ENVIRONMENTAL MANAGEMENT PLAN
FOR
SHAMVHURA INTERIM WATER SUPPLY PROJECT

Namibia Water Corporation
Private Bag 13389
Windhoek
Namibia

Applied Scientific Services
Contact person: I Kangootui
Tel: +264-61712104
Email: KangootuiI@namwater.com.na

JUNE 2020

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LIST OF ABBREVIATIONS

AIDS	Acquired Immune Deficiency Syndrome
CoC	Code of Conduct
EMA	Environmental Management Act No 7 of 2007
EMP	Environmental Management Plan
ENV	Environment
DEA	Department of Environmental Affairs
DWSSC	Directorate of Water Supply and Sanitation
FC	Flow Controller
OD	Outside Diameter
HDPE	High Density Polyethylene
HIV	Human Immunodeficiency Virus
I&AP	Interested and Affected Parties
km	kilometer
MAWF	Ministry of Agriculture, Water, and Forestry
m	meter
m^3/h	cubic meter per hour
mm	millimeter
MET	Ministry of Environment and Tourism
mg/L	milligram per liter
mWh	megawatt hour
NEM	NamWater Environmental Manager
NTU	Nephelometric Turbidity Unit
NWQG	Namibian Water Quality Guideline
PPE	Personal Protective Equipment
mgPt/L	milligram platinum per liter
STI's	Sexually Transmitted Infections
UV	Ultra violet
WSS	Water Supply Scheme

GLOSSARY OF TERMS

Environmental Impact Assessment (EIA): The continuous method of assessing adverse effects of development on the environment.

Interested and affected parties (I&AP): Persons or group of people, organization, institution that may, directly or indirectly affected by the proposed development.

Namibian Water Quality Guideline (NWQG): Guidelines used to evaluate drinking water quality, to promote safe drinking water and safeguard water supply.

Namibian Water Quality Standards (NWQS): A basic set of determinants to which water quality should comply and adhere.

Unplasticized Polyvinyl Chloride (uPVC): A type of plastic material commonly used and ideally applicable for transportation of potable, waste and storm water.

Water Supply Scheme (WSS): A collection of NamWater transportation infrastructure aimed at providing potable water to specific communities or industrial areas.

1. INTRODUCTION

Shamvhura is a village in Ndiyona Constituency in the Kavango East Region, situated 127 km east of Rundu. The Shamvhura communities depend mainly on boreholes for water supply. These boreholes also supply water to other villages around Shamvhura. The villages supplied by these boreholes are Shinyungwe, Mbwata, Livuyi, Korokoko, Mashivi, Mukuvi, Mbabi, Manga and Shamangorwa. Because of this situation NamWater with the Ministry of Agriculture, Water and Land Reform planned and organised activities and resources in order to solve the water crisis at Shamvhura.

The location of Shamvhura is illustrated in Figure 1 below.

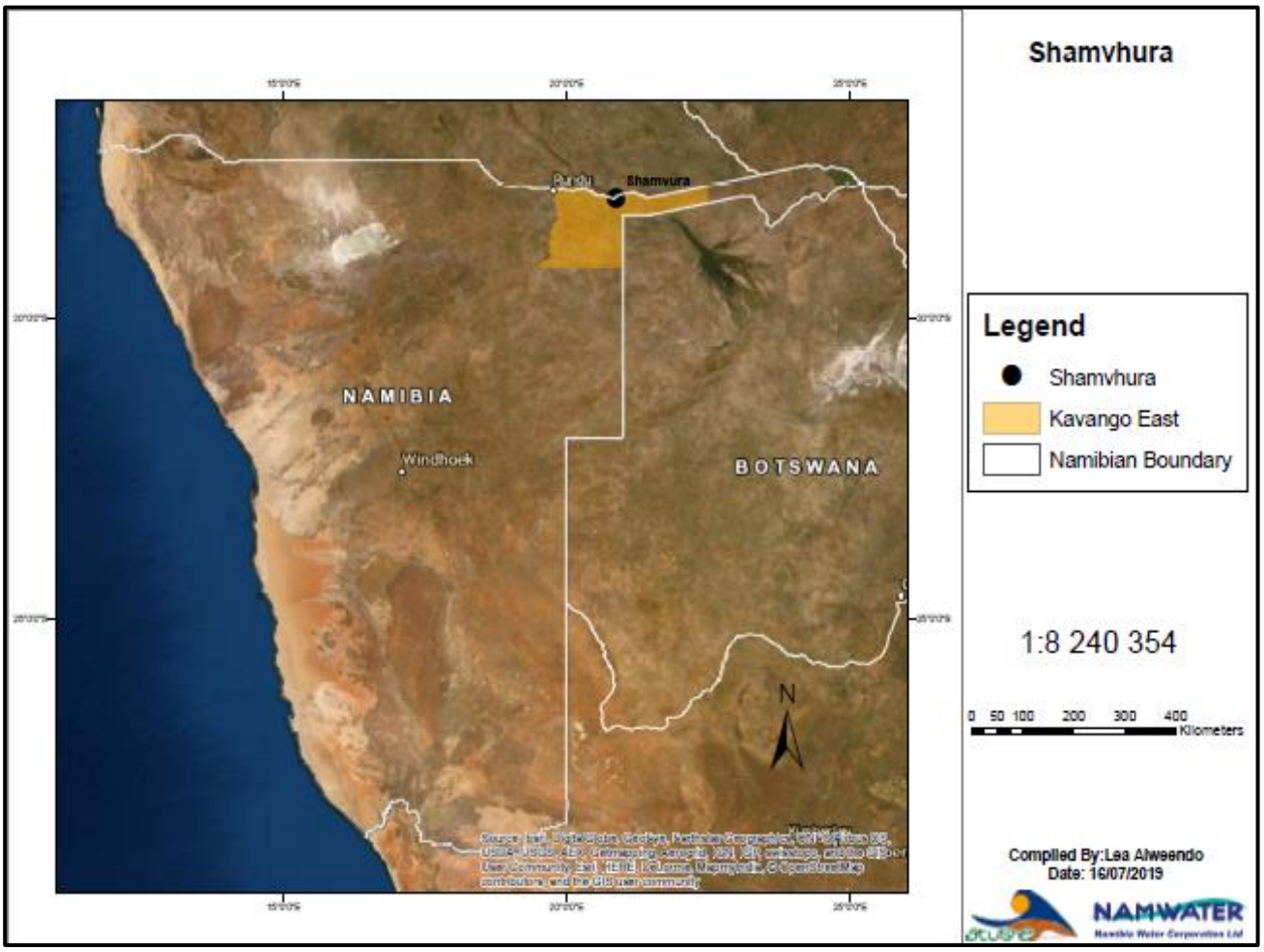

Figure 1: Shamvhura Location Map

The interim solution, which NamWater will apply given the situation described above, is to utilize the containerized plant, which was designed for iron removal at Kalkfeld. This plant must be relocated from Kalkfeld to Shamvhura to improve the water quality by mainly reducing the iron content. This containerized plant was constructed to rectify the water quality at Kalkfeld, however, during commissioning, it was found that the borehole water quality improved and as a result, the plant was no longer needed at Kalkfeld. It has since been idle and

redundant. The solution to the water problem at Shamvhura and the surrounding villages have been delayed and there is a need for urgent implementation of strategies to improve the quality of water supplied. However, there could be environmental impacts and therefore NamWater compiled this Environmental Management Plan (EMP) to ensure sound environmental management during implementation and operation of the interim solution.

