

**DECEMBER 2021**

**ENVIRONMENTAL IMPACT ASSESSMENT**

**FOR THE PROPOSED CONSTRUCTION OF A DECENTRALISED WASTEWATER  
TREATMENT SYSTEM (DEWATS) AT MIX INFORMAL SETTLEMENT IN WINDHOEK,  
KHOMAS REGION, NAMIBIA**

**FINAL SCOPING REPORT**

**CLIENT:**

City of Windhoek



**COMPILED BY:**

Health and Environment Services Division  
City of Windhoek



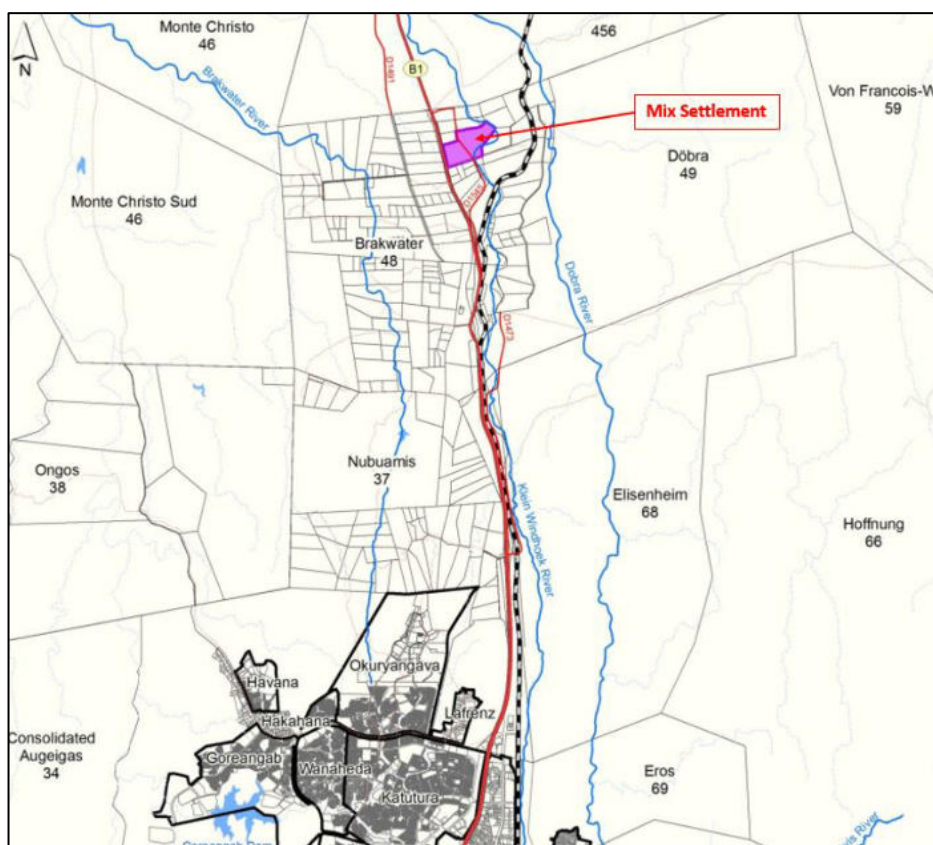
## PROJECT INFORMATION

|  |   |
|--|---|
| <b>PROPONENT:</b>                                  | City of Windhoek<br>P.O Box 59<br>Windhoek  |
| <b>PROJECT TITLE:</b>                              | Construction of a Decentralized Wastewater Treatment System (DEWATS) at Mix Informal Settlement in Windhoek, Khomas Region, Namibia   |
| <b>PROJECT TYPE:</b>                               | Environmental Impact Assessment Study   |
| <b>PROJECT LOCATION:</b>                           | Mix Informal Settlement, Windhoek, Khomas Region, Namibia   |
| <b>COMPETENT AUTHORITY:</b>                        | Office of the Environmental Commissioner<br>(Ministry of Environment and Tourism)   |
| <b>ENVIRONMENTAL ASSESSMENT PRACTITIONER (EAP)</b> | City of Windhoek (Health and Environment Services Division)<br><b>Contact person:</b> Mr. Olavi Makuti<br><b>Cell:</b> +264 811405033<br><b>E-mail:</b> <a href="mailto:Olavi.Makuti@windhoekcc.org.na">Olavi.Makuti@windhoekcc.org.na</a><br><b>Lead EAP:</b> Mr. Olavi Makuti |
| <b>DATE OF RELEASE</b>                             | 7 December 2021   |

## EXECUTIVE SUMMARY

The City of Windhoek (CoW) with financial and technical assistance from the Free Hanseatic City of Bremen from Germany, intends to develop a Decentralized Wastewater Treatment System (DEWATS) at Mix Informal Settlement.

Mix Informal Settlement is located about 20 km north of Windhoek in the Brakwater area, east of the B1 road as shown on the locality map below. There are  $\pm 700$  households at Mix Settlement with a population of  $\pm 2000$  people. The settlement is named after a German national, Heiner Mix, who allowed people to settle on his 50-hectare plot in the 1980s.



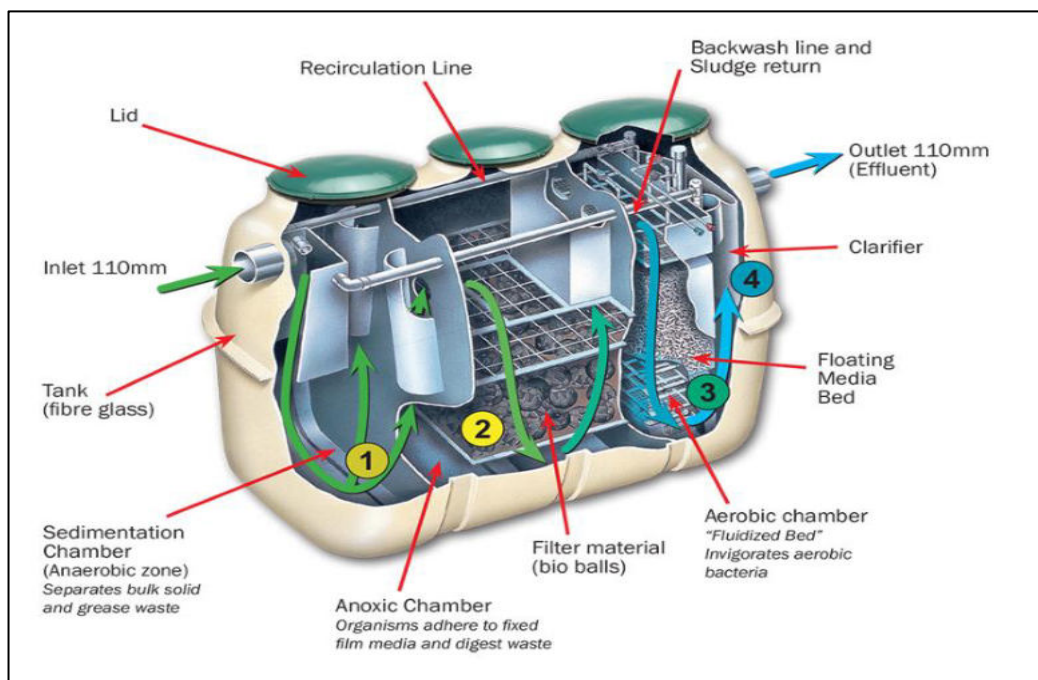
**Locality of Mix Informal Settlement**

The provision of basic sanitation in Windhoek's informal settlements was identified as a priority for the City and an area where support from the City of Bremen would be valuable. The Municipal Council of Windhoek decided to implement this pilot project at the Mix Informal Settlement as it is one of many informal settlements with no access to municipal services such as sewer.

To satisfy the requirements of Namibia's *Environmental Management Act No.7 of 2007* and to ensure environmental sustainability, the Project Team has requested the City's Health and Environment Services Division to conduct this Environmental Impact Assessment (EIA) of the proposed DEWATS Plant at Mix Informal Settlement and apply for Environmental Clearance.

The wastewater treatment plant identified for this project is the Clarus Fusion. This plant is a complete factory built unit requiring less time for on-site installation. The modular design of the plant enable residents and communities to adjust the treatment and run parallel modules to increase treatment capacity. The system is available in a variety of treatment capacities from 1,500 l/d to 15,000 l/d. The reactor selected for the Mix Settlement has the capacity of 15000 liters per day.

The system is a smaller version of traditional municipal biological treatment plant with a three stage activated sludge process for COD reduction as well as nutrient removal. It consist of a primary treatment (sedimentation tank), COD and nutrient (anoxic and aerobic stages), solids removal (secondary settling), UV-disinfection and desludging. The final effluent can be disposed of in the environment or used for Irrigation depending on the effluent quality.



