UPGRADE OF THE EXISTING FIREWATER SUPPLY TO THE WALVIS BAY OIL INDUSTRY TERMINALS

ENVIRONMENTAL MANAGEMENT PLAN

Prepared by:

Prepared for:

June 2021

Project:	**UPGRADE OF THE EXISTING FIREWATER SUPPLY TO THE WALVIS BAY OIL INDUSTRY TERMINALS: ENVIRONMENTAL MANAGEMENT PLAN**	
Report: **Version/Date:**	Draft June 2021	
Prepared for: **(Proponent)**	National Petroleum Corporation of Namibia (Pty) Ltd Private Bag 13196 Windhoek.	
Lead Consultant	Geo Pollution Technologies (Pty) Ltd PO Box 11073 Windhoek Namibia	TEL.: (+264-61) 257411 FAX.: (+264) 88626368
Main Project Team:	**André Faul** (B.Sc. Zoology/Biochemistry); (B.Sc. (Hons) Zoology); (M.Sc. Conservation Ecology); (Ph.D. Medical Bioscience) **Wikus Coetzer** (B.Sc. Environmental and Biological Sciences); (B.Sc. (Hons) Environmental Sciences)	
Cite this document as:	Faul A, Coetzer W. 2021 June; Upgrade of the Existing Firewater Supply to the Walvis Bay Oil Industry Terminals: Environmental Management Plan	
Copyright	Copyright on this document is reserved. No part of this document may be utilised without the written permission of Geo Pollution Technologies (Pty) Ltd.	
Report Approval	**André Faul** Conservation Ecologist	

I _____ acting as a representative of the National Petroleum Corporation of Namibia (Pty) Ltd hereby confirm that the project description contained in this report is a true reflection of the information which the Proponent provided to Geo Pollution Technologies. All material information in the possession of the proponent that reasonably has or may have the potential of influencing any decision or the objectivity of this assessment is fairly represented in this report and the report is hereby approved.

Signed at _____ on the _____ day of _____ 2021.

_____ _____

National Petroleum Corporation of Namibia (Pty) Ltd Business Registration/ID Number

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

AIDS	Acquired Immune Deficiency Syndrome
BE	Biological/Ecological
DWA	Department of Water Affairs
DEA	Directorate of Environmental Affairs
EA	Environmental Assessment
EIA	Environmental Impact Assessment
EMA	Environmental Management Act No 7 of 2007
EMP	Environmental Management Plan
EMS	Environmental Management System
EO	Economic/Operational
ES	Environmental Classification
GPT	Geo Pollution Technologies
HIV	Human Immunodeficiency Virus
IAPs	Interested and Affected Parties
IUCN	International Union for Conservation of Nature
m/s	Meter per second
mbs	Meters below surface
MEFT	Ministry of Environment, Forestry and Tourism
mm/a	Millimetres per annum
MSDS	Material Safety Data Sheet
NaCl	Sodium chloride
PC	Physical/Chemical
PPE	Personal Protective Equipment
ppm	Parts per million
SANS	South African National Standards
SC	Sociological/Cultural
WHO	World Health Organization

GLOSSARY OF TERMS

Alternatives - A possible course of action, in place of another, that would meet the same purpose and need but which would avoid or minimize negative impacts or enhance project benefits. These can include alternative locations/sites, routes, layouts, processes, designs, schedules and/or inputs. The "no-go" alternative constitutes the 'without project' option and provides a benchmark against which to evaluate changes; development should result in net benefit to society and should avoid undesirable negative impacts.

Assessment - The process of collecting, organising, analysing, interpreting and communicating information relevant to decision making.

Competent Authority - means a body or person empowered under the local authorities act or Environmental Management Act to enforce the rule of law.

Construction - means the building, erection or modification of a facility, structure or infrastructure that is necessary for the undertaking of an activity, including the modification, alteration, upgrading or decommissioning of such facility, structure or infrastructure.

Cumulative Impacts - in relation to an activity, means the impact of an activity that in itself may not be significant but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area.

Environment - As defined in the Environmental Assessment Policy and Environmental Management Act - "land, water and air; all organic and inorganic matter and living organisms as well as biological diversity; the interacting natural systems that include components referred to in sub-paragraphs, the human environment insofar as it represents archaeological, aesthetic, cultural, historic, economic, palaeontological or social values".

Environmental Impact Assessment (EIA) - process of assessment of the effects of a development on the environment.

Environmental Management Plan (EMP) - A working document on environmental and socio-economic mitigation measures, which must be implemented by several responsible parties during all the phases of the proposed project.

Environmental Management System (EMS) - An Environment Management System, or EMS, is a comprehensive approach to managing environmental issues, integrating environment-oriented thinking into every aspect of business management. An EMS ensures environmental considerations are a priority, along with other concerns such as costs, product quality, investments, PR productivity and strategic planning. An EMS generally makes a positive impact on a company's bottom line. It increases efficiency and focuses on customer needs and marketplace conditions, improving both the company's financial and environmental performance. By using an EMS to convert environmental problems into commercial opportunities, companies usually become more competitive.

Evaluation – means the process of ascertaining the relative importance or significance of information, the light of people's values, preference and judgements in order to make a decision.

Hazard - Anything that has the potential to cause damage to life, property and/or the environment. The hazard of a particular material or installation is constant; that is, it would present the same hazard wherever it was present.

Interested and Affected Party (IAP) - any person, group of persons or organisation interested in, or affected by an activity; and any organ of state that may have jurisdiction over any aspect of the activity.

Mitigate - The implementation of practical measures to reduce adverse impacts.

Proponent (Applicant) - Any person who has submitted or intends to submit an application for an authorisation, as legislated by the Environmental Management Act no. 7 of 2007, to undertake an

activity or activities identified as a listed activity or listed activities; or in any other notice published by the Minister or Ministry of Environment & Tourism.

Public - Citizens who have diverse cultural, educational, political and socio-economic characteristics. The public is not a homogeneous and unified group of people with a set of agreed common interests and aims. There is no single public. There are a number of publics, some of whom may emerge at any time during the process depending on their particular concerns and the issues involved.

Scoping Process - process of identifying: issues that will be relevant for consideration of the application; the potential environmental impacts of the proposed activity; and alternatives to the proposed activity that are feasible and reasonable.

Significant Effect/Impact - means an impact that by its magnitude, duration, intensity or probability of occurrence may have a notable effect on one or more aspects of the environment.

Stakeholder Engagement - The process of engagement between stakeholders (the proponent, authorities and IAPs) during the planning, assessment, implementation and/or management of proposals or activities. The level of stakeholder engagement varies depending on the nature of the proposal or activity as well as the level of commitment by stakeholders to the process. Stakeholder engagement can therefore be described by a spectrum or continuum of increasing levels of engagement in the decision-making process. The term is considered to be more appropriate than the term "public participation".

Stakeholders - A sub-group of the public whose interests may be positively or negatively affected by a proposal or activity and/or who are concerned with a proposal or activity and its consequences. The term therefore includes the proponent, authorities (both the lead authority and other authorities) and all interested and affected parties (IAPs). The principle that environmental consultants and stakeholder engagement practitioners should be independent and unbiased excludes these groups from being considered stakeholders.

Sustainable Development - "Development that meets the needs of the current generation without compromising the ability of future generations to meet their own needs and aspirations" – the definition of the World Commission on Environment and Development (1987). "Improving the quality of human life while living within the carrying capacity of supporting ecosystems" – the definition given in a publication called "Caring for the Earth: A Strategy for Sustainable Living" by the International Union for Conservation of Nature (IUCN), the United Nations Environment Programme and the World Wide Fund for Nature (1991).

1 INTRODUCTION

The National Petroleum Corporation of Namibia (Pty) Ltd (Namcor) requested Geo Pollution Technologies (Pty) Ltd to prepare an Environmental Management Plan (EMP) for the upgrade of the **existing** firewater supply system of the oil industry terminals in Walvis Bay (Figure 2-1). The pump station and main water line is located on the shoreline within the fishing harbour on a registered pipeline servitude. The firewater system supplies seawater for firefighting purposes to various petroleum storage terminals in Walvis Bay. Seawater is extracted directly from the ocean and reticulated in underground pipelines to the various terminals for storage in their firefighting backup water reservoir. The upgrade will require all existing pumps and pipelines to be removed and replaced as well as the installation of two bulk potable water storage tanks. As part of the proposed development, the seawater intake point and filtration system will also be upgraded. General operations involve the reticulation of seawater to the fuel terminals, general maintenance and cleaning of seawater intake points, pumps and pipelines, operations of related infrastructure and day to day administrative tasks.

The development of the EMP is required to comply with Namibian legislation, and to adhere to all codes and standards applied in Namcor's operations. The EMP provides management options to ensure environmental impacts of the upgrade and operations of the firewater supply system are minimised. The environment being defined in the Environmental Management Act as "land, water and air; all organic and inorganic matter and living organisms as well as biological diversity; the interacting natural systems that include components referred to in sub-paragraphs, the human environment insofar as it represents archaeological, aesthetic, cultural, historic, economic, paleontological or social values".

The EMP is thus a tool used to take pro-active action by addressing potential problems before they occur. This limits potential future corrective measures that may need to be implemented and allows for application of mitigation measures for unavoidable impacts. This document should be used as an on-site reference document during all phases (planning, construction (upgrade, care and maintenance), operations and decommissioning) of the firewater supply system. All monitoring and records kept should be included in a report to ensure compliance with the EMP. Parties responsible for transgression of the EMP should be held responsible for any rehabilitation that may need to be undertaken. A Health, Safety, Environment and Quality policy as well as Environmental Policy could be used in conjunction with the environmental management plan. Operators and responsible personnel must be taught the contents of these documents. Municipal or national regulations and guidelines must be adhered to and monitored regularly as outlined in the EMP.

The EMP will be used to apply for an environmental clearance certificate in compliance with Namibia's Environmental Management Act (Act No 7 of 2007).

2 SCOPE

The scope of the EMP is to:-

- Provide a brief overview of all components and related upgrade and operations of the firewater supply.
- Summarise the legal and regulatory framework within which the project operates.
- Provide a brief overview of the environment, i.e. the physical, biological, social and economic conditions, potentially impacted by the project.
- To identify potential impacts of the project on the environment.
- Identify a range of management actions which could mitigate the potential adverse impacts to acceptable levels.
- To provide sufficient information to the relevant competent authorities and the Ministry of Environment, Forestry and Tourism to make informed decisions regarding the development.

