydrology and Hydrogeology (Relative Weight Factor 1.5)

Based on the site visit, Site D scored a sub criterion weight of 5, this area consists of stunted vegetation growth and with the presence of hard rock near ground level, it is a clear indication of possible low drainage density which makes it the most favourable for landfill construction. In addition, Sites B & C also scored a sub criterion weight of 5 however, Site C is the existing dumping site while Site B is adjacent to the sewage ponds which might magnify the negative impacts to the hydrology and hydrogeology of the area. On the contrary Site A with the sub criterion score of 1 is the least favourable site for this criterion because the surrounding trees and shrubs are taller and bigger in size indicating good access to water and the less compacted soil shows moderate/ or high drainage density meaning a negative impact will likely materialize regardless of any preventative measures.

13. Local Ecological Conditions (Relative Weight Factor 2.0)

Karibib lies within the Tree-and-shrub Savanna Biome, the largest biome in Namibia characterised by large, open expanses of grasslands dotted with Acacia trees. It is specifically in the Acacia Tree-and-shrub Savanna sub-biome. The vegetation structure in the sub-biome consists of 'large, open expanses of grasslands dotted with Acacia trees. The trees are tallest in areas of deeper sands in the east, with plant growth becoming progressively shrubby further west where the soils are shallower and the landscape is hillier and rockier (Mendelsohn, et al, 2002). The vegetation in the proposed development area consists mainly of Acacia species and grasslands.

Based on the site survey, Site D scored a sub criterion weight of 5 making it the most favourable area, this assessment was based on the physical features of the sites. It was observed that Site D is highly disturbed with sand mining activities having taken place in the past and consist of sparsely populated vegetation of common trees and shrub species. Site C also scored a sub criterion weight of 5 because this is an existing municipal dumping area. Due to the good vegetation structure at Sites A & B they scored a sub criterion weight of 3 making them least favourable, as it is certain that a negative impact will materialize

regardless of any preventative measure (e.g., habitat removal, fragmentation or disturbance to or loss of biodiversity).

14. Topography (Relative Weight Factor 1.0)

All sites are located on relatively flat land surface suitable for "land-fill" as opposed to "land-raise". A sub criterion weight of 5 is therefore allocated to all the sites.

15. Soil and Land Stability Conditions (Relative Weight Factor 1.5)

Sites A and B consist of sandy soils that are reasonably easier to excavate, whereas at Sites C and D one could observe signs of hard rock. Engineering solutions are however available to overcome challenges on the specific site, albeit with a cost implication. The preferred site will be subjected to further technical studies of the soil structure. Sites A and B score a weight of 5 each, with Sites C and D scoring 3 each.

APPENDIX B: **A Typical Daily Waste Composition Recording Sheet**

WASTE COMPOSITION	DATE	LOAD 1	LOAD 2	LOAD 3	LOAD 4	LOAD 5	TOTAL
GENERAL HOUSEHOLD WASTE in m^3							
GLASS BOTTLES in m^3							
PLASTIC BOTTLES in m^3							
PLASTICS in m^3							
WHITEPAPER in m^3							
NEWS PAPER in m^3							
BOXES/CARTONS in m^3							
CANS in m^3							
STEEL/METALS in m^3							
GARDEN/PUTRESCIBLE in m^3							
TYRES in numbers or m^3							
OILS/SLUDGES in m^3							
BUILDING RUBBLE in m^3							
INDUSTRIAL/HAZARDOUS in m^3							
OTHER WASTE in m^3							

Computation:

* Estimated Load in m^3
* Depending on the open pick-up truck load-box capacity: L X B X H = m^3

In RED – Not compulsory- ONLY IF IN SIGNIFICANT QUANTITIES

Electronic version of this recording and inspection sheets will be made available to the Karibib Town Council for appropriate amendments and usage purposes accordingly.

APPENDIX C: A Typical Site Inspection Report Structure for Ensuring Best Practice

SITE INSPECTION REPORT

Site Name ……

Ref No …….

Date of Inspection …… Time in ……..

Inspector's Name …….

Reason for Inspection …… Time out ……

Weather …….

