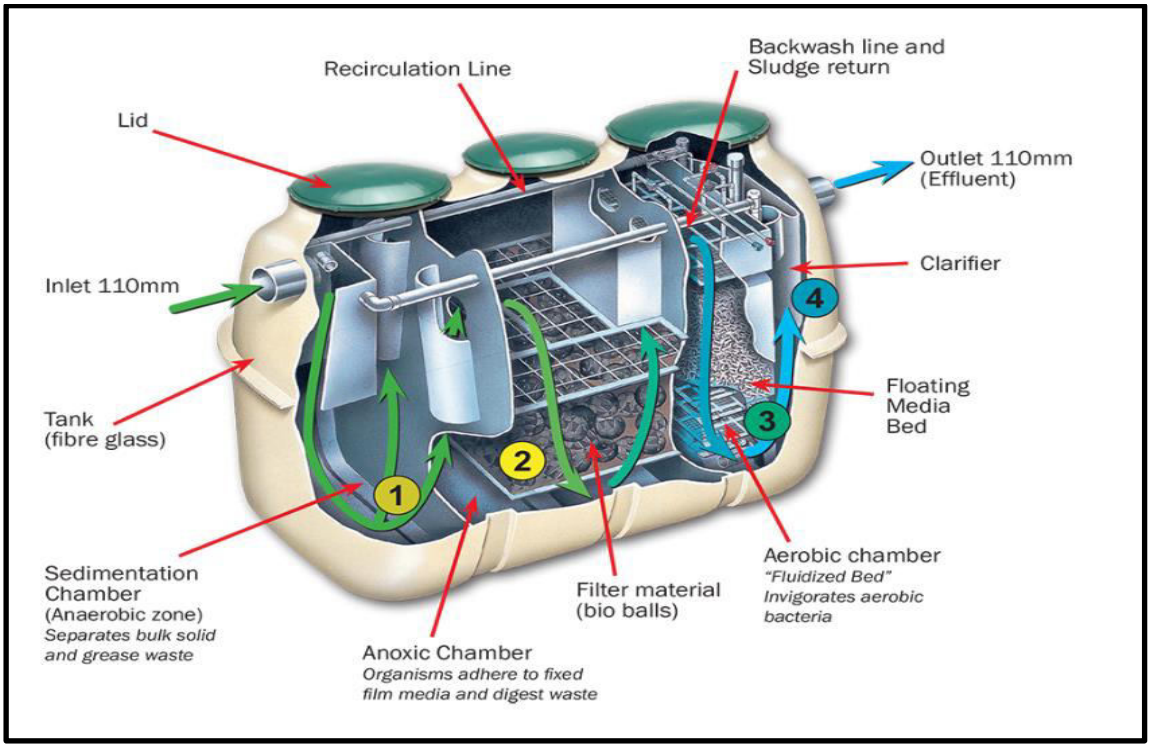
ENVIRONMENTAL MANAGEMENT PLAN (EMP)

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



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City of Windhoek

The Gateway to Endless Opportunities

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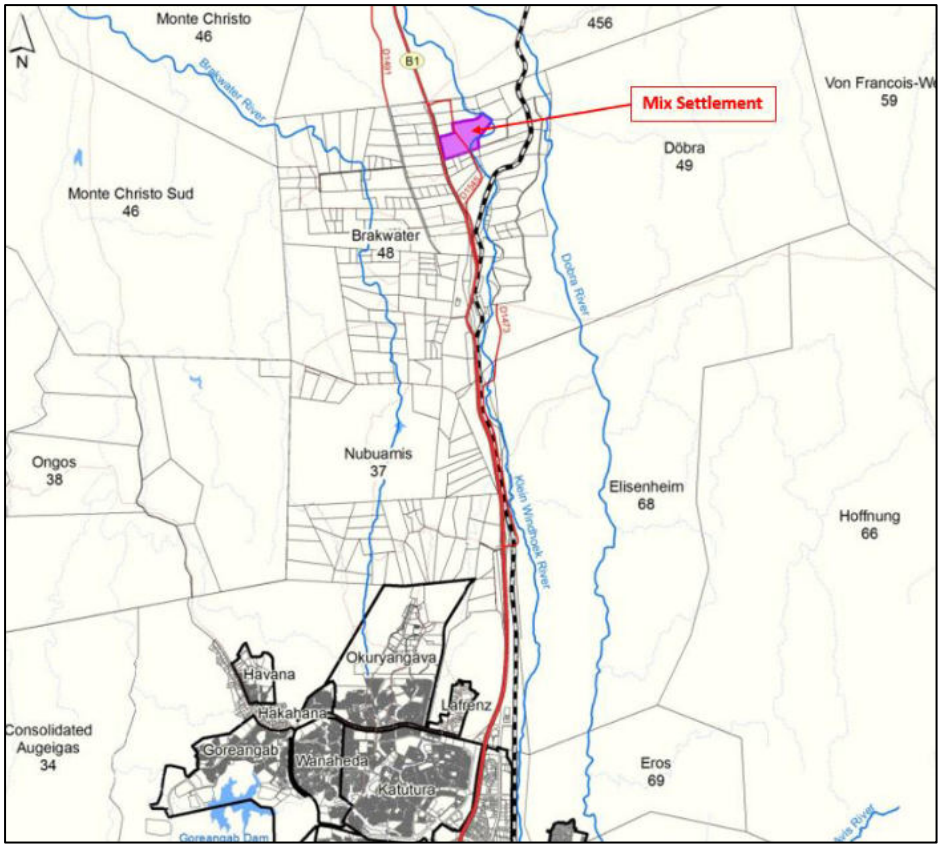
1. INTRODUCTION AND BACKGROUND