### Wastewater Treatment Process Flow Diagram

The site where the plant will be located is disturbed and is void of any natural vegetation except a few alien species (*Prosopis* species) that lines the nearby Klein Windhoek River banks. Residents of Mix Informal Settlement have informally inhabited and cleared the area and the City of Windhoek is in the process of relocating the affected residents.

Rainfall in Windhoek follows the national trend and occurs mainly between November and April, but is described as unpredictable, sporadic and of high intensity. The mean annual rainfall is in the order of 350 to 400 mm per annum with an average evaporation in the region of 3400 mm per annum. The average daily maximum temperature in summer in Windhoek is approximately 32°C (December) and the minimum 4°C in winter (July).

The study area is underlain by biotite schist of the Kuiseb Formation, characteristic of the southern zone of the Damara Sequence. Biotite schist is a moderately coarse-grained foliated crystalline rock with monoclinic biotite minerals. Windhoek generally has poorly

developed thin topsoil that is the product of alluvial and colluvial deposition of mainly fine sands and silts intermixed with residual quartz pebbles. River alluvium along ephemeral river (Klein Windhoek River that runs near the project site) courses and valleys comprising sand, gravel and stones form the thickest soils.

Mix Informal Settlement habitat is classified as Khomas Hochland Brokenveld with rolling to steep hills. This habitat can be further be divided into Rocky Outcrops, Side slopes (*Acacia erubescens* savannah), Klein Windhoek River and Windhoek Valley habitats. Natural biodiversity in these habitats has been largely disturbed by anthropogenic activities and the proliferation of alien invasive species.

The significance of all the impacts identified and assessed for this project can be effectively mitigated through the implementation of mitigation measures recommended in the Environmental Management Plan (EMP). No impacts with a “*high*” significance rating are expected on this project. The few impacts that were rated “*medium*” before mitigation for both the construction and operational phase of the plant can be successfully reduced to “*low*” with the implementation of the recommended mitigation measures.

#### **Impacts with a “medium” rating and their source.**

| IMPACT                                  | SOURCE  |
|---|---|
| <b>Noise</b>                            | Noise emanating from construction vehicles and equipment such as drills, compactors and other machineries.  |
| <b>Pollution</b>                        | Various pollutants associated with construction activities such as chemical pollution from oil spills resulting from the handling of various machineries used during construction, building rubble and empty bags and containers. |
| <b>Dust</b>                             | Loosening of the substrate, excavation work and movements of construction vehicles.   |
| <b>Relocation of affected residents</b> | Affected residents are relocated to another area to make way for the proposed DEWATS Plant.   |



|  |   |
|--|---|
| <b>Pollution from effluent discharged from the plant</b> | If the effluent discharged from the plant does not meet the Namibian Effluent Discharge Standards, it may result in pollution of the environment. |
|--|---|

This study concludes that the proposed development of the DEWATS Plant at Mix Informal Settlement will not cause any irreversible threats to the biophysical and socio-economic environment of the area. The social and environmental benefits to be derived from this investment will far out-weigh the few impacts identified.

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## 1. INTRODUCTION

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### 1.1 BACKGROUND

The City of Windhoek (CoW) and the Free Hanseatic City of Bremen enjoy fraternal relations under a cooperation agreement signed in 2000. In October 2017, provision of basic sanitation in Windhoek's informal settlements was identified as a priority for the City and an area where support from the City of Bremen would be valuable. A Joint Technical Team made up of representatives of the two cities put together a proposal to access funding for the construction, initial operation and knowledge transfer relating to the operation and maintenance of a Decentralized Wastewater Treatment System (DEWATS). The proposal was approved in December 2018, to implement a pilot project and thereafter approval to accept a non-repayable grant of 143,200 Euros (equivalent to approximately N\$ 2 million at the time) was granted in April 2019. The ultimate goal of the project was for a DEWATS to be constructed and be operational by the end of 2020, with the necessary knowledge exchange completed so that the responsible municipal authorities can acquire the skills to operate and maintain the DEWATS, with little to no external support.

The Municipal Council of Windhoek decided to implement this pilot project at the Mix Informal Settlement. Mix is one of Windhoek's many informal settlements with no access to municipal services such as sewer. The City has commenced with the process of formalizing Mix Informal Settlement (layout plans has been developed and approved already). However, it will be difficult to connect this settlement to the City's sewer network due to its geomorphology (drainage is northwards while the City's treatment plant is south of the settlement). It is against this background that the Council feels that a decentralized system is appropriate for this settlement.

To satisfy the requirements of Namibia's *Environmental Management Act No.7 of 2007* and to ensure environmental sustainability, the Project Team has requested the

City's Health and Environment Services Division to conduct this Environmental Impact Assessment (EIA) of the proposed DEWATS Plant at Mix Informal Settlement and apply for Environmental Clearance.

## **1.2 NEED AND DESIRABILITY**

According to Weber & Mendelsohn, 2017, the percentage of urban residents without toilets almost doubled from 13% in 1991 to 24% in the 2011. There are various environmental and public health risks associated with poor sanitation in urban areas. Many communicable diseases such as hepatitis E spread faster in areas with poor sanitation provisions. Lack of toilet facilities also expose residents of informal settlements to crime when obliged to use the bush at night.

As a result, the City of Windhoek through the years have implemented various projects to construct communal toilets in the informal settlements. However, most of these toilets are out of order and not utilized by the residents. Problems related to maintenance responsibilities shared among users are often the cause of their dilapidated and dysfunctional state.

To solve the above issues, the City of Windhoek is prioritizing the installation of individual toilets for each household to promote the sense of ownership and improve maintenance and care of such toilets. Due to environmental concerns, the use of long drop toilets is discouraged due to potential pollution of underground water resources. The best option is to install waterborne toilet for each household.

Household wastewater in Windhoek drains to the Gammams Wastewater Treatment Plant located south of the Mix Settlement via gravity. However, most informal settlements on the northern outskirts of the city can only be connected to the Gammams plant by investing in expensive sewer lift pump stations as the area drain northwards.

It is against this background that the City of Windhoek is considering decentralized treatment solutions for these areas. Mix Settlement was selected for this pilot project, as it is one of the informal settlements that is located outside the boundaries of the City of Windhoek's sewer network.

### **1.3 TERMS OF REFERENCE**

The proponent required the Environmental Assessment Practitioner to carry out this study as per the requirements of the *Environmental Management Act No.7 of 2007* and the *Environmental Assessment Regulations* (February 2012).

The EIA process will investigate if there are any potential significant biophysical and socio-economic impacts associated with the intended construction and operation of the wastewater treatment plant. Public participation is the cornerstone of the EIA process as this is the stage where Interested and Affected Parties (I&APs) are considered and involved in the decision making process. The EIA process would therefore provide the I&APs an opportunity to raise issues of concern and suggestions for enhanced benefits as provided for in the EMA and Environmental Assessment Regulations.

### **1.4 ENVIRONMENTAL ASSESSMENT PRACTITIONERS (EAPs)**

- **Olavi Makuti (Lead Assessment Practitioner)**

Mr. Makuti's main area of expertise includes Urban Environmental Management, Biodiversity Conservation, Strategic Environmental Assessments (SEA), Environmental Impact Assessments (EIA), and Environmental Management Systems (EMS). Olavi has 18 years' experience in the field of environmental management and has a Master's Degree in Environmental Management (University of the Free State, South Africa), B.Tech Degree in Natural Resources

Management (Polytechnic of Namibia) and National Diploma in Nature Conservation (Polytechnic of Namibia). He has also done the MDP (Management Development Program) with the University of Stellenbosch and other short courses. He has successfully completed more than 15 EIAs as a Lead Environmental Assessment Practitioner. His CV is attached for further information on his educational qualifications and experience.