Site: Open/Closed

Status at Time of Inspection	Satisfactory = S Partial Satisfactory = PS Unsatisfactory = US		S	PS	UP	Not Checked Inapplicable	Comments
Environ. Man. Plan Compliance							
Types of Waste							
Layering/Compaction of Waste							
Covering of Waste							
Litter Screens & Litter Control							
Liner/Protective Layer							
Condition of Site Roads							
Condition of Site Entrance							
Access Road Cleaning							
Site Tidiness							
Fires and smoke							
Insects/Vermin/Birds							
Surface Water							
Leachate (on-site)							
Landfill Gas							
Odours							
Noise							
Dust							
Gate/Fencing/Security							
Office/Site Notice Board							
Manning & Supervision							
Site Record Keeping							
Cover Stockpile							
Site Environs	Litter						
	Leachate						
Other Observations/Actions Required:							
IMMEDIATE ACTION IS REQUIRED ON:							
Site Operator's Comments:							
Samples Taken: Yes/No Photographs Taken: Yes/No	Inspector's Signature:					Received by& When:	

THE WATER ACT, 1956 (ACT 54 OF 1956) AND ITS REQUIREMENTS IN TERMS OF WATER SUPPLIES FOR DRINKING WATER AND FOR WASTE WATER TREATMENT AND DISCHARGE INTO THE ENVIRONMENT

1. INTRODUCTION

The provisions of the Water Act are intended, amongst other things, to promote the maximum beneficial use of the country's water supplies and to safeguard water supplies from avoidable pollution.

The drinking water guidelines are not standards as no publication in the Government Gazette of Namibia exists to that effect. However the Cabinet of the Transitional Government for National Unity adopted the existing South African Guidelines (461/85) and the guidelines took effect from 1April 1988 under the signature of the then Secretary for Water Affairs.

The sections of the Water Act that relate to the discharge of industrial effluents are:
- Section 21(1) which states that
-- The purification of waste water shall form an integral part of water usage and
-- that purified effluents shall comply with the General Standard Quality restrictions as laid out in Government Gazette R553 of 5 April 1962 and
- Section 21(2) which further stipulate that this purified effluent be returned as close as possible to the point of abstraction of the original water.
Where a local authority has undertaken the duty of disposing of all effluents from an industrial process the provisions of Section 21(1) and 21(2) apply to the local authority and not the producer of the effluents. If there is difficulty in complying with these provisions then the applicant may apply for an exemption from the conditions in terms of Section 21(5) and 22(2) of the Water Act. The Permanent Secretary after consultation with the Minister may grant the issuance of a Waste Water Discharge Permit under Sections 21(5) and 22(2) subject to such conditions as he may deem fit to impose.

After independence, the Government of the Republic of Namibia decided that for the interim the existing guidelines will continue to be valid and to remain in use until a proper study has been conducted and new standards have been formulated (Article 140 of Act 1 of 1990).

2. GUIDELINES FOR THE EVALUATION OF DRINKING-WATER QUALITY FOR HUMAN CONSUMPTION WITH REGARD TO CHEMICAL, PHYSICAL AND BACTERIOLOGICAL QUALITY

Water supplied for human consumption must comply with the officially approved guidelines for drinking-water quality. For practical reasons the approved guidelines have been divided into three basic groups of determinants, namely:

- Determinants with aesthetic / physical implications: TABLE 1.
- Inorganic determinants: TABLE 2.
- Bacteriological determinants: TABLE 3.

2.1 CLASSIFICATION OF WATER QUALITY

The concentration of and limits for the aesthetic, physical and inorganic determinants define the group into which water will be classified. See TABLES 1 and 2 for these limits. The water quality has been grouped into 4 quality classes:

- Group A: Water with an excellent quality
- Group B: Water with acceptable quality
- Group C: Water with low health risk
- Group D: Water with a high health risk, or water unsuitable for human consumption.

Water should ideally be of excellent quality (Group A) or acceptable quality (Group B), however in practice many of the determinants may fall outside the limits for these groups.
If water is classified as having a low health risk (Group C), attention should be given to this problem, although the situation is often not critical as yet.
If water is classified as having a higher health risk (Group D), urgent and immediate attention should be given to this matter.

Since the limits are defined on the basis of average lifelong consumption, short-term exposure to determinants exceeding their limits is not necessarily critical, but in the case of toxic substances, such as cyanide, remedial measures should immediately be taken.

The overall quality group, into which water is classified, is determined by the determinant that complies the least with the guidelines for the quality of drinking water.

TABLE 1: DETERMINANTS WITH AESTHETIC / PHYSICAL IMPLICATIONS

DETERMINANTS	UNITS*	LIMITS FOR GROUPS			
		A	B	C	D**
Colour	mg/l Pt***	20			
Conductivity	mS/m !at 25 °C	150	300	400	400
Total hardness	mg/l $CaCO_3$	300	650	1300	1300
Turbidity	N.T.U****	1	5	10	10
Chloride	mg/l Cl	250	600	1200	1200
Chlorine (free)	mg/l Cl	0,1- 5,0	0,1 – 5,0	0,1 – 5,0	5,0
Fluoride	mg/l F	1,5	2,0	3,0	3,0
Sulphate	mg/l SO_4	200	600	1200	1200
Copper	µg/l Cu	500	1000	2000	2000
Nitrate	mg/l N	10	20	40	40
Hydrogen Sulphide	µg/l H_2S	100	300	600	600
Iron	µg/l Fe	100	1000	2000	2000
Manganese	µg/l Mn	50	1000	2000	2000
Zink	mg/l Zn	1	5	10	10
pH****	pH-unit	6,0 – 9,0	5,5 – 9,5	4,0 – 11,0	4,0 – 11,0

