

CENTRAL NORTH WATER SUPPLY AREA: ZONE 2

ENVIRONMENTAL MANAGEMENT PLAN

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LIST OF ABBREVIATIONS

AIDS	Acquired Immune Deficiency Syndrome
CoC	Code of Conduct
DEA	Directorate of Environmental Affairs
EMA	Environmental Management Act
EMP	Environmental Management Plan
HIV	Human Immunodeficiency Virus
I&AP	Interested and Affected Parties
MEFT	Ministry of Environment, Forestry and Tourism
NEM	NamWater Environmental Manager
MSDS	Material Safety Data Sheet
NWQG	Namibian Water Quality Guidelines
NWQS	Namibian Water Quality Standards
STI's	Sexually Transmitted Infections
WTW	Water Treatment Works

1. PURPOSE OF THE EMP

This Environmental Management Plan (EMP) has been compiled and updated for the management of potential environmental impacts during the operation, and decommissioning phases of the existing Central North Water Supply Area (CNWSA): Zone 2 Water Supply Scheme. Best practice is proposed for the generic issues of construction management and supervision as well as the on-going management and operation of the water supply scheme.

In terms of the Environmental Assessment Policy of 1994 and the Environmental Management (Act No 7 of 2007) (EMA), the activities required for the construction of the proposed project requires authorization from the Directorate of Environmental Affairs at the Ministry of Environmental, Forestry and Tourism (MEFT: DEA).

An Environmental Clearance Certificate (ECC) was originally issued in 2018 and this EMP serves as an application for the renewal of the ECC.

2. INTRODUCTION

The Central North Water Supply Area (CNWSA) is located in the North Central area of Namibia, and covers areas of the Oshikoto, Omusati, Oshana and Ohangwena Regions. CNWSA infrastructure components have been divided into 8 separate zones.

The infrastructure of CNWSA: Zone 2 includes, the Olushandja and Ruacana Purification Plants, pump stations at each of these plants, as well as the Ruacana Head Bay Raw Water and the Olushandja–Ruacana Booster Pump Stations, the Olushandja–Ruacana and the (old) Olushandja–Eunda–Onesi–Tsandi pipelines.

Both the Ruacana and Olushandja Purification Plants can supply water to Ruacana Town. The Olushandja Purification Plant also pumps water in a south-westerly direction towards Tsandi, via the (old) Olushandja–Eunda–Onesi–Tsandi Pipeline.

2.1 Olushandja Batch (Old) Purification Plant

The “batch plant” is the original plant which was constructed in the late 1970s. The plant is located adjacent to the Calueque–Olushandja Dam canal, and a few hundred metres upstream (i.e. west) of the dam itself.

2.2 Olushandja New Purification Plant

This Slow Sand Filtration (SSF) plant was constructed in the year 2000. The purpose of the slow sand filtration plant was to:

- Supply potable water to Ruacana Town and Oshifo, and the rural area between Olushandja and Ruacana,
- Serve as experimental treatment system in order to:
 - Evaluate the suitability of roughing and slow sand filtration technology on Kunene River water,
 - Determine optimum design parameters and pre-treatment requirements for future similar plants,
 - Assess the viability of applying this technology in other remote rural areas.

The plant was constructed in a modular configuration in order to allow the addition of further modules in future, if required. The pump station, raw water tank and clear water sump were constructed to provide sufficient capacity for a three-modular size plant.

2.3 Ruacana Purification Plant

With the exception of the many so-called Stengel water purification works in the Cuvelai area, this is one of the oldest treatment plants in the Project Area. The plant was constructed in the 1970s to supply potable water to Ruacana Town as well as to consumers below the escarpment at the hydro-electric plant. The plant was, however, taken out of operation in 2007, and water is now supplied to NamPower and the border post from the 4 600 m³ capacity reservoir at the watershed.

The location of CNWSA: Zone 2 is depicted in **Figure 1**.

The EMP is for an existing CNWSA: Zone 2 and it is therefore only for the operation and maintenance of the scheme.