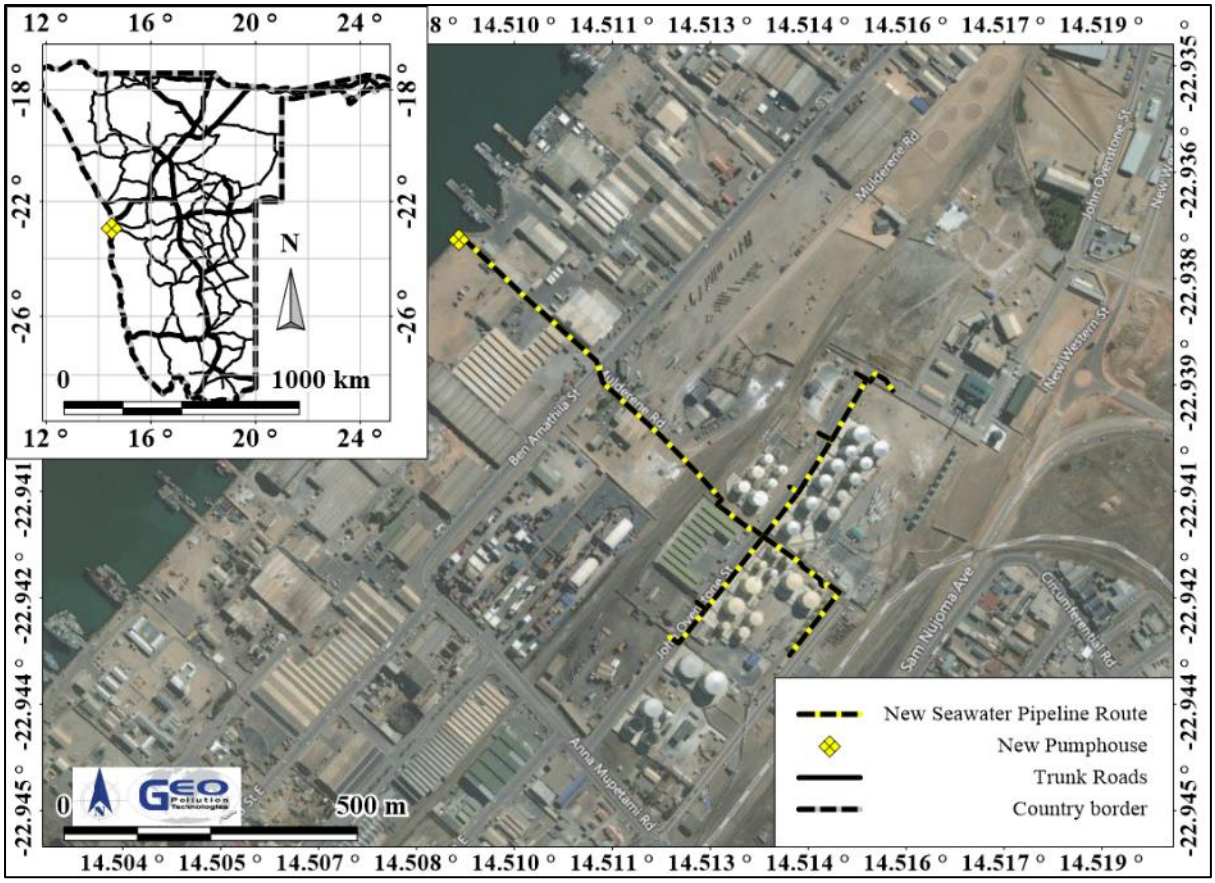

Figure 2-1. Project location and layout

3 METHODOLOGY

The following methods were used to prepare the EMP:

1. Baseline information about the site and its surroundings was obtained from primary information and existing secondary information.
2. Potential environmental impacts emanating from the operations, construction / maintenance and decommissioning of the project were considered and possible enhancement measures were listed for positive impacts while mitigation / preventative measures were provided for negative impacts as part of the EMP.

4 FACILITY OPERATIONS AND RELATED ACTIVITIES

The seawater pump station and potable water tanks are situated within a registered servitude on the shoreline at Etosha Fishing Corporation (Pty) Ltd, Ben Amathila Avenue, in Walvis Bay. The majority of the seawater supply pipelines are situated within underground trenches, in a registered pipeline servitude, and crosses various erven and road servitudes within the industrial area from the pump station to the terminals. It is anticipated that the upgrade of the seawater supply system will commence once an environmental clearance certificate has been issued by the MEFT and the various additional permits and licences have been issued by the various regulatory bodies.

4.1 PLANNED INFRASTRUCTURE

The proponent proposes to upgrade the existing firewater supply system of the oil industry terminals in Walvis Bay. The firewater supply system consist of a seawater intake, seawater pump and associated diesel driven pumps and infrastructure, underground pipeline and associated fire hydrants, valves etc. The proposed upgrade will require all equipment to be removed and replaced.

Construction activities will involve:

- Removal of existing equipment, piping, fittings and electrical equipment.
- Demolition of existing pump and foam stations and construction of new, upgraded stations.
- Excavate, remove and replace existing seawater pipelines with a new 250 mm diameter high density polyethylene (HDPE) pipeline and associated infrastructure.
- Replace fire hydrants in Ovenstone Street.
- Construction of concrete seawater intake point and associated infrastructure.
- Installation of seawater intake screens, pipelines, two diesel driven seawater pump sets, self-cleaning filtration systems, and two 10 m^3 potable water tanks at the pump station.
- Construction of concrete palisade fencing around pump station for safety and security purposes.
- Construction of a concrete parking area at the pump station
- Removal and disposal / recycling of all building rubble and removed equipment.

4.2 OPERATIONAL ACTIVITIES

Seawater will be extracted directly from the ocean and supplied to fuel terminals for storage in their firefighting backup water reservoirs. Water will be reticulated from the ocean to the terminals by means of two diesel driven pumps situated at the seawater extraction point. Seawater will pass through a self-cleaning filtration system (basket strainer) prior to reticulation to remove and prevent biofouling from attaching to the filter. The basket strainer is essentially a screen which rotates on a daily basis to remove and return all biofouling to the ocean.

Seawater extraction and reticulation will be irregular, as water will only be supplied to terminals if and when required. Seawater for firefighting purposes is supplied to the Puma Energy Namibia terminal, Total Namibia terminal, Engen Namibia terminal, Afrox Namibia and the National Oil Storage Site (Namcor). The two 10 m^3 potable water tanks will be used to flush and prime the system with clean water after use. The potable water will replace the seawater in the system and discharge into the ocean after flushing. This will discourage the growth of biofouling in the system as well as prevent corrosion and ultimately extend the life span of the equipment and piping. Flushing and priming the system will use approximately 12.7 m^3 of potable water, of which the majority will be discharged into the ocean. No chemicals will be used in the system.

Additional operations of the project may include daily administrative activities as well as general care and maintenance of the property and infrastructure.

5 ADMINISTRATIVE, LEGAL AND POLICY REQUIREMENTS

To protect the environment and achieve sustainable development, all projects, plans, programmes and policies deemed to have adverse impacts on the environment require an environmental assessment, as

per the Namibian legislation. The legislation and standards provided in Table 5-1 to Table 5-3 govern the environmental assessment process in Namibia and/or are relevant to the facility.

Table 5-1. Namibian law applicable to the project

Law	Key Aspects
The Namibian Constitution	♦ Promote the welfare of people ♦ Incorporates a high level of environmental protection ♦ Incorporates international agreements as part of Namibian law
Environmental Management Act Act No. 7 of 2007, Government Notice No. 232 of 2007	♦ Defines the environment ♦ Promote sustainable management of the environment and the use of natural resources ♦ Provide a process of assessment and control of activities with possible significant effects on the environment
Environmental Management Act Regulations Government Notice No. 28-30 of 2012	♦ Commencement of the Environmental Management Act ♦ List activities that requires an environmental clearance certificate ♦ Provide Environmental Impact Assessment Regulations
The Water Act Act No. 54 of 1956	♦ Remains in force until the new Water Resources Management Act comes into force ♦ Defines the interests of the state in protecting water resources ♦ Controls the disposal of effluent ♦ Numerous amendments
Water Resources Management Act Act No. 11 of 2013	♦ Provide for management, protection, development, use and conservation of water resources ♦ Prevention of water pollution and assignment of liability ♦ Not in force yet
Marine Resources Act Act No. 27 of 2000	♦ Prevents the discharge of anything that may be injurious to marine resources or may disturb ecological balance in any area of the sea or which may detrimentally affect the marketability of marine resources, or which may hinder their harvesting
The Namibian Ports Authority Act Act No. 2 of 1994	♦ Provide for the establishment of the Namibian Ports Authority and its functions ♦ Responsible to protect the environment within its areas of jurisdiction
Local Authorities Act Act No. 23 of 1992, Government Notice No. 116 of 1992	♦ Define the powers, duties and functions of local authority councils ♦ Regulates discharges into sewers
Public Health Act Act No. 36 of 1919	♦ Provides for the protection of health of all people
Public and Environmental Health Act Act No. 1 of 2015, Government Notice No. 86 of 2015	♦ Provides a framework for a structured more uniform public and environmental health system, and for incidental matters ♦ Deals with Integrated Waste Management including waste collection disposal and recycling; waste generation and storage; and sanitation.

Law	Key Aspects
Labour Act Act No 11 of 2007, Government Notice No. 236 of 2007	♦ Provides for Labour Law and the protection and safety of employees ♦ Labour Act, 1992: Regulations relating to the health and safety of employees at work (Government Notice No. 156 of 1997)
Hazardous Substances Ordinance Ordinance No. 14 of 1974	♦ Applies to the manufacture, sale, use, disposal and dumping of hazardous substances as well as their import and export ♦ Aims to prevent hazardous substances from causing injury, ill-health or the death of human beings
Pollution Control and Waste Management Bill (draft document)	♦ Not in force yet ♦ Provides for prevention and control of pollution and waste ♦ Provides for procedures to be followed for licence applications

Table 5-2. Municipal by-laws, guidelines and regulations

Municipal By-laws, Guidelines or Regulations	Key Aspects
Integrated Urban Spatial Development Framework for Walvis Bay	♦ Overall vision to transform Walvis Bay to being the primary industrial city in Namibia ♦ Aims to ensure that appropriate levels of environmental management is enforced for all developments in Walvis Bay
Integrated Environmental Policy of Walvis Bay (Agenda 21 Project)	♦ Indicates the directions that the Municipality of Walvis Bay will move towards in the forthcoming years to fulfil its responsibilities to manage the environment of Walvis Bay together with the town's residents and institutions ♦ Strong focus on conservation and protection of environment
Namibian Ports Authority Specifications and Regulations	♦ Enforced Standards and Codes which governs construction and operations relating to the port.

