

ENVIRONMENTAL MANAGEMENT PLAN

for the

Construction, operation, maintenance, and decommissioning of the proposed Karibib Powdered Activated Carbon (PAC) Plant and Ground Reservoir.

A PROJECT BY NAMWATER

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LIST OF ABBREVIATIONS & ACRONYMS

BID:	Background Information Document
DEA:	Directorate of Environmental Affairs
DWA:	Department of Water Affairs
EAP:	Environmental Assessment Practitioner
ECC:	Environmental Clearance Certificate
EIA:	Environmental Impact Assessments
EMA:	Environmental Management Act No. 7 of 2007
EMP:	Environmental Management Plan
EPA:	Environmental Protection Agency
ERC:	Erongo Regional Council
Erongo RED:	Erongo Regional Electricity Distributor
GN:	Government Notice
I&APs:	Interested and Affected Parties
KWSS:	Karibib Water Supply Scheme
KWTP:	Karibib Water Treatment Plant
MAWLR:	Ministry of Agriculture, Water, and Land Reform
MEFT:	Ministry of Environment, Forestry, and Tourism
MSDS:	Material Safety Data Sheet
NHC:	National Heritage Council
PAC:	Powdered Activated Charcoal
PPE:	Personal Protective Equipment
NamWater:	Namibia Water Corporation Ltd
ToR:	Terms of Reference
WHO:	World Health Organisation
WRM:	Water Resources Management

1 INTRODUCTION AND BACKGROUND

1.1 Introduction

NamWater owns and operates the Karibib Water Supply Scheme (KWSS) that supplies water to the Karibib Town Council, NDF Air Force Base, the Otjimbingwe Scheme (commissioned in June 2017) and other online customers on the pipelines supplying the Otjimbingwe Scheme and the Namibian Defence Force (NDF) Base.

Raw water is abstracted from the Swakoppoort Dam and transferred via the Swakoppoort-Okongava and Okongava-Karibib pipelines to the Karibib Water Treatment Plant (KWTP). The Swakoppoort Dam has a full supply capacity of 63 489 Mm³, with a 95% yield of 4.5 Mm³. Raw water is sourced from the Swakoppoort Dam, from where it is pumped to the Okongava Reservoir. From Okongava Reservoir, the raw water is conveyed via gravity to the KWTP. The existing Swakoppoort – Okongava Scheme supplies raw water to both the Navachab mine and KWTP and lately also to the Desert Lion Energy Mine. The Swakoppoort – Okongava scheme and the schematic layout of the raw water Swakoppoort Dam Reservoir are shown in **Figure 1** and **Figure 2** respectively.

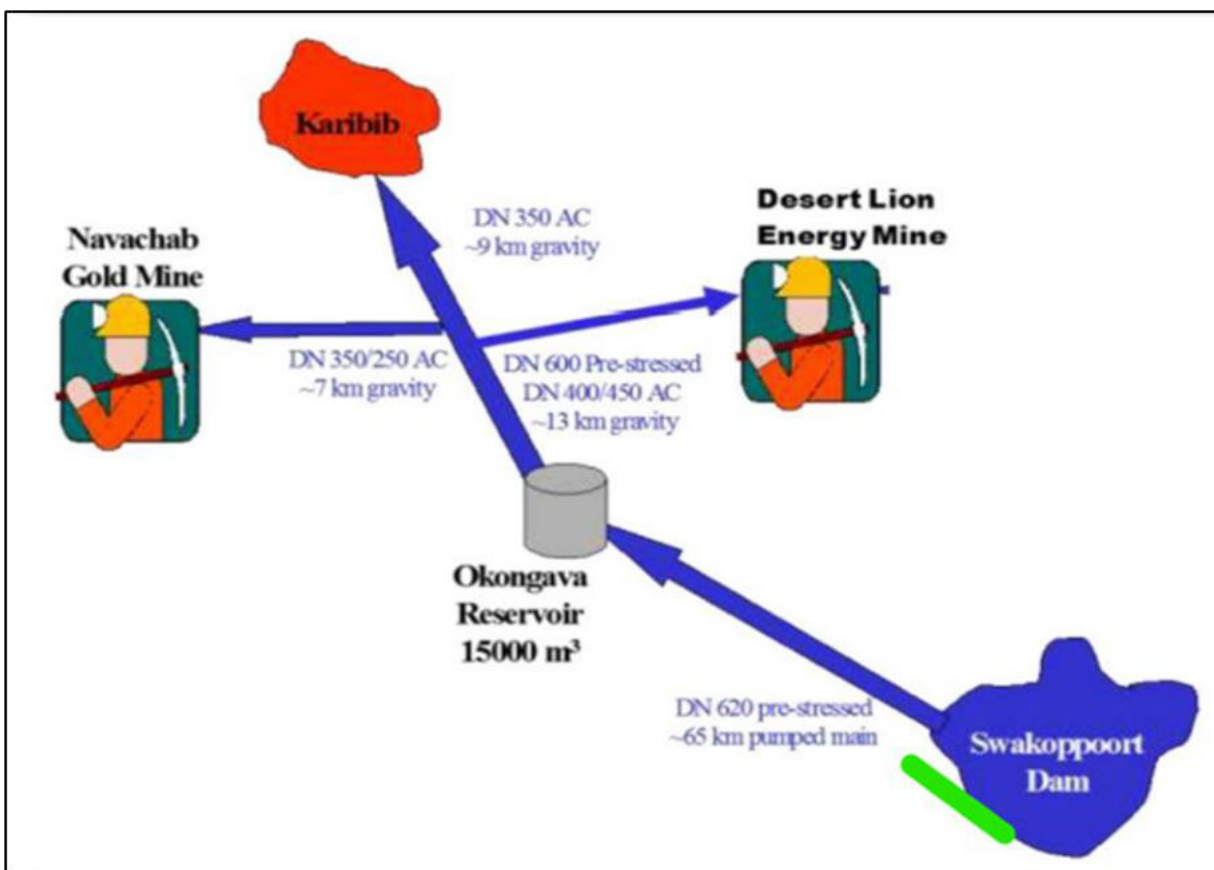


Figure 1: Swakoppoort – Okongava- Karibib scheme

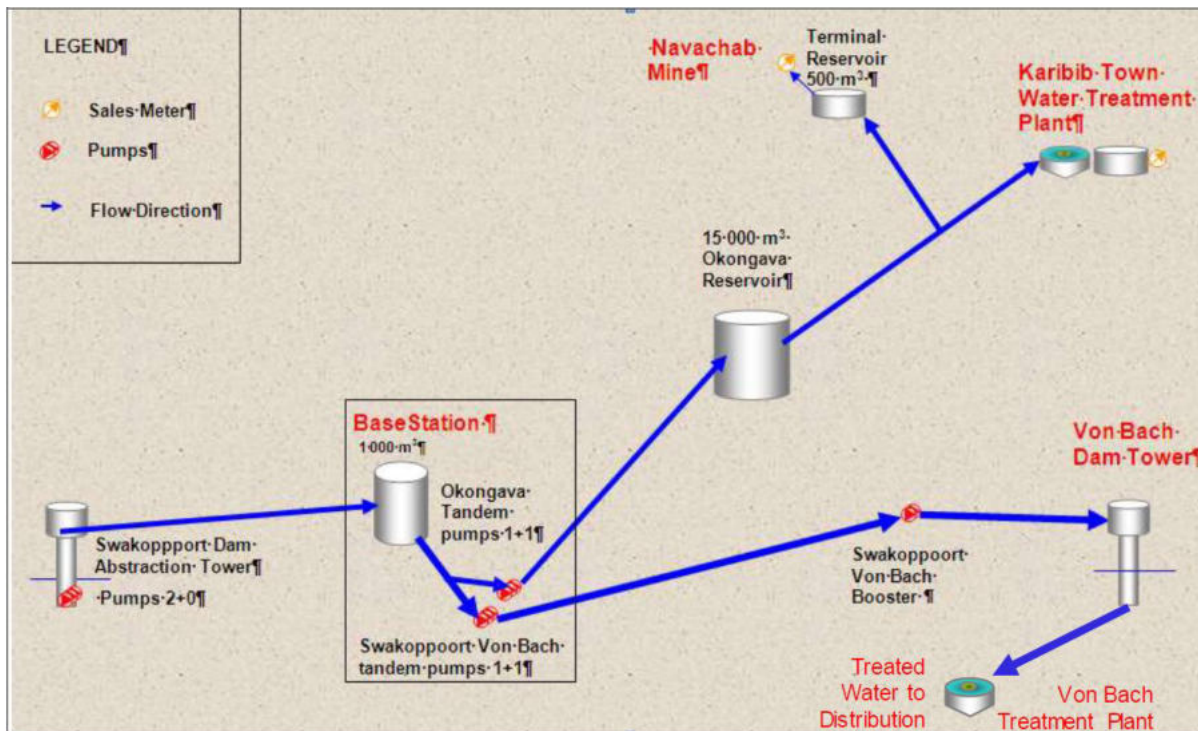


Figure 2: Map illustrating Water Transfers from Swakoppoort Dam

1.2 Karibib Water Treatment Plant (KWTP)

The existing KWTP is located in 2nd Street, of Karibib town. The plant area covers approximately 4ha of the land surface and is enclosed with a barbed wire mesh fence, approximately 2.8 m high with lockable gates.

Raw water is sourced from the Swakoppoort Dam, from where it is pumped to the Okongava Reservoir. From Okongava Reservoir, the raw water is conveyed via gravity to the KWTP.

The KWTP was completed in 1993 and has a design capacity of 216 m³/hour or 4 700 m³/d (60 l/s) at a 22-hour operation. However, a performance test of the treatment plant revealed that the product water quality does not always comply with the Water Quality Standards (acceptable standard), depending on the quality of the raw water from the Swakoppoort Dam (NamWater, 2018).

To eliminate the pathogens that are responsible for waterborne diseases, the water supplied to the public undergoes a thorough a purification process. Water purification is the process of removing undesirable chemicals, biological contaminants, suspended solids, and gases from contaminated water. The goal of this process is to produce water fit for a specific purpose. Most water is disinfected for human consumption (drinking water). In general the methods used include physical processes such as filtration, sedimentation, and distillation, biological processes such as slow sand filters or biologically active carbon, chemical processes such as flocculation and chlorination and the use of electromagnetic radiation such as ultraviolet light.

The purification process of water reduces the concentration of particulate matter including suspended particles, parasites, bacteria, algae, viruses, fungi; and a range of dissolved and particulate material derived from the surfaces that water may have made contact with after falling as rain.

The standards for drinking water quality are typically set by governments or by international standards. These standards will typically set minimum and maximum concentrations of contaminants for the use

that is to be made of the water. For Namibia, the new Water Resource Management Act (WRMA) 11 of 2013 along with new water quality standards of 2013 which are being enforced by the Directorate of Water Affairs and NamWater is required to meet these standards.

The treatment process at the KWTP is summarised as follows:

- Coagulant dosing at the raw water inlet and dosing of PAC at 10 mg/L at the inlet works as well as dosing of lime to stabilise the water.
- Flocculation and settling: The flocculated water flows through a flocculation canal to a horizontal settling tank. After settling, the clear water is collected in two launders and conveyed to three sand filters in parallel.
- Intermediate chlorination
- Sand filtration: There are three rapid sand filters reported to have a single media bed depth of only 400 mm and a loading rate of 5 m/h.
- Clearwater well (110 m³) and final chlorination: The filtered water flows into a clear water sump which also serves as a chlorine contact tank for disinfection.
- After disinfection, the water is pumped to the Karibib reservoir (size of 1250 m³) for storage and distribution to Karibib, via a pipeline with tee-off to the NDF and the Otjimbingwe Water Supply Scheme.

Other infrastructures at the plant are (**shown in Figure 3: Infrastructure at the KWTP**)

- Offices, Chlorine dosing room and a pump station housing various raw water and clear water pump sets.
- Sludge lagoons/drying beds

1.3 Need and desirability of the project

Raw water from Swakoppoort Dam is frequently experiencing low water quality due to high nutrient loads that consequently have increased production rates causing blue-green algae species counts to shoot up. These could be attributed to seasonal variations of the hydrological runoff, coupled with salinization, uplift and dynamics of sediments in Swakoppoort Dam.

The KWTP sometimes experiences challenges in removing the blue-green algae and associated taste and odour in the raw water (NamWater, 2018). To eliminate these challenges, NamWater decided to install a PAC pre-treatment plant for taste & odour control and toxin removal (methyl-iso-borneol (MIB) and geosmin) to support the treatment process done at the KWTP.

Moreover, to cater for future water demand for the Karibib Town (future housing and development, agricultural plots, and Namibia Defence Force (NDF) Air Force Base) and the Otjimbingwe settlement, a clear water ground-level reservoir will be constructed. The new reservoir will thus enable a two-day storage at average annual daily demand, which provides a measure of water security, and should sources fail to serve as a buffer for daily and hourly peaks.

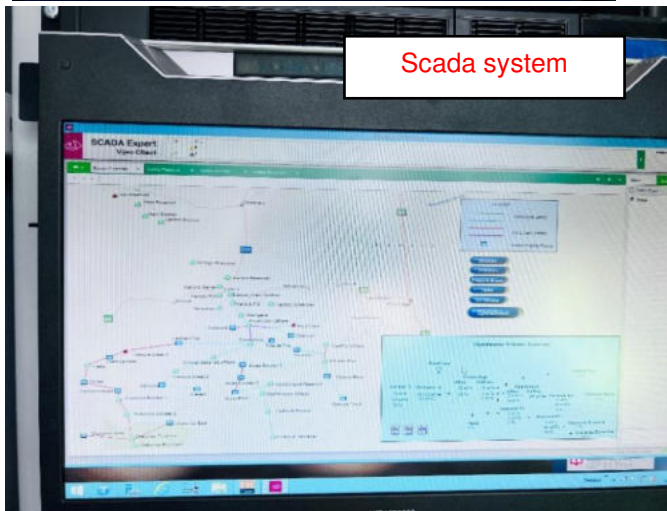
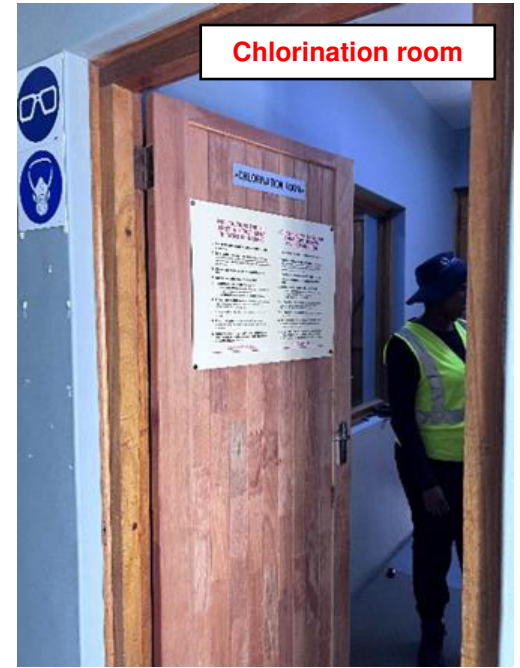


Figure 3: Infrastructure at the KWTP

2 ENVIRONMENTAL MANAGEMENT PLAN

2.1 What is an Environmental Management Plan?

Environmental Management Plans (EMPs) are important tools that focus on the management actions that are required to ensure the environmental compliance of a project. The Environmental Impact Assessment Regulations (2012) of the Environmental Management Act No. 7 of 2007, state that *“management plan means a plan that describes how activities that may have significant effects on the environment are to be mitigated, controlled and monitored”*.

It further indicates that a draft management plan should include:

- “Information on any proposed management, mitigation, protection or remedial measures to be undertaken to address the effects on the environment that have been identified including objectives in respect of the rehabilitation of the environment and closure.
- as far as is reasonably practicable, measures to rehabilitate the environment affected by the undertaking of the activity or specified activity to its natural or predetermined state or to a land use which conforms to the generally accepted principle of sustainable development; and
- a description of the way the applicant intends to modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation remedy the cause of pollution or degradation and migration of pollutants.”

2.2 Objectives of the EMP

This EMP has been compiled for the management of potential environmental impacts during the planning, design, operation, and decommissioning phases of the proposed Karibib Powdered Activated Carbon Plant and Ground Reservoir. The EMP also includes best practices for the generic issues of construction management and supervision as well as the ongoing management and operation of the scheme.

The specific objectives of this EMP are:

- Present measures to avoid, lessen and mitigate adverse impacts on various environmental components, and enhance the value of environmental components where possible.
- Defining the roles and responsibilities for the implementation of environmental management and mitigation measures.
- Explain the need for compliance with regulatory provisions and guidelines.
- Explain procedures for compliance monitoring and reporting to the relevant competent and regulatory authorities.
- Present procedures for the possible decommissioning and required environmental rehabilitations.

EMP implementation is a repeated process that converts mitigation measures into actions. This is achieved through continuous monitoring, auditing, review and corrective action to ensure conformance with the aims and objectives of this EMP. An EMP should be flexible and respond to unforeseen events and changes in project implementation that were not considered before. To ensure that the EMP remain effective, through monitoring and auditing, feedback for continual improvement in environmental performance must be provided and corrective actions must be taken.