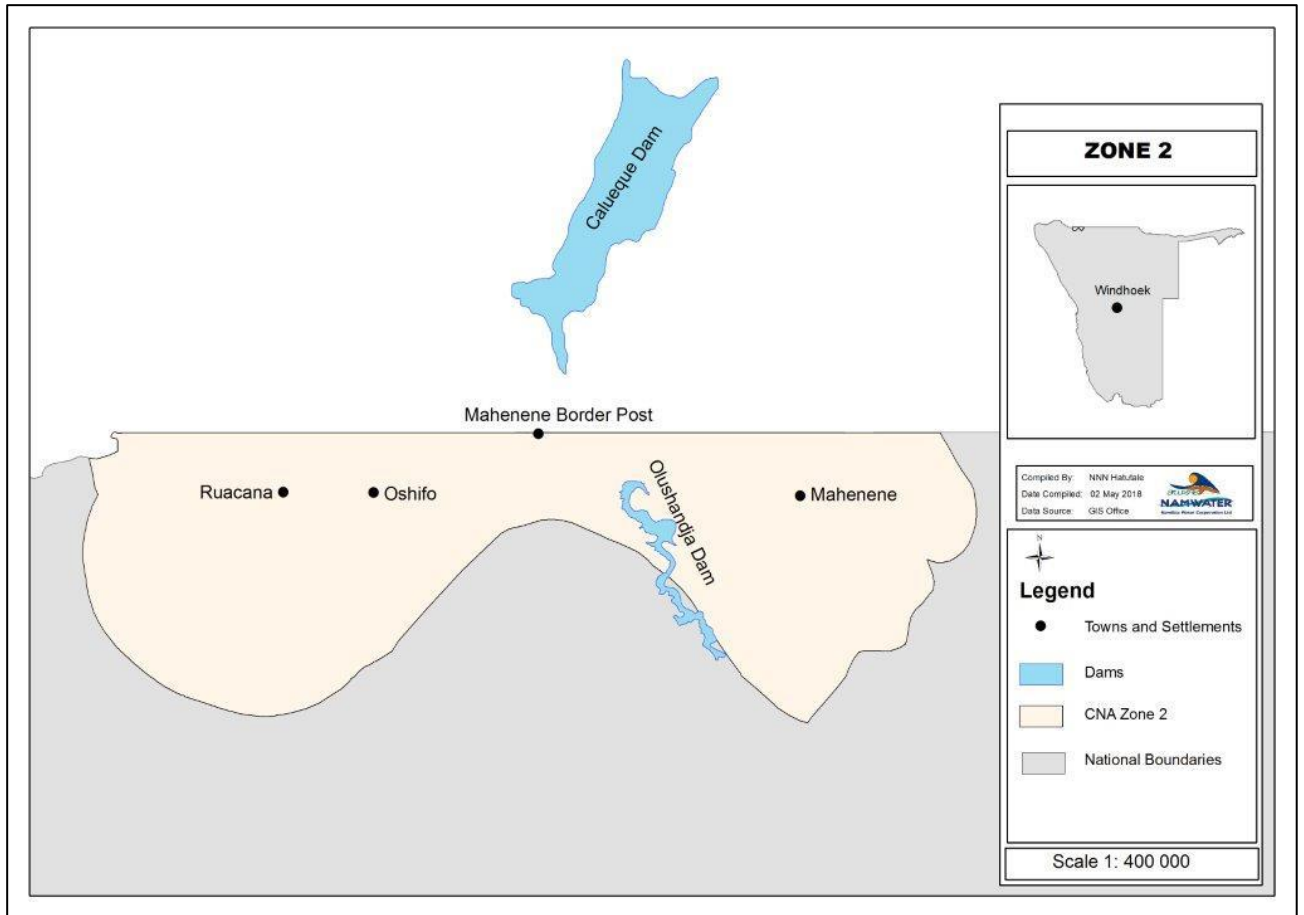


Figure 1: CNWSA: Zone 2 Location Map

3. EXISTING CNWSA: ZONE 2 WATER SUPPLY INFRASTRUCTURE

3.1 Water Source

3.1.1 Olushandja Batch Purification Plant

Water is drawn from the Calueque – Olushandja Canal, and pumped into the batch settlers. After the sludge has settled out, the settled water is pumped out of the settling tanks, and into a steel ground level reservoir.

A schematic layout of the existing infrastructure is indicated in **Figure 2- Figure 4** below

3.1.2 Olushandja New Purification Plant

Two raw water pumps at the newer portion of the Olushandja Purification Plant draw raw water from the Calueque – Olushandja Canal and deliver the water into a 330 m³ elevated reservoir. Water from this reservoir gravitates past a dosing point, and through two roughing filters and through two slow sand filters. The water from the sand filters water is discharged into a 400 m³ clear water sump below the pump station.

From the 400 m³ clear water sump, two pumps draw and deliver water into the Olushandja – Ruacana Pipeline. Other pumps deliver water to Areas C and D of the Ombalantu North Rural Water Supply Scheme.

3.1.3 Ruacana Purification Plant

The purification plant previously was supplied with raw water from the Head Bay by means of the Head Bay Raw Water Pump Station and a 150 mm diameter steel pipeline.

3.2 Water Quality and Disinfection

The quality of water supplied to the Portable Water Reservoir was evaluated for compliance with the guidelines presented in the Water Act, 1956 (Act 54 of 1956), Namibian Water Quality Guidelines (NWQG) and the draft Namibian Water Quality Standards (NWQS) as contained in the draft regulations of the Water Resources Management Act of 2013. The Department of Water Affairs, as the custodian of water affairs in Namibia, is applying the new regulations even though it is not yet promulgated. It is expected that the Act and Regulations will come in force before the end of the year (2017) or by early next year (2018). The Guidelines and Standards were formulated to ensure the safety of water supplied for human consumption. Evaluations for compliance to NWQS are not mandatory yet but it indicates compliance with the standards.

According to the NWQG the water can be classified as Group A (see appendix attached).

3.2.1 Olushandja Batch (Old) Purification Plant

3.2.1.1 Dosing System

A simple system is used to dose alum and lime: The chemicals are made up into solutions in plastic drums. The flow on the pipeline from the raw water pumps to the settlers is then throttled by means of a valve on the pipeline, and forced through a venturi by means of which the solution is injected into the pipe.

3.2.1.2 Batch Settlers

Four batch settlers are located on an elevated platform adjacent to the treatment plant building. The settlers are conical in shape and each one has a capacity of 200 m³. Raw water enters the settlers at the top of the settler, just below the maximum water level. By means of a

horizontal bend, water is discharged in a direction tangential to the settler, thereby inducing a rotating flow in the settler.

The settlers are utilised on a rotational basis. After filling of a particular settler, the water is allowed to stand while flocs settle to the bottom of the settler. Normally after four hours, the water is clear enough. The clarified water is then pumped out of the settler into the 600 m³ potable water reservoir at a rate of 290 m³/h, or pumped directly into the (old) Olushandja–Eunda–Tsandi Pipeline at a rate of 65 m³/h. If the quality of the water is not acceptable for whatever reason, it is discharged to the sludge pond.

The suction pipework consists of a flexible suction hose fixed to a floating platform. The platform drops with the water and in this way only the clearest water at the top is drawn off. After drawing off the clarified water, the rest of the water, containing the sludge, is discharged to the sludge pond under gravity.

3.2.2 Olushandja New Purification Plant

3.2.2.1 Roughing Filters (RF)

The purpose of the roughing filters is to remove solids from the water when the water from the canal is very dirty. If the RF is not used then the Slow Sand Filtration Filter (SSF) will need more frequent cleaning. This is especially necessary if the water is relatively dirty, or if coagulants have been dosed in the water.

The RF consists of two sets of five compartments each. The cross-sectional area of the compartments increases progressively from compartment 1 to compartment 2 so that the water velocity reduces. The velocity is initially high to assist with floc formation and then tapers off to allow floc growth. In the subsequent compartments, the media is progressively made smaller. This is to trap the bulk of the flocculated matter in the larger pores of the media, and to remove the finer matter in the subsequent smaller pores of the finer media.

3.2.2.2 Slow Sand Filtration Filters

The slow sand filters consist of two hydraulically isolated compartments. It is in the SSF that the water is cleaned and where the biological action takes place that disinfects the water. The biological environment in the SSF therefore needs to be kept viable through a continuous supply of oxygen and nutrients, which are brought in by the raw water. The SSF must therefore be operated continuously.

The flow through the SSFs can be determined by means of V-notches mounted on the outlet of the SSFs. The flow can be read off from the graduated ruler mounted in the same tank as the V-notch.

3.2.2.3 Wash Water Disposal

Wash water is discharged to the existing sludge pond of the batch filtration plant. The sludge pond itself is overgrown with reeds, and the overflow water flows through a shallow, overgrown earth channel, through part of the adjacent settlement, through a pipe culvert under a gravel road and through part of the settlement, before discharging into the Olushandja Dam.

3.2.2.4 Chlorination

Chlorination is normally applied at the point of water production, where the purified water enters the distribution system. In long distribution systems, en-route, supplementary, chlorination is practised, since free chlorine residuals are dissipated quickly.

For the Olushandja – Ruacana Pipeline, water is retained in the distribution system for eight to eleven days (depending on consumption), before reaching the Ruacana Terminal Reservoir.