Table 5-3. Relevant multilateral environmental agreements for Namibia and the development

Agreement	Key Aspects
Stockholm Declaration on the Human Environment, Stockholm 1972.	♦ Recognizes the need for a common outlook and common principles to inspire and guide the people of the world in the preservation and enhancement of the human environment.
1985 Vienna Convention for the Protection of the Ozone Layer	♦ Aims to protect human health and the environment against adverse effects from modification of the Ozone Layer are considered. ♦ Adopted to regulate levels of greenhouse gas concentration in the atmosphere.
United Nations Framework Convention on Climate Change (UNFCCC)	♦ The Convention recognises that developing countries should be accorded appropriate assistance to enable them to fulfil the terms of the Convention.
Convention on Biological Diversity, Rio de Janeiro, 1992	♦ Under article 14 of The Convention, EIAs must be conducted for projects that may negatively affect biological diversity.
National Marine Pollution Contingency Plan of 2017	♦ Coordinated and integrated national system for dealing with oil spills in Namibian waters
Benguela Current Commission	♦ Interim Agreement between Namibia, South Africa and Angola to establish a permanent mechanism for the sustainable management of the marine environment and its resources of the Benguela Current Large Marine Ecosystem (BCLME) ♦ Propose a set of sediment and water quality guidelines
The Convention on Wetlands of International Importance especially as Waterfowl Habitat (referred as the Ramsar Convention)	♦ It is a framework for international cooperation in the conservation and wise use of wetlands and their resources ♦ Recognizes the Walvis Bay Nature Reserve – a tidal lagoon consisting of Pelican Point, adjacent intertidal areas, sandbars serving as roosting sites and mudflats exposed during low tide (12,600 ha) as a Wetland of International Importance
UN Convention for the Prevention of Marine Pollution from Land-based Sources	♦ Concerns itself with the protection of marine fauna and flora by preventing marine pollution from land-based sources ♦ Contracted parties, are committed to take all possible steps to prevent pollution of the sea as well as the direct or indirect introduction of substances or energy by humans into the marine environment resulting in such adverse effects as harm to living resources and to marine ecosystems, hazards to human health, damage to services/ facilities or interference with other legitimate uses of the area

The project is listed as an activity requiring an environmental clearance certificate as per the following points from Section 8 and 10 of Government Notice No. 29 of 2012:

1. 8.1 “The abstraction of ground or surface water for industrial or commercial purposes.”
2. 10.1 (e) “The construction of any structure below the high water mark of the sea.”

6 ENVIRONMENTAL CHARACTERISTICS

This section lists pertinent environmental characteristics of the study area and provides a statement on the potential environmental impacts on each.

6.1 LOCALITY AND SURROUNDING LAND USE

The seawater intake point and pump station is located within the fishing harbour and industrial area of Walvis Bay (22.9374°S, 14.5086°E) (Figure 2-1). The firewater supply pipeline is situated within a registered pipeline servitude and extends from the pump station to the fuel storage terminals situated along Ovenstone Street. The greater area is generally classified as an industrial area with a variety of industries linked to shipping, fishing, transport and oil. The pump station is situated at Etosha Fishing Corporation's warehouse premises whilst the underground pipeline crosses various erven as well as a railway reserve and road reserves. There are no heritage or cultural sites located on or in close proximity to the site.

Implications and Impacts

The project is situated in an area zoned mainly for industrial purposes. Seawater abstraction for industrial uses is a common practice within fishing harbour. No significant land use impact is expected on nearby establishments.

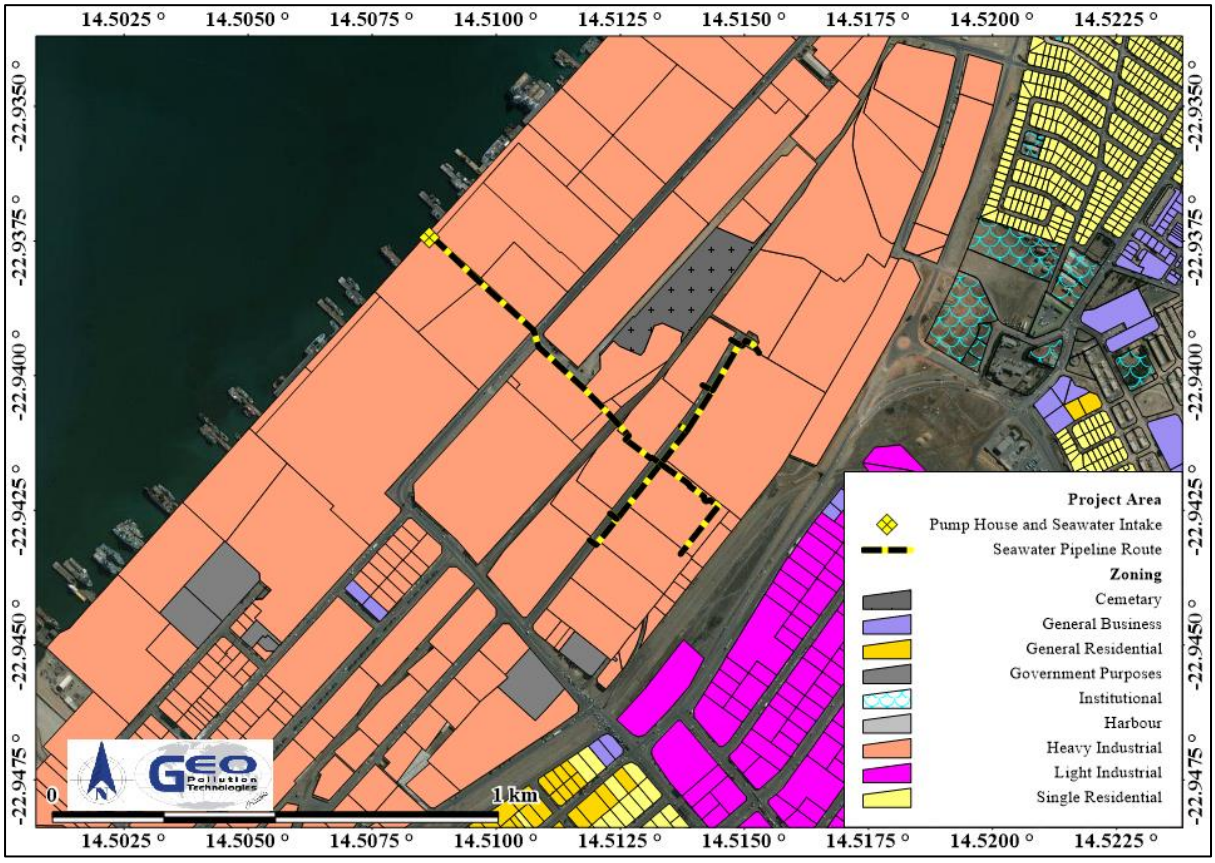

Figure 6-1. Surrounding land use

6.2 CLIMATE

Namibia's climate is dominated by dry conditions for most of the year and particularly so in the west. The location of Namibia with respect to the Intertropical Convergence Zone, Subtropical High Pressure Zone and Temperate Zone is what determines the climate, with the Subtropical High Pressure Zone being the major contributor to the dry conditions (Atlas of Namibia, 2002; Bryant, 2010). Precipitation over Namibia is mainly controlled by the South Atlantic High (SAH), a high pressure cell (anticyclone) situated west of Namibia in the Subtropical High

Pressure Zone. The SAH shifts during the year and is at higher latitudes in winter and lower latitudes in summer. In winter, as a result of being situated more north, the high pressure cell pushes any moisture originating from the Intertropical Convergence Zone northwards, preventing rain over Namibia. In summer, because the high pressure cell moves further south, and has less of an effect on the Intertropical Convergence Zone, moist air reaches Namibia, resulting in summer rains.

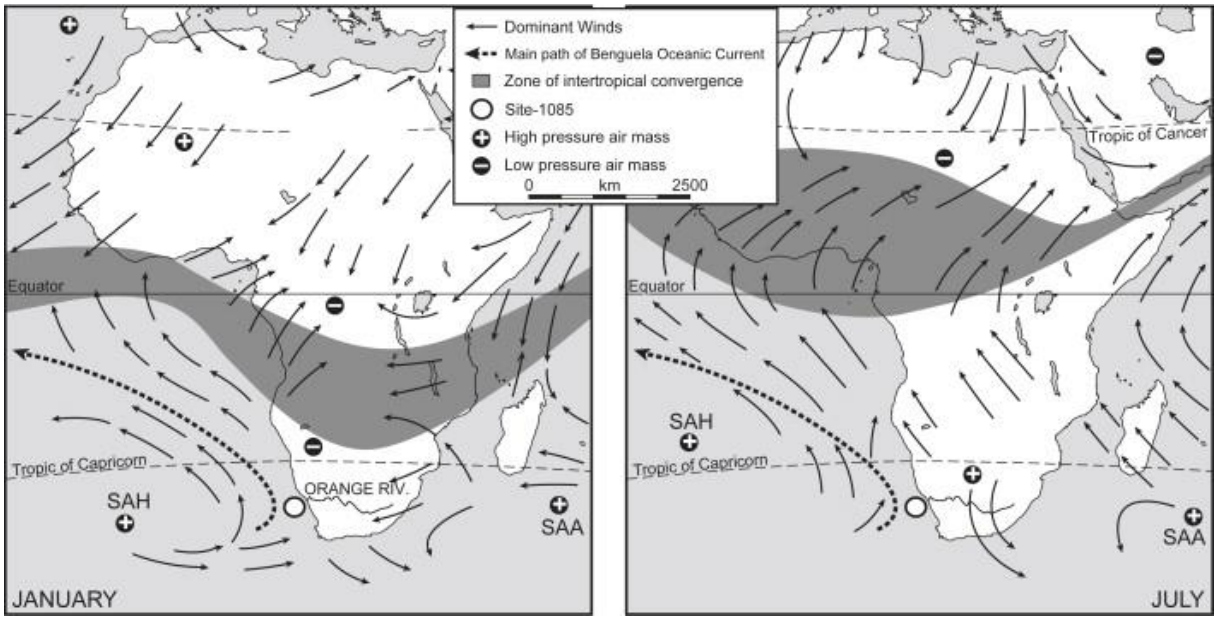

Figure 6-2. Map indicating the Intertropical Convergence Zone, Subtropical High Pressure Zone (SAH+), Benguela Current and Temperate Zone south of Tropic of Capricorn (not indicated) (from: http://www.meteoweb.eu)

On a more localised scale, the climatic conditions on the central Namibian coast, and inland thereof (coastal plains), are strongly influenced by the cold Benguela current, the SAH and the relatively flat coastal plains separated from the central highlands by a steep escarpment. The anticlockwise circulation of the high pressure SAH and the action of the earth's Coriolis force result in strong southerly (longshore) winds blowing northwards up the coastline of Namibia (Bryant, 2010; Corbett, 2018). This longshore wind is responsible for upwelling of the cold, deep waters of the Benguela Current. As a result of the temperature difference between the cold surface water of the Benguela Current and the warm coastal plains, the southerly wind is diverted to a south south-westerly to south-westerly wind along the coast. At Walvis Bay the temperature gradient that forms over the warmer darker sands south of the Kuiseb River, compared with the cooler lighter coloured gravel plains to the north of the river, leads to the formation of cyclonic circulation (localised low-pressure systems) centred over the dune area, due to warm air that rises. This, together with topographical changes and land-use, causes a local deflection of wind flow over the Walvis Bay area, from south to southwest in Walvis Bay (Figure 6-3), to more southwest to westerly further inland, as well as reduced wind speeds.