2.3 Legal implications and obligations under this EMP

The proposed project is a listed activity under the EIA Regulations: Environmental Management Act of 2007 (Act No. 07 of 2007) which may not be undertaken without an environmental clearance certificate (ECC), and is listed as follows:

Table 1: The listed activities of the project

Proposed project activities	Activities Triggered	
	Categories	Specific Activity
<ul style="list-style-type: none"> Construction and operation of the PAC Plant 	No. 2. Waste Management, Treatment, handling, and disposal activities	2.1 The construction of facilities for waste sites, treatment of waste and disposal of waste
<ul style="list-style-type: none"> Construction of a groundwater reservoir 	No. 8. Water Resource Developments	No. 8.5 Construction of dams, reservoirs, levees and weirs.
		8.6 Construction of industrial and domestic wastewater treatment plants and related pipeline systems.

Considering the above, an application for an ECC can only be made once an EIA study has been undertaken and approved by the Competent Authority (Department of Water Affairs (DWA) and the Regulatory Authority (Ministry of Environment, Forestry, and Tourism (MEFT)).

This Environmental Management Plan (EMP) was prepared in line with Section 8 (j) of the EIA Regulations (GN 30 of February 2012), and the proponent's Terms of Reference.

The EMP will be sent to the Ministry of Environment, Forestry and Tourism's (MEFT) Department of Environmental Affairs (DEA) for approval. Once the DEA is satisfied with the contents of the EMP, they will issue an ECC to the Proponent. The ECC is linked to the recommendations of the EMP.

The EMP, once accepted, therefore becomes a legally binding document and each role-player including contractors and sub-contractors who are made responsible to implement the relevant sections of this EMP is required to abide by the conditions stipulated in this EMP document.

3 PROPOSED DEVELOPMENT

The proposed development entails the construction of:

- A Pre-treatment PAC Plant with associated infrastructure e.g. storage units, wastewater facilities, etc.) the existing KWTP is situated approximately (3.1 km) from the KWTP.
- A clear water concrete ground-level reservoir is to be constructed within the NamWater premises at the existing KWTP.

3.1 Pre-treatment PAC Plant

According to the Environmental Protection Agency (EPA) of the United States of America (2016), the PAC application point should allow for an adequate contact time between the PAC and organics.

The PAC dosages can range between 1 to 100 mg/L depending on the type and concentrations of organic compounds present and dosages of 1 to 20 mg/L are typical for nominal taste and odour control (EPA, 2016). The EPA also states that a minimum contact time of about 15 minutes is required for most taste and odour compounds, however, significantly longer contact times may be required for methyl-iso-borneol (MIB) and geosmin removal.

3.1.1 Locality

The PAC plant is proposed to be constructed on a 1010 m² piece of land (a Portion of Rem. Of Portion B) Karibib Town Land and Townlands No. 57, located opposite Karibib Extension 6 next to the C32 road (**Figure 4**). The portion is currently zoned as undetermined. The site currently has no building structures and is located within business-zoned properties (across the C32 road) which includes brickmaking, marble processing plants, offices, Kodo Drilling etc.

3.1.2 Scope of work

The construction of the PAC pre-treatment dosing plant required will assist to control the raw water taste and odour problems 216 m³pumped from Swakoppoort Dam to the KWTP. The PAC plant will be tapping raw water from the main bulk water transfer pipeline from the Swakoppoort Dam, approximately 3.1 km before the KWTP. The raw water will be mixed with the PAC in the 3 tanks. The mixture will be constantly stirred to ensure sufficient mixing and then pumped back into the main pipeline of the KWTP, using positive displacement dosing pumps. There will be telemetry communication between the PAC plant and KWTP. The lay out of the PAC is illustrated in **Figure 5** & **Figure 6**.

The PAC plant will consist of the following operational mechanisms:

- Automatic operation of the PAC plant.
- Remote operation and monitoring via Telemetry.

3.1.3 Proposed PAC Plant Building plan

The proposed PAC plant will be sized at an area of 170 m². The building plan is presented in **Figure 5**, and the PAC building will include the following sections:

- Operations rooms
- PAC bag and air filters storage room
- Safety room/ablution facilities
- Telecommunications room



Figure 4: Locality for the pre-treatment PAC plant

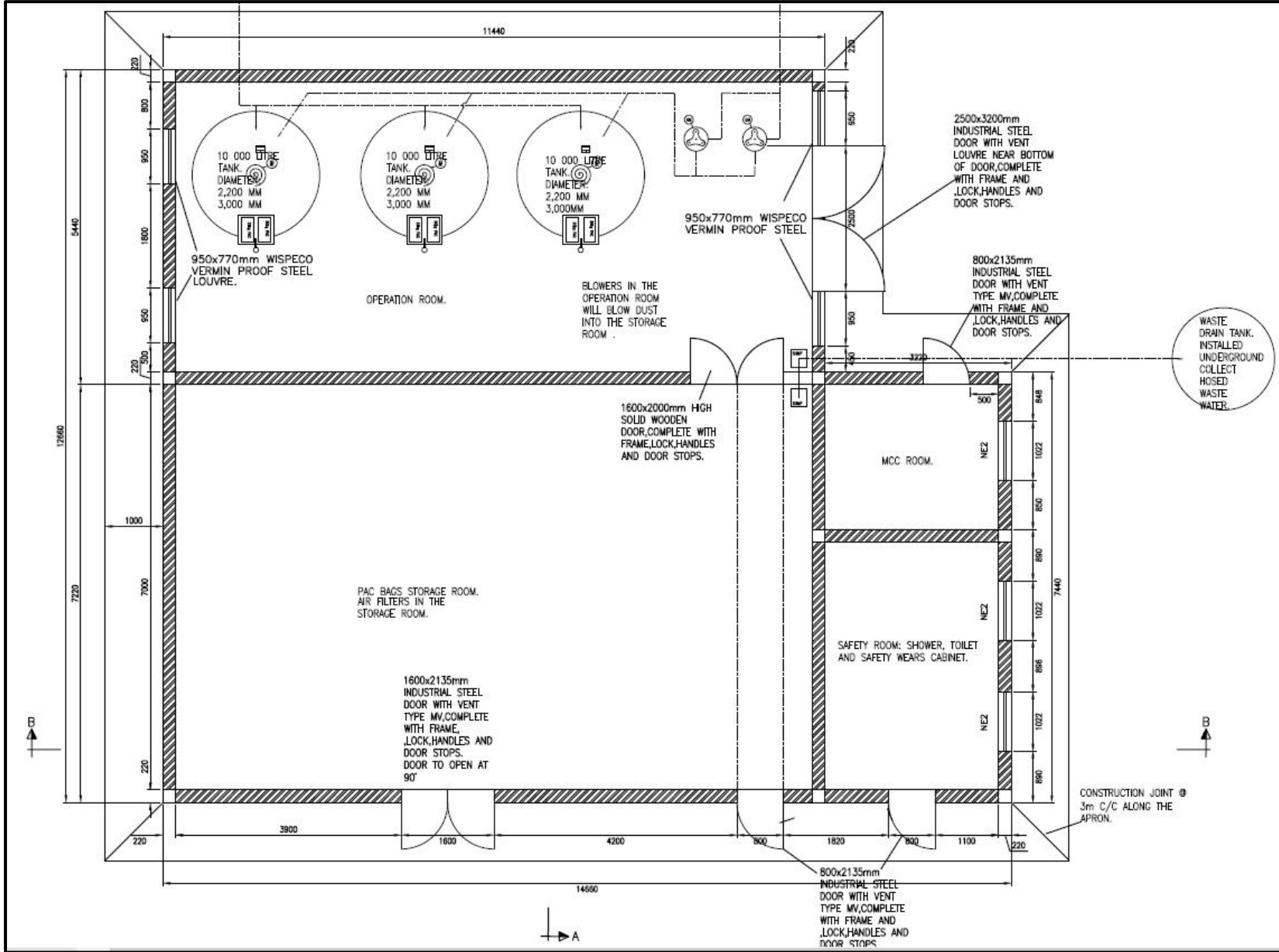


Figure 5: PAC building lay-out

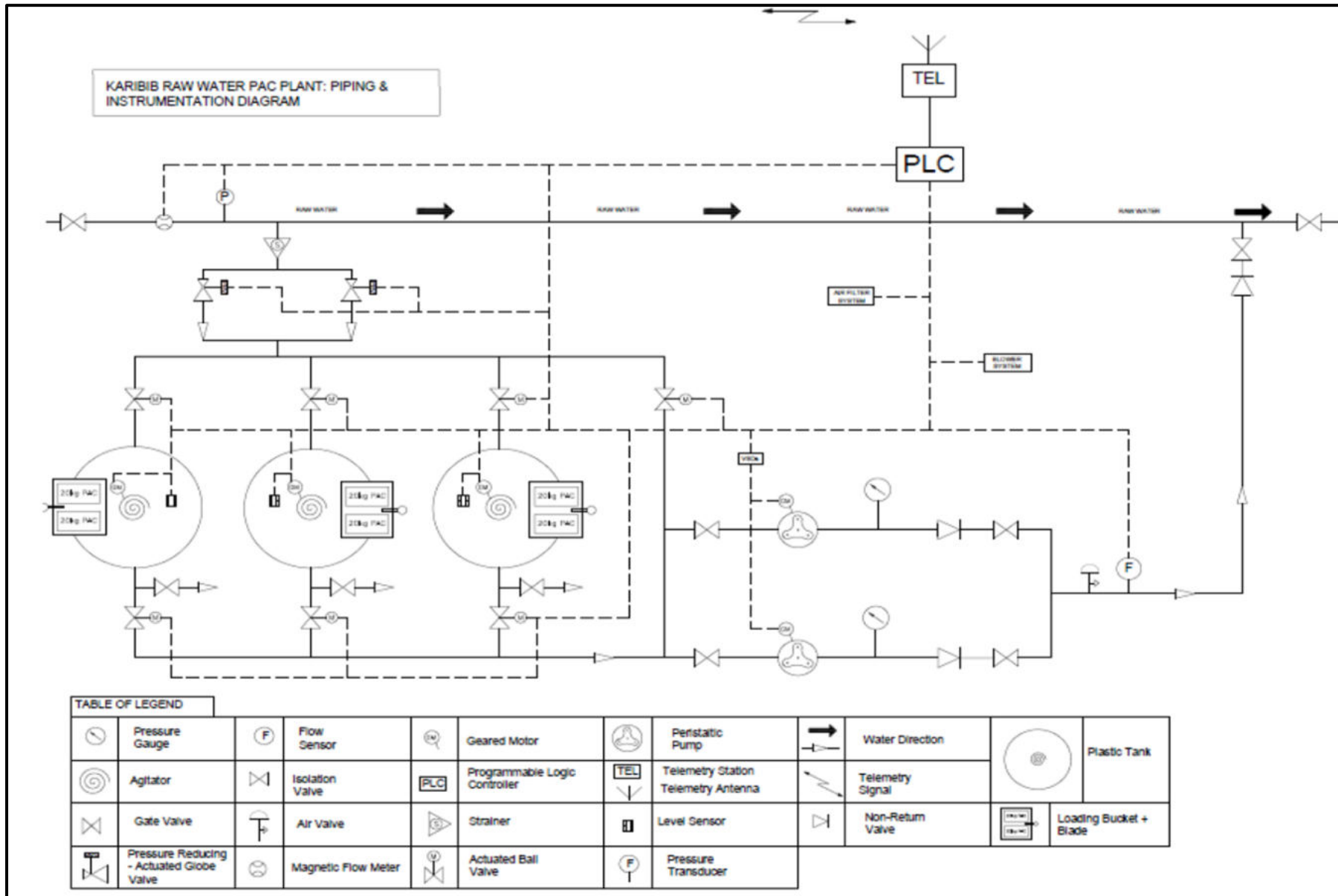


Figure 6: Proposed P&ID for PAC Plant

3.1.4 Design Parameters

3.1.4.1 Dosing Rate

The PAC dosages can range between 1 to 100 mg/L depending on the type and concentrations of organic compounds present and dosages of 1 to 20 mg/L are typical for nominal taste and odour control (EPA, 2016). The EPA also states that a minimum contact time of about 15 minutes is required for most taste and odour compounds, however, significantly longer contact times may be required for methyl-iso-borneol (MIB) and geosmin removal. **Table 2** shows the theoretical amount of PAC required to reduce the Geosmin from 187ppt (95th percentile value) to an acceptable standard of 30 ppt. The amount of PAC required ranges between 8-21 mg/L for the different types of PACs (Table 2).

Table 2: PAC Dose

PAC Sample	Log K	K	1/n	n	Acceptable standard, New Ce	Log Ce	log (Co-Ce)	log m	Carbon Dose needed, M (mg/L)
LQ325	0.17	1.49	0.47	2.11	30.00	1.48	2.20	1.32	21.11
CAD 900	0.83	6.74	0.16	6.45	30.00	1.48	2.20	1.14	13.81
Aqua Sorb	-0.83	0.15	1.42	0.70	30.00	1.48	2.20	0.93	8.49
GL 35	-0.07	0.86	0.80	1.26	30.00	1.48	2.20	1.09	12.27

With a maximum flowrate of 216 m³/h, the pump should have a range of 1- 187 l/h (with 10 000 m³ tanks and slurry concentration used). Plant dosing rate and capacity are shown in Table 3. The tanks have an agitator to ensure carbon slurry is always effectively mixed and in suspension.

Table 3: PAC Plant Dosing Rate & Capacity

PAC Plant Dosing Rate & Capacity			
Maximum concentration required for PAC solution at Karibib WTP	C _{max}	20	mg/L
Mixing tank size		10,000	L
Weight of PAC bags		20	kg
Number of bags required for mixing tank		5	
Make up tank solution concentration		10,000	mg/L
Percent concentration		1.0	%
Maximum raw water flow rate	Q	216	m ³ /h
Maximum PAC mixture dosing rate (Incl. 10%)		484	L/h

3.1.4.2 Flowmeter, Inlet Pressure Reducing & Isolating Valves

An electromagnetic flow meter will be installed in the main pipeline from the Okongava reservoirs to the KWTP downstream of the tap-off point, to monitor the flow for the calculation of the PAC dosing rate. Two high-quality pressure control globe-type valves, one operating plus one standby, will be installed after the point of tap-off from the main pipeline to reduce the pressure to the PAC plant.

Table 4: Valves

Valves			
Description	Qty	Characteristics	Control
Flowmeter	1	<ul style="list-style-type: none">• 16 bar, 350 NB Electromagnetic	24 Vdc
Isolating valves	2	<ul style="list-style-type: none">• 350 NB• 16 bar Isolating gate valves• Installed before the tapping point and after the dosing point	Manual
Pressure reducing valves	2	<ul style="list-style-type: none">• 16 bar pressure reducing globe valves• Actuated	400 V

3.1.4.3 Handling of PAC Bags

The PAC will be handled by the PAC plant operators who will be using the following procedure:

- Loading the PAC bags onto a pallet in the storage room, which will then be conveyed with a hand fork trolley to a fixed hydraulic lifting platform (See pictures in Figure 7) that will be constructed next to each mixing tank in the dosing room.
- The pallet will then be loaded onto the platform and lifted to the top of each tank.
- The operator will climb via a ladder onto an elevated galvanized platform that will be constructed next to the tanks to offload one bag at a time.
- The operator will load the bag into a loading bucket, after which he/she can cut it open.
- For each mixing tank, there will be a loading bucket mounted directly on top of the accessing hole of each mixing tank.



Figure 7: Hydraulic lifting platform and a Hand fork trolley

3.1.4.4 Mixing Tanks with Agitators

The mixing tanks will be fitted with agitators to continuously mix the concentration. The tanks will each be fitted with a scour valve and needs to be routinely flashed with raw water for cleaning.

Table 5: Mixing tanks and agitators

Mixing Tanks			
Description	Qty	Characteristics	Power ; Control
Isolating ball valves	6	<ul style="list-style-type: none"> • 16 bar • 3 x 80NB – Inlet • 3 x 50NB -outlet 	
Tank	3	<ul style="list-style-type: none"> • Polyethylene Tanks • 10 000 Liters 	
Level Transducer	3	<ul style="list-style-type: none"> • 24V DC 	DC ; PLC via 4 – 20 mA Signal
Agitators			
Description	Qty	Characteristics	Power ; Control
Agitator	3	<ul style="list-style-type: none"> • Power Rating: 1.5 kW • Speed: 141 rpm • Impeller Diameter = 1.2 m • Top Installation • Couple to Geared Motor 	Controlled by Motor
Geared Motor	3	<ul style="list-style-type: none"> • 1.5 kW • n1= 1410 rpm • 400 V • n2 = 44 rpm • 10 Gear Ratio 	3 Phase ; PLC

3.1.4.5 Dosing Pump System

A pair of peristaltic pumps coupled with geared VSD-driven motors will dose the concentration back into the main pipe.

Table 6: Dosing pump system

Pumping System			
Description	Qty	Characteristics	Power ; Control
Pump	2	<ul style="list-style-type: none"> • Peristaltic Pump • 0.7 kW Pump Power • Flow = 540 L/h • n2= 88 rpm • Discharge Pressure = 12 bar 	
Geared Motor	2	<ul style="list-style-type: none"> • 0.90 kW • n1= 1410 rpm • 400 V • n2 = 88 rpm • 16 Gear Ratio 	3 phase; 400 V
Variable Speed Drives	2	<ul style="list-style-type: none"> • 5 kW 	400 V

3.1.5 PAC Plant Control Philosophy

The PAC dosing will only be initiated when the raw water quality deteriorates, and results of the taste and odour compounds are high. The flow is detected via the electromagnetic flow meter, installed in the main raw water gravity feed pipeline between the Okongava Reservoirs and the KWTP at the PAC plant see **Figure 6** for the process flow diagram.