- **Lorraine !Gaoses (Hydrogeology and DEWATS Assessment)**

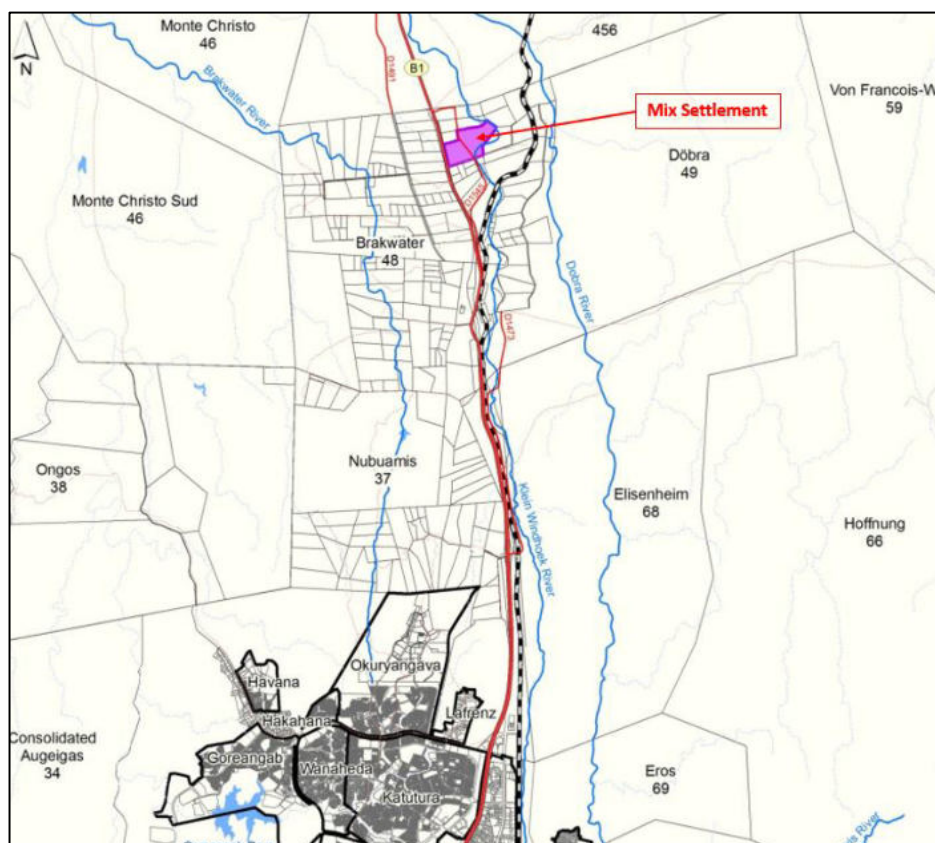
Ms. !Gaoses has over 20 years of experience in implementing solutions to industrial effluents and wastewater problems. She has an MBA (University of South Wales) and Masters in Development Finance from the University of Stellenbosch with a focus on Environmental Finance. Her junior degree is Honors in Chemistry from the University of KwaZulu-Natal (UKZN) and a subsequent Graduate Diploma in Civil Engineering (Environmental Engineering) from the University of Witwatersrand (WITS). She is a trained environmental management systems lead auditor. Ms. !Gaoses has worked on more than four EIAs in her private capacity and has provided input on several feasibility studies on social economic impacts. She has attended several training on environmental management, hazardous waste management and have completed an MDP with the University of Witwatersrand. Her CV is attached for further information on her qualifications and experience.



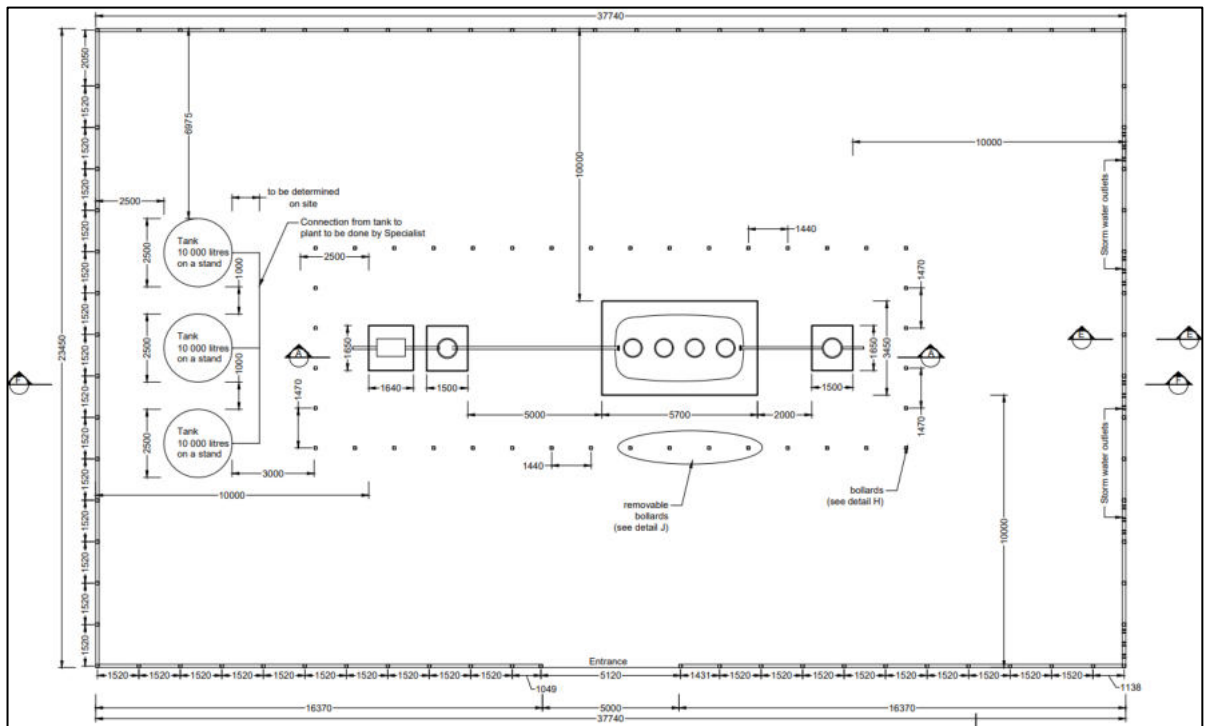
## 2. DESCRIPTION OF THE PROPOSED PROJECT

### 2.1 LOCATION

The project will take place at the Mix Informal Settlement north of the Windhoek. The settlement is located about 20 km north of Windhoek in the Brakwater area, east of the B1 road. Please refer to below locality map of Mix Settlement (Figure 1). The Mix Informal Settlement developed spontaneously on Portions of Farm Emmarentia No.380. Mix Informal Settlement is part of the greater Brakwater area. It is by far the largest with  $\pm 700$  households. Approximately  $\pm 2000$  people inhabit it. The settlement is named after a German national, Heiner Mix, who allowed people to settle on his 50-hectare plot in the 1980s.



**Figure 1:** Location of Mix Informal Settlement.



**Figure 2:** Layout plan of the site

The site where the plant will be located is disturbed and is void of any natural vegetation except a few alien species (*Prosopis* species) that lines the nearby river banks as depicted on picture 1 below. Residents of Mix Settlement have informally inhabited the area and the City of Windhoek is in the process of relocating the affected residents.



**Picture 1:** Part of the site for the DEWATS Plant

## **2.2 PROJECT ALTERNATIVES**

### **2.2.1 Conventional Treatment**

This option involves a centralized treatment system such the Gammams Wastewater Treatment Plant used in Windhoek. Now the Gammams Plant receives all domestic wastewater in Windhoek for treatment before the effluent is send to the WINGOC Water Reclamation Plant and the access released into the environment.

Although this option can effectively treat large volumes of wastewater at a high rate, it will be too costly for the City of Windhoek to finance such a plant in an area like Mix Settlement that is far from the sewer network. The capital cost, operating, and maintenance cost for a centralized system is significant. A centralized plant also requires a large area to accommodation all the infrastructure that is not available at Mix Settlement. It is against the above reasons why this option was not considered for the Mix Settlement.

### 2.2.2 Decentralized Treatment System

This appears to be the logical solution for areas such Mix Settlement that cannot be connected to the centralized system. Mix Settlement cannot be connected to the Gammams Plant because it is located far from the centralized plant and it drains in the opposite direction.

The Decentralized Wastewater Treatment Systems (DEWATS) are gaining popularity around the world for the following reasons:

- **Decentralization:** DEWATS serves as a solution for areas that are unable to be connected to a conventional sewer network, due to either financial limitations, topographical challenges, lack of density or the rapid growth of unplanned settlements. The DEWATS is not a single technology and is instead based on a set of treatment modules that have been identified for their reliability, longevity, and tolerance to inflow fluctuations. This makes them suitable for diverse local conditions and versatile in application, whilst requiring only moderate investment costs and short planning and implementation timelines.
- **Simplicity:** Simplicity is achieved through on-site treatment without chemicals or energy requirement, and by low maintenance requirements. The lack of energy requirements means that the DEWATS offers permanent and continuous operation, and the treatment modules do not require sophisticated control and maintenance.
- **Reuse of treatment products:** DEWATS provides treatment for wastewater flows from domestic or industrial sources with close BOD/COD ratios and can be adapted for flows from 1m<sup>3</sup> to 1000 m<sup>3</sup> per unit per day. Appropriate modules can be selected depending on the treatment efficiency required and can reduce pollution load to fit local regulations so that treated water can be

discharged or reused in agriculture as suits the environment of a given location. The sludge can be used in agriculture as a fertilizer/compost. In addition, DEWATS can provide a renewable energy source in the form of biogas.

