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APP-006066

PHASE 1 LAND RECLAMATION AND EXPANSION OF THE PORT OF LÜDERITZ IN ROBERT HARBOUR, LÜDERITZ, ||KHARAS REGION
ENVIRONMENTAL IMPACT ASSESSMENT



Assessed by:

Assessed for:

February 2026

Project:	**PHASE 1 LAND RECLAMATION AND EXPANSION OF THE PORT OF LÜDERITZ IN ROBERT HARBOUR, LÜDERITZ, ǁKHARAS REGION**	
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Report Approval:	 **Dr André Faul** Conservation Ecologist	

I, Elzevir Gelderbloem, acting as the Proponent's representative (Namibian Ports Authority), 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 17 day of February 2026.



Namibian Ports Authority

EXECUTIVE SUMMARY

Introduction

The Namibian Ports Authority, Namport, is mandated by the Namibian Ports Authority Act of 1994 to control and manage ports within Namibia. To meet the growing demand for port service in Lüderitz, Namport proposes to expand the existing port through a process of land reclamation to increase both berthing and onshore operational space. This project consists of two phases and this report focuses on Phase 1 port expansion. Geo Pollution Technologies (Pty) Ltd was appointed by Namport, as independent environmental consultant, to assist with the necessary studies to determine the potential environmental impacts, and ultimately whether an environmental clearance certificate may be granted for this project. To achieve this, an environmental impact assessment with selected specialist studies was undertaken to determine the potential positive and negative impacts of the Proponent's proposed exploration activities on the environment. The assessment also guided the development of an environmental management plan aimed at preventing or limiting negative impacts while enhancing the positive benefits of the project.

Scope and Methodology

The environmental assessment is conducted to determine all environmental, safety, health and socio-economic impacts associated with the project. Relevant environmental data was compiled by using secondary data, primary data (noise, visual, and archaeological and heritage assessments) and during a reconnaissance site visit. Potential environmental impacts and associated social impacts were identified and are addressed in this report.

Project Description

The main construction component of Phase 1 will be a 500 m quay wall extension with about 14 ha reclaimed backup land. This phase can further be subdivided into subsections and completed in sub-phases. Construction activities for Phase 1 will involve the following: 1) dredging and spoiling the existing loose sandy material which covers the rock where the new quay wall must be built; 2) installation of a steel sheet pile retaining wall directly on the bedrock and filling the uneven gaps on the seabed between the steel wall and the bedrock with concrete (alternatively a reinforced concrete deck on piles type of quay wall may also be built with a rock revetment below the deck to contain the sand fill behind it); 3) Land reclamation in between the quay wall and the eastern shore of Shark Island, within the existing legal jurisdiction of the Port of Lüderitz; 4) installation of two rows of anchor-walls to hold the steel wall in place whilst filling and compacting with suitable sandy material; 5) installing a reinforced concrete capping wall on top of the sheet pile wall which will also contain a service tunnel to house all the quayside services required by ships; and 6) installing onshore services such as roads, pavements, railway extension, water, sewer, lighting and electricity distribution.

Apart from the land reclamation process, the port has existing infrastructure that may require periodic construction and maintenance activities in order to maintain or upgrade the port infrastructure, or to construct completely new infrastructure as the demand for various port services and facilities change. Some aspects of such construction activities may require their own environmental assessments, depending on the type and scale of the proposed construction activity.

Environment

Development of the port is planned offshore within port limits, in an area which is under jurisdiction of Namport. Nearby sensitivities include, on the west of the proposed area, Shark Island, an area of heritage significance, accommodation establishments, and residences. Towards the north, Penguin and Seal Island are important for breeding bird colonies, and ranching and onshore culturing of abalone relies on clean, quality water. South and east are various industries and businesses, many depending on the port to sustain their business activities. The town has many historic buildings dating to the early 1900's. Lüderitz itself is surrounded by the Tsau //Khaeb (Sperrgebiet) National Park and the Namibian Islands' Marine Protected area. Most of the land around Lüderitz is restricted due to the presence of diamond mining licence areas. The marine environment falls within a designated Important Bird Area and a rock lobster sanctuary. The benthic communities in the proposed port development area are not particularly unique and the seafloor mostly has a fine silt layer.

Public Participation

As part of the environmental assessment process, public consultation was performed. This entailed compilation of a stakeholder database; compilation of a background information document, press notice, notification letters, and site notice; environmental assessment announcements in two nationally distributed newspapers, once a week for two consecutive weeks (The Namibian and Republikein on 18 and 25 August 2025); hand delivery of notification letters to the executive directors' offices of key ministries; e-mail and multimedia messages with notification letters to identified stakeholders; placing of a site notice at the entrance to the Lüderitz port; and conducting three public meetings in Lüderitz. All comments and concerns were compiled in a comments and responses table as part of this report.

Impacts

Positive impacts arising from the port expansion project include increased availability of berthing and operational port space; employment, training and development of the Namibian workforce; increased economic resilience of employees and contractors; and economic injection into the Namibian economy through the sourcing of goods and services, often with funds obtained from foreign investors.

Significant negative environmental impacts resulting from construction and operations of the port are expected unless suitable preventative and mitigating measures are implemented. The most important of the impacts are archaeology/heritage, visual, noise, waste, pollution and health and safety. Shark Island neighbouring the port expansion area has significant, albeit tragic, heritage significance due to the atrocities inflicted by German colonial rule on the Nama and Ovaherero people of Namibia. As such, the memory of Shark Island, and what is left of this dark chapter of Namibian history, must be preserved. Port expansion activities and operations, if proceeding without due consideration of Shark Island, could destroy or damage remnants (known or undiscovered) of heritage significance remaining on the island. Similarly, the sense of place of the island can be negatively impacted.

Management of Impacts

Positive impacts can be enhanced by supporting local industries and contractors and appointment of local Namibian employees, as far as is practically possible. It should however be noted that the technologies are sometimes not available in Namibia and will then require international expertise.

To minimise impacts on Shark Island, a 20 m buffer (exclusion zone) must be maintained between the northern section of the proposed port expansion and Shark Island. The chance find procedure must be initiated for any potentially significant archaeological or heritage finds. All infrastructure must be designed and finished to blend in with the surroundings and construction activities must be restricted to day time to limit noise disturbances at noise sensitive receptors. Good housekeeping must be performed at all times and equipment must be on site to deal with any emergencies such as spills, fire and injuries. Future port tenants must operate in accordance with the existing operational environmental management plan of Namport.

The environmental management plan accompanying this document should be used as an on-site reference document during planning and construction activities for the project. All monitoring and records kept should be included in a report to ensure compliance with the environmental management plan and environmental clearance certificate conditions. Namport's health, safety, environment and quality policy, or similar, should be used in conjunction with the environmental management plan. Contractors and responsible personnel must be taught the contents of these documents. National regulations and guidelines must be adhered to and compliance monitored regularly as outlined in the environmental management plan.

Conclusion

The Port of Lüderitz is a national asset that must be operated and developed for the benefit of Namibia. This said, it should be done so in an environmentally responsible manner, with due regard for ecological, social, archaeological and heritage sensitivities. Based on the environmental assessment and the associated specialist studies, the port expansion should be allowed, given that the preventative and mitigation measures as proposed are implemented and the buffer zone is implemented and maintained. The environmental management plan must form part of the contracts of all parties involved with the

construction and processes. Future port tenants must conduct their own environmental assessments and implement their environmental management plans which must draw upon the operational environmental management plan of Namport. Parties responsible for transgression of the environmental management plan should be held responsible for any rehabilitation that may need to be undertaken.

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LIST OF ABBREVIATIONS

AIDS	Acquired immunodeficiency syndrome
BCLME	Benguela Current Large Marine Ecosystem
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
FPIC	Free, Prior and Informed Consent
GPT	Geo Pollution Technologies
HAT	Highest Astronomical Tide
HIV	Human Immunodeficiency Virus
I&APs	Interested and Affected Parties
IBA	Important Bird Area
ISO	International Standards Organisation
ISPS	International Ship and Port Facility Security
IUCN	International Union for the Conservation for Nature
LAT	Lowest Astronomical Tide
LTC	Lüderitz Town Council
Ma	Megaannum
MAFWLR	Ministry of Agriculture, Fisheries, Water and Land Reform
MBL	Marine Atmospheric Boundary Layer
mCD	Metres Relative to Chart Datum
MEFT	Ministry of Environment, Forestry and Tourism
MHWN	Mean High Water Neaps
MHWS	Mean High Water Springs
ML	Mining Licence
MLWN	Mean Low Water Neaps
MLWS	Mean Low Water Springs
MSDS	Material Safety Data Sheet
MUCH	Maritime Underwater Cultural Heritage
Namport	Namibian Ports Authority
NDP	National Development Plan
NHC	National Heritage Council of Namibia
NIMPA	Namibian Islands' Marine Protected Area
NSI	Namibian Standards Institution
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
spp	Species
TBT	Tributyltin
TPH	Total Petroleum Hydrocarbons
TSS	Total Suspended Solids
UNFCCC	United Nations Framework Convention on Climate Change
WHO	World Health Organisation

GLOSSARY OF TERMS

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

Mariculture - 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.

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.

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.

Reclamation - the process of creating new land or restoring degraded land for productive use. This can involve creating new land from bodies of water by pumping water out or filling in the seabed.

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 tasked with the management and development of ports in Namibia. As part of their mandate, they are planning for the expansion of the Port of Lüderitz in the ǁKharas Region (Figure 1-1). To achieve this, Namport proposes two phases of expansion within Namport's area of jurisdiction as defined by the officially declared port limits (Figure 1-2). Phase 1 will entail extending the main quay wall by 500 m and reclaiming of approximately 14 hectares of sea area, below the high water mark, to serve as backup land for the extended quay. Phase 2 will see demolition of the existing wooden jetty in the southernmost part of the harbour, reclamation of approximately 3 ha of sea area, and construction of a new concrete jetty at the north-end of the reclaimed area. The extended quay walls, new jetty and additional backup land will allow for the berthing of additional vessels and increased backup cargo storage space, and thus increase the much-needed cargo handling capacity of the port.

The reclamation of land from below or above the high-water mark of the sea, as well as the construction of harbours, require environmental clearance from the Department of Environmental Affairs (DEA), Ministry of Environment, Forestry and Tourism (MEFT). An environmental clearance is required in terms of the Environmental Management Act, Act no. 7 of 2007 (EMA), as administered by the MEFT. Namport thus commissioned this environmental assessment with the purpose of, upon a favourable outcome of the assessment, applying for environmental clearance. In response to the pressing demand for expanded operational and berthing capacity at the Port of Lüderitz, separate environmental clearance applications will be submitted for Phase 1 and Phase 2 of the proposed development. This approach ensures that, should the issuance of an Environmental Clearance Certificate (ECC) for one phase be delayed, the other may proceed independently without hindrance.

Geo Pollution Technologies (Pty) Ltd (GPT) was appointed as independent environmental consultant by Namport to carry out the assessments. The current assessment focusses on the Phase 1 expansion project and will be submitted to the DEA in the form of an environmental impact assessment (EIA), environmental management plan (EMP) and various supporting documentation. 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".

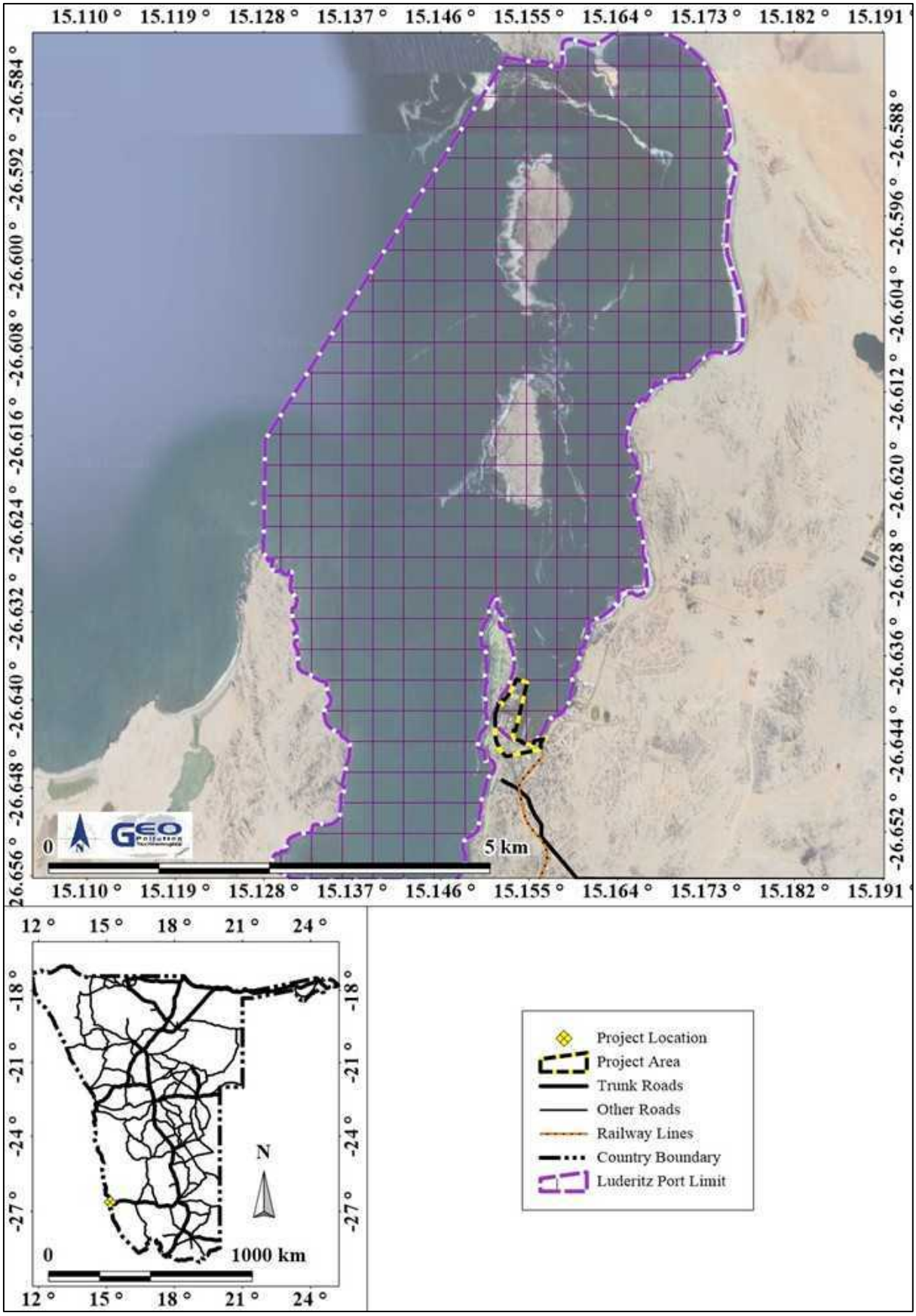


Figure 1-1 Existing commercial harbour

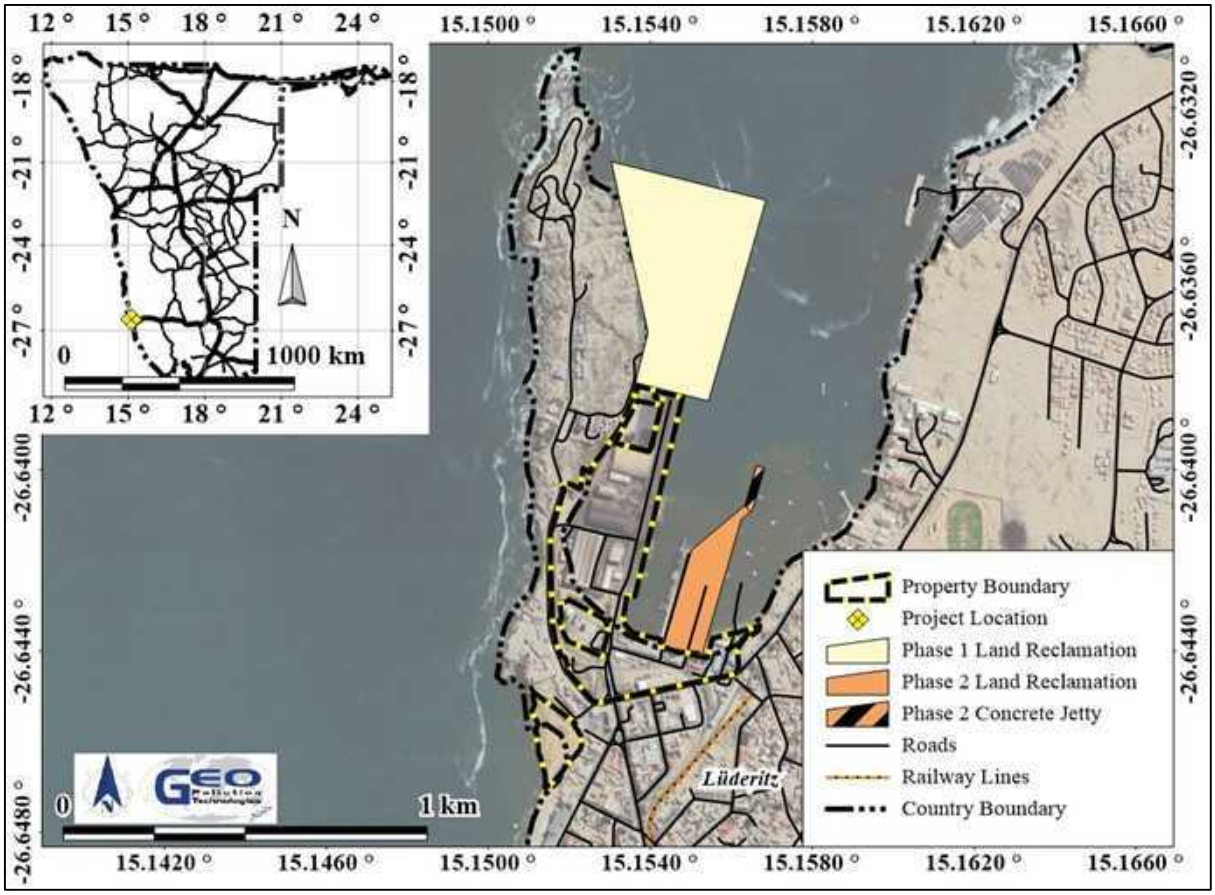


Figure 1-2 Phase 1 and Phase 2 port expansion areas

2 BACKGROUND

The Namibian Ports Authority Act, Act Number 2 of 1994, as proclaimed in Government Gazette No. 810, made provision for "*the establishment of the Namibian Ports Authority to undertake the management and control of ports and lighthouses in Namibia and the provision of facilities and services related thereto; and to provide for matters incidental thereto.*" Under this act, Namport, a state owned enterprise, was established as the port authority and under their control is the Port of Walvis Bay on the central coast and the Port of Lüderitz on the southern coast of Namibia.

Namport's key roles are to (www.namport.com.na):

- Manage the port facilities to cater for current trade needs.
- Develop the ports for future demands.
- Contribute to the competitiveness of the Southern African Development Community (SADC) region's trade through the efficient, reliable and cost-effective supply of port services.
- Facilitate economic growth in Namibia by enabling regional development and cross-border trade.
- Promote the Ports of Walvis Bay and Lüderitz as preferred routes for sea-borne trade between SADC, Europe and the Americas.
- As the founding architects of the Walvis Bay Corridor Group, assist with developing cross-border trade.
- Minimize the impact of port operations on the natural environment by applying International Organisation for Standardisation (ISO) 14001 standards.
- Uplift and support the communities in which Namport operates.

Namport strives to be a world-class ports authority and thus works according to international standards, namely ISO 9001, ISO 14001 and Occupational Health and Safety Assessment Series (OHSAS) 18001, to uphold quality as well as environment and occupational health and safety standards.

Historically, Lüderitz has functioned primarily as a fishing port, supporting Namibia's national fishing industry. In later years, however, the port has seen growing demand from mining and offshore sectors, particularly diamond, zinc, and lead operations in southern Namibia. This evolving reliance underscores Lüderitz's emerging role as a strategic logistics hub. The port is increasingly positioned to support a broader range of mineral and petroleum activities, with notable interest in its potential as an export gateway for manganese ore—and potentially other commodities—originating from South Africa, as well as a port and base from which support to the offshore oil and gas industries can be provided. The port functions with Namport as the port operator and landlord with various tenants conducting business in and from the port.

3 PROJECT JUSTIFICATION

The existing operational area and quay within the Port of Lüderitz, located inside Robert Harbour, were established through land reclamation around 1996. This infrastructure has provided adequate berthing and operational capacity for several decades. However, Namport identified early on the strategic necessity to expand the port to accommodate anticipated growth in maritime traffic and cargo volumes.

In 2011, a comprehensive feasibility study evaluated nine development scenarios, ranging from constructing entirely new port facilities elsewhere in Lüderitz Bay to expanding the current infrastructure within Robert Harbour. These options were assessed against key environmental and engineering constraints, including shallow water depths, hard bedrock, high-energy wave conditions, and prevailing wind regimes. These natural limitations significantly influenced the viability and cost-effectiveness of each alternative.

Recent industrial developments, particularly in offshore oil and gas exploration and the emerging need to export metal ores from southern Africa, have shifted the operational paradigm. These sectors require shallow draught port services, which align well with the existing bathymetric and geological conditions of Robert Harbour. This shift effectively mitigates previous constraints and opens up opportunities for targeted expansion of quay facilities and backup land within the sheltered zone behind Shark Island.

From an EIA perspective, this approach offers several advantages:

- Reduced Environmental Footprint: Expanding within the existing port footprint minimizes disturbance to undisturbed marine and coastal ecosystems compared to greenfield development elsewhere in the bay.
- Optimized Use of Existing Infrastructure: Leveraging reclaimed land and established operational zones reduces the need for extensive new construction and associated environmental disruption.
- Accelerated Implementation: Development within Robert Harbour can proceed within shorter timeframes and budget envelopes, enhancing responsiveness to market demand while maintaining environmental safeguards.
- Alignment with Strategic Policy: The proposed development supports Namibia's Vision 2030 and National Development Plans (NDPs), which prioritize the creation of a safe, reliable, and sustainable transport network. It also contributes to the establishment of a world-class logistics hub that connects SADC to global markets.

It is essential however, to recognize that the Port of Lüderitz and its surrounding areas hold profound cultural and historical significance, particularly in relation to the Nama and Ovaherero genocide during the early 20th century. Shark Island, adjacent to the proposed development zone, was the site of a concentration camp where many Nama and Ovaherero people were imprisoned and perished under colonial rule. This legacy represents a deeply sensitive chapter in Namibia's history and must be carefully considered in all phases of port expansion. Any development within this context requires respectful engagement with affected communities, heritage specialists, and relevant authorities to ensure that cultural memory is preserved, impacts are mitigated, and opportunities for commemoration and education are integrated into the project design. This approach aligns with both national heritage legislation and international best practices for culturally responsible infrastructure development.

In summary, the proposed expansion of the Port of Lüderitz within Robert Harbour presents a technically feasible, environmentally responsible, and strategically aligned development pathway. It

leverages existing infrastructure to meet emerging demand from offshore energy and mineral export sectors, while minimizing ecological disruption and optimizing cost and implementation timelines. Crucially, the project must proceed with full recognition of the area's sensitive cultural and historical context—particularly the legacy of the Nama and Ovaherero genocide associated with Shark Island. This requires respectful engagement, heritage safeguarding, and integration of commemorative considerations into the planning process. When approached holistically, the development supports Namibia's Vision 2030 and national goals for a sustainable, inclusive, and globally connected transport and logistics network. Thus, in agreement with Namibia's vision, Namport strives to continue operating the Port of Lüderitz to reliably and effectively serve Namibia and its neighbours.

4 SCOPE

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

- Provide a detailed description of the project components.
- Present the legal setting within which the project must be planned and executed.
- Provide a description of all environmental components that may be impacted by the project.
- Present and rate the environmental impacts that may emanate from the proposed project.
- List management actions which could prevent or mitigate the potential adverse impacts to acceptable levels.
- Conduct the required public participation processes and present and address all communication received from interested and affected parties (I&AP).
- Provide sufficient information to the MEFT and other relevant authorities to make an informed decision regarding the issuing of an ECC for the proposed project.

5 METHODOLOGY

The following methods were used to execute and complete the environmental assessment process:

1. Preliminary designs and construction activities were received from the client and are presented in this report.
2. Baseline information about the area and surroundings was obtained from existing literature and previous environmental assessment reports of the port and surroundings.
3. Primary information was obtained from specialist studies commissioned in response to the requests made by I&APs.
4. I&APs were consulted about their views, comments and opinions and these are put forward in this report.
5. As per the findings of this environmental assessment, an EIA report and EMP were prepared and these will be submitted to the MEFT.

6 PROJECT DETAILS

The following sections provide a brief overview of current port infrastructure and operations as well as the proposed plans for port expansion.

6.1 EXISTING INFRASTRUCTURE AND OPERATIONS

The footprint of the existing commercial harbour of the Port of Lüderitz is indicated in Figure 6-1. The entire water area on the eastern side of the port limits, within the bay of Lüderitz, are under jurisdiction of Namport. The main components are the commercial harbour, a concrete jetty, an old defunct wooden jetty and the navigational water area which requires periodic dredging to maintain water depth.



Figure 6-1 Current port footprint



Photo 6-1 Northern quay section of existing port



Photo 6-2 Cruise liner in the port

Various port tenants operates within the commercial harbour. The main operations and port activities are briefly discussed below.

6.1.1 Cargo Imports

Sea ports are typically the main avenue for imports. These can include chemicals, mineral ores, coal, fuel, etc. Currently the main cargo imported into Namibia via the Port of Lüderitz are fuel, fish and general cargo. General cargo made up the bulk of imports at 61,082 tonnes in 2023/2024 (Namport Annual Report 2023/24). This was followed by fuel at 59,112 tonnes and fish at 30,107.

The Port of Lüderitz currently only receive diesel fuel by means of tanker ships. Diesel is offloaded at the quay wall and pumped via an underground pipeline to the bulk fuel storage

facility of Impala Terminals Namibia (Figure 6-2). The port could potentially also receive other petroleum products in future.

6.1.2 Bulk and Break-Bulk Exports

Mining ore can be exported in bulk via the port. Currently the main bulk export product is manganese ore and in 2023/2024 it totalled 83% (880,770 tonnes) of all exports via Lüderitz (Namport Annual Report 2023/24). Zinc and zinc concentrate, were the second most exported product, although it declined by about 50% since 2018/19 to 75,085 tonnes (Namport Annual Report 2023/2024). Ice (31,866 tonnes), lead (19,515 tonnes), fish and bait (184 tonnes), and other non-specified products (48,128 tonnes) made up the remaining export products.

6.1.3 Fuel Bunkering

Diesel bunkering of ships is performed by Impala Terminals Namibia. Underground pipelines service both the quay area and the concrete jetty where hose trolleys are used for port bunkering purposes. Currently, no offshore bunkering occurs within port limits. Bunkering outside of port limits does not fall under the jurisdiction of Namport.



Figure 6-2 Bulk fuel storage facility and pipeline routes

6.1.4 Fishing Operations and Mariculture

Wave action along the western shore of the Robert Harbour prevents safe berthing of fishing vessels at jetties of the fish factories. Fishing vessels therefore mostly use the commercial harbour for berthing to offload fish and to replenish supplies.

Mariculture of oysters and abalone takes place within port limits. These activities does not form part of Namport's operations. However, mariculture is recognized by government as an important sector in Namibia and port activities may impact on the mariculture industry.

6.1.5 Cruise Liners

Cruise liners make regular stops in Lüderitz. Large cruise ships anchors off Angra Point and shuttle passengers to Lüderitz due to the shallow depth of the port. Smaller cruise liners can

berth inside the port, but limited berthing space necessitates careful scheduling to accommodate all calls to port.

6.1.6 Stevedoring

Stevedoring refers to the loading, unloading, and handling of cargo between ships and the shore. It typically involves the use of cranes, forklifts, and other equipment to transfer goods efficiently and safely, and is carried out by specialized operators or contractors. Stevedoring is a core activity in port logistics, directly supporting maritime trade and vessel turnaround.

6.1.7 Traffic

Land based traffic into and out of the port is regulated at the access gate, which is permanently manned by security. The access gate is off Hafen Street and limited off-street parking space is provided outside the access gate.

A railway line with sidings is present. It is currently only utilised to receive manganese ore, but forms part of the future plans of optimisation of the port for imports and exports.

Access to the port through town is mainly via Bismarck Street which hosts the town centre and many historically significant buildings.

6.1.8 Security

The entire landside of the port area is fenced off and security personnel man the entrance gate. No unauthorised access is allowed in the port area and all visitors must obtain an entrance permit from Namport security.

6.1.9 General

As landlord, Namport primarily acts as a regulator, facilitator, and strategic asset manager, while private operators (tenants) handle cargo handling and terminal operations. Namport's operational role include:

- Strategic oversight and planning
  - Master planning for port development, land use, and infrastructure expansion
  - Zoning and spatial allocation of port areas for different uses (cargo, passenger, industrial, etc.)
  - Environmental and heritage compliance oversight, including EIA coordination and monitoring
- Infrastructure management
  - Development and maintenance of common-use infrastructure:
  - Quays, breakwaters, access roads, rail links, utilities
  - Dredging and hydrographic surveys to maintain navigable depths
  - Asset lifecycle management for port-owned facilities
- Lease and concession management
  - Negotiating and administering leases or concessions with terminal operators, logistics firms, and other tenants
  - Monitoring compliance with lease terms, including performance, safety, and environmental obligations
  - Revenue collection from rent, throughput fees, and service charges
- Maritime and navigational services
  - Harbour master functions: vessel traffic coordination, pilotage oversight, anchorage management
  - Port security coordination under International Ship and Port Facility Security Code (ISPS Code)
  - Emergency response planning for spills, fires, or vessel incidents
- Regulatory and compliance functions
  - Enforcing port bylaws and safety regulations

- Customs and border agency coordination
- Monitoring environmental performance and stakeholder engagement (especially relevant in heritage-sensitive areas like Lüderitz)

- Stakeholder engagement and facilitation
  - Coordination with government, industry, and community stakeholders
  - Facilitating trade and logistics development
  - Supporting national development goals (e.g., Vision 2030)

6.2 PLANNED EXPANSIONS

The aim of the planned expansion of the port is to firstly increase the berthing space in the port and secondly to increase the operational areas (back-up land) within the port. The following is a summary of the proposed Phase 1 expansion project of the port.

6.2.1 Additional Footprint

The entire footprint of the planned expansion project is offshore and east of Shark Island (Figure 6-3). Although it may not be all developed at once, the existing quay wall will ultimately be extended by 500 m in a northern direction. The sea area on the western side of the quay wall will be laid dry and developed as additional backup land for port operations. This will add an additional 14 ha to the existing port footprint.



Figure 6-3 Additional planned port area

6.2.2 Construction Activities

The main construction component of Phase 1 will be a 500 m quay wall extension with 14 ha reclaimed backup land. Note that this phase can further be subdivided into subsections and completed in sub-phases. Construction activities for Phase 1 will involve the following:

6.2.2.1 Dredging and Spoiling of Sandy Overburden

Prior to quay wall construction and land reclamation, dredging will be undertaken to remove the loose sandy sediment overlaying the bedrock in the designated construction zone. This material must be cleared to expose competent rock for structural anchoring. The dredging activity is already covered under the Port of Lüderitz's existing dredging EIA/EMP and ECC, which includes provisions for sediment handling, turbidity control, and spoil management.

6.2.2.2 Quay Wall Construction

Two alternative quay wall designs are under consideration:

Steel Sheet Pile Retaining Wall: A sheet pile is a long, thin structural component, most commonly made of steel, which interlocks with others to form a continuous wall. These walls are typically used for earth and water retention in projects like retaining walls, seawalls, cofferdams, and supporting excavations. This option involves driving the steel sheet piles directly into the exposed bedrock. Irregular voids between the sheet pile and seabed will then be filled with concrete to ensure structural stability and prevent undermining.

Reinforced Concrete Deck on Piles: Alternatively, a piled deck structure may be constructed. With this method, concrete piles are anchored into the bedrock and a concrete deck is placed on the piles. A rock revetment are then placed beneath the deck to contain the sand fill and prevent erosion.

Both designs aim to minimize seabed disturbance and ensure long-term durability under marine conditions.

6.2.2.3 Installation of Anchor Walls

To stabilize the steel sheet pile wall for backfilling, two rows of anchor walls will be installed. These structures will resist lateral pressure from the reclaimed fill and ensure the integrity of the quay wall during and after construction.

6.2.2.4 Land Reclamation between Quay Wall and Shark Island

After installation of the sheet pile, land reclamation will be carried out in the area between the newly constructed quay wall and the eastern shoreline of Shark Island. This reclamation will be confined to areas below the high-water mark and include a buffer zone aimed at protecting any heritage remains that may be present along the shoreline. Reclamation is thus remaining within the legally defined boundaries of the Port of Lüderitz. The reclaimed area will provide essential backup land for port operations and vessel servicing.

6.2.2.5 Sourcing and Placement of Fill Material

Fill material for land reclamation can be sourced from two primary locations:

Offshore Dredged Material: Sediment can be obtained by dredging the offshore areas and pumping it into the reclamation area. Such sediment is subject to quality screening to establish its suitability for reclamation purposes. Any dredged material encountered that is deemed unsuitable for reclamation will be disposed of at the port's existing approved offshore dredged sediment disposal site (Figure 6-1), in accordance with the dredging EMP protocols.

Onshore Quarries: Sand and gravel can be sourced from licensed quarries outside Lüderitz town. Such quarries are subject to separate EIA processes as per requirements of the EMA.

6.2.2.6 Installation of Capping Wall and Service Tunnel

Upon completion of the quay wall and backfilling reclamation process, a reinforced concrete capping wall will be constructed atop the quay structure. This wall will

incorporate a service tunnel designed to house essential quayside utilities, including water supply, electrical distribution, communications, and fuel lines required for vessel servicing.

6.2.2.7 Extension of Onshore Services

To ensure seamless integration with existing port infrastructure, the following onshore services will be extended into the newly reclaimed area:

- Internal access roads and pedestrian pavements
- Railway spur extensions for cargo handling
- Water supply and sewerage networks
- Electrical and lighting systems
- Storm water drainage and fire protection infrastructure

These installations will follow existing design standards and environmental safeguards to maintain operational continuity and minimize terrestrial impact.

6.2.3 Operations

Operations of the new port area will be similar to the operations of the current port footprint and be on a landlord and tenant principle. Port tenants conducting activities which are also listed in the EMA as requiring environmental clearance, will be subject to their own environmental assessment, with an EMP which must align with that of Namport.

Port infrastructure under direct control of Namport will require periodic maintenance, replacement or upgrade in order to ensure continued functionality. Construction of completely new infrastructure as the demand for various port services and facilities change, may also be required. Some aspects of such construction activities may require their own environmental assessment or amendment of the port's EMP, depending on the type and scale of the proposed construction activity.

7 ALTERNATIVES

Various alternatives are considered. These mainly relate to location, construction methods and type of infrastructure, and the no go alternative. These are discussed below.

7.1 LOCATION

Various locations for port expansion and new port development have and are still being considered by the Proponent. A feasibility study completed in 2011 (Aurecon, 2011) compared nine different alternatives, ranging in location from Northeast Point in the north of Lüderitz Bay to Diaz Point (Figure 7-1). Shallow water depths, hard bedrock, and persistent strong winds, exacerbated by rough sea conditions, significantly constrain the feasibility of port expansion. Although each proposed option could be technically engineered into a functional port, doing so would entail substantial costs. Such development should only be pursued if supported by a guaranteed and financially viable client base. Furthermore, some options like Option 2 and 3 in Figure 7-1 are not considered feasible due to the impact it will have on Shark Island, a site of National Heritage Importance. Similarly, Option 1 as presented in Figure 7-1, is also no longer feasible due to the proposed extent of onshore development encroaching on Shark Island.



Figure 7-1 Port alternatives considered in 2011 feasibility study (Aurecon, 2011)

A recently considered option for port expansion entails land reclamation within Lüderitz Harbour, on the western side of Shark Island. This option is still under consideration and is possibly one of the main large scale port expansion options available to Namport. Current port demand does however not warrant immediate investment into this option.



Figure 7-2 Port expansion option into Lüderitz Harbour as considered during 2025

Currently, the most feasible port expansion project is a modified version of the 2011 Option 1 alternative. The design of Option 1 was altered in order to not infringe on Shark Island and impact on its cultural heritage. The entire development is offshore and is directly linked to the current port infrastructure, with access to the new reclaimed area via the existing port. It is considered the most favourable alternative as it is the option that can provide much needed berthing and operational space in the shortest time. With all other viable alternatives, there will be a need to, in addition to port infrastructure, also develop new roads, railway lines and utilities. This will not only have huge financial implications, but also delay the provision of much needed port space.

7.2 CONSTRUCTION METHODS

Table 7-1 presents some alternatives under consideration for the port expansion project.

Table 7-1 Construction method alternatives

Alternative	Advantages	Disadvantages	Preferred Option
Quay Wall Construction			
Steel Sheet Pile Retaining Wall	♦Faster construction time ♦Reduced costs ♦Can accommodate some ground movement and differential settlement	♦Susceptible to corrosion ♦Regular maintenance required ♦Requires tie-back anchors to increase load bearing capacity ♦High noise and vibration levels during installation of sheet pile	♦Steel sheet pile retaining wall due to shorter construction period and reduced costs
Reinforced Concrete Deck on Piles	♦Increased durability ♦Lower maintenance ♦High load bearing capacity	♦Slower construction time ♦Increased costs	

	♦Lower noise and vibration impact when pre-drilling (boring) is conducted	♦Rigid structure sensitive to differential settlement	
Fill Material for Reclamation			
Dredged Sediments	♦Dual purpose – deepening of port and reclamation ♦Cheaper ♦Reduced heavy vehicle traffic through town to the port	♦Sediments may not be of suitable quality	♦Dredged sediments if suitable quality available
Onshore Quarry Material	♦Suitable material can easily be identified	♦High traffic volumes through town ♦Expensive ♦Terrestrial impacts at quarry	
Water Supply			
NamWater Koichab Supply Scheme	♦Already available and reticulated to the existing port	♦Could create water supply disruptions to Lüderitz if supply is not sustainable	♦NamWater Koichab Supply Scheme if sustainable supply is confirmed
Desalinated Water (Mobile Unit)	♦Being a mobile unit it can quickly be commissioned ♦No additional pressure on NamWater supply	♦Additional localised impacts on marine environment through brine return ♦More expensive	

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. ♦ 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.

Law	Key Aspects
Namibian Ports Authority Act **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 **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 **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. o Declaration of the Namibian Islands' Marine Protected Area: Marine Resources Act (2009). o Regulations relating to Namibian Islands' Marine Protected Area: Marine Resources Act, 2000 (2012).
Water Resources Management Act **Act No. 11 of 2013, Government Notice No. 332 of 2013**	♦ Provide for management, protection, development, use and conservation of water resources. ♦ Prevention of water pollution and assignment of liability. ♦ Licensing for abstraction of water and disposal of wastewater.
Dumping At Sea Control Act **Act No. 73 of 1980, Government Notice No. 1149**	♦ Provide for the control of dumping of substances in the sea.
Marine Traffic Act **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 **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 **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 **Act No. 18 of 2002**	♦ Regulates aquaculture activities to ensure sustainable development. ♦ Provides for water quality monitoring to protect aquaculture activities.
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.
Regional Councils Act **Act No. 22 of 1992; Government Notice No. 115**	♦ Sets out the powers, duties, functions, rights and obligations of Regional Councils. ♦ Provides the legal basis for the drawing up of Regional Development Plans.

Law	Key Aspects
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.
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).
National Heritage Act of Namibia **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. ♦ 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. ♦ Promote the integration of wetland management into other sector policies. ♦ 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.
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. ♦ Not adopted yet.
Hazardous Substances Ordinance **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.
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

Agreement	Key Aspects
	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. ♦ Provides an overarching legal framework for all marine-related programmes in West, Central and Southern Africa.
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. ♦ Includes the EMP 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 8 and 10 of Government Notice No. 29 of 2012 of the Environmental Management Act:

Water Resource Developments

8.1 The abstraction of ground or surface water for industrial or commercial purposes – only applicable if desalinated water will be used during the construction or operational phase.

8.10 Reclamation of land from below or above the high-water mark of the sea or associated inland waters – Reclamation of land constitutes a major activity during the expansion of the port.

8.12 The release of brine back into the ocean by desalination plants - only applicable if desalinated water will be used during the construction or operational phase.

Infrastructure

10.1 The construction of-

(c) railways and harbours – a new area is developed as a harbour.

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 port expansion project 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). All port expansion activities will take place within the port boundaries of Namport, but sourcing of filling material may be from licenced quarries in the region with suitable fill material.

West of the reclamation area is Shark Island, an area with significant heritage history (see Section 9.8) (Figure 9-1). It was declared a heritage site in terms of the National Heritage Act in 2019. However, until mid-2025, Shark Island continued to be under the management of Namibia Wildlife Resorts as a campsite. It was then placed under the management of the National Heritage Council (NHC) and camping is thus no longer allowed.

West of the existing commercial harbour, on Shark Island, are accommodation establishments, residences and the Directorate of Fisheries, Ministry of Agriculture, Fisheries, Water and Land Reform (MAFWLR). Southwest of the existing port is part of Namport's properties and it hosts the Port of Lüderitz head office and Lüderitz Boatyard. South of the entrance gate to Namport is the business district of Lüderitz while to the southeast the Lüderitz Waterfront is located. Onshore and offshore land use 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. Lüderitz in its entirety is surrounded by the Tsau //Khaeb (Spergebiet) National Park and Namibian Islands' Marine Protected Area (NIMPA) (Figure 9-2). Almost the entire coastline around Lüderitz falls within one of the numerous mining and exclusive prospecting licence areas. The harbour and proposed expansion areas are within diamond mining licence area ML-32.

Prior to German colonial rule, Lüderitz was the territory of the local Nama people. Today the !Aman Traditional Authority is regarded as having jurisdiction over the area of Lüderitz, in so far as the Traditional Authorities Act makes provision therefor.

Implications and Impacts

Jurisdiction over the existing harbour and proposed expansion area is a mix between the Ministry of Works and Transport (ports, marine traffic and pollution control), MAFWLR (authority over the offshore environment and NIMPA), Ministry of Industries, Mines and Energy (mining and exploration), and the !Aman Traditional Authority. Support for the development therefore needs to come from various authorities in order for its successful implementation.

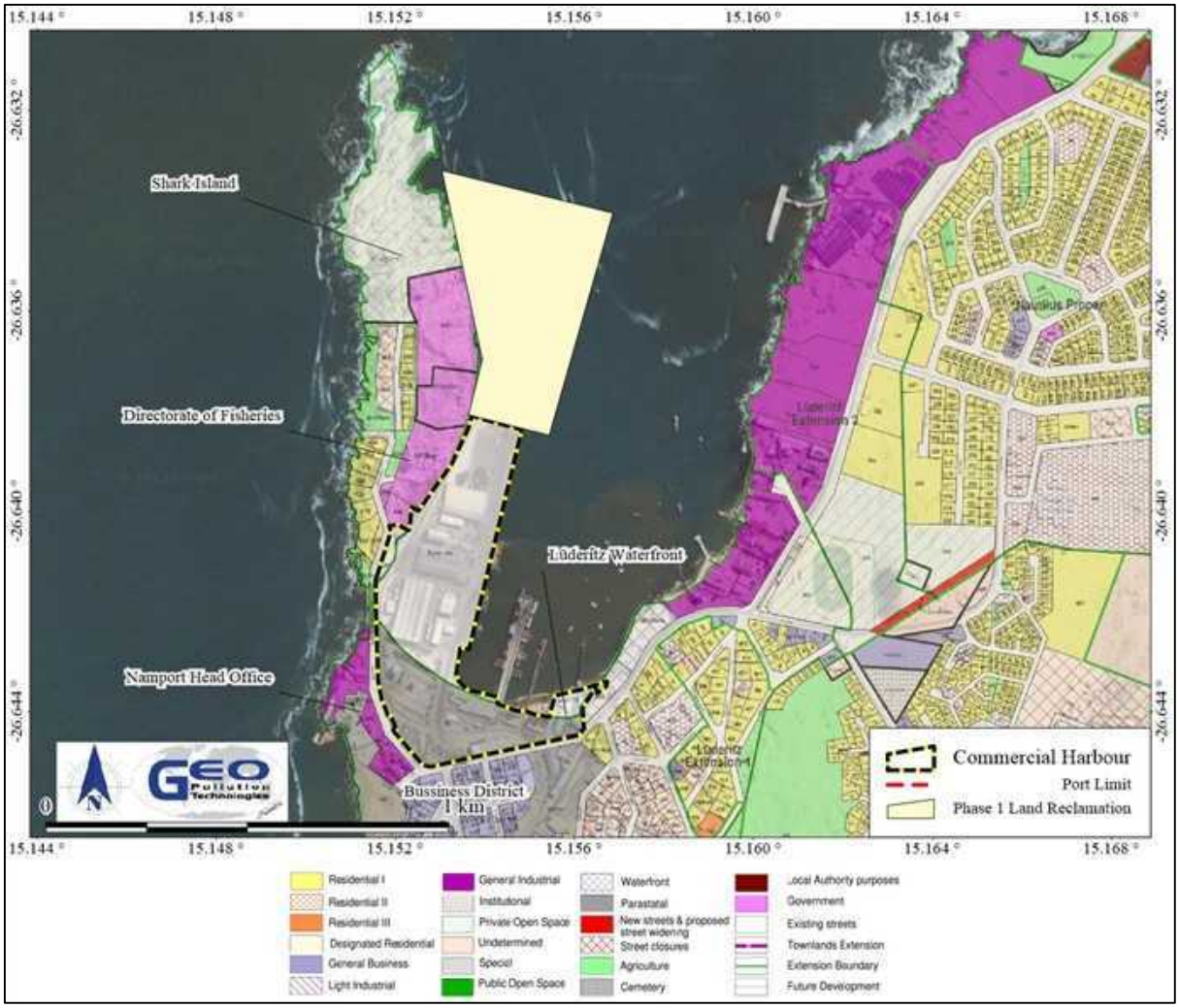


Figure 9-1 Surrounding land use

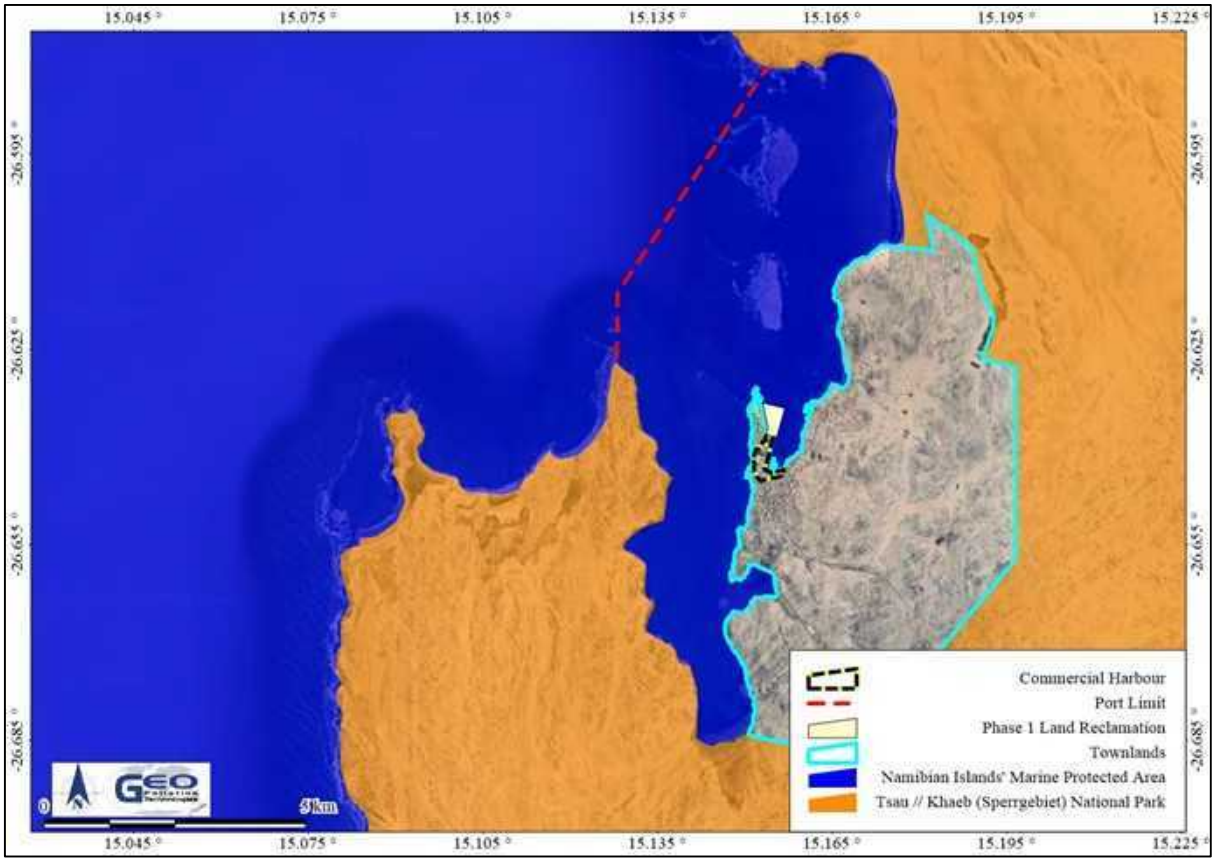


Figure 9-2 Lüderitz in relation to protected areas

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).

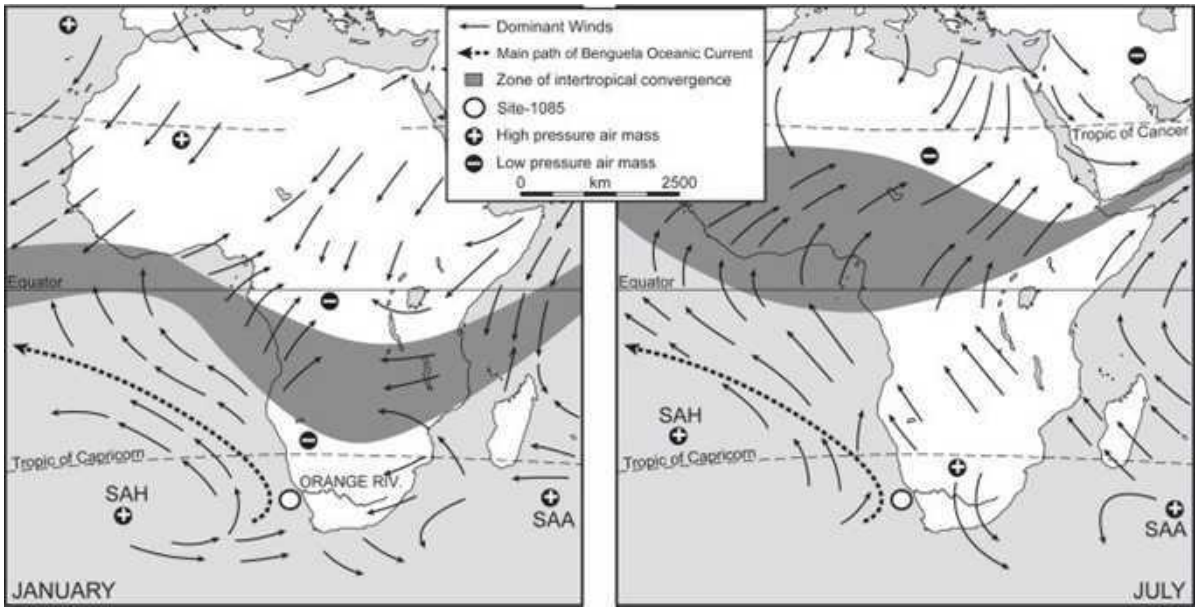


Figure 9-3 Map indicating the Intertropical Convergence Zone, Subtropical High Pressure Zone (SAH+), Benguela Current and Temperate Zone south of Tropic of Capricorn (not indicated) (from: http://www.meteoweb.eu)

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 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). 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 $^{\circ}$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.

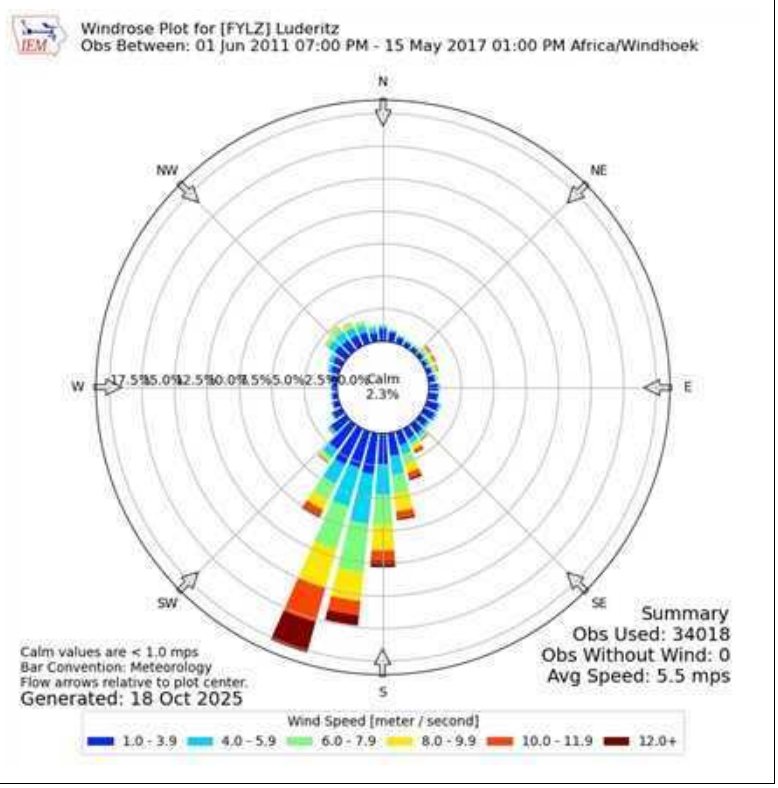
Temperature at Lüderitz is strongly regulated by the cold Benguela current. As a result, there is typically limited variation between diurnal and seasonal temperatures. Average annual temperatures are approximately 16 °C with the maximum temperature seldom above 24 °C and minimums rarely below 9 °C (Table 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. It also influence wave action and is one of the main determining factors when planning for port expansion. Wind also plays an important role in the dispersal of noise, either increasing or decreasing noise levels at receptors, depending on direction and speed.

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 Average minimum: Between 16.5 °C in February and 9.1 °C in August 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 18 October 2025 for the Lüderitz Airport (http://mesonet.agron.iastate.edu/)	

9.3 CORROSIVE ENVIRONMENT

The corrosive environment of Lüderitz can be closely related to that of Walvis Bay. Figure 9-4 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 sodium chloride 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.

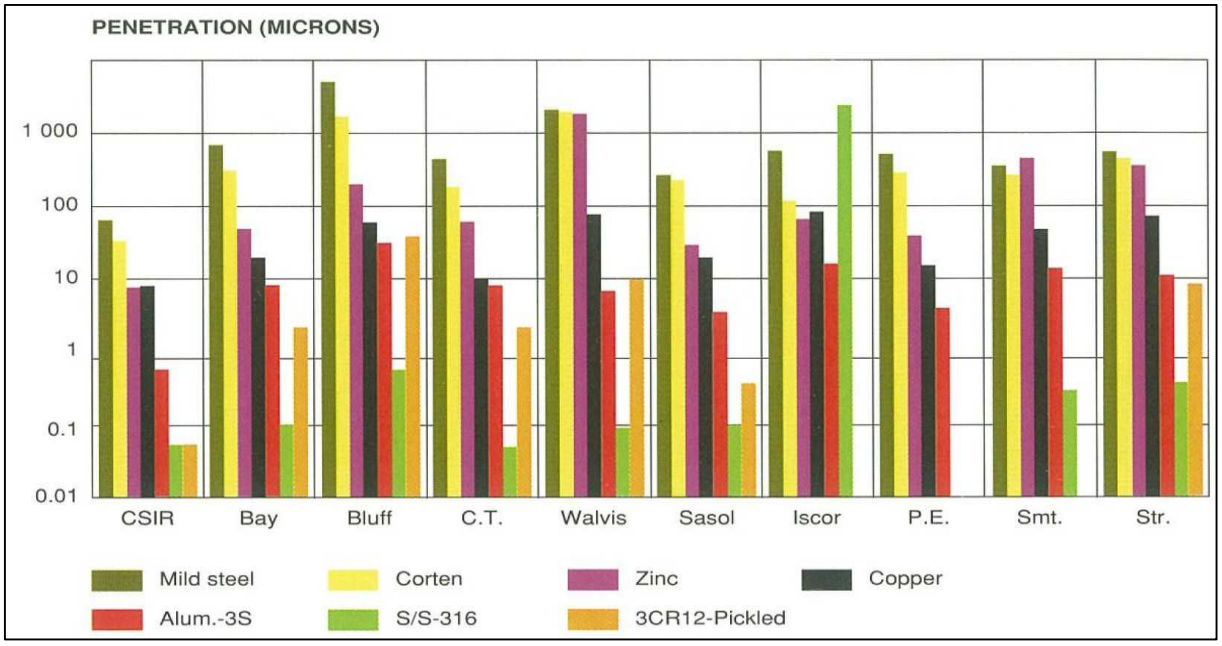


Figure 9-4 Twenty year corrosion exposure results in southern African towns (Callaghan, 1991)

Implications and Impacts

Corrosion levels may be high and must be kept in mind when planning construction activities to ensure longevity of infrastructure.

9.4 TOPOGRAPHY

The whole of Lüderitz Bay area is characterized by mostly rocky shores with small, scattered sandy bays and lagoons (Figure 9-5). Offshore within Lüderitz Bay are small rock island formations namely Shark-, Penguin-, Seal- and Flamingo Island (Figure 9-5). 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 9-6). The depths west of Penguin Island and north of Lüderitz Harbour reach 10 to 15 mbs.