The winds are strongest in early to mid-summer (September to January) when the SAH is at its strongest and most persistent, and the temperature difference between the sea and the desert plains are at its greatest. Wind speeds then occasionally exceed 32 km/h and usually peaks late morning to early afternoon. In winter, the SAH loses strength and the southerly to south-westerly winds are at their weakest. Winter winds do not have enough strength to reach far inland. Autumn to winter conditions do however promote the formation of east wind conditions (berg winds) that can reach speeds of more than 50 km/h and transport a lot of sand. East winds occur when the inland plateau is cold with a localised high pressure cell, while a low pressure system is present at the coast. The high pressure cell forces air off the escarpment and as the air descents, it warms adiabatically as well as create a low pressure system due to the vertical expansion of the air column. The warm air flows toward the coastal low and ass it passes over the Namib plains, it

heats up even further. The wind manifests itself as very strong, warm and dry winds during the mornings to early afternoon, but dies down late afternoon.

Throughout the year the prevailing night time wind is a weak easterly wind. This results from the mainland cooling to below the temperature of the coastal water. This results in a coastal low versus an onshore high pressure system with first no wind in the early evening, when temperatures between water and land is similar, and then weak easterly winds as the temperature difference increase.

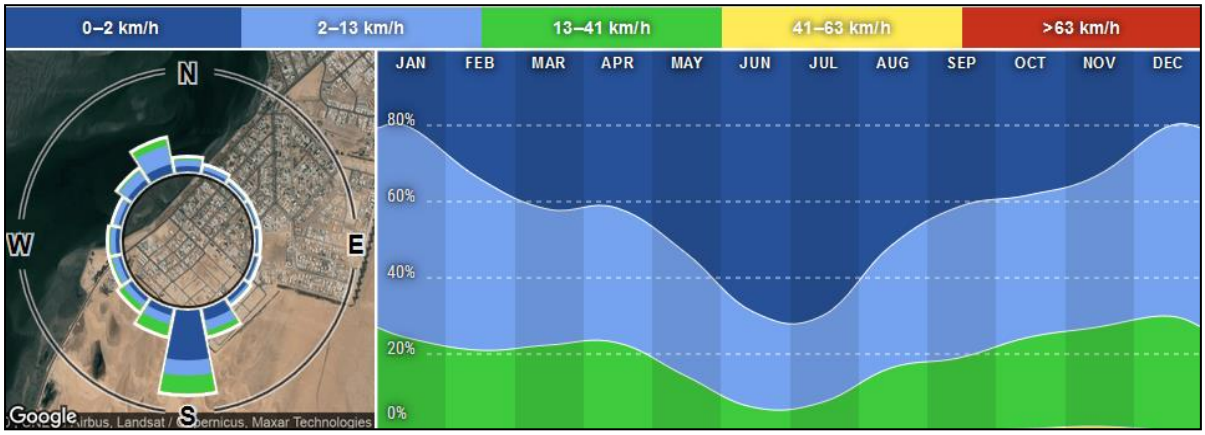

Figure 6-3. Wind direction and strength at the Walvis Bay Lagoon as measured between 2013 and 2020 (From: https://www.windfinder.com/windstatistics/walvis_bay_airport)

Temperature at Walvis Bay is strongly regulated by the cold Benguela current. As a result, there is typically limited variation between diurnal and seasonal temperatures. Average annual temperatures are approximately 18 °C to 19 °C with the maximum temperature seldom above 30 °C and minimums rarely below 5 °C (Figure 6-4). The only real temperature extremes are experienced during east wind conditions in the autumn to early winter months when temperatures can reach the upper thirties or even low forties. This results in these months having an average maximum temperature ranging from 30 °C to 35 °C. As one moves inland from Walvis Bay, daytime temperatures increases rather quickly while night time temperatures can get significantly colder in the desert environment.

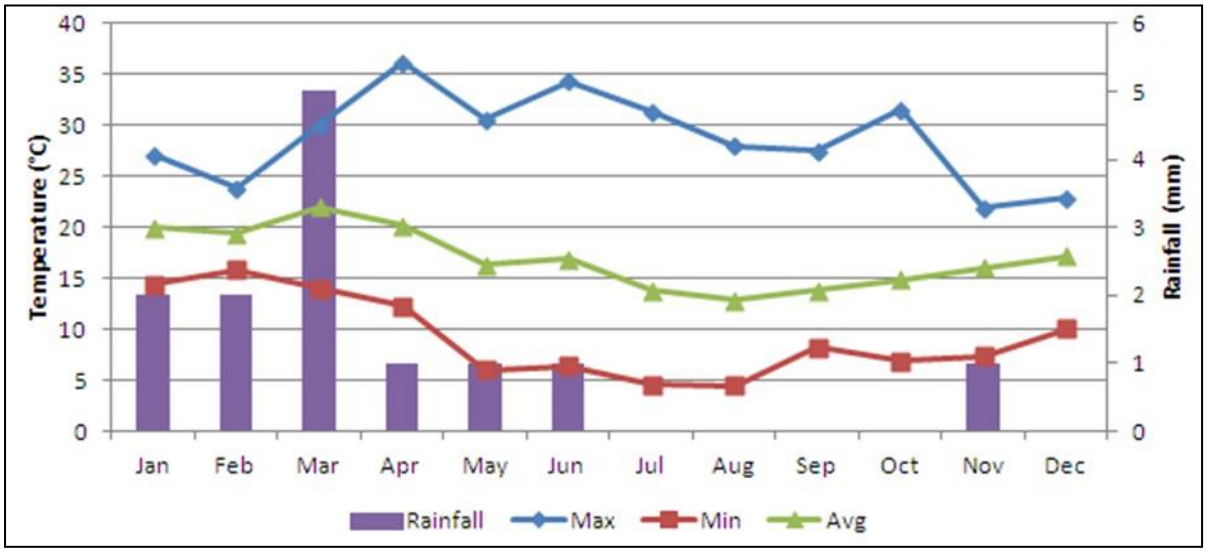

Figure 6-4. Temperature and rainfall at Walvis Bay (From: uMoya-NILU, 2020)

As explained above, the SAH severely limits the amount of rainfall over Namibia and especially at the coast and over the Namib Desert. As such, the average annual rainfall in Walvis Bay is below 50 mm (Figure 6-4), with variation in annual rainfall exceeding 100%. Infrequent, heavy rainfall do occur and typically results in rather chaotic conditions as Walvis Bay, and other coastal

towns, has not been developed to cater for large volumes of stormwater. Fog plays a very significant role as source of water for many plants and animals along Namibia's coast and the Namib Desert. Walvis Bay has up to 900 hours of fog per year and it results from the cold Benguela water cooling the humid air above it to such a temperature that the water vapour condenses to form fog and low level clouds (Mendelsohn et al., 2002).

Implications and Impacts

Water is a scarce and valuable resource in Namibia and Walvis Bay is characterized by low and extremely variable seasonal rainfall. This makes water an extremely vulnerable resource. Occasional flooding does occur and if the facility is not adequately designed may experience damage. Flooding may further result in uncontained pollution from spill or leakages during the construction phase ending up in the ocean. The use of seawater for firefighting purposes further reduces pressure on the local water supply scheme.

6.3 CORROSIVE ENVIRONMENT

Walvis Bay is located in a corrosive environment, which may be attributed to the frequent salt-laden fog, periodic winds and abundance of aggressive salts (dominantly NaCl and sulphates) in the soil. The periodic release of hydrogen sulphide (H_2S) from the ocean is expected to contribute to corrosion. See Figure 6-5 for corrosion comparison data with other centres. The combination of high moisture and salt content of the surface soil can lead to rapid deterioration of subsurface metal (e.g. pipelines) and concrete structures. Chemical weathering of concrete structures due to the abundant salts in the soil is a concern.

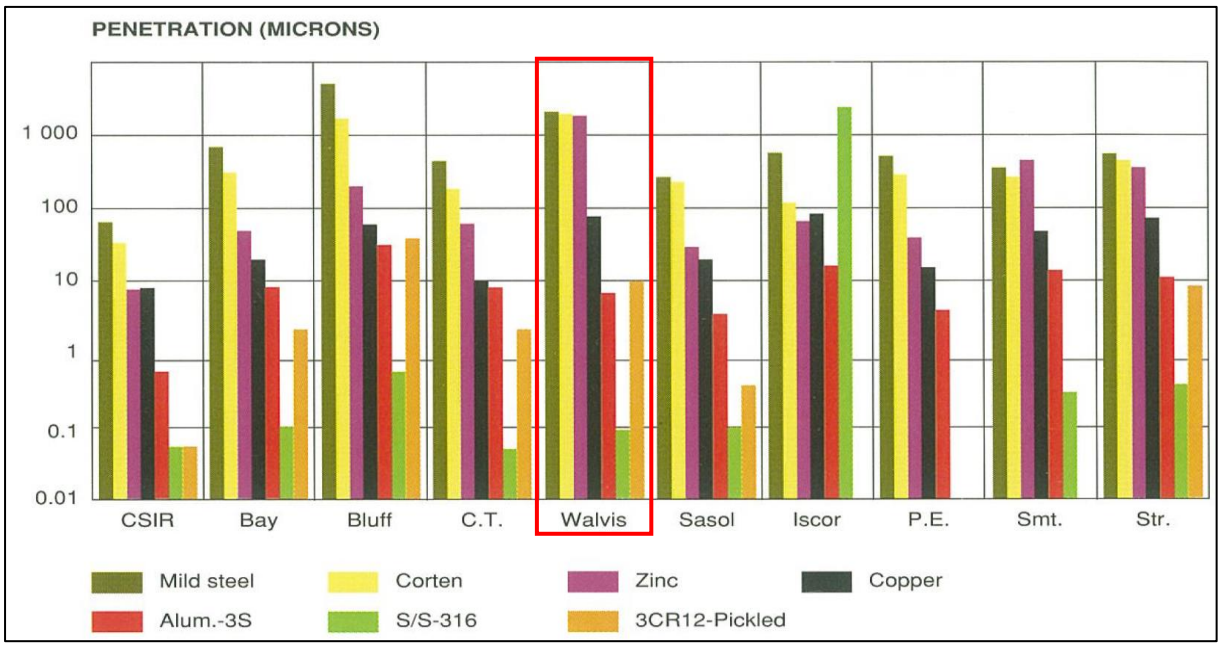

Figure 6-5. Twenty year corrosion exposure results in southern African towns (Callaghan 1991)

Implications and Impacts

Corrosion levels may be high and must be kept in mind when planning the installation and maintenance of the firewater supply system.

