**APP-003688**

# UPDATE OF THE ENVIRONMENTAL IMPACT ASSESSMENT FOR THE CAPITAL AND MAINTENANCE DREDGING OF LÜDERITZ HARBOUR

**Assessed by:**

**Assessed for:**

April 2022

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| **Project:** | **UPDATE OF THE ENVIRONMENTAL IMPACT ASSESSMENT FOR THE CAPITAL AND MAINTENANCE DREDGING OF LÜDERITZ HARBOUR** |
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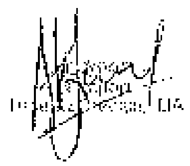
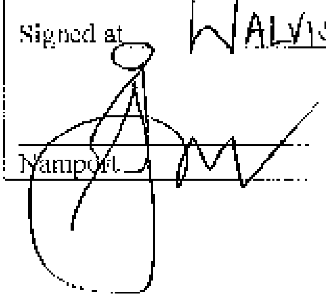
| **Report Approval** | <br>**André Faul**<br>Conservation Ecologist |

I, ____________________, acting as the Proponent's representative (Namport), hereby approve this report and confirm that the project description contained in herein is a true reflection of the information which the proponent has 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.

Signed at WALVIS BAY on the 26th day of APRIL 2022.



Namport

# SUMMARY

The Namibian Ports Authority, Namport, is mandated by the Ports Authority Act of 1994 to control and manage ports within Namibia. To ensure the Port of Lüderitz continues functioning optimally, periodic maintenance dredging is required to remove sediment from vessel operating areas. The last such dredging exercise was in 2015 and Namport is thus in the process of planning for dredging to be conducted within the next five to ten years. In addition to maintenance dredging, capital dredging may be considered to deepen the port, should port expansion become feasible due to increased demand for port services.

Dredging of the port is an activity that requires an environmental clearance certificate (ECC) to be issued by the Ministry of Environment, Forestry and Tourism. Previously, environmental impact assessments (EIAs) and environmental management plans (EMPs) were submitted to the Ministry in support of ECC applications, which were subsequently approved and issued. Namport has now appointed Geo Pollution Technologies to update their existing Port of Lüderitz dredging EIA and EMP to include possible dredging to be conducted within the next five to ten years. The updated documents will be submitted to the Department of Environmental Affairs of the Ministry of Environment, Forestry and Tourism in support of renewal of the Port's dredging ECC.

Namport envisions the maintenance dredging of approximately 170,000 $m^3$ of sediment in port operational areas within the next five to ten years. Should capital dredging realise, some drilling and blasting will be required, as the bedrock in the bay is shallow. Capital dredging will aim to increase water depth from -8.75 mCD to -12.8 mCD. All dredged material will be disposed of at an approved offshore disposal site.

Positive and negative impacts will realise from dredging activities. Job creation and skills development will be a temporary positive spinoff during dredging when the dredging contractor employ local companies for selected services. Continued, efficient port operations will maintain direct and indirect employment while continuing to be a driver of economic development in the town. Negative environmental impacts will realise from dredging activities. In terms of social impacts the influx of people to Lüderitz, especially foreign dredging contractors, may increase social ills in the town. Health and safety of crew include excessive noise and vibration exposure, exposure to elements such as cold temperatures, reduced air quality due to the release of hydrogen sulphide gas that can be lethal in high concentrations, and injuries related to operations of machinery and equipment.

Ecological impacts are mainly related to an increase in turbidity (suspended sediments / particles) in the water column during dredging and the dumping of dredged material at the disposal site. Increased suspended sediments / particles can contain various chemicals of concern such as heavy metals which reduces water quality. Reduced water quality can in turn impact on sensitive receptors such as mariculture areas, fish factory seawater intakes for processing water, and marine biological communities. Dredging activities and associated noise, as well as drilling and blasting impacts, may have detrimental effects on marine life, especially marine mammals, and may temporarily displace such animals and possible birds from the area. Furthermore, dredging per se will result in habitat destruction at the dredging site itself and where settling suspended dredged materials inundate benthic communities. During the commissioning and decommissioning phases, ballast water exchanges may result in the introduction of alien species into new habitats that may have long term consequences.

Enhancement of the positive impacts of dredging include maximising local involvement by appointing local companies and consultants for the supply of support services. Various preventative and mitigation measures can be implemented to reduce negative impacts, however key to this is the contracting of a dredging company that is reputable, with a known history of environmental responsibility and adherence to all maritime laws and regulations. During dredging, the necessary communications, signalling and safety equipment must be present and in working order on the vessel. Measures must be implemented to reduce dredged material suspension and real time water turbidity monitoring must be conducted to ensure the total suspended solids are kept within set limits.

Adherence to the updated EMP, to be implemented for the dredging operations, will ensure negative impacts from dredging and dredged material disposal are minimized while positive impacts are

maximized. The EMP describes the preventative and mitigation measures to be implemented by Namport, the dredging contractor and any subcontractors or consultants during dredging. It also includes certain baseline conditions determination, monitoring and reporting requirements that must be adhered to and communicated to the relevant authorities.

The EIA and EMP should be reviewed on a regular basis, in order to ensure that it remains relevant to project updates, improvements in dredging equipment and techniques, changing legislation and new knowledge gained. The EMP must form part of the contracts of all parties involved with the dredging process. Operators and responsible personnel must be taught the contents of these documents. Parties responsible for transgression of the EMP should be held responsible for any rehabilitation that may need to be undertaken.

**Impact summary class values**

| Impact Category | Impact Type | Dredging Operations | Indirect Impacts |
|---|---|---|---|
| | *Positive Rating Scale: Maximum Value* | 5 | 5 |
| | *Negative Rating Scale: Maximum Value* | -5 | -5 |
| EO | Employment | 2 | 4 |
| EO | Revenue Generation | 2 | 4 |
| EO | Skills, Technology and Development | 2 | 4 |
| SC | Demographic Profile and Community Health | -2 | -2 |
| SC | Seafaring Traffic | -2 | N/A |
| SC | Health, Safety and Security | -3 | N/A |
| PC | Fire and Explosion | -2 | N/A |
| PC | Noise and Vibration | -3 | N/A |
| PC | Waste Production | -3 | N/A |
| PC | Sediment Quality | -2 | N/A |
| PC | Suspended Sediments | -2 | N/A |
| PC | Water Quality | -2 | N/A |
| BE | Impacts on Marine Ecosystems | -3 | -3 |
| SC | Visual Impact | -2 | N/A |
| SC | Heritage Impact | -4 | N/A |
| PC/SC | Land-based Infrastructure Impact | -3 | N/A |
| | Cumulative Impact | -2 | 4 |

*BE = Biological/Ecological EO = Economical/Operational PC = Physical/Chemical SC = Sociological/Cultural*

# TABLE OF CONTENTS

## LIST OF APPENDICES



## LIST OF FIGURES

## LIST OF PHOTOS



## LIST OF TABLES

# LIST OF ABBREVIATIONS

| | |
|---|---|
| **AIDS** | Acquired immunodeficiency syndrome |
| **AIS** | Automatic Identification System |
| **BCLME** | Benguela Current Large Marine Ecosystem |
| **BWM** | The International Convention for the Control and Management of Ships' Ballast Water and Sediments |
| **CITES** | Convention on International Trade in Endangered Species of Fauna and Flora |
| **COLREG** | International Regulations for Preventing Collisions at Sea |
| **CSD** | Cutter Suction Dredger |
| **DEA** | Department of Environmental Affairs |
| **ECC** | Environmental Clearance Certificate |
| **EIA** | Environmental Impact Assessment |
| **EMA** | Environmental Management Act |
| **EMP** | Environmental Management Plan |
| **EMS** | Environmental Management System |
| **GPT** | Geo Pollution Technologies |
| **HIV** | Human Immunodeficiency Virus |
| **IAPs** | Interested and Affected Parties |
| **IBA** | Important Bird Area |
| **IMO** | International Maritime Organisation |
| **ISO** | International Standards Organisation |
| **IUCN** | International Union for the Conservation for Nature |
| **MAMSL** | Meters Above Mean Sea Level |
| **MARPOL** | The International Convention for the Prevention of Pollution from Ships |
| **MBL** | Marine Atmospheric Boundary Layer |
| **mCD** | Meters Relative to Chart Datum |
| **MEFT** | Ministry of Environment, Forestry and Tourism |
| **MFMR** | Ministry of Fisheries and Marine Resources |
| **ML** | Mining Licence |
| **MSDS** | Material Safety Data Sheet |
| **NIMPA** | Namibian Islands' Marine Protected Area |
| **NDP5** | Fifth National Development Plan |
| **NTU** | Nephelometric Turbidity Units |
| **OHSAS** | Occupational health and safety information, guidance and resources |
| **OPRC** | International Convention on Oil Pollution Preparedness, Response and Co-operation |
| **PAH** | Poly Aromatic Hydrocarbon |
| **PCB** | Polychlorinated Biphenyl |
| **PPE** | Personal Protective Equipment |
| **PPM** | Parts Per Million |
| **SADC** | Southern African Development Community |
| **SAH** | South Atlantic High |
| **SOLAS** | Safety of Life at Sea |
| **TBT** | Tributyltin |
| **TEU** | Twenty-foot Equivalent Unit |
| **THSD** | Trailing Hopper Suction Dredger |
| **TPH** | Total Petroleum Hydrocarbons |
| **TSS** | Total Suspended Solids |
| **UNFCCC** | United Nations Framework Convention on Climate Change |
| **WHO** | World Health Organisation |

# GLOSSARY OF TERMS

**Alien Species** - a plant or animal introduced to an environment that is not the location of its natural occurrence.

**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.

**Aquaculture -** The farming and ranching of aquatic organisms.

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

**Biota -** The animal and plant life of a specific region, habitat, or geological period.

**Capital Dredging** - Refers to the process of deepening previously undisturbed areas of the ocean floor such as for example new harbour developments and deepening of existing harbour basins and channels (also see maintenance dredging) by removing the seabed substrate.

**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.

**Dredged Material** – refers to substrate on the ocean floor consisting of sediments, soils, clays, silt, rock, sand and debris removed from the seafloor during dredging.

**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.

**Maintenance Dredging** – Removal of substrate that has built-up over time in previously dredged areas due to natural sedimentation and seabed scouring by vessel propellers.

**Mariculture -** The farming and ranching of specifically marine organisms.

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

**Non-native** – a plant or animal introduced to an environment that is not the location of its natural occurrence

**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 Namibian Ports Authority, Namport, is in the process of planning and updating their dredging schedule for the Port of Lüderitz (Figure 1-1). Dredging can, in terms of harbours, be defined as the process of removing substrate like sediments, soils, clays, silt, rock, sand and debris from a water environment, with the aim of increasing or maintaining water depth to allow for safe passage and manoeuvring of ships / vessels. In harbours, it is generally performed to create and maintain the entrance channel, berthing areas, turning circles and other operational areas. One can typically distinguish between capital and maintenance dredging. Capital dredging being the deepening of new areas through a first round of dredging, and maintenance dredging being the periodic removal of material such as sediments, soils, clays, silt, sand and debris (hereafter referred to collectively as sediment) from such dredged areas, in order to maintain water depth. Maintenance dredging is periodically required due to natural sedimentation and seabed scouring by vessels' propellers that results in gradual siltation of the seafloor.

An environmental clearance certificate (ECC), as issued by the Ministry of Environment, Forestry and Tourism (MEFT), is required for dredging operations. The ECC is required in terms of the Environmental Management Act, Act no. 7 of 2007 (EMA), as administered by the MEFT. In 2014 an ECC was issued to Namport for their previous dredging exercise at the Port of Lüderitz. The ECC was issued based on an environmental impact assessment (EIA) and environmental management plan (EMP) that were prepared specifically for the then proposed capital and maintenance dredging activities. Dredging was initiated towards the end of 2015 and finalised beginning of 2016 and only consisted of maintenance dredging.

Geo Pollution Technologies (Pty) Ltd (GPT) was appointed by Namport to update the EIA and EMP approved in 2014, in order to include the expected dredging to be performed in the Lüderitz harbour within the next five to ten years. Currently, the planned dredging will consist of maintenance dredging with the aim of removing about 170,000 $m^3$ sediment from the entrance channel and quayside areas of the harbour. Although only maintenance dredging is presently planned, the updated EIA and EMP will continue to contain an assessment for potential capital dredging, with the purpose of deepening the harbour area to allow for larger vessels. The updated EIA and EMP will be submitted to the MEFT in order to renew the ECC for the proposed dredging activities.

For purposes of the EIA and EMP update, the risk assessment that was previously undertaken to determine the potential impacts of dredging on the environment, will be reassessed. 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 updated EIA and EMP will be submitted to the MEFT in order to renew the ECC for the proposed dredging activities.

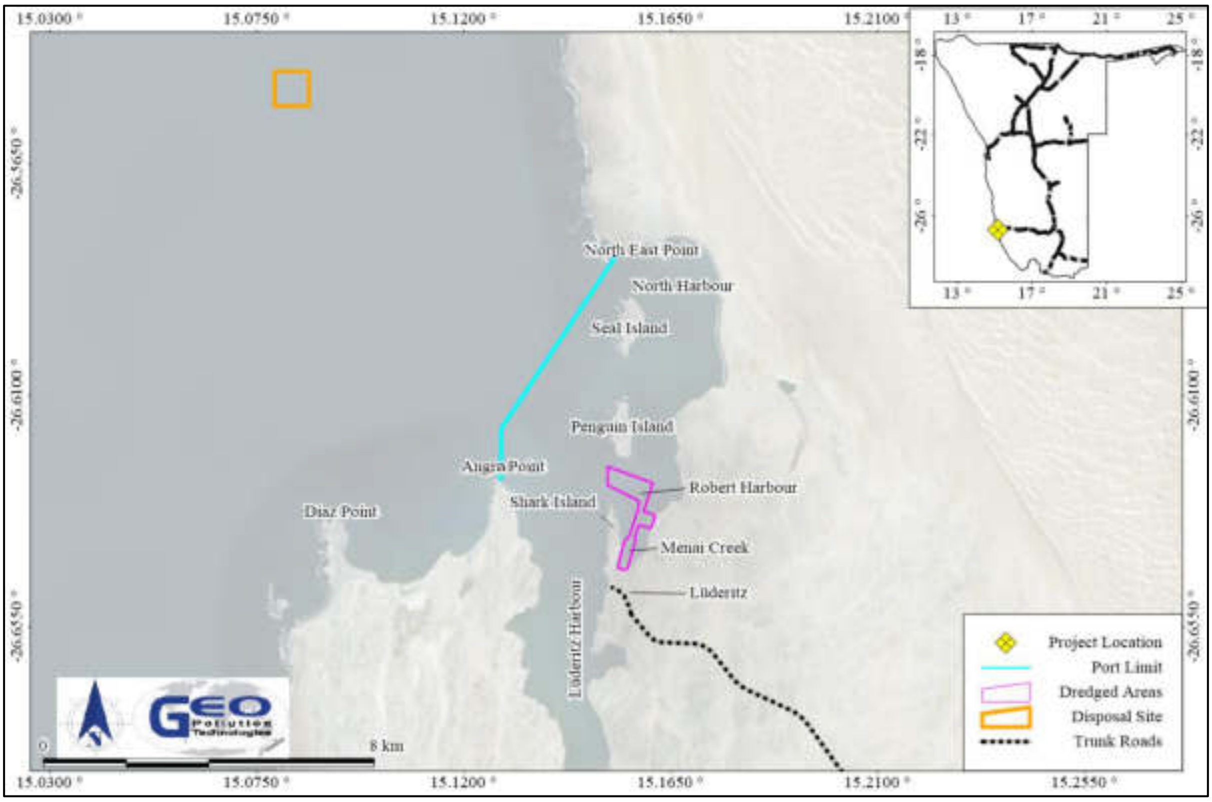



**Figure 1-1 Project location**

## 2 BACKGROUND

Namport was established under the Namibian Ports Authority Act of 1994 to manage and control ports and lighthouses in Namibia, and to provide, among others, facilities and services related to ports. Namibia currently has two ports – the principle port being the Port of Walvis Bay situated centrally on the western coastline, and the much smaller Port of Lüderitz, situated on the southern coastline of Namibia. Namport strives to be a world-class ports authority and thus work according to international standards, namely ISO 9001, ISO 14001 and OHSAS 18001, to uphold quality as well as environment and occupational health and safety standards.

Vision 2030 and Namibia's various development plans, the latest being the Fifth National Development Plan (NDP5), desires Namibia to have a safe, reliable, affordable and sustainable transport infrastructure with a world-class logistic hub connecting the Southern African Development Community (SADC) to international markets. Key to this is the ports connecting Namibia, and other southern African countries, to international markets. Thus, in agreement with Namibia's vision, Namport strives to continue operating the Port of Lüderitz to reliably and effectively serve Namibia and its neighbouring countries.

Traditionally, Lüderitz has been a fishing port, serving the needs of the Namibian fishing industry at a national level. However, mining projects in southern Namibia and offshore activities, have, to varying degrees, become reliant on port services. These mainly include the diamond, zinc and lead mining sectors of southern Namibia. Lüderitz has the potential to increasingly serve as an important gateway and logistics base for various mineral operations as well as the petroleum industry. An example of this is the growing interest in the Port of Lüderitz as gateway for the export of manganese ore (and potentially other ores) originating from South Africa.

## 3 PROJECT JUSTIFICATION

Water depth is the main limiting factor for the size of vessels calling in the Port of Lüderitz and thus determines the volume of cargo that can be imported or exported via the Port. The current water depth of -8.75 mCD allows for a maximum of approximately 30,000 tonnes per vessel. While there are no immediate plans for deepening of the harbour, due to environmental and financial unfeasibility, it is essential to maintain existing water depth in order to continue allowing for the optimum use of the port. As such, Namport periodically has to initiate a round of dredging in the Lüderitz Harbour to maintain the water depth at -8.75 mCD at all vessel operating areas.

Benefits of the continued operations of the Port of Lüderitz, and the dredging project itself, include:

- Continued receipt of vessels by the Port of Lüderitz for import and export purposes at the current maximum vessel size and thus optimal use of the port facilities.
- The Port of Lüderitz continuing to be one of the main economic drivers within the town and region, offering employment and thus sustaining livelihoods and increasing spending power of the local community.
- Potential encouragement of additional investments and expansion of trade and industrial activity in the town and country as a whole resulting from reliable and efficient port services.
- Enhanced security of import and export of goods to and from the whole of Namibia and its neighbours (strategic national asset).
- Local skilled and unskilled workers and industries will work with trained experts (mainly the dredging contractor and his subcontractors) and skills transfer will occur and work experience gained.
- Potential increase in port capacity, should capital dredging realise in future and potential cargo handling volumes increase. This will significantly increase all existing benefits associated with the port and potentially result in additional new benefits and opportunities.

# 4 SCOPE

The scope of the updated environmental assessment is to, in continued compliance with Namibia's Environmental Management Act (2007):

1. Provide a detailed and updated description of the project components.
2. Update the legal register and environmental description to be relevant to the status quo.
3. Update the potential environmental impacts emanating from the proposed dredging operations and provide management actions which could prevent or mitigate the potential adverse impacts to acceptable levels.
4. Provide sufficient information to the Ministry of Environment and Tourism to make an informed decision regarding the issuing of an environmental clearance certificate for the proposed project.

# 5 METHODOLOGY

The following methods were used to investigate and update the potential impacts on the social and natural environment due to the project:

1. Detailed dredging plans and procedures received from the client are presented in this report.
2. Baseline information about the dredging area and surroundings was updated to include any new information, including information gathered during the previous dredging exercise.
3. Registered and new interested and affected parties (IAPs) were consulted about their views, comments and opinions and these are put forward in this report.
4. As per the findings of this environmental assessment, an updated scoping report and environmental management plan (EMP) were prepared and these will be submitted to the MEFT.

# 6 PROJECT DEVELOPMENT AND OPERATIONS

Namport is in the process of planning and updating their dredging schedule for the Port of Lüderitz. Although no significant dredging is expected to be required within the near future, maintenance dredging is periodically required due to natural sedimentation and seabed scouring. In addition, capital dredging also forms part of Namport's long term planning, but will only be executed once feasibility realises. As such capital dredging remains an important component of this EIA.

## 6.1 PROJECT BACKGROUND

The previous dredging EIAs and EMPs that were prepared for the Port of Lüderitz were based on the review of various environmental studies, EIAs and EMPs for Lüderitz as well as extensive stakeholder engagement. Literature used included: an EIA for a new quay at Lüderitz (CSIR, 1997) and its EMP (CSIR, 1998); an EIA and EMP for construction of a concrete jetty at the contractor treatment facility in Lüderitz (Pisces, 2003); water and mussel analysis data from Namport in connection with dredging which took place in 2004; and the 2006 dredging EIA and EMP for Walvis Bay (COWI, 2006). For purposes of the current update of the dredging EIA, the information presented in the above literature will not be repeated in as much detail as presented in the 2014 EIA. Focus will rather only be on the most relevant information while previous literature can be consulted, if required. The updated EIA will also be amended based on knowledge gained during the previous dredging exercise. This will allow for a more streamlined and relevant EIA that will both simplify the review process as well as be more user friendly for relevant parties at Namport and the contracted dredging company.

## 6.2 PROPOSED DREDGING PROGRAMME

The following is a summary of the proposed dredging activities for the next five to ten years. Figure 6-1 presents the area within the harbour that requires periodic maintenance dredging and that will require capital dredging should the port be developed to cater for larger vessels. Capital dredging may however extend slightly beyond these boundaries to allow for adequate manoeuvring space for larger vessels.

### 6.2.1 Capital Dredging

Although not foreseen for the near future, capital dredging may be required should the volume of cargo to be imported and exported via the port increase to such an extent that it will require larger vessels, and an investment in the expansion of the port's capacity becomes feasible. Capital dredging will entail the possible widening and deepening of the entrance channel, berth area basin and vessel operational areas. It is envisioned that capital dredging will be performed to deepen the port from -8.75 mCD to -12.8 mCD, but this may change depending on final design parameters, if ever implemented. Due to the hard bedrock in the Port of Lüderitz, capital dredging will involve drilling and blasting in addition to dredging.

### 6.2.2 Maintenance Dredging

Maintenance dredging will be conducted in all areas such as the entrance channels, turning basins and berthing areas, where the water depth must be maintained at -8.75 mCD (current) or -12.8 mCD (future). This type of dredging normally needs to be repeated every five to ten years, but may be more regular depending on the rate of sedimentation. Near the quays and jetties, localised, small volume maintenance dredging is conducted on a much more regular basis.

The current expectation is that with the next round of maintenance dredging approximately 170,000 $m^3$ of sediment will be dredged. Sediment will be disposed of at the approved offshore disposal site (see section 6.3). Dredging will be performed over the entire operational area as indicated in Figure 6-1.

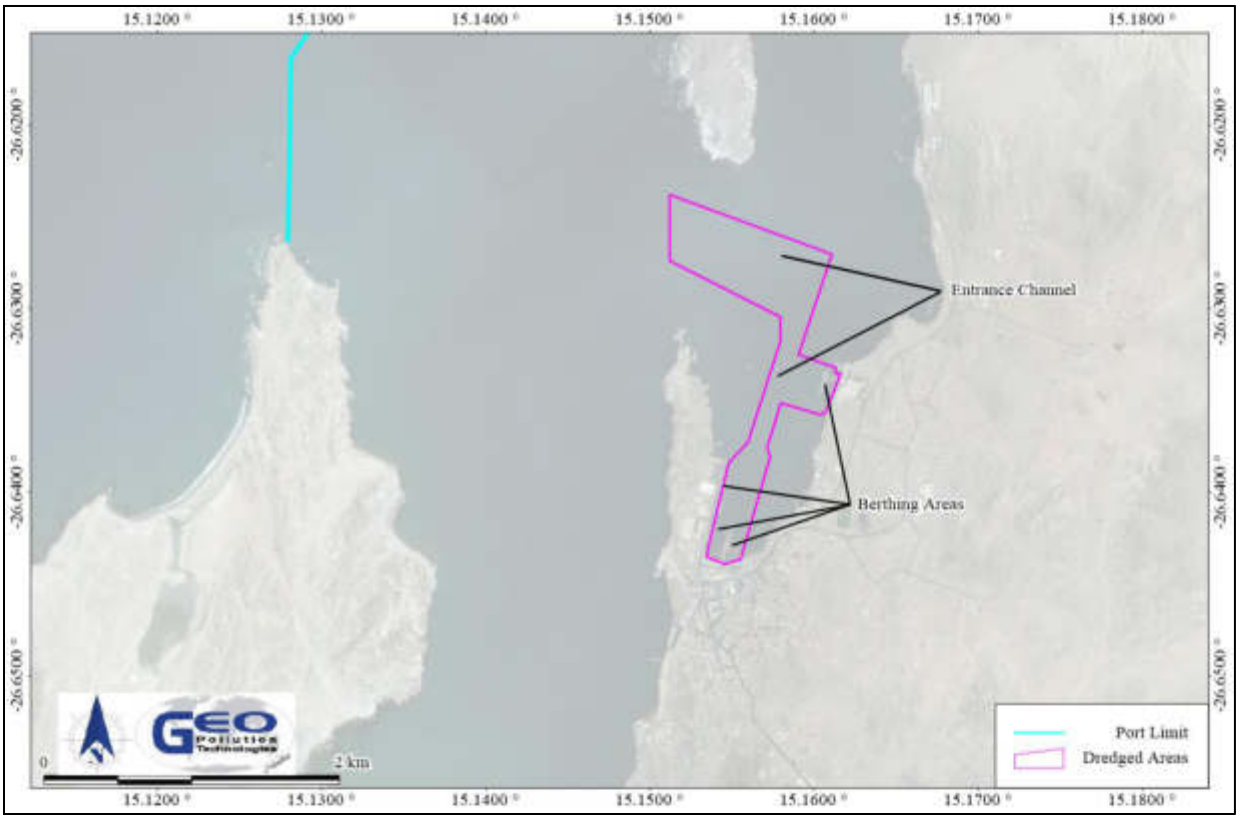



**Figure 6-1 Area within the port requiring dredging**

## 6.3 SEDIMENT DISPOSAL

During dredging, potentially large volumes of dredged material is generated that requires disposal. Due to the sheer volume of the dredged material, land-based disposal is not possible. In some instances the dredged material can be used for beneficial purposes, such as land reclamation, as was the case with the construction of the new container terminal in the Port of Walvis Bay. However, where beneficial use is not possible, dredged material disposal typically takes place at a predetermined and approved offshore location.

For the Port of Lüderitz, Namport has an offshore site for the disposal of dredged material from capital and maintenance dredging activities (see Figure 1-1). The site was assessed and approved in 1998 (CSIR, 1998) and is located in approximately 40 m deep water, 14 km southwest of the harbour and 7 km due west from the nearest shoreline. The disposal site is located outside the coastal current, thus limiting the transport of the disposed material away from the site.

## 6.4 DREDGING METHODS

Dredging equipment can be classified into three main types: (1) mechanical; (2) hydraulic; and (3) hydro-dynamic. Each of these employ different techniques and equipment and has its own set of advantages and disadvantages for different conditions. A dredger typically collects the dredged material inside a hopper which transports it to a disposal site, or it delivers the dredged material to a disposal site via a pipeline. Hoppers can either be a separate barge or it can be part of the actual dredging vessel. The different methods will be discussed in brief and are based on literature provided by Vlasblom (2003) and Pullar and Hughes (2009).

### 6.4.1 Mechanical Dredgers

Mechanical dredgers, also called scoop type dredgers, collect material mechanically from the ocean floor with the use of buckets or grabs. Dredged material is typically deposited into a separate hopper for later disposal, but some mechanical dredgers are self-propelled with their own hoppers. Mechanical dredgers are stationary dredgers and three main types are used.

The **bucket ladder/chain dredger** has a series of buckets mounted on a chain to form the so-called ladder. This ladder is mounted on the dredger vessel, between the pontoons, and as the ladder rotates the buckets scoop material from the ocean floor. The dredged material is then deposited via chutes to the hopper barge. Bucket sizes vary from a few litres to about 1 $m^3$.

The **grab dredger (or clamshell dredger)** is a relatively simple dredger. It consists of a crane mounted on a vessel with or without its own hopper. A grab is lowered on a chain/cable and hydraulically or mechanically closed to pick up material from the sea floor. The grab size varies between 1 $m^3$ and 200 $m^3$.

The **hydraulic cranes** (**backhoe and front shovel dredger)** typically has a barge mounted with a crane that resembles a land based excavator. The backhoe has a bucket that is dragged over the ocean floor to be filled while the shovel dredge pushes a bucket over the floor in a shovel-like manner. The buckets are emptied into a hopper. The backhoe dredger typically has a bucket size ranging from a few to 20 $m^3$.

### 6.4.2 Hydraulic Dredgers

Hydraulic dredgers use centrifugal pumps to transport a slurry of water and material to a barge or a disposal site. It essentially functions like a vacuum cleaner, but many variations exist and the choice of dredger depends on the type of material and conditions in the area to be dredged. Both stationary and mobile hydraulic dredgers exist and the main types are:

**Plain suction dredgers** are stationary dredgers where a suction pipe is lowered to the ocean floor and suction is created using a dredge pump. Water and material are sucked into the pipe and delivered to the hopper via a delivery pipe. Water jets at the entrance of the suction pipe may be present to aid lifting of dredged material. Different types of plain suction dredgers exist. They are standard plain suction dredgers that deliver the dredged material to the disposal site via a pipeline; barge loading suction dredgers that load dredged material into the hopper for disposal at a distant site; deep suction dredgers that are typically used at depths of more than 30 m; and dustpan dredgers with wide suction mouths.

**Cutter suction dredgers (CSD)** are stationary suction dredgers that have cutter heads that excavate the substrate to be dredged before it is sucked into the vessel barge or hopper barge. These dredgers are particularly useful for hard material and where accuracy is required.

**Bucket wheel dredgers** are similar to cutter suction dredgers except that the cutter is replaced by a bucket wheel that rotates in line with the dredging vessel. The wheel contains buckets that cut into the substrate, similar to the mechanical bucket ladder dredger. The buckets discharge into the suction line leading to the hopper.

**Trailing suction hopper dredgers (TSHD**) are mobile dredgers that can dredge while moving. The vessel is self-propelled and include a hopper for dredged material discharge. The suction tubes are trailed behind the vessel during dredging so that the suction mouths (dragheads) drag over the ocean floor while dredge pumps suck material from the seabed.

### 6.4.3 Hydrodynamic Dredgers

Hydrodynamic dredgers can employ either mechanical or hydraulic mechanisms in order to excavate material, but dredged material is then released directly into the water at the site of dredging in order for it to be dispersed by natural water flow and currents.

Hydrodynamic dredging include **agitation dredging** where the seabed is disturbed and material is forced into suspension. This can be achieved with water jets, raking or pumping. **Water injection dredging** makes use of low pressure jets of water that is continuously pumped directly into the seabed. This lifts the material, without bringing it into suspension, and the dredged material take on a liquid-like state that can flow with the currents or downhill where slopes are present.

## 6.5 DREDGER CHOICE

No single dredger can be employed in all dredging projects. The choice of dredger depends on a range of criteria, including:-

- type and volume of material to be dreged
- characteristics and depth of area to be dredged and of the disposal site
- distance to disposal site
- method of disposal
- quality of material to be dredged (contamination levels)
- environmental impact
- cost and availability

Table 6-1 summarizes some important features of the main mechanical and hydraulic dredger types as adapted from Vlasblom (2003) and Bray (2008). It should be noted that various factors such as dredger specific modifications, dredger operator experience and techniques and environmental conditions can influence parameters linked to safety, accuracy, turbidity, mixing, spill and dilution and the characteristics presented in Table 6-1 may be different for different scenarios and circumstances. Even though certain dredgers might seem to be the better options, factors like cost and availability might disqualify it as being suitable. Considering the specific conditions and requirements in the Port of Lüderitz, two dredgers, a grab dredger and a TSHD, are considered to be most suitable for maintenance dredging while a CSD, in combination with drilling and blasting, will typically be more suitable for capital dredging. The grab dredger would be suitable for use near the quay, in hard to reach areas and where debris (wires, chains, scrap metal), with the potential to damage other dredgers, can be found. The TSHD is preferred for the access channel due to its manoeuvrability which would allow normal shipping traffic to continue with minor disturbances. It also has high productivity and the ability to dispose of dredged materials in distant disposal sites. The cutter suction dredger is more suited for capital dredging due to the hard bedrock found in Lüderitz Bay. More detailed descriptions on these dredgers are provided below.

**Table 6-1 Important characteristics of main dredger types.**

| | | **Mechanical Dredgers** | | | **Hydraulic Dredgers** | | |
|---|---|---|---|---|---|---|---|
| | | **Bucket Ladder** | **Grab** | **Backhoe** | **Plain Suction** | **Cutter Suction** | **Trailing Suction Hopper** |
| **Material Type** | **Sandy** | yes | yes | yes | yes | yes | yes |
| | **Clayey** | yes | yes | yes | no | yes | yes |
| | **Rocky** | yes | no | yes | no | yes | no |
| **Anchoring wires** | | yes | yes | no | yes | yes | no |
| **Maximum dredging depth (m)** | | 30 | >100 | 20 | 70 | 25 | 100 |
| **Accurate dredging possible** | | yes | no | yes | no | yes | no |
| **Offshore dredging possible** | | no | yes | no | yes | no | yes |
| **Transport via pipeline** | | no | no | no | yes | yes | no |
| **Dredging in situ densities possible** | | yes | yes | yes | no | limited | no |
| **Safety** | | < | < | < | > | > | =/> |
| **Accuracy** | | > | < | > | < | > | < |
| **Turbidity** | | </= | </= | </= | > | =/> | </= |
| **Mixing** | | =/> | = | > | < | =/> | < |
| **Spill** | | > | > | > | < | = | = |
| **Dilution** | | > | > | > | = | = | < |

Key:
Relative to other dredgers, the symbols mean: < below average = average > above average

### 6.5.1 Grab Dredgers

Grab dredgers are the most commonly used dredgers in the world. They have large variation in size and may be self-propelled with its own hold for dredged material, or it may be without propulsion in which case independent hopper barges will be used for dredge material storage and disposal. Variations exist in the characteristics of the grab itself and the choice and size of grab mostly depends on dredge material properties. For sand and soft clay larger, but lighter, grabs can be used while for harder clay smaller, but heavier, grabs can be used.