Figure 9-5 Major bays, beaches and islands in relation to the port expansion area

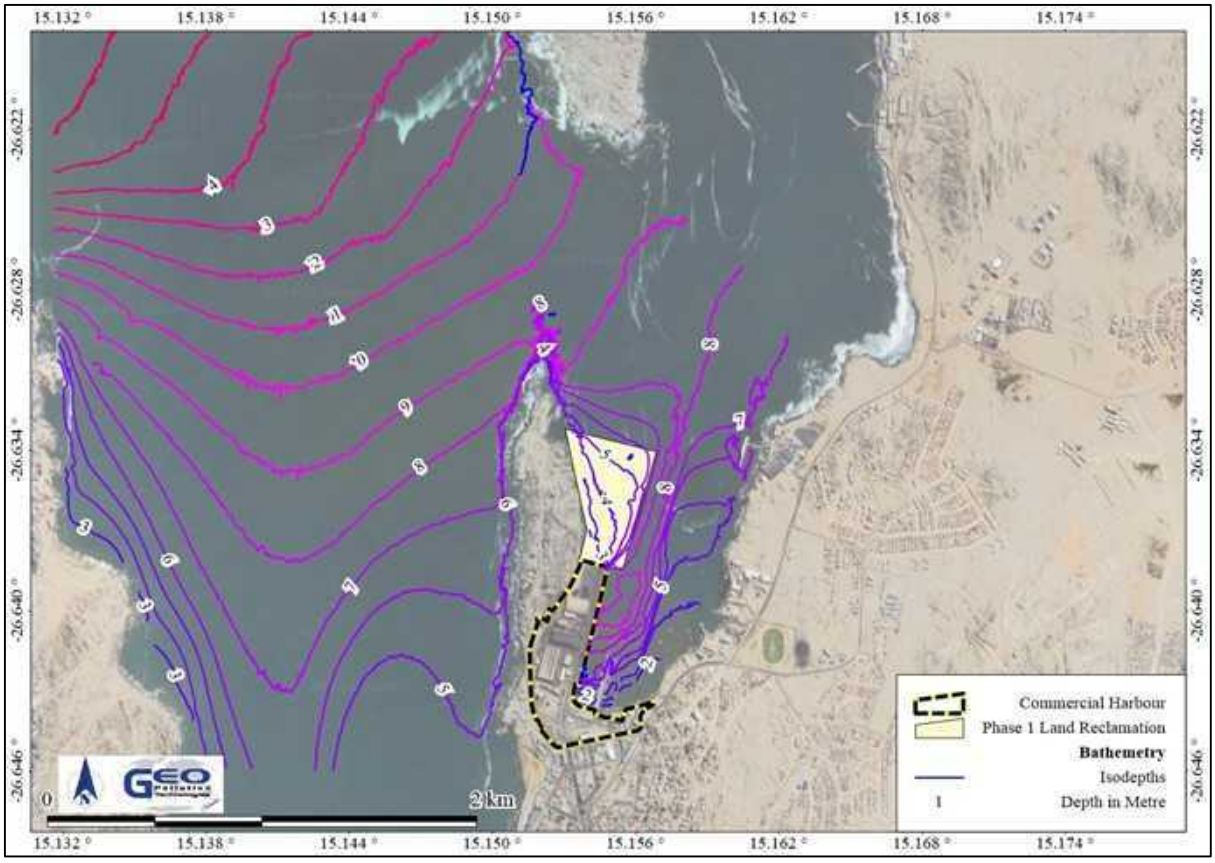


Figure 9-6 Bathymetry in relation to the port expansion area

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.

9.5 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 limits port depth and will influence construction methods.

9.6 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, the port expansion.

9.6.1 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. 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
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 dredging plumes and spills 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.

Wave action is more pronounced on the eastern side of Robert Harbour, thus limiting port development opportunities in this area. Fishing industries operating from this area can also not always use their own jetties and must make use of the port when increased wave action is experienced.

9.6.2 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 metres 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 port construction activities, like 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 an infrequent 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 9-7 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 possible re-suspension of sediments during construction activities 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. Dredging of sediments will require adherence to the existing Port of Lüderitz EMP for dredging.

9.6.3 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. The release of associated nutrients from the dredged sediments will likely have further impacts on the environment.

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 9-8) (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 9-8). 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 9-8 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

9.6.4 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 9-9). 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 9-9 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.

9.6.5 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 9-10).

The IBA consist of the four island - Halifax, Penguin, Seal and Flamingo Island, as well as the rocky shoreline of the mainland. The islands support more than 10,000 birds while the rocky shorelines of the mainland support more than 14,000 shorebirds (https://www.keybiodiversityareas.org). 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. More recently, the NIMPA was established to, among others, protect threatened seabirds, breeding on the islands, from anthropogenic activity. On the islands most of the birds' numbers are declining despite the islands being protected and off-limits to the general public. Events such as recent outbreaks of Avian Influenza in 2018/19 near Lüderitz and 2021/22 further north, also took an additional toll on the African Penguin's long-term survival (Pers. Comm. Jessica Kemper).

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/). 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).

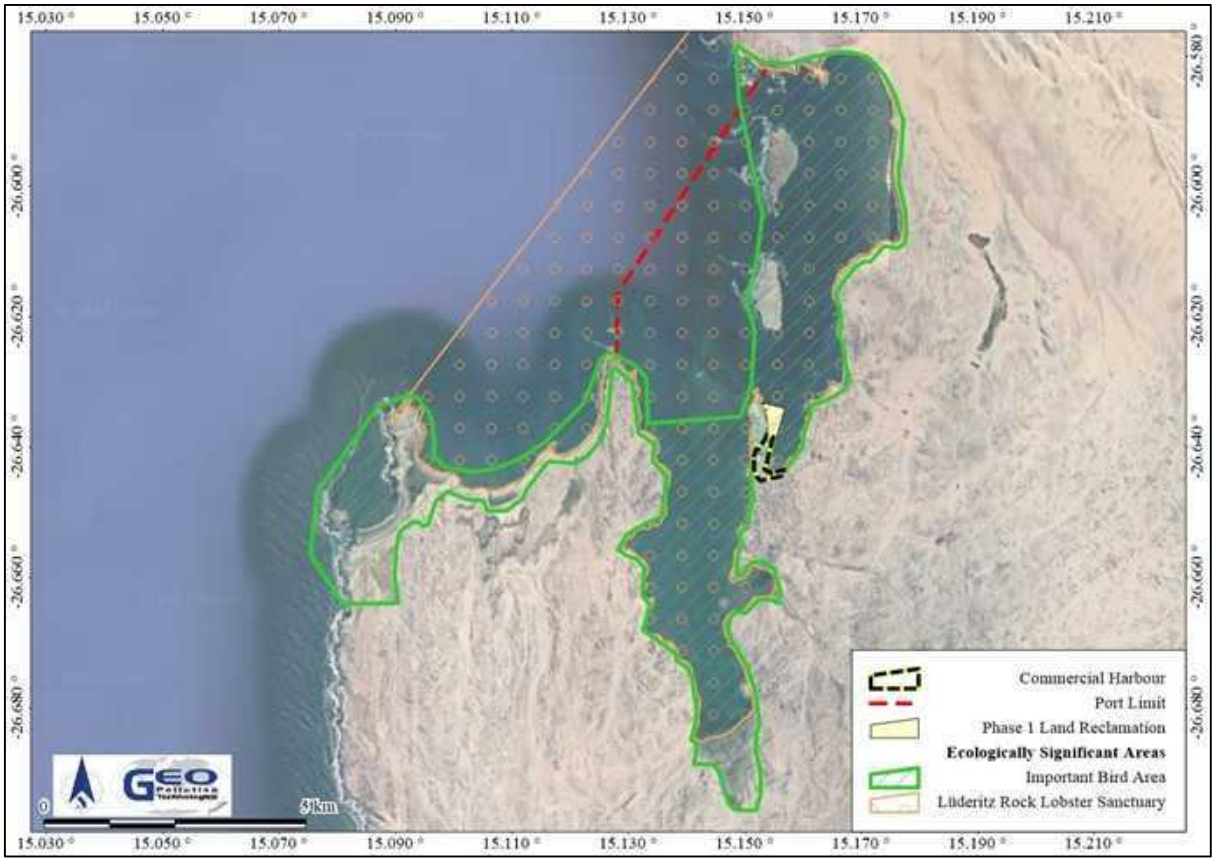


Figure 9-10 Ecologically significant offshore areas at Lüderitz

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). Breeding endemic to Namibia and South Africa	Critically Endangered (2024)	Rapid population decline with no sign of reversal	Commercial fishing and shifts in prey populations. Disease.
Bank Cormorant (*Phalacrocorax neglectus*)	Breeding endemic to Namibia and South Africa	Endangered (2018)	Very rapid decline in small population	Human disturbance, displacement by seals, food shortages and low quality food
Cape Cormorant (*Phalacrocorax capensis*)	Breeding resident in Namibia	Endangered (2018)	Decreasing population	Human disturbance, pollution, energy production and mining
Damara Tern (*Sternula balaenarum)*	Regional breeding endemic	Vulnerable until 2021 then Least Concern	Decreasing population	Habitat disturbance and mining

Common Name (Scientific Name)	Range	Status (Last Assessed)	Comments	Current Threats
Curlew Sandpiper (*Calidris ferruginea)*	Namibian resident with wide global distribution	Vulnerable (2024)	Decreasing population	Habitat loss and degradation, human disturbance
Eurasian Curlew Sandpiper	Non-breeding native to Namibia	Near Threatened (2017)		
Lesser Flamingo (*Phoeniconaias minor*)	Namibian breeding resident with relatively wide global distribution	Near Threatened (2018)	Decreasing population	Mining, power generation and transmission
Greater Flamingo	Breeding resident in Namibia	Least Concern (2018)	Increasing	Human disturbance, pollution, predation, power lines
Caspian Tern	Breeding resident in Namibia	Least Concern (2018)	Increasing	Human disturbance
African Oystercatcher (*Haematopus moquini*)	Namibian resident	Near Threatened till 2021, then Least Concern	Increasing population	Human disturbance e.g. off-road driving on beaches
Crowned Cormorant (*Microcarbo coronatus*)	Breeding endemic to Namibia and South Africa	Near Threatened till 2021, then Least Concern	Small but stable population	Disturbance and marine pollution
Cape Gannet (*Morus capensis*)	Breeding endemic to Namibia and South Africa	Endangered (2018)	Decreasing population	Food shortage, storms, habitat loss, marine pollution, etc.

Source: The IUCN Red List of Threatened Species (https://www.iucnredlist.org/)

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, Heaviside'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. 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 sediment at the proposed site for port expansion consists mainly of very fine silt and has low species diversity and abundance compared to the near shore benthos where rock, gravel and sand provides diverse habitats and niche differentiation (Pers. Comm. Vanessa Maitland). Photo 9-1 to Photo 9-6 are screen captures from video footage taken during the diver searches as part of the maritime and underwater cultural and heritage assessment. The footage are of the near shore eastern side of Shark Island.



Photo 9-1 Macro algae attached to rocks (Maitland 2025)



Photo 9-2 Gravel bottom with low diversity (Maitland 2025)



Photo 9-3 Starfish (Maitland 2025)



Photo 9-4 Rocks with various mollusc (Maitland 2025)



Photo 9-5 Anemone (Maitland 2025)



Photo 9-6 Kelp with anemones (Maitland 2025)



Photo 9-7 Sandy bottom with crayfish (Maitland 2025)



Photo 9-8 Mussel bed (Maitland 2025)

Implications and Impacts

Habitat destruction where reclamation will take place is inevitable. This area however has decreased species richness and abundance when compare to shallower water close to the rocky shore. Pollution and waste can impact marine species and birds, including breeding colonies on nearby islands. Birds foraging on the eastern Shark Island rocky shore will likely leave during construction, but may return during the operational phase. Bright lighting used at night will impact birds, like flamingos, that fly at night.

9.7 SOCIO-ECONOMIC ENVIRONMENT

Lüderitz developed in the early 20th 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 few 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 culturing of kelp for export purposes.

Diamond mining used to be a major part of the mining industry with zinc mining being the other major component. Their contribution to the local economy have however significantly diminished in recent years. The local community's expectation now is that offshore oil and gas development and onshore green energy technologies will bring much needed employment and economic input in the town and region.

Tourism plays an important part in the local economy, unfortunately a very small percentage of tourists visiting Namibia also visits Lüderitz. This is because Lüderitz is essentially located in a cul-de-sac with tourists having to drive hundreds of kilometres to mainly be able to visit Lüderitz,

and then drive the same route back. Cruise liners do make periodic stops in Lüderitz, boosting the local tourism industry mainly through passengers taking short guided excursions in the area. Main attractions are Kolmanskop, Diaz Point, historic buildings of the town and guided trips by concession holders into the Tsau //Khaeb (Sperrgebiet) National Park. A new maritime museum also recently opened, the largest of its kind in Africa.

Most basic services and products are provided by a small business 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 sightseeing tours in Lüderitz Bay are launched.

Between 2001 to 2011, the Lüderitz Constituency (now !Nami#Nûs) and Lüderitz had a declining population trend (from 14,542 to 13,859 for the constituency). By 2023 the population has however increased to 17,243 (Namibia Statistics Agency, 2011; Namibia Statistics Agency, 2024). The remoteness of Lüderitz and the lack of employment and economic diversification opportunities possibly contributed to the earlier decline, while new economic drivers in the form of oil and gas exploration, green energy and increased port exports of metal ores from South Africa have led to the recent increase.

In 2011, Lüderitz had an unemployment rate of 28.2% which was slightly lower than the rate of 32.2% of the ||Kharas Region (Namibia Statistics Agency, 2011). Census data of 2023 shows unemployment in the !Nami#Nûs Constituency decreased to 24.8% compared to 29.7% for the ||Kharas Region and 36.9% for Namibia.

Table 9-7. Demographic characteristics of !Nami#Nûs Constituency, the //Kharas Region and Nationally (Namibia Statistics Agency, 2024)

	!Nami#Nûs Constituency	||Kharas Region	Namibia
Population (Males)	7,831	55,670	1,474,224
Population (Females)	8,294	54,223	1,548,177
Population (Total)	16,125	109,893	3,022,401
Population Density (persons/km^2)	59.7	0.7	3.7
Unemployment Rate (%)	24.8	29.7	36.9

Implications and Impacts

The Port of Lüderitz directly and indirectly sustains 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 the town, the region and Namibia as a whole. Services provided for port operations, and the proposed expansion, 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 caused by construction activities. The filter feeding mussels and oysters, and the sensitive abalone could be adversely affected by, for example, heavy metals and other pollutants that are re-suspended and dissolved in the water column during dredging and carried towards the mariculture areas by currents.

9.8 CULTURAL, HERITAGE AND ARCHAEOLOGICAL ASPECTS

Lüderitz has a rich history related to the discovery of diamonds, but also one of colonial trauma and genocidal legacy. In 1487, Bartholomew Dias, a Portuguese explorer landed at what is now known as Dias Point. It marks the first European contact with the Namibian coast, though no settlement was established at the time. The area remained largely uninhabited until the late 19th century, when German merchant Adolf Lüderitz purchased the land from local Nama chiefs, leading to the establishment of the town Lüderitz. By the 1890's, Lüderitz had developed into a key trading port under German South-West Africa, serving as a supply base, to the discovery of diamonds and the subsequent diamond rush in the early 1900's. Lüderitz therefore has some of

the oldest buildings in Namibia and it developed around the port area, and thus the historic centre of the town is also situated around the port. A number of buildings have been declared National Monuments in Lüderitz and these include, among others, the Railway Station Building in Bahnhof Street, the German Lutheran Church in Kirch Street, the Deutsche Africa Bank Building and Krabbenhöft und Lampe Building in Bismarck Street.



Photo 9-9 Krabbenhöft und Lampe building



Photo 9-10 Deutsche Africa Bank Building

In 1904, shortly before the discovery of the first diamond, Shark Island, which at that stage were still surrounded by the ocean and only connected with the mainland by a wooden bridge was turned into a concentration camp. Here the Germans imprisoned Nama and Ovaherero rebels and slaves. They had to live here in the extremely harsh conditions of Lüderitz, with the bare minimum as shelter. Based on written and photographic records and the information shared by survivors of the concentration camp, they were not only used to work as slaves, but were tortured, starved, raped and murdered, while the skulls of those who died were send back to Germany to be studied. Diseases raged through the camp, worsened by malnutrition and extreme physical labour, leading to many more deaths. The bodies of those who died were either thrown into the ocean, buried in shallow graves on the island, close to the shoreline, or buried on the outskirts of Lüderitz, such as at Radford Bay. Those buried on Shark Island were quickly exposed by wave action and washed away. The Shark Island concentration camp was finally closed in 1908 and the prisoners moved to a new, less exposed, site outside Lüderitz.

Today, very little physical evidence of the tragic history of Shark Island remains. Some areas were backfilled and the area developed as a camping and recreational site. However, in 2019 Shark Island was declared a heritage site and in 2025 it was placed under custody of the NHC. Although the port expansion project is completely offshore from Shark Island, a terrestrial archaeology study, focusing on the eastern shoreline closest to proposed reclamation area, was conducted by Dr. John Kinahan. The report is available in Appendix A and is discussed in section 9.8.1. A maritime and underwater cultural heritage (MUCH) assessment was also commissioned. This study focused on the offshore environment where the Phase 1 port expansion is planned. The report is available in Appendix B and is discussed in section 9.8.2.

The discovery of the first diamond in 1908 led to the diamond rush and further development of the Lüderitz, and specifically Kolmanskop, a thriving diamond town and headquarters of Consolidated Diamond Mines of South West Africa Ltd. By the late 1930's, larger diamonds were discovered at the mouth of the Orange River, and the demise of Kolmanskop started. It continued as a transport depot with the last people leaving in the mid 1960's. Today it is one of Namibia's most popular and iconic tourist attractions and arguably the main attraction and only reason why many tourists includes Lüderitz in their itinerary.

9.8.1 Terrestrial Archaeology

The following is a summary of the terrestrial archaeology study conducted on Shark Island in 2024 (Kinahan, 2024) (Appendix A). A field survey of Shark Island on the eastern shoreline of the island, where direct impacts of the Namport Quay Extension project are most likely,

were conducted. Seven significant archaeological sites were discovered. Six of the sites seems to be remains of the Shark Island concentration camp and appear to be the only visible physical remains of the concentration camp surviving the extensive landscaping of Shark Island to create the camping site. Further remains may be preserved beneath the landscaped surface, but these would only be detected by geophysical prospection or excavation. The archaeological sites found, together with two monuments, are presented in Figure 9-11 together with significance and vulnerability to the threat of development. Details on each find is summarised in Table 9-8.

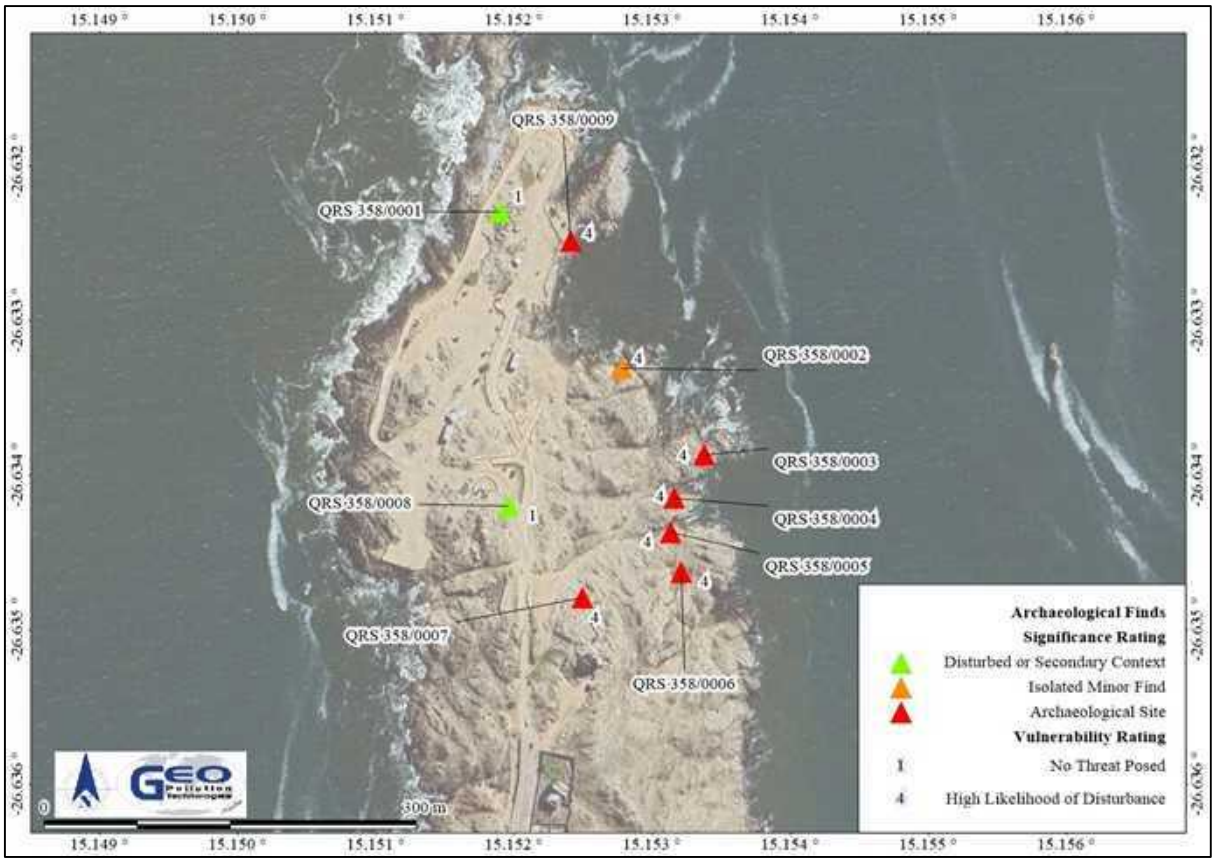


Figure 9-11 Terrestrial archaeology sites located on the archaeological survey of 2024

Table 9-8 Terrestrial archaeology site details for the archaeological survey of 2024 (see Figure 9-11)

ID	Description	Significance	Sensitivity
QRS-358/0001	Recently erected monument that has toppled over.	1	1
QRS-358/0002	Sherds of 19th century green bottle glass probably associated with the Shark Island concentration camp.	2	4
QRS-358/0003	Small 1 × 2 m shell midden mainly *Patella argonvillei* and *P. granularis*, associated with clear and green 19th century bottle glass sherds as well as fragments of rusted iron and charcoal, probably associated with the Shark Island concentration camp.	3	4
QRS-358/0004	Green, purple and clear 19th century bottle glass sherds retouched as small implements probably associated with the Shark Island concentration camp. These are associated with three typical "robin's egg" blue glass beads dated to approximately 1904 on sites in the !Khuiseb Delta.	3	4

ID	Description	Significance	Sensitivity
QRS-358/0005	Iron stanchion with "X" section set into rock and with iron shackle probably from horse saddlery attached to short length of heavy barbed wire, probably associated with the Shark Island concentration camp.	3	4
QRS-358/0006	19th century earthenware and glass sherds with small scatter *Patella argonvillei* and probably associated with the Shark Island concentration camp.	3	4
QRS-358/0007	Dense, highly fragmented shell midden approx. 5 × 10m. Probably predates the concentration camp	3	4
QRS-358/0009	Monuments to the Fredericks clan, Vogelsang and reburied human remains from the old Nautilus cemetery.	1	1
QRS-358/0009	Small shell midden mainly fragmented *Patella* spp with 19th century bottle glass probably associated with the Shark Island concentration camp.	3	4

9.8.2 Maritime and Underwater Cultural Heritage

The following is a summary of the MUCH assessment (Maitland, 2025) (Appendix B). Desktop studies, magenetometer surveys and diver searches were used for the MUCH assessment. Based on the desktop assessment, nine shipwrecks of low to medium significance may be in the vicinity of the port expansion area, but their locations are unknown and the likelihood of their presence is low. Two shipwrecks with no significance are located in the port expansion zone, the Christiaan de Wet, wrecked in 2011 and an unidentified vessel wrecked in 2022. The magnetometer survey aimed at detecting shipwrecks and metal objects indicated three sites requiring investigation. During the diver searches these three sites were investigated, but nothing of archaeological significance was found. It is possible that objects may be covered with silt. Furthermore, the diver searches only found modern objects, mostly waste, such as glass bottles, tyres and one metal object, maybe originating from the 2022 unidentified shipwreck. No human remains or any object that could be linked to the concentration camp on Shark Island were detected. However, the shallow waters near the coastline could not be investigated and there may be artefacts of significance, especially in the small inlets between rocky outcrops. The likelihood of human remains being present after more than a century is extremely small.

Implications and Impacts

With the port expansion being offshore, construction is not expected to directly impact on any of the known or potentially undiscovered cultural or historically significant artefacts on Shark Island or buildings in town. Discovering significant artefacts in the sediments of the expansion area is unlikely. However, damage to artefacts of heritage significance can occur if construction teams and machinery move outside of the project footprint.

10 PUBLIC CONSULTATION

Consultation with the public forms an integral component of an environmental assessment investigation and enables I&APs, for example neighbouring landowners, local authorities, environmental groups, civic associations and communities, to comment on the potential environmental impacts associated with a project and to identify additional issues which they feel should be addressed during the environmental assessment process.

The need for archaeological, visual and noise specialist studies was identified at an early stage of Namport's planning process to initiate the environmental assessment for the port expansion. Hence, these studies were commissioned prior to the official public consultation process in order to allow for the provision of up to date, specialised information to IAPs. Once the specialist studies were completed,

the environmental assessment's public participation process was made public in accordance to the regulations of the EMA. This entailed:

- Compilation of a stakeholder database.
- Compilation of a background information document, press notice, notification letters, and site notice.
- Environmental assessment announcements in two nationally distributed newspapers, once a week for two consecutive weeks (The Namibian and Republikein on 18 and 25 August 2025).
- Hand delivery of notification letters to the executive directors' offices of key ministries.
- E-mail and multimedia messages with notification letters to identified stakeholders.
- A site notice was placed at the entrance to the Lüderitz port.

Through this process, IAPs were invited to register with Geo Pollution Technologies in order be included in the public participation process, to comment on the project, and ultimately to review and comment on the EIA, EMP and specialist reports.

Due to the nature and location of the project, three public meetings were scheduled in Lüderitz (3 and 4 October 2025), even though public meetings are not a requirement of the EMA for an environmental assessment process (Photo 10-1 and Photo 10-2). The agenda of the three meetings were the same, but were scheduled as three separate meetings to allow for flexibility in attendance and cater for those who had to travel.

Proof of notifications, the stakeholder database, registered IAPs, minutes of meetings, and a comments and responses table are included in Appendix E to Appendix G.



Photo 10-1 Public meeting



Photo 10-2 !Aman Traditional Authority attendees at public meeting

Prior to the commencement of the current environmental assessment process, the operational EMP of the Port of Lüderitz was amended to renew the port's ECC. The proposed port expansion project was initially included in this process, but the need for a stand-alone environmental process was quickly ascertained. All environmental assessment work related to the expansion project was thus halted, until the current process was initiated in 2024. To avoid duplication, all communication between GPT and I&APs during the EMP amendment process is not included in Appendix F, but is available upon request.

11 ASSESSMENT AND MANAGEMENT OF IMPACTS

The purpose of this section is to identify, describe and assess environmental impacts that are expected from a project.

For each impact, an environmental classification is 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 11-1).

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 11-2.

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 11-1 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 11-2 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

Preventative and mitigatory measures are also provided for impacts and an EMP based on these identified impacts are produced. 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 corrective measures needed, although additional mitigation measures may require implementation for some impacts.

The impacts, descriptions and environmental management measures are provided in the tables and descriptions below. The management measures should be adhered to during the various phases of construction. Ultimately the operations of the new expanded port will be incorporated into the existing operational EMP of the Port of Lüderitz.

This section of the report can act as a stand-alone document. All contractors and personnel taking part in the construction of the expanded port should be made aware of the contents of this section, so as to plan the construction process accordingly and in an environmentally sound manner.

The objectives of the EMP are:

- to include all components of construction 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 contractors and personnel in applying such controls; and
- to ensure that appropriate environmental training is provided to responsible contractors and 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 medium to low significance. The spatial extent of impacts are mostly limited to the proposed port expansion area and the immediate surroundings. Some impacts are of a permanent nature. Due to the nature of the surrounding areas, some cumulative impacts are possible.

11.1 ENVIRONMENTAL MANAGEMENT PLAN

11.1.1 Planning

During the planning phase it is the responsibility of the Proponent to ensure they, and all contractors, sub-contractors, consultants and other personnel who will be involved with the construction of the new port area comply with all legal and industry specific requirements. Management measures must be put in place prior to, and during construction, to ensure

potential environmental impacts and risks are minimised. The following actions are recommended during the planning phase and should continue for the duration of the project:

Namport

- Ensure that all necessary permits from the various ministries, local authorities and any other bodies that govern or authorise port construction are in place and remains valid.
- Ensure that reputable contractors and sub-contractors are appointed and enter into an agreement, which 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.
- Appoint a community liaison officer who can receive and deal with complaints and suggestions and share the contact details with the community.
- Communicate Namport's various emergency response procedures and operational procedures which are relevant to construction, to the relevant contractors involved in the port expansion project.
- For any dredging, comply with the existing EIA and EMP for dredging of the Port of Lüderitz.
- Ensure sufficient insurance 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 construction as outlined in the EMP in accordance with ECC conditions.
- Update the EIA and EMP if required and apply for renewal of the environmental clearance certificate prior to expiry.

Contractor

- Enter into an agreement with Namport which includes the EMP and environmental compliance, monitoring and reporting as required by Namport and the ECC.
- Where applicable, ensure that all requirements of the Ministry of Home Affairs, Immigration, Safety and Security are met with respect to work permits and entry into Namibia.
- 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.
- Obtain and implement all Namport's emergency response and operational procedures.
- Ensure sufficient insurance 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 construction as outlined in the ECC and as in agreement with Namport.

11.1.2 Employment

The construction of the expanded port will require various contractors, sub-contractors, building materials, equipment and infrastructure. Employment within goods and services suppliers' businesses will thus be sustained and new job opportunities may be created. Once operational, the new expanded port will require Namport to appoint new employees to be able to manage the larger footprint. However, more importantly, the additional space will be available to various new port tenants who will through both construction of for example new warehouses, and operations of those warehouse, sustain and create employment.

Project Activity / Resource	Nature (Status)	(A1) Importance	(A2) Magnitude	(B1) Permanence	(B2) Reversibility	(B3) Cumulative	Environmental Classification	Class Value	Probability
Construction	Sustaining or creating employment opportunities by appointing a contractor(s) and through support services offered to the contractor(s)	3	2	2	2	2	36	4	Definite
Operations	Enlarged Namport employee base. New businesses operating in the port requiring a new employee base.	3	2	3	2	2	42	4	Definite
Indirect Impacts	Port services sustain the majority of business relying on imports and exports of goods. Port operations will thus indirectly sustain and create new employment within those business.	4	3	3	2	3	96	5	Definite

Desired outcome: Provision of employment to local Namibians and adhering to Namibian legal requirements with respect to work permits.

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.
- Work permits for foreign employees and contractors.

Responsible Body:

- Proponent
- Contractors

Data Sources and Monitoring:

- Immigration Control Act 7 of 1993.
- Work permits and employee contracts on file.
- Bi-annual reporting 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).

11.1.3 Revenue Generation

During construction, contractors, resources and services will be procured locally where available and feasible, contributing to the economy of the town, region and Namibia. Through the efficient functioning of the expanded Port of Lüderitz, additional businesses will establish in the port, also contributing to revenue generation. Payment of employees' salaries and wages contribute to the overall economy of the town, region, Namibia and SADC countries exporting and importing goods via Lüderitz.

Project Activity / Resource	Nature (Status)	(A1) Importance	(A2) Magnitude	(B1) Permanence	(B2) Reversibility	(B3) Cumulative	Environmental Classification	Class Value	Probability
Construction	Local procurement of resources and support services by the resulting in revenue generation	3	2	2	2	2	36	3	Definite
Operations	Additional employment and port operations continuously require resources and services resulting in revenue generation	3	2	3	2	2	42	3	Definite
Indirect Impacts	Port services sustain the majority of business relying on imports and exports of goods. Port operations will thus indirectly result in the livelihoods of employees of such businesses.	4	3	3	2	3	96	5	Definite

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

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.
- Resources and services must be procured locally, if available. Deviations from this must be justified.
- Payment of taxes and remuneration in accordance with Namibian legislation.

Responsible Body:

- Proponent

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.
- Bi-annual reporting 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).

11.1.4 Skills, Technology and Development

Through employment and contracting of local companies and employees for certain aspects of construction, 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 operations 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 port with associated benefits of training of employees and acquiring of new skills.

Project Activity / Resource	Nature (Status)	(A1) Importance	(A2) Magnitude	(B1) Permanence	(B2) Reversibility	(B3) Cumulative	Environmental Classification	Class Value	Probability
Construction	Technological development and transfer of skills to the local population	2	1	2	2	1	10	2	Probable
Operations	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.

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.
- Training and skills development must be focussed on Namibians.
- Employees to be informed about parameters and requirements for references upon employment.

Responsible Body:

- Proponent
- Contractors

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.
- Bi-annual reporting summarising any training or skills development programmes provided to Namibians.

11.1.5 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 construction there will be an influx of foreign people in Lüderitz. 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 construction it is foreseen that the influx of people will create a significant or permanent change in the demographic profile of the local community, and may result in significant instances of socially deviant behaviour.

The prospects of more operators in the port may entice jobseekers to migrate to the town. The probability of negative impacts occurring, as discussed above, thus increases. More pressure will be placed on goods and services supply and housing. This is further aggravated by the remoteness of Lüderitz from

Project Activity / Resource	Nature (Status)	(A1) Importance	(A2) Magnitude	(B1) Permanence	(B2) Reversibility	(B3) Cumulative	Environmental Classification	Class Value	Probability
Before Mitigation/Prevention									
Construction	Social ills and deviant behaviour resulting from the temporary presence of foreign contractors	2	-2	2	2	2	-24	-3	Probable
Operations	Social ills and deviant behaviour resulting from an influx of jobseekers into the town and related unemployment	2	-3	3	2	2	-42	-4	Probable
After Mitigation/Prevention									
Construction	Social ills and deviant behaviour resulting from the temporary presence of foreign contractors	2	-1	2	2	2	-12	-2	Probable
Operations	Social ills and deviant behaviour resulting from an influx of jobseekers into the town and related unemployment	2	-2	3	2	2	-28	-3	Probable

Desired Outcome: To prevent growth in informal settlements and an increase in social ills, the spread of communicable diseases, and prevent / discourage socially deviant behaviour and criminal activities.

Actions:

Enhancement

- Timely information sharing with local, regional and national authorities as well as the suppliers of services to ensure timely development of the town and services to meet growing demands.
- As far as is practically possible, Namibian contractors and support services must be sourced from the town, region or nationally (if available). Deviations from this practice should be justified appropriately.

- Appoint reputable contractors with a proven track record of social responsibility.
- Maintain a comprehensive employee wellness program, ensuring that relevant support are provided to employees with information sessions on aspects such as dangers and prevention of communicable diseases such as HIV/AIDS, alcohol and drug abuse, and sound financial planning.
- No intoxicating substances, or persons under the influence of such substances, may be allowed in the port and construction areas.
- Adhere to all applicable laws and regulations relating to public and environmental health (e.g. sanitation requirements, work conditions, etc.).
- Disciplinary steps, within the legal parameters of Namibia, to be taken for socially deviant behaviour during working hours, should be clearly stipulated in employment contracts.

Mitigation

- Take disciplinary action against employees not adhering to contractual agreements with regard to socially deviant behaviour (e.g. alcohol or drug abuse during working hours).

Responsible Body:

- Proponent
- Contractors

Data Sources and Monitoring:

- Bi-annual reporting summarising employee demographics, educational programmes provided, information session attendance and training conducted.

11.1.6 Health, Safety and Security

Construction and operations rely on human labour who are exposed to health and safety risks. Working at heights and in confined spaces, diving, handling of hazardous chemicals, working with machinery all pose risks.

During operations, working with 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.

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

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

Project Activity / Resource	Nature (Status)	(A1) Importance	(A2) Magnitude	(B1) Permanence	(B2) Reversibility	(B3) Cumulative	Environmental Classification	Class Value	Probability
Before Mitigation/Prevention									
Construction	Physical injuries, chemical exposure, hypothermia or drowning, etc.	1	-3	3	3	1	-21	-3	Probable
Operations	Physical injuries, exposure to chemicals, dust and emissions, and criminal activities.	2	-2	3	3	1	-28	-3	Highly Probable
After Mitigation/Prevention									
Construction	Physical injuries, chemical exposure, hypothermia or drowning, etc.	1	-3	3	3	1	-21	-3	Improbable
Operations	Physical injuries, exposure to chemicals, dust and emissions, and criminal activities.	2	-2	3	3	1	-28	-3	Probable

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

Actions

Prevention

- 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, material safety data sheets (MSDS) and signage requirements (personal protective equipment (PPE), flammable etc.).
- Appointment of reputable contractors with a known history of responsible and safe construction practices.
- 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. This includes strict security to prevent unauthorised entry.
- Provide all employees with required and adequate PPE.
- Ensure that all personnel receive adequate training on operations of equipment / handling of harmful materials.

- 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.
- Dredging, if any, to adhere to the approved dredging EMP of the Port of Lüderitz.

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 emergency response procedures in case of incidents.

Responsible Body:

- Proponent
- Contractors

Data Sources and Monitoring:

- Industry standards and protocols, etc.
- An up-to-date health and safety file to be maintained.
- Any incidents or complaints must be recorded with action taken to prevent future occurrences.
- A bi-annual report should be compiled of all incidents reported. The report should contain dates when training were conducted and when safety equipment and structures were inspected and maintained, incidents or complaints received, including action taken to prevent future occurrences, must be included.

11.1.7 Traffic

Construction activities will increase traffic thorough the town to deliver constructing material, equipment, infrastructure, as well as filling material for land reclamation (if sourced from land). Should the latter be required, it will result in a significant temporary increase in traffic. Routes through town and into the port are limited and all traffic ultimately pass via Bismarck Street in the business area of town. This increases the likelihood of traffic delays, traffic incidents and road surface damage.

Future operations of the new port area 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 parking in town may block business' entrances and increase the likelihood of accidents and incidents.

Project Activity / Resource	Nature (Status)	(A1) Importance	(A2) Magnitude	(B1) Permanence	(B2) Reversibility	(B3) Cumulative	Environmental Classification	Class Value	Probability
Before Mitigation/Prevention									
Construction	Traffic congestion, accidents, and road wear and tear.	2	-3	2	2	3	-42	-4	Highly Probable
Operations	Traffic congestion, accidents, and road wear and tear.	3	-2	3	3	2	-48	-4	Highly Probable
After Mitigation/Prevention									
Construction	Traffic congestion, accidents, and road wear and tear.	2	-2	2	2	3	-28	-3	Highly Probable
Operations	Traffic congestion, accidents, and road wear and tear.	3	-1	3	3	2	-24	-3	Highly Probable

Desired Outcome: Minimum impact on traffic, no transport or traffic related incidents, good quality roads.

Actions

Mitigation

- Continuous consultation with the Lüderitz Town Council (LTC), Roads Authority and port users to find feasible measures and alternative to alleviate traffic congestion in town (for both construction and operational phases. This could include investigation and implementation of truck staging areas outside town, alternative access roads, bridges, etc.
- Trucks should not be allowed to park, overnight or obstruct any traffic in areas surrounding the port and the town.
- Adhere to The Road Traffic and Transport Regulations and all other applicable legislation related to road transport and maximum axle loads.
- If any traffic impacts are expected, such as during delivery of abnormal loads, traffic management should be performed.
- The placement of signs to warn and direct traffic or placement of marshals at potentially high incident areas (close too schools, at four way stops, etc.) will aid in mitigation of traffic impacts.

Responsible Body:

- Proponent
- Contractor

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.

11.1.8 Seafaring Traffic

Seafaring traffic may experience delays or in extreme instances be involved in collisions or allisions due to the construction of the expanded port area. Delays in ship arrivals or departures at the port can disrupt the timely delivery of goods, interfere with cruise liner schedules, affecting the tourism industry, and lead to a build-up of export-bound cargo within the port. 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.

Project Activity / Resource	Nature (Status)	(A1) Importance	(A2) Magnitude	(B1) Permanence	(B2) Reversibility	(B3) Cumulative	Environmental Classification	Class Value	Probability
Before Mitigation/Prevention									
Construction	Delays in calling to port and potential collisions and allisions.	2	-2	2	2	1	-10	-2	Probable
After Mitigation/Prevention									
Construction	Delays in calling to port and potential collisions and allisions.	2	-2	2	2	1	-10	-2	Improbable

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

Actions

Prevention

- Proper communication, management and planning will largely prevent seafaring vessel delays and accidents.
- Timely issuing of navigational warnings (Namport).
- Planning and communication with regular provision of construction updates to the Port Captain.
- All communications, navigational and warning systems on the vessel in working order and regularly tested and maintained.

Mitigation

- 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.

Responsible Body:

- Proponent
- Contractor

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
- Ships' logs to be duly maintained.
- Any complaints or incident reports received from seafaring traffic, with regard to port construction, should be recorded together with corrective action taken and measures implemented to prevent impacts from repeating itself.
- Bi-annual reporting on all seafaring traffic related incidents reported, complaints received, and action taken.

11.1.9 Fire and Explosion Risk

Products used during construction, e.g. fuel, solvents, 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. Dredging also pose fire risks on board the dredging vessel.

Project Activity / Resource	Nature (Status)	(A1) Importance	(A2) Magnitude	(B1) Permanence	(B2) Reversibility	(B3) Cumulative	Environmental Classification	Class Value	Probability
Before Mitigation/Prevention									
Construction	A fire that may lead to an explosion and infrastructure damage, injury or loss of life	2	-2	3	3	1	-28	-3	Probable
Operations	A fire that may lead to an explosion and infrastructure damage, injury or loss of life	2	-2	3	3	2	-32	-3	Probable
After Mitigation/Prevention									
Construction	A fire that may lead to an explosion and infrastructure damage, injury or loss of life	2	-2	3	3	1	-28	-3	Improbable
Operations	A fire that may lead to an explosion and infrastructure damage, injury or loss of life	2	-2	3	3	1	-28	-3	Improbable

Desired Outcome: To prevent injury or physical damage as a result of fire or explosions.

Actions

Prevention

- A holistic fire protection and prevention plan is needed. 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.
- Appointment of reputable contractors with known histories of responsible and safe construction practices.
- Share the requirements for firefighting based on the products kept on site with Namport.
- Ensure all materials are stored strictly according to MSDS instructions. This include segregation of incompatible products.
- Maintain firefighting equipment, implement good housekeeping and conduct personnel training (firefighting, fire prevention and responsible housekeeping practises).
- Operations of the dredger must be according to the approved EMP for dredging.

Mitigation

- Implement the emergency and firefighting plan immediately if a fire is detected.

Responsible Body:

- Proponent
- Contractor

Data Sources and Monitoring:

- 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, etc.
- Any incidents must be recorded with action taken to prevent future occurrences.
- Bi-annual report on all record keeping and incidents, including corrective action taken.

11.1.10 Noise and Vibration

Noise and vibrations are closely linked. The main noise activities that will result from port construction activities are related to the installation of the steel sheet pile, pile driving (if conducted, compaction of fill material, and heavy motor vehicle movement through town. Operational noise will vary depending on the activities of tenants, but will likely constitute vehicle and train noise, audible warning signals, cranes, picking up and putting down skips and containers, vessel engine noise, and closing and opening of doors and hatches. Noise can cause permanent hearing loss if continued exposure to loud noises occur or can be a nuisance to nearby community members such as at residences and accommodation establishments. Whole body vibration is common in vehicle and heavy machinery operators. It can cause lower back pain, motion sickness, bone damage, and digestive issues. Long-term exposure may lead to fatigue, drowsiness, and reduced concentration. Hand-arm vibration affects workers using power tools. It can result in nerve damage, vascular disorders, and musculoskeletal problems.

Not only living organisms are affected by vibrations. Machinery and structures also undergo wear and tear as it leads to accelerated mechanical fatigue and component degradation, loosened joints, cracks, and structural instability.

A noise impact specialist study was commissioned and is presented in Appendix C. Nearby residences and businesses were identified as noise sensitive receptors. Baseline noise levels were determined around the port. Measurements taken during both day and night reflect ambient sound levels characteristic of a low-noise urban environment. However, areas in close proximity to the port exhibited elevated noise levels, primarily due to the continuous operation of cranes and other port-related activities, which were clearly perceptible and acoustically dominant. In contrast, locations farther from the port resembled a typical coastal soundscape, where natural elements such as bird calls, wind, and waves prevailed. Depending on these natural ambient conditions, sounds from the port could be distinctly heard up to 750 metres away.

Conceptual noise models indicate potential noise impacts associated with the project would be: 1) of a high significance for daytime construction activities; 2) of a low significance for daytime operational activities associated with the port operational activities; and 3) of a high significance for night-time activities associated with the port operational activities. The author suggested various mitigating actions which are included below. It was concluded that existing port activities are generally audible at the closest noise sensitive receptors and the proposed expansion will slightly raise these noise levels. The increase is not flagged as a fatal flaw, and the expansion project authorisation from a noise impact perspective is recommended.

Project Activity / Resource	Nature (Status)	(A1) Importance	(A2) Magnitude	(B1) Permanence	(B2) Reversibility	(B3) Cumulative	Environmental Classification	Class Value	Probability
Before Mitigation/Prevention									
Construction	Noise and vibrations causing health impacts and a nuisance	2	-2	2	2	3	-28	-3	Definite
Operations	Noise and vibrations causing health impacts and a nuisance	2	-3	3	2	2	-42	-4	Definite
After Mitigation/Prevention									
Construction	Noise and vibrations causing health impacts and a nuisance	2	-2	2	2	3	-28	-3	Definite
Operations	Noise and vibrations causing health impacts and a nuisance	2	-2	3	2	2	-28	-3	Definite

Desired Outcome: To ultimately reduce noise and vibration levels in order to prevent hearing loss and other health impacts on 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.

Actions

Mitigation

- The potential noise levels and construction schedule should be discussed with all noise sensitive receptors staying within 500 m from the construction and future operational site. Measures that will be used to reduce noise levels should be highlighted
- 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 construction activities to daytime hours.
- Confine noise generating operational activities to daytime hours as far as possible.
- Should piles be installed, vibratory pile driving with pre-drilling (coring) is preferred to reduce noise.
- Shrouds, noise barriers and acoustic enclosures must be used to limit noise.
- Contractors that use newer, quieter equipment should be appointed. Equipment should be well maintained as per manufacturers requirements, with the engine compartments closed.
- Induction training should include an environmental noise component, which should be given to all employees and contractors, highlighting the sensitivity of the area to noise. Sources of noise should be highlighted, especially the potential impact of material handling noises.
- Use white noise alarms (squawkers) instead of tonal reverse alarms on heavy vehicles and fork-lifts operating within the port area and consider changes to policies and guidelines for contractors and port users.
- Hearing protectors must be issued as part of PPE when working in noisy environments.
- Mechanisms to reduce vibration impact must be employed. This includes frequently rotating operators and wearing of PPE such as vibration absorbing gloves.
- Any machinery and vehicles that cause excessive vibrations should be given defect notices and taken off site immediately. Machinery and/or vehicles may only be used again on site once they have been serviced and approval has been granted by the site supervisor.
- Unnecessary vibrations can be minimised by ensuring that no machinery or vehicles are left idling when not in use.
- The appropriate and correct placement of specific work activities can ensure the reduction of handling of machinery that cause heavy vibrations. Careful placement of infrastructure and transport routes within the expansion area can optimize the noise-reduction effectiveness of walls and buildings. This could include locating loading and unloading activities to allow buildings to act as noise barriers.
- Pre assessment to allow for mitigation measures for any elevated levels of vibrations should take place if there is any suspicion that there may be excessive vibrations levels onsite during construction. These mitigation measures should then be in accordance with local regulations and standards or international best practice.
- Namport could install a real-time noise monitoring system to provide immediate and accurate noise levels to the contractors and Namport.
- Conduct annual noise auditing to assist in classifying noise sources, defining the associated noise levels (magnitude of the noise emission levels) and identifying the specific measures that could reduce noise levels.
- Investigate reasonable and valid noise complaints and implementing viable noise management measures

Responsible Body:

- Proponent
- Contractors

Data Sources and Monitoring:

- Health and Safety Regulations of the Labour Act and WHO 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.
- Bi-annual reporting of all record keeping, including corrective action taken.

11.1.11 Waste

Various types of waste will be produced during the construction phase and the volume of waste originating from the port will increase during the operational phase. Where waste is not securely stored, it may be blown into the sea or town during strong winds and may wash up on the coastline and islands or blow into the desert. This form of pollution will not only have a visual impact, but may also negatively impact on marine and terrestrial animals like dolphins, seals and birds (e.g. entanglement, accidental ingestion, etc.).

Some wastes are hazardous and may deteriorate the quality of the environment, especially the waters in the bay (see section 11.1.12).

Project Activity / Resource	Nature (Status)	(A1) Importance	(A2) Magnitude	(B1) Permanence	(B2) Reversibility	(B3) Cumulative	Environmental Classification	Class Value	Probability
Before Mitigation/Prevention									
Construction	Waste entering the environment	2	-2	2	2	2	-24	-3	Definite
Operations	An increase in waste requiring disposal	2	-2	3	2	2	-28	-3	Definite
After Mitigation/Prevention									
Construction	Waste entering the environment	2	-1	2	2	2	-12	-2	Probable
Operations	An increase in waste requiring disposal	2	-1	3	2	2	-14	-2	Probable

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

Actions

Prevention

- Appointment of reputable contractors with a known history of environmental responsibility.
- Communicate proper waste disposal procedures to the contractor and employees.
- 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 within the confines of the port and ensure waste cannot be blown away by wind.
- Prevent scavenging (human and non-human) of waste.
- For hazardous substances, see the material safety data sheets available from suppliers for disposal of contaminated products and empty containers.

Mitigation

- Waste should regular be disposed of at appropriately classified disposal facilities, this includes hazardous materials (empty chemical containers and contaminated rugs, paper, water and soil), if any. Since Lüderitz does not have a hazardous waste site, such waste will have to be transported to Windhoek or Walvis Bay for disposal.
- 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 record should be kept of any disposal of hazardous waste.
- Any complaints received regarding waste should be recorded with notes on action taken.
- Bi-annual reporting on all record keeping, including corrective action taken.

11.1.12 Water Quality

Impacts on water quality may negatively affect various receptors such as aquatic organisms, mariculture farms and seawater intakes (fish processing and land-based mariculture). Water quality can deteriorate during construction as a result of mixing of sediment in the water column (during dredging or filling of the reclaimed area), spilled or leaked hydrocarbons and chemicals directly entering the water or being blown/washed into the water from nearby surfaces.

With the larger port, more vessels can dock and load/offload cargo simultaneously. For bulk product loading/offloading this increases the potential for dust to be produced and blown into the water.

Many pollutants that can enter the water may result in reproductive abnormalities and reduced fertility, which may put the local food web at risk. It may also accumulate in aquatic organisms, especially filter feeders like mussels and oysters, and magnify in higher trophic levels where physiological stress and abnormalities can realise. For the mariculture industry, it may prevent the export of mariculture products and causes financial losses if pollution plumes reach mariculture areas.

Project Activity / Resource	Nature (Status)	(A1) Importance	(A2) Magnitude	(B1) Permanence	(B2) Reversibility	(B3) Cumulative	Environmental Classification	Class Value	Probability
Before Mitigation/Prevention									
Construction	Suspension of sediments during dredging and reclamation and hazardous substances and waste entering the water	2	-3	3	2	1	-36	-3	Probable
Operations	Hazardous substances and waste entering the water	2	-3	3	2	2	-42	-4	Probable
After Mitigation/Prevention									
Construction	Suspension of sediments during dredging and reclamation and hazardous substances and waste entering the water	2	-2	3	2	1	-20	-24	Probable
Operations	Hazardous substances and waste entering the water	2	-2	3	2	2	-28	-3	Probable

Desired Outcome: To protect sensitive receptors against impacts of reduced water quality as a result of construction activities and pollution

Actions

Prevention

- Appointment of reputable contractors with a known history of environmental responsibility.
- Regularly inspect and maintain all vehicles and infrastructure, to minimize the chances of infrastructure failure. Regular training and refresher courses for operators of machinery and infrastructure that can cause pollution.
- Vehicles and heavy machinery should not be serviced on site.
- Dredger operators must adhere to the approved EMP for dredging.
- Port tenants must, where applicable, conduct their own EIA and operate according to their EMP which must be in line with the port's EMP.

Mitigation

- Use drip trays to contain leaks and repair such leaks before continuing to use the equipment/vehicle.
- Clean-up action must be taken immediately for all instances where any hazardous (and non-hazardous product is spilled or leaked.
- Where relevant a conditions survey should be conducted post-clean-up to confirm successful clean-up.
- For large spills containment equipment must be available such as absorbents and booms for oil spills in the ocean.
- Regular inspection and reporting on non-compliance to EMP requirements. Issue non-compliance order and follow up to confirm corrective action taken.

Responsible Body:

- Proponent
- Contractors

Data Sources and Monitoring:

- Inspection registers, logging of incidents, reporting of incidents, corrective action taken and inclusion in bi-annual report.

11.1.13 Ecological

Construction activities will impact the marine ecosystem in a localised small footprint. The area earmarked for the port expansion as well as its manoeuvring areas to be dredged will be completely destroyed. No range restricted endemic or unique species are expected or known of in the area.

Marine mammals do not frequent the area earmarked for construction and they will likely avoid the area during construction as a result of noise and activity.

During operations, various structures can act as suitable areas for birds to roost or nest. Bright lights used at night may impact birds like flamingos that fly at night. They may become blinded and disorientated, causing collisions with structures or veering off course.

Operational impacts will mostly be the same as that of the existing port, although at a larger scale.

Project Activity / Resource	Nature (Status)	(A1) Importance	(A2) Magnitude	(B1) Permanence	(B2) Reversibility	(B3) Cumulative	Environmental Classification	Class Value	Probability
Before Mitigation/Prevention									
Construction	Habitat destruction and displacement, injury or mortality of marine organisms, pollution	2	-2	3	3	2	-32	-3	Definite
Operations	Reduced water quality, impact of bright lights on birds, pollution	2	-3	3	2	2	-42	-4	Probable
After Mitigation/Prevention									
Construction	Habitat destruction and displacement, injury or mortality of marine organisms, pollution	2	-1	3	3	2	-16	-2	Definite
Operations	Reduced water quality, impact of bright lights on birds, pollution	2	-2	3	2	2	-28	-3	Probable

Desired Outcome: To prevent or minimise destruction, degradation and disturbance of the ecological environment.

Actions:

Prevention

- Appointment of reputable contractors with a known history of environmental responsibility.
- Clearly define the footprint of the project area and work within this footprint at all times.
- Follow the EMP sections on noise, water quality and waste in order to minimise impacts on marine and terrestrial organisms and the environment.
- Dredger operators must adhere to the approved EMP for dredging.
- Port tenants must, where applicable, conduct their own EIA and operate according to their EMP which must be in line with the port's EMP.
- If any mortalities in marine fauna are observed at or around the construction site, it should be reported to the Directorate of Fisheries and the cause investigated and corrective action implemented if applicable.

Mitigation

- All lighting should be directed downwards to construction and operational areas to not blind birds flying at night.

- Use the minimum lighting required for safe operations and use auto dimming lights when no activity is ongoing.
- Record any bird strikes and take corrective action if needed.

Responsible Body:

- Proponent
- Contractor

Data Sources and Monitoring:

- Record any marine mammal sightings 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 MAFWLR.
- Bi-annual reporting of all record keeping, including corrective action taken.

11.1.14 Visual

The expansion project will increase the footprint of the commercial harbour significantly, while the industrial nature will remain the same. This will have an impact on the visual character of the area, and considering Shark Island, a visual impact assessment was commissioned to determine the extent of impacts on the environment (Appendix D). This study indicated that "the visual effect of the Project, during both construction and operation, will lead to negative alterations to the visual baseline. These changes would be noticeable from nearby heritage and tourist observation points. The likelihood of a negative visual impact is high. The cumulative impact of the proposed Project activities, combined with the existing urban and industrial character of the port, is regarded as of moderate significance, as the Project activities would contribute negatively to the current visual and aesthetic baseline, particularly for sensitive viewing areas." With mitigation as presented below, the conclusion of the assessment is however that the project should proceed.

Project Activity / Resource	Nature (Status)	(A1) Importance	(A2) Magnitude	(B1) Permanence	(B2) Reversibility	(B3) Cumulative	Environmental Classification	Class Value	Probability
Before Mitigation/Prevention									
Construction	The presence of construction teams and equipment	2	-2	2	2	2	-24	-3	Highly Probable
Operations	The presence of new port facilities and infrastructure changing the landscape character	2	-3	3	3	2	-48	-4	Definite
After Mitigation/Prevention									
Construction	The presence of construction teams and equipment	2	-1	2	2	2	-12	-2	Highly Probable
Operations	The presence of new port facilities and infrastructure changing the landscape character	2	-2	3	3	2	-32	-3	Definite

Desired Outcome: To minimize the negative visual impact of the new port expansion.

Actions

Mitigation

- Confine construction to day time only.
- Contain construction and establishment activities within specifically demarcated areas with the smallest footprint possible.
- Regular waste disposal at an approved landfill site.
- Paint the buildings and structures with colours that reflect and complement the colours of the surrounding landscape, rock, and other structures.
- Minimise scale and massing. Break up large expanses of walling or roofing, as in the proposed warehouses, by using a textured effect on the western walls of these structures. This will create areas of light and shade, visually reducing the massing of the walls.
- Consider planting rows of palm trees along the western and northern edges of the warehouse areas. This would also, reduce the scale of the structures when viewed from Shark Island.
- "Housekeeping" procedures should be developed for the Project to ensure that the Project sites and lands adjacent to the Project sites are kept clean of debris, garbage, graffiti, fugitive trash, or waste generated onsite; procedures should extend to control of "track out" of dirt on vehicles leaving the port area.