6.4 TOPOGRAPHY AND DRAINAGE

Walvis Bay is located in the Central Western Plain of Namibia. The Kuiseb River forms the southern boundary of this landscape group, with the Namib Dune Field being present south of the Kuiseb River. A bay is formed by a peninsula commonly known as Pelican Point. On the southern part of the bay is a lagoon which used to be the mouth of the Kuiseb River. Dune migration however forced the flow of the Kuiseb River to the north. This flow was stopped through the construction of a flood control wall to prevent flooding of the town of Walvis Bay,

thus forcing the flood waters to move through the dune area to the lagoon. The Kuiseb River now rarely reaches the lagoon.

The topography is generally flat with a local gentle downward slope in a westerly direction toward the ocean. Drainage is poorly developed due to the lack of rainfall <50 mm/annum received in the area. A dune field is present southeast of Walvis Bay and also further to the northeast. These dunes generally migrate in a northerly direction. Further inland is the gravel plains of the central areas of the Namib Naukluft Park. Surface water around Walvis Bay is limited to the marine salt pans, lagoon and ocean as well as a man-made wetland formed as a result of the sewage treatment works. The project area and surrounding areas are generally flat.

Implications and Impacts

Any pollutants that are not contained and transported via surface water flow will be transported away from the project location and potentially pollute the Atlantic Ocean and surrounding areas. Therefore, care must be taken to prevent any contaminant from entering the environment.

6.5 GEOLOGY AND HYDROGEOLOGY

Northerly dune migration is forcing the Kuiseb River in a northerly direction, with Kuiseb River paleochannels being present as far south as Sandwich Harbour.

Following the breakup of West-Gondwana during the early Cretaceous (130 – 135 Ma ago), continental uplift took place, enhancing erosional cutback and the formation of the Namibian Escarpment. A narrow pediplain formed, mainly over Damara Age rocks. The South Central started filling in over the pediplain, with marine conditions established around 80 Ma ago. Towards the end of the Cretaceous (70 – 65 Ma ago) a relative level surface was created, on which later deposition of sediments took place. Marine deposition took place in the parts covered by the newly formed South Central Ocean, while terrestrial deposits took place on land. Further continental uplift moved the shoreline to its present position.

Northwards migration of sand covered parts of the exposed marine deposits, with Kuiseb floods also depositing material over the marine sediments. Depth to bedrock in Walvis Bay is expected to be deeper than 40 m below surface. Based on previous work conducted in the area, it is expected that the sediments under the project area would consist of medium to coarse grain sand with thin lenses of more clayey material and layers of shell material.

Groundwater in the area is expected less than 2 m below surface and related to seawater intrusion. Tidal fluctuations is expected to result a variation in groundwater depth.

Implications and Impacts

Groundwater is not utilised in the area. Pollution of the groundwater is however still prohibited. Spill control measures should be implemented during the construction phase as well as for the diesel driven pumps to successfully prevent pollution of groundwater, surface water or soil. The lack of surface cover at the site will result in the rapid infiltration of any uncontained pollution. Shallow groundwater will lead to rapid lateral spreading of hydrocarbon products spilled or leaked. This will further have potential to contaminate seawater or impact on underground utilities and may cause impacts on neighbouring properties.

6.6 SURFACE WATER

No freshwater sources are found in close proximity to the project. The pump station is however situated on the shore of the Atlantic Ocean and will extracted seawater for firefighting purposes. Seawater is widely extracted and used as processing water in the area, mainly by surrounding fish factories.

Implications and Impacts

Any pollutants that enter the Atlantic Ocean, whether through water returned to the ocean during maintenance or directly from spills / leaks will deteriorate the quality of the aquatic environment. This may also reduce the quality of seawater used as processing water by other nearby users.

6.7 PUBLIC WATER SUPPLY

Public water supply to Walvis Bay and the surrounding developments is provided by NamWater from the NamWater Kuiseb Water Supply Scheme.

Implications and Impacts

The use of seawater for firefighting purposes as opposed to potable water use reduces strain on the potable water supply. Upgrading the system will ensure a reliable supply of seawater remains available.

6.8 FAUNA AND FLORA

Of note nearby is the Walvis Bay Lagoon, the salt works and the southern part of the bay west of the lagoon, which are the key components of the 12,600 ha Ramsar site (Wetland of International Importance). It is important both as an over-wintering area for Palaearctic migrant wader species as well as for African species such as Greater and Lesser Flamingos, Great White Pelican and Chestnut-Banded Plovers. The sewerage ponds, situated about 2 km south of the study area, are regarded as sensitive manmade wetlands. Although a manmade fresh water source, they are an attraction for pelicans and flamingos. These wetlands also support 53% of the duck and geese population in the area. The wetland is formed by the constant inflow of semi-purified water and supports extensive stands of reeds. There is also flight paths for birds between the sewerage ponds, the lagoon and the offshore bird breeding platform (Ghwano Island) 7 km north northeast of the site. The project area is located close to the flight path between the Walvis Bay Lagoon and Bird Island).

The marine mammals, occurring at various times in the Walvis Bay area, are the cetaceans which are the Common Bottlenose Dolphins, the Namibian endemic Heaveside's Dolphins, Dusky Dolphins, Humpback Whales, Southern Right Whales and Pigmy Right Whales as well as the Cape Fur Seals. The Common Bottlenose Dolphin, Heaveside's dolphin and Cape Fur Seal are seen most frequently (daily), the Pigmy Right Whale less frequently (monthly) and the rest infrequently as they are seasonal or infrequent visitors.

The Namibian coastal waters are home to five species of turtles and all five species are listed as threatened under the IUCN which is controlled through CITES. The most common occurring turtles near the proposed development are the Leatherback Turtle and Green Sea Turtle with the Hawksbill Sea Turtle occurring occasionally.

Implications and Impacts

The proposed development will take place in an already disturbed area, thus no immediate threat to the terrestrial biodiversity in the area is expected. Lighting used at night may blind or disorientate birds like flamingos that fly at night.

Pollutants entering the marine environment may negatively impact on marine mammals as well as on the food chains that sustain them. Larger species may also get trapped at the seawater intake point, which may lead to injury or death of the animal.

6.9 AQUATIC ENVIRONMENT - CURRENTS AND TIDES

The Benguela Current flows in a north-westerly direction along the Namibian coast. The average speed of the current is between 0.25 and 0.35 m/s (DMC-CSIR, 2010). The most important hydraulic conditions are shown in Table 6-1 (Tractebel, 1998; COWI, 2003a; DMR-CSIR, 2010).

Water enters and exits the bay at the northern tip of Pelican Point (DMC-CSIR 2010). Water entering flows below the exiting water. Current velocities are on average 0.12 m/s with sporadic maximums up to 0.25 m/s.

A study in 1965 indicated a pre-dominant clockwise circulation of currents in the bay (Tractebel, 1998). This was later confirmed in the COWI (2003b) and DMC-CSIR (2010) studies. Circulation occurs mostly in the upper layer and it depends on the wind direction. The current pattern is clockwise in the morning, towards the south. At Pelican Point, the current moves mostly northward for the whole day. A general northward current is found along the east side of the bay, very close to the coast.

Water currents prior to the construction of the new container terminal as well as modelling of currents once construction is completed are depicted in Figure 6-6. From this figure it can be seen that, in the vicinity of the project area, the water current flows in north-easterly direction along the quay walls and is expected to see an increase in current strength as a result of the development of the container terminal.