The purification plant made use of a continuous purification process which included chemical dosing, flash mixing, flocculation, settling, filtration and disinfection. Two filter pumps pumped the water from the clarifier through four sand filters, arranged in two sets of two in parallel, and into a 400 m³ deep well. Water entering the well was dosed with chlorine.

A filter backwash pump drew water from the well for the backwash of the sand filters. The “NamPower pump” drew water from the well to supply NamPower consumers at the hydroelectric power station. Two other pumps also drew water from this well and delivered the water into the 4 600 m³ Ruacana Reservoir, from where the water gravitated to Ruacana Town.

3.3 Pipe Work

3.3.1. Olushandja New Purification Plant

3.3.1.1 Chemical Dosing for Coagulation and Flocculation

The purification plant is intended to operate without chemically assisted flocculation, but facilities to dose coagulants have nevertheless been provided. This was done to assist the purification system during short periods of high turbidity of the raw water.

The plant has been configured to dose only a liquid polymer that does not require on-site preparation and does not require the addition of a base chemical such as lime. The coagulants can be dosed by means of metering pumps, into the outlet pipe of the raw water reservoir, just above the orifice plate.

3.3.1.2 Outlet Pipework

Water for the RFs and SSFs is provided from the raw water tank under gravity flow. Discharge from the tank to the RFs and SSFs is controlled by means of the orifice plates in the outlet pipes of the reservoir. The flow from the elevated tanks to the RFs and SSFs therefore depends on the water level in the elevated reservoir. The raw water pumps maintain the full supply level in the elevated reservoir. If the water level in the reservoir is not maintained at the required level (in case of power failure, for example), then the water level will gradually drop and the flow to the Roughing Filters (RF) and SSFs will reduce.

3.3.2. Olushandja – Ruacana Pipeline

Treated water from the Olushandja Purification Plant is pumped towards Ruacana through a pipeline of different materials and diameters. An in-line booster pump station is located some 22.156 km from Olushandja, on the 700 mm diameter section of pipeline. The pipeline is located on the northern side of the tar road to Ruacana. The total length of the pipeline from Olushandja to Ruacana is approximately 49 km, made up as follows:

- 34.32 km – 700 mm AC Class 18,
- 10.06 km – 700 mm AC Class 12,
- 4.61 km – 250 mm AC Class 12

3.3.3. Olushandja – Eunda – Onesi – Tsandi Pipeline

The initial intention of this pipeline was the transfer of water from Olushandja via Tsandi to Okahao as part of the primary phase. The secondary phase entailed the transfer of water from Ogongo, via Okahao and Tsandi to Olushandja – thus the transfer of water along the pipeline in both directions.

Between Olushandja and Eunda, the pipeline is 10.64 km long and consists of 250 mm diameter Class 4 uPVC pipe. For the 38.529 km between Eunda and Tsandi, the pipeline configuration is as follows:

- 9.891 km – 250 mm diameter Class 12 AC pipe between Eunda and Onesi,
- 9.588 km – 250 mm diameter Class 12 AC pipe,
- 4.558 km – 250 mm diameter Class 18 AC pipe,
- 14.492 km – 300 mm diameter Class 18 AC pipe up to Tsandi.

3.3.4. Olushandja – Ruacana Rural Pipeline

Some 4.6 km from the Olushandja Purification Plant, a 3.19 km long, 63 mm diameter uPVC Class 9 pipeline branches off the Olushandja – Ruacana Pipeline to supply water to the elevated storage tanks located at the Namibian Border Post. Two 10 m³ polyethylene tanks rest on a platform at the top of the 9 m high elevated tank stand.

The elevated storage reservoir is located approximately 3.2 km from the off-take at the old pump station where the pipeline branches off to Ruacana.

3.4 Reservoirs

3.4.1 Olushandja Batch (Old) Purification Plant

The potable water reservoir is a covered steel plate structure, with a capacity of 600 m³.

3.4.2 Olushandja New Purification Plant

A pipeline from the inlet works runs to the raw water pumps, which pumps the water into a 330 m³ capacity raw water reservoir situated above the pump station.

3.4.3 Namibian/Angola Border Post

The area has two 10 m³ polyethylene tanks resting on a platform at the top of the 9 m high elevated tank stand.

3.5 Power Supply and Control System

3.5.1 Olushandja Batch (Old) Purification Plant

3.5.1.1 Raw Water Pump

The raw water pump consists of a Rapid Allweiler pump with a 11 kW, 380 V, English Electric motor running at 1 445 rpm, situated in the treatment plant building next to the canal, at a level lower than that of the canal. The (manually operated) pump is used to pump water from the canal to the individual batch settlers, at a flow rate of 232 m³/h.

3.5.1.2 Clear Water Pump: Delivery to Ground Reservoir

One clear water pump transfer clear water from the batch settlers to a ground reservoir on site. The pump is manually operated. The installation consists of a KSB pump with a 7.5 kW, 380 V, VEM motor running at 1 450 rpm.

3.5.1.3 Clear Water Pump: Delivery towards Eunda

Two clear water pumps installed in parallel pump clear water from the ground water reservoir to the Eunda region. These pumps are operated manually. The installation consists of two KSB pumps (Model ETA B 80-20) with 5.5 kW, 380 V, Eberle Electric motors running at 1 465 rpm. One pump has a capacity of 82 m³/h at 127 kPa.

The main power supply to the purification plant is via an 80 A TP circuit breaker situated in the distribution board underneath an 11 000 / 400 V, 200 kVA pole mounted transformer at the plant. The transformer is the property of NORED Electricity and maintenance costs for the transformer are the responsibility of NORED.

3.5.2 Olushandja New Purification Plant

3.5.2.1 Raw Water Pumps

The two raw water pumps consisting of Rapid Allweiler pumps (Model 100-200) and 7.5 kW, 400 V, WEG motors running at 1 470 rpm, operate in parallel in a duty / standby configuration and are level controlled from an ultrasonic level detector in the raw water reservoir. The pumps are of the constant speed type.

3.5.2.2 High Pressure Filter Cleaning Pumps

The two high pressure filter pumps operate in parallel in a duty / standby configuration and are automatically operated. The installation consists of two Rapid Allweiler pumps (Model NB 2/25-200) with 11 kW, 380 V, WEG motors running at 2 950 rpm. One pump has a capacity of 5 m³/h at 819 kPa.

3.5.2.3 Transfer Pumps: Transfer to the Ground Reservoir

The two transfer pumps which transfer clear water from the clear water sump to the ground reservoir operate in parallel in a duty / standby configuration and are automatically operated by means of an ultrasonic level detector installed in the ground reservoir with little maintenance required. The installation consists of two Rapid Allweiler pumps (Model NB 80-200) with 5.5 kW, 380 V, WEG motors running at 1 465 rpm. One pump has a capacity of 75 m³/h at 34 kPa.