The EMP aims to ensure that best practices are implemented and environmental degradation is avoided through appropriate environmental protection, adherence to legal requirements and maintaining good community relationships. It also aims to get as much benefit as possible from positive impacts. Construction activities regardless of the scale of construction have the potential to cause impacts on the environment. Mitigation of impacts is possible if NamWater ensure that the EMP is properly implemented. Therefore, the purpose of this EMP report is to ensure that negative environmental impacts that might be triggered by the construction and operation of the interim solution for the Shamvhura village are minimised.

2. PROJECT BACKGROUND

The current water scheme that supplies water to the Shamvhura Community and surrounding villages was constructed by the Ministry of Agriculture, Water and Land Reform and with the establishment of Namibia Water Corporation (NamWater), had been transferred to NamWater. The current scheme consists of a borehole and approximately 25 km of pipeline to supply water to 10 villages (Shamvhura, Shinyungwe, Mbwati, Livuyu, Korokoko, Mashivi, Mukuvi, Mbambi, Manga, and Shamangorwa). NamWater is responsible for operation and maintenance of the existing scheme.

Ministry of Agriculture, Water and Land Reform requested NamWater in 2017 to investigate and recommend remedial actions and to make a proposal on addressing the challenges and shortcomings of the scheme. The concern at the time was the poor water quality supplied to the community. Beside the high level of iron content that rendered the water quality low, the scheme was not equipped with a disinfection system to address the water's bacteriological quality.

NamWater proposed that an interim solution be applied to address the immediate concerns which should be followed by a permanent solution after detailed investigations and designs. The interim solution proposed is to rehabilitate the borehole at Shamvhura and installation of an iron removal plant. A temporary chlorine dosing system will be installed to ensure that the bacteriological quality is safe for consumption. The upgraded scheme will be operated and maintained by NamWater.

3. EXISTING WATER SUPPLY INFRASTRUCTURE

3.1 Water Source

In March 2019, NamWater rehabilitated borehole WW202433 to augment water supply to the communities of Shamvhura and the surrounding villages. The borehole is currently yielding 10m^3/h. The water quality of borehole WW202433 was found to have substandard water with regard to iron, turbidity, colour and manganese (see Annexure 1 for chemical results).

Table 1 below indicates the parameters of concern:

Table 1: Parameters of concern in borehole WW202433

Determinant	Water Quality Standard	Borehole Water Quality (95 Percentile)	Unit	Comment
	Acceptable Limit (95 Percentile)			
pH	6.0 -9.0	6.5		
Colour	<15	**62**	mgPt/L	Not acceptable
NTU (Borehole)	<2	**26.1**	NTU	Not acceptable
Fe (mg/l)	<0.3	**5.77**	mg/l	Not acceptable
Mn (Mg/l)	<0.1	0.195	mg/l	Not acceptable

It is clear that treatment is required to ensure that the water meet the proposed national water quality standards as announced by the Department of Water Affairs.

3.2 Borehole Installation and Existing Reservoir

A submersible solar borehole pump with stainless steel casing had been in use. Water from the borehole (WW 202433) is pumped through a 90 OD HDPE 1.35 km long pipeline into a 150 m^3 corrugated metal sheet elevated reservoir. This is a 20 m high reservoir. Water gravitates from this reservoir in a 25 km pipeline, whence it's distributed to supply ten communities. A 75 mm class 9 HDPE pipeline from the steel tank reservoir is used to transfer water to take-off point.

The borehole and the steel tank reservoir is fenced with a standard stock proof fence.

4. DESCRIPTION OF THE PROPOSED PROJECT

4.1 Interim solution objective

The primary objectives of the project are to:

- Provide interim treatment process solution for Shamvhura borehole water.
- Provide water security for Shamvhura and surrounding communities.

4.2 Scope of Work

4.2.1 Pipeline and power line

The interim Shamvhura Water Treatment project will make use of the existing pipeline from the borehole ((WW202433) and the existing power line.

The water treatment plant will produce a certain amount of wastewater; NamWater intends to construct a 200 mm diameter, 175 m uPVC pipeline to transport the wastewater from the treatment plant to the sludge ponds.

4.2.2 Package Water Purification Plant

The proposed package plant to be installed will serve as an interim solution which consist of a containerized plant with two dosing stations and filtration process. **Figure 2** below illustrates the overall proposed package plant process flow. The plant has a capacity of 6 m^3/h and will remove iron from the incoming raw water. This volume of 6 m^3/h will not be sufficient to supply the water demand and an additional raw water stream of 4 m^3/h will be filtered through sand filters. The filtration process will improve turbidity and colour and promote removal of manganese in the water. Water from the treatment plant and the filters will be blended to ensure that all parameters are in compliance with the quality standards. A blended volume of 10 m^3/h will be produced. The blended product water from the containerized plant and filtration process will be collected into a 10 m^3 mixing tank whence it will be transferred to the elevated reservoir.

The containerized plant contains a UV disinfection unit and calcium hypochlorite dispensers will be added in the mixing tank for enhancing disinfection. After disinfection, the water will be pumped to the elevated reservoir, which is 1.35 away from the plant. Additional hypochlorite dispensers deposited in the elevated reservoir will ensure that a chlorine residual of 0.5 – 0.8 mg/L in the product water is maintained. Water with a free chlorine concentration of 0.5 mg/l is bacteriologically safe for human consumption.

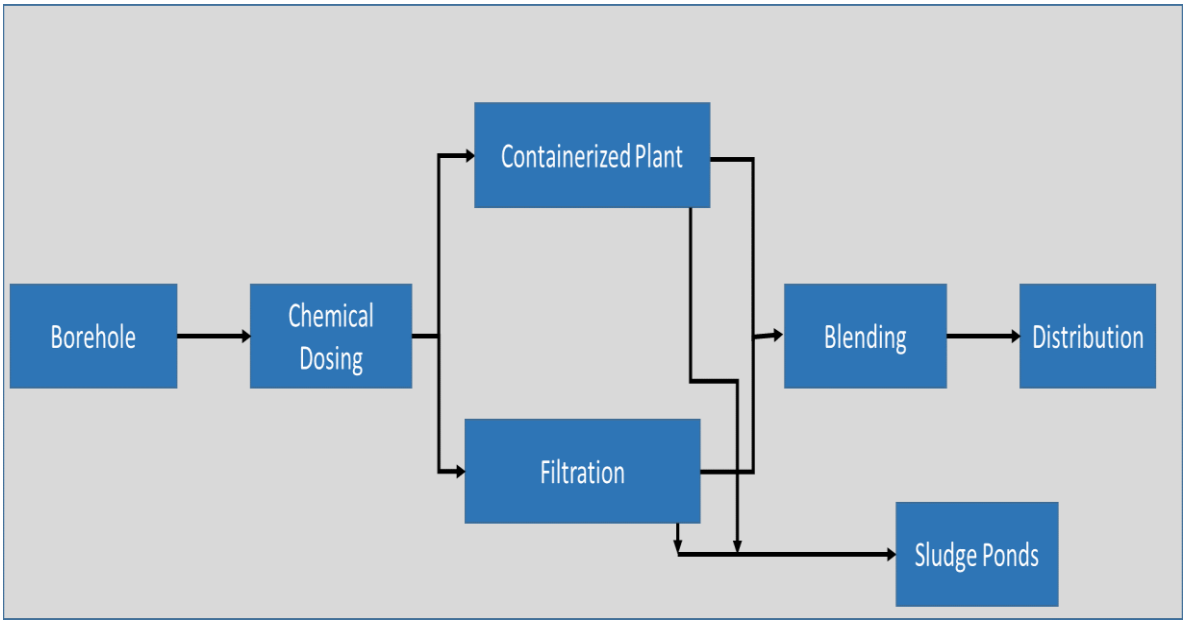

Figure 2: Proposed Interim Solution Package Plant Process Flow Diagram

4.2.3 Plant Operations and Control

The plant will be operated by an artisan at an output of 9.2 m^3/h for 20 h/day or till it gets full. The operator will be needed to monitor the iron, turbidity and chlorine residual on a two hourly basis in order to make sure that the water supplied complies with the recommended standard. The operator should record the operation parameters in the log sheet provided.