The major advantages of grab dredgers are the fact that small grab dredgers can be used to reach locations that is difficult to access, like harbours, and they can pick up a range of materials, including debris that are often found near quay walls, without being damaged. Furthermore they can work at varying depths and at depths in excess of 100 m. With increasing depth, however, a decrease in accuracy occurs.

The most common grab dredgers are the boom type dredgers where a boom swings around a vertical axis (Photo 6-1). The grab is lowered (and lifted) from the boom using cables and a winch and once on the substrate it is closed with a second set of cables or with hydraulic cylinders. To prevent the grab from swinging or rotating, a tagline is used which runs from the middle of the boom to the grab. Before dredging can commence the vessel must be anchored, keeping in mind its position to maximize dredging range. A stationary position is maintained with anchors or spuds (poles).

When dredging contaminated soils with a grab dredger, a closed clamshell grab is preferred as it prevents spillage of dredged materials. Contaminants can therefore be contained relatively well and dredged material can be disposed of in a suitable dumping site. Since disposal of contaminated dredged material is often expensive, the volume of dredged material needs to be kept to a minimum. This means that the grab should not pick up uncontaminated soil and thus the closing curve of the grab is important. For this reason horizontal closing grabs are preferred for contaminated soils. Minimizing dredging of unwanted materials and maximizing productivity of dredgers requires expert understanding of dredger positioning and grab control. Thus, an expert and experienced operator must be contracted for dredging operations.

**Photo 6-1 Typical grab dredger (from Vlasblom, 2003)**

**Photo 6-2 An example of a trailing suction hopper dredger (from Vlasblom, 2003)**

### 6.5.2 Trailing Suction Hopper Dredgers

Ideal for silt and sandy material, the TSHD remains one of the most widely applied dredgers worldwide (Photo 6-2). Its popularity most likely stemming from the fact that it is mobile during dredging and therefore ideal for busy waterways like ports. Although cutter suction dredgers have the advantage when it comes to accuracy, range of materials that can be dredged and containment of dredged material (low mixing, dilution, spilling and suspension of material), the TSHD can work at depths, offshore, is completely mobile and can transport dredged material over long distances. Mobilisation of the TSHD is also relatively simple and inexpensive.

The typical design of a TSHD includes:

- one or more suction pipes with dragheads and their associated gantries to hoist them;
- dredge pumps to create suction;
- a hopper for dumping dredged material;
- an overflow system for water discharge from the hopper;
- a mechanisms to empty the hopper;
- a swell compensator to compensate for vertical movement of the vessel in relation to the sea-bed.

The TSHD can operate at a speed of 1 to 1.5 m/s and once it arrives at the site the suction pipes and dragheads are lowered. The pumps are started just above the sea-bed and once the draghead is on the sea-bed, dredging commence. Dredged material is deposited into the hopper and depending on the dredged material characteristics, the hopper is either filled with no overflow allowed or overflow is allowed to remove excess water and maximise dredged material. In instances where the dredged material stays in suspension for a long time and settling occurs slowly, or where contaminated soils are dredged, overflow is typically not allowed to prevent dredged material (or contaminants) from returning to the ocean. Where dredged material settle quickly, the hopper is allowed to overflow to remove excess water and maximise dredged material retention. Some dredgers have adjustable overflows that allows the operator to adjust the amount of water that is allowed to overflow depending on dredged material properties.

When dredging stops (e.g. when hopper is full) the suction pumps are pumped clean and raised out of the water. The ship can now increase speed and proceed to the disposal site. Typical TSHDs open valves or doors in the base of the hopper to discharge the dredged material when dumping is offshore. Onshore dumping can also be achieved with offloading pipelines.

### 6.5.3 Cutter Suction Dredger

Due to the fact that bedrock is found at Robert Harbour from 10 mbs (Vonk and Brabers 2010), and a TSHD can only operate in areas of unconsolidated substrate, mechanical equipment is required to break the rock to acquire the desired depth. This can be done either by using a CSD or by drilling and blasting, or a combination of both. Large heavy-duty cutter dredgers are capable of dredging some types of rock without pre-treatment (i.e. blasting and drilling). The rock found in Lüderitz Bay is extremely hard and it is doubtful that a CSD could be used to remove any bedrock beyond the first layers of weathered rock, without the assistance of drilling and blasting.

The CSD has a rotating cutter head, attached to an arm (or “ladder”) that is lowered to the seabed (Photo 6-3). The cutter head has blades which can be equipped with “teeth”. As it rotates it cuts the substrate and a centrifugal pump sucks the material into a suction pipe inside the ladder. Spud poles are used to keep the dredger in place by being lowered to the seafloor. The dredger can rotate around the main spud pole. Steel cables, pulleys and winches rotates the dredger with its ladder and cutter head from side to side, thus allowing the cutter head to cut substrate along a transverse arc. Accuracy and the ability to cut harder substrates are the obvious advantages of this type of dredger. It is also capable of dredging from deeper water into shallow water by dredging a “path” in front of the dredger. This makes the CSD suitable for dredging for example dig out basins. Manoeuvrability is however lost in the CSD due to its anchoring with the spud poles. The dredged material is either piped into a nearby hopper barge, or it can be pumped via a floating pipeline to specific disposal sites which can include pumping it onto land.

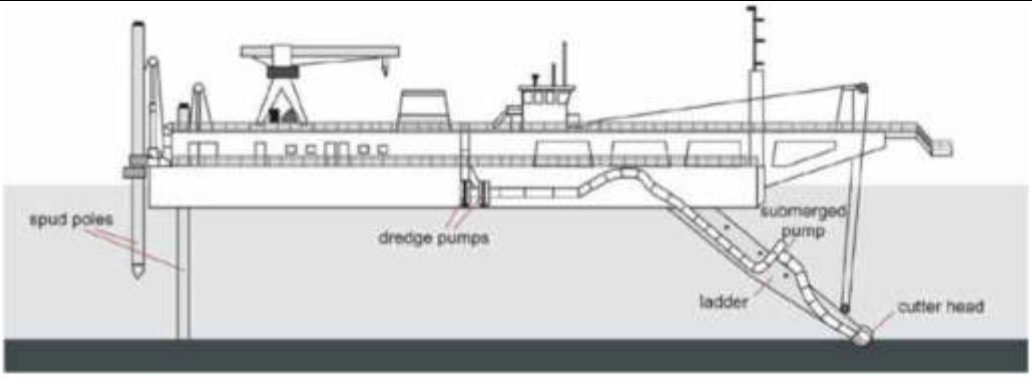



**Photo 6-3 Example of a cutter suction dredger (from Mills and Kemps, 2016)**

#### 6.5.4 Drilling and Blasting

If capital dredging of the Port of Lüderitz is initiated, drilling and blasting will most likely be required for all areas earmarked for dredging. Drilling and blasting involve hydraulically drilling holes in the bedrock and filling them with explosives. Following blasting, the rocky material can be dredged. Alternatively, surface blasting can be undertaken, where explosives are placed directly on the bedrock. Although this eliminates the need for drilling, it is a relatively inefficient method and only applicable in shallow water areas (COWI, 2006).

### 6.6 MODIFICATIONS TO DREDGERS AND OPERATIONS TO REDUCE TURBIDITY

One side effect of dredging is the suspension of dredged material in the water column causing plumes of suspended solids and increased turbidity. This can have adverse impacts on the environment and its associated biodiversity. Certain precautions can be taken to reduce the amount of material brought into suspension and therefore decreasing the dredging plume. One of the first things to consider is of course the type of dredger, but in many cases the choice of dredger is determined by other parameters and not solely by its ability to decrease dredged material plumes.

The four causes of high turbidity when using TSHDs are: (1) overflow from the hopper, especially if it contains suspended fine particulate matter; (2) intake bypass, an automatic system bypassing the hopper and dumping the dredge stream in the ocean when dredged material content is below a set threshold; (3) turbulence caused by the vessel propeller, especially in shallow water; and (4) draghead disturbance of the seabed. For TSHDs some modifications exist that helps limiting the amount of particulate matter suspended in the water around the dredging operation.

One obvious option to reduce turbidity is not to allow overflow, but the negative side effect of this is reduced productivity since the hopper will contain a lot of water when going to the disposal site. This increases the dredging timeframe and thus the continued impact of dredging on the environment, as well as costs.

Most TSHDs nowadays have the overflow level of the hopper at keel height. This significantly reduces turbidity and the dispersal of particulate matter. Dredging in biogenic gaseous deposits may result in gas accumulation in centrifugal pumps. This reduces pumping efficiency and prolongs dredging activities and lead to increased particulate matter suspension and turbidity. De-gassing equipment may be installed which will eliminate this problem.

Additional mechanisms that are employed on TSHD dredging vessels to reduce turbidity can include:

Low turbidity valves installed in the overflow funnel of the hopper reduce turbidity by decreasing the dispersal of particulate matter in the overflow stream. This is achieved with an adjustable valve that “chokes” the overflow and therefore eliminates air in the overflow stream. The overflow stream is now much denser with minimum turbulence and the suspended material is carried to the sea floor more effectively.

A recycling pipe that is mounted on the dredge pipe. Overflow is pumped through the recycling pipe and back into the suction head where it is used as process water. The overflow water containing dredged material does therefore not fall back into the ocean where it causes a particulate matter plume.

Turbidity is not only a problem at the dredging site, but may also be a problem at the disposal site. Typical disposal systems dumps the dredged material from the hopper by opening doors or valves and discharging from the surface. In deep water with strong currents this may result in dredged material dispersing and causing increased turbidity. This can be prevented with controlled placement where dredged material is typically released beneath the water surface and close to the disposal site floor. Special infrastructure on the hopper is required for this process.

Cutter suction dredgers can cause high turbidity when the material excavated by the cutter head ends up outside the reach of the suction pipe or when the excavation occurs at a rate faster than the suction pipe can effectively handle. Also, similar to a TSHD, when the hopper overflow some dredged material is returned to the ocean. Where dredged material is pumped via a pipeline, leakages can occur that release dredged material into the water column. Some methods to reduce suspension of dredged material when using a CSD include shielding of the cutter and/or suction head as well as optimising the cutter head and the speed at which it is used.

Grab dredgers can result in significant suspension of dredged material through (1) impact of the grab on the seabed; (2) disturbance of the seabed when closing the grab; (3) material spillage when hoisting the grab; (4) spillage and overflow from barges; and (5) washing of residual material from grab when lowering. The major modifications to grab dredgers to reduce particulate matter suspension is using water tight grabs and to, where possible, use a hydraulic grab on an arm instead of on a wire rope.

The use of silt and bubble screens/curtains can also alleviate the problems associated with turbidity during dredging operations. Their use are however limited to specific projects. Silt screens can for example become so heavy that it is not possible to remove the screen from the water and bubble screens have enormous power consumption rates.

### 6.7 SUSPENDED SOLIDS PLUME DISPERSAL

Lüderitz Bay's sediments have been classified as fine to medium sandy sediments (Pulfrich 2010a). Studies indicated that for these types of sediments, increased suspended solids, due to dredging and subsequent disposal, should be confined to within approximately 1,000 m. Also, suspension of the material should have short duration spans of between several hours and one or two days. However, site-specific hydrodynamics must be considered to prevent impacts on sensitive receptors like mariculture farms (Pulfrich 2010a). Plumes could become very problematic for mariculture farms and local ecosystems if they persist beyond 10 days.

# 7 ALTERNATIVES

The no-go alternative cannot be considered as it will ultimately result in sedimentation of the port to such an extent that only small vessels with a shallow draught can be handled. This will reduce the economic viability of the port and may ultimately result in port closure with negative consequences at both national and international level. Instead, alternatives that can be considered relates to dredger choice, timing of dredging events and the implementation of specific measures aimed at reducing dredging impacts. Since dredging per se is a destructive process with complete habitat destruction in the dredged areas, no alternatives can be considered that will protect the local ecology at dredged locations.

One of the major impacts, for which alternatives can be considered, is the suspension of particulate matter and its potential negative impacts (see section 11). Apart from dredger choice, alternatives that can and should be considered to reduce suspension of dredged material and thus turbidity have been discussed in section 6.6.

# 8 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 8-1 to Table 8-3 govern the environmental assessment process in Namibia and/or are relevant to the project.

**Table 8-1 Namibian law applicable of specific interest**

| Law | Key Aspects |
|---|---|
| **The Namibian Constitution** | ♦ Promote the welfare of people.<br>♦ Incorporates a high level of environmental protection.<br>♦ Incorporates international agreements as part of Namibian law. |
| **Environmental Management Act**<br><br>**Act No. 7 of 2007, Government Notice No. 232 of 2007** | ♦ Defines the environment.<br>♦ Promote sustainable management of the environment and the use of natural resources.<br>♦ Provide a process of assessment and control of activities with possible significant effects on the environment. |
| **Environmental Management Act Regulations**<br><br>**Government Notice No. 28-30 of 2012** | ♦ Commencement of the Environmental Management Act.<br>♦ List activities that requires an environmental clearance certificate.<br>♦ Provide Environmental Impact Assessment Regulations. |
| **Namibia Ports Authority Act**<br><br>**Act No. 2 of 1994, Government Notice No. 30** | ♦ Provides for the establishment of the Namibian Ports Authority to undertake the management and control of ports. |
| **Territorial Sea and Exclusive Economic Zone of Namibia Act**<br><br>**Act No. 3 of 1990, Government Notice No. 28** | ♦ Determine and define the territorial sea, internal waters, contiguous zone, exclusive economic zone and continental shelf of Namibia. |
| **Marine Resources Act**<br><br>**Act No. 27 of 2000, Government Notice No. 292** | ♦ Provide for the conservation of the marine ecosystem and the responsible administration, conservation, protection and promotion of marine resources on a sustainable basis.<br>o Declaration of the Namibian Islands' Marine Protected Area: Marine Resources Act (2009).<br>o Regulations relating to Namibian Islands' Marine Protected Area: Marine Resources Act, 2000 (2012). |
| **The Water Act**<br><br>**Act No. 54 of 1956** | ♦ Remains in force until the new Water Resources Management Act comes into force.<br>♦ Defines the interests of the state in protecting water resources.<br>♦ Controls the disposal of effluent.<br>♦ Numerous amendments. |
| **Water Resources Management Act**<br><br>**Act No. 11 of 2013** | ♦ Provide for management, protection, development, use and conservation of water resources.<br>♦ Prevention of water pollution and assignment of liability.<br>♦ Not in force yet. |

| Law | Key Aspects |
|---|---|
| **Dumping At Sea Control Act**<br><br>**Act No. 73 of 1980, Government Notice No. 1149** | - Provide for the control of dumping of substances in the sea. |
| **Marine Traffic Act**<br><br>**Act No. 2 of 1981, Government Notice No. 282** | - Regulate marine traffic in Namibia. |
| **Prevention and Combating of Pollution of the Sea by Oil Act**<br><br>**Act No. 6 of 1981, Government Notice No. 342** | - Provides for the prevention of pollution of the sea where oil is being or is likely to be discharged. |
| **Prevention and Combating of Pollution of the Sea by Oil Amendment Act**<br><br>**Act No. 24 of 1991, Government Notice No. 150** | - Amends the Prevention and Combating of Pollution of the Sea by Oil Act of 1981 to be more relevant to Namibia after independence. |
| **Aquaculture Act**<br><br>**Act No. 18 of 2002** | - Regulates aquaculture activities to ensure sustainable development.<br>- Provides for water quality monitoring to protect aquaculture activities. |
| **Local Authorities Act**<br><br>**Act No. 23 of 1992, Government Notice No. 116 of 1992** | - Define the powers, duties and functions of local authority councils.<br>- Regulates discharges into sewers. |
| **Regional Councils Act**<br><br>**Act No. 22 of 1992; Government Notice No. 115** | - Sets out the powers, duties, functions, rights and obligations of Regional Councils.<br>- Provides the legal basis for the drawing up of Regional Development Plans. |
| **Public and Environmental Health Act**<br><br>**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.<br>- Deals with Integrated Waste Management including waste collection disposal and recycling; waste generation and storage; and sanitation. |
| **Labour Act**<br><br>**Act No 11 of 2007, Government Notice No. 236 of 2007** | - Provides for Labour Law and the protection and safety of employees.<br>- Labour Act, 1992: Regulations relating to the health and safety of employees at work (Government Notice No. 156 of 1997). |
| **National Heritage Act of Namibia**<br><br>**Act No. 27 of 2004** | - Provides for the protection and conservation of places and objects of heritage significance and the registration of such places and objects.<br>- Provides for reporting of heritage finds, issuing of permits, and archaeological impact assessments. |
| **Namibia's Draft Wetland Policy (2004 Draft)** | - Aims to protect and conserve wetland diversity and ecosystem functioning without compromising human needs.<br>- Promote the integration of wetland management into other sector policies.<br>- Recognise and fulfil Namibia's international and regional obligations concerning wetlands, including those laid down in the Ramsar Convention and the SADC Protocol on Shared Water Systems. |

| Law | Key Aspects |
|---|---|
| **Integrated Coastal Zone Management Bill of 2014** | ♦ Aims at coastal management and give effect to Namibia's obligations in terms of international law regulating coastal management.<br>♦ Not adopted yet |
| **Hazardous Substances Ordinance**<br>**Ordinance No. 14 of 1974** | ♦ The ordinance's primary purpose is to prevent hazardous substances from causing injury, ill-health or the death of human beings. |
| **Marine Notice No. 04 of 2018**<br>**Ministry of Works and Transport** | ♦ Provides guidance on shipboard garbage management requirements in Namibia, in terms of the International Convention for the Prevention of Pollution from Ships (MARPOL) |
| **National Marine Pollution Contingency Plan of 2017** | ♦ Coordinated and integrated national system for dealing with oil spills in Namibian waters. |

**Table 8-2 Relevant multilateral environmental agreements for Namibia**

| 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. |
| **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. |
| **Benguela Current Convention of 2013** | ♦ The Convention is a formal treaty between the governments of Angola, Namibia and South Africa that sets out the countries' intention "to promote a coordinated regional approach to the long-term conservation, protection, rehabilitation, enhancement and sustainable use of the Benguela Current Large Marine Ecosystem, to provide economic, environmental and social benefits. |
| **Abidjan Convention of 1981** | ♦ The Convention for Cooperation in the Protection, Management and Development of the Marine and Coastal Environment of the Atlantic Coast of the West, Central and Southern Africa Region<br>♦ Provides an overarching legal framework for all marine-related programmes in West, Central and Southern Africa. |
| **Convention on the International Maritime Organization (IMO)** | ♦ Regulates shipping with respect to, among others, maritime safety and marine environmental protection<br>♦ Key IMO conventions include International Convention for the Safety of Life at Sea and International Convention for the Prevention of Pollution from Ships and others as discussed below.<br>♦ See www.imo.org for a complete account of all the conventions and treaties. |
| **International Convention for the Safety of Life at Sea (SOLAS 1974)** | ♦ With its origins in 1914, it is today regarded as the most important international treaty related to the safety of merchant ships. |

| Agreement | Key Aspects |
|---|---|
| | ♦ Among others deals with fire, life-saving, radio communications, safety and navigation, safe operations, etc. |
| **International Convention for the Prevention of Pollution from Ships (MARPOL 1973)** | ♦ Dealing with the prevention of pollution of the sea by oil, sewage and garbage from ships.<br>♦ Annex I –Regulations for the Prevention of Pollution by Oil<br>♦ Annex II –Regulations for the Control of Pollution by Noxious Liquid Substances in Bulk<br>♦ Annex III –Prevention of Pollution by Harmful Substances Carried by Sea in Packaged Form<br>♦ Annex IV –Regulations for the Prevention of Pollution by Sewage from Ships<br>♦ Annex V –Prevention of Pollution by Garbage from Ships<br>♦ Annex VI –Regulations for the Prevention of Air Pollution from Ships |
| **International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM 2004)** | ♦ Aims to prevent the spread of harmful aquatic organisms from one region to another, by establishing standards and procedures for the management and control of ships' ballast water and sediments. |
| **Convention on the International Regulations for Preventing Collisions at Sea (COLREG 1972)** | ♦ Among others, provides rules related to navigation to be followed by vessels at sea to prevent collisions. |
| **International Convention on Oil Pollution Preparedness, Response and Cooperation (OPRC 1990)** | ♦ International maritime convention establishing measures for dealing with marine oil pollution incidents nationally and in co-operation with other countries. |

**Table 8-3 Standards or Codes of Practise**

| Standard or Code | Key Aspects |
|---|---|
| **Namport Specifications and Legislation** | ♦ Enforced standards and codes which governs construction and operations relating to the port.<br>♦ Includes the Environmental Management Plan of the Port of Lüderitz. |

### 8.1 THE ENVIRONMENTAL MANAGEMENT ACT

The project is listed as an activity requiring an environmental clearance certificate as per the following points from Section 2 and 10 of Government Notice No. 29 of 2012 of the Environmental Management Act:

- "2.1 The construction of facilities for waste sites, treatment of waste and disposal of waste." Dredged material is regarded as a form of waste that requires disposal.
- "10.1 The construction of- (c) railways and harbours;" Capital and / or maintenance dredging forms part of harbour construction / maintenance.

## 9 ENVIRONMENTAL CHARACTERISTICS

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

### 9.1 LOCALITY AND SURROUNDING LAND USE

The proposed dredging activities will take place in Lüderitz Bay and specifically in what is known as Robert Harbour and Menai Creek, where the Port of Lüderitz is situated (Figure 1-1 and Figure 6-1). All dredging will take place within the port boundaries of Namport, but disposal of dredged material will take place in deeper water outside of port limits. Almost the entire coastline around Lüderitz falls within one of the numerous mining and exclusive prospecting licence areas. The harbour and dredging area are within mining licence area (ML) -32 and ML-36G, while the offshore disposal site is located ML-111 (Figure 9-1). The offshore disposal site has been approved and in use since 1998.

Onshore and offshore land uses in and around Lüderitz include mariculture, fishing and fish processing, port operations, as well as a variety of residential, tourism, business and industrial related uses. On land, Lüderitz is surrounded by the Tsau //Khaeb (previously Sperrgebiet) National Park, while the offshore area around Lüderitz, as well as the rocky shores, falls within the proclaimed Namibian Islands' Marine Protected Area (NIMPA) (Figure 9-2).

***Implications and Impacts***

Jurisdiction over the port and dredging areas is a mix between the Ministry of Works and Transport (ports, marine traffic and pollution control), Ministry of Fisheries and Marine Resources (authority over the offshore environment and NIMPA) and Ministry of Mines and Energy (mining and exploration). Dredging and the associated disposal of dredged material will take place within a declared protected area, NIMPA, and in close proximity to potential sensitive receptors. Mariculture activities and seawater intakes for onshore fish processing may be impacted by increased suspended material in the water column. Mining licence holders must be notified in advance of dredging activities and since the port's operations is of national and international importance, dredging and related activities should not be hampered by such third parties.

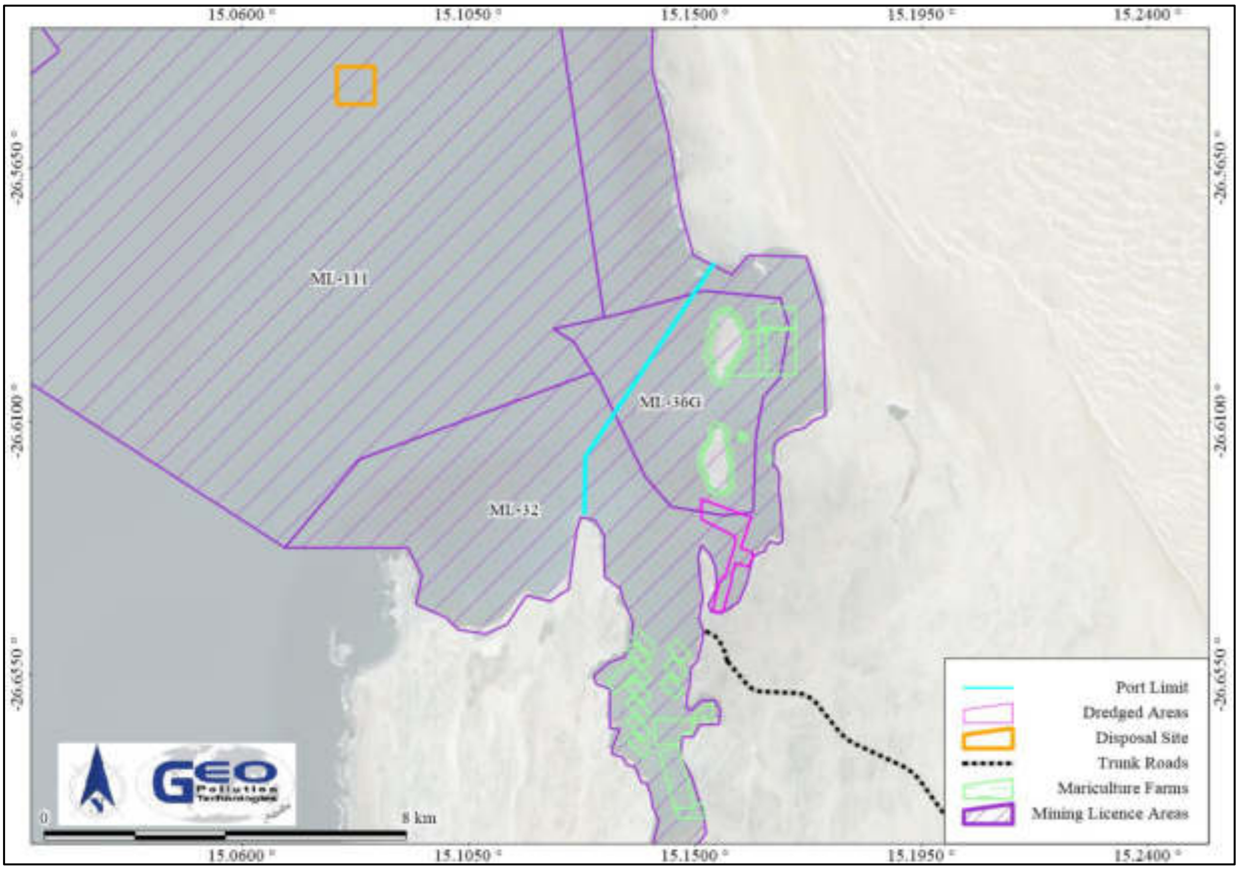



**Figure 9-1 Dredging areas and disposal site in relation to offshore land use**

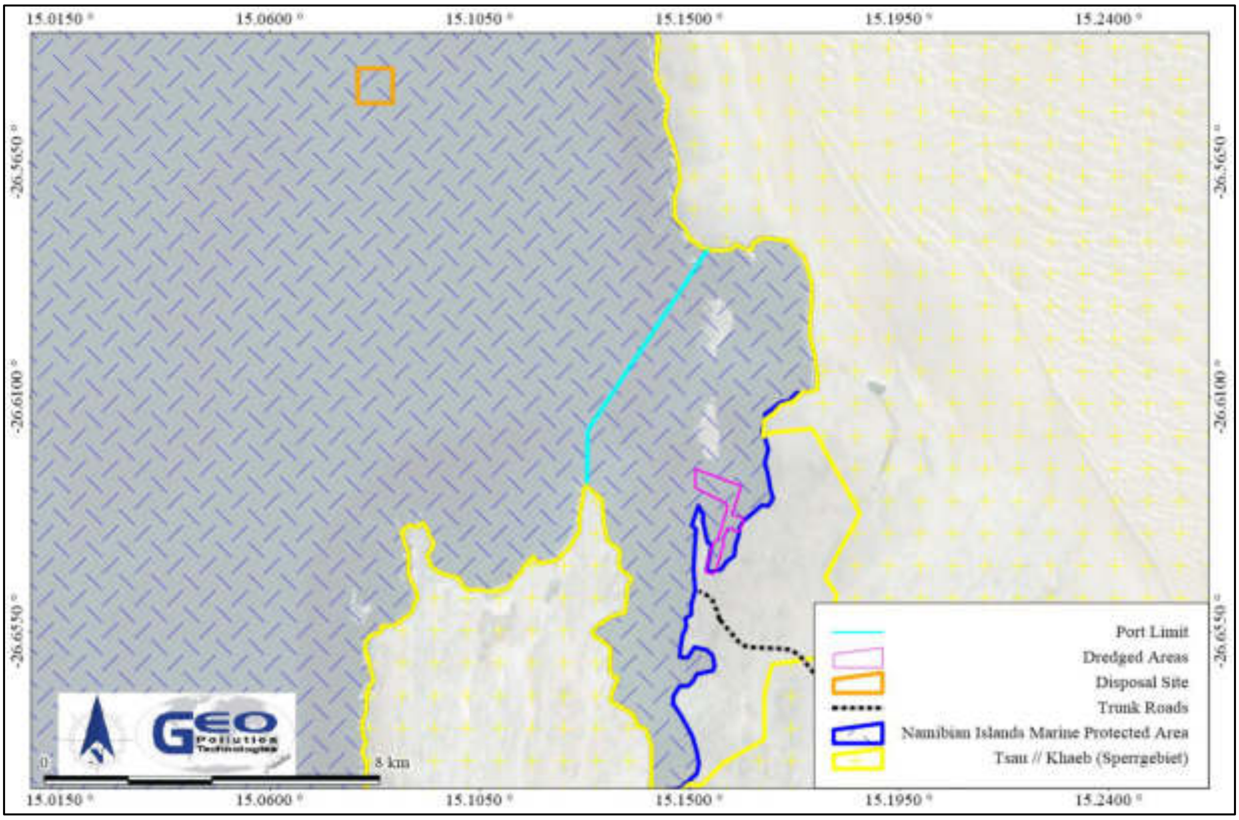



**Figure 9-2 Dredging areas and disposal site in relation to protected areas**

## 9.2 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 (Mendelsohn et al., 2002; Bryant, 2010).

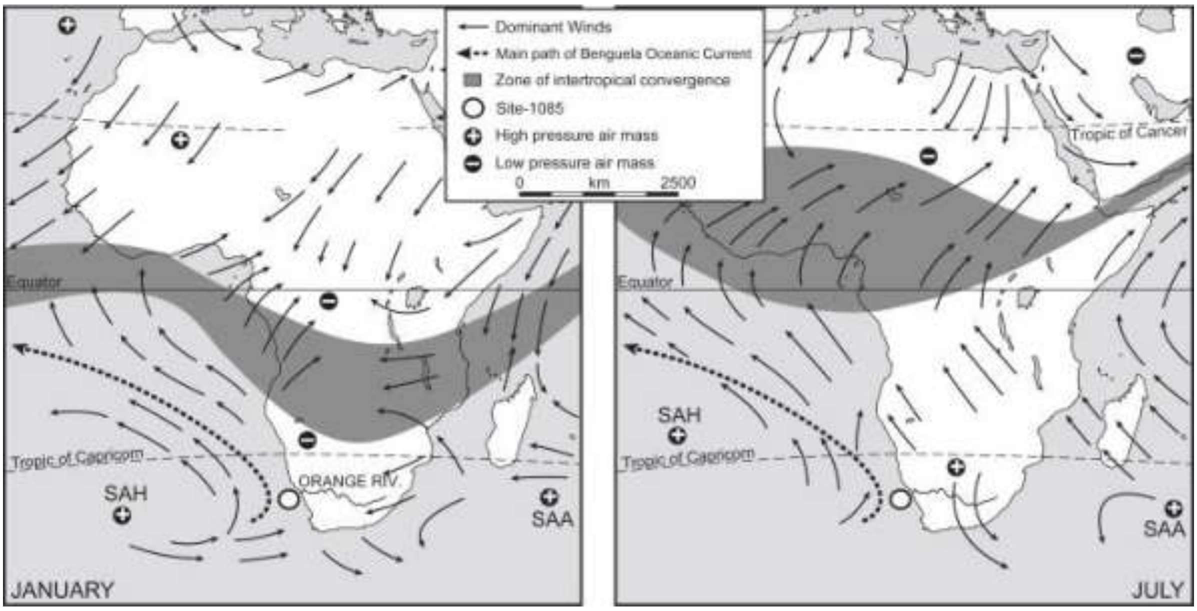



**Figure 9-3 Map indicating the Intertropical Convergence Zone, Subtropical High Pressure Zone (SAH+), Benguela Current and Temperate Zone south of Tropic of Capricorn (not indicated) (from: http://www.meteoweb.eu)**

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.

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 at along the coast.

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. These winds manifest themselves in the form of strong prevailing south to south-westerly winds, which range from an average of 20 knots (37 km/h) during winter months to as high as 60 knots (111 km/h) during the summer (Table 9-1). Figure 9-4 and Figure 9-5 presents a series of windroses throughout the year, indicating the dominance of the southerly winds over the long term. Daily fluctuations in wind speed are characterised by calmer winds in the morning with strong wind from late morning to late afternoon. During winter, the east winds generated over the hot Namib Desert have a strong effect on temperature, resulting in temperatures in excess of 30 ˚C and tend to transport plenty of sand.