The raw water will be drawn from the raw water pipeline and the pressure will be reduced with high-quality pressure control globe-type valves, one-operating plus one standby configuration.

The dosing of the PAC solution into the raw water feed pipeline to the KWTP will be done automatically. A manual operational mode will be available but should only be used if the auto mode is not available. Dosing will be done from all three tanks simultaneously and will last for 3 days with a 20-hour operation period per day.

A single dewatering pump controlled by a float will be used to transfer the PAC wastewater back into the mixing tank. And using the peristaltic pumps, the mix will be pumped into the main pipe.

All three mixing 10 m³ tanks will be installed with a scouring pipe and manually operated valve to allow for the scouring of a tank when required. Each tank will have its own scour pipeline to the outside of the building.

3.1.6 Ablution Facilities & Waste Production

There is currently no sewage reticulation system installed in the area. The effluent from the PAC plant includes waste from the PAC mixing tank (non-toxic) and sewage wastewater (toxic waste) from the ablation facilities. They will be accumulated and stored in a septic tank, and

regular collection of the effluent will be arranged, for disposal at the Karibib Town Council sewerage evaporation ponds.

3.2 New Concrete Ground Water Reservoir

The proposed location for the new reservoir is identified to be within the NamWater yard at the KWTP. The reservoir will be 2 250 m³ in size (as shown in Figure 8). The size was determined based on the calculated future water demand taking into consideration NamWater's storage philosophy. The new reservoir will thus enable a two-day storage at an average annual daily demand, which provides a measure of water security, and should sources fail, serve as a buffer for daily and hourly peaks.

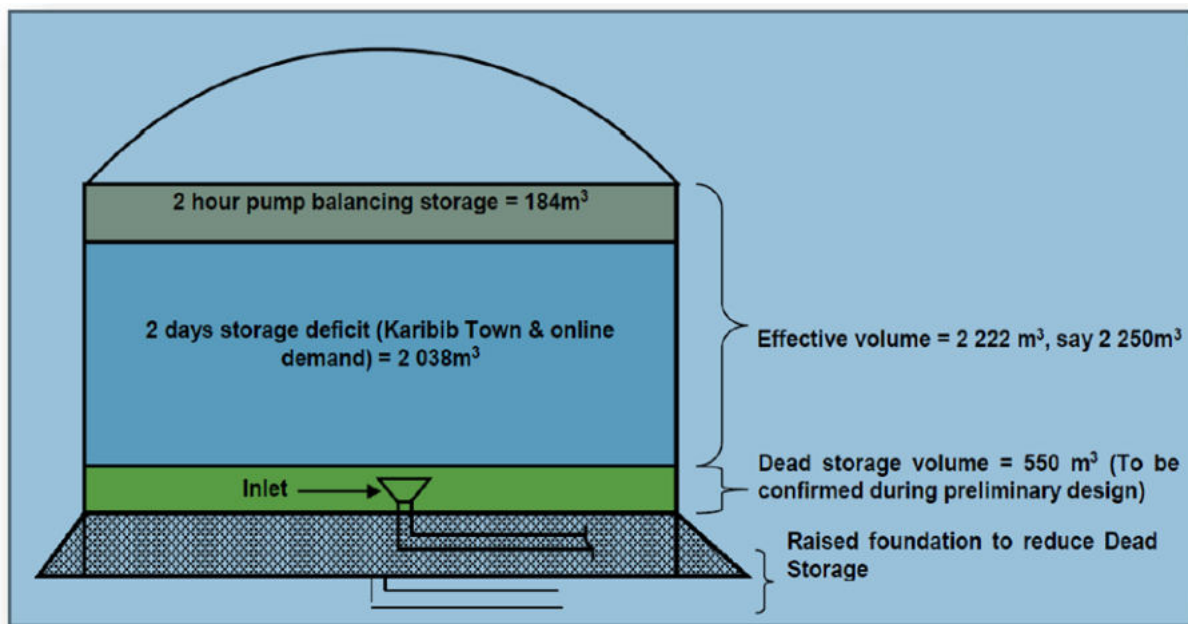


Figure 8: Concrete 2 250 m³ ground reservoir cross-sectional sketch

3.3 Resource requirements for the construction of the PAC and the Ground Water Reservoir

3.3.1 Sourcing materials-

Most of the construction materials i.e., sand, cement, gravel, stones, etc are available locally and in Namibia. PAC bags are also available from local suppliers such as Aqua Services and Engineering, a Namibian supplier and service partner for reagents, chemicals and equipment for water and wastewater treatment.

3.3.2 Land requirements

The site for the PAC is currently owned by NamWater, and the water from the PAC will be fed into the existing pipelines. The KWTP where the ground reservoir will be constructed is also owned by NamWater.

3.3.3 Electricity requirement

The new PAC plant will need to be connected to the existing Erongo RED power grid within the town of Karibib.

3.3.4 Workforce requirements during construction

The construction of the PAC plant and the ground-level reservoir will be outsourced to contractors in line with the Public Procurement Act 15 of 2015 and the Public Procurement Regulations of 1 April 2017 (GN 47/2017). Temporary jobs during this phase will be created in the form of contract labourers. The actual number of jobs to be created during the construction phase is not known yet.

3.4 Project Implementation Phases

The life cycle of the project constitutes different phases, and the EMP's contents have been arranged accordingly, i.e.:

- Planning and Design Phase.
- Site establishment Phase.
- Construction Phase.
- Operation and Maintenance Phase.
- Decommissioning Phase.

The above-mentioned phases will apply to both the proposed development (i) Pre-treatment PAC Plant and associated infrastructure and (ii) a clear water concrete ground-level reservoir.

This EMP makes provision for the decommissioning phase at a preliminary level. More detailed decommissioning phase mitigation measures should be revised with each 3-yearly renewal of the ECC for this project.

4 GENERAL REQUIREMENTS OF THE EMP

The implementation of the EMP requires a multitude of administration of various role players, each with specific responsibilities to ensure that the proposed infrastructure is planned and designed, constructed, operated, and maintained in an environmentally sound manner.

4.1 Administration of EMP

Copies of this EMP should be kept at the site office and need to be distributed to all senior contract personnel. All senior personnel are required to familiarize themselves with the contents of this document.

4.2 Roles and their responsibilities

4.2.1 Project involvement

Table 7: EMP Project Team

NO.	SPECIFIC PROJECT ROLE	ADDRESS AND CONTACTS
1.	Proponent	<p>NamWater Ltd. Project Manager: Mr. Lazarus Muhimba Email: MuhimbaL@namwater.com.na</p> <p>Environmental Services Sub-Division: Mrs. Jolanda Kamburona Tel: +264 (61) 71-2105 Email: KamburonaJ@namwater.com.na</p> <p>Mr. Fillemon Aupokolo Tel: +264 (61) 71-2095 Email: AupokoloF@namwater.com.na</p>
2.	Environmental Assessment Practitioner	<p>Lana Environmental Consulting CC Ms. Nangula Amutenya Amatsi Mobile: +264812024059 Email: nangula.a@gmail.com</p> <p>Ms Faye Brinkman Mobile: +264 813320920 Email: brinkman.faye@gmail.com</p>
3.	Permitting Authority	<p>Ministry of Environment Forestry and Tourism Directorate of Environmental Affairs Chief Conservation Scientist – Mr. Damian Nnchido Mobile: +264 61 284 2701 Email: Damian.Nchido@mef.gov.na</p>

4.3 Proponent (NamWater)

The Proponent will play an important role to ensure the successful implementation of this EMP. This can be achieved by designating a Project Team that should take responsibility to ensure that the EMP is adhered to during the planning & design, construction, and decommissioning

phase. The Proponent shall support the Contractor in the management and monitoring of possible adverse environmental, social and climate impacts and risks associated with the implementation of the construction, operation, maintenance and decommissioning of the Karibib Powdered Activated Carbon Plant and Ground Reservoir.

NamWater, as the implementing agency, the following officials will be responsible for:

4.3.1 Resident Engineer

The Resident Engineer (RE) is responsible for:

- a) Ensuring that the objectives of the EMP are met.
- b) Ensuring that the Designing Engineer is aware of this EMP and has applied the relevant proposed mitigation measures outlined in this EMP.
- c) Take disciplinary actions in cases of transgressions and non-compliance.
- d) Ensuring that all environmental impacts are managed according to the environmental principles of avoiding, minimizing, mitigating, and rehabilitation as contained in this EMP.
- e) To ensure and support occupational health and safety as well as health protection in the workplace.
- f) Ensuring that appropriate monitoring and compliance auditing are executed.
- g) To anticipate and avoid adverse impacts on the health and safety of project-affected communities during the project life cycle from both routine and nonroutine circumstances.
- h) Ensuring that the environment is rehabilitated to its natural state as far as possible.
- i) Examine and approve Method Statements.
- j) Appropriate compliance monitoring is executed as outlined in Section 9.
- k) Handle grievances/complaints in the prescribed manner as outlined in Section 11.

4.3.2 Manager: Environmental Services Sub-division

In collaboration with the RE and the Project Team, the Environmentalists will:

- a) Oversee compliance with the EMP.
- b) Be present at the project site inspections and meetings.
- c) To ensure and support occupational health and safety as well as health protection in the workplace.
- d) Receive and attend to complains as received from the RE and the ECO.
- e) Resolve complaints/grievances which have been escalated to their attention.
- f) Notify the DWA and MEFT of any proposed changes to the scope of the project and potential environmental impacts.
- g) Keep a record of emergencies and take corrective actions as per Section 8.
- h) To promote and provide means for effective and inclusive engagement with project-affected parties throughout the project life cycle on issues that could potentially affect them.
- i) To ensure that appropriate project information on environmental and social risks and impacts is disclosed to stakeholders in a timely, understandable, accessible and appropriate manner and format.

4.3.3 Environmentalist

The Environmentalist must be an appropriately qualified person in environmental

management and must possess the skills necessary to impart environmental management skills to all personnel involved in the contract. The Proponent needs to appoint the Environmentalist who will act as the on-site implementing agent and has the responsibility to ensure that the Proponent's responsibilities are executed in compliance with relevant legislation and the EMP.

Any on-site decisions regarding environmental management are ultimately the responsibility of the Environmentalist. The on-site Environmentalist shall assist the RE and the ECO (where necessary) and will have the following responsibilities in terms of the implementation of this EMP:

- The Environmentalist will be on-site at a predetermined frequency (at least once every third week) and will be responsible for ensuring the implementation of the EMP throughout the construction period.
- Ensuring that the necessary environmental authorizations and permits have been obtained.
- Liaison with the Proponent, Engineer, Resident Engineer and Environmental Authorities. The Environmentalist will be responsible to the Proponent.
- The Environmentalist shall make recommendations independent of the Engineer; take immediate action on Site when (i) prescriptive conditions are violated or in danger of being violated, and inform the Engineer, Resident Engineer/s and Contractor/s immediately of the occurrence and to take action, e.g. issuing of fines; and (ii) where clearly defined and agreed 'no go' areas are violated or in danger of being violated, and to inform the Engineer, Resident Engineer/s and Contractor/s of the occurrence and action taken.
- Assisting the Contractor in finding environmentally responsible solutions to problems with input from the ECO where necessary.
- Ordering the removal of person(s) and/or equipment not complying with the EMP specifications.
- The Environmentalist must oversee the mitigation measures and ensure compliance with the conditions of approval and the EMP.
- Issuing fines for transgressions of site rules and penalties for contravention of the EMP.
- Providing input into the ECO's ongoing internal review of the EMP, this review report is submitted to the Proponent.
- Conduct compliance monitoring as outlined in Section 9.2 of this EMP.
- The Environmentalist along with the Engineer and RE, must obtain, examine and approve Method Statements.

4.3.4 Project Team

NamWater (the Proponent) will be responsible for the establishment of an Environmental Project Team which will comprise of NamWater officials, such as the Engineer, the Resident Engineer and an Environmentalist or any other nominee in the event of one of the members not being able to attend.

The core function of this team will be to –

- Provide feedback to stakeholders regarding the Project and implementation of the EMP.
- Highlight stakeholder concerns regarding implementation and address stakeholder concerns; and
- Handle any disputes or disagreements between role players on Site (concerning environmental management).

Regular meetings will be held by the Project Team, the purposes of the meetings shall be:

- To establish the suitability of the Contractors' methods and machinery to lower the risk involved for the environment.
- To discuss possible non-conformance to EMP guidelines or environmental legislation.
- To discuss the general state of the environment on site and discuss any environmental problems which may have materialized.

4.3.5 Scheme Superintendent

As the overall responsible official for the operation of the KWSS, they shall oversee the implementation of this EMP during the operation and maintenance phases. The Scheme Superintendent shall ensure.

- That a copy of this EMP is always kept in the office.
- That all employees involved in the operation and maintenance of the KWTP pipeline are aware of this EMP and provide brief training (when necessary).
- To ensure and support occupational health and safety as well as health protection in the workplace.
- That all employees and contractors are aware to avoid all forms of discrimination of their employees.
- To protect scheme workers, including vulnerable workers such as women, persons with disabilities, children (of working age) and migrant workers, contracted workers, community workers and primary supply workers, as appropriate.
- To promote the fair treatment, non-discrimination and equal opportunity of project workers
- Are made aware to condemn forced labour and child labour, ban discrimination in respect of employment and occupation, and support the freedom of association and the right to collective bargaining under national laws.
- To have in place effective measures to address emergency events.
- Keep a record of emergencies and take corrective actions as per Section 8.
- All operation and maintenance activities are in line with NamWater's environmental code of conduct.

- To provide project workers with accessible means to raise workplace concerns.
- Handle grievances in the prescribed manner as outlined in Section 10.3.
- Take appropriate disciplinary action against the KWTP maintenance employees in case of a transgression.
- To avoid or minimize community exposure to project-related traffic and road safety risks, diseases and hazardous materials.
- To promote and provide means for effective and inclusive engagement with project-affected parties throughout the project life cycle on issues that could potentially affect them.
- To ensure that appropriate project information on environmental and social risks and impacts is disclosed to stakeholders in a timely, understandable, accessible and appropriate manner and format.

4.4 Contractor and sub-contractors

The Contractor (irrespective of whether internal or external) shall conduct his activities to cause the least possible disturbance to the existing amenities, whether natural or man-made, under all the current statutory requirements. Special care shall be taken by the Contractor to prevent irreversible damage to the environment. The Contractor shall take adequate steps to educate all members of his workforce (in Consultation with NamWater) as well as his supervisory staff on the relevant environmental laws and protection requirements. The Contractor shall supplement these steps with prominently displayed notices and signs in strategic locations to remind personnel of environmental obligations.

The Contractor is responsible / should:

- Acquire a basic understanding of the key environmental features on the site and its immediate environment.
- Become familiar with the environmental controls contained in the EMP.
- To ensure and support occupational health and safety as well as health protection in the workplace.
- Are informed that natural features (e.g., rock formations) are not defaced or marked for survey or other purposes unless agreed beforehand with the engineer and natural water sources (e.g. streams) are not allowed to be used for swimming, personal washing, and the washing of machinery or clothes.
- To promote the fair treatment, non-discrimination and equal opportunity of project workers.
- To protect project workers, including vulnerable workers such as women, persons with disabilities, children (of working age) and primary supply workers, as appropriate.
- Avoid all forms of discrimination against their employees.
- Avoid negatively influencing existing conflict dynamics.
- Is aware of NamWater's Code of Conduct.
- Is aware of the need to conserve water and minimise waste.
- Receive and issue pertinent, written instructions regarding compliance with the relevant environmental management requirements (viz. typical environmental "do's" and "don'ts").
- Is made aware of any other environmental matters as deemed necessary by the Engineer / Environmentalist and ECO.

- Condemn forced labour and child labour, ban discrimination in respect of employment and occupation, and support the freedom of association and the right to collective bargaining under national laws.
- 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.
- To provide project workers with accessible means to raise workplace concerns.
- Handle grievances in the prescribed manner as outlined in Section 7.4.
- To avoid or minimize community exposure to project-related traffic and road safety risks, diseases and hazardous materials.
- To ensure that the safeguarding of personnel and property is carried out in a manner that avoids or minimizes risks to the project-affected communities.
- To promote and provide means for effective and inclusive engagement with project-affected parties throughout the project life cycle on issues that could potentially affect them.
- Ensure that appropriate project information on environmental and social risks and impacts is disclosed to stakeholders in a timely, understandable, accessible, and appropriate manner and format.
- Are made aware of the importance of preserving archaeological sites.
- Receive detailed training in site health and safety requirements, emergency responses and site evacuation procedures in terms of the Contractor's health and safety plan.
- 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.

The Contractor/s upon receiving this EMP, should ensure compliance with this EMP by:

- Ensure that a copy of this EMP is always kept on site.
- Undertaking their activities in an environmentally sensitive manner and within the context of this EMP.
- To have in place effective measures to address emergency events.
- Keeping a record of emergencies and taking corrective actions as per Section 10.
- Taking appropriate disciplinary actions against their employees in case of transgression.

