# DESALINATION PLANT AND WATER CARRIAGE SYSTEM TO SECURE SUPPLY TO THE CENTRAL COAST (SUPPLY SCENARIO 1)

## Environmental and Social Management Plan

Prepared for: Namibia Water Corporation (Ltd)

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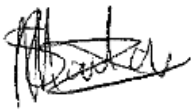

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# CONTENTS

## LIST OF TABLES



## LIST OF FIGURES



## APPENDICES

# ACRONYMS AND ABBREVIATIONS

| Acronym / Abbreviation | Definition |
|---|---|
| AIS | Alien Invasive Species |
| BCLME | Benguela Current Large Marine Ecosystem |
| CDP | Community Development Plan |
| CIP | Clean in Place |
| CITES | Convention on International Trade in Endangered Species |
| DAF | Dissolved air flotation |
| DMF | Dual Media Filtration |
| ECC | Environmental Clearance Certificate |
| ED | Enterprise Development |
| EIA | Environmental Impact Assessment |
| ESIA | Environmental and Social Impact Assessment |
| EMA | Environmental Management Act, 2007 (No. 7 of 2007) |
| ESMP | Environmental and Social Management Plan |
| EPC | Engineering, Procurements, Construct |
| EPFIs | Equator Principle Financial Institutions |
| EPRP | Emergency Preparedness and Response Plan |
| NamWater | Namibia Water Corporation (Pty) Ltd |
| HSE | Health, Safety and Environment |
| IFC | International Finance Corporation |
| ILO | International Labour Organisation |
| IWRM | Integrated Water Resources Management |
| MEFT | Ministry of Environment, Fisheries and Tourism |
| MHI | Major Hazard Installation |
| MS | Method Statement |
| MSDS | Material Safety Data Sheets |
| NACOMA | Namibian Coast Conservation & Management Project |
| NDPs | National Development Plans |
| NIRP | National Integrated Resource Plan, 2016 |
| O&M | Operations & Maintenance |
| POPs | Persistent Organic Pollutants |
| PPE | Personal Protective Equipment |
| PS | Performance Standard |
| PV | Photovoltaic |
| RO | Reverse Osmosis |
| SEAs | Strategic Environmental Assessments |
| SED | Socio-Economic Development |

| Acronym / Abbreviation | Definition |
|---|---|
| S&EP | Social and Environmental Policy |
| SMBS | Sodium Metabisulphate |
| SS1 | Supply Scenario 1 |
| SWRO | Seawater Reverse Osmosis |
| TOC | Total organic carbon |
| TDS | Total dissolved solids |
| TSS | Total suspended solids |
| UNCBD | United Nations Convention on Biological Diversity |
| UNDRIP | United Nations Declaration on the Rights of Indigenous Peoples |
| UNEP | United Nations Environment Programme |
| WRMA | Water Resources Management Act (No. 11 of 2013) |

# Desalination Plant and Water Carriage System to Secure Supply to the Central Coast (Supply Scenario 1)

## 1. INTRODUCTION

The Namibia Water Corporation Limited (hereafter referred to as "NamWater") is the national water utility of Namibia. NamWater undertook a Feasibility Study for the proposed development of a desalination plant and a water carriage system to supply water to the Central Coast, Windhoek, and en-route users (Arandis, Usakos, Karibib and Okahandja). The primary objective of the Feasibility Study, which was informed by the findings of the Scoping phase, was to investigate feasible and affordable water supply options that would diversify and secure supply alternatives to the target areas and identify the preferred project alternative(s) to be considered in the Impact Assessment phase. The development and implementation of the desalination plant to meet the water demands of the Central Coastal Area (CCA) (i.e. Supply Scenario 1, SS1) was found to be imperative and considered to be the most viable project. Based on the findings of the Feasibility Study, NamWater has thus decided to proceed with SS1 only.

### 1.1 PROJECT BACKGROUND

The Desalination Plant seeks to supply 36.2 $Mm^3$/yr of water per annum, feeding into the Omdel-Swakopmund pipeline, for supply of water to the CCA of Namibia. SS1 consists of the following key components:

- Desalination Plant comprising of the:
  - Marine seawater intake (Intake works and Intake Pump Station);
  - Brine discharge system;
  - Water pipeline linking the pump station to the desalination plant;
  - Pre-treatment system;
  - Reverse osmosis treatment;
  - Post-treatment;
  - 2x steel storage tanks located at the pump station (storage volume of 50 000 $m^3$ each); and
  - Various buildings and ancillary infrastructure.
- A new water pipeline (approximate 4.5 km) connecting the desalination plant to the existing Omdel-Swakopmund pipeline;
- 2x steel storage tanks located at the Swakopmund Base Station (storage volume of 50 000 $m^3$ each);
- The proposed #Gaingu Power Plant (consisting of solar PV and Li-ion BESS) (subject to a separate ESIA process);
- 33 kV power line connecting to the new Khan 33kV substation) (subject to a separate ESIA process);
- Access roads to the desalination plant, intake pumpstation and the proposed PV power plant (PV plant access road subject to a separate ESIA process).

The desalination plant will be located north of Wlotzkasbaken, close to the existing Orano Desalination Plant. The proposed location is in close proximity to the Swakopmund-Henties Bay (C34) road. The projects locality is shown in Figure 1-1.

Development and operation of the Desalination Plant is subject to the Ministry of Environment, Forestry and Tourism (MEFT) granting an Environmental Clearance Certificate (ECC) in terms of the Environmental

Management Act, 2007 (No. 7 of 2007) (EMA) and the Environmental Impact Assessment[1] (EIA) Regulations, 2012. In applying for an ECC, it is necessary for NamWater to undertake an Environmental and Social Impact Assessment (ESIA) and compile an Environmental and Social Management Plan (ESMP) (See Section 1.2).

**IMPORTANT NOTE:**

The scope of this ESMP relates specifically to the management of environmental and social risks associated with the **Desalination Plant only**. A separate ESMP has been prepared for the management of the #Gaingu PV power plant facility and associated infrastructure.

The compilation of this Final ESMP has been informed by comments received following the distribution of the draft ESIA report for a 30-day comment period (22 September to 23 October 2023, extended from 20 November to 6 December 2023) and those raised during public information-sharing meetings. Comments received by SLR on or before 6 December 2023 are recorded and responded to in a Comments and Responses Report (see Appendix C.5 of the ESIA report). It should be noted that all significant changes to the Draft ESIA Report and ESMP are underlined and in a different font (Times New Roman) to the rest of the text.

This Final ESIA Report and ESMP is submitted to the Ministry of Mines and Energy (MME): Department of Water Resource Management for consideration and review. In terms of Section 32 of the Environmental Management Act, 2007 (No. 7 of 2007), MME is required to make a recommendation on the acceptance or rejection of the report to the Ministry of Environment, Forestry and Tourism (MEFT): Directorate of Environmental Affairs (DEA), who will make the final decision.

[1] The Namibian legislation refers to EIA and EMP whereas international legislation/regulations refer to ESIA and ESMP. The terms will thus be used interchangeably throughout the document.

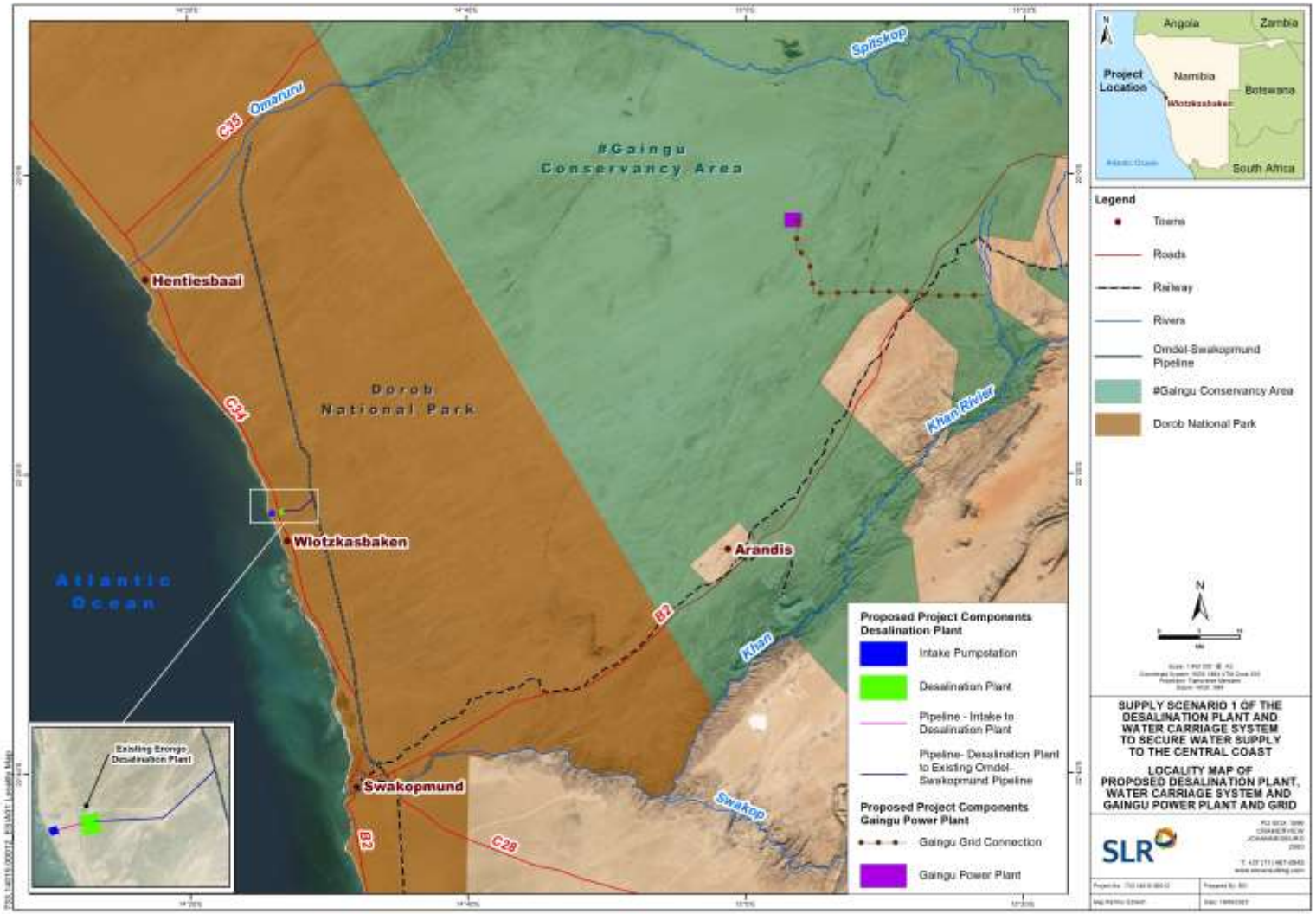


**Figure 1-1: Project locality**

The purpose of this ESMP is to ensure that potential impacts associated with the construction, operational and decommissioning phases of the proposed desalination plant are avoided and, where they cannot be avoided, are kept to a minimum and mitigated. The ESMP, which has as its basis the mitigation measures listed in the ESIA Report, sets environmental targets for the Contractors and reasonable standards against which the Contractor's performance can be measured during the construction and operational phases.

While NamWater will own the Desalination Plant, the development of the facilities will be undertaken by an Engineering Procurement Construction (EPC) Contractor. Initially, the operation of the facility will be done by an Operations and Maintenance (O&M) Operator. The duration of the operation of the desalination plant by the O&M Operator is still to be determined.

## 1.2 EIA PROCESS

In accordance with the EIA Regulations 2012, the ESIA approach included the following:

- The scoping process was conducted to identify the environmental issues associated with the proposed project and to define the terms of reference for the required specialist studies and the ESIA.
- Specialist studies were commissioned in accordance with the relevant terms of reference. The specialists were selected on the basis of their expertise and knowledge of the project area (Refer to Table 1-1 below).
- The ESIA report and this ESMP were prepared on the basis of the findings of the specialist studies.
- A project specific public participation process (PPP) was conducted.

The following specialist studies were identified in the Scoping Phase and undertaken during the Impact Assessment Phase. These studies have assisted with the investigation and assessment of the key impacts, as well as providing recommendations to reduce and manage those impacts as best as possible.

**Table 1-1: Environmental and Social Specialists**

| Aspect | Specialist | Description |
|---|---|---|
| Visual | Green Tree Environmental | Assessment of the potential visual impact. |
| Surface Hydrology | SLR | Assessment of the potential surface water impacts. |
| Noise | SLR | Assessment of the potential noise impacts during construction and operation. |
| Heritage | Beyond Heritage | Assessment of heritage and archaeological impacts. |
| Terrestrial ecology | Henriette Potgieter | Assessment of the potential impacts on terrestrial biodiversity. |
| Socio-economic | Ashby Associates cc | Assessment of the potential socio-economic impacts. |
| Climate Change | SLR | Assessment of the climate change risks associated with the proposed Project. |
| Marine and Coastal Biodiversity and Ecology | Pisces Environmental Consulting Services Ltd | Assessment of the potential impacts to marine and coastal biodiversity. |

| Aspect | Specialist | Description |
|---|---|---|
| Avifauna | African Conservation Services cc | Assessment of the potential impacts on birdlife associated with the construction and operation phases. |
| Coastal Physical Processes | PRDW | Assessment of potential coastal physical processes and dynamics impacts. |
| Brine Dispersion Modelling | PRDW | Determines the suitable pipeline length and diffuser configuration for the brine discharge and describes the dispersion of the plume as input to the Marine and Coastal Biodiversity and Ecology Specialist Study. |

### 1.2.1 Summary and overview of the ESIA process and findings

Water demand in Namibia continues to increase due to economic development, population growth and urbanisation. The number of people affected by water scarcity continues to grow. Without water basic human rights cannot be met and development cannot proceed. It is thus essential to secure a diversified, climate-independent supply of water and to reduce the heavy reliance on groundwater for the CCA, which the Project aims to achieve.

The proposed Project is likely to result in a range of environmental and social impacts, being both negative and positive (some of which are motivating factors discussed above). Negative and positive impacts identified and assessed as part of the ESIA are summarised in Table 1-2.

**Table 1-2: Summary of the significance of potential impacts associated with the proposed project**

| Impact/Issue | Without Mitigation | With Mitigation |
|---|---|---|
| **Biophysical Impacts** | | |
| **Surface water** | | |
| Contamination of surface water resources in construction phase | Medium | Low |
| Contamination of surface water resources in operational phase | High | Medium |
| Contamination of surface water resources in decommissioning and closure phase | Medium | Low |
| Flooding in construction, operation, decommissioning and closure phases | Medium | Low |
| Alteration of natural drainage patterns and flow during construction and operational phases | Medium | Low |
| **Terrestrial Ecology** | | |
| Impact of destruction of habitat and organisms | Low | Very low |
| Impact of Disturbance of animals and interference with their behaviour | Medium | Very low |
| Impact of light pollution | Low | Very low |
| **Avifauna** | | |

| Impact/Issue | Without Mitigation | With Mitigation |
|---|---|---|
| Impact of physical/human disturbance of birds, including noise and light disturbance | Medium | Low |
| Impact of direct and indirect modification/loss/destruction of bird habitat | High | Medium |
| Impacts of brine discharge and other pollutants from the desalination plant on food sources for birds | Medium | Low |
| Impact of attraction of birds to novel habitats through the artificial provision of scarce resources | Medium | - |
| **Marine ecology and biodiversity** | | |
| Impact of disturbance and loss of Subtidal, Intertidal and Coastal biota | Low | Low |
| Impact of reduced physiological functioning of marine organisms due to increased turbidity or redeposition of suspended sediments in nearshore waters during excavations | Low | Low |
| Impact of disturbance of shore birds and marine biota through construction noise | Low | Very low |
| Impact of disturbance and injury of shore birds and marine biota through pylon-driving and blasting | Medium | Low |
| Impact of habitat alteration due to installation of marine structures | Medium | Medium |
| Compromised water quality through discharge of membrane storage solution and membrane rinsing | Insignificant | Insignificant |
| Loss of marine species through impingement and entrainment | Medium | Low |
| Detrimental effects of residual chlorine levels, excessive bacterial re-growth, formation of halogenated by-products and reduction in dissolved oxygen concentrations | Insignificant to Low (Halogenated By-Products) | Insignificant |
| Reduced physiological functioning of marine organisms due to elevated salinity | Medium | Medium |
| Avoidance behaviour by invertebrates, fish and marine mammals of the discharge area | Insignificant | Insignificant |
| Reduced physiological functioning of marine organisms due to elevated temperature | Insignificant | Insignificant |
| Reduced physiological functioning of marine organisms due to reduced dissolved oxygen concentrations and formation of H2S | Very Low | Insignificant |
| Detrimental effects on marine biota through discharge of co-pollutants in backwash waters | Medium | Insignificant |
| Detrimental effects on marine organisms through discharge of antiscalants in backwash waters | Low | Insignificant |
| Detrimental effects on marine organisms or ambient seawater pH through discharge of residual cleaning solutions used periodically for cleaning-in-place | Insignificant | Insignificant |
| Detrimental effects on marine organisms of heavy metals from corrosion processes | Very Low | Insignificant |

| Impact/Issue | Without Mitigation | With Mitigation |
|---|---|---|
| Detrimental effects on marine biota through accidental hydrocarbon spills and litter in the coastal zone during construction | Low | Very Low |
| **Physical Impacts** | | |
| **Heritage** | | |
| Impact to heritage resources | Insignificant | Insignificant |
| **Visual** | | |
| Impact of dust created during the construction phase | Low | Very low |
| Alteration of the landscape character during the construction phase | Medium | Medium |
| Change in sense of place during operational phase | Medium | Medium |
| Visibility of the project | Medium | Medium |
| Light impact | Medium | Low |
| **Noise** | | |
| Construction noise impact | Low | Very Low |
| Operational noise impact | Very low | Very low |
| **Coastal Physical Processes** | | |
| Impact of temporary jetty on coastal physical processes | Very low | Very low |
| Impact of temporary berms, bunds and cofferdams | Medium | Low |
| Impact of trench on coastal physical processes | Very low | Very low |
| Impact of residual construction materials in the coastal zone | Low | Low |
| Impact of general construction activities in the coastal zone | Medium | Low |
| Impact of marine pipelines | Very low | Very low |
| Impact of seawater intake and outfall on hydrodynamics | Low | Low |
| Impact of pipeline and intake structure after decommissioning | Low | Very low |
| **Socio-economic** | | |
| Affordability of desalinated water | High | Low |
| Coastal Economy | Medium + | High + |
| Job creation and skills development | Very high + | Very high + |
| Community Health and Safety | Medium | Low |

Based on the baseline receiving environments conditions, the majority of the negative **biophysical impacts** were assessed to have a **medium** to **low** significance prior to implementing any mitigation actions. With the exception of the impact of direct and indirect modification/loss/destruction of bird habitat and contamination of surface water resources in the operational phase which significance was assessed to be high. The availability of mitigation actions and their implementation as included in the ESMP would further reduce the significance of any negative impact further. Most negative impacts could have mitigation applied to reduce significance to range between **medium** or **insignificant** (with the exception of the impact on the *attraction of birds to novel habitats through the artificial provision of scarce resources* in which adaptive management measures are proposed).

Negative physical impacts to **visual, noise, costal physical processes and heritage** were assessed to range in significance between **medium** and **insignificant** prior to mitigation being applied. Mitigation is expected to reduce significance to low/very low in all but three assessment criteria (*Alteration of the landscape character during the construction phase, change in sense of place during operational phase and Visibility of the project*) for which mitigation could not be applied to reduce their significance.

From a socio-economic perspective, most of the assessment criteria identified positive benefits, with the exception of the impact of affordability of the desalinated water, as well as community health and safety. However, mitigation measures can be adopted to reduce the impact significance to **low**. The remaining social impacts are considered to have a **highly** beneficial (positive) result for Namibia and can be developed on and refined to increase their effectiveness.

The No Go option would result in NamWater not developing the proposed desalination plant project. The assessment of this option requires a comparison between the options of proceeding with the project with that of not proceeding with the project. In this scenario, the negative impacts would not occur, and the baseline environment would persist. The No Go option would, however, forgo the positive opportunities and benefits associated with the project.

While several negative environmental impacts have been identified, the majority of these without mitigation are considered to be of **medium to low** significance and are not considered fatal flaws. Mitigation would reduce the significance of these impact further. Conversely, the proposed project is aligned with Namibia's planning objectives and are likely to result in significant national and regional socio-economic benefits such as an increase in the security of water supply to the central coastal areas. On this basis, it is SLR's opinion that, subject to the implementation of this ESMP, the proposed NamWater Desalination Plant and associated infrastructure project should be approved and granted an ECC.

# 2. SCOPE AND OBJECTIVES

The ESMP applies to all activities associated with site clearance and construction activities, as well as the operational phase of the NamWater desalination plant and associated infrastructure. The ESMP includes all activities conducted by, or on behalf of NamWater on the project site, including EPC Contractor and O&M Operator and sub-contractors.

The project life is expected to extend for at least 30 years with potential upgrades extending the projects longevity. The decommissioning phase was assessed under the scope of the ESIA based on available information, however due to the various legal, Project Ownership and technological changes that may occur over the 30-year timespan, this ESMP may need to be revised at least 2 years prior to the intended decommissioning date.

The key objective of this ESMP is to provide a framework for the implementation of environmental and social management initiatives. Best practice principles require that every reasonable effort is made to reduce and prevent negative impacts while enhancing the benefits.

This ESMP will be reviewed by NamWater and updated, when required, through the appropriate MEFT process. This ensures best practice and that the adaptive management features of this ESMP are appropriately implemented. A key feature of the ESMP is the idea of continual improvement – an ongoing process of reviewing, correcting and improving the system. The most common approach for this is implemented through the Plan – Do – Check – Review cycle, as shown in Figure 2-1.


**Figure 2-1: Plan-Do-Check-Review Cycle**

NamWater will have overall responsibility, authority and accountability for environmental and social issues associated with the project. This ESMP outlines the key steps to be taken by all project personnel and their contractors, to effectively manage the environmental and social impacts and risks associated with the construction and operation of the project. All personnel engaged in the project are required to fully comply with the requirements of the ESMP in order to limit the potential for unacceptable environmental and/or social impacts or regulatory non-compliance.

# 3. ADMINISTRATION AND REGULATION OF ENVIRONMENTAL OBLIGATIONS

## 3.1 ROLES AND RESPONSIBILITIES AND ORGANISATIONAL STRUCTURE

Details of the anticipated management structure for this ESMP are presented below. All official communication and reporting lines including instructions, directives and information shall be channelled according to the management structure presented below.