This alternative was found to be cost effective over other available treatment methods. It also requires a smaller area. This is the preferred alternative, as it will address the social and environmental challenges faced by the Mix community in a cost and environmental effective manner.

### **2.2.3 The No Action Alternative**

This alternative implies that the status quo is maintained. This will mean that the current worsening poor sanitation conditions will persist. This alternative is not acceptable on either the social or the environmental grounds. This is the least preferred option as the cost far outweigh the benefit to be accrued.

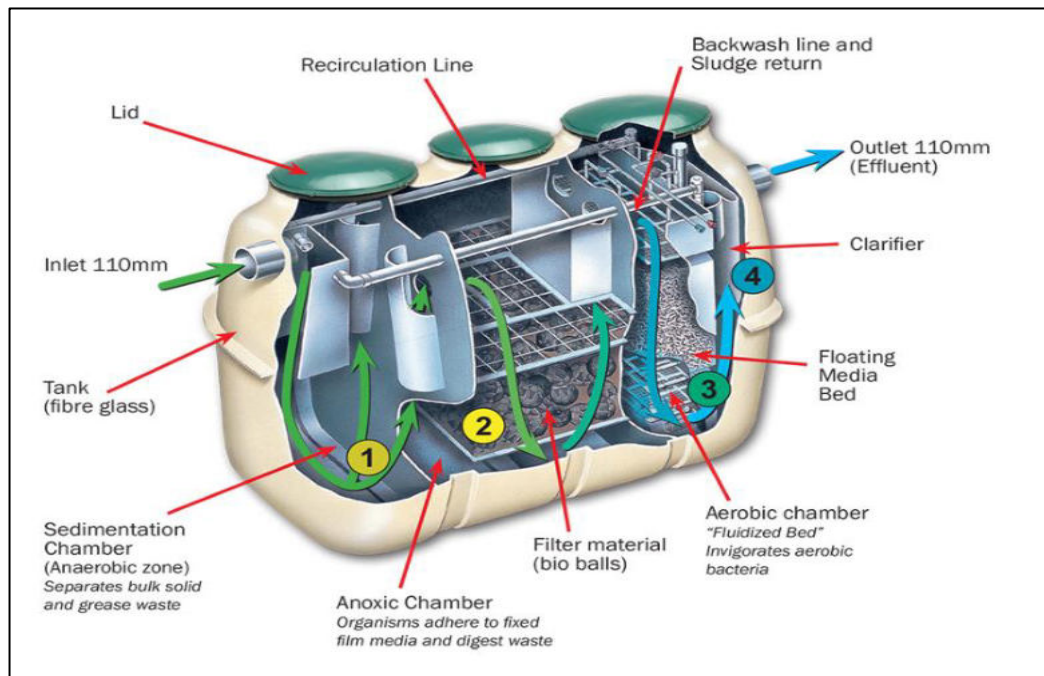
## **2.3 TREATMENT PLANT DESIGN**

The wastewater treatment plant identified for this project is the Clarus Fusion. This plant is a complete factory built unit requiring less time for on-site installation. The modular design of the plant enable residents and communities to adjust the treatment and run parallel modules to increase treatment capacity. The system is available in a variety of treatment capacities from 1,500 l/d to 15,000 l/d. The reactor selected for the Mix Settlement has the capacity of 15000 liters per day.

### **2.3.1 Process Description**

The system is a smaller version of traditional municipal biological treatment plant with a three stage activated sludge process for COD reduction as well as nutrient

removal. It consist of a primary treatment (sedimentation tank), COD and nutrient (anoxic and aerobic stages), solids removal (secondary settling), UV-disinfection and desludging. The final effluent can be disposed of in the environment or used for Irrigation depending on the effluent quality.



**Figure 3:** Wastewater Treatment Process Flow Diagram

### 2.3.2 Detailed Treatment Process

To ensure the protection of the wastewater treatment processes, the plant will be fitted with a screen to remove coarse materials such as rags, papers, sticks and other large debris. This is followed by a balancing sump that will act as a feeder to the bioreactor.

**The processes depicted in Figure 3 above are further described in detail below.**

#### 1. Sedimentation Chamber

The first chamber is designed to physically separate solids (sludge) and fat/grease (scum) from the incoming wastewater.

## **2. Anaerobic Chamber**

The second chamber contains a spherical-skeleton type of filter media of 109mm in diameter. Through fixed film processes on the surface of the filter media, biological anaerobic treatment thrives while suspended solids are captured. Furthermore, the microorganisms in this chamber convert nitrates in the recirculated water returning from the aerobic chamber to gaseous nitrogen. The nitrogen then escapes to the atmosphere.

## **3. Aerobic Filter Media Chamber**

The aerobic floating and circulating filter media chamber consists of an aeration upper section and a filter media lower section. The chamber is filled with hollow, cylindrical filter media of 15mm in diameter and 14mm long). Biological treatment takes place on the fixed film growth on the filter media surface. Aeration is continuous and is achieved through a small linear aeration pump, which moves air into this chamber for aeration as well as for backwash purposes. The aeration pump is the only moving part within the system.

The filter media circulating in this section capture residual suspended solids it is backwashed twice a day for 5 or 10 minutes cycle by the backwash system located at the bottom of the chamber. An airlift pump transfers the backwashed water back into the sedimentation chamber for further digestion.

## **4. Treated Water Storage Chamber**

During normal operation, a recirculation line transfers a portion of the treated water back into the sedimentation chamber by way of an airlift pump. This chamber is designed to temporarily store treated water coming out of the aerobic



filter media chamber. The treated water in the storage chamber is ready for discharge.

### **5. Desludging**

Sludge is expected to settle in all the chambers except in the aeration chamber, as the accumulated sludge is air lifted back into the sedimentation chamber for further digestion. A sludge (settled) accumulation of more than 46cm in the aerobic chamber requires pumping, whereas the sedimentation chamber requires pumping at an accumulation of more than 94cm. The sludge in the aerobic as well as the sedimentation chamber is typically brown indicating undigested sludge and gradually becomes darker with digestion.

### **6. Disinfection**

The treatment plant comes standard with a ultraviolet (UV) disinfection chamber, however chlorine can be used as an alternative.

### **7. Polishing**

The final effluent will be stored in a 10000L tank, where it will go through a polishing step before it is discharged into the River.

**Please note that the detailed engineering drawings of the proposed plant and specifications are attached to this report as Appendix F.**

#### **2.3.3 Effluent Quality**

To ensure optimal effluent quality, the operational parameters of the treatment plant are analyzed on a six-month basis during maintenance. The effluent quality complies with the *Water Quality Special Standard for Effluent* (Namibia National Effluent Standards as per Regional Effluent Standard: R553 of 15 April 1962 and amendments (Water Act, Act 54 of 1956) as stipulated in the Department of Water Affairs and

Forestry Code of Practice (Volume 6), as it will be discharged directly into the Klein Windhoek River.

## 2.4 ASSOCIATED INFRASTRUCTURE AND SERVICES

- **Water & Electricity Supply**

Electricity will be installed at the plant although the plant will operate with minimum power requirements. The plant will be connected to the municipal water network.

- **Refuse and Waste Management**

- **Construction Phase:**

The waste to be generated from construction activities will be stored in skip containers. Once the containers are full, they will be transported to the Kupferberg Landfill Site. Construction workers will also be encouraged to refrain from littering. Hazardous waste generated from construction activities such as used oil and paint containers will be stored in specialized containers and thereafter disposed of responsibly at the Hazardous Waste Cell at Kupferberg.

- **Operational Phase:**

During the operations of the treatment plant, the main waste stream will be the effluent that will be discharged from the plant. The effluent will be discharged in compliance with the conditions of the Domestic and Industrial Wastewater Purification and Effluent Disposal Exemption Permit that was issued by the Ministry of Agriculture, Water and Land Reform.

- **Accessibility**

The existing gravel road that runs through the Mix Informal Settlement will be used to access the project site. The road is currently in a poor state of maintenance but it can still accommodate the vehicles that will bring material to the site during construction and facilitate access to the site during the operational phase. With the formalization of the settlement, all infrastructure including roads will be improved as per the approved layout plan of the formal township.

## **2.5 EFFLUENT DISCHARGE PERMIT**

The Ministry of Agriculture, Water and Land Reform has issued the Windhoek Municipality with a Domestic and Industrial Wastewater Purification and Effluent Disposal Exemption Permit on **29 April 2021**, which is valid for a period of five years (it will expire on 29 May 2026).