4.4.1 Environmental Control Officer

A suitably qualified and experienced Environmental Control Officer (ECO) shall be appointed by the Contractor before the commencement of construction to ensure that the mitigation and rehabilitation measures are implemented and to ensure compliance with the provisions of the EMP.

The ECO is responsible to oversee and monitor compliance with and implementation of the EMP. The ECO's responsibilities include:

- Liaison with the community, NamWater, Resident Engineer and Environmental Authorities.

- Liaise with stakeholders from neighbouring communities to ensure that the project does not adversely impact the living conditions of communities, in particular indigenous peoples and other vulnerable groups, as well as to ensure the rights, living conditions and values of indigenous peoples.
- Monitoring of all the Contractor's activities for compliance with the various environmental requirements contained in this EMP.
- To promote the fair treatment, non-discrimination and equal opportunity of project workers.
- Monitoring of all Contractor's activities for compliance with occupational health and safety requirements as well as health protection in the workplace.
- Monitoring of all Contractor's activities to avoid or minimize community exposure to project-related traffic and road safety risks, diseases and hazardous materials.
- Ensuring that the requisite remedial action is implemented in the event of non-compliance.
- Ensuring the proactive and effective implementation and management of environmental protection measures.
- Ensuring that a register of employee and public complaints is maintained by the Contractor and that all employees and public comments or issues are appropriately reported and addressed.
- Routine recording and reporting of social and environmental activities, incidents and non-compliance every month.
- To have in place effective measures to address emergency events. Keeping a record of emergencies and taking corrective actions as per Section 10.
- To promote and provide means for effective and inclusive engagement with project-affected parties throughout the project life cycle on issues that could potentially affect them.
- Ensure that appropriate project information on environmental and social risks and impacts is disclosed to stakeholders in a timely, understandable, accessible, and appropriate manner and format.
- Notifying the Environmental Authorities immediately of any events or incidents that may cause significant environmental damage or breach the requirements of the EMP; and
- Presenting Environmental Awareness Training courses to the Contractor's entire team of workers before commencing with construction. All new appointees should also receive the training.
- The ECO shall be at the site with the construction team to ensure compliance.
- Bi-Monthly compliance reports shall be submitted to the Environmentalist, Resident Engineer and the Environmental Forum. The compliance report shall address all issues of non-compliance, remedial action recommended and implementation thereof. It is recommended that an Environmental Audit Report be carried out 6 months after construction has been completed and submitted to the Environmental Authorities and NamWater.

4.4.2 Environmental awareness training

It is important to ensure that Contractors, sub-contractors, and all Karibib Powdered Activated Carbon Plant and Ground Reservoir employees have the appropriate level of environmental

awareness and competence to ensure continued environmental due diligence and minimization of environmental harm.

To achieve this, all parties involved in any work at the Karibib Powdered Activated Carbon Plant and Ground Reservoir during the construction, operation, maintenance, and decommissioning phases should be briefed on their obligation towards environmental protection in terms of the EMP before work commences. The training should also cover the actions outlined in the emergency response plan, the NamWater's environmental code of conduct.

The Environmental Awareness Training Course should be conducted by the ECO and the Contractor's Environmental Health and Safety officer, who shall provide the site staff with an appreciation of the project's environmental requirements, and how they are to be implemented. All new staff coming onto the site after the commencement of construction activities must also attend the Awareness Training Course, and refresher courses should be undertaken every quarter. A detailed record of all training sessions, including a list of attendees must be compiled by the Contractor and submitted to the Project Manager regularly.

The initial Environmental Awareness Training Course shall be held within 14 days from the site mobilisation date, and subsequent courses shall be arranged for all new employees arriving after the initial training course.

The Contractor shall provide a suitable venue with necessary facilities and ensure that all employees attend the environmental, health and safety induction course. The course shall be held in the morning during normal working hours. The Contractor shall provide proof of attendance by all of his employees in the form of a signed attendance register.

Environment and health awareness training programmes should be targeted at three distinct levels of employment, i.e., the executive, middle management and labour. The Proponent shall ensure that adequate environmental training takes place. All employees should be given an induction presentation on environmental awareness and the content of the EMP. The presentation shall be conducted, as far as possible, in the employees' language of choice.

As a minimum, training should include:

- Explanation of the importance of complying with the EMP, including a basic explanation of the importance of environmental sustainability for the survival of mankind.
- Aware of the importance of preserving archaeological sites.
- Receive detailed training on on-site health and safety requirements, emergency responses and site evacuation procedures in terms of the Contractor's health and safety plan.
- 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 and that any person who commits or attempts to commit a sexual act with a child under the age of 16 years shall be guilty of an offence.
 - Are aware of the requirements of any approved Method Statements that have to bear on their activities, and where necessary, any specialised training required to ensure compliance with the approved Method Statements has been provided.
 - Are informed that employee information posters, outlining the environmental "do's" and "don'ts" (as per the environmental awareness training course) will be placed at prominent locations throughout the site.

- Discussion of the potential environmental impacts of construction activities.
- Employees' roles and responsibilities, including emergency preparedness.
- Explanation of the mitigation measures required to be implemented when carrying out their work activities.
- Environmental legal requirements and obligations.
- Details regarding floral/faunal species of special concern and protected species, and the procedures to be followed should these be encountered during the construction of the pipeline, access roads, approach roads or construction camp.
- The importance of not littering.
- The importance of using supplied toilet facilities.
- The need to use water sparingly.
- Details of and encouragement to minimise the production of waste and re-use, recover and recycle waste where possible.
- Details regarding archaeological and/or historical sites which may be unearthed during construction and the procedures to be followed should these be encountered.

The Contractor shall keep records of all environmental training sessions, including names, dates and the information presented.

5 LEGAL AND POLICY FRAMEWORK

The EMP implementation shall be guided by the legislative framework as outlined in the EIA report and briefly presented here below.

Table 8: Applicable legislation

LEGISLATION	PROJECT IMPLICATIONS
National legal requirements	
Constitution of the Republic of Namibia (1990)	The proponent shall advocate for sound environmental management through the implementation of the environmental management plan, as set out in the constitution.
Namibia Water Corporation Act 12 of 1997	The Act makes provision for the planning & designing, construction, operation, maintenance, and decommissioning of the Karibib Powdered Activated Carbon Plant and Ground Reservoir since NamWater is carrying out its functions as mandated by the Act.
Water Act No. 54 of 1956, as amend	<p>This Act, along with the Water Resources Management Act, No 11 of 2013 requires the Proponent and Project team to investigate and implement measures to ensure the sustainable use of water resources and ensure that no pollution of any above or below-ground water takes place.</p> <p>The Applied Scientific Services Division is responsible for conducting microbiological analysis while the physical/ aesthetic and chlorine analyses are done at KWSS on different frequency as follow:</p> <ul style="list-style-type: none"> • Physical/aesthetic quality: every two hours, daily • Chlorine suspension: every two hours, daily • microbiological quality: Monthly <p>The Water Act 54 of 1956 has been replaced with a new Water Resource Management Act (WRMA) 11 of 2013 along with new water quality standards. The WRMA has not yet come into force legally. However, the DWA has started enforcing the water quality standards of 2013 and NamWater in endeavour to meet these standards.</p>
Environmental Management Act 7 of 2007	Application for the Environmental Clearance Certificate for the activities will be submitted to the competent and regulatory authority.
Forest Act (No. 12 of 2001)	Ensure the protection and preservation of trees in line with the Act.

LEGISLATION	PROJECT IMPLICATIONS
	National legal requirements
Nature Conservation Ordinance 14 of 1975 and its amendments	Ensure the protection and preservation of natural resources in line with the Ordinance.
Namibia's Second National Biodiversity Strategy and Action Plan (2013-2022)	Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society
Pollution Control and Waste Management Policy, 2003	All waste management activities generated by the Karibib Powdered Activated Carbon Plant and Ground Reservoir activities are the responsibility of NamWater.
MEFT Policy on HIV/AIDS	The proponent and its Contractor must adhere to the guidelines provided to manage the aspects of HIV/AIDS. Experience with construction projects has shown that a significant risk is created when migrant construction workers interact with local communities.
National Heritage Act No. 27 of 2004	All protected heritage resources (e.g., human remains, etc.) discovered, need to be reported immediately to the National Heritage Council (NHC) and require a permit from the NHC before they may be relocated.
Local Authorities Act No. 23 of 1992	The development must comply with provisions of the Local Authorities Act.
Public Health and Environmental Act No. 1 of 2015	<ul style="list-style-type: none"> • Nuisance such as dust, noise, bad odours, etc. should be controlled during all project phases. • Sanitary conveniences should be provided as per the minimum requirements prescribed by the law.
National Labour Act 11 of 2007	<ul style="list-style-type: none"> • The Proponent, Contractors, and Sub-Contractor shall all be guided by this Act when recruiting or handling employment-related issues. • Contractors must adhere to the minimum workplace safety standards such as all employees must be provided with appropriate Personal Protective Equipment (PPE).
Public Procurement Act 15 of 2015 and the Public Procurement Regulations of 1 April 2017 (GN 47/2017).	<ul style="list-style-type: none"> • The appointment of Contractors and labour force shall all be guided by this Act and its regulations.
Criminal Procedure Act 51 of 1977 and its amendments	<ul style="list-style-type: none"> • Make provision for procedures and related matters in criminal proceedings.

LEGISLATION	PROJECT IMPLICATIONS
	National legal requirements
The Combating of Rape Act No. 8 of 2000	<ul style="list-style-type: none"> • Is a progressive law on rape. The Act gives greater protection to young girls and boys against rape, provides for stiffer minimum sentences for rapists.
United Nations Sustainable Development Goals (SDGs) 2015	<p>Of relevance to water is SDG 6: Clean Water and Sanitation which aims to “ensure access to water and sanitation for all”. Access to safe water, sanitation and hygiene is the most basic human need for health and well-being.</p> <p>Of relevance to ecology is SDG 15: Life on Land which aims to “Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss”.</p>

6 ENVIRONMENTAL MANAGEMENT REQUIREMENTS

The successful implementation of this EMP will depend on various factors such as training and awareness, enforcement, good record keeping, and reporting.

6.1 Construction phase

As part of tender requirements, Contractor/s and subcontractors are obliged to educate their employees on the implementation of the EMP and NamWater's environmental code of conduct. The Contractor/s and subcontractors should provide training to their employees on environmental issues related to construction. This training can be in the form of an onsite talk before the commencement of any work. Employee information posters, outlining the environmental "do's" and "don'ts" (as per the environmental awareness training course) should be placed at prominent locations throughout the site. Record of such training should be kept by the Contractor and should be handed to the Resident Engineer.

6.2 Operation and maintenance phase

The Scheme Superintendent should ensure that the Karibib Powdered Activated Carbon Plant and Ground Reservoir maintenance staff receive appropriate training on the environmental issues pertaining to the operation and maintenance of the proposed new pipeline and to carry out their works under this EMP.

6.3 Recordkeeping

There should be an up-to-date filing system for the Karibib Powdered Activated Carbon Plant and Ground Reservoir whereby method statements, environmental incidents reports, training records, audit reports, and public complaints registers are kept. It is advised that photographs of the site should be taken as a visual reference. The grievance register must be kept by the Resident Engineer (RE) during the construction phase and by the Scheme Superintendent during the operation phases, respectively.

6.4 Enforcement

This EMP upon approval by MEFT shall be a legally binding document, thus, the commitment and cooperation of the identified responsible person(s) will ensure the effective implementation of the EMP. Adherence to this EMP will ensure that the environmental impacts associated with the project will be mitigated to a greater extent thus promoting sustainable development. The EMP will be enforced in accordance with the provisions of Section of the Environmental Management Act 07 of 2007 through a contract between NamWater and the Contractor.

6.4.1 Method statements

Method Statements are statements that come into effect when the original project design changes significantly enough to disturb areas that were not part of the EIA study. In this case, the method statement will outline the number of deviations, description, maps, and new designs. Coupled with the environmentalists' input on the impact the deviation could have on the environment.

Method statements from the Contractor can also be required for specific sensitive actions on request of the authorities or Environmentalist. In this case, the method statement will form the baseline information on which sensitive area work takes place.

Should they be necessary, the following method statements will be necessary during the construction phase:

- Construction procedures.
- Materials and equipment to be used.
- How and where materials will be stored.
- The containment of accidental leaks or spills as prescribed by this EMP (Section 8.3.2: Emergency Response Procedures).
- Timeline and location of activities; and
- Any other information deemed necessary by the Environmentalist /RE.

A method statement describes the scope of the intended work in a step-by-step description in order for the Environmentalist or Engineer to understand the Contractor's intentions. This will enable them to assist in devising any mitigation measures, which would minimise environmental impact during these tasks. The method statement should also clearly stipulate mitigation methods of the intended works, against which the contractor's performance will be measured. For each instance wherein it is requested that the Contractor submit a method statement to the satisfaction of the Environmentalist and Engineer, the format should clearly indicate the following:-

- **What** - a concise, description of the task/work to be undertaken;
- **How** - a detailed description of the process of work, methods, materials and mitigation strategies;
- **Where** - a description/sketch map of the locality of work (if applicable); and
- **When** - the sequencing of actions with due commencement dates and completion date estimates.

Therefore:

- The Contractor must submit the method statement two weeks before the commencement of any construction activity.
- Work may not commence until the method statement has been accepted by the RE and ECO and communicated to the workforce.
- The Contractor shall, except in the case of emergency activities, allow 14 days for consideration and approval of the method statement.
- The RE and Environmentalist may require changes to the method statement if the proposal does not comply with the specifications or if, the proposal may result in damage to the environment more than that permitted by the specifications.
- Approved method statements shall be communicated to all relevant personnel.

A generic example of a method statement is in Annexure A.

6.4.2 Lay-out plan for the lay – down areas

The lay out /description of the laydown areas is required especially during the construction phase to describe and indicate how they will be set up and managed. This should be provided in a step-by-step description for the RE or ECO to understand the contractor's intentions. This will enable them to assist in devising any mitigation measures, which would minimize environmental impact during construction. These descriptions of the layout should also clearly stipulate mitigation methods of the intended works, against which the contractor's performance will be measured. In this case, the following method statements will be necessary during the construction phase.

6.4.3 Non-compliance and disciplinary actions

In cases of transgressions and non-compliance to the EMP, the following actions may be taken against the transgressor.

- Disciplinary actions
- Legal actions
- Termination of contract

The Environmentalist collaboration with the designated ECO will ensure that the EMP is fully complied with by the appointed Contractor and employees during the construction phase. The RE and ECO shall issue disciplinary actions based on the severity of the environmental damages and the nature and extent of the transgression / non-compliance. In addition, the Proponent may also institute legal actions against the transgressor in line with the Public Procurement Act 15 of 2015 and NamWater's contract agreement.

The Scheme Superintendent will ensure compliance during the operation and maintenance phase. Non-compliance or transgression shall result in disciplinary actions being taken against the transgressor. Transgressions should be recorded in a dedicated register and be filed.

6.5 Environmental Audit Reports

The ECO shall prepare monthly audit reports and submit them to the Environmentalist. The report should indicate the environmental performance, compliance to the EMP, and matter of incidental. The report should also identify:

- Environmental issues caused by construction.
- Issues that have been resolved.
- Issues that remain unresolved and how they plan to address them.

Furthermore, the Proponent shall ensure regular monitoring of project activities during all project phases and keep records. These records may be required by the competent authority when deemed necessary or for the renewal of the ECC if the project is not complete within three years. The records will be required when applying for renewal of the ECC and NamWater will also have to indicate how the EMP was adjusted to make provision for improved mitigation measures and action plans.

7 MANAGEMENT OF IDENTIFIED IMPACTS

This section outlines the proposed mitigation measures to avoid, prevent and mitigate and/or enhance the identified potential impacts associated with the proposed Karibib Powdered Activated Carbon Plant and Ground Reservoir. It also outlines the responsibilities of each party involved in the project implementation under each phase. The project activities are grouped according to the different operational processes and stages (planning & design, construction, operational, and decommissioning phases).

7.1 Planning and Design phase

The first step in avoiding and preventing any possible negative impacts during the construction, operation, maintenance, and decommissioning phase, should start with the planning and designing phase. The planning and design phase includes the drafting of the pipeline design plan, surveying activities and pipeline route selections before construction commences.

This EMP aims to ensure best practices are implemented and environmental degradation is avoided through appropriate environmental protection and adherence to legal requirements. The EMP also ensures that the best alternative options are selected and implemented as recommended in the Scoping report.

The recommended actions are presented in Section 7.1.1 below.