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.

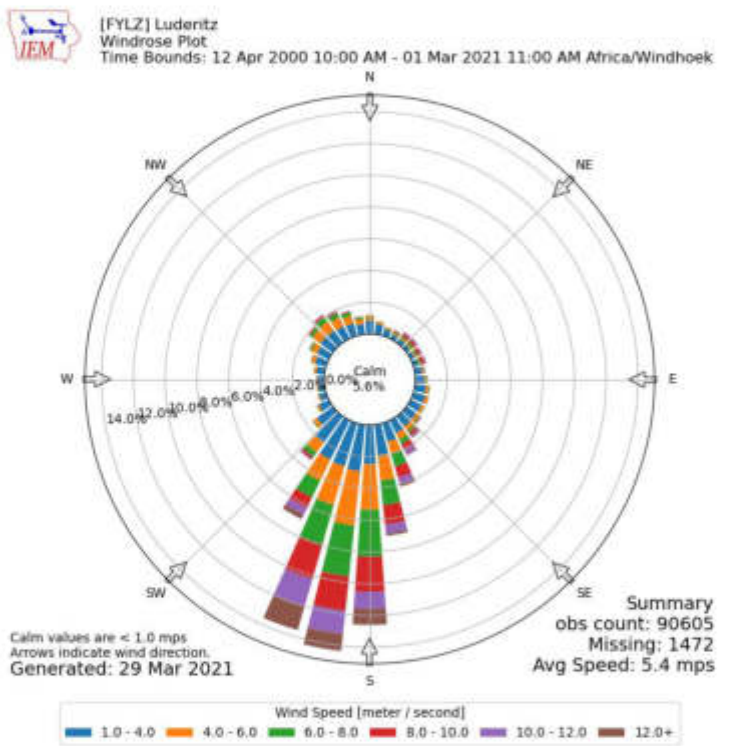
Temperature at Lüderitz is strongly regulated by the cold Benguela current. As a result, there is typically limited variation between diurnal and seasonal temperatures. Average annual temperatures are approximately 16 °C with the maximum temperature seldom above 24 °C and minimums rarely below 9 °C (Table 9-1). 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. As one moves inland from Lüderitz, daytime temperatures increases rather quickly while night time temperatures can get significantly colder in the desert environment.

Rainfall is typically low with high variability of 80% to 90%. This results in average annual rainfall figures between 0 and 50 mm. Occasional however, high rainfall events do occur. One such occasion was when 102 mm of rain was recorded at Lüderitz between 16 and 23 April 2006 (Eckardt et al., 2012).

***Implications and Impacts***

The characteristic windy conditions of Lüderitz play a role in the movement of the water masses in the various bays, inlets and channels between the islands. For this reason, the effect of wind on the movement and extent of suspended particulate matter plumes created by dredging activities must be considered since strong winds may move such plumes towards sensitive receptors.

**Table 9-1 Summary of climate data (Atlas of Namibia Project, 2002)**

| | |
|---|---|
| Average annual rainfall | 0-50 mm; half of the rainfall occurs from May to June |
| Variation in annual rainfall | 80 – 90% |
| Average annual evaporation | 2,400-2,600 mm |
| Average annual water deficit | 1,701-1,900 mm |
| Temperature | Average maximum: Between 24 °C in March/April and 19.3 °C in September<br>Average minimum: Between 16.5 °C in February and 9.1 °C in August<br>Annual average: ≈16 °C |
| Fog | Approximately 126.7 days of fog per year |
| Wind | Prevailing wind strong south-westerly |
| All year wind rose for the period 12 April 2000 to 01 March 2021 for the Lüderitz Airport (http://mesonet.agron.iastate.edu/) |   |

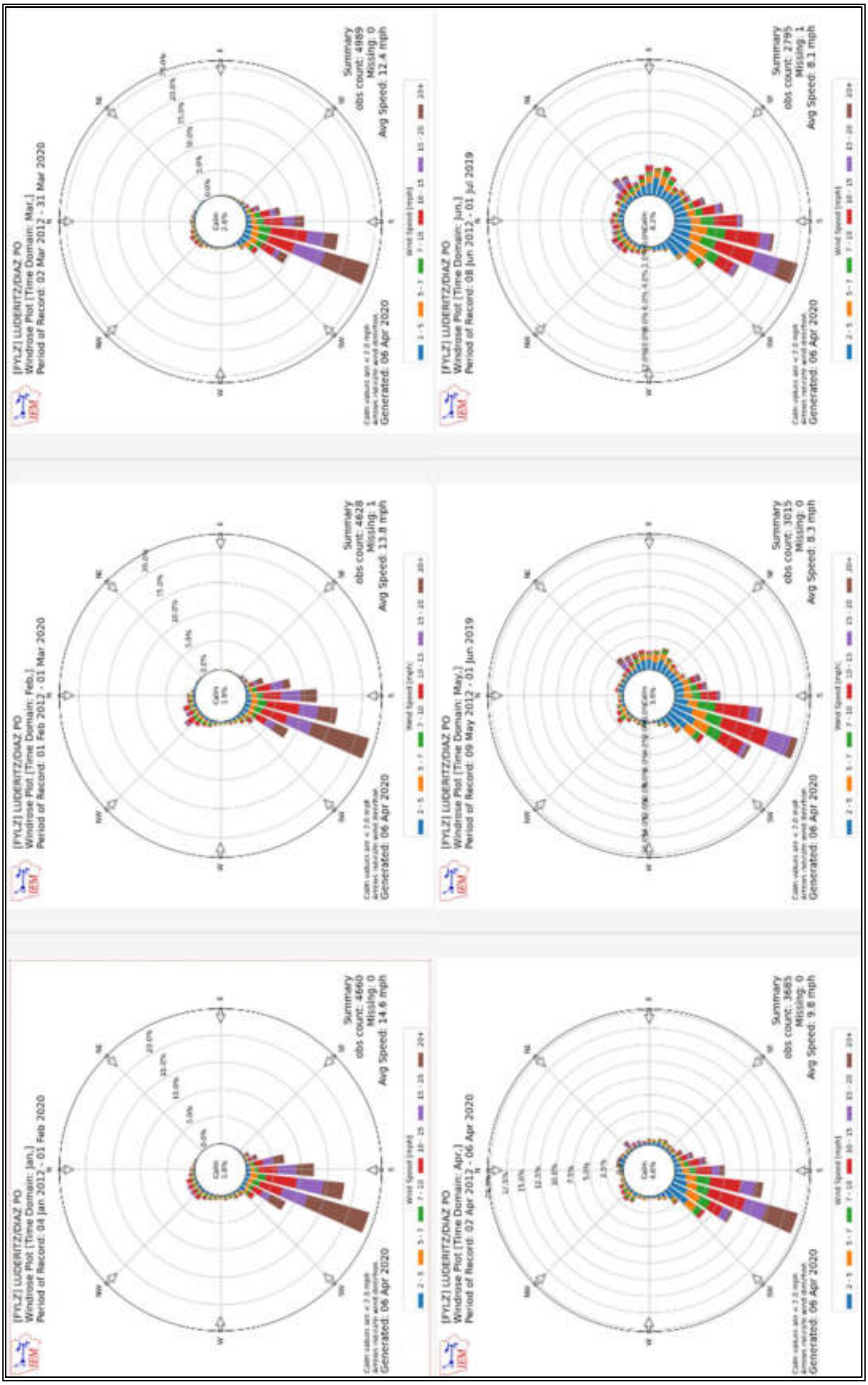



**Figure 9-4 January to June wind roses (www.mesonet. agron.iastate.edu/)**

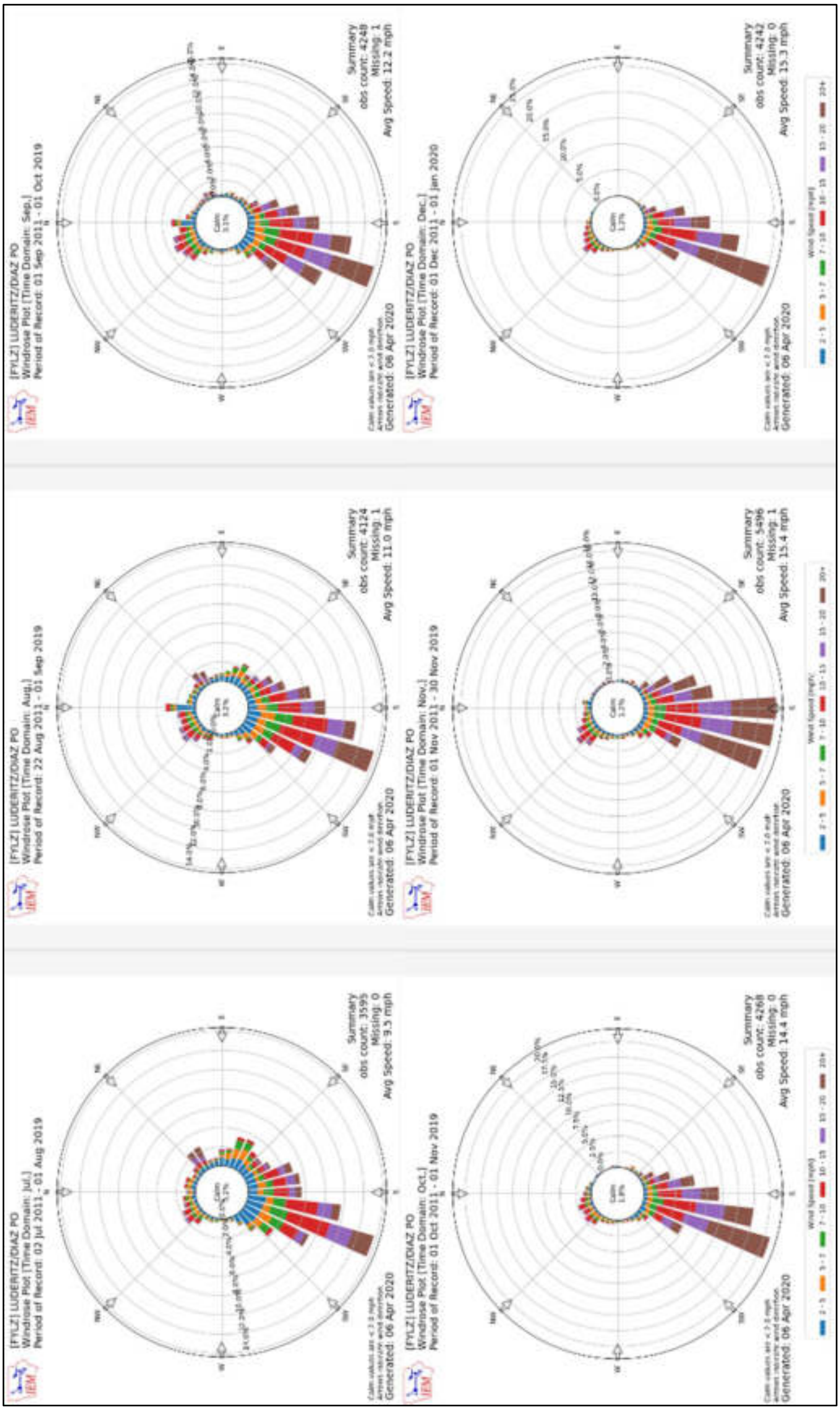



**Figure 9-5 July to December wind roses (www.mesonet.agron.iastate.edu/)**

## 9.3 CORROSIVE ENVIRONMENT

The corrosive environment of Lüderitz can be closely related to that of Walvis Bay. Figure 9-6 indicates corrosion data for Walvis Bay compared with other centres in southern Africa (Callaghan, 1991). The corrosive environment 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. 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.

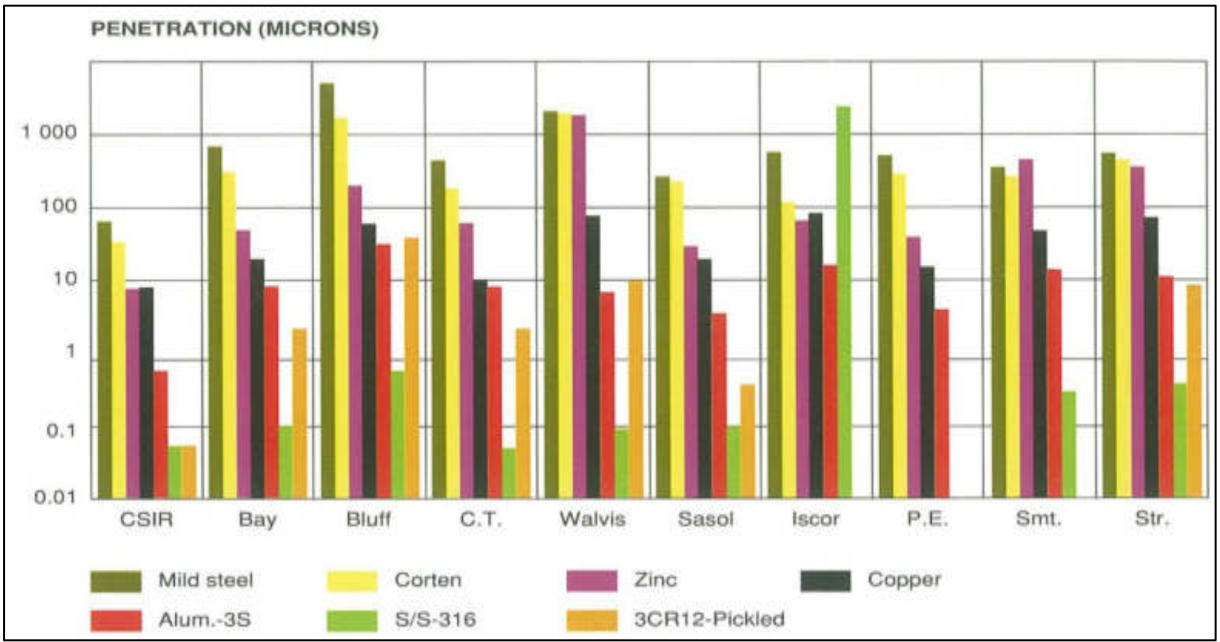



**Figure 9-6 Twenty year corrosion exposure results in southern African towns (Callaghan, 1991)**

***Implications and Impacts***

Corrosion levels may be high and must be kept in mind for the maintenance of dredging and related equipment.

## 9.4 TOPOGRAPHY

The whole of Lüderitz Bay area is characterized by mostly rocky shores with small, scattered sandy bays and lagoons (Figure 9-7). Offshore within Lüderitz Bay are small rock island formations namely Shark-, Penguin-, Seal- and Flamingo Island (Figure 9-7). The intertidal habitats found between Robert Harbour and North East Point, inclusive of the islands, as well as those of Lüderitz Harbour and Second Lagoon, comprise mostly of sheltered and exposed rocky shores, mixed sand and rocky shores and small sandy enclaves (NSI, 2012).

The port itself is partially located on Shark Island, which was linked to the mainland through land reclamation in the early 1900's. Lüderitz Bay is generally shallow with depths ranging from around 3 mbs in the inner harbour to 6 to 8 mbs in the middle of Robert Harbour (Menai Creek) and in Lüderitz Harbour west of Shark Island (Figure 9-8). The depths west of Penguin Island and north of Lüderitz Harbour reach 10 to 15 mbs.

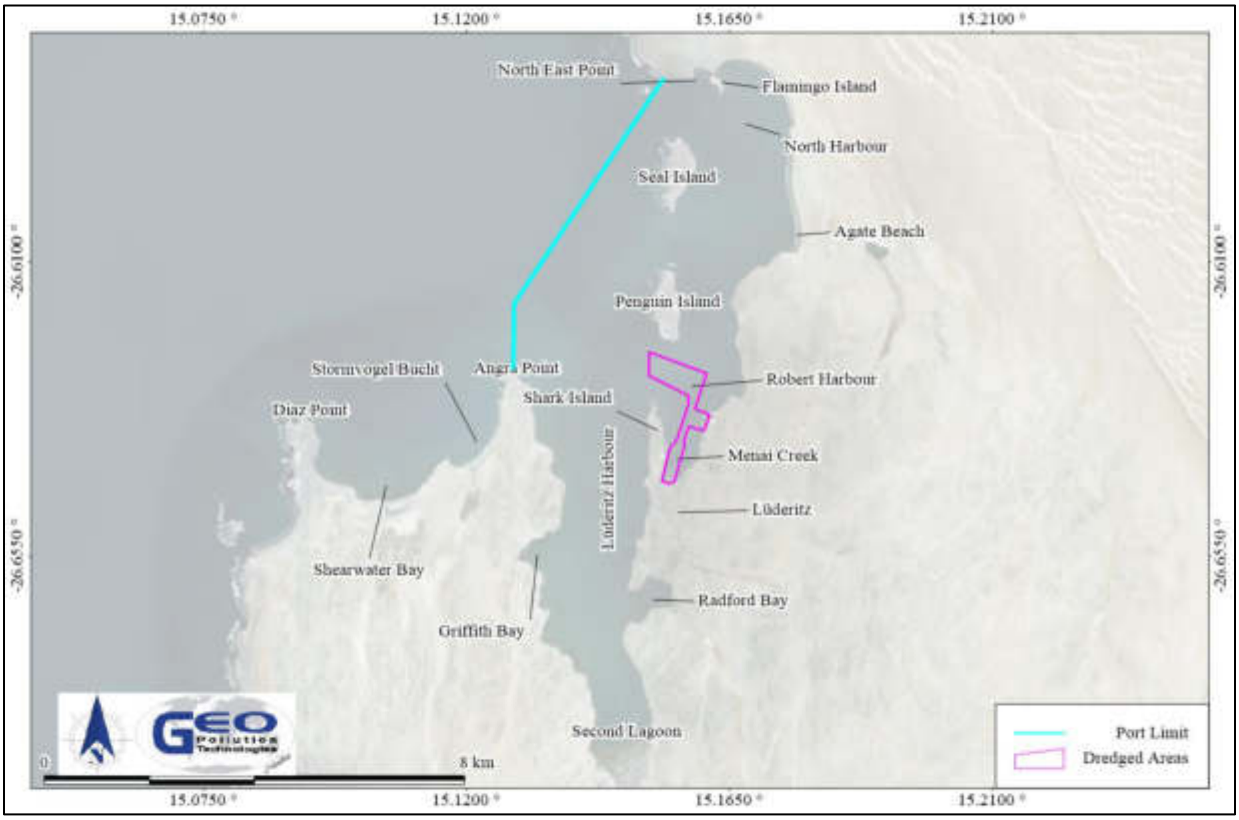



**Figure 9-7 Major bays, beaches and islands in relation to the dredging area**

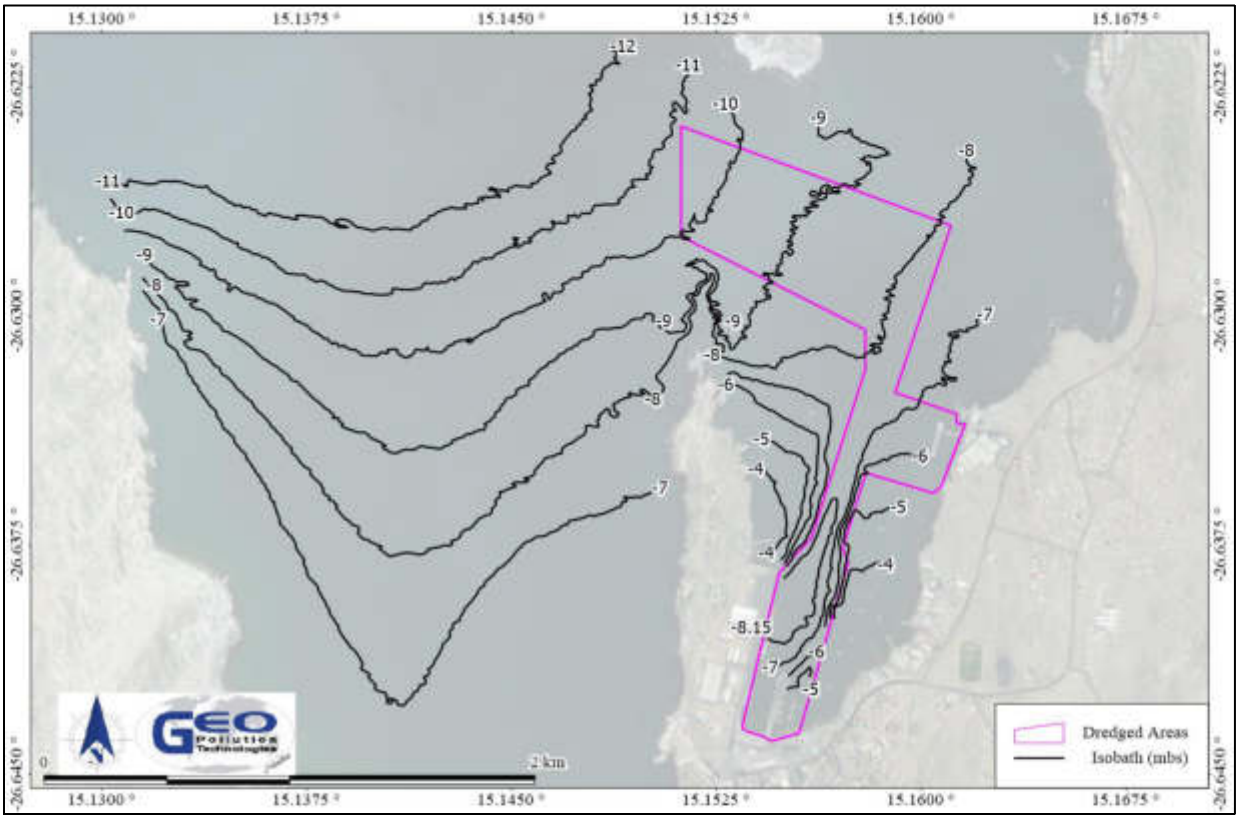



**Figure 9-8 Bathymetry in relation to the dredge area in Lüderitz Bay**

***Implications and Impacts***

The topography of the area provides for sheltered areas with relatively calm waters and this allows for the presence of the Port of Lüderitz. The mainland is sheltered from open ocean wave action and deposition and erosion processes associated with longshore drift. The rocky coastline restricts the dynamic shoreline processes which are more prevalent along sandy shores. Limited water depth and the presence of hard rock substrates are the limiting factors in the development of a deepwater port. It also necessitates dredging to allow safe ships' traffic into and out of the Port of Lüderitz.

## 9.5 THE MARINE ENVIRONMENT

This section deals with various aspects, including physical processes and conditions, of the marine environment that may potential affect, or be affected by, dredging operations.

### 9.5.1 Hydrodynamic Conditions

The Namibian coastline is characterised by the cold, northward flowing Benguela Current. Accounts of current speed varies between different literature sources, but in general estimates range between 0.10 m/s to 0.35 m/s, with a mean speed estimated at around 17 m/s (Shannon, 1985; O'Toole, 1997; Wedepohl et al., 2000; NSI, 2012). As the Benguela Current passes Diaz Point in a northerly direction, it diffracts eastwards and flow into Lüderitz Bay (NSI, 2012).

As a result of the topography in the bay (e.g. islands), Robert Harbour is relatively sheltered with a negligible current in Menai Creek, apart from a tidal current sometimes occurring on the east side of Shark Island during flood tide (NSI, 2012). Current velocity in Robert Harbour is about 0.1 m/s, but towards North Harbour and North East Point it can exceed 15 m/s (HPC Hamburg Port Consulting GmbH. 2007). These currents are mostly wind and tide driven and given the predominantly south-westerly winds, the currents flow northwards out of the bay and past North East Point. Within Robert Harbour water circulation is anti-clockwise with surface currents influenced by wind direction. In general it is believed that local currents are predominantly wind driven with a northward surface movement and counter southward bottom movement of water (Pers. Comm. Jean-Paul Roux). At Lüderitz Harbour, water exchange in Second Lagoon is estimated to occur every 3 to 5 days in winter and 7 to 8 days in the summer months (Liebner and Partners, 1967 in NSI, 2012).

Waves mainly originate from a southerly to south-westerly direction and is largely influenced by wind (Pulfrich, 2010b). Waves are diffracted and reflected by Diaz Point, Angra Point and Shark Island as it enters Lüderitz Bay. The result is waves, with diminished wave height of less than 0.5 m, entering from the north into Robert Harbour. During strong north to north-westerly winds, waves entering Robert Harbour can however reach heights of up to 1 m. General tide and sea-level data for Lüderitz are presented in Table 9-2. Chart datum is equal to the lowest astronomical tide (LAT) being zero and is -1.055 m relative to land levelling datum (mean sea level is commonly used to refer to land levelling datum). Chart datum used to be -0.94 m in relation to land levelling datum until 2003, but was set to -1.055 m in 2003.

**Table 9-2 Tide and sea-level data for Lüderitz (HPC Hamburg Port Consulting GmbH. 2007)**

| Hydrological conditions | Description |
|---|---|
| Land Levelling Datum (Mean Sea Level) | +1.055 mCD |
| Mean Level (Mean of MHWS, MLWS, MHWN, MLWN) | +0.94 mCD |
| Tidal Pattern | Semidiurnal |
| Tidal Range | 1.42 m on a spring tide and 0.57 m on a neap tide |
| Lowest Astronomical Tide (LAT) | -0.0 mCD |
| Highest Astronomical Tide (HAT) | +1.99 mCD |
| Mean High Water Springs (MHWS) | +1.65 mCD |

| Hydrological conditions | Description |
|---|---|
| Mean Low Water Springs (MLWS) | +0.23 mCD |
| Mean High Water Neaps (MHWN) | +1.22 mCD |
| Mean Low Water Neaps (MLWN) | +0.63 mCD |

***Implications and Impacts***

Current velocity and direction are important for predicting where resultant dredging plumes will go and how quickly they will disperse. Sensitive receptors most likely to be influenced by such plumes are seawater intakes (water quality and particulate matter), mariculture areas (water quality) and Radford Bay and Second Lagoon (water quality and sedimentation), as well as ecologically significant rocky shores and reefs.

#### 9.5.2 Upwelling, Sediments, Algal Blooms and Sulphur Eruptions

Strong upwelling of cold, nutrient rich water along the Namibian coast is one of the key environmental characteristics of the Benguela Current. The magnitude of upwelling is strongly influenced by wind and it leads to high biological productivity supporting significant fish populations (O'Toole, 1997; Pulfrich, 2010b). Lüderitz is reported to be situated within the most intense upwelling system (O'Toole, 1997; Pisces, 2003). An abundance of nutrients are brought from the sediments on the sea floor by this upwelling system to the photic zone. Large amounts of dead phyto- and zoo-plankton, which bloom as a result of this nutrient flux, settle on the seafloor together with silt, and contributes to anoxic conditions in the vicinity of Lüderitz and result in the occasional hydrogen sulphide eruption (Pulfrich, 2010b; NSI, 2012).

The biological fallout, together with inorganic particles to a lesser extent, forms layers of organic sediment or "mud belts" on the sea floor. These can be between three and four meters thick and is specifically noticeable at Walvis Bay (COWI, 2006). Lüderitz is situated at the northern limit of one such mud belt whose organic carbon content exceeds 15% in places (COWI, 2003).

Low oxygen levels related to the mud belt develop in two ways. Firstly, localised, small scale nutrient remineralisation, resulting in oxygen deficient conditions, occur in the bottom waters of the Benguela system. This process is dependent on the organic material build-up in the sediments. Low oxygen conditions affect marine biota and can have sub-lethal effects, such as reduced growth and feeding, and increased inter-moult period in the rock lobster populations. (During the summer months of upwelling, lobsters show a seasonal inshore migration, and during periods of low oxygen become concentrated in shallower, better-oxygenated near-shore waters.) The impacts of dredging at this time of year could exacerbate the problem by altering near-shore water quality and in particular oxygen levels in the shallow waters. The second natural cause of low oxygen levels in the ocean can be attributed to harmful algal blooms. These larger scale events can create low oxygen events having catastrophic effects on the marine communities leading to large-scale stranding of rock lobsters, and mass mortalities of white mussels, rocky shore biota and fish. These events are however a rare occurrence along the southern coast of Namibia.

Hydrogen sulphide accumulates in the sediments as a result of anaerobic bacteria reducing sulphates in the absence of oxygen to obtain energy. This produces hydrogen sulphide and when sufficient pressure is reached a hydrogen sulphide (or sulphur) eruption occur. The abundance of hydrogen sulphide in the water kills or drives away many marine organisms and reduces air quality at the surface. During dredging the risk of releasing hydrogen sulphide gas is present. Such eruptions are accompanied by a characteristic pungent smell along the coast and the sea takes on a lime green colour. These eruptions have been known to occur off the Namibian coast for centuries and the biota in the area are likely to be naturally adapted to such pulsed events, and to subsequent hypoxia. Recent surveys point to more frequent, more extensive and protracted eruptions than previously observed.

Assessment of the sediments in Robert Harbour (Menai Creek), when the concrete quay (east side of Shark Island) was expanded in 1998, showed that they consisted primarily of silt and clay fractions which were unsuitable for reclamation purposes (COWI, 2006). Subtidal sediments in Lüderitz are dominated by fine sand and depths for the most part are less than 10 m (NSI, 2012). Below these sediments, the bedrock of the surrounding formations, was found.

Harbour sediments often contain elevated concentrations of toxic compounds, most typically heavy metals, poly aromatic hydrocarbons (PAH) and/or tributyltin (TBT). TBT originates from marine paints which typically contain an agent to prevent fouling of the ship with barnacles and other organisms, which eventually will slow the ship and impede its movements (COWI, 2003). Samples of the harbour and bay sediments were taken prior to the dredging carried out in 2015. The samples were analysed for a wide range of organic contaminants and heavy metals. The sediment samples were analysed for more than 200 different elements and compounds including heavy metals, mono aromatic compounds, phenols, polycyclic aromatic hydrocarbons, polychlorinated biphenyls and pesticides. Those contaminants that were detected in the samples are presented in Table 9-3. A number of heavy metals exceeded the Benguela Current Large Marine Ecosystem (BCLME) guideline values as well as the BCLME probable effect concentrations. From Table 9-3 it is evident that metal concentrations are higher closer to the harbour, which is to be expected given the industrial nature of harbour activities.