3.5.2.4 Booster Pumps: Transfer to the Olushandja – Ruacana Booster Pump Station

The two booster pumps that deliver clear water to the Olushandja – Ruacana Booster Pump Station operate in parallel in a duty / standby configuration and are pressure controlled via a telemetry signal from a pressure switch situated at the Olushandja – Ruacana Booster Pump Station. Currently, the operator has to switch off the pumps manually to prevent line breaks. The pumps are variable speed driven with a duty cycle. The installation consists of two KSB pumps (Model 100-50/2) with 45 kW, 380 V, WEG motors running at 1 470 rpm. One pump has a capacity of 157 m³/h at 530 kPa.

3.5.2.5 Booster Pumps: Transfer to the Ombalantu North RWSS

The four booster pumps supplying clear water to the Ombalantu North Rural Water Supply Scheme are installed in parallel and are pressure and flow controlled. The pumps are variable speed driven with a duty cycle. The installation consists of four Grundfos pumps (Model CR32-4) with 7.5 kW, 400 V, motors running at a maximum speed of 2 880 rpm. One pump has a capacity of 30 m³/h at 580 kPa.

3.5.3 Ruacana Purification Plant

3.5.3.1 NamPower Pump

One pump pumps clear water to the NamPower facilities. The installation consists of one KSB pump (Model ETA 50-26) with a 11 kW, 380 V, Siemens motor running at a speed of 2 940 rpm and has a capacity of 60 m³/h at 790 kPa.

3.5.3.2 Filter Pumps

Two filters pumps are installed in parallel. The installation consists of two Sulzer pumps (Model AZ 80-160) with a 3 kW, 380 V, Kapak motor for Pump 1 and a 4 kW, 380 V, Siemens motor

for Pump 2, running at speeds of 1 435 and 1430 rpm respectively. One pump has a capacity of 84 m³/h at 83 kPa.

3.5.3.3 Filter Backwash Pump

One backwash filter pump is installed. The installation consists of one Sulzer pump (Model AZ 80-160) with a 3 kW, 380 V, Eberle motor running at a speed of 1 425 rpm and has a capacity of 83 m³/h at 82 kPa.

3.5.4 Ruacana Head Bay Pump Station

The Ruacana Head Bay Raw Water Pump Station draws raw water from the main water reservoir and pumps this through a strainer and up the escarpment to the Ruacana Purification Plant, through a 150 mm diameter steel pipeline, where the raw water is purified.

Two pumps are installed in parallel in a duty / standby configuration and are variable speed driven. The pumps are pressure controlled. A motorised valve is closed when the pressure falls below a certain value in the supply pipeline of the pumps and one of the pumps is started until the pressure is restored to an acceptable value, when both pumps are switched off and the motorised valve is opened.

The installation consists of two KSB pumps (Model 100-50/2) with 45 kW, 380 V, WEG motors running at 1 470 rpm. One pump has a capacity of 157 m³/h at 530 kPa.

3.5.5 Olushandja – Ruacana Booster Pump Station

This pump station is used as a booster pump station to provide clear water from Olushandja to the Ruacana water reservoir, which supplies water to the town.

3.6 Scheme Processes/Operation

There are fulltime NamWater operators based at each purification plant in CNWSA: Zone 2.

3.7 Maintenance

Maintenance is done by a permanent NamWater team.

3.7.1 Pumps

All motors bearings should be lubricated with a high-temperature lithium-based grease after 3000 hours.

If a pump/s were out of operation for six months, lubrication is required before service commence on all motor bearings.

3.7.2 Air Valves

The valves must be opened monthly to be descaled and cleaned to ensure effective operation. The service intervals will depend on the severity of the conditions.

3.7.3 Pressure Gauges and Transducers

The gauge cocks must be turned monthly to bleed-off air and ensure accurate readings. Turning prevents scale accumulation which prevents the gauge cock from functioning. The operational or service intervals will depend on the severity of the conditions.

3.7.4 Reservoirs

The reservoirs should be checked for leaks and other damages on a monthly basis. If leaks are detected, it should be fixed immediately.

3.7.5 Pipe Breaks/leaks

Monthly monitor of pipes should be done to avoid wastage of water in an event a major pipe break. The pipeline corridor for maintenance work is 10 m by 5 m.

