DEVELOPMENT AND OPERATIONS OF A LIQUID MUD PLANT IN THE PORT OF WALVIS BAY

ENVIRONMENTAL MANAGEMENT PLAN

Prepared by:

Prepared for:

June 2024

Project:	**ENVIRONMENTAL MANAGEMENT PLAN FOR THE DEVELOPMENT AND OPERATIONS OF A LIQUID MUD PLANT IN THE PORT OF WALVIS BAY**	
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Report Approval	**André Faul** Conservation Ecologist	

I Victor Joseph acting as the Proponent's representative (Baker Hughes Energy Services Namibia (Pty) Ltd), hereby confirm that the project description contained in this report 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 _____ on the _____ day of _____ 2024

_____ _____

Baker Hughes Energy Services Namibia (Pty) Ltd Company Registration Number

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1 INTRODUCTION

Geo Pollution Technologies (Pty) Ltd was appointed by Baker Hughes (the Proponent) to prepare an environmental management plan for the development and operations of a liquid mud plant in the Port of Walvis Bay (Figure 1-1). The EMP will provide management options to ensure environmental impacts of the plant are minimised. The environment being defined in the Environmental Assessment Policy and Environmental Management Act as "land, water and air; all organic and inorganic matter and living organisms as well as biological diversity; the interacting natural systems that include components referred to in sub-paragraphs, the human environment insofar as it represents archaeological, aesthetic, cultural, historic, economic, paleontological or social values".

The EMP is thus a tool used to take pro-active action by addressing potential problems before they occur. This limits potential future corrective measures that may need to be implemented and allows for application of mitigation measures for unavoidable impacts.

The ECC renewal is required in compliance with Namibia's Environmental Management Act (Act No 7 of 2007).

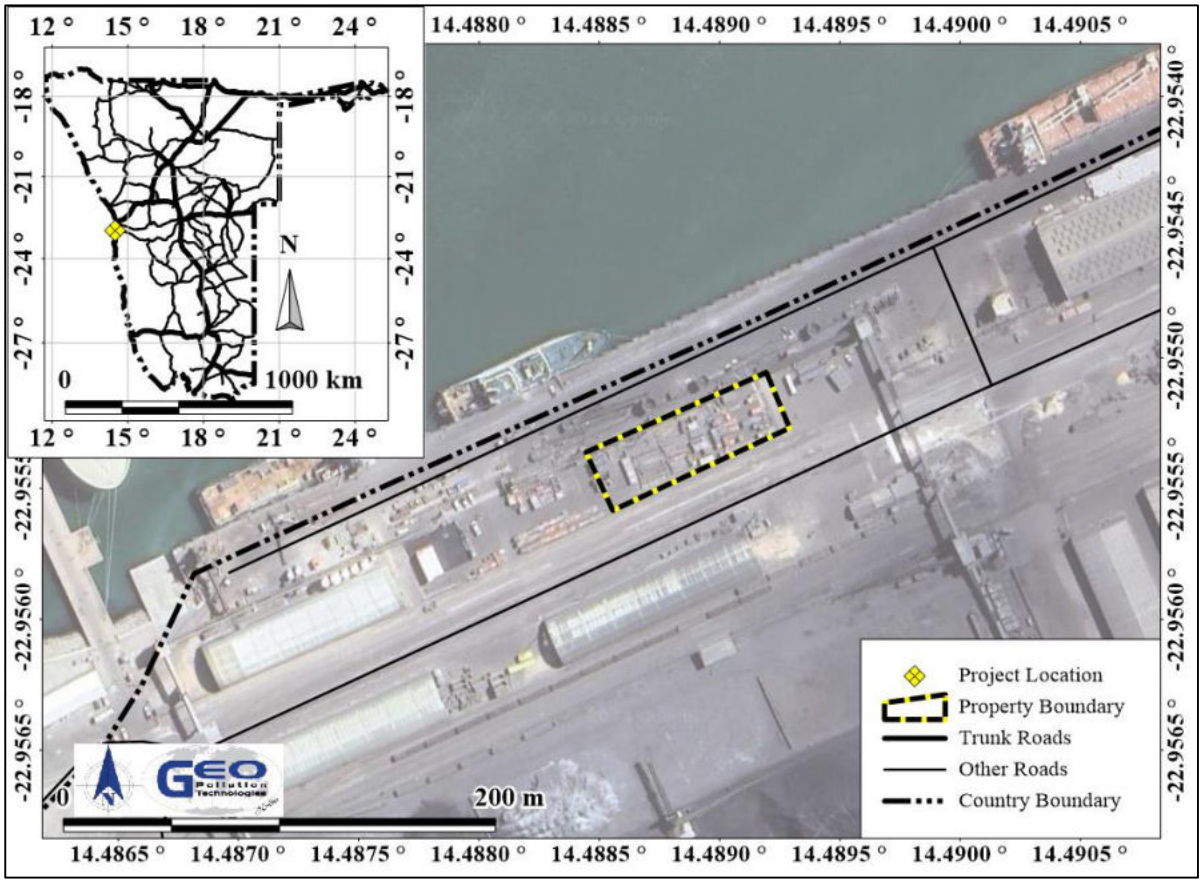


Figure 1-1 Project location

2 SCOPE

The scope of the EMP is to:

- Provide a brief overview of all components, and their operations, related to the liquid mud plant.
- Summarise the legal and regulatory framework within which the plant operates.
- Provide a brief overview of the environment, i.e. the physical, biological, social and economic conditions, potentially impacted by the plant.
- To identify and assess potential impacts of the plant on the environment.

- Identify a range of management actions which could mitigate the potential adverse impacts to acceptable levels.
- To provide sufficient information to the relevant competent authorities and the Ministry of Environment and Tourism to make informed decisions regarding the development.

3 METHODOLOGY

The following methods were used to prepare the EMP:

- Infrastructure and operational procedures were received from the Proponent and are described in the EMP.
- A legal register relevant the project was compiled.
- Baseline information about the site and its surroundings was obtained from existing secondary information and is described in the EMP.
- Potential environmental impacts were identified and preventative and mitigating measures recommended.

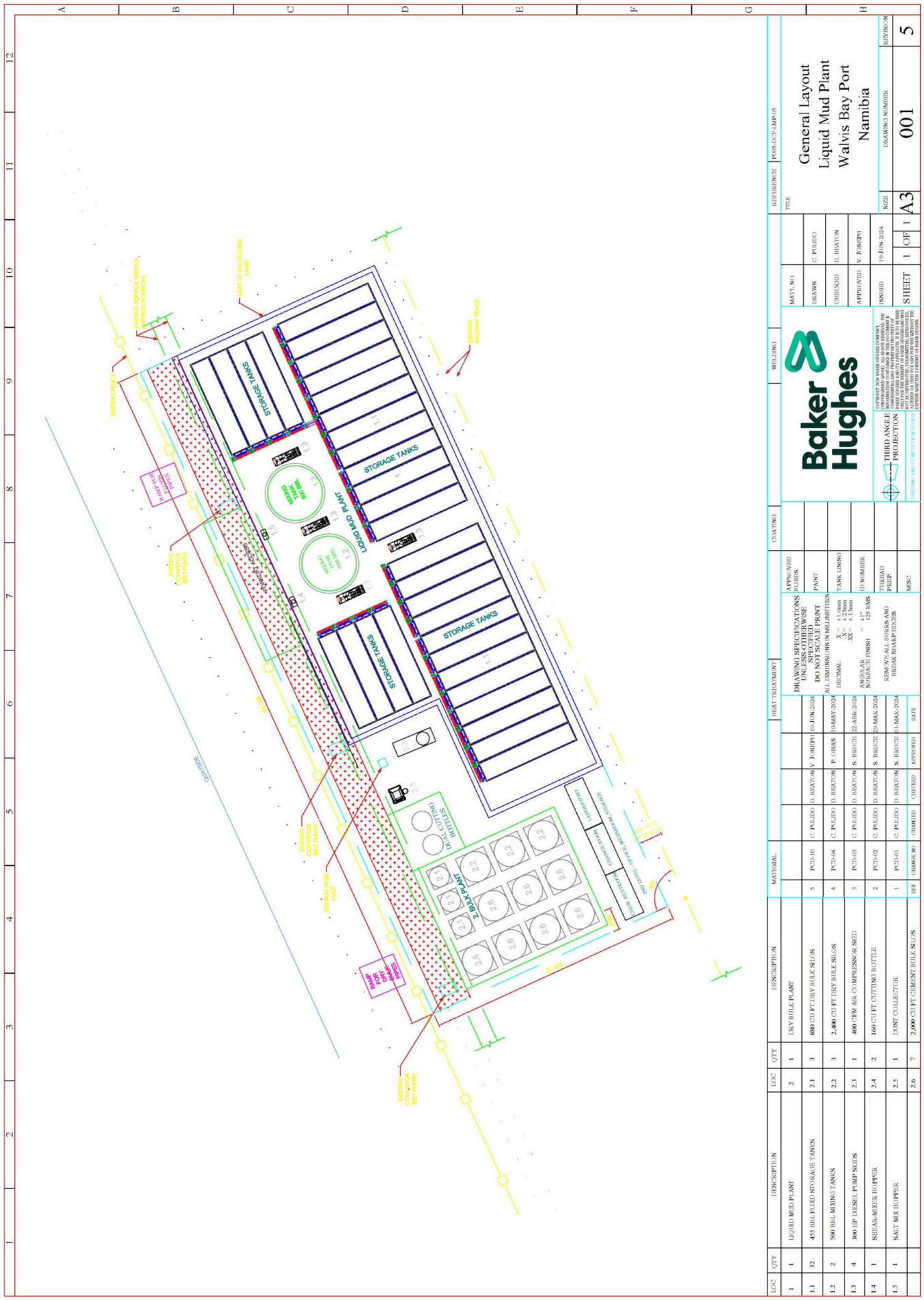
4 PROJECT DESCRIPTION

Baker Hughes is an oil field services company that provides products and services for oil well drilling, formation evaluation, completion, production and reservoir consulting. With the recent developments in offshore oil exploration in Namibia, Baker Hughes intends to develop and operate a liquid mud plant, dry bulk plant, and cement bulk plant within the commercial harbour of the Port of Walvis Bay. The purpose of which will be to mix, condition, store and transfer drilling and completion fluids for oil wells, and storage and transfer of dry bulk powders.

Drilling fluid (or drilling mud) is a viscous fluid used in oil and gas drilling activities to, among others, transport drill cuttings to the surface, stabilize the walls of the well, and lubricate and cool the drill bit. Completion fluid is a brine liquid circulated through a completed well to clear any remaining solids in the well, as part of the processing of preparing the well for production. Dry bulk powders can be products used to make drilling mud more dense or viscous, or it can be cement used to isolate, support and protect the casing inside a well.