The permit was issued in terms of Section 21 (5) and 22 (2) of the Water Act 54 of 1956 as Amended Water Act 22 of 1985, exempting the Windhoek Municipality from compliance with the provision of Section 21 (1) and 21 (2) of the Water Act, in order that domestic and industrial wastewater be treated and disposed as conditions attached to this permit (Permit is attached as **Appendix G**).

This permit and attached conditions will regulate the operations of the proposed Mix Settlement DEWATS plant.

## 2.6 RELOCATION OF AFFECTED RESIDENTS

The City of Windhoek has developed township layout for the formalization of the Mix Settlement. The relevant authorities have approved the township layout. The proposed DEWATS plant site is on an erf zoned Municipal. Forty-eight (48) residents occupy the erf. Various meetings were held with the affected residents to inform them about the need to be relocated to make way for the proposed plant. The city has identified an area in the Mix Settlement that is zoned for residential purposes where the affected residents will be moved. By November 17, 2021 when the public meeting was held, it was indicated by the responsible officials that 42 out of the 48 affected residents have been assisted by the City to relocate. The remaining six residents have also indicated their willingness to move in the coming week or two.



**Picture 2:** Debris at the vacated site

### 3. LEGAL REQUIREMENTS

This section provides an analysis of the policies and legislations that are relevant to the proposed construction of the decentralized wastewater treatment plant at Mix Informal Settlement. This section aims to inform the proponent about the requirements to be fulfilled in undertaking the proposed project.

The table below lists the various environmental and developmental policies and legislations that have relevance to the project.

**Table 1:** Legal framework of the project.

| LEGISLATION   | PROVISION   | REGULATORY AUTHORITY   | APPLICATION TO THE PROJECT   |
|---|---|--|--|
| <b>The Constitution of the Republic of Namibia</b>                          | Article 91 (c) and 95 (i) which commit the state to actively promote and maintain environmental welfare of all Namibians by promoting sustainable development | Government of the Republic of Namibia  | The project should not pose a threat to the natural and human environment. |
| <b>Environmental Management Act No.7 of 2007 and EIA Regulations (2012)</b> | Provides a list of listed activities that may not be undertaken without environmental clearance   | Ministry of Environment, Forestry and Tourism (Office of the Environmental Commissioner) | An Environmental Clearance will be required before project Commences.      |
| <b>Water Act 54 of 1956</b>   | Control of disposal of sewage, the purification of effluent, the prevention of surface and groundwater pollution, and the sustainable use of water resources. | Ministry of Agriculture, Water and Forestry (Department of Water Affairs)                | The wastewater treatment plant must adhere to the provisions of this Act.  |

|   |  |   |  |
|---|--|---|--|
| <b>The Water Resources Act 24 of 2004</b>                       | Control of disposal of sewage, the purification of effluent, the prevention of surface and groundwater pollution, and the sustainable use of water resources.  | Ministry of Agriculture, Water and Forestry (Department of Water Affairs) | Ministry of Agriculture, Water and Land Reform should be consulted before the wastewater treatment facility is installed.                        |
| <b>Forestry Act No 27 of 2004</b>                               | The Act affords protection to certain indigenous plant species.  | Ministry of Environment, Forestry and Tourism (Directorate of Forestry)   | A permit is required before any protected plants are removed.  |
| <b>Nature Conservation Ordinance no. 4 of 1975</b>              | Chapter 6 provides for legislation regarding the protection of indigenous plants   | Ministry of Environment, Forestry and Tourism                             | Indigenous and protected plants have to be managed within the legal confines.  |
| <b>Soil Conservation Act No 76 of 1969</b>                      | Combating and prevention of soil erosion, the conservation, improvement and manner of use of the soil and vegetation and the protection of the water sources   | Ministry of Agriculture, Water and Land Reform                            | The proponent should ensure that soil erosion and soil pollution is avoided during construction and operation of the wastewater treatment plant. |
| <b>Atmospheric Pollution Prevention Ordinance No 45 of 1965</b> | Part II - control of noxious or offensive gases, Part III - atmospheric pollution by smoke, Part IV - dust control, and Part V - air pollution by fumes emitted by vehicles.                             | Ministry of Health and Social Services                                    | The development should consider the provisions outlined in the ordinance.  |
| <b>Hazardous Substance Ordinance 14 of 1974</b>                 | To provide for the control of substances which may cause injury or ill-health to or death of human beings by reason of their toxic, corrosive, irritant, strongly sensitizing or flammable nature or the | Ministry of Health and Social Services                                    | The handling, usage and storage of hazardous substances on site should be carefully controlled according to this Ordinance.                      |

|  |   |  |  |
|--|---|--|--|
|  | generation of pressure thereby in certain circumstances; to provide for the division of such substances into groups in relation to the degree of danger; to provide for the prohibition and control of the importation, manufacture, sale, use, operation, application, modification, disposal or dumping of such substances; and to provide for matters connected therewith. |  |  |
| <b>Local Authorities Act No. 23 of 1992</b>        | The Local Authorities Act prescribes the manner in which a town or municipality should be managed by the Town or Municipal Council.   | Ministry of Urban and Rural Development                          | The development has to comply with provisions of the Local Authorities Act.  |
| <b>The Labour Act of 1992</b>                      | Employees are subject to the terms of the Labour Act. The act also contains the Health and Safety Regulations.  | Ministry of Labour, Industrial Relation and Employment Creation. | Given the employment opportunities presented by the construction of the plant infrastructure, compliance with the labour law is essential. |
| <b>Public and Environmental Health Act of 2015</b> | This Act (GG 5740) provides a framework for a structured uniform public and environmental health system in Namibia. It covers notification, prevention and control of diseases and sexually transmitted infections; water and food supplies; waste management; health nuisances; public and environmental health planning and reporting. It repeals the                       | Ministry of Health and Social Services                           | Contractors and users of the proposed plant are to comply with these legal requirements.   |



|  |   |                                      |   |
|--|---|--------------------------------------|---|
|  | Public Health Act 36 of 1919<br>(SA GG 979)   |                                      |   |
| <b>National Heritage Act, 2004 (Act N0.27 of 2004)</b>   | This Act calls for the protection, conservation and registration of places and objects of heritage significance.                            | National Heritage Council of Namibia | Even though the scoping exercise did not discover any archaeological material on the site, should there be any such discovery (e.g. graves) the National Heritage Council should be informed immediately.   |
| <b>Atmospheric Pollution Prevention Ordinance (1976)</b> | This Ordinance generally provides for the prevention of the pollution of the atmosphere. Part IV of this ordinance deals with dust control. | Ministry of Environment and Tourism. | This Ordinance requires that any person carrying out industrial activities which is liable to cause a nuisance to persons residing in the vicinity or to cause dust pollution to the atmosphere, shall adopt the best practicable means to prevent such dust from becoming dispersed and causing a nuisance. Activities at the lodge construction site such as excavation and land clearing need to properly controlled to ensure dust is not a nuisance. |

## 4. DESCRIPTION OF THE RECEIVING ENVIRONMENT

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### 4.1 CLIMATE

Rainfall in Windhoek follows the national trend and occurs mainly between November and April, but is described as unpredictable, sporadic and of high intensity. The mean annual rainfall is in the order of 350 to 400 mm per annum with an average evaporation in the region of 3400 mm per annum. The average daily maximum temperature in summer in Windhoek is approximately 32°C (December) and the minimum 4°C in winter (July).

Wind in Windhoek is common throughout the year and is highly variable. Prevailing winds are generally from a southeasterly direction. (Mendelsohn, *et al* 2002).

### 4.2 GEOLOGY AND SOILS

According to the Windhoek Environmental Structure Plan, the study area is underlain by biotite schist of the Kuiseb Formation, characteristic of the southern zone of the Damara Sequence. Biotite schist is a moderately coarse-grained foliated crystalline rock with monoclinic biotite minerals (Africon, 2004).

The biotite schist is intersected by a north-south running band of sand calcrete gravel and alluvium, especially along rivers and defined drainage lines. Sand calcrete gravel is an unconsolidated surficial deposit consisting of sand and calcrete and acts as an infiltration medium for surface water. It is highly permeable and the presence of calcrete indicates seasonal perched water. Alluvium, on the other hand, is a general term used to describe transported material such as riverine deposits (Africon, 2004).

Windhoek generally has poorly developed thin topsoil that is the product of alluvial and colluvial deposition of mainly fine sands and silts intermixed with residual quartz pebbles. River alluvium along ephemeral river (such as the Klein Windhoek River that runs near the project site) courses and valleys comprising sand, gravel and stones form the thickest soils (Africon, 2004).