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.

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 ±700 households at Mix Settlement with a population of ± 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

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.

2. THE PROPOSED PROJECT ACTIVITIES

The wastewater treatment plant identified forth 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.

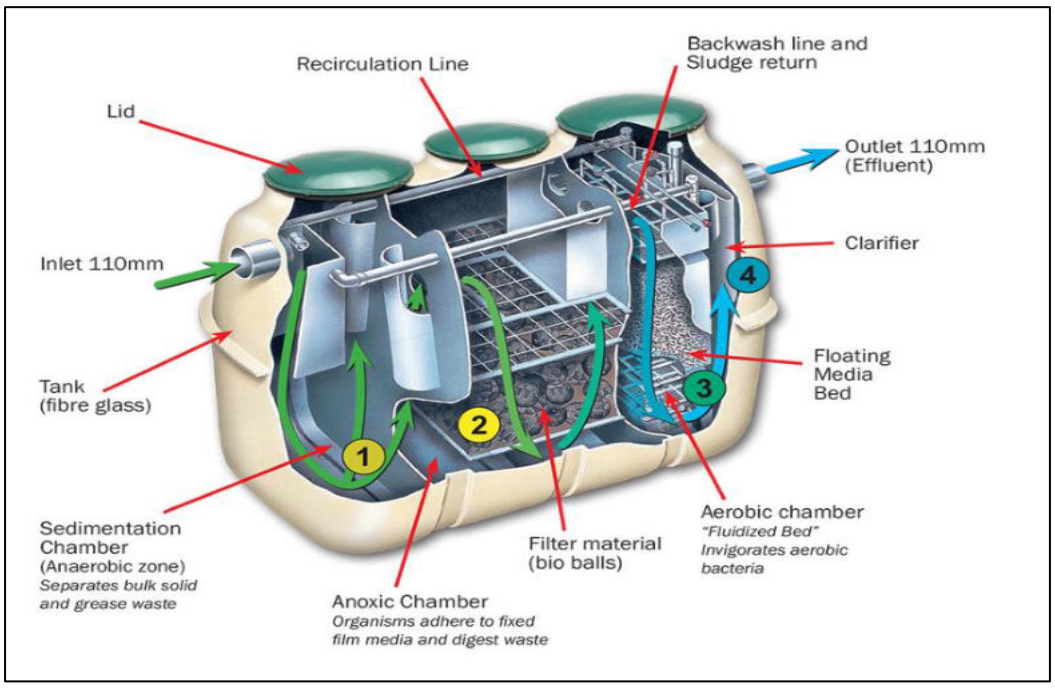


Figure: Wastewater Treatment Process Flow Diagram

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.

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.

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.

Services and other infrastructure required will be provided as follow:

- **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.

3. EMP OBJECTIVES

An Environmental Management Plan (EMP) describes the processes that the proponent (City of Windhoek) and associates will follow to maximize compliance and minimize harm to the environment. This plan will also help the City of Windhoek map out progress toward achieving continual improvements. The EMP comprises of a list of actions needed to mitigate the potential negative environmental impacts identified in the EIA.

The development of an EMP is a requirement for any EIA project as per Namibia's *Environmental Management Act No.7 of 2007*. Therefore this EMP is a legal document that must accompany the EIA Report before an Environmental Clearance is issued.