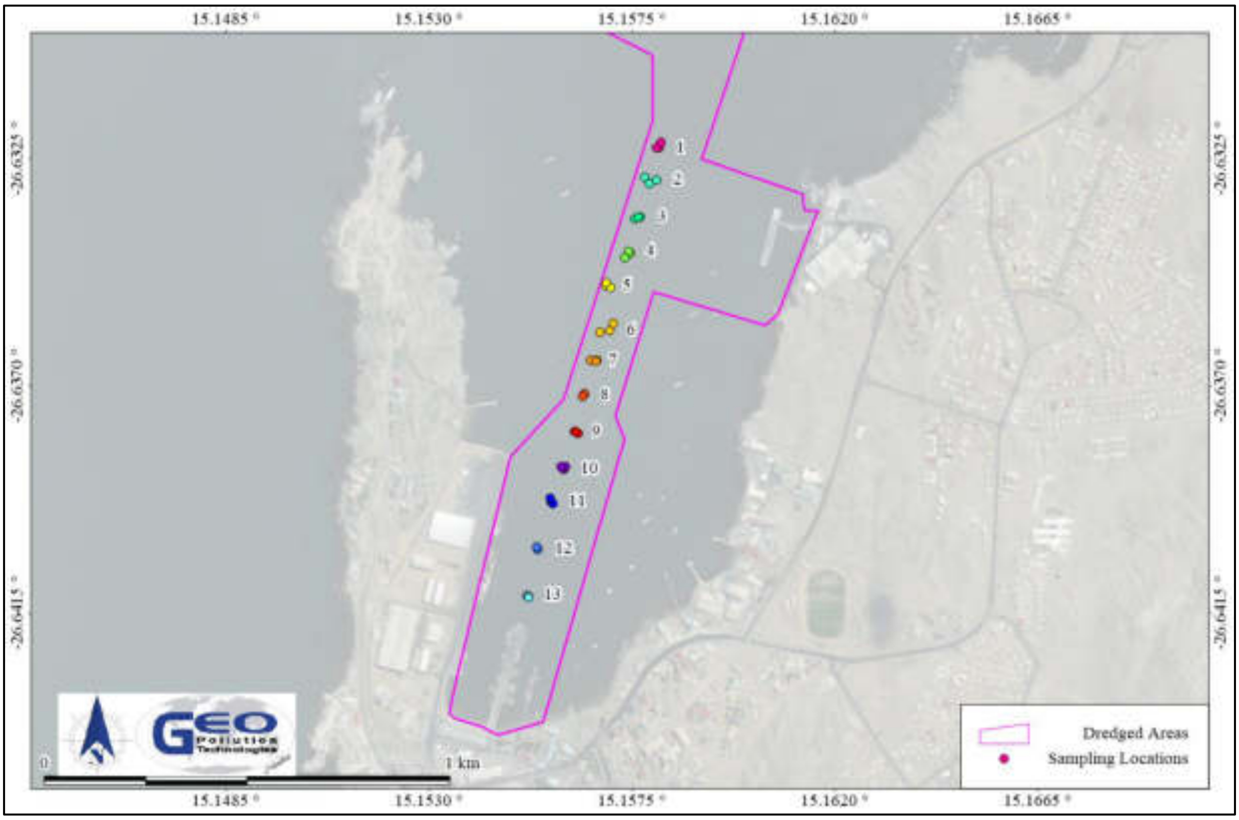



**Figure 9-9 Sediment sampling locations for the 2015 dredging campaign (Botha and Faul, 2015)**

**Table 9-3 Sediment analysis results (samples 1 to 6) prior to the 2015 dredging campaign (Botha and Faul, 2015)**

**Luderitz Harbour Baseline Sediment Sampling**

| | |
|---|---|
| Project number | G139-19 |
| Certificate number | 2015124099 |
| Certificate number | 2015124091 |
| Start date | 05-11-2015 |
| Report date | 12-11-2015 |
| Date sampling | 28-10-2015 |
| Sampler | I.White/A. Faul |

| | Map Number | | | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|---|---|
| **Analysis** | **Unit** | **BCLME Sediment (Recommended Guideline Value)** | **BCLME Sediment (Probable Effect Concentration)** | | | | | | |
| **TerrAttesT** | | | | | | | | | |
| Version number | | | | 7.23 | 7.23 | 7.23 | 7.23 | 7.23 | 7.23 |
| **Characteristics** | | | | | | | | | |
| Dry matter | % (w/w) | | | 51.2 | 46.6 | 45.9 | 40.7 | 42.8 | 42.2 |
| Organic matter | % (w/w) dm | | | 8.8 | 10.4 | 10.7 | 12 | 12.6 | 12.9 |
| Fraction < 2 µm (Clay) | % (w/w) dm | | | 9.4 | 13.6 | 11.8 | 18.4 | 17.4 | 15.6 |
| **Metals** | | | | | | | | | |
| Arsenic (As) | mg/kg dm | 7.24 | 41.6 | 7 | 7.1 | 7 | 7.5 | 9 | 7.8 |
| Barium (Ba) | mg/kg dm | No Value | No Value | 56 | 63 | 64 | 65 | 65 | 68 |
| Cadmium (Cd) | mg/kg dm | 0.68 | 4.21 | 1.1 | 1 | 0.87 | 0.84 | 0.9 | 0.91 |
| Chromium (Cr) | mg/kg dm | 52.3 | 160 | 71 | 80 | 79 | 89 | 87 | 98 |
| Copper (Cu) | mg/kg dm | 18.7 | 108 | 16 | 18 | 17 | 20 | 22 | 23 |
| Lead (Pb) | mg/kg dm | 30.2 | 112 | 8.4 | 8.9 | 8.6 | 9.4 | 10 | 11 |
| Molybdenum (Mo) | mg/kg dm | No Value | No Value | | 1.1 | | 1.1 | 1.1 | 1.2 |
| Nickel (Ni) | mg/kg dm | 15.9 | 42.8 | 21 | 23 | 24 | 25 | 25 | 27 |
| Vanadium (V) | mg/kg dm | No Value | No Value | 37 | 39 | 38 | 40 | 39 | 42 |
| Zinc (Zn) | mg/kg dm | No Value | No Value | 52 | 56 | 55 | 60 | 63 | 67 |
| Cobalt (Co) | mg/kg dm | No Value | No Value | 5.9 | 6.3 | 6.1 | 6.4 | 6.3 | 6.8 |
| **Phenols** | | | | | | | | | |
| p-Cresol | mg/kg dm | No Value | No Value | 0.03 | 3.1 | | | 1.8 | 0.03 |
| Cresols (sum) | mg/kg dm | No Value | No Value | 0.03 | 3.1 | | | 1.8 | 0.03 |
| Phenol | mg/kg dm | No Value | No Value | | 1.5 | | | 0.08 | 0.36 |
| **Polycyclic Aromatic Hydrocarbons** | | | | | | | | | |
| Pyrene | mg/kg dm | 153 | 1398 | 0.01 | 0.01 | 0.01 | 0.02 | 0.01 | 0.02 |
| PAH 16 EPA (sum) | mg/kg dm | 1684 | 16770 | 0.06 | 0.03 | 0.01 | 0.05 | 0.04 | 0.05 |
| Phenanthrene | mg/kg dm | 86.7 | 544 | 0.01 | | | 0.01 | | |
| Fluoranthene | mg/kg dm | 113 | 1494 | 0.02 | 0.02 | 0.01 | 0.03 | 0.02 | 0.02 |
| Chrysene | mg/kg dm | 108 | 846 | 0.01 | | | 0.01 | 0.01 | 0.02 |
| Benzo(b)fluoranthene | mg/kg dm | No Value | No Value | | | | | | |
| PAH 10 VROM (sum) | mg/kg dm | No Value | No Value | 0.04 | 0.02 | 0.01 | 0.05 | 0.04 | 0.05 |
| Benzo(a)anthracene | mg/kg dm | 74.8 | 693 | | | | | | 0.01 |
| Benzo(k)fluoranthene | mg/kg dm | No Value | No Value | | | | | 0.01 | |
| Benzo(a)pyrene | mg/kg dm | 88.8 | 763 | | | | | | |
| **Phtalates** | | | | | | | | | |
| Bisethylhexylphtalate | mg/kg dm | No Value | No Value | | | | | | |
| Phtalates (sum) | mg/kg dm | No Value | No Value | | | | | | |
| Butylbenzylphtalate | mg/kg dm | No Value | No Value | | | | | | |
| **Total Petroleum Hydrocarbons** | | | | | | | | | |
| TPH (C12-C16) | mg/kg dm | No Value | No Value | | | 6.1 | 7.4 | | |
| TPH (C30-C35) | mg/kg dm | No Value | No Value | 7.5 | 8.2 | | | 7.6 | |
| TPH (C35-C40) | mg/kg dm | No Value | No Value | | | | | | |
| TPH (C10-C12) | mg/kg dm | No Value | No Value | | | | 4 | | |
| **Miscellaneous Organic compounds** | | | | | | | | | |
| Organotin sum Sn factor 0,7 | mg Sn/kg dm | No Value | No Value | 0.021 | 0.021 | 0.021 | 0.021 | 0.021 | 0.021 |
| Organotin sum (factor 0.7) | mg/kg dm | No Value | No Value | 0.057 | 0.057 | 0.057 | 0.057 | 0.057 | 0.057 |

**Notes:**

Only parameters detected are reported on

| |
|---|
| Not Detected / No Guideline Value |
| < BCLME Sediment (Recommended Guideline Value) |
| > BCLME Sediment (Recommended Guideline Value) < BCLME Sediment (Probable Effect Concentration) |
| > BCLME Sediment (Probable Effect Concentration) |
| > BCLME Sediment (Probable Effect Concentration) x 100 |

**Table 9-4 Sediment analysis results (samples 7 to 13) prior to the 2015 dredging campaign (Botha and Faul, 2015)**

**Luderitz Harbour Baseline Sediment Sampling**

| | |
|---|---|
| Project number | G139-19 |
| Certificate number | 2015124099 |
| Certificate number | 2015124091 |
| Start date | 05-11-2015 |
| Report date | 12-11-2015 |
| Date sampling | 28-10-2015 |
| Sampler | I.White/A. Faul |

| | **Map Number** | | | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Analysis** | **Unit** | **BCLME Sediment (Recommended Guideline Value)** | **BCLME Sediment (Probable Effect Concentration)** | | | | | | | |
| **TerrAttesT** | | | | | | | | | | |
| Version number | | | | 7.23 | 7.23 | 7.23 | 7.23 | 7.23 | 7.23 | 7.23 |
| **Characteristics** | | | | | | | | | | |
| Dry matter | % (w/w) | | | 36.5 | 36.4 | 37.7 | 36.8 | 38.6 | 34.5 | 32.4 |
| Organic matter | % (w/w) dm | | | 12.9 | 13.4 | 12.5 | 12.6 | 11.9 | 13.3 | 13.6 |
| Fraction < 2 µm (Clay) | % (w/w) dm | | | 19.7 | 18.3 | 19.3 | 19.1 | 18.7 | 20.8 | 18.9 |
| **Metals** | | | | | | | | | | |
| Arsenic (As) | mg/kg dm | 7.24 | 41.6 | 8 | 7.6 | 8.3 | 8.4 | 8.2 | 8.5 | 8.7 |
| Barium (Ba) | mg/kg dm | No Value | No Value | 72 | 72 | 69 | 71 | 71 | 71 | 73 |
| Cadmium (Cd) | mg/kg dm | 0.68 | 4.21 | 0.87 | 0.85 | 0.9 | 0.89 | 0.87 | 0.88 | 0.88 |
| Chromium (Cr) | mg/kg dm | 52.3 | 160 | 99 | 100 | 96 | 110 | 97 | 100 | 99 |
| Copper (Cu) | mg/kg dm | 18.7 | 108 | 24 | 26 | 27 | 28 | 30 | 32 | 32 |
| Lead (Pb) | mg/kg dm | 30.2 | 112 | 11 | 13 | 13 | 13 | 14 | 16 | 17 |
| Molybdenum (Mo) | mg/kg dm | No Value | No Value | 1.4 | 1.3 | 1.3 | 1.5 | 1.3 | 1.2 | 1.2 |
| Nickel (Ni) | mg/kg dm | 15.9 | 42.8 | 28 | 28 | 27 | 28 | 27 | 28 | 28 |
| Vanadium (V) | mg/kg dm | No Value | No Value | 43 | 44 | 42 | 44 | 43 | 43 | 43 |
| Zinc (Zn) | mg/kg dm | No Value | No Value | 70 | 76 | 83 | 80 | 100 | 99 | 110 |
| Cobalt (Co) | mg/kg dm | No Value | No Value | 7 | 7 | 6.7 | 6.9 | 6.8 | 6.9 | 6.8 |
| **Phenols** | | | | | | | | | | |
| p-Cresol | mg/kg dm | No Value | No Value | 0.02 | | | 2 | | | |
| Cresols (sum) | mg/kg dm | No Value | No Value | 0.02 | | | 2 | | | |
| Phenol | mg/kg dm | No Value | No Value | | | | 0.16 | | 0.02 | |
| **Polycyclic Aromatic Hydrocarbons** | | | | | | | | | | |
| Pyrene | mg/kg dm | 153 | 1398 | 0.01 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 |
| PAH 16 EPA (sum) | mg/kg dm | 1684 | 16770 | 0.03 | 0.06 | 0.07 | 0.05 | 0.03 | 0.02 | 0.05 |
| Phenanthrene | mg/kg dm | 86.7 | 544 | | 0.01 | 0.01 | 0.01 | | | 0.01 |
| Fluoranthene | mg/kg dm | 113 | 1494 | 0.02 | 0.02 | 0.03 | 0.02 | 0.02 | 0.02 | 0.02 |
| Chrysene | mg/kg dm | 108 | 846 | 0.01 | 0.02 | 0.02 | 0.02 | 0.01 | | 0.02 |
| Benzo(b)fluoranthene | mg/kg dm | No Value | No Value | 0.01 | 0.01 | 0.02 | 0.01 | | | 0.01 |
| PAH 10 VROM (sum) | mg/kg dm | No Value | No Value | 0.03 | 0.06 | 0.07 | 0.05 | 0.03 | 0.02 | 0.05 |
| Benzo(a)anthracene | mg/kg dm | 74.8 | 693 | | 0.01 | | | | | |
| Benzo(k)fluoranthene | mg/kg dm | No Value | No Value | | | | | | | |
| Benzo(a)pyrene | mg/kg dm | 88.8 | 763 | | | 0.01 | | | | |
| **Phtalates** | | | | | | | | | | |
| Bisethylhexylphtalate | mg/kg dm | No Value | No Value | 0.3 | | | 0.2 | | 0.2 | 0.3 |
| Phtalates (sum) | mg/kg dm | No Value | No Value | 0.3 | | | 0.2 | | 0.5 | 0.3 |
| Butylbenzylphtalate | mg/kg dm | No Value | No Value | | | | | | 0.3 | |
| **Total Petroleum Hydrocarbons** | | | | | | | | | | |
| TPH (C12-C16) | mg/kg dm | No Value | No Value | | | | | | 5.8 | |
| TPH (C30-C35) | mg/kg dm | No Value | No Value | | 6.4 | | | | | |
| TPH (C35-C40) | mg/kg dm | No Value | No Value | | | | | | | |
| TPH (C10-C12) | mg/kg dm | No Value | No Value | | | | | 6.4 | 9.5 | 3.7 |
| **Miscellaneous Organic compounds** | | | | | | | | | | |
| Organotin sum Sn factor 0,7 | mg Sn/kg dm | No Value | No Value | 0.021 | 0.021 | 0.021 | 0.021 | 0.021 | 0.021 | 0.021 |
| Organotin sum (factor 0.7) | mg/kg dm | No Value | No Value | 0.057 | 0.057 | 0.057 | 0.057 | 0.057 | 0.057 | 0.057 |

**Notes:**

Only parameters detected are reported on

| |
|---|
| Not Detected / No Guideline Value |
| < BCLME Sediment (Recommended Guideline Value) |
| > BCLME Sediment (Recommended Guideline Value) < BCLME Sediment (Probable Effect Concentration) |
| > BCLME Sediment (Probable Effect Concentration) |
| > BCLME Sediment (Probable Effect Concentration) x 100 |

The re-suspension of sediments will contribute to the nutrient load of the water column and possibly the re-suspension of contaminants such as heavy metals. The timing of dredging in the year, and thus the current velocity and directions, will determine to what extent this artificial introduction of nutrients and contaminants will disperse. The heavy metal contents of the dredged material must be assessed prior to dredging to predict the probable effects on organism functioning.

### 9.5.3 Turbidity

Turbidity is a measure of the optical clarity of water and presents an indication of the amount of light scattering particles in water. Its unit of measure is nephelometric turbidity units (NTU). When calibrated, turbidity is a representation of the concentration (or weight) of suspended particles in water or total suspended solids (TSS), which is measured as milligram of solids per millilitre of water (mg/ml). The water within Lüderitz Bay is characterized by relatively high turbidity. This mainly results from a combination of shallow water, coupled with wind induced waves and currents, which continuously bring sediment into suspension.

During dredging, sands and fine particulate matter (silts and clays) are released into the sea in the form of dredger overspill. Whereas the sand fraction settles rapidly, fine particles form turbid plumes which may under certain wind and wave conditions persist for a few days before dispersing. This may negatively impact on marine ecology and especially filter feeders.

Prior to the 2015 maintenance dredging exercise in the Port of Lüderitz, short term baseline turbidity conditions for the Lüderitz Bay area were determined at four locations within the Bay (Figure 9-10) (Botha and Faul, 2015). Average turbidity readings were determined for strategic locations around the dredging areas and then converted to TSS with a laboratory based determined turbidity to TSS conversion equation. The baseline turbidity and TSS data is presented in Table 9-4. The locations chosen were specifically monitored to observe and prevent possible impacts on sensitive receptors such as seawater intakes of fish factories, the mariculture industry and the lagoons within Lüderitz Harbour.

Based on the baseline as presented in Table 9-4, more turbid conditions were noted at the shallower locations marked as T1, T2 and T4, and reduced turbidity at the deeper location marked T3 (Figure 9-10). This corresponds well with the notion that sediment in shallower water is more likely to be agitated by wind, wave and current action, resulting in increased turbidity. The results provided in Table 9-4 can be used as reference for future dredging exercises.

> Increased TSS in the marine environment as a result of dredging may impact on marine organisms by reducing photosynthetic rates and smothering organisms. Turbidity is a quick and easy, albeit indirect, measurement of total suspended matter. To reduce the impact of re-suspended material on natural and cultured marine organisms, the measurement of turbidity is useful for determining when to halt dredging activities. Turbidity probes must be calibrated for local water and substrate conditions and a device specific turbidity to TSS factor must be determined.


**Figure 9-10 Locations for determining baseline turbidity conditions during the 2015 dredging exercise (Botha and Faul, 2015)**

**Table 9-4 Baseline total suspended solids as reported on during the 2015 dredging baseline conditions determining exercise (Botha and Faul, 2015)**

| Day* | 80th Percentile (mg/ml) | | | | Average TSS (mg/ml) | | | | Maximum TSS (mg/ml) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | T1 | T2 | T3 | T4 | T1 | T2 | T3 | T4 | T1 | T2 | T3 | T4 |
| 1 | 13.0 | 13.2 | 6.4 | 11.3 | 9.9 | 9.6 | 4.6 | 7.8 | 33.6 | 39.7 | 36.5 | 34.1 |
| 2 | 13.1 | 15.3 | 8.2 | 12.3 | 9.1 | 10.9 | 6.0 | 9.0 | 33.3 | 39.7 | 36.5 | 31.8 |
| 3 | 12.2 | 12.0 | 7.6 | 11.8 | 9.5 | 8.7 | 5.5 | 8.4 | 33.5 | 39.3 | 23.5 | 38.5 |
| 4 | 15.3 | 15.4 | 7.7 | 14.5 | 10.8 | 10.5 | 6.1 | 10.2 | 33.3 | 38.9 | 21.4 | 33.9 |
| 5 | 14.8 | 17.4 | 6.6 | 10.6 | 9.7 | 11.4 | 5.1 | 8.2 | 33.6 | 39.7 | 35.4 | 38.5 |
| 6 | 16.0 | 14.9 | 5.9 | 8.6 | 11.9 | 10.2 | 4.1 | 6.8 | 33.6 | 39.7 | 15.9 | 38.5 |
| 7 | 16.6 | 16.6 | 6.2 | 11.2 | 12.8 | 12.5 | 4.7 | 7.7 | 33.6 | 39.0 | 20.7 | 22.8 |
| 8 | 13.7 | 19.0 | 4.8 | 12.1 | 9.6 | 12.0 | 4.7 | 8.4 | 32.0 | 36.5 | 36.5 | 38.5 |
| 9 | 11.1 | 12.2 | 6.1 | 16.7 | 9.2 | 9.5 | 4.4 | 12.1 | 26.3 | 22.7 | 36.5 | 30.6 |

* Number of days after cleaning of the turbidity sensor on the permanently deployed probe

### 9.5.4 Water quality

Water quality is typically affected by natural and anthropogenic factors. Natural contributors typically relate to sand influx due to wind, sediment transport via rivers and leaching of naturally occurring elements from sediments. Namibian coastal waters for example seem to have naturally higher cadmium concentrations (Faul and Botha, 2015). In ports, water quality can be compromised due to the presence of nearby onshore industrial activities and port operations resulting in the release of contaminants into the ocean (effluent discharge, windblown dust, ship repair, etc.) and spills from vessels (e.g. oil or fuel). Previously, ships were painted with antifouling paints containing harmful chemicals such as tributyltin (TBT). Although now banned, traces of TBT can still be detected in sediment and thus sometimes also in water samples taken from harbours.

During the 2015 dredging campaign in the Port of Lüderitz, a baseline water quality assessment was conducted prior to the onset of dredging. Six locations strategically located throughout the Lüderitz Bay area was selected (Figure 9-11). The water samples were analysed for more than 200 different elements and compounds including heavy metals, mono aromatic compounds, phenols, polycyclic aromatic hydrocarbons, polychlorinated biphenyls and pesticides. A summary of the results of only those elements measurable in the water samples is presented in Table 9-5. Based on the results the water quality in the Port of Lüderitz can be regarded as relatively good. However, long term water quality monitoring data is not available to confirm this.


**Figure 9-11 Water sampling locations for the 2015 dredging campaign (Botha and Faul 2015)**

**Table 9-5 Water quality baseline as determined prior to the 2015 dredging campaign (Botha and Faul, 2015)**

**Luderitz Port Maintance Project - Water Baseline Sampling**

| | |
|---|---|
| Your project number | G139-19 |
| Certificate number | 2015124081/1 |
| Certificate number | 2015124074/1 |
| Start date | 06-11-2015 |
| Report date | 17/11/2015 |
| Date sampling | 28-10-2015 |
| Sampler | A. Faul/ I.White |

| Map Number | | | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|---|
| Analysis | Unit | BCLME Water (Recommended Guideline Value) | | | | | | |
| **TerrAttesT** | | | | | | | | |
| Version number | | | 7.23 | 7.23 | 7.23 | 7.23 | 7.23 | 7.23 |
| **Characteristics** | | | | | | | | |
| EC-temp. corr. factor (mathematical) | | | 1.089 | 1.086 | 1.089 | 1.089 | 1.096 | 1.096 |
| Electric conductivity 25 °C | µS/cm | | 53000 | 53000 | 53000 | 53000 | 53000 | 53000 |
| Electric conductivity 25 °C | mS/m | | 5300 | 5300 | 5300 | 5300 | 5300 | 5300 |
| Electric conductivity 20°C | mS/m | | 4700 | 4700 | 4700 | 4700 | 4700 | 4700 |
| Measuring temperature (EC) | °C | | 20.7 | 21.2 | 21.1 | 21.1 | 20.8 | 20.8 |
| Measuring temperature (pH) | °C | | 20.8 | 21.6 | 21.5 | 21.6 | 20.9 | 20.9 |
| pH | | | 7.4 | 7.5 | 7.5 | 7.4 | 7.4 | 7.4 |
| **Metals** | | | | | | | | |
| Arsenic (As) | ppm | No Value | | 0.0031 | 0.0033 | | 0.0031 | 0.0033 |
| Barium (Ba) | ppm | No Value | 0.0071 | 0.0058 | 0.0059 | 0.0055 | 0.0072 | 0.0073 |
| Mercury (Hg) | ppm | 0.0004 | 0.00063 | | | | 0.00037 | 0.0004 |
| Molybdenum (Mo) | ppm | No Value | 0.0012 | 0.001 | 0.0011 | 0.001 | 0.0011 | 0.0011 |
| Vanadium (V) | ppm | 0.1 | | 0.0022 | 0.0022 | 0.0022 | | |
| Zinc (Zn) | ppm | 0.015 | 0.016 | | | | | 0.037 |
| **Volatile Organic Hydrocarbons** | | | | | | | | |
| Toluene | ppm | 0.18 | | 0.00019 | | 0.00036 | 0.00022 | |
| o-Xylene | ppm | No Value | | | | 0.00014 | | |
| m,p-Xylene | ppm | No Value | | | | 0.00028 | 0.00018 | |
| Xylenes (sum) | ppm | No Value | | | | 0.00042 | | |
| Ethylbenzene | ppm | 0.005 | | | | | 0.00011 | |
| **Total Petroleum Hydrocarbons** | | | | | | | | |
| TPH (C12-C16) | ppm | No Value | | | | | | 0.0019 |
| TPH (C16-C21) | ppm | No Value | | | | | 0.016 | |
| **Volatile halogenated Hydrocarbons** | | | | | | | | |
| 1,1-Dichloroethene | ppm | No Value | | 0.00012 | | | | |
| **Miscellaneous Organic compounds** | | | | | | | | |
| Biphenyl | ppm | No Value | | 0.0002 | | 0.0004 | | |
| **Polycyclic Aromatic** | | | | | | | | |
| Chrysene | ppm | No Value | | | 0.0003 | 0.0002 | | |

**Notes:**

Only parameters detected are reported on

- Not Detected / No Guideline Value
- < BCLME Water (Recommended Guideline Value)
- > BCLME Water (Recommended Guideline Value)

The re-suspension of sediments can change the water quality. The analysis of water samples before, during and after dredging activities confirms the possible impacts that dredging could have on receptors such as mariculture, fisheries and natural ecosystems. The results from analyses can be used to determine whether dredging should continue or halt temporarily so that receptors can experience a reprieve from poor water quality.

### 9.5.5 Ecology of Lüderitz Bay

The coastal waters of Namibia is characteristic of cool surface waters and high productivity (Sakko, 1998). Although it has relatively low species diversity it has high abundance resulting from the nutrient rich upwelling systems. It is typically also a dynamic ecosystem with relatively high resilience against impacts, when compared with the more tropical waters of, for example, the east coast of southern Africa.

The Lüderitz Bay seashore is mostly rocky with intertidal rocky shores and submerged reefs. Growth on the sea bottom is characterised by *Gracilaria* spp., a gelatinous red algae (Esterhuizen, 2019). Biological communities found in these habitats are not particularly unique and their presence are mostly determined by the environmental characteristics such as depth, wave action and substrate (Pulfrich, 2010a). Also according to Pulfrich (2010a), Lüderitz Bay is not ecologically unique within the Benguela ecosystem, neither is it particularly pristine. However, it is important to note that the entire Lüderitz Bay area is a proclaimed rock lobster (*Jasus lalandii*) sanctuary and part of the Important Bird Area (IBA) NA017, the Lüderitz Islands IBA (Figure 9-12).

The IBA consist of the four islands; Halifax, Penguin, Seal and Flamingo Island, as well as the rocky shoreline of the mainland. The island support more than 10,000 birds while the rocky shorelines of the mainland support more than 14,000 shorebirds (BirdLife International 2021). Historically anthropogenic pressures on many of the bird species have led to a steep decline in their numbers. This was largely as a result of guano harvesting, egg collection and habitat alteration and loss.

Some important species that are considered endangered, vulnerable or near threatened, and occurring within or near IBA NA017, are presented in Table 9-6 with some notes on their status and threats (https://www.iucnredlist.org/; BirdLife International 2021). The various shallow bay areas, and specifically Angra Point and the Second Lagoon area of Lüderitz Harbour, are important, specifically for flamingos and waders (Pulfrich, 2010a).

**Table 9-6 Key bird species in IBA NA017 (list not exhaustive)**

| Common Name (Scientific Name) | Range | Status (Last Assessed) | Comments | Current Threats |
|---|---|---|---|---|
| African Penguin (*Spheniscus demersus*) | Endemic to southern Africa (Namibia; South Africa; Angola; Mozambique) | Endangered (2019) | Rapid population decline with no sign of reversal | Commercial fishing and shifts in prey populations |
| Bank Cormorant (*Phalacrocorax neglectus*) | Native to Namibia and South Africa | Endangered (2018) | Very rapid decline in small population | Human disturbance, displacement by seals, food shortages and low quality food |
| Damara Tern (*Sternula balaenarum)* | Breeding resident in Namibia | Vulnerable (2018) | Decreasing population | Habitat disturbance and mining |
| Curlew Sandpiper (*Calidris ferruginea)* | Namibian resident with wide global distribution | Near Threatened (2016) | Decreasing population | Habitat loss and degradation, human disturbance |
| Red Knot (*Calidris canutus)* | Namibian native with wide global distribution | Near Threatened (2018) | Decreasing population | Habitat loss and human disturbance |
| Lesser Flamingo (*Phoeniconaias minor*) | Namibian native with relatively wide global distribution | Near Threatened (2018) | Decreasing population | Mining, power generation and transmission |
| White-chinned Petrel (*Procellaria aequinoctialis*) | Non-breeding native to Namibia with wide global geographic | Vulnerable (2018) | Decreasing population | Commercial fishing |

| | | | | |
|---|---|---|---|---|
| African Oystercatcher (*Haematopus moquini*) | Native to Namibia and South Africa | Near Threatened (2016) | Small population, probably increasing population | Human disturbance e.g. off-road driving on beaches |
| Crowned Cormorant (*Microcarbo coronatus*) | Native to Namibia and South Africa | Near Threatened (2016) | Small but stable population | Disturbance and marine pollution |
| Cape Gannet (*Morus capensis*) | Native to southern Africa | Endangered (2018) | Decreasing population | Food shortage, storms, habitat loss, marine pollution, etc. |

Source: The IUCN Red List of Threatened Species Website https://www.iucnredlist.org/; BirdLife International 2021

Approximately 25 species of cetaceans occur along the Namibian coast. This includes migratory, resident and semi-resident species. Under Namibian law, all whales and dolphins are protected species and may not be harvested. Bottlenose dolphins, Heaveside's dolphins and dusky dolphins occur within Lüderitz Bay. Humpback whales and the Southern Right whale are also encountered in Lüderitz Bay (Pulfrich, 2010a).

Namibia has quite a large population of Cape fur seals. A small colony are present at Diaz Point close to the proposed project location. Historically, Cape fur seal populations showed significant declines in population numbers due to overharvesting. However, the Namibian population has shown significant increases over the last two decades with new populations of seals establishing all along the coast

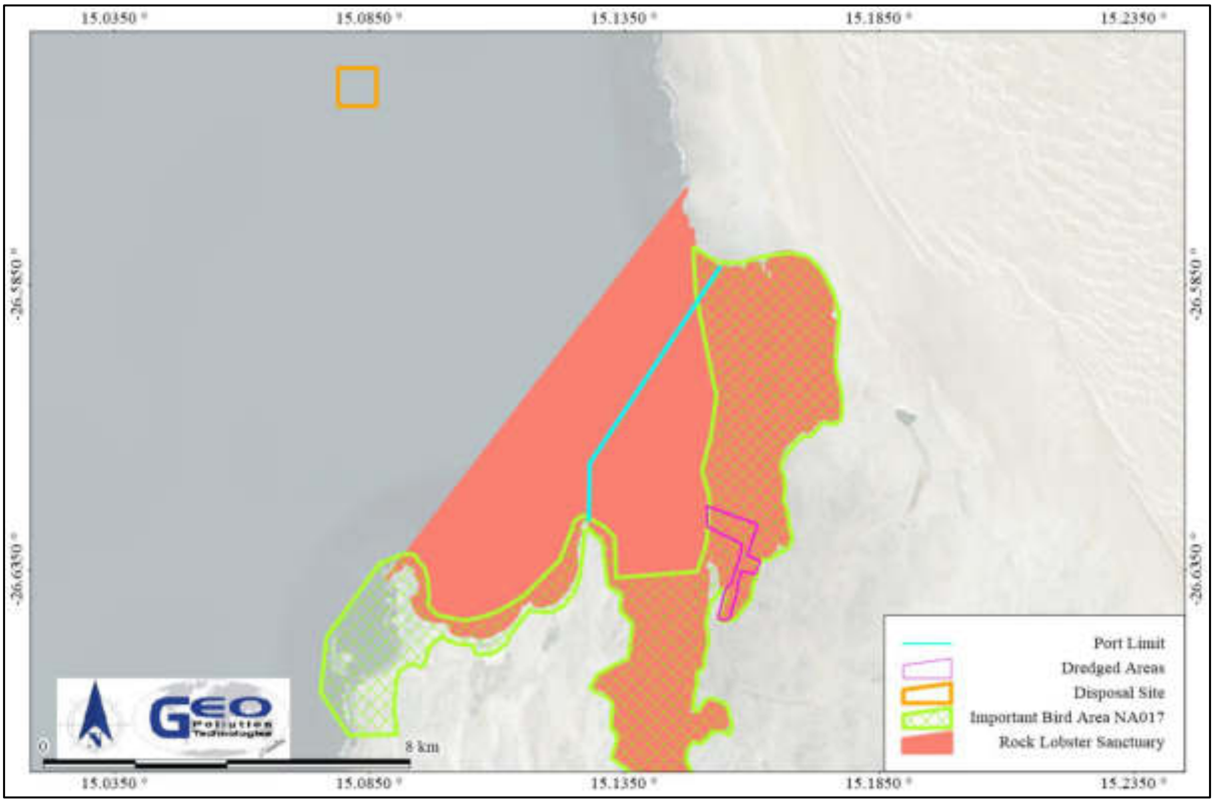



**Figure 9-12 Ecologically significant offshore areas at Lüderitz**

***Implications and Impacts***

Suspended particulate matter may inundate rocky shores or impact on sessile filter feeders. During the prevailing south-westerly wind conditions, such particulate matter is likely to travel towards Penguin and Seal Islands while during northerly winds it will travel into Robert Harbour and Lüderitz Harbour.

Monitoring during previous dredging exercises has indicated that, given that appropriate preventative and mitigating measures are implemented, very little impact as a result of sediment plumes can be expected. Mitigating measures include real time turbidity monitoring to allow for cessation of dredging when suspension of particulate matter is severe and persistent, especially as it approach sensitive receptors.

Habitat destruction is inevitable at the dredging locations, but given the dynamic nature of the ecosystem would likely quickly recover. At the disposal site inundation of the benthic communities will occur.

## 9.6 SOCIO ECONOMIC ENVIRONMENT

It is important that the key-socio-economic trends in Lüderitz are understood as a basis for the scoping assessment.

From 2001 to 2011, the //Karas Region showed a population increase of 1.1%. This is less than the Namibian intercensal growth rate of 1.4%. For the same period, Lüderitz however, showed a decline in population size of 5.6% and had a population size of 12,537 in 2011 (Namibia Statistics Agency, 2011). The remoteness of Lüderitz and the lack of employment and economic diversification opportunities possibly contributes to this decline. This may lead to some inhabitants relocating to other urban centres offering better prospects.

Lüderitz has an unemployment rate of 28.2% which is slightly lower than the rate of 32.2% of the //Karas Region (Namibia Statistics Agency, 2011).

Lüderitz developed in the early 20$^{th}$ century mainly as a result of the diamond mining industry. Today however, the sustaining industries in Lüderitz are fishing, mariculture, mining and tourism. The majority of employment is provided by the fishing industry which mainly exports fisheries products to Europe. A small fleet of demersal trawlers and long-liners operate out of Lüderitz. The fleet primarily catches whitefish, including hake, monkfish and kingklip. A number of fish factories are located along the eastern coast from Robert Harbour northwards. Lüderitz Bay itself falls within in a no commercial fishing zone. The commercial rock lobster industry forms an important part of the coastal economy of southern Namibia as Namibia's commercial rock-lobster industry is centred in Lüderitz.

Mariculture of abalone and oysters are also actively pursued in Lüderitz. Oysters are cultured in baskets on long lines within Lüderitz Harbour while abalone is either ranched in the vicinity of Penguin and Seal Islands as well as in land-based facilities. Recent developments also include the proposed culturing of kelp for export purposes.