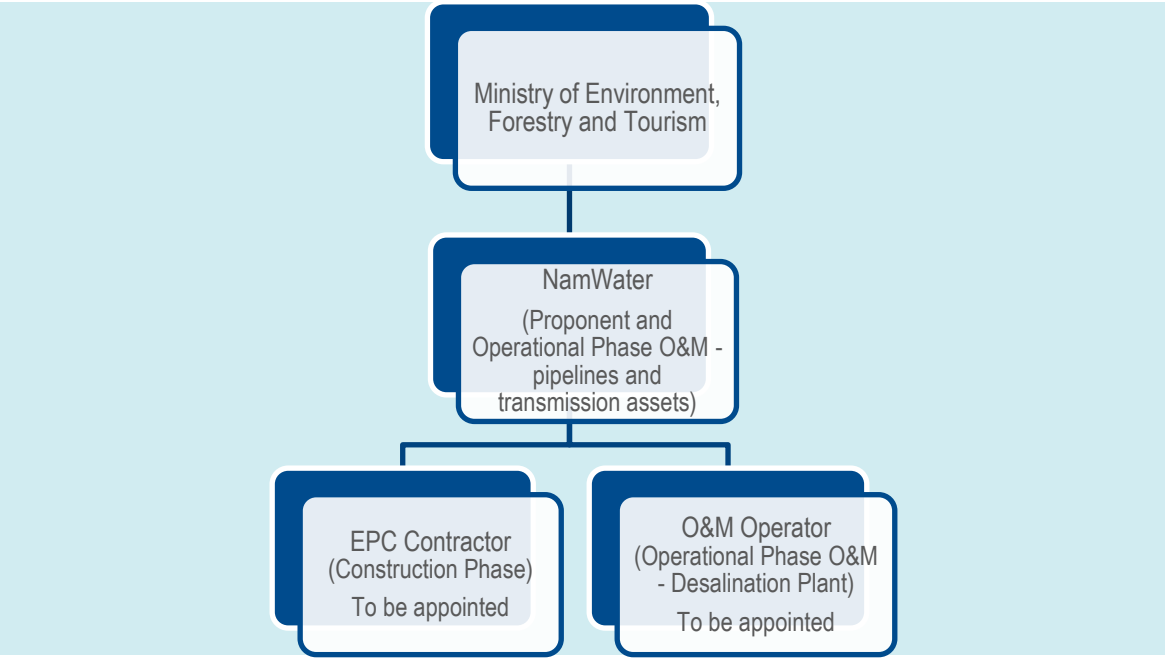


**Figure 3-1: Anticipated Organisational Structure**

MEFT is the designated authority responsible for authorising this ESMP and has overall responsibility for ensuring that the NamWater complies with this ESMP, and any conditions listed in the ECC. MEFT shall also be responsible for approving any significant amendments that may be required to the ESMP. MEFT may further perform ad hoc site inspections to check compliance with the ESMP.

NamWater is ultimately responsible for the implementation of the ESMP and the financial cost of all environmental control measures. NamWater must ensure that any person acting on its behalf complies with the conditions / specifications contained in this ESMP.

NamWater, as the operating entity, will take responsibility for the O&M of certain parts of the assets (such as pipelines and transmission assets) and will fully or partially outsource the operation and maintenance of the desalination plant. NamWater is, thus, responsible for the appointment of an EPC Contractor who will be responsible for the construction of the plant and an O&M Operator who will be responsible for operational phase of the facility. Designated roles responsible for the implementation of the ESMP will be defined through the contracts between NamWater and the EPC Contractor and the O&M Operator.

The EPC Contractor and the O&M Operator will be responsible for the implementation of the ESMP and NamWater will be responsible for providing oversight and will be accountable to MEFT for compliance.

## 3.2 ROLES AND RESPONSIBILITIES

The implementation of this ESMP requires the involvement of several stakeholders, each fulfilling a different but vital role to ensure sound environmental management during the various Project phases.

### 3.2.1 Proponent

The Proponent (NamWater) is the holder of the ECC and is ultimately responsible for the following tasks, amongst others:

- Implementation of the ESMP and the financial cost of all environmental control measures.
- Ensuring that any person acting on its behalf complies with the conditions/specifications contained in this ESMP and conditions of the ECC.
- Provide all Contractors with a copy of this ESMP as part of tender contract documentation to allow the contractors to cost for its requirements within their respective contracts.
- Addressing any site problems pertaining to the environment at the request of the MEFT, Engineer and/or the Environmental Control Officer (ECO).

The Proponent will also be responsible for contracting the (1) Engineer, (2) Contractor and (3) ECO.

### 3.2.2 Engineer

The Engineer shall oversee the planning, design and construction phases of the Project. The Engineer shall appoint a Resident Engineer (RE) to act as the Owner's on-site implementing agent. The Engineer shall address any site problems pertaining to the environment at the request of the RE and/or the ECO. The Engineer shall also be responsible for issuing penalties for contravention of the ESMP.

#### 3.2.2.1 Resident Engineer

The RE shall act as the Proponent's on-site implementing agent and has the responsibility to ensure that their obligations are executed in compliance with the ESMP. Any on-site decisions regarding environmental management are ultimately the responsibility of the RE. The RE shall assist the ECO where necessary and shall have the following responsibilities in terms of the implementation of this ESMP:

- Reviewing and approving the Contractor's Method Statements with input from the ECO and NamWater's Environmental Manager where necessary;
- The day-to-day monitoring and verifying that the ESMP and Method Statements are adhered to at all times and taking action if specifications are not followed;
- Keeping a photographic record of construction activities on site;
- 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 ESMP specifications;
- Issuing fines for transgressions of site rules and penalties for contravention of the ESMP;
- Delaying any construction activity if he/she believes the environment has been or is likely to be seriously harmed/impacted;
- Providing input into the ECO's ongoing review of the ESMP; and
- Communicating environmental issues to the ECO.

### 3.2.3 Contractor

The Contractor shall have the following responsibilities:

- To implement all provisions of the ESMP. If the Contractor encounters difficulties with specifications, he/she must discuss alternative approaches with the RE and/or the ECO before proceeding.
- To ensure that all staff, including sub-contractors, are familiar with the ESMP.
- Monitoring and verifying that the environmental impacts are kept to a minimum.
- To make personnel aware of environmental issues and to ensure they show adequate consideration of the environmental aspects of the Project.
- To prepare the required Method Statements.
- To report any incidents of non-compliance with the ESMP to the RE and/or the ECO.
- To rehabilitate any sensitive environments damaged due to his / her negligence. This shall be done in accordance with the RE's specifications.

Failure to comply with the ESMP may result in fines and reported non-compliance may result in the suspension of work or termination of the contract by the Engineer.

The Contractor shall appoint, at his / her own cost, competent individuals as the on-site Environmental, Health, and Safety (EHS) Officer to act as the Contractor's on-site implementing agent. The EHS Officer must be appropriately trained in environmental management and must possess the skills necessary to impart environmental management and environmental training (including induction and toolbox talks) to all personnel involved in the contract.

#### 3.2.3.1 Environmental, Health, and Safety Officer

The Contractor-appointed EHS Officer shall be responsible for monitoring, reviewing and verifying the Contractor's compliance with the ESMP during the construction phase. The HSE Officer's duties in this regard shall include, *inter alia*, the following:

- Monitoring and verifying that the ESMP and Method Statements are adhered to at all times and taking action if specifications are not followed;
- Monitoring and verifying that environmental impacts are kept to a minimum;
- Inspecting the site on a daily basis with regard to compliance with the ESMP;
- Keeping accurate and detailed records of these inspections;
- Completing weekly checklists;
- Producing monthly reports on environmental, social, health and safety performance of the project;
- Supervision of work where environmental management is a key aspect (e.g., in sensitive areas, with high environmental risk, etc.);
- Keeping a record of on-site incidents and accidents and how these were dealt with;
- Reporting any incidents of non-compliance with the ESMP to the RE and/or the ECO;
- Training and awareness of environmental, social, health and safety requirements to all persons onsite (i.e., contractors and subcontractors) including day visitors where necessary; and
- Compiling and implementing the Contractor's Environmental, Health, Safety and Labour policies in accordance with relevant legislation and the Employer's requirements.

### 3.2.4 Environmental Control Officer

The Proponent shall ensure that an appropriate person is assigned as an Environmental Control Officer (ECO). The ECO's duties shall include, *inter alia*, the following:

- Updating the ESMP to include relevant ECC conditions or other significant ESMP.
- Reviewing Method Statements.
- Presenting the initial environmental awareness training course to the Contractor's site staff.
- Advising the Contractor and/or the RE on environmental issues within defined construction areas.
- Undertaking regular site visits to ensure compliance with the ESMP and verifying that environmental impacts are kept to a minimum throughout the contract. For the proposed Project, it is likely that, as a minimum, four site inspections will be sufficient: (1) prior to construction during site demarcation; (2) during construction activities (site clearance activities in particular); (3) upon completion of construction; and (4) post-decommissioning.
- Completing environmental checklists/reports during site visits.
- Keeping a photographic record of progress on site from an environmental perspective.
- Attending site meetings.
- Assisting the Contractor and/or EHS Officer in finding environmentally acceptable solutions to construction problems.
- Recommending additional environmental protection measures should this be necessary.
- Assisting the RE in ensuring that the necessary environmental authorisations and permits have been obtained.
- Ensuring that MEFT is informed of work progress on site and ensuring that MEFT approves any deviations to the approved site layout and any amendments to the ECC.
- Preparing and submitting bi-annual environmental compliance reports to MEFT outlining any incidents that may or have caused damage to the environment or breaches of the ESMP as well as reporting on ESMP compliance.
- Recommending the issuing of fines for transgressions of site rules and penalties for contraventions of the ESMP (via the RE).
- Advising on the removal of person(s) and/or equipment not complying with the specifications (via the RE).
- Compiling a final environmental audit report at the conclusion of the construction phase for submission to MEFT, and any other reports as specified by MEFT.

## 3.3 ESMP ADMINISTRATION

Copies of the ESMP shall be made available to the EPC Contractor and O&M Operator and be retained on site. The EPC Contractor and O&M Operator staff are to be briefed on the contents and obligations contained in the ESMP relevant to the respective construction and operational phases.

The ESMP must be updated where the findings of the environmental audit reports indicate insufficient mitigation of environmental impacts associated with the proposed project, or insufficient levels of compliance with the ESMP.

Any significant revisions to the ESMP document must be approved by MEFT before the ESMP is revised.

Other administrative actions to be undertaken by NamWater and the EPC Contractor and/or O&M Operator include:

- **Commencement notification** - NamWater or the EPC Contractor shall give MEFT at least two weeks (or as specified in the ECC) written notice to the MEFT prior to the commencement of construction. A general notification letter shall also be sent to neighbouring residents and published in a locally distributed newspaper. The O&M Operator is to provide written notice to MEFT of the facility's operational commencement.
- **Information notice boards** – During construction, the EPC Contractor is to publish notice boards advising the public of construction activities and provide the contact details of the EPC Contractor. During operation, the O&M Operator is to erect notices providing contact details.
- **Method Statements** - The EPC Contractor shall submit written Method Statements to RE and/or the ECO for all environmentally sensitive aspects of the work. A list of typical method statements is provided in Appendix A for reference purposes.
- **Record keeping** - The EPC Contractor and O&M Operator shall keep a record of environmental management activities on site, including but not limited to, meetings attended, Method Statements received and approved, monitoring results, issues arising on site, non-compliance, and corrective actions taken to solve problems that arise.
- **Review and auditing** - The EPC Contractor and O&M Operator shall establish an internal review procedure to monitor the progress and implementation of the ESMP. Internal compliance auditing shall be undertaken at regular intervals, as per an internal audit schedule. An external audit should be conducted a minimum of once per annum during the operational phase of the project. During the construction phase a pre-site clearing/preparation survey should be completed, with quarterly audits for the duration of construction.
- **Emergency Preparedness and Response Plan** - The EPC Contractor and O&M Operator are to develop and implement an Emergency Preparedness and Response Plan (EPRP) inclusive of but not limited to the following: a Health Plan (e.g., snake bites), Safety Plan (e.g., electrocution, explosions), Environmental Response Plan (e.g., a spill), social and local economic development (e.g. fire), labour (e.g. worker demonstrations, explosions) and security (e.g. a civil conflict). In order to create an EPRP, the following steps shall be followed:
    - **Step 1:** Assess potential emergency scenarios, probabilities and therefore risk;
    - **Step 2:** Ensure adequate controls to prevent an emergency are reflected within relevant operational procedures and supporting documents;
    - **Step 3:** Develop an EPRP encompassing each scenario and how it will be managed in an easy to read and quickly accessible format;
    - **Step 4:** Ensure that in developing responses to each scenario, all internal departments that will need to work together are consulted and outlined, all external emergency services are consulted (e.g., the fire department) and community representatives (where relevant) are consulted and their part is understood and agreed to ensure the plans are workable and effective;
    - **Step 5:** Communicate and train on the EPRP with all relevant staff, contractors, and where applicable, communities;
    - **Step 6:** Test the EPRP regularly (as a minimum annually or more frequently for high risks), and develop lessons learnt, integrating these into any updates of the EPRP; and
    - **Step 7:** Conduct periodic review of EPRP, at least annually, but for high-risk scenarios more frequently.
- **Plant Operation and Maintenance Plan** - Plant Operation and Maintenance Plan shall be developed/updated by the O&M Operator to align and include measures outlined in Appendix D.

The Plan is to include provisions for, amongst others, management of the seawater intake system and sea outfall discharge.

- **Biological Monitoring Programme** - A biological monitoring programme shall be developed (See Appendix E).
- **Physiochemical Monitoring Programme** - A physiochemical monitoring programme shall be developed (See Appendix F)
- **Stormwater Management Plan** – A detailed Stormwater Management Plan shall be developed for built-up infrastructure, as part of the detailed design phase (See Appendix G).
- **Hydrological Management Plan** – Adherence to the Hydrological Management Plan is required (Appendix H)
- **Surface Water Quality Monitoring Plan** - Adherence to the Surface Water Management Plan is required (Appendix I)
- **Grievance Mechanism** – Grievances raised by stakeholders shall be managed through a transparent process that is culturally appropriate, understandable, readily acceptable to all segments of affected communities, and at no cost and without retribution (See Appendix J).
- An **Energy and Carbon Management** plan should be prepared with the desalinisation plant and water carriage system. This plan should include emission reduction targets and practical energy efficiency initiatives.
- **Dorob National Park Management Plan** - Adherence to the Dorob National Park Management Plan is required (Appendix K)
- A comprehensive **Restoration Plan** should be drawn up by an expert before construction commences, at least at conceptual level, and should make provision for monitoring and adaptive management as the project continues. Some rehabilitation actions should be implemented during operations in order to be effective, e.g., removal and storage of topsoil; location of waste dumps; road and pipeline locations. Project engineers and managers should work closely with the restoration expert from the planning phase to construction and through operations and decommissioning.
- **Close-out audit** - At the conclusion of construction (including rehabilitation) phase, an environmental audit report shall be compiled and submitted to MEFT. It shall, as a minimum, outline the implementation of the ESMP, and highlight any problems and issues that arose during the construction period to report, on a formal basis, the lessons learned from this project.

## 3.4 COMPLIANCE

While NamWater will remain ultimately accountable to MEFT for compliance with the EPC Contractor. The liabilities associated with the implementation of ESMP will be transferred contractually to the EPC Contractor and O&M Operator.

## 3.5 STATUS OF THIS DOCUMENT

The development and implementation of environmental specifications is an on-going process that is iterative in nature. Any significant revisions to the ESMP document must be approved by the MEFT before the ESMP is revised.

# 4. ESMP IMPLEMENTATION

## 4.1 PERMITS AND AGREEMENTS

The following permits and agreements are required:

- Abstraction (Section 33(3)(c)) and discharge permit (Section 60) from the Ministry and Agriculture, Water and Land Reform in terms of the Water Resources Management Act, 2004 (No. 24 of 2004);
- Landowner lease agreement and servitude agreements (Erongo Regional Council);
- Protected species removal permit from the Directorate of Forestry in terms of the Forest Act 12 of 2001 (as necessary);
- Agreements with the nearest local authority (Henties Bay or Swakopmund Municipality) for the supply of during construction:
    - Potable water;
    - Domestic solid waste disposal;
    - Domestic wastewater; and
    - Building plans, if required.
- Prior to commencing with any ocean-based pipe laying activities involving watercraft, the EPC Contractor should make contact with the following organisations to inform them of the construction activity, and provide details of the operations and details around the specific locations and the expected duration of such activities.
    - NamPort;
    - Swakopmund Sea Rescue Institute; and
    - Any local yacht and recreation boat or fishing clubs.
- Rock-breaking and blasting may only be undertaken by a registered blaster once the relevant blasting permit has been obtained.

## 4.2 TRANSFER OF COMMITMENTS TO EPC CONTRACTOR AND O&M OPERATOR

As part of the appointment of the preferred EPC Contractor and O&M Operator, NamWater is to contractually transfer the responsibilities outlined in this ESMP to the respective Contractor/Operator.

## 4.3 ENVIRONMENTAL CONSIDERATIONS IN DESIGNS

- General:
    - Reduce the project footprint to the efficient minimum by optimizing the footprint and clever use (double use) of the areas.
    - All liquid chemical storage areas and tanks should be bunded to 110% of the total maximum volume of chemical storage capacity to contain accidental spills and leaks.
    - All dry chemical storage areas shall restrict unauthorized access (i.e., lockable) and have impervious floors and adequate weather protection (rain and wind) to prevent the accidental spillage, dispersal, or spoilage of chemicals stored. All chemical storage areas must be equipped with the relevant emergency provisions required to deal with a potential emergency in that environment.
    - The chlorine storage area must be equipment with various safety and emergency equipment, including leak detection, ventilation, isolation chambers (secondary containment), isolation valves, personal protective equipment (including breathing

equipment), wind vein, emergency alarms, emergency escape routes, fire extinguishers, emergency showers/ eye washing facilities, etc.

- Provision should be made in the facility design for the collection and storage of solid waste (general and hazardous). Such storage areas should be weather-resistant and should make provision for the separation and storage of recyclables and returnable packaging (especially chemical containers) in an effort to reduce the volume of waste (and the hazard level) entering the landfill site. Where potentially hazardous wastes are produced, these should be stored within dedicated, signposted receptacles and transported to an appropriate waste facility (Walvis Bay Hazardous Waste Facility) for recovery or disposal. General waste should be transported and disposed at the nearest landfill site (either in Swakopmund or Walvis Bay).

- Surface water:
  - Stormwater infrastructure is to be included in detailed engineering design of the facility.
  - The desalination plant and associated infrastructure, according to International Finance Corporation (IFC) requirements, must be sited and operated such that the facilities do not impede the flow of water.
  - Stormwater management infrastructure should be designed in a manner that prevents frequent spills and minimize flooding.
- Socio-economic considerations:
  - Road safety measures are to be implemented to manage traffic and to reduce traffic collision risks. This should be augmented through the appropriate road hazard/information signage to warn road users of the turning of heavy vehicles.
  - NamWater should ensure the designs for Phase 1 of SS1 and subsequent phases, are not over-capitalised in any one phase to keep costs as low as possible.
- Visual:
  - Design lighting to avoid the spillage of light into the surrounding areas. The following are measures proposed to be considered in the lighting design of the project:
    - Install light fixtures that provide precisely directed illumination to reduce light “spillage” beyond the immediate surrounds of the site.
    - Avoid high pole top security lighting along the periphery of the site and use only lights that are activated on illegal entry to the site.
    - Minimise the number of light fixtures to the bare minimum, including security lighting.
  - The desalination plant building should be planned to minimise the potential visual impact on the landscape. The use of a natural colour scheme, such as brown, is proposed to be used when painting the buildings and the roofs.
- Noise:
  - Implement typical noise abatement/attenuation measures, such as:
    - Acoustic attenuation devices should be installed on all ventilation outlets and high-pressure gas, or liquid should not be ventilated directly to the atmosphere, but through an attenuation chamber or device.
    - Vibrating equipment must be equipped with vibration isolation mountings on their mounting plinths.
  - Positioning noisier equipment in enclosures should be implemented where possible. Where equipment cannot be housed, using building structures for screening can be effective to

ensure noise is not directed towards sensitive receivers – the most sensitive being the village of Wlotzkasbaken (2.7 km South of the site) – meaning noisy external equipment should be installed on the North (or East) facades of the site.

- Birds:
  - Roads, pipelines, cables should share servitudes as far as possible to reduce the disturbance footprint.
  - Outside lighting of the facility (including security lighting) must be kept to the minimum. Where required, all overhead lighting must be shielded and pointed downwards onto the area where illumination is needed, rather than directed upwards or outwards, in order to avoid light pollution. The guidelines by the International Dark-Sky Association for the quality of outdoor lighting (including light design, wattage and light colour [preferably amber]) can be followed as a reference for preserving and protecting the night-time environment, including its wildlife (www.darksky.org).
  - If the facility is to be fenced, the upper wire strand of any fencing should be demarcated to ensure that it is visible to low flying birds in low light conditions.
  - Ensure adequate dispersion and dilution of the brine in the receiving surf zone environment through suitable engineering designs (Aurecon & SLR 2014).
  - The following mitigation actions are recommended, to reduce the impact of brine discharge on the biota and benthic communities (CSIR 2009):
    - Careful consideration of available technologies and processes in the design for the desalination plant; for example, avoid nutrient-enriching antiscalants, monitor the dissolved oxygen levels, aerate the brine and conduct regular pigging of intake.
    - Design the discharge to ensure sufficient mixing of the discharged brine with the receiving water body (i.e., ensure complete mixing throughout the full extent of the water column at the point of discharge).
    - Use sodium bisulphite (SBS) to dechlorinate the effluent prior to discharge, to reduce potential biocide impacts; pigging of intake and discharge pipelines can reduce the need for and costs of biocides.
    - Aerate brine prior to discharge, if overdosing with SBS occurs.
- Marine ecology
  - Engineering designs of the discharge pipeline and diffuser system must be such that the highest required dilution of brine is achieved, thereby limiting increased salinities to the minimum achievable mixing zone only. From an environmental perspective it is, therefore, recommended that Configuration B (as outlined in the ESIA report) be implemented as the engineering design for the diffuser of the proposed NamWater desalination plant.
  - Adjust intake velocities to ~0.1 - 0.15 m/s.
  - Install velocity caps and screens as part of the engineering design.
  - Undertake an impingement and entrainment study at start-up to quantify the actual entrainment and impingement rates to quantify the loss of marine species relative to their abundance in the surrounding water column.
  - Consider potential recycling/re-use alternatives for brine.
  - Design the plant to reduce corrosion to a minimum by ensuring that dead spots and threaded connections are eliminated. Corrosion resistance is considered good when the corrosion rate is <0.1 mm/a.
- Terrestrial ecology

- Sufficient and effective pass-overs should be designed and built along the proposed pipelines.
- The pumphouse infrastructure should avoid the hummock dunes.
- A specialist on brown hyaenas should be consulted for input during the design phase to make provision for adequate corridors for hyaenas and other large animals to migrate.
- An invertebrate specialist must be engaged during the design phase for implementation before construction to ensure that the project does not increase the risk of extinction of a population.