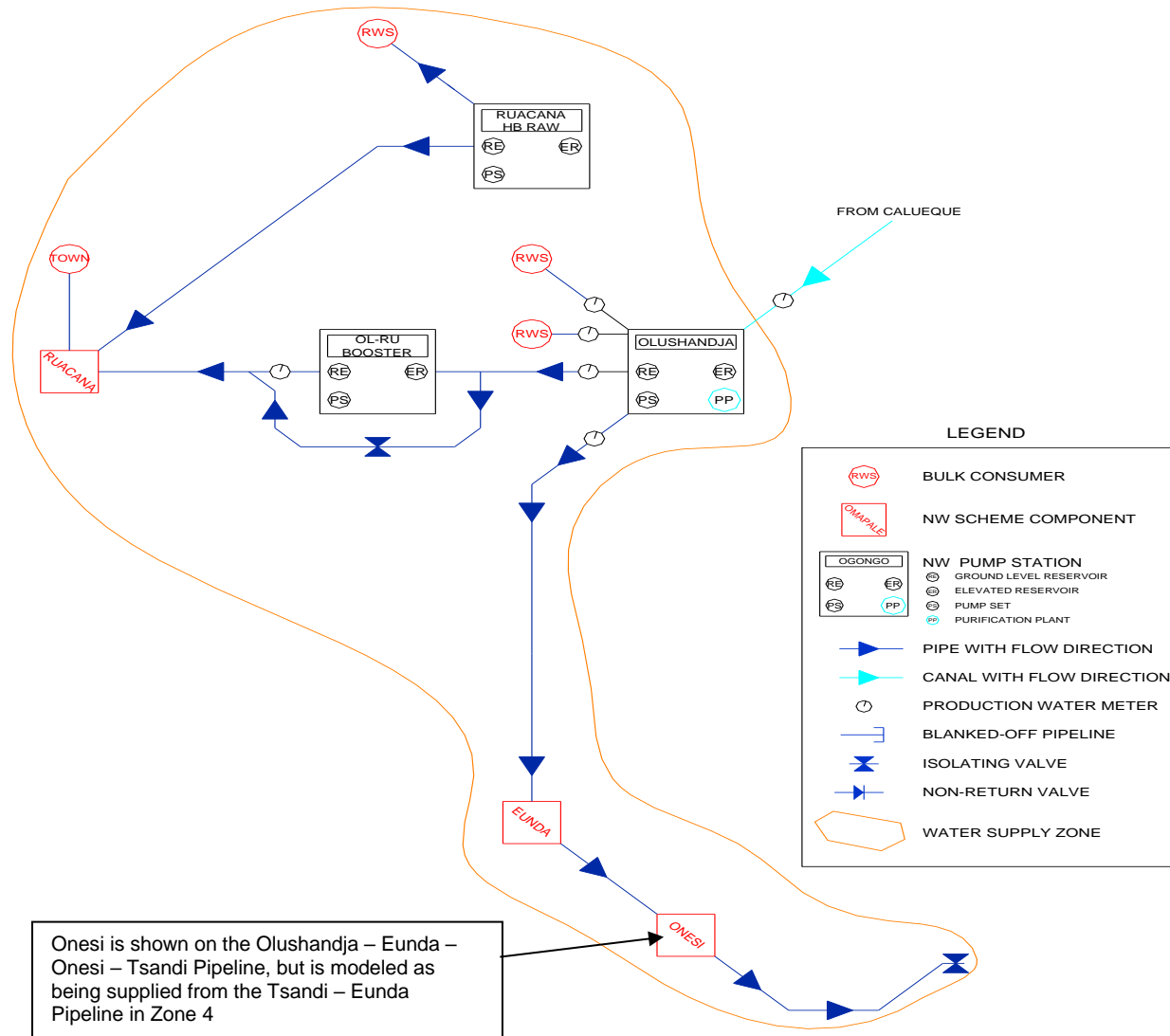


Figure 2: CNWSA: Zone 2 Scheme Layout

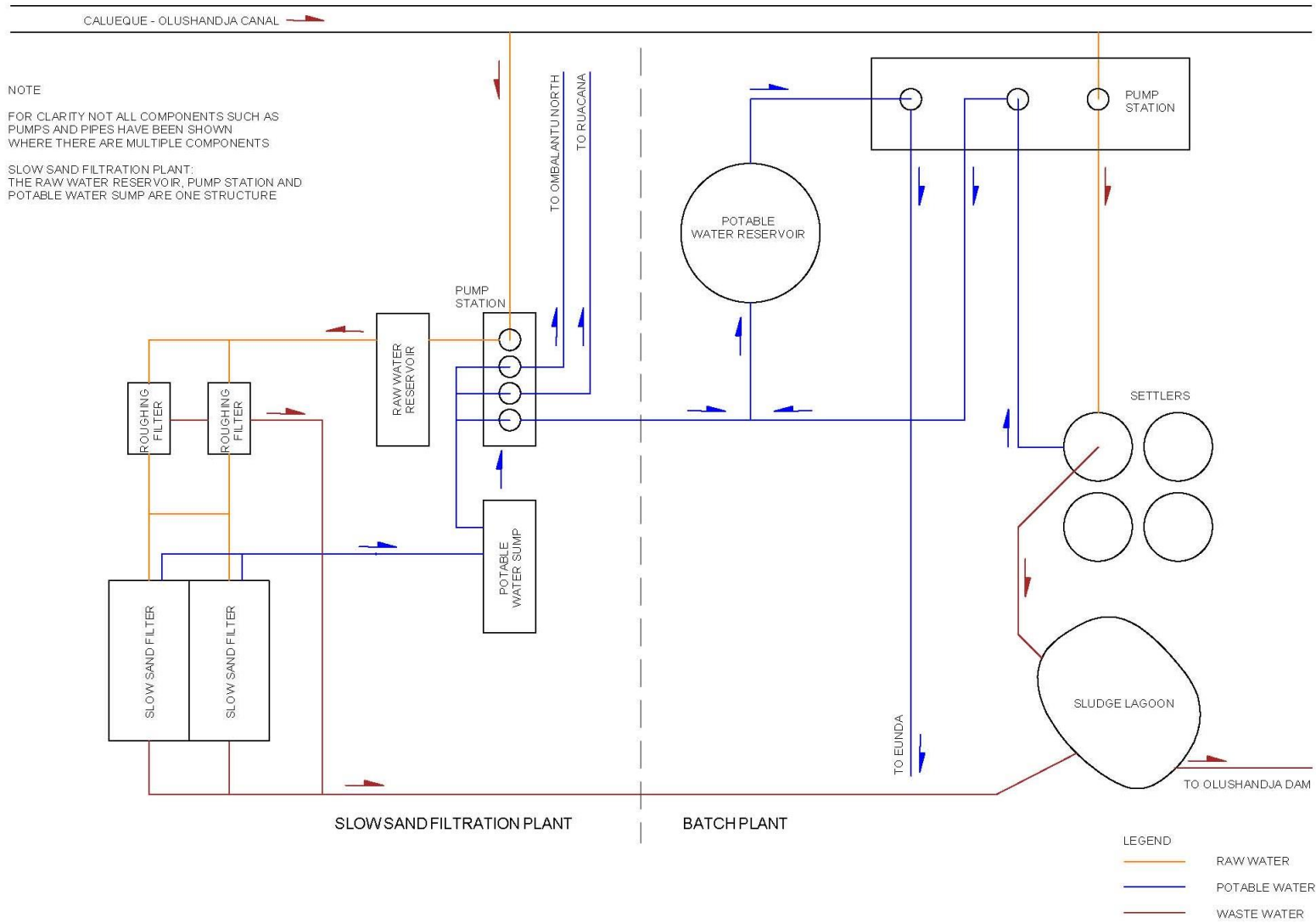


Figure 3: Configuration of the Olushandja Purification Plant

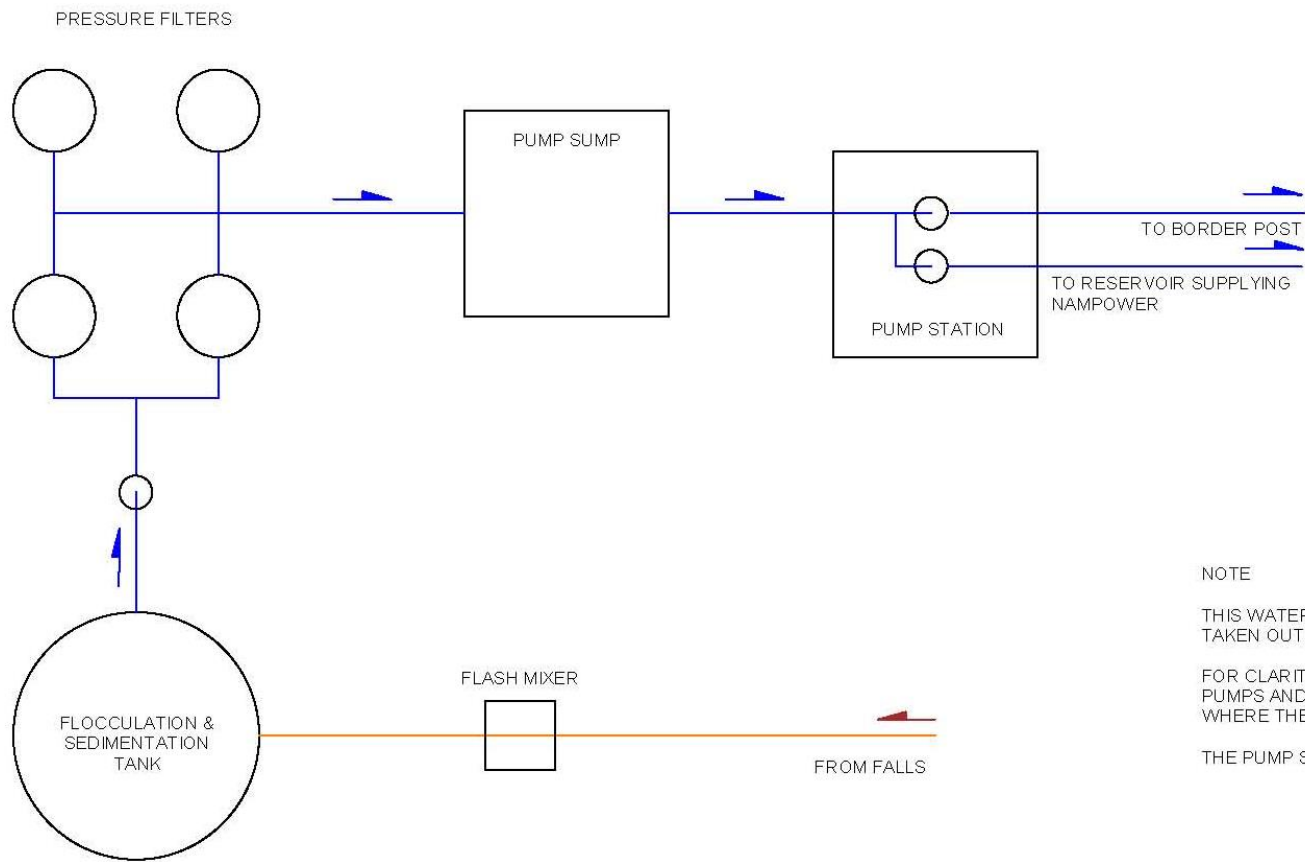


Figure 4: Configuration of the Ruacana Purification Plant

4. BRIEF DESCRIPTION OF THE RECEIVING ENVIRONMENT

The baseline description provided below focuses on the receiving environment:

4.1 Climate

The North Central portion of Namibia has a semi-arid climate, which is characterised by rainfall which varies greatly in amount and timing. Almost all the rain falls in during the summer months, when temperatures are highest, roughly between November and April. The eastern areas generally receive higher and more reliable rainfall than the western areas. Average rainfall varies from about 550 – 600 mm per annum in the east to about 350 – 400mm per annum in the west (Mendelsohn *et. al.*, 2000).

4.1.1 Precipitation

The driest month is June and most precipitation falls in January. Precipitation at CNWSA: Zone 2 is between 550 mm to 600 mm annually. Dry season is from April to October, whilst, the wet season is from November to March (Mendelsohn, *et al.*, 2002).

4.1.2 Temperature

The temperature of CNWSA: Zone 2 varies greatly between the seasons, as it has very hot summers and mild winters. In summer, the heat is often subdued by the rains but temperatures may rise well above 37.5 °C (Hangula *et al.* 1998). Average winter temperatures ranges between 6°C to 8°C and summer temperatures ranges between 34°C to 38°C (Mendelsohn *et al.*, 2000).

4.2 Geology

The topography of the area is generally flat, with moderate changes in elevation. The ground generally slopes from the north to the south, towards the Etosha Pan, which is located south of CNWSA: Zone 2.

CNWSA: Zone 2 is underlain mostly by sediments of silt, clay, limestone and sandstone, which soils generally have a low potential for crop cultivation due to a poor water holding capacity, low nutrient content, high salt content and hard layers of clay below the surface. Much of the area is characterised by thousands of drainage channels, pans or oshanas, which from part of the Cuvelai Delta which drains southwards towards the Etosha Pan (after Mendelsohn *et. al.*, 2000).