4.2.4 Construction of effluent ponds

Two effluent ponds will be constructed with a capacity of 95 m^3 each for the disposal of effluent from the treatment plant. An estimated 2 m^3/h effluent will be produced. The proposed effluent ponds will have a length of 21.5 m by 18.5 m width and excavated to 1.16 m depth. Some of the backfill from the excavation will be used to form the pond embankments with additional impermeable soil or rock where necessary. These ponds will be lined with an impervious layer to prevent pollution to groundwater.

A 200 mm diameter uPVC pipe will be used to carry the effluent away from the plant to the ponds that will be located about 175m away from Shamvhura treatment plant.

5. DESCRIPTION OF THE ENVIRONMENT

The baseline description provided below focuses on the Shamvhura receiving environment:

5.1 Climate

The Shamvhura area has a hot semi-arid climate, characterised by warm summers and fairly mild winters. Days are warm while the nights are slightly cold (Mendelsohn*, et al.,* 2009).

5.1.1 Precipitation

The average annual rainfall for this area is between 500 mm to 550 mm. The highest expected rainfall is received between January and February and the least rainfall is experienced in June (Mendelsohn, et al., 2002).

5.1.2 Temperature

Shamvhura average maximum temperature during the hottest month of the year (which is September) ranges between 32 °C to 34 °C while the average minimum temperature during the coldest month (July) varies between 4 °C to 6 °C respectively (Mendelsohn, *et al.,* 2002).

5.2 Geology

The Shamvhura geology is of the Kalahari Sequence deposit. The Kalahari Sequence deposit is of the basal rocks of the Damara Sequence and the Karoo Sequence sediments, covered and intruded by volcanics of Karoo age. The southern Kavango Region near Karukuwisa is underlain by late-Karoo plateau basalts. The Kalahari basal layers thickness is lowest along the Botswana border (less than 50 m) and increases towards the middle reaches of the Omatako Omuramba and further to the northwest towards Nkurenkuru at the Okavango River (Christelis et al., 2011).

5.3 Natural Flora

Shamvhura's landscape is dominated by broadleaved tree and shrub (Biome) Savannah, the area is known to have Northern Eastern Kalahari woodland vegetation. Hardwoods which are suitable for timber and firewood are in abundance in the area and few small areas have valuable stocks of teak (*Baikiaea plurijuga*) and kiaat (*Pterocarpus angolensis*). Mopane trees (*Colophospermum mopane*) are also found in the area. Other valuable vegetation species that occur in the area are the wild syringa (*Burkea Africana*), cluster leaf (*Terminalia prunioides*) and Silver Terminalia (*Terminalia sericea*) (Mendelsohn, et al., (2009).

5.4 Fauna

Today there is minimal wildlife diversity found in Shamvhura area. Previously the wildlife species that were known to inhabit this area are the following: the elephant *(Loxodonta),* kudu *(Tragelaphus strepsiceros),* lion (*Panthera lio*), leopard *(Panthera pardus),* cheetah (Acinonyx jubatus), wild dog *(Lycaon pictus*), buffalo *(Syncerus caffer) and* spotted hyena (Crocuta crocuta). Furthermore, locals have sighted local birds such as the Stripped Kingfisher (*Halcyon chelicuti) and Meyer's parrot (Poicephalus meyeri)* (Mendelsohn, *et al.,* (2009).

6. RESPONSIBLE PARTIES

6.1 Contractor

The contractor is responsible for the implementation of the EMP during the construction phase of the Shamvhura interim solution project. The EMP will be included in all tender and contract documents. This ensures that the contractor is up to date with what his obligations and responsibilities are.

It is the Contractor's responsibility to make sure that his workforce (in Consultation with NamWater) and the team supervisor are educated in all the necessary environmental laws and environmental management requirements. The Contractor shall supplement these steps with prominently displayed notices and signs in strategic locations to remind personnel of environmental obligations.

The Contractor shall ensure that all his employees, and those of his Sub-Contractors, attend an Environmental, Awareness Training provided by team supervisor. This training shall be structured to ensure that attendees:

- Acquire a basic understanding of the key environmental features on the site and its immediate environs;
- Become familiar with the environmental controls contained in the EMP;
- Are made aware of all protected areas and that the trapping, poisoning, and/or shooting of animals is strictly forbidden. No domestic pets are allowed on site;
- Are informed that natural features (e.g. rock formations) are not defaced or marked for the survey or other purposes unless agreed beforehand with the engineer,
- Natural water sources (e.g. streams) are not allowed to be used for the purposes of swimming, personal washing, and the washing of machinery or clothes;
- Are made aware of the need to conserve water and minimise waste;
- Receive pertinent, written instructions regarding compliance with the relevant environmental management requirements (viz. typical environmental "do's" and "don't");
- Are made aware of any other environmental matters as deemed necessary by the Engineer.
- Are made aware of the importance of preserving archaeological sites and fauna and flora. What about sensitive fauna and flora issues?
- Are made aware of NamWater's Code of Conduct;

- HIV/AIDS awareness training and the training should indicate where condoms are freely available on site;
- Awareness around birth control and the potential long-term risks associated with casual sex;
- Are made aware that prostitution shall not be tolerated in the construction camp;
- Are aware that a copy of the EMP is readily available on site and that all site staff are aware of the location and have access to the document;
- Are aware of the requirements of any approved Method Statements that have bearing on their activities, and where necessary, any specialised training required to ensure compliance with the approved Method Statements has been provided; and
- Are informed that employee information posters, outlining the environmental "do's" and "don'ts" (as per the environmental awareness training) will be placed at prominent locations throughout the site.
- Contractor should make use of the CoC and adhere to its recommendations as it deem fit.

6.2 NamWater

NamWater's Environmental Manager is to oversee the implementation of the EMP during the operation and maintenance phases for the Shamvhura interim solution project. He/she should also ensure proper implementation of the EMP by the Contractor. NamWater will do monitoring via compliance audits. NamWater as the implementing agency, is responsible for:

- Ensuring that the objects of the EMP are being obtained;
- Ensuring that all environmental impacts are managed according to the environmental principles of avoiding, minimizing, mitigating and rehabilitation. This will be achieved by the successful implementation of the EMP;
- Ensuring that appropriate monitoring and compliance auditing are executed;
- Oversee that contractor ensure that the environment is rehabilitated to its natural state as far as possible.

7. LEGAL ENVIRONMENT

A legal review was done and the key laws of concern include those which protect the ecological integrity of the Shamvhura ecosystem and its water resource, including the Water Act of 1954 and the Water Resources Management Act of 2004, and applicable international treaties such

as the Convention on Biological Diversity. These laws and conventions place Namibia under an obligation to conserve the integrity of the Shamvhura ecosystem for sustainable use by Namibians.

7.1 The Constitution of the Republic of Namibia

There are two clauses contained in the Namibian Constitution that are of particular relevance to sound environmental management practice, viz. articles 91(c) and 95(l). In giving effect to articles 91(c) and 95(l) of the Constitution of Namibia, general principles for sound management of the environment and natural resources in an integrated manner have been formulated. The formulation of these general principles resulted in Namibia's Environmental Assessment Policy of 1994. To give statutory effect to this Policy, the Environmental Management Act was approved in 2007 and gazetted as the Environmental Management Act (Act No. 7 of 2007) (herein referred to as the EMA).