7.1.1 Proposed mitigation measures during the planning and design phase

Issues	Description	Enhancement measures	Responsibility
Siting of the PAC Plant	<ul style="list-style-type: none"> The proposed PAC plant is proposed to be constructed on a piece of land owned by NamWater. The site is located next to the existing water pipeline, which is supplying water from Okongava Reservoir to the KWTP. 	<ul style="list-style-type: none"> The location on the PAC should remain as such as described in the Development Proposal. The location of the PAC plant makes it ideal to meet the minimum distance (a minimum of 1.5 km) from the plant needed to achieve a retention time (minimum of 15 minutes or longer for methyl-iso-borneol (2MIB) and geosmin removal)). Based on a maximum flowrate of 216 m³/h and a pipe diameter of 350 mm, the current location is ideal to meet those minimum requirements and conditions, as it is placed at 3.1 km from the KWTP and will give a minimum retention/contact time of 40 minutes. 	Design Engineer
Siting of the clear water ground water reservoir	<ul style="list-style-type: none"> The proposed ground reservoir is expected to be constructed within the existing KWTP yard and no additional development site or encroachment beyond the boundaries is necessary, thereby limiting the development footprint. 	<ul style="list-style-type: none"> The location on the reservoir should remain as such as described in the Development Proposal. 	Design Engineer
Building plans for the PAC Plan	<ul style="list-style-type: none"> The architectural drawings of the PAC will have to comply with the building regulations of the Karibib Town Council. 	<ul style="list-style-type: none"> The final building plans for the PAC plant will need to be submitted for approval by the Karibib Town Council. 	Design Engineer
Civil designs for the ground water reservoir	<ul style="list-style-type: none"> The civil designs of the ground water reservoir will have to comply with the building regulations of the Karibib Town Council. 	<ul style="list-style-type: none"> The final designs for the ground water reservoir will need to be submitted for approval by the Karibib Town Council. 	Design Engineer
Planning for construction activities	Poor planning for construction could lead to unnecessary delays.	<ul style="list-style-type: none"> The EMP should be part of the tender/BID documents and contract for the construction contract. Construction staff members should all be issued with name tags, and uniforms and all vehicles should be branded/easy to identify. Before the commencement of construction, NamWater and the Contractor must conduct a field visit together. 	Project Manager

Issues	Description	Enhancement measures	Responsibility
		<ul style="list-style-type: none"> The workforce should be accommodated in the town of Karibib and on project sites. 	

7.2 Construction phase

7.2.1 Environmental specifications

The following specifications cover the requirements for controlling the impact of construction activities on the natural and social environment. Although the specifications below apply during the construction phase, many of the activities are similar to the operation, maintenance, and decommissioning activities, hence, these specifications, where applicable will apply to these project phases as well.

7.2.1.1 Construction camp

- No construction campus should be established at the KWTP or at the site for the PAC plant.
- Construction workers should be accommodated in Karibib.

7.2.1.2 Cement and concrete batching

- The ideal location of a batching plant (including the location of cement stores and sand and aggregate stockpiles) shall be inside the KWTP or at the PAC site.
- If this is not possible then it should be indicated on the laydown areas site layout plan and approved by the Environmentalist or RE.
- Concrete shall not be mixed directly on the ground. Boards, plastic sheeting, or other protective materials shall be used for this purpose.

7.2.1.3 Access routes

- Existing road should be used as far as possible.
- No off-road driving should be allowed.
- Notices should be placed on visible locations in the vicinity of the construction site to warn the public of construction activities and indicate that heavy vehicles may be using the road.
- Contractor/s shall control the movement of all vehicles and plant machinery so that they remain on designated/demarcated routes.

7.2.1.4 No-go areas

- Only the existing service road should be used as the working corridor/ working area.
- Any area outside the service road or the demarcated laydown area "should be considered a no-go" area.
- The Contractor shall ensure that no unauthorized entry, stockpiling, dumping or storage of equipment or materials shall be allowed within the "no go" areas.

7.2.1.5 Earthwork and trenching

Earthworks are to be phased so that no areas are left exposed for longer periods than necessary. This is especially important during the rainy season when runoff causes siltation downstream & overall erosion and loss of topsoil, etc. Trenches shall be re-filled to the same level as (or slightly higher to allow for settlement) the surrounding land surface to minimize erosion.

7.3 Proposed mitigation measures: Construction of the Karibib Powdered Activated Carbon Plant and Ground Reservoir

7.3.1 General Mitigation measures

Environmental Issue/Impacts	Source of Impact	Mitigation Measures	Responsibility
Dust and Air Pollution	<ul style="list-style-type: none"> Excavation and construction-related activities i.e., cement mixing and backfilling will generate fugitive dust that can pose serious health risks and irritation to humans, especially those working on the construction site. However, the worst case of dust pollution would be during windy conditions. Other atmospheric pollution is in the form of fumes and noxious gases i.e., hydrocarbon vapours, carbon monoxide, and sulphur oxides released from vehicles and construction equipment. However, the emissions of dust and emissions from the construction activities will occur for a short time and will likely be insignificant since the pipeline route is far from residential areas. 	<p>Employ dust control measures such as:</p> <ul style="list-style-type: none"> Regular dust suppression (e.g., spraying with water), during times of strong winds. Mixing of cement should be done with a concrete mixture. Trucks transporting construction materials such as sand and stones should be covered with a tarpaulin. Ensure proper maintenance of vehicles and equipment to minimize the release of fumes and other pollutants in the air. All vehicles should be driven at a minimum speed limit of 60 km/hr in town and all construction vehicles and machinery must be roadworthy. The Contractor/s 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. Consider temporary ceasing of work during high wind conditions. Personnel are to be issued with dust masks for health reasons (when required). 	Contractor/s
Disturbance and loss of flora	<ul style="list-style-type: none"> The Project requires some unavoidable removal of trees (those directly affected) especially at the site for the PAC plant. Plant species that are of potential of value to local communities or protected under legislation and are 	<ul style="list-style-type: none"> All disturbances will be limited to the KWTP yard. All disturbances will be limited within the PAC plant site (a 1010 m³ piece of land). All Contractors and sub-contractors must be made aware of their environmental responsibilities and non – compliance and disciplinary actions be applied when unnecessary damage is done. Responsibility for damage 	Contractor/s Environmentalist/ ECO

Environmental Issue/Impacts	Source of Impact	Mitigation Measures	Responsibility
	<p>located along the pipeline route and need to be removed as observed during the site visit (presents locally occurring trees).</p> <ul style="list-style-type: none"> Disturbance to vegetation may also occur because of vehicle movement and off-road driving. 	<p>must lie with the main contractor, regardless of whether it was done by a sub-contractor, to prevent “passing of the buck”.</p> <ul style="list-style-type: none"> Only use existing service and access roads as far as possible. Vehicles must be driven by authorized drivers. All employees must be sensitised to minimise disturbances. 	
Disturbance to local fauna	<ul style="list-style-type: none"> The affected fauna is up made of small burrowing animals, insects, beetles and avifauna. Impacts on fauna may occur due to the loss of habitat, and fragmentation during construction. Other impacts such as noise, vibration, dust emission, improper handling of waste and littering during the construction works will also have a serious bearing on the local fauna. 	<ul style="list-style-type: none"> All disturbances should be limited to the project sites Avoid the use of open fire. Only use existing access routes as far as possible. All employees must be sensitised to minimise disturbances. Avoid killing or trapping, chasing, or injuring any animal crossing or found along the pipeline route. Open trenches should be demarcated with danger tapes to ensure the safety of people. 	Contractor/s Environmentalist ECO
Soil disturbances from bulk earthworks and civil works	<ul style="list-style-type: none"> Soil is one of the most important natural resources which support a community of diverse organisms. The excavation of trenches and the movement of construction vehicles will disturb the organisms it contains and expose the soil to wind erosion. Soil may also be contaminated by leaks and spills from construction vehicles. Moreover, excavations may also expose the soil to wind and water erosions. 	<ul style="list-style-type: none"> The topsoil from the construction site must be carefully extracted and kept separate from construction waste for use as backfill materials. Limit the movement of vehicles within the construction working corridor and make use of existing access routes. 	Contractor/s

Environmental Issue/Impacts	Source of Impact	Mitigation Measures	Responsibility
Disturbance to sites of palaeontological and archaeological importance.	Damage and destruction of important palaeontological and archaeological sites could occur during construction.	<ul style="list-style-type: none"> Follow the Chance Finding Procedure (Annexure H) which covers actions to be taken on the discovery of a heritage site or object. Do not disrupt any archaeological or palaeontological sites. Inform the ECO 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. 	Contractor/s ECO
Landscape and visual/aesthetic impacts	Visual impacts associated with the construction of the PAC plant and ground water reservoir could occur because of the uncollected waste stockpile, unpacked construction materials, open trenches, and other facilities which makes the view of the site unappealing.	<ul style="list-style-type: none"> The stripped topsoil must be backfilled carefully in position after the completion of the pipe laying. Waste generated should be stored in enclosed bins and disposed of weekly. Construction materials should be properly stacked in one place. The construction area and lay down areas should be kept neat as far as possible. 	Contractor/s
Erosion	Construction activities especially for the ground water reservoir (due to the location of the KWTP which is on a hill) could accelerate erosion during construction.	<ul style="list-style-type: none"> Runoff on steep inclines should be diverted to prevent the formation of erosion gullies. 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. Runoff should be guided to a point where it will not cause damage. Scour by the discharge of runoff should be prevented. 	Contractor/s

Environmental Issue/Impacts	Source of Impact	Mitigation Measures	Responsibility
Dust Control	Generation of dust	<ul style="list-style-type: none"> • 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. • Consider temporary ceasing of work during high wind conditions. 	Contractor/s
Noise	Noise pollution is a negative impact that will surely result from operating construction equipment such as cranes, trucks, drilling, concrete mixer, etc. The major negative impact that could result is the noise generated during the working hours or the day.	<ul style="list-style-type: none"> • The occurrence of noise impacts will only be temporary. • All construction activities must be limited to normal working hours (08:00-17:00) and avoid operating during odd hours. • All equipment should be regularly maintained to maintain good working conditions. • Install and maintain silencers on trucks and machinery. • Repair faulty brakes. • Operators should not use hooters for general communication. 	Contractor/s
Increased traffic	Construction activities will result increased movement of construction vehicles in and out of the sites. Therefore, normal traffic movement, especially in streets in the vicinity of the construction site may be slightly disrupted during the construction period.	<ul style="list-style-type: none"> • The contractor must erect a construction signage at the construction site. • Construction vehicles must be driven by authorized drivers only and stick to the maximum speed limits. • Heavy-duty vehicles and machinery must be tagged with reflective signs or tapes to maximize visibility and avoid accidents. • No operator should operate any equipment when he/she is under the influence of alcohol. • Adhere to safety rules. • Always keep your headlights on. • Drivers must have the correct licence for the vehicle they are driving. 	Contractor/s
Water requirements and consumption	Construction activities will require a substantial amount of water.	<ul style="list-style-type: none"> • Employ water-saving measures such as: <ul style="list-style-type: none"> ○ Re-use water for least important activities. ○ Use water sparingly. • Avoid wastage, spillage, contamination, etc. 	Contractor/s

Environmental Issue/Impacts	Source of Impact	Mitigation Measures	Responsibility
Concrete batching	Pollution and contamination of the environment may occur as a result of improper handling of concrete.	<ul style="list-style-type: none"> • Concrete batching shall take place on a smooth impermeable surface enclosed with a bund and in lay down area only. • Batching shall take place at least 20 m away from any water source to avoid contamination. • All wastewater 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 and disposed-off appropriately. 	Contractor/s Resident Engineer
Fire outbreaks	Construction activities such as welding. This can be aggravated by the presence of flammable and combustible items i.e., fuel, and vegetation.	<ul style="list-style-type: none"> • In terms of the Atmospheric Pollution Prevention Act (No. 45 of 1965), burning is not permitted as a waste disposal method. • Any fires that occur shall immediately be reported to the RE. • Ensure a designated smoking area far from fire hazard areas such as the workshop and fuel storage areas and any areas where the vegetation or other material is such as to make liable the rapid spread of an initial flame. • Cigarette butts must be disposed of in a designated container. • There must be a competent fire safety officer who shall be responsible for ensuring immediate and appropriate actions in the event of a fire and shall ensure that employees are aware of the procedures to be followed. • The Contractor shall be equipped with appropriate basic fire-fighting equipment (e.g., fire buckets, extinguishers, fire beaters, etc.) at all times. • Open fires for cooking purposes are not allowed. 	Contractor/s
Criminal activities i.e., theft	Construction materials and untended equipment kept onsite may attract criminals.	<ul style="list-style-type: none"> • Materials and equipment must not be left on site so that it does not attract criminals. • All criminal activities should be reported to the local police immediately. • Telephone numbers for the local police station are presented in Annexure C. 	Contractor/s
Handling of complaints and grievances	A grievance may be received from residents concerning construction activities.	<ul style="list-style-type: none"> • All complaints and grievances shall be reported in the Form (Annexure G) and submitted to the RE. 	Resident Engineer

Environmental Issue/Impacts	Source of Impact	Mitigation Measures	Responsibility
		<ul style="list-style-type: none"> The RE shall handle the grievance as per the Grievance response procedure presented in Section 11 	

7.3.2 Waste Management

Environmental issues/impacts	Source of impact	Mitigation measures	Responsibility
Construction Waste Management	<p>The following types of waste will be generated during the construction phase, in relatively small volumes:</p> <ul style="list-style-type: none"> Domestic waste (non-hazardous). Building rubble (bricks, cement bags, straps and so on) Industrial waste – non-hazardous (offcuts, scrap metal, empty containers, plastics and packaging and building rubble) Industrial waste – hazardous (i.e., hydrocarbon-contaminated material/soil) <p>All these types of waste will have a negative impact on surrounding areas if not disposed of properly and regularly. In addition, the process of transporting all construction debris may also result in windblown litter from the vehicles transporting waste.</p>	<p>Description of possible mitigation measures:</p> <ul style="list-style-type: none"> Waste bins must be provided at the construction sites. Waste bins should be secured (i.e., enclosed cages) to prevent windblown litter. All general waste generated at the site must be contained and removed from the site regularly for disposal at the Karibib waste disposal site. Hazardous waste will be disposed of at the Walvis Bay hazardous waste dump site. Provide sufficient waste bins on site. No waste should be buried. Remove all temporary buildings, concrete slabs etc., when construction is completed. Recyclable waste i.e., empty product containers, paper, plastic, etc., should be collected, sorted, and supplied to the recycling companies. Vehicles transporting waste should be sealed with a tarpaulin to avoid waste from being blown away by the wind. After construction, the entire area will be rehabilitated as set out in the EMP (see Section 7.4). 	Contractor/s
Litter produced during construction.	<ul style="list-style-type: none"> Littering (food wraps, paper, plastic etc.) can be blown away into the surrounding environment. 	<ul style="list-style-type: none"> No littering should be allowed. The construction area will be kept free of waste at all time. All construction sites will be cleaned daily before leaving the construction site. 	Resident Engineer

Environmental issues/impacts	Source of impact	Mitigation measures	Responsibility
	<ul style="list-style-type: none"> They can also be consumed by animals and lead to death. 	<ul style="list-style-type: none"> Provide sufficient waste bins at worksites and in laydown areas. 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 dogs 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 is taken to an appropriate waste dump site. The central waste storage vessel shall be emptied weekly or as necessary. Vehicles transporting waste should be sealed with a tarpaulin to avoid waste from being blown away by the wind. 	Contractor/s ECO –
Waste from ablution	<ul style="list-style-type: none"> Liquid waste from construction workers will be generated. All these types of waste will harm surrounding areas if not disposed of properly and regularly. 	<ul style="list-style-type: none"> Provision must be made for sufficient portable ablution facilities during the construction period. In terms of the general health Regulations (GN 121. 1969), it is recommended to have at least 1 toilet within 500 m along the pipeline route and 2 toilets for every 25 people (separate water closet for males and females) at the construction site. Two mobile toilets Female and Male should be provided. Sewage from ablution facilities should be contained in a tank and disposed of at the Municipality wastewater sewerage evaporation ponds 	Resident Engineer /Contractor
Hazardous Waste	Poor handling of hazardous waste which includes fuels, lubrication oils, hydraulic and brake fluid, solvents, paints, anticorrosive, insecticides and pesticides, chemicals, acids etc.	<ul style="list-style-type: none"> Used solvents and grease should be stored in drums or other suitable containers. It should be sealed and recycled or disposed of at an appropriate disposal site. Hazardous substances should be disposed of at designated hazardous disposal sites. 	Contractor/s

Environmental issues/impacts	Source of impact	Mitigation measures	Responsibility
		<ul style="list-style-type: none"> • Do not change 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 should not be discarded on the soil or buried. It should be removed from the site and taken back to an appropriate dump site. • Hazardous waste should not be burnt. 	
Fuel and lubricants spill or leaks at construction, refuelling, and storage sites	<p>The poor handling and spillage of fuel, lubricants, and chemicals i.e., oil, and grease from construction vehicles could contaminate the soil.</p>	<ul style="list-style-type: none"> • Drip trays should be provided for vehicles and machines with leakages. • All construction vehicles must be serviced at the maintenance workshop and no offsite maintenance should be allowed. • If refuelling is to be done onsite, fuel tanks should be left in vehicles only and not be offloaded on the ground. • All leakages and spillages of oil and grease should be contained, cleaned up, stored in sealed containers and then disposed of at the Walvis Bay Hazardous Waste disposal site. • Follow the spillage procedures as outlined in the EMP. • In the event of a hazardous spill: <ul style="list-style-type: none"> ○ Immediately implement actions to stop or reduce the spill. ○ Contain the spill. ○ Arrange implementation of the necessary clean-up procedures. ○ Do not bury polluted soil, but rather dispose of it at an appropriate dump site. ○ Contaminated soil, water and other materials should be stored in sealed containers and disposed it at an appropriate waste dump site. • Collect contaminated soil, water and other materials and dispose of it at an appropriate waste dump site. • Fire extinguishers must be available at all refuelling sites. Staff should be trained to handle such equipment. 	<p>Resident Engineer Contractor/s</p>