- Coastal and Physical Processes
  - A general topographic and photographic survey of the site should be conducted by the contractor to document the pre-construction state of the coastal zone. This should be used to verify successful impact mitigation, such as post-construction reinstatement of the beach profile and removal of construction materials from temporary works.
  - To avoid impacts of downdrift erosion at the Orano shore crossing, the detailed design stage undertaken by the EPC contractor will need to predict the beach change arising from temporary works and ensure that the changes will not substantially impact the Orano site (e.g., through limiting the cross-shore extent). If changes at the Orano shore-crossing cannot be avoided, then measures to mitigate the impact could include sand by-passing (e.g., using a slurry pump or excavators), or the provision of temporary protection to the Orano shore crossing.
  - The detailed design by the EPC contractor must determine an appropriate setback for any landside infrastructure (e.g., seawater intake basin and pump station) considering the design life of the plant. Determining the appropriate setback will need consideration of the following:
    - Erosion risk from changes in the shoreline position due to natural variability (including short-term and long-term trends), and storm erosion.
    - Flooding risk during extreme conditions due to atmospheric tides, storm surge, and wave run-up.
    - For both the erosion and flooding risks, the effects of climate change over the design life need to be considered, including increased mean water levels due to sea level rise, increased extreme water levels and wave run-up due to increased storminess, and coastline recession due to sea level rise.
- Greenhouse Gas
  - An energy recovery system must be installed before construction to recover hydraulic energy from the brine, thereby reducing electricity consumption.
  - Only high-efficiency motors should be used for the desalinisation plant and water carriage system.
  - Variable speed drives should be fitted to all motors which handle variable flows to better match the speed and/or torque of the motor to the process demands, thereby reducing electricity consumption.

## 4.4 BASELINE MONITORING

- Noise - The EPC Contractor and O&M Operator shall establish a noise baseline at the various potentially sensitive receptors prior to construction commencement and again prior to operational commencement.

## 4.5 PROJECT CONTRACT DOCUMENTATION

- NamWater should develop local employment and procurement targets for the contractor for inclusion in the tender documents.
- The bidding process should include proposals to involve Namibian Small and Medium Enterprises to be involved (e.g., using labour-based works) in the construction phase.
- The EPC Contractor and O&M Operator must compile a draft Social and Environmental Policy (S&EP) in line with NamWater's Environmental Policy and the Health and Safety (HS) policy, statutory requirements and the provision forthwith. The S&EP of the successful bidder will, upon award of the contract, be finalised for approval. Compliance with the S&EP will be reviewed by NamWater.
- The Contractor should submit a site-specific health and safety plan, which includes a task-specific risk assessment. The risk assessment covers environmental, health and safety aspects, work methods and construction risks associated with each task that the Contractor team will or is likely to perform in the execution of the works.

## 4.6 CONSTRUCTION PHASE

The ESMP has been compiled for the management of potential construction phase impacts. Whilst an ESMP is comprised of mitigation measures identified through the ESIA process, the construction phase impacts are mostly generic in nature, are generally well understood, and have an established set of standard mitigation measures and best practices pertaining to construction management and supervision, which are presented here in addition to the ESIA recommendations.

### 4.6.1 Scope

The general principles contained within the ESMP shall apply to all construction activities (and all maintenance activities involving construction-type activities and decommissioning activities). All construction activities shall observe all relevant environmental legislation and in so doing shall be undertaken in such a manner as to minimise impacts on the natural and social environment.

### 4.6.2 General

The ESMP is to be included in all construction-related Tender and Contract documentation to ensure that the EPC Contractor is aware of the obligations and given the opportunity to cost for the implementation of the ESMP requirements.

The EPC Contractor will carry the following responsibilities:

- Ensuring that all environmental impacts are managed in accordance with this ESMP;
- Ensuring that all monitoring and compliance auditing occurs in line with the ESMP;
- Ensuring that the environment is rehabilitated as far as practicable to its natural state or existing land use practices;
- Any environmental damage, pollution, pumping and treatment of extraneous water or ecological degradation as a result of activities both in and outside the site boundaries; and
- Any conditions contained in the environmental clearance are upheld.

The EPC Contractor shall conduct his activities to cause the least possible disturbance to the existing amenities, whether natural or man-made, in accordance with 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 as well as his supervisory staff on the

relevant environmental laws, sensitive areas, and protection requirements. The Contractor shall supplement these steps with prominently displayed notices and signs in strategic locations to remind personnel of their environmental obligations.

### 4.6.3 Environmental Awareness Training

All the EPC Contractor's and any sub-contractor's employees and any suppliers that spend more than one day a week or four days in a month on site, must attend an Environmental Awareness Training course developed and presented by the ECO, before the commencement of any construction activities. Subsequent courses shall be held as and when required. A register shall be kept for all environmental awareness training.

Environmental awareness posters will also be erected at a prominent location on the site to remind construction staff of their obligations in terms of the ESMP. Refer to Appendix B for an example of an Environmental do's and don'ts poster.

The EPC Contractor shall compile and issue all construction staff with an information booklet, based on the environmental awareness training course, at the commencement of the project, containing key information regarding the project, safety regulations and environmental do's and don'ts. All employees will be required to sign a register indicating receipt and understanding of the information booklet. The EPC Contractor will ensure that environmental issues and risks are dealt with as part of daily/weekly "toolbox talks" and that specific environmental duties or tasks are assigned to individuals.

The Environmental Awareness Training shall also address a code of behaviour for employees on Health and safety levels (such as alcohol abuse, disease protection etc.) in alignment with community values.

### 4.6.4 Construction Phase EMP

Table 4-1 sets out the relevant management measures to be implemented during the construction phase. Mitigation measures have been divided into Biophysical, Ecological and Socio-economic components.

**Table 4-1: Construction Phase EMP**

| Reference Number | E&S Aspect/Issue | Mitigation Measures/Action Plans – Construction Phase | Responsibility |
|---|---|---|---|
| **Biophysical Impacts** | | | |
| EMP-C-001 | Air Emissions | 1. Adopt suitable measures to manage fugitive dust generated during the construction phase. This will include a programme of dust management that limits both occupational and community exposure to dust.<br>2. Adopt measures to control fugitive dust generated from construction traffic including limiting construction vehicles' speeds to 20 km/hr on the unpaved access road to site and on site.<br>3. Ensure that exposed areas and material stockpiles are adequately protected against the wind (e.g., wetting exposed soil / gravel areas during windy conditions, covering of material stockpiles, etc.);<br>4. Ensure that the location of stockpiles take into consideration the prevailing wind directions and locations of sensitive receptors. | EPC Contractor |
| | Greenhouse Gas Emissions | 1. All construction vehicles should be fitted with a telemetry system to monitor fuel consumption and driver behaviour (e.g., excessive breaking, idling, and so on) in order to reduce liquid fuel consumption.<br>2. When higher-than-average consumption is detected, appropriate action should be taken against the driver. | EPC Contractor |
| EMP-C-002 | Noise Emissions | 1. Avoid or limit noisy construction activities outside of daytime hours (7 a.m.-6 p.m.). If nighttime work is required, the EPC Contractor should inform nearby residents 24 hours in advance of undertaking the required noisy activities.<br>2. If the piling method employed involves hydraulic hammer or vibratory action, the nearest community (Wlotzkasbaken) should be notified prior to piling commencement. Piling should under no circumstances be permitted during evening and night-time hours.<br>3. The permitted construction area footprint to be fenced, and vehicles must not be permitted beyond the boundaries.<br>4. Large site generators and similar equipment shall be located as far away from nearby receptors as possible and where this is not possible put in place noise attenuation measures in the event of noise impacts.<br>5. Vehicles and auxiliary power systems should be turned off when not in use. Warm-up idling should not be permitted.<br>6. Equipment and vehicles should always be in good working order and undergo regular servicing. A maintenance plan and register of vehicles and equipment should be provided and maintained by the contractor to the ECO. | EPC Contractor |

| Reference Number | E&S Aspect/Issue | Mitigation Measures/Action Plans – Construction Phase | Responsibility |
|---|---|---|---|
| | | 7. Limiting construction vehicles speeds to 20 km/hr on unpaved access road to site and on site.<br>8. Construction vehicles and plant will be serviced according to the manufacturer's specifications, and maintenance records must be kept up to date and presented for inspection as required.<br>9. Adhere to local regulations regarding the generation of noise and hours of operation.<br>10. Avoid onshore blasting during the breeding season of shore-birds (October – June) and offshore blasting during the peak whale migration period (June – August and November - January).<br>11. The on-site occupational health and safety officer should implement and manage an employee's noise management programme to manage noise-induced hearing loss, according to the applicable Namibian governmental labour regulation (Labour Act 1992, Occupational Health and Safety of Employees Regulation).<br>12. Where blasting may occur, the Wlotzkasbaken village community should be engaged to agree on the most acceptable time to carry out the blasting. The schedule must be planned and made known to the stakeholders in advance. The services of a blasting specialist should be employed if blasting is proposed.<br>13. The Wlotzkasbaken village community should be notified prior to construction activities, specifically for noisy operations such as hydraulic piling and highly impulsive sources.<br>14. Stakeholders should be provided with a contact number and/ or email address for lodging complaints relating to noise nuisance. All complaints received should be logged on an electronic spreadsheet register saved on a device connected to a cloud-based server backup system. The complainant must be provided with a fill-out form to provide the following details:<br>a. Name<br>b. Location of disturbance and complainant physical address<br>c. Time and date of the disturbance/s<br>d. Nature of the disturbance (e.g., piling or knocking at around 9 pm to 10 pm)<br>15. The contractor should be obligated to formulate a response to the complainant within 48 hours with a plan to investigate the disturbance. | |
| EMP-C-003 | Surface water contamination | 1. Minimise the disturbance of soils as much as possible by restricting construction activities within demarcated areas.<br>2. Phasing / scheduling of earthworks should be implemented to minimise the footprint that is at risk of erosion at any given time, or schedule works according to the season. Construction is recommended for months or seasons where there is less rainfall.<br>3. Progressive rehabilitation of disturbed land should be carried out to minimize the amount of time that bare soils are exposed to the erosive effects of rain and subsequent runoff.<br>4. Traffic and movement over stabilised areas should be controlled (minimised and kept to certain paths), and damage to stabilised areas should be repaired timeously and maintained.<br>5. In case of an occurrence of a discharge incident that could result in the pollution of surface water resources, an emergency response procedure should be implemented.<br>6. Water quality monitoring should be undertaken as per the monitoring programme (as outlined in Appendix I). | EPC Contractor |

| Reference Number | E&S Aspect/Issue | Mitigation Measures/Action Plans – Construction Phase | Responsibility |
|---|---|---|---|
| | | 7. Maintenance of vehicles is to be undertaken in a bunded lined area or off-site the project area.<br>8. A spill kit must be kept on-site and be easily accessible.<br>9. Good housekeeping practices should be implemented and maintained by timeous cleaning-up of accidental spillages. Waste should be disposed to a licensed waste site. In addition, spill cleaning kits and material safety data sheets for chemical and hazardous substances should be accessible and available. | |
| | Flooding | 1. Rainwater harvesting is recommended to manage water emanating from impervious areas.<br>2. Monitoring and inspection of channels, containment berms, silt traps, culverts, and pipelines for signs of erosion, cracking, silting and blockages of inflows, to ensure the efficient performance of the storm water infrastructure during storm events is recommended.<br>3. Monitoring should be undertaken monthly during the wet season and after storm events or as per the site management schedule, where available.<br>4. The monitoring plan should be reviewed regularly to ensure the effectiveness of the measures recommended. | EPC Contractor |
| | Alteration of Natural Drainage Patterns and Flow | 1. The increased flow resulting from the development must be managed by the SWMP measures (as Appendix G) to avoid frequent stormwater discharges into the downstream watercourses and provide some flow attenuation. | EPC Contractor |
| **Ecological Impacts** | | | |
| EMP-C-003 | Terrestrial ecology | 1. Keep the overall development footprint as small as possible.<br>2. The extent and location of the construction site should be demarcated, and all construction activities should take place within the demarcated area (not applicable to pipelines). Adherence should be strictly enforced.<br>3. Mitigation actions specifically for the two water pipelines include:<br>a. Use the same road during construction and for maintenance during operations.<br>b. The road should be close to the pipeline to ensure a narrow strip of disturbance.<br>c. Excavated and laid-down soil should be levelled.<br>d. Lay the pipeline as close as possible to the exiting road reserve, in an already disturbed area.<br>4. Demarcate the lichen field and strictly enforce a no-go policy.<br>5. All roads and tracks should be planned to minimise fragmentation or disturbance of habitats.<br>6. Anti-erosion measures should be taken where roads and tracks cross a wash or drainage.<br>7. Carefully plan the placement of stockpiling construction material to avoid sensitive areas such as the lichen field, drainage lines, hummock dunes, nests, dens, burrows and other breeding or shelter locations.<br>8. Limit construction activities to daytime hours to reduce noise and minimise the disturbance of animals in their daily foraging and movement behaviour.<br>9. Limit blasting activities to the minimum possible.<br>10. Educate construction and permanent staff as to their environmental obligations. All contractors should be held responsible for transgressions, and significant penalties should be levied to ensure compliance. | EPC Contractor |

| Reference Number | E&S Aspect/Issue | Mitigation Measures/Action Plans – Construction Phase | Responsibility |
|---|---|---|---|
| | | 11. Position temporary construction infrastructure (e.g., site office, ablution facilities) in areas that will be disturbed during operations.<br>12. Erect linear structures (pipelines) as close as possible to existing roads and tracks.<br>13. Hummock dunes: supply road for intake pipeline during construction should be planned to run on the exact route where the maintenance road during operations will be. This will minimise destruction of the dunes.<br>14. No sewerage overflow or French drain may be placed within 100 m of a large drainage.<br>15. Identify nests, dens, burrows, and other breeding locations, demarcate them, and avoid these sites. If avoidance is not possible, commission specialists to relocate the animals.<br>16. Reptiles that are exposed during ground clearing should be captured for translocation by a qualified expert.<br>17. No collection of plants should be allowed. No fires should be allowed on site.<br>18. Avoid damage to lichens by staying on designated roads and restricting foot and vehicle traffic to the project site. | |
| | Avifauna | 1. Scheduling: if possible, adapting the timing of construction activities to avoid disturbing birds during sensitive periods, e.g., during breeding seasons for Damara Tern (mainly October-February).<br>2. Abatement controls to reduce noise disturbance created during construction.<br>3. Operational controls to manage and regulate contractor activity, such as:<br>4. A speed limit should be strictly enforced.<br>5. The construction activity should be restricted to the actual construction site and no unnecessary movement of vehicles or people should be allowed outside the construction zone. All vehicles should be fitted with silencers.<br>6. Exclusion fencing should be erected around identified sensitive areas, if required (e.g., pre-identified active nesting sites).<br>7. Anti-poaching measures should be strictly enforced, with zero tolerance, and this should be emphasised during induction to contractors; offenders should be prosecuted.<br>8. Ongoing awareness to construction workers should be promoted about the value of biodiversity and the negative impacts of disturbance, especially to breeding birds, and of poaching and road mortality.<br>9. Impacts related to blasting can be mitigated as follows: by restricting the blasting to a minimum; by conducting a visual inspection by the ECO of the blasting area for flocks of swimming and diving birds prior to blasting; blasting should be postponed should a flock of swimming and/or diving birds be spotted within a 2-km radius around the blasting point; blasting should be done using smaller blasts in quick succession to minimise environmental effects.<br>10. As far as possible, the use of outdoor lighting should be minimised (Jenkins et al. 2017). Security lighting should be kept to the minimum and directed downward and away from any reflective surfaces.<br>11. Lighting on any high structures (e.g., weather/communication masts) should preferably be flashing rather than static (G Martin pers. comm.); and red, intermittent lighting is recommended in general (Bennun et al. 2021), if permitted by the Namibian Civil Aviation Authority (NCAA). | |

| Reference Number | E&S Aspect/Issue | Mitigation Measures/Action Plans – Construction Phase | Responsibility |
|---|---|---|---|
| | | 12. Standard mitigation measures should be followed to reduce the impact of noise generated during the operation of the plant on birds:<br>a. Restrict blasting to the absolute minimum required (one blast per day) in daylight;<br>b. Use blasting methods which minimise the environmental effects of shock waves through the use of smaller, quick succession blasts directed into the rock;<br>c. The possibility of using a bubble curtain for blasts exceeding 50 Pascal seconds should be investigated;<br>d. Avoid onshore blasting as far as possible during the breeding season of shore-birds;<br>e. Patrol of area (approximately 2 km from blasting location) by boat immediately before the intended blast (visual observations) and limit blasting to periods when there are no flocks of birds, marine mammals and turtles present in the immediate vicinity;<br>f. If flocks of seabirds are observed in the risk area, wait for 30 to 60 minutes. Large congregations of birds follow floats of fish which usually disperse within a fairly short time (< 60 minutes) when under pressure from foraging birds;<br>g. Any surplus charges not detonated immediately following each blast will be removed; and<br>h. Visible fish/bird mortalities will be removed immediately following blasting to minimise attraction of scavenging fish and birds to the area and dispose accordingly at the closest municipal landfill site.<br>13. Micro-siting: where possible avoid the unnecessary destruction of habitat or degradation of the environment; water courses and drainage lines are particularly sensitive.<br>14. Rehabilitate degraded or damaged biodiversity features and ecosystem services that cannot be completely avoided and/or minimised, e.g., by restoration of temporary-use and lay-down areas as soon as reasonably practicable after construction activities are complete.<br>15. Implement abatement control measures to reduce emissions and pollutants (erosion, dust, waste) created during construction; wastewater management and water conservation measures.<br>16. Implement operational controls to manage and regulate contractor activity, such as exclusion fencing around sensitive areas (e.g., pre-identified active nest sites), designated machinery and lay-down areas, minimisation of vegetation loss and disturbance to soil; managing the timing of vegetation control activities at suitable intervals.<br>17. Ongoing awareness to construction workers should be promoted about the value of biodiversity and the negative impacts of habitat destruction.<br>18. Ensure strict and effective waste management (including of food) during construction activities, to discourage an unnatural increase in scavenging species such as Pied Crow.<br>19. Avoid creating new habitats with open water, e.g., accumulations of stormwater or pipe leakages/open water/run-off, that may attract birds.<br>20. Minimising wet works construction footprints and duration as far as possible.<br>21. Lay pipelines in such a way that any required rock blasting is kept to a minimum.<br>22. Backfill excavations above mean sea level with the excavated material as trenching progresses, so as to maintain the original shore profile as far as possible. Rehabilitation below mean sea level, will be passive. | |

| Reference Number | E&S Aspect/Issue | Mitigation Measures/Action Plans – Construction Phase | Responsibility |
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| | | 23. Restrict traffic in the upper intertidal[2] and supralittoral zones[3] to minimum required.<br>24. Restrict traffic to clearly demarcated access routes and construction / laydown areas only.<br>25. As far as practically possible, locate pipeline laydown area in previously disturbed habitat.<br>26. Have good house-keeping practices in place during construction. | |
| | Construction noise, pylon-driving and blasting | 1. Inspect the area around the blasting site visually before blasting commences and blasting postponed should a marine mammal, sea turtle or flocks of swimming and diving birds be spotted within a 2-km radius around the blasting point.<br>2. Schedule the blasting programme to allow seals and other scavengers feeding on dead fish to have left the area before the next blasting event.<br>3. Restrict construction noise and vibration-generating activities to the absolute minimum required.<br>4. All blasting activities should be conducted in accordance with recognised standards and safety requirements. Rock-breaking and blasting may only be undertaken by a registered blaster once the relevant blasting permit has been obtained.<br>5. Restrict the number of blasts to the absolute minimum required, and to smaller, quick succession blasts directed into the rock using a time-delay detonation.<br>6. Avoid onshore blasting during the breeding season of shore-birds (October – June) and offshore blasting during the peak whale migration period (June – August and November - January).<br>7. Pre-blast surveys should be undertaken to ensure impact zones are clear of marine mammals and diving seabirds (large flocks) and only once the impact zone and an associated buffer zone (i.e., within a 2-km radius of blasting point) have been declared free of marine mammals and diving seabirds should blasting commence. It is also recommended that:<br>a. Observer teams are stationed some distances to the north and south of the blasting point (possibly just outside the impact zones) to monitor coastal dolphin movements immediately prior to any blasting. Observers are to be positioned at suitable vantage points (at some altitude) along the coast;<br>b. Observers on land should record and report all sensitive fauna, their positions, occurrence of calves and direction of movement to the Operations Manager.<br>8. Consider the use of a Passive Acoustic Monitoring (PAM) system to detect the presence of small cetaceans in the impact area prior to blasting, particularly if species of conservation importance are likely to be encountered in the area, or where a given species or group is difficult to detect by visual observation alone. Such monitoring can provide distance and bearing of the animals from the blast area. Although PAM would only identify animals that are calling or vocal, it has the advantage of 24 hour per day availability as opposed to visual monitoring, which can only be confidently carried out during daylight hours, or under adequate visibility conditions. | |

[2] Intertidal zone is the area where the ocean meets the land between high and low tides.