Diamond mining continues to be a major part of the mining industry with zinc mining being the other major component. Tourism does play an important part in the local economy, unfortunately a very small percentage of tourists visiting Namibia also visits Lüderitz. The main reason for this is Lüderitz's location which is off major tourist routes. However, the uniqueness of Lüderitz within Namibia, and the presence of tourist attractions like Kolmanskop ghost town, Diaz Point, war artefacts, architecture, the annual speed sailing event (Lüderitz Speed Challenge) etc., makes a visit to Lüderitz worthwhile.

Most basic services and products are provided by a small tertiary sector within Lüderitz. A number of guesthouses, hotels and self-catering units are present with a limited number of restaurants in town. The Lüderitz waterfront development aims to be a key tourism attraction and a site from which sea cruises and dolphin tours are launched. The success of the development is however very limited.

***Implications and Impacts***

The Port of Lüderitz directly and indirectly provide a significant portion of the employment opportunities in the town. It is also responsible for opportunities for investment and economic diversification of the town.

The Port of Lüderitz's continued operations have a positive economic impact on Lüderitz, the region and Namibia as a whole. Services provided for the dredging operations, and the influx of foreign dredging contractors, will result in an economic injection in the town, but may also contribute to an increase in social ills in the area. Mariculture areas are probable receptors of potentially lower quality seawater. The filter feeding mussels and oysters, and the sensitive abalone could be adversely affected by heavy metals and other pollutants that are re-suspended and dissolved in the water column and carried towards the mariculture areas.

## 9.7 GEOLOGY AND HYDROGEOLOGY

The area around Lüderitz is dominated by a desert with dunes and crystalline rock outcrops of the Mid-Proterozoic Era. This includes geology from the Namibian- and Mokolian Age. The Mokolian Age rocks is the oldest to be found in Namibia, dating back to 2,200 Ma. Quaternary deposits in the form of sand shifting dunes were formed by eroded sands that have been transported to the area by water and wind. The dunes occurs 7 km northeast of the project area.

The subsurface geology consist of rocks from the Mokolian Age. This subsurface geology consists primarily of gneiss and granites of the Namaqua Metamorphic Complex. The gneiss is mainly of pre- to syntectonic biotite-rich augen gneiss.

The local and regional geology were subjected to numerous events of deformation which led to the formation of geological folds, faults, fractures and thrusts. Groundwater flow would be mostly along fractures, faults (secondary porosity) and other geological structures present within the formations as well as through primary porosity in the unconsolidated top cover. No known permanent natural fresh surface water sources exist near Lüderitz. No known boreholes are present within the immediate surroundings of Lüderitz.

***Implications and Impacts***

The presence of hard rock at shallow depths below the surface within Robert Harbour will determine the methods of capital dredging and the type of machinery that should be used.

## 9.8 CULTURAL, HERITAGE AND ARCHAEOLOGICAL ASPECTS

Lüderitz has a relatively rich history ranging from Bartholomew Dias, a Portuguese explorer's landing at what is now known as Dias Point in 1487 to the discovery of diamonds and the subsequent diamond rush in the early 1900's. Terrestrial archaeological finds include, on the western bank of the Lüderitz Lagoon, the remains of a Khoisan / Strandloper male. This indicates that they had settlements nearby and likely foraged along the coastline (Werz, 2007). There is also a possibility that shell middens may be present in the area. On Angra Point one can still today see the remains of World War 1 entrenchments as well as the remains of an old wailing station. In terms of Lüderitz town, many buildings, especially the town centre, are considered to be of heritage value requiring protection (SPC, 2015).

More importantly for the dredging operations is the archaeological artefacts found offshore. This relates mainly to various shipwrecks, likely fishing vessels, in the area. Some of these shipwrecks, and other smaller objects like mooring blocks with chains and unidentified structures, were identified in 2009 during a geophysical survey of the Lüderitz Harbour (Vonk and Brabers 2010). About 18 objects were surveyed to be present in or directly around the dredging area. None of these were identified to be shipwrecks, but rather mooring blocks, chains and unidentified objects. Shipwrecks are more associated with the Angra Point area (Figure 9-13).

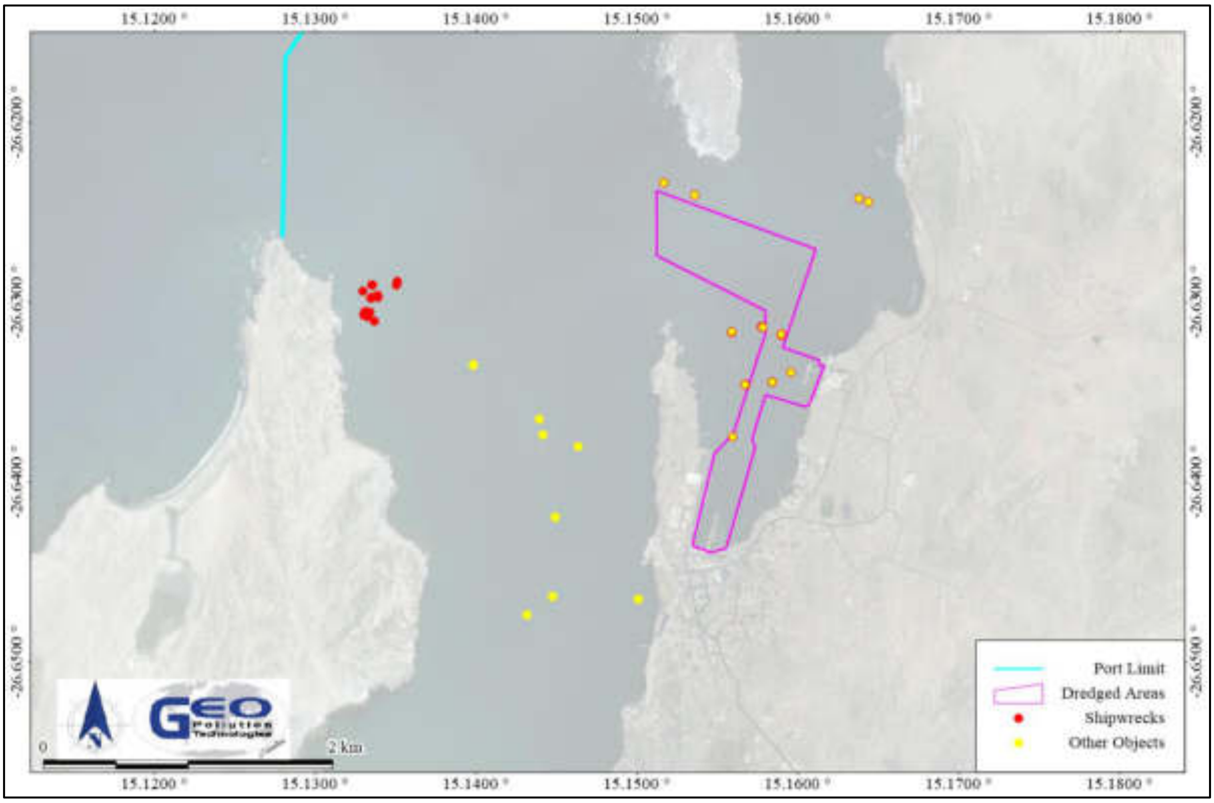



**Figure 9-13 Locations of wrecks and miscellaneous objects around Lüderitz Bay (source: Vonk and Brabers, 2010)**

***Implications and Impacts***

Being offshore, the maintenance dredging activities is not expected to impact on any of the cultural or historically significant areas or buildings. During capital dredging, blasting activities, if not performed by trained experts, may result in vibrations that may damage old buildings and structures of heritage value.

Knowledge about the positions of known wrecks and miscellaneous objects on the sea floor will assist the dredge contractor to avoid risky areas and prepare to remove objects from the floor using the correct means. However, since the existing dredged area has been dredged more than once in the past, the chances of encountering such artefacts there, are much smaller.

# 10 PUBLIC CONSULTATION

Consultation with the public forms an integral component of an environmental assessment investigation and enables interested and affected parties (IAPs) e.g. neighbouring landowners, local authorities, environmental groups, civic associations and communities, to comment on the potential environmental impacts associated with the facility and to identify additional issues which they feel should be addressed in the environmental assessment.

Public consultation formed part of the process of the original preparation and subsequent update of the EIA for dredging activities in Lüderitz. Public participation notices were distributed and advertised in national newspapers and public meetings were conducted. Relevant authorities, port users, members of the fishing and mariculture industries, and other stakeholders were invited directly. Views, comments and opinions expressed by IAPs were noted and incorporated into the EIA reports. See Appendix B and Appendix Cfor proof of the public consultation process.

For the 2021 update of the EIA, very few, if any, of the impacts addressed in the previous EIA are expected to change. This is because the extent and methods of dredging are not changing, and only where new receptors are present, may additional or more significant impacts be expected.

# 11 MAJOR IDENTIFIED IMPACTS

The following section provides a brief description of the impacts (positive and negative) that are regarded as major dredging related impacts (direct and indirect). These are based on the previous assessments and public consultation, as augmented by the current assessment and additional knowledge gained during the previous dredging campaign.

Typical conceptual models of potential environmental impacts of marine dredging and disposal are presented in Figure 11-1 and Figure 11-2 (MEMG 2003). As can be discerned from the figures, almost all of the impacts result from the suspension of particulate matter in the water column. Since such suspension of particulate matter is inevitable, measures to reduce the volume of suspended matter and to prevent it from reaching sensitive receptors, are key.

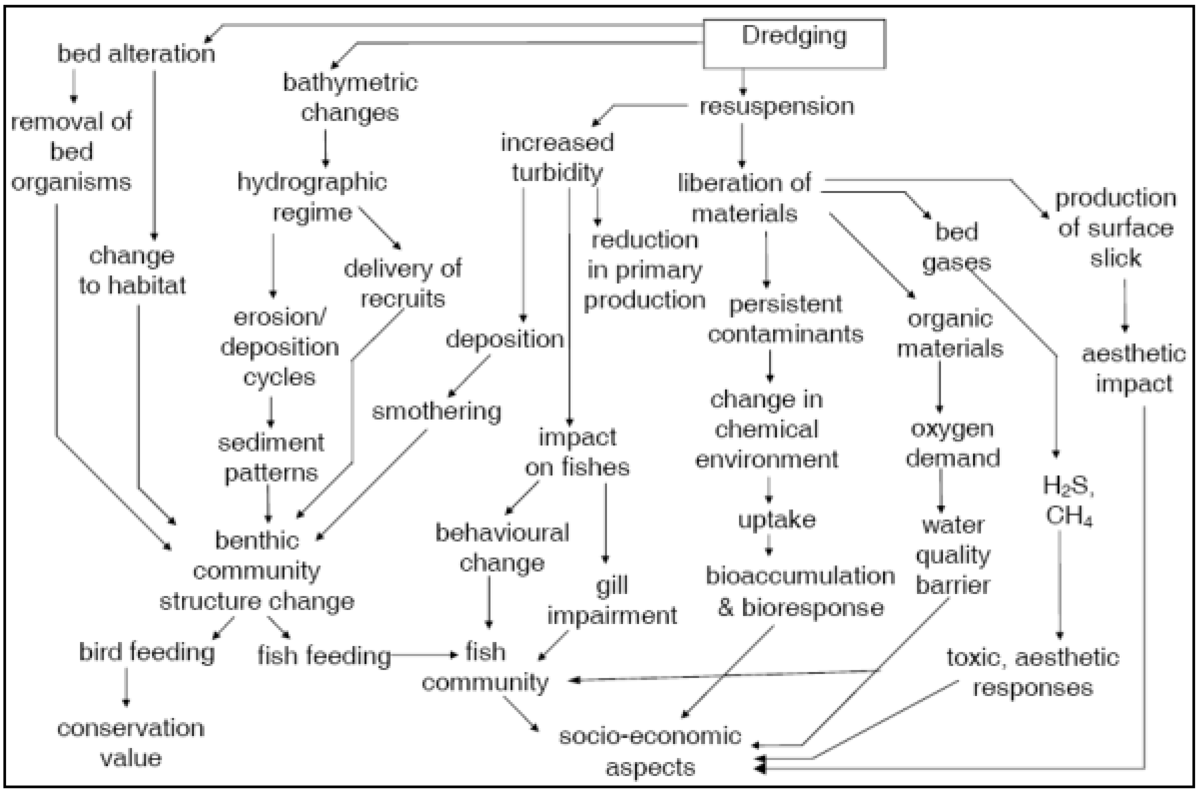



**Figure 11-1 A conceptual model of potential environmental impacts of marine dredging (MEMG 2003)**

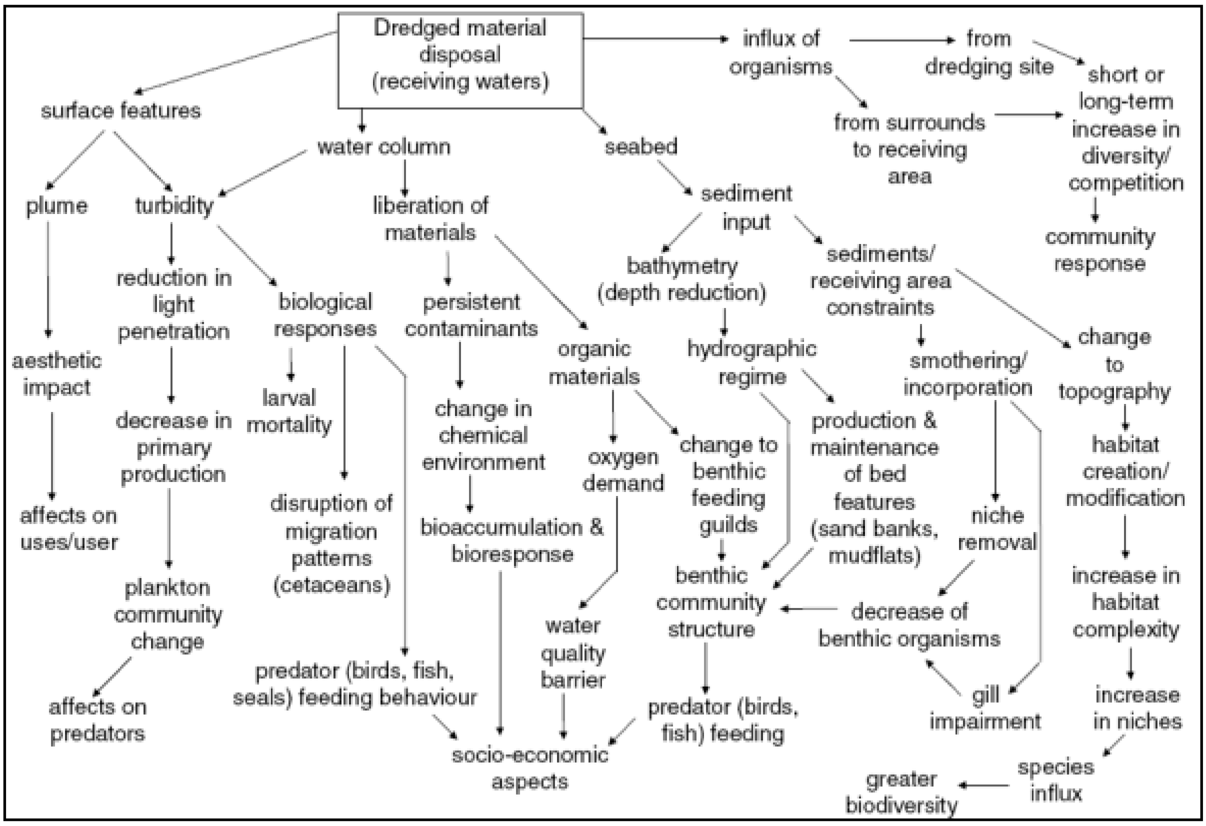



**Figure 11-2 A conceptual model of potential environmental impacts of marine dredging material disposal (MEMG 2003)**

## 11.1 SOCIO-ECONOMIC IMPACTS

The Port of Lüderitz is one of the key economic drivers of the town. Its operations is responsible for direct and indirect employment opportunities and thus the sustenance of livelihoods in the town, region and nationally. Through its operations, and the import and export of goods, contributions are made to the national economy and gross domestic product.

The nature of a harbour is such that toxicants like heavy metals and TBT may accumulate in sediments. Some toxicants also occur naturally in the environment. In extreme events, increased turbidity and the mobilisation of toxicants during dredging operations may affect water quality at mariculture farms by increasing the toxicants' bioavailability. This may impact the mariculture industry by resulting in increased heavy metal levels in oysters and abalone, which in turn will temporarily prevent their export to international markets. However, previous monitoring programmes during dredging operations indicated that under controlled circumstances, dredging can be conducted with minimal or no impact on such receptors.

Dredging activities persisting in the bay may scare marine mammals and birds, resulting in reduced sightings. This may reduce the appeal of the area for tourists and may negatively impact on offshore sightseeing cruises.

## 11.2 MARINE ECOSYSTEM IMPACT

Habitat destruction is an inevitable consequence of dredging, specifically in the area that are being dredged and to a lesser extent in the immediate surroundings and dredged material disposal site where some inundation occurs. Benthic communities in dredged areas will likely recover relatively quickly in the dynamic conditions characteristic of the Namibian coast.

Similar to the impacts on mariculture organisms, mobilised toxic substances may become bioavailable to all marine life and can bio-accumulate and bio-magnify in food chains. This may result in negative impacts of varying magnitude. Some consequences of heavy metal poisoning include reduced reproductive success, vulnerability to disease, and even death.

Dredging vessels and barges can collide with marine mammals, notably whales, resulting in injury and possibly mortalities.

During capital dredging in Lüderitz, underwater drilling and the use of explosives will be required. Loud underwater explosions and excessive noise may negatively impact on marine mammals and fish. According to Pulfrich (2010a), the range of these impacts are relatively limited and does not exceed much more than 10 m.

Dredging vessels and barges arriving from other marine environments may introduce alien species through ballast water or biofouling. These may become invasive under local conditions and may have significant negative impacts on the ecosystem. This impact is not related only to dredging vessels, but to all seafaring traffic calling at the port.

## 11.3 HEALTH, SAFETY AND SECURITY IMPACTS

Working at sea comes with its own inherent risks. Especially in an environment such as the Namibian coast with very cold water and rough conditions. Lüderitz Bay is however relatively protected against rough seas, but the disposal site is located in an area where conditions can deteriorate quickly. Falling overboard and being exposed to cold water will quickly result in hypothermia which may rapidly become fatal.

During dredging activities, there is a risk of gaseous emissions engulfing ship personnel. Hazardous gasses are likely to be hydrogen sulphide and methane. Hydrogen sulphide gas is specifically very dangerous and can be fatal to humans at concentrations anywhere from 300 to 600 ppm. It is initially recognised as a rotten egg smell, but within a short period the olfactory nerves adapt to the smell, and it is no longer detected. At this stage it may be thought that the gas is no longer present, but the contrary could be true.

Other health impacts include mechanical equipment and moving parts causing physical injury, slipping and falling on wet surfaces, and illnesses and diseases transmitted among crew (e.g. Covid-19).

## 11.4 FIRE AND EXPLOSION RISK

Products used on board vessels (e.g. fuel) may be volatile and if the correct ratio of oxygen is mixed with such a product, highly flammable or explosive conditions can exist, especially in confined spaces. The primary causes of such accidents may include human error, technical failures and inadequate maintenance. If precautions are not taken, fires and subsequent safety risks may become more likely.

## 11.5 WASTE PRODUCTION

On the vessel, waste in the form of domestic waste (e.g. paper, plastic, food waste produced by crew), sewage, hazardous wastes (e.g. hydrocarbon contaminated water, old oils and hydraulic fluids, etc.) will be produced. These could end up in the ocean and wash up on the seashore if not properly contained and discarded.

## 11.6 SEAFARING TRAFFIC IMPACTS

Seafaring traffic may experience delays or in extreme instances be involved in collisions due to the dredging vessel and barges operational in the area. The possibility for such events occurring increases when the proper navigational warnings are not issued, or vessels that are not seaworthy and without proper communications systems operate within the area.

## 11.7 WATER QUALITY

Apart from the suspension of possibly contaminated particulate matter reducing water quality during dredging, the intentional or accidental release of hazardous substances, waste and sewage can also reduce water quality. Oil or fuel spills entering the ocean can for example disperse quickly under rough sea and strong wind conditions and can have significant negative impacts.

### 11.8 Noise and Vibration

Noise and vibration are closely linked. Noise and vibration generated by dredging vessels during operations is expected to have minimal impact on marine mammals and other marine organisms and birds. Marine mammals and birds are highly mobile and should also move away from noise, should it be a hindrance. Drilling and blasting activities during capital dredging can have more significant impacts (see section 11.2).

Noise and vibrations on the vessel may negatively impact on workers. Long term exposure to high noise levels can lead to hearing loss. Typically, vibration impacts in general can range from short term related fatigue to more serious short term to permanent neurological consequences, depending on the magnitude and duration of exposure.

## 12 ASSESSMENT AND MANAGEMENT OF IMPACTS

The purpose of this section is to assess and identify the most pertinent environmental impacts that are expected from the dredging and disposal activities. An EMP based on these identified impacts are also incorporated into this section.

For each impact an environmental classification was determined based on an adapted version of the Rapid Impact Assessment Method (Pastakia, 1998). Impacts are assessed according to the following categories: Importance of condition (A1); Magnitude of Change (A2); Permanence (B1); Reversibility (B2); and Cumulative Nature (B3) (see Table 12-1).

Ranking formulas are then calculated as follow:

Environmental Classification = A1 x A2 x (B1 + B2 + B3)

The environmental classification of impacts is provided in Table 12-2.

The probability ranking refers to the probability that a specific impact will happen following a risk event. These can be improbable (low likelihood); probable (distinct possibility); highly probable (most likely); and definite (impact will occur regardless of prevention measures).

**Table 12-1 Assessment criteria**

| Criteria | Score |
|---|---|
| **Importance of condition (A1) – assessed against the spatial boundaries of human interest it will affect** | |
| Importance to national/international interest | 4 |
| Important to regional/national interest | 3 |
| Important to areas immediately outside the local condition | 2 |
| Important only to the local condition | 1 |
| No importance | 0 |
| **Magnitude of change/effect (A2) – measure of scale in terms of benefit / disbenefit of an impact or condition** | |
| Major positive benefit | 3 |
| Significant improvement in status quo | 2 |
| Improvement in status quo | 1 |
| No change in status quo | 0 |
| Negative change in status quo | -1 |
| Significant negative disbenefit or change | -2 |
| Major disbenefit or change | -3 |
| **Permanence (B1) – defines whether the condition is permanent or temporary** | |
| No change/Not applicable | 1 |
| Temporary | 2 |
| Permanent | 3 |

| Reversibility (B2) – defines whether the condition can be changed and is a measure of the control over the condition | |
|---|---|
| No change/Not applicable | 1 |
| Reversible | 2 |
| Irreversible | 3 |
| **Cumulative (B3) – reflects whether the effect will be a single direct impact or will include cumulative impacts over time, or synergistic effect with other conditions. It is a means of judging the sustainability of the condition – not to be confused with the permanence criterion.** | |
| Light or No Cumulative Character/Not applicable | 1 |
| Moderate Cumulative Character | 2 |
| Strong Cumulative Character | 3 |

**Table 12-2 Environmental classification (Pastakia 1998)**

| Environmental Classification | Class Value | Description of Class |
|---|---|---|
| 72 to 108 | 5 | Extremely positive impact |
| 36 to 71 | 4 | Significantly positive impact |
| 19 to 35 | 3 | Moderately positive impact |
| 10 to 18 | 2 | Less positive impact |
| 1 to 9 | 1 | Reduced positive impact |
| 0 | -0 | No alteration |
| -1 to -9 | -1 | Reduced negative impact |
| -10 to -18 | -2 | Less negative impact |
| -19 to -35 | -3 | Moderately negative impact |
| -36 to -71 | -4 | Significantly negative impact |
| -72 to -108 | -5 | Extremely Negative Impact |

The EMP provides management options to ensure impacts of the proposed project are 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 tables and descriptions below. The management measures are separated into two sections: 1) those to be performed by Namport and all their subcontractors and consultants; and 2) those to be performed by the dredging contractor and all their subcontractors and consultants. During dredging, Namport's function will be more of a management and monitoring function, whilst the dredging contractor execute the actual dredging activities, inclusive of monitoring.

These management measures should be adhered to during the various phases of dredging. This section of the report can act as a stand-alone document. All personnel taking part in the dredging exercise should be made aware of the contents of 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 dredging, dredged material disposal and related activities;
- 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.

Various potential and definite impacts will emanate from the project. The majority of these impacts can be mitigated or prevented. The impacts, risk rating of impacts, as well as prevention and mitigation measures are listed below.

As depicted in the tables below, impacts are expected to mostly be of medium-high significance and can mostly be mitigated to have a low to medium-low significance. The spatial extent of impacts are mostly limited to the dredging area and the immediate surroundings. Impacts are not of a permanent nature. Due to the nature of the surrounding areas, limited cumulative impacts are possible.

## 12.1 ENVIRONMENTAL MANAGEMENT PLAN

### 12.1.1 Planning

During the planning phase for dredging and related activities, it is the responsibility of the Proponent and the dredging contractor to ensure they, and all sub-contractors, consultants and other personnel involved with the dredging activities are, and remain, compliant with all legal and industry specific requirements. Management measures must be put in place prior to, and during all activities, to ensure potential environmental impacts and risks are minimised. The following actions are recommended for Namport and the dredging contractor during the planning phase and should continue during various activities of the project:

**Namport**

- Ensure that all necessary permits from the various ministries, local authorities and any other bodies that govern or authorise operations related to dredging are in place and remains valid. This includes notifications to the directorate of maritime affairs, mining licence and exclusive prospecting licence holders, potentially affected port users, etc.
- Ensure the selected reputable dredging contractor, and any other third party contractors that may be involved with the dredging process, enters into an agreement, that includes adherence to the EMP, with Namport.
- Assign a Health, Safety and Environmental Coordinator to oversee implementation of and compliance to the EMP, by all responsible parties.
- Communicate Namport's various emergency response procedures and operational procedures which are relevant to the dredging operations to the relevant parties involved in the dredging operations.
- Develop the terms of reference for the determination of baseline conditions (dredge material quality, water quality, total suspended solids) by an independent consultant prior to dredging.
- Develop the terms of reference for the appointment of an independent third party to conduct environmental monitoring (dredge material quality, water quality, total suspended solids) and EMP compliance monitoring.
- Ensure sufficient insure cover is available for aspects of environmental damage, pollution clean-up or restoration, if ever needed.
- Establish and maintain a reporting system to report on aspects of dredging as outlined in the EMP.
- Submit monitoring reports every six months to allow for environmental clearance certificate renewal applications. This is a requirement of the Department of Environmental Affairs.
- Update the EIA and EMP if required and apply for renewal of the environmental clearance certificate prior to expiry.

**Dredging Contractor**

- Enter into an agreement with Namport which includes environmental compliance, monitoring and reporting as required by Namport and the MEFT.
- Prior to calling in the Port of Lüderitz, ensure that all port procedures are understood as per Part III of the regulations proclaimed under the Namibian Ports Authority Act, the Merchant Shipping Act and the Marine Traffic Act. This includes compliance to, among others, the following (inclusive of any amendments and updates):
  - International Convention for the Safety of Life at Sea (SOLAS), 1974
  - Convention on the International Regulations for Preventing Collisions at Sea (COLREG)

  - Convention on the International Maritime Organization (IMO), 1948
  - International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM), 2004
  - International Convention for the Prevention of Pollution from Ships (MARPOL), 1973.
- Annex I – Regulations for the Prevention of Pollution by Oil.
- Annex II – Regulations for the Control of Pollution by Noxious Liquid Substances in Bulk.
- Annex III – Prevention of Pollution by Harmful Substances Carried by Sea in Packaged Form.
- Annex IV – Regulations for the Prevention of Pollution by Sewage from Ships.
- Annex V – Prevention of Pollution by Garbage from Ships.
- Annex VI – Regulations for the Prevention of Air Pollution from Ships.
  - Namibia's National Marine Pollution Contingency Plan, 2017.
- Ensure that all requirements of the Ministry of Home Affairs and Immigration are met with respect to work permits and entry into Namibia.
- Appoint an independent environmental consultant to conduct environmental baseline determination and environmental monitoring as outlined in the EMP.
- In consultation with the environmental consultant, finalise the baseline and monitoring strategy to be employed, reporting parameters and frequency, and the emergency response procedures to be followed in the event of a potential or actual environmental incident.
- Where relevant, include the EMP as part of all contracts for the procurement of services.
- Assign a Health, Safety and Environmental Coordinator to oversee the implementation of, and compliance to, the EMP, by both the dredging contractor and all applicable sub-contractors and consultants.
- Obtain and implement all Namport's emergency response and operational procedures relevant to the dredging operations.
- Ensure sufficient insure cover is available for aspects of environmental damage, pollution clean-up or restoration, if ever needed.
- Establish and maintain a reporting system to report on aspects of dredging as outlined in the EMP and as in agreement with Namport.

### 12.1.2 Employment

Operators in Namibia only has capacity to do minor dredging along and around quays and jetties. For major dredging operations, international companies have to be contracted. Dredging vessels will thus be operated by a foreign crew. However, some support services will be provided by local Namibian companies and consultants and thus local employment will be created and/or sustained.

All foreign employees require work permits to be able to perform work activities in Namibia.

Through the continued, efficient functioning of the Port of Lüderitz, employment will indirectly be sustained in the various industries operating in the port and offering services to the port.

| Project Activity / Resource | Nature (Status) | (A1) Importance | (A2) Magnitude | (B1) Permanence | (B2) Reversibility | (B3) Cumulative | Environmental Classification | Class Value | Probability |
|---|---|---|---|---|---|---|---|---|---|
| Dredging Operations | Sustaining or creating employment opportunities through support services offered to the dredging contractor | 3 | 1 | 2 | 2 | 2 | 18 | 2 | Definite |
| Indirect Impacts | Port operations continuously sustain and result in new employment opportunities | 3 | 2 | 2 | 2 | 3 | 42 | 4 | Definite |

**<u>Desired outcome:</u>** Provision of employment to local Namibians and adhering to Namibian legal requirements with respect to work permits.

**<u>Actions:</u>**

| Responsible Body | Enhancement / Prevention / Mitigation |
|---|---|
| Namport<br>Dredging Contractor | ♦ If the skills exist locally, employees and sub-contractors must first be sourced from the town, then the region and then nationally. Deviations from this must be justified.<br>♦ Ensure work permits for foreign employees are obtained prior to calling at the port. |

**<u>Data Sources and Monitoring:</u>**

- Immigration Control Act 7 of 1993.
- Work permits and employee contracts on file.
- Close-out report or bi-annual reporting, whichever comes first, based on employee records that provides details on number of employees and demographic profile such as male vs. female, local vs. foreign, and disabled employees).

#### 12.1.3 Revenue Generation

During dredging operations, resources and services will be procured locally, contributing to the economy of the town, region and Namibia.

Through the continued, efficient functioning of the Port of Lüderitz, revenue generation will indirectly be sustained in the various industries operating in the port and offering services to the port.

| Project Activity / Resource | Nature (Status) | (A1) Importance | (A2) Magnitude | (B1) Permanence | (B2) Reversibility | (B3) Cumulative | Environmental Classification | Class Value | Probability |
|---|---|---|---|---|---|---|---|---|---|
| Dredging Operations | Local procurement of resources and support services by the dredging contractor resulting in revenue generation | 3 | 1 | 2 | 2 | 2 | 18 | 2 | Definite |
| Indirect Impacts | Port operations continuously require resources and services resulting in revenue generation | 3 | 2 | 2 | 2 | 3 | 42 | 4 | Definite |

**Desired outcome:** Revenue generation and contribution to the local, regional and Namibian economy.

**Actions:**

| Responsible Body | Enhancement / Prevention / Mitigation |
|---|---|
| Namport<br>Dredging Contractor | ♦ Resources and services must be procured locally, if available. Deviations from this must be justified. |

**Data Sources and Monitoring:**

- Where requested, proof must be provided to show that goods and services are procured locally, and if this is not the case, justification for foreign acquisition of such goods and services must be provided.

### 12.1.4 Skills, Technology and Development

Through employment and contracting of local companies and employees for certain aspects of the dredging operations, some skills will be transferred to an unskilled workforce and technologies that are new to Namibia may be introduced. Development of people and technology are key to economic development.

Overall maintenance and development of the Port of Lüderitz may promote the port as a reliable location to conduct port related business ventures. This may further stimulate technological development in the town.

| Project Activity / Resource | Nature (Status) | (A1) Importance | (A2) Magnitude | (B1) Permanence | (B2) Reversibility | (B3) Cumulative | Environmental Classification | Class Value | Probability |
|---|---|---|---|---|---|---|---|---|---|
| Dredging Operations | Technological development and transfer of skills to the local population | 2 | 1 | 2 | 2 | 1 | 10 | 2 | Probable |
| Indirect Impacts | Growth in port services and operations and associated technological development and transfer of skills | 3 | 2 | 3 | 2 | 2 | 42 | 4 | Probable |

**Desired outcome:** To see an increase in skills of local Namibians, as well as development and technology advancements in the port and port users.

**Actions:**

| Responsible Body | Enhancement / Prevention / Mitigation |
|---|---|
| Namport<br>Dredging Contractor | ♦ If the skills exist locally, contractors, sub-contractors and employees must first be sourced from the town, then the region and then nationally. Deviations from this practice must be justified.<br>♦ Training and skills development must be focussed on Namibians.<br>♦ Employees to be informed about parameters and requirements for references upon employment. |

**Data Sources and Monitoring:**

- Record should be kept of all training or development programmes provided to Namibians.
- Ensure that all training is certified or managerial references provided (proof provided to the employees) inclusive of training attendance, completion and implementation.
- Close-out report or bi-annual reporting, whichever comes first, summarising any training or skills development programmes provided to Namibians.