Environmental issues/impacts	Source of impact	Mitigation measures	Responsibility
		<ul style="list-style-type: none"> Above-ground fuel tanks should be on an impervious floor with bunding walls 	

7.3.3 Workshops, vehicle and equipment management

Environmental issue/impacts	Source of impact	Mitigation measures	Responsibility
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.	<ul style="list-style-type: none"> Store machinery, vehicles, and materials only in lay down areas. Do not leave machinery and equipment standing around if not in use. Only park vehicles in designated areas. Do not park heavy vehicles or store equipment under or near trees. Do not store machinery, vehicles or materials in undisturbed or rehabilitating areas. 	Resident Engineer Contractor/s
Leakage of fuels and lubricants from vehicles and equipment.	The use of vehicles and equipment that may leak fuel and lubricants.	<ul style="list-style-type: none"> Only service machinery and vehicles in designated areas lay down areas. Regularly check your vehicle for fuel and oil leaks. Maintain vehicles and equipment in good condition through regular and thorough servicing. No vehicles, machinery or equipment with leaks or causing spills may be allowed to operate on the construction site. Inform the Resident Engineer of leaking vehicles and machinery so that he can schedule repairs. Only refuel by means of a pump and on the bund created for that purpose. Immediately clean any accidental fuel and oil spills – do not hose spills into the natural environment. 	Resident Engineer Contractor/s

Environmental issue/impacts	Source of impact	Mitigation measures	Responsibility
		<ul style="list-style-type: none"> • Dispose of contaminated soil as hazardous waste in the correct location on site. • If a mobile fuel bowser is used, then all refuelling shall occur with appropriate measures in place to prevent spillages (drip trays, funnels, non-dripping dispensing nozzles etc.) • All mobile fuel bowsers shall carry a spill kit that is adequately sized to contain at least a 200-litre spill. • A spill kit must be available at the construction site and there must be at least one person with appropriate authority who is trained in hazmat response. 	
Theft of stock and equipment	Incidences of stock and equipment theft could occur	<ul style="list-style-type: none"> • Security should be arranged to guard the laydown areas/camp. • It is important that the necessary precautions be taken to protect property against theft. • Equipment should remain within the fenced-off area during night-time. • Theft should be reported to the Police immediately 	Resident Engineer Contractor/s

7.3.4 Health and safety of Construction workers

Environmental issues/impacts	Source of impact	Mitigation measures	Responsibility
Risk of HIV infection	<ul style="list-style-type: none"> Migrant construction workers are likely to engage in casual relationships with locals. This may contribute to the spread of sexually transmitted diseases. 	<ul style="list-style-type: none"> Minimise the risk of HIV infection and the increase of STI's by providing an AIDS awareness program to all the staff. Regular health check-ups. Any employee who commits or attempts to commit a sexual act with a child under the age of 16 years shall be guilty of an offence. This person must be reported to the police immediately. Non-local employees should be encouraged to return to their original residential areas after completion of the contract. 	Resident Engineer Contractor/s
Construction-related injuries.	<ul style="list-style-type: none"> Construction-related injuries could occur. Occupational health hazards are expected particularly for the construction workers who will be present at the site. Workers will be exposed to dust, vibrations, high noise levels, sun exposure (sunstroke), and dehydration during the summer months. The safety of the public may also be compromised by certain construction activities i.e., uncovered trenches, increase in traffic volume generation of dust, noise, and vibration. 	<ul style="list-style-type: none"> 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 construction points. Ensure the evacuation of seriously injured people. Dangerous areas must be marked and access to these areas controlled or restricted. Train people who handle fuels in the correct procedure/technique to transfer fuels. Refuelling of vehicles and machinery should be done at a designed transfer site supported with a bunding wall, big enough to contain 120% of the volume of the fuel tank. Make sure all vehicles are roadworthy. Repair faulty brakes, exhausts, etc. immediately. 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 refuelling sites. Staff should be trained to handle such equipment. 	Resident Engineer Contractor/s

Environmental issues/impacts	Source of impact	Mitigation measures	Responsibility
		<ul style="list-style-type: none"> • Fire extinguishers shall be present whenever undertaking any form of hot work, i.e., welding, gas cutting, angle grinding, etc. • Nobody is allowed to dispose of a burning or smouldering object in an area where it may cause the ignition of a fire. • The Contractor must ensure that no wildfires will be caused because of his activities. • 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. • Keep clear of blasting sites. • Keep a record of all incidents, accidents and illnesses on site and make the information available at meetings. • Employees must also be trained on the nature of their jobs and made aware of potential hazards at their workplace. • Ensure that, there is a safety representative who is equipped with a first aid kit at the construction site. • Shade and enough water should be provided at the lay-down areas. • The team should have trained the first aider and the fully stocked first aid kit should always be present 	

7.4 Site closure and post-construction rehabilitation

Post-construction/maintenance rehabilitation is the process of returning the land in a given area that has been disturbed by construction and earthworks to some degree of its former 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 are associated with the proposed Karibib Powdered Activated Carbon Plant and Ground Reservoir. The project could be mitigated and restored to an acceptable level. Poorly rehabilitated construction areas provide a difficult legacy issue for governments, communities and companies, and ultimately tarnish the reputation of developers as a whole.

Construction will have temporary effects on several areas, and these will require rehabilitation. Impacts may be short (lay down areas) and rehabilitation could occur immediately after the impact ends, or permanent (construction of the pipeline and associated infrastructure) and rehabilitation is impossible. However, rehabilitation management is an ongoing process which should continue, if necessary, for long after the completion of the construction project.

Objectives of proper site closure and rehabilitation include the following:

- 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.).
- Excavation of contaminated material and disposal thereof in an acceptable manner.

Rehabilitation measures to implement:

- a) A site inspection will be held after completion of the project to determine if the necessary rehabilitation work was done. Rehabilitation will be done to the satisfaction of NamWater.
- b) Rehabilitation work should be done as soon as construction work is completed.
- c) All excess construction materials should be removed from construction sites.
- d) All newly established roads no longer required must be rehabilitated. Tracks can be rehabilitated by raking the area or dragging tyres or branches (or other suitable material) behind a vehicle. Make sure that the central ridge in the road is removed. Remove all windrows.
- e) Remove all waste, rock stockpiles, construction equipment, surplus materials and temporary structures, fences and demarcation material established by the contractor.
- f) Breaks up all bunds, and concrete slabs and removes these with all waste concrete to an appropriate waste dump.
- g) Make sure all polluted soil is stored in drums and removed to an appropriate waste dump.
- h) Make sure all windblown litter is removed.
- i) Make sure that all potential hazards (i.e., the sewerage pit) are properly closed and left in a safe and neat position.
- j) Newly established borrow pits should be neatly worked off.
- k) Repair all fences and gates if damaged by the contractor.
- l) All rehabilitated areas shall be considered “no-go” areas and the Contractor shall ensure that none of his staff or equipment enters these areas.

During operation and pipeline maintenance exercises, the Scheme Superintendent shall conduct a site inspection after every maintenance work and ensure the rehabilitation of disturbed areas. Rehabilitation measures during the operation phase will include:

- Clean up all soil pollution during maintenance work and disposal to an appropriate waste dump site.
- Remove all windblown litter once maintenance has ceased.
- Remove all potential hazards and ensure the area is left safely and neatly.
- Any temporary work camps/lay down areas setup should be dismantled, and the area rehabilitated as far as practicable, to their original state.
- Pickup all worn-out parts/pieces and pipes which has been replaced.

7.4.1 Post-construction land restoration management actions

Parameter	Management Action	Responsibility
Overall	Progressive rehabilitation shall be undertaken to minimise the amount of disturbance time. The disturbed area will be re-profiled to original or stable contours, re-establishing surface drainage lines and other land features.	Resident Engineer Construction Contractor/s
Infrastructure	All temporary infrastructure, signage and other installations other than those required for environmental, or safety reasons shall be removed once backfilling and tie-ins are completed.	Construction Contractor/s
Waste	All waste materials (e.g., bags, pegs, skids, pillows) shall be removed from the construction areas once backfilling and tie-ins are completed.	Construction Contractor /s
Soils	Compaction relief shall be undertaken by scarifying or ripping as required along the contours, followed by raking and levelling.	Construction Contractor /s
Erosion	<ul style="list-style-type: none"> • The beds of watercourses to be restored to the original gradient and the bank to the natural contours post-disturbance. • Backfill crown to be graded and shaped as closely as practicable to pre-existing contours and flow patterns of the riverbed and riparian zone. • Banks are to be reinstated in a manner that minimises erosion potential and does not alter natural streamflow - this may include the installation of rock gabions, rip rap, cement/s and hessian bags. 	Construction Contractor / s

7.5 Proposed mitigation measures: Operation and maintenance phase

Environmental Issue/Impacts	Source of Impact and Description	Mitigation Measures	Responsibility
Biophysical	Disturbance to local flora and fauna	<ul style="list-style-type: none"> Existing maintenance roads should be used as far as possible. All vehicles should be driven at a minimum speed limit of 60 km/hr. 	Scheme Superintendent
	Soil disturbances and contamination.	<ul style="list-style-type: none"> Soil disturbance from this activity is expected to be minimal. Contaminated soil must be cleaned up and disposed of appropriately at the nearest dump site. 	Scheme Superintendent
	Fuel and lubricants spills or leaks.	<ul style="list-style-type: none"> All leakages and spillages of oil and grease should be contained, cleaned up, and disposed of at the nearest Municipal Landfill site. 	Scheme Superintendent
	Dust and air pollution	<ul style="list-style-type: none"> All vehicles and machinery must be roadworthy and driving speed limits should be adhered to. Maintenance and repair will be concessionary, hence the limited impacts. All silencing mechanisms on all equipment must be in a good state of repair. All routine maintenance shall be restricted to daylight hours. 	Scheme Superintendent
	<p>Waste generation - The operation of the PAC plant will result in the generation of different types of waste such as general household waste and wear-off parts from maintenance services</p>	<ul style="list-style-type: none"> General household waste should be contained in the municipal refuse bins for disposal at the Karibib Town Council disposal site. Alternatively, general household waste can be sorted into separate categories and sent to the local recycling plants (if available). Wear-off metal parts can be collected and sent to the local scrap yard. Other items such as PAC bags should also be disposed of at the waste disposal site. Worn-out parts can be collected and sent to the local scrap yards. All empty containers should be sent to the local recycling companies or properly cleaned before re-use. Hazardous waste such as used oil, paints, unused chemicals, etc., should be collected separately and sent to the Walvis Bay Hazardous waste site. 	Scheme Superintendent
<p>Ablution facilities and waste production at the PAC plant – There is currently no sewage reticulation system installed in the PAC plant. The effluent from the PAC plant which includes</p>	<ul style="list-style-type: none"> Waste from the PAC plant mixing tank (non-toxic) and sewage wastewater (toxic waste) from the ablution facilities should be regularly collected for disposal at the Karibib Town Council oxidation ponds. 		

Environmental Issue/Impacts	Source of Impact and Description	Mitigation Measures	Responsibility
	waste from the PAC mixing tank (non-toxic) and sewage wastewater (toxic waste) from the ablution facilities, will be accumulated and stored in a septic tank.		
Socio-Economic	Safety, security, and health hazards. Potential health and safety risks that are associated with the PAC plant operation are such as the risk of falling and drowning by both operation and maintenance staff	<ul style="list-style-type: none"> • The PAC plant area must be fenced off and out of bounds to the public. • Operators and maintenance staff must be trained and made aware of potential occupation risks associated with their job and always equipped with the appropriate PPE. • Employees should be equipped with appropriate PPE. 	Scheme Superintendent
Nuisance	The potential source of a nuisance during the operation phase is excessive noise from running pumps, especially if not properly maintained.	<ul style="list-style-type: none"> • The pumps are to be housed in one single room, hence the noise generated will not be emitted to the surrounding. • The combined noise produced in the pump station should not exceed 85 dBA as recommended by the National Labour Act. 	Scheme Superintendent
Public health and safety risks	<ul style="list-style-type: none"> • The KWSS maintenance staff are at risk of numerous risks such as. <ul style="list-style-type: none"> ○ Presence of disease-carrying vectors i.e., flies, mosquitoes 	<ul style="list-style-type: none"> • Maintenance staff must be made aware of potential occupational health hazards associated with their jobs. • Employees must be equipped with appropriate PPE suitable for each task undertaken. • Keep the area clean and tidy by removing waste and unwanted vegetation. 	Scheme Superintendent
Waste generation	<p>The operation of the KWSS will result in the generation of different types of waste from different plant operational activities such as:</p> <ul style="list-style-type: none"> • General household waste from office operations and operator houses. • Worn-off parts from maintenance and repair of plant infrastructures, pipelines, vehicles, and equipment. • Lubricants from maintenance of vehicles and equipment. • Building rubble from renovations • Empty containers and packaging materials. 	<ul style="list-style-type: none"> • Compile an inventory of all types and quantities of waste generated at the site. • Provide adequate and separate waste handling facilities for each waste type at the site and ensure regular collection and disposal. • Follow the waste management hierarchy in managing waste, as follows: Avoid- Reduce- Reuse-Recycle- Recover- Treat- Dispose. • General household waste, debris from the building rubble, and worn-out non-metallic parts must be disposed of at the nearest town waste disposal site. • Metallic worn-out parts should be taken to the nearest scrap yards for recycling. • Empty containers which contained hazardous chemicals should be taken to the nearest Hazardous Waste site. 	Scheme Superintendent

Environmental Issue/Impacts	Source of Impact and Description	Mitigation Measures	Responsibility
Risk of fire	Sources of fire outbreaks during operations could be electrical shocks and due to the presence of flammable and combustible items i.e., fuel.	<ul style="list-style-type: none"> • Ensure that all firefighting devices are in good working condition and are serviced. • Holistic fire protection and prevention plan are needed. This plan must include an emergency response plan, a firefighting plan, and a spill recovery plan. • Maintain regular site, mechanical and electrical inspections, and maintenance. • Clean up and contain all oil spills/leaks. 	Scheme Superintendent
Visual Impact	Improper handling of waste in and around the site could compromise the aesthetic view of the place.	<ul style="list-style-type: none"> • Ensure regular waste disposal, at least weekly. • Ensure good housekeeping and routine maintenance of infrastructures and surroundings. 	Scheme Superintendent
Increase in crime-related issues.	The KWSS infrastructures i.e., fences, pumps, etc., are at risk of vandalism from the public.	<ul style="list-style-type: none"> • Provide security around the site and ensure regular inspections for all booster stations infrastructures. • Ensure proper and regular maintenance of the perimeter fence around the site. • Breaches in the fencing must be repaired immediately. 	Scheme Superintendent
Emergency response	An emergency may occur any time during the operation and maintenance phase and may affect the water supply scheme operation and disrupt the quality and quantity of water supply to the area.	<ul style="list-style-type: none"> • Emergencies shall be handled as per the Emergency Response Plan (ERP) presented in Section 10. 	Scheme Superintendent
Handling of complaints and grievances	A grievance may be received from residents, or customers with regards to operation or maintenance.	<ul style="list-style-type: none"> • All complaints and grievances shall be reported in the Form (see Annexure G) and submitted to the Scheme Superintendent. 	Scheme Superintendent

7.6 Proposed enhancement measures for positive impacts

The proposed development will also result in several positive impacts during the construction and operation phases. However, certain enhancement measures must be implemented to fully realize such positive impacts. These impacts are as follows.

Table 9: Assessment of positive impacts during the construction and operation phase

Description/nature of the impact	Magnitude and scale	Duration	Enhancement measures
<p>Job opportunities</p> <p>The proposed project will create job opportunities both direct and indirect for local people during the construction phase.</p>	Local	Temporary	As part of the tender requirements, Contractors must be encouraged to give priority to locally qualified people.
<p>Gender roles</p> <p>Equal opportunities for men and women.</p>	Local	Temporary	Equal opportunities for men and women.
<p>Business opportunities</p> <p>The construction works will create business opportunities for consultants, building contractors, and local suppliers of building materials. Other local businesses such as hotels, guest houses, and street vendors will also benefit indirectly from the construction works.</p>	Regional	Temporary	Building materials must be sourced from local businesses as far as possible. Qualified Namibian construction companies should be given a fair chance to compete in the bidding process.
<p>Economic prosperity</p> <p>During the construction phase, it is expected that the local economy will be beneficially impacted by increased temporary employment opportunities and business opportunities.</p>	Regional	Temporary	<ul style="list-style-type: none"> Local people and businesses must be given a fair chance to benefit from the project. There must be a water demand management plan for the area and all major economic activities proposed in the area should be subjected to the water demand management plan.
Improved water quality (free of odour and green algae)	Regional	Permanent	<ul style="list-style-type: none"> Construction of the PAC plant to be done accordingly.