Ground water in the North Central portion of Namibia is available from the Discontinuous Perched Aquifer which is relatively shallow, or the Main Shallow (Saline) Aquifer, which underlies the whole Cuvelai at a depth of between 20 and 40 m below ground (Mendelsohn *et. al.*, 2000). Traditionally, shallow, hand-dug wells or omithima, located throughout the Project Area, have been used to draw water from the shallow Discontinuous Perched Aquifer after the oshanas have dried up. However, useful amounts of water are only located in certain places, some of these wells dry up during the winter months, and most of the water drawn from these wells is saline and unfit for human consumption.

4.3 Natural Fauna and Flora

Wildlife viewing in CNWSA: Zone 2 area is excellent. It boasts large concentrations of elephant (*Loxodonta*), lion (*Panthera leo*), and wild dog (*Lycaon pictus*). Other fauna species include: sable (*Martes zibellina*), roan (*Hippotragus equinus*), antelope (*Alcelaphinae*), and leopard (*Panthera pardus*). The marshes are home to red lechwe (*Kobus leche*), sitatunga (*Tragelaphus spekii*), hippo (*Hippopotamus amphibius*) and crocodile (*Crocodylinae*). Moving along the waterways are animals such as: kudu (*Tragelaphus strepsiceros*), zebra (*Equus quagga*), buffalo (*Bubalus*

bubalis), waterbuck (*Kobus ellipsiprymnus*) and impala (*Aepyceros melampus*) (Mendelsohn, *et al.*, 2009).

During the dry season, most of the oshanas are covered by grass, while on the higher ground in between, saline Kalahari sands support Mopane scrub and various larger trees. These raised areas also support much of the crop production and grazing areas – various saline grasses dominate the vegetation (Mendelsohn *et al.*, 2000). The vegetation in the CNWSA: Zone 2 is generally poor, more so in the north western portion of the area, with the eastern areas generally featuring better vegetation cover.

5. THE LEGAL ENVIRONMENT

A legal review was done and the key laws of concern include those which protect the ecological integrity of the CNWSA: Zone 2 ecosystem and its water resource, including the Water Act of 1954 and the Water Resources Management Act of 2004, and applicable international treaties such as the Convention on Biological Diversity. These laws and conventions place Namibia under an obligation to conserve the ecological integrity of the CNWSA: Zone 2 ecosystem for the sustainable use by Namibians.