To summarize, Articles 91(c) and 95(l) refer to:

- Guarding against over –utilization of biological natural resources;
- Limiting over-exploitation of non-renewable resources;
- Ensuring ecosystem functionality
- Protecting Namibia's sense of place and character;
- Maintaining biological diversity and
- Pursuing sustainable natural resource use.

7.2 Environmental Assessment Policy (1995)

Cabinet endorsed Namibia's Environmental Assessment Policy in 1995 as the first formal effort in Namibia to regulate the application of environmental impact assessments and environmental management. Amongst others, the Policy provides a procedure for conducting EIA's which sets out to:

- Better inform decision makers and to promote accountability of decisions taken;
- Strive for a high degree of public participation and involvement of all sectors of the Namibian community during the execution of the EIA;
- Take into account the environmental costs and benefits of projects and programs;
- Promote sustainable development in Namibia;
- Ensure that anticipated adverse impacts are minimized and that positive impacts are maximized.

7.3 Environmental Management Act (No 7 of 2007) (EMA)

The Environmental Management Act (EMA) was promulgated in 2007 by Parliament and gives effect to the Environmental Assessment Policy. The Act specifies the environmental assessment procedures to be followed as well as the listed activities (activities that require an EIA).

Of relevance to this project are the following listed activity, as provided in Section 27 of this Act, which includes:

- Water use and disposal.

7.4 EIA Regulations Government Notice No. 30, promulgated on 6 February 2012

The regulations, promulgated in terms of the EMA, were promulgated on 6 February 2012 and indicated certain activities that require an Environmental Clearance from MET: DEA prior to commencing.

7.5 Water Act 54 of 1956 and Water Resources Management Act 11 of 2013

The Water Resources Management Act 11 of 2013 is presently without regulations; therefore the Water Act 54 is still in force. The Act provides for the management and protection of surface and groundwater resources in terms of utilisation and pollution.

7.6 Water Act 54 of 1956 and Water Resources Management Act 11 of 2013

The Convention on Biological Diversity (CBD) stems from the growing recognition that biological diversity is an asset of tremendous value to present and future generations across the world.

The CBD is the international legal instrument for "the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources" that has been ratified by 196 nations.

8. ENVIRONMENTAL MANAGEMENT PLAN

An Environmental Management Plans (EMP) is an important tool focusing on the management actions that are required to ensure environmental compliance of a particular project.

The EMP is a dynamic document that relates to the local natural and socio environment, and will be regularly updated as required. The document is tailor made for particular conditions and proposed development, and it is valid for all contractors and subcontractors. The EMP provides for the establishment of a grievance procedure during the life cycle of the project and related infrastructure. Monthly audits will be done during construction phase and more regularly if EMP compliance is not satisfactory. Operational and maintenance audits will be done annually and more frequently if compliance is poor.

EMP implementation is a cyclical process that converts mitigation measures into actions and through cyclical monitoring, auditing, review and corrective action, ensures conformance with

stated EMP aims and objectives. Monitoring and auditing, feedback for continual improvement ensures that environmental performance has been provided and corrective action is taken for an effective EMP.

There are some environmental impacts that cannot be avoided. These environmental impacts require mitigation, and in order to mitigate against these impacts, an EMP is required. The aims of an EMP is to ensure that the best practices are implemented and environmental degradation is avoided by following the right environmental protection channel, adherence to legal requirements and maintaining good community relationships. The project activities are grouped according to the different operational processes and stages. Impacts to the environment can be avoided in most cases by practicing good housekeeping. The EMP also aims to enhance positive impacts.

9. MANAGEMENT ACTIONS

9.1 Construction Phase, Operation and Maintenance Phases

Objectives	Risk Sources	Management Action	Monitoring
a. Minimize the disturbance of vegetation and faunal communities and their habitats during the construction of the interim solution.	Disturbance of vegetation and faunal communities and their habitats.	• Identify and demarcate the extent of the construction or accommodation site and associated work areas using danger tape with steel droppers. • Identify animal species, populations and nest to be relocated. Relocate to areas with no associated risks. Such operations should be planned well in advance. • Protect identified plants using danger tape and steel droppers. • Keep disturbance of vegetation and fauna to a minimum. The area to be disturbed should be as small as possible.	Visual inspection to ensure that construction activities are done within the demarcated area. Frequency: Daily, especially during the first phase of construction, as this is the time when most disturbances to the vegetation and fauna and their habitats are most likely occur. Responsible Person: NEM and Resident Engineer.
b. Prevent unnecessary removal of trees/plants of importance.	Unnecessary removal of trees/plants of importance.	• Do not remove any vegetation unless it is absolutely necessary. Make sure that bulldozer, grader and excavator operators are informed.	Visual inspection/checks to prevent, as well as to ensure the unnecessary removal of trees/plants. Frequency: Daily

Objectives	Risk Sources	Management Action	Monitoring
		• The clearing of plants or natural features for the proposed construction should be managed to avoid the further damage to vegetation cover. • The use of herbicides and pesticides is prohibited.	Responsible Person: NEM
c. Minimize the loss of rare/endangered fauna and flora species.	Loss of rare / endangered fauna or flora species.	• Avoid small mammal/reptile and bird nesting where possible. Do not hurt, kill or unnecessarily disturb birds or animals. • Maintain plant demarcations in position until the construction works cease.	Checks to ensure that construction is limited to the demarcated area. Visual checks to ensure that no unnecessary movement occurs in breeding and habitats of these species. Frequency: Daily Responsible Person: NEM
d. Prevent the poaching of flora and fauna.	Poaching of fauna and flora.	• Employees who poached fauna and/or flora will be handed to the authorities for prosecution. • Employees who set traps will be handed to the authorities for prosecution. No wild animals under any circumstance be hunted illegally, handled, removed or be interfered with.	Visual inspection. Frequency: Weekly visual checks. Responsible Person: NEM and Resident Engineer.

Objectives	Risk Sources	Management Action	Monitoring
		• The Contractor will be held liable for the replacement of any plant or animal that is removed or damaged due to the Contractor's negligence or mismanagement. • Regular checks of the surrounding environment must be undertaken to ensure no traps or snares have been set. Any snares or traps found on or adjacent to the site must be disposed of. • Employees should not collect any fruits or seeds with permission from appropriate persons.	
e. Minimise the creation and use of tracks outside existing roads.	Creation of tracks outside existing roads.	• The Contractor shall be held responsible for all project related traffic. • Use existing roads. • Construction traffic shall be controlled to ensure minimal disruption to other road users. • Do not construct new roads when the quality of existing roads deteriorates. Where possible, repair or upgrade existing roads. • Areas to be cleared for road construction should be as small as possible.	Visual checks to ensure that no off-road driving exists. Frequency: Weekly Responsible Person: NEM and Resident Engineer.

Objectives	Risk Sources	Management Action	Monitoring
		• Road construction methods should ensure good road surfaces to preclude vehicles driving off-road to find smoother surfaces with less corrugation or potholes. • Ensure that adequate vehicle turning areas are allowed for. • Enforce speed limits at all times. Unless otherwise specified, the speed limit on construction roads is 50km/h. • Runoff from roads must be managed to avoid erosion and pollution problems. • Roads not required for further use shall be rehabilitated immediately. • Enter and exit roadways and construction areas at demarcated entrances. • Erect signage to warn motorists about construction activities and heavy vehicle movement where appropriate. • Use 3-point turns and not U-turns. Confine turning to the road. • Prevent shortcuts between roads.	