[3] Supralittoral is above the high-tide mark and is usually not under water.

| Reference Number | E&S Aspect/Issue | Mitigation Measures/Action Plans – Construction Phase | Responsibility |
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| | | 9. As a blasting event may attract seals and scavenging birds to stunned or dead fish, the blasting programme should be scheduled to allow seals to have left the area before the next blasts.<br>10. Development of a responsible blasting schedule. | |
| EMP-C-004 | Alien invasive vegetation | 1. Alien invasive seedlings and saplings must be removed as they become evident for the duration of construction.<br>2. Staff at the plant must be educated and made aware of alien vegetation that could be present and that must be eradicated.<br>3. Sourcing of fill material: any requirement for fill material to create a level platform for site development should be sourced from weed free areas to minimise the risk of spreading alien invasive species and to reduce the ongoing maintenance requirements.<br>4. On-site alien invasive plant monitoring and control (removal and disposal).<br>5. Clearing of vegetation should be limited to the development footprint areas.<br>6. Access roads should be planned in areas that have already been disturbed or transformed to limit additional fragmentation within the landscape and additional loss of vegetative cover.<br>7. All construction vehicles and equipment, as well as construction material should be free of plant material when leaving the site to avoid contamination of road reserves. Therefore, all equipment and vehicles should be thoroughly cleaned prior to leaving the site. | EPC Contractor |
| EMP-C-005 | Hazardous Substance Storage | 1. Hazardous substances stored on site should be within a bunded area and(or) contained in an appropriate, compatible, appropriately labelled containers to prevent reaction with containers and spillage during handling.<br>2. The relevant Material Safety Data Sheet (MSDS) should be clearly displayed in the hazardous substance storage area.<br>3. Storage to be located away from ephemeral drainage lines.<br>4. Relevant training should be provided to all employees/contractors on the correct storage and handling procedures and records of this training kept on site. | EPC Contractor |
| EMP-C-006 | Hazardous Substance Spills | 1. Construction vehicles and equipment will be regularly serviced off site. Spills of fuel and lubricants from vehicles and equipment will be contained using a drip tray with plastic sheeting filled with adsorbent material.<br>2. All equipment that is required to work in the intertidal and subtidal zones shall be inspected daily for oil and fuel leaks, and cleaned or repaired as required, prior to commencing with wet works.<br>3. Keep heavy vehicle traffic associated with pipeline installation in the coastal zone to a minimum. Only equipment and vehicles actively involved in construction should be permitted on the beach and in associated works areas. When not in use, and overnight, all equipment and plant must be withdrawn to higher ground. Once the design is finalised and the associated construction site is determined, the area located outside of the site should be clearly demarcated and regarded as a 'no-go' area. | EPC Contractor |

| Reference Number | E&S Aspect/Issue | Mitigation Measures/Action Plans – Construction Phase | Responsibility |
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| | | 4. Accidental spillage of potentially contaminating liquids and solids must be immediately contained and cleaned up by trained staff with the correct equipment and disposed of in an appropriate manner. In the event of a hazardous spill:<br>a. Immediately implement actions to stop or reduce the spill.<br>b. Contain the spill.<br>c. Arrange implementation of the necessary clean-up procedures.<br>d. Collect contaminated soil, water and other materials and dispose of it at an appropriate waste disposal site.<br>5. The Contractor shall ensure that a spill kit is kept on site and that staff are trained in its use to attend to any spillage of hydrocarbons.<br>6. Refuelling of equipment and plant shall not occur in the intertidal or subtidal zones. | |
| EMP-C-007 | Hazardous Waste | 1. Hazardous wastes are separated and contained in compatible, appropriately labelled containers to prevent reaction with containers and spillage during handling.<br>2. Storage of hazardous waste to be located away from any ephemeral drainage lines.<br>3. Storage areas must have clear signage for the various hazardous waste streams.<br>4. Potentially contaminating fluids and other hazardous wastes must be contained in containers on hard, level surfaces in contained and covered from rain, and be clearly marked.<br>5. Develop and implement a site-specific Hazardous Waste Management Plan (HWMP) for the management, handling and disposal of hazardous waste streams.<br>6. Hazardous waste will be trucked out and disposed of at a licensed landfill site. A waste manifest must be kept for all hazardous wastes that are disposed of and maintained on site.<br>7. Disposal and potential treatment of sewage and contaminated soil will be included in the HWMP. | EPC Contractor |
| EMP-C-08 | Soil Erosion | 1. The placement of soil stockpiles will be identified prior to the commencement of construction to minimise soil erosion.<br>2. Land clearance will only be undertaken just prior to construction of a particular activity and unnecessary land clearance must be avoided. Work areas will be clearly defined to avoid disturbance outside of the footprint.<br>3. Construction vehicles are to remain on designated prepared roads.<br>4. Design site drainage and stormwater runoff to minimise the risk of erosion. | EPC Contractor |
| EMP-C-009 | Fire | 1. No open fires shall be allowed on site, unless in safe areas specially demarcated for that purpose.<br>2. Ensure that the telephone number of the local Fire and Emergency Service is displayed at the site offices.<br>3. Ensure suitable fire-fighting equipment is provided on site. As a minimum this should include fire extinguishers, fire suppression system (as required, e.g., in power cabins) and a mobile water bowser.<br>4. Appoint a fire officer(s) from the staff who shall be responsible for ensuring immediate and appropriate action in the event of a fire as well as maintenance of the fire-fighting equipment. The appointed fire officer shall notify the local Fire and Emergency Services in the event of a fire and shall not delay doing so until such time as the fire is beyond his/her control.<br>5. Take all reasonable steps to prevent the accidental occurrence or spread of fire. | EPC Contractor |

| Reference Number | E&S Aspect/Issue | Mitigation Measures/Action Plans – Construction Phase | Responsibility |
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| | | 6. Ensure that all site personnel are aware of the procedure to be followed in the event of a fire.<br>7. Hot-work (e.g. welding, grinding, cutting torch, etc.) must take place in specially designated areas only.<br>8. Smoking is not allowed on site, other than at designated smoking points. Cigarette butts shall not be discarded on the ground. | |
| EMP-C-010 | Lighting | 1. Ensure that any lighting installed on the site does not interfere with road traffic or cause a reasonably avoidable disturbance to the surrounding users and local communities.<br>2. Install light fixtures that provide precisely directed illumination to reduce light "spillage" beyond the immediate surrounds of the site.<br>3. Avoid high pole top security lighting along the periphery of the site and use only lights that are activated on illegal entry to the site.<br>4. Minimise the number of light fixtures to the bare minimum, including security lighting.<br>5. During construction security lighting should only be used where necessary and carefully directed, preferably away from sensitive viewing areas.<br>6. Outdoor lights should be directed downwards and not up into the sky.<br>7. Direct the lights to shine exactly where illumination is needed.<br>8. Use yellow or amber outdoor lights because invertebrates don't detect yellow light as well as white.<br>9. Install insect screens in doors and windows located in buildings that are used after sunset. | EPC Contractor |
| EMP-C-011 | Concrete Mixing | 1. Concrete should be mixed within a mixing tray and/or ready mix should be utilised.<br>2. If ready-mix cement is not brought to site, concrete batching activities and/or mixing shall be located within the construction camp in areas of low environmental sensitivity.<br>3. Concrete mixing directly on the ground shall not be allowed and shall only take place on impermeable surfaces.<br>4. If concrete mixers are washed on site, then contaminated runoff water must be channelled to an impermeable collection point.<br>5. Washing of excess concrete into the ground or water resources is prohibited.<br>6. All cement-contaminated runoff from mixing areas shall be strictly controlled.<br>7. At the end of the contract, any ponds used for contaminated water collection shall be dried out and the solids disposed of appropriately.<br>8. Unused (full) cement bags shall be stored out of the rain and where runoff will not affect them;<br>9. Used cement bags shall not be used for any other purpose and shall be disposed of on a regular basis.<br>10. All excess concrete and aggregate shall be removed from site on completion of concrete works and disposed of appropriately. | EPC Contractor |
| EMP-C-012 | Construction Laydown Areas and Worker Accommodation | 1. The construction laydown areas shall be located at an easily accessible point and within an area of low environmental sensitivity (i.e., >50 m from the highwater mark).<br>2. The construction laydown areas shall be demarcated by a fence.<br>3. Suitable sanitary arrangements will be provided. There should be minimum one toilet for every 15 workers on site. Toilets must be easily accessible and shall be secured in order to prevent them from blowing over. | EPC Contractor |

| Reference Number | E&S Aspect/Issue | Mitigation Measures/Action Plans – Construction Phase | Responsibility |
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| | | 4. Ensure that all ablution facilities are maintained in a clean and sanitary condition.<br>5. Ensure that there is no spillage when the chemical toilets are cleaned and that the contents are properly removed from site.<br>6. Establish eating areas with adequate temporary shade to ensure that employees do not move off-site to eat.<br>7. Provide adequate refuse bins at all eating areas and ensure that all eating areas are cleaned up on a daily basis.<br>8. Ensure that there is access to clean drinking water for all employees on site. If water is stored on site, drinking water and multi-purpose water storage facilities shall be clearly distinguished and demarcated. | |
| **Socio-Economic Impacts** | | | |
| EMP-C-013 | Community Development, Local Employment and Local Content | 1. The competitive bidding process to design-build and operate the desalination plant should include providing a recruitment weighting for the component of Namibian staff employed at all levels of its workforce.<br>2. The bidding process should include proposals to involve Namibian Small and Medium Enterprises to be involved (e.g., using labour-based works) in the construction phase.<br>3. All local recruitment and labour management will be undertaken by the EPC Contractor, or third-party contractors, consistent with Namibian national labour and occupation health and safety laws. This will include any international obligations (including any applicable International Labour Organisation (ILO) provisions signed and ratified by Namibia).<br>4. Establish suitable Human Resources and Recruitment Procedures that establish rules for local recruitment and preferential employment. These procedures will be issued to the construction contractor for adoption with the own internal recruitment procedures during the construction phase. The procedures will also apply to the operational workforce.<br>5. Establish suitable local content procedures as part of their overall procurement system. The procedures will be issued to the construction contractor for adoption with the own internal procurement procedures during the construction phase. The procedures will also apply to local procurement of materials and services during the operational life of the Project.<br>6. For the purposes of local recruitment and procurement, the terms *local* shall be defined by multiple levels, and priority will be given to household and community in the order below:<br>a. Priority Level 1 – Households immediately surrounding the Project site and final transmission line (Wlotzkasbaken and Henties Bay).<br>b. Priority Level 2 – Communities nearest to the Project site and final transmission line in Swakopmund and Surrounds.<br>c. Priority Level 3 – Persons and businesses based in Erongo, and thereafter nationally.<br>7. Measures will be put in place to ensure no employee or job applicant is discriminated against on the basis of his or her race, gender, marital status, nationality, age, religion or sexual orientation. | EPC Contractor and NamWater |

| Reference Number | E&S Aspect/Issue | Mitigation Measures/Action Plans – Construction Phase | Responsibility |
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| | | 8. Develop a Labour Plan outlining the need to recruit and train local labour. A Local Recruitment Policy should be implemented to ensure that local procurement of labour is maximised.<br>9. Communicate all recruitment criteria for ongoing recruitment in advance.<br>10. No employment activities will take place at the entrance to the site. Only formal channels for employment will be used.<br>9. Management measures should be implemented to enhance skills development and on-the-job training.<br>10. The construction and operations company must strictly adhere to any rules and regulations regarding creating new tracks or other protective measures agreed with MEFT, prior to project commencement.<br>11. With limited experience of constructing, managing and operating a desalination plant of this magnitude in Namibia, the transfer of skills from expatriates to Namibians must be an essential component of the final construction and operating contract(s).<br>12. NamWater should increase its capabilities to manage PPP contracts by a combination of training staff (to a limited extent) but mainly by recruiting competent new staff members and by including external consultancy(ies).<br>13. NamWater should proactively give bursaries to Namibians in specific fields required for this project.<br>14. NamWater must oversee that its contractors promote sound worker-management relationships and safe and healthy working conditions. | |
| EMP-C-014 | Community Health, Safety and Security | 1. The construction contractor should not allow recruitment for unskilled and semi-skilled construction workers at the sites or camp, but only in Henties Bay, Swakopmund and the #Gaingu Conservancy offices.<br>2. The construction contractor must operate an alcohol-free and drug-free worksite which will include daily testing of employees/contractors on entry to the work site, at the beginning of shifts and at random times on duty.<br>3. The construction contractor must ensure that all armed security workers who may be engaged directly or by contract to provide security to the sites, are well trained so they do not cause a security risk to the workforce or nearby community.<br>4. Free condoms should be always in supply in every ablution block and toilet.<br>5. NamWater should ensure there are penalty clauses in the contracts for non-compliance with these mitigation measures.<br>6. Rip currents can also be dangerous to recreational beach users. It is recommended that recreational beach access to the site be prohibited during construction | EPC Contractor and NamWater |
| EMP-C-015 | Access, Traffic and Safety | 1. Only demarcated and approved access routes shall be used, routes and detailed schedule of deliveries shall be defined and approved by the EPC Contractor.<br>2. Driving licences/certificates and proof of training and adoption of drivers code of conduct shall be obtained from all delivery drivers.<br>3. Ensure that access through the site is always maintained for other road users and is in a suitable condition.<br>4. Ensure that all regulations relating to traffic management are observed. | EPC Contractor |

| Reference Number | E&S Aspect/Issue | Mitigation Measures/Action Plans – Construction Phase | Responsibility |
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| | | 5. Ensure that adequate traffic accommodation, signage and safety measures (as appropriate) are put in place on site but more importantly along transport routes delivering panels and equipment to site.<br>6. Ensure that any traffic and safety signage remain clear throughout the construction period and that it is replaced or relocated as appropriate at the end of the construction period.<br>7. Restrict traffic in the upper intertidal and supralittoral zones to minimum required. | |
| EMP-C-016 | Occupational Health and Safety | 1. The EPC Contractor, and where relevant any third-party contractors, will adopt all required occupational health and safety requirements as stipulated in Namibia, as well as conform with any relevant international best practice standards.<br>2. This will include the establishment of occupational health and safety policies, procedures and actions during both the construction and operational phase that results in strict adherence to health and safety measures by the EPC Contractor staff, third-party contractors and supply chain contractors.<br>3. Implement and manage an employee's noise management programme to manage noise induced hearing loss, according to the applicable regulation (Labour Act 1992, Occupational Health and Safety of Employees Regulation)<br>4. Provide Personal Protective Equipment (PPE), training and monitoring as well as ongoing safety checks and safety audits.<br>5. Provide adequate clean drinking water and safe food for all workers.<br>6. Workers will be provided with access to primary health care and basic first aid at worksites.<br>7. Develop and implement an internal Grievance Mechanism that is easily accessible to the employees, contractors and sub-contractors, through which complaints related worker rights and health and safety can be lodged and responded to.<br>8. Armed security workers who may be engaged directly or by contract to provide security to the sites, are to be well trained so they do not cause a security risk to the workforce or nearby community.<br>9. Free condoms should be always in supply in every ablution block and toilet.<br>10. NamWater should ensure there are penalty clauses in the contracts for non-compliance with these mitigation measures.<br>15. Develop and implement an employee health awareness program to educate employees (and contractors) about the importance of drinking water and identifying the early signs of heat stroke/dehydration; and<br>16. Provide employees with appropriate PPE to reduce the risk of heat stroke/dehydration. | EPC Contractor |
| EMP-C-017 | Seaworthiness and Construction Staff Competence | 1. The Contractor shall ensure that any vessel used to lay the ocean pipes is seaworthy and is equipped with all necessary safety and emergency equipment including flares, buoyancy devices, spill kits, first aid kits, air, or fog-horns and fire extinguishers.<br>2. All construction staff working at sea or within the active surf zone should first demonstrate a proficiency in swimming and should receive safety training.<br>3. The EPC Contractor shall limit construction at sea to day light hours, Monday to Friday and no construction on Saturdays, Sundays and public holidays due to the increase in recreational boating over these times and in the target area and increased risks associated with this. | EPC Contractor |

| Reference Number | E&S Aspect/Issue | Mitigation Measures/Action Plans – Construction Phase | Responsibility |
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| | | 4. The Contractor shall also observe weather forecast and only conduct construction operations during suitable weather conditions. The planning for the commencement of operations must also consider weather forecasts. | |
| EMP-C-018 | Landscape and Visual Amenity | 1. To reduce the visual impact of the Project on road users and nearby residents, the topography of the area be copied or mimicked and the slightly rolling topography be used as screens. This can be accomplished by creating berms to screen views from sensitive viewing points. This mitigation measure should however only be considered if feasible and on condition that no additional impacts be generated as a result of it.<br>2. Buildings are to be painted using a natural colour pallet.<br>3. Security fence to be finished in a colour that is not visually intrusive.<br>4. Security lighting at night to be aimed downward and used according to best practise standards.<br>5. Dust suppression techniques should be in place during the construction and decommissioning. | EPC Contractor |
| EMP-C-019 | Cultural Heritage | 1. Avoidance of known features.<br>2. Conduct a pre-construction survey of new project development areas.<br>3. Adhere to heritage site development plan.<br>4. In the event that previously unknown fossils, heritage resources or burial grounds and graves are exposed or found during the life of the Project by implement the chance find procedure when required.<br>5. Management of Chance Finds.<br>6. Avoidance and in situ preservation of heritage sites.<br>7. Monitoring of heritage features during construction and routine monitoring of land-clearing activities.<br>8. Contractors, Subcontractors, and employees should be sensitized to the procedures that must be followed in case of a discovery and the potential presence of archaeological resources that may be discovered during land-clearance and mechanical excavation activities. | EPC Contractor |
| | Coastal Physical Processes and Dynamics | 1. Minimise the extent of the construction footprint by limiting the construction site to a reasonable size for the required activities to prevent unnecessary disturbance,<br>2. Minimising the dimensions of the trench and the duration of construction<br>3. Demarcate the agreed area and access routes and monitoring by the on-site Environmental Compliance Officer (ECO) and Site Engineer.<br>4. Contractor must remove all temporary works from the beach as far as reasonably practicable.<br>5. Reinstatement of the beach profile to its pre-construction form. | EPC Contractor |

### 4.6.5 Construction Phase Monitoring Plan

**Table 4-2: Construction Phase Monitoring Plan**

| Reference Number | E&S Aspect/Issue | Monitoring Aspects – Construction Phase | Monitoring Frequencies | Monitoring Parameters | Key Performance Indicators/Limits | Responsibility |
|---|---|---|---|---|---|---|
| MP-C-001 | Ecology | 1. Ensure that the fence surrounding the plant is erected at the initial stages of construction.<br>2. Monitor access control during construction.<br>3. The no-go areas identified during site walk over are to be inspected to ensure integrity has not been compromised during construction. | Prior to construction and monthly after construction started. | Changes to pre-construction conditions | No access into no-go areas | EPC Contractor |
| MP-C-002 | Rehabilitation/Restoration | 1. Areas which have been restored or rehabilitated should be checked regularly to monitor natural plant regrowth and presence of erosion.<br>2. A general topographic and photographic survey of the site should be conducted by the contractor to document the pre-construction state of the coastal zone. This should be used to verify successful impact mitigation, such as post-construction reinstatement of the beach profile and removal of construction materials from temporary works.<br>3. The impacts of the construction activities on updrift and downdrift shorelines should be monitored to highlight risks. It is recommended that two cross-shore beach profiles updrift and downdrift of the shore crossing (approximately 100 m and 500 m on either side) be surveyed by the contractor once every two weeks. The profiles should include one profile immediately south of the Orano shore crossing to highlight any risks to the infrastructure. Profiles should be surveyed during spring low tide to ensure the greatest coverage of the beach profile. | Bi-weekly (during construction)<br><br>After construction - 1 month, 3month and 1 year after completion of construction and then annually thereafter up to 5 years after completion. | Extent of regrowth and presence of erosion. | No erosion<br>Re-instatement of the beach profile | EPC Contractor |

| Reference Number | E&S Aspect/Issue | Monitoring Aspects – Construction Phase | Monitoring Frequencies | Monitoring Parameters | Key Performance Indicators/Limits | Responsibility |
|---|---|---|---|---|---|---|
| MP-C-003 | Noise | Monitor community complaints with respect to noise. | Ongoing | Complaints from local communities | Zero complaints | EPC Contractor |
| MP-C-004 | Air Emissions | Visual monitoring of fugitive dust (particulate matter) emissions.<br>Monitoring of complaints by local communities. | Ongoing | Visual inspection | Zero complaints received | EPC Contractor |
| MP-C-005 | General Waste | General waste handling, storage, transport and disposal management. | Monthly | Quantity ($m^3$) of general waste produced.<br>Quantity ($m^3$) of waste recycled.<br>On site waste handling and storage area inspections.<br>Tracking of corrective actions. | Zero non-compliances with EMP waste management requirements. | EPC Contractor |
| MP-C-006 | Hazardous Waste | Hazardous waste handling, storage and disposal management | Monthly | Types and quantity ($m^3$) of hazardous waste generated.<br>Labelling of hazardous waste storage containers (through inspections).<br>Waste Manifest Documentation.<br>Site/contractor/disposal facility weighbridge slips. | 100% of hazardous waste disposed of (or recycled) at suitably licensed facilities.<br>Zero non-compliances with EMP waste management requirements.<br>Permits/licenses for all waste transported and disposal facilities used.<br>Accurate waste tracking documents (including disposal records) available for all waste streams. | EPC Contractor |
| MP-C-007 | Employee Health and Safety | 1. H&S Inspections (compliance with H&S plans, procedures, SOP, etc.) | 1. Weekly | Namibian labour law | 1. Legal requirements | EPC Contractor |

| Reference Number | E&S Aspect/Issue | Monitoring Aspects – Construction Phase | Monitoring Frequencies | Monitoring Parameters | Key Performance Indicators/Limits | Responsibility |
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| | | 2. H&S legal compliance audits | 2. Annually | EPC Contract | 2. Contractual requirements | |
| MP-C-008 | Grievances | Grievances logged and tracking of items | Monthly | 1. Resolution Time Frame.<br>2. Satisfaction with Process and Outcome | Zero unresolved grievances | EPC Contractor (records) and NamWater (manage & track) |
| MP-C-009 | Local Employment | Number of local people employed compared to total number of people employed. Numbers for woman to be indicated. | Monthly | Number of local people employed compared to total number of people employed. | In line with NamWater policies | EPC Contractor |
| MP-C-010 | Community H&S | Number of community H&S incidents | Monthly | Number of community H&S incidents | Zero community H&S incidents | EPC Contractor |
| MP-C-011 | Heritage | Clearing activities and Excavation/ construction activities<br>Known Heritage Sites | Weekly – During Construction<br>Monthly – first year<br>Yearly thereafter | Number of heritage resources encountered. | Zero heritage sites encountered/impacted | EPC Contractor |
| MP-C-012 | Flooding (Refer to guideline in Appendix I for further detail) | 1. Inspection of flooding of infrastructure must be undertaken during an intense rainfall event where drainage lines are likely to flow.<br>2. This includes built up infrastructure, particularly at the desalination plant, intake works and pump station.<br>3. A combination of sandy soil which saturates quickly and an increase in impervious areas might cause the desalination and pump station area to be vulnerable to flooding. | After heavy storms and during all rainfall storms during the wet season. | Inspection of:<br>• Access roads to the desalination and pump station<br>• Stormwater management infrastructure<br>• Workshop/office areas<br>• Pump station area | No flooding | ECO and/or RE |
| MP-C-013 | Surface water quality (Refer to guideline in Appendix I for further detail) | 1. Various chemicals could be used and stored such as chlorine gas, oil, fuel and other hydrocarbons during all project phases. These chemicals might | Quarterly | Namibia water quality guidelines | As per the legal requirement | ECO and/or RE |

| Reference Number | E&S Aspect/Issue | Monitoring Aspects – Construction Phase | Monitoring Frequencies | Monitoring Parameters | Key Performance Indicators/Limits | Responsibility |
|---|---|---|---|---|---|---|
| | | spill and contaminate soils which after rains would result in contamination of surface water. Clearing of vegetation and topsoil on site might silt up drainage lines.<br>2. Location of monitoring points are provided the specialist report. Additional monitoring points and locations can be established during the first monitoring. | | | | |
| MP-C-014 | Soil erosion and sedimentation (Refer to guideline in Appendix I for further detail) | Soil erosion and sedimentation monitoring in all potential soil erosion locations. Erosion and scour can occur where water is dispersed or concentrated. | After every rainstorm or flood event | Presence of erosion | No erosion | ECO and/or RE |
| MP-C-015 | Leakage/spill events (Refer to guideline in Appendix I for further detail) | 1. A leak and spill management plan must be formulated to monitor and detect as soon as possible.<br>2. Site walkovers to determine the condition of facilities and identify any leaks or overflows, blockages, overflows, and system malfunctions for immediate remedial actions. | Monthly or directly after a leakage has been detected | Inspect access roads and areas where vehicles commute and areas where chemical storage containers are located (e.g., fuelling stations) and workshop areas. Areas where leakage is visible/detected. | No spills/leakages | ECO and/or RE |
| MP-C-016 | Infrastructure (Refer to guideline in Appendix I for further detail) | Inspection of the stormwater management measures, channels/ diversions, and culverts for signs of erosion, cracking and silting to ensure the performance of these are still as intended. | Daily | Erosion, cracking and silting of stormwater management measures, channels/ diversions, and culverts | No erosion, cracking and silting of stormwater management measures, channels/ diversions, and culverts | ECO and/or RE |