- Install light fixtures that provide precisely directed illumination to reduce light "spillage" beyond the immediate surroundings of the site.
- Avoid high pole top security lighting along the periphery of the site, specifically along the western and northern boundaries of Phase 1 and use only lights that are activated on illegal entry to the site.
- Minimise the number of light fixtures to the bare minimum, including security lighting.

Responsible Body

- Proponent
- Contractors

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.

11.1.15 Culture, Heritage and Archaeology

Various buildings, objects and areas in and around Lüderitz have some degree of cultural, heritage or archaeological significance. These range from being declared national monuments (e.g. buildings) to unprotected remnants of early habitation (e.g. middens). Directly relevant to the port expansion project are Shark Island and the water area surrounding it, and the historic buildings, trucks to and from the existing and planned port expansion will pass. Section 9.8 briefly discuss culture, heritage and archaeological aspects while two specialist studies are included in Appendix A and Appendix B.

Construction activity or human presence outside of the planned port footprint and on Shark Island can damage known or undiscovered heritage and archaeological remnants or artefacts. Dredging of sediments can also uncover similar items that may be present underneath sediments on the seabed. The proximity of the planned port in relation to Shark Island has also sparked public concern, especially among some of the Nama. It can lead to a diminished sense of place due to, among others, noise and visual impacts. Exhaust gases and dust of trucks passing old buildings can damage the paintwork and cause localised acidic conditions (acid rain) during fog or rain events.

Project Activity / Resource	Nature (Status)	(A1) Importance	(A2) Magnitude	(B1) Permanence	(B2) Reversibility	(B3) Cumulative	Environmental Classification	Class Value	Probability
Before Mitigation/Prevention									
Construction	Damage to known or undiscovered heritage and archaeological remnants or artefacts. Damage to old buildings.	4	-3	3	3	1	-84	-5	Highly Probable
Operations	Damage to known or undiscovered heritage and archaeological remnants or artefacts. Diminished sense of place. Damage to old buildings.	4	-3	3	3	2	-96	-5	Highly Probable
After Mitigation/Prevention									
Construction	Damage to known or undiscovered heritage and archaeological remnants or artefacts. Damage to old buildings.	4	-2	3	3	1	-49	-4	Improbable
Operations	Damage to known or undiscovered heritage and archaeological remnants or artefacts. Diminished sense of place. Damage to old buildings.	4	-2	3	3	1	-56	-4	Improbable

Desired Outcome: To prevent damage to, or loss of, artefacts and buildings of archaeological / heritage value. To minimise indirect impacts on Shark Island leading to a diminished sense of place.

Action:

Prevention

- Appointment of reputable contractors.
- All construction and operational personnel must, as part of induction, be:
  - Informed of the heritage sensitivity of Shark Island.
  - Expected to consistently show respect for the area.

  - Informed to be vigilant for and report on any artefacts that may constitute an archaeologically or heritage significant find.
  - To prevent damage to any artefacts that may constitute an archaeologically or heritage significant find.
- A 20 m buffer (no-go zone) as measured on the water's surface, using mean sea level, must be maintained between the northern part of the port expansion area and Shark Island (Figure 11-1).
- No waste or overfill of sediments may enter the 20 m buffer zone.
- No construction or operational personnel may enter the 20 m buffer zone or access Shark Island from the port and port expansion area other than via the official entrance gate to Shark Island.

Mitigation
- Implementing preventative and mitigating measures in respect of impacts such as noise, visual and waste, will assist in maintaining the sense of place coupled to Shark Island.
- Any reporting on artefacts that may constitute an archaeologically or heritage significant find must be investigated by a designated person and the chance find procedure must be implemented. Work in the vicinity of the find must be stopped and can only continue once cleared by an archaeologist/heritage specialists registered with the NHC.
- Namport, together with the various authorities (NHC, LTC, etc.) must work together to protect what remains of Shark Island as a heritage site and implement measures to recognise its past and inform the public and tourists likewise. This can be achieved by erecting informative signage, supporting the capturing of the history of the genocide told by survivors and passed on over generations, and preserving and potentially exhibiting (museum) of remnants of the genocide (photos, objects, etc.).
- Vehicle emissions and dust affecting buildings requires a joint effort by Namport, LTC and port operators to find alternatives and solutions to redirect traffic or implement strict control over allowable emissions and the covering of loads.

Responsible Body:
- Proponent
- Contractors

Data Sources and Monitoring:
- National Heritage Act
- Chance find procedure
- Record any discoveries of potentially significant archaeological or heritage artefacts and report it to the NHC.
- Bi-annual report of all record keeping and the proof of reporting of any discoveries to the NHC.



Figure 11-1 Approximate 20 m buffer/exclusion zone

11.1.16 Infrastructure

Damage can be caused to the existing port infrastructure during the construction phase. This may temporarily disrupt port services or create unsafe working conditions.

Project Activity / Resource	Nature (Status)	(A1) Importance	(A2) Magnitude	(B1) Permanence	(B2) Reversibility	(B3) Cumulative	Environmental Classification	Class Value	Probability
Before Mitigation/Prevention									
Construction	Damage to existing infrastructure	2	-2	2	2	1	-20	-3	Probable
After Mitigation/Prevention									
Construction	Damage to existing infrastructure	2	-2	2	2	1	-20	-3	Improbable

Desired Outcome: To prevent the damage to existing port infrastructure.

Action:

Prevention

- Appointment of reputable contractors with a known history of safe and responsible work practices.
- Trained operators of equipment.
- Emergency response plan with contact details of emergency personnel.
- Inform relevant stakeholders of the intention to work close to their facilities.
- Ensure the proper and correct functioning of all operational equipment and warning systems.

Mitigation

- Implement emergency response plan if any incident occurs.

Responsible Body:

- Proponent
- Contractors

Data Sources and Monitoring:

- Record and report to Namport any incidents with the corrective actions taken.
- Bi-annual report of all record keeping and the proof of reporting of any incidents to Namport.

11.2 DECOMMISSIONING

Closure and decommissioning of the expanded port as a whole is highly unlikely. However, it is possible that certain components of the project—such as auxiliary structures or civil infrastructure—may be decommissioned, upgraded or replaced at a later stage. Decommissioning is therefore included for this purpose, as well as to account for any construction activities that may involve the modification or removal of infrastructure.

Future land use after decommissioning should be assessed prior to the initiation of works, particularly if the affected land will not be used for similar purposes. Should decommissioning occur at any stage, rehabilitation of the area may be required to return the site to an acceptable condition. Decommissioning will entail the complete removal of infrastructure, including buildings, foundations, marine structures and associated support systems that are not required for the future use of the area. Any pollution present on-site must be identified, documented, and remediated in accordance with applicable environmental standards.

The impacts associated with the decommissioning phase include increased noise, dust, and waste production as structures are dismantled. These impacts are typically short-term and localised, but they must be managed effectively to avoid nuisance or environmental degradation. Noise levels must be maintained within the limits stipulated in the Health and Safety Regulations of the Labour Act and/or World Health Organization guidelines. Implementation of a waste management plan, especially for the identification and disposal of hazardous or contaminated materials, will be paramount. Waste must be securely contained and transported to licensed waste disposal sites; dumping or stockpiling in surrounding areas is not permitted. The EMP and associated waste management plan will need to be reviewed and updated at the time of full decommissioning to reflect any site changes, updated legislation, and improved mitigation approaches.

11.3 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;
- Periodic (internal and external) audits and reviews of environmental performance and the effectiveness of the EMS; and
- The EMP.

To ensure Namport continues to adhere to ISO14001, the 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.

12 CONCLUSION

Namport proposes to expand the Port of Lüderitz's operational areas through a process of land reclamation in Robert Harbour. It is aimed at meeting the immediate demand for additional port services and land. Reclamation will entail construction of a new quay wall and backfilling of the area behind the quay wall to create backup land. This development will diversify and enlarge the business and industrial

sector of Lüderitz and provide much needed employment opportunities during the construction and operational phases.

Significant negative environmental impacts resulting from construction and operations of the port are expected, unless suitable preventative and mitigating measures are implemented. The most important of the impacts are archaeology/heritage, visual, noise, waste, pollution and health and safety.

The EMP accompanying this report specifies some of the enhancement measures aimed at increasing the positive impacts. This include maximising the appointment of local Namibian companies as contractors and for support services. To minimise impacts on Shark Island, a 20 m buffer must be maintained on the north-eastern side of Shark Island as indicated in Figure 11-1. The chance find procedure must be initiated for any potentially significant archaeological or heritage finds. All infrastructure must be designed and finished to blend in with the surroundings. Construction activities must be restricted to day time. Good housekeeping must be performed at all times and equipment must be on site to deal with any emergencies such as spills, fire and injuries.

The EMP also describes a monitoring programme to be carried out by Namport and contractor(s). This is a typical condition linked to ECCs and aims to show compliance to the EMP and environmental responsibility.

Specialists contracted to determine archaeological, visual and noise impacts, agree that the project can continue, given that the appropriate preventative and mitigating measures are employed. Should the DEA find that the impacts and related mitigation measures, which have been proposed in this report, are acceptable, an ECC may be granted to Namport. The ECC, based on this document, will render it a legally binding document which should be adhered to. Focus should be placed on section 11, 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.

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Appendix A Terrestrial Heritage Impact Assessment

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Windhoek
Namibia

7th March 2024

GeoPollution Technologies (Pty) Ltd
Windhoek
Namibia

For attention: Andre Faul

QRS Job 358: PHASE 2 ARCHAEOLOGICAL ASSESSMENT OF THE PROPOSED LüDERITZ NAMPORT QUAY EXTENSION, //KHARAS REGION, NAMIBIA

DECLARATION

We hereby declare that we:

(a) have knowledge of and experience in conducting archaeological assessments, including knowledge of Namibian legislation, specifically the National Heritage Act (27 of 2004), as well as regulations and guidelines that have relevance to the proposed activity;

(b) perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;

(c) comply with the aforementioned Act, relevant regulations, guidelines and other applicable laws.

We also declare that we have no interests or involvement in:

(i) the financial or other affairs of either the applicant or his consultant

(ii) the decision-making structures of the National Heritage Council of Namibia.

Note: The purpose of this report is to guide the client in gaining consent under the National Heritage Act (27 of 2004) to proceed with development activities at specific locations as defined herein.

The report must always be quoted in full, and not in part, summary or précis form.

The report may not be distributed or used for any other purpose by the client, the National Heritage Council of Namibia or any other party and remains the copyright of the author.



John Kinahan, Archaeologist



Jill Kinahan, Archaeologist

EXECUTIVE SUMMARY

An archaeological field survey and assessment was carried out on Shark Island, Lüderitz to determine the possible impact of a proposed extension of the NamPort quay. The island survey located seven archaeological sites including the first documented material remains of its use as a concentration camp during the suppression of the 1905 Nama revolt. The sites are of limited research potential but may justify further investigation prior to the commencement of development work, should the proposed quay extension be granted consent to proceed. The present Phase 2 survey was limited to the eastern shoreline of the island above the highwater mark and it is recommended that an underwater survey be undertaken to exclude the possibility of damage to submerged remains. It is recommended that a Phase 3 investigation should include limited excavation of shell midden sites on Shark Island. This study also recommends that Shark Island should be considered for proclamation as a National Monument under the provisions of the National Heritage Act (27 of 2004).

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1. INTRODUCTION

1.1 Background

Geo Pollution Technologies (Pty) Ltd is carrying out an environmental assessment of a proposed extension of the Lüderitz NamPort quay. The project will entail civil engineering works on the eastern shoreline of Shark Island, an important historical site currently used for recreational purposes. Major civil works are listed in the Environmental Management Act (2007) as requiring environmental assessment and the issuance of an Environmental Clearance Certificate.

Archaeological remains in Namibia are protected under the National Heritage Act (27 of 2004) and National Heritage Regulations (Government Notice 106 of 2005), and Geo Pollution Technologies (Pty) Ltd appointed the undersigned, J. Kinahan, archaeologist, to carry out an assessment of the proposed NamPort extension works. A site survey of the eastern side of Shark Island was carried out between 17th and 18th February 2024. The following report sets out the results of the survey and an assessment of the project against the background of previous work in the same area.

1.2 Terms of Reference

Archaeological assessment in Namibia is carried out in three phases: A Phase 1 desk study is usually combined (as here) with a Phase 2 field survey, followed by a Phase 3 mitigation of possible impacts. The primary task of the archaeological assessment reported here was to identify sensitive archaeological sites that could be affected by the proposed NamPort project, focussing on the eastern shoreline of Shark Island. The archaeological assessment forms the basis of recommended management actions to avoid or reduce negative impacts, as part of the environmental assessment. The study is intended to satisfy the requirements of the relevant legislation and regulations, in which the process of review and clearance may require further, or different mitigation measures to be adopted.

Specifically, the archaeological assessment addresses the following primary elements:

1. The identification and assessment of potential impacts on archaeological/heritage resources, including historical sites arising from the proposed project.
2. The identification and demarcation of highly sensitive archaeological/heritage sites requiring special mitigation measures to eliminate, avoid or compensate for possible destructive impacts.
3. Formulation and motivation of specific mitigation measures for the project to be considered by the authorities for the issuance of clearance certificates.
4. Identify permit requirements as related to the removal and/or destruction of heritage resources.

1.3 Assumptions & Limitations

Archaeological assessment relies on the indicative value of surface finds recorded in the course of field survey. In the case of the present assessment the field survey is specifically focussed on the area above the high tide level. A separate underwater survey may be required to examine the area below the high tide level adjacent to Shark Island. Field survey results are augmented wherever possible by inference from the results of surveys and excavations carried out in the course of previous work in the same general area as the proposed project, as well as other sources such as historical documentation. Based on these data, it is possible to predict the likely occurrence of further archaeological sites with some accuracy, and to present a general statement (see Archaeological setting, below) of the local archaeological site distribution and its sensitivity. However, since the assessment is limited to surface observations and existing survey data, it is necessary to caution the proponent that hidden, buried or submerged archaeological or palaeontological remains might be exposed as the project proceeds. It is for this reason that the developer is urged to adopt the Archaeological Chance Finds Procedure attached here as Appendix 1.

2. LEGAL REQUIREMENTS

The principal instrument of legal protection for archaeological/heritage resources in Namibia is the National Heritage Act (27 of 2004). Part V Section 46 of the Act prohibits removal, damage, alteration or excavation of heritage sites or remains. Section 48 *ff* sets out the procedure for application and granting of permits such as might be required in the event of damage to a protected site occurring as an inevitable result of development. Section 51 (3) sets out the requirements for impact assessment. Heritage sites or remains are defined in Part 1, Definitions 1, as “any remains of human habitation or occupation that are 50 or more years old found on or beneath the surface”.

Of particular relevance to the proposed NamPort extension activities, Section 57 (1) of the Act defines as historic shipwrecks and shipwreck objects, “the remains of all ships that have been situated on the coast or in the territorial waters or the contiguous zone of Namibia for 35 years or more are historic shipwrecks for the purposes of this section.” Also relevant here is Section 57 (4) (a) (i) which notes that “a place where the remains of a ship are located [may] be declared a protected place; or (ii) an article associated with a ship [may] be declared a protected object”. Section 57 (4) (b) states that “a provisional protection order [may] be made in relation to a place where an article or articles appearing to be the remains of a ship are located”.

Although the National Heritage Act provisions in respect of underwater heritage are thus primarily focussed on shipwrecks, it should be noted that Namibia is a signatory to the 2001 UNESCO Convention on the Protection of Underwater Cultural Heritage. Article 1 (a) (i) of the Convention extends protection to “artefacts and human remains, together with their archaeological and natural context”. The Convention significantly broadens to scope of heritage protection in Namibia to include any material remains that are found or suspected to exist below the high tide level on the shores of the Namibian mainland and offshore islands.

It is important to be aware that no specific regulations or operating guidelines have been formulated for the implementation of the National Heritage Act in respect of archaeological assessment. However, archaeological impact assessment of large projects has become accepted practice in Namibia during the last 25 years, especially where project proponents need also to consider international guidelines. In cases where international guidelines are applicable, those of the IFC, specifically Guidance Note 8: Cultural heritage, are most appropriate. Of these guidelines, those relating to project screening, baseline survey and mitigation are the most relevant.

Archaeological impact assessment in Namibia may also take place under the rubric of the Environmental Management Act (7 of 2007) which specifically includes anthropogenic elements in its definition of environment. The list of activities that may not be undertaken without Environmental Clearance Certificate: Environmental Management Act, 2007 (Govt Notice 29 of 2012), and the Environmental Impact Assessment Regulations: Environmental Management Act, 2007 (Govt Notice 30 of 2012) also apply to the management of impacts on archaeological sites and remains whether these are considered in detail by the environmental assessment or not.

3. HISTORICAL AND ARCHAEOLOGICAL SETTING

The western parts of Namibia are recognized as a globally important archaeological landscape, having abundant evidence of human settlement spanning the last one million years.[1] Of particular interest and significance are archaeological sites dating to within the last 12 000 years, a period of marked climatic instability that brought many changes in human settlement and subsistence behaviour.[2] This period, the Holocene, commenced with the onset of warm, moist conditions following the Last Glacial Maximum, and saw a rapid expansion of human occupation over the entire Namib Desert. A sudden onset of arid conditions about 5 000 years ago caused a general retreat from the desert, but with a small number of notable exceptions.

Figure 1 shows the archaeological setting of the proposed NamPort expansion project at Lüderitz. The site distribution differentiates between precolonial and colonial huma occupation. The site distribution suggests a relatively limited human presence in precolonial times, presumably due to the scarcity of water and other resources at Lüderitz.[3] This is in marked contrast to the high concentration of human settlement at other places on the Namibian coast such as Walvis Bay[4]. Lüderitz saw one of the earliest of Namibian encounters with European visitors in 1488 when Bartholemew Diaz anchored briefly in the bay.[5] There was intense commercial activity in the 1840s around Ichabo Island and Hottentot Bay (see Figure 1) during the short-lived Guano Rush.

[1] Mitchell, P. 2002. *The archaeology of southern Africa.* Cambridge: Cambridge University Press.
[2] Deacon, J. & Lancaster, N. 1988. *Late Quaternary palaeoenvironments of southern Africa.* Oxford: Oxford University Press.
[3] Wendt, W.E. 1972. Preliminary report on an archaeological research programme in South West Africa. *Cimbebasia* (B) 2: 1–61.
[4] Kinahan, J.H.A. 2000. *Cattle for Beads: The archaeology of historical contact and trade on the Namib coast.* Uppsala University: Studies in African Archaeology 17.
[5] Kinahan, J.H.A. 1988. *The Pillar in the Mist: A History of the Dias Padrão at Lüderitz.* Windhoek: National Monuments Council.

Only at the end of the 19th century was a permanent settlement founded at Lüderitz with the onset of German colonial rule. The settlement rose to importance in 1905 as the point of landing for German colonial troops *en route* to the interior to quell an uprising of the Nama people.[6]

At the turn of the last century communications between the coast at Lüderitz and the interior were poorly developed and there was so little travel between the two that no fixed route existed. Logistical services for the German colonial army were provided by highly experienced Boer ox-wagon transport riders who established an efficient passage to the interior. Many tons of military materiél were carried to Kubub in this way, leaving enduring archaeological traces (see Figure 1). It was during this period that work commenced on the railway between Lüderitz and Aus, [7] a large construction project in which many Nama and Herero prisoners of war were put to work [8]. These prisoners were drawn from among those held on Shark Island, the focus of the present study.

Although it was used as a concentration camp for less than two years, Shark Island has become infamous following detailed archival studies by historians of the colonial genocide. During the time of its existence, the camp is believed to have accommodated approximately two thousand OvaHerero and two thousand Nama captives although numbers at any one time were much lower. This is partly due to the very high mortality rate among prisoners and to the fact that prisoners were moved elsewhere to replenish labour requirements on the railway and other projects, most never to return. When the camp was closed in 1907 the remaining prisoners were moved to Radford Bay where about half died within a few months. Those prisoners were buried in individual graves although it seems that prior to this the prisoners who died on Shark Island were consigned to mass graves on the outskirts of Lüderitz. [9]

A surviving sketch map of Shark Island shows that Nama and Ovaherero prisoners were segregated into two camps on the northern end of the island where they lived in crude shelters among the rocks. In its original state, the island had little or no soil cover and it is therefore unlikely that deceased prisoners were buried on the island itself. Although the areas of encampment are demarcated on the sketch map it is not clear that they were actually fenced. More formal structures are shown at the southern end of the island and these presumably housed the camp administrators and guards; these structures no longer exist. It may be that it was in this area

[6] Drechsler, H. 1980. *Let us die fighting: The struggle of the Herero and Nama against German imperialism.* London: Zed Press.
[7] Bravenboer, B. & Rusch, K. 1997. *First one hundred years of state railways in Namibia.* Windhoek: TransNamib Museum.
[8] Dierks, K. 2002. *Chronology of Namibian History.* Windhoek, Namibia Scientific Society
[9] Olusoga, D. & Erichsen, C. 2010. *The Kaiser's Holocaust: Germany's forgotten genocide and the colonial roots of Nazism*. London: Faber & Faber.

that human remains were processed and packed for export to "racial science" research institutes in Germany.[10] The same area was also occupied by the staff of the lighthouse sited on the highest point on the island.

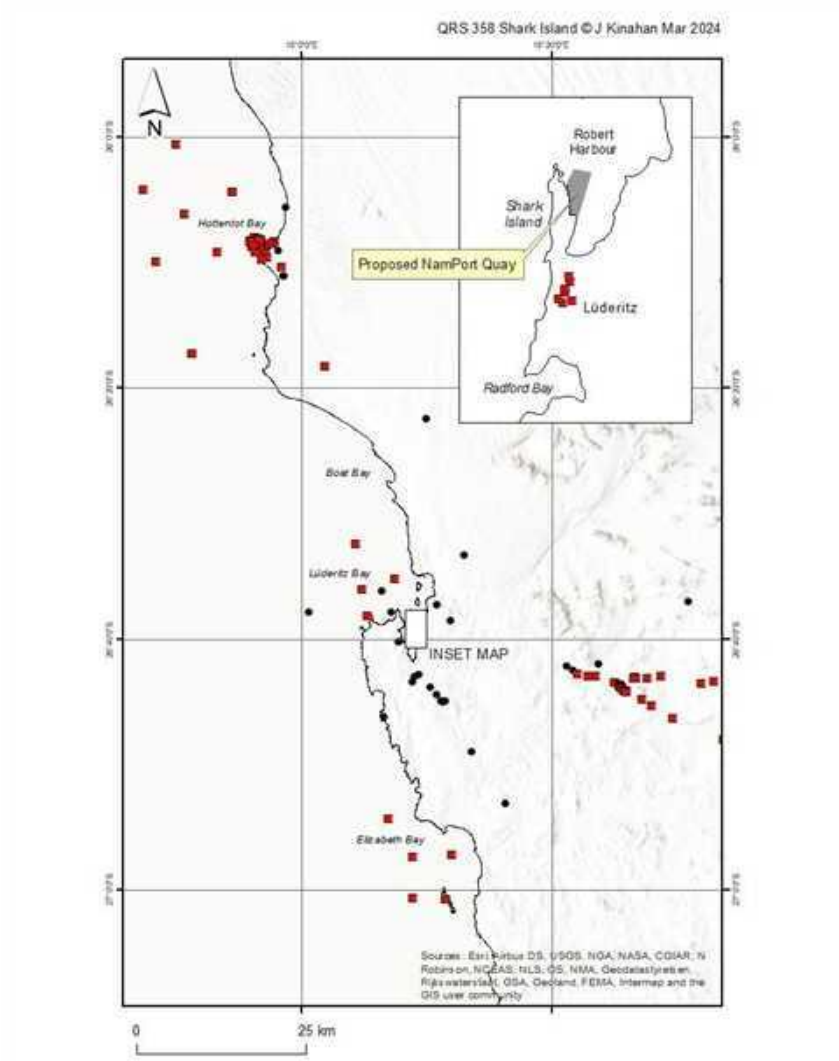


Figure 1: The archaeological setting of Shark Island (see Inset Map), showing precolonial sites as black dots and colonial era sites as red squares (including recorded shipwrecks). Note the concentration of sites at Hottentot Bay associated with the 1840's guano rush (upper left) and the sites associated with the 1905 German military campaign against the Nama (lower right). The sites shown in the Inset Map are proclaimed National Monuments which are primarily German colonial buildings.

[10] Faber-Jonker, L. 2018. *More than just an object: a material analysis of the return and retention of Namibian skulls from Germany*. Leiden: African Studies Centre.

The documentary research on which the history of Shark Island is based was not accompanied by studies of the physical site. In the years following Namibian Independence the island was completely transformed so that it could be used as a recreational site. The rugged contours of the island were covered by large volumes of soil to form terraces held in place by rock walls. These works as well as the construction of amenities took place without any attempt to document traces of the concentration camp period or to consider the cultural and historical importance of Shark Island to survivors and descendants of the affected communities, measures that are now mandatory under the provisions of the National Heritage Act of 2004.[11]

4. OBSERVATIONS

A field survey was carried out over the eastern shoreline of Shark Island to locate and document its archaeological features (see Figure 2). Site location was determined by hand-held GPS and the sites were described according to standard criteria and photographed where appropriate. The location and descriptive details of the sites are listed in the site gazetteer below. Each of the sites was assessed as to its archaeological Significance and Vulnerability to the proposed NamPort project, following standard criteria as set out in Table 1.

Table 1: Significance and Vulnerability Ranking of archaeological sites

Significance Ranking		**Vulnerability Ranking**	
0	no significance	0	not vulnerable
1	disturbed or secondary context	1	no threat posed
2	isolated minor find	2	low or indirect threat
3	archaeological site	3	probable threat
4	multi-component site	4	high likelihood of disturbance
5	major archaeological site	5	direct and certain threat

4.1 Site Gazetteer:

QRS 358/0001
Position (WGS 84): -26.632795 15.151899
Precision: 1
Setting: Among outcropping rocks on high ridge
Description: Recently erected monument that has toppled over
Records: site notes, locality data
Significance rating: 1
Vulnerability rating: 1

QRS 358/0002
Position (WGS 84): -26.633808 15.152781

[11] Unlike the German prisoner-of-war camp at Aus which was proclaimed as a National Monument (Proc 84/95), the concentration camp on Shark Island has received no official recognition or protection, and this may well have led to its inappropriate use as a recreational site.

Precision: 1
Setting: Rock fissure approx. 5masl
Description: Sherds of 19th century green bottle glass probably associated with the Shark Island concentration camp.
Records: site notes, locality data
Significance rating: 2
Vulnerability rating: 4

QRS 358/0003
Position (WGS 84): -26.634369 15.153374
Precision: 1
Setting: Rock fissure approx. 5masl
Description: Small 1 x 2m shell midden mainly *Patella argonvillei* and *P. granularis* (see Figure 3), associated with clear and green 19th century bottle glass sherds as well as fragments of rusted iron and charcoal, probably associated with the Shark Island concentration camp.
Records: site notes, locality data
Significance rating: 3
Vulnerability rating: 4

QRS 358/0004
Position (WGS 84): -26.634648 15.153161
Precision: 1
Setting: Rock fissure approx. 5masl
Description: Green, purple and clear 19th century bottle glass sherds retouched as small implements probably associated with the Shark Island concentration camp. These are associated with three typical "robin's egg" blue glass beads dated to approximately 1904 on sites in the !Khuiseb Delta (see Figures 4 & 5).[12]
Records: site notes, locality data
Significance rating: 3
Vulnerability rating: 4

QRS 358/0005
Position (WGS 84): -26.634868 15.153135
Precision: 1
Setting: Outcropping rock approx. 8masl
Description: Iron stanchion with "X" section set into rock and with iron shackle probably from horse saddlery attached to short length of heavy barbed wire, probably associated with the Shark Island concentration camp (see Figure 6).

Records: site notes, locality data
Significance rating: 3
Vulnerability rating: 4

QRS 358/0006
Position (WGS 84): -26.635128 15.153208
Precision: 1
Setting: Rock fissure approx. 5masl

[12] Kinahan, J.H.A. 2000. *Cattle for Beads: The archaeology of historical contact and trade on the Namib coast.* Uppsala University: Studies in African Archaeology 17.

Description: 19th century earthenware and glass sherds with small scatter *Patella argonvillei* and probably associated with the Shark Island concentration camp
Records: site notes, locality data
Significance rating: 3
Vulnerability rating: 4

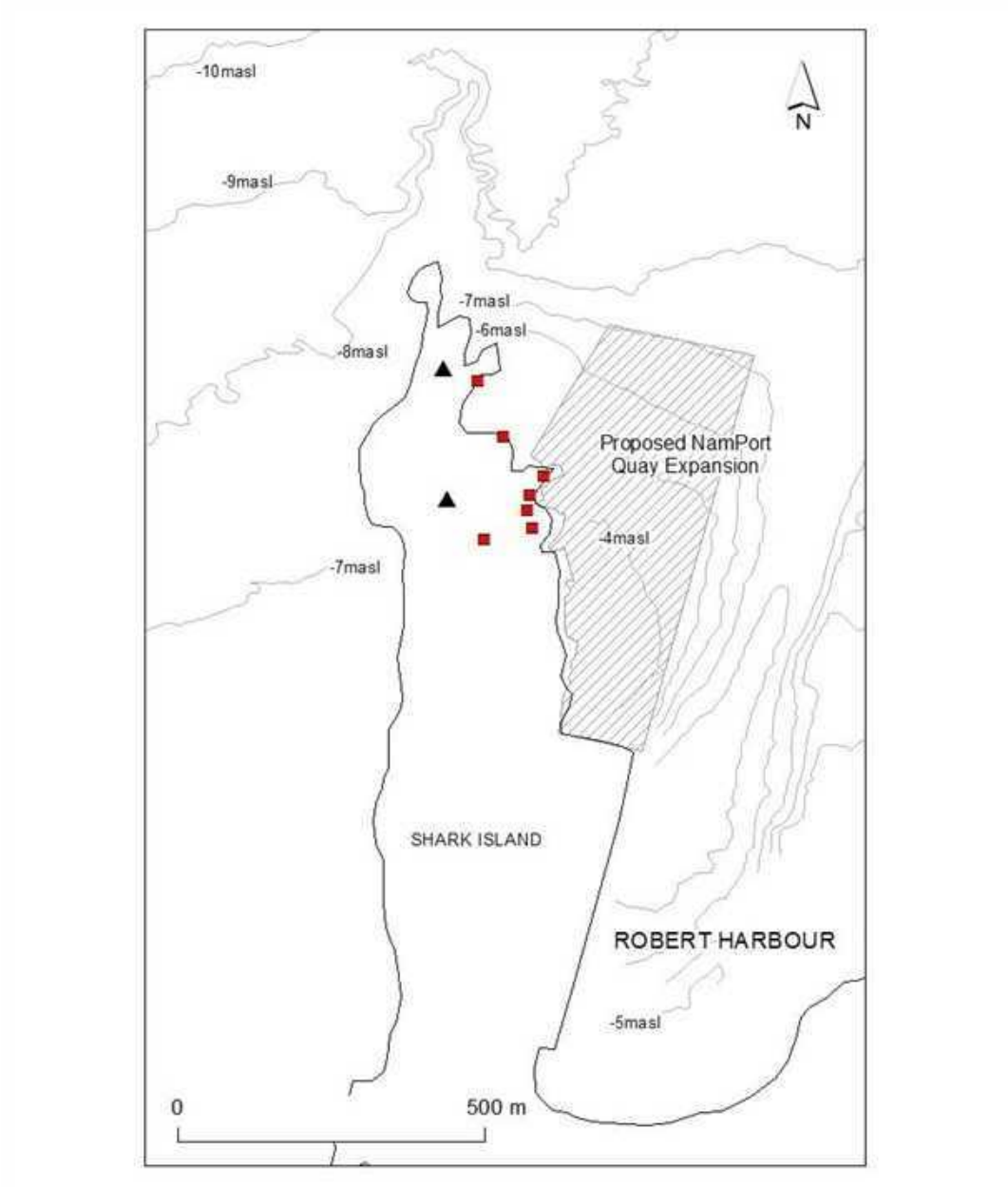


Figure 2: Shark Island, Lüderitz, showing the proposed NamPort quay extension in relation to archaeological sites documented in the course of the survey covering the eastern shoreline of the island. Also shown are two monument sites. Bathymetric contours show the comparatively shallow water on the eastern or Robert Harbour side of the island.

QRS 358/0007
Position (WGS 84): -26.635293 15.152492
Precision: 1
Setting: Open area on north side of highest point on Shark Island
Description: Dense, highly fragmented shell midden approx. 5x10m. Probably predates the concentration camp
Records: site notes, locality data
Significance rating: 3
Vulnerability rating: 4

QRS 358/0008
Position (WGS 84): -26.634699 15.151955
Precision: 1
Setting: On N and NE sides of prominent outcrop
Description: Monuments to the Fredericks clan, Vogelsang and reburied human remains from the old Nautilus cemetery
Records: site notes, locality data
Significance rating: 1
Vulnerability rating: 1

QRS 358/0009
Position (WGS 84): -26.632983 15.152408
Precision: 1
Setting: Rock fissure approx. 5masl
Description: Small shell midden mainly fragmented *Patella* spp with 19th century bottle glass probably associated with the Shark Island concentration camp
Records: site notes, locality data
Significance rating: 3
Vulnerability rating: 4

4.2 Summary of Finds:

Apart from the two recently erected monuments (which may be protected under the National Heritage Act) the survey of the eastern shoreline of Shark Island revealed one suspected precolonial shell midden and six other sites which are probably associated with the Shark Island concentration camp. One of these sites, the iron stanchion with barbed wire at QRS 358/0005 may be the sole surviving remnant of the concentration camp boundary fence. The remaining sites consist of late 19th century bottle glass sherds with some showing clear indications of deliberate flaking and retouch for use as small implements. The bottle glass is in most instances associated with small concentrations of limpet shells. These probably represent the attempts by concentration camp inmates to supplement their diet with shellfish. One of the midden sites is associated with blue glass trade beads such as have been dated to the 1904 genocide at sites in the !Khuiseb Delta.

Although of relatively low archaeological Significance most of the sites are considered as archaeologically Vulnerable having a ranking of 4, with a high likelihood of disturbance. In addition to the sites described above the survey also briefly inspected some fragments of bone protruding from the road near the entrance to Shark

Island and reported to be of human origin. The bones appear to be of large bovid, probably cattle, and equid, either horse or mule. No human bones were observed.

4.3 Analysis of Glass Trade Beads:

Glass trade beads were distributed throughout the world during the late precolonial expansion of merchant trade. Detailed research on trade beads has shown them to be a generally reliable means to estimate the age of recent archaeological sites.[13] In southern Africa, glass trade beads have formed the basis of high-resolution sequences, especially where large and typologically diverse assemblages are present. [14] On the Namib Desert coast intensive and sustained trading relations between European merchants and indigenous pastoralists resulted in the circulation of glass beads within the local exchange economy. Exchange and distribution of glass beads continued from the 18th to the early 20th century when the indigenous pastoral economy collapsed under German rule. Glass trade beads were especially important in determining the chronology of this history, producing dating methods that can be widely applied on the Namib coast.[15]

Although Shark Island site QRS 358/0004 had only three glass trade beads visible among the limpet fragments on the surface of the shell midden these provide reliable evidence that the site was occupied during the period period when Nama prisoners were confined there. On the basis of this dating the Shark Island shell middens can be identified as the first documented evidence of life under concentration camp conditions during the colonial genocide. The beads may be described as follows:

1 x simple short hand-drawn barrel bead (Type 39)[16] length 2.1mm, diameter 3.3mm; colour: robin's egg blue (Munsell code 7.5B 5/8 – 10B 4/10). The same bead type occurs on six !Khuiseb Delta sites dating between 1786 and 1915 AD. The most recent example in the !Khuiseb Delta was associated with a 1907 German 1 *pfennig* coin. The estimated date for the circulation of a Type 39 bead is therefore 1907, on present evidence.

1 x simple wound circular bead (fragment) (Type W11) length 4.5mm, diameter >7.5mm; colour (opaque) Cerulean blue (Munsell code 7.5B 4/8). The same bead type occurs on five !Khuiseb Delta sites, the most recent being associated with a coffin made from timber marked 1904. The estimated date for the circulation of a Type W11 bead is therefore 1904, on present evidence.

1 x short mould-pressed circular bead (Type MP3) length 4.8mm, diameter 9mm; colour robin's egg blue (Munsell code 5B 6/8). The same bead type occurs on one !Khuiseb Delta . Similar beads commonly occur in recent museum ethnographic collections from the first decade of the 20th century.

[13] Beck, H. 1928. Classification and Nomenclature of Beads and Pendants. *Archaeologia* 77: 1- 76. Karklins, K. 1985. *Glass Beads*. Studies in Archaeology, Architecture and History. Ottowa: National Historic Parks and Sites Branch, Parks Canada.
[14] Wood, M., 2012. *Interconnections: Glass beads and trade in southern and eastern Africa and the Indian Ocean-7th to 16th centuries AD* (Doctoral dissertation, Department of Archaeology and Ancient History).
[15] Kinahan, J.H.A. 2000. *Cattle for Beads: The archaeology of historical contact and trade on the Namib coast.* Uppsala University: Studies in African Archaeology 17.
[16] Type numbering follows Kinahan, J.H.A. 2000.



Figure 3: QRS 358/ 0003 Partial view of small 1 x 2m shell midden mainly *Patella argonvillei* and *P. granularis*.

5. CONCLUSIONS & RECOMMENDATIONS

The field survey of Shark Island at Lüderitz focussed on the eastern shoreline of the island, where direct impacts of the NamPort Quay Extension project are anticipated. The survey did not examine the margins of Shark Island below the high water mark. Seven archaeological sites were located, of which six appear to be remains of the Shark Island concentration camp. These include a suspected boundary fence post and five small shell middens located in rock fissures immediately above the high water mark. The sites comprise dense accumulations of limpet shell, mainly *Patella argonvillei* and *P. granularis* that were probably harvested from the rocks by the prisoners to supplement their diet. The shell accumulations are associated with flakes of bottle glass of the type in common use at the turn of the century. These seem to have been fashioned into small implements, probably to extract the meat of limpets. One of the sites had three blue glass trade beads dated to between 1904 and 1907, confirming their association with the concentration camp.

The sites reported here appear to be the only physical remains of the concentration camp to have survived on the island itself, following the extensive landscaping of Shark Island to create the present tourist facilities. The island has been so transformed by these works that it has largely lost its historical features, although even these changes do not negate its historical importance. It is not impossible that further remains are preserved beneath the landscaped surface but these would only be the detected by geophysical prospection or excavation. Such

activities will require a permit from the National Heritage Council. It is possible that further remains could be found below the high-water mark given that the waters of Robert Harbour are both sheltered and shallow, and an underwater survey is certainly feasible on the eastern side of the island. Although it is unlikely that this would recover human remains, given the passage of time since the concentration camp was closed, other relevant remains may be located there.

In the event that NamPort is granted consent to proceed with the quay expansion project this permission should be subjects to stringent conditions. The survey reported here covers the visible on-land remains of human occupation on Shark Island but if earthworks are initiated on the island the project EMP should adopt the Archaeological Chance Finds Procedure in Appendix 1. Given the circumstances on Shark Island the attention of the project management is drawn to the specific provisions regarding human remains. Consent should also be subject to a competent underwater archaeological survey and it is recommended that the project management should engage the services of Ms Vanessa Maitland whose details are attached as Appendix 2.

Four further (Phase 3) mitigation measures are recommended as conditions for consent. First of these is that limited excavation should be undertaken at the shell midden sites identified here in order to recover further evidence of the living circumstances of prisoners on Shark Island. Second is that the project should give due consideration to the preservation of the physical setting of the Shark Island concentration camp as it is envisaged by the National Heritage Act (27 of 2004, Part 1) where "works" includes: " *(a) any physical intervention, excavation or action that may result in a change to the nature, appearance or physical nature of a place; (b) any change to the natural or existing conditions or topography of land*". Third is that more detailed information on the significance of Shark Island should be made available in the form of information boards. Finally, it is recommended that the National Heritage Council of Namibia should consider proclamation of Shark Island as a National Monument in view of its historical and cultural significance.

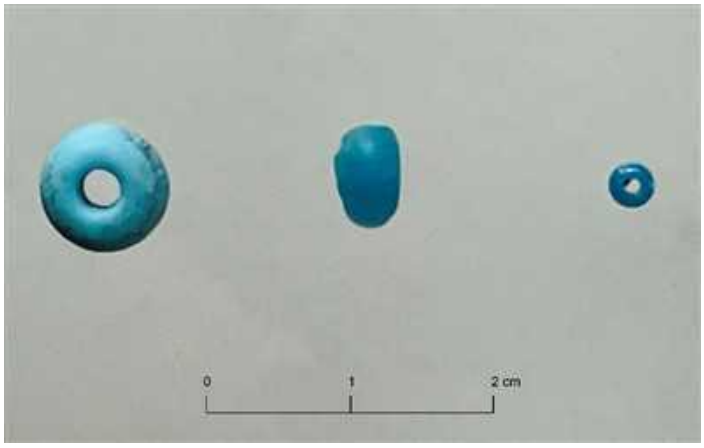


Figure 4: QRS 358/0004 Glass trade beads (ca. 1904) associated with shell midden deposit.



Figure 5: QRS 358/0004 Flaked bottle glass implements associated with shell midden deposit.



Figure 6: QRS 358/0005 Iron stanchion with shackle and barbed wire, possibly marking boundary of Shark Island concentration camp.

Appendix 1: Archaeological Chance Finds Procedure

Areas of proposed development activity are subject to heritage survey and assessment at the planning stage. These surveys are based on surface indications alone, and it is therefore possible that sites or items of heritage significance will be found in the course of development work. The procedure set out here covers the reporting and management of such finds.

Scope: The "chance finds" procedure covers the actions to be taken from the discovery of a heritage site or item, to its investigation and assessment by a trained archaeologist or other appropriately qualified person.

Compliance: The "chance finds" procedure is intended to ensure compliance with relevant provisions of the National Heritage Act (27 of 2004), especially Section 55 (4): *"a person who discovers any archaeological …. object ……must as soon as practicable report the discovery to the Council".* The procedure of reporting set out below must be observed so that heritage remains reported to the NHC are correctly identified in the field.

Responsibility:

Operator	To exercise due caution if archaeological remains are found
Foreman	To secure site and advise management timeously
Superintendent	To determine safe working boundary and request inspection
Archaeologist	To inspect, identify, advise management, and recover remains

Procedure:

Action by person identifying archaeological or heritage material

a) If operating machinery or equipment stop work

b) Identify the site with flag tape

c) Determine GPS position if possible

d) Report findings to foreman

Action by foreman

a) Report findings, site location and actions taken to superintendent

b) Cease any works in immediate vicinity

Action by superintendent

a) Visit site and determine whether work can proceed without damage to findings

b) Determine and mark exclusion boundary

c) Site location and details to be added to project GIS for field confirmation by archaeologist

Action by archaeologist

a) Inspect site and confirm addition to project GIS

b) Advise NHC and request written permission to remove findings from work area

c) Recovery, packaging and labelling of findings for transfer to National Museum

In the event of discovering human remains

a) Actions as above

b) Field inspection by archaeologist to confirm that remains are human

c) Advise and liaise with NHC and Police

d) Recovery of remains and removal to National Museum or National Forensic Laboratory, as directed.

Appendix 2: Recommended maritime archaeologist

Vanessa Maitland, MARITIME ARCHAEOLOGIST

Elandskraal, Western Cape

Cell: 082 490-4066

E-mail: vanessa@cocojams.co.za

ASAPA (Association of Southern African Professional Archaeologists) Member No: 326

EDUCATION

1986 Hill College Port Elizabeth
- Matriculated

1987-1988 University of Cape Town Cape Town
- BA – First & Second Year

1992-1993 University of Witwatersrand Johannesburg
- Completed BA, majored in Archaeology and Jewish Studies
- Other subjects studied include: Anthropology, Geology, Classical Civilizations, Hebrew, History, Biblical Archaeology

1996 University of Witwatersrand Johannesburg
- BA Honours – Archaeology

2010 - 2012 NAS/SAHRA/IZIKO Cape Town
- NAS I, II & III: Underwater Survey and Fieldwork Courses
- Iziko Waterlogged Artefact Conservation Course

2010 University of Witwatersrand Johannesburg
- ARCGIS Course

2011 University of Witwatersrand Johannesburg
- GRASS & QGIS Course

2013-2019 University of South Africa Pretoria
- Masters Degree in Maritime Archaeology

ARCHAEOLOGICAL EXPERIENCE

Archaeological excavations at:
- Border Cave, KZN (Stone Age Archaeology)
- The Castle, C.T. (Historical Archaeology)
- Roosfontein Shelter, F.S. (Stone Age Archaeology)
- Rose Cottage Cave, F.S. (Stone Age Archaeology)
- de Hoop, Mpumalanga (Stone Age Archaeology)
- Nettleton Dump, JHB (Historical Archaeology)
- Modderfontein Railway Dump, JHB (Historical Archaeology)

- Stone Age Site near Maun, Botswana. (Stone Age Archaeology)
- Bulhoek, Eastern Cape (Historical Archaeoology)
- Site Archaeologist on the *County of Pembroke* wreck (Maritime Archaeology)
- Site Archaeologist on the *Karin* wreck site (Maritime Archaeology)
- Survey of Robben Island wrecks (Maritime Archaeology)
- Survey of "The Barrel Wreck", Table Bay (Maritime Archaeology)
- Survey of *Odd* wreck site, Durban (Maritime Archaeology)
- Scoping Report, Berths 203-5 & Salisbury Island, Durban Harbour
- Underwater HIA, Berths 203-5 & Sand Winning Sites, Durban Harbour
- Underwater HIA and Land HIA, Pier 1, Durban Harbour
- Platberg Mission Station (Historical Archaeology)
- Inhambane (Mozambique) Slave Wreck Project Magnetometer Survey
- Bloubergstrand, Cape Town Slave Wreck Project Magnetometer Survey
- Senegal, African Slave Wreck Project Magnetometer Survey & Training
- Ilha de Mozambique Slave Wreck Project Magnetometer Survey & Training
- Durban, SAPREF Pipeline Desktop & Magnetometer Survey
- Cape Recife, Port Elizabeth WWTW Desktop, Magnetometer Survey & diver searches
- Cape Recife, Port Elizabeth Wreck Mapping
- False Bay, Cape Town Desalination Desktop, Magnetometer Survey & diver searches
- Hermanus, Western Cape; Magnetometer Survey and diver searches for Neptune Divers
- Port of Ngqura, Port Elizabeth; Magnetometer Survey

WORK EXPERIENCE

1987–1988 First Bowrings Gauteng
Data Capturer
- Vacation work.

1989–1991 Dryflora Gauteng
Owner

1990–1992 Charlotte Firbank-King Gauteng
Researcher

1993–2003 C.F.K. Fine Art & Publishing cc. Gauteng
Co-owner & Manager

2004 Subtech Diving & Marine Port Elizabeth
Admin Assistant & Archaeological Advisor
- Research on unknown wreck site
- Compiling interim reports on *County of Pembroke* wreck site

2007-2008 Independent Consultant Port Elizabeth
Site Archaeologist

- Diving and collecting data on *County of Pembroke* wreck site
- Liasing with Bayworld re curation of artefacts
- Research
- Archaeological reports

2009 Independent Consultant Durban
- Diving and collecting data on "Anomaly 27" wreck site
- Liasing with SAHRA regarding site

2010 Independent Consultant Durban
Site Archaeologist
- Fieldwork and research on the *Karin* ("Anomaly 27") wreck
- Archaeological report on the *Karin*
- NAS (Nautical Archaeology Society) I course on Robben Island
- NAS II course on Robben Island
- NAS III (1st & 2nd Module) course on Robben Island
- Editing and co-authoring NAS II group report
- Organising and training at NAS I (Durban) Course

2011 Independent Consultant Durban
Site Archaeologist
- Fieldwork and tutor on NAS II Robben Island Course
- Fieldwork and tutor on NAS II Durban Course
- Heritage Scoping Report for the Proposed Developments at the Container Terminal at the Port of Durban for CSIR

2012 Independent Consultant Durban
Site Archaeologist
- Fieldwork and tutor on NAS II Robben Island Course
- Fieldwork on "The Barrel Wreck" for Masters degree
- Underwater HIA for Berth 203-5 & Sand Winning Areas at Durban Harbour for Nemai Consulting

2013 Independent Consultant/ACHA Durban
Maritime Archaeologist
- Underwater HIA and Land HIA, Pier 1, Durban Harbour
- Registered for Masters at UNISA
- Fieldwork at Bulhoek – Free State

2014 ACHA Durban
Maritime Archaeologist
- Fieldwork at Platberg Mission Station – Free State
- Inhambane (Mozambique) Slave Wreck Project Magnetometer Survey
- Underwater HIA for Pier 1 at Durban Harbour for Jeffares & Green

2015 ACHA Durban
Maritime Archaeologist
- Bloubergstrand, Cape Town Slave Wreck Project Magnetometer Survey

- HIA for Pier 1 at Durban Harbour for Jeffares & Green
- Tutor WITS MUCH Field School - Durban
- Fieldwork at Platberg Mission Station – Free State
- Site Archaeologist at KZN Children's Hospital – Durban
- Project Director Transnet MUCH Project

2016 ACHA Durban
Maritime Archaeologist

- Senegal, African Slave Wreck Project Magnetometer Survey and Training
- Ilha de Mozambique, African Slave Wreck Project Magnetometer Survey and Training
- Fieldwork at Platberg Mission Station – Free State
- Saldanha Bay shipwreck research for Dr Jonathan Sharfman
- Site Archaeologist at KZN Children's Hospital – Durban
- Maritime Heritage Desktop Survey for Umgeni Water Amanzi's proposed construction of desalination plants at: Lovu River & Tongaat – KZN
- Maritime Heritage Desktop Survey for Ibhubesi Gas Project
- MUCH Heritage Display for Transnet's Maritime School of Excellence Graduation
- Project Director Transnet MUCH Project

2017 ACHA/Independent Consultant Cape Town
Maritime Archaeologist

- Project Director Transnet MUCH Project
- Ilha de Mozambique, African Slave Wreck Project Magnetometer Survey
- UHIA and Magnetometer Survey, Richard's Bay Floating Dock
- UHIA and Magnetometer Survey, Hitachi Water Remix Project
- Statement on Maritime Structures, Gansbaai and Still Bay
- SAPREF UHIA and Assessment of ROV Survey
- UHIA, De Beers, West Coast Concessions

2018 ACHA/Independent Consultant Cape Town
Maritime Archaeologist

- SAPREF Magnetometer Survey, Durban
- Magnetometer and Diver Survey for CoCT on Monwabisi and Strandfontein Desalination Sites, Cape Town
- UHIA, Magnetometer and Diver Survey for NMBM Outfall Pipes, Cape Recife, Alogoa Bay
- UHIA, Alexkor, West Coast Concessions
- Wreck Mapping for for NMBM Outfall Pipes, Cape Recife, Alogoa Bay
- Ilha de Mozambique, African Slave Wreck Project Magnetometer Survey

2019 ACHA/Independent Consultant Knysna

- SAPREF Magnetometer Survey, Durban
- Wreck Mapping for for NMBM Outfall Pipes, Cape Recife, Alogoa Bay
- HIA for Buccara-Africa's Noetzie Helipad and Walkway Development

2020 ACHA/Independent Consultant Knysna

- Hermanus, Western Cape Magnetometer Survey and Diver Searches for local dive company, Neptune Divers
- Port of Ngqura Desktop Assessment, Magnetometer Survey and Diver Searches

OTHER QUALIFICATIONS & EXPERIENCE

- NAUI Dive Master
- Commercial Diver Class IV
- CRM Field Director – ASAPA
- CRM Accreditation – Amafa

Appendix B Maritime and Underwater Cultural Heritage Assessment

UNDERWATER HERITAGE IMPACT DESKTOP ASSESSMENT & PHASE 1 UNDERWATER ARCHAEOLOGICAL ASSESSMENT: NAMPORT'S QUAY EXTENSION, SHARK ISLAND, LÜDERITZ, NAMIBIA



UNDERWATER HERITAGE IMPACT DESKTOP ASSESSMENT & PHASE 1 UNDERWATER ARCHAEOLOGICAL ASSESSMENT: NAMPORT'S QUAY EXTENSION,
SHARK ISLAND,
LÜDERITZ,
NAMIBIA

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Declaration:
I, Vanessa Maitland, declare that I have no financial or personal interest in the proposed development, nor its developers or any of their subsidiaries, apart from the provision of heritage assessment and management services.



Vanessa Maitland
Maritime Archaeologist
03-02-2026

EXECUTIVE SUMMARY

This report is an addendum to the Phase 2 Archaeological Assessment undertaken by Kinahan & Kinahan (2024), a part of the Environmental Impact Assessment (EIA) by Geo Pollution Technologies (Pty) Ltd for the Namport Quay Extension on the eastern edge of Shark Island, Lüderitz, Namibia

It consists of two parts, the first is an Underwater Heritage Impact Assessment (UHIA), a desktop study of potential shipwrecks and review of the known maritime history of the area. The second part is a magnetometer survey of the area to search for shipwrecks as well as diver searches along the eastern edge of Shark Island for sites or artefacts related to pre-colonial human occupation and the colonial era concentration camp.

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GLOSSARY OF ACRONYMS

ASAPA	Association of Southern African Professional Archaeologists
EIA	Environmental Impact Assessment
GRT	Gross Registered Tonnage
HIA	Heritage Impact Assessment
MUCH	Maritime and Underwater Cultural Heritage (Includes underwater and land maritime heritage)
NHA	National Heritage Act (27 of 2004)
NHC	National Heritage Council
NM	Nautical Mile
UHIA	Underwater Heritage Impact Assessment
UNESCO	United Nations Educational, Scientific and Cultural Organization

1. INTRODUCTION

This document serves as an Underwater Heritage Impact Assessment (UHIA), forming an addendum to the Phase 2 Archaeological Assessment conducted by Kinahan & Kinahan (2024). It is submitted as part of the broader Environmental Impact Assessment (EIA) process undertaken by Geo Pollution Technologies (Pty) Ltd for the proposed Namport Quay Extension on the eastern side of Shark Island, Lüderitz, Namibia.

Part 1 of this report presents an assessment of potential heritage resources within the development area. It includes:

- A desktop review of documented shipwrecks within the area defined in Section 5, and
- A brief desktop analysis of the Shark Island concentration camp, focusing on aspects relevant to the underwater survey in Section 6.

Part 2 outlines the results of the underwater archaeological survey conducted below the high-water mark. This includes findings from the magnetometer survey of the proposed Quay Extension Zone, followed by diver investigations of the identified magnetic anomalies. Additionally, this section reports on diver surveys conducted along the eastern edge of Shark Island, aimed at locating heritage sites associated with both the pre-colonial period and the Shark Island concentration camp.

2. TERMS OF REFERENCE

The aim of the desktop survey is to determine if there are any known shipwrecks within the defined area.
The scope of work consisted of the following:

- Desktop study, consisting of a database of known and suspected wrecks in the area ascertained through study of available written and oral resources

The aim of the field survey is to determine if any of the wrecks identified in the desktop are within the area of the development. Additionally, to determine if there are any sites, artefacts or human remains along the eastern edge of Shark Island that relate to pre-colonial human occupation and the colonial era concentration camp.

The scope of work consisted of the following:

- Magnetometer Survey of the designated area to identify magnetic anomalies that may be underwater cultural heritage
- Diver searches on the magnetic anomalies to determine their significance
- Diver searches along the eastern edge of Shark Island, to locate artefacts and/or human remains

The objectives are to:

- Assess potential impacts on potential sites and recommend management measures for sites before and during development.

3. HERITAGE RESOURCES

3.1. THE LEGISLATION

While Namibian heritage resources are protected by the National Heritage Act (27 of 2004) (NHA), there are no specific regulations with regards Heritage Impact Assessments or Underwater Heritage Impact Assessments. However, these assessments have become standard over the last 26 years, particularly with respect to projects that have an international component (Kinahan 2022). Additionally, Namibia ratified the 2001 UNESCO (United Nations Educational, Scientific and Cultural Organization) Convention on the Protection of Underwater Cultural Heritage on 9 March 2011 (UNESCO 2023), this sets out basic principles for the protection and preservation of underwater cultural heritage.

Section 57 of the NHA, states:

“Historic shipwrecks and shipwreck objects

57. (1) The remains of all ships that have been situated on the coast or in the territorial waters or the contiguous zone of Namibia for 35 years or more are historic shipwrecks for the purposes of this section.

(2) All articles that have been situated on the coast or in the territorial waters or the contiguous zone of Namibia for 35 years or more and that were associated with ships are historic shipwreck objects for the purposes of this section.

(3) The Minister may, by notice in the Gazette, declare that -

(a) subsection (1) does not apply to the remains, or part of the remains, of a particular ship or class of ships; or

(b) subsection (2) does not apply to any specified article or class of articles.

(4) If the Council proposes to recommend to the Minister -

(a) under section 28, that -

(i) a place where the remains of a ship are located be declared a protected place; or

(ii) an article associated with a ship be declared a protected object; or

(b) under section 41 that a provisional protection order be made in relation to a place where an article or articles appearing to be the remains of a ship are located, the Council must obtain and submit to the Minister, together with the Council's report and recommendation, any comments or advice which the Minister responsible for fisheries and marine resources may wish to make or give in relation to the proposed declaration."

While the National Heritage Act (27 of 2004) specifically delineates shipwrecks and their components, it can be reasonably inferred that this relates to any cultural heritage resources situated underwater. This Act is bolstered by the UNESCO Convention on the Protection of Underwater Cultural Heritage which states, "artefacts and human remains, together with their archaeological and natural context".