### **4.3 HYDROGEOLOGY**

The Mix Informal Settlement is located on the banks of the Klein Windhoek River. This is an ephemeral river and only flow when there is runoff in the catchment area. There is however sometimes small streams of water in the river even during the dry season. This is because of effluent discharge from the Ujams Wastewater Treatment Plant located upstream. The ground and surface water in the area flows northwards. According to Urban Green, 2013, the water level in the area is very shallow (2-5 m) due to the presence of a shallow alluvium and weathered bedrock aquifer. The Klein Windhoek River is the source of recharge for both shallow and deeper aquifers.

The Klein Windhoek River forms part of the Swakop River catchment. Pollution from the Mix Informal Settlement (mainly due to poor sanitation) and the effluent from the Ujams Wastewater Treatment Plant poses a major threat to water quality in the area.

### **4.4 HABITATS AND ASSOCIATED BIODIVERSITY**

According to the Windhoek Environmental Structure Plan, the Mix Informal Settlement habitat is classified as Khomas Hochland Brokenveld with rolling to steep hills. According to Urban Green, 2013, the area can further be divided into four distinct habitats that are discussed below.

- **Rocky Outcrops**

The outcrops are an important refuge for biodiversity in an urbanized landscape. Rocky outcrops may have a direct effect on temperature/radiation, surface airflow and humidity and soil type. These rocky outcrops serves as areas where water collects that drains to the east and north of the settlement. Rocky outcrops also contributes to the aesthetic quality of the area.

- **Side slopes (*Acacia erubescens* savannah)**

These are the side terrains of the ridgelines declining towards the valley bottoms. Although side slopes are often developable, the gradients might vary significantly and it's more costly to construct on the side slopes compared to the lower slope ranges. Any developments in this habitat will render the slope unstable and this will in turn result in soil erosion and increased surface runoff. Vegetation on the side slopes is dominated by *Acacia erubescens*.

- **Klein Windhoek River**

The Klein Windhoek River habitat comprises of the riverine vegetation and associated dry riverbed and floodplains and smaller drainage lines. Typically the structure is a closed thicket (about 50 to 75 % cover) dominated by the woody species *Acacia karroo* (sweetthorn) and the associated species *Ziziphus mucronata* (buffalo thorn), *Rhus lancea* (Karee) and *Acacia hebeclada* subsp. *hebeclada* (candle-pod acacia). Typical herbaceous species are the grasses *Setaria verticillata*, *Eragrostis echionchloidea*, *E. rotifer* as well as various other annual herbs. Also occurring widespread within this vegetation type are the (naturalised) exotic herbs *Tagetes minuta*, *Bidens pilosa*, *Datura inoxica*, *D. ferox*, *D. strumaria*, *Achyranthes aspera* var. *sicula*, *Argemone ochroleuca* and

*Pupalia lapaceae*. Typical for the sandbanks in the dry riverbeds are *Stipagrostis namaquensis* (Africon, 2004).

The riverine vegetation provides stability and protects the riverbanks from erosion. The riverbanks on the other hand protect the alluvial plains and lowlands adjacent to the river from erosion.

Various exotic plant species such as *Prosopis* spp. (mesquite trees) and *Nicotiana glauca* (blue tobacco) are threats to the local biodiversity in this area. This habitat is disturbed at the Mix Informal Settlement due to tree cutting, deforestation, sand mining and pollution.



**Picture 3:** Klein Windhoek River near the project site

- **Windhoek Valley**

This habitat comprise of the lowlands and the alluvial plains and forms the lowest part of the landscape. The alluvial plains of the Windhoek basin support *Acacia erioloba* woodland and a high diversity of herbaceous and geophytic vegetation. The low, undulating lands along the river system are dominated by *Acacia mellifera* (black thorn) shrubland.

At the Mix Informal Settlement, this habitat is in a degraded state due to various anthropogenic activities and the proliferation of alien invasive species. This is also the preferred habitat for the construction of informal structures due to the favorable slope conditions.

#### **4.5 SOCIO-ECONOMIC SETTING**

The Namibian population is fast moving from a rural-based population to an urban-based one. This is resulting in the rapid proliferation of informal settlements in most major urban centers of the country (Weber & Mendelsohn, 2017). Thus far, it is conservatively estimated that about 51.04% of Namibia's population lives in cities and urban areas, and about 48.96% lives in rural areas. This is a significant increase in the urban population since 2009 when 40.6% of the population was urban.

Informal settlements experience most of the growth in urban areas. According to Weber & Mendelsohn, 2017, the number of urban shacks grew each year by 11.2% between 1991 and 2001, and by 10.1% between 2001 and 2011. Urban formal housing only grew by 3.7% each between 1991 and 2001, and by 4.4% from 2001 to 2011.

The driving factor for the high rural to urban migration includes amongst others the quest for jobs and money, rural poverty and education. When they arrive in cities,

many people settle in informal settlements as cannot afford the high prices of accommodation in cities. Informal structures are mainly constructed with corrugated iron and lack basic municipal services such as water and electricity.

The Mix Informal Settlement is one of Windhoek's many informal settlements. It has  $\pm 700$  households with a population of approximately  $\pm 2000$  people. Access to safe sanitation, which includes waterborne sanitation, chemical toilets and ventilated pit latrines, is a recognized indicator of development and well-being. The increasing trend of residents having to rely on the bush for their ablutionary measures is an issue of concern. No proper sanitation exists at Mix Informal Settlement, although a few dry toilets facilities have been erected. This constitutes a serious health risks to the residents and can potentially pollute the surrounding environs.

In a survey conducted in 2008, 47% of household heads in Mix Informal Settlement did earn an income and this number increased to about 62% in the subsequent survey carried out in 2010. Inhabitants also supplemented their income by operating shebeens and cuca shops (Urban Green, 2013).

#### **4.6 ARCHAEOLOGY**

The scoping exercise did not discover any archaeological material on the site of the treatment plant, should there be any such discovery during the course of the construction phase, the National Heritage Council of Namibia should be informed immediately and all construction activities must be halted. The National Heritage Council will assess the discovery and based on the findings of their assessment they will advise on the way forward.

## 5. PUBLIC CONSULTATION

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### 5.1 OBJECTIVES OF PUBLIC CONSULTATION

Public participation is the cornerstone of the EIA process as this is the stage where Interested and Affected Parties are considered and involved in the decision making process. Its key objective is to assist stakeholders to raise issues of concern and suggestions for enhanced benefits, and to comment on the findings of the EIA. *Namibia's Environmental Management Act No.7 of 2007* and its regulations require that the Interested and Affected Parties be adequately consulted during the EIA process.

### 5.2 PUBLIC PARTICIPATION DURING THE SCOPING PHASE

Interested and Affected Parties (I&APs) during the scoping exercise were given an opportunity to get background information on the proposed development and raise their concerns through newspaper advertisements that called for stakeholders to register as I&AP. Information on the project was provided to Interested and Affected Parties upon request.

*Information to I&APs regarding the proposed development of a decentralized wastewater treatment plant was disseminated through the following means:*

- **Newspaper Notices**

Newspaper notices were placed in two daily newspapers (*New Era and Namibia Sun*). The notices were placed once a week for two weeks as required by the EIA Regulations. The newspaper notices of the environmental clearance application for the proposed construction of wastewater treatment



plant are attached as **Appendix E**. The newspaper notices stated that an application for an Environmental Clearance is to be submitted to the Environmental Commissioner, provided information on the nature of the activity and location, invited I&AP to register as such and provided contact details where further information on the application or activity can be obtained.

- **Background Information Document (BID)**

A BID was prepared for the proposed project (**Appendix D**). The BID was intended to provide information about the EIA being undertaken for the proposed construction of a wastewater treatment plant and provided: an overview of the project; a description of the manner in which the EIA was undertaken, an indication of how Interested and Affected Parties (I&AP) may become involved in the EIA process; and provided contact details of the person to whom I&APs may submit their comments. The BID was circulated to all that registered as I&AP.

- **Public Meeting**

A public meeting was held on November 17, 2021, at the Mix Informal Settlement. About 96 people (those who completed the attendance register) attended the meeting and this number could be much higher if the attendees who did not complete the attendance register are considered.

The public meeting generally agreed that the proposed project would fill the gap of lack of sound sanitation system in the Mix Informal Settlement and other informal settlements in Windhoek. The table below provides a summary of the main issues that came out of the meeting.