* In this and all following tables “l” (lower case L in ARIAL) is used to denote dm^3 or litre
** All values greater than the figure indicated.
*** Pt = Platinum Units
**** Nephelometric Turbidity Units
***** The pH limits of each group exclude the limits of the previous group

TABLE 2: INORGANIC DETERMINANTS

DETERMINANTS	UNITS	LIMITS FOR GROUPS			
		A	B	C	D*
Aluminium	µg/l Al	150	500	1000	1000
Ammonia	mg/l N	1	2	4	4
Antimonia	µg/l Sb	50	100	200	200
Arsenic	µg/l As	100	300	600	600
Barium	µg/l Ba	500	1000	2000	2000
Beryllium	µg/l Be	2	5	10	10
Bismuth	µg/l Bi	250	500	1000	1000
Boron	µg/l B	500	2000	4000	4000
Bromine	µg/l Br	1000	3000	6000	6000
Cadmium	µg/l Cd	10	20	40	40
Calcium	mg/l Ca	150	200	400	400
Calcium	mg/l $CaCO_3$	375	500	1000	1000
Cerium	µg/l Ce	1000	2000	4000	4000
Chromium	µg/l Cr	100	200	400	400
Cobalt	µg/l Co	250	500	1000	1000
Cyanide (free)	µg/l CN	200	300	600	600
Gold	µg/l Au	2	5	10	10
Iodine	µg/l I	500	1000	2000	2000
Lead	µg/l Pb	50	100	200	200
Lithium	µg/l Li	2500	5000	10000	10000
Magnesium	mg/l Mg	70	100	200	200
Magnesium	mg/l $CaCO_3$	290	420	840	840
Mercury	µg/l Hg	5	10	20	20
Molybdenum	µg/l Mo	50	100	200	200
Nickel	µg/l Ni	250	500	1000	1000
Phosphate	mg/l P	1	See note below	See note below	See note below
Potassium	mg/l K	200	400	800	800
Selenium	µg/l Se	20	50	100	100
Silver	µg/l Ag	20	50	100	100
Sodium	mg/l Na	100	400	800	800
Tellurium	µg/l Te	2	5	10	10
Thallium	µg/l Tl	5	10	20	20
Tin	µg/l Sn	100	200	400	400
Titanium	µg/l Ti	100	500	1000	1000
Tungsten	µg/l W	100	500	1000	1000
Uranium	µg/l U	1000	4000	8000	8000
Vanadium	µg/l V	250	500	1000	1000

* All values greater than the figure indicated.

Note FOR Table 2 on phosphate: Phospates are not toxic and essential for all life-forms. Natural water will, however, seldom contain phosphate; it is generally seen as an indicator of pollution and is usually accompanied by other pollutants. Wherever drinking water is combined with or consists wholly of reclaimed or recycled water, it may be expected to contain phosphate. The general guideline for a concentration level to be aimed at is 1 mg/l as P. But in many cases this may be difficult to achieve technically. For this reason the Department will allow a phosphate concentration level of up to 5 mg/l as P in water intended for human consumption. Please refer also to the "Note on Phosphate" under Section 3: General Standards for Waste/Effluent.

2.2 BACTERIOLOGICAL DETERMINANTS

The bacteriological quality of drinking water is also divided into four groups, namely:

- Group A: Water which is bacteriological very safe;
- Group B: Water which is bacteriological still suitable for human consumption;
- Group C: Water which is bacteriological risk for human consumption, which requires immediate action for rectification;
- Group D: Water, which is bacteriological unsuitable for human consumption.

TABLE 3: BACTERIOLOGICAL DETERMINANTS

DETERMINANTS	LIMITS FOR GROUPS			
	A**	B**	C	D*
Standard plate counts per 1 ml	100	1000	10000	10000
Total coliform counts per 100 ml	0	10	100	100
Faecal coliform counts per 100 ml	0	5	50	50
E. coli counts per 100 ml	0	0	10	10

* All values greater than the figure indicated.
** In 95% of the samples.

NB If the guidelines in group A are exceeded, a follow-up sample should be analysed as soon as possible.

2.3 FREQUENCY FOR BACTERIOLOGICAL ANALYSIS OF DRINKING-WATER SUPPLIES

The recommended frequency for bacteriological analysis of drinking water is given in Table 4.