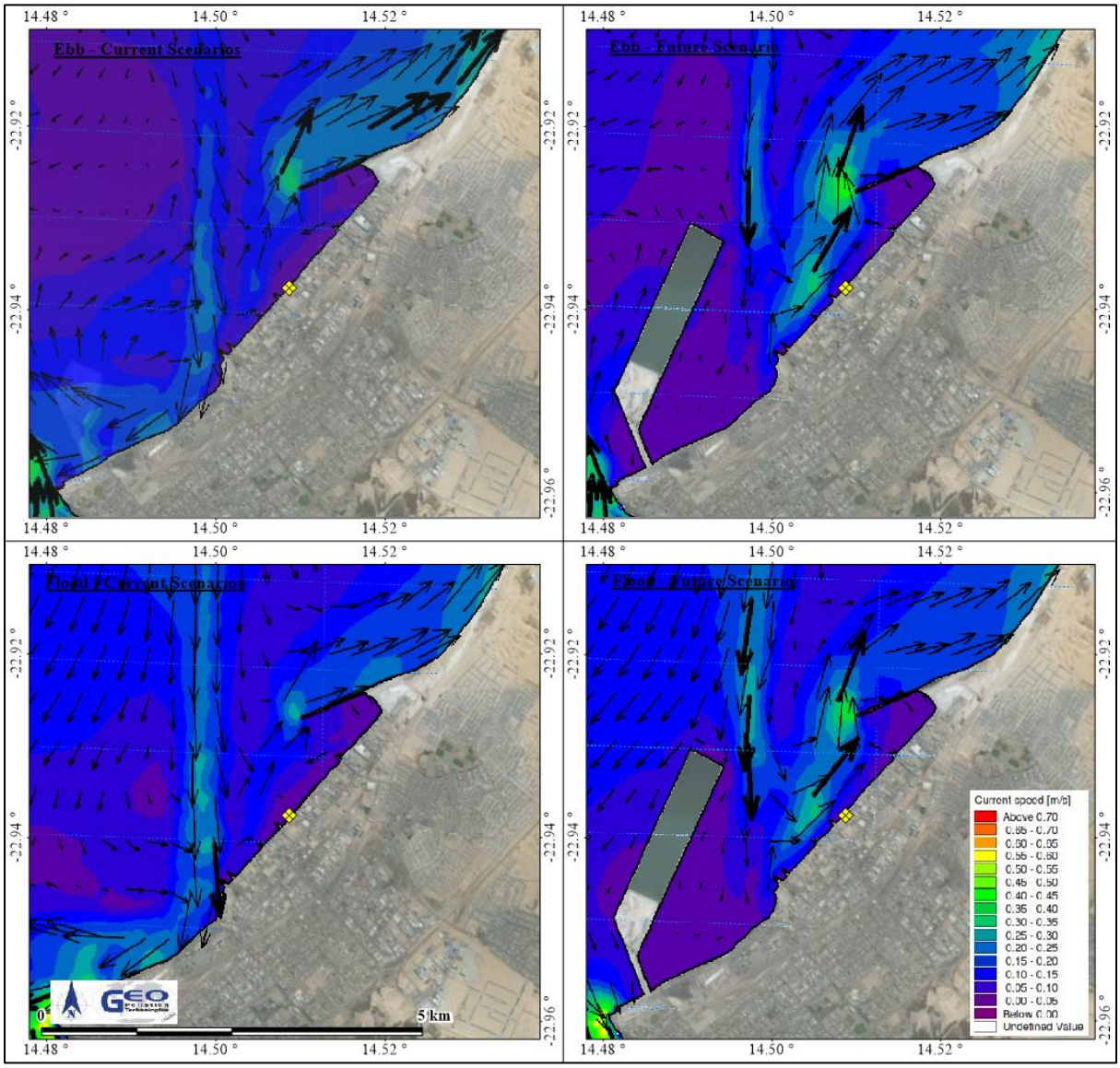

Figure 6-6. Comparison of Ebb (top) and Flood (bottom) Scenarios for Before and After the Construction of the New Container Terminal (Source: Hydrodynamic Modelling Report of DMC-CSIR 2010)

Table 6-1. The Oceanographic and Hydraulic Conditions of the Bay and the Sea (adapted from Tractebel, 1998; COWI, 2003b; DMR-CSIR, 2010).

Hydrological Conditions	Description
Tides and sea level -Tide statistics for Walvis Bay from SA Tide Tables	Highest Astronomical Tide +1.97 Mean High Water of Spring Tide +1.69 Mean High Water of Neap Tide +1.29 Mean Level +0.98 Mean Sea Level +0.966 Mean Low Water of Neap Tide +0.67 Mean Low Water of Spring Tide +0.27 Lowest Astronomical Tide 0.00
Waves	60 % southerly 23 % south-south-westerly 7 % south-westerly
Ocean current	The Benguela current runs north-westerly along the Namibian coastline at a speed between 0.25 m/s to 0.35 m/s
Tidal current	Negligible

Implications and Impacts

Any contamination that may enter the ocean at the pump house may be carried upstream by the current to sensitive receptors nearby, specifically seawater intakes of the fishing industry, which may negatively impact their operations. This is however not expected as no chemicals will be to the return water when the system is being flushed, and return water from the filtration system will only consist of solids and water extracted from the ocean.

6.10 DEMOGRAPHIC AND ECONOMIC CHARACTERISTICS

At local level Walvis Bay has an urban population size of 62,096 (Namibia Statistics Agency, 2014) although the current estimate is around 90,000 to 100,000. Walvis Bay is the principal port of Namibia, and is an import/export facility for processed fish, mining products and beef. The area is linked to Namibia's air, rail and road network, making its port well situated to service Zambia, Zimbabwe, Botswana, Southern Angola and South Africa. The fishing industry is the major employer of low skilled workers on a permanent and seasonal basis. The total employment of this sector is estimated at 2% of the total Namibian workforce. Economic activities relate mostly to businesses within the area and around the site.

Table 6-2. Demographic Characteristics of Walvis Bay, the Erongo Region and Nationally (Namibia Statistics Agency, 2011)

	Walvis Bay	Erongo Region	Namibia
Population (Males)	30,500	79,823	1,021,912
Population (Females)	29,000	70,986	1,091,165
Population (Total)	62,096	150,809	2,113,077
Unemployment (15+ years)	N/A	22.6%	33.8%
Literacy (15+ years)	N/A	96.7%	87.7%
Education at secondary level (15+ years)	N/A	71.8%	51.2%
Households considered poor	N/A	5.1%	19.5%

Implications and Impacts

The project itself is not expected to create any additional employment opportunities apart from job opportunities created during construction activities. However, the effective operations of the firewater supply system will aid in reducing fire related risks to the oil terminals. Some skills development and training will also benefit employees during the construction and operational phase.

6.11 HERITAGE, CULTURAL AND ARCHAEOLOGICAL ASPECTS

There are no churches, mosques or related buildings in close proximity to the site. No known archaeological resources have been noted in the vicinity since the urbanisation of the area. No other structures, sites or spheres of heritage of cultural significance was determined to be in close proximity to the site.

Implications and Impacts

No heritage, cultural or archaeological impact expected as a result of proposed construction and operational activities.

7 ENVIRONMENTAL MANAGEMENT PLAN

The purpose of this section is to list the most pertinent environmental impacts that are expected from the operational, construction (installation, upgrades, maintenance, etc.) and potential decommissioning activities of the firewater supply system.

7.1 OBJECTIVES OF THE EMP

The EMP provides management options to ensure impacts of the project is minimised. An EMP is a tool used to take pro-active action by addressing potential problems before they occur. This should limit the corrective measures needed, although additional mitigation measures might be included if necessary. The environmental management measures are provided in the descriptions below. These management measures should be adhered to during the various phases of the operation of the project. This section of the report can act as a stand-alone document. All personnel taking part in the operations of the project should be made aware of the contents in this section, so as to plan the operations accordingly and in an environmentally sound manner.

The objectives of the EMP are:

- to include all components of construction activities (installation, upgrades, maintenance, etc.) and operations of the project;
- to prescribe the best practicable control methods to lessen the environmental impacts associated with the project;
- to monitor and audit the performance of operational personnel in applying such controls; and
- to ensure that appropriate environmental training is provided to responsible operational personnel.

7.2 IMPLEMENTATION OF THE EMP

Section 7.3 outline the management of the environmental elements that may be affected by the different activities. Impacts addressed and mitigation measures proposed are seen as minimum requirements which have to be elaborated on. Delegation of mitigation measures and reporting activities should be determined by the proponent and included in the EMP. The EMP is a living document that must be prepared in detail, and regularly updated, by the proponent as the project progress and evolve.

The EMP and Environmental Clearance Certificate (ECC) must be communicated to the site managers. A copy of the ECC and EMP should be kept on site. All monitoring results must be reported on as indicated. Reporting is important for any future renewals of the ECC and must be submitted to the Ministry of Environment, Forestry and Tourism. Renewal of ECC will require six monthly reports based on the monitoring prescribed in this EMP.

Various potential and definite impacts will emanate from the operations and decommissioning phases. The majority of these impacts can be mitigated or prevented. The prevention and mitigation measures are listed below.

7.3 MANAGEMENT OF IMPACTS: OPERATIONS AND CONSTRUCTION

The following section provide management measures for both the operational phase as well as construction activities related to the project.

7.3.1 Planning

During the phases of planning for operations, construction and decommissioning of the project, it is the responsibility of the proponent to ensure they are and remain compliant with all legal requirements. The proponent must also ensure that all required management measures are in place prior to and during all phases, to ensure potential impacts and risks are minimised. The following actions are recommended for the planning phase and should continue during various other phases of the project:

- Ensure that all necessary permits from the various ministries, local authorities and any other bodies that governs the construction activities and operations of the project are in place and remains valid. This includes the permits for the seawater abstraction and effluent (flush water) disposal from the Department of Water Affairs and municipal approvals.
- Ensure that design parameters, where required, is approved by relevant authorities prior to construction activities.
- Ensure all appointed contractors and employees enter into an agreement which includes the EMP. Ensure that the contents of the EMP are understood by the contractors, sub-contractors, employees and all personnel present or who will be present on site.
- Make provisions to have a Health, Safety and Environmental Coordinator to implement the EMP and oversee occupational health and safety as well as general environmental related compliance at the site.
- Have the following emergency plans, equipment and personnel on site where reasonable to deal with all potential emergencies:
    - Risk management / mitigation / EMP/ Emergency Response Plan and HSE Manuals
    - Adequate protection and indemnity insurance cover for incidents;
    - Comply with the provisions of all relevant safety standards;
    - Procedures, equipment and materials required for emergencies.
- Establish and maintain a fund for future ecological restoration of the project site should project activities cease and the site is decommissioned and environmental restoration or pollution remediation is required.
- Establish and / or maintain a reporting system to report on aspects of construction activities, operations and decommissioning as outlined in the EMP.
- Submit bi-annual reports to the MEFT to allow for environmental clearance certificate renewal after three years. This is a requirement by MEFT.
- Appoint a specialist environmental consultant to update the EMP and apply for renewal of the environmental clearance certificate prior to expiry.

7.3.2 Skills, Technology and Development

Various levels of unskilled to skilled labour will be used during the construction phase. Some skills transfer to unskilled workers may result. Some skill training will be provided during operations to run the development effectively and according to required standards. The upgrades required for effective operations is often new to the local industry. Development of people and technology are key to economic development.

Desired Outcome: To see an increase in skills of local Namibians, as well as development and technology advancements in the fuel industry and associated firefighting capabilities.

Actions

Mitigation:

- The proponent must employ local Namibians where possible.
- If the skills exist locally, employees must first be sourced from the town, then the region and then nationally.
- Deviations from this practice must be justified.

Responsible Body:

- Proponent

Data Sources and Monitoring:

- Summary report based on employee records.
- Bi-annual summary reports on all training conducted.

7.3.3 Demographic Profile and Community Health

The project relies on labour for construction and operations. The scale of the project is limited and forms part of existing operations, it is therefore not foreseen that it will create a change in the demographic profile of the local community. Community health may still to some extent be exposed to factors such as communicable disease like HIV/AIDS and alcoholism/drug abuse during the construction phase as a result of an increase in foreign people in the area.

Desired Outcome: To prevent the in-migration and growth in informal settlements, prevent the spread of communicable disease and prevent/discourage socially deviant behaviour.

Actions:

Prevention:

- Employ only local people from the area, deviations from this practice should be justified appropriately.
- Adhere to all municipal by-laws relating to environmental health.

Mitigation:

- Educational programmes for employees on HIV/AIDs and general upliftment of employees' social status.
- Appointment of reputable contractors.

Responsible Body:

- Proponent

Data Sources and Monitoring:

- Bi-annual summary report based on educational programmes and training conducted.
- Bi-annual report and review of employee demographics.

7.3.4 Secure supply of firefighting water to the fuel terminals

The firewater supply system supplies seawater to various fuel terminals for storage as firefighting water. The proposed upgrade will ensure a reliable supply remains available to the industry. The use of seawater further reduces strain on the freshwater supply of Walvis Bay.