3.2. CONCLUSION – THE LEGISLATION IN TERMS OF THE PROJECT

Within the scope of this project, the NHA specifically declares shipwrecks and their associated objects as part of the national heritage estate and therefore protected. The purpose of the study is to identify potential MUCH sites and mitigate damage to them. If, despite the mitigation measures provided by the report, potential MUCH sites are uncovered during the work, a maritime archaeologist needs to be contacted to assess the find. Thereafter, in conjunction with the National Heritage Council (NHC), a decision will be made regarding the significance of the site. If it is deemed to be culturally significant, the company can apply to the NHC for a permit for removal, excavation, or destruction in terms of Section 46-52 of the NHA.

4. DESCRIPTION OF THE AFFECTED ENVIRONMENT

4.1. SITE LOCATION AND DESCRIPTION

The area under consideration is on the eastern side of Shark Island (red polygon in Figure 1). It is 0.13 km² and runs from the north end of the General Purpose Quay to the north end of Shark Island. It encompasses the slip and c.70 m jetty.

The second area (green polygon in Figure 1) has been previously dredged and is not considered in this report.

The bathymetry of this site, according to the marine chart (Figure 2) runs from -2.5 m, at the jetty, to a maximum of -4.3 m to the north of the zone (Garmin Marine Charts 2022). According to the multibeam survey (Figure 3), the bathymetry runs from -1.1 at the jetty to -7.57 m to the north of the zone (Underwater Surveys (Pty) Ltd 2024).

The channel in Menai Creek is kept dredged to allow access to Robert Harbour.



Figure 1: Location of Expansion Zones, Lüderitz (Google Earth 2024)

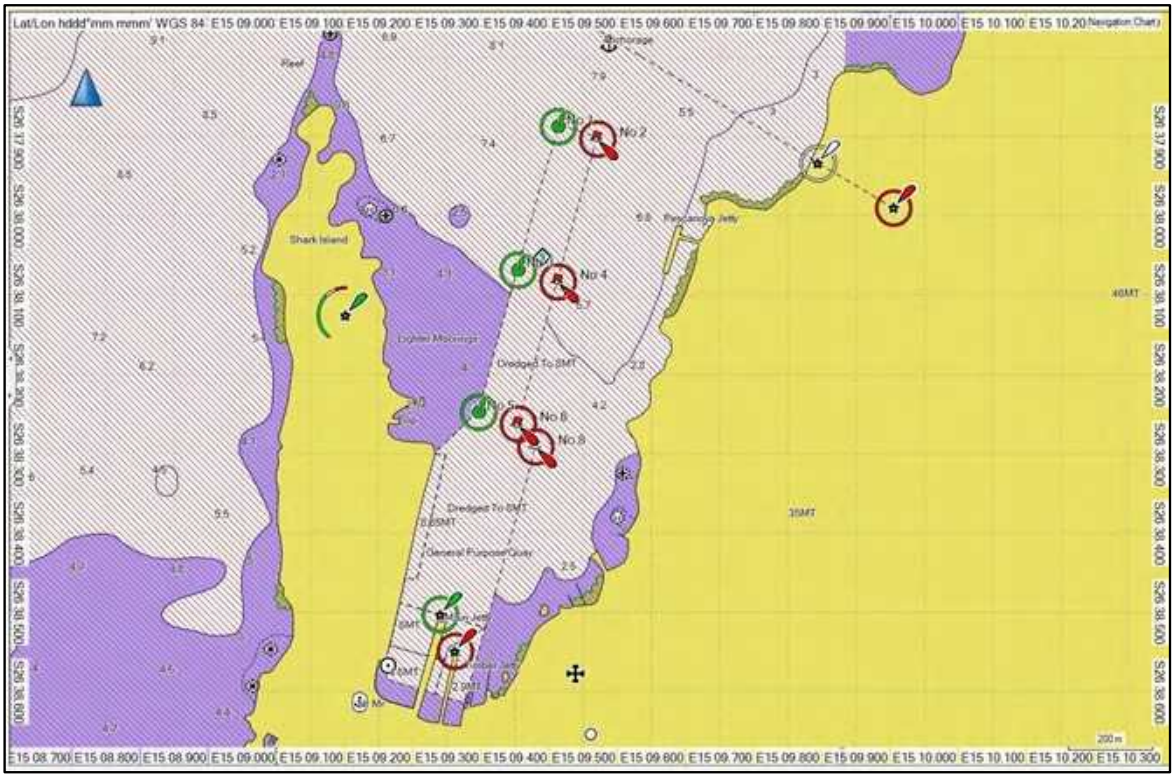


Figure 2: Robert Harbour Bathymetry (Garmin Marine Charts 2022)

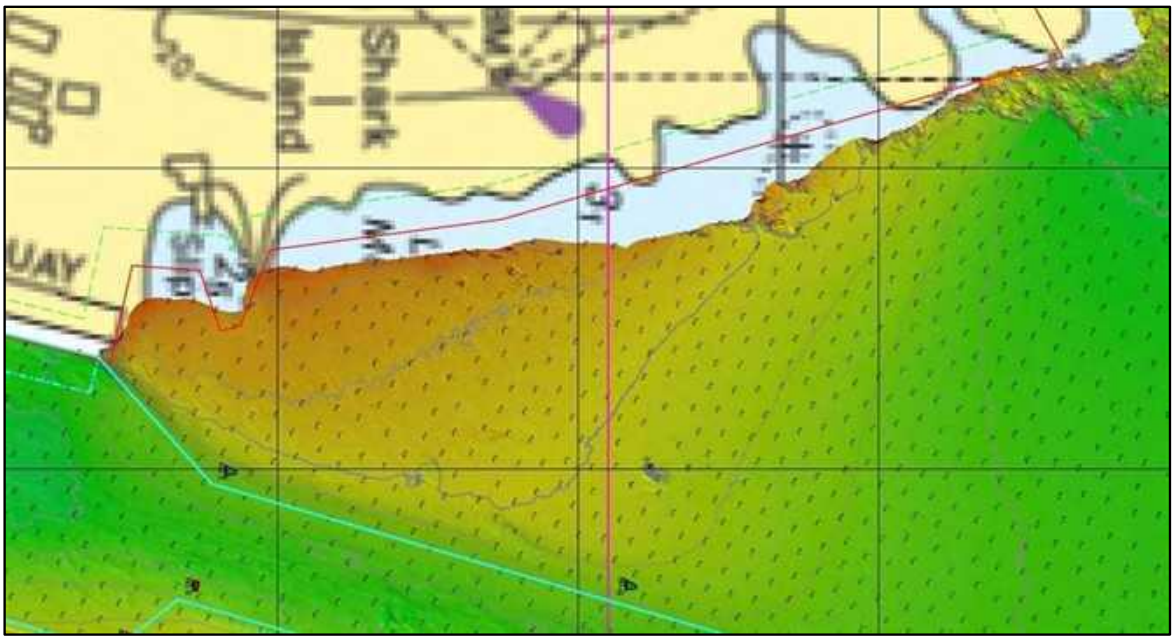


Figure 3: Multibeam Bathymetric Survey (Underwater Surveys (Pty) Ltd 2024)

4.2. BRIEF HISTORY OF LÜDERITZ FROM A MARITIME PERSPECTIVE

4.2.1. EARLY PORTUGUESE EXPLORATION AND CARTOGRAPHIC DISCREPANCIES

In August 1487, King João II of Portugal dispatched two 50-ton vessels and a supply ship under the command of Bartholomeu Dias to continue the search for a sea route to the East Indies. Upon reaching the area now known as Lüderitz, the fleet named the bay Angra dos Ilhéus (Bay of Islets), according to Axelson (1988). However, Kinahan (1988) argues that the bay was originally called Golfo de São Cristóvão (Gulf of St Christopher) and was later renamed Angra das Voltas (Bay of Tacks), owing to the difficulty the ships experienced when attempting to sail out.

These naming inconsistencies suggest that Axelson may have conflated two separate bays. A limestone padrão was erected at the point of the bay (Kinahan 1988). Dias named the point Serra Parda (Grey Mountain), later referred to as Diaz Point, and now known as Pedestal Point (Theal 1903).

The 1786 voyage of the Nautilus recorded the coordinates of the padrão as 26° 36’ 50” S and 15° 16’ 30” E (Kinahan 1990), approximately 18.5 km east of its actual location. In November 1825, during the Royal Navy’s coastal survey led by Captain Owen (1833: 158–159), the coordinates were recorded as 26° 38’ 4” S and 15° 2’ 5” E. While the latitude was accurate, the longitude placed the marker 5.7 km out to sea, likely due to faulty chronometers. These inaccuracies persisted in Admiralty Chart No. 632 (1913), which incorporated data from Owen’s 1825 survey alongside more recent updates (Figure 4). The cartographic history of this region is thoroughly explored in Kinahan (1990), and the inconsistencies underscore the importance of caution when using historical sources to locate shipwrecks.

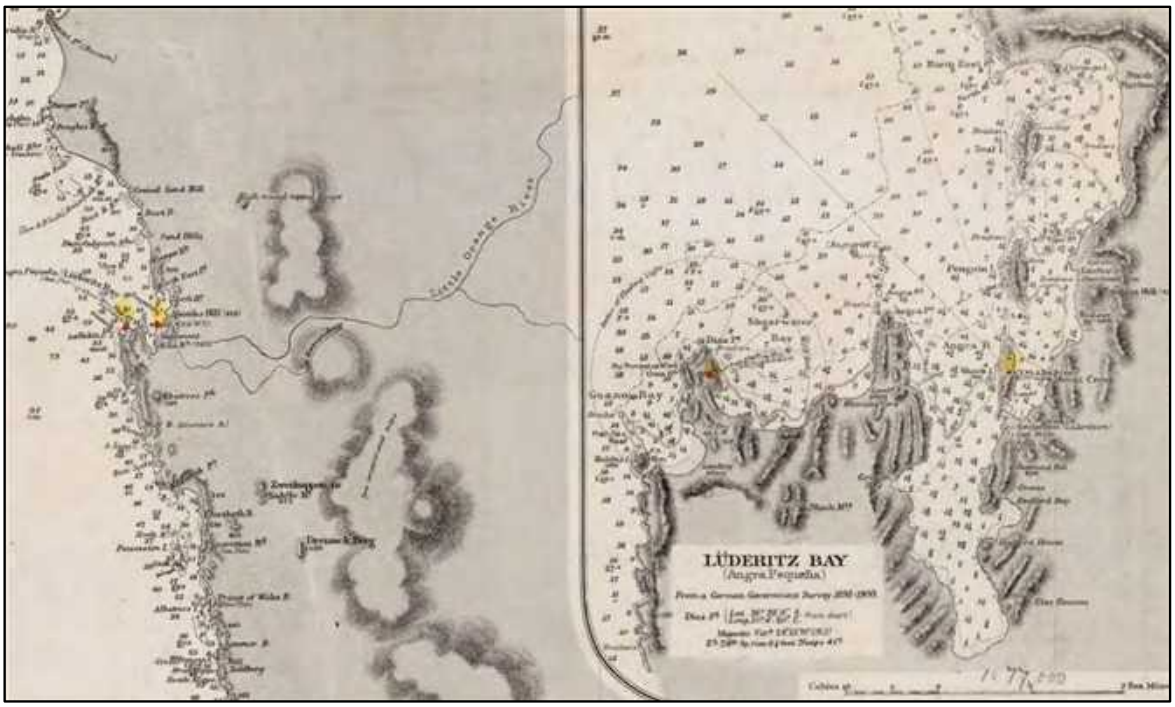


Figure 4: Lüderitz portion of Admiralty Chart No. 632 (Owen et al. [1881]1913)

4.2.2. Mummified Human Remains and Their Interpretations

Two mummified bodies were discovered in 1844 and 1845 that are possible indirect sources for shipwrecks. The first, found on Ichaboe Island, was described as the preserved remains of a man believed to be a Portuguese sailor:

> "…the body, which is supposed to be that of a Portuguese sailor, was discovered embedded in the guano, at a depth of six feet three inches below the surface. It was wrapped in canvas, and across the breast was fastened what appeared to have been the stave of a flour-cask, on which was carved, in rude characters, 'Christopher Delano, buried 1791.' … The features are quite distinct... The arms are flexible, both at the elbows and shoulders…" (Westmorland Gazette 1845-03-01)

An earlier article names the individual as "Columbus Delano" (St James Chronicle 1844-04-18).

The second mummy was found on Possession Island and described as follows:

> "The mummy is that of a negro, apparently about 25 years of age, length 5 feet 10 inches. The body, which was found in a coffin, is entirely perfect … the skin has not suffered the least incision, the teeth are a perfect set, and every one in its respective socket … The subject has received the rites of sepulture, the jaws being bound up, and the great toes tied together; the hands are crossed upon the body, just below the breast; and, what is very extraordinary, the shirt is in perfect preservation without adhering to the mummy … The coffin was found imbedded in guano, about four feet from the surface, and an inscription, which unfortunately has not come into the possession of the owners, is stated by Captain Douglas to show the date of interment to have been nearly 100 years ago." (St James Chronicle 1845-08-05)

Thus, at least two mummies were discovered: the first dated to 1791, likely of European origin, and the second of African descent, possibly dating to c. 1745. The latter was reportedly buried with Catholic rites, though binding of the jaws and feet is common in several cultures. Without direct archaeological analysis, no firm conclusions can be drawn.

Although most deaths at sea were marked by formal burials at sea (Stewart 2005), these two individuals may have died during sealing or whaling expeditions rather than as victims of shipwrecks. As with other findings, verification remains crucial.

A similar cautionary tale is found in the case of the skeleton in the Eberlanz Collection. Once identified as a marooned West African woman left behind by Dias (Axelson 1988), anthropological analysis and radiocarbon dating later proved the remains belonged to a Khoisan male, aged 40–60, who had died at least 240 years before Dias arrived bay (Wendt 1988; Winkler & Winkler-Holler 1988).

4.2.3. Rumours of Pirates and Hidden Treasure

In 1695, Captain William Kidd was commissioned by King William III to hunt pirates and engage French privateers. However, Kidd ultimately turned pirate himself (Strong 2004). In 1908, the salvage vessel Alfred Nobel was at Lüderitz, ostensibly to recover the Dunbeth wreck, but it emerged that the crew was searching for treasure allegedly hidden by Kidd during a visit to the bay in 1696. This rumour gained traction following the discovery of a "treasure chest" containing Spanish doubloons on Possession Island (Green 1950; Rosenthal 1954).. However, as Kidd's turn to piracy occurred after his documented visit, any hidden treasure would not date from that encounter.

4.2.4. Trade, Whaling, and German Colonial Expansion

By the 18th century, the bay was referred to as Angra Pequeña (Axelson 1988). In 1793, Captain Duminy of the Meermin sailed from Table Bay to the Namibian coast in an attempt to establish gold mines. Alongside the maritime voyage by Sebastian and Dirk van Reenen, an overland party led by Barend Freyn explored the area. Duminy renamed local landmarks: Halifax Island became "Meermin Island," Guano Bay became "Daniel's Bay," and Shearwater Bay was renamed "Rhenius Bay." These names were mostly ephemeral, though "Rhennin's Cove" persists today (Theal 1888).

A 1796 letter from Commodore Blankett to Henry Dundas notes the presence of 30 English and American whalers around "Thompson's Island" (Possession Island) the prior season (Theal 1897: 313, 1908). While the Whaling History database (New Bedford Whaling Museum & Mystic Seaport Museum 2023) contains hundreds of recorded voyages, many vessel fates remain unknown.

Oral testimony from Fred Cogill, a former police constable, describes discovering multiple wrecks during coastal patrols:

> "I came across a number of wooden wrecks, four of them well-preserved… In my opinion several of those wrecks were old American whaling ships… I also found skeletons beside one wreck. It seemed to me that a whole crew had perished there…" (Green 1952: 67).

Although Green's travel accounts rely heavily on anecdotal material, they contain valuable leads worthy of investigation.

4.2.5. German Colonisation and the Guano Trade

Angra Pequeña was declared a British possession in 1795 (Theal 1908). In September 1828, American whaler Benjamin Morrell claimed to have seen Dias's padrão still standing (Morrell 1832); however, this contradicts Captain Vidal's 1825 report describing its destruction (Owen 1833) . Morrell's writings helped trigger the guano rush of 1844–1845, which in turn brought increased shipping traffic — and shipwrecks — to the bay.

In 1883, German merchant F.A.E. Lüderitz purchased land around the bay from Captain Joseph Fredericks of Bethanie for 200 rifles and £100, later expanding his claim. Following diplomatic negotiations and shifting geopolitical interests, the German flag was raised in August 1884, marking the start of the German Protectorate. This excluded the 12 guano islands, annexed to the Cape Colony in 1873 (Theal 1908).

During the German annexation, Heinrich Vogelsang ceremonially removed the British flag and hoisted the German flag over David Radford's house. Reportedly, an old cannon marked "1760" was unearthed and fired in celebration (Green 1950, 1952), though this account is likely apocryphal due to the cannon's poor condition.

4.2.6. Conclusion: Context for Wreck Documentation

The diamond rush of 1908 brought a further increase in maritime activity and the likelihood of shipwrecks. From the mid-19th century onward, these wrecks are better documented and will be addressed in detail in the accompanying database.

Historical cartography remains an essential tool in tracing past activity. Admiralty Chart No. 632 (1913), based on Owen's 1825 survey, and the 1914 Union Defence Force map (Figure 5), offer key insights into the region's landscape and historical maritime incidents, including the location of the *Dunbeth* (see Section 5.2.5). These records are synthesised in Figure 6.

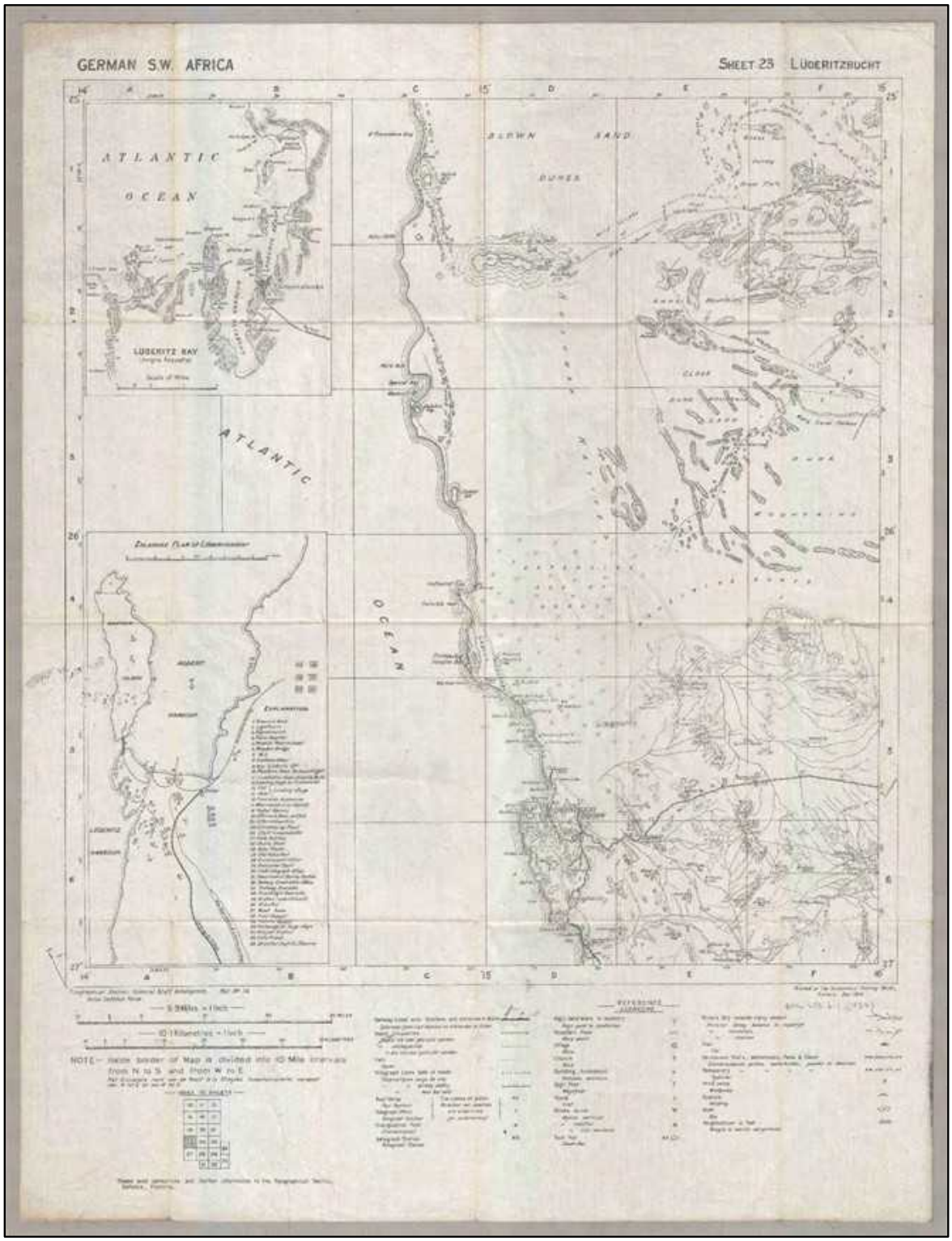


Figure 5: 1914 Map of Lüderitz (Union Defence Force 1914)



Figure 6: Landmarks of Lüderitz (Google Earth 2024)

5. PART 1: DESKTOP STUDY

5.1. STUDY APPROACH AND METHODOLOGY

5.1.1. EXTENT OF THE ASSESSMENT

The desktop survey is concerned with MUCH and covers the area as described in Section 5. However, shipwrecks are a difficult cultural resource to pin to a specific area, and therefore this UHIA covers a broader area, than the designated areas.

In addition to shipwrecks, a much larger part of our cultural heritage encompasses pre-colonial history. It is not possible to do a desktop assessment of pre-colonial sites underwater. However, the possibility of their existence must be borne in mind. The transition from Middle to Later Stone Age took place during the coldest time of the last glacial period, when sea levels were much lower than today. Therefore, artefacts from this period may be impacted.

5.1.2. METHODOLOGY

A shipwreck database was compiled from the available written and oral sources and is available in Section 5.

LIMITATIONS

- The database is a research tool that is constantly evolving as information is uncovered and added.
- The solitary nature of many wrecks means that information may be scarce and/or inaccurate. Therefore, without definitive information, shipwrecks are allocated to an area, based on limited information and certain assumptions regarding the dynamic nature of the environment.
- Shipwrecks that may initially be considered outside of the area, may drift many miles on the surface or just under the water surface after being abandoned. Therefore, these are also included in the Desktop Survey.
- Namibia's existing shipwreck databases are underdeveloped, most of the known wrecks date from the mid-19th century as explorers, missionaries, prospectors, and traders moved through the country.
- The nature of the Namibian coastline with a largely semi-nomadic population meant that potentially hundreds of wrecks went unreported.

- The desert sands are highly mobile and there are several reports of wrecks, bays and islets “disappearing” under the sand.

5.2. SHIPWRECK DATABASE

The nature of the environment, poor historical reporting and the length of time since the wrecks occurred means that underwater cultural heritage sites may literally be anywhere and are thus hard to pinpoint with any accuracy beforehand. It is important to have a database because if MUCH sites are uncovered during the project, it will be easier to identify the wreck and thus assess its cultural and historical significance.

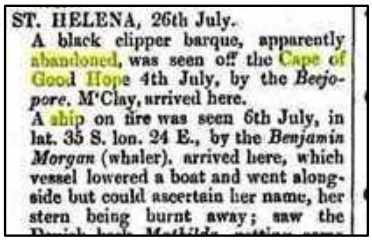
There are several points to bear in mind when compiling and making use of any shipwreck database.

- There are thousands of reported wrecks around the Southern Africa coastline and thousands more that disappeared mid-ocean (Figure 8 and Figure 9).
- There is some anecdotal evidence that the Phoenicians circumnavigated Africa (Herodotus, 1954). However, if this is true, these ships had to stick right to the coastline and therefore are unlikely to be far offshore.
- There’s increasing evidence that the Chinese voyages of the 1400s explored parts, if not all, of the African coast (Paine, 2013). However, once again the archival evidence to date, and availability to Western researchers, limits this knowledge.
- The first recorded European voyages down the west coast of Africa were by the Portuguese. When the Portuguese first sent out their explorers, they stuck close to the coastline, in order to map the land. The present-day Cape Voltas may be a survival of the Portuguese name Volta das Angras. Dias and his fleet passed the Orange River Mouth in 1487/1488 (Axelson, 1973). Thereafter, the rate of exploration and trade increased exponentially, as is evidenced by the increase in shipwrecks over the centuries.

  These early voyages were not well documented, and the archives often merely report that a fleet of a certain number of vessels left and only a certain amount returned, with only vague references to their place and manner of loss. Additionally, it seems that there were often private vessels that accompanied the fleets, these are underreported (Subrahmanyam 1997).

  Therefore, there are many undocumented Portuguese wrecks. This statement is reinforced by the Cabral Fleet of 1500 (#11-14 below).

- Due to the Treaty of Tordesillas in 1494, Spain claimed all lands west of 46° 30’ W, while Portugal claimed all lands to the east (Paine 2013). However, the Portuguese and Spanish, Iberian Union from 1580 to 1640, brought both kingdoms and colonies under the Spanish monarchy (Marques 1972). This increased the presence of Spanish vessels along the west coast of Africa, especially with regard to the trans-Atlantic slave trade (Landers 1997). While tere are no recorded Spanish wrecks in Namibia, there is anecdotal evidence of a Spanish wreck south of Bogenfels (c. 100 km south of Luderitz) and a report on the recovery of Spanish cannon in 1859 at Walvis Bay (Cape & Natal News 1859-09-05).
- While the Vereenigde Nederlandsche Geoctroyeerde Oostindische Compagnie or Dutch East India Company (VOC) kept detailed records of their voyages and this information is freely available online ((Huygens Instituut 2023), there is evidence of a vast unofficial Dutch trade, specifically in the trans-Atlantic slave trade, of which there are fewer records. Additionally, there was a rich history of pirates and privateers operating on the west coast of which there are few records except brief newspaper articles referring to unsuccessful attacks (Sutton 2009).
- Bear in mind when reading the below database, the term “Abandoned”, generally means that the vessel was further out to sea. Older ships were sometimes badly maintained. A lifetime of rough seas had a heavy toll on the old vessels. Through storms and possibly bad maintenance, ships could become death traps. If the vessel was leaking badly and running repairs and continuous pumping had little to no effect, the captain would decide to abandon ship. However, sometimes these vessels would not sink but float along in the currents and could end up thousands of miles from where they were abandoned. There are numerous accounts of such derelicts being spotted. Figure 7 is an example of such a sighting. This vessel was spotted off the Cape south coast, it was on fire and had been abandoned. The whaler that spotted it could not read the name.



ST. HELENA, 26th July.
A black clipper barque, apparently abandoned, was seen off the Cape of Good Hope 4th July, by the *Beejopore*. M'Clay, arrived here.
A ship on fire was seen 6th July, in lat. 35 S. lon. 24 E., by the *Benjamin Morgan* (whaler), arrived here, which vessel lowered a boat and went alongside but could ascertain her name, her stern being burnt away; saw the

Figure 7: London Lloyd's List 13-09-1856

- The ocean currents could move abandoned vessels hundreds of kilometres away from their reported position.

Under the NHA, any shipwreck older than 35 years is considered heritage. The Shipwreck Database uses several conventions to assess the impact of projects on heritage resources (Appendix I).

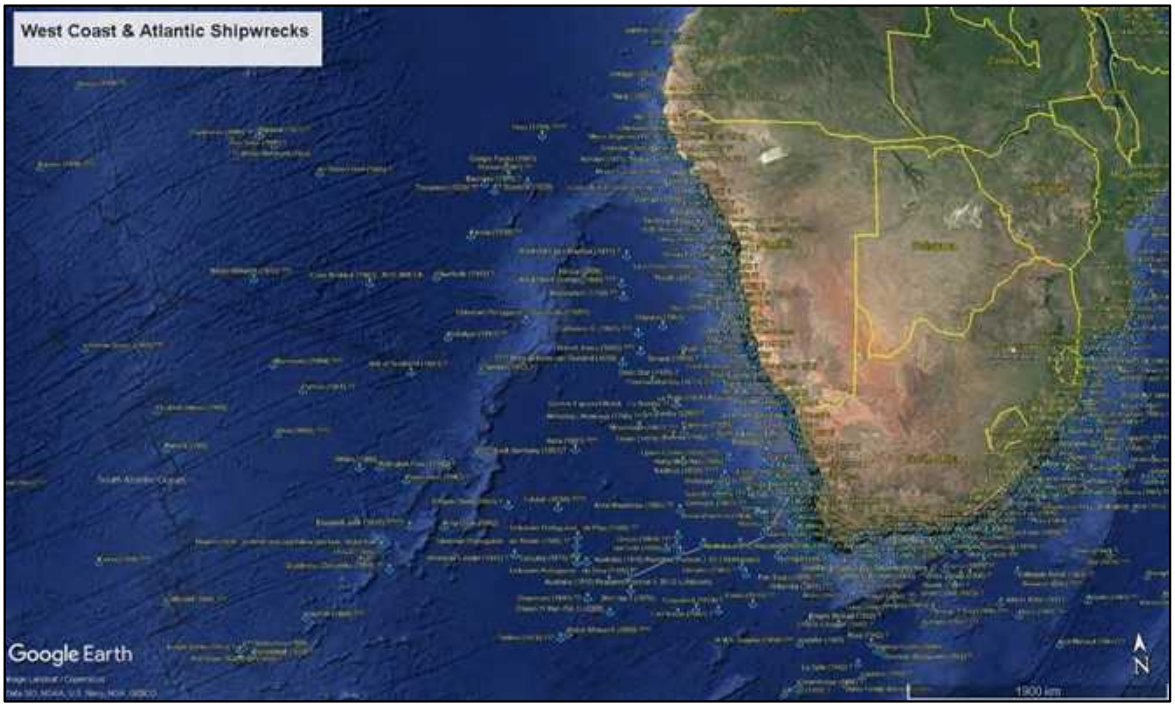


Figure 8: Southern African Shipwrecks (Google Earth 2024; Hocking 1969; Levine 1989; Maitland 2023; Reocities 2022; SAHRA 2022; Turner 1988; U-boat.net 2022; van den Bosch 2009)



Figure 9: Namibian and Atlantic Ocean Shipwrecks (Google Earth 2024; Hocking 1969; Levine 1989; Maitland 2023; Reocities 2022; SAHRA 2022; Turner 1988; U-boat.net 2022; van den Bosch 2009)



Figure 10: Shipwrecks in and around Lüderitz (Google Earth 2024; Hocking 1969; Levine 1989; Maitland 2023; Reocities 2022; SAHRA 2022; Turner 1988; U-boat.net 2022; van den Bosch 2009)

5.2.1. SHIPWRECKS POSSIBLY IN THE QUAY EXTENSION ZONE

See Figure 10

#	Name	Events	Nation	Date
1	*Adventure*	Wrecked	Britain	1852-09-29

This 85-ton schooner was built in 1849 at Miramichi, Canada. The vessels measurements are as follows: L - 19.6 m; B – 5.5 m; D – 3 m. It was built of black birch and larch wood and fastened with copper, iron and wood treenails and partially sheathed with “yellow metal”. Owned by de Wolf, and registered in Liverpool (Official #: LR10245) (Lloyd’s Surveyor 1850).

“Table Bay, 9th Oct. The ADVENTURE, (schr.) Roberts, was totally wrecked at Angra Pequena, previous to 29th Sept." (Lloyd’s List 1852-11-16)

The construction details are extracted from the Lloyd's Register of 1852. While the vessel in the Register has the captain listed as J. Best, the captains were frequently changed and the Lloyd's Register not updated. This is the only vessel named *Adventure* that was reported as sailing to "Africa". It is not listed in the 1853 Lloyd's Register. The exact vessel may need to be changed if more information comes to light, not all trading vessels were registered with Lloyd's.

Conclusion:

There is not enough information on this wreck to narrow down its location within Lüderitz.

Location	Significance
Lüderitz	Medium

#	Name	Events	Nation	Date
2	*Bali* (ex- *Erna*)	Aground, Sank	Norway	1910-12-24

This steel, 1132-ton barque was built by Robert Thompson & Sons in Sunderland, England in 1891. The vessels measurements are as follows: L - 63 m; B – 10.5 m; D – 6.1 m.

Ownership History: 1891 - *Erna* delivered to Adolph Schiff of Elsfleth, Germany

1907 - Sold to Edward Carr Sohne, Hamburg renamed *Bali*

1910 – Sold to Larsen, Gudmund Andreas, Sandefjord.

The *Bali* under Captain Lovdal had a cargo of coal from Cardiff for Lüderitz. It went ashore "on a reef off Whale Island, right in the narrow entrance to Lüderitzbucht". Apparently, it sank shortly after hitting the reef and only the three masts were visible. The wreck was off Penguin Island in 8 fathoms (14.5 m) of water. After spending the night on the sunken vessel, the crew were all saved. The Norwegian Consul arranged for their accommodation, and they were transported by the *SS Hellopes* to Cape Town (Cape Times 1911-01-03, 1911-01-04, 1911-01-07).

The wrecked barque was advertised for sale by public auction on 24 January at the Custom House, it was sold on the 25th for £62 10s (Cape Times 1911-01-20, 1911-02-07). Whether she was successfully salvaged or not is not recorded.

Conclusion:

The vessel sank rapidly in relatively deep water “off” Penguin Island. It was a steel vessel so would take longer to break apart.

While it is possible that the *Bali* hit the reef off Angra Point to the west, there is a wreck on the marine charts, 142 m from Penguin Island at 26 37.150 S 15 09.013 E at a depth of 12-13 m. This location is where the seabed drops from 5 to 12.2 m. It is likely that this is the *Bali*.

Location	Significance
Probably 142 m west of Penguin Island	Low

#	Name	Events	Nation	Date
3	*Dunbeth*	Ashore, refloated	Britain	1906-06-06

The *Dunbeth* was a steel vessel built in 1905 propelled by both sail and steam. Under Captain J. Swanson, it had a cargo of hay and mules, as well as passengers.

The ship was sailing from Rosario, Argentina to Swakopmund (Morning Post 1906-08-08), when it was wrecked during a storm (van den Bosch 2009).

The Gearing Wrecking Company visited the wreck site and stated they could not refloat the vessel and the Salvage Association of London stated that they were trying to engage the Harbour Board of Lüderitz salvage it (Lloyd's List 1906-06-26). In The Daily Telegraph (1906-08-09), it is mentioned that the vessel is hoped to be floated on the 5th of August but no news had been heard yet.

In 1907, Captain Gardiner of the *Alfred Nobel* arrived in Lüderitz on the pretence of attempting to salvage the *Dunbeth*. It had already been stripped of brass, copper and cargo where it lay "in a rocky trap off Shark Island" and was considered a "worthless hull". This wreck was the excuse Gardiner need to allegedly look for Captain Kidd's treasure, however, it is believed that this too was a ruse and the salvors were actually after illicit diamonds (Green 1950: 57). Due to the above description, I believe the "Stranded English Steamer" noted in a 1914 map (Figure 5) is the *Dunbeth* (Union Defence Force 1914)

Despite the 1907 proclamation of the *Dunbeth* as worthless wreck, in 1909 the vessel was successfully refloated (Bridlington Free Press 1910-09-16) and taken to Tyne, England for repairs in 1910 (Liverpool Journal 1910-09-06). The ship was refitted and sold a number of times until it was renamed *Orkedal* and sunk after striking a mine in the North Sea in 1916 (Norheim 2014a).

Conclusion:

This is not a wreck.

Location	Significance
NOT A WRECK	

#	Name	Events	Nation	Date
4	*Konkiep*		Namibia	2017-01-11

This motor fishing vessel, GRT 66 tons, also known as *Weskus Four*, was owned by Lalandii (Pty) Ltd and sank in the Lüderitz Harbour. (van den Bosch 2022).

It may have sunk at the Lalandii Jetty, opposite Penguin Island and it may have been removed by the harbour authorities.

Location	Significance
Lüderitz Harbour (Robert Harbour)	None

#	Name	Events	Nation	Date
5	*Lizzie*	Abandoned	Cape Colony	1861-01-21

This wooden cutter left its home port of Cape Town in November 1860, to go fishing. It was seen abandoned on the coast, "at the lagoon of Angra Pequeña" (Lloyd's List 1861-04-01).

Conclusion:

There is no further information as to whether the vessel was ever recovered or returned, therefore it should remain in the database as a possible wreck.

Location	Significance
Lüderitz	Medium

#	Name	Events	Nation	Date
6	*Magna*	Sank, abandoned	Norway	1910-10-05

This wooden barque built in New Brunswick, Canada in 1879 had a GRT of 1179 tons and was 56 m in length (Figure 11).

"1910 Dismasted and sprang a leak 29/09 in the South Atlantic Ocean whilst on a voyage from Cardiff, Wales to Lüderitz Bay, German South-West Africa (Namibia) with coal. Arrived Walvis Bay, German South-west Africa as a port of refuge.

1911 Towed to Lüderitz Bay. Discharged and condemned." (Nesje 2024)

"Magna. - Skien, Oct. 8. - Owner of barque Magna, of Langesund, from Cardiff for Luderitz Bay (coals), informs us that a cable has been received from the captain dated Swakopmund Oct. 5, stating that the vessel has arrived Walfisch Bay, with loss of sails and rigging." (Lloyd's List 1910-10-12)

"LUDERITZ BAY. Magna. Thormadsen [10/6] C[a]rdiff at Walfisch Bay abt Oct 5. with loss of sails and rigging." (Lloyd's List 1910-10-22)

It appears that the vessel sank in the harbour and was left to decay at the pier, but the image of the wreck (Figure 12) may not be the *Magna* but one of the fishing boat wrecks in the area. It would need confirmation, and it seems that the vessel in the wreck image may be too small, the *Magna* had a length of 56 m.

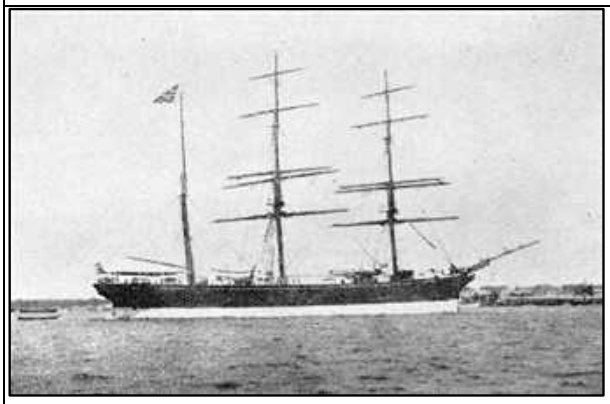


Figure 11: The *Magna* (Norheim 2014b)



Figure 12: Purportedly the *Magna* (Namibweb 2024; van den Bosch 2009)

Location	Significance
Lüderitz – Possibly Main Jetty, east of Shark Island	Medium

#	Name	Events	Nation	Date
7	*Ranza*	Wrecked	Britain	>1936

This steel, screw steamer was built by William Chalmers & Co in Rutherglen, Scotland. It had a GRT of 96 tons and its length was 81.2 feet (24.7 m) (Scottish Built Ships 2023).

According to van den Bosch (2022), it was wrecked in Lüderitz and the boiler was still visible 1963, however there is no source mentioned.

"Wearin lost the *Magnet* in a Hout Bay gale in 1916. Six years later he visited Britain and bought the ninety-ton *Ranza*, a Glasgow herring-carrier. He brought her to Table Bay with a crew of seven in six weeks, and went on with his sealing. South Africa's "one-man shipping line", as people called him, was established again. The *Ranza* served him well for five years; then he sold her and travelled to Britain again in search of another ship." (Green 1950: 146).

The *Ranza* was apparently used to rescue the crew of the Limpopo in 1930, "…A Government tug and the coasting steamer "RANZA" was sent to rescue the rest of the crew. …When these two ships arrived they found the surf lashing the "LIMPOPO". It was impossible to send a boat ashore at that spot where the crew had gathered. Signals were sent and Captain Taylor, who after 8 days had abandoned his ship, and his crew were ordered to walk 12 miles down the coast, where a slight indentation gave a little shelter. A surfboat from the "RANZA" managed to pick up the castaways, all sunburnt and suffering from exposure" (Anon. ca. 1972: 29).

In 1933, The Ranza was still being used. (Murray 1933: 346)

The website Scottish Built Ships (2023) state that in 1933 it was bought by Theodor Sievers of Lüderitz and that the ship was removed from the British Registry in 1937. Whether this means it was registered elsewhere or it was wrecked is unclear.

Location	**Significance**
Lüderitz	Low

#	**Name**	**Events**	**Nation**	**Date**
8	*South West Plover*	Sank	Namibia	2016-07-14

This fishing vessel, sank in the Lüderitz Harbour" (van den Bosch 2022).

It may have been removed by the harbour authorities.

Location	**Significance**
Lüderitz Harbour	None

#	**Name**	**Events**	**Nation**	**Date**
9	*Superb*	Ashore, condemned	Britain	Before 1844-10-18

This wooden, copper sheathed barque of 278-tons was built by Reay & Robson at the North Hylton shipyard at Sunderland, England in 1835. Previously owned by R. Reay, at the time of wrecking it was owned by Murrat & Co. Its home port was London and was under the command of Captain Wild.

In December 1844, the captain of the *Earl of Devon*, on returning to Britain stated that the *Superb* started leaking at sea and the pumps barely kept up. The *Earl of Devon* sailed with them until they reached Angra Pequeña. There, the crew ran the ship ashore to attempt repairs. When the *Earl of Devon* left, the ship had been stripped and ballast removed, there were fears that it would have to be abandoned (Shipping & Mercantile Gazette 1844-12-27).

The Lloyds's Register (1844) has 11 vessels named *Superb*. Four of these were said to sail to the southern hemisphere and of these, two are listed as sailing to "Africa" and the other to India. Of the two Africa traders, one is listed as wrecked. This vessel was built in 1835. The Lloyd's Survey (1850) states the vessel's destination as the "Guano Islands". I believe this is the vessel condemned at Angra Pequeña.

Despite all the surveys stating the vessel was in good condition, the Lloyd's Survey (1850) states, "At present the hooding ends have been caulked & ... a pair of iron knee riders have been fitted [below] the 3rd upper deck beam to the breast hooks and an iron strap from the breasthook to the 3 upper deck beams bolted thro [back beam]. She appears in efficient condition and may continue as classed.".

Conclusion:

The *Superb* was not seaworthy and was beached near Lüderitz. As it was condemned, the vessel remains may still be in the area.

Location	Significance
Lüderitz	Medium

#	Name	Events	Nation	Date
10	Unknown-001			1843

This wreck is referred to as a “sailer van Reenen bought”, both of the sources for this no doubt obtained the information from Von Schumann’s 1994 database ((Möhle 2023; Mowa 2020).

Conclusion:

In the time available, I could not find any other references to this wreck in the newspapers or in any other database. This does not mean that the wreck doesn’t exist, it just needs more research and is therefore left in the database.

Location	Significance
Lüderitz	Medium

5.2.1. SHIPWRECKS POSSIBLY IN THE PHASE 2 JETTY AREA

Although the Phase 2 area near the jetty has been dredged, it is possible that remains of the *Magna* (1910) may be found during development.

5.2.2. SHIPWRECK IN THE MULTIBEAM SURVEY

Figure 13 is the multibeam survey of the area (Underwater Surveys (Pty) Ltd 2024) and shows a feature in the vicinity of -26.634454° 15.155924° (circled in red). It is presumed to be a wreck.

At the time the magnetometer survey was undertaken, the removal of this wreck was already underway. It is confirmed by Cold Water Divers that the wreck is the *Christiaan de Wet*, sunk after 2011 when it was last recorded in Walvis Bay. It was apparently a wooden fishing boat under Capt. Hilmar Snorrason. The only Namibian fishing boat that I could locate by this name is pictured below in Figure 14 and Figure 15. The name on the 2007 and 2011 images aligns with images of the wreck taken by Cold Water Divers in 2025 (Figure 16).

This wreck was not on the shipwreck database, and this underscores the incomplete data within the Namibian shipwreck database.

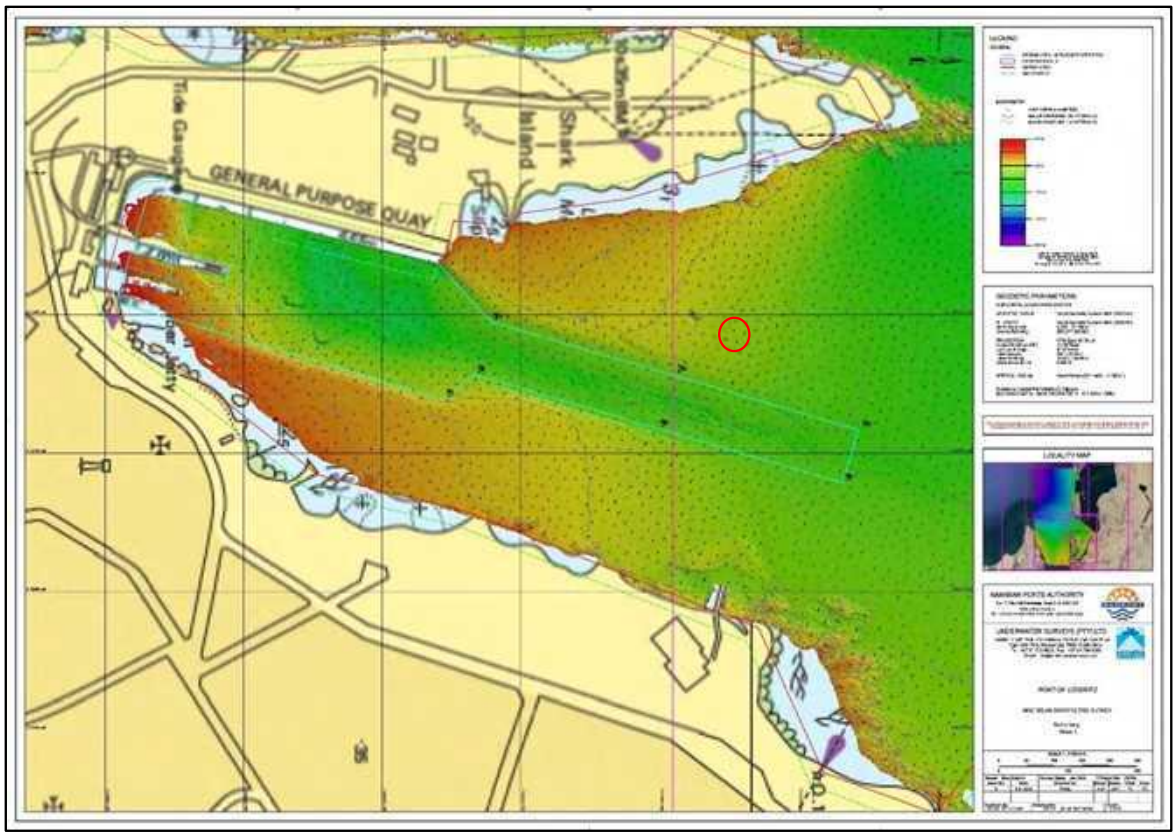


Figure 13: Multibeam Bathymetric Survey (Underwater Surveys (Pty) Ltd 2024)



Figure 14: The *Christiaan de Wet* at Walvis Bay in 2011(Snorrason 2011)



Figure 15: The *Christiaan de Wet* in 2007 (Snorrason 2007)



Figure 16: The *Christiaan de Wet* wreck (Cold Water Divers)

5.2.3. SHIPWRECKS IN THE SIDE SCAN SONAR

The side scan sonar was undertaken by the CSIR in 2009 (Figure 17), the targets identified in the report were extracted and overlaid on Google Earth (Figure 18), as can be seen none of the targets identified are within the designated development area. The shipwrecks that were identified in the survey are off Angra Point.

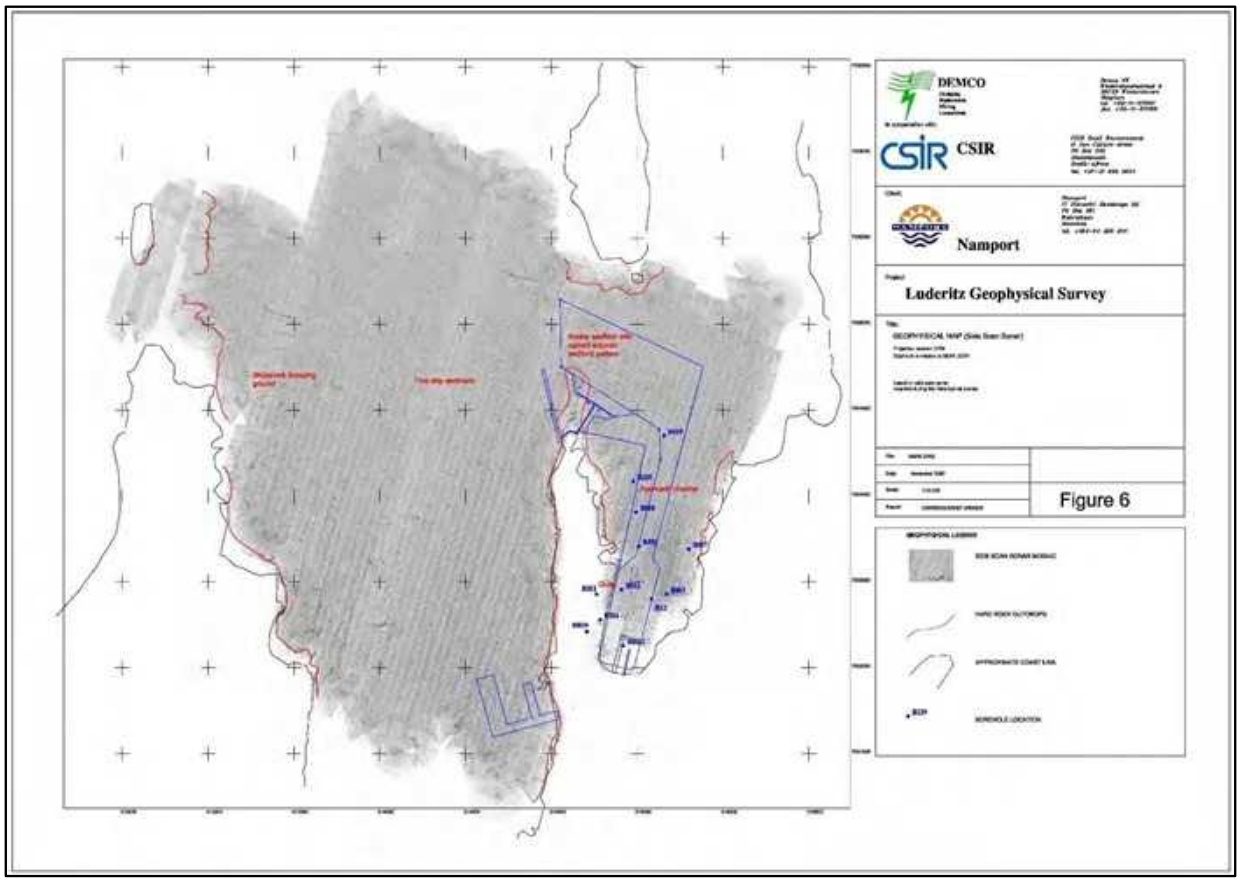


Figure 17: Side scan sonar map of Lüderitz (Vonk & Brabers 2010)



Figure 18: Side scan targets with relation to the designated area

5.2.4. SHIPWRECKS NOTED DURING THE FIELDWORK

During the fieldwork, a shipwreck was observed on the rocks near Shark Island. Based on historical imagery from Google Earth (Figure 19 and Figure 20), the wreck occurred sometime between March and November 2022. As of 2025, some of the remains are still visible on the rocks (Figure 21). Figure 22 illustrates how the wreck has dispersed over the past three years: in 2022, the main structure was located approximately 50 m north of its current position, while a rounded metal object (Figure 64), found during diver searches and discussed in Section 8.2, lies about 65 m south of the present-day remains.



Figure 19: Google Earth image from March 2022



Figure 20: Google Earth Image from November 2022, the shipwreck is visible



Figure 21: Remains of the 2022 shipwreck on Shark Island



Figure 22: Placemark illustrating the dispersal of the shipwreck

5.2.5. Shipwrecks in Lüderitz but NOT in the Quay Extension Zone

#	Name	Date	Area
1	*Atlantic Challenger*	c.2015	Lüderitz – Second Lagoon (-26.678628° 15.151129°)
2	*Canute*	1861-02-09	Lüderitz – Pedestal Point / Shearwater Bay
3	*Elena V*	c. 2012	Lüderitz – Redford Bay
4	*Jellyfish*	2012-07-20	Lüderitz – 35 km NWW of Northeast Point (-26.575668° 15.120334°)
5	*Statendam*	c. 2015	Lüderitz – Redford Bay
6	*Tilly*	1885-02-01	Lüderitz – Shearwater Bay or out at sea
7	Unknown-002 (Mussel Boat)	c. 2005	Lüderitz – In the bay west of Flamingo Island

5.2.6. Indirect Shipwreck Evidence

In 1883, when Heinrich Vogelsang removed the British flag and raised the German flag over David Radford's house, it is reported, "A rusty cannon had been found in the sand beside the bay. This was charged with gunpowder and fired in honour of the occasion." The cannon had a date of 1760 on it (Green 1950, 1952). This may have been salvaged from a wreck, as cannon were not often abandoned. It points to a wreck post-dating 1760 in the area.

5.2.7. Ships that Disappeared in the Atlantic Ocean

These are vessels that disappeared either between local ports or between continents, they were last known to be in the Atlantic. They are included as there are many unknown wrecks in Namibia. The Namibian coast was always sparsely inhabited and there is a paucity of reliable wreck information prior to the 1850s.

This is a growing database; some have more information than others but hopefully this will expand over time. The Portuguese information is hard to be clear on, only some of the Portuguese ships that are missing are on here. The information in the historical books is vague, contradictory, and sometimes repetitive (Figure 8 and Figure 9)

#	Name	Events	Nation	Date	History
1	*Abberkerk*	Wrecked	Netherlands	1779	Built in 1772 for the van Hoorn Chamber. It was 140 Dutch feet long, 850 tons and had a crew of 174-268 people. Under Capt. Kasper Burger, the ship left China on 29 January

					1779, reached the Cape on the 26th of May, and departed for the Netherlands on the 24th of June and was not heard from again (De VOC Site, 2022).
2	*Bevalligheid*		Netherlands	1769	VOC vessel, homeward bound from Batavia, left the Cape and disappeared (Huygens Instituut 2023)
3	*Boa Viagem*			1585	Under Lourenço Soares de Mel,) lost at sea due to overloading (Domingues et al. 2023).
4	*Bradford / Bradfort City*	Torpedoed, Sank	Britain	1841-11-01	Torpedoed by U-68, co-ordinates 22 59.00S,09 49.00E (Hocking 1969; Levine 1989; van den Bosch 2009)
5	*Cabral Fleet*	Lost	Portugal	1500	Levine (1989) states: "Thirteen vessels under command of Pedro Alvares Cabral – the first Portuguese fleet which sailed annually to the Indies – and found Brazil. Twenty days after the fleet sailed from Brazil, it was struck by storms and four ships, including the one under command of Bartolomeu Dias, foundered. Duffy [Shipwrecks and Empire, 1955] writes that the ships were lost off the Cape of Good Hope, but, according to Axelson [Levine cites personal correspondence], the fleet could not have been off the Cape of Good Hope then; they would have been in the vicinity of the shortly-to-be-discovered islands of Tristao da Cunha." There is such scant and contradictory information regarding the loss of these four vessels that I am including them in this database, even though the chances of them being here is exceedingly slim.
6	*Catterina D / Catherina D.*	Fire, abandoned	Austria	1887-10	This 610-ton barque from Liverpool for Cape Town with a cargo of coal caught fire. It was apparently abandoned before it sank, 480km west of Hottentot Point. The captain and crew reached Walvis Bay in the lifeboats (Levine, 1989; van den Bosch, 2009). As it was abandoned before it sank and could have drifted south, this vessel is included in the database.
7	Cedro			1563	Under D Rodrigo or Pedro de Castro, lost at sea (Domingues et al. 2023)
8	*Consolacao*			1607	Lost (Cordeiro & da Roche 2016)
9	*Discovery*	Disappeared	Britain	1644	This ship of 500 tons, was built in 1621 at Woodbridge. Under Capt John Allison. 1640/1 Surat and Persia. Capt John Allison. Its last trading voyage was as follows: Depart: Downs 3 Apr 1641 At: Surat 27 Sep At: Bandar Abbas 2 Feb 1642 At: Surat 13 Apr At: Mokha 22 Aug - 31 Oct At: Surat 30 Jan 1643 - 18 Feb At: Bandar Abbas 27 Apr At: Mokha 3 Nov At: Surat 29 Jan 1644 After leaving Surat, India, the ship was not seen again (Wrecksite.eu, 2022).
10	*Doric Star*			1939-12-02	Sunk by the *Admiral Graf Spee,* southwest of Walvis Bay (Levine 1989; van den Bosch 2009)
11	*Drechterland*		Netherlands	1744	VOC vessel, homeward bound from Batavia, left the Cape and disappeared (Huygens Instituut 2023)
12	*Duinenburg*		Netherlands	1773	VOC vessel, homeward bound from Batavia, left the Cape and disappeared (Huygens Instituut 2023)
13	*Elizabeth Jane*			1834-01-20	This vessel seems to be a whaler that operated in Tasmania and the southern oceans (van den Bosch, 2009). Although I can find no further information on its status at this time, I have left it in the database.