Drilling fluid can either be water based or oil based mud and ultimately, the Proponent intends to produce both types at the project site. However, for purposes of initial operations of the Proponent, and thus for this EMP, only the production of water based drilling fluid is included. The project will thus be developed in two main phases: Phase 1 being the water based liquid mud plant, the completion fluids plant, and the dry bulk powders plant; and Phase 2 the oil based mud plant.

Section 4.1 to 4.14 provide an overview of the location, different components and operations of phase 1 of the development. The general layout of the plant is presented in Figure 4-1.



LOC	QTY	DESCRIPTION	LOC	QTY	DESCRIPTION	MATERIAL					HEAT TREATMENT		COATING
1	1	LIQUID MUD PLANT	2	1	DRY BULK PLANT							APPROVED PLIOTIS	
1.1	32	455 BBL FLUID STORAGE TANKS	2.1	3	880 CU FT DRY BULK SILOS	5	PCTD-10	C. PULIDO	D. BEATON	V. JOSEPH	15-JUN-2024	PAINT	
1.2	2	500 BBL MIXING TANKS	2.2	3	2,400 CU FT DRY BULK SILOS	4	PCTD-04	C. PULIDO	D. BEATON	P. CHIAS	10-MAY-2024	TANK LINING	
1.3	4	300 HP DIESEL PUMP SKIDS	2.3	1	400 CFM AIR COMPRESSOR SKID	3	PCTD-03	C. PULIDO	D. BEATON	S. BRUCE	22-ABR-2024	ID NUMBER	
1.4	1	SHEAR-MIXER HOPPER	2.4	2	160 CU FT CUTTING BOTTLE	2	PCTD-02	C. PULIDO	D. BEATON	S. BRUCE	20-MAR-2024	THREAD	
1.5	1	SALT MIX HOPPER	2.5	1	DUST COLLECTOR	1	PCTD-01	C. PULIDO	D. BEATON	S. BRUCE	11-MAR-2024	PIGTP	
			2.6	7	2,000 CU FT CEMENT BULK SILOS	REV	CHANGE NO	CHECKED	APPROVED	DATE		MISC	

DRAWING SPECIFICATIONS UNLESS OTHERWISE SPECIFIED
DO NOT SCALE PRINT
ALL DIMENSIONS IN MILLIMETERS
DECIMAL X = ±1.6mm XX = ±.25mm XXX = ±.13mm
ANGULAR = ±1°
SURFACE FINISH = 125 SMS
REMOVE ALL BURRS AND BREAK SHARP EDGES

REFERENCE P005-DCS-DMP-05
TITLE
DRAWN C. PULIDO
CHECKED D. BEATON
APPROVED V. JOSEPH
ISSUED 15-JUN-2024
SIZE A3
DRAWING NUMBER 001
REVISION 5

Figure 4-1 Site layout

4.1 LOCATION

The liquid mud plant will be located within the commercial harbour of the Port of Walvis Bay which is managed by the Namibian Ports Authority (Namport). It will be developed on berth 8 of the port which is located towards the western side, near the new container terminal. It will cover 2,712 m^2.

4.2 INFRASTRUCTURE

4.2.1 Liquid Mud Plant

The liquid mud plant will have combined storage capacity for 2,384.74 m^3 of water based drilling fluids and completion fluids. Storage will be in carbon steel, atmospheric, horizontal tanks (Photo 4-1). Two atmospheric, metallic vertical fluid mixing tanks of 79.49 m^3 each will be present for the mixing of the fluids (Photo 4-2). Together with the tanks, chemical mixing hoppers (Photo 4-3), diesel driven centrifugal pumps (Photo 4-4) and a reticulation network make up the main components of the liquid mud plant. The entire plant will be located in a bund with an impermeable membrane placed over geotextile on the existing interlocking paving on berth 8. The bund will have a volume of at least 110% of the largest tank within the bund area. Areas in the bund with human traffic will be covered by heavy duty track mats to prevent damage to the impermeable membrane.

Photo 4-1 Drilling and completion fluid storage tanks

Photo 4-2 Fluid mixing tank

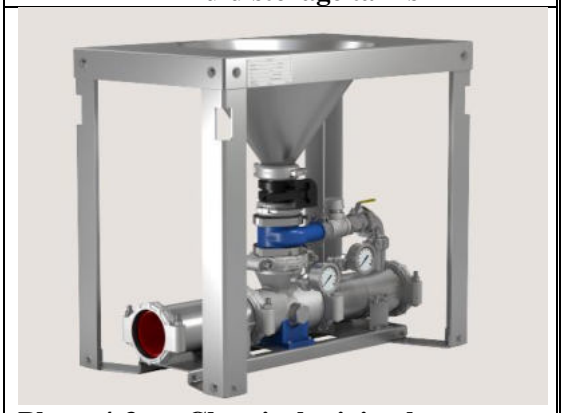


Photo 4-3 Chemical mixing hopper

Photo 4-4 Diesel driven centrifugal pump

4.2.2 Dry Bulk Storage

The dry bulk storage will cover approximately 400 m^2. The dry bulk plant for storage of products such as barite, bentonite and calcite.

The dry bulk plant will have three silos of 24.92 m^3 and three silos of 67.96 m^3 each for a total volume of 278.64 m^3. A cutting silo will also be present and will be used to open and

empty bulk bags of dry bulk products and pumping it to their respective storage silos. Each silo will be connected to a bag filter system that traps any dust contained in the air existing the silos as they are filled. The dust trapped in the filters will be collected and returned to the silos so that no product is wasted.

An air compressor with 2 m^3 air storage tank and 12.3 bar operating pressure will be used to provide pressure to transport bulk dry products (pneumatic transport) through a network of pipes (pneumatic transport) to their respective silos as well as from silos to platform supply vessels, trucks or the liquid mud plant. All reticulation will meet the required pressure specifications and the entire system will be fitted, among others, with pressure gauges and pressure release valves at critical points.

Silos will be fitted with an electronic weight measuring system in order to determine the amount of product added or removed from the silos. All silos and the cutting table are electrically grounded to discharge any static electricity or lightning strikes. Bulk powder transport pipes have access points at strategic points such as curves or pressure drop points to allow for unclogging of the pipes if required.

An emergency shower and eyewash station will be placed next to the cutting table. Fire extinguishers will be placed at critical locations throughout the dry bulk storage area, such as at the compressors. Drip trays will also be placed under compressors and their motors for containment of any lubricating oil spills. Emergency lighting will be present in case of power failures.

4.2.3 Cement Bulk Plant

The cement bulk plant used for dry bulk cement storage will consist of two silos of 62.3 m^3 each, two silos of 42.5 m^3 each, three silos of 39.6 m^3 each, two small multi-purpose silos of 12.75 m^3 each, one of cutting bottle of 6 m^3 and one of dust collector of 2 m^3 with a total volume of 365 m^3. The cutting bottle will be used to empty 1.5 ton bulk bags of dry bulk cement product. As each of cement bags weights 1.5 tons, the cutting bottle will be filled with five bags at a time and after which it will be pneumatically transported to the respective storage silos. One dust collector will be connected to all the silos and will function as filter system that traps any dust contained in the air existing the silos as they are filled. The dust trapped in the filters will be collected and returned to the silos so that no product is wasted.

Pneumatic transport of cement, safety features, emergency equipment, etc. will all be in place exactly the same as for the dry bulk storage section.

MSDS is provided and placed in front of every silo along with a stand board or plate to state the contents of the silo (e.g. 50T G Cement or Zero Ton (empty)). This allows all operational personnel to know the exact contents of each silo.

4.3 OPERATIONS

4.3.1 Liquid Mud Plant

Drilling and completion fluids are comprised of three main phases: 1) The liquid phase of fluid is referred to as the continuous phase. It also makes up the largest part of the fluid. For water based fluid, the continuous phase is potable water to which the active solids phase is added; 2) The active solids phase are solid materials added to the continuous phase which react with each other and with the continuous phase, thus altering the physicochemical properties of the fluid. Active solids phase components include viscosifiers such as bentonite, pH controllers such as lime or caustic soda, refiners, filtrate reducers and emulsifiers; 3) The inert solids phase are solids that do not react chemically with the continuous or solids phases, but changes the physical and technological characteristics of the fluid. This include weighting agents which increases the density of the fluid (e.g. barite or calcite) and loss circulation materials that prevent fluid loss during drilling in permeable substrate (e.g. micas or cellulose fibres).

The exact composition and characteristics of the fluid to be mixed varies according to the characteristics of the geological formations where drilling occurs, and is specified by the drilling and completion fluids technical team. It is the responsibility of the fluid engineer to combine the appropriate volumes and types of active and inert solids to the continuous phase (water) to meet the required specifications. Figure 4-2 provides an overview of the liquid mud plant operations.

All active and inert solid phase products, required for the preparation of water based fluids, will be ordered from local suppliers at the time when they are required. Potable water will be supplied by Namport via the internal potable water reticulation network as obtained from NamWater. Once an order for drilling or completion fluid is received, the fluid engineer determines the required products and their volumes and a mixing recipe for the fluid is prepared. These products will be received in various types and sizes of packaging, ranging from 25 kg bags to 1,500 kg bulk bags and 20 litre drums to 8,000 litre bulk tanks. A warehouse in the vicinity of berth 8, in an area provided by Namport, will store chemicals, and by only receiving the products at the time they will be used, negates the need for additional permanent storage space at the liquid mud plant itself.

Active and inert solids will be received by truck and offloaded on berth 8. The products will remain packed and on wooden pallets, with a plastic cover or stretch film for protection against moisture, for the short period until they are used (See section 4.3.2 for operations related to bulk dry chemicals.) For fluid production, water will be pumped to the mixing tank and active and inert solids added either directly to the mixing tank or via the chemical mixing hopper. Throughout this process the fluid mixture will be circulated through the same tank. Once the fluid is ready, a sample will be taken for testing to determine if it meets the requirements as specified by the drilling and completion fluid technical team. If it does not meet the requirements, it will be adjusted until it meets the requirements. It is then pumped to the fluid storage tanks for temporary storage until it can be pumped to the platform supply vessel’s tank for transport to the drilling rig. Storage tanks will be vented to allow for the escape of any vapour generated through evaporation inside the tanks.