The main purpose of this EMP is to:

- Minimize adverse impacts on the environment;

- Protect the environmental quality of the site;
- Meet the requirements of all national and local legislations;
- Outline guidelines for construction of services and operational phase of the plant.
- Provide detailed specifications for the management and mitigation of activities that have the potential to impact negatively on the environment.

4. LEGISLATIVE FRAMEWORK

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: Legal framework of the project.

LEGISLATION	PROVISION	REGULATORY AUTHORITY	APPLICATION TO THE PROJECT
The Constitution of the Republic of Namibia	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.
Environmental Management Act No.7 of 2007 and EIA Regulations (2012)	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.
Water Act 54 of 1956	Control of disposal of sewage, the purification of effluent, the prevention of surface and groundwater pollution, and the	Ministry of Agriculture, Water and Forestry (Department of Water Affairs)	The wastewater treatment plant must adhere to the provisions of this Act.

	sustainable use of water resources.		
The Water Resources Act 24 of 2004	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.
Forestry Act No 27 of 2004	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.
Nature Conservation Ordinance no. 4 of 1975	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.
Soil Conservation Act No 76 of 1969	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.
Atmospheric Pollution Prevention Ordinance No 45 of 1965	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.
Hazardous Substance Ordinance 14 of 1974	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 generation of pressure thereby in certain circumstances; to provide for the division of such substances into groups in relation to the degree of danger;	Ministry of Health and Social Services	The handling, usage and storage of hazardous substances on site should be carefully controlled according to this Ordinance.

	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.		
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.	Ministry of Urban and Rural Development	The development has to comply with provisions of the Local Authorities Act.
The Labour Act of 1992	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.
Public and Environmental Health Act of 2015	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 Public Health Act 36 of 1919 (SA GG 979)	Ministry of Health and Social Services	Contractors and users of the proposed plant are to comply with these legal requirements.
National Heritage Act, 2004 (Act N0.27 of 2004)	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.
Atmospheric Pollution Prevention Ordinance (1976)	This Ordinance generally provides for the prevention of the pollution of the atmosphere. Part	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

	IV of this ordinance deals with dust control.		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.

5. ENVIRONMENTAL MANAGEMENT PLAN

5.1 EMP ADMINISTRATION

In order to successfully implement the provisions of this EMP, there is a strong need to clearly outline the roles and responsibilities of all stakeholders. There is also a need for proponent to appoint an overall responsible person (Environmental Control Officer) to ensure the successful implementation of the EMP. The Environmental Control Officer (ECO) needs to be someone who has a basic understanding of EMP administration. The City of Windhoek has a fully-fledged environmental management function and this responsibility will therefore fall within the mandate of this function. Under the management actions, each action is allocated to a responsible entity to ensure that the specific action is managed and documented properly.

Furthermore, all key role players such as contractors who will be involved during the construction of facilities at the plant must be informed about the contents of this EMP and activities to be undertaken to mitigate the potential impacts identified.

5.2 TRAINING

All key role players such as the contractors who will be involved during the construction of the facilities at the plant must be informed about the contents of this EMP through structured training programs, this can form part of the regular site meetings. It is recommended that the EMP forms part of the Terms of Reference to all contractors to be involved in the construction phase of the project.

5.3 GUIDELINES FOR CONSTRUCTION ACTIVITIES

Construction activities even though it will be on a small scale for this project can impact the environment negatively if it is not properly managed. The table below subscribe some general rules that can be given to the site contractor to minimize their impact on the environment.

General housekeeping to be used by the construction team

ASPECT	GENERAL RULES
Roads and Vehicles used for construction	• Vehicles shall not move on side slopes prone to erosion or sensitive to disturbance without specific approved management measures.
Workshops	• Temporary workshops provided on site shall be properly constructed and equipped so as to contain and prevent any form of contamination or pollution of soil and water that may arise from vehicle maintenance, servicing, parking and fuelling activities. • All hydrocarbons – polluted parts such as oil filters shall be stored in closed containers and disposed of as oily waste responsibly. • All solvents, paint or other chemical containers shall not be disposed of as general or domestic waste, but must be collected on site and disposed of to a licensed hazardous waste site (Kupferberg).
Material Storage	• Any material capable of causing pollution, discharged to the environment through water or air shall be stored in proper containers or covered facilities. • Storage of hazardous of flammable materials, including explosives if applicable, shall be strictly in accordance with the appropriate risk and fire prevention standards.
Fuel Storage	• Temporary fuel storage facilities erected on site shall comply fully with the relevant specifications for storage and handling of petroleum products. • Temporary fuel storage tanks and the fuel dispensing area shall be placed on a concrete slab or similar and approved impervious material must be provided with bund walls of the prescribed height and have proper collection sumps for containment and removal of any spillage or effluent from within the containment area.
Rehabilitation	• All disturbed areas shall be repaired and rehabilitated to the satisfaction of the Project Manager and ECO (Health and Environment Division of the City of Windhoek). • All temporary structures and facilities shall be properly and safely decommissioned and removed from site once all construction activity associated with such facilities