### 12.1.5 Demographic Profile and Community Health

Impacts related to the demographic profile and community health relate to the influx of people (foreigners and Namibians) to the town, and the potential social ills and deviant behaviour that often accompany such events. This includes the spread of communicable diseases such as HIV/AIDS and increased criminal activities. Additional employment opportunities also mean more spending power which can lead to increased misuse of alcohol and drugs.

For the duration of maintenance dredging there will be an influx of foreign people (dredge vessel crew) in Lüderitz. The majority will however mostly remain on the vessels and may visit the town for short periods. Management personnel may however be stationed in town. Additional contractors, employees or consultants may be sourced in Namibia and may require temporary accommodation and offices in town. Due to the scale and duration of maintenance dredging it is not foreseen that the influx of people will create a significant or permanent change in the demographic profile of the local community or result in significant instances of socially deviant behaviour. The potential impact is further minimized as employment will be sourced locally as far as possible.

During capital dredging, the team consisting of the dredging crew and all appointed contractors, employees and consultants, will most likely be larger and stationed within Lüderitz for a longer period of time. The team will also most likely require more people from outside of Lüderitz and possibly Namibia as the expertise required for the project may not be available locally. The possibility also exist that a larger project may entice jobseekers to migrate to the town. The probability of negative impacts occurring, as discussed above, thus increases.

| Project Activity / Resource | Nature (Status) | (A1) Importance | (A2) Magnitude | (B1) Permanence | (B2) Reversibility | (B3) Cumulative | Environmental Classification | Class Value | Probability |
|---|---|---|---|---|---|---|---|---|---|
| Dredging Operations | Social ills and deviant behaviour resulting from the temporary presence of the dredging team | 2 | -1 | 1 | 2 | 2 | -10 | -2 | Probable |
| Indirect Impacts | Social ills and deviant behaviour resulting from an influx of jobseekers into the town and related unemployment | 2 | -1 | 1 | 2 | 2 | -10 | -2 | Probable |

**<u>Desired Outcome:</u>** To prevent social ills, the spread of communicable diseases and prevent / discourage socially deviant behaviour and criminal activities.

**<u>Actions:</u>**

| Responsible Body | Enhancement / Prevention / Mitigation |
|---|---|
| Namport | ♦ For support services, local people from Namibia, and specifically from the town or region (if available), must be contracted. Deviations from this practice should be justified appropriately. |
| Dredging Contractor | ♦ For support services, local people from Namibia, and specifically from the town or region (if available), must be contracted. Deviations from this practice should be justified appropriately.<br>♦ Employees must be educated on the dangers and prevention of communicable diseases such as HIV/AIDS.<br>♦ Educational programmes must include issues such as alcohol and drug abuse. No such substances, or persons under the influence of such substances, may be allowed in the work place. |

| Responsible Body | Enhancement / Prevention / Mitigation |
|---|---|
| | ♦ Adhere to all applicable laws and regulations relating to public and environmental health (e.g. sanitation requirements, living conditions, etc.) for both onshore and offshore (dredging vessel) environments.<br>♦ The steps for disciplinary action in the event of employees not adhering to rules and regulations such as the restrictions on alcohol or drug use to be part of employee contracts. |

**Data Sources and Monitoring:**

- Close-out report or bi-annual reporting, whichever comes first, summarising employee demographics, educational programmes provided and training conducted.

### 12.1.6 Seafaring Traffic

Seafaring traffic may experience delays or in extreme instances be involved in collisions due to the dredging vessel and barges operational in the area. The possibility for such events occurring increases when the proper navigational warnings are not issued, or vessels that are not seaworthy, and without proper communications systems, operate within the area. Using mobile dredgers such as a TSHD, as opposed to a CSD, reduces the chances of these impacts.

| Project Activity / Resource | Nature (Status) | (A1) Importance | (A2) Magnitude | (B1) Permanence | (B2) Reversibility | (B3) Cumulative | Environmental Classification | Class Value | Probability |
|---|---|---|---|---|---|---|---|---|---|
| Dredging Operations | Increase traffic, road wear and tear and accidents | 2 | -1 | 2 | 2 | 1 | -10 | -2 | Probable |

**Desired Outcome:** Minimum impact on seafaring traffic and no accidents.

**Actions**

| Responsible Body | Enhancement / Prevention / Mitigation |
|---|---|
| Namport | ♦ Contracting a TSHD, if suitable to the task, will minimize delays for seafaring vessels.<br>♦ Proper communication, management and planning will largely prevent traffic impacts.<br>♦ Timely issuing of navigational warnings (Namport). |
| Dredging Contractor | ♦ Planning and communication with regular provision of updates to Namport (Port Captain) on the dredging schedule.<br>♦ All communications, navigational and warning systems on the vessel in working order and regularly tested and maintained.<br>♦ Should an incident occur, it must immediately be reported to the Port Captain, followed by a detailed report within 24 hours, and corrective action should be taken to prevent any future occurrences of such events. |

**Data Sources and Monitoring:**

- Part III of the regulations proclaimed under the Namibian Ports Authority Act; Merchant Shipping Act; Marine Traffic Act.; Convention on the International Regulations for Preventing Collisions at Sea; International Convention on Standards of Training, Certification and Watchkeeping for Seafarers
- Ship's log to be duly maintained.
- Any complaints or incident reports received from seafaring traffic, with regard to dredger operations, should be recorded together with corrective action taken and measures implemented to prevent impacts from repeating itself.
- Close-out report or bi-annual reporting, whichever comes first, on all seafaring traffic related incidents reported, complaints received, and action taken.

### 12.1.7 Health, Safety and Security

The protection of personnel, the public and equipment is paramount. The Namibian coast is characterised by very cold water and rough conditions. Falling overboard and being exposed to cold water will quickly result in hypothermia which may rapidly become fatal.

During dredging activities, there is a risk of gaseous emissions engulfing ship personnel. Hazardous gasses are likely to be hydrogen sulphide and methane. Hydrogen sulphide gas is specifically very dangerous and can be fatal to humans at concentrations anywhere from 300 to 600 ppm. It is initially recognised as a rotten egg smell, but within a short period the olfactory nerves adapt to the smell, and it is no longer detected. At this stage it may be thought that the gas is no longer present, but the contrary could be true. During previous dredging the most hydrogen sulphide gas was detected in the outer channel in combination with high concentrations of methane.

Other health impacts include mechanical equipment and moving parts causing physical injury, slipping and falling on wet surfaces, and illnesses and diseases transmitted among crew (e.g. Covid-19).

Security measures must be in place to protect equipment from theft, especially for land based infrastructure and equipment.

| Project Activity / Resource | Nature (Status) | (A1) Importance | (A2) Magnitude | (B1) Permanence | (B2) Reversibility | (B3) Cumulative | Environmental Classification | Class Value | Probability |
|---|---|---|---|---|---|---|---|---|---|
| Dredging Operations | Physical injuries, health and theft | 2 | -2 | 2 | 2 | 1 | -20 | -3 | Probable |

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

**Actions**

| Responsible Body | Enhancement / Prevention / Mitigation |
|---|---|
| Namport | ♦ Appointment of a reputable dredging contractor with a known history of responsible and safe operations. |
| Dredging Contractor | ♦ All health and safety standards specified in the various legislation, guidelines, regulations, etc. should be complied with.<br>♦ Selected personnel should be trained in first aid and a first aid kits must be available in areas of operation.<br>♦ The contact details of all emergency services must be readily available.<br>♦ Ensure that all personnel receive adequate training on the operations of equipment and handling of hazardous substances.<br>♦ Clearly label dangerous and restricted areas as well as dangerous equipment and products.<br>♦ Provide all employees with required and adequate personal protective equipment (PPE). This includes life jackets at sea.<br>♦ All seafaring vessels used must have all the required safety and emergency equipment as per maritime standards.<br>♦ Equipment must be placed and secured in such a way as not to encourage criminal activities (e.g. theft).<br>♦ To prevent and/or mitigate the impacts of hydrogen sulphide and methane gas, the following must be in place:<br>• Ensure that the vessel and hopper are equipped with appropriate technology, and correct placement of such technology, to avoid |

| Responsible Body | Enhancement / Prevention / Mitigation |
|---|---|
| | poisonous gases from affecting crew, especially below deck and in confined spaces.<br>• Ensure that appropriate breathing apparatuses are available to crew to protect them from any dangerous gas that is liberated from the submerged and dredged material.<br>• Where appropriate, a ship specific degassing system must be in place.<br>• Continuous hydrogen sulphide monitoring must be performed in all areas identified to be at risk of being engulfed by the gas. This include real time remote monitoring or portable (handheld) monitoring devices to be carried on person. Areas to be monitored include all areas of the vessel that are at risk, including below deck, and on quays, jetties and berths when dredging is in close proximity thereof.<br>• Near the quays, jetties and berths, dredging must be done mainly while there are fewer activities and preferably when no vessels are moored.<br>• If sensors are triggered, dredging must stop and gas levels allowed to drop to acceptable safe levels. If required the dredging vessel must be manoeuvred away from the area where high gas levels are detected.<br>• Seafaring traffic may not come within 100 m of the dredger unless authorised to do so and must, if possible, pass upwind of the dredger. |

**Data Sources and Monitoring:**

- Labour Act; International Convention for the Safety of Life at Sea; International Convention on Maritime Search and Rescue; Namport operational procedures and emergency response plans
- Real-time hydrogen sulphide gas monitoring during dredging
- All monitoring and analysis reports kept on file.
- Any incidents and complaints received must be recorded with action taken to prevent future occurrences.
- Close-out report or bi-annual reporting, whichever comes first, of all complaints, incidents and monitoring, including corrective action taken. The report should contain dates when training was conducted and when safety equipment and structures were inspected and maintained.

### 12.1.8 Fire and Explosion Risk

Products used on board vessels, e.g. fuel, cleaning materials, lubricants, etc., may be flammable to varying degrees. Whilst unlikely, these may become explosive under very specific conditions and in confined spaces. The primary causes of such accidents may include human error, technical failures and inadequate maintenance. Methane and hydrogen sulphide can be released from dredged material and both are flammable.

| Project Activity / Resource | Nature (Status) | (A1) Importance | (A2) Magnitude | (B1) Permanence | (B2) Reversibility | (B3) Cumulative | Environmental Classification | Class Value | Probability |
|---|---|---|---|---|---|---|---|---|---|
| Dredger Operations | A fire that may lead to an explosion occurring on the dredging vessel | 1 | -2 | 2 | 2 | 1 | -10 | -2 | Probable |

**<u>Desired Outcome:</u>** To prevent injury or physical damage as a result of fire or explosions.

**<u>Actions</u>**

| Responsible Body | Enhancement / Prevention / Mitigation |
|---|---|
| Namport | ♦ Appointment of a reputable dredging contractor with a known history of responsible and safe operations.<br>♦ Verify the Dredging Operator's adherence to the requirements of the maritime industry with regard to fire safety and firefighting equipment and training. |
| Dredging Operator | ♦ All fire precautions and fire control on board the vessel must be in accordance with maritime standards, inclusive of sufficient firefighting equipment, water, foam, etc.<br>♦ A holistic fire protection and prevention plan is essential and all crew must be familiar with this plan, with regular training and fire drills.<br>♦ All crew must be sensitised about the risk of fire and responsible fire prevention measures.<br>♦ Regular inspections must be carried out to inspect and test fire-fighting equipment which must be readily available throughout the vessel.<br>♦ Regular inspections and maintenance must be performed on all electrical circuits, fuel installations and flammable material storage areas to ensure their integrity and prevent electrical short-circuits and leaks. Where maintenance is no longer possible, defective equipment must be replaced and all obsolete consumables must be disposed of in accordance with their respective MSDS documents.<br>♦ Fire prevention considerations specifically applicable to engine rooms include fire doors, fire pumps, and emergency fuel-flow stopping devices.<br>♦ Real-time methane and hydrogen sulphide monitoring should be conducted on the vessel.<br>♦ In the event of a fire, the firefighting and/or evacuation plan must be initiated immediately. |

**<u>Data Sources and Monitoring:</u>**

- International Convention for the Safety of Life at Sea; Convention on the International Maritime Organization; Namport operational procedures and emergency response plans
- Record should be kept of all inspections and maintenance performed on firefighting equipment (date of last service, date of next service, replacement date, etc.).
- Record should be kept of all training related to firefighting, fire drills and evacuation procedures.

- Record should be kept of all inspections and maintenance performed on equipment whose failure may result in a fire and/or explosion. This include electrical installations, fuel storage and reticulation, kitchen appliances used for cooking, etc.
- Any incidents must be recorded with action taken to prevent future occurrences.
- Close-out report or bi-annual reporting, whichever comes first, of all record keeping and incidents, including corrective action taken.

### 12.1.9 Noise and Vibration

Noise and vibrations are closely linked. The noise and vibrations generated by the dredging vessel and its operations may impact both the crew and marine organisms, especially marine mammals. Different areas on board the vessel will expose crew members to different noise and vibration levels. For example the machine rooms will be much noisier with more vibrations than the cabins. Continuous exposure to loud noise may lead to hearing impairment. Vibration can be hand-arm vibration or whole body vibration that may lead to hand-arm vibration syndrome, inflammation and fatigue.

It is expected that, under normal operational conditions, and given modern machinery and technologies, the noise and vibrations generated by dredging vessels during maintenance dredging will not have a significant impact on marine mammals, but may temporarily scare them away. Similarly, birds feeding in the area may temporarily move away. Due to the location and small footprint of maintenance dredging, birds on islands are not expected to be affected.

Should capital dredging be performed, drilling and blasting may result in more significant noise impacts. Such noise impacts will affect marine organisms in the form of pressure waves that may cause injury and even mortality.

| Project Activity / Resource | Nature (Status) | (A1) Importance | (A2) Magnitude | (B1) Permanence | (B2) Reversibility | (B3) Cumulative | Environmental Classification | Class Value | Probability |
|---|---|---|---|---|---|---|---|---|---|
| Dredging Operations | Noise and vibrations generated from the vessel, dredging equipment, drilling and blasting | 2 | -2 | 2 | 2 | 1 | -20 | -3 | Definite |

**<u>Desired Outcome:</u>** To ultimately reduce noise and vibration levels in order to prevent hearing loss in workers, side-effects of vibration, a nuisance to nearby receptors, and impacts on animals. Where noise and vibration levels cannot be lowered, the potential impacts thereof must be minimized.

**<u>Actions</u>**

| Responsible Body | Enhancement / Prevention / Mitigation |
|---|---|
| Namport | ♦ Appointment of a reputable dredging contractor with a known history of responsible and safe operations. |
| Dredging Contractor | ♦ As far as is practically possible, use state of the art equipment that is designed to reduce the production of noise and vibrations.<br>♦ Numerous actions, including the design of vessels, the correct alignment of engine, gear and shaft, flexible mounting systems, and adjusting the propeller pitch may reduce noise and vibration. In addition, regularly servicing and/or lubricating equipment and isolating noisy equipment/environments with barriers or enclosures, may further reduce noise and vibration.<br>♦ To protect workers, where noise and vibrations cannot be reduced to safe levels, hearing protectors must be worn at all times, crew must be rotated frequently to reduce exposure time, and the number of workers in close proximity to the noise and vibrations source must be reduced.<br>In addition to the above, for capital dredging inclusive of drilling and blasting, the following must be implemented:<br>♦ A trained expert in underwater drilling and the use of explosives should be contracted. |

| Responsible Body | Enhancement / Prevention / Mitigation |
|---|---|
| | ♦ The minimum amount of explosives and its correct placement are paramount in reducing underwater noise (shock waves).<br>♦ Blasting should, where possible, coincide with spring low tide and during a swell to reduce the transmission interface with the surrounding water and attenuate noise and vibrations.<br>♦ Prior to blasting, the presence of any nearby marine mammals must be noted (the use of "spotters" or marine mammal observers is highly recommended) and blasting should only continue if no marine mammals are in close proximity to the blasting site. |

**Data Sources and Monitoring:**

- International Maritime Organization Code on Noise Levels on Board Ships (Resolution MSC.337(91); ISO 21984:2018 Ships and marine technology — Guidelines for measurement, evaluation and reporting of vibration with regard to habitability on specific ships; International Labour Conference: Maritime Labour Convention, 2006; IMO MEPC.1/Circ.833: Guidelines for the Reduction of Underwater Noise from Commercial Shipping to Address Adverse Impacts on Marine Life; World Health Organisation Guidelines on Community Noise
- Maintain a register to record complaints received from workers and the general public. Complaints should be investigated and if required, a noise and vibration survey should be conducted.
- Close-out report or bi-annual reporting, whichever comes first, of all record keeping, including corrective action taken.

### 12.1.10 Waste Production

On-board the dredging vessel, domestic waste, sewage, and potentially hazardous waste may be produced. Where waste is not securely stowed, it may be blown off the ship by strong winds and end up in the sea and may wash up on the coastline and islands. This form of pollution will not only have a visual impact, but may also negatively impact on marine animals and birds (e.g. entanglement, accidental ingestion, etc.).

| Project Activity / Resource | Nature (Status) | (A1) Importance | (A2) Magnitude | (B1) Permanence | (B2) Reversibility | (B3) Cumulative | Environmental Classification | Class Value | Probability |
|---|---|---|---|---|---|---|---|---|---|
| Dredging Operations | Uncontained waste entering the environment | 2 | -2 | 2 | 2 | 2 | -24 | -3 | Probable |

**Desired Outcome:** To reduce the amount of waste produced and prevent pollution of the environment.

**Actions**

| Responsible Body | Enhancement / Prevention / Mitigation |
|---|---|
| Namport | ♦ Appointment of a reputable dredging contractor with a known history of environmental responsibility.<br>♦ Communicate proper waste disposal procedures to the dredging contractor. |
| Dredging Contractor | ♦ Waste reduction measures should be implemented and all waste that can be re-used / recycled must be kept separate.<br>♦ Ensure adequate storage facilities for waste are available on-board and that such waste cannot be blown away by strong wind.<br>♦ Waste should be disposed of at appropriately classified disposal facilities, this includes hazardous materials (empty chemical containers and contaminated rugs, paper, water and soil), if any.<br>♦ For hazardous substances, see the material safety data sheets available from suppliers for disposal of contaminated products and empty containers. |

**Data Sources and Monitoring:**

- International Convention for the Prevention of Pollution from Ships (MARPOL); Namport operational procedures and emergency response plans
- A record should be kept of any disposal of hazardous waste.
- Any complaints received regarding waste should be recorded with notes on action taken.
- Close-out report or bi-annual reporting, whichever comes first, of all record keeping, including corrective action taken.

#### 12.1.11 Dredged Material Quality

Marine sediments / substrate may contain elevated levels of elements that may be potentially toxic to organisms. These may be from natural sources or may be as a result of anthropogenic activities. The latter expected from the industrial activities associated with harbours. Thus, the material to be dredged may contain elevated levels of heavy metals originating from harbour activities. For example, in the case of Lüderitz, it is reasonable to expect elevated zinc and lead levels due to the long history of its export via the port. Also, anti-fouling paints typically contained toxic compound such as tributyltin that may still be present in the substrate.

In the unlikely event that significantly contaminated material is present in areas earmarked for dredging, it would not be prudent to, without due regard to the possible consequences, dispose of such material elsewhere in the marine environment where it may negatively impact on marine life (see also section 12.1.13). Continuous disposal of contaminated material at the disposal site may over the long run increase toxicity of the environment to very high levels. Thus, even though the disposal site has been approved by the authorities, investigations into dredged material quality must first be conducted in order to determine the best disposal techniques and locations.

| Project Activity / Resource | Nature (Status) | (A1) Importance | (A2) Magnitude | (B1) Permanence | (B2) Reversibility | (B3) Cumulative | Environmental Classification | Class Value | Probability |
|---|---|---|---|---|---|---|---|---|---|
| Dredging Operations | Contaminated dredged material, which when disposed, contaminate the marine environment with potentially toxic impacts on organisms. | 2 | -1 | 2 | 2 | 1 | -10 | -2 | Probable |

**Desired Outcome:** To prevent or limit the spread of toxic material in the ocean and prevent the build-up of highly contaminated conditions at the disposal site.

**Actions**.

| Responsible Body | Enhancement / Prevention / Mitigation |
|---|---|
| Namport | ♦ For any once-off dredging exercise targeting more than 5,000 $m^3$ of dredged material, appoint an independent specialist to collect and analyse substrate from the area to be dredged for elevated levels of chemicals of concern. |
| Independent Specialist | ♦ Prior to dredging, devise a substrate sampling protocol with the aim of providing information with regard to contamination levels of the various dredge areas. The data generated must inform and enable Namport and the relevant authorities to decide on the correct disposal methods and locations for sediment. Different areas may have different contamination levels and may have different disposal requirements.<br>♦ At all predetermined sampling locations, three individual samples must be taken and mixed into a homogenous mixture from which one sample (composite) must be collected for analysis.<br>♦ Samples must be analysed for at least: tributyltin (TBT), cadmium (Cd), mercury (Hg), copper (Cu), chromium (Cr), lead (Pb), zinc (Zn), arsenic (As), nickel (Ni), polychlorinated biphenyls (PCBs), total petroleum hydrocarbons (TPH) and polycyclic aromatic hydrocarbons (PAHs)<br>♦ The analysis must be carried out by an accredited laboratory, using suitable analytical methods with a detection limit below the current BCLME maximum limit values for the given parameter. |

| Responsible Body | Enhancement / Prevention / Mitigation |
|---|---|
| | ♦ Compare results with BCLME guidelines (if available) and compile baseline report with recommendations regarding dredged material disposal.<br>♦ Where any of the chemicals of concern tested is elevated to more than 100 times the BCLME guideline value, dredged material from that area requires special approval for dumping at the disposal site.<br>♦ As part of the baseline sampling, the presence of muddy oozes should be determined and these should be mapped and communicated to the dredging contractor to allow for extra mitigation measures to be implemented to prevent increases suspension of fine particles / muddy ooze.<br>♦ Repeat sampling and analysis during dredging as per the dredging contractor's responsibility outlined below. |
| Dredging Contractor | ♦ Based on the outcome of the baseline sediment assessment, devise a dredging and disposal schedule, to be approved by Namport, to conform to the requirements for disposal of uncontaminated or insignificantly contaminated dredged material versus significantly contaminated dredged material.<br>Substrate sampling and analysis by an independent consultant has to be repeated as follows:<br>♦ For less than 5,000 $m^3$ no sampling required<br>♦ **Maintenance dredging:** one substrate sample per 10,000 $m^3$ dredged material, or part thereof, before dredging that material.<br>♦ **Capital dredging:** one substrate sample per 50,000$m^3$ dredged material, or part thereof, before dredging that material.<br>♦ Analysis and interpretation of results, and subsequent handling of dredged material, must be the same as for the baseline sampling. |

**Data Sources and Monitoring:**

- BCLME Guideline Values or any updates or replacement guidelines that may come in force
- Baseline and subsequent sampling reports with recommendations
- Close-out report or bi-annual reporting, whichever comes first, of all sampling records and recommendations as well as actual actions taken.

### 12.1.12 Suspended Particulate Matter

Dredging can result in the excessive suspension of particulate matter (solids) in the water column. This may negatively affect aquatic organisms, mariculture farms and seawater intakes (fish processing and land-based mariculture). Excessive suspension of particulate matter in the water column can especially occur where very fine, diatomaceous oozes are present. Agitation of the seabed by the dredger, hopper overflow and the dumping of dredged material at the disposal site are the main causes of suspension of particulate matter. Impacts of increased suspension of such particulate matter include: reduced light penetration in the water column and thus reduced photosynthesis by algae resulting in less oxygen production; clogging of fish gills, inundation of benthic organisms when suspended particles settle to the seafloor; and increasing the bioavailability of toxic elements that may occur naturally in, or may have accumulated through anthropogenic impacts in, the substrate.

Various preventative and mitigating methods can be employed to prevent excessive suspension of particulate matter. Some of these are listed below, but it is important to note that not all of the modifications or procedures mentioned should necessarily be employed. It is the responsibility of the contractor, in consultation with Namport, to determine which modifications or procedures would best prevent particulate matter suspension, while keeping in mind operational timeframes and financial feasibility. Also, dredging techniques that result in lower suspension of particulate matter, that, as a result of the techniques required to lower such suspension occur over longer periods of time, may have more serious adverse effects. This is because acute, high level exposure to negative impacts may have less consequences than, chronic low level exposure.

Environmental conditions that may increase the risk of elevated total suspended solids reaching the sensitive receptors include: tidal conditions; rough sea conditions (high wave/swell action); wind conditions.

Total suspended solids is determined through turbidity measurements (nephelometric turbidity units (NTU)) that can be converted to total suspended solids (mg/ml) through turbidity sensor calibration techniques.

| Project Activity / Resource | Nature (Status) | (A1) Importance | (A2) Magnitude | (B1) Permanence | (B2) Reversibility | (B3) Cumulative | Environmental Classification | Class Value | Probability |
|---|---|---|---|---|---|---|---|---|---|
| Dredging Operations | Excessive suspension of particulate matter | 2 | -1 | 3 | 2 | 2 | -14 | -2 | Probable |

**Desired Outcome:** To limit the suspension of particulate matter to acceptable levels and to specifically protect sensitive receptors.

**Actions**.

| Responsible Body | Enhancement / Prevention / Mitigation |
|---|---|
| Namport | ♦ Appointment of a reputable dredging contractor with a known history of environmental responsibility.<br>♦ Determine the baseline turbidity / TSS conditions at strategic locations (Figure 12-1) throughout the harbour for at least three months prior to dredging. The results must serve as baseline for real time turbidity monitoring as indicated in the dredging contractors responsibility below. |
| Independent Consultant | ♦ Prior to dredging, devise a turbidity monitoring program with the aim of providing information with regard to the natural level of suspended solids in the water column. The data generated must inform the dredging operator and |

| Responsible Body | Enhancement / Prevention / Mitigation |
|---|---|
| | Namport on the effectiveness of preventative and mitigation measures aimed at preventing the mobilisation and spread of particulate matter. Real time turbidity monitoring can act as a warning system for situations where excessive suspension of particulate matter occur.<br>♦ Continue the turbidity monitoring during dredging as per the dredging contractor's responsibility outlined below. |
| Dredging Contractor | ♦ Appoint an independent consultant to conduct real-time turbidity (TSS) monitoring specifically aimed at protecting sensitive receptors (Radford Bay, Second Lagoon, fish factory processing water abstraction points, mariculture area, rocky shores).<br>♦ The following TSS concentrations for the upper portion (-3 m) of the water column are recommended as threshold values for determining responses to real time monitoring:<br>o < 20 mg/l or 80$^{th}$ percentile of background levels – desirable low risk scenario.<br>o 20 – 80 mg/l for continuous periods of three days or longer - lower threshold of possible adverse ecological effects.<br>o 80 – 100 mg/l for more than six hours - probable adverse effects, mitigation measures must be considered.<br>o 150 mg/l - proven negative impacts, cease dredge operations.<br>♦ The TSS of the water at the monitoring locations (see Figure 12-1) must not exceed 80 mg/l or the 80th percentile of the background TSS as determined by a baseline study, whichever is the highest value.<br>Preventative measures used to reduce suspension of particulate matter include:<br>♦ Using the most appropriate dredger and the dredgers most suitable draghead, cutter head or grab that are designed to reduce particulate matter suspension.<br>♦ Shielding of the cutter and/or suction head as well as optimising the cutter head and the speed at which it is used.<br>♦ Use a water tight grab<br>♦ Limited or no overflow from the hopper.<br>♦ Overflow of the hopper at or below keel level.<br>♦ Automated choking of overflow from the hopper.<br>♦ Recirculation of overflow to the draghead, using the water as process water.<br>Mitigation measures used to prevent impacts resulting from suspended particulate matter include:<br>♦ Slowing down the rate of dredging or ceasing dredging altogether when suspended solids reach a predetermined cut-off level (based on baseline results).<br>♦ The use of silt curtains (not effective in strong currents).<br>♦ Coordinating dredging near sensitive receptors to coincide with tides, tidal currents and winds that will take plumes away from such receptors. |

**<u>Data Sources and Monitoring:</u>**

- Baselines and real time turbidity monitoring reports with recommendations
- Close-out report or bi-annual reporting, whichever comes first, of all record keeping, including corrective action taken.


| Monitoring Location | Longitude (Decimal degrees) | Latitude (Decimal degrees) |
|---|---|---|
| T1 | -26.6219 | 15.1647 |
| T2 | -26.6343 | 15.1605 |
| T3 | -26.6205 | 15.1513 |
| T4 | -26.6364 | 15.1417 |

**Figure 12-1 Turbidity (TSS) monitoring locations**

### 12.1.13 Water Quality

Impacts on water quality may negatively affect various receptors. These include aquatic organisms, mariculture farms and seawater intakes (fish processing and land-based mariculture). Dredging can influence and reduce water quality through the excessive suspension of particulate matter in the water column, especially where contaminated substrate (or sediments) and/or very fine, diatomaceous oozes are present. This can, among others, occur at the site of dredging, through hopper overflow, and through the dumping of dredged material at the disposal site. Increased suspension of particulate matter can increase the bioavailability of toxic elements that may occur naturally in, or may have accumulated through anthropogenic impacts in, substrate/sediment. Increased bioavailability of heavy metals like cadmium or lead for example, may result in reproductive abnormalities and reduced fertility, which may put the local food web at risk. It may also accumulate in mariculture organisms, especially filter feeders like mussels and oysters, making them unsafe to eat. This may prevent the export of mariculture products and causes financial losses.

Various preventative and mitigating methods can be employed to prevent excessive suspension of particulate matter, and thus reduced water quality. Some of these are listed below, but it is important to note that not all of the modifications or procedures mentioned should necessarily be employed. It is the responsibility of the contractor, in consultation with Namport, to determine which modifications or procedures would best prevent particulate matter suspension, while keeping in mind operational timeframes and financial feasibility.

| Project Activity / Resource | Nature (Status) | (A1) Importance | (A2) Magnitude | (B1) Permanence | (B2) Reversibility | (B3) Cumulative | Environmental Classification | Class Value | Probability |
|---|---|---|---|---|---|---|---|---|---|
| Dredging Operations | Reduction in water quality due to the excessive suspension of particulate matter | 2 | -1 | 3 | 2 | 2 | -14 | -2 | Improbable |

**Desired Outcome:** To protect sensitive receptors against impacts of reduced water quality by limiting the suspension of particulate matter to acceptable levels, especially where contaminated substrate/sediments are present.

**Actions**.

| Responsible Body | Enhancement / Prevention / Mitigation |
|---|---|
| Namport | ♦ Appointment of a reputable dredging contractor with a known history of environmental responsibility.<br>♦ For any once-off dredging exercise targeting more than 5,000 $m^3$ of material, appoint an independent specialist to determine baseline water quality conditions by analysing for elevated levels of chemicals of concern (see list below). |
| Independent Consultant | ♦ Prior to dredging, devise a turbidity monitoring and water sampling protocol, with the aim of providing information with regard to spread of suspended solids and contamination in the water column and to sensitive receptors (Radford Bay, Second Lagoon, fish factory processing water abstraction points, mariculture area, rocky shores). The data generated must inform the dredging operator and Namport on the effectiveness of preventative and mitigation measures aimed at preventing the mobilisation and spread of particulate matter and contaminants. Real time turbidity monitoring can act as a warning system for situations where excessive suspension of particulate matter occur. As real-time water quality (chemicals of concern) monitoring is not possible, turbidity monitoring must act as a pro-active approach to |

| Responsible Body | Enhancement / Prevention / Mitigation |
|---|---|
| | prevent the spread of contaminants while chemical of concern monitoring, with delayed results, will serve to guide future dredging, rather than dictating current dredging.<br>♦ For baseline water quality determination, at all predetermined sampling locations (Figure 12-2), a water sample must be collected from below the surface. Sampling and subsequent handling of the sample must be according to the approved protocol of the accredited laboratory who will be responsible for the analysis.<br>♦ Samples must be analysed for at least: tributyltin (TBT), cadmium (Cd), mercury (Hg), copper (Cu), chromium (Cr), lead (Pb), zinc (Zn), arsenic (As), nickel (Ni), polychlorinated biphenyls (PCBs), total petroleum hydrocarbons (TPH) and polycyclic aromatic hydrocarbons (PAHs)<br>♦ The analysis must be carried out by an accredited laboratory, using suitable analytical methods with a detection limit below the current BCLME maximum limit values for the given parameter.<br>♦ Compare results with BCLME guidelines (if available) and compile baseline report.<br>♦ Repeat sampling and analysis during dredging as per the dredging contractor's responsibility outlined below. |
| Dredging Contractor | Appoint an independent consultant to conduct real-time turbidity (TSS) monitoring specifically aimed at protecting sensitive receptors (see Figure 12-2).<br>The following TSS concentrations for the upper portion (-3 m) of the water column are recommended as threshold values for determining responses to real time monitoring:<br>♦ < 20 mg/l or 80$^{th}$ percentile of background levels – desirable low risk scenario.<br>♦ 20 – 80 mg/l for continuous periods of three days or longer - lower threshold of possible adverse ecological effects.<br>♦ 80 – 100 mg/l for more than six hours - probable adverse effects, mitigation measures must be considered.<br>♦ 150 mg/l - proven negative impacts, cease dredge operations.<br>The TSS of the water at the inlet to the lagoon, the mariculture areas and the fishing harbour must not exceed 80 mg/l or the 80$^{th}$ percentile of the background TSS as determined by a baseline study, whichever is the highest value.<br>Preventative measures used to reduce suspension of particulate matter, and thus chemicals of concern, include:<br>♦ Using the most appropriate dredger and the dredgers most suitable draghead, cutter head or grab that are designed to reduce particulate matter suspension.<br>♦ Shielding of the cutter and/or suction head as well as optimising the cutter head and the speed at which it is used.<br>♦ Use a water tight grab.<br>♦ Limited or no overflow from the hopper.<br>♦ Overflow of the hopper at or below keel level.<br>♦ Automated choking of overflow from the hopper.<br>♦ Recirculation of overflow to the draghead, using the water as process water.<br>Mitigation measures used to prevent impacts resulting from suspended particulate matter, and thus chemicals of concern, include:<br>♦ Slowing down the rate of dredging or ceasing dredging altogether when suspended solids reach a predetermined cut-off level (based on baseline results).<br>♦ The use of silt curtains (not effective in strong currents).<br>♦ Coordinating dredging near sensitive receptors to coincide with tides, tidal currents and winds that will take plumes away from such receptors.<br>Water sampling and analysis by an independent consultant has to be repeated as follows:<br>♦ For less than 5,000 $m^3$ no water sampling required. |

| Responsible Body | Enhancement / Prevention / Mitigation |
|---|---|
| | ♦ **Maintenance dredging:** one water sample before and one water sample after dredging 10,000 $m^3$ dredged material, or part thereof.<br>♦ **Capital dredging:** one water sample before, one during and one after dredging 100,000 $m^3$ dredged material, or part thereof.<br>♦ Water quality during dredging must be compared with baseline data and mitigation measures implemented if a deterioration in water quality, that is suspected to result from dredging activities, is discerned. |

**Data Sources and Monitoring:**

- BCLME Guideline Values or any updates or replacement guidelines that may come in force
- Baselines, real time turbidity monitoring and subsequent sampling and monitoring reports with recommendations
- Close-out report or bi-annual reporting, whichever comes first, of all record keeping, including corrective action taken.


| Monitoring Location | Latitude (Decimal degrees) | Longitude (Decimal degrees) |
|---|---|---|
| WO1 | -26.6404 | 15.1584 |
| WO2 | -26.6353 | 15.1573 |
| WO3 | -26.625 | 15.1583 |
| WO4 | -26.6181 | 15.1647 |
| WO5 | -26.5888 | 15.1661 |
| WO6 | -26.6424 | 15.1420 |

**Figure 12-2 Water quality monitoring locations**

### 12.1.14 Impacts on Marine Ecosystems

Dredging pose risks to marine life. Potential negative impacts of maintenance dredging include habitat destruction, smothering of benthic communities due to settling of suspended particulate matter and dumping of dredged material at the disposal site, possible temporary displacement of animals (including birds) from the areas that are dredged, marine mammal strikes by the vessels or their propellers, and reduced water quality due to the suspension of particulate matter or through pollution. During capital dredging the same impacts may be experienced, but will include possible injuries or mortality of marine animals as a result of drilling and blasting activities.