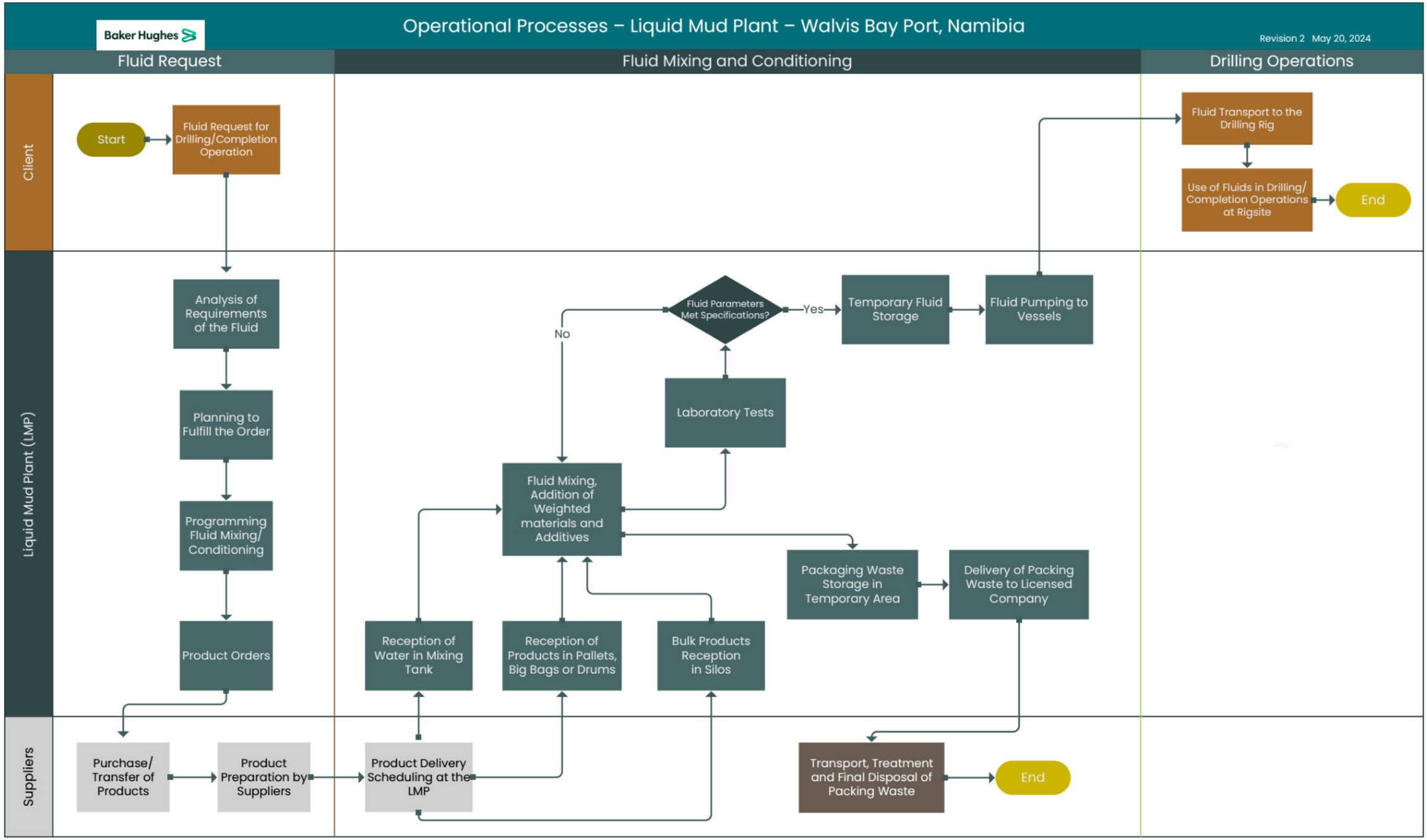


Figure 4-2 Water based liquid mud plant operational process

4.3.2 Dry Bulk Storage

Dry bulk products will be received as bulk cargo in bulk trucks or in bulk bags of 1,000 to 1,500 kg. From bulk trucks the products will be pneumatically transferred directly to the storage silos. Bulk bags will arrive on trucks and will be offloaded using forklift. The bag will be lifted above the cutting silo and emptied into the silo via a hopper. When complete, the cutting silo will be closed, pressurised and the material pneumatically transferred to the storage silos.

The dry bulk products remain in the silos until they are needed in the liquid mud plant or at the drill rig. Silos will then be pressurised and the product pneumatically pumped to the platform support vessel or the liquid mud plant.

Silos will periodically be inspected, maintained and cleaned and access will be via manholes on the tanks.

Photo 4-5 Dry bulk powder silos

4.4 TANK AND PIPELINE CLEANING

During normal operations of the plant, and particularly if the composition of the fluids change, cleaning of tanks and pipelines will be required. The configuration of the plant is however planned in such a way that it can mix the different fluids in independent, separate systems. A specialized company will be contracted for tank and pipeline cleaning and all waste will be discarded at an approved waste disposal facility through the contractor.

4.5 SAFETY

Strict protocols will be in place to ensure the protection of workers' and nearby receptors' health and safety. Access to the production area will be controlled. Warning signs and signage will indicate the risk areas as well as the need to use personal protective equipment (PPE), access restrictions, no smoking, indications of electrical hazards, etc. It will be the responsibility of the plant supervisor to ensure that only authorized personnel enter the premises, as well as to keep escape routes clear and visible. PPE will include safety hats, goggles, and boots; rubber gloves (Neoprene) long shaft or equivalent; gas masks with an activated carbon filter when necessary; neoprene apron or similar or disposable protective coveralls; and hearing protectors when near motors and compressors. Engine noise monitoring will be carried out annually during occupational health and hygiene measurements.

Any spilled products will be dealt with immediately using the spill cleaning kits, including absorbent material (saw dust, clay, etc.), on site. Cleaning tools (shovels, wheelbarrows, etc.) as well as containers to pack the collected material for correct treatment and final disposal, by a contracted company, will also be on site.

Other safety and environmental control equipment include:

- Tank level indicators
- Pressure release valves
- Emergency eyewash and shower station
- Safety signs
- Guardrail and belt arrest falls on tank ladders
- Spill cleaning kits
- Fire extinguishers (CO_2 and dry chemical powder)
- Safety cables on all hoses
- Hoses certified annually by hydrostatic test
- Certified pressure gauges in fluid lines
- Grounding of all tanks and equipment
- Restricting access to critical plant parts
- Em,egency lights
- Colour coding of pipes
- Marking and identification of all pipes
- Protection for moving parts of equipment.
- Operations manuals.
- Emergency plans
- Safety information of the products handled (MSDS, packaging).

4.6 LIQUID EFFLUENTS AND LIQUID WASTE MANAGEMENT

A modified container on site will act as ablution facility and sanitary waste will be collected and disposed of by a third party licensed contractor. Industrial liquid waste will not be produced actively at the facility and any spills or rainwater that may accumulate in the bund area will be re-used in the fluid production process. Should any liquid waste be produced that requires disposal, it will be disposed of by a reputable waste handling contractor for safe disposal at an appropriate waste disposal facility.

4.7 SOLID WASTE

Packaging and containment material will be the main type of waste produced. Differentiation can be made between contaminated and uncontaminated solid waste. Contaminated drums will be returned to the Proponent's distribution centre or disposed of at an approved hazardous waste disposal facility or recycler. Empty bags that cannot be re-used will also be disposed of at an approved waste disposal facility or recycler. Uncontaminated and general waste will be disposed of at the municipal waste disposal facility for general waste.

All waste will be contained and temporarily stored until it can be collected by a third party contractor for appropriate handling and disposal.

4.8 ATMOSPHERIC EMISSIONS

The main expected sources of air emissions will be:

- Solid particles during emptying of bulk dry powders such as barite and bentonite into the cutting silo. Emission will be minimized by associating all silos and pipes with a bag filter. The cutting silo will also be installed inside a cutting house, built on a metal support structure with a roof and walls in galvanized sheets, reducing the action of the wind on suspended particles.
- Dust during the emptying of bags in the hopper of the fluid mixing system. To control this source of emission, a chemical hopper will be used for the fluid mixing system. The hopper operation is based on a venturi system that generates strong suction of the material, reducing

emissions to a minimum. Chemical hoppers will also be installed in well-ventilated areas and employees will constantly wear dust masks as part of their PPE.
- Greenhouse gas emissions of exhaust gases from forklifts and diesel engines.

4.9 NOISE CONTROL
The main continuous sources of noise during plant operations will be forklifts, generators, compressors, diesel driven pumps and trucks in the vicinity of the plant (receiving materials). The evaluation of the effect of noise on employees will be carried out while the plant is in operation.

4.10 FIRE FIGHTING SYSTEM
An emergency fire prevention and response plan will be implemented for the facility. It will be drafted taking cognisance of the emergency plan of Namport. The firefighting measures will be developed and adapted to the characteristics of the location, including as a minimum:

- Emergency plan.
- Portable fire extinguishers.
- Alarm systems and detectors.
- Safety warnings.
- Inspection and monitoring system.
- Emergency lights.

Portable fire extinguishers will be strategically positioned throughout the plant area, as directed by the Baker Hughes health, safety and environment (HSE) department.

Fire extinguishers will be inspected by the plant operator before each operation. At least once a month the fire extinguishers will be inspected by the HSE technician or the rental Supervisor. This monthly inspection will be recorded on the body of the extinguishers. All fire extinguishers will be refilled and certified by an accredited company.

4.11 LIGHTNING PROTECTION SYSTEM
The design and execution of the lightning protection system will be by a qualified company, including the electrical grounding mesh system of the tanks, silos and plant components. Before going into operation, the system will be certified by a qualified professional.

4.12 ELECTRICAL INSTALLATIONS
The main equipment of the fluid and bulk plants, such as pumps and compressors, were designed to be driven by electric motors. A total of approximately 166.4 kW of installed capacity and 207.9 kVA are estimated. Electricity will be supplied through a direct contract with Namport. In addition, the plant will have a 500 kVA diesel standby generator.

4.13 OFFICE AND LABORATORY
The plant will have the following office and laboratory resources:

- One 6 m container adapted for office space
- One 6 m container adapted to a fully equipped laboratory for drilling and completion fluid testing
- One 6 m refectory container
- One 6 m chemical restroom container
- One 6 m container for spare parts and tool storage
- One 6 m ablution container

4.14 EMPLOYMENT
The operation of the plant will be carried out by a team composed of approximately twelve employees (one supervisor and four plant operators per shift), but this may vary based on the volume of services required. Operations will be from Monday to Sunday, 24 hours a day in 12-hour shifts. This will however also vary according to production needs and will likely not require 24 hour operations.

5 ADMINISTRATIVE, LEGAL AND POLICY REQUIREMENTS

To protect the environment and achieve sustainable development, all projects, plans, programmes and policies deemed to have adverse impacts on the environment require an environmental assessment, as per the Namibian legislation. The legislation and standards provided Table 5-1 to Table 5-2 govern the environmental assessment process in Namibia and/or are relevant to the facility.