14	*Enkhuizen*		Netherlands	1742	VOC vessel, homeward bound from Batavia, left the Cape and disappeared (Huygens Instituut 2023)
15	*Florence Barclay*	Fire, abandoned	Britain	1872-11-7	This 243-ton barque was built in 1866. Under Captain J.H. Voller, it was bound from Hull for Table Bay and Mauritius. Somewhere off the west coast, the vessel caught fire and was abandoned. The crew were in three lifeboats, one of which disappeared during the first night at sea. The other two boats arrived at Pomona Island (Namibia) three days later. The survivors were taken to Table Bay by the *Lilla* (Levine, 1989; van den Bosch, 2009). As the crew beached on the west coast of southern Africa, I have included this vessel.
16	*Galega*			1538	Capt. Bernardim da Silveira. lost at sea. Left Lisbon 6 April (Domingues et al. 2023)
17	*Haversham Grange*			1906	Disappeared 1237 km NW of Cape Town (Levine 1989; van den Bosch 2009)
18	*Hazelside*			1941	Reported coordinates, 23 10.00S, 01 36.00E (Hocking 1969; Levine 1989; van den Bosch 2009). Although these coordinates are well west of the coast, it is where the reported attack occurred, not necessarily where it sank. In addition, the coordinates mentioned are subject to the technical limitations of the period.
19	*Hero*		Britain	1789	Ashore and condemned on the “coast of Africa”.
20	*Hofvliet*		Netherlands	1744	VOC vessel, homeward bound from Batavia, left the Cape and disappeared (Huygens Instituut 2023)
21	*Honkoop / Honcoop / Hencoop*	Disappeared	Netherlands / Britain	c.1796	This Dutch vessel of 1 150 tons and 20 guns, under Capt Alex Landt was built in 1770 for the Zeeland Chamber was taken by the British at The Battle of Saldanha (1871), it was being sailed at a prize back to England when it disappeared (van Niekerk, 2015)
22	*India*	Abandoned	Sweden	1881-8-24	This British iron barque, under Capt McPhail, was on a voyage from Britain to Australia, when it began leaking after being battered by several gales. From 2 January to 24 February, the barque limped down the west coast of Africa. At this time, as the leak was so serious, the crew abandoned ship at 7º E. Their lifeboats had been smashed in one of the storms, so when they saw a passing ship, they asked for assistance. When they left the distressed vessel, it was still afloat (van den Bosch, 2009). The currents may have pulled it towards the West Coast or further out into the Atlantic.
23	*Llandilo*			1942	Torpedoed by U-172 at 27 03.00S,03 08.00W (Hocking 1969; Levine 1989; van den Bosch 2009). Although these coordinates are well west of the coast, it is where the U-boat reported torpedoing the vessel, not necessarily where it sank. In addition, the coordinates mentioned are subject to the technical limitations of the period.
24	*Loreto*			1607	Lost (Cordeiro & da Roche 2016)
25	*Maria Adriana*		Netherlands	1743	VOC vessel, homeward bound from Batavia, left the Cape and disappeared (Huygens Instituut 2023)
26	*Mary*	Disappeared	Britain	1870-07-24	Under Captain Anderson, this vessel left Simon’s Bay for Falmouth and disappeared (Levine, 1989) As the intended route goes up the west coast, I have included this vessel.
27	*Mississippi*	Abandoned	USA	1862-08-31	This 2030-ton steamship was abandoned about 450 km off the West Coast after severe weather was causing extensive leaks (The Daily Southern Cross, 1862). It may have drifted closer to land before sinking.
28	*Nortun*	Torpedoed	Panama	1943-03-20	This 3 663-ton ship was bound from Table Bay to Bahia when it was torpedoed and sunk by the U-516 about 130km south-west of Lüderitz at 28º 00´ S 14º 55´ E (Levine, 1989; van den Bosch, 2009). According to U-boat net (2022) the position is further north at 27° 35'S, 14° 22'E.

					Although these coordinates are south of Lüderitz, there are conflicting positions, and it is where the U-boat reported torpedoing the vessel, not necessarily where it sank. In addition, the coordinates mentioned are subject to the technical limitations of the period.
29	*Nossa Senhora da Graca*		Portugal	1565-03-15	Captain: Diogo Lopes da Lima. Lost at the Cape of Good Hope; however, the early Portuguese often used this term when referring to southern Africa (Guinote et al. 1998)
30	*Oliver Cromwell*		Britain	1874	This vessel, on a voyage from Newcastle to Aden with a cargo of coal, caught fire. The crew were rescued by the barque Saxon and brought to Table Bay (Levine 1989; van den Bosch 2009)
31	*Oswin*	Leaking, abandoned	Britain	1819-1-27	This vessel was en-route to the East. According to Captain Ray, the commander of the vessel, the ship rounded the Cape and sprung a leak in the vicinity of the Agulhas Bank and while the pumps were working 24 hours a day, they were unable to make any headway on the leak. By the next day, there was 1.5m of water in the hold and this was increasing. The crew launched the longboat and filled it with supplies. “Embarking in the boat the commander and crew steered for Saint Helena and were from 31 Jan to 12 Feb exposed to great sufferings and anxiety, until they reached Saint Helena. During this time, they ran about 1400 miles and were particularly fortunate in making the Island to a mile.” (The Asiatic Journal and Monthly Register, 1820) Despite having rounded the Cape, the Benguela current seems to have pulled the vessel back around the Cape while they were attempting to repair it. They state that they travelled 1400 miles after abandoning it. Depending on whether this report was using nautical miles or statute miles, makes a difference to the location of the wreck. Statute miles puts the vessel off Lüderitz, nautical miles puts the wreck in the vicinity of the West Coast.
32	*Point Pleasant Park*			1945	Torpedoed in the Atlantic.
33	*Prins Wilhelm van Zeeland*		Netherlands	1659	VOC vessel, homeward bound from Batavia, left the Cape and disappeared (Huygens Instituut 2023)
34	*Rabaul*			1941	Reported coordinates, 19 26.00S,04 05.00E (Hocking 1969; Levine 1989; van den Bosch 2009). Although these coordinates are well west of the coast, it is where the reported attack by the *Atlantis* occurred, not necessarily where it sank. In addition, the coordinates mentioned are subject to the technical limitations of the period.
35	*Redwing*		Britain	1827	REDWING, brig-sloop, 18 guns, 382 tons, Com. D. C. Clavering, foundered off the coast of Africa, about September 1827. 1829 - United Service Journal & Naval and Military Magazine RN Database says West Africa
36	*Reis Magos*			1573	Capt. Duarte de Melo, lost at sea (Cordeiro & da Roche 2016)
37	*Robert Jones*			1882	Abandoned c. 480km west of Lüderitz. Survivors were picked up by the *Holly Bough* and landed in Cape Town.
38	*'s Graveland*		Netherlands	1729	VOC vessel, homeward bound from Batavia, left the Cape and disappeared (Huygens Instituut 2023)
39	*Salsette*			1895	Disappeared between London and Table Bay (Levine 1989; van den Bosch 2009)
40	*Santa Bartolomeu / S. Bartholomeu*		Portugal	1590	Disappeared between Portugal and India (Cordeiro & da Roche 2016)
41	*Santa Cruz /Burgalesa*			1555	Lost on way back to Portugal, Capt. Belchior de Sousa (Domingues et al. 2023)

42	*São Bartolomeu*			1595-04-15	Under Lopo de Pina de Azavedo, lost at sea, en route to Portugal (Cordeiro & da Roche 2016; Domingues et al. 2023)
43	*São Francisco*			1573-04-23	Under Pedro Leitão de Gamboa, lost at sea (Domingues et al. 2023)
44	*São Jacinto*			1604	Lost, cargo saved (Cordeiro & da Roche 2016)
45	*São Joao*			1600	Lost, cargo saved (Cordeiro & da Roche 2016)
46	*São Lucas*			1590	Lost (Cordeiro & da Roche 2016)
47	*São Martinho*			1563	Capt. Jorge Manuel, lost at sea (Domingues et al. 2023)
48	*São Pedro*			1593	Lost, but cargo was saved (Cordeiro & da Roche 2016)
49	*São Valentim*			1600	Lost (Cordeiro & da Roche 2016)
50	*Scientist*		Britain	1939	Reported coordinates, 960 km from St. Helena (Hocking 1969; Levine 1989; van den Bosch 2009). Although these coordinates are well west of the coast, it is where the reported attack by the *Atlantis* occurred, not necessarily where it sank. In addition, the coordinates mentioned are subject to the technical limitations of the period.
51	*Stadt Hamburg*		Germany	1851	No other information, only that it is in some of the databases (SAHRA 2022; van den Bosch 2009)
52	*Star of Scotland*			1942	Reported coordinates, 26° 45.178'S 0° 2.056'W (Hocking 1969; Levine 1989; van den Bosch 2009). Although these coordinates are well west of the coast, it is where the reported attack occurred, not necessarily where it sank. In addition, the coordinates mentioned are subject to the technical limitations of the period.
53	*Tairoa*			1939	Reported coordinates, 21 38.00S,03 13.00E (Hocking 1969; Levine 1989; van den Bosch 2009). Although these coordinates are well west of the coast, it is where the reported attack by the Graf Speer occurred, not necessarily where it sank. In addition, the coordinates mentioned are subject to the technical limitations of the period.
54	*Trafalgar*			1941	Reported coordinates, 25 17.00S,01 35.00E (Hocking 1969; Levine 1989; van den Bosch 2009). Although these coordinates are well west of the coast, it is where the reported attack occurred, not necessarily where it sank. In addition, the coordinates mentioned are subject to the technical limitations of the period.
55	*Trevanion*			1939	Reported coordinates, 960 km from Lüderitz (Hocking 1969; Levine 1989; van den Bosch 2009). Although these coordinates are well west of the coast, it is where the reported attack by the *Graf Speer* occurred, not necessarily where it sank. In addition, the coordinates mentioned are subject to the technical limitations of the period.
56	*Trindade / Bicainha*			1552	Lost between Lisbon and the East.
57	*Vredejaar*		Netherlands	1771	VOC vessel, homeward bound from Batavia, left the Cape and disappeared (Huygens Instituut 2023)
58	*Vredenhof*		Netherlands	1779	VOC vessel, homeward bound from Batavia, left the Cape and disappeared (Huygens Instituut 2023)
59	*Zeelt*		Netherlands	1672	VOC vessel, homeward bound from Batavia, left the Cape and disappeared (Huygens Instituut 2023)

5.3. CONCLUSIONS

A wide variety of sources were consulted to build this database. It may well be missing earlier, unrecorded wrecks. There is always the possibility of an early unknown wreck being found, as happened in Oranjemund when the *Bom Jesus* (1533) was discovered in 2008 during diamond mining operations (Alves, 2011). There were no submerged

objects or wrecks noted on SAN Chart 1002 (SA Navy, 1995) or in the Garmin electronic charts (Garmin Marine Charts, 2022).

According to the existing database, in the Lüderitz area there are 17 known shipwrecks, dating from the early 1800s through to modern times and possibly at least one dating to the late 1700s. One of these, the *Dunbeth* (1906) was refloated and sailed in 1909.

According to database, within the Quay Extension Zone:

There were no DEFINITE or PROBABLE wrecks.

There were at least nine POSSIBLE wrecks.

However, the multibeam survey indicated a possible wreck at -26.634454° 15.155924°. By the time the Phase 1 Archaeological Survey was started, this had been identified as a wreck and its removal initiated. Divers confirmed it was the wooden fishing boat *Christiaan de Wet*, sunk after 2011 and as it is younger than 35 years, it is not considered a historic wreck under Namibian legislation..

The other 59 shipwrecks may be found in this area during work, although it is IMPROBABLE. These are vessels that either disappeared between two ports or were abandoned mid-ocean. One tries, through research, to narrow down the areas where these vessels were lost, if they are still in the list, it is because there is insufficient information to remove them. These ships range from the 1500s to the 20th century.

The significance of most of the wrecks is medium. There are, however, a several that may have a high significance factor. These include very old ships, war-time losses, and other vessels with a specific national or international significance. The significance of a shipwreck is hard to pinpoint without significant research and would have to be dealt with on an ad hoc basis if they are discovered.

The potential for recovering pre-Colonial, Stone Age artefacts as well as sites from the Shark Island concentration camp must be borne in mind.

6. PART TWO: PHASE 1 UNDERWATER ARCHAEOLOGICAL SURVEY

During the fieldwork, meetings were held every day with the project stakeholders, these included the NTLA (Nama Traditional Leaders Association), !Aman Traditional Authority Bethanie, Lüderitz Town Council, !Nami‡Nûs Constituency Councilor and the National Heritage Council. The purpose was to keep the stakeholders updated with regards to methodologies, expectations and results. The attendee's register is located in Appendix IV.

Repetition from earlier reports has been retained where necessary to clarify the rationale, methodologies, and resulting conclusions.

The Phase 2 Archaeological Assessment (Kinahan & Kinahan 2024) describes the archaeological setting of Shark Island in detail.

The areas of interest with respect to this study are:

- The terrestrial archaeological sites
- Zones associated with human activity during the concentration camp period on the island
- Practices employed in the handling and interment of the deceased

6.1. TERRESTRIAL ARCHAEOLOGY SITES

Table 1: Kinahan & Kinahan's Terrestrial sites (2024)

Site	Latitude	Longitude	Setting	Description
QRS 358/0001	-26.632795	15.151899	Among outcropping rocks on high ridge	Recently erected monument that has toppled over
QRS 358/0002	-26.633808	15.152781	Rock fissure approx. 5masl	Sherds of 19th century green bottle glass probably associated with the Shark Island

				concentration camp.
QRS 358/0003	-26.634369	15.153374	Rock fissure approx. 5masl	Small 1 x 2m shell midden mainly *Patella argonvillei* and *P. granularis*, associated with clear and green 19th century bottle glass sherds as well as fragments of rusted iron and charcoal, probably associated with the Shark Island concentration camp.
QRS 358/0004	-26.634648	15.153161	Rock fissure approx. 5masl	Green, purple and clear 19th century bottle glass sherds retouched as small implements probably associated with the Shark Island concentration camp. These are associated with three typical “robin’s egg” blue glass beads dated to approximately 1904 on sites in the !Khuiseb Delta
QRS 358/0005	-26.634868	15.153135	Outcropping rock approx. 8masl	Iron stanchion with “X” section set into rock and with iron shackle probably from horse saddlery attached to short length of heavy barbed wire, probably associated with the Shark Island concentration camp
QRS 358/0006	-26.635128	15.153208	Rock fissure approx. 5masl	19th century earthenware and glass sherds with small scatter *Patella argonvillei* and probably associated with the Shark Island concentration camp
QRS 358/0007	-26.635293	15.152492	Open area on north side of highest point on Shark Island	Dense, highly fragmented shell midden approx. 5x10m. Probably predates the concentration camp
QRS 358/0008	-26.634699	15.151955	On N and NE sides of prominent outcrop	Monuments to the Fredericks clan, Vogelsang and reburied human remains from the old Nautilus cemetery
QRS 358/0009	-26.632983	15.152408	Rock fissure approx. 5masl	Small shell midden mainly fragmented *Patella* spp with 19th century bottle glass probably associated with the Shark Island concentration camp

Erichsen (2005) relates how Samuel Isaak, a member of the Witboois, stated that the prisoners ate all the shellfish and all other edible sea life in order to survive. This oral testimony is represented by the archaeological excavations of 2024.

On 2025-07-03, I visited Shark Island, fallen monument (QRS 358/0001) has been moved and laid out at the following coordinates: -26.632636° 15.151922° (Figure 23). A new monument has been erected at -26.632686° 15.151972° (Figure 24). The sites are mapped in Figure 25.



Figure 23: QRS 358/001 laid out fallen monument



Figure 24: New monument



Figure 25: Monuments and archaeological sites on Shark Island after Kinahan & Kinahan (2024)

6.2. ZONES ASSOCIATED WITH HUMAN ACTIVITY DURING THE CONCENTRATION CAMP PERIOD

Forensis and Forensic Architecture (2024) undertook a very detailed analysis of sites relating to Shark Island's concentration camp, mapping out the different zones on the island (Figure 26)

The sand infill occurred between 1965 and 1984, during South Africa's colonisation of Namibia, burying most traces of the concentration camp. Their analysis geo-locating historical photographs to the present-day landscape located several areas of interest for future archaeological investigations.

Furthermore, they located rocks that show the marks from human incisions and tied it to a historic photograph of a woman with a pickaxe. These are hugely evocative artefacts of the period (Forensis and Forensic Architecture 2024).

Apparently, all prisoners with smallpox were isolated and left to perish on the rock northeast of the island (Eckl et al. 2024)

Even though the concentration camp was closed in April 1907, on the 1914 map of Lüderitz (Figure 5), the northern end of Shark Island is still shown as a "Prisoner's Kraal" (Forensis and Forensic Architecture 2024; Union Defence Force 1914).

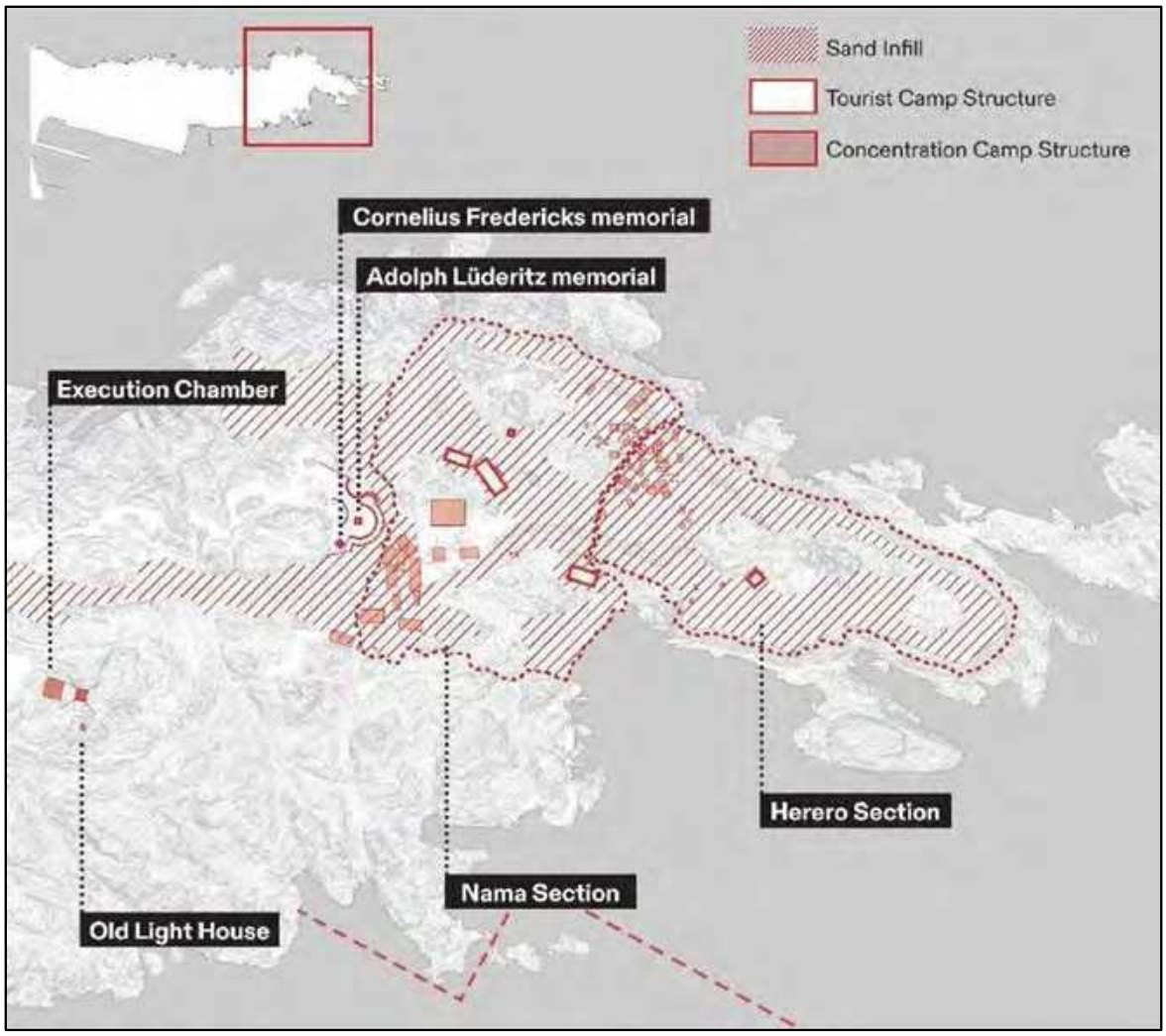


Figure 26: Concentration camp zones (Forensis and Forensic Architecture 2024: 6)

6.3. SHARK ISLAND AND HUMAN REMAINS

The primary objective of the diver survey off Shark Island was to identify any human remains or artefacts associated with the concentration camp period. This investigation rests on two key questions:

- How were deceased prisoners managed and interred on Shark Island?
- What taphonomic processes (natural changes to remains) might have occurred to human remains after more than 120 years in a marine environment?

6.3.1. PRACTICES EMPLOYED IN THE HANDLING AND INTERMENT OF THE DECEASED

A range of practices relating to the treatment and disposal of human remains at Shark Island have been documented in both the terrestrial Archaeological Assessment (Kinahan & Kinahan 2024) and the Architectural Reconstruction Report (Forensis and Forensic Architecture 2024).

Summarise disposal methods include:

- **Export to Germany:**
  Inmates' bodies were subjected to various forms of mutilation and processing. The prisoners were decapitated, some heads were preserved whole, but the majority were boiled and stripped of flesh. These were shipped to Germany to support so-called "scientific" racial studies (Faber-Jonker 2018; Forensis and Forensic Architecture 2024; Kinahan & Kinahan 2024; Olusoga & Erichsen 2011).

- **Disposal at sea:**
  Many bodies were simply cast into the ocean. There are historical accounts of corpses washing up on nearby beaches, often left unburied and subsequently scavenged by jackals and other animals(Administrator's Office, Windhuk, South-West Africa 1918).

- **Burial:**
  Some prisoners were interred individually or in mass graves. Documented burial sites include those in Radford Bay, while others are mentioned in archival sources but remain unlocated (Forensis and Forensic Architecture 2024). Transport riders recalled seeing bodies taken from the island for burial, with some reportedly buried in shallow beach graves later disturbed or washed away by tides. The missionary Laaf also referenced burials within the area known as Burenkamp (Erichsen 2005).

Figure 27 illustrates both confirmed and theorised burial grounds around Lüderitz. Based on historical accounts, it is likely that burials also occurred along the Lüderitz–Aus railway line and in areas where prisoners were forced into labour. In some cases, the deceased were left where they died (Erichsen 2005), and their remains were later covered by natural processes

Known formal cemeteries

- **Lüderitz Cemetery**, includes a Jewish section:
  Coordinates: -26.656736° 15.163730°
- **Nautilus Cemetery** (New Public Cemetery):
  Coordinates: -26.632488° 15.177507°
- **Diaz Point Cemetery**, one marked and eight unmarked graves:
  Coordinates: -26.636872° 15.094313°

Known informal burial grounds, contain individual and mass graves (Forensis and Forensic Architecture 2024)

- **Radford Bay Site 1:**
  Coordinates: -26.662666° 15.156738°
- **Radford Bay Site 2:**
  Coordinates: -26.664075° 15.155330°

Theorised burial sites (unverified)

- **Lenz Camp**
  Coordinates: -26.641086° 15.159942°
- **Burenkamp**
  Coordinates: -26.655988° 15.152866°



Figure 27: Cemeteries and burial grounds around Lüderitz

6.3.2. TAPHONOMIC PROCESSES ON HUMAN REMAINS IN THE OCEAN

The ocean affects bodies on several levels, leading to their decomposition and dispersal:

Immersion Effects: Bodies in water undergo changes influenced by factors such as water type (salt or fresh), temperature, tidal conditions, and the presence of predators.

Decomposition Rate: Decomposition in water occurs at roughly half the rate of decomposition in air in temperate climates. Bloating due to gas formation can cause the body to float to the surface.

Ocean and Tidal Effects: Bodies will drift, sometimes for tens of kilometres with the ocean currents.

Post-Mortem Injuries: Bodies moved by water can sustain injuries from contact with underwater obstructions like rocks or piers. Marine life, such as fish and crustaceans, cause post-mortem damage, including detachment of limbs and consumption (Haglund & Sorg 2001)

There are numerous historical reports attesting to bodies washing up on the beaches around Lüderitz, as well as scavenging by the terrestrial animals. The ocean in this area has particularly rich marine life including sharks and smaller scavengers.

6.3.3. HUMAN REMAINS WITHIN UNDERWATER ARCHAEOLOGICAL SITES

Human remains have been documented in a range of submerged contexts, as outlined in Table 2. These include two submerged burial sites, one anaerobic peat bog, one underwater cave, and six shipwrecks. The shipwrecks typically represent catastrophic events in which individuals were trapped within the hull. Over time, these wrecks became buried by silt and sediment, resulting in anaerobic conditions that are favourable to the preservation of organic material, including human remains.

Table 2: Underwater sites where human remains have been recovered

Site	Location	Age	Details
Atlit Yam	Israel (Mediterranean)	8 100–7 900 BP	Submerged burials (Galili et al. 1993)
Manasota Key Offshore	Florida, USA	7 200 BP	Submerged cemetery (Duggins et al. 2018)
Hoyo Negro (Sac Actun) Cave System	Yucatán, Mexico	12 000 –13 000 BP	Underwater cave (Fox 2014)

Windover Site	Florida, USA	8 000 BP	Freshwater peat pond (Brown 1994)
Antikythera Shipwreck	Greece (Aegean Sea)	1st C BCE	Shipwreck, deep and beneath sediment (Marchant 2016)
Mary Rose	Solent, UK	1545	Shipwreck, beneath anaerobic silt (Bradford 1982; Mitchell 2022)
Vasa	Stockholm, Sweden	1628	Shipwreck, beneath silt (Statens maritima och transporthistoriska museer 2022)
La Belle	Gulf of Mexico, USA	1686	Shipwreck, beneath mud and a cofferdam (Ambers et al. 2020)
USS Monitor	North Carolina, USA	1862	Shipwreck, very cold and silt entered the turret and preserved the remains (Hoffman 2022)
Kronan	Baltic Sea	1676	Shipwreck in cold, low oxygen water, the remains were within the wreck (Levesque 2023)

6.3.4. INDIRECT EVIDENCE OF HUMAN REMAINS

Prisoners were frequently restrained using a range of iron shackles, including neck collars, handcuffs, wristlets, and leg irons (Figure 31). In many cases, individuals were also chained together. This form of restraint posed a significant risk; if one prisoner fell, the others were compelled to continue moving, which could result in fatal outcomes for the fallen individual due to asphyxiation or trampling.

An account provided by Jacob Katjakundu, a Herero witness interviewed regarding conditions at the Omaruru prison, stated,

> "No convicted native prisoner (male) was ever without chains. The women were not chained as a rule, though in a few cases this was done."
> (Administrator's Office, Windhuk, South-West Africa 1918: 116)

According to this testimony, at least three distinct types of chains were employed in addition to standard handcuffs and wristlets:

- **Ankle and neck chains:** Iron bands secured around the ankles, connected by a short chain. A secondary chain ran from the midpoint of this connector to an iron collar around the neck (Figure 28).
- **Neck chains for group restraint**: Iron collars connected by chains, used to link individuals together during forced outdoor labour (Figure 29).
- **Rigid bars for limbs**: A solid iron bar approximately 45 cm in length connected either the wrists or ankles, with an additional chain linking to limb rings. These were not used in combination with the neck chains (Figure 30).

If these were found during the survey, they would be indirect evidence of human remains as well as being powerful, evocative material culture.

Should any of these items be encountered during the archaeological survey, they would constitute indirect evidence of human remains associated with the concentration camp. As artefacts, they represent a powerful and significant category of material culture, closely associated with the lived experiences of incarceration and forced labour.

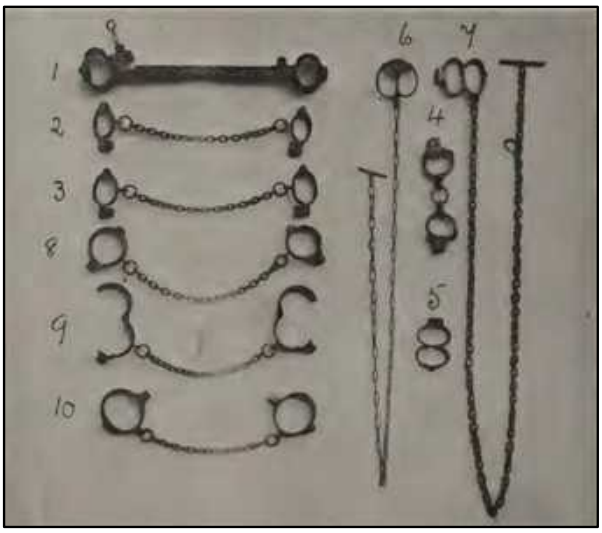


Figure 28: Leg and arm constraints

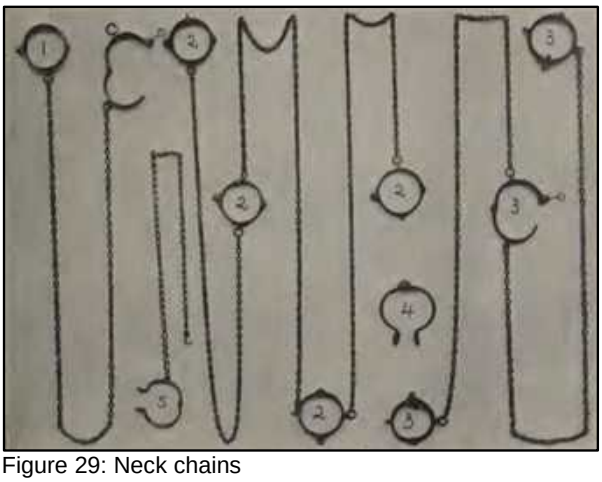


Figure 29: Neck chains

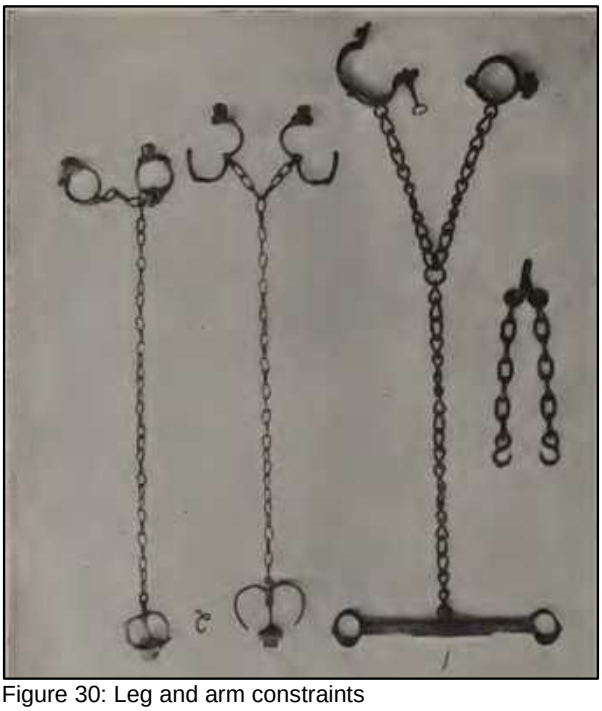


Figure 30: Leg and arm constraints



Figure 31: Chained prisoners

6.3.5. SUMMARY

Historical sources document multiple methods of body disposal, including burial (both formal and informal), disposal at sea, and the export of human remains for so-called scientific research.

Given the high-energy marine environment surrounding Shark Island and the absence of conditions conducive to long-term preservation—such as rapid burial in an anaerobic setting—it is unlikely that human remains would survive unless associated with a catastrophic event like a shipwreck. Nevertheless, a diver survey was undertaken around the island's margins to identify any surviving human remains or associated artefacts linked to the concentration camp period.

6.4. HARBOUR DEVELOPMENT DURING THE CONCENTRATION CAMP PERIOD

As Walvis Bay was in British hands, the Germans need a harbour to facilitate their colonial endeavour. There were plans for a wave breaker extending from the northern part of the island as well as a pier on the eastern side. These are the structures drawn with dashed lines in Figure 32. The bridge connecting the mainland to Shark Island was wooden and it surmised that it was originally built to forestall Britain annexing the island as they had done to all the other islands off the Namibian coast (Erichsen 2005). During meetings with the Nama traditional leaders, I asked if they knew what structures had been built by the prisoners. They stated that they had built the causeway leading from the mainland. While the publication *An Unresolved Issue: Genocide in Colonial Namibia* (Eckl et al. 2024) states, "since 1908, a dam connects Shark Island with the mainland" but this statement is not referenced, the 1914 British map still marks this as a "Wooden Bridge" (Union Defence Force 1914).

Work by the prisoners on the island consisted of blowing up and pickaxing rocks to flatten them and to obtain the materials for the harbour developments (see Section 6.2 above). The larger rocks were used for pier projects and the smaller one for building structures. These materials were transported by prisoners to their destination. At the end of 1906, prisoners were also made to build roads on the island to facilitate transport of materials. It appears that work was started on the wave breaker and the eastern pier. However, the bathymetric survey does not show any definitive remnants of these structures (Figure 33), if these structures were built, one would expect to see a straight line of rocks in the multibeam survey, the existing rocks are consistent with natural formations. By 1907. It seems that the harbour works were abandoned due to increased deaths amongst the prisoners, no doubt exacerbated by the terrible living and working conditions (Erichsen 2005).

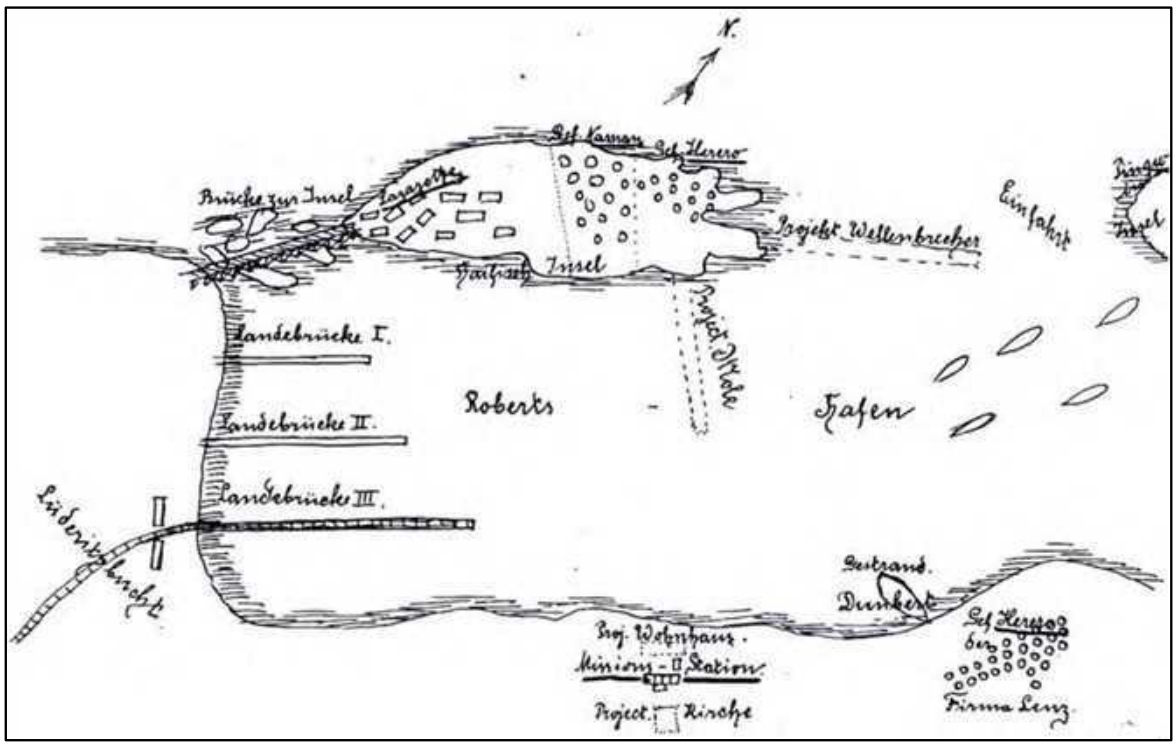


Figure 32: The hand-drawn map of Lüderitz's harbour works (Laaf in Erichsen 2005: 114)

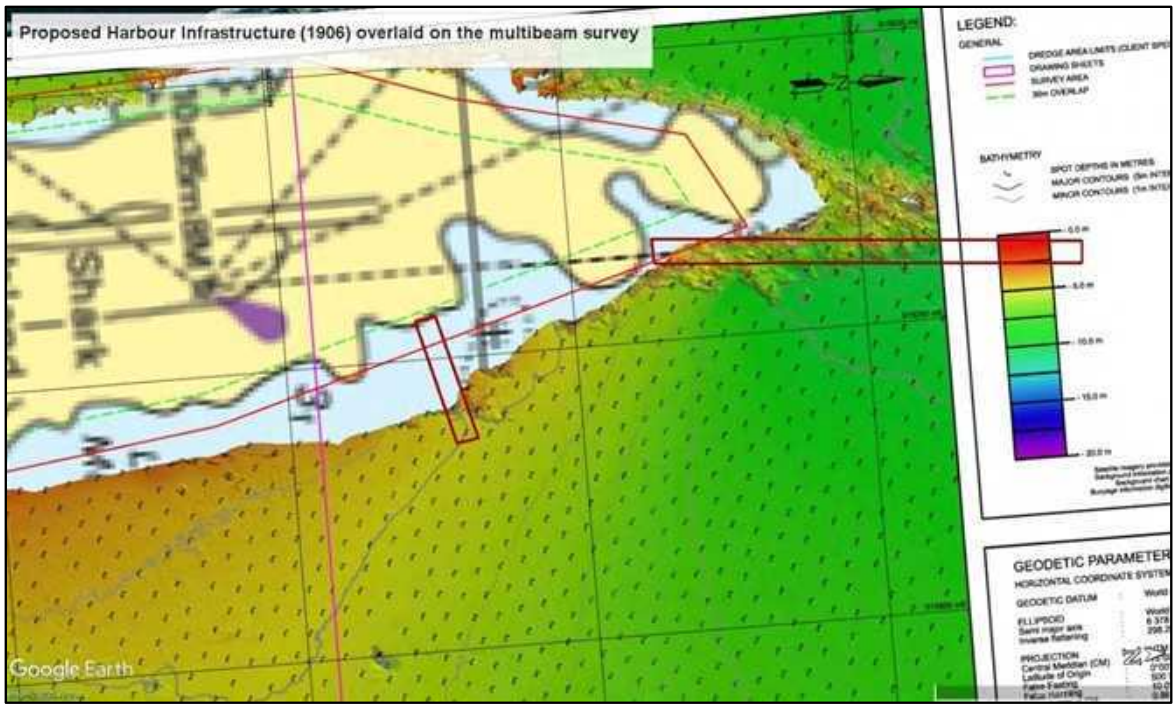


Figure 33: General area of the proposed harbour infrastructure in 906, overlaid on the multibeam survey

7. MAGNETOMETER SURVEY

7.1. MAGNETOMETER SURVEY METHODOLOGY

The best way to mitigate damage to MUCH resources is a magnetometer survey. All wrecks that can be found on our coast, even the very old wooden ones have a large amount of ferrous metal on them, including anchors, cannons, fastenings, mast straps, and cargo. Ferrous objects associated with the Shark Island concentration camp may also be found.

Briefly, magnetometry depends on the fact that the earth has an ambient magnetic field with the north and south poles. Ferrous objects (containing iron) are magnetised due to their atomic composition. These objects can be detected against the earth's ambient magnetism. They can create a dipole, that is negative and positive poles, similar to a bar magnet. The centre of the dipole is usually where the shipwreck is situated (See Figure 38). In the southern hemisphere, the positive pole is to the south and the negative pole is to the north of the dipole. Monopoles, that is single peaks up or down may also be indicative of ferrous articles.

A Geometrics G-882 caesium-vapor marine magnetometer (Figure 34) is towed behind a suitable vessel, with a layback of 10-20 meters, at an average speed of 5 knots/hour (9 km/hour), utilising 15 m run-lines. It collects 10 readings/second. A magnetometer survey is not like other geophysical surveys, as the device is sensitive to magnetic fields, long straight lines provide the cleanest data. When turning at the end of a run line, data collection is paused to keep the data clean. Knocking the magnetometer during data collection creates false positives, this means you cannot mag in high swells, very choppy seas or "across" swells or chop.



Figure 34: Geometrics magnetometer (Image: Maitland 2020)



Figure 35: Magging off a RIB (Image: Maitland 2018)

The magnetometer data collected by MagLog® software is analysed twice. The first or field analysis is performed as the magnetometer is towed. Possible sites are marked and analysed according to the environmental conditions in the field. In Figure 36, the top left slot records the magnetic signature of the anomaly; the right slot shows the boat's track and anomalies that are flagged while surveying. The other slots record the depth of the magnetometer, signal strength, geographic co-ordinates, and speed of the boat. These flags can be compared to conditions in the field, for example, passing vessels, buoys, or visible wrecks.

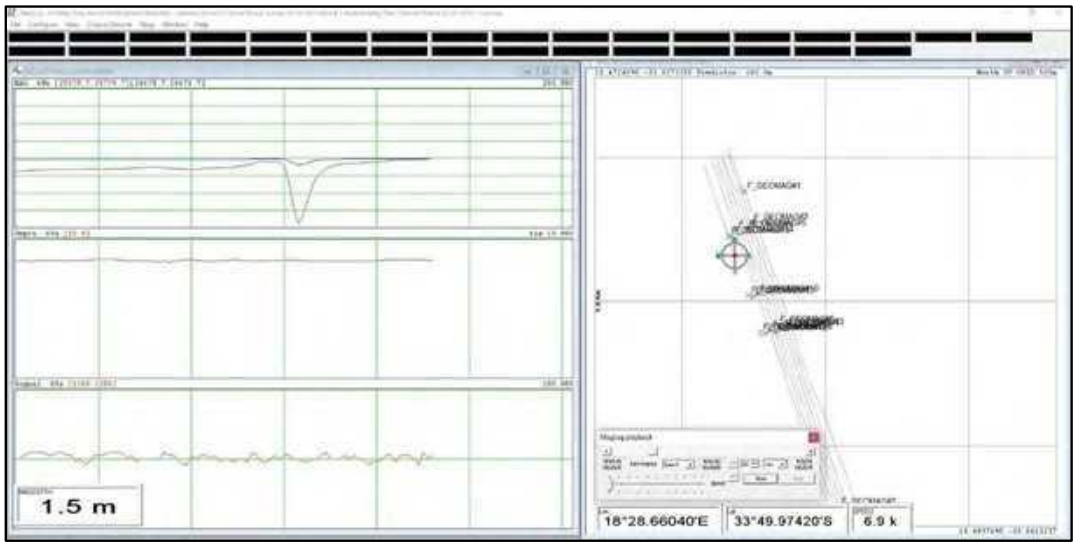


Figure 36: MagLog data capture screen (Image: Maitland 2015)

The post-field analysis is interpreted with Surfer® geophysical software, with knowledge of the conditions in the field. The analyses are compared, and a final analysis completed.

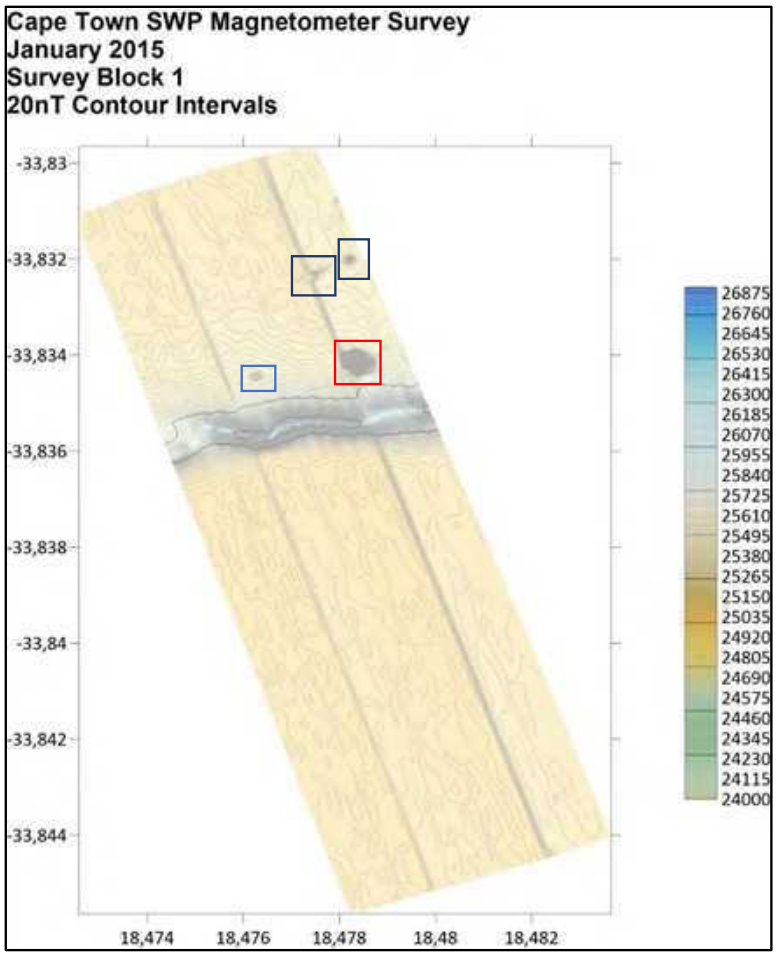


Figure 37: Example of a Magnetometer Survey Block

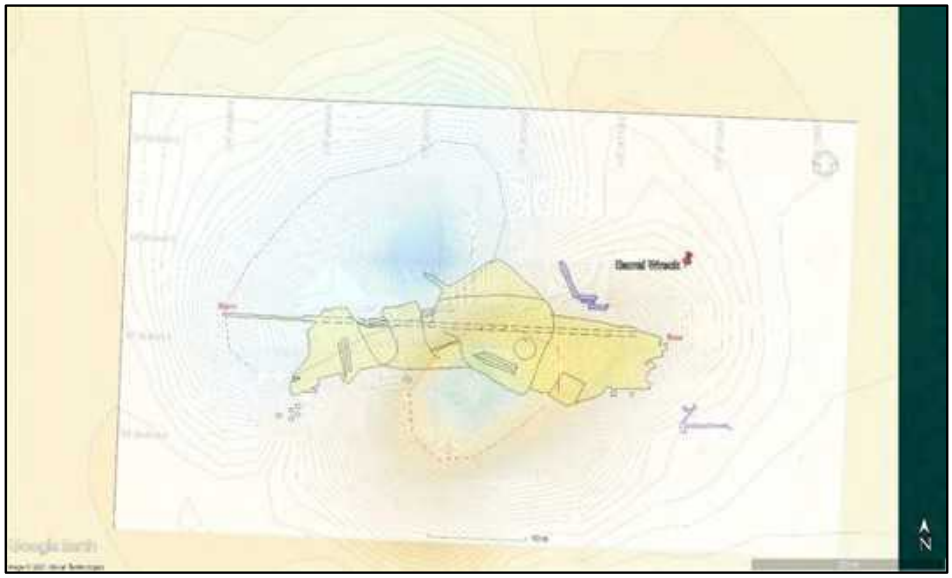


Figure 38: Site map of a wreck overlaid on the magnetic data – red block in Figure 4 (Maitland 2020)

Any magnetic anomalies are then ground-truthed by diver searches, in order to ascertain if they are MUCH resources or just debris. This can only be determined after the magnetometer survey if the size and position of the anomalies are sufficient.

7.2. MAGNETOMETER SURVEY RESULTS

The magnetometer survey was undertaken on Tuesday 2025-07-01.

Initially the survey was planned to run north-south (Figure 39). However, due to the limitations listed below, a new survey was planned running east-west (Figure 40). Ultimately, we did as many lines as possible in both directions (Figure 41).

We were unable to get closer to the island due to the shallow depth.

LIMITATIONS:

- Namport was unable to move the moored fishing boats out of the survey area timeously, thus they were avoided.
- There were numerous moorings for the fishing boats, these consisted of mooring blocks with several ropes and buoys attached. This area had to be avoided, as the equipment and boat propellor could become entangled.
- The fishing boat wreck (Section 0) was in the process of being removed, this section had to be avoided.



Figure 39: Planned survey N-S



Figure 40: Planned survey E-W



Figure 41: Actual survey lines run, with surface obstructions and no-go zones demarcated

The survey lines were processed using Surfer®, merged, and clipped to the shapefile boundary. Surface obstructions were then plotted, and identified anomalies were assessed in relation to these features. As can be seen in Figure 42 the large anomalies all correlate with the moored vessels (Figure 43), channel markers (Figure 44), wreck and associated salvage equipment (Figure 45), moorings (Figure 46 and Figure 47) or the pier (Figure 48).

There were three small anomalies noted along the western edge of the survey, near to Shark Island (Table 3). These anomalies were only visible on the last line of the survey; we were unable to get closer to the island to collect more data. Therefore, it is possible that the object is closer to the island. Nevertheless, these were flagged for diver searches.

Table 3: Shark Island magnetic anomalies

Name	Latitude	Longitude
MA001	-26.634837°	15.154026°
MA002	-26.635648°	15.154098°
MA003	-26.636893°	15.154414°

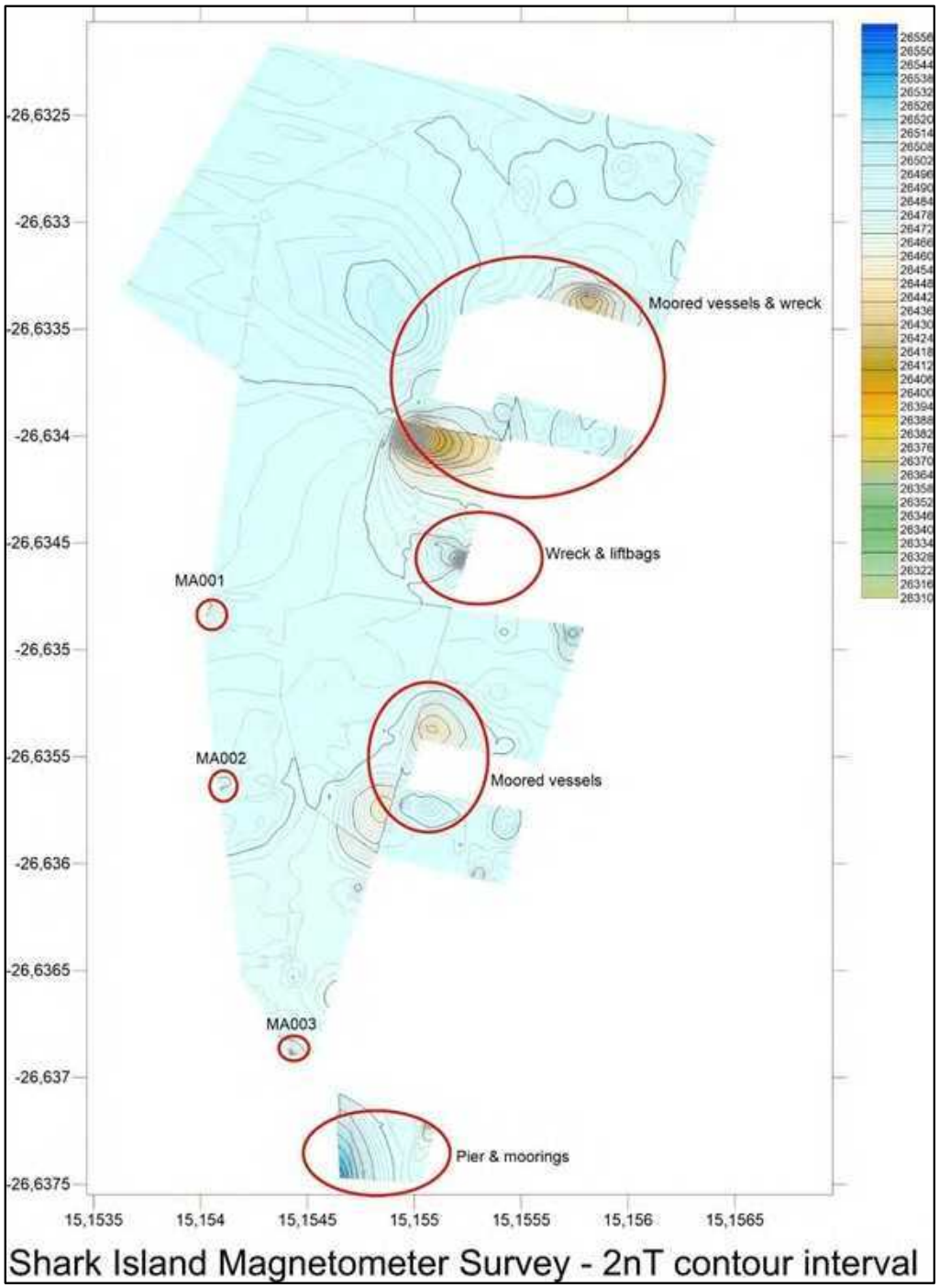


Figure 42: Magnetometer survey anomalies, 2nT contour intervals



Figure 43: Moored vessel



Figure 44: Channel marker



Figure 45: Lifting bags for wreck removal



Figure 46: Mooring buoys



Figure 47: Mooring buoy



Figure 48: Pier

8. DIVER SEARCHES METHODOLOGY

The anomalies are analysed, and diver searches planned (Figure 49). Circular searches (Figure 50) are conducted with a GPS unit attached to a drift buoy (Figure 51Figure 50). Features may be photographed and tied back to the GPS using time stamps. These wreck mapping techniques can be augmented with photogrammetry of sites using GoPro footage (Figure 52), if necessary.

Once all the data is collected, collated and analysed a report is prepared. If a wreck site is discovered, this can be marked using a buoy and an exclusion zone instituted to avoid damage. In-situ preservation of wrecks is considered archaeological best practice; this preserves the heritage for future generations with meaningful research questions.



Figure 49: Anomaly positions for diver searches



Figure 50: Marker buoy and attached search reel (Maitland 2018)



Figure 51: GPS on a drift buoy to map searches and wreck sites

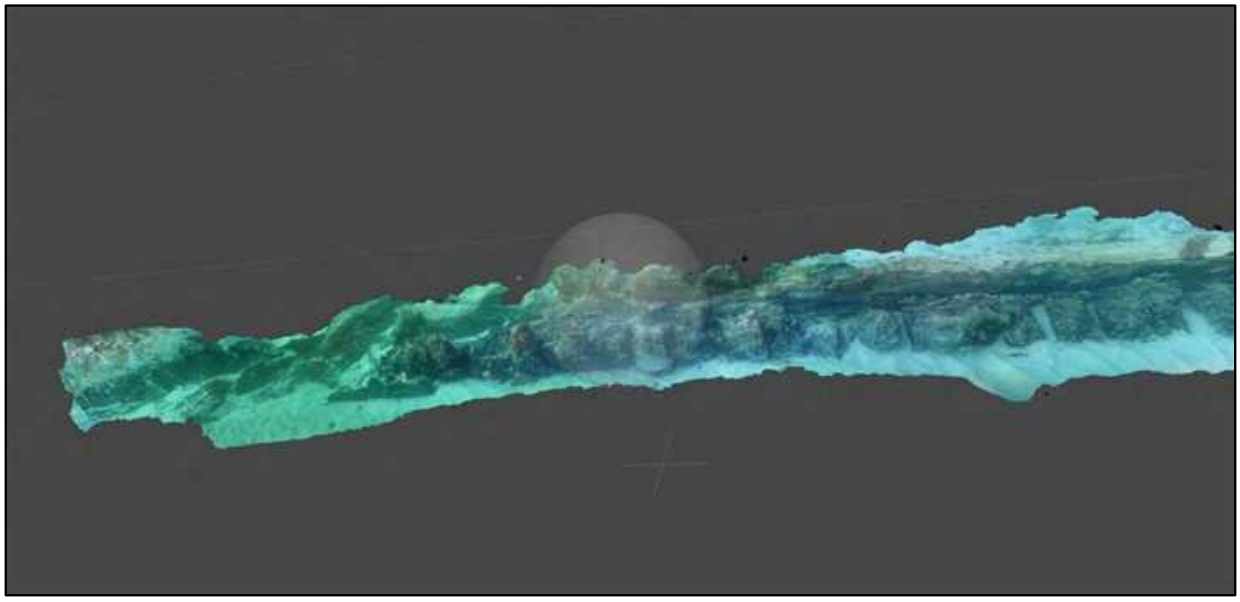


Figure 52: An example of photogrammetry on a large frame section of a wreck (Maitland 2022)

8.1. DIVER SEARCHES RESULTS

Two days of diver searches were undertaken between 2025-07-02 to 2025-07-03.

LIMITATIONS:

- Cold water temperatures reduced allowable dive times.
- Visibility was low but manageable on the first day (Figure 53); however, it deteriorated significantly on the second day (Figure 54).
- On the second day, increased surge conditions made diving near the island's rock face more hazardous, particularly in combination with poor visibility.
- In some areas, ground visibility was obscured by dense seaweed cover (Figure 55).
- Photographic documentation is limited due to low visibility and the need for divers to maintain a protective hand position near the head to prevent impact with submerged rock surfaces.

OBSERVATIONS:

- Near the pier, large areas of the seabed were covered with kelp lice (Figure 56).
- The northeastern seabed supported extensive mussel colonies (Figure 57). However, south of the terrestrial archaeological sites (see Figure 25), no living mussels or other shellfish were observed. This may suggest that

shell middens are unlikely to be present on the southeastern part of the island, due to the limited availability of shellfish in that area.

- Numerous crayfish (Figure 58) were observed along the entire shoreline. These crustaceans are known scavengers.
- The seabed composition varies across the area. Close to the pier, it is predominantly rocky, with pockets of sand and accumulated shells (Figure 59). Approximately 120 metres north of the pier, it consists of coarse gravel mixed with shell fragments (Figure 60). Near the terrestrial archaeological sites, about 250 metres north of the pier, the seabed is again rocky, while just offshore from the island it transitions to a mixture of sand and silt (Figure 61).