## 4.7 OPERATIONAL PHASE

### 4.7.1 Introduction

Following the construction phase, the project will enter into the commissioning and operations phase of the project lifecycle. It is likely that NamWater will appoint an O&M Operator to oversee the operations phase of the project. However, NamWater will retain ultimate responsibility for the management and compliance of the facility in line with this ESMP, all statutory requirements and any conditions associated with the environmental clearance. It is also possible that NamWater would develop and extend its HSE system and associated policies and procedures to include the operation of this facility. The O&M Operator will, therefore, need to work closely with NamWater to ensure the facility meets all the requirements of the NamWater HSE system and demonstrate commitment to the continual improvement philosophy that underpins and Environmental Management System.

This section of the ESMP contains specific measures associated with the operation of the desalination plant and the mitigation of potential impacts. Any O&M operations that involve construction-type activity or repair work to any of the structures or infrastructure shall be conducted in accordance with the provisions set out under the construction phase of this ESMP (Refer to Section 4.6).

### 4.7.2 Operational Phase EMP

Table 4-3 sets out the relevant management measures to be implemented during the operational phase. Mitigation measures have been divided into Biophysical, Ecological and Socio-economic components as per the ESIA structure.

## Table 4-3: Operational Phase EMP

| Reference Number | E&S Aspect/Issue | Mitigation Measures/Action Plans – Operational Phase | Responsibility |
|---|---|---|---|
| **Biophysical Impacts** | | | |
| EMP-OP-001 | Air Emissions | 1. Adopt measures to control the generated of fugitive dust from traffic including limiting vehicle speeds to 20 km/hr on the access road to site and on site. An appropriate speed must be adopted on access roads to the site to ensure limited dust generation.<br>2. Ensure that fugitive dust emissions will be actively managed during the operational life of the Project.<br>3. Establish a grievance mechanism throughout the operation phase to deal with any community complaints regarding dust. | O&M Operator |
| | Greenhouse Gas Emissions | 1. Pumps, variable speed drives, and energy recovery systems must be maintained in accordance with the manufacturers' specifications, thereby reducing electricity consumption.<br>2. Cartridge filters and Reverse Osmosis (RO) membranes must be replaced in accordance with the manufacturers' specifications, thereby reducing electricity consumption.<br>3. An energy and carbon management plan should be prepared with the desalinisation plant and water carriage system. This plan should include emission reduction targets and practical energy efficiency initiatives. | O&M Operator |
| | Noise Emissions | 1. External extraction fans and engine or generator exhausts are fitted with appropriate attenuators to minimize noise emissions and hence the affected area.<br>2. Compressed air or other pressurized system release valve noise events should be managed and implemented by the supplier using appropriate silencers or attenuators. | O&M Operator |
| EMP-OP-002 | Contamination of surface water resources | 1. Stormwater management measures have been recommended whereby:<br>a. Dirty water catchments will be separated from clean water catchments.<br>b. Clean water diversion berms will be designed to divert any clean surface water generated upstream of the proposed infrastructure, away from the development and dirty water areas.<br>c. Dirty water will be collected in lined channels and contained. Containment facilities will be lined and sized to contain at least the 1:100-year storm event in accordance with World Bank Group Environmental, Health and Safety (EHS) Guidelines (April 2007) requirements.<br>d. Dirty water that cannot be contained or re-used will be treated before being discharged into the environment.<br>e. Dirty water dams/ponds must be designed, constructed, maintained, and operated to have a minimum of a 0.8 m freeboard above full supply level.<br>2. Water quality monitoring should be undertaken as per the monitoring programme (as outlined in Appendix I).<br>3. An emergency response plan procedure should be formulated and adhered to during any occurrence of incident discharge or spillage of chemicals.<br>4. Good housekeeping practices should be implemented and maintained by timeous cleaning-up of accidental spillages. Waste should be disposed to a licensed waste site. In addition, spill cleaning kits and material safety data sheets for chemical and hazardous substances should be accessible and available.<br>5. Adhere to the mitigation measures as per the SWMP (Appendix G). | O&M Operator |

| Reference Number | E&S Aspect/Issue | Mitigation Measures/Action Plans – Operational Phase | Responsibility |
|---|---|---|---|
| | | | |
| | Flooding | 1. Rainwater harvesting is also recommended to manage water emanating from impervious areas.<br>2. Monitoring and inspection of channels, containment berms, silt traps, culverts, pipelines for signs of erosion, cracking, silting and blockages of inflows, to ensure the efficient performance of the storm water infrastructure during storm events is recommended.<br>3. Monitoring should be undertaken monthly during the wet season and after storm events or as per the site management schedule, where available.<br>4. The monitoring plan should be reviewed regularly to ensure effectiveness of measures recommended. | O&M Operator |
| | Alteration of Natural Drainage Patterns and Flow | 1. The increased flow resulting from the development must be managed by the SWMP measures (Appendix G) to avoid frequent stormwater discharges into the downstream watercourses and provide some flow attenuation. | O&M Operator |
| Ecological Impacts | | | |
| EMP-OP-003 | Avifauna | 1. Ensure strict and effective waste management (including of food), to discourage an unnatural increase in scavenging species such as Pied Crow.<br>2. Avoid creating new habitats with open water, e.g., accumulations of stormwater or pipe leakages/open water/run-off, that may attract birds. | O&M Operator |
| EMP-OP-004 | Terrestrial ecology | 1. Keep the overall development footprint as small as possible.<br>2. Mitigation actions specifically for the two water pipelines include:<br>a. Use the same road during construction and for maintenance during operations.<br>b. The road should be close to the pipeline to ensure a narrow strip of disturbance.<br>c. Excavated and laid-down soil should be levelled.<br>d. Lay the pipeline as close as possible to the exiting road reserve, in an already disturbed area.<br>3. Strictly enforce a no-go policy on the lichen field at the site of the desalination plant. It is recommended that the no-go area be demarcated prior to commencing with construction.<br>4. All roads and tracks should be planned to minimise fragmentation or disturbance of habitats.<br>5. Anti-erosion measures should be taken where roads and tracks cross a wash or drainage line.<br>6. Educate construction and permanent staff as to their environmental obligations. All contractors should be held responsible for transgressions, and significant penalties should be levied to ensure compliance.<br>7. Erect linear structures (pipelines) as close as possible to existing roads and tracks.<br>8. Hummock dunes: supply road for intake pipeline during construction should be routed / aligned on the exact route where the maintenance road during operations will be located. This will minimise destruction of the dunes.<br>9. No sewerage overflow or French drain may be placed within 100 m of a large drainage.<br>10. Identify nests, dens, burrows and other breeding locations, demarcate them, and avoid these sites. If avoidance is not possible, commission specialists to relocate the animals. | O&M Operator |

| Reference Number | E&S Aspect/Issue | Mitigation Measures/Action Plans – Operational Phase | Responsibility |
|---|---|---|---|
| | | 11. Reptiles that are exposed during ground clearing should be captured for translocation by a qualified expert.<br>12. No collection of plants should be allowed. No fires should be allowed on site.<br>13. Avoid damage to lichens by staying on designated roads and restricting foot and vehicle traffic to the project site.<br>14. Strict adherence to the Management Plan for the Dorob National Park(Appendix K).<br>*15.* Should any of the following species be found on site a permit needs to be obtained from MEFT before it may be removed, and all efforts should be made to relocate individual plants where feasible: *Commiphora saxicola, Eberlanzia sedoides, Euphorbia giessi, Euphorbia mauritanica, Euphorbia phylloclada, Hoodia currori and Welwitschia mirabilis.*<br>16. Project engineers and managers should work closely with the restoration expert from the planning and through all implementation phases.<br>17. Some rehabilitation actions should be implemented during operations in order to be effective, e.g. removal and storage of topsoil; location of waste dumps; road and pipeline locations.<br>18. Care should be taken to prevent substrate disruption along the proposed pipeline from the desalination plant to the existing pipeline by staying on designated roads and keeping foot and vehicle traffic away from the lichen field.<br>19. The extent of the operation should be clearly demarcated on site layout plans, and on the ground, it should be either fenced in or marked with clear signposts.<br>20. Areas surrounding the desalination plant and related installations that are not part of the demarcated development should be considered no-go zones. No employees, visitors, vehicles, or machinery should be allowed in such zones.<br>21. Infrastructure should be confined to as narrow a strip as possible.<br>22. Passovers designed for large mammals should be built across both proposed pipelines. A specialist should be engaged to design the passovers (in cooperation with the project engineers) so that they are suitable for large mammals, there are enough, and they are located optimally.<br>23. No off-road driving or driving next to established roads/tracks should be allowed.<br>24. No fires should be allowed on site.<br>25. Train all staff and contractors how to interact with wildlife in a sensitive and situation-appropriate manner.<br>26. A specialist on brown hyaenas should be consulted for input on the restoration/rehabilitation plan during the detailed design phase. The plan should make provision for adequate corridors for hyaenas and other large animals to migrate.<br>27. Adherence to the restoration plan should be strictly enforced. | |
| EMP-OP-005 | Marine ecology | 1. Blend membrane storage fluid and co-discharges generated during rinsing of the membranes with the discharged seawater and ensure adequate dilution.<br>2. Undertake 'pigging' of intake pipelines to reduce the need for and costs of biocides.<br>3. Use a non-oxidising biocide (dibromonitrilopropionamide (DBNPA)) in preference to chlorine.<br>4. Implement intermittent shock dosing of biocide in preference to continual dosing.<br>5. If an oxidising biocide is used, monitor the brine for excessive bacterial re-growth and if necessary use SMBS shock dosing to reduce bacterial numbers (note that the brine will be oxygen depleted after this treatment and needs to be aerated before discharge). | O&M Operator |

| Reference Number | E&S Aspect/Issue | Mitigation Measures/Action Plans – Operational Phase | Responsibility |
|---|---|---|---|
| | | 6. Dechlorinate effluent with sodium metabisulphite (SMBS) prior to discharge.<br>7. Avoid overdosing of SMBS to ensure oxygen levels in the effluent are not reduced.<br>8. Implement a water quality monitoring programme to monitor constituents of the effluent (e.g. residual chlorine, dissolved oxygen, halogenated by-products, bacterial load) to validate the predictions of the hydrodynamic modelling study (see later) and to ensure compliance with water quality guidelines.<br>9. Use low-toxicity chemicals as far as practicable.<br>10. Collect residual cleaning solutions and membrane filter washes and neutralize and remove solids before discharge.<br>11. Treat sludge in an on-site sludge handling facility or transported to a landfill site.<br>12. Limit the use of scale-control additives to minimum practicable quantities.<br>13. Avoid antiscalants that increase nutrient levels (e.g., polyphosphate antiscalants).<br>14. Select an antiscalant that has relevant eco-toxicological testing.<br>15. Conduct Whole Effluent Toxicity (WET) testing of the brine effluent to evaluate the integrated effects of all chemicals in the discharge on the ability of specific test organisms to survive, grow and reproduce. The tests consist of a control and a minimum of five effluent concentrations. The US-EPA recommends the use of ≥0.5 dilution factor and five effluent concentrations and a control. The test duration is typically 24, 48, or 96 hours.<br>16. Monitor corrosion rate in the plant, establish limits for heavy metal concentrations in the brine discharges (e.g. copper, cadmium, lead, mercury, nickel, chromium, and arsenic), and monitor the brine regularly to avoid exceedance of these limits. | |
| EMP-OP-006 | Alien invasive vegetation | 1. Monitor for any emerging Alien Invasive Species (AIS) and ensure that these are rapidly removed. Only environmentally approved herbicides that comply with Namibian legal requirements and relevant international conventions should be used. Persistent Organic Pollutants (POPs) and Pesticides as listed by UNEP will not be allowed.<br>2. Staff at the plant must be educated and made aware of alien vegetation that could be present and that must be eradicated.<br>3. Quarterly inspections around the site shall be performed in order to identify any alien invasive vegetation. If encountered, then:<br>i. Alien vegetation management shall be undertaken within all areas disturbed by construction activities for a period of a year after project completion; and<br>ii. Any alien vegetation removal shall be undertaken by a suitably qualified sub-contractor.<br>4. No on-site burying, dumping, stockpiling or burning of any weeds and alien plant species may occur. Such material shall be removed from the site and disposed of at a suitable municipal collection point or landfill site from where seed cannot escape. | O&M Operator |
| EMP-OP-007 | Hazardous Substance Storage | 1. Hazardous substances stored on site should be within a bunded area and(or) contained in an appropriate, compatible, appropriately labelled containers to prevent reaction with containers and spillage during handling.<br>2. The relevant MSDS sheets should be clearly displayed in the hazardous substance storage area.<br>3. Relevant training should be provided to all employees/contractors on the correct storage and handling procedures and records of this training kept on site. | O&M Operator |

| Reference Number | E&S Aspect/Issue | Mitigation Measures/Action Plans – Operational Phase | Responsibility |
|---|---|---|---|
| EMP-OP-008 | Hazardous Substance Spills | 1. Hazardous substances stored on site should be within a bunded area and(or) contained in an appropriate, compatible, appropriately labelled containers to prevent reaction with containers and spillage during handling.<br>2. Appoint a dedicated environmental control officer to monitor all environmental aspects of, commissioning and operation.<br>3. Maintain vehicles and equipment to ensure that no oils, diesel, fuel or hydraulic fluids are spilled.<br>4. Vehicles should have a spill kit (peatsorb/ drip trays) onboard in the event of a spill.<br>5. Ensure regular collection and removal of refuse and litter from intertidal and coastal areas.<br>6. Have good house-keeping practices in place at all times.<br>7. Accidental spillage of potentially contaminating liquids and solids must be immediately contained and cleaned up by trained staff with the correct equipment and disposed of in an appropriate manner. | O&M Operator |
| EMP-OP-009 | Hazardous Waste | 1. Hazardous wastes must be separated and contained in compatible, appropriately labelled containers to prevent reaction with containers and spillage during handling.<br>2. Storage areas must have clear signage for the various hazardous waste streams.<br>3. Potentially contaminating fluids and other hazardous wastes must be contained in containers on hard, level surfaces in contained and covered locations, and be clearly marked.<br>4. Develop and implement a site specific HWMP for the management, handling and disposal of hazardous waste streams.<br>5. Hazardous waste will be trucked out and disposed of at a licensed landfill site. A waste manifest must be kept for all hazardous wastes that are disposed of and maintained on site.<br>6. Disposal and potential treatment of sewage and contaminated soil will be included in the HWMP. | O&M Operator |
| EMP-OP-010 | Fire | 1. Ensure that the telephone number of the local Fire and Emergency Service is displayed at the site offices.<br>2. Ensure suitable fire-fighting equipment is provided on site. As a minimum this should include fire extinguishers, fire suppression system (as required, e.g. in power cabins) and any additional requirements as specified in the emergency response plan.<br>3. Appoint a fire officer who shall be responsible for ensuring immediate and appropriate action in the event of a fire as well as maintenance of the fire-fighting equipment. The appointed fire officer shall notify the local Fire and Emergency Services in the event of a fire and shall not delay doing so until such time as the fire is beyond his/her control.<br>4. Take all reasonable steps to prevent the accidental occurrence or spread of fire.<br>5. Ensure that all site personnel are aware of the procedure to be followed in the event of a fire.<br>6. Hot-work (e.g. welding, grinding, cutting torch, etc.) must take place in specially designated areas only.<br>7. Smoking is not allowed on site, other than at designated smoking points. Cigarette butts shall not be discarded on the ground. | O&M Operator |
| EMP-OP-011 | Lighting | 1. Ensure that any lighting installed on the site does not interfere with road traffic or cause a reasonably avoidable disturbance to the surrounding users and local communities.<br>2. Install light fixtures that provide precisely directed illumination to reduce light “spillage” beyond the immediate surrounds of the site. | O&M Operator |

| Reference Number | E&S Aspect/Issue | Mitigation Measures/Action Plans – Operational Phase | Responsibility |
|---|---|---|---|
| | | 3. Minimise the number of light fixtures to the bare minimum, including security lighting.<br>4. Avoid lights on high poles and rather install motion detectors to limit light use to the minimum possible.<br>5. Outdoor lights should be directed downwards and not up into the sky.<br>6. Direct the lights to shine exactly where illumination is needed.<br>7. Use yellow or amber outdoor lights because invertebrates don't detect yellow light, as well as white.<br>8. Install insect screens in doors and windows located in buildings that are used after sunset.<br>9. Lighting on any high structures (e.g., weather/communication masts) should preferably be flashing rather than static ; and red, intermittent lighting is recommended in general, if permitted by the Namibian Civil Aviation Authority (NCAA). | |
| Socio-Economic Impacts | | | |
| EMP-OP-012 | Community Development, Local Employment and Local Content | 1. The competitive bidding process to design-build and operate the desalination plant should include providing a recruitment weighting for the component of Namibian staff employed at all levels of its workforce.<br>2. The bidding process should include proposals to involve Namibian Small and Medium Enterprises to be involved (e.g. using labour-based works) in the construction phase.<br>3. With limited experience of constructing, managing and operating a desalination plant of this magnitude in Namibia, the transfer of skills from expatriates to Namibians must be an essential component of the final construction and operating contract(s).<br>4. NamWater should increase its capabilities to manage PPP contracts by a combination of training staff (to a limited extent) but mainly by recruiting competent new staff members and by including external consultancy(ies).<br>5. NamWater should proactively give bursaries to Namibians in specific fields required for this project.<br>6. NamWater must oversee that its contractors promote sound worker-management relationships and safe and healthy working conditions.<br>7. NamWater should publicly report annually on the progress made by the IPP, joint venture partner(s), contractors and NamWater itself, to transfer skills and jobs to Namibians. | O&M Operator |
| | Socio-Economic considerations | 1. NamWater should ensure the designs for Phase 1 of SS1 and subsequent phases, are not over-capitalised in any one phase to keep costs as low as possible.<br>2. NamWater should negotiate grants / subsidies / favourable interest rates / longer pay-back periods from collaborating financiers to reduce the overall capital costs of the project.<br>3. NamWater and municipalities, in consultation with all stakeholders, should propose a new tariff structure for all coastal users that is fair and transparent yet subsidises the most vulnerable.<br>4. NamWater should monitor the impacts of its tariffs on the pricing of potable water to the most vulnerable communities at the coast.<br>5. NamWater should charge the mines, and any other large commercial user, a simpler, more equitable and more transparent pricing system | NamWater |
| EMP-OP-013 | Occupational Health and Safety | 1. The O&M Operator, and where relevant any third-party contractors, will adopt all required occupational health and safety requirements as stipulated under the Namibian labour law, as well as conform with any relevant international best practice standards. | O&M Operator |

| Reference Number | E&S Aspect/Issue | Mitigation Measures/Action Plans – Operational Phase | Responsibility |
|---|---|---|---|
| | | 2. This will include the establishment of occupational health and safety policies, procedures and actions during both the construction and operational phase that results in strict adherence to health and safety measures by the O&M Operator staff, third-party contractors and supply chain contractors.<br>3. Provide PPE, training and monitoring as well as ongoing safety checks and safety audits.<br>4. Provide adequate clean drinking water and safe food for all workers.<br>5. Workers will be provided with access to primary health care and basic first aid at worksites.<br>6. Develop and implement an employee health awareness program to educate employees (and contractors) about the importance of drinking water and identifying the early signs of heat stroke/dehydration; and<br>7. Provide employees with appropriate PPE to reduce the risk of heat stroke/dehydration. | |