TABLE 4: FREQUENCY FOR BACTERIOLOGICAL ANALYSIS

POPULATION SERVED	MINIMUM FREQUENCY OF SAMPLING
More than 100 000	Twice a week
50 000 – 100 000	Once a week
10 000 – 50 000	Once a month
Minimum analysis	Once every three months

3 GENERAL STANDARDS FOR WASTE / EFFLUENT WATER DISCHARGE INTO THE ENVIRONMENT

All applications in terms of Section 21(5) and 22(2), for compliance with the requirements of Section 21(1) and 21(2) of the Water Act (Act 54 of 1956) that purified water shall comply with the General Standard as laid out in Government Gazette Regulation R553 of 5 April 1962.

TABLE 5 GENERAL STANDARDS FOR ARTICLE 21 PERMITS (EFFLUENTS)

DETERMINANTS	MAXIMUM ALLOWABLE LEVELS
Arsenic	0,5 mg/l as As
Biological Oxygen Demand (BOD)	no value given
Boron	1,0 mg/l as B
Chemical Oxygen Demand (COD)	75 mg / l as O
Chlorine, residual	0,1 mg/l as Cl_2
Chromium, hexavalent	50 µg/l as Cr(VI)
Chromium, total	500 µg/l as Cr
Copper	1,0 mg/l as Cu
Cyanide	500 µg/l as CN
Oxygen, Dissolved (DO)	at least 75% saturation**
Detergents, Surfactants, Tensides	0,5 mg/l as MBAS – See also Note 2
Fats, Oil & Grease (FOG)	2,5 mg/l (!gravimetric method)
Fluoride	1,0 mg/l as F
Free & Saline Ammonia	10 mg/l as N
Lead	1,0 mg/l as Pb
Oxygen, Absorbed (OA)	10 mg / l as O*
pH	5,5 – 9,5
Phenolic Compounds	100 µg/l as phenol
Phosphate	1,0 mg/l as P - See also Note 1
Sodium	not more than 90 mg/l Na more than influent
Sulphide	1,0 mg/l as S
Temperature	35°C
Total Dissolved Solids (TDS)	not more than 500 mg /l more than influent
Total Suspended Solids (TSS)	25 mg/l
Typical faecal Coli.	no typical coli should be counted per 100 ml
Zinc	5,0 mg/l as Zn

* Also known as *Permanganate Value* (or *PV*).
** In Windhoek the saturation level is at approx. 9 mg/l O_2.

Note (1) on phosphate: Phospates are not toxic and essential for all life forms. Natural water will seldom contain phosphate; it is generally seen as an indicator of pollution and is usually accompanied by other pollutants. Wherever drinking water is combined with or consists wholly of reclaimed or recycled water, it may be expected to contain phosphate. There is no general guideline for phosphate contained in the Regulation 553. But generally it is assumed that eutrophication or algal bloom in dams is promoted by nutrient concentrations as low as 0,01 mg/l as P; generally a phosphate concentration limit for dams of 0,1 mg/l is recommended. All water that is consumed and subsequently discharged, will eventually end up in rivers, dams or

groundwater – that is why for potable water, a concentration level of 1 mg/l as P is aimed at.
But, again, in many cases of waste and effluent treatment, this may be difficult to achieve technically, or the required waste and effluent treatment infrastructure is not available; as the required infrastructure is sophisticated and expensive. The current situation calls for a compromise and for this reason, this Department will judge each application individually on its merits and allow, in certain cases, a phosphate concentration level of up to 15 mg/l as P in any effluent or waste stream to be discharged into the environment. This regulation is subject to be reviewed every two years, calculated from the date of approval of this document.

Note (2) on detergents, surfactants and ten sides: The MBAS (or methylene blue active substances) – test does not encompass all surface active compounds currently, commercially available. The limit given is therefore only a guideline. Many of the cleaning agents are toxic to biological life-forms in rivers and dams.
It should be taken into consideration that some commercial products interfere with the effective removal of oil, fat and grease by grease and fat traps, by breaking up such long-chain molecules into shorter ones. These cleaning agents thus effectively allow such components to pass through the traps and land into sections of a treatment plant further down the line and interfere with the process there.
Many cleaning agents contain very powerful disinfectants, and/or biocides. Such substances may interact with biological treatment processes. They may reduce the effectiveness of such treatment or 'kill' it completely, if they land in septic tanks, biofilters or even activate-sludge plants. Their activity may be attenuated by dilution.

4. AUTHORIZATION

Herewith, the Guidelines for the Evaluation of Drinking Water for Human Consumption with regard to Chemical, Physical and Bacteriological Quality, as well as the General Standards for Article 21* Permits, amended for detergents, surfactants, ten sides, as well as phosphates, are confirmed and remain in force until further notice.

Issued under my hand with the authority vested in my office, within the Ministry for Agriculture, Water and Rural Development,

PERMANENT SECRETARY
Dr V Shivute

WINDHOEK, **DATE STAMP**