Ships' ballast water may result in the possible introduction of exotic or invasive species that may have significant impacts on local community structure and functioning. This is not an impact that is unique to dredging vessels, but can result from any international seafaring traffic visiting Namibian waters.

| Project Activity / Resource | Nature (Status) | (A1) Importance | (A2) Magnitude | (B1) Permanence | (B2) Reversibility | (B3) Cumulative | Environmental Classification | Class Value | Probability |
|---|---|---|---|---|---|---|---|---|---|
| Dredging Operations | Physical destruction or inundation of habitat and displacement, injury or mortality of living organisms. | 2 | -2 | 2 | 3 | 2 | -28 | -3 | Definite |
| Indirect Impacts | Reduced water quality or introduction of alien species may have long term indirect effects on ecosystem structure and functioning | 2 | -2 | 2 | 3 | 2 | -28 | -3 | Probable |

**<u>Desired Outcome:</u>** To prevent or minimise destruction, degradation and disturbance of the ecological environment.

**<u>Actions</u>**

| Responsible Body | Enhancement / Prevention / Mitigation |
|---|---|
| Namport | ♦ To reduce the impact on birds, it is proposed that, where possible, dredging takes place outside of the critical bird breeding period of February to May as established during previous public consultation processes.<br>♦ Clearly define the area to be dredged and monitor the dredging contractor's adherence to dredging only this area in order to minimize the impact footprint.<br>♦ Monitor dredging contractor's adherence to dumping within the boundaries of the official disposal site to restrict inundation impact. |
| Dredging Contractor | ♦ Limit dredging and disposal to within the boundaries of the areas defined by Namport.<br>♦ Make use of a marine mammal observer to identify any animals that may be within a collision course with moving vessels and take evasive action.<br>♦ If any mortalities in marine fauna are observed at or around the dredging location, all dredging activities should be ceased and the cause investigated. Dredging can continue once it is determined to be safe to do so.<br>♦ Exchange ballast water as per set IMO guidelines.<br>♦ A trained expert in underwater drilling and the use of explosives should be contracted.<br>♦ The minimum amount of explosives and its correct placement are paramount in reducing underwater noise (shock waves). |

| Responsible Body | Enhancement / Prevention / Mitigation |
|---|---|
| | ♦ Blasting should, where possible, coincide with spring low tide and during a swell to reduce the transmission interface with the surrounding water and attenuate noise and vibrations.<br>♦ Prior to blasting, the presence of any nearby marine mammals must be noted (the use of "spotters" or marine mammal observers is highly recommended) and blasting should only continue if no marine mammals are in close proximity to the blasting site. |

**Data Sources and Monitoring:**

- International Convention for the Control and Management of Ships' Ballast Water and Sediments; International Convention for the Prevention of Pollution from Ships (MARPOL); Namport operational procedures and emergency response plans
- Record all ballast water exchange details and specifically location.
- Make use of the automatic identification system (AIS) to record vessel movement and submit records to Namport on a daily basis.
- During disposal of dredged material, record the start and end time of disposal and submit records to Namport on a daily basis.
- Record any marine mammal sightings and/or collisions and any other significant encounters or observations of animals and birds (including sick or dead animals) and report these to the local offices of the MEFT and MFMR.
- Close-out report or bi-annual reporting, whichever comes first, of all record keeping, including corrective action taken.

### 12.1.15 Visual Impact

During dredging, the aesthetic appeal of the area for tourists and locals may temporarily decrease. This is mostly linked to instances of suspension of particulate matter to such an extent that the water colour changes significantly, or a sheen or foam layer is created on the water that may spread and collect on the shore. This may impact on local tour operators operating sightseeing cruises in the bay.

| Project Activity / Resource | Nature (Status) | (A1) Importance | (A2) Magnitude | (B1) Permanence | (B2) Reversibility | (B3) Cumulative | Environmental Classification | Class Value | Probability |
|---|---|---|---|---|---|---|---|---|---|
| Dredging Operations | Excessive discoloration of water or creation of a sheen or foam layer on the water's surface that is unsightly | 2 | -1 | 2 | 2 | 1 | -10 | -2 | Probable |

**Desired Outcome:** To enhance aesthetically pleasing attributes of the existing landscape character and prevent degradation.

**Actions**

| Responsible Body | Enhancement / Prevention / Mitigation |
|---|---|
| Namport | ♦ Appointment of a reputable dredging contractor with a known history of environmental responsibility. |
| Dredging Contractor | ♦ Preventative and mitigation measures related to the prevention or minimisation of particulate matter suspension will successfully mitigate the impact. |

**Data Sources and Monitoring:**

- Record all complaints received and investigate the validity of such complaints. Record all corrective measures taken.
- A bi-annual report should be compiled of all complaints received and actions taken.

### 12.1.16 Heritage Impact

The areas to be dredged have all been dredged before and no wrecks or artefacts of archaeological significance are expected to be present or found during maintenance dredging. Should capital dredging be performed, that may go beyond the current dredged area boundaries, some objects may be encountered. However, based on the survey by Vonk and Brabers (2010), no wrecks are expected to be present.

During capital dredging, excessive vibrations caused during drilling and blasting of areas close to the shore may damage old buildings of heritage value, some of which are declared national monuments.

| Project Activity / Resource | Nature (Status) | (A1) Importance | (A2) Magnitude | (B1) Permanence | (B2) Reversibility | (B3) Cumulative | Environmental Classification | Class Value | Probability |
|---|---|---|---|---|---|---|---|---|---|
| Dredging Operations | Damage to archaeologically significant objects and heritage buildings. | 3 | -2 | 2 | 3 | 1 | -36 | -4 | Improbable |

**<u>Desired Outcome:</u>** To prevent the destruction or damage of items of archaeological / heritage value.

| Responsible Body | Enhancement / Prevention / Mitigation |
|---|---|
| Namport | ♦ Appointment of a reputable dredging contractor with a known history of environmental responsibility. |
| Dredging Contractor | ♦ If a wreck or any other artefact of possible archaeological value is found during the dredging activities, the dredging process must be halted and the National Heritage Council must be informed. Dredging may only continue at that location once permission has been given to do so. |

**<u>Data Sources and Monitoring:</u>**

- National Heritage Act
- Record any discoveries of potential archaeological value and report it to the National Heritage Council.
- Close-out report or bi-annual reporting, whichever comes first, of all record keeping and the proof of reporting of any discoveries to the National Heritage Council.

#### 12.1.17 Land-based Infrastructure Impact

Collisions with land-based infrastructure during dredging activities resulting in damage, downtime and financial losses. Excessive vibrations and shockwave impacts of blasting damaging land-based structures.

| Project Activity / Resource | Nature (Status) | (A1) Importance | (A2) Magnitude | (B1) Permanence | (B2) Reversibility | (B3) Cumulative | Environmental Classification | Class Value | Probability |
|---|---|---|---|---|---|---|---|---|---|
| Dredging Operations | Damage to land-based infrastructure due to collisions and/or blasting. | 2 | -2 | 2 | 2 | 1 | -20 | -3 | Improbable |

**<u>Desired Outcome:</u>** To prevent the damage to existing land-based infrastructure.

| Responsible Body | Enhancement / Prevention / Mitigation |
|---|---|
| Namport | ♦ Appointment of a reputable dredging contractor with a known history of operational responsibility.<br>♦ Issue the dredging operator with the locations of any known sensitive or problem areas that needs to be considered during the dredging exercise. |
| Dredging Contractor | ♦ Inform relevant stakeholders of the intention to dredge close to their facilities.<br>♦ Schedule the dredging operations when no traffic is expected to be present at the specific site.<br>♦ Ensure the proper and correct functioning of all operational equipment, navigational and warning systems.<br>♦ Heighten the awareness of all personnel on board the vessel to the potential dangers associated with dredging in close proximity to land-based infrastructures.<br>♦ Care should be taken to also consider underwater moving parts and not only those structure of the vessel that is above water. |

**<u>Data Sources and Monitoring:</u>**

- Record and report to Namport any incidents with the corrective actions taken.
- Close-out report or bi-annual reporting, whichever comes first, of all record keeping and the proof of reporting of any incidents to Namport.

### 12.1.19 Cumulative Impact

Cumulative impacts related to dredging operations are considered to be relatively low, mostly due to the relative remote (offshore) nature of dredging. Cumulative impacts are mostly associated with normal seafaring traffic and thus the cumulative character will increase should there be an increase (temporary or permanent) in ships' traffic to and from the Port of Lüderitz. The positive impacts resulting from continued port operations due to maintained or increased port depth and capacity will have a stronger cumulative nature. This is because continued, reliable port operations support a variety of industries, which in turn rely on other local, national or international industries, for support and services.

| Project Activity / Resource | Nature (Status) | (A1) Importance | (A2) Magnitude | (B1) Permanence | (B2) Reversibility | (B3) Cumulative | Environmental Classification | Class Value | Probability |
|---|---|---|---|---|---|---|---|---|---|
| Dredging, Operations | The build-up of minor impacts, resulting from different activities of different industries or operators to become more significant | 2 | -1 | 2 | 2 | 1 | -10 | -2 | Improbable |
| Indirect Impacts | Port operations and sustaining of various industries | 3 | 2 | 2 | 2 | 2 | 36 | 4 | Definite |

**Desired Outcome:** To minimise negative and enhance positive cumulative impacts associated with the dredging operations and port operations.

**Actions**

**Mitigation:**

- Addressing each of the individual impacts as discussed and recommended in the EMP would reduce the cumulative impact.
- Reviewing biannual 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 | Enhancement / Prevention / Mitigation |
|---|---|
| Namport<br>Dredging Operator | - Addressing each of the individual impacts as discussed and recommended in the EMP would reduce the cumulative negative impacts while enhancing the positive impacts.<br>- Take cognisance of periods when high volumes of seafaring traffic is expected, and planning dredging operations accordingly, will reduce cumulative impacts.<br>- Reviewing biannual and close-out reports for any new or re-occurring impacts or problems would aid in identifying cumulative impacts. This will aid in planning for improvement in management plans, if not during the current dredging exercise, then in future similar exercises. |

**Data Sources and Monitoring:**

- Bi-annual and close-out reports provide a summary of the impacts of the dredging operations and highlight cumulative impacts.

### 12.2 DECOMMISSIONING

Decommissioning will entail ceasing of dredging operations and the departure of the dredging vessels from Namibia's waters. Continued adherence to all maritime laws and regulations, and specifically Namport's requirements, will be required. No significant impacts or activities are otherwise expected from decommissioning.

### 12.3 ENVIRONMENTAL MANAGEMENT SYSTEM

Namport subscribes to an environmental management system (ISO14001) that 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 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.

To ensure Namport continues to adhere to ISO14001, the dredging contractor must also adhere to the parameters prescribed by this EMS. It remains Namport's responsibility to ensure that all contractors operating on behalf of Namport adhere to all environmental compliance requirements.

## 13 CONCLUSION

Dredging forms part of the required procedures that has to be performed to ensure safe and improved operations of all harbours. There are no actions that can be taken by port operators to prevent the periodic need for dredging. As such, Namport has to, at all times, be in possession of an up-to-date dredging schedule and ensure that planned dredging activities comply to national and international standards and requirements. One such requirement by the MEFT of Namibia is a valid ECC with accompanying EIA and EMP.

For the Port of Lüderitz, maintenance dredging of approximately 170,000 $m^3$ is planned for the next five to ten year period. Capital dredging is not likely to realise within this period, but should it become necessary, it will likely involve removing substrate (includingbedrock) to deepen the port from -8.75 mCD to -12.8 mCD. All dredged material will be disposed of at the pre-approved offshore disposal site, unless, due to its contamination levels, the dredged material is not deemed suitable for disposal there. Should an alternative disposal location or method be required, it will be determined and approval obtained at such time.

Environmental impacts from the proposed dredging activities are expected. The majority of such impacts being related to the suspension of particulate matter during the dredging process or resulting from the disposal of dredged material. Particulate matter suspension may result in: increased turbidity of the water; mobilization of heavy metals and organic components with risk of spreading of such potentially toxic compounds to sensitive receptors; smothering or suffocation of benthos and marine animals; visual impacts; etc. Health, safety, security and socio-economic impacts may also be expected. These range from negative impacts such as injuries on the dredging vessel, exposure to extreme conditions, and social ills due to the influx of people and specifically foreigners, to positive impacts such as job creation, skills transfer, technological development and opportunities for economic and business development.

The EMP accompanying this report specifies some of the enhancement measures aimed at increasing the positive impacts of the dredging exercise. This include maximising the appointment of Namibian companies and citizens for support services. Furthermore it is the responsibility of Namport to contract a dredging contractor with a history of being environmentally responsible. The contractor must adhere to the laws and regulations governing the maritime industry. The dredging vessel(s) must be equipped with the necessary technological features designed to minimize negative impacts. This include measures to reduce greenhouse gas emissions, air quality monitoring equipment to detect hydrogen sulphide released from dredged material, devices and measures to reduce suspension of particulate matter and maritime navigation and signalling instruments. In terms of ecological impacts the most important are measures to reduce suspended particulate matter in the water column. These can be physical modifications to the dredger to for example reduce seafloor substrate agitation and dredged material overflow from the hopper, or procedural methods such as minimizing dredging speed, duration or location during specific conditions.

The EMP also describes a monitoring programme to be carried out by the Contractor. Baseline studies to determine new reference data for turbidity and chemical of concern concentrations in material to be dredged need to be determined prior to dredging. During dredging, turbidity monitoring and substrate and water quality sampling should be repeated and compared with the baselines. This should guide the dredging programme and act as a warning system for scenarios where excessive particulate matter suspension occur. Furthermore, all dredged material shall be disposed of at disposal sites approved by the Namibian authorities and according to the conditions stipulated in the approvals for sites.

Should the Directorate of Environmental Affairs (DEA) find that the impacts and related mitigation measures, which have been proposed in this report, are acceptable, a new environmental clearance certificate may be granted to Namport. The environmental clearance certificate issued, based on this document, will render it a legally binding document which should be adhered to. Focus should be placed on Section 12, which includes an EMP for this project. It should be noted that the assessment process's aim is not to stop the activity, or any of its components, but to rather determine its impact and guide sustainable and responsible development as per the spirit of the EMA.

**Table 13-1 Impact summary class values**

| Impact Category | Impact Type | Dredging Operations | Indirect Impacts |
|---|---|---|---|
| | *Positive Rating Scale: Maximum Value* | 5 | 5 |
| | *Negative Rating Scale: Maximum Value* | -5 | -5 |
| EO | Employment | 2 | 4 |
| EO | Revenue Generation | 2 | 4 |
| EO | Skills, Technology and Development | 2 | 4 |
| SC | Demographic Profile and Community Health | -2 | -2 |
| SC | Seafaring Traffic | -2 | N/A |
| SC | Health, Safety and Security | -3 | N/A |
| PC | Fire and Explosion | -2 | N/A |
| PC | Noise and Vibration | -3 | N/A |
| PC | Waste Production | -3 | N/A |
| PC | Sediment Quality | -2 | N/A |
| PC | Suspended Sediments | -2 | N/A |
| PC | Water Quality | -2 | N/A |
| BE | Impacts on Marine Ecosystems | -3 | -3 |
| SC | Visual Impact | -2 | N/A |
| SC | Heritage Impact | -4 | N/A |
| PC/SC | Land-based Infrastructure Impact | -3 | N/A |
| | Cumulative Impact | -2 | 4 |

*BE = Biological/Ecological EO = Economical/Operational PC = Physical/Chemical SC = Sociological/Cultural*

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# Appendix A BCLME Guideline Values for Chemicals of Concern in Water and Sediment

**Recommended water quality guidelines for toxic substances**

| Toxic Substances | Recommended Guideline Value in µg/ℓ |
|---|---|
| Total Ammonia-N | 910 |
| Total Residual Chlorine-Cl | 3 |
| Cyanide (CN-) | 4 |
| Fluoride(F-) | 5 000 |
| Sulfides (S-) | 1 |
| Phenol | 400 |
| Polychlorinated Biphenyls (PCBs) | 0.03* |
| **Trace metals (as Total metal):** | |
| Arsenic | As(III) - 2.3; As(V) - 4.5 |
| Cadmium | 5.5 |
| Chromium | Cr (III) - 10; Cr (VI) - 4.4 |
| Cobalt | 1 |
| Copper | 1.3 |
| Lead | 4.4 |
| Mercury | 0.4 |
| Nickel | 70 |
| Silver | 1.4 |
| Sn (as Tributyltin) | 0.006 |
| Vanadium | 100 |
| Zinc | 15 |
| **Aromatic Hydrocarbons (C6-C9 simple hydrocarbons - volatile):** | |
| Benzene (C6) | 500 |
| Toluene (C7) | 180 |
| Ethylbenzene (C8) | 5 |
| Xylene (C8) | Ortho - 350; Para - 75; Meta - 200 |
| Naphthalene (C9) | 70 |
| **Poly-Aromatic Hydrocarbons (< C15 - acute toxicity with short half-life in water)** | |
| Anthracene (C14) | 0.4 |
| Phenanthrene (C14) | 4 |
| **Poly-Aromatic Hydrocarbons (> C15, chronic toxicity, with longer half-life in water)** | |
| Fluoranthene (C15) | 1.7 |
| Benzo(a)pyrene (C20) | 0.4 |
| **Pesticides:** | |
| DDT | 0.001 |
| Dieldrin | 0.002 |
| Endrin | 0.002 |

**Recommended sediment quality guidelines for toxic substances**

| Toxic Substances | Recommended Guideline Value | Probable Effect Concentration |
|---|---|---|
| **Trace Metals (mg/kg dry weight)** | | |
| Arsenic | 7.24 | 41.6 |
| Cadmium | 0.68 | 4.21 |
| Chromium | 52.3 | 160 |
| Copper | 18.7 | 108 |
| Lead | 30.2 | 112 |
| Mercury | 0.13 | 0.7 |
| Nickel | 15.9 | 42.8 |
| Silver | 0.73 | 1.77 |
| Tin as Tributyltin-Sn | 0.005 | 0.07 |
| Zinc | 124 | 271 |
| **Toxic Organic Compounds (µg/kg dry weight normalized to 1% organic carbon)** | | |
| Total PAHs | 1,684 | 16,770 |
| Low Molecular PAHs | 312 | 1,442 |
| Acenaphthene | 6.71 | 88.9 |
| Acenaphthalene | 44 | 640 |
| Anthracene | 46.9 | 245 |
| Fluorene | 21.2 | 144 |
| Naphthalene | 34.6 | 391 |
| Phenanthrene | 86.7 | 544 |
| High Molecular Weight PAHs | 655 | 6,676 |
| Benzo(a)anthracene | 74.8 | 693 |
| Benzo(a) pyrene | 88.8 | 763 |
| Dibenzo(a,h)anthracene | 6.22 | 135 |
| Chrysene | 108 | 846 |
| Fluoranthene | 113 | 1,494 |
| Pyrene | 153 | 1,398 |
| Toxaphene | - | - |
| Total DDT | 3.89 | 51.7 |
| p,p'- DDE | 2.2 | 27 |
| Chlordane | 2.26 | 4.79 |
| Dieldrin | 0.72 | 4.3 |
| Total PCBs | 21.6 | 189 |

# Appendix B Proof of Public Consultation

## Newspaper Advertisements





### EDITORIAL

President Hage Geingob's message of unity and prosperity at yesterday's Independence Day celebrations at Swakopmund could not have come at a better time, especially with the prevailing winds of discontentment towards government.

Indeed, 32 years after attaining freedom, Namibia has a lot to be proud of. Without being oblivious to the struggles of many Namibians, as a nation we have made great strides in areas such as provision of water, social safety nets and maintaining a safe and peaceful environment.

While some may claim that people do not eat peace and stability, those ideals are indeed a panacea to any envisaged growth and development aspirations.

However, this should not blind us to the work that still lies ahead.

In 1990 the future of a democratic Namibia was teeming with hope, with multiple promises of future prosperity inspiring many who yearned for a better life.

But just over three decades later, much of that initial promise remains unfulfilled. The Swapo-led government continues to draw stark condemnation for the country's ongoing struggles such as abject poverty, high levels of inequality, gender-based violence, education and health crises as well as corruption in the public sector.

While government has taken the most flak for the struggles of the country, a situation compounded by the uphill battle of having to devise measures to grow the economy, manage the country's excessive debt levels, we must wage new frontiers to fulfil the glorious promises made to our people at the dawn of independence.

LOVE YOUR COUNTRY: President Hage Geingob. PHOTO FILE

# Apartheid

Continued from page 1

"What is not understandable is the unreasonable assertion by some that the days of racist, apartheid South West Africa were better than those of post-independent Namibia. Also, it's incomprehensible and deplorable for some Namibians to claim that for the past 32 years, nothing has been achieved, therefore Namibians have no reason to celebrate independence. Such mindsets are not only unpatriotic but insulting to those who made immense sacrifices in the quest for freedom. Our Independence Day is sacred and should be above our personal feelings and politics of the day," said Geingob.

The president further assured the nation that the country's progress towards prosperity rests on a dynamic and robust economy and that although government has made every effort possible to support economic growth, government's role is only that of facilitation.

"The government's priority is not to conduct business. Instead, our focus is on fulfilling the needs of vulnerable members of our society through implementing social relief programs and creating a conducive business environment. As the engine of our economy, the Private Sector must also play its role. Only through the holding of hands and pulling 13 in one direction, will we be able to achieve a society in which shared prosperity can exist," he said.

Geingob also repeated that his administration has ensured that corruption is not endemic in Namibia, however, there are isolated cases where individuals have engaged in high-level acts of corruption.

This has prompted the government to foster closer co-operation with international anticorruption agencies to help fight corruption.

"Our national ambitions are threatened by the scourge of corruption, which, if allowed to gain a foothold in our society, places our national security, sovereignty, and economic development under severe threat. Corruption is a global problem and requires a united approach if we aim to defeat it," he said.

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# Independence

Continued from page 1

"From the onset, government's primary focus has been on improving the welfare of all Namibians," he said.

"We have improved and expanded access to primary education; we have expanded access to medical care; and we have expanded the supply of safe and clean drinking water to rural areas."

Geingob also waxed lyrical about government's rural electrification program, which he said has brought electricity to thousands of Namibians.

"We have expanded our physical and communications infrastructure, including building new roads, modernising our harbours, and rolling out mobile telecommunications technology throughout the country."

He also praised government's expenditure of N$7 billion on social safety nets.

The chaos that marked yesterday's celebrations contradicted the glossy picture painted by Geingob regarding the country's state of affairs.

Cabinet Secretary George Simataa Simataa said there was no outcry from the members of public who could not attend the Independence Day proceedings at Swakopmund yesterday because "everyone was catered for".

As a result, he said, there was no stain on Geingob's "Namibian House" mantra, which suggests no one is left out of the state's welfare. "Everybody ate, there is nobody who did not eat. We fed them," he said.

However, the feeling on the ground was contrary to the official version: "Apparently it was N$2 million that was budgeted for, and what are we getting from this N$2 million?" an irate woman, who was part of a group seeking food, said in Afrikaans.

"Ministers are going to eat fancy [food] and sleep in hotels. We must vote and stand in the sun and now we are made to stand at the gate for brotchen and cooldrink for N$2 million. When it is voting time then we are treated like humans but after voting we are treated like dogs. What do we taste for this N$2 million? Must we stand here for N$2 million?"

Simataa said he spent 30 minutes explaining to the public why they could not be allowed into the venue, adding that government respected Covid-19 protocols by requesting the public to remain outside.

Presidential Press secretary Alfredo Hengari echoed Simataa's sentiments around the Covid-19 regulations as a factor that influenced the decision to refuse access to members of the public.

"The Presidency would like to apologize to members of the public who would have liked to join the President today for the Independence Day celebrations in Swakopmund. The Presidency appreciates the show of support and would like to thank those who came to the stadium for their patriotism," he said.

"However, unfortunately and regrettably, the government was limited by the Covid-19 health regulations and could not permit more citizens joining the President and the First Lady Monica Geingos in celebrating this milestone celebration of our young nation's coming of age," he said.

Deputy prime minister Netumbo Nandi-Ndaitwah said, while they (members of the public) could not enter the stadium because of Covid-19 protocols, arrangements were made to serve them with lunch.

Nandi-Ndaitwah added that "arrangements were made make sure that those people that were standing around the stadium could hear the speeches and they were given the lunch." Information minister Peya Mushelenga said he could not respond on whether provision was made for the public as it was too 'technical' a question.

"There was a committee who arranged these things, you should speak to them, you are now asking me technical matters and I am a policy maker. You know very well that there were Covid-19 restrictions. The most important thing here was the message. We made sure that the sound system was of such nature that those outside the stadium could hear and those in the surrounding areas," he said.

**Bad taste**

The leader of the Political Opposition Popular Democratic Movement (PDM) McHenry Venaani said the arraignment of these celebrations was in very bad taste and should have been a 50/50 quota system for dignitaries and the public.

According to Venaani, who also attended yesterday's proceedings, "it is just wrong to have the electorate excluded at such an important event when at the end of the day the country belongs to them".

"It was really very poorly done; they should have had limited VIP guests instead there was a total disregard of the public. I was very disappointed," he said.

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# Debmarine

Continued from page 1

While it took almost a decade of planning and execution to turn the dream into reality, Debmarine CEO Otto Shikongo was delighted with the results and indicated that the megaproject was executed three months ahead of schedule and 17% under budget.

In her test run in Namibian waters last month, the Benguela Gem recorded 103 hours of non-stop operation at name plate capacity and recovering 30 000 carats.

Shikongo said the vessel will create 160 high-skilled jobs for Namibians and will produce over 500 000 carats annually - with revenues expected to exceed N$3 billion.

This will further cement Debmarine as the largest private sector contributor to the Namibian fiscus.

"This makes her the single biggest contributor to Debmarine Namibia and Namdeb Holdings' income," Shikongo said. Debmarine Namibia belongs to Namdeb Holdings, which is an equal partnership between Namibia's government and world diamond giant de Beers joint venture.

The chief executive officer of the De Beers group, Bruce Cleaver, said Debmarine Namibia has been "brilliant for the past twenty years".

Mines minister Tom Alweendo was delighted with the realization of such a "meaningful investment".

"Diamonds have always been crucial as part of our economy, and are therefore regulated differently. It is extremely important that we manage industry in such a way as not to pollute the image of diamonds," he said.

**Hold hands**

President Hage Geingob, who spoke off the cuff, savoured the moment and called for increased collaboration between the government and the private sector.

"As Namibians, we must hold hands and work with Harambee with the private sector." He says process, systems and institutions need to be established and used. "I don't have to be here anymore, but what we decided must continue to exist. It cannot depend on individuals," he said.

Geingob said Covid-19 has made it clear that everyone is equal.

"People started dying. People we grew up with, people we know, white, black, yellow. The disease taught us that we are one and can survive only by holding hands. Now we are holding hands to build the economy on diamonds," he said.

***Additional reporting by Augetto Graig.***

Sun
TUESDAY 29 MARCH 2022
NEWS
5

# Better to have school uniforms

OPINION

IMMANUEL ARON

**In recent days the media have been flooded with issues pertaining to education, ranging from the revised curriculum, to learners' hairstyles and the latest one being that of school uniforms, which appeared in The Namibian newspaper, via SMS, dated Friday, 18 March 2022.**

The SMS reads: "Dear teachers, remember not every parent can afford a full uniform, and you are trying to make it a rule. What if there's a rule saying all teachers must have VW Amaroks, would you be able to afford it?"

Although it is not clear what constitutes a full school uniform in this context, and the author did also not go further to elucidate what the learners may wear in the absence of the uniform, it is worth contributing to the debate on the subject at hand for educational purposes.

The Education Act (Act 16 of 2001) is silent specifically on the issue of school uniform. It is nonetheless very clear on the issue with regard to the learners' hygiene, cleanness and appearance.

The said Act mandates the school board of every state school, after consultation with the school parents, learners and teachers, to draft and adopt a learner code of conduct, which usually includes the school uniform. It is therefore of great significance to mention that the parents' voices and contributions in the affairs of their children's education, particularly school rules, are recognised.

Teachers do not have a solitary role of drafting and adopting the school rules as such.

School uniforms are common in almost every school in Namibia, both private and state, due to the number of reasons and benefits both to the schools as organisations and to the parents and learners as individuals. School uniforms serve as a social leveller by removing social status. Parents would not have to worry much about buying designer clothes for their children to wear to school.

In the same way, it removes peer pressure among the learners that would have been associated with not being able to be at the same level with their friends.

This type of peer pressure normally leads to depression and/or low self-esteem.

School uniform also helps to instil discipline among the learners, especially when travelling between their homes and the schools. It is observed that the children would behave courteously when wearing the school uniform as opposed to when wearing differently.

And in the event that they do not behave appropriately, they are easily identifiable according to their school colours and such ill behaviours can thus be corrected immediately.

All in all, school uniform helps in achieving that homogeneity and sense of belongingness. It is obvious that everyone wants to feel part and parcel of the group as opposed to being othering.

While it's important to take part in discussions pertaining to education such as school uniforms, it is equally important to first know the importance of such rules and provide our support as parents for they are meant to shape the children in a certain way and protect them against unwanted behaviours.

Good behaviour will undoubtedly shape the characters of the learners which will eventually inform that of the entire nation.

It is a known fact that our society is characterised by serious inequalities, and it is also true that some parents will struggle to afford their children's school uniforms.

Nonetheless, it appears to be also true that it is better to struggle to afford a school uniform than not to.

**Aron is a school principal at Mwadhina Gwanembenge Combined School in Oshana Region.*
*The views expressed in this article, are in his personal capacity. He can be reached at aron.immanuel@gmail.com*

# Independence is ours; it's for all of us

OPINION

NDONGO YAMANDONGO

Growing up with my cousins in my grandparents' humble abode carved out of the dusty streets of Mondesa, there was always one thing we looked forward to: although the foggy mist stood thick, impairing our vision; although the future seemed bleak and uncertain at times; we always knew that beyond it, there lies one event in which we find hope – the Namibian Independence Day celebration.

While we might have contented ourselves with the debilitating four-bedroom house built in the apartheid era, our grandparents taught us that Independence was the magic paintbrush with which we could refurbish our home. While we were better off than our more unfortunate neighbours and contented ourselves to one meal of porridge a day, for seven days a week, our grandparents taught us and likened Independence to the Second Coming of Christ, a day we would all relish in the land of milk and honey, relinquishing the everyday 'pap en vis.'

Although we might have contented ourselves to an everyday life without electricity and no running water, our grandparents taught us that Independence was like the Oshigambo River, while almost never carrying surface water, we must have faith that someday its banks will break, providing amply for us.