5.1 The Constitution of the Republic of Namibia

There are two clauses contained in the Namibian Constitution that are of particular relevance to sound environmental management practice, viz. articles 91(c) and 95(l). In giving effect to articles 91(c) and 95(l) of the Constitution of Namibia, general principles for sound management of the environment and natural resources in an integrated manner have been formulated. The formulation of these general principles resulted in the Namibia's Environmental Assessment Policy of 1994. To give statutory effect to this Policy, the Environmental Management Act was approved in 2007, and gazetted as the Environmental Management Act (Act No. 7 of 2007) (herein referred to as the EMA. As the organ of state responsible for management and protection of its natural resources, MET: DEA is committed to pursuing the 13 principles of environmental management that is set out by Part 2 of the Act.

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

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

5.2 Environmental Assessment Policy (1995)

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

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

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

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

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

- Water use and disposal;
- Transportation

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

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

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

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

6. RESPONSIBLE PARTIES

NamWater's Environmental Manager is primarily responsible for the implementation of the EMP during the operational and maintenance phases.

6.1 NamWater

NamWater, as the implementing agency, is responsible for:

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

NamWater shall ensure that all employees attend an Environmental, Awareness Training Course. This course shall be structured to ensure that attendees:

- Become familiar with the environmental controls contained in the EMP;
- Are made aware of the need to conserve water and minimise waste;
- Are made aware of NamWater's Code of Conduct;
- Are aware that a copy of the EMP is readily available at the plant and that all staff are aware of the location and have access to the document;
- 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.

7. ENVIRONMENTAL MANAGEMENT PLAN

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

EMP implementation is a cyclical process that converts mitigation measures into actions and through cyclical monitoring, auditing, review and corrective action, ensures conformance with stated EMP aims and objectives. Monitoring and auditing, feedback for continual improvement ensures that environmental performance has been provided and corrective action is taken for an effective EMP.

The main aim of this EMP is to ensure that the project complies with the goals of the Namibian Environmental Management Act (No. 7 of 2007); and, more specifically, to provide a framework for implementing the management actions as described in the EMP for the operational and maintenance phases of the scheme. Best practice is proposed for the operation of the scheme.

There are some environmental impacts that cannot be avoided. These environmental impacts require mitigation, and in order to mitigate against these impacts an EMP is required. The EMP aims to ensure best practises are implemented and environmental degradation is avoided through appropriate environmental protection, adherence to legal requirements and maintaining good community relationships.

MET indicated that EMP's for existing operations are sufficient.

The project activities are grouped according to the different operational processes and stages. Most of the impacts can be reduced through good housekeeping.

8. MANAGEMENT ACTIONS

8.1 Operation and Maintenance phase of the CNWSA: Zone 2 Water Supply Scheme

8.1.1 Introduction

The Operational Phase Section relates to the management and mitigation measures required to ensure that the continuation of the bulk water supply network and the maintenance of the infrastructure is operated in a manner that demonstrates responsible, precautionary environmental management.

The EMP will address specific areas of concern in terms of the long-term environmental management of the affected environment and is intended to serve as a guide to the on-going management of the water supply scheme site as well as the affected environment. The EMP will therefore aim to provide NamWater with the necessary tools to ensure that the potential impacts on the natural environment of the site during the operation of the water supply scheme are minimised. Moreover, it will aim to ensure that the infrastructure is operated and maintained according to Best Practice, in an environmentally sensitive and sustainable manner, and that the operation of the infrastructure does not result in reasonably avoidable environmental impacts.

Table 2: Operation and Maintenance Phase Management Table

Issue	Objective	Strategy	Actions	Time frame
Maintenance and emergency procedures	To ensure correct procedures are in place to avoid environmental impacts associated with maintenance activities as well as proactive intervention to avoid, and if required, to respond to emergencies	<ul style="list-style-type: none"> • Establish environmentally sensitive and technically sound maintenance procedures as well as reporting structures. • Compile a staff competency assessment and training programme. • Establish emergency procedures to ensure appropriate response and minimise potential risk to the biophysical and social environment. 	<ol style="list-style-type: none"> 1. Establish regular reporting procedures on maintenance 2. Undertake regular inspection and maintenance of all infrastructure to ensure in working order and to assess damaged / deficient equipment, as per the O&M Manual. 3. Review, and if necessary, revise maintenance manual. 4. Establish emergency procedures guidelines for the blockage/failure, flooding, contaminant removal and disinfection, power failure and fire of the scheme. 5. Implement the response procedures when emergency incident occurs. 6. Complete the incident report checklist in the case of emergency and keep with monitoring records for submission. 7. Undertake annual education course for all operational staff. 8. Review, and if necessary revise emergency manual. 	<p>Bi-monthly for the lifespan of infrastructure as per the maintenance manual.</p> <p>Bi-annually for lifespan of works.</p> <p>When emergency incident occurs.</p> <p>Emergency incident</p> <p>Annually for lifespan of operation.</p> <p>Annually for lifespan of operation</p> <p>Annually for lifespan of operation</p>

8.2 Maintenance Procedures

The optimal operation and effective maintenance of all the scheme components is important in protecting the environment and ensuring that resources are not wasted and environmental incidents arising out of equipment or infrastructure failures, are avoided. Operation and Maintenance Manuals are available for the CNWSA: Zone 2 Water Treatment Works (WTW). The manuals provide a detailed guidance on the operation of all machinery and associated systems as well as related maintenance procedures, including maintenance schedules. Implementation of this manuals by NamWater will facilitate the proactive management of potential risks and thus result in impacts on the receiving environment being averted.

The maintenance procedures set out in the manuals, provides specific guidance in terms of the monitoring and maintenance of the scheme components. These procedures will specify the equipment item and specific component of each piece of equipment requiring checking, the scope and nature of the check that is to be carried out including detailed instructions related to the specific check, and the programme for conducting each check.

8.3 Facility Management and Operations

NamWater shall ensure that sufficient budget allocations and provisions are made available to ensure that the infrastructure can be adequately operated and maintained. NamWater must also attend to damage to the scheme components resulting in water loss as a matter of high priority.

8.4 Routine Maintenance and Repairs

The condition of the infrastructure shall be inspected routinely and a maintenance list compiled. Identified, preventative maintenance issues shall be undertaken as soon as possible. Any wastes arising from the repair and maintenance work must be removed and disposed-off at a designated waste disposal site as part of the operation.