Table 5-1 Namibian law applicable to the facility and related operations

Law	Key Aspects
The Namibian Constitution	♦ Promote the welfare of people ♦ Incorporates a high level of environmental protection ♦ Incorporates international agreements as part of Namibian law
Environmental Management Act Act No. 7 of 2007, Government Notice No. 232 of 2007	♦ Defines the environment ♦ Promote sustainable management of the environment and the use of natural resources ♦ Provide a process of assessment and control of activities with possible significant effects on the environment
Environmental Management Act Regulations Government Notice No. 28-30 of 2012	♦ Commencement of the Environmental Management Act ♦ List activities that requires an environmental clearance certificate ♦ Provide Environmental Impact Assessment Regulations
Namibia Ports Authority Act Act No. 2 of 1994	♦ Provides for the establishment of the Namibian Ports Authority to undertake the management and control of ports ♦ Outlines the functions of the Namibian Ports Authority among which is the protection of the environment
Marine Resources Act Act No. 27 of 2000	♦ Provides for the conservation of the marine ecosystem and the responsible administration, conservation, protection and promotion of marine resources on a sustainable basis
Water Resources Management Act Act No. 11 of 2013	♦ Provides for management, protection, development, use and conservation of water resources ♦ Prevention of water pollution and assignment of liability
Local Authorities Act Act No. 23 of 1992, Government Notice No. 116 of 1992	♦ Define the powers, duties and functions of local authority councils ♦ Regulates discharges into sewers
Public and Environmental Health Act Act No. 1 of 2015, Government Notice No. 86 of 2015	♦ Provides a framework for a structured more uniform public and environmental health system, and for incidental matters ♦ Deals with Integrated Waste Management including waste collection disposal and recycling; waste generation and storage; and sanitation
Petroleum Products and Energy Act Act No. 13 of 1990, Government Notice No. 45 of 1990	♦ Regulates petroleum industry ♦ Makes provision for impact assessment ♦ Petroleum Products Regulations (Government Notice No. 155 of 2000) ♦ Prescribes South African National Standards (SANS) or equivalents for construction, operation and decommissioning of petroleum facilities (refer to Government Notice No. 21 of 2002)

Law	Key Aspects
Labour Act Act No 11 of 2007, Government Notice No. 236 of 2007	♦ Provides for Labour Law and the protection and safety of employees ♦ Labour Act, 1992: Regulations relating to the health and safety of employees at work (Government Notice No. 156 of 1997)
Atmospheric Pollution Prevention Ordinance Ordinance No. 11 of 1976	♦ Governs the control of noxious or offensive gases ♦ Prohibits scheduled process without a registration certificate in a controlled area ♦ Requires best practical means for preventing or reducing the escape into the atmosphere of noxious or offensive gases produced by the scheduled process
Hazardous Substances Ordinance Ordinance No. 14 of 1974	♦ Applies to the manufacture, sale, use, disposal and dumping of hazardous substances as well as their import and export ♦ Aims to prevent hazardous substances from causing injury, ill-health or the death of human beings
Pollution Control and Waste Management Bill (draft document)	♦ Not in force yet ♦ Provides for prevention and control of pollution and waste ♦ Provides for procedures to be followed for licence applications
Foreign Investment Act 27 of 1990 (as amended by Foreign Investment Amendment Act 24 of 1993)	♦ Provides for the promotion of foreign investment in Namibia ♦ Considers environmental impacts associated with foreign investments.
Draft Wetland Policy of 2003	♦ Considering the proximity of the Walvis Bay Lagoon, a RAMSAR site, the Wetland Policy of 2003 is of importance and includes protection and conservation of wetlands and ecosystems.
National Marine Pollution Contingency Plan of 2017	♦ Coordinated and integrated national system for dealing with oil and other spills in Namibian waters.
Namport Safety, Health, Environment and Quality Policy	♦ Provides guidance to all members responsible for managing Safety, Health, Environment and Quality related aspects. ♦ Ensures compliance with all applicable legal SHEQ and related requirements.

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

Municipal By-laws, Guidelines or Regulations	Key Aspects
Integrated Urban Spatial Development Framework for Walvis Bay	♦ Overall vision to transform Walvis Bay to being the primary industrial city in Namibia ♦ Aims to ensure that appropriate levels of environmental management is enforced for all developments in Walvis Bay
Integrated Environmental Policy of Walvis Bay (Agenda 21 Project)	♦ Indicates the directions that the Municipality of Walvis Bay will move towards in the forthcoming years to fulfil its responsibilities to manage the environment of Walvis Bay together with the town's residents and institutions ♦ Strong focus on conservation and protection of environment
Municipal By-law 19 and 20 on Effluents Entering Sewers	♦ Regulates the discharge of effluent into sewers and prohibits the introduction of certain wastes or products including steam into the sewers system.

Town Planning Scheme No. 35	♦ Manages and regulates development related to land use ♦ Proposes and identifies areas for specific future land use

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

Agreement	Key Aspects
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."
Convention on Biological Diversity (CBD)	♦ Primary goal is the conservation of biodiversity ♦ Prescribes the precautionary principle ♦ Parties to the convention are obliged to: ♦ Establish a network of protected areas; o Create buffer areas adjacent to these protected areas using environmentally sound and o sustainable development practices; and o Rehabilitate degraded habitats and populations of species.
The Convention on Wetlands of International Importance especially as Waterfowl Habitat (referred as the RAMSAR Convention)	♦ It is a framework for international cooperation in the conservation and wise use of wetlands and their resources. ♦ Recognizes the Walvis Bay Nature Reserve – a tidal lagoon consisting of Pelican Point, adjacent intertidal areas, sandbars serving as roosting sites and mudflats exposed during low tide (12,600 ha) as a Wetland of International Importance.
UN Convention for the Prevention of Marine Pollution from Land-based Sources	♦ Concerns itself with the protection of marine fauna and flora by preventing marine pollution from land-based sources. ♦ Contracted parties, are committed to take all possible steps to prevent pollution of the sea as well as the direct or indirect introduction of substances or energy by humans into the marine environment resulting in such adverse effects as harm to living resources and to marine ecosystems, hazards to human health, damage to services/ facilities or interference with other legitimate uses of the area.
International Convention on Oil Pollution Preparedness, Response and Cooperation of 1990	♦ International maritime convention establishing measures for dealing with marine oil pollution incidents nationally and in co-operation with other countries.
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 ♦ Provides an overarching legal framework for all marine-related programmes in West, Central and Southern Africa.
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

6 THE RECEIVING ENVIRONMENT

For purposes of this EMP a detailed environmental description is not provided. However, this section briefly summarises the most important environmental characteristics of the study area, as well as a short statement on the potential impacts/implications of the port operations on each.

6.1 LOCALITY AND SURROUNDING LAND USE

The commercial harbour of the Port of Walvis Bay is situated centrally on the west coast of Namibia. The port town of Walvis Bay is the biggest coastal town of Namibia and originated around the harbour. The harbour holds its value due to the natural deep waters of the bay, protected by the Pelican Point sand spit. Walvis Bay was originally established as mainly a fishing and port town and these two industries remain the main driving force behind the town's economy. The port is surrounded by a variety of land uses including residential, business and industrial. The port itself, and therefore the area where the Proponent will be located, is zoned for harbour and railway use and surrounding port users constitute similar industries.

Of specific importance near the harbour are the Walvis Bay Lagoon, the salt works and the southern part of the bay west of the lagoon, which are the key components of a 12,600 ha Ramsar site (Wetland of International Importance). On land, Walvis Bay is further mostly surrounded by the Dorob National Park which falls under the management of the Ministry of Environment, Forestry and Tourism (Figure 1-1).

Implications and Impacts

On its land side, the port is surrounded by residential, commercial and industrial properties. Noise emanating from the Proponent's activities may negatively impact on residents directly neighbouring the port. In addition, development and operations of the port may lead to increased traffic impacts.

The Proponent will operate near a sensitive environment, the Walvis Bay Lagoon (RAMSAR Site) and environmental consideration should take its sensitivity into account.

6.2 CLIMATE

Namibia's climate is dominated by dry conditions for most of the year and particularly so in the west. The location of Namibia with respect to the Intertropical Convergence Zone, Subtropical High Pressure Zone and Temperate Zone is what determines the climate, with the Subtropical High Pressure Zone being the major contributor to the dry conditions (Atlas of Namibia Project, 2002; Bryant, 2010), see Figure 6-1.

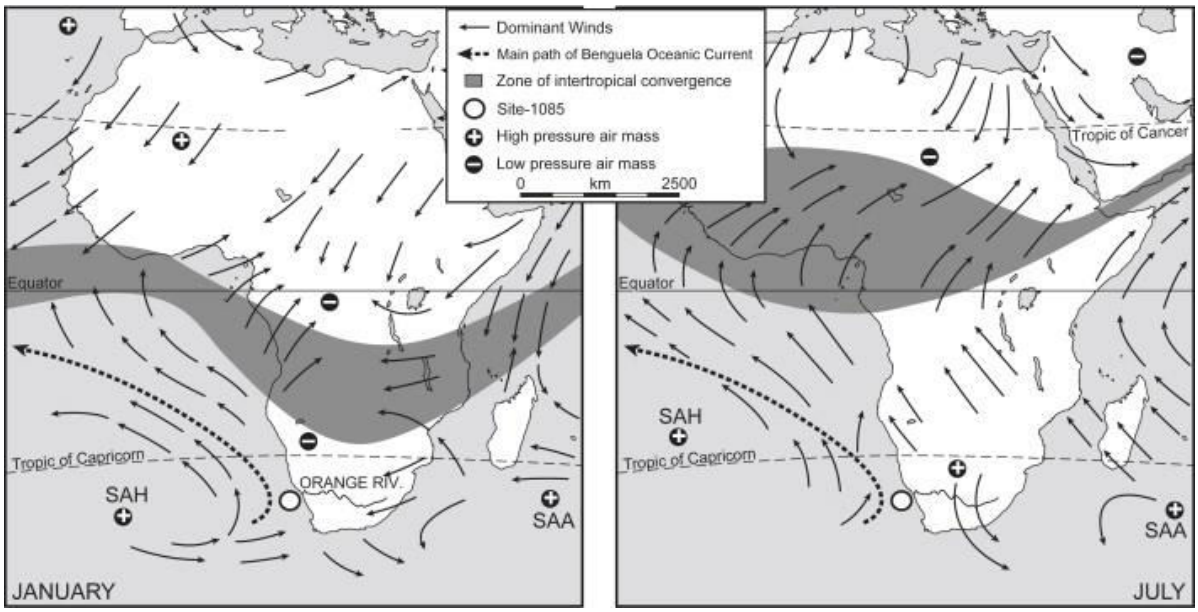


Figure 6-1 Map indicating the Intertropical Convergence Zone, Subtropical High Pressure Zone (SAH+), Benguela Current and Temperate Zone south of Tropic of Capricorn (not indicated) (from: http://www.meteoweb.eu)

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.