<p>Provision of water supply</p> <p>One of the significant positive impacts that will result from the proposed project is the improved water supply to the area. Hence, the increased supply capacity will ensure a reliable supply of safe drinking water to Karibib..</p>	Regional	Long Term	<ul style="list-style-type: none"> • Ensure timely fixing of leaks and breaks on the pipeline to minimise water supply interruptions. • Residents must be sensitised to use water sparingly.
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8 DECOMMISSIONING AND LAND RESTORATION

8.1 Decommissioning of the newly Karibib Powdered Activated Carbon Plant and Ground Reservoir

The decommissioning of the proposed Karibib Powdered Activated Carbon Plant and Ground Reservoir is not foreseen during the validity of the environmental clearance certificate. Should decommissioning occur at any stage, this section of the EMP should be updated by the Proponent.

The decommissioning will entail the complete removal of all associated infrastructures. Any pollution present on the site must be remediated. The impacts associated with this phase include noise and waste production as structures are dismantled. All waste materials from the decommissioning activities should be contained and disposed of at a Karibib waste disposal site. The EMP for the facility will have to be reviewed at the time of decommissioning to cater for changes made to the site and implement guidelines and mitigation measures. Furthermore, the Proponent should thus consult with the relevant authority before any proposed demolition and removal of site infrastructure to best mitigate any potential impacts.

The updated EMP should entail the following components:

- The nature of the envisaged decommissioning and rehabilitation process.
- Types and nature of components to be decommissioned i.e., buildings, piping, etc.
- Types and quantity of waste to be produced i.e., hazardous waste and non-hazardous waste like building rubble, uPVC, HDPE, concrete, etc.
- Proposed waste management strategy.
- Responsibilities of each party to be involved in the decommissioning process.
- Envisaged environmental rehabilitation procedures.

Some of the expected environmental impacts associated with the demolishment of the PAC plant and the ground-level reservoirs are as follows:

- **Land use effects:**

The KWTP and the PAC plant are located within a built-up area, hence demolishing them will cause disturbances to the adjacent neighbouring residents and land users. Dust, Noise, and Vibration to be generated from excavations and demolishing works.

- **Environmental pollution**

Different types of waste will be generated i.e., building rubbles, general household, excess sand, etc., and tanks, and concrete materials which are to be demolished. Soil contamination from spills and leaks of lubricants and oil from vehicles, machinery, and equipment could also occur.

- **Safety and health hazards:**

The safety of residents living in the proximity of the site and the employees could be compromised by workplace hazards. All employees should be equipped with appropriate PPE. The site should be fenced off and out of bounds during the demolishing work.

- **Visual/Aesthetic impacts**

If the existing infrastructure is kept for many years without any repair, it will dilapidate and may become an eyesore.

Building rubble and other general waste should be disposed of at the nearest approved dump site.

Hazardous waste should be handled by an approved Contractor and disposed of at the approved site.

The Environmental Management Plan for this phase will have to be reviewed and updated at the time of decommissioning to cater for changes made to the development.

Since all above-identified impacts are similar to issues during the construction phase, such impacts can be mitigated by applying measures provided in Section 7.3., above.

8.2 Post decommissioning rehabilitation

Rehabilitation is defined as the process of taking all the necessary actions to repair the damaged environment in-order to make the land suitable for other uses or to simply beautify the affected area. In this case, the rehabilitation will entail clean-up, treatment, or restoration of contaminated areas (e.g., contaminated soils by oil or fuel spills, concrete spills, etc.) and refilling of excavated pits with the overburden. Upon commencing construction works, the ECO and RE shall conduct a site inspection and instruct the responsible contractor to do the following:

- Removal of all waste produced to be disposed of appropriately.
- Rehabilitate the disturbed areas and refill excavations.
- Clean up all spills and leave the area safe and tidy.

During the operation phase, the Scheme Superintendent shall conduct a site inspection after every maintenance work and ensure the rehabilitation of disturbed areas. Rehabilitation measures during the operation phase must include:

- Clean up all soil pollution during maintenance work and disposal to an appropriate waste dump site.
- Remove all windblown litter once maintenance has ceased.
- Remove all potential hazards (i.e., the sewerage pit) and ensure the area is left safely and neatly.
- Any temporary work camps setup should be dismantled, and the area rehabilitated as far as practicable, to their original state.
- Driving vehicles in newly rehabilitated areas should be prohibited.
- Temporary access roads not required for long-term maintenance access should be closed and rehabilitated to a condition compatible with the surrounding land use.
- Signage should be erected where access routes are to be retained but are not public access.

Table 10: Rehabilitation management actions

Parameter	Rehabilitation Management Action	Responsibility
Overall	Progressive rehabilitation shall be undertaken to minimise the amount of disturbance time. The disturbed area will be re-profiled to original or stable contours, re-establishing surface drainage lines and other land features.	Construction Contractor
Infrastructure	All temporary infrastructure, signage and other installations other than those required for environmental, or safety reasons shall be removed once backfilling and tie-ins are completed.	Construction Contractor
Waste	All waste materials (e.g., bags, pegs, skids, pillows) shall be removed from the construction areas once backfilling and tie-ins are completed.	Construction Contractor
Soils	Compaction relief shall be undertaken by scarifying or ripping as required along the contours, followed by raking and levelling.	Construction Contractor
Erosion	Backfill crown is to be graded and shaped as closely as practicable to pre-existing contours and flow patterns of the riverbed and riparian zone.	Construction Contractor
Erosion	Banks are to be reinstated in a manner that minimises erosion potential and does not alter natural streamflow - this may include the installation of rock gabions, rip rap, cement/s and hessian bags.	Construction Contractor

9 ENVIRONMENTAL MONITORING

To ensure continual improvement in environmental performance and reduce adversity of potential negative impacts, it is advisable to keep monitoring the identified environmental receptors.

9.1 Monitoring during the construction phase

Monitoring of all activities during the construction period will be under the responsibility of the Contractor, whose environmental performance will be controlled by the RE, Environmentalist, ECO and NamWater's Environmental Section.

Table 11: Monitoring plan during construction

Element	Location	Type of monitoring	Frequency of monitoring	Purpose of monitoring
Dust	At the construction sites	Visual monitoring	During periodic site visits	To ensure adherence to environmental protection requirements
Wastewater flows generated at the construction sites	At the construction sites	Visual monitoring	During monthly site visits	To ensure adherence to environmental protection requirements
Collection of solid waste	At the construction sites	Visual monitoring	During periodic site visits	To ensure adherence to environmental protection requirements
Use of dangerous materials (paints with heavy metals, lead compositions, cement slabs, pipes, inflammable, toxic substances, etc.)	At the construction sites with the right documentation	Visual monitoring and study of documentation	Each month	To ensure adherence to environmental protection requirements
Protective measures at the construction site	At the construction sites with the right documentation	Visual monitoring	Each month	To ensure adherence to environmental protection and safety requirements
Earth restoration after excavation works	At the construction sites	Visual monitoring	After construction works	To ensure adherence to environmental

Element	Location	Type of monitoring	Frequency of monitoring	Purpose of monitoring
				protection requirements
Noise & vibrations resulting from equipment work	Project area/close to settlements	Portative noise metering device	During periodic site visits, daily	To ensure adherence to environmental protection requirements
Traffic operation /movement	At the construction sites	Visual monitoring of machinery and trucks carrying construction materials	During periodic site visits	To ensure adherence to environmental protection requirements
Vehicle and pedestrian safety when there are no construction activities	At the construction sites	Visual monitoring by supervisor	On daily basis during the construction phase	To ensure adherence to requirements

9.2 Monitoring during the operation phase

During the operation phase, the Scheme Superintendent must ensure that compliance monitoring is conducted at different intervals/frequencies throughout the Karibib Powdered Activated Carbon Plant and Ground Reservoir operational life span as indicated in the table below.

Table 12: Monitoring plan during the operation phase

The issue to be monitored	Monitoring Objectives	What needs to be monitored	Frequency and Means of Monitoring
Production and distribution losses	Prevent water wastage and ensure water conservation.	<ul style="list-style-type: none"> Overflows, leakages, pipe bursts, etc. 	Daily inspections and meter reading
Occupational health risks	Ensure health and safe working conditions	Chemical exposure and the presence of health hazards	Daily physical observations.
Water quality	Supply of safe and quality drinking water in line with the Water Quality Guidelines of the Water Act.	<ul style="list-style-type: none"> Physical quality of raw, settled, and treated water (Chlorine level, N.T.U, pH, Conductivity, and Temperature). Microbiological/ bacteriological quality (Free Chlorine, Heterotrophic Plate 	Daily water sampling and testing.

The issue to be monitored	Monitoring Objectives	What needs to be monitored	Frequency and Means of Monitoring
		count, Total Chlorine, Coliforms & Faecal Coliforms).	-Monthly sampling and laboratory testing
Water Balance	Ensure water security of the supply area.	Production figures vs. sales figures and demand management	Monthly water balance checks.
Waste management	Prevent environmental pollution and contamination.	Litter, chemical storage & handling, cleanliness, Chemical composition of sludge.	-Daily inspections and physical observation.
Implementation of the EMP	Ensure compliance to this EMP and adherence to the regulative measures during planning & design, construction, operation, maintenance, and decommissioning of the envisaged Karibib Powdered Activated Carbon Plant and Ground Reservoir.	Implementation of specified measures and compliance to the EMP and other relevant legal requirements.	Biannual environmental report to MEFT.

10 EMERGENCY RESPONSE PLAN

This section provides an emergency response plan which entails the types and effects of emergencies associated with the proposed Karibib Powdered Activated Carbon Plant and Ground Reservoir as well as procedures and actions to be taken in case of emergency during the construction, operation, and maintenance of the Karibib Powdered Activated Carbon Plant and Ground Reservoir.

10.1 Types and effects of emergencies

Emergencies can occur at any time or place either during the construction, operation, and maintenance of the Karibib Powdered Activated Carbon Plant and Ground Reservoir. These emergencies may affect the KWTP operation and disrupt the quality and quantity of water supply to the area. Some of the emergencies which are associated with the proposed construction, operation, maintenance, and decommissioning of the Karibib Powdered Activated Carbon Plant and Ground Reservoir, are as follows:

- Substance spillage i.e., oil, concrete, chemicals, etc.
- Construction accidents
- Fire outbreak
- Power failure
- Equipment failure

10.2 Sources of Emergencies

10.2.1 Accidents

Accidents may occur during construction, operation or maintenance works and can cause an unavoidable interruption to the Karibib Powdered Activated Carbon Plant and Ground Reservoir works, personal injury, and/or property damage.

10.2.2 Faulty maintenance

Faulty maintenance may cause unexpected breakdowns on the Karibib Powdered Activated Carbon Plant and Ground Reservoir to Omutsegwonime pipeline which may have a direct bearing on its operation and the life span Karibib Powdered Activated Carbon Plant and Ground Reservoir. Good maintenance will result in the infrastructure performing throughout the design period; however, poor maintenance or faulty maintenance will shorten the expected life of the infrastructure. Although some breakdowns can be repaired during a regularly scheduled repair program and probably do not represent an emergency, the regular occurrence of such breakdowns will affect the continued satisfactory operation of the Karibib Powdered Activated Carbon Plant and Ground Reservoir which may constitute an emergency condition.

10.2.3 Negligent operation

Certain operational procedures need to be followed to ensure the satisfactory performance of the Karibib Powdered Activated Carbon Plant and Ground Reservoir. Not following correctly, the established procedures constitute negligent operation. Although the negligent operation may not be as readily noticeable as faulty maintenance, the emergency condition resulting

from it could be more severe because it could affect the operation before being discovered. The Scheme Superintendent shall ensure routine maintenance of the KWSS, keep an extra supply of parts that require frequent replacements and ensure to always stock of enough chemicals to maintain operations for at least 30 days.

10.3 Emergencies response procedures

10.3.1 Response priorities

Depending on the nature of the emergency, the following response plan must be implemented as an integral part of the Karibib Powdered Activated Carbon Plant and Ground Reservoir routine operations to lessen the severity of the emergency. All response actions should be geared toward the following priorities in the order below:

- Safety of People (always First)
- Protection of the Environment
- Protection of Assets

Table 13: Emergency response procedures

NO.	Type of Emergency	Response actions	Responsible
1.	Substance spill i.e., concrete, oil, chemicals, etc.	<ul style="list-style-type: none"> • Stop and control the spill at the source first. • Contain the spill/leakage with appropriate containers i.e., drip trays, sumps, etc., and in an approved manner to the satisfaction of the RE. • Clean the affected area with water or an approved cleaning product. • The contaminated soil should be removed and disposed of at the Nearest Town waste disposal site. • Repair vehicle or machinery with leakage. • If it cannot be repaired, such vehicle or machinery should not be used until it is safe to do so. • Report the incident to the RE and record it in the logbook. • A spill kit must be available at the construction site (during the construction phase) and at KWTP and there must be at least one person with appropriate authority who is trained in hazmat response. • Refuelling vehicles should be equipped with specific vehicle spill kits 	Contractor Safety Representatives Resident Engineer
2.	Power failure	<ul style="list-style-type: none"> • Ensure there is an emergency power supply capable of maintaining minimum water treatment operations. • The emergency power equipment should be checked at least monthly to ensure that they remain in good operating condition. • Provide a log to document a monthly check of emergency power supply operations. • List name and number of power supplier: Erongo Regional Electricity Distributor • In case of power loss. <ul style="list-style-type: none"> ○ Check if the power failure is local (site) or the whole suburb/town. ○ If the whole town, contact Erongo RED. ○ If locally, inspect the source of power loss, and restart the main switch. ○ If necessary, inform critical customers. ○ Record the source of power shortage in the power supply logbook 	Scheme Superintendent
3.	Fire outbreak	Follow the holistic Fire Approach as presented in Annexure D	Scheme Superintendent

NO.	Type of Emergency	Response actions	Responsible
4.	Chemical leakage i.e., chlorine leak	In case of Chlorine or CO ₂ gas leakage: <ul style="list-style-type: none"> • Make sure storerooms are built according to legal requirements for the storage of chlorine with appropriate ventilation. • Wear a face mask with a B2P3 filter. • Evacuate all persons in the affected room. • Shut down all the dosage system valves. • Check the information on the dosage system control panel. • Isolate the faulty dosage system and replace the gas cylinder with the leak. • Record in the incident report form. 	Scheme Superintendent
5.	Accident i.e., injury to a person	<ul style="list-style-type: none"> • The priority after a construction accident should be to get medical attention for an injured person. • Assess the injured person's situation by checking breath, and pulse. • Notify the First Aid Person • Assist the First Aid Personnel • Record in the incident report form. • Report the incident to the Scheme Superintendent 	Contractor/Scheme Superintendent
6.	Equipment failure i.e., pumps failure, loss of pressure, etc.	In case of faulty pump/s: <ul style="list-style-type: none"> • First, analyse the source of the emergency by checking the information displayed on the SCADA system. • Check the flow rate of each pump to identify the fault. • Ensure that the standby pump is switched on. 	Scheme Superintendent

11 GRIEVANCE HANDLING PROCESS

A complaint /grievance is hereby defined to be any, complaint or misunderstanding arising from the interpretation, application or observance or enforcement of the provisions of projects` environmental and social performance.

This procedure outlines the procedure for receiving and dealing with concerns and complaints of employees and members of the affected public relating to the construction, operation, maintenance, and decommissioning of the Karibib Powdered Activated Carbon Plant and Ground Reservoir.

The Resident Engineer is responsible for receiving and handling complaints and must ensure that:

- All complaints are taken seriously and dealt with appropriately.
- Any immediate actions required are implemented.
- All complaints are investigated, to identify the remedial actions required, the root cause, and preventative measures necessary to avoid recurrence.
- Further to the investigation, any actions requiring approval are addressed promptly, added to the Site Improvement Plan, and actioned in a timely manner in collaboration with the ECO.
- A record is made of all complaints, along with any response and/or actions taken (Annexure G)
- Periodically, the complaints records are reviewed to identify any trends and appropriate steps required.
- Avail a lockable grievance/complaint/ suggestion (specifically assigned to this project) box for unanimous submission of written complaints on-site and at the KWTP in Karibib.
- Periodically bi-monthly) open the grievance boxes.

All employees (including contractors) must:

- Report any complaint that is received to the RE immediately and such enquiries/complaints shall be recorded and tracked in the log sheet maintained by the RE.
- Report any incident which may cause a nuisance, or give rise to a complaint, to the responsible RE immediately.
- Write their complaint/ grievance (using the form in Annexure G) and submit it to the RE or in the grievance/ complaint box unanimously.

Members of the Public

- Report complaints / grievances in writing and submit them into the grievance/ complaint box at NamWater offices in Karibib.

11.1 Grievance Procedure

Upon receipt of the registered grievance forms, the Resident Engineer or Scheme Superintendent shall screen and assess to either act to solve the grievance locally or refer it to head office. If the grievance is referred to the head office, the line manager should decide. If the grievance is to be solved locally, it should either be rejected or handled appropriately and the decision should be communicated to the aggrieved person. See **Figure 9** below for the graphical representation of the grievance procedure.