### 4.7.3 Operational Phase Monitoring Plan

**Table 4-4: Operational Phase Monitoring Plan**

| Reference Number | E&S Aspect/Issue | Monitoring Aspects – Operational Phase | Monitoring Frequencies | Monitoring Parameters | Key Performance Indicators/Limits | Responsibility |
|---|---|---|---|---|---|---|
| MP-OP-001 | Ecology | The no-go areas identified during the site walk over and incidentally during operation should be monitoring to the integrity of these features is maintained | Biannually (for period of 5 years) | Changes/impacts to pre-construction conditions | No nett loss when compared to baseline conditions prior to constriction. | O&M Operator |
| MP-OP-002 | Alien vegetation | Monitoring of alien invasive plants. | Quarterly | Numbers/areas and locations of alien invasive plant species. | Zero presence of alien invasive plant species. | O&M Operator |
| MP-OP-003 | General Waste | General waste handling, storage and disposal management. | Quarterly | Quantity of general waste produced.<br>Quantity of waste recycled.<br>On site waste handling and storage area inspections.<br>Tracking of corrective actions. | NA | O&M Operator |
| MP-OP-004 | Hazardous Waste | 1. Hazardous waste handling, storage and disposal management plan | Annually | Types and quantity ($m^3$) of hazardous waste generated.<br>Labelling of hazardous waste storage containers (through inspections).<br>Waste Manifest Documentation.<br>Site/contractor/disposal facility weighbridge slips. | 100% of hazardous waste disposed of (or recycled) at suitably licensed facilities.<br>Zero non-compliances with EMP waste management requirements.<br>Permits/licenses for all waste transported and disposal facilities used.<br>Accurate waste tracking documents (including disposal | O&M Operator |

| Reference Number | E&S Aspect/Issue | Monitoring Aspects – Operational Phase | Monitoring Frequencies | Monitoring Parameters | Key Performance Indicators/Limits | Responsibility |
|---|---|---|---|---|---|---|
| | | | | | records) available for all waste streams. | |
| MP-OP-005 | Employee Health and Safety | 1. H&S Inspections (compliance with H&S plans, procedures, SOP, etc.)<br>2. H&S legal compliance audits | 1. Monthly<br>2. Annually | 1. Namibian labour laws | Namibian labour law O&M Contract | 1. Legal requirements<br>2. Contractual requirements |
| MP-OP-006 | Grievances | Grievances logged and tracking of items | Monthly | 1. Resolution Time Frame.<br>2. Satisfaction with Process and Outcome | Zero unresolved grievances | O&M Operator (records) and NamWater (manage & track) |
| MP-OP-007 | Local Employment | Number of local people employed compared to total number of people employed. Numbers for woman to be indicated. | Annually | Number of local people employed compared to total number of people employed. | As per NamWater employment policies and Namibian legislative requirements | O&M Operator |
| MP-OP-008 | Community H&S | Number of community H&S incidents | Monthly | Number of community H&S incidents | Zero community H&S incidents | O&M Operator |
| MP-OP-009 | Enterprise Development (ED) and Socio-Economic Development (SED) | ED and SED initiatives implementation and progress. | Monthly | To be defined in O&M Contract | O&M Contract | O&M Operator |
| MP-OP-010 | Physiochemical monitoring of the brine (Refer to guideline in Appendix F for further detail) | 1. Implement a water quality monitoring programme to validate the predictions of the hydrodynamic modelling study and monitor constituents of the effluent to ensure compliance with water quality guidelines (e.g., salinity, residual chlorine, dissolved oxygen, halogenated by-products, bacterial load.<br>2. Monitor corrosion rate in the plant. | Once a month for the initial six- to 12-month period of operation | Effluent Water quality samples should be analysed for salinity, pH and for any biocides, antiscalants and Clean-in-Place (CIP) chemicals that are used in the plant.<br><br>Establish limits for heavy metal concentrations in the brine discharges (e.g., copper, cadmium, lead, mercury, | As per the guidelines. | O&M Operator |

| Reference Number | E&S Aspect/Issue | Monitoring Aspects – Operational Phase | Monitoring Frequencies | Monitoring Parameters | Key Performance Indicators/Limits | Responsibility |
|---|---|---|---|---|---|---|
| | | | | nickel, chromium, and arsenic), and monitor the brine regularly to avoid exceedance of these limits. | | |
| MP-OP-011 | Biological monitoring | 1. Biological marine monitoring, diffusion and whole effluent toxicity test and validation requirements. | As per the guideline (Appendix E) | As per the guideline (Appendix E) | As per the guideline (Appendix E) | As per the guideline (Appendix E) |
| MP-OP-012 | Noise emissions (not covered under grievance mechanism) | 1. Once the plant is fully operational, commissioning noise measurements (monitoring) must be conducted by a qualified independent acoustic consultant. For survey details please refer to NamWater Desalination ESIA Report 2023 – Noise Impact Assessment. | Not later than 3 months after full plant operation commencement | As per guideline | As per guideline | O&M Operator |
| MP-OP-013 | Climate Change | 1. Continuously monitor seawater temperature at the intake. Should the seawater temperature near the design range of the plant, additional measures may need to be identified and implemented to keep seawater temperature within the optimal range. | Duration of operations phase | Ongoing | Periodic monitoring of the seawater temperature at the intake. | Business Unit Coastal |
| MP-C-014 | Flooding (Refer to guideline in Appendix I for further detail) | 1. Inspection of flooding of infrastructure must be undertaken during an intense rainfall event where drainage lines are likely to flow. This includes built up infrastructure, particularly at the desalination plant, intake works and pump station. A combination of sandy soil which saturates quickly and an increase in impervious areas might cause the desalination and pump station area to be vulnerable to flooding. | After heavy storms and during all rainfall storms during the wet season. | Inspection of:<br>• Access roads to the desalination and pump station<br>• Stormwater management infrastructure<br>• Workshop/office areas<br>• Pump station area | No flooding | ECO and/or RE |
| MP-C-015 | Surface water quality (Refer to guideline in | 1. Various chemicals could be used and stored such as chlorine gas, oil, fuel and other hydrocarbons during all project phases. These | Quarterly | Namibia water quality guidelines | As per the legal requirement | ECO and/or RE |

| Reference Number | E&S Aspect/Issue | Monitoring Aspects – Operational Phase | Monitoring Frequencies | Monitoring Parameters | Key Performance Indicators/Limits | Responsibility |
|---|---|---|---|---|---|---|
| | Appendix I for further detail) | chemicals might spill and contaminate soils which after rains would result in contamination of surface water. Clearing of vegetation and topsoil on site might silt up drainage lines.<br>2. For location of monitoring points please refer to NamWater Desalination ESIA Report 2023 – Surface Water Impact Assessment. Additional monitoring points and locations can be established during the first monitoring. | | | | |
| MP-C-016 | Soil erosion and sedimentation (Refer to guideline in Appendix I for further detail) | 1. Soil erosion and sedimentation monitoring in all potential soil erosion locations. Erosion and scour can occur where water is dispersed or concentrated. | Monthly during first, the wet season or during routine maintenance inspections, as applicable. | Presence of erosion | No erosion | ECO and/or RE |
| MP-C-017 | Leakage/spill events (Refer to guideline in Appendix I for further detail) | 1. A leak and spill management plan must be formulated to monitor and detect as soon as possible.<br>2. Site walkovers to determine the condition of facilities and identify any leaks or overflows, blockages, overflows, and system malfunctions for immediate remedial actions. | Monthly, or directly after a leakage has been detected and during maintenance activities | Inspect access roads and areas where vehicles commute and areas where chemical storage containers are located (e.g., fuelling stations) and workshop areas. Areas where leakage is visible/detected. | No spills/leakages | ECO and/or RE |
| MP-C-018 | Infrastructure (Refer to guideline in Appendix I for further detail) | 1. Inspection of the stormwater management measures, channels/ diversions, and culverts for signs of erosion, cracking and silting to ensure the performance of these are still as intended. | Daily | Erosion, cracking and silting of stormwater management measures, channels/ diversions, and culverts | No erosion, cracking and silting of stormwater management measures, channels/ | |

| Reference Number | E&S Aspect/Issue | Monitoring Aspects – Operational Phase | Monitoring Frequencies | Monitoring Parameters | Key Performance Indicators/Limits | Responsibility |
|---|---|---|---|---|---|---|
| | | | | | diversions, and culverts | |

# 5. MANAGEMENT OF CHANGE

Changes in the Project may occur due to unanticipated situations. Adaptive changes may also occur during the course of final design, commissioning or even operations. The project will implement a formal procedure to manage changes (e.g., layout, technology, resources, etc.). The objective of the procedure must be to ensure that the impact of changes on the health and safety of personnel, the environment, adjacent communities, plant and equipment are identified and assessed prior to the changes being implemented. The management of change procedure must ensure that:

- proposed changes have a sound technical, safety, environmental, social and commercial justification;
- changes are reviewed by competent personnel and the impact of changes is reflected in documentation, including operating procedures and drawings;
- changes are communicated to personnel who are provided with the necessary skills, via training, to effectively implement changes; and
- the appropriate developer lead accepts the responsibility for the change.

Changes to be managed could include a risk to people, the environment, communities or the business, and might be related to a process, equipment, materials, people or the environment or project context. Change management process includes the following steps:

1. Identify and describe the change using Management of Change Form;
2. Assess the E&S risks associated with the change;
3. Identify control measures (for risk that cannot be eliminated);
4. Appoint someone to review the risk assessment;
5. Develop actions to manage the change with clear responsibilities and timeline;
6. Implement actions; and
7. Review the change to ensure it has been effective.

All changes to the project shall be subject to a Risk Assessment. All environmental and social legal requirements related to the change shall also be identified and implemented as required. Mitigation measures and monitoring requirements associated with significant environmental and social risks as related with the change shall be captured in this ESMP. Substantive changes to the mitigation measures described in this ESMP will need to be communicated to the MEFT and may require an application for amendment to the ECC be lodged with MEFT.

# 6. DECOMMISSIONING PHASE

The plant will be designed to have a 30-year operational life, which coincides with the current NamWater Life of Project plan. At the end of the design life period, the plant may be refurbished for continued operation, upgraded, or may be decommissioned, broken down and the site rehabilitated, or sold as a going concern, depending on the situation and needs at that time.

However, in the event that the plant is decommissioned and dismantled, and the site rehabilitated, a detailed Decommissioning and Rehabilitation Plan must be developed at least 2 years prior to the decommissioning of project and the associated facilities. This plan should include, but not be limited to, management of socio-economic aspects such as employment loss, removal, re-use and recycling of materials and vegetative rehabilitation to prevent erosion, infrastructure removals, waste disposal, hazardous substance spillages and alien invasive vegetation control. The plan will detail all site-specific measures to be implemented to rehabilitate all areas disturbed by the project. Additionally, the provisions made under the construction phase of this ESMP shall be amended as required and apply to all de-construction activities. In the event of decommissioning, NamWater shall make every effort to have the various materials in the plant reclaimed for recycling or reuse elsewhere and reduce the volume of waste going to landfill.

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# APPENDIX A: GUIDELINE LIST OF CONSTRUCTION METHOD STATEMENTS

The purpose of the following list is to provide guidance as to Method Statements (MS) to be prepared. The list is not to be considered prescriptive or exhaustive:

**MS1:** Construction camp location and layout;
**MS2:** Site clearing;
**MS3:** Hazardous substances;
**MS4:** Solid waste management;
**MS5:** Wastewater management;
**MS6:** Erosion and sediment control;
**MS7:** Cement and concrete batching;
**MS8:** Fire control;
**MS9:** Dust control programme;
**MS10:** Temporary site closure;
**MS11:** Emergency procedures;
**MS12:** Ocean-based construction methods; and
**MS13:** Rehabilitation Plan.

# APPENDIX B: ENVIRONMENTAL DO'S AND DONTS

# APPENDIX C: CHANCE FIND PROCEDURE

**Archaeological Chance Finds Procedure**

The following procedural guidelines must be considered in the event that previously unknown fossils, heritage resources or burial grounds and graves are exposed or found during the life of the Project.

**Initial Identification and/or Exposure (Chance Find)**

If during the construction, operations, or decommissioning phases of this Project, any person employed by NamWater/Contractors, O&M Operator and subcontractors, or service provider, find any artefact of cultural significance, this person must cease work at the site of the find. They must report this find to their immediate supervisor, and through their supervisor to the senior on-site manager. The following steps and legal requirements and reporting structure must be observed:

- A Project archaeologist should be appointed.
- The person or group (identifier) who identified or exposed the heritage resource or burial ground must cease all activity in the immediate vicinity of the site;
- The identifier must immediately inform the senior on-site Manager of the discovery;
- The senior on-site Manager must make an initial assessment of the extent of the find, and confirm the extent of the work stoppage in that area and ensure that the site is secured and control access;
- The senior on-site Manager will inform the Environmental Officer (EO) officer of the chance find and its immediate impact on operations. The EO will then contact the archaeologist.

**Chance Find Procedures: Heritage Resources and Fossils**

In the event that previously unidentified heritage resources are identified and/or exposed during construction or operation of the Project, the following steps must be implemented subsequent to those outlined above:

- The Project archaeologist must be notified of the discovery;
- The Project archaeologist will visit the site for a field-based assessment of the finds and appropriate mitigation measures will then be presented to the client;
- Should the specialist conclude that the find is a heritage resource protected in terms of legislation, they must inform the National Heritage Council of Namibia (NHC) of their discovery;
- Based on the comments received from the authorities, the Project archaeologist will provide the developer with a Site Incident Report outlining the processes followed and the way forward.

**Chance Find Procedures: Burials and Graves**

In the event that previously unidentified burial grounds and graves are identified and/or exposed during construction or operation of the project, the following steps must be implemented subsequent to those outlined above:

- The Project archaeologist must immediately be notified of the discovery in order to take the required further steps:
    - The local Police, traditional authority and NHC should be notified;
    - The Project archaeologist will inspect the exposed burial and determine in consultation with the relevant authorities if any additional graves may exist in the vicinity as well as the temporal context of the remains, i.e.:
        - Forensic;

  - Recent or historical; or
  - Archaeological;
- Should the Archaeologist conclude that the find is a heritage resource protected in terms of legislation, the lead consultant must notify the authorities following the Chance Find Procedure as outlined above.

**Conclusion**

The Chance Find Procedures presented in this document serve as international best practice policy for the accidental discovery of heritage resources and burial grounds and graves guided by National Legislation. Based on the definitions provided within this document and the proposed lines of communication, NamWater/Contractor will be able to mitigate the accidental discovery of heritage resources and burial grounds and graves throughout the various phases of the Project.

The Project archaeologist should be available to assist with the recommendation of mitigation for the accidental discovery of heritage resources and burial grounds and graves and to liaise with the relevant authorities.

# APPENDIX D: GENERAL PLANT OPERATION AND MAINTENANCE

The following provides particular guidance to marine biodiversity considerations to be included as part of the desalination plant operation and maintenance planning.

**Introduction**

The desalination plant and associated infrastructure should undergo routine maintenance and repairs to ensure that it continues to operate in accordance with the pre-construction section. The use of chemicals on site and the discharge of concentrate containing potentially deleterious chemicals could change with the wear and tear of the plant, becoming more detrimental to the marine environment. The O&M Operator shall conduct regular tests on the water quality to confirm that the plant continues to operate at its design specification.

A detailed Operation and Maintenance (O&M) Manual shall be developed by the plant manufacturer / Engineer. The manual will provide detailed guidance on the safe operation of all equipment and associated systems as well as maintenance inspections, procedures and schedules. The implementation of this manual is seen as proactive management in addressing potential risks to the biophysical environment through breakdowns or equipment failures.

The appearance of all buildings, fences, roadways and all other structures shall be maintained to ensure the plant doesn't detract from the scenic value of the area as viewed by the general public. NamWater should conduct inspections to confirm that the maintenance programme is being implemented in accordance with the manual.

All materials should be stockpiled in a neat and orderly fashion in designated areas. The O&M Operator shall make provision to undertake routine inspections and address areas where housekeeping practices are lacking. Where maintenance work requires construction activity, such activities should be carried out in conformance with the principles contained the Construction phase of this ESMP.

**Seawater Intake System**

Care should be taken through design and operation to reduce the average intake velocity of the feedwater to ~0.1 - 0.15 m/s, so as to ensure that fish and other organisms can escape the intake current.

Should chlorination of the intake water be necessary, this should be undertaken intermittently to ensure that the intake pipeline and feed-water pumping systems remain free of biofouling organisms, and to prevent bacterial re-growth in the brine. However, as the RO membranes are sensitive to oxidizing chemicals, neutralisation of residual chlorine, with sodium metabisulfite (SMBS), is necessary if membrane damage is to be avoided. It is important to ensure that chlorine is at all times sufficiently neutralised before discharge of the brine.

Scaling of the plant pipelines and RO membranes is controlled by the addition either of acid or specific antiscalant chemicals. Acids and polyphosphates cause eutrophication through formation of algal blooms and macroalgae and should therefore be avoided. The preferred method would be to use phosphonate and organic polymer antiscalants, which have a low toxicity to aquatic invertebrate and fish species. Depending

on the membrane type, the antiscalant product should preferably be one for which relevant eco-toxicological testing has already been undertaken.

**Sea outfall brine discharge**

The discharge pipe should be fitted with a suitable diffuser system at its seaward end to ensure rapid and efficient dilution of the effluent with the receiving water, thereby reducing plume footprints near the seabed and minimising impacts on marine ecology. Ensure engineering designs of the discharge pipeline and diffuser system achieve the highest required dilution of brine, thereby limiting increased salinities to the minimum achievable mixing zone only. From an environmental perspective, it is therefore recommended that Configuration B (as detailed in the Brine Dispersion Modelling report) be implemented as the engineering design for the diffuser of the proposed NamWater desalination plant. The design of the diffuser and discharge rates would meet the requirements of the South African Marine Water Quality Guidelines and the Operational Policy for the Disposal of Land-derived Water containing Waste to the Marine Environment insofar as they are applicable to this type of installation.

During the commissioning of the desalination plant, it may be necessary to discard the membrane storage solution and rinse the membranes before plant start-up. If the membrane storage solution contains a biocide or other chemicals these must either be neutralised before being discharged to sea, or the storage solution disposed of at an appropriate waste disposal facility.

Traces of residual chlorine in the brine discharge must be kept below 3µg/ℓ (ANZECC (2000) guideline levels) by neutralising with SMBS. As marine organisms are extremely sensitive to residual chlorine, it is vital to ensure that the residual chlorine concentration in the discharged brine is at all times reduced to a level below that which may have lethal or sublethal effects on the biota, particularly the larval stages. Should the exceedance of the recommended guideline (<3µg/ℓ) be a more persistent or recurrent event, there could be serious implications for marine biota in the discharge gully and the plant would need to be closed down until the problem has been rectified.

Although it is predicted that residual chlorine levels in the discharge will be below guideline levels, continuous monitoring of the effluent for residual chlorine and dissolved oxygen levels is essential. Should residual chlorine be detected in the brine, SMBS dosing should immediately be increased. The use of SMBS during dechlorination is, however, associated with oxygen depletion in the effluent if overdosing occurs, as this substance is an oxygen scavenger. Shock dosing with SMBS is also an effective way of eliminating re-growth of aerobic bacteria in the discharge pipelines. Aeration of the effluent prior to discharge is therefore recommended, preferably with a permanent aeration system. Alternatively, if a permanent in situ effluent monitoring system is in place, aeration can be undertaken intermittently when monitoring results detect unacceptably low dissolved oxygen levels in the effluent.

If DBNPA (biocide) were to be used as alternative to chlorine, mitigation measures to ensure low residuals of DBNPA in any discharge to the marine environment include appropriate design of the brine basin to ensure greater and sufficient dilution of the DBNPA residuals in the effluent stream and higher degradation rate before discharge. A better option would be carefully monitored dosing to ensure minimal DBNPA concentrations in the discharge.

The solids generated by the filtration, backwash, and CIP processes will be mixed with the Dissolved Air Flotation (DAF) sludge and co-discharged with the brine. As a pro-active measure in favour of direct discharge to the sea, the sludge (mixed with other cleaning waste solutions) should be treated in an on-site sludge handling facility where it can be neutralised, and the solids removed and recycled or transported to a landfill site. The remaining wastewater could then be blended into and co-discharged with the brine effluent.

**End of the pipe monitoring programme**

It is recommended that an 'end of pipe' monitoring programme be compiled to enable regular monitoring of the composition and quality of the effluent. A monitoring frequency of once a month for the initial six- to twelve-month period of operation is recommended to ensure that the discharge system is functioning correctly. The monitoring data will serve to 'protect' NamWater from negative public perceptions and reduce its risks due to the installation of the Desalination Plant and discharge of effluents into the marine environment. It would also provide evidence of due diligence that the Desalination Plant is operating correctly, and the effluent complies with discharge permit conditions. Effluent Water quality samples should be analysed for salinity, pH and for any biocides, antiscalants and CIP chemicals that are used in the plant.

This information should be used to develop a contingency plan that examines the risk of contamination, and considers procedures that must be implemented to mitigate any unanticipated impacts (e.g., emergency incidents and upset conditions). The contingency plan must consist of stipulated procedures, schedules and responsibilities which include amongst others:

- standard operating procedures for detection of problems and responding to emergency incidents as well as upset conditions;
- programmes for the maintenance replacement and surveillance of the physical condition of equipment, facilities and pipelines;
- staff schedules;
- alternative personnel and services for the continued operation and maintenance of effluent discharge facilities during employee shortages;
- stocklists and suppliers for chemicals, spare parts and equipment components that can adequately ensure the continued operation of the effluent discharge facility during an emergency or breakdown;
- schedule of monitoring and sampling analyses when emergency or upset conditions occur at the plant;
- details on the type of mitigating measures to be implemented if effluent discharge into the coastal environment exceeds the limits prescribed in the Coastal Water Discharge Permit;
- reporting procedures and protocols for events of malfunctioning of the effluent disposal system, as well as pollution events.

If 'end of pipe' values exceeds the water quality guidelines for the coastal zone of the BCLME (CSIR 2006) at any time, the operation would be in violation of the Waste Water and Effluent Disposal exemption permit, and the cause of poor effluent quality must immediately be identified, reported and rectified. These events must be recorded as per internal procedures and must be reported to the responsible authorities on local, regional, and national levels, including, but not limited to the reporting of emergency incidents in terms of the Marine Resources Act and the Environmental Management and Assessment Act.

# APPENDIX E: BIOLOGICAL MONITORING

A marine ecologist is to be appointed to assist with the biological marine monitoring, diffusion and whole effluent toxicity test and validation requirements.