Studies indicate the presence of a thermal inversion layer at Walvis Bay. Originally this was thought to be at approximately 500 mamsl (Taljaard and Schumann 1940), but recent studies indicate it as low as 200 mamsl (Patricola and Chang, 2017; Corbett, 2018). A marine atmospheric boundary layer (MBL) exists offshore of the coastline that thins from more than 500 mamsl to 200 mamsl as it nears the coast (Figure 6-2). The MBL is a layer of cool, well-mixed, stable air that is capped by a thermal inversion (Patricola and Chang, 2016; Corbett 2018). This thermal layer or inversion layer will prevent the escape of pollutants such as smoke higher into the atmosphere. The MBL however contribute to high velocity wind speeds by funnelling the winds created by the SAH, resulting in what is referred to as the Benguela Low-Level Coastal Jet (Figure 6-2). Since the MBL overlap partially with the coastal plain, the wind generated by the Benguela Low-Level Coastal Jet also reaches inland, but diminishes relatively quickly further inland.

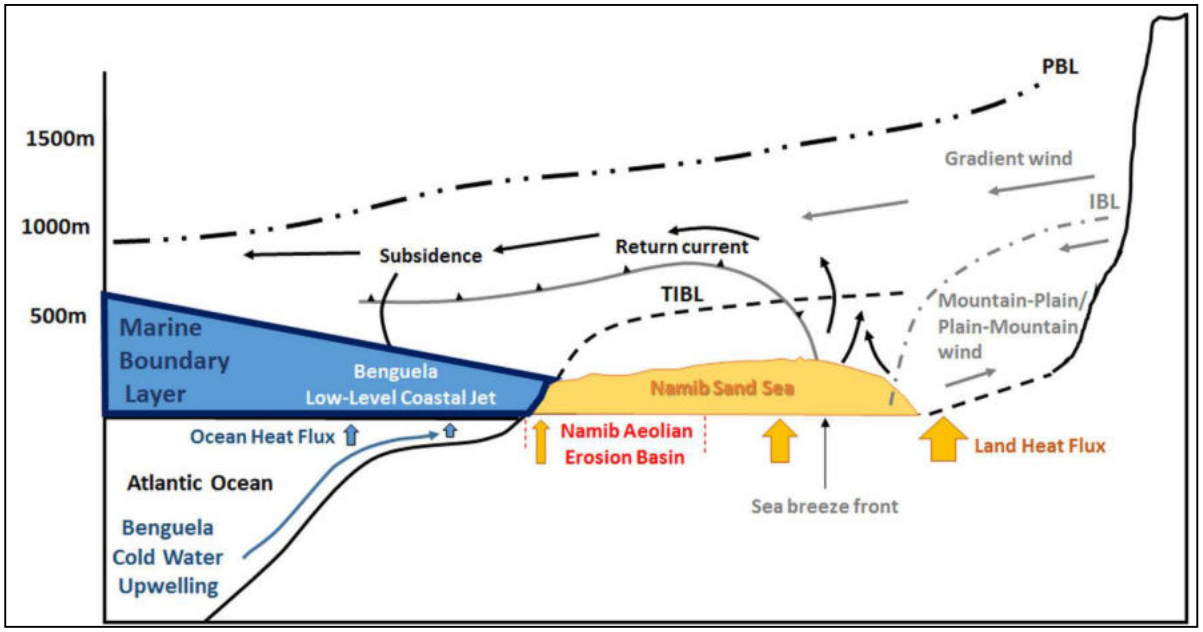


Figure 6-2 Marine atmospheric boundary layer (from: Corbett, 2018)

On a more localised scale, the climatic conditions on the central Namibian coast, and inland thereof (coastal plains), are strongly influenced by the cold Benguela Current, the SAH and the relatively flat coastal plains that are separated from the central highlands by a steep escarpment.

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

reduced wind speeds. The more low speed, westerly winds are for example experienced at the Walvis Bay Airport (Rooikop).

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

Throughout the year the prevailing night time regional wind is a weak easterly wind. This results when the mainland cools 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. Wind within the MBL remains dominated by the Benguela Low-Level Coastal Jet, causing a localised southerly wind over Walvis Bay, see Figure 6-2.

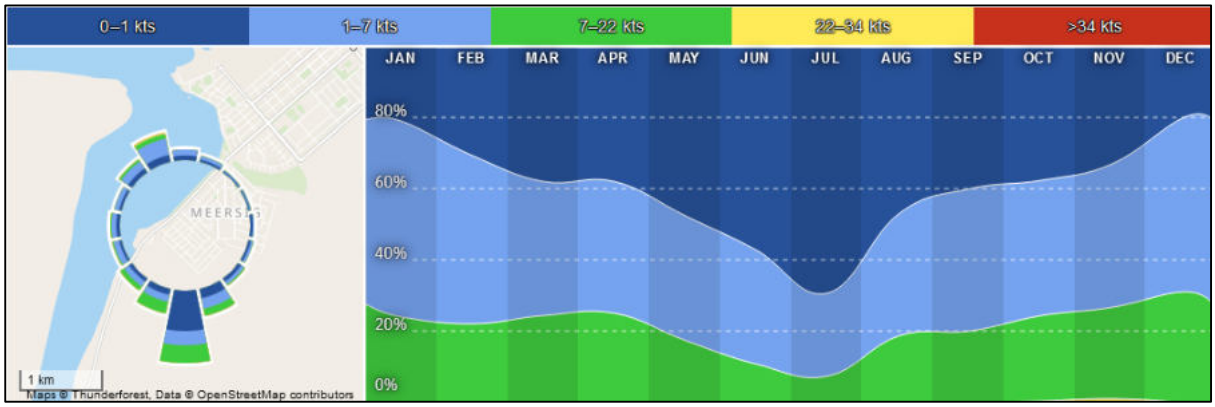


Figure 6-3 Wind direction and strength at the Walvis Bay Lagoon as measured between 2013 and 2024 (https://www.windfinder.com/windstatistics/walvis_bay_lagoon)

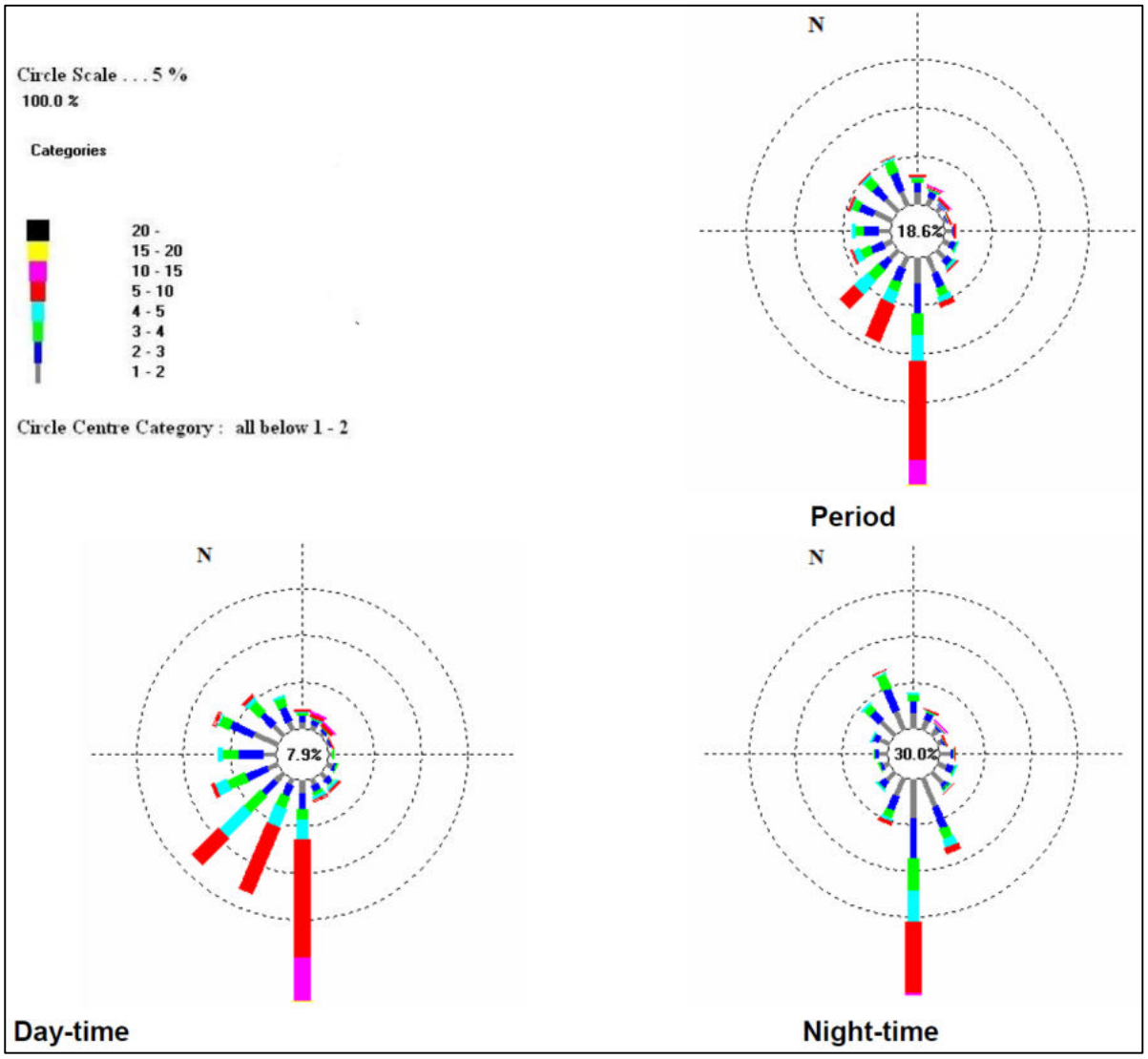


Figure 6-4 Period, daytime and night-time wind roses for Walvis Bay town for the period 2006 (Petzer, G. & von Gruenewaldt, R., 2008)