	has ceased. Closure, decommissioning and rehabilitation shall extend to removing any residual pollution or sources of pollution.
Training and Awareness	All site staff shall be made formally aware of the contents of this EMP and its conditions.

5.4 MANAGEMENT ACTIONS OF ENVIRONMENTAL ASPECTS – CONSTRUCTION PHASE

- **Noise**

DESCRIPTION	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.
MITIGATION MEASURES	• All workers on site must be equipped with ear plugs to be used when the noise becomes unbearable. • Switch off machines that are not used. • construction activities which known to generate vibration should be scheduled for day periods and not at night. • Construction activities must not start before 08h00 and not exceed 17h00 to avoid disturbing the residents of Mix Settlement.
MONITORING	Monitoring and measurement of noise and vibration impacts in the surrounding areas as per law or best available standards.
RESPONSIBLE PARTY	Site Manager/ Health and Environment Services Division

- **Disturbance of natural slope and clearing of vegetation**

DESCRIPTION	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.
MITIGATION MEASURES	• All infrastructure should be constructed in such a way that it does not promote erosion especially on steeper slopes. • Steep slopes should be strengthened with retaining walls. • Trees on site should be incorporated in the landscaping as much as possible.
MONITORING	Regular visual inspection
RESPONSIBLE PARTY	Health and Environment Services Division of the City

- **Pollution**

DESCRIPTION	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.
MITIGATION MEASURES	Ensure that all waste from construction activities is stored and contained in designated containers and transported to Kupferberg Waste Disposal Site for proper disposal.
MONITORING	Regular visual inspection
RESPONSIBLE PARTY	Site Manager and Health and Environment Services Division

- **Dust**

DESCRIPTION	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.
MITIGATION MEASURES	• Equip all the workers exposed to dust with dust masks • Spray the areas that are most affected to minimize dust. • Minimize activities that can generate dust during windy days.
MONITORING	Regular visual inspection
RESPONSIBLE PARTY	Site Manager and Health and Environment Services Division

- **Visual and sense of place impacts**

DESCRIPTION	The construction of infrastructure such as a wastewater treatment plant can have an effect on the aesthetic quality of an area.
MITIGATION MEASURES	Blending the built structures with the natural surrounding will maintain the natural aesthetic value of the area e.g., infrastructure should be painted with earth colours instead of bright colours.
MONITORING	Visual inspection
RESPONSIBLE PARTY	Site Manager and Health and Environment Division

- **Relocation of affected residents**

DESCRIPTION	Forty-eight (48) residents who occupy the erf were the plant will be constructed will be moved to another area. Relocation has various inherent socio-economic impacts if not carried out properly.
MITIGATION MEASURES	• Ensure that the area were residents are moved is provided with basic municipal services • Provide relocation assistance to ease the financial and logistical burden on the residents.
MONITORING	Inspect area regularly.
RESPONSIBLE PARTY	Site Manager and Human Settlement Division

- **Employment opportunities**

DESCRIPTION	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.
MITIGATION MEASURES	To further enhance the socio-economic benefits of the surrounding communities from the development, the Project Manager should make it mandatory to all contractors that all unskilled work should be given to the residents of Mix Informal Settlement.
MONITORING	Ensure adherence to recruitment policy.
RESPONSIBLE PARTY	Site Manager

5.5 MANAGEMENT ACTIONS OF ENVIRONMENTAL ASPECTS – OPERATIONAL PHASE

- **<u>Pollution from effluent discharged from the plant</u>**

DESCRIPTION	If the plant is not operated and maintained properly, it can result in poor quality of effluent released into the environment.
MITIGATION MEASURES	• Treat effluent to meet national standards • Develop a plant maintenance plan • Train the plant operators on how to operate the plant properly.
MONITORING	Regular inspection and appropriate operational policies.
RESPONSIBLE PARTY	Bulk and Wastewater Division and Health and Environment Services (oversight).