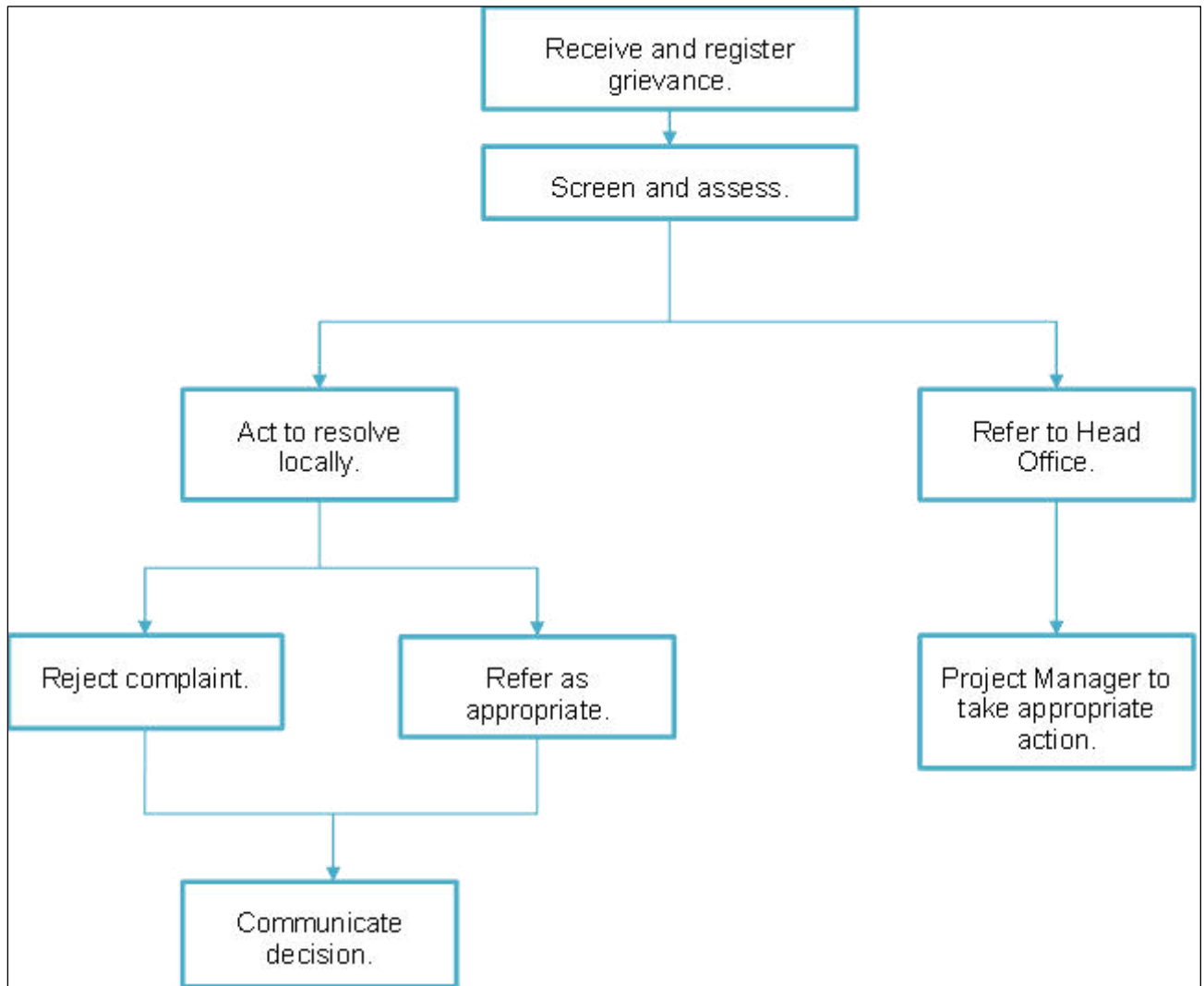


Figure 9: Grievance response procedure

12 CONCLUSION

The preparation of this EMP is based on the current information provided, any changes or deviations concerning the proposed pipeline route and /or the proposed ground-level reservoir site shall trigger changes to this EMP. If all mitigation measures are implemented as outlined in the EMP, it is anticipated that the consequences and/or probability of the predicted negative impacts will be managed/reduced.

Although the implementation of this EMP requires a multitude of administration, NamWater should play a central role in the implementation as outlined in this report. NamWater should also ensure proper coordination with all parties involved in the project activities during all project phases. NamWater shall also ensure to avail of necessary resources (i.e., human, financial, etc.) and training to enable the full implementation of this EMP. The implementation of this EMP can be combined with NamWater's environmental code of conduct. Monitoring of certain environmental parameters must be conducted regularly as outlined in this EMP. Environmental biannual reports must be kept available for possible submissions to the MEFT and ensure the renewal of the project's ECC.

Upon approval by the MEFT, this EMP should be used as an on-site reference document for the design, construction, operation and maintenance, and decommissioning phase of the Karibib Powdered Activated Carbon Plant and Ground Reservoir. The EMP documents are applicable for all project phases, thus a copy of this EMP shall be always kept onsite. It is a legally binding document, thus, any deviation or transgression from this EMP is punishable by law as per the Environmental Management Act 07 of 2007. Parties responsible for transgressing may be held responsible for any rehabilitation that may need to be undertaken.

13 ANNEXURES

Annexure A - Generic example of a method statement

Annexure B - Environmental compliance monitoring checklist

Annexure C: Essential Services Contacts

Annexure D: Fire response procedures

Annexure E: Incident / Accident Report form

Annexure F: Nam Water's environmental code of conduct

Annexure D: Grievances register form

Annexure H: Chance Finds Procedure (CFP) management guideline for Archaeology

13.1 Annexure A - Generic example of a method statement

METHOD STATEMENT

Contractor:

Date:

What work is to be undertaken - brief description of the works)

Where are the works to be undertaken? (Where possible, provide an annotated plan and a full description of the extent of works)

Start and end date of works for which the method statement is required.

Start Date

End Date

How are the works to be undertaken? Provide as much detail as possible, including annotated sketches and plans where possible) *Note: please attach extra pages if more space is required

13.2 Annexure B: Environmental Compliance Monitoring Checklist

The following checklist should be used during compliance monitoring.

PART 1: ADMINISTRATIVE INFORMATION

Project Title:		Date:
Project location:	Reporting period	Individual Preparing Checklist:
Region:		Department:
Scheme Superintendent:		Phone No.:

PART 2: ENVIRONMENTAL ASPECTS

ENVIRONMENTAL ASPECT/IMPACT	ENVIRONMENTAL COMPLIANCE (AS PER EMP REQUIREMENT?)		Remarks (specify the location, a good practice observed, causes of non-conformity, and proposed action)
	YES	NO	
Waste management			
Water quality testing			
Water balance check			

PART 3: RECOMMENDATION

FOR EACH ITEM CHECKED IN PART 2, DESCRIBE THE CORRESPONDING CONTROLS TO BE IMPLEMENTED TO REDUCE POTENTIAL ENVIRONMENTAL IMPACTS (e.g., spill prevention, erosion controls, air emission controls including dust suppression, selection of materials, etc.). Provide details of the activities and impacts for each box and the proposed mitigations. Include attachments where appropriate. Use the same number system for your input.

ECO: Signature: _____ Date: _____

Scheme Superintendent: Signature: _____ Date: _____

13.3 Annexure C: Contact Details for Emergency. Essential Services & Police Stations

Table 14: Contact Details for Emergency. Essential Services & Police Stations – Karibib

Town	Type of Service	Contact Number
Karibib	Police Service	064 550 008
	Fire Brigade	064 81 422 1805
	Karibib Health Centre	064 550 073/0811562665
	Erongo RED	064 550 996
	Water Services	0813009274
	Solid Waste Collection	0813987777
	Roads and Sewer	0812311122
	Karibib Town Council Corporate Number	0813454116

13.4 Annexure D: Fire Response Procedures

Things you must-do if you discover a fire!!!

STEP 1



- Do not panic
- Press the nearest alarm button
- Rescue any person in immediate danger, if safe to do so

STEP 2



- If possible, commence fighting the fire
- Call fire brigade

STEP 3



- Leave the building by the nearest emergency exit.
- Ensure all other personnel are warned along the way.
- Do not stop to collect personal belongings.
- Do not use lifts, use stair ways.

STEP 4



- Report to the assembly point
- Do not return to the building until authorized to do so

13.5 Annexure E: Incident / Accident Report Form

This form is to be completed in case of an environmental incident and shall be forwarded to the Project's RE during the construction phase and NamWater's Environment Section during the operation and maintenance phase.

Note: This form is not intended to replace other NamWater's internal reporting procedures.

Section 1. GENERAL DETAILS	
Date:	Reported By:
Time: am / pm	Name:
	Position:
	Company:
	Phone:

Section 2. RESPONSIBLE PARTIES	
Name:	Phone:
Company Name:	Email:
Witness Details (if applicable)	
Name:	Phone:
Witness Statement Taken? <input type="checkbox"/> Yes <input type="checkbox"/> No	

Section 3. INCIDENT DETAILS	
Type of Incident:	<input type="checkbox"/> Spill <input type="checkbox"/> Waste/rubbish <input type="checkbox"/> Wildlife disturbance <input type="checkbox"/> Vegetation disturbance/damage <input type="checkbox"/> Acid Sulphate Soils disturbance <input type="checkbox"/> Cultural Heritage disturbance/damage <input type="checkbox"/> Chemicals/herbicide Use <input type="checkbox"/> Water pollution/contamination <input type="checkbox"/> Nuisance (noise, air quality) <input type="checkbox"/> Other:
Incident Description	
Immediate Response Actions Taken:	

Section 4. CONTRIBUTING FACTORS AND PREVENTATIVE ACTIONS**(to be completed by Manager/Supervisor)****Cause, Circumstances, and Contributing Factors:****Measures that were in place to prevent this type of incident:****Measures to be implemented to prevent/minimize this type of incident from occurring again****Manager / Supervisor General Comments****Comments:****Name:****Position:****Company:****Signature:****Date:****Section 5. NAMWATER ENVIRONMENT OFFICE ONLY****Assessed Level of Potential or Actual Harm:****Is an Investigation Required?** Yes No**Investigation Team:****FOLLOW UP ACTION:****COMMENTS****Name:****Position:****Signature:****Date:**

13.6 Annexure F: NamWater environmental code of conduct

NAMWATER ENVIRONMENTAL CODE OF CONDUCT

What is an Environmental Code of Conduct?

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

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 drilling process.



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 drilling site. 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 Contractor 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 enquiry and which may result in that person being asked to leave the drilling site 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 FOREMAN, CONTRACTOR'S REPRESENTATIVE or EMPLOYER'S REPRESENTATIVE. 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 drilling areas at demarcated entrances.
2. Wear protective clothing and equipment as per signboards on site and according to instructions from your foreman.
3. Report to your CONTRACTOR'S REPRESENTATIVE if you see a stranger or unauthorised person in

the drilling area.

4. Never enter any area that is out of bounds or that is demarcated as dangerous without permission of your CONTRACTOR'S REPRESENTATIVE.
5. Never climb over any fence or enter private property without permission of the landowner or your CONTRACTOR'S REPRESENTATIVE.
6. Do not remove any vehicle, machinery, equipment, or any other object from the drilling site without the permission of your CONTRACTOR'S REPRESENTATIVE.
7. Keep clear of blasting sites. Follow the instructions of your CONTRACTOR'S REPRESENTATIVE.
8. Never enter or work in the drilling area while under the influence of alcohol or other intoxicating substances.
9. Make your camp at a designated area. If possible, camp at already disturbed areas.
10. Campsites and work sites should not be on an archaeological site or sites of scenic or cultural interest. Camp sites and working sites must be clearly demarcated.
11. Keep drilling areas as small as possible.
12. All drilling areas and open trenches should be clearly demarcated.
13. All staff should know the emergency procedures in case of accidents.

Waste Disposal

14. 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.

15. 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.
16. Recycle drums, pallets and other containers.
17. Never bury or burn any waste on site, all waste is to be disposed in allocated refuse disposal containers, bins or bags.

18. Never overfill any waste container. Inform your CONTRACTOR'S REPRESENTATIVE if you notice a container that is nearly full.
19. Do not litter.
20. Do not bury litter or rubbish in the backfill trench.

Plants and Animals

21. **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.
22. Never feed, tease, play with, or set devices to trap any animal or livestock. Wild animals are not to be domesticated.
23. Keep off the rock outcrops unless given specific permission by the EMPLOYER'S REPRESENTATIVE to be there.
24. Never cut down any tree or branches for firewood.
25. Never leave rubbish or food scraps or bones where it will attract animals, birds, or insects.
26. Rubbish must be thrown into allocated waste disposal bins/bags.
27. Always close the gates behind you.



Preventing Pollution

28. Only work with hazardous materials in banded areas.

29. 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.

30. Clean up spills immediately.

31. Immediately report to your CONTRACTOR'S REPRESENTATIVE when you

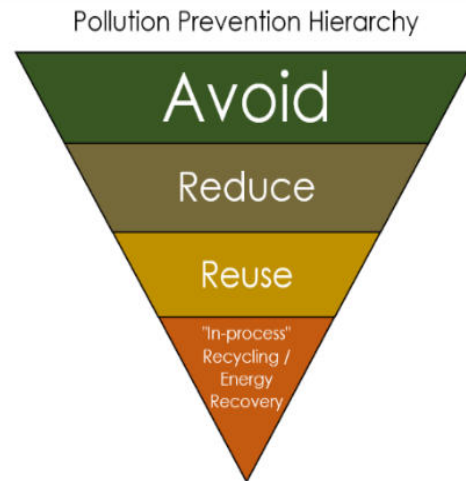
spill, or notice any hazardous substance overflow, leak or drip or spill on site, into the streambeds or along the road.

32. Immediately report to your FOREMAN when you notice any container, which holds hazardous substances overflow, leak or drip. Spillage must be prevented.

33. Only wash vehicles, equipment and machinery, containers and other surfaces at work site areas designated by your CONTRACTOR'S REPRESENTATIVE.

34. Do not change oil on uncovered surfaces.

35. If you are not sure how to transport, store, use, or get rid of any hazardous substances ask your CONTRACTOR'S REPRESENTATIVE for advice.



Health

36. Drink lots of clean water every day.
37. Use toilets that have been provided.
38. Take the necessary precautions to avoid contracting HIV / AIDS.
Condoms are available at most Clinics.
39. Inform your CONTRACTOR'S REPRESENTATIVE when you are sick.
40. Do not work with any machinery when you are sick.
41. If you are working in malaria areas you must take the necessary precautions.



Dust Control

42. Stockpile the top 20 cm of topsoil in small heaps and protect from wind erosion.
43. Do not make any new roads or clear any vegetation unless instructed to do so by your CONTRACTOR'S REPRESENTATIVE.
44. Keep to established tracks and pathways.
45. Keep within demarcated work areas.

Saving Water

- 47. Always use as little water as possible. Reduce, re-use and recycle water.
- 48. Never leave taps or hose pipes running. Close all taps after use.
- 49. Report any dripping or leaking taps and pipes to your CONTRACTOR'S REPRESENTATIVE.



Working Hours

- 50. Inform local authorities when the drilling process will commence.
- 51. You may only work on weekends and after hours with the consent of the CONTRACTOR'S REPRESENTATIVE.

Archaeological and Cultural Objects

- 52. If you find any archaeological, cultural, historical or pre-historical object on the drilling site you must immediately notify your CONTRACTOR'S REPRESENTATIVE.
- 53. 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.

For any enquiries, please call

Fillemon Aupokolo

Tell: 061-71 2095

Cell: 081 325 3301

OR

Jolanda Kamburona

Tell: 061-71 2105

Cell: 081 217 8116

13.7 Annexure G: Grievances Register Form

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

13.8 Annexure H: Chance Finds Procedure (CFP) management guideline for Archaeology:

(Extracted from - Archaeological Guidelines for Exploration & Mining in the Namib Desert, Kinnanhan, 2012).

INTRODUCTION: Areas of proposed mining and related activity are subject to heritage survey and assessment at the planning stage. These surveys are based on surface indications alone, and it is therefore possible that sites or items of heritage significance will be found in the course of development work. The personnel and Contractor heritage induction process is intended to sensitize people so that they may recognize heritage “chance finds” in the course of their work. The procedure set out here covers the reporting and management of such finds.

SCOPE: The “chance finds” procedure covers the actions to be taken from the discovery of a heritage site or item to its investigation by a trained archaeologist or other appropriately qualified person.

INTENT: The “chance finds” procedure is intended to ensure compliance with the AMP, which is based on archaeological best practice, and the relevant provisions of the National Heritage Act (27 of 2004), especially Section 55 (4): “a person who discovers any archaeological ... object ... must as soon as practicable report the discovery to the Council.” The procedure of reporting set out below must be observed so that heritage remains reported to the NHC are correctly identified in the field.

RESPONSIBILITIES:

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

PROCEDURE:

Action by person identifying archaeological or heritage material:

- a) If operating machinery or equipment, stop work
- b) Identify the site with flag tape
- c) Determine GPS position if possible
- d) Report findings to Foreman

Action by Foreman:

- a) Report findings, site locations and actions taken to Superintendent
- b) Cease any work in the immediate vicinity

Action by Superintendent:

- a) Visit the site and determine whether work can proceed without damage to the findings
- b) Determine and mark exclusion boundary
- c) Add site location and details to AMP GIS for field confirmation by archaeologist

Action by Archaeologist:

- a) Inspect site and confirm the addition to AMP GIS
- b) Advise NHC and request written permission to remove findings from the work area
- c) Recover, package and label finds for transfer to National Museum

In the event of discovering human remains

- Actions as above
- Field inspection by archaeologists to confirm that remains are human
- Advise and liaise with NHC Guidelines
- Recovery of remains and removal to the National Museum or National Forensic Laboratory, or as directed.