Desired Outcome: Ensure effective operations and maintenance of the development.

Actions

Mitigation:

- Ensure compliance to the Namibia regulations related to seawater abstraction and effluent disposal.
- Proper management and maintenance to ensure a reliable supply.
- Record water supply and reticulation problems and take corrective actions.

Responsible Body:

- Proponent

Data Sources and Monitoring:

- Record problems and corrective actions taken and compile a bi-annual summary report.

7.3.5 Traffic

Construction activities (upgrade and installation) may result in traffic impacts at various locations, especially where pipelines crosses road reserves. Heavy vehicle accessing the areas for delivery and collection of equipment, and upgrade of pipelines crossing road and railway reserves may result in temporary interruptions of traffic flow.

Desired Outcome: Minimum impact on traffic and no transport or traffic related incidents.

Actions

Prevention:

- Heavy vehicle waiting to collect / deliver equipment should not be allowed to obstruct any traffic of entrances/exists of facilities in surrounding areas.

Mitigation:

- If any traffic impacts are expected, traffic management should be performed to prevent these, this should include diversion of traffic, appropriate warning signs etc.

Responsible Body:

- Contractor
- Proponent

Data Sources and Monitoring:

- Any complaints received regarding traffic issues should be recorded together with action taken to prevent impacts from repeating itself.
- A report should be compiled of all incidents reported, complaints received, and action taken.

7.3.6 Health and Safety

Activities associated with the construction and operational phases are reliant on human labour and therefore exposes them to health and safety risks. Health and safety risk are mostly related to the construction phase and include excavation activities, falling objects, moving vehicles and drowning. Construction activities in public areas further exposes pedestrians to health risks. Health and safety risk present during the operational phase are mostly related to various other operators active in the areas and include moving vehicles and forklifts, exposure to hot temperatures and slipping on wet surfaces.

Desired Outcome: To prevent injury, health impacts and theft.

Actions

Prevention:

- Clearly label dangerous and restricted areas as well as dangerous equipment and products.
- Equipment that will be locked away on site must be placed in a way that does not encourage criminal activities (e.g. theft).
- Provide all employees with required and adequate personal protective equipment (PPE), including reflector vests / high visibility clothing.
- Ensure that all personnel receive adequate training on operation of equipment/handling of hazardous substances.
- Barricade construction sites to prevent pedestrian access.
- All trenches should be backfilled as soon as construction activities are completed.
- All health and safety standards specified in the Labour Act should be complied with.
- Construction activities should be demarcated to prevent unauthorised access and incidents.

Mitigation:

- Selected personnel should be trained in first aid and a first aid kit must be available on site. The contact details of all emergency services must be readily available.
- Implement and maintain an integrated health and safety management system, to act as a monitoring and mitigating tool, which includes: colour coding of pipes, operational, safe work and medical procedures, permits to work, emergency response plans, housekeeping rules, MSDS's and signage requirements (PPE, flammable etc.).
- Strict security that prevents unauthorised entry during construction phases.

Responsible Body:

- Proponent
- Contractors

Data Sources and Monitoring:

- Any incidents must be recorded with action taken to prevent future occurrences.
- A bi-annual report should be compiled of all incidents reported. The report should contain dates when training were conducted and when safety equipment and structures were inspected and maintained.

7.3.7 Noise

Construction (including maintenance and upgrades) may generate noise as a result of heavy machinery accessing the construction areas. This will be a temporary impact. During operations, diesel driven pumps for seawater extraction and reticulation will generate a low frequency droning noise, noise pollution impacts will however be limited as the pumps will not be operated frequently and is situated in a pump house within the fishing harbour of Walvis Bay, surrounded by industrial activities.

Desired Outcome: To prevent any nuisance and hearing loss due to noise generated.

Actions

Prevention:

- Follow World Health Organization (WHO) guidelines on maximum noise levels (Guidelines for Community Noise, 1999) to prevent hearing impairment.
- All machinery must be regularly serviced to ensure minimal noise production.

Mitigation:

- Hearing protectors as standard PPE for workers in situations with elevated noise levels.

Responsible Body:

- Proponent
- Contractors

Data Sources and Monitoring:

- WHO Guidelines.
- Maintain a complaints register.
- Report on complaints and actions taken to address complaints and prevent future occurrences.

7.3.8 Waste production

Waste will be produced during the construction and operational phase. Construction waste will include building rubble, old pipes and pumps etc. Waste generated during operations will mainly be domestic waste. Contaminated materials, soil and water is considered as a hazardous waste.

Desired Outcome: To reduce the amount of waste produced, and prevent pollution and littering.

Actions

Prevention:

- All waste that can be re-used/recycled must be kept separate.
- Ensure adequate temporary waste storage facilities are available for the construction phase.
- Ensure waste cannot be blown away by wind.
- All regulations and by-laws relating to environmental health should be adhered to.

Mitigation:

- Waste should be disposed of regularly and at appropriately classified disposal facilities, this includes hazardous material, if any (empty chemical containers, contaminated rugs, paper water and soil).
- See the material safety data sheets available from suppliers for disposal of contaminated products and empty containers, if any.
- Liaise with the municipality regarding waste and handling of hazardous waste as required.

Responsible Body:

- Proponent
- Contractors

Data Sources and Monitoring:

- A register of hazardous waste disposal should be kept. This should include type of waste, volume as well as disposal method/facility.
- Any complaints received regarding waste should be recorded with notes on action taken.
- All information and reporting to be included in a bi-annual report.

7.3.9 Ecosystem and Biodiversity Impact

The nature of the operational activities is such that the probability of creating a habitat for terrestrial flora and fauna to establish is low. Biofouling may however occur on any submerged structures (i.e. growth of organisms like molluscs, algae, etc. on the structures). No significant impact on the terrestrial biodiversity of the area is predicted as the affected areas are developed and currently void of natural fauna and flora. Noise related to the upgrade of the seawater intake may impact on nearby marine animals. The harbour is however a noisy environment and animals may be used to noise or leave the area at the onset of activities. Larger species may also get trapped at the seawater intake points, which may lead to injury or death of the animal. Further impacts are mostly related to pollution of the environment as well as potential impacts of bright lights on birds flying at night.

Desired Outcome: To avoid pollution of and impacts on the ecological environment.

Actions.

Mitigation:

- Report any extraordinary animal sightings to the Ministry of Environment, Forestry and Tourism.
- Mitigation measures related to waste handling and the prevention of groundwater, surface water and soil contamination should limit ecosystem and biodiversity impacts.
- Direct all lights down to working surfaces and use minimal lighting at night.
- The establishment of habitats and nesting sites at the facility should be avoided where possible.
- Seawater intake point should have a screen to prevent the intake and entrainment of larger marine organisms.

Responsible Body:

- Proponent

Data Sources and Monitoring:

- All information and reporting to be included in a bi-annual report.

7.3.10 Surface Water, Groundwater and Soil Contamination

During normal operations, after seawater extraction, potable water will be used to flush seawater out of the system which will then be discharged into the ocean. This is however not expected to impact surface water quality as the process will be infrequent and no chemicals will be added to the water. During construction, groundwater soil or surface water contamination may result due to breakdowns and leakages from heavy vehicles.

Desired Outcome: To prevent the contamination of water and soil.

Actions

Prevention:

- Regular inspection and maintenance of seawater intake screen.
- Water discharged into the ocean should be diffused / discharged onto a rocky area to prevent the upwelling of sediments and possible contaminants captured in the sediment.
- Contaminated water, if any, must be prevented from entering the ocean and treated as hazardous waste.
- The procedures followed to prevent environmental damage during service and maintenance, and compliance with these procedures, must be audited and corrections made where necessary.
- Chemicals used, if any, may not be allowed to enter the ocean in any way.
- Adhere to water abstraction and disposal permit conditions as supplied by the Ministry of Agriculture, Water and Land Reform.

Mitigation:

- Spill clean-up means must be readily available on site as per the relevant MSDS.
- Any chemical spill must be cleaned up immediately.
- Use of reputable and well trained contractors are essential.

Responsible Body:

- Proponent
- Contractors

Data Sources and Monitoring:

- A report should be compiled bi-annually of all spills or leakages reported. The report should contain the following information: date and duration of spill, product spilled, volume of spill, remedial action taken, comparison of pre-exposure baseline data (previous pollution conditions survey results) with post remediation data (e.g. soil/groundwater hydrocarbon concentrations) and a copy of documentation in which spill was reported to Ministry of Agriculture, Water and Rural Development.

7.3.11 Visual Impact

This impact is not only associated with the aesthetics of the site, but also the structural integrity. The development will result in the upgrade of existing infrastructure, increasing the aesthetics of the firewater supply system. Construction activities will require excavation of the entire pipeline, if the areas are not sufficiently repaired and rehabilitation once upgrades are completed, this may have lasting negative aesthetic impact.

Desired Outcome: To minimise negative aesthetic impacts associated with the project and increase the aesthetics of the facility.

Actions

Mitigation:

- Regular waste disposal, good housekeeping and routine maintenance on infrastructure will ensure that the longevity of structures are maximised and a low visual impact is maintained.

Responsible Body:

- Proponent
- Contractors

Data Sources and Monitoring:

- A maintenance record should be kept.
- A report should be compiled of all complaints received and actions taken.

7.3.12 Impacts on Utilities and Infrastructure

Construction activities such as heavy vehicles accessing the project area and excavation activities may lead to accidental damage to utilities and infrastructure or fuel lines, which in turn may lead to spillages or to interruption of services such as water and electricity supply to the area.

Desired Outcome: No impact on utilities and infrastructure.

Actions

Prevention:

- Appointing qualified and reputable contractors is essential.
- The contractor must determine exactly where amenities and pipelines are situated before construction commences (utility clearance e.g. ground penetrating radar surveys where applicable).
- Liaison with the suppliers of services is essential.
- Prior approval to be obtained for all existing infrastructure that will be repurposed.

Mitigation:

- Emergency procedures for corrective action available on file.

Responsible Body:

- Proponent
- Contractors

Data Sources and Monitoring:

- A bi-annual report should be compiled of all incidents that occurred and corrective action taken.

7.3.13 Cumulative Impact

Possible cumulative impacts associated the proposed upgrade and operations is mostly related to traffic and noise impacts. Although the impacts of the project are minimal, multiple traffic and noise impacts from industries operational in area they may result in a notable cumulative impact.

Desired Outcome: To minimise cumulative all impacts associated with the development.