**Table 2: Issues raised at the public meeting**

| ISSUES RAISED  | RESPONSE FROM CITY OFFICIALS  |
|--|---|
| <p><b><u>Relocation of affected residents:</u></b></p> <ul style="list-style-type: none"> <li>- Were the affected people consulted before the relocation?</li> <li>- There are sites at Mix Settlement that are open, why can't the City build the plant there instead of moving people?</li> <li>- The area where people are relocated is not fit for human habitation (toilets not constructed) and earthworks (levelling) has not been done properly.</li> <li>- The community is concerned that the affected residents were only given a 30-day notice to relocate.</li> </ul> | <ul style="list-style-type: none"> <li>- The City's Human Settlement Division organized various meetings with the affected residents. Consensus was reached regarding the relocation.</li> <li>- The layout plan for the formalization of Mix Settlement has been approved. According to this plan, the selected site is best suited as it is zoned "Municipal" and can therefore accommodate municipal infrastructure such as a wastewater treatment plant. The open spaces referred to are zoned for other land uses.</li> </ul> <p>The area where affected residents are relocated to is zoned for residential purposes in the approved layout plan.</p> <p>Ample time was given to affected residents and they were adequately consulted.</p> |
| <p><b><u>Plant design and workmanship:</u></b></p> <ul style="list-style-type: none"> <li>- The City must ensure robust manhole design to ensure that sewage does not flow into people's houses when there are blockages.</li> </ul>   | <ul style="list-style-type: none"> <li>- The project engineers will consider this concern.</li> </ul>   |
| <p><b><u>Community benefits from the plant:</u></b></p> <ul style="list-style-type: none"> <li>- Job opportunities for the community.</li> </ul>   | <ul style="list-style-type: none"> <li>- Residents of Mix Settlement must be considered for all non-skilled work during the construction of the plant.</li> </ul>   |

- There are rumours that there will be a gardening project associated with the DEWATS Plant.

- There are currently no plans to establish a gardening project as part of the DEWATS project. Studies should be conducted in future to determine if the effluent from the plant is fit for this purpose.



**Picture 4:** Residents of Mix Informal Settlement attending the public meeting

- **Mobile Announcement**

Like all other meetings organized by the City of Windhoek, the City official from the Public Engagement Section drove through the community a day before the public meeting to announce and invite community members to the meeting using loud speakers. Various community leaders such as the Constituency Development Community were also used to inform the residents about the meeting.

## 6. ENVIRONMENTAL IMPACT ASSESSMENT

### 6.1 METHOD OF ASSESSMENT

The significance of the identified impacts of the proposed construction of a decentralized wastewater treatment plant at Mix Informal Settlement was assessed using the criteria discussed on table 2 below.

**Table 3:** Criteria used to determine the significance of impacts and their definitions.

| CRITERIA                                  | DESCRIPTION   |
|---|---|
| <b>NATURE</b>                             | This criteria indicates whether the proposed activity has a <b>positive</b> or <b>negative</b> impact on the environment (environment comprises both socio-economic and biophysical aspects).   |
| <b>EXTENT</b>                             | This criteria measures whether the impact will be site specific; local (limited to within 15 km of the area); regional (limited to about 100 km radius); national (limited to within the borders of Namibia) or international (beyond Namibia's borders).   |
| <b>DURATION</b>                           | This criteria looks at the lifetime of the impact, as being short (days, less than a month), medium (months, less than a year), long (years, less than 10 years), or permanent (more than 10 years).  |
| <b>INTENSITY</b>                          | This criteria is used to determine whether the magnitude of the impact is destructive and whether it exceeds set standards, and is described as none (no impact); low (where the environmental functions are negligible affected); medium (where the environment continues to function but in a noticeably modified manner); or high (where environmental functions and processes are altered such that they temporarily or permanently cease). |
| <b>PROBABILITY</b>                        | Considers the likelihood of the impact occurring and is described as improbable (low likelihood), probable (distinct possibility), highly probable (most likely) or definite (impact will happen regardless of prevention measures).  |
| <b>DEGREE OF CONFIDENCE IN PREDICTION</b> | This is based on the availability of information and knowledge used to assess the impacts.  |

The significance of the potential impacts identified for this project is determined using a combination of the criteria discussed on the above table. The significance rating of impacts is described on the table below.

**Table 4:** Definition of the various significance ratings

| SIGNIFICANCE RATING | CRITERIA  |
|---------------------|---|
| <b>Low</b>          | Where the impact will have a negligible influence on the environment and no mitigations are required.   |
| <b>Medium</b>       | Where the impact could have an influence on the environment, which require some modifications on the proposed project design and/or alternative mitigation.     |
| <b>High</b>         | Where the impact could have a significant influence on the environment and, in the case of a negative impact, the activity causing it, should not be permitted. |

## 6.2 POTENTIAL IMPACTS IDENTIFIED AND ASSESSED

### 6.2.1 CONSTRUCTION RELATED IMPACTS

- **NOISE**

Construction vehicles and equipment such as drillers, compactors and other machineries used to install services during the construction phase can be a nuisance and disturbance. Noise and vibrations will also have an impact on animals such as birds and reptiles. Birds are known to abandon their nests if subjected to continuous noise. The nearby riverine ecosystem of the Klein Windhoek River is home to a number of bird species.

**Table 5:** Assessment of impacts associated with noise.

| IMPACT                 | NATURE  | EXTENT | DURATION | INTENSITY | PROBABILITY | DEGREE OF CONFIDENCE | SIGNIFICANCE   |   |                 |
|------------------------|---|--------|----------|-----------|-------------|----------------------|----------------|---|-----------------|
|                        |   |        |          |           |             |                      | PRE MITIGATION | PRESCRIBED MITIGATION   | POST MITIGATION |
| Increased noise levels | Negative effect on construction workers and residents | Local  | Medium   | Low       | Probable    | Medium               | Medium         | All workers on site must be equipped with earplugs to be used when the noise becomes unbearable.                              | Low             |
|                        |   |        |          |           |             |                      | Medium         | Switch off machines that are not used.  | Low             |
|                        |   |        |          |           |             |                      | Medium         | Construction activities must not start before 08h00 and not exceed 17h00 to avoid disturbing the residents of Mix Settlement. | Low             |

- **DISTURBANCE OF NATURAL SLOPE AND CLEARING OF VEGETATION**

The construction of the wastewater treatment plant will involve the clearing of some areas to make way for the proposed infrastructure. The removal of vegetation and disturbance to the natural slope can facilitate soil erosion if not done properly.

**Table 6:** Assessment of impacts associated with disturbance of natural slope and land clearing.

| IMPACT                       | NATURE  | EXTENT        | DURATION  | INTENSITY | PROBABILITY | DEGREE OF CONFIDENCE | SIGNIFICANCE   |  |                 |
|------------------------------|---|---------------|-----------|-----------|-------------|----------------------|----------------|--|-----------------|
|                              |   |               |           |           |             |                      | PRE MITIGATION | PRESCRIBED MITIGATION  | POST MITIGATION |
| Disturbance of natural slope | Negative effect on the slope stability.                               | Site specific | Permanent | Low       | Probable    | Medium               | Low            | All infrastructure should be constructed in such a way that it does not promote erosion especially on steeper slopes.  | Low             |
|                              |   |               |           |           |             |                      | Low            | Steep slopes should be strengthened with retaining walls.  | Low             |
| Habitat destruction          | Negative effect on biodiversity when vegetation is cleared from site. | Site specific | Permanent | Low       | Probable    | Medium               | Low            | -Trees on site should be incorporated in the landscaping as much as possible.<br><br>-Indigenous vegetation should be used in the landscaping of the site to promote biodiversity. | Low             |

## • POLLUTION

There are various types of pollution associated with the construction phase. The most important one is probably chemical pollution from oil spills resulting from the handling of various machineries used during the construction phase. Other sources of pollution include building rubble and empty bags and containers. Construction workers can also pollute the surrounding environs if they are not provided with adequate toilet facilities. If the waste is not handled properly, it can have a detrimental effect on the surrounding environs.

**Table 7:** Assessment of impacts associated with pollution.

| IMPACT    | NATURE   | EXTENT | DURATION | INTENSITY | PROBABILITY | DEGREE OF CONFIDENCE | SIGNIFICANCE   |  |                 |
|-----------|--|--------|----------|-----------|-------------|----------------------|----------------|--|-----------------|
|           |  |        |          |           |             |                      | PRE MITIGATION | PRESCRIBED MITIGATION  | POST MITIGATION |
| Pollution | Negative effect on the ecosystem when waste emanating from construction activities is not managed. | Local  | Medium   | Low       | Probable    | Medium               | Medium         | Ensure that all waste from construction activities is stored and contained in designated containers and transported to Kupferberg Waste Disposal Site for proper disposal. | Low             |

- DUST**

Construction activities are generally associated with dust as the substrate is loosened during construction. Activities such as the clearing of vegetation and levelling of land will slightly affect the air quality. This will especially be an issue during windy days. Dust can affect the health of the construction workers and residents of the Mix Informal Settlement.