Monitoring plays a key role in ensuring that plant operations function as intended and achieve the provision of water with minimal environmental impacts. It includes validation, operational monitoring, verification, and surveillance. Validation is the process of obtaining evidence that control measures are capable of operating as required, in other words, it should confirm that specific pieces of equipment achieve accepted performance standards. Operational monitoring is the planned series of observations or measurements undertaken to assess the ongoing performance of individual control measures in preventing, eliminating, or reducing hazards. Operational monitoring will normally be based on simple and rapid procedures such as measurement of turbidity and chlorine residuals or inspection of the distribution system integrity. Verification provides assurance that a system as a whole is providing safe water while surveillance reviews compliance with identified guidelines standards and regulations.

A monitoring programme should be developed to study the effects of the discharged brine on the receiving water body, and/or intertidal biological communities surrounding the discharge location, particularly as monitoring of the affected subtidal benthic communities is in this case not feasible. This recommendation is reinforced by the Guidelines for Environmental Evaluation for Seawater Desalination published by the South African Department of Water Affairs and Forestry (DWAF 2007), in which it is stated that it is essential that the effects of the discharge of brine into any water body be monitored according to a monitoring programme performed at 6-monthly intervals over a period of approximately 4-years. This monitoring programme would validate numerical modelling results and/or ecological assessments based on these. Depending on initial results, reduced monitoring (i.e., annually) may be acceptable. This monitoring will include measurement of the main water quality parameters such as temperature, salinity and dissolved oxygen as a minimum. It is further recommended that every effort be made to publish the results in a peer-reviewed journal.

Once the desalination plant is in full operation, a monitoring programme should be implemented to ensure that the required level of dilution (as predicted by the numerical modelling) is achieved. Typical brine and thermal footprints need to be confirmed by sampling with a conductivity-temperature-depth (CTD) probe after an initial period of operation of the discharge both to confirm the performance of the discharge system and the numerical model predictions. This should be done for a suitably representative range of “conservative” environmental conditions, i.e., conditions for which dispersion of the effluent is likely to be the most limited. It is envisaged that two to three field surveys of one to two days duration would be adequate to confirm the performance of the discharge system and the accuracy of model predictions. If field observations and monitoring fail to mirror predicted results, the forecasted impacts will need to be re-assessed. To ensure complete confidence in the potential effects of the antiscalant to be used in the desalination plant and that the co-discharged waste-water constituents are being managed to concentrations that will not have significant environmental impacts, it will be necessary to undertake toxicity testing of the discharge for a full range of operational scenarios (i.e., shock-dosing, etc.). Once samples of the different operational scenario effluents have been collected, these should be tested according to the criteria tabulated below and the results (or brine’s physiochemical profile) should be communicated to the Ministry of Fisheries and Marine Resources. Such sampling and whole effluent toxicity testing need only be undertaken for the duration and extent necessary to determine an effluent profile

under all operational scenarios. Given that there are uncertainties regarding the effects and combined effects of chlorinated or de-chlorinated water, backwash sludge and CIP chemicals on the marine environment, whole effluent toxicity tests be conducted at the plant as soon as possible after it comes online. In this whole effluent toxicity test a range of species from different phyla are exposed to increasing dilutions of effluent from the plant for use in determining the \lowest Observed Effective concentration and Predicted No Effect Concentration values for the effluent. This data can be used in conjunction with data from the dilution modelling and biological monitoring studies, to confirm if dilutions achieved in the near field are adequate to minimise impacts on the environment. Alternative mitigations relating to the discharging the backwash sludge and CIP chemicals may need to be sought if the required dilutions cannot be achieved within the near field (22 m from point discharge).

Entrainment and impingement of marine organisms on the intake screens of the intake pipe should also be assessed and recorded once a month for the first three months of operation to assess the actual magnitude of these impacts. Results should be assessed by a qualified marine biologist.

# APPENDIX F: PHYSIOCHEMICAL MONITORING OF BRINE

In line, real time monitoring instruments / probes should be positioned on the seawater intake pipeline and the brine discharge pipeline. These instruments should provide data on volumes, electrical conductivity, dissolved oxygen, and temperature. Where anomalous readings are detected in these indicator readings, an investigation should be initiated, and additional water samples taken to determine the underlying cause and identify corrective actions. This system should persist for the operational life of the desalination plant.

**Applicable Water Quality Guidelines**

The Water Resources Management Act does not contain target values for water quality associated with brine effluent. These will form part of the regulations associated with the new Water Act and will be implemented at a future date. As far as can be established, South Africa is the only southern African country that currently has an official set of water quality guidelines for coastal marine waters. In terms of policy, legislation and practice South Africa's operational policy for the disposal of land-derived wastewater to the marine environment (DWAF 2004 a-c) is thus of relevance. Specifically, environmental quality objectives need to be set for the marine environment, based on the requirements of the site-specific marine ecosystems, as well as other designated beneficial uses (both existing and future) of the receiving environment. The identification and mapping of marine ecosystems and the beneficial uses of the receiving marine environment provide a sound basis from which to derive site-specific environmental quality objectives (Taljaard *et al*. 2006). To ensure that environmental quality objectives are practical and effective management tools, they need to be set in terms of measurable target values, or ranges for specific water column and sediment parameters, or in terms of the abundance and diversity of biotic components. The South African Water Quality Guidelines for Coastal Marine Waters (DWAF 2005) provide recommended target values (as opposed to standards) for a range of substances, but these are not exhaustive. Therefore, in setting site-specific environmental quality objectives, the information contained in the DWAF guideline document is supported by additional information obtained from published literature and best available international guidelines (e.g., BCLME 2006; ANZECC 2000; World Bank 1998; EPA 2006). Recommended target values are also reviewed and summarized in the Benguela Current Large Marine Ecosystem (BCLME) document on water quality guidelines for the BCLME region (CSIR 2006). Recommended target values extracted from these guidelines are provided in the tables below.

A mixing zone is the area around an effluent discharge point where the effluent is actively undergoing dilution with the water of the receiving environment. This zone usually encompasses the near-field and mid-field regions of dilution to allow for the plume to mix throughout the water column. No water quality criteria for physical and chemical stressors are defined within the mixing zone. Instead, these water quality criteria ('trigger values') are defined at the boundary of the mixing zone to ensure the quality of nearby waters does not deteriorate as a result of the effluent discharge. The boundaries of a proposed mixing zone are typically defined according to an estimated distance from the discharge point at which point defined water quality guidelines will be met, as predicted by numerical modelling of the discharge.

The area around an effluent discharge point where the effluent is actively diluted with the water of the receiving environment is termed the "sacrificial mixing zone". This zone usually encompasses the near-field and mid-field regions of dilution to allow for the plume to mix throughout the water column. No water quality criteria for physical and chemical stressors are defined within the mixing zone. Instead, these water quality criteria ('trigger values') are defined at the boundary of the mixing zone to ensure the quality of

nearby waters does not deteriorate as a result of the effluent discharge. The boundaries of a proposed mixing zone are typically defined according to an estimated distance from the discharge point at which point defined water quality guidelines will be met, as predicted by numerical modelling of the discharge. The plume modelling study undertaken by PRDW (2023) determined that the distances required to meet maximum dilutions were 287 m for Configuration A and 85 m for Configuration B.

## Water Quality Guidelines for the Discharge of Brine into the Marine Environment

| Variable | South Africa (DWAF 2005) | Australia/New Zealand (ANZECC 2000) | World bank [a] (World Bank 1998) | US Environmental Protection Agency (EPA 2006) |
|---|---|---|---|---|
| **Zone of impact/mixing zone** | To be kept to a minimum, the acceptable dimensions of this zone are informed by the ESIA and requirements of licensing authorities, based on scientific evidence. | No guideline found | 100 m radius from point of discharge for temperature | No guideline found |
| **Temperature** | The maximum acceptable variation in ambient temperature is ± 1°C | Where an appropriate reference system is available, and there are sufficient resources to collect the necessary information for the reference system, the median (or mean) temperature should lie within the range defined by the 20%ile and 80%ile of the seasonal distribution of the ambient temperature for the reference system. | < 3°C above ambient at the edge of the zone where initial mixing and dilution take place. Where the zone is not defined, use 100 meters from the point of discharge when there are no sensitive aquatic ecosystems within this distance. | No guideline found |
| **Salinity[b]** | 33 – 36 psu | Low-risk trigger concentrations for salinity are that the median (or mean) salinity should lie within the 20%ile and 80%ile of the ambient salinity distribution in the reference system(s). The old salinity guideline (ANZECC 1992) was that the salinity change should be <5% of the ambient salinity. | No guideline found | No guideline found |
| **Total residual Chlorine** | No guideline, however, deleterious effects recorded for concentrations as low as 2 – 20 µg/ℓ. A conservative trigger value is <2 µg/ℓ. | 3 µg Cl/ℓ measured as total residual chlorine (low reliability trigger value at 95% protection level, to be used only as an indicative interim working level) (ANZECC 2000)[c] | 0.2 mg/ℓ at the point of discharge prior to dilution | Long-term and short-term water quality criteria for chlorine in seawater are 7.5 µg/ℓ and 13 µg/ℓ, respectively |

| Variable | South Africa (DWAF 2005) | Australia/New Zealand (ANZECC 2000) | World bank [a] (World Bank 1998) | US Environmental Protection Agency (EPA 2006) |
|---|---|---|---|---|
| **Total residual dibromonitrilopropionamide (DBNPA)** | No guideline exists, to suggest values ranging between 0.035 mg/ ℓ and 0.070mg/ ℓ | No guideline found | No guideline found | No guideline found |
| **Dissolved oxygen** | For the west coast, the dissolved oxygen should not fall below 10 % of the established natural variation. For the south and east coasts, the dissolved oxygen should not fall below 5 mg/ℓ (99 % of the time) and below 6 mg/ℓ (95 % of the time) | Where an appropriate reference system is available, and there are sufficient resources to collect the necessary information for the reference system, the median lowest diurnal DO concentration for the period for DO should be >20%ile of the ambient dissolved oxygen concentration in the reference system(s) distribution. The trigger value should be obtained during low flow and high temperature periods when DO concentrations are likely to be at their lowest. | No guideline found | No guideline found |
| **Nutrients** | Waters should not contain concentrations of dissolved nutrients that are capable of causing excessive or nuisance growth of algae or other aquatic plants or reducing dissolved oxygen concentrations below the target range indicated for dissolved oxygen (see above) | Default trigger values of<br>$PO_4$-P: 100 µg/ℓ<br>$NO_x$-N: 50 µg/ℓ<br>$NH_4^+$-N: 50 µg/ℓ<br>for the low rainfall southern Australian region (Table 3.3.8 in ANZECC 2000) | No guideline found | No guideline found |
| **Chromium** | 8 µg/ℓ (as total Cr) | Marine moderate reliability trigger value for chromium (III) of 10 µg./ℓ with 95% protection | 0.5 mg/ℓ (total Cr) for effluents from thermal power plants | 1 100 µg/ℓ for highest concentration at brief exposure without unacceptable effect |

| Variable | South Africa (DWAF 2005) | Australia/New Zealand (ANZECC 2000) | World bank [a] (World Bank 1998) | US Environmental Protection Agency (EPA 2006) |
|---|---|---|---|---|
| | | Marine high reliability trigger value for chromium (VI) of 4.4 µg/ℓ at 95% protection. | | 50 µg/ℓ highest concentration at continous exposure without unacceptable effect |
| **Iron** | No guideline found | Insufficient data to derive a reliable trigger value. The current Canadian guideline level is 300 µg/ℓ | 1.0 mg/ℓ for effluents from thermal power plants | No guideline found |
| **Molybdenum** | No guideline found | Insufficient data to derive a marine trigger value for molybdenum. A low reliability trigger value of 23 µg/ℓ was adopted to be used as indicative interim working levels. | No guideline found | No guideline found |
| **Nickel** | 25 µg/ℓ (as total Ni) | 7 µg/ℓ at a 99% protection level is recommended for slightly-moderately disturbed marine systems. | No guideline found | 74 µg/ℓ for highest concentration at brief exposure without unacceptable effect<br><br>8.2 µg/ℓ highest concentration at continous exposure without unacceptable effect |

a) The World Bank guidelines are based on maximum permissible concentrations at the point of discharge and do not explicitly take into account the receiving environment, i.e. no cognisance is taken of the fact of the differences in transport and fate of pollutants between, for example, a surf zone, estuary or coastal embayment with poor flushing characteristics and an open and exposed coastline. It is for this reason that we include in this study other generally accepted Water Quality guidelines that take the nature of the receiving environment into account.
b) The ANZECC (2000) Water Quality guideline for salinity is less stringent than, but roughly approximates, the South African Water Quality guideline that requires that salinity should remain within the range of 33 psu to 36 psu (=ΔS of approximately 1 psu). Scientific studies have shown that effects on marine biota are primarily observed for increases of >4 psu above ambient level. ΔS 1 psu and 4 psu have been chosen for assessment purposes.
c) In case of chlorine "shocking", which involves using high chlorine levels for a short period of time rather than a continuous low-level release, the target value is a maximum value of 2 mg/ℓ for up to 2 hours, not to be repeated more frequently than once in 24 hours, with a 24-hour average of 0.2 mg/ℓ (The same limits would apply to bromine and fluorine.).

Every six months, laboratory samples should be taken from the intake pipeline, the brine discharge pipeline and the brine sampling point at the edge of the predicted mixing zone and sent for testing and analysis to confirm that the plant is operating within its expected design parameters and to confirm that the chemical profile of the discharge roughly match the expected values and that the rate of dilution is occurring as predicted. These results should be communicated to the Ministry of Fisheries and Marine Resource. The following provisional water quality standards for Namibia have been provided. The laboratory should test for all criteria contained in the guidelines in the tables to follow.

The water quality at the edge of the mixing zone should comply with the guidelines and the provisional standards provided below.

### Special Water Quality Standards for Effluents

| Criteria | Proposed Special Water Quality Standards for Effluents |
|---|---|
| Turbidity | <5 NTU |
| Colour | <10% |
| Suspended solids | <25 mg/l |
| TDS | <500 mg/l above the intake potable water quality |
| pH | 6.5- 9.5 |
| Temp | ± 1ºC of ambient |
| Nitrate as N | < 15 mg/l (as N) |
| Nitrite as N | <2 mg/l |
| Fluoride (F) | < 1 mg/l |
| Na | <50mg/l above the intake potable water quality |
| Ca | - |
| Mg | - |
| K | - |
| Chloride as Cl | <40mg/l above the intake potable water quality |
| Alkalinity as CaCO3 | Not specified |
| Hardness as CaCO3 | Not specified |
| Sulphate as SO4 | <20mg/l above the intake potable water quality |
| Iron as Fe | <200 µg/l |

The O&M Operator shall monitor and report changes in shoreline dynamics around the seawater intake or brine discharge structures. Should these changes persist for more than a few months or appear to be rapidly changing, the O&M Operator shall inform NamWater, who should consult with a specialist and determine if the change is associated with the structures and secondly if an intervention is required. Where interventions are required that may require earthworks or other construction activities, the provision made under the construction phase of this ESMP shall apply.

# APPENDIX G: STORMWATER MANAGEMENT PLAN

Good stormwater management practice begins at the planning level which is implemented during construction and ends at decommissioning. The following recommendations are proposed for new and existing infrastructure (where amendments are possible) and apply to both permanent and temporary structures.

A preliminary layout of the Desalination plant and Pump Station was provided by the external design engineers (ILF Consulting Engineers) and provides the basis for the stormwater management recommendations for the desalination plant that are provided. As the detailed design of the facility was not available this stormwater management plan (SWMP) is to be updated to a detailed SWMP once the detailed design information become available.

**Planning (Pre-Rehabilitation) & Rehabilitation (Construction)**

During the planning phase, a detailed stormwater management plan should be compiled for built-up infrastructure, particularly at the desalination plant, intake works and pump stations. This is due to the presence of mechanical structures and associated workshops, grease spills etc. In The stormwater management plan should contain at a minimum, the following:

**General Areas**

- The desalination plant and associated infrastructure should be located outside of any 1:100-year flood lines according to IFC requirements and must be sited and operated such that the facilities do not impede the flow of water.
- Planning should include the collection of dirty water and re-use of dirty water as far as is practicable.
- Planning of all new infrastructure should ensure that clean and dirty water systems are kept separate by:
    a) Designing channels/berms to divert clean surface water generated from upstream of the proposed infrastructure, away from the development and dirty water areas.
    b) Ensuring that dirty water will be collected in lined channels and contained. Containment facilities should be lined and sized to contain at least the 1:100-year storm event in accordance with EHS requirements. Lining requirements should be determined according to the pollutant potential of the dirty water as determined by a geochemical waste assessment.
    c) Ensuring that dirty water that cannot be contained or re-used will be treated before being discharged into the environment.
    d) Designing, constructing, maintaining and operating dirty water dams/ponds to have a minimum of a 0.8 m freeboard above full supply level.

**Desalination Plant, Pump and Fuelling Stations**

- A spill/leakage control system should be implemented to inspect spills and monitor all tanks, pipelines and bunds regularly to develop an early detection system. Any spills must be cleaned up immediately. Spill kits or adsorbent materials will be placed in all areas where potentially polluting substances are dispensed and stored. Once used, this material will be treated as hazardous waste and disposed of accordingly.
- Vehicles, pumps, motors and equipment must be properly maintained, and oil or fuel leaks should be repaired immediately upon detection.
- Plant equipment servicing must be undertaken within suitably equipped facilities, either within workshops, or within bunded areas, from which any storm water is conveyed to a dirty water containment sump/pond, after passing through an oil and grit separator.

- All fuel tanks should be above ground and within concrete bunds. All day-to-day spillage within the bund and filling / delivery areas should be channelled into a dirty water containment sump/pond, after passing through an oil and grit separator.
- Concrete bunds will be established and maintained around all diesel generators. Minimum requirements for the bunds will include:
    a) All bunded areas must have a capacity of 110 % of the capacity of product that will be stored in the bunded area.
    b) Bunded areas should be equipped with an outlet pipe, but a manual stop valve must be installed.
    c) Outlet pipes must empty into an oil and grease trap.
- Oil/water separators and grease traps should be installed and maintained as appropriate at pump stations, workshops, wash bays, fuel storage and containment areas. Contaminated residues will be disposed of as hazardous wastes.

**Offices**

- Rainwater harvesting of water for human needs may be considered. This would reduce the impact of stormwater on site. This will additionally reduce the demand on clean water sources.

**Stockpiling Areas**

- Stockpiling areas should be located outside of any 1:100-year flood line and must be sited and operated such that activities do not impede the flow of water.
- Clean water diversion berms will be designed to divert clean water from entering and dirty water from exiting the stockpiling areas.
- Dirty water will be contained within the diversion berms and allowed to evaporate. A liner may be required, and liner requirements should be determined according to the pollutant potential as determined by a geochemical waste assessment.

**Water Treatment Facilities**

- Recycling and re-using of stormwater will require water treatment to provide potable water for labourers and staff.
- As a last resort, an additional water treatment facility may be required to treat dirty stormwater, if it is determined that the stormwater has a high pollution potential. Basic treatment would entail, physical, biological and chemical processes. The treatment should be guided by ambient water quality standards before use.

**Other stormwater infrastructure**

- Channels and culverts must be cleared or maintained. Structures must be inspected for debris and accumulation of sediment. This must be cleared to ensure the structural integrity of the structure.

**Operational Phase**

The stormwater management plan should be adhered to during the operational phase, however, operations should also consider the following to maintain good stormwater management practices:

**Desalination Plant, Pump and Fuelling Stations**

- A spill/leakage control system should be implemented to inspect spills and monitor all tanks, pipelines and bunds regularly to develop an early detection system. Any spills must be cleaned up immediately. Spill kits or adsorbent materials will be placed in all areas where potentially polluting substances are dispensed and stored. Once used, this material will be treated as hazardous waste and disposed of accordingly.
- Vehicles, pumps, motors and equipment must be properly maintained, and oil or fuel leaks should be repaired immediately upon detection.
- Vehicles, pumps, motors and equipment servicing must be undertaken within suitably equipped facilities, either within workshops, or within bunded areas, from which any storm water is conveyed to a dirty water containment sump/pond, after passing through an oil and grit separator.
- Oil/water separators and grease traps should be installed and maintained as appropriate at workshops, wash bays, storage and containment areas. Contaminated residues shall be disposed of as hazardous wastes.

**Other stormwater infrastructure**

- Channels and culverts must be cleared or maintained. Structures must be inspected for debris and accumulation of sediment. This must be cleared to ensure the structural integrity of the structure.

**Decommissioning Phase**

Decommissioning works should include measures that ensure no stormwater flow is impeded and natural stream flows are restored after the works are decommissioned.

**Erosion Control Measures**

Erosion and scour occur where water is dispersed or concentrated and as a result should be minimised by ensuring the flow velocities are maintained below critical values. Critical values can generally be described as flow velocities higher than 3m/s in most cases. Channels and crossings are key areas which can show signs of flooding, erosion and deposition of silt and debris These areas can experience exacerbated situations due to large floods increasing the flow velocities in the channel bed.

As part of this project, the erosion and scour can be controlled by incorporating all or some of the following measures:

- Clear debris and solid waste – regular maintenance and clean-up of the channels and berms should be included in the monitoring plans to remove large debris and solid waste especially during high rainfall periods;
- Reduction/rehabilitation of steep slopes – disturbed slopes along channels can be rehabilitated (where amendments are possible);
- Dense vegetated cover or grassing may be used for slope protection;
- Gravel, cobbles or stone pitching – may be used for slope protection;
- Geofabrics - may be used for slope protection in combination with vegetation or gabions;
- The use of gabions or reno mattresses – these engineered baskets filled with stone, rock and other material may be used around culvert inlets and outlets; wingwalls and aprons to slow down flow velocities and limit movement of natural sediment; and
- Pre-formed scour holes – these simple engineered structures create a plunging effect whereby high flows can dissipate energy before eroding the surrounding culvert outlet.

**Recommendations**

Implementation of control measures and monitoring thereof must be documented in a detailed Stormwater Management Plan to be prepared as part of the detailed design. Where safety is a concern as a result of stormwater containment infrastructure (e.g., ponds), these should be covered appropriately. The results of stormwater monitoring will help determine the effectiveness of the recommended measures and overall stormwater management plan.

The Environment Protection Agency (EPA) of the United States: Industrial Stormwater Monitoring and Sampling Guide provides guidance on compiling a monitoring plan. The monitoring plans should include inspections, visual assessments, and monitoring (i.e., sampling) of specified stormwater discharges.