Figure 53: 2025-07-02 visibility



Figure 54: 2025-07-03 visibility



Figure 55: Seaweed



Figure 56: Kelp lice (*Kelp Lice* 2025)

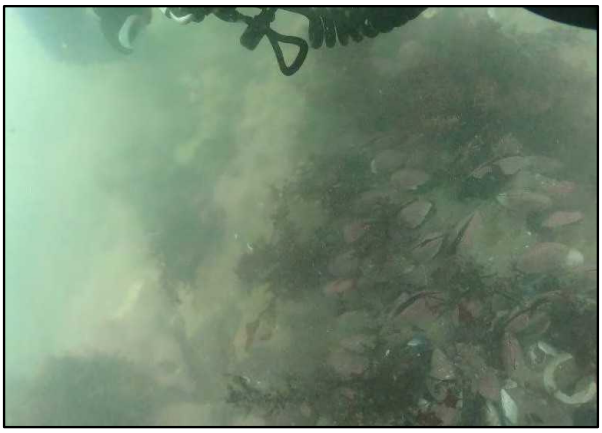


Figure 57: Mussel bed



Figure 58: Crayfish



Figure 59: Rocks with sandy pockets



Figure 60: Gravel and shell seabed



Figure 61: Silt and sand seabed

8.2. 2025-07-02 WEDNESDAY

Diver searches were undertaken from 09:00 – 11:40. The water temperature was 11° C. Figure 62 shows the search track along the eastern edge of Shark Island. The two divers were spread apart, so the actual area covered was greater than represented.

Numerous objects were located during the diver search, including:

- Modern – glass bottles
- Modern – metal conduit pipe with electrical and/or communication cable inside (Figure 63)
- Modern – rubber tyre
- Possibly modern – rounded metal object (Figure 64), deeply embedded in the silt – possibly related to the shipwreck on the Shark Island rocks (see Section 5.2.3)



Figure 62: Diver Search Tracks 2025-07-02



Figure 63: Conduit with cable



Figure 64: Rounded metal object, embedded in silt

8.3. 2025-07-03 THURSDAY

Diver searches were undertaken from 08:30 – 11:30. The water temperature was 11° C. Figure 65 shows the search first dive's tracks along the eastern edge of Shark Island. The two divers were spread apart, so the actual area covered was greater than represented. Figure 66 shows the second dive in the island's bays and the anomaly dives.

Despite poorer visibility and stronger surge compared to the previous day, bottles and other modern debris were still visible.

Circular searches were conducted around the three anomalies mentioned in Section 7.2. The seabed in this area consists of silt, as described in Section 8.1, and visibility was extremely poor. Combined with the multibeam survey data (Figure 13), which indicates a flat, sandy seabed, it is likely that any objects of interest are buried beneath the silt.



Figure 65: First dive of 2025-07-03



Figure 66: Second dive of 2025-07-03, including the anomaly dives

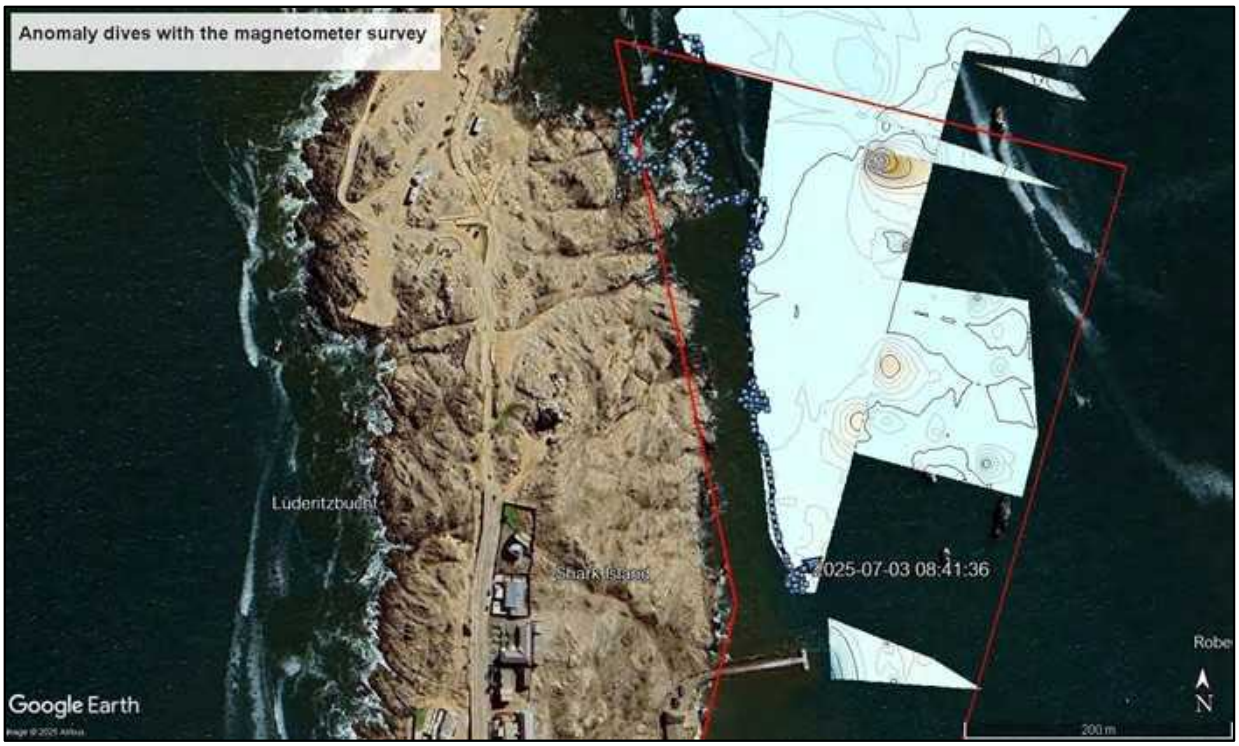


Figure 67: Anomaly dives

9. SUMMARY

Nine possible shipwrecks were identified in the vicinity based on historical records, but their exact locations are uncertain.

Two wrecks lie within the development zone. The first, the *Christiaan de Wet*, was wrecked after 2011 and is currently in the process of being removed. The second, an unidentified vessel, was wrecked in 2022. Neither of these wrecks is protected under the NHA.

No confirmed historical shipwrecks were found within the proposed quay extension zone.

Diver searches of magnetic anomalies and the Shark Island shoreline revealed no significant archaeological material, but poor visibility and silt cover may have obscured buried objects.

It is unlikely that discrete, identifiable human remains will be recovered in the marine environment surrounding Shark Island due to the high-energy conditions, including strong currents, high turbidity, mobile sediments, biological scavenging, and the absence of rapid burial in anaerobic conditions. These processes are well documented in marine taphonomy and significantly reduce the likelihood of preservation over extended periods.

Despite this, the rocky nearshore areas – particularly the bay adjacent to where prisoners were historically confined, as well as the zone between Shark Island and the former quarantine area – retain a higher potential for the preservation of buried artefacts and/or human remains related to the colonial-era concentration camp or earlier periods of human activity. While these areas are also subject to turbidity and disturbance, sheltered rocky inlets are more likely to retain archaeological material than exposed sandy seabeds.

The absence of recoverable evidence must not be interpreted as evidence of absence. Rather, it reflects the destructive and dispersive nature of the marine environment and underscores the need for precautionary management should any material of potential heritage significance be encountered during development.

Further terrestrial development on Shark Island is not recommended due to the risk of disturbing unexcavated archaeological sites.

Further terrestrial development on Shark Island is not recommended due to the risk of disturbing unexcavated archaeological sites. Based on the locations of known terrestrial sites (Kinahan & Kinahan 2024) and areas where

prisoners were held (Forensis and Forensic Architecture 2024), a marine buffer zone (Figure 68) is recommended around the northern end of the island. This would help preserve any artefacts embedded in sediment and protect the underwater extension of the concentration camp landscape.

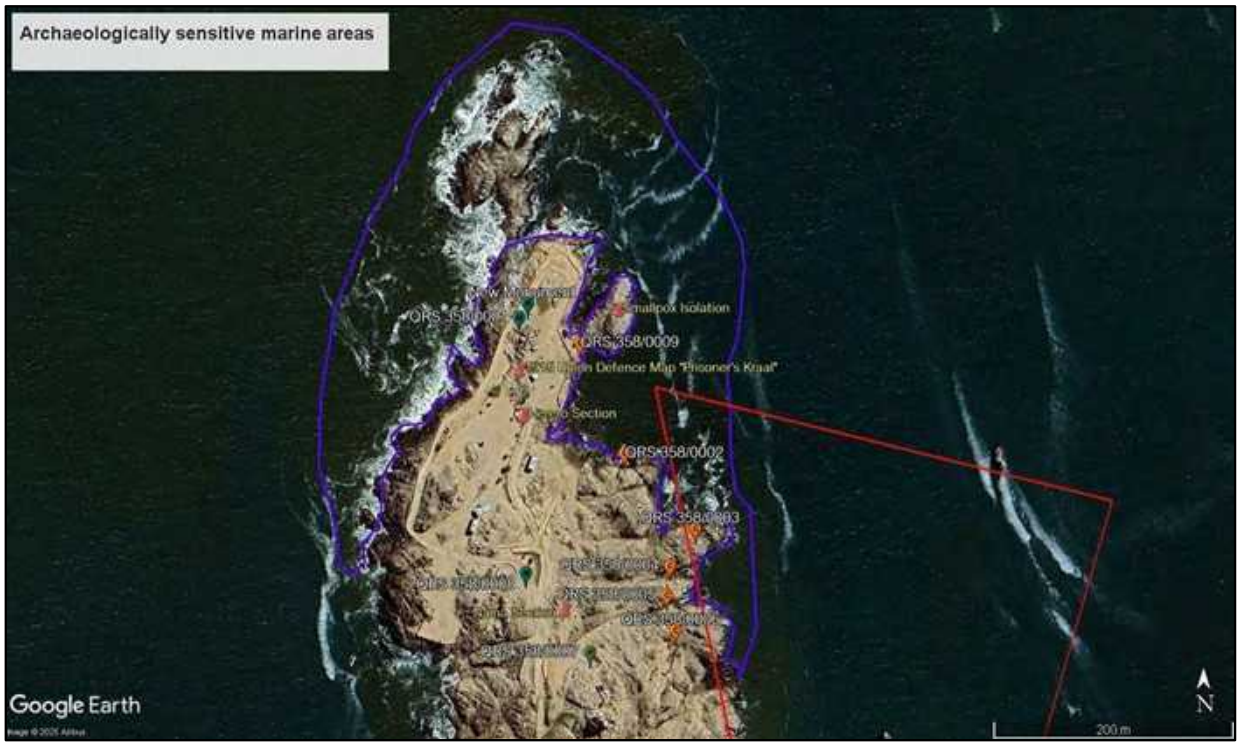


Figure 68: Sensitivity buffer zone

10. IMPACT TABLE

TABLE 4: IMPACT TABLE - INDIVIDUAL SHIPWRECKS

Impact Assessment pre-mitigation																			Impact Assessment post-mitigation								
Name of Vessel	Year	Aesthetic	Historic	Scientific	Social	Importance (0-12)	Authenticity / Credibility (0-3)	Integrity (0-3)	Value (0-18)	Spatial Scale	Duration	Severity	Consequence	Probability	Magnitude	Impact Significance	Rating	Status	Mitigation	Spatial Scale	Duration	Severity	Consequence	Probability	Magnitude	Impact Significance	Rating	Status
Adventure (1852)	1852	1	1	1	1	4	2	3	9	3	3	3	9	2	18	162	Medium	-ve		1	1	1	3	1	3	27	Low	+ve
Bali (1910)	1910	1	1	1	1	4	2	3	9	3	3	3	9	1	9	81	Low	-ve		1	1	1	3	1	3	27	Low	+ve
Konkiep	2017	0	0	0	0	0	2	3	5	3	3	3	9	1	9	45	Low	-ve		1	1	1	3	1	3	15	Low	+ve
Lizzie (1861)	1861	1	1	1	1	4	2	3	9	3	3	3	9	2	18	162	Medium	-ve		1	1	1	3	1	3	27	Low	+ve
Magna (1911)	1911	1	1	1	1	4	3	3	10	3	3	3	9	0	0	0	No Change	-ve		1	1	1	3	1	3	30	Low	+ve
Ranza	>1936	0	1	0	1	2	2	3	7	3	3	3	9	1	9	63	Low	-ve	Mag Survey	1	1	1	3	1	3	21	Low	+ve
South West Plover	2016	0	0	0	0	0	2	3	5	3	3	3	9	1	9	45	Low	-ve	Diver	1	1	1	3	1	3	15	Low	+ve
Superb (1844)	1844	2	1	1	1	5	2	3	10	3	3	3	9	2	18	180	Medium	-ve	Searches	1	1	1	3	1	3	30	Low	+ve
Unknown-001 (1843)	1843	2	2	1	2	7	0	3	10	3	3	3	9	2	18	180	Medium	-ve	Assesment	1	1	1	3	1	3	30	Low	+ve
Unknown Wrecks 1500 - 1800		3	3	3	3	12	2	3	17	3	3	3	9	1	9	153	Medium	-ve		1	1	1	3	1	3	51	Low	+ve
Unknown Wrecks 1800- 1900		1	2	2	2	7	2	3	12	3	3	3	9	1	9	108	Low	-ve		1	1	1	3	1	3	36	Low	+ve
Unknown Wrecks 1901-1988		2	1	1	1	5	2	3	10	3	3	3	9	1	9	90	Low	-ve		1	1	1	3	1	3	30	Low	+ve
War Wrecks		2	3	3	3	11	2	3	16	3	3	3	9	1	9	144	Medium	-ve		1	1	1	3	1	3	48	Low	+ve

CUMULATIVE IMPACTS

Historically, maritime and underwater cultural heritage (MUCH) has been significantly under-studied in southern Africa. Since the signing of the UNESCO Convention in 2011 and a growing awareness of the cultural and historical value of MUCH, attention to this field has increased. Simultaneously, the expanding use of marine spaces—both for mineral extraction and green-energy initiatives—raises the likelihood of impacts on submerged heritage. Accordingly, cumulative impacts must be considered at a broader spatial scale and addressed through strategic, integrated planning.

The value and significance of heritage resources is both subjective and often emotive. Certain sites are considered significant due to their age or the nature of the activities associated with them, such as slave ships or vessels lost in wartime. Others may be rare or unique in terms of construction and archaeological context. Some wrecks, while neither old nor unique, may hold spiritual or community value, particularly if there were fatalities associated with the loss. Assessments must therefore be sensitive to multiple layers of significance and avoid imposing external value systems. Wrecks that may seem insignificant today could have important meaning in the future; their destruction, without due diligence, risks irreversible heritage loss.

Shipwreck databases typically rely on reported wrecks, and confidence in historical reporting is generally higher around inhabited and well-trafficked ports. In contrast, the Namibian coastline, with its low historical population density, presents a higher likelihood of unreported wrecks, especially older ones. Moreover, even when wrecks are recorded, they are often difficult to locate, and the physical traces may be subtle or buried.

The formation of a wreck site typically progresses through three overlapping stages:

- The wrecking event, influenced by environmental conditions (such as storms) and human factors (such as the crew's response).
- A dynamic transformation stage, in which the wreck interacts with the environment—shifting, breaking down, or becoming partially buried.
- Assimilation, where the wreck becomes indistinguishable from its surroundings.

These stages are not always linear. For example, a second vessel might wreck on the site of a previous one, restarting the process. Likewise, storms or shifting sands may cyclically disturb and re-expose a site. Over centuries, the remains may become fully integrated into the surrounding seabed or reef.

Due to the incomplete and uncertain nature of regional shipwreck data, it is not currently possible to assess cumulative impacts with any degree of confidence. Each site must be considered on a case-by-case basis. If every discovery is approached with the understanding that its significance may not be immediately apparent, whether on a local or international scale, then appropriate mitigation measures can be applied to reduce long-term heritage loss.

Shark Island is a site of considerable historical and archaeological significance. Since the early 20th century, it has been subjected to unregulated development, including building construction and land infilling to create camping facilities. These activities may have disturbed or concealed archaeological deposits related to the concentration camp period. Further development of this area should be strongly discouraged, as buried deposits may contain valuable information capable of contributing to a fuller understanding of this difficult chapter in Namibian history.

11. RECOMMENDED MANAGEMENT MEASURES

Heritage sites are fixed features in the environment, occurring within specific spatial confines. Any impact upon them is permanent and non-reversible.

Initial mitigation against loss of MUCH resources consisted of the following:

- A magnetometer survey of the area
- Diver searches on magnetic anomalies to establish their identity
- Diver searches along the eastern shore of Shark Island to search for sites and human remains associated with the island’s pre-colonial history and the concentration camp period

No further mitigation is possible due to the environment. However, a sensitivity buffer would preserve the existing underwater landscape.

Memorialisation and Historical Ownership

- **Establish a museum at Shark Island:** A museum dedicated to the Shark Island concentration camp and the genocide in Namibia should be created on the site. It could display documents and artefacts from the period alongside multimedia presentations of oral and written histories from the camps, offering an opportunity to educate visitors about the atrocities that occurred.
- **Promote historical ownership through scholarship:** None of the existing histories, as far as can be determined, have been written by the descendants of the genocide. A dedicated scholarship for Nama and Ovaherero students to study history would enable them to reclaim ownership of their past and contribute to a process of empowerment and healing.

Objectives

- Protection of heritage sites within the project boundary against vandalism, destruction, and theft.
- The preservation and appropriate management of new discoveries in accordance with the NHA, should these be discovered during development activities.

The following shall apply:

- The Environmental Control Officer should be given a short induction, by the heritage practitioners, on archaeological site and artefact recognition.
- The contractors and workers should be notified that archaeological sites might be exposed during the development activities.
- Should any heritage artefacts be exposed during development, work on the area where the artefacts were discovered, shall cease immediately and the Environmental Control Officer and NHC shall be notified as soon as possible;
- All discoveries shall be reported immediately to a heritage practitioner so that an investigation and evaluation of the finds can be made. Acting upon advice from these specialists, the Environmental Control Officer will advise the necessary actions to be taken;
- Where possible, if any heritage resources are accidently recovered photographs of them must be taken, noting the date, time, location and types of artefacts found. Under no circumstances may any artefacts be removed, destroyed or interfered on the site, unless under permit from the NHC.
- Under no circumstances shall any artefacts be removed, destroyed or interfered with by anyone on the site.

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APPENDIX I: CONVENTIONS USED TO ASSESS THE IMPACT OF PROJECTS ON HERITAGE RESOURCES

Significance

The significance of heritage sites and artefacts is determined by it aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technical value in relation to the uniqueness, condition of preservation and research potential. It must be kept in mind that the various aspects are not mutually exclusive, and that the evaluation of any site is done with reference to any number of these.

Matrix used for assessing the significance of each identified site/feature

1. Importance

Artistic	Historic	Scientific	Social
Importance in aesthetic characteristics	Importance to community or pattern in country's history	Possession of uncommon, rare or endangered natural or cultural heritage aspects	Association to community or cultural group for social, cultural or spiritual reasons
Degree of technical / creative skill at a particular period	Site of significance relating to history of slavery	Information potential	Importance in demonstrating the principal characteristics of human activities (including way of life, philosophy, custom, process, land-use, function, design or technique) in the environment of the nation, province, region or locality
	Association with life or work of a person, group or organisation of importance in the history of the country	Importance in demonstrating principle characteristics	

2. Authenticity / Credibility

Score	Description	Rating
0	Credibility of information cannot be determined: conjecture, unverified personal opinions; biases evident.	None/negligible
1	Secondary and tertiary information sources: popular media, newspapers, magazines; 'information' websites e.g. Wikipedia, etc.; individual opinions.	Low
2	Credible secondary sources: factually correct textbooks, popular publications, etc.; official websites; verifiable oral accounts.	Medium
3	Highly credible information sources: peer reviewed publications; primary sources; verified oral accounts.	High

3. Integrity

As the wrecks are mostly unknown, they are all given a full integrity score, to err on the side of caution

The degree of integrity is based on the condition of the resource at the time of assessment, compared to an ideal or other example. Integrity can therefore only be assessed once the resource's authenticity has been determined, as information regarding a heritage resource should provide comparative examples against which its condition may be measured.

Score	Description	Rating
0	Resource degraded to extent where no information potential exists; resource cannot be restored; single, isolated find, without any site context;	None/negligible
1	Poor condition, active decay visible; excessive restoration required; little information potential	Low
2	Fair to good condition; well preserved; some decay present; can be easily restored / conserved / preserved; good information potential	Medium
3	Excellent/pristine; extremely well preserved; little to no decay present; little restoration required/restoration will greatly enhance resource; excellent information potential	High

4. Value
This is a combination of Importance, Credibility, and Integrity

5. Consequence
This is a combination of Scale, Duration and Severity.

Scale		
Score	**Description**	**Rating**
0	No effect on any part/aspect of heritage resource	None
1	Isolated parts/aspects of heritage resource will be affected	Low
2	Large parts/aspects of heritage resource will be affected	Medium
3	Most or entire heritage resource will be affected	High
Duration		
Score	**Description**	**Rating**
0	No impact will occur during life of project	None
1	Impact will be short and reversible	Low
2	Impact will occur throughout life of project, but is reversible	Medium
3	Impact is permanent and irreversible	High
Severity		
Score	**Description**	**Rating**
0	Negligible to no change/alteration/damage/destruction of heritage resource	None
1	Reversible changes/alterations to heritage resource	Low
2	Parts/aspects of heritage resource will be permanently altered/changed/destroyed Medium	Medium
3	Entire heritage resource will be permanently altered/changed/destroyed	High

6. Probability

Probability pre-mitigation		
Score	**Description**	**Rating**
0	Impact will not occur	None
1	Impact could occur	Low
2	Impact may occur	Medium
3	Impact will definitely occur	High
Probability post-mitigation		
Score	**Description**	**Rating**
0	Impact will not occur	None
1	Impact could occur, but will minimise impacts	Low
2	Impact may occur during life of project regardless of implementation of project mitigation measures	Medium
3	Impact will definitely occur, project mitigation measures will minimise impacts	High

7. Magnitude

This is Consequence multiplied by Probability.

Score	Description	Rating
0	No/negligible environmental impacts expected on heritage resource.	None/ negligable
1-8	Low magnitude of environmental impacts on heritage resource	Low
9-16	Medium magnitude of environmental impacts on heritage resource	Medium
17-27	High/exceptional magnitude of environmental impacts on heritage resource	High

8. Significance of Impact

This is Magnitude multiplied by Value.

		Archaeology / Palaeontology	Built Environment/Structures	Historic Landscape	Intangible/Associations
0	No Change	No change	No change to fabric or setting	No changes to landscape elements, parcels, or components; no visual or audible changes; no changes in amenity or community factors.	No change
1-122	Low	Very minor changes to key archaeological materials, or setting.	Slight changes to historic building elements or setting that hardly affect it.	Very minor changes to key historic landscape elements, parcels or components; virtually unchanged visual effects; very slight changes in noise or sound quality; very slight changes to use or access; resulting in very small change to historic landscape character.	Very minor changes to area that affect the ICH activities or associations or visual links and cultural appreciation
123-243	Medium	Changes to key archaeological materials, such that the resource is slightly altered; slight changes to the setting.	Change to key historic building elements, such that the resource is slightly different; change to setting of an historic building, such that it is noticeably changed.	Change to few key historic landscape elements, parcels or components; slight visual changes to few key aspects of the historic landscape; limited changes in noise or sound quality; slight changes to use or access; resulting in limited changes to historic landscape character.	Changes to area that affect the ICH activities or associations or visual links and cultural appreciation
243-486	High	Changes to many key archaeological materials, such that the resource is clearly modified; changes to the setting that affect the character of the asset	Change to many key historic building elements, such that the resource is significantly modified; change to setting of an historic building, such that it is significantly modified.	Change to many key historic landscape elements, parcels or components; visual change to many key aspects of the historic landscape; noticeable differences in noise or sound quality; considerable changes to use or access; resulting in moderate changes to historic landscape character.	Considerable changes to area that affect the ICH activities or associations or visual links and cultural appreciation
		Changes to attributes that convey outstanding national value of national estate; Most or all key archaeological materials, including those that contribute to ONV such that the resource is totally altered; comprehensive changes to setting	Change to key historic building that contribute to outstanding national value of national estate such that the resource is totally altered; Comprehensive changes to setting. Change to most or all key historic landscape elements, parcels or components; extreme visual effects; gross change of noise or change to sound quality; fundamental changes to use or access; resulting in total change to h	Change to most or all key historic landscape elements, parcels or components; extreme visual effects; gross change of noise or change to sound quality; fundamental changes to use or access; resulting in total change to historic landscape character unit and loss on outstanding national value.	Major changes to area that affect the ICH activities or associations or visual links and cultural appreciation

APPENDIX II: CURRICULUM VITAE OF SPECIALIST

VANESSA MAITLAND

MARITIME ARCHAEOLOGIST

Elandskraal, Western Cape

Cell: 082 490-4066

E-mail: vanessa@cocojams.co.za

ASAPA (Association of Southern African Professional Archaeologists) Member No: 326

EDUCATION

1986 Hill College Port Elizabeth

- Matriculated

1987-1988 University of Cape Town Cape Town

- BA – First & Second Year

1992-1993 University of Witwatersrand Johannesburg

- Completed BA, majored in Archaeology and Jewish Studies
- Other subjects studied include: Anthropology, Geology, Classical Civilizations, Hebrew, History, Biblical Archaeology

1996 University of Witwatersrand Johannesburg

- BA Honours – Archaeology

2010 - 2012 NAS/SAHRA/IZIKO Cape Town

- NAS I, II & III: Underwater Survey and Fieldwork Courses
- Iziko Waterlogged Artefact Conservation Course

2010 University of Witwatersrand Johannesburg

- ARCGIS Course

2011 University of Witwatersrand Johannesburg

- GRASS & QGIS Course

2013-2015; 2019-2022 University of South Africa Pretoria

- Masters Degree in Maritime Archaeology

ARCHAEOLOGICAL EXPERIENCE

Archaeological excavations at:

- Border Cave, KZN (Stone Age Archaeology)
- The Castle, C.T. (Historical Archaeology)
- Roosfontein Shelter, F.S. (Stone Age Archaeology)
- Rose Cottage Cave, F.S. (Stone Age Archaeology)
- de Hoop, Mpumalanga (Stone Age Archaeology)
- Nettleton Dump, JHB (Historical Archaeology)
- Modderfontein Railway Dump, JHB (Historical Archaeology)

- Stone Age Site near Maun, Botswana. (Stone Age Archaeology)
- Bulhoek, Eastern Cape (Historical Archaeology)
- Site Archaeologist on the *County of Pembroke* wreck (Maritime Archaeology)
- Site Archaeologist on the *Karin* wreck site (Maritime Archaeology)
- Survey of Robben Island wrecks (Maritime Archaeology)
- Survey of "The Barrel Wreck", Table Bay (Maritime Archaeology)
- Survey of *Odd* wreck site, Durban (Maritime Archaeology)
- Scoping Report, Berths 203-5 & Salisbury Island, Durban Harbour
- Underwater HIA, Berths 203-5 & Sand Winning Sites, Durban Harbour
- Underwater HIA and Land HIA, Pier 1, Durban Harbour
- Platberg Mission Station (Historical Archaeology)
- Inhambane (Mozambique) Slave Wreck Project Magnetometer Survey
- Bloubergstrand, Cape Town Slave Wreck Project Magnetometer Survey
- Senegal, African Slave Wreck Project Magnetometer Survey & Training
- Ilha de Mozambique Slave Wreck Project Magnetometer Survey & Training
- Durban, SAPREF Pipeline Desktop & Magnetometer Survey
- Cape Recife, Port Elizabeth WWTW Desktop, Magnetometer Survey & diver searches
- Cape Recife, Port Elizabeth Wreck Mapping
- False Bay, Cape Town Desalination Desktop, Magnetometer Survey & diver searches
- Hermanus, Western Cape; Magnetometer Survey and diver searches for Neptune Divers
- Port of Ngqura, Port Elizabeth; Magnetometer Survey
- Algoa Bay, Lost Anchor Survey
- Port of Saldanha, Western Cape Magnetometer Survey and diver searches
- Port of Richards Bay, Magnetometer Survey
- Port of Dar es Salaam, Tanzania, Magnetometer Survey
- Table Bay Lost Anchor Survey
- East London, Lost Dredger Head Survey
- Algoa Bay, Lost Anchor Survey

ARCHAEOLOGICAL WORK EXPERIENCE

2004 Subtech Diving & Marine Port Elizabeth

Admin Assistant & Archaeological Advisor

- Research on unknown wreck site
- Compiling interim reports on *County of Pembroke* wreck site

2007-2008 Site Archaeologist Port Elizabeth

- Diving and collecting data on *County of Pembroke* wreck site
- Liaising with Bayworld re curation of artefacts
- Research
- Archaeological reports

2009 Independent Contractor Durban

- Diving and collecting data on “Anomaly 27” wreck site
- Liaising with SAHRA regarding site

2010 Independent Contractor Durban

- Fieldwork and research on the *Karin* (“Anomaly 27”) wreck
- Archaeological report on the *Karin*
- NAS (Nautical Archaeology Society) I course on Robben Island
- NAS II course on Robben Island
- NAS III (1st & 2nd Module) course on Robben Island
- Editing and co-authoring NAS II group report
- Organising and training at NAS I (Durban) Course

2011 Independent Contractor Durban

- Fieldwork and tutor on NAS II Robben Island Course
- Fieldwork and tutor on NAS II Durban Course
- Heritage Scoping Report for the Proposed Developments at the Container Terminal at the Port of Durban for CSIR

2012 Independent Contractor Durban

- Fieldwork and tutor on NAS II Robben Island Course
- Fieldwork on “The Barrel Wreck” for Masters degree
- Underwater HIA for Berth 203-5 & Sand Winning Areas at Durban Harbour for Nemai Consulting

2013 Independent Contractor/ACHA Durban

- Underwater HIA and Land HIA, Pier 1, Durban Harbour
- Registered for Masters at UNISA
- Fieldwork at Bulhoek – Free State

2014 ACHA Durban

- Fieldwork at Platberg Mission Station – Free State
- Inhambane (Mozambique) Slave Wreck Project Magnetometer Survey
- Underwater HIA for Pier 1 at Durban Harbour for Jeffares & Green

2015 ACHA Durban

- Bloubergstrand, Cape Town Slave Wreck Project Magnetometer Survey
- HIA for Pier 1 at Durban Harbour for Jeffares & Green
- Tutor WITS MUCH Field School - Durban
- Fieldwork at Platberg Mission Station – Free State
- Site Archaeologist at KZN Children’s Hospital – Durban
- Project Director Transnet MUCH Project

2016 ACHA Durban

- Senegal, African Slave Wreck Project Magnetometer Survey and Training
- Ilha de Mozambique, African Slave Wreck Project Magnetometer Survey and Training
- Fieldwork at Platberg Mission Station – Free State

- Saldanha Bay shipwreck research for Dr Jonathan Sharfman
- Site Archaeologist at KZN Children's Hospital – Durban
- Maritime Heritage Desktop Survey for Umgeni Water Amanzi's proposed construction of desalination plants at: Lovu River & Tongaat – KZN
- Maritime Heritage Desktop Survey for Ibhubesi Gas Project
- MUCH Heritage Display for Transnet's Maritime School of Excellence Graduation
- Project Director Transnet MUCH Project

2017 ACHA/Independent Consultant Cape Town

- Project Director Transnet MUCH Project
- Ilha de Mozambique, African Slave Wreck Project Magnetometer Survey
- UHIA and Magnetometer Survey, Richard's Bay Floating Dock
- UHIA and Magnetometer Survey, Hitachi Water Remix Project
- Statement on Maritime Structures, Gansbaai and Still Bay
- SAPREF UHIA and Assessment of ROV Survey
- UHIA, De Beers, West Coast Concessions

2018 ACHA/Independent Consultant Cape Town

- SAPREF Magnetometer Survey, Durban
- Magnetometer and Diver Survey for CoCT on Monwabisi and Strandfontein Desalination Sites, Cape Town
- UHIA, Magnetometer and Diver Survey for NMBM Outfall Pipes, Cape Recife, Algoa Bay
- UHIA, Alexkor, West Coast Concessions
- Wreck Mapping for for NMBM Outfall Pipes, Cape Recife, Algoa Bay
- Ilha de Mozambique, African Slave Wreck Project Magnetometer Survey

2019 ACHA/Independent Consultant Knysna

- SAPREF Magnetometer Survey, Durban
- Wreck Mapping for NMBM Outfall Pipes, Cape Recife, Algoa Bay
- HIA for Buccara-Africa's Noetzie Helipad and Walkway Development

2020 ACHA/Independent Consultant Knysna

- Hermanus, Western Cape Magnetometer Survey and Diver Searches for local dive company, Neptune Divers
- Port of Ngqura Desktop Assessment, Magnetometer Survey and Diver Searches

2021 ACHA/Independent Consultant Knysna

- Mossel Bay. WC, Desktop Assessment for the Proposed Undersea Gas Pipeline, ASHA Consulting
- Port of Saldanha, Desktop Assessment, Magnetometer Survey and Diver Searches for Gas to Power Powership, Triplo4 Sustainable Solutions
- Port of Dar es Salaam, Tanzania, Magnetometer Survey with Tritan Survey for CHC
- Port of Richards Bay Magnetometer Survey with Tritan Survey for Gas to Power Powership Project
- Table Bay Lost Anchor Magnetometer Survey

2022 ACHA/Independent Consultant Knysna

- Mossel Bay. WC, Desktop Assessment for the PetroSA

- East London, Lost Dredger Head Magnetometer Survey
- Algoa Bay Lost Anchor Magnetometer Survey
- UHIA, West Coast Concessions

OTHER QUALIFICATIONS & INFORMATION

- NAUI Dive Master
- Commercial Diver Class IV
- CRM Field Director – ASAPA
- CRM Accreditation – Amafa
- South African and British Passports
- Fully Vaccinated with Pfizer for Covid-19

APPENDIX III: DECLARATION OF INDEPENDENCE

UNDERWATER HERITAGE IMPACT DESKTOP ASSESSMENT & PHASE 1 UNDERWATER ARCHAEOLOGICAL ASSESSMENT: NAMPORT'S QUAY EXTENSION, SHARK ISLAND, LÜDERITZ, NAMIBIA

Terms of Reference

This assessment is the Underwater Heritage Impact Assessment, and it assesses the overall cultural heritage potential within area in terms of the proposed development.

Declaration

I …**Vanessa Maitland**……, as the appointed independent specialist hereby declare that I:

- act/ed as the independent specialist in the compilation of the above report;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and
- do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed;
- have and will not have any vested interest in the proposed activity proceeding;
- have disclosed any material information that has or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document;
- have provided access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not; and
- am aware that a false declaration is an offence.



Signature of the specialist

- Maritime Archaeologist

Date: 19 August 2025

APPENDIX IV: STAKEHOLDER ATTENDANCE REGISTER

Appendix C Noise Impact Assessment

The Namibian Ports Authority

ENVIRONMENTAL NOISE IMPACT ASSESSMENT

for the proposed

Namport Expansion Project,

Lüderitz, Namibia



Study done for:

Prepared by:

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EXECUTIVE SUMMARY

INTRODUCTION AND PURPOSE

Enviro-Acoustic Research ("EARES") was contracted by Geo Pollution Technologies (Pty) Ltd to determine the potential noise impact on the surrounding environment due to the proposed Namport expansion Project, located in the Port of Lüderitz (PoL), Namibia.

This report describes ambient sound levels in the area, potential noise levels and the potential noise impacts that the project may have on the surrounding sound environment, highlighting the methods used, potential issues identified, findings and recommendations.

As Namibia do not have any guidelines or local regulations covering noise, this assessment will considered international guidelines, using the terms of reference as proposed by the South African National Standard (SANS) 10328:2008 to allow for a comprehensive Environmental Noise Impact Assessment.

PROJECT DESCRIPTION

The PoL, located 254 nautical miles south of the Port of Walvis Bay along Namibia's coastline, caters for the southern part of the country, and provides access to markets in the Northern Cape of South Africa. The PoL offers logistical services and links to other towns in Namibia and South Africa. For the fruit industry's exports to Europe, particularly grapes from Aussenkehr and from the Northern Cape Province, shipping from Lüderitz saves more than 2 days in delivery time.

The PoL's 500-metre-long main berth has a depth of 8.75 metres. It is considered a shallow port and it is founded on bedrock which is not financially viable to dredge. Recognising the need for dedicated bulk facilities to cater for the mining and related industry, Namport proposed to expand the port infrastructure to the north as part of its master plan for enhancing responsiveness to its customers. The additional expansion would have a water depth of 14 to 16 metres to accommodate deeper draught vessels.

SURROUNDING LAND USE AND POTENTIAL NOISE-SENSITIVE RECEPTORS

The area surrounding the PoL is used for both commercial, light industrial and residential purposes. Potentially sensitive receptors, also known as noise-sensitive developments ("NSR"), located near the project area was identified using Google Earth®, considering comments raised during the Environmental Clearance Certificate renewal process for the PoL land operations. A number of NSR locations were identified based on these.

BASELINE ASSESSMENT

Sound pressure levels were measured in the vicinity of the PoL between 23 and 26 May 2025, with average day- and night-time data indicating ambient sound levels typical of a quiet urban noise district. Noise levels closer to the port area where higher – with noises from an operational crane and port activities clearly audible and dominant, with ambient sound levels further from the port area more typical of a coastal area where natural noises dominate. Depending on the prevailing ambient sound levels (due to birds, wind and wave action), noises from the port activities were audible up to 750m from the port.

DESIRED NOISE LIMITS

Considering the recommended noise limits as defined by the World Bank Group and the International Finance Corporation, recommended noise limits would be:

- 55 dBA for daytime residential use; and
- 45 dBA for night-time residential use.

The PoL should also limit the noise level to less than 70 dBA on the boundary during the day- and night-time periods).

NOISE IMPACT DETERMINATION AND FINDINGS

This assessment considered the findings of the site visit (sound pressure level measurements and observations) to develop a noise model to illustrate potential existing noise levels (scenario 1). Using conceptual noise models, it was determined that the potential noise impacts associated with the project would be:

- of a **high significance** for daytime construction activities. While this **high significance** might relate to the strict EIA criteria used (with the assumption that the higher noise levels may be considered disturbing or annoying by the closest NSR). Mitigation measures were recommended that could reduce noise levels as well as the probability of noise complaints being registered, which could assist in reducing the significance of the noise impact to **medium**, potentially to **low**;
- of a **low significance** for daytime operational activities associated with the PoL activities (all scenarios as evaluated);
- of a **high significance** for night-time activities associated with the port operational activities. While this **high significance** might relate to the strict EIA criteria used (with the assumption that the higher noise levels may be considered disturbing or annoying by the closest NSR). Mitigation measures were recommended that could reduce noise levels as well as the probability of noise complaints being registered, which could assist in reducing the significance of the noise impact to **medium**, potentially to **low**.

MANAGEMENT AND MITIGATION

The study considers the potential noise impact on the surrounding environment due to future operational activities at PoL. The potential noise impact would be of a **high significance** during the daytime period (mainly due to noises from pile driving activities within 250m from the Shark Island Camping site). Measures that may assist in reducing the probability of noise impacts occurring are:

- The potential noise levels and construction schedule should be discussed with all NSR staying within 500m from future areas where pile driving will take place. Measures that will be used to reduce noise levels should be highlighted;
- Namport should select the use of vibratory pile driving instead of hammer pile driving. If viable, the vibratory hammer should be fitted with a pile drive shroud;
- Namport could consider drilling a hole to cast the pile in place instead of pile driving, or predrilling a pilot hole before piling (if viable). The drill could be fitted with a shroud, with noise barrier or acoustic enclosures used around mobile equipment (such as the air compressor or concrete pump);
- Namport should select contractors that use newer, quieter equipment. Equipment should be well maintained as per manufacturers requirements, with the engine compartment closed;
- Induction training should include an environmental noise component, which should be given to all employees and contractors, highlighting the sensitivity of the area to noise. Sources of noise should be highlighted, especially the potential impact of material handling noises;
- Namport could install a real-time noise monitoring system at the Shark Island Camp Site to provide immediate and accurate noise levels to the contractors and Namport.
- Namport should investigate the use of white noise alarms (squawkers) instead of tonal reverse alarms on heavy vehicles and fork-lifts operating within the port area and consider changes to policies and guidelines for contractors and port users.

Considering the future operational activities at the PoL, the potential noise impact would be of a **high** significance during the night-time periods and the implementation of various mitigation measures could assist in reducing this significance. Such measures could include:

- The potential operational noise levels and activities should be discussed with all NSR staying within 500m from port activities. The PoL should initiate a forum or similar mechanism to provide feedback about measured noise levels and noise-reduction measures that were implemented;

- Induction training should include an environmental noise component, which should be given to all employees and contractors, highlighting the sensitivity of the area to noise. Sources of noise should be highlighted, especially the potential impact of material handling noises (e.g. skip hitting the hole covers during loading/unloading);
- Namport could install a real-time noise monitoring system at the Shark Island Camp Site to provide immediate and accurate noise levels to the contractors and Namport;
- Namport must conduct annual noise auditing to assist in classify noise sources, defining the associated noise levels (magnitude of the noise emission levels) and identify the specific measures that could reduce noise levels. Namport should commit to implementing viable noise mitigation measures;
- Namport should commit to investigate reasonable and valid noise complaints and implementing viable noise management measures;
- Namport should ensure that contractors and port users have appropriate equipment maintenance programmes in place;
- Namport could investigate the use of squawker reverse alarms instead of tonal reverse alarms within the port area. Namport should highlight the benefit of squawker reverse alarms at the induction training to contractors and other users of the port area;
- Namport should plan the location of infrastructure and transport routes within the expansion area to optimize the noise-reduction effectiveness of walls and buildings. This could include locating loading and unloading activities to allow buildings to act as noise barriers.

NEED AND DESIRABILITY OF PROJECT

Due to economic advantages, ports do provide valuable employment, support numerous businesses and allows for continuous business opportunities. However, when such industrial projects are near to potential NSR, consideration must be given to ensure a compatible co-existence. The potential sensitive receptors should not be adversely affected and yet, at the same time the project needs to reach an optimal scale in terms of layout and production.

While the proposed expansion project will provide continued economic and social benefits to the area, the noises will be audible at the closest NSR and some NSR may find the noises annoying at night. In terms of acoustics, there is no benefit to the surrounding environment (closest receptors). It is noted that the NSRs are also directly linked to the operation, which would also foster a more positive attitude towards to future noise levels.

The project however will greatly assist in the economic growth in Namibia. This will assist in providing additional employment and business opportunities for the local communities. Considering only noise, people in the area not directly affected by increased noise levels would have a positive perception of the project and could see the need and desirability of the project.

CONCLUSION AND RECOMMENDATION

The various noise-generation scenarios generally consider noise-generating activities close to the NSR, considering potential cumulative effects from existing port activities. Existing port activities are generally audible at the closest NSR and the proposed expansion will result in additional activities that would slightly raise the noise levels at the closest NSR. The increase however is not considered a fatal flaw, and it is recommended that the PoL expansion project be authorised (from a noise impact perspective).

This noise impact assessment is sufficient, but it is recommended that noise monitoring programme be designed for implementation.



Enviro-Acoustic Research cc
2025 – 09 – 02

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APPENDICES

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GLOSSARY OF ABBREVIATIONS

ASTER	Advanced Spaceborne Thermal Emission and Reflection Radiometer
CRP	Chrome Recovery Plant
DFFE	Department of Forestry, Fisheries and Environment
EARES	Enviro-Acoustic Research cc
ECA	Environment Conservation Act
ECC	Environmental Clearance Certificate
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EMP	Environmental Management Programme
ENIA	Environmental Noise Impact Assessment
ENM	Environmental Noise Monitoring
EPs	Equator Principles
EPFIs	Equator Principles Financial Institutions
GN	Government Notice
HME	Heavy Mobile Equipment
IEC	International Electrotechnical Commission
IFC	International Finance Corporation
ISO	International Organisation for Standardisation
METI	Ministry of Economy, Trade, and Industry
NASA	National Aeronautical and Space Administration
NSR	Noise-sensitive Receptor
PFA	Project Focus Area
PoL	Port of Lüderitz
PWL	Sound Power Level

SABS	South African Bureau of Standards
SANS	South African National Standards
SPL	Sound Power Level
TSF	Tailings Storage Facility
UTM	Universal Transverse Mercator
WHO	World Health Organisation

GLOSSARY OF UNITS

dB	Decibel (expression of the relative loudness of the un-weighted sound level)
dBA	Decibel (expression of the relative loudness of the A-weighted sound level)
Hz	Hertz (measurement of frequency)
kg/m^2	Surface density (measurement of surface density)
km	kilometre (measurement of distance)
m	Meter (measurement of distance)
m^2	Square meter (measurement of area)
m^3	Cubic meter (measurement of volume)
mamsl	Meters above mean sea level
m/s	Meter per second (measurement for velocity)
^oC	Degrees Celsius (measurement of temperature)
µPa	Micro pascal (measurement of pressure – in air in this document)

1 THE AUTHOR

The Author started his career in the mining industry as a bursar Learner Official (JCI, Randfontein), working in the mining industry, doing various mining-related courses (Rock Mechanics, Surveying, Sampling, Safety and Health [Ventilation, noise, illumination etc.] and Metallurgy. He did work in both underground (Coal, Gold and Platinum) as well as opencast (Coal) for 4 years. He changed course from Mining Engineering to Chemical Engineering after the second year of his studies at the University of Pretoria.

After graduation he worked as a Water Pollution Control Officer at the Department of Water Affairs and Forestry for two years (first year seconded from Wates, Meiring and Barnard), where duties included the perusal (evaluation, commenting and recommendation) of various regulatory required documents (such as EMPR's, Water Licence Applications and EIA's), auditing of licence conditions as well as the compilation of Technical Documents.

Since leaving the Department of Water Affairs, Morné has been in private consulting for the last 15 years, managing various projects for the mining and industrial sector, private developers, business, other environmental consulting firms as well as the Department of Water Affairs. During that period he has been involved in various projects, either as specialist, consultant, trainer or project manager, successfully completing these projects within budget and timeframe, gradually moving towards environmental acoustics, focusing on this field exclusively since 2007.

He has been interested in acoustics as from school days, doing projects mainly related to loudspeaker design. Interest in the matter brought him into the field of Environmental Noise Measurement, Prediction and Control. He has been doing work in this field for the past 8 years, and was involved with the following projects in the last few years:

Wind Energy Facilities	*Full Environmental Noise Impact Assessments for - Bannf (Vidigenix), iNCa Gouda (Aurecon SA), Isivunguvungu (Aurecon), De Aar (Aurecon), Kokerboom 1 (Aurecon), Kokerboom 2 (Aurecon), Kokerboom 3 (Aurecon), Kangnas (Aurecon), Plateau East and West (Aurecon), Wolf (Aurecon), Outeniqwa (Aurecon), Umsinde Emoyeni (ARCUS) , Komsberg (ARCUS), Karee (ARCUS), Kolkies (ARCUS), San Kraal (ARCUS), Phezukomoya (ARCUS), Canyon Springs (Canyon Springs), Perdekraal (ERM), Scarlet Ibis (CESNET), Albany (CESNET), Sutherland (CSIR), Kap Vley (CSIR), Kuruman (CSIR), Rietrug (CSIR), Sutherland 2 (CSIR), Perdekraal (ERM), Teekloof (Mainstream), Eskom Aberdene (SE), Dorper (SE), Spreeukloof (SE), Loperberg (SE), Penhoek Pass (SE), Amakhala Emoyeni (SE), Zen (Savannah Environmental – SE), Goereesoe (SE), Springfontein (SE), Garob (SE), Project Blue (SE), ESKOM Kleinzee (SE), Namas (SE), Zonnequa (SE), Walker Bay (SE), Oyster Bay (SE), Hidden Valley (SE), Deep River (SE), Tsitsikamma (SE), AB (SE), West Coast One (SE), Hopefield II (SE), Namakwa Sands (SE), VentuSA Gouda (SE), Dorper (SE),*

	Klipheuwel (SE), INCA Swellendam (SE), Cookhouse (SE), Iziduli (SE), Msenge (SE), Cookhouse II (SE), Rheboksfontein (SE), Suurplaat (SE), Karoo Renewables (SE), Koningaas (SE), Spitskop (SE), Castle (SE), Khai Ma (SE), Poortjies (SE), Korana (SE), IE Moorreesburg (SE), Gunstfontein (SE), Boulders (SE), Vredenburg (Terramanzi), Loeriesfontein (SiVEST), Rhenosterberg (SiVEST), Noupoort (SiVEST), Prieska (SiVEST), Dwarsrug (SiVEST), Graskoppies (SiVEST), Philco (SiVEST), Hartebeest Leegte (SiVEST), Ithemba (SiVEST), !Xha Boom (SiVEST), Spitskop West (Terramanzi), Haga Haga (Terramanzi), Vredenburg (Terramanzi), Msenge Emoyeni (Windlab), Wobben (IWP), Trakas (SiVest), Beaufort West (SiVest), Pienaarspoort 1 and 2 (SE), Mphepo Zambia (SLR), Koup 1 (SiVEST), Koup 2 (SiVEST), Hamlet (SE), Aeoulus (SE), Ripponn (SE), Redding (SE), Wind Garden (SE), Fronteer (SE), Hendrina North (Cabanga), Hendrina South (Cabanga), Hoogland Northern Cluster (SLR), Hoogland Southern Cluster (SLR), Jessa M, S and Z cluster of Wind Farms (SLR), Heuweltjies (SiVEST), Kraaltjies (SiVEST), Patatskloof (SiVEST), Bergriver (SE), Overberg (Arcus), Newcastle North (CESNET), Newcastle South (CESNET), Ngxwabangu (CESNET), Taaibos North (CESNET), Taaibos South (CESNET), Soutrivier North (CESNET), Soutrivier South (CESNET), Soutrivier Central (CESNET), Soyuz 1 (AEP/CESNET), Soyuz 2 (AEP/CESNET), Soyuz 3 (AEP/CESNET), Soyuz 4 (AEP/CESNET), Soyuz 5 (AEP/CESNET), Soyuz 6 (AEP/CESNET), Kaladokhwe 1 (AEP/CSIR), FE Red Sands North East (Enviro-Insight), FE Red Sands South West (Enviro-Insight), FE Red Sands North West (Enviro-Insight), FE Red Sands South East (Enviro-Insight), FE De Rust North (Enviro-Insight), FE De Rust South (Enviro-Insight), Springbok (SE), Aberdene 1 (AEP/SE), Aberdene 2 (AEP/SE), Aberdene 3 (AEP/SE), Ezelsjacht (SLR), Amsterdam (Rochdale, Emvelo, Sheepmoor) (ERM); Loxton 1, 2 & 3 (ARCUS); Kariega 1, 2, 3 & 4 (EnviroAGRI); Hugo & Khoe (ERM); Taaibosch Puts Cluster (Khoemana, Gorachouqua) (JAWS); Eland (Praxos); Houmoed (Enviro-Insight); Stinkputs (Enviro-Insight); Zuurfontein (Enviro-Insight); Karoo Cluster (1, 2, 3) (SES), Tango (Savannah), Kudu (Savannah), Angora (Savannah), Oryx (Savannah)
Mining and Industry	*Full Environmental Noise Impact Assessments for – Delft Sand (AGES), BECSA – Middelburg (Golder Associates), Kromkrans Colliery (Geovicon Environmental), SASOL Borrow Pits Project (JMA Consulting), Lesego Platinum (AGES), Tweefontein Colliery (Cleanstream Environmental), Evraz Vametco Mine and Plant (JMA), Goedehoop Colliery (Geovicon), Hacra Project (Prescali Environmental), Der Brochen Platinum Project (J9 Environment), Brandbach Sand (AGES), Verkeerdepan Extension (CleanStream Environmental), Dwaalboom Limestone (AGES), Jagdlust Chrome (MENCO), WPB Coal (MENCO), Landau Expansion (CleanStream Environmental), Otjikoto Gold (AurexGold), Klipfontein Colliery (MENCO), Imbabala Coal (MENCO), ATCOM East Expansion (Jones and Wagner), IPP Waterberg Power Station (SE), Kangra Coal (ERM), Schoongesicht (CleanStream Environmental), EastPlats (CleanStream Environmental), Chapudi Coal (Jacana Environmental), Generaal Coal (JE), Mopane Coal (JE), Glencore Boshoek Chrome (JMA), Langpan Chrome (PE), Vlakpoort Chrome (PE), Sekoko Coal (SE), Frankford Power (REMIG), Strahrae Coal (Ferret Mining), Transalloys Power Station (Savannah), Pan Palladum Smelter, Iron and PGM Complex (Prescali Environmental), Fumani Gold (AGES), Leiden Coal (EIMS), Colenso Coal and Power Station (SiVEST/EcoPartners), Klippoortjie Coal (Gudani), Rietspruit Crushers (MENCO), Assen Iron (Tshikovha), Transalloys (SE), ESKOM Ankerlig (SE), Nooitgedacht Titano Project (EcoPartners), Algoa Oil Well (EIMS), Spitskop Chrome (EMAssistance), Vlakfontein South (Gudani), Leandra Coal (Jacana), Grazvalley and Zoetveld (Prescali), Tjate Chrome (Prescali), Langpan Chromite (Prescali), Vereeniging Recycling (Pro Roof), Meyerton Recycling (Pro Roof), Hammanskraal Billeting Plant 1 and 2 (Unica), Development of Altona Furnace, Limpopo Province (Prescali Environmental), Haakdoorndrift Opencast at Amandelbult Platinum (Aurecon), Landau Dragline relocation (Aurecon), Stuart Coal Opencast (CleanStream Environmental), Tetra4 Gas Field Development (EIMS), Kao Diamonds – Tiping Village Relocation (EIMS), Royal Sheba*

	project (Cabanga),Kao Diamonds – West Valley Tailings Deposit (EIMS), Upington Special Economic Zone (EOH), Arcellor Mittal CCGT Project near Saldanha (ERM), Malawi Sugar Mill Project (ERM), Proposed Mooifontein Colliery (Geovicon Environmental), Goedehoop North Residue Deposit Expansion (Geovicon Environmental), Mutsho 600MW Coal-Fired Power Plant (Jacana Environmentals), Tshivhaso Coal-Fired Power Plant (Savannah Environmental), Doornhoek Fluorspar Project (Exigo), Royal Sheba Project (Cabanga Environmental), Rietkol Silica (Jacana), Gruisfontein Colliery (Jacana), Lehlabile Colliery (Jaco-K Consulting), Bloemendal Colliery (Enviro-Insight), Rondevly Colliery (REC), Welgedacht Colliery (REC), Kalabasfontein Extension (EIMS), Waltloo Power Generation Project (EScience), Buffalo Colliery (Marang), Balgarthen Colliery (Rayten), Kusipongo Block C (Rayten), Zandheuvel (Exigo), NamPower Walvis Bay (GPT), Eloff Phase 3 (EIMS), Dunbar (Enviro-Insight), Smokey Hills (Prescali), Bierspruit (Aurecon), ECM Lannex (Prescali). ECM Tweefontein (Prescali), Smokey Hills (Prescali), Dalyshope (Digby Wells), Eland Platinum Mine (JEMS), Tweefontein (Prescali), Lannex (Prescali), Salene Manganese (Prescali), Baberton Gas to Power (Rayten), SISHEN Expansion (Shangoni), Goedgevonden EMP Amendment (Jacana), Rietkol Amendment (Jacana), Vlakfontein Bunker Project (Gudani), Vlakfontein West Project (Gudani), Vygenhoek Platinum (EMAssistance), Lesego Amendment (OMI Solutions), Mpenyisi Gas to Power (Nsovo), Basani Gas to Power (Nsovo), Newlands Gas to Power (Savannah), Sudor Coal (JacoK), Nooitgedacht Titanomanganese (Ikwezi), Inyanda Project (JacoK), Ermelo Project (Zyntha), (Schurvekop Coal (Cabanga), Vlakfontein Coal (EMAssistance), Zandheuvel (Jacana), Zondagsvlei Coal (Zyntha), Sereti Witbank South (Zyntha), Bright Alloys (Phakani), Gold One (Prime Resources), Consol Nigel (Zitholele), Hendrina Green Hydrogen and Ammonia project (Enertrag/WSP), Kegakilwe Diamonds (Gudani), Naudesbank (Zyntha), Brackenfell Data Centre (Linspace), Springfield & Redan (MENCO), Somkhele Project (Ophondweni, Emamahleni, Mahujini) (MENCO), Beta Gold (OMIsolutions), Rietfontein Gold (OMIsolutions), Bright Alloys Smelter (Phakani), Sweet Sensations Sand (Digby Wells), Anglo Motlhotlo (Digby Wells), Soufflet Malt (RHDHV), Braamspruit Coal (Shangoni), Southern Sphere Project (Shangoni), Renoster 1 (SRK)
Urban, Roads and Railway	*K220 Road Extension (Urbansmart), Boskop Road (MTO), Sekoko Mining (AGES), Davel-Swaziland-Richards Bay Rail Link (Aurecon), Moloto Transport Corridor Status Quo Report and Pre-Feasibility (SiVEST), Postmasburg Housing Development (SE), Tshwane Rapid Transport Project, Phase 1 and 2 (NRM Consulting/City of Tshwane), Transnet Apies-river Bridge Upgrade (Transnet), Gautrain Due-diligence (SiVest), N2 Piet Retief (SANRAL), Atterbury Extension, CoT (Bokomoso Environmental), Riverfarm Development (Terramanzi), Conakry to Kindia Toll Road (Rayten), Sutherland Road Project (Veers Group), Sassalemba Project (Enviro-Insight), Barra da Donde Angola (Enviro-Insight), Musina-Makhado SEZ (Gudani), Highbury Depot (AGES Limpopo), Mokopane project (AGES Limpopo), Deerpark Filling Station (AGES Limpopo), Highlands Estate (NALI), IPHC Wonderpark (Magoda), Busstop7,*
Airport	*Oudtshoorn Noise Monitoring (AGES), Sandton Heliport (Alpine Aviation), Tete Airport Scoping (Aurecon)*
Noise monitoring and Audit Reports	*Peerboom Colliery (EcoPartners), Thabametsi (Digby Wells), Doxa Deo (Doxa Deo), Harties Dredging (Rand Water), Xstrata Coal – Witbank Regional (Xstrata), Sephaku Delmas (AGES), Amakhala Emoyeni WEF (Windlab Developments), Oyster Bay WEF (Renewable Energy Systems), Tsitsikamma WEF Ambient Sound Level study (Cennergi and SE), Hopefield WEF (Umoya), Wesley WEF (Innowind), Ncora WEF (Innowind), Boschmanspoort (Jones and Wagner), Nqamakwe WEF (Innowind), Hopefield WEF Noise Analysis (Umoya), Dassiesfontein WEF Noise Analysis (BioTherm), Transnet Noise Analysis (Aurecon), Jeffries Bay Wind Farm*

	(Globeleq), Sephaku Aganang (Exigo), Sephaku Delmas (Exigo), Beira Audit (BP/GPT), Nacala Audit (BP/GPT), NATREF (Nemai), Rappa Resources (Rayten), Measurement Report for Sephaku Delmas (Ages), Measurement Report for Sephaku Aganang (Ages), Bank of Botswana measurements (Linnspace), Skukuza Noise Measurements (Concor), Development noise measurement protocol for Mamba Cement (Exigo), Measurement Report for Mamba Cement (Exigo), Measurement Report for Nokeng Fluorspar (Exigo), Tsitsikamma Community Wind Farm Pre-operation sound measurements (Cennergi), Waainek WEF Operational Noise Measurements (Innowind), Sedibeng Brewery Noise Measurements (MENCO), Tsitsikamma Community Wind Farm Operational noise measurements (Cennergi), Noupoort Wind Farm Operational noise measurements (Mainstream), Twisdraai Colliery (Lefatshe Minerals), SASOL Prospecting (Lefatshe Minerals), South32 Klipspruit (Rayten), Sibanye Stillwater Kroondal (Rayten), Rooiberg Asphalt (Rooiberg Asphalt), SASOL Shondoni (Lefatshe), SASOL Twisdraai (Lefatshe), Anglo Mototolo (Exigo), Heineken Inyaniga (AECOM), Glencore Izimbiwa (Cleanstream), Glencore Impunzi (Cleanstream), Black Chrome Mine (Prescali) Sibanye Stillwater Ezulwini (Aurecon), Sibanye Stillwater Beatrix (Aurecon), Bank of Botshwana (Linspace), Lakeside (Linspace), Skukuza (SiVest), Rietvlei Colliery (Jaco-K Consulting), TCTA – Mokolo Project (GIBB), Various (Linspace), Sulzer Hydromining (Sulzer), WCO WEF (Aurora), Great Kei (EDF-Renewables), Elands Platinum (JEMS), Hartebeest WEF (juwi), Mamba Cement (TMCC), Booysens (MDTE), West Rand (MDTE), Devland (MDTE), Zandheuvel (Jacana), Glencore (Kroondal, Rhovan, Rietvly, Waterval-West, Helena, Lion Smelter, Magareng, Thorncliffe, Boshoek, Rustenburg Smelter, Wonderkop) (JMA), McDonalds Albert Street (Linspace), Waterfall Data Centre (Linspace), Zondereinde (Linspace), Copper Sunset Sands (Digby Wells), Exxaro Lephalale (Digby Wells), Tawana Mining (Tawana Mining),
Project Modelling and Consulting	*JW Angola Urban Development (Rayten), Mooi-Mgeni Hydro Project (Rayten), Consmodder (Rayten), Samrand Data Centre (Rayten), Luculus Road (Rayten), Atlanta Weir (Rayten), Beestekraal Weir (Rayten)! Paul Hugo Weir (Rayten), Newcastle Coal Mine (Rayten), Boldman Coal (Rayten), Worcester N1 Upgrade (Rayten), Angola Railway Project (Rayten), Nekkies Road Project (Rayten), George N2 Bypass Road (Rayten), Vanmag project (Rayten), N2 Bypass Borrowpits (Rayten),*
Small Noise Impact Assessments	*TCTA AMD Project Baseline (AECOM), NATREF (Nemai Consulting), Christian Life Church (UrbanSmart), Kosmosdale (UrbanSmart), Louwlardia K220 (UrbanSmart), Richards Bay Port Expansion (AECOM), Babalegi Steel Recycling (AGES), Safika Slag Milling Plant (AGES), Arcelor Mittal WEF (Aurecon), RVM Hydroplant (Aurecon), Grootvlei PS Oil Storage (SiVEST), Rhenosterberg WEF, (SiVEST), Concerto Estate (BPTrust), Ekuseni Youth Centre (MENCO), Kranskop Industrial Park (Cape South Developments), Pretoria Central Mosque (Noman Shaikh), Soshanguve Development (Maluleke Investments), Seshego-D Waste Disposal (Enviroxcellence), Zambesi Safari Equipment (Owner), Noise Annoyance Assessment due to the Operation of the Gautrain (Thornhill and Lakeside Residential Estate), Upington Solar (SE), Ilangalethu Solar (SE), Pofadder Solar (SE), Flagging Trees WEF (SE), Uyekraal WEF (SE), Ruuki Power Station (SE), Richards Bay Port Expansion 2 (AECOM), Babalegi Steel Recycling (AGES), Safika Ladium (AGES), Safika Cement Isando (AGES), RareCo (SE), Struisbaai WEF (SE), Perdekraal WEF (ERM), Kotula Tsatsi Energy (SE), Olievenhoutbosch Township (Nali), , HDMS Project (AECOM), Quarry extensions near Ermelo (Rietspruit Crushers), Proposed uMzimkhulu Landfill in KZN (nZingwe Consultancy), Linksfield Residential Development (Bokomoso Environmental), Rooihuiskraal Ext. Residential Development, CoT (Plandev Town Planners), Floating Power Plant and LNG Import Facility, Richards Bay (ERM), Floating Power Plant project, Saldanha (ERM), Vopak Growth 4 project (ERM), Elandspoort Ext 3 Residential Development (Gibb Engineering), Tiegerpoort Wedding Venue (Henwood Environmental),*

Monavoni Development (Marindzini), Rezoning of Portion 1 (Primo Properties), Tswaing Mega City (Makole), Mabopane Church (EP Architects), ERGO Soweto Cluster (Kongiwe), Fabio Chains (Marang), GIDZ JMP (Marang), Temple Complex (KWP Create), Germiston Metals (Dorean), Sebenza Metals (Dorean), Malmesbury Abattoir Expansion (Roelcor), Mogalakwena PV Project (Zutari), Serengeti PV Review (Zutari), Nyakallo PV (GCS), Robinson Deep (IQS), Zonnebloem (Zyntha), Forzando North (Cabanga), Tumelo (Cabanga), Daggafontein projects (Kongiwe), Genesis Steyn PV (Kongiwe), ERGO Soweto Cluster (Kongiwe), Kriel PV (NALA), Mhlabatshane project (NEMAI), Coega G2P (Nsovo), Cape Roan Desalination Project (Rayten), AJCOR (Rayten), Swartfontein PV (Savannah)

2 DECLARATION OF INDEPENDENCE

I, Morné de Jager declare that:

- I act as the independent specialist in this application
- I will perform the work relating to this study in an objective manner, even if this results in views and findings that are not favourable to the applicant
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting environmental noise impact assessments;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not;
- all the particulars furnished by me in this form are true and correct;
- I do not have and will not have any vested interest (either business, financial, personal or other) in the proposed activity proceeding other than remuneration for work performed in terms of the Environmental Impact Assessment Regulations, 2014.