**Table 8:** Assessment of impacts associated with dust emission.

| IMPACT  | NATURE  | EXTENT | DURATION | INTENSITY | PROBABILITY | DEGREE OF CONFIDENCE | SIGNIFICANCE   |   |                 |
|---|---|--------|----------|-----------|-------------|----------------------|----------------|---|-----------------|
|   |   |        |          |           |             |                      | PRE MITIGATION | PRESCRIBED MITIGATION   | POST MITIGATION |
| Health effect of dust on the construction workers and Mix residents | Respiratory sicknesses can result from prolonged exposure to dust | Local  | Medium   | Low       | Probable    | Medium               | Medium         | - Equip all the workers exposed to dust with dust masks<br><br>-Spray the areas that are most affected to minimize dust and minimize activities that can generate dust during windy days. | Low             |



- **VISUAL AND SENSE OF PLACE IMPACTS**

The construction of infrastructure such as a wastewater treatment plant can have an effect on the aesthetic quality of an area.

**Table 9:** Assessment of visual impacts of the project.

| IMPACT                                  | NATURE   | EXTENT | DURATION  | INTENSITY | PROBABILITY | DEGREE OF CONFIDENCE | SIGNIFICANCE   |   |                 |
|---|--|--------|-----------|-----------|-------------|----------------------|----------------|---|-----------------|
|   |  |        |           |           |             |                      | PRE MITIGATION | PRESCRIBED MITIGATION   | POST MITIGATION |
| Impact on visual properties of the area | The wastewater treatment plant can have an impact on the visual quality of the area. | Local  | Permanent | Low       | Probable    | Medium               | Low            | Blending the built structures with the natural surrounding will maintain the natural aesthetic value of the area e.g., structures should be of earth colours instead of bright colours. | Low             |

- **RELOCATION OF AFFECTED RESIDENTS**

Forty-eight (48) residents who occupy the erf where the plant will be constructed will be moved to another area. Relocation has various inherent socio-economic impacts if not carried out properly.

**Table 10:** Assessment of impacts associated with the relocation of affected residents.

| IMPACT                                       | NATURE   | EXTENT | DURATION  | INTENSITY | PROBABILITY | DEGREE OF CONFIDENCE | SIGNIFICANCE   |   |                 |
|--|--|--------|-----------|-----------|-------------|----------------------|----------------|---|-----------------|
|  |  |        |           |           |             |                      | PRE MITIGATION | PRESCRIBED MITIGATION   | POST MITIGATION |
| Socio-economic impact on affected residents. | The relocation of affected residents to make way for the plant | Local  | Permanent | Low       | Probable    | Medium               | Medium         | Ensure that the area where residents are moved is provided with basic | Low             |

|  |                                |  |  |  |  |  |  |   |  |
|--|--------------------------------|--|--|--|--|--|--|---|--|
|  | can disrupt their livelihoods. |  |  |  |  |  |  | municipal services<br><br>Provide relocation assistance to ease the financial and logistical burden on the residents. |  |
|--|--------------------------------|--|--|--|--|--|--|---|--|

- **EMPLOYMENT OPPORTUNITIES**

The project will provide a few temporary jobs during the construction phase. This will be a welcomed relief considering the high rate of unemployment in Windhoek and in Namibia as a whole.

**Table 11:** Assessment of impacts associated with employment opportunities.

| IMPACT   | NATURE   | EXTENT | DURATION | INTENSITY | PROBABILITY | DEGREE OF CONFIDENCE | SIGNIFICANCE   |   |                 |
|--|--|--------|----------|-----------|-------------|----------------------|----------------|---|-----------------|
|  |  |        |          |           |             |                      | PRE MITIGATION | PRESCRIBED MITIGATION   | POST MITIGATION |
| Employment opportunities during the construction of wastewater treatment plant | The construction of the plant will create a few temporary jobs and this will have a positive economic impact on the Mix Settlement | Local  | Medium   | Low       | Probable    | Medium               | Low            | To further enhance the socio-economic benefits from the development of the plant, the Project Manager should make it mandatory to all contractors that all unskilled work should be given to the residents of Mix Settlement. | Low             |

## 6.2.2 OPERATION RELATED IMPACTS

- **POLLUTION FROM EFFLUENT DISCHARGED FROM THE PLANT**

If the plant is not operated and maintained properly, it can result in poor quality of effluent released into the environment.

**Table 12:** Assessment of impacts associated with pollution from effluent discharge.

| IMPACT                         | NATURE  | EXTENT | DURATION  | INTENSITY | PROBABILITY | DEGREE OF CONFIDENCE | SIGNIFICANCE   |  |                 |
|--------------------------------|---|--------|-----------|-----------|-------------|----------------------|----------------|--|-----------------|
|                                |   |        |           |           |             |                      | PRE MITIGATION | PRESCRIBED MITIGATION  | POST MITIGATION |
| Pollution from lodge operation | Effluent can pollute the surrounding environs if it does not meet national standards. | Local  | Permanent | Low       | Probable    | Medium               | Medium         | Treat effluent to meet national standards<br><br>Develop a plant maintenance plan<br><br>Train the plant operators on how to operate the plant properly. | Low             |

- **ODOURS**

If the plant is not operated and maintained properly, it can result in bad odours that will affect the quality of life of the residents.

**Table 13:** Assessment of impacts associated with odours

| IMPACT      | NATURE  | EXTENT | DURATION | INTENSITY | PROBABILITY | DEGREE OF CONFIDENCE | SIGNIFICANCE   |  |                 |
|-------------|---|--------|----------|-----------|-------------|----------------------|----------------|--|-----------------|
|             |   |        |          |           |             |                      | PRE MITIGATION | PRESCRIBED MITIGATION  | POST MITIGATION |
| Bad odours. | Odours can affect the quality of life of the residents. | Local  | Medium   | Low       | Probable    | Medium               | Low            | Treat effluent to meet national standards<br><br>Develop a plant | Low             |

|  |  |  |  |  |  |  |  |   |  |
|--|--|--|--|--|--|--|--|---|--|
|  |  |  |  |  |  |  |  | maintenance plan<br>Train the plant operators on how to operate the plant properly. |  |
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## 7. CONCLUSIONS AND RECOMMENDATIONS

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### 7.1 Conclusions

This project upon completion will help to alleviate the poor sanitation challenges faced by the Mix Informal Settlement. The lessons to be learned during the implementation of this project will be used in rolling out decentralized wastewater treatment solutions to other informal settlements that cannot be connected to the City of Windhoek's centralized system (Gammams).

This project does not pose any serious environmental concern, except those mentioned in this report, which can be satisfactorily addressed through the implementation of mitigation measures recommended in the Environmental Management Plan. The positive environmental and social impacts that the project will realize far out scales the negative ones.

### 7.2 Recommendations

Having considered the information collected, collated and analyzed for this study, the following recommendations were arrived at:

- The proponent (City of Windhoek) should immediately commence with the project once this report is approved;
- The project site should be properly fenced off and secured to ensure that unauthorized entry is avoided;
- Ensure that the occupational health and safety of workers during both the construction and operational phase of the project is maintained and enforced;
- The plant design should ensure comprehensive treatment of wastewater to meet the Namibian wastewater discharge standards before releasing the effluent into the Klein Windhoek River;

- The City of Windhoek's Health and Environment Service Division should carry out regular environmental audits to ensure that the plant complies to all relevant standards and the Environmental Management Plan;
- The Environmental Management Plan developed for this project should form part any contracts to be entered into with any service provider during both the construction and operational phase of the project;
- The City of Windhoek should ensure that all the complaints raised by the affected parties (residents that were moved to make way for the plant) are adequately addressed; and
- Once the project is complete, there is a need to for the City to develop plans to recycle water from the plant instead of just discharging it into the environment.

## 8. REFERENCES

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## **APPENDICES**

### **APPENDIX A: ENVIRONMENTAL MANAGEMENT PLAN**

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**APPENDIX B: CV OF ENVIRONMENTAL ASSESSMENT  
PRACTITIONER**

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## **APPENDIX C: INTERESTED AND AFFECTED PARTIES REGISTER**

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## **APPENDIX D: BACKGROUND INFORMATION DOCUMENT**

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## **APPENDIX E: PRESS NOTICES**

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## **APPENDIX F: ENGINEERING DRAWINGS**

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**APPENDIX G: DOMESTIC AND INDUSTRIAL WASTEWATER  
PURIFICATION AND EFFLUENT DISPOSAL EXEMPTION PERMIT**

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