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

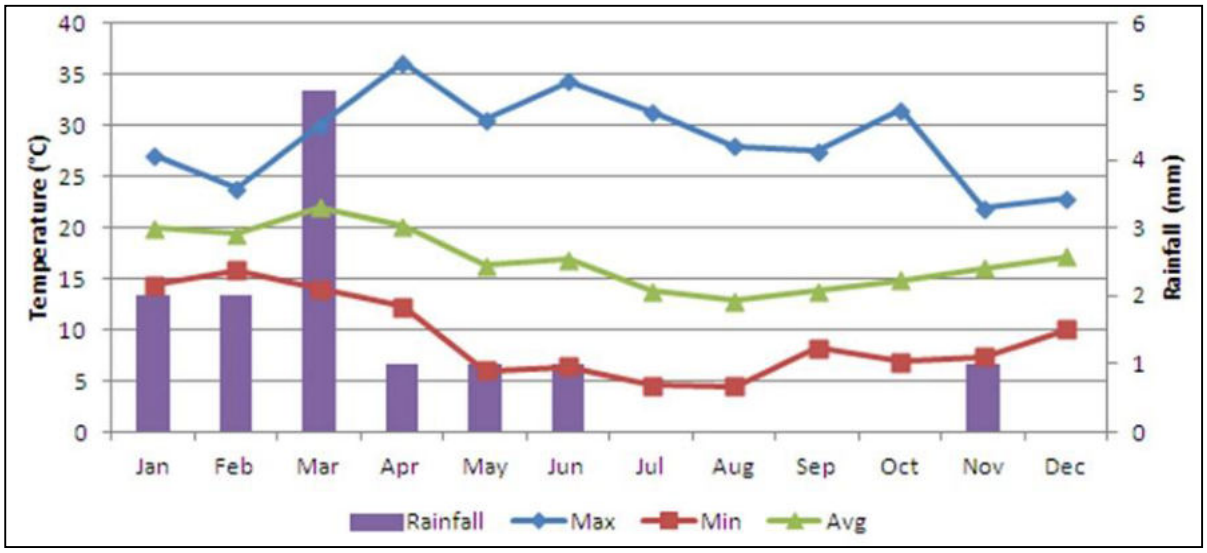


Figure 6-5 Temperature and rainfall at Walvis Bay (from: uMoya-NILU, 2020)

As explained above, the SAH severely limits the amount of rainfall over Namibia and especially at the coast and over the Namib Desert. As such, the average annual rainfall in Walvis Bay is below 50 mm (Figure 6-5), with 100% variation in annual rainfall. Infrequent, heavy rainfall does occur and typically results in rather chaotic conditions as Walvis Bay, and other coastal towns, has not been developed to cater for large volumes of storm water. Fog plays a very significant role as source of water for many plants and animals along Namibia's coast and the Namib Desert. Walvis Bay has up to 900 hours of fog per year and it results from the cold Benguela water cooling the humid air above it to such a temperature that the water vapour condenses to form fog and low level clouds (Mendelsohn et al., 2002).

Implications and Impacts

Due to the ability of the strong winds to carry dust to sensitive receptors, wind is an important factor to be considered for the Proponent's operations. Wind is predominantly a strong south-westerly wind with occasional northerly winds. This means dust pollution originating at the Proponent will normally be carried northeast, away from receptors such as surrounding neighbours, but towards the ocean and to vessels that may be berthed nearby. During east winds, contaminants carried by wind will travel towards the new container terminal and the lagoon entrance.

In terms of climate change and sea level rise, the port should be safe in the short to medium term future.

6.3 CORROSION ENVIRONMENT

The Namibian coastline is well known for being a very corrosive environment, which may be attributed to the frequent occurrence of salt-laden fog, periodic winds and abundance of aggressive salts (dominantly sodium chloride and sulphates) in the soil. The periodic release of hydrogen sulphide (H_2S) from the ocean is also expected to contribute to corrosion potential. Figure 6-6 presents corrosion comparison data for a number of locations in southern Africa, including Walvis Bay. The combination of high moisture and salt content of the surface soil can lead to rapid deterioration of metal and concrete structures.

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

Implications and Impacts

Chemical weathering of metal and concrete structures is a concern. Due to the extreme corrosive environment the choice of building materials is important and regular maintenance is essential to maintain the integrity of all infrastructure.

6.4 FAUNA OF THE BAY

6.4.1 Birds

Walvis Bay falls within Important Bird Area (IBA) NA014 and NA013 (http://datazone.birdlife.org; Simmons et al. 1999). Important Bird Area NA014 can be regarded as the most important coastal wetland area in southern Africa. Of note is the Walvis Bay Lagoon, the salt works and the southern part of the bay west of the lagoon, which are the key components of the 12,600 ha RAMSAR site (Wetland of International Importance. It is important both as an over-wintering area for Palaearctic migrant wader species as well as for African species such as Greater and Lesser Flamingos, Great White Pelican and Chestnut-Banded Plovers. The sewerage ponds, situated about 3 km southeast of the study area, are regarded as sensitive artificial wetland. Although a manmade fresh water source, it is an attraction for pelicans and flamingos. The artificial wetland also support 53% of the duck and geese population in the area. The wetland is formed by the constant inflow of semi-purified water and supports extensive stands of reeds. There are flight paths for birds between the sewerage ponds, the lagoon and the offshore bird breeding platform (Ghwano Island) north northeast of the harbour.

Important Bird Area NA013 consist of the coastal area between Walvis Bay and Swakopmund, and is approximately 30 km long and 700 m wide. Bird counts on this exceed 13,000 shorebirds of approximately 31 species, most of which are Palearctic migrants. IBA NAO13 is not only the richest shoreline in terms of shorebird density anywhere in southern Africa, but also supports the densest colony of breeding Damara Terns known (Scott & Scott 2013). Important in this area is the guano platform, or bird island, that provides roosting and breeding sites to large numbers of birds.

Implications and Impacts

The aforementioned areas surrounding the harbour are important bird breeding and bird feeding grounds. Pollution events, specifically oil spills, can have serious negative effects on species like the

Bank Cormorant. Bright lights used at night, such as leading lights, has the potential of disorientating birds like flamingos that fly at night. This may lead to collisions with man-made structures.

6.4.2 Marine Animals

The marine mammals occurring at various times in the Walvis Bay area are cetaceans: Common Bottlenose Dolphins, the Namibian endemic Heaveside's Dolphins, Dusky Dolphins, Humpback Whales, Southern Right Whales and Pigmy Right Whales; as well as Cape Fur Seals. The Common Bottlenose Dolphin, Heaveside's dolphin and Cape Fur Seal are seen most frequently (daily), the Pigmy Right Whale less frequently (monthly) and the rest infrequently as they are seasonal or infrequent visitors. The Common Bottle Nose Dolphin with a population of less than a 100 individuals is thought of as quite unique in being one of the smallest mammal populations in Africa.

Namibia has quite a large population of Cape fur seals. A large colony are present at Pelican Point. 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.

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

Implications and Impacts

Whales, dolphins and seals are often considered as flagship species to which people attach great inherent value. This is evident from the million dollar tourism industry based on the presence of these mammals. Pollution may have a negative impact on locally occurring populations. Increased ship traffic may also result in more frequent ship strikes with whales, dolphins and turtles. Excessive noise producing events in the marine environment may also negatively impact on marine mammals. Pollution of the marine environment may negatively impact on all marine animals.

6.5 SOCIO ECONOMIC ENVIRONMENT

According to the preliminary results of the 2023 population and housing census, Walvis Bay has an urban population size of 51,618 and a total population (urban and rural combined) of 103,115 (Namibia Statistics Agency, 2024). Walvis Bay is the principal port of Namibia, and is an import/export facility for processed fish, mining products and beef, amongst others. The area is linked to Namibia's air, rail and road network, making the port well situated to service Zambia, Zimbabwe, Botswana, southern Angola and South Africa. The port and related industries provide secure employment to residents of the area. The fishing industry is the major employer of low skilled workers on a permanent and seasonal basis. The total employment of this sector is estimated at 2% of the total Namibian workforce. Based on the 2011 census, unemployment in Walvis Bay was at 21.8%, which is well below the Namibian rate of 37%. Economic activities relate mostly to businesses related to the harbour. The town is known as a business and industrial area.

The waters of the bay and lagoon at Walvis Bay provides the local and national community with a range of benefits. Small scale purse-seine fishing for mainly mullet occurs north of the town. Fish factories make use of the harbours water for the processing of fish. Tourists frequent Walvis Bay and especially the lagoon and bay where sightseeing and sunset boat tours to view seals, dolphins and whales and the rare sunfish (*Mola mola*), are very popular. Bird watching along the eastern shore of the lagoon is also a major tourist attraction. Mariculture, especially for mussels and oysters, has become important for both local and international markets. All the aforementioned beneficial uses of the bay's natural environment would be seriously jeopardised if major environmental impacts occurred in the bay.

Table 6-1 Demographic characteristics of Walvis Bay, the Erongo Region and Nationally (Namibia Statistics Agency, 2024)

	Walvis Bay Urban	Erongo Region	Namibia
Population (Males)	26,212	122,322	1,474,224
Population (Females)	25,406	117,884	1,548,177
Population (Total)	51,618	240,206	3,022,401
Population Density (persons/km^2)	2,730.8	3.8	3.7

Walvis Bay is considered to have a high HIV vulnerability. Local and foreign businessmen, fishermen as well as truck drivers are mobile workers which have been identified to make more use of sex workers. There is a higher concentration of such local and foreign labourers in Walvis Bay. The town is also a destination site for internal migrants looking for work in the construction and fishing sectors. Such workers also make use of transactional sex which is supplied by mostly women, to supplement their income. The high prevalence to engage in commercial sex, increases the HIV probability and risk profile of the mobile and local community.

Implications and Impacts

Some skills development and training may also result during the dredging phase and revenue will be generated and livelihoods sustained.

The spending power of locals is likely to increase which may increase the occurrences of social ills such as alcohol or drug abuse.

6.6 CULTURAL, HERITAGE AND ARCHAEOLOGICAL ASPECTS

Walvis Bay does not have particularly rich heritage features or archaeologically significant aspects. The port area where the Proponent will be located has been developed long ago. No other object or building of specific archaeological or cultural significance is nearby.

Implications and Impacts

No implications or impacts expected.

7 ENVIRONMENTAL MANAGEMENT PLAN

The EMP provides management options to ensure impacts of the facility 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. These management measures should be adhered to during the various phases of the operation of the facility. This section of the report can act as a stand-alone document. All personnel taking part in the operations of the facility should be made aware of the contents in this section, so as to plan the operations accordingly and in an environmentally sound manner.