Objectives	Risk Sources	Management Action	Monitoring
f. Minimise the damage and destruction of important palaeontological and archaeological sites during construction.	Disturbance to sites of palaeontological and archaeological importance.	• Do not disrupt any archaeological or palaeontological sites. Inform NEM (N.P. du Plessis at cell no 081 127 9040) who will take the necessary action. • All workers will be educated about the importance of preserving archaeological sites. • Educate specific workers about tell-tale signs of archaeological sites and the action to be taken if one is identified.	Monitoring can and should involve field induction of key construction personnel so that they will be able to recognize the important palaeontological and archaeological sites themselves Frequency: Monthly Person Responsible: Key Construction Personnel.
g. Borrow pits should only be established if its really necessary and careful excavation should be considered to minimise impact.	Establishment of borrow pits.	• No borrow pits should be established.	Checks to ensure that no borrow pits are established. Frequency: Monthly Responsible Person: NEM and Resident Engineer

Objectives	Risk Sources	Management Action	Monitoring
h. Minimise the number of heavy vehicles on the road.	Increased number of heavy vehicles on the road.	• Heavy vehicles should be limited to the numbers necessary.	Checks to ensure that there is a minimal heavy vehicles on the road. Frequency: Weekly Responsible Person: Resident Engineer
i. Minimise and prevent the activities that accelerate erosion during construction.	Erosion.	• Runoff on steep inclines should be diverted to prevent the formation of erosion gullies. • Vegetative cover is the most efficient and economical means of controlling soil erosion. • Berms should be constructed at selected intervals on long sloping areas to prevent erosion. Diversion berms should be reshaped as necessary to divert runoff. • When equipment crossings are necessary, diversions may be wider with flatter side slopes to minimise erosion. • Berms should be constructed with compacted soil, have a minimum top width of 60 cm and a minimum height of 30 cm, and should allow for 10% settlement. It should have side slopes with a gradient of at least 2:1.	Visual inspection to ensure that activities that accelerate soil erosion are minimised and if possible prevented at all cost. Frequency: Daily Responsible Person: NEM and Resident Engineer

Objectives	Risk Sources	Management Action	Monitoring
		• Runoff should be guided to a point where it will not cause damage. Scour by the discharge of runoff should be prevented.	
j. Minimise and prevent the collection and removal of firewood during construction.	Collection of firewood.	• No vegetative matter may be removed for firewood. • The collection and removal of firewood are not allowed. Is it not the same as the previous recommendation? • Fire extinguishers should be readily available at designated locations. • Cooking places shall be located at a safe distance from fuel / hazardous material storage area and vehicle parking bays. • The Contractor shall either provide firewood or limit the use thereof by providing gas or fuel-efficient stoves.	Checks to ensure that there's no removal and collection of firewood by the employees. Frequency: Weekly Responsible Person: NEM.
k. Dust control	Generation of dust	• The Contractor shall take all reasonable measures to minimise the generation of dust as a result of construction activity. • Construction vehicles to use only designated roads and to adhere to speed regulations.	Visual inspection to ensure that activities that generate dust are minimised and if possible prevented. Frequency: Daily

Objectives	Risk Sources	Management Action	Monitoring
		• Consider temporary ceasing of work during high wind conditions.	Responsible Person: NEM and Resident Engineer
l. Noise	Generation of noise	• Install and maintain silencers on trucks and machinery. • Repair faulty brakes. • Operators should not use hooters for the purposes of general communication.	Visual inspection to ensure that activities that generate noise are minimised and if possible prevented. Frequency: Daily Responsible Person: NEM and Resident Engineer
m. Driving	Increased risk for accidents	• No operator will operate any equipment when he is under the influence of any narcotics. • Adhere to safety rules. • Always keep your headlights on. • Drivers must have the correct licence for the vehicle they are driving.	Visual inspection to ensure that activities that generate noise are minimised and if possible prevented. Frequency: Daily Responsible Person: NEM and Resident Engineer
n. Concrete Batching	Solid waste accumulation, pollution	• Concrete batching shall take place on a smooth impermeable surface enclosed with a bund. • Batching shall take place at least 20m away from any water source to avoid contamination.	Checks to ensure that concrete batching is properly done.

Objectives	Risk Sources	Management Action	Monitoring
		• All waste water resulting from batching of concrete shall be contained and disposed of appropriately and shall not be discharged into the environment. • Any spillages of concrete shall be cleaned –up immediately and disposed of through the solid waste disposal system. • Empty cement bags shall be collected continuously and stored in containers until disposal at appropriate disposal sites. • Bulk cement storage should be at the main construction camp.	Frequency: Daily and as required. Responsible Person: NEM and Resident Engineer
o. Site establishment		• No establishment within 100 metres from any watercourse. • At existing disturbed areas • Away from prominent roads to minimise visual impact. • All vehicles to be parked at dedicated parking area. • Constructing camp should be fenced?	
p. Trenching		• Contractors urged to ensure all open trenches are back filled.	

Objectives	Risk Sources	Management Action	Monitoring
		• Back fill to same contours or slightly higher to allow for settlement.	
q. Blasting	Blasting can cause noise, dust, and vibration, and can cause injury to employees.	• Vehicles carrying explosives should be appropriately marked with warning signs. • Explosives should be stored in dry and well-secured areas. • Contractor shall hire the best experienced qualified persons for blasting actions. • Employees are not allowed to handle any explosives, unless he/she has been trained to handle explosives.	

Waste Management

Objectives	Potential Impact	Management Action	Mitigation Action
a. To prevent the improper disposal of waste	Pollution	• Enforce a waste management programme. • All waste will be removed to an appropriate waste dump. • No waste should be buried. • General Waste: Includes waste paper, plastic, cardboard, harmless organic (e.g. vegetables) and domestic waste.	A visual check to ensure wastes is managed according to the waste management plan Frequency: Weekly.

Objectives	Potential Impact	Management Action	Mitigation Action

		• Hazardous Substances includes: sewerage, fuels, lubrication oils, hydraulic and brake fluid, solvents, paints, anticorrosive, insecticides and pesticides, chemicals, acids, etc. It should be disposed of at designated hazardous disposal sites.
		• Contaminated soil should be stored in drums and taken to the nearest appropriate waste dumpsite.
		• Do not change the oil on the uncovered ground. Drip trays will be used to catch oil when vehicles are repaired in the field.
		• Used oil and hydraulic fluids will not be discarded on the soil or buried. It will be removed from the site and taken back to an appropriate dumpsite.
		• In the event of a hazardous spill:
		  • Immediately implement actions to stop or reduce the spill.
		  • Contain the spill.
		  • Arrange implementation of the necessary clean-up procedures.
			Person Responsible: Scheme Supervisor.

Objectives	Potential Impact	Management Action	Mitigation Action
		• Collect contaminated soil, water, and other materials and dispose of it at an appropriate waste dumpsite. • Used solvents and grease should be stored in drums or other suitable containers. It should be sealed and recycled or disposed at an appropriate disposal site. • Hazardous waste should not be burnt. • Bunding, concrete slabs and/or other protective measures should be installed where hazardous materials are handled. • Ensure that the staff are informed and have information pertaining to the management of spills or ingestion.	
b. To avoid potential chemical /hazardous substance pollution	Pollution	• Designated areas for the storage of potentially hazardous material will be lined with concrete and secured. The bunded area will be of adequate capacity to contain 1.5 times the volume of the hazardous material to be stored in the bunded area.	Visual checks to ensure chemical/hazardous substances are stored appropriately. Frequency: Monthly. Responsible Person: Scheme Supervisor.