8.5 Environmental Awareness

Instilling a sense of environmental awareness and consideration in all employees, but especially those involved with the scheme operations is vital to the overall success of any environmental management plan. It is therefore recommended that a general environmental awareness course for the Scheme Staff Members, who may be required to carry out duties on the scheme, be undertaken.

8.6 Waste and Pollution Management

8.6.1 Waste and Pollution Prevention

To prevent the improper disposal of waste and to prevent pollution, the following management actions shall be enforced:

- All waste will be removed to an appropriate waste dump.
- No waste should be buried.
- General Waste: Includes waste paper, plastic, cardboard, harmless organic (e.g. vegetables) and domestic waste.
- No littering will be allowed. The plant area will be kept free of waste at all times.
- Provide sufficient waste bins at worksites. Make sure that all waste is removed from the worksites.

- Hazardous Substances include: sewerage, fuels, lubrication oils, hydraulic and brake fluid, solvents, paints, anti-corrosives, insecticides and pesticides, chemicals, acids etc. It should be disposed of at designated hazardous disposal sites.
- Contaminated soil should be stored in drums and taken to the nearest appropriate waste dumpsite.
- Do not change oil on uncovered ground. Drip trays will be used to catch oil when vehicles are repaired in the field.
- Used oil and hydraulic fluids will not be discarded on the soil or buried. It will be removed from site and taken back to an appropriate dump.
- In the event of a hazardous spill:
 - ✓ Immediately implement actions to stop or reduce the spill.
 - ✓ Contain the spill.
 - ✓ Arrange implementation of the necessary clean-up procedures.
 - ✓ Collect contaminated soil, water and other materials and dispose it at an appropriate waste dumpsite.
- Used solvents and grease should be stored in drums or other suitable containers. It should be sealed and recycled or disposed at an appropriate disposal site.
- Hazardous waste should not be burnt.
- Bunding, concrete slabs and/or other protective measures should be installed where hazardous materials are handled.
- Ensure that the staff are informed and have information pertaining to the management of spills or ingestion.

8.6.2 Hazardous Materials

Where hazardous materials are required for repair and maintenance work (including fuels and oils), care will be taken to ensure that a competent individual is appointed to enforce the responsible use of such materials. The operational staff or maintenance teams shall carry a copy of the relevant Material Safety Data Sheet (MSDS) whenever using such materials. The Scheme Supervisor shall ensure that persons working with hazardous materials have been trained in the handling of such substances, as well as in emergency procedures to be followed in the event of an accidental spillage or medical emergency. Maintenance teams shall also carry a spill kit containing the appropriate neutralizing chemicals, absorbent materials and other relevant equipment required to undertake a clean-up of any spill that may occur.

8.6.3 Noise Management

During maintenance operations, all silencing mechanisms on all equipment must be in a good state of repair. Except for in emergency situations, no amplified sound may be broadcast. All routine maintenance shall be restricted to daylight hours.

8.7 Health and Safety

To minimise the risk of HIV infection and the increase of STI's and the occurrence injuries the following management actions shall be enforced:

- Provide an AIDS awareness programme to all the staff.

- 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 Scheme.
- Establish an emergency rescue system for evacuation of serious injured people.
- Emergency procedures for accidents should be communicated to all employees.
- Dangerous areas must be clearly marked and access to these areas controlled or restricted.
- Good driving and adherence to safety rules will result in a minimum number of road and workplace accidents.
- Fire extinguishers must be available at all refuelling sites. Staff should be trained to handle such equipment.
- Nobody is allowed to dispose a burning or smouldering object in an area where it may cause the ignition of a fire.
- Hazardous substances must be kept in adequately protected areas to avoid soil, air or water pollution.
- Work areas, such as these for the maintenance of equipment, must be on concrete slabs.
- Explosives should be stored according to the prescribed regulations.

9. SITE CLOSURE AND REHABILITATION

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 associated with the reservoir construction 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 operators as a whole.

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 quarterly by the scheme supervisor after every maintenance work during operation of the scheme. Rehabilitation will be done to the satisfaction of the ENV section and MET.
- b. Frequent inspections of the scheme and effective follow-up procedures, to prevent minor defects from becoming major repair jobs.
- c. Make sure all soil polluted during maintenance work is properly stored in drums and removed to an appropriate waste dump.
- d. Make sure all windblown litter is removed once maintenance has seized.
- e. Make sure that all potential hazards (i.e., the sewerage pit) are properly closed and left in a safe and neat position.

Rehabilitation will be completed when the above have be achieved.

10. NAMWATER ENVIRONMENTAL CODE OF CONDUCT

What is an Environmental Code of Conduct?

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

What is the ENVIRONMENT?

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

Do these ENVIRONMENTAL RULES apply to me?

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

ALL PERSONNEL must study and keep to the Environmental Code of Conduct

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

What if I do not understand the ENVIRONMENTAL RULES?

ASK FOR ADVICE, if any member of the WORKFORCE does not understand, or does not know how to keep any of the Environmental Rules, that person must seek advice from the SCHEME SUPERVISOR. The PERSON that does not understand must keep asking until he/she is able to keep to all the Environmental Rules.

Safety and Security

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

Waste Disposal

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

Containers will be provided for different types of wastes.

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

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

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

32. Immediately report to your SCHEME SUPERVISOR 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 SCHEME SUPERVISOR.
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 SCHEME SUPERVISOR 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 SCHEME SUPERVISOR 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. Do not make any new roads or clear any vegetation unless instructed to do so by your SCHEME SUPERVISOR.
43. Keep to established tracks and pathways.
44. 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 SCHEME SUPERVISOR.

Working Hours

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

Archaeological and Cultural Objects

52. If you find any archaeological, cultural, historical or pre-historical object on the construction site you must immediately notify your SCHEME SUPERVISOR.
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.

Sensible Driving

54. Tracks and roads should be kept to a minimum. Where possible follow existing roads.
55. No off-road driving is allowed.
56. Never drive any vehicle without a valid licence for that vehicle class and do not drive any vehicle that is not road-worthy.
57. Never drive any vehicle when under the influence of alcohol.
58. **Always** keep your headlights on when driving on dusty roads.
59. Keep to the roads as specified by your SCHEME SUPERVISOR. Vehicles may only be driven on demarcated construction roads. Drivers should always use three points turns, “u-turns” are not allowed. Do not cut corners.
60. Do not drive on rocky outcrops.

Noise

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

Fire Control

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

Dealing with Environmental Complaints

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

NP du Plessis

Tell: 061-71 2093

Cell: 081 127 9040

OR

Jolanda Kamburona

Tell: 061-71 2105

Cell: 081 144 1528

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ANNEXURE 1: GRIEVANCE PROCEDURE AND REGISTRATION FORM