The objectives of the EMP are:

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

7.1 IMPLEMENTATION OF THE EMP

Various potential and definite impacts will emanate from the construction, operations and decommissioning phases. 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 subsections below, impacts related to the operational phase are expected to mostly be of low to medium significance and can mostly be mitigated to have a low significance. The extent of impacts are mostly site specific to local and are not of a permanent nature. Due to the nature of the surrounding areas, cumulative impacts are possible and include noise pollution, traffic impacts and impacts on birds flying at night (bright lighting).

7.1.1 Planning

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

- Ensure that all necessary permits from the various ministries, local authorities and any other bodies that may govern the construction (maintenance) and operations of the facility are in place and valid.
- Ensure all appointed contractors and employees enter into an agreement which includes the EMP. Ensure that the contents of the EMP are understood by the contractors, sub-contractors, employees and all personnel present or who will be present on site.
- Make provisions to have a Health, Safety and Environmental (HSE) Coordinator to implement the EMP and oversee occupational health and safety as well as general environmental related compliance at the site.
- Make provisions to have a community liaison officer on site who will handle complaints and community input, and through whom, where reasonable, monitoring data can be requested. Communicate the contact details of the community liaison officer to neighbours and potential interested and affected parties when the project is initiated.
- Have the following on site where reasonable to deal with all potential emergencies:
    - Risk management / mitigation / EMP/ emergency response plan and HSE manuals;
    - Adequate protection and indemnity insurance cover for incidents;
    - Comply with the provisions of all relevant safety standards;

- Procedures, equipment and materials required for emergencies.

- If one has not already been established, establish and maintain a fund for future ecological restoration of the project site should project activities cease and the site is decommissioned and environmental restoration or pollution remediation is required.
- Establish and / or maintain a reporting system to report on aspects of construction activities, operations and decommissioning as outlined in the EMP.

7.1.2 Skills, Technology and Development

During various phases of construction and operations, training will be provided to a portion of the workforce. Skills are transferred to an unskilled workforce for general tasks. The technology required for the development of the facility is often new to the local industry, aiding in operational efficiency. Development of people and technology are key to economic development.

Desired Outcome: To see an increase in skills of local Namibians, as well as development and technology advancements in associated industries.

Actions

Enhancement:

- If the skills exist locally, contractors and employees must first be sourced from the town, then the region and then nationally. Deviations from this practise must be justified.
- Skills development and improvement programs to be made available as identified during performance assessments.

Responsible Body:

- Proponent
- Contractors

Data Sources and Monitoring:

- Record should be kept of training provided.
- Ensure that all training is certified or managerial reference provided (proof provided to the employees) inclusive of training attendance, completion and implementation.
- Bi-annual summary report based on records kept.

7.1.3 Revenue Generation

The project will change the way revenue is generated and paid to the national treasury. An increase of skilled and professional labour will result from the operations of the project and related wages and salaries will be paid. Revenue will be generated through the contracting of port and related contractors' services.

Desired Outcome: Contribution to the local and national economy. Contribution to national treasury.

Actions

Enhancement:

- The Proponent must employ local Namibians and source Namibian contractors, goods and services as far as is practically possible. Deviations from this practise must be justified.

Responsible Body:

- Proponent

Data Sources and Monitoring:

- Bi-annual summary report based on employee records.

7.1.4 Employment

An increase of skilled and professional labour will result from the operations of the project. Employment will be sourced locally as far as practically possible.

Desired Outcome: Provision of employment to local Namibians.

Actions

Mitigation:

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

Responsible Body:

- Proponent

Data Sources and Monitoring:

- Bi-annual summary report based on employee records.

7.1.5 Demographic Profile and Community Health

The project is reliant on labour during the construction and operational phases. Local construction teams in Walvis Bay will be used for all construction, general maintenance and upgrade activities. The scale of the construction portion of the project is limited and it is not expected to create a change in the demographic profile of the local community. Community health may be exposed to factors such as communicable disease like HIV/AIDS and alcoholism/drug abuse, associated with increased spending power of the labour force. Foreign persons in the area may increase the cumulative risk of communicable disease in Walvis Bay.

Positive impacts will related to employees and contractors' increased economic resilience and improved livelihoods.

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

Actions:

Prevention:

- Employ local people from the area where possible, deviations from this practise should be justified appropriately.
- Adhere to all municipal by-laws relating to environmental health which includes, but is not limited to, sanitation requirements for workers on site.
- Appointment of reputable contractors.

Mitigation:

- Educational programmes for employees (especially truck drivers) on HIV/AIDs and general upliftment of employees' social status.

Responsible Body:

- Proponent

Data Sources and Monitoring:

- Facility inspection sheet for all areas which may present environmental health risks, kept on file.
- Bi-annual summary report based on educational programmes and training conducted.
- Bi-annual report and review of employee demographics.

7.1.6 Health, Safety and Security

Activities associated with the construction and operational phases are reliant on human labour and therefore exposes them to health and safety risks. Activities such as the operation of machinery, unsafe stacking, falling from heights and handling of hazardous chemicals (inhalation of dust and potential health effects chemicals), poses risks to employees. If not contained, windblown dust may further pose health risk to nearby receptors.

Security risks are related to unauthorized entry, theft and sabotage.

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

Actions

Prevention:

- All Health and Safety standards specified in the Labour Act, or better, should be followed.
- Clearly label dangerous and restricted areas as well as dangerous equipment and products.
- Transfer pipelines must be secured to prevent pipe whiplash during accidental decoupling while under pressure.
- Provide all employees with required and adequate personal protective equipment (PPE) including dust masks and protective clothing for workers in close proximity to, or working with, the dust producing cargo. Accidental inhalation, ingestion, dermal or eye contact with dust must be prevented at all times.
- Ensure that all personnel receive adequate training on operations of equipment / handling of industrial cargo.
- Regularly check and service the dust filtering systems to ensure optimal working conditions.
- Equipment on site must be stored in a way that does not encourage criminal activities (e.g. locked away to prevent theft).
- Security procedures and proper security measures must be in place to protect workers.
- Strict security that prevents unauthorised entry into the site, especially during times when passenger vessels visits the port.

Mitigation:

- Selected personnel should be trained in first aid and a first aid kit must be available on site. The contact details of all emergency services must be readily available.
- Implement and maintain an integrated health and safety management system, to act as a monitoring and mitigating tool, which includes operational, safe work and medical procedures, permits to work, emergency response plans, housekeeping rules, MSDS's and signage requirements (PPE, flammable etc.).
- Implement emergency response procedures in case of incidents.
- Emergency wash stations in case of accidental exposure to chemicals or dust.

Responsible Body:

- Proponent
- Contractors

Data Sources and Monitoring:

- Port Captain on schedule of planned passenger vessel visits.
- Industry standards and protocols, etc.
- A bi-annual report should be compiled of all incidents reported. The report should contain dates when training were conducted and when safety equipment and structures were inspected and maintained.

7.1.7 Traffic

The operations of the client will increase the volume of trucks accessing the port area. This will increase traffic on the roads through town, to and from the port. Heavy motor vehicles may result in an increased, cumulative impact on the road surface of the area, especially when turning on these roads. Trucks may block neighbouring business' entrances and increase the likelihood of accidents and incidents.

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

Actions

Mitigation:

- Trucks delivering or collecting goods should not be allowed to obstruct any traffic in surrounding areas and the town.
- Trucks associated with the facility should not be allowed to park or overnight in the port area or near the entrance/exit gates, and may only overnight at areas designated for this purpose.
- Adhere to The Road Traffic and Transport Regulations, 2001 and all other applicable legislation related to road transport and maximum axle loads.
- If any traffic impacts are expected, traffic management should be performed to prevent these.
- The placement of signs to warn and direct traffic will mitigate traffic impacts.

Responsible Body:

- Proponent

Data Sources and Monitoring:

- The Road Traffic and Transport Regulations, 2001.
- Any complaints received regarding traffic issues should be recorded together with action taken to prevent impacts from repeating itself.
- A bi-annual report should be compiled of all incidents reported, complaints received, and action taken.

7.1.8 Air Quality Related Impacts

Reduced air quality as a result of exhaust gases (greenhouse gases) of diesel pumps as well as trucks visiting the property. This may have localised health impacts, but are expected to disperse relatively quickly due to the prevailing south-westerly winds in Walvis Bay. It will however still contribute to greenhouse gas emissions that in turn contribute to climate change. The contribution of greenhouse gas emissions from pumps and trucks related to this project is not considered to be significant, but does have a cumulative nature when considering the entire operational area of the port.

Air quality as a result of windblown dust can cause health effects, especially through chronic inhalation of such dust, in the nearby communities. The risk is related to the toxic/irritant nature respirable fractions (PM10) and thoracic fraction (PM2.5) of dust when chemicals and dry bulk cargo are not contained.

Desired Outcome: To prevent health impacts and to reduce greenhouse gas emissions.

Actions

Prevention:

- All cargo must be suitably contained and secured to prevent product loss and dust.
- Forklift operators and operators of the liquid mud plant and associated storage facilities must be suitably trained.
- Regularly check and service the dust filtering systems to ensure optimal working conditions.
- Ensure that all debagging operations (bag cutting) is within an enclosed space and that all debagging personnel wear adequate PPE.

Mitigation:

- Spilled products must be cleaned immediately.
- All diesel engines of pumps and vehicles must be serviced regularly and make use of technology to reduce emissions. This include selective catalytic reduction, diesel particulate filters and diesel oxidation catalysts.

Responsible Body:

- Proponent
- Contractors

Data Sources and Monitoring:

- Any complaints received regarding dust must be recorded, investigated and the problem rectified.
- Any incidents must be recorded with action taken to prevent future occurrences.
- A bi-annual report should be compiled of all incidents and complaints reported. The report should contain dates when safety equipment and structures were inspected and maintained.

7.1.10 Fire

Construction and operational activities may increase the risk of the occurrence of fires if proper maintenance and housekeeping are not conducted. Some chemicals used on site is flammable and chemical or dry bulk cargo dust (fines) suspended in the air can become flammable, and even explosive, if present in excessive quantities.

The coal conveyor traversing the site presents a special risk as it can generate static electricity when operational and failing bearings may generate significant heat. Flammable vapours or suspended dust fines can then potentially ignite.

Desired Outcome: To prevent property damage, possible injury and impacts caused by uncontrolled fires.

Actions:

Prevention:

- Prepare and regularly update the firefighting and prevention plan and equipment according to the materials stored on site, keeping in mind the activities on neighbouring properties.
- Share the requirements for firefighting on site with Namport.
- Ensure all materials are stored strictly according to MSDS instructions. This include segregation of incompatible products.
- Maintain regular site, mechanical and electrical inspections and maintenance. This should include ensuring that all grounding (earthling) structures are in place.
- Clean all spills / leaks immediately.
- Stop operations if dust containment fails and dust becomes airborne. Operations can continue once the cause is rectified.
- Schedule operations to not coincide with operations of the coal conveyor.
- Ensure sufficient firefighting and fire prevention measures are in place for the specific products being stored and handled on site. This includes specific fire suppressants compatible with the materials used/stored.