Objectives	Potential Impact	Management Action	Mitigation Action
c. Prevent diesel and oil spills during operation and maintenance and ensure adequate clean up.	Concrete, diesel and oil spills and inadequate clean up.	• Clean up concrete, fuel and oil spills immediately. • Clean small oil or fuel spills with an approved/appropriate absorbent material. • Contain oil or fuel spills in water using an approved oil absorbent fibre. • In cases where oil spills cannot be cleaned up immediately, monitor seepage into deeper soils and groundwater. • Do not bury polluted soil, but rather dispose it at an appropriate dumpsite. • Provide bunding at fuel storage and transfer sites. The bunding should be big enough to contain 110% of the volume of the tank. Where a bund wall encloses a group of tanks, the bund wall must be able to contain 110% of the volume of the largest tank in the group. Tanks must stand on a concrete slab, or otherwise have a sealed, base in order to prevent the leakage of contaminants into the soil.	Checks to prevent and minimise oil and diesel spills and to ensure adequate clean up should spills occur. Frequency: Daily throughout the operation period. Responsible Person: Scheme Supervisor.

Objectives	Potential Impact	Management Action	Mitigation Action
d. Waste Management	Littering (Litter such as paper, plastic, etc. can be blown away into the surrounding environment).	• No littering will be allowed. The operation and maintenance areas will be kept free of waste at all times. All maintenance sites will be cleaned on a daily basis before leaving the site. • Provide sufficient waste bins at worksites. Make sure that all waste is removed from the worksites. • Bins should be placed in pairs to ensure that one is always present while the other is being emptied. • Areas likely to generate higher quantities of waste shall be equipped with additional bins. • Refuse bins must be stable, i.e. cannot be tipped by animals, and have scavenger and baboon proof lids. • Make sure that the bins are covered so that plastic bags, paper etc. are not blown away. • Make sure that the bins are regularly emptied and the waste taken to an appropriate waste dumpsite. • The central waste storage vessel shall be emptied weekly or as necessary.	Checks to ensure that litter is disposed of correctly in bins provided. Frequency: Daily, at the end of the work day. Responsible Person: Scheme Supervisor.

9.2 Workshops, vehicle and equipment management

Objectives	Potential Impact	Management Action	Mitigation Action
a. Appropriate storage of machinery, vehicles, and materials.	Inappropriate storage of machinery, vehicles, and materials may result in the possible damage /disturbance of nearby undisturbed environments.	• Store machinery, vehicles, and materials only in demarcated areas; • Do not leave machinery and equipment standing around if not in use; • Do not store machinery, vehicles or materials in undisturbed or rehabilitating areas	Regular inspection to ensure that machinery, vehicles, and equipment are stored in designated areas. Frequency: Daily. Responsible Person: Scheme Supervisor.
b. Minimize the leakage of fuels and lubricants from vehicles and equipment.	The use of vehicles and equipment that may leak fuel and lubricants.	• Only service machinery and vehicles in designated areas. • Regularly check your vehicle for fuel and oil leaks. • Maintain vehicles and equipment in good conditions through regular and thorough servicing. • Inform the Foreman of leaking vehicles and machinery so that he can schedule repairs. • Only refuel on the bund created for that purpose. • Immediately clean any accidental fuel and oil spills – do not hose spills into the natural environment.	Visual inspection to ensure that vehicles and equipment are in excellent condition and also to ensure that there is no leakage of fuels and lubricants. Frequency: Daily. Responsible Person: Scheme Supervisor.

Objectives	Potential Impact	Management Action	Mitigation Action
		• Dispose of contaminated soil as hazardous waste in the correct location on site. • If a mobile fuel bowser is used, then all refueling shall occur with appropriate measures in place to prevent spillages (drip trays, funnels, non-dripping dispensing nozzles, etc.) • All mobile fuel browsers shall carry a spill kit that is adequately sized to contain at least a 200-litre spill. • Train staff in the correct procedure/technique to transfer fuels. • Make sure all vehicles are roadworthy. Repair faulty brakes, exhausts, etc. immediately. • Fire extinguishers shall be present whenever undertaking any form of hot work, i.e. welding, gas cutting, angle grinding, etc.	

9.3 Health and safety

Objectives	Potential Impact	Management Action	Mitigation Action
a. Minimise the risk of HIV infection and the increase of STI's.	Risk of HIV infection.	• Provide an AIDS awareness programme for all the staff.	Verify that an awareness and education programme on the risks of HIV/AIDS and recommended preventative measures have been conducted. Frequency: Monthly Responsible Person: Scheme Supervisor.
b. Minimize the occurrence of injuries.	Injuries.	• Contractor is obliged to provide PPE to their employees. • Make sure that all staff are equipped and know how to use safety and protective gear. This includes hard hats, goggles, hearing protectors, dusk masks, steel-toed shoes, etc. • Keep a comprehensive first aid kit at the scheme offices and at maintenance sites.	Checks to ensure that correct procedures are followed and that protective clothing are worn at all times during maintenance. Visual checks to ensure that machinery and equipment

Objectives	Potential Impact	Management Action	Mitigation Action
		• Establish an emergency rescue system for evacuation of serious injured people. • Emergency procedures for accidents should be communicated to all employees. • Dangerous areas must be clearly marked and access to these areas controlled or restricted. • Good driving and adherence to safety rules will result in a minimum number of road and workplace accidents. • Fire extinguishers must be available at all refueling sites. Staff should be trained to handle such equipment. • Nobody is allowed to dispose of a burning or smoldering object in an area where it may cause the ignition of a fire. • Hazardous substances must be kept in adequately protected areas to avoid soil, air or water pollution. • Work areas, such as these for the maintenance of equipment, must be on concrete slabs. • Explosives should be stored according to the prescribed regulations.	used during maintenance are in good working condition. Frequency: Check weekly. Responsible Person: Scheme Supervisor.

10. REHABILITATION AND SITE CLOSURE

11.1 What is Rehabilitation?

Rehabilitation is the process of returning the land in a given area that has been disturbed by operation and maintenance to its original state, or an otherwise determined state. Many projects, if not all, will result in the land becoming degraded to some extent. However, with proper rehabilitation most impacts associated with the operation and maintenance of the scheme and pipelines could be mitigated and restored to an acceptable level. Poorly rehabilitated areas provide a difficult legacy issue for governments, communities, and companies, and ultimately tarnish the reputation of companies as a whole.

Rehabilitation has always been a major part of the scheme and pipeline's planning. Rehabilitation proposals and concept plans are developed well before construction of the scheme or pipelines and those plans are revised from time to time. In preparing these plans, the advice and skill of a large range of experts, including soil scientists, hydrologists, engineers, aquatic biology and water quality specialists have been sought.

11.2 Objectives of proper site closure and rehabilitation

The goal is to restore the area to its original state as much as possible.

The objectives of the rehabilitation plan should be based upon the specific characteristics of the construction area and should reflect:

- Reduction or elimination of the need for a long-term management program to control and minimise the long-term environmental impacts;
- Clean-up, treatment or restoration of contaminated areas (e.g. soils contaminated by oil or fuel spills, concrete spills, etc.). Disposal thereof in an acceptable manner.
- Improving the visual appearance of the disturbed areas.
- Establishing a cover to provide erosion control.
- Improving runoff water quality by minimising silt loads.