Signature of the specialist:

Name of company:
Enviro-Acoustic Research cc

Date:
2025 – 09 – 02

3 INTRODUCTION

3.1 INTRODUCTION AND PURPOSE

Enviro-Acoustic Research ("EARES") was contracted by Geo Pollution Technologies (Pty) Ltd to determine the potential noise impact on the surrounding environment due to the proposed Namport expansion Project, located in the Port of Lüderitz (PoL), Namibia.

This report describes ambient sound levels in the area, potential noise levels and the potential noise impacts that the project may have on the surrounding sound environment, highlighting the methods used, potential issues identified, findings and recommendations.

As Namibia do not have any guidelines or local regulations covering noise, this assessment will considered international guidelines, using the terms of reference as proposed by the South African National Standard (SANS) 10328:2008 to allow for a comprehensive Environmental Noise Impact Assessment.

3.2 NAMPORT HISTORY

The Namibian Ports Authority Act, Act Number 2 of 1994, as proclaimed in Government Gazette No. 810, made provision for "the establishment of the Namibian Ports Authority to undertake the management and control of ports and lighthouses in Namibia and the provision of facilities and services related thereto; and to provide for matters incidental thereto."

Under this act, Namport, a state owned enterprise, was established as the port authority and under their control is the Port of Walvis Bay on the central coast and the PoL on the southern coast of Namibia (see also **Figure 3-1**).

- Manage the port facilities to cater for current trade needs;
- Develop the ports for future demands;
- Contribute to the competitiveness of the SADC region's trade through the efficient, reliable and cost-effective supply of port services;
- Facilitate economic growth in Namibia by enabling regional development and cross-border trade;
- Promote the Ports of Walvis Bay and Lüderitz as preferred routes for sea-borne trade between SADC, Europe and the Americas;
- As the founding architects of the Walvis Bay Corridor Group, assist with developing crossborder trade;

- Minimize the impact of port operations on the natural environment by applying International Organisation for Standardisation (ISO) 14001; and
- Uplift and support the communities in which Namport operates.

3.3 BRIEF OVERVIEW OF PORT OF LÜDERITZ ACTIVITIES

The PoL, located 254 nautical miles south of the Port of Walvis Bay along Namibia's coastline, caters for the southern part of the country, and provides access to markets in the Northern Cape of South Africa. The PoL offers logistical services and links to other towns in Namibia and South Africa. For the fruit industry's exports to Europe, particularly grapes from Aussenkehr and from the Northern Cape Province, shipping from Lüderitz saves more than 2 days in delivery time.

Typical activities at the port include:

- Bulk and break-bulk imports - these can include chemicals, mineral ores, coal, etc. Currently the main break-bulk cargo imported into Namibia via the PoL are fuel, fish and general cargo. Break-bulk cargo are typically bulk bags or crates that are offloaded by means of cranes. The PoL currently only receive diesel fuel by means of tanker ships. Diesel is offloaded at the quay wall and pumped via an underground pipeline to the bulk fuel storage facility of Puma Energy Namibia. The port could potentially also receive other petroleum products in future.
- Bulk and break-bulk exports - Currently the main bulk export product is manganese ore, with zinc ingots, zinc ore and concentrate being the second most exported product. Ore is transported into the port area by means of trucks and trains and either offloaded in dedicated temporary storage areas (typically rub halls) or directly loaded onto ships. The trucks typically are either side tipper trucks or flatbeds with skips. Side tipper trucks enter the temporary storage areas for offloading, while the skips are lifted off the trucks and emptied directly into the bulk cargo hulls of ships by means of cranes with skip tipplers. Trains typically transport containers which are stacked in the port and emptied into ships with cranes. The capacity of both the rail network to Lüderitz as well as the rail yard within the PoL are however limited.
- Fuel Bunkering - Diesel bunkering of ships is performed by Puma Energy. Underground pipelines service both the quay area and the concrete jetty where hose trolleys are used for port bunkering purposes. Currently, no offshore bunkering occurs within port limits. Bunkering outside of port limits does not fall under the jurisdiction of Namport.
- Fishing and Mariculture operations - Wave action along the western shore of the Robert Harbour prevents safe berthing of fishing vessels at jetties of the fish

factories. Fishing vessels therefore use the commercial harbour for berthing to offload fish and to replenish supplies. Mariculture of oysters and abalone takes place within port limits. These activities do however not form part of Namport's operations.

- Infrastructure, traffic and security management.

3.4 BRIEF PROJECT DESCRIPTION

The PoL's 500-metre-long main berth has a depth of 8.75 metres. It is considered a shallow port and it is founded on bedrock which is not financially viable to dredge. Recognising the need for dedicated bulk facilities to cater for the mining and related industry, Namport proposed to expand the port infrastructure to the north as part of its master plan for enhancing responsiveness to its customers. The additional expansion would have a water depth of 14 to 16 metres to accommodate deeper draught vessels.

3.4.1 Proposed Construction Activities

Construction of the extended main quay wall will be conducted in phases over the next 3 to 10 years as the actual demand for capacity dictates. Ultimately it is foreseen that up to 700 m of additional quay wall length may be added, with a total of approximately 15 to 17 hectares of backup land (reclaimed land). However, the initial phase might only see the construction of 200 m of quay wall length and a smaller backup area. The construction activities will nonetheless involve the following:

- Dredging and spoiling the existing loose sandy material which covers the rock where the new quay wall must be built. This activity is already covered in the port's existing Environmental Management Programme (EMP) and Environmental Clearance Certificate (ECC) for dredging activities.
- Installation of a steel sheetpile retaining wall directly on the bedrock and filling the uneven gaps on the seabed between the steel wall and the bedrock with concrete.
- Land reclamation in between the quay wall and the eastern shore of Shark Island.
- Installation of two rows of dead man anchors to hold the steel wall in place whilst filling and compacting with suitable sandy material.
- The source of the fill material to reclaim the land at the back of the wall will most likely be sourced from dredged material, and/or from outside town from suitable sand and gravel quarries or from old mine tailings in the Sperrgebiet. Any unsuitable dredged material will be spoiled at the existing approved offshore dump site.
- Once the steel wall installation and land reclamation is completed, a reinforced concrete capping wall will be installed on top of the steel wall which will also contain a service tunnel to house all the quayside services required by ships.

- Onshore services will also be installed, i.e., roads, pavements, railway extension, water, sewer, lighting and electricity distribution etc., so that all services in the existing port can simply continue into the extended section.

3.4.2 Proposed Operational Activities

Operational activities focus on typical port related activities which include ship navigation in port limits, offloading and loading of bulk, break bulk and containerised cargo, storage and handling of cargo, storage and handling of dangerous cargo, ship repair activities, etc. Operations are performed by Namport and its contractors and / or by tenants and their contractors. The main sources of noise will be import and export activities (and associated actions).

3.5 STUDY AREA

The PoL is located 254 nautical miles south of the Port of Walvis Bay, servicing imports and exports from southern Namibia and South Africa's Northern Cape Province. The project area is further described in terms of environmental components that may contribute to or change the sound character in the area.

3.5.1 Topography

The surface area in the vicinity of the PoL can be described as undulating, with rocky outcrops and small hills defining the topography. These rocky outcrops will impact on the propagation of noise from certain areas located within the port.

3.5.2 Climate

Namibia is situated within an anti-cyclone belt of the southern hemisphere. Winds generated from the high-pressure cell over the Atlantic Ocean blow from a southerly direction when they reach the Namibian coastline. As the Namibian interior is warm (particularly in summer), localised low-pressure systems are created which draws the cold southerly winds towards the inland desert areas. 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 (120 km/h) during the summer. Daily fluctuations in wind speed are characterised by calmer winds in the morning with strong wind from late morning to later afternoon.

3.5.3 Surrounding Land Use

The PoL is situated in one of the oldest towns in Namibia, dating back to the late 19th century. Originally established as mainly a fishing and mining town, these two natural resources remain the main economic drivers of the town and port. Due to the town's

development around the port, the most important historic buildings of the town are also the closest to the port and its access route. A number of tourist establishments are also found along the access route to the port and on Shark Island, west of the port. Shark Island is also a proclaimed National Heritage Site. The port is further surrounded by a variety of land uses including residential, business and industrial zones.

On land, Lüderitz is surrounded by the Tsau //Khaeb National Park which falls under the management of the Ministry of Environment and Tourism. Due to the diamond mining in the Tsau //Khaeb National Park, most of its area is off limits to the general public and tourists. The Tsau //Khaeb National Park covers approximately 26,000 km^2 and falls mainly within the Succulent Karoo Biome which is characteristic of high species diversity and endemism.

The offshore area around Lüderitz, as well as the rocky shores, fall within the proclaimed Namibian Islands' Marine Protected Area, in an Important Bird Area (NA017), as well as the Lüderitz Rock Lobster Sanctuary.

3.5.4 Roads and Railways

Only one road, the B4 main road, provides access to Lüderitz from central Namibia. The railway line to Lüderitz has mostly been upgraded, but a section of 42 km between the Sandverhaar and Buchholzbrunn sidings east of Aus still needs to be rehabilitated. The rail network is thus not capable of carrying heavy traffic at this stage. Furthermore, the number of railcars that can enter Lüderitz is limited due to the steep descent towards the town. With the envisioned manganese exports from the port, an increase in traffic, and specifically heavy vehicle traffic, can be expected. Increased imports and exports via the port will ultimately have to rely on a functioning heavy haul railway line and road.

3.5.5 Ground conditions and vegetation

The area falls within the Succulent Karoo biome, with a succulent steppe vegetation type and dwarf shrubland structure Most of the natural areas around Lüderitz are sparsely vegetated.

Taking into consideration available information it is the opinion of the author that the ground conditions (when considering acoustic propagation on a ground surface) can be classified as medium to hard, which implies that the ground surface will reflect some of the acoustic energy hitting the ground surface. It should be noted that this factor is only relevant for air-borne waves being reflected from the ground surface, with certain frequencies slightly absorbed by the vegetation.

3.5.6 Existing Ambient Sound Levels

Sound pressure levels were measured in the vicinity of the PoL between 23 and 26 May 2025, with average day- and night-time data indicating ambient sound levels typical of a quiet urban noise district. Noise levels closer to the port area where higher – with noises from an operational crane and port activities clearly audible and dominant, with ambient sound levels further from the port area more typical of a coastal area where natural noises dominate. Depending on the prevailing ambient sound levels (due to birds, wind and wave action), noises from the port activities were audible up to 750m from the port.

The results and findings of the ambient sound level measurements are summarised in **Section 5.2**.

3.6 POTENTIAL NOISE-SENSITIVE RECEPTORS (DEVELOPMENTS) AND NO-GO AREAS

Potentially sensitive receptors, also known as noise-sensitive developments ("NSR"), located near the project area was identified using Google Earth®, considering comments raised during the Environmental Clearance Certificate renewal process for the PoL land operations. A number of NSR locations were identified based on these comments, with representative NSR locations illustrated in **Figure 3-2**.

Generally, noises from such industrial activities:

- could be high and very significant within 200 m both night and day;
- can be significant at NSR locations staying within 500 m from active industrial activities, with noise levels at a sufficient level to be considered disturbing at night;
- are normally limited to a distance of approximately 1,000 m from the active industrial activities. Ambient sound levels are increased due to noises from the activities, with the potential noise impact measurable. Noise levels from such activities are generally less than 45 dBA further than 1,000 m from such activities.
- may be audible from active mining and industrial activities up to a distance of 4,000 m at night (depending on the prevailing ambient sound levels). Industrial noises are normally of a low concern at distances greater than 2,000 m from activities at night.

3.7 COMMENTS REGARDING NOISE RECEIVED DURING THIS PROJECT

A number of comments were raised during the Environmental Clearance Certificate renewal process for the PoL land operations. This includes a general concern about noise raised by:

- Public using the Shark Island government camping site;
- Representatives of the Nama and Herero communities in the area.

There are also a number of commercial accommodation facilities in the near vicinity of the port area, with GPT requesting that they be added as NSR locations.

3.8 LEGISLATIVE REQUIREMENTS AND TERMS OF REFERENCE

Namibia currently do not have any specific guidelines, standards or regulations covering environmental noise, and this assessment will lean on international standards and guidelines. Most important would be the SANS 10328 (roughly based on British Standard 5228) and SANS 10103 (roughly based on International Standards Organization (ISO) document 1996.

In South Africa, the document that addresses the issues specifically concerning environmental noise is SANS 10103:2008. It provides the maximum average ambient noise levels during the day and night to which different types of developments should be exposed.

SANS 10328 specifies the methodology to assess the potential noise impacts on the environment due to a proposed activity. This standard also stipulates the minimum requirements to be investigated for environmental impact assessment ("EIA") purposes. These minimum requirements are:

1. The purpose of the investigation – **section 3.1**;
2. A brief description of the planned development or the changes that are being considered – **section 3.2**;
3. A brief description of the existing environment – **section 5**;
4. The identification of the noise sources that may affect the particular development, together with their respective estimated sound pressure levels or sound power levels (or both) – **section 5.2.1**;
5. The identified noise sources that were not taken into account and the reasons why they were not investigated – **section 5.2.1**;
6. The identified noise-sensitive developments and the estimated impact on them – **sections 3.6**, **9** and **10**;
7. Any assumptions made with regard to the estimated values used – **section 8**;
8. An explanation, either by a brief description or by reference, of the methods that were used to estimate the existing and predicted rating levels – **section 7**;
9. The location of the measurement or calculation points, i.e., a description, sketch or map – **section 9**;
10. Estimation of the environmental noise impact – **sections 9** and **10**;

11. Alternatives that were considered and the results of those that were investigated – **section 9.4**;
12. A list of all the interested or affected parties that offered any comments with respect to the environmental noise impact investigation – **section 3.7**;
13. A detailed summary of all the comments received from interested or affected parties as well as the procedures and discussions followed to deal with them – **section 3.7**;
14. Conclusions that were reached – **section 13**;
15. Recommendations, i.e., if there could be a significant impact, or if more information is needed, a recommendation that an environmental noise impact assessment be conducted – **section 13**; and
16. If remedial measures will provide an acceptable solution, which would prevent a significant impact, these remedial measures should be outlined in detail and included in the final record of decision if the approval is obtained from the relevant authority. If the remedial measures deteriorate after a certain time and a follow-up auditing or maintenance programme (or both) is instituted, this programme should be included in the final recommendations and accepted in the record of decision if the approval is obtained from the relevant authority – **section 11**.

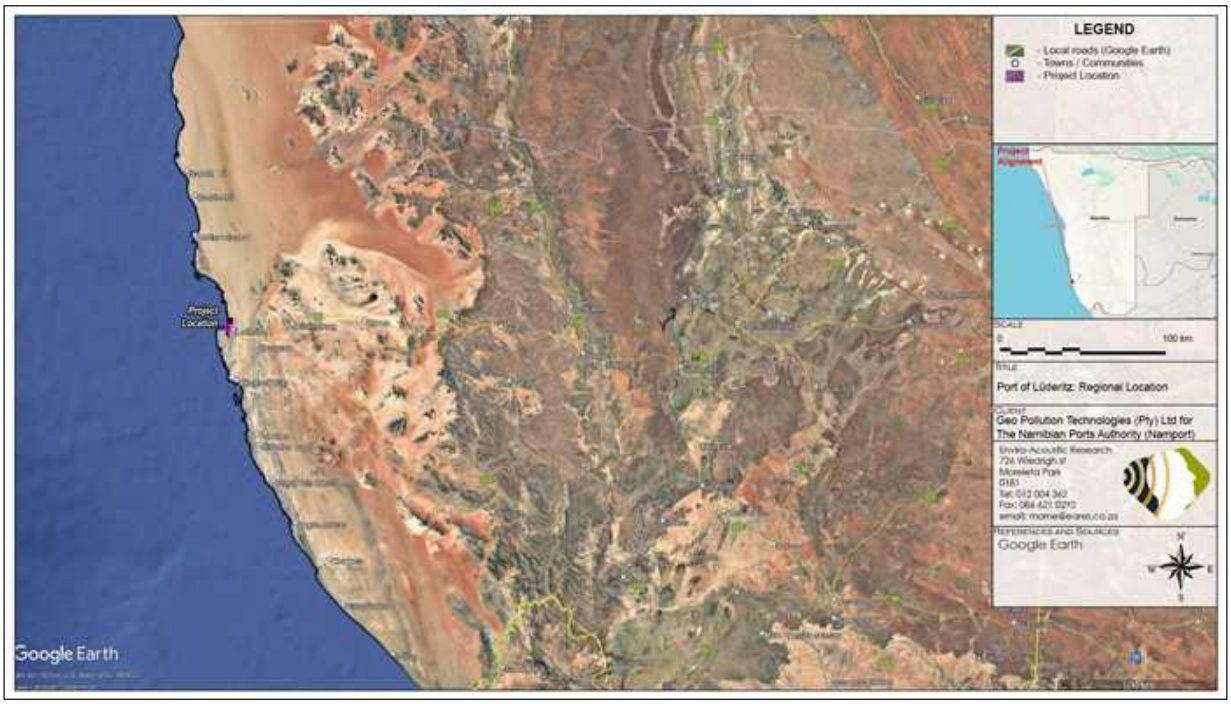


Figure 3-1: Aerial image indicating the regional location of the proposed PoL Expansion Project



Figure 3-2: Aerial image indicating identified potential NSR close to PoL Expansion Project

4 LEGAL CONTEXT, POLICIES AND GUIDELINES

4.1 THE ENVIRONMENT MANAGEMENT ACT (ACT 7 OF 2007)

The Act provides for administrative mechanisms such as the necessity of environmental clearance certificates and environmental assessments. The impact of activities on the environment has to be considered and interested or affected parties have to be given an opportunity to participate in environmental assessment when Government institutions or private persons are intending or planning anything likely to have a significant effect on the environment. With regard to such activities, environmental assessments have to be conducted before any decisions are made. For specific activities or projects having an environmental impact, an environmental clearance certificate is required. This Act however does not specifically address noise.

4.2 LEGISLATION IN PREPARATION: POLLUTION CONTROL AND WASTE MANAGEMENT BILL

The bill aims to promote sustainable development, and, in terms of noise, regulate the discharge of pollutants to the air, water and land, including noise, dust and odour pollution. This bill however does not set any noise limits and this assessment will consider the examples set in the International Guidelines and Legislation.

4.3 NOISE STANDARDS (SOUTH AFRICA)

There are a few South African scientific standards (SABS) relevant to noise from developments, industry and roads. They are:

- SANS 10103:2008. 'The measurement and rating of environmental noise with respect to annoyance and to speech communication'.
- SANS 10328:2008. 'Methods for environmental noise impact assessments'.

The relevant standards use the equivalent continuous rating level (calculated from the sound pressure levels over the reference time, see **Appendix A**) as a basis for determining what is acceptable. The levels may take single event noise into account, but single event noise by itself does not determine whether noise levels are acceptable for land use purposes. With regards to SANS 10103:2008, the recommendations are likely to inform decisions by authorities, but non-compliance with the standard will not necessarily render an activity unlawful *per se.*

4.3.1 SANS 10103:2008

SANS 10103 provide standard procedures to measure and define rating levels with respect to annoyance and speech communication, with a number of important principles discussed in subsections:

- clause 4.1 - Ambient indoor noise;
- clause 4.2 – Typical noise in various districts; and
- clause 4.5 – Assessment of annoyance.

4.3.1.1 Clause 4.1 – Ambient indoor noise

This is a critical section, frequently ignored by authorities and even acoustic specialists. This clause provides recommended rating levels ($L_{Req,T}$) for ambient noise for different areas of occupancy during the time periods when the areas are used for their intended purposes and with the building services (e.g. ventilation systems, air-conditioning systems, lifts, plumbing and lighting) under normal operating conditions. The rating levels given in column 2 of the table are design values, while those given in column 3 are the maximum levels beyond which the ambient noise can be considered to be annoying or otherwise intrusive. Note 2 highlights that, where these levels are used as guidance for the design of buildings in non-residential areas where the ambient noise exceeds the typical level for the type of development, the building design should provide sufficient acoustic isolation to result in the occupancy level specified in Table 1 of SANS 10103 (see example for residential use in **Table 4-1**).

Table 4-1: Recommended ambient noise for different areas of occupancy indoors (Table 1 - SANS 10103:2008)

1	2	3
Types of occupancy or activity	**Design equivalent continuous rating level ($L_{Req,T}$)a for ambient noise dBA**	**Maximum equivalent continuous rating level ($L_{Req,T}$)a for ambient noise dBA**
9. Residential buildings		
Living rooms	35	45
Kitchens and service areas	45	55
Bathrooms and toilets	40	55
Bedrooms	30	40

4.3.1.2 Clause 4.2 – Typical noise in various districts

This section covers typical rating levels ($L_{Req,T}$) for ambient noise in different districts in Table 2 (duplicated in **Table 4-2**). This standard recommends that these values not be exceeded, and outdoor ambient noise exceeding these levels will be considered to be annoying to the community. The levels may be used as a guide for zoning purposes and assumes that a building with natural ventilation and open windows will provide sound

insulation of about 10 dBA, with the rating levels considering Table 1 rating levels. This standard highlight in note 1 that, where occupancies have to be allowed within areas where the acceptable outdoor values are exceeded for the particular type of occupancy, the sound insulation of the building housing the occupancy should be proven to comply to the indoor levels defined in Table 1 (see example for residential use in **Table 4-1**) of this standard.

Table 4-2: Acceptable Zone Sound Levels for noise in districts (Table 2 - SANS 10103:2008)

1	2	3	4	5	6	7
Type of district	**Equivalent continuous rating level ($L_{Req,T}$) for noise dBA**					
	Outdoors			**Indoors, with open windows**		
	Day/night $L_{R,dn}$	**Daytime $L_{Req,d}$**	**Night-time $L_{Req,n}$**	**Day/night $L_{R,dn}$**	**Daytime $L_{Req,d}$**	**Night-time $L_{Req,n}$**
a) Rural districts	45	45	35	35	35	25
b) Suburban districts with little road traffic	50	50	40	40	40	30
c) Urban districts	55	55	45	45	45	35
d) Urban districts with one or more of the following: workshops; business premises; and main roads	60	60	50	50	50	40
e) Central business districts	65	65	55	55	55	45
f) Industrial districts	70	70	60	60	60	50

It must be noted that SANS 10103:2008 does stipulate *"for industries legitimately operating in an industrial district during the entire 24 h day/night cycle, $L_{Req,d} = L_{Req,n} = 70$ dBA can be considered as typical and normal".*

4.3.1.3 Clause 4.5 – Assessment of annoyance

This section recommends investigation only when the rating level ($L_{Req,T}$) of the ambient noise exceeds the rating level ($L_{Req,T}$) of the residual noise (ambient sound levels) at the same location during the relevant time period. The ambient indoor or outdoor sound level should be compared with the appropriate level given in Table 1 (see 4.3.1.1) or Table 2 (see 4.3.1.2). This standard state that it is probable that the noise is annoying or otherwise intrusive to the community or to a group of persons if the rating level of the ambient noise under investigation exceeds the applicable of the following:

a) the rating level of the residual noise (determined in the absence of the specific noise under investigation);
b) the maximum rating level for the ambient noise given in table 1 (see example for residential use in **Table 4-1**); or

c) the typical rating level for the ambient noise for the applicable environment given in table 2 (duplicated in **Table 4-2**). The probable community or group response to the excess ($\Delta L_{Req,T}$) is given in **Figure 4-1**.

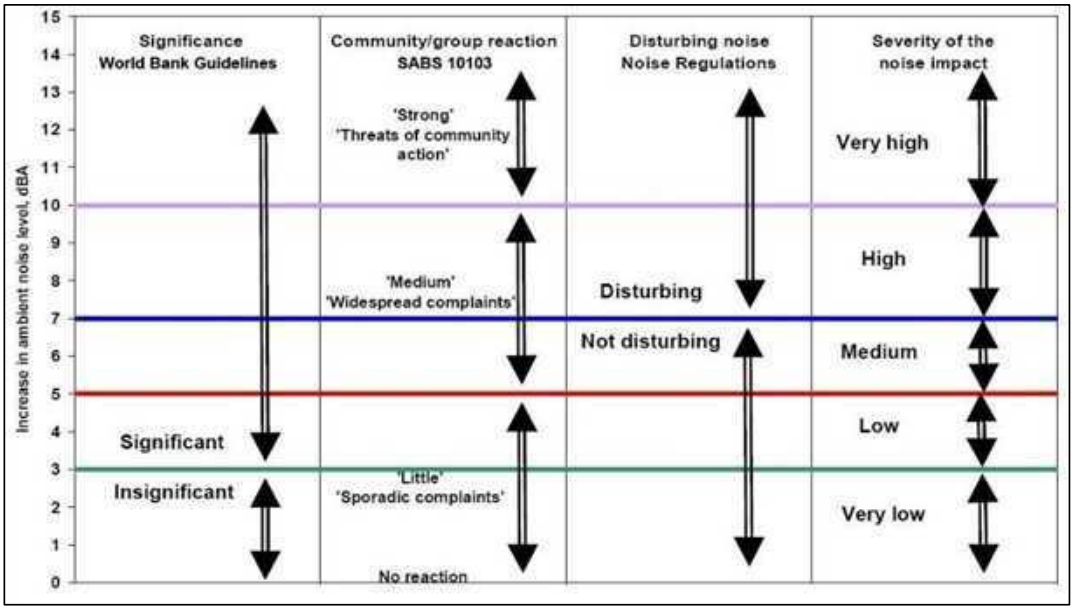


Figure 4-1: Criteria to assess the significance of impacts stemming from noise

4.3.2 SANS 10328:2008

SANS 10328 recommends that the procedures given in clause 6 to clause 8 (inclusive) be followed if:

a) an application, in respect of any activities identified in terms of the current relevant legislation are proposed, if noise sources listed in clauses 3.17 and 3.18 (of of SANS 10328) are to be developed, or the issues listed in clause 5 (of SANS 10328) may take place, is made to the relevant authority;
b) an application for a noise-sensitive development (see 3.16 of SANS 10328) is made to the relevant authority;
c) an application for a change in land use is made to the relevant authority; or
d) an environmental noise impact investigation is requested by an applicant or any interested or affected party.

4.4 INTERNATIONAL GUIDELINES

While a number of international guidelines and standards exists, those selected below are used by numerous countries for environmental noise management.

4.4.1 Guidelines for Community Noise (WHO, 1999)

The World Health Organisation's (WHO) document on the *Guidelines for Community Noise* is the outcome of the WHO expert task force meeting held in London, United Kingdom, in April 1999. It is based on the document entitled "Community Noise" that was prepared for the WHO and published in 1995 by the Stockholm University and Karolinska Institute.

The scope of WHO's effort to derive guidelines for community noise is to consolidate actual scientific knowledge on the health impacts of community noise and to provide guidance to environmental health authorities and professionals trying to protect people from the harmful effects of noise in non-industrial environments. It discusses the specific effects of noise on communities including:

- Interference with communication, noise-induced hearing impairment, sleep disturbance effects, cardiovascular and psychophysiological effects, mental health effects, effects on performance, annoyance responses and effects on social behaviour.

It further discusses how noise can affect (and propose guideline noise levels) specific environments such as residential dwellings, schools, preschools, hospitals, ceremonies, festivals and entertainment events, sounds through headphones, impulsive sounds from toys, fireworks and firearms, and parklands and conservation areas.

To protect the majority of people from being affected by noise during the daytime, it proposes that sound levels at outdoor living areas should not exceed 55 dB L_{Aeq} for a steady, continuous noise. To protect the majority of people from being moderately annoyed during the day, the outdoor sound pressure level should not exceed 50 dB L_{Aeq}. At night, equivalent sound levels at the outside façades of the living spaces should not exceed 45 dBA and 60 dBA L_{Amax} so that people may sleep with bedroom windows open. It is critical to note that this guideline requires the sound level measuring instrument to be set on the "fast" detection setting.

4.4.2 European Parliament Directive 200/14/EC (2000)

Directive 2000/14/EC relating to the noise emission in the environment by equipment for use outdoors was adopted by the European Parliament and the Council and first published in May 2000 and applied from 3 January 2002. The directive placed sound power limits on equipment to be used outdoors in a suburban or urban setting. Failure to comply with these regulations may result in products being prohibited from being placed on the EU market. Equipment list is vast and includes machinery such as compaction machineries, dozers, dumpers, excavators, etc. Manufacturers as a result started to consider noise emission levels from their products to ensure that their equipment will continue to have a market in most countries.

4.4.3 Equator Principles (2003)

The **Equator Principles** (EPs) are a voluntary set of standards for determining, assessing and managing social and environmental risk in project financing. Equator Principles Financial Institutions (EPFIs) commit to not providing loans to projects where the borrower will not or is unable to comply with their respective social and environmental policies and procedures that implement the EPs.

The EPs were developed by private sector banks and were launched in June 2003. The banks chose to model the EPs on the environmental standards of the World Bank and the social policies of the International Finance Corporation (IFC). As of March 2021, one hundred and sixteen (116) financial institutions (in 37 different countries) have adopted the EPs, which have become the de facto standard for banks and investors on how to assess major development projects around the world. The environmental standards of the World Bank have been integrated into the social policies of the IFC since April 2007 as the IFC Environmental, Health and Safety (EHS) Guidelines.

4.4.4 IFC: General EHS Guidelines – Environmental Noise Management (2007)

These guidelines are applicable to noise created beyond the property boundaries of a development that conforms to the EPs. The environmental standards of the World Bank have been integrated into the social policies of the IFC since April 2007 as the International Finance Corporation Environmental, Health and Safety (EHS) Guidelines.

It states that noise prevention and mitigation measures should be applied where predicted or measured noise impacts from project facilities/operations exceed the applicable noise level guideline at the most sensitive point of reception. The preferred method for controlling noise from stationary sources is to implement noise control measures at source. It goes as far as to propose methods for the prevention and control of noise emissions, including:

- Selecting equipment with lower sound power levels;
- Installing silencers for fans;
- Installing suitable mufflers on engine exhausts and compressor components;
- Installing acoustic enclosures for equipment casing radiating noise;
- Improving the acoustic performance of constructed buildings, apply sound insulation;
- Installing acoustic barriers without gaps and with a continuous minimum surface density of 10 kg/m^2 in order to minimise the transmission of sound through the barrier. Barriers should be located as close to the source or to the receptor location to be effective;
- Installing vibration isolation for mechanical equipment;
- Limiting the hours of operation for specific pieces of equipment or operations, especially mobile sources operating through community areas;

- Re-locating noise sources to less sensitive areas to take advantage of distance and shielding;
- Placement of permanent facilities away from community areas if possible;
- Taking advantage of the natural topography as a noise buffer during facility design;
- Reducing project traffic routing through community areas wherever possible;
- Planning flight routes, timing and altitude for aircraft (airplane and helicopter) flying over community areas; and
- Developing a mechanism to record and respond to complaints.

It sets noise level guidelines (see **Table 4-3**) and highlights certain monitoring requirements pre- and post-development. It adds another criterion in that the existing background ambient noise level should not rise by more than 3 dBA. This criterion will effectively sterilize large areas of any development. Therefore, it is EARES's considered opinion that this criterion was introduced to address cases where the existing ambient noise level is already at, or in excess of the recommended limits.

Table 4-3: IFC Table 7.1-Noise Level Guidelines

Receptor type	One hour L_{Aeq} (dBA)	
	Daytime 07:00 - 22:00	Night-time 22:00 – 07:00
Residential; institutional; educational	55	45
Industrial; commercial	70	70

The document uses the $L_{Aeq,1hr}$ noise descriptors to define noise levels. It does not determine the detection period, but refers to the IEC standards, which requires the fast detector setting on the Sound Level Meter during measurements in Europe.

4.4.5 Night Noise Guidelines for Europe (WHO, 2009)

Refining previous Community Noise Guidelines issued in 1999, and incorporating more recent research, the WHO has released a comprehensive report on the health effects of night-time noise, along with new (non-mandatory) guidelines for use in Europe. Rather than a maximum of 30 dB inside at night (which equals 45-50 dB max outside), the WHO now recommends a maximum year-round outside night-time noise average of 40 dB to avoid sleep disturbance and its related health effects. The report notes that only below 30 dB (outside annual average) are "*no significant biological effects observed*," and that between 30 and 40 dB, several effects are observed, with the chronically ill and children being more susceptible; however, "*even in the worst cases the effects seem modest*." Elsewhere, the report states more definitively, "*There is no sufficient evidence that the biological effects observed at the level below 40 dB (night, outside) are harmful to health*." At levels over 40

dB "*Adverse health effects are observed*" and "*many people have to adapt their lives to cope with the noise at night. Vulnerable groups are more severely affected*."

The 184-page report offers a comprehensive overview of research into the various effects of noise on sleep quality and health (including the health effects of non-waking sleep arousal), and is recommended reading for anyone working with noise issues. The use of an outdoor noise standard is in part designed to acknowledge that people do prefer to leave windows open when sleeping, though the year-long average may be difficult to obtain (it would require longer-term sound monitoring than is usually budgeted for by either industry or neighbourhood groups).

While recommending the use of the average level, the report notes that some instantaneous effects occur in relation to specific maximum noise levels, but that the health effects of these "cannot be easily established."

4.4.6 Environmental Noise Guidelines for the European Region (WHO, 2018)

This document identifies levels at which noise has significant health impacts and recommends actions to reduce exposure. Compared to previous WHO guidelines on noise, this version contains five significant developments:

- Stronger evidence of the cardiovascular and metabolic effects of environmental noise;
- Inclusion of new noise sources, namely wind turbine noise and leisure noise, in addition to noise from transportation (aircraft, rail, and road traffic);
- Use of a standardised approach to assess the evidence;
- A systematic review of evidence, defining the relationship between noise exposure and risk of adverse health outcomes;
- Use of long-term average noise exposure indicators to better predict adverse health outcomes.

5 CURRENT ENVIRONMENTAL SOUND CHARACTER

5.1 EFFECT OF SEASON ON SOUND LEVELS

Natural sounds are a part of the environmental noise surrounding humans. In rural areas the sounds from insects and birds would dominate the ambient sound character, with noises such as wind flowing through vegetation increasing as wind speed increase. Work by Fégeant (2002) stressed the importance of wind speed and turbulence causing variations in the level of vegetation-generated noise. In addition, factors such as the season (e.g., dry or no leaves versus green leaves), the type of vegetation (e.g., grass, conifers, deciduous), the vegetation density and the total vegetation surface all determine both the sound level as well as spectral characteristics.

Ambient sound levels are significantly affected by the area where the sound measurement location (or a listener) is situated. When the sound measurement location is situated within an urban area, close to industrial plants or areas with a constant sound source (ocean, rivers, etc.), seasons and higher wind speeds may have an insignificant impact on ambient sound levels.

Sound levels in undeveloped rural areas (away from occupied dwellings), however, are impacted by changes in season for a number of complex reasons. The two main reasons are:

- Faunal communication is more significant during the warmer spring and summer months as various species communicate in an effort to find mates. Faunal communication is normally less during the colder months, with ambient sound levels measured during the winter period frequently being very low.
- The occurrence of temperature inversions, see **Sub Section 5.1.1**, and
- Seasonal changes in weather patterns, mainly due to increased wind speeds (also see **Sub Section 5.1.2 5.1.1**below) and potential gustiness of the wind.

For environmental noise, weather plays an important role. The greater the separation distance, the greater the influence of the weather conditions, so, from day to day, a road 1,000 m away can sound very loud or can be completely inaudible. Other, environmental factors that impact on sound propagation includes wind, temperature and humidity, as discussed in the sub-sections below.

Ambient sound levels are generally less during the colder months (due to less faunal communication) and higher during the warmer months.

5.1.1 Effect of Temperature inversions

On a typical sunny afternoon, the air is the hottest near the ground surface and temperature decreases at higher altitudes. This temperature gradient causes sound waves to refract upward, away from the ground and results in lower noise levels being heard at a measurement location. In the evening, this temperature gradient will reverse, but, during certain meteorological conditions, the normal vertical temperature gradient could be inverted so that the air is colder near the surface, with a warmer layer blanketing the lower layer. This is illustrated in **Figure 5-1** below.

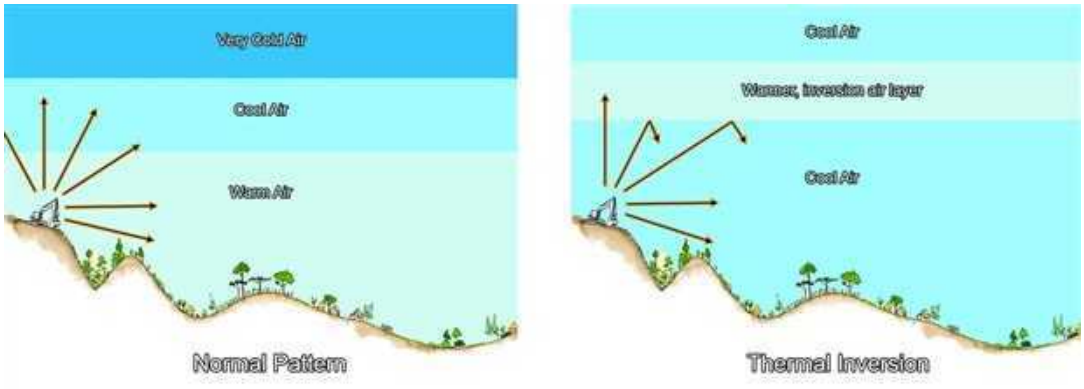


Figure 5-1: Influence of temperature inversions on the propagation of sound

When such an inversion layer is present, some of the sound waves will be refracted[1] by the temperature gradient, with the refracted sound waves returned to the ground. This effect has been noticed near airports and roads, where noises can be heard over greater distances at night than other times of day (Parnell, 2015; Saurenman, 2005; Van der Berg, 2003) for various industries.

Like wind gradients, temperature gradients can influence sound propagation over long distances, complicate sound level measurements as well as propagation modelling.

5.1.2 Effect of Wind

Wind alters sound propagation by the mechanism of refraction, that is, wind bends sound waves. Wind nearer to the ground moves more slowly than wind at higher altitudes, due to surface characteristics such as hills, trees, and man-made structures that interfere with the wind. This wind gradient, with faster wind at higher elevation and slower wind at lower elevation, causes sound waves to bend downward when they are traveling to a location downwind of the source and to bend upward when traveling toward a location upwind of the

[1] Redirecting the wave propagation direction due to a change in the density of the air which influence the speed of sound.

source. Waves bending downward means that a listener standing downwind of the source will hear louder noise levels than the listener standing upwind of the source. This phenomenon can significantly impact sound propagation over long distances and when wind speeds are high. Over short distances wind direction has a small impact on sound propagation as long as wind velocities are reasonably slow, i.e., less than 5 m/s.

Wind speed frequently plays a role in increasing sound levels in natural locations. With no wind, there is little vegetation movement that could generate noises and faunal noises (normally birds and insects) dominate, however, as wind speeds increase, the rustling of leaves increases which subsequently can increase sound levels. This directly depends on the type of vegetation in a certain area. The impact of increased wind speed on sound levels depends on the vegetation type (deciduous versus conifers), the density of vegetation in an area, seasonal changes (in winter deciduous trees are bare) as well as the height of this vegetation. This excludes unanticipated consequences, as suitable vegetation may create suitable habitats and food sources attracting birds and insects (and the subsequent increase in faunal communication).

5.2 AMBIENT SOUND LEVEL MEASUREMENTS

Ambient (background) sound levels were measured at a number of locations between 23 and 26 May 2025, including one long-term and 5 short-term measurement locations.

Table 5-1: Details of Sound Level Equipment used for short-term measurements

Equipment	Model	Serial no	Calibration Date
Sound Level Meter 1	SVAN 977	36176	Feb 2024
Pre-amplifier	SV 12L	25685	Feb 2024
Microphone	ACO 7052E	49596	Feb 2024
Sound Level Meter 2	Svan 977	34160	October 2024
Pre-amplifier	SV 12L	32395	October 2024
Microphone	ACO 7052E	54645	October 2024
Calibrator	Quest CA-22	J 2080094	July 2024

The sound pressure level measurement locations are illustrated in **Figure 5-2**, with the results of the short-term measurements discussed in **Table 5-2** (NPSTSL01), **Table 5-3** (NPSTSL02), **Table 5-4** (NPSTSL03), **Table 5-5** (NPSTSL04) and **Table 5-6** (NPSTSL05). Short-term measurements were collected over a period of 1-hour each. The long-term measurements are discussed in **section 5.2.1**.



Figure 5-2: Localities where ambient sound levels were measured

Table 5-2: Summary of the ambient sound levels measured at location NPSTSL01

Date - Time	L_{Amax}	L_{Aeq}	L_{A90}	L_{Amin}	Comments[2] (Photo of the measurement location presented in **Appendix B**)
23/05 - 18:15	62.8	49.5	46.9	43.5	D. Mostly water noises for surf against rock. Voices and music from camping areas. Impulsive noises every few minutes from port area (skip hitting side of ship). Passing vehicle around every 10 minutes slight impact on measurement. A. Surf against rocks. Music from campers. Voices for surrounding campers. Humming noise from Pescanova factory. Noises from port area with material being loaded (crane engine noises). Impulsive noises at times from port area. Passersby at times. Birds at times.
24/05 - 04:05	59.7	47.6	45.5	42.9	D. Surf waves against rocks significant. Impulsive noises at times from port area. Humming noise from port. Bird noises at times (calls quite loud at times). A. Relative constant noises from port area (suspected from the crane). Birds and wave noises. BA. Some wind-induced noises during quiet periods.
24/05 - 15:00	64.6	47.2	43	40.1	D. Surf against rocks. Passing vehicles at times. Bird sounds at times. A. Surf sounds. Hum from port area. Impulsive noises at times from port area.
25/05 - 08:20	53.5	47.7	44.4	43.3	D. Surf against rocks together with bird noises. Passing vehicles at times. Impulsive noises at times from port area. A. Surf sounds. Hum from port area. Impulsive noises at times from port area.
25/05 - 14:00	73.8	50.3	47.6	45.2	D. Waves. A. Waves. Hum from port area. Wind- induced noises at times. Birds at times. 2 – 5 m/s wind from direction of port.
25/05 - 21:16	57.9	51.9	48.2	46.4	D. Waves. Occasional impulsive noises. Music from camping area. A. Waves. Hum from port area. Wind- induced noises at times. Birds at times. Voices at times from campers. BA. Birds. Hum from Pescanova area. Hum from port. 2 – 5 m/s wind from direction of port.

[2] D. (Dominant noise) – Noise that have a clear visible impact on measurement. A. (Audible) – Noise that is generally audible when dominant noises are not present, likely the source of the L_{A90} value. BA. (Barely Audible) – Sounds that can only heard during quieter periods, generally not influencing measurement.

Table 5-3: Summary of the ambient sound levels measured at location NPSTSL02

Date - Time	L_{Amax}	L_{Aeq}	L_{A90}	L_{Amin}	**Comments (**Photo of the measurement location presented in **Appendix B)**
23/05 - 19:30	56.8	40.5	39.1	37.3	D. Waves on rocks. Birds, especially seagulls. A. Birds. Noises from port area (humming noise, reverse alarms at times). Voices from campers in area. Vehicles in distance at times. BA. Music from campers. Fan noises or humming from port area (likely crane).
24/05 - 05:20	45.9	41.9	40.5	39.5	D. Waves on rocks. Birds at times. A. Waves and birds. BA. Voices. Waves. Birds. Impulsive noises from port area (likely crane).
24/05 - 16:15	51.3	37.9	36.1	34.2	D. Waves on rocks. Birds. A. Birds. Noises from port area (humming noise, reverse alarms at times). Voices from campers in area. Vehicles in distance at times. BA. Music from campers. Fan noises or humming from port area.
25/05 - 09:35	50.4	38.6	36.8	35.9	D. Waves on rocks. Birds. Reverse alarms from port area. A. Birds. Noises from port area (humming noise, reverse alarms at times). Voices from campers in area. Vehicles in distance at times. BA. Fan noises or humming from port area.
25/05 - 15:20	51.9	43.6	41.7	40.5	D. Waves on rocks. Wind induced noises. Hum from port with reverse alarms. A. Waves and birds. Voices at times. Hum from port area. *3 - 5 m/s wind from port area during measurement*
25/05 - 22:30	46.1	43.5	42.3	41.7	D. Waves on rocks. Wind induced noises. Hum from port with reverse alarms. A. A. Waves and birds. Voices at times. Hum from port area. *3 - 5 m/s wind from port area during measurement*

Table 5-4: Summary of the ambient sound levels measured at location NPSTSL03

Date - Time	L_{Amax}	L_{Aeq}	L_{A90}	L_{Amin}	**Comments (**Photo of the measurement location presented in **Appendix B)**
23/05 - 20:40	62.3	54.9	52.4	50.8	D. Port activities, especially noises from humming noise from crane doing loading of ore. Reverse alarms at times. A. Truck moving around on port area. Large static crane and small mobile crane/lift used to move containers. Reverse alarms at times. Seagulls at times. BA. Seagulls in distance.
24/05 - 06:35	69.2	55.6	52.3	50.7	D. Port noises, mainly from humming noise from crane. Reverse alarms at times A. Birds and port noises.

25/05 - 16:45	66.4	54.6	51.9	49.4	D. Port noises, humming noise from crane. Other port noises at times (vehicles moving around, reverse alarms at times). A. Port noises, crane, with other noises at times (vehicles moving around, reverse alarms at times). BA. Traffic in far distance at times. Engine or unidentifiable noise from Pescanova factory direction. Voices in far distance.

Table 5-5: Summary of the ambient sound levels measured at location NPSTSL04

Date - Time	L_{Amax}	L_{Aeq}	L_{A90}	L_{Amin}	Comments
24/05 - 07:50	68.7	52.4	47.2	44.2	D. Port noises (large crane, some impulsive noises at times, container crane/lift). Passing vehicles at times (during event). A. Port noises. Seagulls at times. *Site is not as noisy as NPSTSL03, likely due to buildings acting as noise barrier.*
24/05 - 17:30	53.2	49.7	46.8	46.4	As previous

Table 5-6: Summary of the ambient sound levels measured at location NPSTSL05

Date - Time	L_{Amax}	L_{Aeq}	L_{A90}	L_{Amin}	Comments (Photo of the measurement location presented in **Appendix B**)
24/05 - 10:15	65.5	52.8	50.5	47.9	D. Port noises (crane, traffic, reverse alarms). Impulsive noises due to skip hitting side of boat opening (cover of opening). Birds at times. A. Port noises. Birds. Passing vehicles. *During crane idle (crane not moving - fan or engine noise), noise level 49 - 51 dBA. Cycle around 6 - 9 minutes, with maximum noise around 56 - 59 dBA for a few seconds. Fans or engine from crane likely source of constant humming noise.*
25/05 - 18:50	74.5	52.3	50.6	50.1	D. Port noises (crane, traffic, reverse alarms). Birds at times. A. Port noises. Birds. Passing vehicles.
26/05 - 06:40	65.6	47.7	44	43.1	D. Port noises (traffic, reverse alarms). Crane not operating during measurement. A. Various port noises. Voices in distance. Birds. Vehicles during passing. Unidentified impulsive noises from port area.

5.2.1 Ambient Sound Level Measurement Location – NPLTSL00

The microphone was deployed on a small grassed section next to the house, with vehicles passing on the Kreplin road clearly audible and visible. There was a significant rocky outcrop between the microphone and the existing port area. **Table 5-7** defined sounds heard during equipment deployment and collection, with a photo of the measurement location presented in **Appendix B**.

Table 5-7: Noises/sounds heard during site visits at NPLTSL00

Noises/sounds heard during onsite investigations		
Magnitude Scale Code: •Barely Audible •Audible •Dominating	**During equipment deployment**	
	Faunal and Natural	Seagulls clearly audible. Ocean noises (waves on rocks audible)
	Sounds associated with the household	Voices at times (during deployment of instrument).
	Industrial & transportation	Passing vehicles (at times, during passing event). *Though not audible, the property owner mentioned that port activities were audible at times.*
	During equipment collection	
	Faunal and Natural	Birds clearly audible and generally dominant. Ocean noises (waves on rocks audible)
	Sounds associated with the household	-
	Industrial & transportation	-

Fast time-weighted equivalent sound levels $L_{AFeq,10min}$ are presented in **Figure 5-3** and summarised in **Table 5-8** below. The maximum (L_{Amax}), minimum (L_{Amin}) and 90th percentile (L_{A90}) statistical values are illustrated in **Figure 5-4**.

The L_{A90} level is presented in this report to define the "background ambient sound level", or the sound level that can be expected if there were little single events (loud transient noises) that impacts on average sound level. It is used in a number of international countries as the sound descriptor to describe the "background noise level". The L_{A90} level is elevated both day and night and higher than the ambient sound levels expected for an urban noise district, indicating the presence of a constant background noise in the area. Average spectral data indicate that a noise with a relative broadband character effects the background noise levels.

There were a number of times when the maximum noise levels exceeded 65 dBA at night, though this happened less than 10 times at night. The source(s) of the maximum noises were not investigated, though is it suspected that seagull noises were the main source. If maximum noise levels exceed 65 dBA more than 10 times at night, it may increase the

probability where a receptor may be awakened at night, ultimately impacting on the quality of sleep[3].

Table 5-8: Sound level descriptors as measured at NPLTSL00

	$L_{Amax,i}$ (dBA)	$L_{Aeq,f}$ (dBA)	$L_{A90,f}$ (dBA90)	$L_{Amin,f}$ (dBA)
Day arithmetic average	-	45.5	38.5	-
Night arithmetic average	-	41.4	35.2	-
Day equivalent	-	49.5	-	-
Night equivalent	-	42.3	-	-
Day minimum	-	38.0	-	30.9
Day maximum	90.1	62.0	-	-
Night minimum	-	35.2	-	29.1
Night maximum	80.8	48.9	-	-

The numerous 10-minute measurements are further classified for the day- and night-time periods in terms of the SANS 10103:2008 typical noise district areas (see **Table 4-2**) in **Figure 5-5** (night) and **Figure 5-6** (day).

5.3 AMBIENT SOUND LEVELS – FINDINGS AND SUMMARY

Excluding the short-term measurements (1-hr equivalent), the measurements done from 23 – 26 May 2025 resulted in more than 240 daytime and 144 night-time (22:00 – 06:00) measurements. Each measurement was collected over a 10-minute period and included a number of sound level descriptors, including; equivalent values, minimum and maximum levels, statistical sound levels as well as spectral information.

Considering the recommended noise limits as defined by the IFC (see **section 4.4.4**), recommended upper noise limits would be:

- 55 dBA for daytime residential use; and
- 45 dBA for night-time residential use.

In cases where existing ambient sound levels are higher than the recommended noise limit, the introduced noise should not change the sound levels with more than 3 dBA.