# APPENDIX H: HYDROLOGICAL MANAGEMENT PLAN

| Phase | Aspect | Impact | Objective | Enhancement/ Mitigation Measures | Monitoring Mechanism | Time Frame | Target/Performance Indicator | Responsibility |
|---|---|---|---|---|---|---|---|---|
| Construction and Operations | Surface water quality | Deterioration of surface water quality | Avoid surface water contamination due to spills from oil / fuels / lubricants and hydrocarbons. | • Provide spill kits for chemical storage areas and other highly sensitive areas.<br>• Store all hazardous substances or potential contaminants separately in appropriately bunded and demarcated facilities and away from natural drainage lines.<br>• Demarcate clean and dirty water catchments and separate water emanating from these catchments by means of berms.<br>• Dirty/ contaminated water to be contained in lined structures as mentioned in the SWMP section above.<br>• Dirty water that cannot be contained or re-used should be treated before discharging into the environment.<br>• Dirty water dams/ponds to be designed, constructed, maintained and operated to have a minimum of a 0.8 m freeboard above full supply level to minimise frequent spillages.<br>• Drip trays should be placed under all standing machineries.<br>• Spill kits or adsorbent materials must be placed in all areas where potentially polluting substances are dispensed and stored.<br>• Good housekeeping practices should be implemented and maintained by timeous cleaning-up of accidental spillages.<br>• A Spill clean-up plan must be prepared to enable containment and remediation of pollution incidents.<br>• Monitoring water quality at the nearest streams or discharge point. | The following in situ water quality parameters should be monitored quarterly:<br>• pH<br>• Electrical conductivity<br>• Turbidity<br>• Dissolved oxygen saturation<br>• Temperature<br>• Visual inspection for presence of hydrocarbons within the instream environment. | Quarterly for project duration | Water quality within WBG HSE limits for wastewater discharge and Namibia guidelines for the evaluation of drinking water quality for human consumption with regard to chemical, physical and bacteriology. | Environmental Officer |
| Construction and operations | Surface water quality | Deterioration of surface water quality. | Avoid surface water contamination due to effluent discharges, waste generation and handling. | • Develop a waste management plan.<br>• Site sanitation facilities at least 50 m away from streams and rivers.<br>• A sufficient number of appropriate toilets (e.g., Ventilated pit latrines) shall be provided by the contractor in the construction camp area and at appropriate locations. All temporary / portable toilets shall be secured to the ground to prevent them from toppling due to wind or any other cause.<br>• Ensure that no spillage occurs when toilets are cleaned or emptied.<br>• Discharge of waste from toilets into the environment is strictly prohibited.<br>• Design and maintain a proper and adequate sewer treatment facility for construction and operations.<br>• Utilise passive bio reactors to enable improved sewage treatment.<br>• Monitor any discharge from the sewage facilities to determine compliance with Namibia Water Quality Standards (Appendix B) and World Bank Group HSE standards for effluent and wastewater (Appendix C).<br>• Ensure regular maintenance of the sewage system.<br>• Plumb connection of floor drains, if any, in maintenance areas to the wastewater collection and treatment system.<br>• Prevention of discharge of industrial wastes to septic systems, drain fields, dry wells, cesspools, pits, or separate storm drains or sewers. | Quarterly inspections during operational phase.<br>Quarterly water quality monitoring. | Quarterly project duration | Water quality within Namibia Water Quality Standards (Appendix B) and World Bank Group HSE standards for effluent and wastewater (Appendix C) | Environmental Officer |

| Phase | Aspect | Impact | Objective | Enhancement/ Mitigation Measures | Monitoring Mechanism | Time Frame | Target/Performance Indicator | Responsibility |
|---|---|---|---|---|---|---|---|---|
| | | | | • Keep wastewater from service bays out of storm drains by constructing berms or other barriers.<br>• Depending on the volume of contaminants present in the wastewater, and whether the wastewater treatment facility is discharging into NamWater municipal system or directly to surface waters/ ocean, pre-treatment of effluents may be necessary to reduce contaminant concentrations. Pre-treatment systems typically consist of oil / water separators, biological and chemical treatment, and activated carbon systems.<br>• Pollution prevention through basic infrastructure design such as waste storage containment, hardstanding and bunds.<br>• Pollution prevention through education and training of workers (permanent and temporary).<br>• Traffic and movement over stabilised areas should be controlled (minimised and kept to certain paths), and damage to stabilised areas should be repaired timeously and maintained.<br>• Monitoring water quality at the nearest streams or discharge point. | | | | |
| Construction and operations | Soil erosion and sedimentation. | Erosion and sediment deposition from construction operational or decommissioning activities will create a mass debris capable of blocking stormwater measure such as channels and culverts. | Reduce erosion and prevent sedimentation in watercourses. Ensure culverts and channels are not blocked to allow flow of water. | • Maintain clear surface drainage channels.<br>• Limit the gradient of the access road to reduce run-off induced erosion and provide adequate drainage.<br>• Minimise areas that require clearing to the extent that is possible.<br>• Rainwater harvesting should be considered to minimize volumes of surface runoff which might induce erosion.<br>• Concurrent rehabilitation of disturbed land should be carried out to minimise the amount of time that bare soils are exposed to the erosive effects of rain and subsequent runoff.<br>• A service/maintenance plan for the culvert, channels and crossings must be compiled and implemented. The plan must encompass procedures to minimize any soil erosion and impacts on the surrounding environment.<br>• Clear debris and solid waste – regular maintenance and clean-up of the crossings should be included in the monitoring plans to remove large debris and solid waste especially during high rainfall periods.<br>• Gravel, Geofabrics, cobbles, gabions or stone pitching – must be used for slope protection on all exposed soil surfaces.<br>• The use of gabions or reno mattresses – these engineered baskets filled with stone, rock and other material may be used around; culvert inlets and outlets to slow down flow velocities and limit movement of natural sediment; and | Quarterly Environmental Compliance Audits; and<br>Quarterly water quality monitoring. | Project duration | Water quality (total suspended and dissolved solids) Namibia Water Quality Standards (Appendix B) and World Bank Group HSE standards for effluent and wastewater (Appendix C). | Environmental Officer |

| Phase | Aspect | Impact | Objective | Enhancement/ Mitigation Measures | Monitoring Mechanism | Time Frame | Target/Performance Indicator | Responsibility |
|---|---|---|---|---|---|---|---|---|
| Construction and operations | Alteration of natural drainage lines and flows. | Disturbance of natural drainage lines as a results of site clearance and preparation to lay foundations of the desalination plant and supporting infrastructure.<br><br>Altered flow regimes in the streams/ drainage lines due increased paved and compacted surfaces where the plant, construction camps, offices, workshops, access road and other infrastructure will be built. This will cause more water reporting to the streams than it would normally report. | To avoid drastic change in the instream flow regimes. | • Rainwater harvesting to reduce surface runoff during extreme rainfall events.<br>• A detailed stormwater management plan to be developed to maintain natural flow regimes as far as possible. | Stormwater Management Plan.<br>Environmental Compliance Audits, monthly water quantity monitoring (flow monitoring). Or when the rivers flow. | Monthly monitoring preferred but due to streams not flowing all the time.<br>Measurement can be done as and when the streams are flowing. | Water quantity | Environmental Manager |
| Construction and operations | Overtopping and flooding of drainage and other stormwater containment infrastructure. | The project site does not receive a lot of rainfall, but flash floods occasionally occur after short intense heavy rains.<br>Overtopping and flooding of channels, culverts and other stormwater containment infrastructure might occur. | Avoid overtopping and spillage from stormwater management infrastructure.<br><br>Avoiding damage to infrastructure. | • Channels and culverts must be cleared or maintained.<br>• Structures must be inspected for debris and accumulation of sediment.<br>• Dirty water dams/ponds to be designed, constructed, maintained and operated to have a minimum of a 0.8 m freeboard above full supply level to avoid frequent spillage. | Quarterly drainage infrastructure inspection. | Quarterly during operational phase. | Overtopping not occurring.<br>Culverts, bridges are free of debris. | Environmental Manager |
| Decommissioning | Surface water contamination. | Pollution of water resources as a result of decommissioning activities. | Avoid surface water contamination due to effluent discharges, waste generation and handling etc. | • Prevention of discharge of industrial wastes to septic systems, drain fields, dry wells, cesspools, pits, or separate storm drains or sewers.<br>• Drip trays should be placed under all standing machinery and locomotives.<br>• Good housekeeping practices should be implemented and maintained by timeous cleaning-up of accidental spillages.<br>• Pollution prevention through education and training of workers (permanent and temporary).<br>• Develop a spill clean-up plan to enable containment and remediation of pollution incidents.<br>• Monitoring water quality at the nearest streams or discharge point. | The following in situ water quality parameters should be monitored quarterly:<br>• pH<br>• Electrical conductivity<br>• Turbidity<br>• Dissolved oxygen saturation<br>• Temperature<br><br>Visual inspection for presence of hydrocarbons within the instream environment. | Quarterly for project duration | Water quality within Namibia Water Quality Standards (Appendix B) and World Bank Group HSE standards for effluent and wastewater (Appendix C). | Environmental Officer |

| Phase | Aspect | Impact | Objective | Enhancement/ Mitigation Measures | Monitoring Mechanism | Time Frame | Target/Performance Indicator | Responsibility |
|---|---|---|---|---|---|---|---|---|
| Decommissioning | Soil erosion and sedimentation. | Soil erosion from bare ground as a result of demolishing activities. | Reduce erosion and prevent sedimentation in nearby streams/ drainage lines. | • A service/maintenance plan for the channels, culverts crossings and other stormwater management infrastructure must be compiled and implemented. The plan must encompass procedures to minimize any soil erosion and impacts on the surrounding environment. | Quarterly Environmental Compliance Audits; and Quarterly water quality monitoring. | Project duration | Water quality (total suspended and dissolved solids) within Namibia Water Quality Standards (Appendix B) and World Bank Group HSE standards for effluent and wastewater (Appendix C). | Environmental Officer |
| Decommissioning | Altered surface runoff and drainage | Avoid drastic change in flow regime in receiving streams and environment | Proper stormwater management. | • Natural flow regimes should be restored after the works is decommissioned | Monthly inspections during closure. | Monthly. | Proper stormwater management. | Environmental Manager |

# APPENDIX I: SURFACEWATER QUALITY MONITORING PLAN

| Surface water Quality Monitoring Plan | | | | | |
|---|---|---|---|---|---|
| **Description** | **Monitoring Location** | **Frequency of sampling** | **Frequency of Reporting** | **Applicable phase of Project** | **Responsible Party for Implementation / Monitoring/Audit** |
| **Flooding Impact** | | | | | |
| Inspection of flooding of infrastructure must be undertaken during an intense rainfall event where drainage lines are likely to flow.<br>This includes built up infrastructure, particularly at the desalination plant, intake works and pump station.<br>A combination of sandy soil which saturates quickly and an increase in impervious areas might cause the desalination and pump station area to be vulnerable to flooding. | • Access roads to the desalination and pump station<br>• Stormwater management infrastructure<br>• Workshop/office areas<br>• Pump station area. | After heavy storms and during all rainfall storms during the wet season. | After every heavy storm. | All Phases of project | Environmental Compliance Officer (ECO) and or Resident Engineer (RE) |
| **Surface Water Quality** | | | | | |
| Various chemicals could be used and stored such as chlorine gas, oil, fuel and other hydrocarbons during all project phases. These chemicals might spill and contaminate soils which after rains would result in contamination of surface water. Clearing of vegetation and topsoil on site might silt up drainage lines. | Location of monitoring point are provided in Table 4-1 of the specialist report and Table 4-1 of the specialist report. Additional monitoring points and locations can be established during the first monitoring. | Monitoring should be undertaken quarterly. | Reporting should be undertaken after each sampling event. | All Phases of project | ECO/RE |
| **Soil Erosion and Sedimentation** | | | | | |

| Surface water Quality Monitoring Plan | | | | | |
|---|---|---|---|---|---|
| Soil erosion and sedimentation monitoring in all potential soil erosion locations. Erosion and scour can occur where water is dispersed or concentrated. | • Channel and crossings are key areas that shows sign of erosion, silt deposition and debris.<br>• Cleared and compacted areas where the infrastructure will be built.<br>• Points where brine water will be discharged. | Monitoring of erosion should occur during construction after every rainstorm or flood event, and during the operational phase monthly during first the wet season or during routine maintenance inspections, as applicable. | After every major rainstorm / flood.<br>Monthly monitoring report compiled by the appointed ECO during the construction phase. | All phases of project | ECO/RE |
| **Leakage/ spill events** | | | | | |
| A leak and spill management plan must be formulated to monitor and detect as soon as possible.<br><br>Site walkovers to determine the condition of facilities and identify any leaks or overflows, blockages, overflows, and system malfunctions for immediate remedial actions. | Access roads and areas where vehicles commute and areas where chemical storage containers are located (e.g., fuelling stations) and workshop areas. | Identification of any leakage events should occur monthly during the operation and construction phase, or<br>directly after a leakage has been detected and<br>for the operational phase, during maintenance activities. | Monthly monitoring report compiled by the appointed ECO during the construction, operational and closure phases; and<br>Report should be compiled for three phases of the project. | All phases of project | ECO/RE |
| | Areas where leakage is visible/detected. | | | All phases of project | ECO/RE |
| **Infrastructure Monitoring** | | | | | |
| Inspection of the stormwater management measures, channels/ diversions, and culverts for signs of erosion, cracking and silting to ensure the performance of these are still as intended. | All proposed stormwater management infrastructure around the:<br>• Desalination plant<br>• Intake works<br>• Pump stations | Daily during maintenance | Daily. Should erosion occur, measures should be reinstated. | All phases of project | ECO/RE |

# APPENDIX J: GRIEVANCE MECHANISM

**Grievance Redress Mechanism**

*The following Section outlines the Grievance Redress Mechanism (GRM) for the proposed Project.*

A grievance redress mechanism (GRM) is a requirement of IFC PS 1 as follows: "*The client will respond to communities' concerns related to the project .... the client will establish a grievance mechanism to receive and facilitate resolution of the affected communities' concerns and grievances about the client's environmental and social performance*".

Grievances raised differ from comments received. The following key terminology is noted (Table 7-1).

**Table 7-1: Key Terminology (IFC PS 1)**

| Term | Definition |
|---|---|
| **Complaint** | A complaint is a communication received from a stakeholder that includes an allegation that the stakeholder was negatively impacted. A complaint could be about a site-related issue (for example, the procurement policy), in which case it is screened as a credible issue and discussed verbally and logged in the grievance register as a screened-out grievance. A complaint could also relate to an actual site-related incident or potential incident, in which case it is a credible grievance and should be logged in the grievance register as a screened-in grievance. A complaint can also be an allegation that is unrelated to the site and the responsibility of another entity (for example, electricity supply to communities) in that case, the complaint should be discussed, and the stakeholder should refer to the responsible entity. It should be logged in the grievance register as a screened-out grievance (general dissatisfaction). |
| **Credible grievance** | A credible grievance is an allegation/complaint that has been screened and classified as a credible grievance. The definition of a credible grievance is an allegation regarding real or perceived impacts caused by the Project's activities, policies or the behaviour of its employees or contractors. A credible grievance can result from an actual or a potential incident and should be logged. |
| **Credible issue** | A credible issue is an allegation/complaint that has been screened and classified as a credible issue. The definition of a credible issue is an allegation regarding real or perceived impacts resulting from policies and/or procedures. It is not related to an actual or potential incident but rather an expression of dissatisfaction regarding a specific topic (such as recruitment or employment). A credible issue must be logged as a screened-out grievance. |
| **General dissatisfaction** | A general dissatisfaction is an allegation/complaint that has been screened and classified as an allegation regarding real or perceived impacts resulting from the performance and/or non-performance of an entity other than the Project owner/operator (for example, the local or district council). A general dissatisfaction must be logged as a screened-out grievance, and the stakeholder should be referred to the right entity to voice their complaint. |

| Term | Definition |
|---|---|
| **Grievance** | A specific allegation or complaint relating to the site, its policies, activities, real or perceived impacts or the behaviour of its employees or contractors. Grievances are an expression of dissatisfaction with the company on the part of stakeholders. Grievances can be expressed through physical action (e.g., protests, road blockages, land invasions); verbally (during discussions with site staff, etc.); or in writing. All screened-in grievances should be recorded as both a grievance and an (actual or potential) incident and should be. Some grievances, such as protests or road blockages, may have financial, legal, and/or reputational consequences for the site. These should not be classified as an incident with social consequences but as incidents with financial, legal, and/or reputational consequences as appropriate and should also be investigated. |
| **Issues** | Issues are questions, requests for information, or general perceptions. If not addressed well, issues may become grievances. Issues must be recorded as screened-out grievances so that emerging trends can be identified and addressed before they escalate. |

Grievances raised by stakeholders will be managed through a transparent process, is culturally appropriate, understandable, readily acceptable to all segments of affected communities, and at no cost and without retribution, according to the process outlined in Figure 7-1. The mechanism will be appropriate to the scale of impacts and risks of the project and beneficial for both NamWater and stakeholders. The mechanism will not impede access to other judicial or administrative remedies. All received grievances will be recorded in the grievance register. To ensure the grievance redress mechanism is available and stakeholders are aware of how to use it, the project team will publicise it during stakeholder engagement meetings sensitising stakeholders on how to use it and lodge complaints.

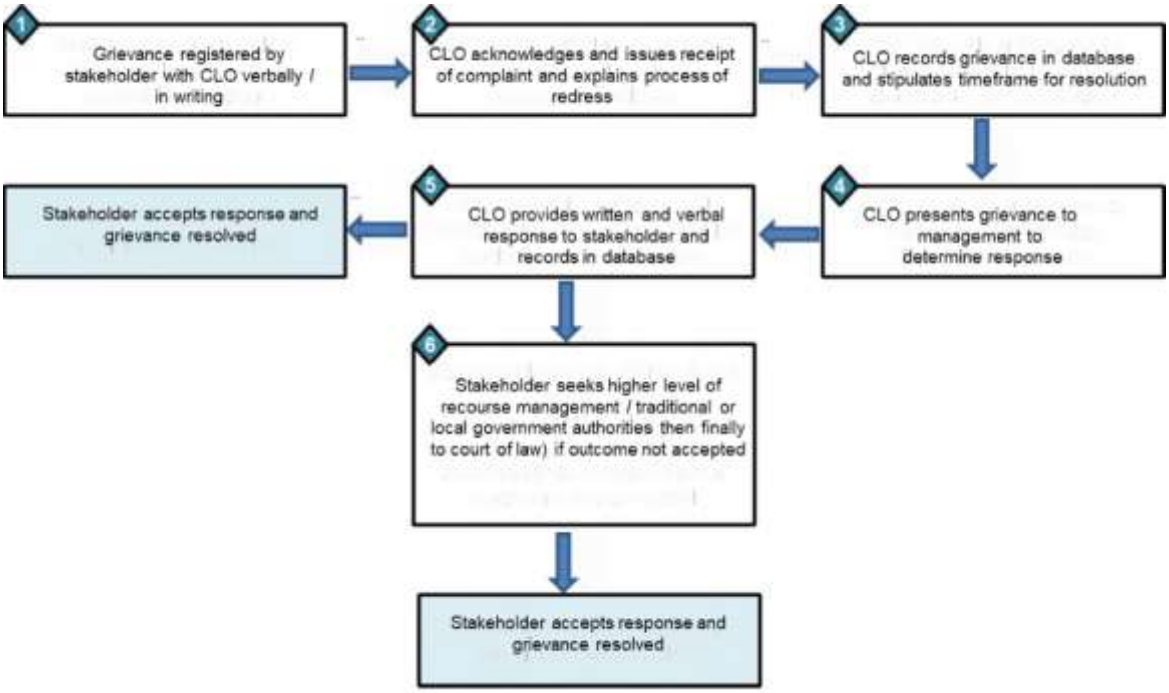


**Figure 7-1: Grievance Mechanism Process**

- A Community Liaison Officer (CLO) will be responsible for receiving and recording all the grievances from the stakeholders. The CLO must have relevant training in handling disputes and stakeholder management and must be viewed as an impartial representative. This is especially important for the building of trust and to ensure that valid concerns and grievances are raised effectively and timeously;
- Grievances can be lodged in writing or verbally, either through the traditional authorities, local committee or individually, as appropriate. The CLO will acknowledge receipt of the grievance and explain (in writing or verbally whichever is more appropriate) in brief, the process of redress that will be followed;
- Grievances may also be lodged anonymously: a grievance box will be placed at a central location during construction and at the desalination plant facility during operations to allow community members to post written grievances. The telephone contact of the CLO will also be widely shared and published on a public notice board at the construction site to allow community members to register grievances verbally;
- All grievances will be recorded in the grievance register, indicating details of the grievant, status and address of the person, type of stakeholder, the date on which the grievance happened and was recorded, a brief description of the grievance, and the outcome that is being sought;
- A timeframe for the resolution of matters is stipulated as follows: 14 days for all general matters and 28 days for more complicated matters that require investigation, verification and consultation. Periods for review and appeal will be stipulated based on the complexity of the case;
- Upon receipt and recording of grievances, a grievance manager (this can be the Resident Engineer (RE) during construction with the assistance of the Manager: Environmental Services and Area Manager during operations) will be assigned the responsibility to investigate and resolve the grievance. Depending on the grievance level, investigation should be recorded in the grievance investigation form;
- After the matter has been resolved, the resolution will be communicated in writing to the grievant, with verbal explanation provided by the CLO where necessary. The date on which the matter was resolved, and a summary of the resolution will be recorded in the grievance register; and
- There will be a higher level of recourse involving NamWater management, and traditional or local government authorities should the complainant not accept the outcome provided. Should the complainant still be dissatisfied, final recourse will be to the courts of law.

**Monitoring Indicators**

Grievance monitoring will be done through environmental and social audits on-site. Ongoing monitoring may be undertaken by NamWater, as required.

**Feedback to Stakeholders**

NamWater will determine appropriate feedback mechanisms for communities, as required. Such methods may include meetings, newsletters, etc.

# APPENDIX K: DOROB NATIONAL PARK MANAGEMENT PLAN

# RECORD OF REPORT DISTRIBUTION

| | |
|---|---|
| SLR Reference: | 733.V140015.00012 |
| Title: | Desalination Plant and Water Carriage System to Secure Supply to the Central Coast (Supply Scenario 1) |
| Report Number: | 01 |
| Client: | Namibia Water Corporation (Ltd) |

| Name | Entity | Copy No. | Date Issued | Issuer |
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