11.3 Rehabilitation measures to implement:

a. Clear and completely remove from site all construction plant, equipment, storage containers, temporary fencing, temporary services and fixtures.

b. Ensure that all access roads utilised during construction (which are not earmarked for closure and rehabilitation) are returned to a usable state and / or a state no worse than prior to construction.

c. Remove from site all temporary fuel stores, hazardous substance stores, hazardous waste stores and pollution control sumps. Dispose of hazardous waste at approved sites and manner.

d. Remove from site all pollution containment structures.

e. Remove from site all temporary sanitary infrastructure and waste water disposal systems. Take care to avoid leaks, overflows and spills and dispose of any waste in the approved manner.

f. Dismantle and flatten temporary drifts and water course crossings, reinstating all drainage lines to approximate their original profile.

g. Rip and / or scarify all disturbed areas of the construction site, including temporary access routes and roads, compacted during the execution of the works.

h. Rip and / or scarify along the contour to prevent the creation of down-slope channels.

i. A site inspection will be held by the scheme supervisor after every maintenance work during the operation of the scheme. Rehabilitation will be done to the satisfaction of the ENV section and MET.

j. Frequent inspections of the scheme and effective follow-up procedures, to prevent minor defects from becoming major repair jobs.

k. Make sure all soil polluted during maintenance work is properly stored in drums and removed to an appropriate waste dump.

l. Make sure all windblown litter is removed once maintenance has seized.

m. Make sure that all potential hazards are properly closed and left in a safe and neat position.

n. Ensure that the area is safe for the intended end land use.

11.4 Rehabilitation and Closure Plan

All contractors will have to submit a Rehabilitation and Closure Plan for approval by the NamWater Environmental Section. The Environmental Section will also audit implementation of the plan.

11. NAMWATER ENVIRONMENTAL CODE OF CONDUCT

What is an Environmental Code of Conduct?

It is a set of rules that everybody has to follow in order to minimise damage to the environment.

What is the ENVIRONMENT?

The ENVIRONMENT means the surroundings within which people live. The ENVIRONMENT is made up of the **soil, water, plants,** and **animals** and those characteristics of the soil, water, air, and plant and animal life that influence **human health and well-being**. **People** and **all human activities** are also part of the environment and have to be considered during the operation of the Scheme.

Do these ENVIRONMENTAL RULES apply to me?

YES, The Environmental Rules apply to EVERYBODY. This includes all permanent, contract, or temporary workers as well as any other person who visits the Scheme. Every person will be required to adhere to the Environmental Code of Conduct.

ALL PERSONNEL must study and keep to the

Environmental Code of Conduct

The SCHEME SUPERVISOR will issue warnings and will discipline ANY PERSON who breaks any of the Environmental Rules. Repeated and continued breaking of the Rules will result in a disciplinary inquiry and which may result in that person being asked to leave the Scheme permanently.

What if I do not understand the ENVIRONMENTAL RULES?

Ask for advice, if any member of the workforce does not understand, or does not know how to keep any of the Environmental Rules, that person must seek advice from the scheme supervisor. The person that does not understand must keep asking until he/she is able to keep to all the Environmental Rules.

Safety and Security

1. Only enter and exit roadways and maintenance areas at demarcated entrances.
2. Wear protective clothing and equipment as per signboards at the Scheme and according to instructions from your SCHEME SUPERVISOR.

3. Report to your SCHEME SUPERVISOR if you see a stranger or unauthorised person in the maintenance area.
4. Never enter any area that is out of bounds or that is demarcated as dangerous without permission of your SCHEME SUPERVISOR.
5. Never climb over any fence or enter private property without permission of the landowner or your SCHEME SUPERVISOR.
6. Do not remove any vehicle, machinery, equipment, or any other object from the maintenance site without the permission of your SCHEME SUPERVISOR.
7. Keep clear of blasting sites. Follow the instructions of your SCHEME SUPERVISOR.
8. Never enter or work in the Scheme while under the influence of alcohol or other intoxicating substances.
9. All staff should know the emergency procedures in case of accidents.

Waste Disposal

10. Learn the difference between different types of waste, namely:
    - general waste, and
    - hazardous waste.

Containers will be provided for different types of wastes.

General Waste includes waste paper, plastic, cardboard, harmless organic (e.g. Vegetables) and domestic waste

Hazardous Waste includes objects, liquids or gases that are potentially dangerous or harmful to any person or the environment. Sewage, fuel, tyres, diesel, oils, hydraulic and brake fluid, paints, solvents, acids, soaps and detergents, resins, old batteries, etc. are all potentially hazardous.

11. Learn how to identify the containers for the different types of wastes. Only throw general waste into containers, bins or drums provided for general waste.
12. Recycle drums, pallets and other containers.
13. Never bury or burn any waste on site, all waste is to be disposed of in allocated refuse disposal containers, bins or bags.
14. Never overfill any waste container. Inform your SCHEME SUPERVISOR if you notice a container that is nearly full.
15. Do not litter.
16. Do not bury litter or rubbish in the backfilled trench.

Plants and Animals

17. **Do not ever pick any plants, or catch any animal.** People caught with plants or animals in their possession will be handed to the authorities for prosecution.
18. Never feed, tease, play with, or set devices to trap any animal or livestock. Wild animals are not to be domesticated.
19. Keep off the rock outcrops unless given specific permission by the SCHEME SUPERVISOR to be there.
20. Never cut down any tree or branches for firewood.
21. Never leave rubbish or food scraps or bones where it will attract animals, birds, or insects.
22. Rubbish must be thrown into allocated waste disposal bins/bags.
23. Always close the gates behind you.

Preventing Pollution

24. Only work with hazardous materials in bunded areas.
25. Never discard any hazardous substances such as fuel, oil, paint, solvent, etc. into stream channels or onto the ground. Never allow any hazardous substances to soak into the soil.
26. Clean up spills immediately.
27. Immediately report to your SCHEME SUPERVISOR when you spill, or notice any hazardous substance overflow, leak or drip or spill on site, into the streambeds or along the road.
28. Immediately report to your SCHEME SUPERVISOR when you notice any container, which holds hazardous substances overflow, leak or drip. Spillage must be prevented.
29. Only wash vehicles, equipment and machinery, containers and other surfaces at work site areas designated by your SCHEME SUPERVISOR.
30. Do not change the oil on uncovered surfaces.
31. If you are not sure how to transport, store, use, or get rid of any hazardous substances ask your SCHEME SUPERVISOR for advice.

Health

32. Drink lots of clean water every day.
33. Use toilets that have been provided.
34. Take the necessary precautions to avoid contracting HIV / AIDS. Condoms are available at most Clinics.
35. Inform your SCHEME SUPERVISOR when you are sick.
36. Do not work with any machinery when you are sick.

37. If you are working in malaria areas, you must take the necessary precautions.

Dust Control

38. Do not make any new roads or clear any vegetation unless instructed to do so by your SCHEME SUPERVISOR.
39. Keep to established tracks and pathways.
40. Keep within demarcated work areas.

Saving Water

41. Always use as little water as possible. Reduce, re-use and recycle water.
42. Never leave taps or hose pipes running. Close all taps after use.
43. Report any dripping or leaking taps and pipes to your SCHEME SUPERVISOR.

Working Hours

44. You may only work on weekends and after hours with the consent of the SCHEME SUPERVISOR.

Archaeological and Cultural Objects

45. If you find any archaeological, cultural, historical or pre-historical object on the maintenance site you must immediately notify your SCHEME SUPERVISOR.
46. Never remove, destroy, or disturb any cultural, historical, or pre- historical object on site.

Cultural and Historical Objects include old buildings, graves or burial sites, milestones, old coins, beads, pottery, and military objects.

Pre-Historical objects include fossils and old bones, old human skeletal remains, pieces of pottery and old tools and implements.

Sensible Driving

47. Tracks and roads should be kept to a minimum. Where possible follow existing roads.
48. No off-road driving is allowed.
49. Never drive any vehicle without a valid licence for that vehicle class and do not drive any vehicle that is not road-worthy.
50. Never drive any vehicle when under the influence of alcohol.
51. **Always** keep your headlights on when driving on dusty roads.