Mitigation:

- A holistic fire protection and prevention plan is needed for flammable products. This plan must include an emergency response plan, firefighting plan and spill recovery plan, and should include specific substances handled at the site. The plan should consider risks posed to and by neighbouring properties.
- Maintain firefighting equipment, implement good housekeeping and conduct personnel training (firefighting, fire prevention and responsible housekeeping practises).

Responsible Body:

- Proponent
- Contractors

Data Sources and Monitoring:

- A register of all incidents must be maintained. This should include measures taken to ensure that such incidents do not repeat themselves.
- A bi-annual report should be compiled of all incidents reported. The report should contain dates when fire drills were conducted and when fire equipment was tested and training given.

7.1.11 Noise

Noise pollution will exist due to heavy motor vehicles accessing the site to load and offload cargo, forklifts offloading and moving cargo, diesel driven pumps, etc. As the site is situated in a port area, noise impacts are expected. The cumulative impact of noise sources originating from the port is however a nuisance in the nearby residential areas. The construction and future maintenance or upgrade phases may generate excessive noise for short periods of time.

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

Actions

Prevention:

- The Health and Safety Regulations of the Labour Act and World Health Organization (WHO) guideline on maximum noise levels (Guidelines for Community Noise, 1999) to prevent hearing impairment for workers on site and not to be a nuisance to communities should be considered during the construction and operational phases.
- Confine noise generating operational activities to daytime hours as far as possible.
- At night, the nuisance created by audible warning signals on trucks and forklifts should be prevented by switching to a flashing light or 'broadband white noise' system.

Mitigation:

- Hearing protectors as standard PPE for workers in situations with elevated noise levels.
- All machinery, such as diesel driven pumps, must be regularly serviced to ensure minimal noise production.

Responsible Body:

- Proponent
- Contractors

Data Sources and Monitoring:

- Health and Safety Regulations of the Labour Act and WHO Guidelines.
- Maintain a complaints register.
- Bi-annual report on complaints and actions taken to address complaints and prevent future occurrences.

7.1.12 Waste production

Various waste streams will result from the operational phase and development of the facility. Waste may include hazardous waste associated with the handling of hazardous products and contaminated packaging material (e.g. during construction and maintenance). Domestic waste will be generated by the facility and related operations. Waste presents a contamination risk and when not removed regularly, may become a fire hazard. Construction waste may include building rubble and discarded equipment. Contaminated soil and water is considered as a hazardous waste.

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

Actions

Prevention:

- Waste reduction measures should be implemented and all waste that can be re-used / recycled must be kept separate.
- Ensure adequate temporary waste storage facilities are available.
- Ensure waste cannot be blown away by wind.
- Prevent scavenging (human and non-human) of waste.

Mitigation:

- Waste should be disposed of regularly and at appropriately classified disposal facilities, this includes hazardous material (empty chemical containers, contaminated rugs, paper, water and soil).
- See the material safety data sheets available from suppliers for disposal of contaminated products and empty containers.
- Liaise with the municipality regarding waste and handling of hazardous waste.
- Due to the nature of some hazardous materials, the containers they are packed in should be disposed of in an appropriate way at an appropriately classified waste disposal facility. See the material safety data sheets available from suppliers for disposal methods.
- To prevent people from using potentially contaminated containers for transport or holding of drinking water, all containers that will be discarded must be crushed or punctured prior to disposal.

Responsible Body:

- Proponent
- Contractors

Data Sources and Monitoring:

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

7.1.13 Ecosystem and Biodiversity Impact

The nature of the operational activities is such that the probability of creating a habitat for flora and fauna to establish is low. No significant impact on the biodiversity of the area is predicted as the site is void of natural fauna and flora. Excessive lighting used at night and especially those that are directed upwards may however blind birds like flamingos that fly at night. This may result in disorientation of birds and collisions with structures. Further impacts will mostly be related to pollution of the marine environment.

Desired Outcome: To avoid pollution of and impacts on the ecosystem and biodiversity.

Actions.

Mitigation:

- Report any extraordinary ecological sightings to the Ministry of Environment, Forestry and Tourism.
- Mitigation measures related to waste handling and the prevention of groundwater, surface water and soil contamination should limit ecosystem and biodiversity impacts.
- Avoid scavenging of waste by fauna.
- The establishment of habitats and nesting sites at the facility should be prevented where possible.
- Lights used at night should be kept to a minimum and should be directed downwards to the working surfaces. If problem areas are identified, corrective action should be implemented to prevent future bird strikes.

Responsible Body:

- Proponent

Data Sources and Monitoring:

- Record any bird strikes and identify problem areas.
- All information of extraordinary ecological sightings to be included in a bi-annual report.

7.1.14 Groundwater, Surface Water and Soil Contamination

Cargo that are not contained can contaminate the environment. The entire property is paved and all storage and mixing facilities will be in suitably bunded areas. Pollution of soil and groundwater is thus not likely. However, dust that is not contained can reach sensitive receptors, like the nearby ocean, during times of strong wind. Oil, hydraulic fluid and fuel leaks from vehicles may also present a pollution risk. Pipes transferring products to vessels can burst and may lead to significant spills if pumping is not quickly stopped.

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

Actions

Prevention:

- Regularly inspect and maintain all infrastructure, including pressure testing, to minimize the chances of infrastructure failure.
- Proper containment of chemicals, delivered to the plant prior to fluid mixing operations, to prevent dust blown into the surrounding environment.
- Training of operators must be conducted on a regular basis (e.g. forklift operators) to limit product containment damage due to incorrect handling.

Mitigation:

- Regularly inspect the bund area for any product spills and clean without delay. All outflow valves from the bund area must at all times be closed and only opened under supervision.
- Clean-up action must be taken immediately for all instances where chemicals or dust is not contained (e.g. spillages and torn bags) or spillages occur (e.g. trucks leaking fuel or oil, or paints and solvents during construction and maintenance)

Responsible Body:

- Proponent
- Contractors

Data Sources and Monitoring:

- The procedures followed to prevent environmental damage during service and maintenance, and compliance with these procedures, must be audited and corrections made where necessary.
- A report should be compiled bi-annually of all spills. The report should contain the following information: date and duration of spill, product spilled, volume of spill, remedial action taken, etc.

7.1.15 Visual Impact

This is an impact that not only affects the aesthetic appearance, but also the integrity of the facility. The site is within an area zoned for port use. The development of the site is in line with the port character.

Operations will be kept tidy and neat which will promote effectiveness and pollution prevention while being aesthetically pleasing. The project is located in close proximity to the docking area for passenger vessels and good housekeeping is important to maintain a good image of the Proponent and of Namport.

Desired Outcome: To minimise aesthetic impacts associated with the facility.

Actions

Mitigation:

- Regular waste disposal, good housekeeping and routine maintenance on infrastructure will ensure that the longevity of structures are maximised and a low visual impact is maintained.
- All structures and infrastructure constructed on site should be in line with the visual character of the surroundings as far as practically possible.

Responsible Body:

- Proponent
- Contractors

Data Sources and Monitoring:

- A bi-annual report should be compiled of all complaints received and actions taken.

7.1.16 Cumulative Impact

The main cumulative impact associated with the operational phase is traffic frequenting the site, noise, and dust should it not be contained. This will have a cumulative impact on traffic flow on surrounding street areas and outside the port, noise at nearby residential areas and the environment.

The cumulative effect of lighting on birds due to various developments in and around the port may also increase the incidences of collisions and interference with bird flight paths at night.

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

Actions

Mitigation:

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

Responsible Body:

- Proponent

Data Sources and Monitoring:

- Review bi-annual summary reports based on all other impacts to gain an overall assessment of the impact of the operational phase.

7.2 DECOMMISSIONING AND REHABILITATION

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

7.3 ENVIRONMENTAL MANAGEMENT SYSTEM

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

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

8 CONCLUSION

Mud plants supply drilling fluids to offshore oil drilling operations. Such plants needs to be located in port areas, on or near the docking areas where platform supply vessel's can be supplied with the required drilling fluids. Suitable locations for the placement of mud plans are thus limited.

Various potential and definite impacts will emanate from the construction, operations and decommissioning phases. The majority of the negative impacts can be mitigated or prevented, while positive impacts should be enhanced. Impacts related to the operational phase are expected to mostly be of low to medium significance and can mostly be mitigated to have a low significance. The extent of impacts are mostly site specific to local and are not of a permanent nature. Due to the nature of the surrounding areas, cumulative impacts are possible and include noise pollution, traffic impacts and impacts on birds flying at night (bright lighting).

This EMP report specifies some of the enhancement measures aimed at increasing the positive impacts of the project. This include maximising the appointment of Namibian companies and citizens for support services. The EMP also describes a monitoring programme to be carried out by the Contractor. Baseline studies to determine preconstruction concentrations of chemical of concern concentrations in the soil is advised where possible. Take care not to damage installed surface covers without permission of Namport.

9 REFERENCES

BirdLife International. 2021a. Important Bird Areas Factsheet: 30-Kilometre Beach: Walvis - Swakopmund. Downloaded from http://www.birdlife.org on 14/06/2021.

BirdLife International. 2021b Important Bird Areas Factsheet: Walvis Bay. Downloaded from http://www.birdlife.org on 14/06/2021.

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

Callaghan B. 1991. Atmospheric Corrosion Testing in Southern Africa – Results of a Twenty-year National Programme.

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

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

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

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

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

Namibia Statistics Agency. Namibia 2024 Population and Housing Census Preliminary Report.

Patricola C, Chang P. 2017. Structure and Dynamics of the Benguela Low-level Coastal Jet. Climate Dynamics 49: 2765–2788.

Petzer G, von Gruenewaldt R. 2009. Air Quality Specialist Assessment for the Proposed Paratus Power Plant Extension in Walvis Bay, Midrand: Airshed Planning Professionals.

Scott RM, Scott HA. 2013. Environmental Impact Assessment for the New Port of Walvis Bay Marine Petroleum Product Import/Export Terminal and Pipeline. Bird specialist report. Unpublished report, African Conservation Services cc, Swakopmund Namibia.

Taljaard JJ, Schumann TEW. 1940. Upper Air Temperatures and Humidities at Walvis Bay, South West Africa. Bulletin of the American Meteorological Society 21: 293 – 296.

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

WHO (2000) Air quality guidelines for Europe, 2nd ed. Copenhagen, World Health Organization Regional Publications, European Series.