## Treacherous act

Independence means everything to us, the poor and underprivileged. Over the years, our leaders and decision-makers have taken plenty from us, we are very much aware of that, but most things taken from us are ephemeral and thus, easily forgivable. This time, what they did on Independence Day in my hometown of Swakopmund is a treacherous act so painful, it is irrevocably unforgivable. We have allowed you to take and squander our resources, but we will not allow you to take away the one thing that gives us hope in this country, the one place where we reinvigorate our dreams of a better tomorrow, the one place where the poor find essence in being Namibian, and shamefully, the one thing, if not the only thing, the rich and poor have in common in this country – the Independence of Namibia.

> NDONGO YAMANDONGO
> our grandparents taught us that Independence was the magic paintbrush with which we could refurbish our home.

## Betrayal

We are angry and we have never felt more betrayed. While you might use tenders around the event to enrich yourselves, the Independence Day celebration is not a private fiesta for politicians and diplomats. You have absolutely no right to not consider us, the poor, in the celebration of our Independence. Nauseatingly, the young deputy minister of ICT who was appointed on tokenism was quick to rush to Twitter in defence of this abomination, citing Covid regulations. When did we lose our sense of reason? When did we lose our sense of inclusivity that our president preaches?

More importantly, when did this administration lose its sense of "Harambe" the "all pull together" spirit? Covid regulations are not reason enough to exclude the masses of the people from such an event; how should we judge parents who host a birthday party in their main bedroom while their kids watch through the windows?

Deplorable, I tell you, it is dishonourable. If everybody in the Namibian house cannot partake in the festivity, then there ought to be no festivities at all.

My brother, Petu, took his two toddlers to celebrate Independence Day, only to be excluded by the same forces which persistently side-line him economically and socially.

My grandmother's great-grandchildren denied the very sense of hope she instilled in us.

The ruling party obliviously continues to sever the last ties the people have to it. For many of us, cultured to love and raised within a tradition intricately linked to the ruling party, it seems like with each passing day that our grandparents' corpses rot six feet under, the ruling party rots away too, and what ensues is the dwindling of the love the poor once felt for the ruling party. It's a pity, but I am glad my grandmother is no longer here to see the demise of her beloved party.

Dinsdag 22 Maart 2022 Republikein NUUS 3

» Reuse-diamantskip begin sy werksaamhede

# Benguela Gem glinster op die water

**Namibië se vennootskap met De Beers bied wêreldleierskap in die herwinning van diamante uit die oseaan.**

Augetta Graig

Die MV Benguela Gem vaar reeds in die Atlantiese Oseaan en sy 310 ton Crawler onderwater-mynbouмeganisme het begin om diamante vanaf die seebodem te herwin.

Dié skip van N$7 miljard en 177 meter, is die mees tegnologies-gevorderde mynvaartuig ter wêreld, en president Hage Geingob het Vrydag die skip amptelik in Walvisbaai se hawe ingehuldig en dit die MV Benguela Gem gedoop.

Voorheen het die skip as die bykomende mynvaartuig 3 (AMV3) bekend gestaan.

Reeds verlede maand tydens sy toetslopie in Namibiese water, kon die MV Benguela Gem vir 103 ure sy verwagte produksie en 30 000 karaat diamante lewer, volgens mnr. Otto Shikongo, uitvoerende hoof van Debmarine Namibië.

Hy sien uit na 30 jaar van produksie soos die MV Benguela Gem op glansende water aanhou vaar en 500 000 karaat per jaar tot Namibië se diamantproduksie bydrae, wat N$3 miljard se inkomste sal genereer, sê hy.

"Dit maak die skip die enkel grootste bydraer tot Debmarine Namibia en Namdeb Holdings se inkomste," het hy gesê.

Debmarine Namibia behoort aan Namdeb Holdings, wat 'n gesamentlike en gelyke vennootskap tussen die Namibiese regering en wêrelddiamantreus De Beers is.

Die uitvoerende hoof van die De Beers-groep, mnr. Bruce Cleaver, het by die geleentheid gesê Debmarine Namibia skitter helder al vir 20 jaar, en is die grootste bydraer uit die private sektor tot die Namibiese fiskus.

Die minister van myne en energie, mnr. Tom Alweendo, was verheug oor so 'n betekenisvolle belegging. "Diamante was altyd deurslaggewend as deel van ons ekonomie, en word dus anders gereguleer. Die uiters belangrik dat ons die nywerheid só bestuur om nie die beeld van diamante te besoedel nie," sê hy.

Geingob het sy voorbereide toespraak tersyde gesit en sy tevredenheid beklemtoon om teenwoordig te wees.

Hy het die waardes van Debmarine Namibia geprys en gesê die regering moet ook daarna streef.

"As Namibiërs moet ons hande vat en saam met die private sektor *harambee*."

Hy sê prosesse, stelsels en instansies moet gevestig en gebruik word.

"Ek hoef nie meer hier te wees nie, maar wat ons besluit het, moet voortgaan. Dit kan nie van individue afhanklik wees nie," het hy gesê.

Geingob sê Covid-19 het dit duidelik gemaak almal is gelyk.

"Mense het begin sterf. Mense saam met wie ons grootgeword het, mense wat ons ken; wit, swart, geel.

"Die siekte het ons geleer dat ons een is en met deur hande te vat, kan ons oorleef. Nou vat ons hande om die ekonomie op diamante te bou. Almal kan hulle dra. Dié leier weet nie alles nie.

"Ek was van plan om te sê, ontwikkel Namibiërs, gee Namibiërs opleiding, sluit Namibiërs van ander plekke in, maar julle doen dit reeds. Ek sien hulle. Ek het net gekom om die vaartuig in te huldig. Ons is gretig om te gaan," het hy gesê. – augetta@republikein.com.na

President Hage Geingob was Vrydag in Walvisbaai om die MV Benguela Gem in te huldig. Hier is mnre. Otto Shikongo en Tom Alweendo saam met die president op die hawe met sy aankoms.

Die Namibiese vlag wapper hoog op die MV Benguela Gem in Walvisbaai se hawe.

# NG Kerk: Namibië kan bande met algemene sinode breek

Ronelle Rademeyer

**In 'n ingrypende stap kan die NG Kerk in Namibië (NGKN) sy bande met die algemene sinode (AS) van die NG Kerk breek indien laasgenoemde nie binne die volgende ses maande instem om sekere van sy besluite, waaronder dié oor selfdegeslagverhoudings, te hersien nie.**

Dié besluit is die naweek tydens die NGKN se sinodesitting in Windhoek geneem.

Dr. De Wet Strauss, assessore en ondervoorsitter van die dagbestuur, het Saterdag na afloop van die Namibiese sinode in 'n verklaring aangekondig 'n besluit is ingevolge artikel 37 van die kerkorde geneem om "'n pad van kerklike tug en dissipline met die NG Kerk se algemene sinode te stap soos dit uitgespel word deur Jesus in Matteus 18:15-17".

Matteus 18 lui: "As jou broer verkeerd opgetree het teen jou, gaan wys hom tereg waar julle eenkant alleen is. As hy na jou luister, het jy jou broer teruggewen."

"Die sinode van Namibië is van oordeel dat die AS nie die NG Kerk met kerklike leierskap dien nie," lui die verklaring.

Strauss sê die Namibiese sinode verwys veral na die besluite wat verband hou met selfdegeslagverhoudings en die bestuur van teologiese opleiding aan die universiteite se teologiese fakulteite waarmee die algemene sinode hom verbind.

Die AS het in 2019 besluit NG-gemeentes kan self besluit of hulle ten gunste van selfdegeslagverhoudings is en of hulle gay predikante wil beroep.

Die Namibiese sinode met sy 45 gemeentes sal oor die komende maande lidmate hieroor inlig en "betrek by die verskillende prosesse wat hierdie ingrypende besluit tot gevolg sal hê", sê Strauss.

Artikel 37 van die kerkorde bepaal 'n streeksinode kan uit die kerkverband tree. Dit kan geskied met behoud van sy naam, bates, regte en voorregte.

Ds. Nelis Janse van Rensburg, moderator van die NG Kerk, het die naweek aan *Rapport* gesê die Namibiese sinode se besluit is "hartseer".

Volgens hom was die 2019-besluit oor selfdegeslagverhoudings nie op die NGKN van toepassing nie aangesien sulke verhoudings in Namibië onwettig is.

Al nege streeksinodes van die NG Kerk in Suid-Afrika, asook dié in Botswana, Zimbabwe, Zambië en Namibië maak deel uit van die algemene sinode, verduidelik ds. Thijs van der Merwe, algemene sekretaris van die NGKN.

"Die Namibiese sinode was een van vyf stigterslede van die AS in 1962. Namibië is deel van die algemene sinode as 'n onafhanklike kerk wat op 3 Maart 1957 tot stand gekom het," verduidelik hy. – ronelle@republikein.com.na

Die NG Kerk in Namibië sal sy ingrypende besluit om bande met die algemene sinode te verbreek indien sekere besluit nie hersien word nie, met die 45 gemeentes bespreek.

## PUBLIC PARTICIPATION NOTICE

**UPDATE OF THE ENVIRONMENTAL ASSESSMENTS FOR DREDGING OF THE PORTS OF WALVIS BAY AND LÜDERITZ**

Geo Pollution Technologies (Pty) Ltd was appointed to update the existing environmental assessments and environmental management plans for capital and maintenance dredging of the Ports of Walvis Bay and Lüderitz. The updates are required to include dredging activities that the Namibian Ports Authority (Namport) intend to conduct in order to develop and maintain the ports. More information regarding the projects is available at:

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The updated environmental assessments will be in accordance with the Environmental Management Act of 2007 and its regulations as published in 2012.

All interested and affected parties are invited to register with the environmental consultant. By registering, you are provided with the opportunity to share any comments, issues or concerns related to the projects, for consideration in the environmental assessments. Additional information can be requested from Geo Pollution Technologies.

All comments and concerns should be submitted to Geo Pollution Technologies by **04 April 2022**.

**André Faul**
**Geo Pollution Technologies**
**Tel:** +264-61-257411
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**E-Mail:** namport@thenamib.com

Dinsdag 22 Maart 2022 Republikein NUUS 3

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**E-Mail:** namport@thenamib.com

**Notified Interested and Affected Parties**

| Name | Organisation/Representative |
|---|---|
| Albert April | Debmarine |
| Alexey Zavitaev | Namport |
| André Burger | Municipality of Walvis Bay |
| Angus Middleton | Namibia Nature Foundation |
| Anja Kreiner | Ministry of Fisheries and Marine Resources |
| Ann Scott | African Conservation Services CC |
| Berdine Botha | Municipality of Walvis Bay |
| Cecil Kamupingene | Namport |
| Chris Brown | Namibian Chamber of Environment |
| Clinton Hay | University of Namibia |
| Cornelia-Snerry Mungungu | De Beers Group |
| Crispin Clay | Lüderitzbucht Foundation |
| David Uushona | Municipality of Walvis Bay |
| Desmond Tom | Ministry of Fisheries and Marine Resources |
| Elretha Mungunda | Ministry of Environment, Forestry and Tourism |
| Elzevir Gelderbloem | Namport |
| Erich Maletzky | Ministry of Fisheries and Marine Resources |
| Estelle Fleidl | Private |
| Ferdie de Villiers | Novaship Namibia |
| Fillipus Hedimbi | Namport |
| Foibe Nghoongoloka | Ministry of Fisheries and Marine Resources |
| Gebhard Shiindi | Puma Energy Namibia |
| Gerd Kessler | Five Roses Aquaculture / Southern Breeze Mariculture / Lagoon Aquaculture |
| Gerhard Kuhrau | Novanam |
| Gloudi De Beer | Ohlthaver & List Group (O&L Aquaculture) |
| Graça D'Almeida | Ministry of Fisheries and Marine Resources |
| Greater Mukumbira | Kelp Blue |
| Heidi Skrypzeck | Ministry of Fisheries and Marine Resources |
| Helmut Plietz | A Plietz Engineering Works |
| Herman J. Theron | Ohlthaver & List Group (O&L Aquaculture) |
| Holger Kolberg | Namibia Bird Club |
| Howard Head | Ghost Town Tours |
| Ignatius Tjipura | Lüderitz Town Council |
| Ingrid Wiesel | Brown Hyena Research Project |
| Innocent Sinvula | Sturrock Grindrod Namibia |
| Jan Albertus Scholtz | //Karas Regional Council - !NAMI #NUS Constituency |
| Jason Burgess | Oceangrown / Lüderitz Mariculture |
| Jean Paul Roux | Seacode/NNF |
| Jessica Kemper | Independent Environmental Scientist |
| Jessica von Hase | Ohlthaver & List Group (O&L Aquaculture) |

| Name | Organisation/Representative |
|---|---|
| Johannes Blaauw | Roads Authority |
| Johannes Coetzer | Debmarine Namibia |
| Johannes Hamukwaya | Ministry of Fisheries and Marine Resources |
| Johannes Isaaks | Namport |
| John Yabe | University of Namibia |
| José-Luis Fernandez | Fermar Seafoods |
| Jürgen Fleidl | Five Roses Aquaculture |
| Katrina Haipinge | De Beers Group |
| Kirsten Kessler | Five Roses Aquaculture / Southern Breeze Mariculture / Lagoon Aquaculture |
| Kolette Grobler | Ministry of Fisheries and Marine Resources |
| Koos Blaauw | Mariculture Association of Namibia |
| Lapaka Kaimbi | Debmarine Namibia |
| La-Toya Shivute | Ministry of Fisheries and Marine Resources |
| Lewis Druker | Coastways Tours Luderitz Pty Ltd. |
| Lorinda Hart | University of Namibia |
| Marion Schelkle | Lüderitz Safaris & Tours |
| Mark Boorman | Namibia Bird Club |
| Martha Kambidhi | Ministry of Environment, Forestry and Tourism |
| Max Kooper | Namport |
| Mbahupu Tjivikua | Walvis Bay Corridor Group |
| Michael Mackenzie | Marco Fishing |
| Miguel Calaca | O&L Aquaculture |
| Mr Ephraim Nambahu | Municipality of Walvis Bay |
| Ms. L. H. Doëses | Erongo Regional Council |
| Muronga Haingura | Municipality of Walvis Bay |
| Mwaka Sinvula | Ministry of Environment, Forestry and Tourism |
| Nadine Kohlstädt | Scientific Society Swakopmund |
| Nangula Amutenya | Municipality of Walvis Bay |
| Nestor Sheefeni | Namcor |
| Patrick Kohlstaedt | Manica Group Namibia (Lüderitz Bay Shipping and Forwarding) |
| Peter Bridgeford | Namibia Bird Club |
| Phinehas Aune | Directorate of Maritme Affairs, Ministry of Works and Transport |
| R Shikwaya | Namport |
| Rassie Erasmus | Benguella Wealth Farming |
| Raymond Ferreira | Marine Plastics (O&L Aquaculture) |
| Reinhardt Ochs | Lüderitz Town Council |
| Renier Botha | De Beers Group |
| Richard Kennedy | Namport |
| Rodney Braby | Marine Spatial Management and Governance Project - MARISMA |
| Ron Wolters | Namibian Hake Association |
| Rudi Cloete | Ministry of Fisheries and Marine Resources |

| Name | Organisation/Representative |
|---|---|
| Simon Elwen | Namibia Dolphin Project |
| Stefanus Gariseb | Namport |
| Talent Kapalilo | De Beers Group |
| Temba Apulile | Access World |
| Thomas Shipepe | Lüderitz Town Council |
| Ulf Grünewald | Lüderitz Nest Hotel |
| Victor Libuku | Ministry of Fisheries and Marine Resources |
| Wayne Handley | Ministry of Environment, Forestry and Tourism |
| Executive Director | Ministry of Health and Social Services |
| Executive Director | Ministry of Mines and Energy |
| Executive Director | Ministry of Industrialisation and Trade |
| Executive Director | Ministry of Fisheries and Marine Resources |
| Executive Director | Ministry of Home Affairs, Safety and Security |
| Executive Director | Ministry of Agriculture, Water and Land Reform |
| Executive Director | Ministry of Works and Transport |
| Executive Director | Ministry of Environment, Forestry and Tourism |
| Executive Director | Ministry Of Public Enterprises |
| Executive Director | Ministry Of Defence & Veterans Affairs |
| | Benguela Current Commission |
| | LLD Namibia Phosphates |
| | Lüderitz Waterfront Development Company |
| | Ministry of Defence and Veteran Affairs |
| | Municipality of Walvis Bay |
| | Namibia Bird Club |
| | Namibia Dolphin Project |
| | Namoyster |
| | Namzinc (Pty) Ltd |
| | Walvis Bay Port Users Association |
| | Walvis Bay Salt Holdings (Pty) Ltd |
| | Sturrock Grindrod Namibia |

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E-MAIL: gpt@thenamib.com

**To:** **The Executive Director**
**Ministry of Agriculture, Water and Land Reform**

**22 March 2022**

**Re:** **Update of the Environmental Assessment for Capital and Maintenance Dredging of the Ports of Walvis Bay and Lüderitz**

In terms of the Environmental Management Act (No 7 of 2007) and the Environmental Impact Assessment Regulations (Government Notice No 30 of 2012), notice is hereby given to all potential interested and/or affected parties (IAPs) that an application will be made to the Environmental Commissioner for renewal of the environmental clearance certificate for the following project:

**Project:** Update of the Environmental Impact Assessment for Capital and Maintenance Dredging at the Ports of Walvis Bay and Lüderitz

**Proponent:** Namibian Ports Authority (Namport)

**Environmental Assessment Practitioner:** Geo Pollution Technologies (Pty) Ltd

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To receive a copy of the draft EIAs and EMPs for review and commenting, please register as an IAP and provide comments by **04 April 2022**. To register, please contact: Email: **gpt@thenamib.com** / Fax: 088-62-6368. Should you require any additional information please contact Geo Pollution Technologies at telephone 061-257411.

Thank you in advance.

Sincerely,

André Faul
Environmental Scientist

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2022 -03- 22
EXECUTIVE DIRECTOR'S OFFICE
MAWLR

Page 1 of 2

Directors: P. Botha (B.Sc. Hons. Hydrogeology) (Managing)

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E-MAIL: gpt@thenamib.com

**To:** **The Executive Director**
**Ministry of Industrialisation and Trade**

**22 March 2022**

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Sincerely,

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Executive Director
MIT

André Faul
Environmental Scientist

Page 1 of 2

**Directors:** P. Botha (B.Sc. Hons. Hydrogeology) (**Managing**)

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**To:** **The Executive Director**
**Ministry of Environment, Forestry and Tourism**

**22 March 2022**

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Sincerely,

André Faul
Environmental Scientist

MINISTRY OF ENVIRONMENT, FORESTRY AND TOURISM
EXECUTIVE DIRECTOR'S OFFICE
22 MAR 2022
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Directors: P. Botha (B.Sc. Hons. Hydrogeology) (Managing)

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**To:** **The Executive Director**
**Ministry of Public Enterprises**

**22 March 2022**

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Sincerely,

André Faul
Environmental Scientist

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Sign:
Date: 22/3/2022

Page 1 of 2

Directors: P. Botha (B.Sc. Hons. Hydrogeology) (Managing)

27 MAR 2022

GEO Pollution Technologies

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**To:** **The Executive Director**
**Ministry of Health and Social Services**

**22 March 2022**

**Re:** **Update of the Environmental Assessment for Capital and Maintenance Dredging of the Ports of Walvis Bay and Lüderitz**

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André Faul
Environmental Scientist



Directors: P. Botha (B.Sc. Hons. Hydrogeology) (Managing)

GEO Pollution Technologies

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**To:** **The Executive Director**
**Ministry of Home Affairs, Safety and Security**

**22 March 2022**

**Re:** **<u>Update of the Environmental Assessment for Capital and Maintenance Dredging of the Ports of Walvis Bay and Lüderitz</u>**

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Thank you in advance.

Sincerely,

MINISTRY OF HOME AFFAIRS, IMMIGRATION, SAFETY & SECURITY
RECEIVED
22 MAR 2022
OFFICE OF THE EXECUTIVE DIRECTOR

André Faul
Environmental Scientist

Page 1 of 2

Directors: P. Botha (B.Sc. Hons. Hydrogeology) (Managing)

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**To:** **The Executive Director**
**Ministry of Defence & Veterans Affairs**

**22 March 2022**

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André Faul
Environmental Scientist

REPUBLIC OF NAMIBIA
MINISTRY OF DEFENCE & VETERANS AFFAIRS
2022 -03- 2 2
EXECUTIVE DIRECTOR

Page 1 of 2

Directors: P. Botha (B.Sc. Hons. Hydrogeology) (Managing)

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E-MAIL: gpt@thenamib.com

**To:** **The Executive Director**
**Ministry of Works and Transport**

**22 March 2022**

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MINISTRY OF WORKS AND TRANSPORT
2022 -03- 22
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**Directors:** P. Botha (B.Sc. Hons. Hydrogeology) (Managing)

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MINISTRY OF FISHERIES & MARINE RESOURCES
EXECUTIVE DIRECTOR
22 MAR 2022
RECEIVED
By:

To: **The Executive Director**
**Ministry of Fisheries and Marine Resources**

**22 March 2022**

Re: **Update of the Environmental Assessment for Capital and Maintenance Dredging of the Ports of Walvis Bay and Lüderitz**

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**To:** **The Executive Director**
**Ministry of Mines and Energy**

**22 March 2022**

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**Environmental Assessment Practitioner:** Geo Pollution Technologies (Pty) Ltd

The Namibian Ports Authority, Namport, is mandated to manage and control ports and lighthouses in Namibia, and to provide, among others, facilities and services related to ports. Namport has to periodically conduct dredging in order to ensure optimal water depth in the Port of Walvis Bay and Port of Lüderitz. Dredging is the mechanical removal of sediment in order to either deepen the water, generally referred to as capital dredging, or maintain the water depth (referred to as maintenance dredging). Areas within a harbour that are typically dredged include the entrance channel, the vessel turning basins, and the vessel berthing basins.

Namport has existing environmental impact assessments (EIA), with associated environmental management plans (EMP) that was last updated in 2013/2014 to make provision for their dredging activities that were performed between 2014 and 2017. Geo Pollution Technologies (Pty) Ltd was appointed by Namport to perform the next update on the Port of Walvis Bay and Port of Lüderitz EIAs in order to include the next 10 years' planned dredging activities. The update of the EIAs will be conducted in line with the Environmental Management Act, Act No 7 of 2007 and its regulations as gazetted in 2012. The updated documents will be used to apply for renewal of their environmental clearance certificates (ECC) with the Ministry of Environment, Forestry and Tourism (MEFT).

As part of the update of the environmental assessment we consult with IAPs who are invited to register with the environmental consultant to receive further documentation and communication regarding the projects. By registering, IAPs will be provided with an opportunity to provide input that will be considered for the updated environmental assessment reports and their associated management plans.

To receive a copy of the draft EIAs and EMPs for review and commenting, please register as an IAP and provide comments by **04 April 2022**. To register, please contact: Email: **gpt@thenamib.com** / Fax: 088-62-6368. Should you require any additional information please contact Geo Pollution Technologies at telephone 061-257411.

Thank you in advance.

Sincerely,

André Faul
Environmental Scientist

MINISTRY OF MINES AND ENERGY
OFFICE OF THE EXECUTIVE DIRECTOR
2022 -03- 22
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Page 1 of 2

**Directors:** P. Botha (B.Sc. Hons. Hydrogeology) (**Managing**)

# Appendix C Registered IAPs and Comments Received

**Registered Interested and Affected Parties**

| Name | Organisation | Date Registered |
|---|---|---|
| Cornelia-Snerry Mungungu | Debmarine Namibia | 2022/03/22 |
| Miguel Calaca | O&L Aquaculture | 2022/03/22 |
| Patrick Kohlstaedt | Manica Group Namibia | 2022/03/22 |
| Heidi Skrypzeck | Ministry of Fisheries and Marine Resources | 2022/03/22 |
| Anton Pretorius | Wesco Project Consultancy Services (Pty) Ltd | 2022/03/22 |
| Elizabeth Petrus | Ministry of Fisheries and Marine Resources | 2022/03/22 |
| Ulf Grünewald | Lüderitz Nest Hotel | 2022/03/23 |
| Sylvia Kalenga | Ministry of Public Enterprises | 2022/03/23 |
| Ndiitah Nghipondoka-Robiati | Ministry of Public Enterprises | 2022/03/23 |
| Penexupifo Elago | Ministry of Public Enterprises | 2022/03/23 |
| Louise Shixwameni | Ministry of Public Enterprises | 2022/03/23 |
| Faith Khiba@mpe.gov.na | Ministry of Public Enterprises | 2022/03/23 |
| Mattheus Hambabi | Ministry of Agriculture, Water and Land Reform | 2022/03/24 |
| Laurica Afrikaner | Ministry of Agriculture, Water and Land Reform | 2022/03/24 |
| Kristian Faber | Rohde Nielsen | 2022/03/25 |
| Commander C T Kashuupulwa | Namibian Defence Force – Navy (NDF – Navy), Ministry of Defence and Veteran Affairs (MoDVA) | 2022/03/25 |
| Sacheus Randy !Gonteb | Namibian Defence Force – Navy (NDF – Navy), Ministry of Defence and Veteran Affairs (MoDVA) | 2022/03/25 |
| Gloudi de Beer | Ohlthaver & List Group | 2022/03/25 |
| Wayne Handley | Karas Parks | 2022/03/28 |
| Rassie Erasmus | Benguella Wealth Farming | 2022/04/06 |

**E-Mail Correspondence Received**

**E-Mail Received: 05 April 2022**
**From: Miguel Calaca, General Manager: Operations Ohlthaver & List Group | O&L Aquaculture [Hangana Abalone]**
**Comments by: Raymond Ferreira, Marine Plastics (Consultant)**

| Comments | Response |
|---|---|
| **Update of the EIA for the capital and maintenance dredging of the Luderitz Harbour**<br>In my capacity as consultant for Hangana Abalone, I represent their interests with regards to the abalone mariculture facility located in the port of Luderitz.<br>We would like to extend our appreciation for informing us of the above and are in agreement that the proposed upgrades to the harbour will in no doubt be of great value, not only to current and prospective NAMPORT clients, but also the local community. Progress is vital for a remote town such as Luderitz.<br>The dredging of the 170 000 m³ of sediment form the harbour area will undoubtedly have a negative effect on the immediate surroundings, especially in terms of the marine ecology. The close proximity to Hangana Abalone and the potential risks associated with such an activity need to be addressed and careful consideration must be given to the methods used. The | General comments noted. |

**E-Mail Received: 05 April 2022**
**From: Miguel Calaca, General Manager: Operations Ohlthaver & List Group | O&L Aquaculture [Hangana Abalone]**
**Comments by: Raymond Ferreira, Marine Plastics (Consultant)**

| Comments | Response |
|---|---|
| potentially destructive effects of large volumes of accumulated, hydrogen sulphide and toxin-rich harbour sediment, brought into suspension by the various dredging methods, simply will not be limited to the immediate harbour area.<br>Abalone production relies rather heavily on good water quality parameters. Success in the hatchery is only achieved by means of culturing pristine surfaces of benthic crustose or coralline algae biofilms and associated beneficial bacterial communities. Abalone larvae hatch at a size of 250 µm in length, which make them extremely vulnerable to changes within the boundary layer of said culture surfaces. Excessive algal growth is controlled by shading and sedimentation is limited by the use of rotating drum filters. These require daily monitoring. The production process then follows a period of 3-6 years of on growing, to produce various sizes for the eastern export market. Our project also includes a ranching operation on Penguin and Seal Island.<br>We would therefore like to present the following aspects for inclusion into your assessment. | |
|  | Currents and tides are discussed in section 9.5 and the potential impact of dredging plumes on nearby sensitive receptors, including the abalone ranching areas and onshore farm, noted. Preventative and mitigation measures provided in sections 12.1.11; 12.1.12; 12.1.13, and 12.1.14.<br>Real time turbidity monitoring at selected locations around the area to be dredged is a condition of the EMP and all dredging must be ceased if the turbidity threshold is exceeded. An independent consultant will be actively involved in the monitoring throughout the dredging period to ensure EMP conditions are adhered to. |

**E-Mail Received: 05 April 2022**
**From: Miguel Calaca, General Manager: Operations Ohlthaver & List Group | O&L Aquaculture [Hangana Abalone]**
**Comments by: Raymond Ferreira, Marine Plastics (Consultant)**

| Comments | Response |
|---|---|
| *The above image indicates the relatively close proximity of the harbour to the Hangana Abalone hatchery in the foreground. Harbour currents are pointed out in yellow with flow direction indicated in red. (Above and Below)*  | |
| 2. Habitat destruction of benthic communities.<br>Due to the settlement of heavier solids, the destructive impact on benthic communities can be expected as you rightly mention and are of major concern for us in terms of the ranching operation in the waters surrounding Penguin and possibly Seal islands. Penguin Island is extremely close to the harbour and also the waste transport route and special care must be applied to prevent the destruction of these habitats. | Real time turbidity monitoring with mitigation and preventative measures as indicated in sections 12.1.11; 12.1.12; 12.1.13, and 12.1.14 aims at halting dredging when too much particulate matter is suspended in the water column. |
| 3. Hydrogen sulphide and heavy metals<br>The culture of abalone remains an investment-hungry activity in terms of time and financial resources. The impacts of bio-toxins and heavy metals can potentially have a devastating and crippling effect, not only on primary production but also future sales.<br>The Luderitz harbour can be characterized by the protection it offers to berthing vessels as well as an abundance of marine life. Unfortunately, due to the nature of the commodities being shipped in and out of Luderitz, it also lends itself perfectly to the accumulation, over time, of various heavy metals.<br>The dredging of the harbour will therefore result in a mass-disturbance of the seafloor. In turn this will lead to the rapid dispersal of the hydrogen sulphide and heavy metal rich “cocktail”. It is therefore of extreme and utmost importance that the correct dredging method is selected.<br>Abalone, incapable of rapid migration, are bound to the areas where they were settled as juveniles and remain so, until harvest, 3-6 years later. Therefore they are unable to escape sudden exposure to hydrogen sulphide, which creates potential for immediate mass mortalities. The effects of long term exposure to disturbed heavy metals (zinc, lead, manganese and copper) during a prolonged dredging operation might not be evident at first. However, the impact on product failing heavy metal testing, after a 6 year growth cycle, is unrecoverable. | Prior to dredging, a sediment quality baseline assessment must be conducted and various chemicals of concern concentrations determined. The resultant data will advise the dredging contractor on areas of special concern and additional measures to limit suspension of sediments (particulate matter) must then be implemented in order to limit potential impacts. It should be noted that previous studies have indicated that the Namibian coastline has naturally high levels of some heavy metals, notably also cadmium. Elevated levels of such metals in organisms tested along the coast are thus not necessarily as a result of dredging.<br>Since hydrogen sulphide is potentially lethal to the dredging crew, real time hydrogen sulphide monitoring on the dredging vessel is conducted and dredging operations ceased immediately if it is detected. |

| **E-Mail Received: 05 April 2022**<br>**From: Miguel Calaca, General Manager: Operations Ohlthaver & List Group \| O&L Aquaculture [Hangana Abalone]**<br>**Comments by: Raymond Ferreira, Marine Plastics (Consultant)** | |
|---|---|
| **Comments** | **Response** |
| 4. Commercial expansion.<br>As you are well aware, the intent to expand to commercial level have already been submitted to your offices. This will create much needed employment and skills transfer in various sectors of the abalone and aquaculture industry but will also come at a major investment cost of several million NA dollars. We simply cannot afford an interruption in the production cycle, nor can we run the risk of exposure to heavy metal toxicity. We would therefore like to request feedback and clarity on the following concerns:<br>a) Paragraph 6.3 refers to a Sediment Disposal site located off-shore. Could you be more specific with regards to the exact location of such a site?<br>b) Once dredging commences what mitigating actions will be taken in response to sudden increases in mortality rates among marine fauna, in both the immediate harbour locality, Penguin and Seal Island, as well as Hangana Abalone stocks, ranched and cultured. | a) The disposal site is indicated in Figure 1-1 on page 2. It is situated 14 km southwest of the harbour and 7 km due west from the nearest shoreline.<br>b) Real time turbidity monitoring, and cessation of dredging if the turbidity threshold is reached, is aimed at preventing environmental conditions from deteriorating to such an extent that biodiversity loss due to high turbidity conditions realize. Should mortality in marine fauna be detected, dredging will cease immediately and the cause investigated. Dredging will only commence once it is safe to do so. This condition was added to section 12.1.14 based on your comments. |
| In conclusion:<br>Once again, we would like to express our gratitude for the opportunity offered to us to highlight our concerns for inclusion into your assessment. We understand that a No-Go alternative cannot be considered and therefore have to stress the importance of selecting the correct dredging method. We also trust that you can comprehend the very real threat this activity poses to our operations and that we will have to give our utmost assurances to the Olthaver and List Group with regards to the safe execution of said dredging operations. | Noted. Environmental protection is of utmost importance to Namport and will be stipulated in tender documents and contracts with dredging operators. Based on observations and monitoring during the previous dredging campaign it was evident that the suspension of sediments remained relatively localised at the site of dredging. We are also not aware of any complaints that were lodged regarding elevated turbidity and reduced water quality at sensitive receptors. |

## Appendix D Consultant's 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 160 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 | : | 21 |
| Nationality | : | Namibian |
| Position | : | Environmental Scientist |
| Specialisation | : | Environmental Toxicology |
| Languages | : | Afrikaans – speaking, reading, writing – excellent<br>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 (Environmental Assessment Practitioner)

**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: | +160 |
| Research Reports & Manuals: | 5 |
| Conference Presentations: | 1 |