52. Keep to the roads as specified by your SCHEME SUPERVISOR. Vehicles may only be driven on demarcated roads. Drivers should always use three-point turns, “U-turns” are not allowed. Do not cut corners.
53. Do not drive on rocky outcrops.

Noise

54. Keep noise levels as low as possible.
55. Do not operate noisy equipment outside normal working hours.

Fire Control

56. Do not make open fires, use a drum or tin and do not collect any vegetation to burn.
57. Do not smoke or make fires near refuelling depots or any other area where fuel, oil, solvents, or paints are used or stored. Fireplaces should be at a safe distance from fuel and explosive storage sites as well as vehicle parking sites.
58. Cigarette butts should always be thrown in allocated refuse bins. Make sure that the cigarette butt is out before throwing it into the bin.
59. Immediately notify your SCHEME SUPERVISOR if you see an unsupervised fire at the campsite or maintenance site.

Dealing with Environmental Complaints

60. If you have any complaint about dangerous working conditions or potential pollution to the environment, talk to your SCHEME SUPERVISOR.
61. If any person complains to you about noise, lights, littering, pollution, or any harmful or dangerous condition, immediately report this to your SCHEME SUPERVISOR.

For any enquiries, please call

NP du Plessis
Tell: 061-71 2093
Cell: 081 127 9040

OR

Jolanda Murangi
Tell: 061-71 2105
Cell: 081 217 8116

12. REFERENCES

1. Christelis, G., and Struckmeier, W. (Eds.). 2011. Groundwater in Namibia an explanation to the Hydrogeological Map. Windhoek.

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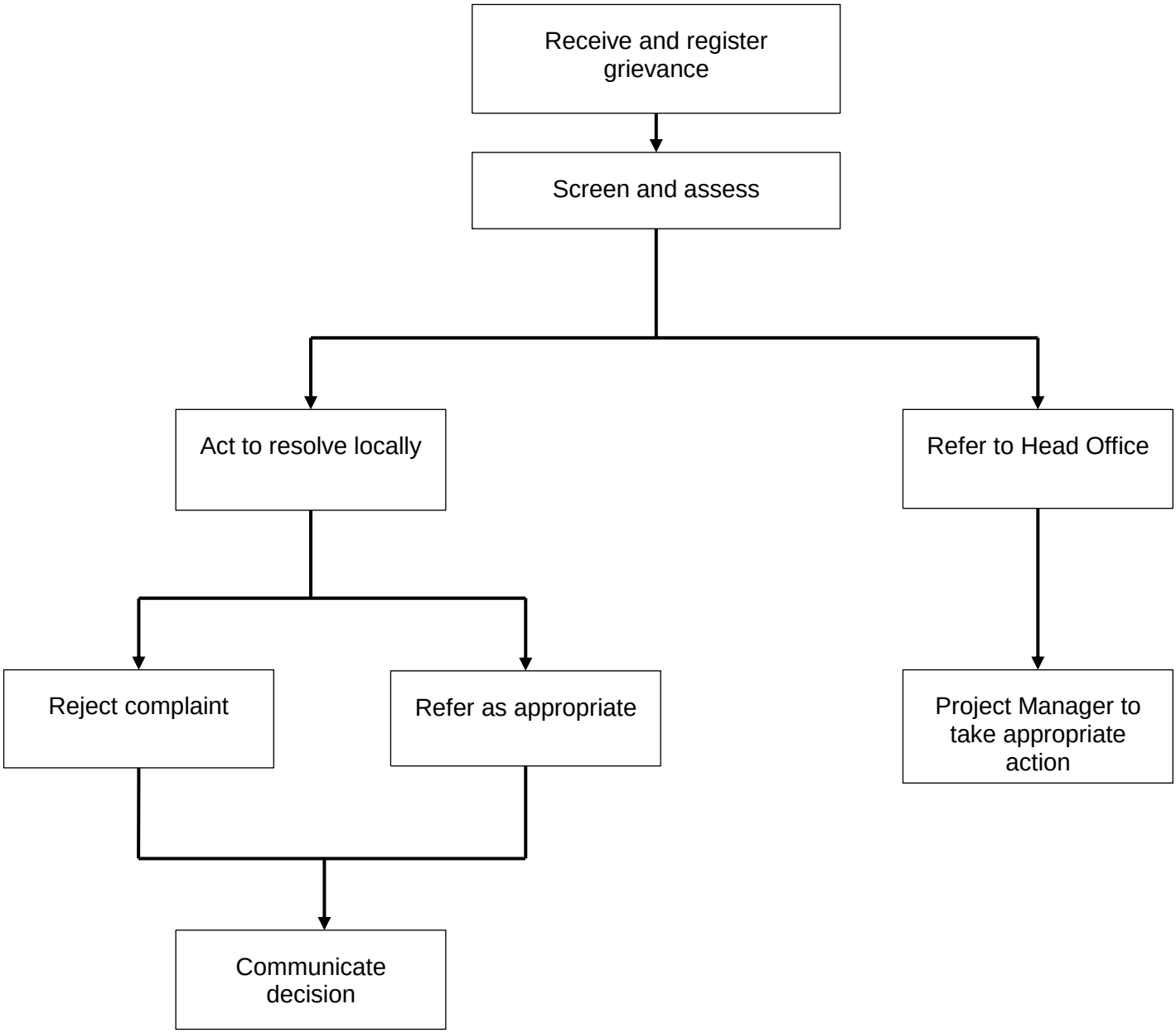
4. Mendelsohn, J., Jarvis, A., Roberts, C. & Robertson, T. 2002. Atlas of Namibia: a portrait of the land and its people. Ministry of Environment & Tourism / David Philip: Cape Town.

ANNEXURE 1: WATER QUALITY ANALYSIS RESULTS

Table 2: Water quality analyses for borehole WW202433 for March-April 2019

Determinant	Water Quality Standard Acceptable Limit (95 Percentile)	Borehole Water Quality (95 Percentile)	Unit	Comment
pH	6.0 -9.0	6.5		
Colour	<15	**62**	mgPt/L	Not acceptable
NTU (Borehole)	<2	**26.1**	NTU	Not acceptable
Cond	<300	15.5	mS/m	
TDS	<2000	103.9	mg/l	
Na	<300	12.5	mg/l	
K	<100	4.0	mg/l	
Ca	<375	31.3	mg/l as CaCO3	
Mg	<292	14.6	mg/l as CaCO	
TH	<400	45.9		
SO4	<300	12.4	mg/l	
NO3	<11	1.3	mg/l	
NO2	<0.5	<0.1	mg/l as N	
SiO2	-	35.0	mg/l as N	
F	<2.0	0.10	mg/l	
Cl	<300	4.0	mg/l	
Alk	-	77.0	mg/l	
P.Alk	-	-	mg/l as CaCO	
Fe	<0.3	**5.77**	mg/l	Not acceptable
Mn	<0.1	0.195	mg/l	Not acceptable
Cu	<2.0	0.0625	mg/l	
Zn	<5.0	0.115	mg/l	
Cd	<0.01	<0.01	mg/l	
Pb	<0.05	0.03	mg/l	

ANNEXURE 2: GRIEVANCE PROCEDURE AND GRIEVANCE REGISTRATION FORM



Grievance Registration	
Case No:	Date:
Name of complainant:	Cell no:
	Email address:
Details of grievance: (Date, location, persons involved, frequency of occurrence, effects of ensuing situation, etc)	
Name of person recording grievance:	Cell number:
Proposed date of response:	
Signature of recording person:	Signature of complainant:
Date of redress:	
Decision and action:	