Actions

Mitigation:

- Addressing each of the individual impacts as discussed and recommended in the EMP would reduce the cumulative impact.
- Reviewing biannual and annual reports for any new or re-occurring impacts or problems would aid in identifying cumulative impacts and help in planning if the existing mitigations are insufficient.

Responsible Body:

- Proponent

Data Sources and Monitoring:

- Bi-annual summary report based on all other impacts must be created to give an overall assessment of the impact of the operational phase.

7.4 DECOMMISSIONING AND REHABILITATION

Decommissioning is not foreseen during the validity of the environmental clearance certificate. Decommissioning was however assessed as construction activities include modification and decommissioning. Should decommissioning occur at any stage, rehabilitation of the area may be required. Decommissioning will entail the complete removal of all infrastructure including buildings and underground infrastructure. Any pollution present on the site must be remediated. The impacts associated with this phase include noise and waste production as structures are dismantled. Noise must be kept within WHO standards and waste should be contained and disposed of at an appropriately classified and approved waste facility and not dumped in the surrounding areas. Future land use after decommissioning should be assessed prior to decommissioning and rehabilitation initiated if the land would not be used for future purposes. The EMP for the project will have to be reviewed at the time of decommissioning to cater for changes made to the site and implement guidelines and mitigation measures.

7.5 ENVIRONMENTAL MANAGEMENT SYSTEM

The proponent could implement an Environmental Management System (EMS) for their operations. An EMS is an internationally recognized and certified management system that will ensure ongoing incorporation of environmental constraints. At the heart of an EMS is the concept of continual improvement of environmental performance with resulting increases in operational efficiency, financial savings and reduction in environmental, health and safety risks. An effective EMS would need to include the following elements:

- A stated environmental policy which sets the desired level of environmental performance;
- An environmental legal register;
- An institutional structure which sets out the responsibility, authority, lines of communication and resources needed to implement the EMS;
- Identification of environmental, safety and health training needs;
- An environmental program(s) stipulating environmental objectives and targets to be met, and work instructions and controls to be applied in order to achieve compliance with the environmental policy; and
- Periodic (internal and external) audits and reviews of environmental performance and the effectiveness of the EMS.
- The EMP

8 CONCLUSION

The proposed upgrade will have a positive impact on Walvis Bay by contributing locally to skills transfer and training which in turn develops the local workforce during construction and operational activities. The firewater supply further plays a significant role in ensuring firefighting measures of the fuel terminals in the area are up to standard and that a reliable source of firefighting water is available at all times.

Negative impacts can successfully be mitigated. Seawater abstraction and effluent disposal permit conditions should be adhered to al all times. Noise pollution should meet the prescribed WHO requirements to prevent hearing loss and not to cause a nuisance. Fire prevention should be adequate, and health and safety regulations should be adhered to in accordance with the regulations pertaining to relevant laws and internationally accepted standards of operation. Any waste produced must be removed from site and disposed of at an appropriate facility or re-used or recycled where possible. Hazardous waste must be disposed of at an approved hazardous waste disposal site.

The EMP should be used as an on-site reference document for the upgrade and operations of the firewater supply system. Parties responsible for transgressing of the EMP should be held responsible for any rehabilitation that may need to be undertaken. The proponent could use an in-house Health, Safety, Security and Environment Management System in conjunction with the environmental management plan. All operational personnel must be taught the contents of these documents.

9 REFERENCES

Bryant R. 2010. Characterising the Wind Regime of Sand Seas: Data Sources and Scaling Issues. Global Sand Seas: Past Present and Future. Working Group Conference: Royal Geographical Society in London.

Callaghan B. 1991. Atmospheric corrosion testing in Southern Africa – results of a twenty-year national programme.

Corbett I. 2018. The Influence of the Benguela Low-Level Coastal Jet on the Architecture and Dynamics of Aeolian Transport Corridors in the Sperrgebiet, Namibia. Unpublished Report. https://pdfs.semanticscholar.org/a036/eb86ca35ceee1f19198d2735c93d36f9ac35.pdf?_ga=2.153498104.1710554377.1586180758-213198396.1586180758 Accessed on 7 April 2020.

Digital Atlas of Namibia Unpublished Report. Ministry of Environment & Tourism

Directorate of Environmental Affairs, 2008. Procedures and Guidelines for Environmental Impact Assessment (EIA) and Environmental Management Plans (EMP), Directorate of Environmental Affairs, Ministry of Environment and Tourism, Windhoek.

http://www.meteoweb.eu/2012/11/litcz-scivola-a-sud-dellequatore-nellafrica-australe-prende-vita-la-stazione-delle-piogge-levoluzione-per-i-prossimi-mesi/166037/ accessed 8 April 2020.

https://www.windfinder.com/windstatistics/walvis_bay_lagoon accessed 8 April 2020.

Mendelsohn J, Jarvis A, Roberts C, Robertson T. 2002. Atlas of Namibia: A Portrait of the Land and its People. David Philip Publishers, Cape Town.

Miller, R.2008. The Geology of Namibia, Volume 2. Neoproterozoic to Lower Palaeozoic, Ministry of Mines and Energy Geological Survey.

Namibia Statistics Agency. Namibia household Income and Expenditure Survey 2009/2010.

Namibia Statistics Agency. Namibia 2011 Population and Housing Census Main Report.

Nickel Development Institute. http://www.nickelinstitute.org/~/Media/Files/TechnicalLiterature/StainlessSteelsinABC_GuidelinesforCorrosionPrevention_11024_.pdf Accessed 08/05/2013

Pastakia, C.M.R.; 1998; The Rapid Impact Assessment Matrix (RIAM) – A new tool for Environmental Impact Assessment.

Petzer, G. & von Gruenewaldt, R. 2008. Air Quality Specialist Assessment for the Proposed Paratus Power Plant Extension in Walvis Bay, Midrand: Airshed Planning Professionals.

uMoya-NILU. 2020. Air Quality Specialist Study for the EIA and Clearance for the NamPower Firm Power Project in Walvis Bay, Namibia, Report No. uMN059-2020, 17 March 2020.

Appendix A: Consultants' Curriculum Vitae

ENVIRONMENTAL SCIENTIST **André Faul**

André entered the environmental assessment profession at the beginning of 2013 and since then has worked on more than 130 Environmental Impact Assessments including assessments of the petroleum industry, harbour expansions, irrigation schemes, township establishment and power generation and transmission. André's post graduate studies focussed on zoological and ecological sciences and he holds a M.Sc. in Conservation Ecology and a Ph.D. in Medical Bioscience. His expertise is in ecotoxicological related studies focussing specifically on endocrine disrupting chemicals. His Ph.D. thesis title was The Assessment of Namibian Water Resources for Endocrine Disruptors. Before joining the environmental assessment profession he worked for 12 years in the Environmental Section of the Department of Biological Sciences at the University of Namibia, first as laboratory technician and then as lecturer in biological and ecological sciences.

CURRICULUM VITAE ANDRÉ FAUL

Name of Firm	:	Geo Pollution Technologies (Pty) Ltd.
Name of Staff	:	ANDRÉ FAUL
Profession	:	Environmental Scientist
Years' Experience	:	18
Nationality	:	Namibian
Position	:	Environmental Scientist
Specialisation	:	Environmental Toxicology
Languages	:	Afrikaans – speaking, reading, writing – excellent English – speaking, reading, writing – excellent

EDUCATION AND PROFESSIONAL STATUS:

B.Sc. Zoology	:	University of Stellenbosch, 1999
B.Sc. (Hons.) Zoology	:	University of Stellenbosch, 2000
M.Sc. (Conservation Ecology)	:	University of Stellenbosch, 2005
Ph.D. (Medical Bioscience)	:	University of the Western Cape, 2018

First Aid Class A	EMTSS, 2017
Basic Fire Fighting	EMTSS, 2017

PROFESSIONAL SOCIETY AFFILIATION:

Environmental Assessment Professionals of Namibia (Practitioner and Executive Committee Member)

AREAS OF EXPERTISE:

Knowledge and expertise in:

- Water Sampling, Extractions and Analysis
- Biomonitoring and Bioassays
- Biodiversity Assessment
- Toxicology
- Restoration Ecology

EMPLOYMENT:

2013-Date	:	Geo Pollution Technologies – Environmental Scientist
2005-2012	:	Lecturer, University of Namibia
2001-2004	:	Laboratory Technician, University of Namibia

PUBLICATIONS:

Publications:	5
Contract Reports	+130
Research Reports & Manuals:	5
Conference Presentations:	1

ENVIRONMENTAL GEOLOGIST **Wikus Coetzer**

Wikus has 6 years' experience in environmental science related fields with 4 years' experience in conducting environmental impact assessments and preparation of environmental management plans. He holds an honours degree in Environmental Sciences – Environmental Geology from the Northwest-University Potchefstroom (NWU) South Africa. He first completed a B.Sc. degree in Geology and Botany in the required time also from the Northwest University Potchefstroom, South Africa. His honours project focused on the rehabilitation and phytoremediation of various tailings types and soils.

He has working experience as an environmental monitor / assisting environmental officer at Petra Diamonds, Cullinan Diamond Mine (CDM) where he gained a proper understanding of environmental monitoring responsibilities as well as legislations, regulations and the implementation of EMS/ISO14001. He started working at Geo Pollution Technologies in 2017, and regularly conducts/assists and report on environmental impact assessments, environmental management plans and pollution surveys.

CURRICULUM VITAE WIKUS COETZER

Name of Firm	:	Geo Pollution Technologies (Pty) Ltd.
Name of Staff	:	WIKUS COETZER
Profession	:	Environmental Geologist
Nationality	:	South African
Position	:	Environmental Geologist
Specialisation	:	Environmental Geology/ Geochemistry
Languages	:	Afrikaans – speaking, reading, writing English – speaking, reading, writing

EDUCATION AND PROFESSIONAL STATUS:

B.Sc. Environmental and Biological Sciences – Geology & Botany	: NWU Potchefstroom 2013
B.Sc. (Hons.) Environmental Sciences – Environmental Geology	: NWU Potchefstroom 2014

First Aid Class A	EMTSS, 2017
Basic Fire Fighting	EMTSS, 2017

AREAS OF EXPERTISE:

Knowledge and expertise in:

- Phytoremediation
- Environmental Geology / Geochemistry
- Environmental Monitoring
- Environmental Compliance
- Environmental Impact Assessments
- Environmental Management Plans

EMPLOYMENT:

2017 - Date:	Geo Pollution Technologies
2015 - 2016:	Petra Diamonds CDM – Environmental monitor / Assisting environmental officer
2015:	Petra Diamonds CDM – Graduate program: Environmental Officer
2014:	NWU Potchefstroom department of Geo and Spatial Sciences – Research assistant

PUBLICATIONS:

Contract Reports: +40