IFC also recommend an upper noise level of 70 dBA at the boundary of the project.

(3) World Health Organization, 2009, '*Night Noise Guidelines for Europe.*

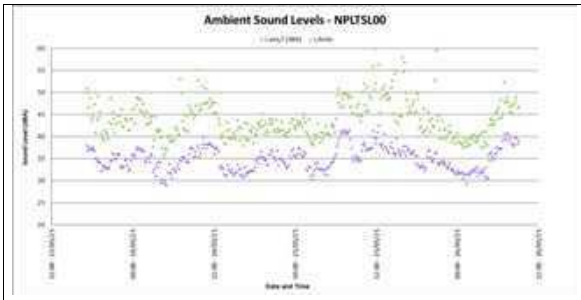


Figure 5-3: Ambient sound levels at NPLTSL00

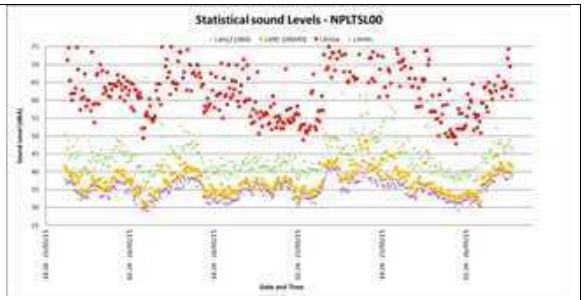


Figure 5-4: Maximum, minimum and statistical values at NPLTSL00

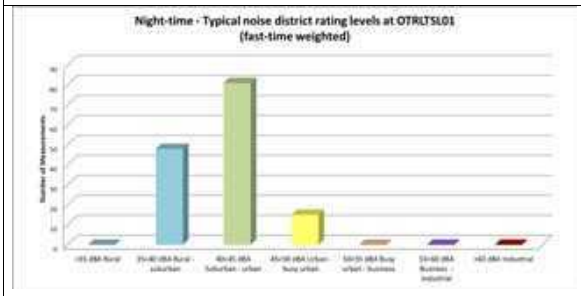


Figure 5-5: Classification of night-time measurements in typical noise districts at NPLTSL00

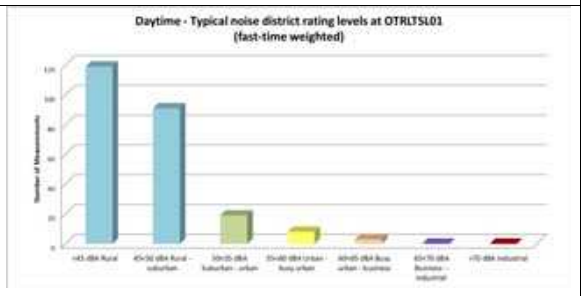


Figure 5-6: Classification of daytime measurements in typical noise districts at NPLTSL00

6 POTENTIAL NOISE SOURCES

Increased noise levels are directly linked with the various activities associated with the construction as well as the operational phases of the expansion project. Noise emitted by the construction and operations can be associated with various noise sources, including mechanical sources due to operation of equipment, material impact noises (such as the noise made when materials are dropped at a height to ground level), electrical noise (reverse hooters from equipment or the "whine" of an electrical pump) and noises from vehicles moving around. While there are existing activities associated with Namport, certain construction activities will result in significant noises.

This noise impact assessment considers conceptual scenarios to estimate the potential impact of noise on the surrounding NSR and the scenarios should not be seen as a reflection of a project schedule, or as a specific noise level at receptors at any specific time. It should be used as a guideline of potential noise levels, that must be used to identify potential source of noise.

This assessment effectively will consider a number of scenarios, namely:

- Scenario 1: Potential noise levels associated with existing operational noises. The noise level contours were developed considering the activities observed during the site visit, activities that can be identified using GoogleEarth images as well as the results of the sound level measurements (see **Figure 5-2** and **Figure 9-1**). It should be noted that commercial railway activities will not be considered;
- Scenario 2: Future noise-generating activities associated with the potential construction activities associated with the expansion project. This scenario mainly considers potential noises from sheet pile driving activities, potential concrete pouring together with the existing noise levels (including Scenario 1 – see **Figure 9-4**);
- Scenario 3: Future noise-generating activities associated with two cranes operating simultaneously at the existing berth area (see also **Figure 9-6** for potential crane locations);
- Scenario 4: Future noise-generating activities associated with two cranes operating simultaneously (one at the existing berth and a second operating at the new berth area) (see also **Figure 9-6** for potential crane locations);
- Scenario 5: Future noise-generating activities associated with three cranes operating simultaneously (one at the existing berth and two operating at the new berth area) (see also **Figure 9-6** for potential crane locations);

- Scenario 6: Future noise-generating activities associated with three cranes operating simultaneously (two at the existing berth and one crane operating at the new berth area – this scenario illustrate the potential mitigation effect from a conceptual 10m building) (see also **Figure 9-6** for potential crane locations, with the position of a conceptual building depicted in **Figure 11-1**).

6.1 POTENTIAL NOISE SOURCES: CONSTRUCTION PHASE

Numerous noise-generating activities and equipment will take place during the construction phase, which will take place concurrently with the existing PoL activities. The two main factors that determine noise levels at a certain location depend on the location where activities are taking place (distance between a noise generating activity and a potential NSR location), as well as the type of activity taking place. Potential construction activities could include:

- Site establishment, including additional land and marine-based equipment to assist with dredging, material handling and logistics etc. This will increase both activities at the at the existing port as well as increase the number of boats and/or barges.
- Dredging activities to remove material covering the rock where the new quay wall must be built.
- Installation of guide piles (followed by sheet piles) to allow for the establishment of a retaining wall (this could include the further piling to assist with installation of reinforced cages, hammer drilling [mainly large compressor and engine noises] and concrete filling [mixing and pumping].
- If required, transport and placing of blocks.
- Form- and engineering work to allow the establishment of the retaining wall (including fitting of pile caps, addition of support systems [bracing frame structure if required], reinforcement, sand filling and compaction, concrete work, etc).
- Water pumping to remove excess water, land reclamation in between the quay wall and the eastern shore of Shark Island (including transport of fill material to the area, compaction, installation of reinforced steel, concrete mixing and pumping, etc).
- Installation of onshore services, i.e., roads, pavements, railway extension, water, sewer, lighting and electricity distribution etc., so that all services in the existing port can simply continue into the extended section.

Of these activities, pile driving and sheet piling activities are the most significant, though impulsive noises associated with material handling (dropping of large steel sheets) would generate high, but transient noises. For the construction noises, this assessment will consider active piling activities (barge with crane and vibratory hammer) near Shark Island, with other activities including:

- Existing Port activities as observed;
- Increased activities along the access route to the expansion area (doubling the potential transport activities along the quay wall); and
- Potential concrete mixing and concrete pumping activities.

There are a number of factors that determine the audibility as well as the potential of a noise impact on receptors. Maximum noises generated can be audible over a large distance, however, are generally of very short duration. This typically contain a noise with an impulsive character (such a material dropping, hammering, etc.) that could increase annoyance with the noise. Maximum noise levels frequently exceeding 65 dBA at a receptor, or if the noise is clearly audible with a significant number of instances where the noise level exceeds the prevailing ambient sound level with more than 15 dB, the noise can increase annoyance levels which may result in noise complaints.

Average or equivalent sound levels are another factor that impacts on the ambient sound levels and is the constant sound level that the receptor can experience. Typical sound power levels associated with various activities that may be found at a construction site is presented in **Table 6-2**.

The noise levels and the octave sound power emission levels used for modelling for the construction (and operational) phase are highlighted in **Table 6-1**.

Table 6-1: Equipment list and Sound power emission levels used for modelling

Equipment	Sound power level, dB re1 pW, in octave band, Hz							Max PWL
Centre frequency	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**(dBA)**
Various equipment and activities								
Concrete Pump (FHWA) - 20% AUF	107.5	108.5	110.5	110.5	113.5	110.5	106.5	117.0
Concrete Truck (FHWA) - 40% AUF	109.2	112.4	111.9	114.9	113.9	112.9	107.1	118.0
Crane (Port of Lüderitz – estimated at 100% AUF)	89	98	101	103	102	102	98	111.0
Pile Driver - Sonic / Vibration	121.6	118.8	125.4	117.8	119	118.6	108.1	124.2
Area noise sources (using the octave sound power characteristics of General Noise)								
General Area Noise (dBA/m^2 re 1 pW)	95.0	100.0	103.0	105.0	105.0	100.0	100.0	55.0
General Area Noise – with expansion activities (dBA/m^2 re 1 pW)	95.0	100.0	103.0	105.0	105.0	100.0	100.0	58.0

Table 6-2: Potential equivalent noise levels generated by various equipment

Equipment Description	Equivalent (average) Sound Levels (dBA)	Operational Noise Level at given distance considering equivalent (average) sound power emission levels simple noise propagation modelling only considering distance) (dBA)											
		5 m	10 m	20 m	50 m	100 m	150 m	200 m	300 m	500 m	750 m	1000 m	2000 m
Air Compressor (Doosan XHP900)	115.3	90.4	84.4	78.3	70.4	64.4	60.8	58.3	54.8	50.4	46.9	44.4	38.3
Bell_D40	109.3	84.4	78.3	72.3	64.4	58.3	54.8	52.3	48.8	44.4	40.8	38.3	32.3
Concrete Pump (FHWA) - 20% AUF	117.0	92.0	86.0	80.0	72.0	66.0	62.5	60.0	56.4	52.0	48.5	46.0	40.0
Concrete Truck (FHWA) - 40% AUF	118.7	93.7	87.7	81.7	73.7	67.7	64.2	61.7	58.2	53.7	50.2	47.7	41.7
Chiller	100.7	75.8	69.8	63.7	55.8	49.8	46.2	43.7	40.2	35.8	32.3	29.8	23.7
Crane (mobile, FM)	107.5	82.5	76.5	70.5	62.5	56.5	53.0	50.5	46.9	42.5	39.0	36.5	30.5
Crane (Port of Lüderitz - estimated at 100% AUF)	107.5	82.5	76.5	70.5	62.5	56.5	53.0	50.5	46.9	42.5	39.0	36.5	30.5
Diamond drilling rig	107.2	82.2	76.2	70.2	62.2	56.2	52.7	50.2	46.7	42.2	38.7	36.2	30.2
Diesel Generator (Large - mobile)	106.1	81.2	75.1	69.1	61.2	55.1	51.6	49.1	45.6	41.2	37.6	35.1	29.1
Diesel loco	110.0	85.1	79.1	73.0	65.1	59.1	55.5	53.0	49.5	45.1	41.6	39.1	33.0
Dryer Stack	102.0	77.0	71.0	65.0	57.0	51.0	47.5	45.0	41.5	37.0	33.5	31.0	25.0
Exhaust Fans	90.6	65.6	59.6	53.5	45.6	39.6	36.0	33.5	30.0	25.6	22.1	19.6	13.5
General noise	108.2	83.3	77.2	71.2	63.3	57.2	53.7	51.2	47.7	43.3	39.7	37.2	31.2
General noise (area)	64.4	39.5	33.4	27.4	19.5	13.4	9.9	7.4	3.9	-0.5	-4.1	-6.6	-12.6
General Noise - Construction (commercial)	96.5	71.6	65.6	59.5	51.6	45.6	42.0	39.5	36.0	31.6	28.1	25.6	19.5
Intake Fans	97.7	72.8	66.8	60.7	52.8	46.8	43.2	40.7	37.2	32.8	29.3	26.8	20.7
JBL TLB	108.8	83.8	77.8	71.8	63.8	57.8	54.3	51.8	48.3	43.8	40.3	37.8	31.8
Pile Driver - Impact	129.4	104.4	98.4	92.4	84.4	78.4	74.9	72.4	68.8	64.4	60.9	58.4	52.4
Pile Driver - Sonic / Vibration	124.2	99.2	93.2	87.2	79.2	73.2	69.6	67.2	63.6	59.2	55.7	53.2	47.2
Pumps (Cavity, slurry, VSD, etc)	89.5	64.5	58.5	52.5	44.5	38.5	35.0	32.5	28.9	24.5	21.0	18.5	12.5
Road Truck average	109.6	84.7	78.7	72.6	64.7	58.7	55.1	52.6	49.1	44.7	41.1	38.7	32.6
Rock Breaker, CAT	120.7	95.7	89.7	83.7	75.7	69.7	66.2	63.7	60.2	55.7	52.2	49.7	43.7
Stepup transformer	97.3	72.4	66.3	60.3	52.4	46.3	42.8	40.3	36.8	32.4	28.8	26.3	20.3

6.2 POTENTIAL OPERATIONAL NOISE-GENERATING ACTIVITIES

Similar to the construction phase, there will be numerous noises generated during the operational phase, with some noise-generating activities taking place simultaneously with other noise-generating activities. This would at least include:

- Increased land-based transport activities, which include trucks entering and leaving the port;
- Noises from ships entering, berthing and leaving the harbour (with some older ships with large engines generating noise with significant low-frequency content);
- Noises from ship auxiliary engines;
- Increased material handling activities, which include forklifts loading or unloading trucks, cranes loading/unloading containers or bulk materials, with this assessment mainly considering the noise from one or more cranes doing loading/off-loading bulk material (the main source of noise as observed during the site visit).

It should be noted that, at any one time, there may be hundreds of activities generating various noises, however not all of these noise-generating activities will operate at the same time. Therefore, when conceptualizing which noise sources to model, it is important to select the most appropriate noise sources (and associated PWL) to consider. Should one model all potential activities that may take place within the port, noise modelling will significantly over-model potential noise levels, yet, similarly, if too little noise sources are selected, potential noise levels may be under-modelled. Fortunately at most projects, there may be only a few activities that generate most noises, with the loading/unloading activities identified as the activity that generates most of the noise.

This assessment therefore considers the results of the noise level measurements as well as visual observations to estimate the existing and potential future noise levels. Potential future noise levels will therefore will be similar to the existing noises, though there will be more activities taking place simultaneously at different locations. This assessment will consider a simplified noise model, using PWLs as associated with loading/unloading activities (using a crane), as well as an area noise source (to account for various other undefined noises, including transport, forklifts, voices, motors, etc. A list of noise-generating equipment (and activities) that were used for noise modelling are defined in **Table 6-1**, with the calculated noise level contours representing the likely long-term equivalent (average) noise level. These contours should not be seen as the potential audibility of noises from the port activities, which is more a function of maximum noise events, the character of the noise as well as the prevailing ambient sound levels.

As with all noises, the audibility, as well as the potential of a noise impact on receptors, is determined by factors such as the sound character, spectral frequencies, number and magnitude of maximum noise events, the typical prevailing ambient sound level that NSR are used to, location(s) where noise generating activities are taking place, time of day [night/day] as well as the attitude of the NSR to the noise source.

6.3 POTENTIAL NOISE SOURCES: FUTURE NOISE SCENARIO – DECOMMISSIONING

The potential for a noise impact to occur during the decommissioning and closure phases will be much lower than that of the construction and/or operational phases. This is because:

1. Decommissioning activities normally are limited to the daytime period, due to the lower urgency to complete this phase; and
2. Decommissioning activities normally use smaller and less equipment, generating less noise than the typical construction or operational phases.

As such, the significance of the noise impact for decommissioning will be less than typical daytime operational activities. However, decommissioning of the port is not anticipated or considered in the medium or long-term and this assessment will not consider potential decommissioning activities.

7 METHODS: NOISE IMPACT ASSESSMENT AND SIGNIFICANCE

7.1 NOISE IMPACT ON ANIMALS[4]

A significant amount of research was undertaken during the 1960's and 70's on the effects of aircraft noise on animals. While aircraft noise has a specific characteristic that might not be comparable to industrial noise, the findings should be relevant to most noise sources. A general animal behavioural reaction to aircraft noise is the startle response with the strength and length of the startle response to be dependent on the following:

- which species is exposed;
- whether there is one animal or a group of animals, and
- whether there have been some previous exposures.

Overall, the research suggests that species differ in their response to noise depending on the duration, magnitude, characteristics and source of the noise, as well as how accustomed the animals are to the noise (previous exposure).

Extraneous noises impact on animals as it can increase stress levels and even impact on their hearing. Masking sounds may affect their ability to react to threats, compete and seek mates and reproduce, hunt and forage, communicate and generally to survive.

Unfortunately, there are numerous other factors in the faunal environment that also influence the effects of noise. These include predators, weather, changing prey/food base and ground-based disturbance, especially anthropogenic. This hinders the ability to define the real impact of noise on animals.

The only animal species studied in detail are humans, and studies are still continuing in this regard. These studies also indicate that there is considerable variation between individuals, highlighting the loss of sensitivity to higher frequencies as human's age. Sensitivity also varies with frequency with humans. Considering the variation in the sensitivity to frequencies and between individuals, this is likely similar to all faunal species. Some of these studies are repeated on animals, with behavioural hearing tests being able to define the hearing threshold range for some animals as indicated in **Figure 7-1** below.

Only a few faunal (animal) species have been studied in a bit more detail so far, with the potential noise impact on marine animals most likely the most researched subject, with a

[4]Report to Congressional Requesters, 2005; USEPA, 1971; Autumn, 2007; Noise quest, 2010

few studies that discuss behavioural changes in other faunal species due to increased noises. Few studies indicate definitive levels where noises start to impact on animals, with most based on laboratory level research that subject animals to noise levels that are significantly higher than the noise levels these animals may experience in their environment (excluding the rare case where bats and avifauna fly extremely close to an anthropogenic noise, such as from a moving car or the blades of a wind turbine).

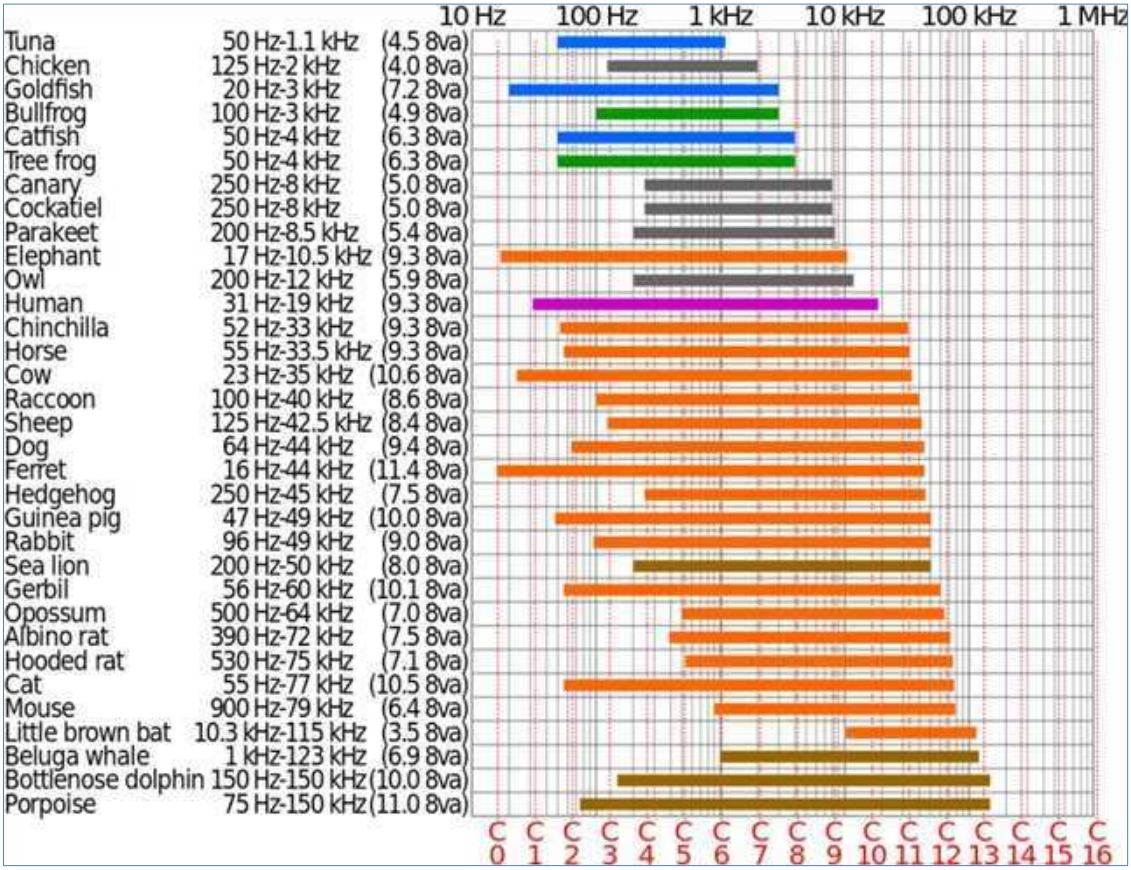


Figure 7-1: Logarithmic Chart of the Hearing Ranges of Some Animals[5]

From these and other studies, the following can be concluded that:

- Animals respond to impulsive (sudden) noises (higher than 90 dBA) by running/flying away. If the noises continue, animals would try to relocate (Drooling, 2007).

[5] https://en.wikipedia.org/wiki/Hearing_range

- Animals start to respond to increased noise levels with elevated stress hormone levels and hypertension. These responses begin to appear at exposure levels of 55 to 60 dBA (Baber, 2009).
- Animals of most species exhibit adaptation to noise (Broucek, 2014), including impulsive noises, by changing their behaviour.
- More sensitive species would relocate to a quieter area, especially species that depend on hearing to hunt or evade prey, or species that makes use of sound/hearing to locate a suitable mate (Drooling, 2007).
- Noises associated with helicopters, motor- and quad bikes do significantly impact on animals. This is due to the sudden and significant increase in noise levels due to these activities.

To date, there are, however, no guidelines or sound limits with regards to noise levels that can be used to estimate the potential significance of noises on animals.

7.1.1 Domestic Animals

It may be that domesticated animals are more accustomed to noise sources of an industrial, commercial or other anthropogenic nature, although exposure to high noise levels may still affect domestic animals' well-being. Sound levels in animal shelters can exceed 100 dB, much more than what can be expected at a domestic dwelling from an industrial, commercial or transportation noise source (10-minute equivalent)[6&7]. The high noise levels may see negative influences on animals' cardiovascular systems and behaviour.

According to Šottník, 2011, noise as high as 80 dB had no negative effect on dairy cows. As noise levels increased (up to 105 dB), feed consumption, milk yield and intensity of milk release decreased.

Unexpected high intensity noise (above 110 dB), such as low altitude jet aircraft overflights at milking time could reduce effectiveness of the milk ejection reflex, decrease efficiency of milk removal, increase residual milk, and lead to overall reduction in milk yield. However, a majority of the studies reviewed suggests that there is little or no effect of aircraft noise on cattle. Adverse effects of low altitude flights have been noted in some studies but have not been uniformly reproduced in other reports (Manci, 1988).

[6]Crista L. Coppola. Noise in the Animal Shelter Environment: Building Design and the Effects of Daily Noise Exposure.
[7] David Key, Essential Kennel Designs.

Domesticated animals may also respond differently to noises than animals in the wild. Domesticated dogs are pack animals and may respond excitedly or vocally to other noises, smells, visual and other stimulants, in contrast to wild animals that may flee due to a slight unfamiliar sound. Animals that are transported at least once in their life (such as pigs to an abattoir) would endure high noise levels for the duration of the delivery period. A change in the heart rate, renal blood flow and blood pressure of study subjects were noted in the above studies. How small changes (in environmental noise levels) may impact on domesticated animals have however not yet been studied.

7.1.2 Wildlife

Many natural based acoustics themselves may be loud or impulsive. Examples include thunder, wind-induced noises that could easily exceed 35 dBA ($L_{A90,fast}$) above wind speeds averaging 6 m/s, noise levels during early morning dawn chorus or loud cicada noises during late evening or early morning.

Potential noise impacts on wildlife are very highly species dependent. Studies showed that most animals adapt to noises and would even return to a site after an initial disturbance, even if the noise continues. The more sensitive animals that might be impacted by noise would most likely relocate to a quieter area. Stress levels can increase in animals restricted to areas where the sound levels are impacting on them (due to the level, character or both).

There are a few specific studies discussing the potential impacts of noise on wildlife associated with construction, transportation and industrial facilities. Available information indicates that noises from transportation and industrial sources may mask the sound of a predator approaching; similarly, predators depending on hearing would not be able to locate their prey.

Studies indicated that most animals adapt to noises, and would even return to a site after an initial disturbance, even if the noise is continuous. The more sensitive animals that might be impacted by noise would most likely relocate to a quieter area. Helldin (2012) however highlights that the network of access road could be a significant factor impacting on animals. Noise impacts are therefore very highly species dependent, but there are also other factors that could impact on animals (such as visibility and increased movement of people and vehicles)[8].

[8] Blickley, 2010; Cummings, 2012; Cummings, 2009; Łopucki, 2016; Noise Quest, 2010; Rabin, 2006

7.1.3 Avifauna[9]

Noise impacts on birds include:

- causing hearing damage (very loud or loud impulsive sounds);
- increasing stress levels (directly and indirectly);
- Masking (directly or indirectly) the sounds of their food, predators or mates;
- Their typical food sources may move;
- Relocation to less suitable habitats; and
- other behavioural reactions.

As with the impact on other wildlife, the impact of noise on avifauna depends on the character of the noise (including the impulsive character), the magnitude or intensity of the noise as well as the familiarity the birds have with the sound.

Similarly, different birds change their response to these sounds differently. Some may not be impacted while other species may:

- avoid noisy areas or completely relocate;
- may start to sing at different times;
- may change the frequency, pitch or character of their calls/singing/signals;
- increase the volume of their calls/singing/signals; or/and
- changes in reproductive success.

As with other animals, there are no guidelines or even studies highlighting acceptable sound levels or other criteria before noise may start to impact on birds.

7.1.4 Laboratory Animal Studies

Although many laboratory animals have wild counterparts (rats, mice) the laboratory test subjects differ in many aspects (genetics, behaviour etc.). Also, noise levels of studies are conducted at generally very high levels at over 100 dB, much more than what would be experienced in environmental settings around industrial, commercial or transportation activities[10] . Other dissimilarities to laboratory tests and a natural environment include the time exposure (duration of noise), the spectral and noise character (impulsive noise vs. constant noise) etc. Although there exist dissimilarities in tests conducted and noise levels around commercial and industrial environments, laboratory rodents exposed to high noise levels did indicate physiological, behavioural changes, hearing loss and other such effects[11].

[9] Autumn, 2007; Brumm, 2004; Cummings, 2009; Dooling, 2007; Francis, 2012; Francis, 2011; Ortega, 2012; Halfwerk, 2011; Parris, 2009, Zwart, 2014.
[10]USEPA, 1971.
[11] Baldwin, 2007.

7.1.5 Concluding Remarks - Noise Impacts on Animals

From these and other studies the following can be concluded:

- To date there are no guidelines or sound limits with regards to noise levels that can be used to estimate the potential significance of noises on animals (Blickley *et al.* 2010).
- Animals respond to impulsive (sudden) noises (higher than 90 dBA) by running away. If the noises continue, animals would try to relocate (Dooling, 2007).
- Terrestrial wildlife responses begin at noise levels of approximately 40 dBA, with 20% of papers documenting impacts below 50 dBA (Shannon *et al.* 2015).
- Animals start to respond to increased noise levels with elevated stress hormone levels and hypertension. These responses begin to appear at exposure levels of 55 to 60 dBA (Baber, 2010), with Helldin *et al.* (2012) reporting that levels of 60–75 dBA have been shown to cause stress, e.g., increased respiration and heart rate, increased vigilance, and decreased time for grazing in domestic animals such as sheep and horses.
- Animals of most species exhibit adaptation with noise (Broucek, 2014), including impulsive noises, by changing their behaviour.
- More sensitive species would relocate to a quieter area, especially species that depend on hearing to hunt or evade prey, or species that makes use of sound/hearing to locate a suitable mate (Dooling, 2007).
- Noises associated with helicopters, motor- and quad bikes significantly impact on animals (startle response). This is due to the sudden and significant increase in noise levels as well as the presence of humans (Autumn, 2007; USEPA, 1971).

7.2 WHY NOISE CONCERNS COMMUNITIES[12]

Noise can be defined as "unwanted sound", and an audible acoustic energy that adversely affects the physiological and/or psychological well-being of people, or which disturbs or impairs the convenience or peace of any person. One can generalise by saying that sound becomes unwanted when it:

- Hinders speech communication;
- Impedes the thinking process;
- Interferes with concentration;
- Obstructs activities (work, leisure and sleeping); and
- Presents a health risk due to hearing damage.

[12]World Health Organization, 1999; Noise quest, 2010; Journal of Acoustical Society of America, 2009

However, it is important to remember that whether a given sound is "noise" depends on the listener or hearer. The driver playing loud rock music on their car radio hears only music, but the person in the traffic behind them hears nothing but noise.

Response to noise is unfortunately not an empirical absolute, as it is seen as a multi-faceted psychological concept, including behavioural and evaluative aspects. For instance, in some cases, annoyance is seen as an outcome of disturbances, in other cases, it is seen as an indication of the degree of helplessness with respect to the noise source.

Noise does not need to be loud to be considered "disturbing". One can refer to a dripping tap in the quiet of the night, or the irritating "thump-thump" of the music from a neighbouring house at night when one would like to sleep.

Severity of the annoyance depends on factors such as:

- Background sound levels, and the background sound levels the receptor is used to;
- The manner in which the receptor can control the noise (helplessness);
- The time, unpredictability, frequency distribution, duration, and intensity of the noise;
- The physiological state of the receptor; and
- The attitude of the receptor about the emitter (noise source).

7.2.1 Noise Annoyance

Annoyance is the most widely acknowledged effect of environmental noise exposure, and is considered to be the most widespread. It is estimated that less than a third of the individual noise annoyance is accounted for by acoustic parameters, and that the non-acoustic factors play a major role. Non-acoustic factors that have been identified include age, economic dependence on the noise source, attitude towards the noise source and self-reported noise sensitivity (Bakker *et al.*, 2012; Council of Canadian Academies, 2015; Ellenbogen *et al.*, 2012; Halfwerk *et al*., 2011; Hanning, 2010; Janssen *et al.*, 2011; Knopper *et al.*, 2014; Merlin *et al.*, 2013; Miedema and Vos, 2003; WHO, 2009).

On the basis of a number of studies into noise annoyance, exposure-response relationships were derived for high annoyance from different noise sources. These relationships, illustrated in **Figure 7-2**, are recommended in a European Union position paper published in 2002, stipulating policy regarding the quantification of annoyance. This can be used in environmental health impact assessment and cost-benefit analysis to translate noise maps into overviews of the numbers of persons that may be annoyed, thereby giving insight into the situation expected in the long-term. It is not applicable to local complaint-type situations or to an assessment of the short-term effects of a change in noise levels.

Severity of the annoyance depends on factors such as:

- Background sound levels and the background sound levels the receptor is used to;
- The manner in which the receptor can control the noise (helplessness);
- The time, unpredictability, frequency distribution, duration, and intensity of the noise;
- The physiological and health state of the receptor; and
- The attitude of the receptor about the emitter (noise source).

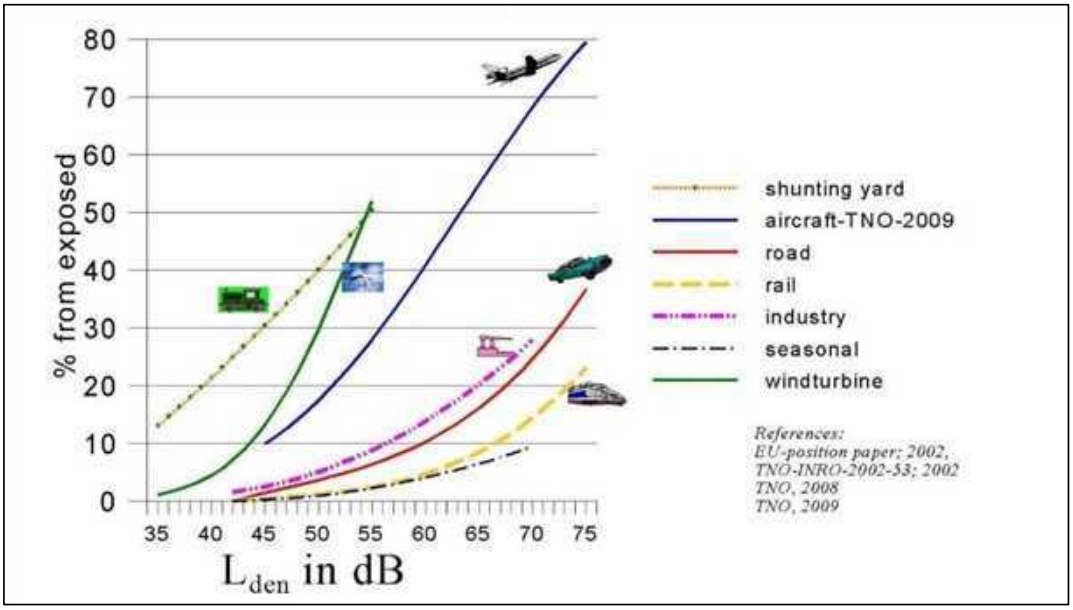


Figure 7-2: Percentage of annoyed persons as a function of the day-evening-night noise exposure at the façade of a dwelling[13]

7.2.1.1 Disturbance to Sleep

Sleep is essential for mental and physical health, and noise is one of the most reported reasons why people may experience sleep interruptions at night. This may be sudden loud noises, with the WHO (2009) reporting that, when maximum noises exceed 60 dBA, with average noise levels exceeding 40 dBA, it may increase the probability of being awakened. People report that quality of life suffer with increased instances of disturbed sleep that may also increase annoyance with a project (Bakker *et al* (2012); Van den Berg *et al* (2014)). It should be noted that Van den Berg *et al* (2008) (see also Van den Berg *et al* - 2014) showed an indirect effect between sleep disturbances and annoyance, but not between

[13] Image from https://rigolett.home.xs4all.nl/ENGELS/topic.htm. Wind Turbine Annoyance curve from Pedersen (2007)

sleep disturbance and the noise level. It is postulated that this is due to increased annoyance due to the visual impact from WTG.

7.2.1.2 Potential Health Effects from noise

The WHO (2009) does report threshold levels where people may report or experience effects from noise, with these thresholds highlighted in **Table 7-1**. The WHO does use the L_{Amax} and L_{night}[14] descriptors to describe these levels.

Table 7-1: Threshold levels reported by the WHO (2009)

Effect	Indicator	Threshold (dBA)
EEG awakening	$L_{Amax,inside}$	35
Onset of motility	$L_{Amax,inside}$	32
Changes in sleep patterns	$L_{Amax,inside}$	35
Waking up in the night and/or too early in the morning	$L_{Amax,inside}$	42
Increased average motility when sleeping	$L_{night,outside}$	42
Self-reported sleep disturbances	$L_{night,outside}$	42
Environmental insomnia	$L_{night,outside}$	42
Hypertension	$L_{night,outside}$	50
Myocardial infarction	$L_{night,outside}$	50
Psychic disorders	$L_{night,outside}$	60

7.2.1.3 Situational and Personal Factors

There are a few other aspects, collectively referred to as non-acoustical factors that may increase annoyance with a project [Miedema and Vos, 2003; Pedersen *et al.*, 2007). These could include:

- Situational factors (visual issues, attractiveness of area) (Merlin *et al.*, 2014; Michaud *et al.* (2016); Van den Berg *et al*, 2008);
- Socio-economic factors (age, gender, income, level of education) [Miedema and Vos, 2003; Michaud *et al.* (2016)],
- Social factors (attitude towards the applicant/producer/government, media coverage) (Pedersen *et al.*, 2007; Superior Health Council, (2013)),
- Personal factors (fear or worry in relation to noise source, sensitivity to noise, economic benefit from project, existing health condition) (Miedema and Vos, 2003; Taylor *et al* (2013); Van Kamp and Davies (2013)), and

[14] Refers to the European Union definition in Directive 2002/49/EC – equivalent outdoor sound pressure level associated with a particular type of noise source to which a receptor is exposed to over the 8-hour night-time period, calculated over a period of a year

- Attitude towards the project and exposure to negative sentiment (Bernstein *et al* (2024); Crichton *et al*. (2014), Crichton *et al* (2014)).

7.3 IMPACT ASSESSMENT CRITERIA

7.3.1 Overview: The common characteristics

The word "noise" is generally used to convey a negative response or attitude to the sound received by a listener. There are four common characteristics of sound, any or all of which determine listener response and the subsequent definition of the sound as "noise". These characteristics are:

- Intensity;
- Loudness;
- Annoyance; and
- Offensiveness.

Of the four common characteristics of sound, the intensity is the only one which is not subjective and can be quantified. Loudness is a subjective measure of the effect sound has on the human ear. As a quantity, it is therefore complicated but has been defined by experimentation on subjects known to have normal hearing.

The annoyance and offensive characteristics of noise are also subjective. Whether or not a noise causes annoyance mostly depends upon its reception by an individual, the environment in which it is heard, the type of activity and mood of the person and how acclimatised or familiar that person is to the sound.

7.3.2 Noise criteria of concern

The criteria used in this report were drawn from the criteria for the description and assessment of environmental impacts considering SANS 10103 as well as guidelines from the WHO.

There are a number of criteria that are of concern for the assessment of noise impacts. These can be summarised in the following manner:

- *Increase in noise levels:* People or communities often react to an increase in the ambient noise level they are used to, which is caused by a new source of the noise. See also **Figure 4-1**.
- *Zone Sound Levels:* Previously referred to as the acceptable rating levels, it sets acceptable noise levels for various areas. See also **Table 4-2**, with the urban rating levels similar as the IFC noise limits for residential use.

- *Absolute or total noise levels:* Depending on their activities, people generally are tolerant to noise up to a certain absolute level, e.g., 65 dBA. Anything above this level will be considered unacceptable.

Considering the average fast-weighted sound level data collected in the area, average:

- daytime fast-weighted sound levels at NSR locations further than 500m from the port activities were low, typical of a quiet urban area; and
- night-time fast-weighted sound levels at NSR locations further than 500m from the port activities were low, typical of a quiet urban environment.

Considering the requirements the World Bank and IFC (see **section 4.4.4**), project activities that could raise noise levels above the recommended limits would be of a concern. The recommended noise limits at NSR locations would be:

- 55 dBA for daytime residential use; and
- 45 dBA for night-time residential use.

However, when residential activities take place close to authorized commercial or industrial areas, this may result in noise-related complaints, because, even of the authorized activities comply with the World Bank/IFC noise limits (70 dBA at the boundary both day and night), NSR may not accept the noises.

It is therefore important the port activities do consider, design and implement measures to limit noise levels at their project boundaries, especially during the night-time periods, when nearby NSR desire and require a quieter environment.

7.3.3 Determining the Significance of the Noise Impact

In order to establish a coherent framework within which all impacts could be objectively assessed, it was necessary to establish a rating system, which was applied consistently to all the criteria. For such purposes each aspect was assigned a value depending on its definition. This assessment is a relative evaluation within the context of all the activities and the other impacts within the framework of the Project.

The impact consequence is determined by summing the scores of Magnitude (**Table 7-2**), Duration (**Table 7-3**) and Spatial Extent (**Table 7-4**). The impact significance (see **Sections 7.3.4** and **7.3.5**) is determined by multiplying the Consequence result with the Probability score (**Table 7-5**). An explanation of the impact assessment criteria is defined in the following tables.

Table 7-2: Impact Assessment Criteria – Magnitude

This defines the impact as experienced by any receptor. In this report, the receptor is defined as any resident in the area but excludes faunal species.		
Rating	**Description**	**Score**
Low	Increase in average sound pressure levels between 0 and 3 dB from the expected ambient sound levels. Ambient sound levels are defined by the average of the measured day- or night-time fast-weighted sound levels during measurement dates. Total projected noise levels are less than the WHO/IFC noise limits in wind-still conditions.	2
Low Medium	Increase in average sound pressure levels between 3 and 5 dB from the expected ambient sound levels. Total projected noise levels are less than the WHO/IFC noise limits in wind-still conditions.	4
Medium	Increase in average sound pressure levels between 5 and 7 dB from the ambient sound levels. Total projected noise levels are higher than the WHO/IFC noise limits in wind-still conditions.	6
High	Increase in average sound pressure levels between 7 and 10 from the ambient sound level. Total projected noise levels are higher than the WHO/IFC noise limits in wind-still conditions.	8
Very High	Increase in average ambient sound pressure levels higher than 10 dBA. Total projected noise levels are higher than the WHO/IFC noise limits in wind-still conditions. A change of 10 dBA is perceived as 'twice as loud', leading to widespread complaints and even threats of community or group action. Any point where instantaneous noise levels exceed 65 dBA at any receptor.	10

Table 7-3: Impact Assessment Criteria - Duration

The lifetime of the impact that is measured in relation to the lifetime of the proposed development (construction, operational and closure phases). Will the receptors be subjected to increased noise levels for the lifetime duration of the project, or only infrequently.		
Rating	**Description**	**Score**
Temporary	Impacts are predicted to be of short duration (portion of construction period) and intermittent/occasional.	1
Short-term	Impacts that are predicted to last only for the duration of the construction period.	2
Medium-term	Impacts predicted to last for a period up to 5 years.	3
Long-term	Impacts that will continue for the life of the Project, but ceases when the Project stops operating.	4
Permanent	Impacts that cause a permanent change in the affected receptor or resource (e.g., removal or destruction of ecological habitat) that endures/last substantially beyond the Project lifetime.	5

Table 7-4: Impact Assessment Criteria – Spatial extent

Classification of the physical and spatial scale of the impact		
Rating	**Description**	**Score**
Site	The impacted area extends only as far as the activity, such as footprint occurring within the total site area.	1
Local	The impact could affect the local area (within 1,000 m from site).	2
Regional	The impact could affect the area including the neighbouring farms, the transport routes and the adjoining towns (further than 1,000 m from site).	3
National	The impact could have an effect that expands throughout the country (South Africa).	4
International	Where the impact has international ramifications that extend beyond the boundaries of South Africa.	5

Table 7-5: Impact Assessment Criteria - Probability

This describes the likelihood of the impacts actually occurring, and whether it will impact on an identified receptor. The impact may occur for any length of time during the life cycle of the activity, and not at any given time. The classes are rated as follows:		
Rating	**Description**	**Score**
Improbable	Daytime noise levels are less than 50 dBA; Night-time noise levels less than 40 dBA.	1
Possible	Daytime noise levels more than 50 dBA, but are less than 55 dBA; Night-time noise levels more than 40 dBA, but less than 45 dBA.	2
Likely	Daytime noise levels more than 55 dBA, but are less than 60 dBA; Night-time noise levels more than 45 dBA, but less than 50 dBA.	3
Highly Likely	Daytime noise levels more than 60 dBA, but are less than 65 dBA; Night-time noise levels more than 50 dBA, but less than 55 dBA.	4
Definite	Daytime noise levels exceeding 65 dBA; Night-time noise levels higher than 55 dBA.	5

In order to assess each of these factors for each impact, the following ranking scales as contained in **Table 7-6** were used.

Table 7-6: Assessment Criteria: Ranking Scales

PROBABILITY		**MAGNITUDE**	
Description / Meaning	**Score**	**Description / Meaning**	**Score**
Definite/don't know	5	Very high/don't know	10
Highly likely	4	High	8
Likely	3	Medium	6
Possible	2	Low Medium	4
Improbable	1	Low	2
DURATION		**SPATIAL SCALE**	
Description / Meaning	**Score**	**Description / Meaning**	**Score**
		International	5
Permanent	5	National	4
Long-Term	4	Regional	3
Short-term	2	Local	2
Temporary	1	Footprint	1

7.3.4 Identifying the Potential Impacts without Mitigation Measures (WOM)

Following the assignment of the necessary weights to the respective aspects, criteria are summed and multiplied by their assigned probabilities, resulting in a Significance Rating (SR) value for each impact (prior to the implementation of mitigation measures).

Significance without mitigation is rated on the following scale:

SR<30	Low (L)	Impacts with little real effect and which should not have an influence on or require modification of the project design or alternative mitigation. No mitigation is required.
30<**SR** <60	Medium (M)	Where it could have an influence on the decision unless it is mitigated. An impact or benefit which is sufficiently important to require management. Of moderate significance - could influence the decisions about the project if left unmanaged.
SR>60	High (H)	The impact is significant, mitigation is critical to reduce impact or risk. Resulting impact could influence the decision depending on the possible mitigation. An impact which could influence the decision about whether or not to proceed with the project.

7.3.5 Identifying the Potential Impacts with Mitigation Measures (WM)

In order to gain a comprehensive understanding of the overall significance of the impact, after the implementation of the mitigation measures, it was necessary to re-evaluate the impact. Significance with mitigation is rated on the following scale:

SR<30	Low (L)	The impact is mitigated to the point where it is of limited importance.
30<**SR** <60	Medium (M)	Notwithstanding the successful implementation of the mitigation measures, to reduce the negative impacts to acceptable levels, the negative impact will remain of significance. However, taken within the overall context of the project, the persistent impact does not constitute a fatal flaw.
SR>60	High (H)	The impact is of major importance. Mitigation of the impact is not possible on a cost-effective basis. The impact is regarded of high importance and taken within the overall context of the project, is regarded as a fatal flaw. An impact regarded as high significance after mitigation could render the entire development option or entire project proposal unacceptable.

8 ASSUMPTIONS AND LIMITATIONS

8.1 MEASUREMENTS OF AMBIENT SOUND LEVELS

Ambient sound levels are the cumulative effects of innumerable sounds generated at various instances both far and near. A high measurement may not necessarily mean that the area is always noisy. Similarly, a low sound level measurement will not necessarily mean that the area is always quiet, as sound levels will vary over seasons, time of day, dependant on faunal characteristics (mating season, dawn chorus[15] early hours of the morning, temperature etc.), vegetation in the area and meteorological conditions (especially wind).

Selecting an ideal measurement location could be difficult, with various criteria assessed to identify the viability of a certain location as a point to define ambient sound levels. When selecting a measurement location, the most important criteria would be:

1. Security of the instrument (minimise risk to the technician; prevent theft or sabotage of the equipment);
2. Safety of the equipment (ensure that it does not prevent, interfere or limit typical agricultural or household activities; ensure that the instrument are not in a location where an animal could damage the instrument); and lastly,
3. The suitability of the measurement location to define ambient sound levels (the presence of certain trees or equipment, wetland or other water resources will influence ambient sound level significantly).

As such, after ensuring that the instrument is safe and secure, there are various environmental factors that could influence ambient sound levels measured. These constraints and limitations are discussed below and could include:

- Seasonal changes in the surrounding environment can influence typical ambient sound levels, as many faunal species are more active during warmer periods than the colder periods. As an example, cicada is usually only active during warmer periods. Certain cicada species can generate noise levels up to 120 dB for mating or distress purposes, sometimes singing in synchronisation magnifying noise levels they produce from their tymbals[16]. Due to the presence of the ocean noises, this is not relevant to this assessment;

[15] Environ. We Int. Sci. Tech. *Ambient noise levels due to dawn chorus at different habitats in Delhi*. 2001. Pg. 134.
[16] Clyne, D. *"Cicadas: Sound of the Australian Summer, Australian Geographic"* Oct/Dec Vol 56. 1999.

- In an area with various noise sources (roads, industry, urban development), defining ambient sound levels using the result of a single measurement may be very inaccurate (very low confidence level in the results) and measurements over a longer-term period is recommended;
- Some equipment that could influence measurements may be missed when deploying instruments, or, the equipment may not the audible. This could include equipment such as hidden water pumps and associated pipelines and outflows, stepdown transformers, hidden compressors, inverters, condensers or other electrical equipment, etc. While not audible during deployment, such equipment may significantly influence ambient sound levels during quiet periods, though none were identified during this assessment;
- Type, the number and sizes of trees in the vicinity of the instrument, as well as the distances between the microphone and these trees. Certain trees, especially fruiting trees could attract birds and other animals that will significantly impact on ambient sound levels. Measurement locations were selected to ensure that vegetation did not impact on the measurement results;
- Exact location of a sound level meter in an area in relation to structures, infrastructure, vegetation, wetlands and external noise sources will influence measurements. It may determine whether you are measuring anthropogenic sounds from a receptors dwelling, or environmental ambient baseline contributors of significance (faunal noises, ocean noises, roads traffic, railway traffic movement etc.); and
- As a residential area develops the presence of people will result in increased dwelling related sounds. These are generally a combination of traffic noise, voices, animals and equipment (incl. TV's and Radios). The result is that ambient sound levels will increase as an area matures.

8.2 CALCULATING NOISE EMISSIONS – ADEQUACY OF PREDICTIVE METHODS

The noise emissions into the environment from the various sources as defined were calculated for the operational phase in detail, using the sound propagation model described in ISO 9613-2.

The following was considered:

- The octave band sound pressure emission levels of processes and equipment;
- The time the activities and equipment are operational and generating the noise rating levels as assumed. For this project a worst-case was assessed, assuming that most equipment (excluding the bulldozer used for clearing of vegetation) would be operating at a 100% load (generating the maximum noise rating levels), 100% of the time. In

practice this is inaccurate as no activity or equipment are 100% operational of the time and the assumption will result in an over-estimated noise rating levels;

- The distance of the receiver from the noise sources;
- The impact of atmospheric absorption;
- The operational details of the proposed project, such as projected areas where activities will be taking place;
- Topographical layout; and
- Acoustical characteristics of the ground. Fifty per cent (50%) soft ground conditions were modelled, as the area where the mining activity would be taking place is well vegetated and sufficiently uneven to allow the consideration of relatively soft ground conditions. This is because the use of hard ground conditions could represent a too precautionary situation.

8.3 ADEQUACY OF UNDERLYING ASSUMPTIONS

Noise experienced at a certain location is the cumulative result of innumerable sounds emitted and generated both far and close, each in a different time domain, each having a different spectral character at a different sound level. Each of these sounds is also impacted differently by surrounding vegetation, structures and meteorological conditions that result in a total cumulative noise level represented by a few numbers on a sound level meter.

As previously mentioned, it is not the purpose of noise modelling to accurately determine a likely noise level at a certain receptor but to calculate a noise rating level that is used to identify potential issues of concern.

8.4 UNCERTAINTIES ASSOCIATED WITH MITIGATION MEASURES

Any noise impact can be mitigated to have a low significance; however, the cost of mitigating this impact may be prohibitive, or the measure may not be socially acceptable (such as the relocation of an NSR). These mitigation measures may be engineered, technological or due to management commitment.

For the purpose of the determination of the significance of the noise impact mitigation measures were selected that is feasible, mainly focusing on management of noise impacts using rules, policy and require a management commitment. This, however, does not mean that noise levels cannot be reduced further, only that to reduce the noise levels further may require significant additional costs (whether engineered, technological or management).

It was assumed that any mitigation measures proposed for the construction phase (if any), will be implemented and continued during the operational phase (if required).

8.5 UNCERTAINTIES OF INFORMATION PROVIDED

While it is difficult to define the character of a measured noise in terms of numbers (third octave sound power levels), it is difficult to accurately model noise rating levels at a receptor from any operation. The projected noise rating levels are the output of a numerical model with the accuracy depending on the assumptions made during the setup of the model. The assumptions include the following:

- That octave sound power levels selected for processes and equipment accurately represent the sound character and power levels of these processes and equipment. The determination of octave sound power levels in itself is subject to errors, limitations and assumptions with any potential errors carried over to any model making use of these results;
- Sound power emission levels from processes and equipment changes depending on the load the process and equipment are subject to. While the octave sound power level is the average (equivalent) result of a number of measurements, this measurement relates to a period that the process or equipment was subject to a certain load (work required from the engine or motor to perform action). Normally these measurements are collected when the process or equipment is under high load. The result is that measurements generally represent a worst-case scenario;
- As it is unknown which processes and equipment will be operational (when and for how long), modelling considers a scenario where processes and equipment are under full load for a set time period. Modelling assumptions comply with the precautionary principle and operational time periods are frequently over-estimated. The result is that projected noise rating levels would likely be over-estimated;
- Modelling cannot capture the potential impulsive character of a noise that can increase the potential nuisance factor;
- The XYZ topographical information is derived from the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) Global DEM data, a product of Japan's Ministry of Economy, Trade, and Industry (METI) and the National Aeronautical and Space Administration (NASA). There are known inaccuracies and artefacts in the data set, yet this is still one of the most accurate data sets to obtain 3D-topographical information;
- The impact of atmospheric absorption is simplified and very uniform meteorological conditions are considered. This is an over-simplification and the effect of this in terms of sound propagation modelling is difficult to quantify; and

- Acoustical characteristics of the ground are over-simplified with ground conditions accepted as uniform. Fifty per cent (50%) soft ground conditions will be modelled as the area where the activities are proposed is considered sufficiently uneven to allow the consideration of medium ground conditions.

8.6 UNCERTAINTY ON HOW NOISE COULD AFFECT PEOPLE

How noise affect communities are discussed in **section 7.2**, with this assessment considering a number of studies and guidelines such as:

- Cooper and Chan (2020) that discuss and present a number of dose-effect relationships as well as summarise a number of international guidelines and standards that can be used to assess noise effects from wind farms;
- Crichton *et al* (2014) that studied how expectations can influence symptom and mood reports in both positive and negative directions;
- Directive 2002/49/EC (2002), directing members of the European Union with a guideline on the assessment and management of environmental noise. This directive recommends the use of dose-effect relationships to assess the effect of noise on populations;
- Miedema and Vos (2013), that integrated the findings from a number of studies on the relationship between noise sensitivities and exposure to noise;
- People that have a negative view of a project, or are exposed to negative sentiment are more likely to complain about noise (Bernstein *et al* (2024); Crichton *et al*. (2014), Crichton *et al* (2014)); and
- SANS 10103 (2008) that can be used to assess how environmental noise can be measured and used to assess annoyance in communities.

It is important to understand that guidelines and dose-effect relationship studies focus on how communities respond to noise and it is difficult to predict or foresee how an individual may respond to noise.

9 PROJECTED NOISE RATING LEVELS

Existing noise rating levels were estimated using the results of the noise monitoring done for this project. The additional activities were duplicated at the proposed location options, assuming similar PWL for the new activities. It is assumed that all activities operate both day and night.

9.1 CONCEPTUAL SCENARIO 1 – NOISE FROM EXISTING ACTIVITIES

A noise model was developed to illustrate the potential existing noise level contours, with the locations of the various noise sources conceptualised in **Figure 9-1**.

The projected existing noise levels are illustrated in:

- **Figure 9-2** for the daytime period, with the calculated noise levels also defined per NSR location in **Appendix C**. These noise levels, together with the measured ambient sound levels will be used to estimate the potential significance of the noise impact on NSR using the methodology at discussed in **section 7.3**; and
- **Figure 9-3** for the night-time period.

9.2 CONCEPTUAL SCENARIOS 2 – FUTURE CONSTRUCTION ACTIVITIES

A noise model was developed for scenario 2 as discussed in **Section 6.1** and conceptualised in **Figure 9-4**. For this conceptual construction scenario, projected noise rating levels are illustrated in **Figure 9-5**, with the potential noise levels defined per NSR in **Appendix C, Table 1** for the daytime period.

9.3 CONCEPTUAL SCENARIOS 3, 4, 5 AND 6 – FUTURE OPERATIONAL ACTIVITIES

A noise model was developed for operational scenario 3 as roughly discussed in **Section 6.2** and conceptualised in **Figure 9-6**. Scenario 3 conceptualize potential noise-generating activities associated with two cranes operating simultaneously at the existing berth area. For scenario 3, projected noise rating levels are illustrated in:

- **Figure 9-7**, with the potential noise levels defined per NSR in **Appendix C, Table 2** for the daytime period; and
- **Figure 9-8**, with the potential noise levels defined per NSR in **Appendix C, Table 3** for the night-time period.

Scenario 4 conceptualize potential noise-generating activities associated with two cranes operating simultaneously (one at the existing berth and a second operating at the new berth area). For scenario 4, projected noise rating levels are illustrated in:

- **Figure 9-9**, with the potential noise levels defined per NSR in **Appendix C, Table 4** for the daytime period; and
- **Figure 9-10**, with the potential noise levels defined per NSR in **Appendix C, Table 5** for the night-time period.

Scenario 5 conceptualize potential noise-generating activities associated with three cranes operating simultaneously (one at the existing berth and two operating at the new berth area). For scenario 5, projected noise rating levels are illustrated in:

- **Figure 9-11**, with the potential noise levels defined per NSR in **Appendix C, Table 6** for the daytime period; and
- **Figure 9-12**, with the potential noise levels defined per NSR in **Appendix C, Table 7** for the night-time period.

Scenario 6 conceptualize potential noise-generating activities associated with three cranes operating simultaneously (two at the existing berth and one crane operating at the new berth area. For scenario 6, projected noise rating levels are illustrated in:

- **Figure 9-13**, with the potential noise levels defined per NSR in **Appendix C, Table 8** for the daytime period; and
- **Figure 9-14**, with the potential noise levels defined per NSR in **Appendix C, Table 9** for the night-time period.

9.4 EVALUATION OF ALTERNATIVES

9.4.1 Alternative 1: No-go option

The ambient sound levels will remain as is and the area would keep the existing noise character.

9.4.2 Alternative 2: Proposed approval of the mining project

The proposed development will raise the noise levels at the closest potential NSR, with the highest impact relating to NSR staying within 500 m from the project activities. Noises created by the project could be audible up to 2,000 m from the project area during quiet periods. Members of the local community may consider the increased noise levels to be annoying and even disturbing at night (with the beeping from reverse alarms and material handling noises raising annoyance levels). The residential community are however also

directly linked to the operation, which would also foster a more positive attitude towards to future noise levels.

The project however will greatly assist in the economic growth and development challenges South Africa is facing by optimizing the extraction of the mineral resource. This will assist in providing additional employment and business opportunities for the local communities. Considering only noise[17], people in the area not directly affected by increased noise levels would have a positive perception of the project and could see the need and desirability of the project.

[17] Considering only noise as other factors may affect other NSR



Figure 9-1: Conceptual noise-generating activities considered for existing operational activities (scenario 1)

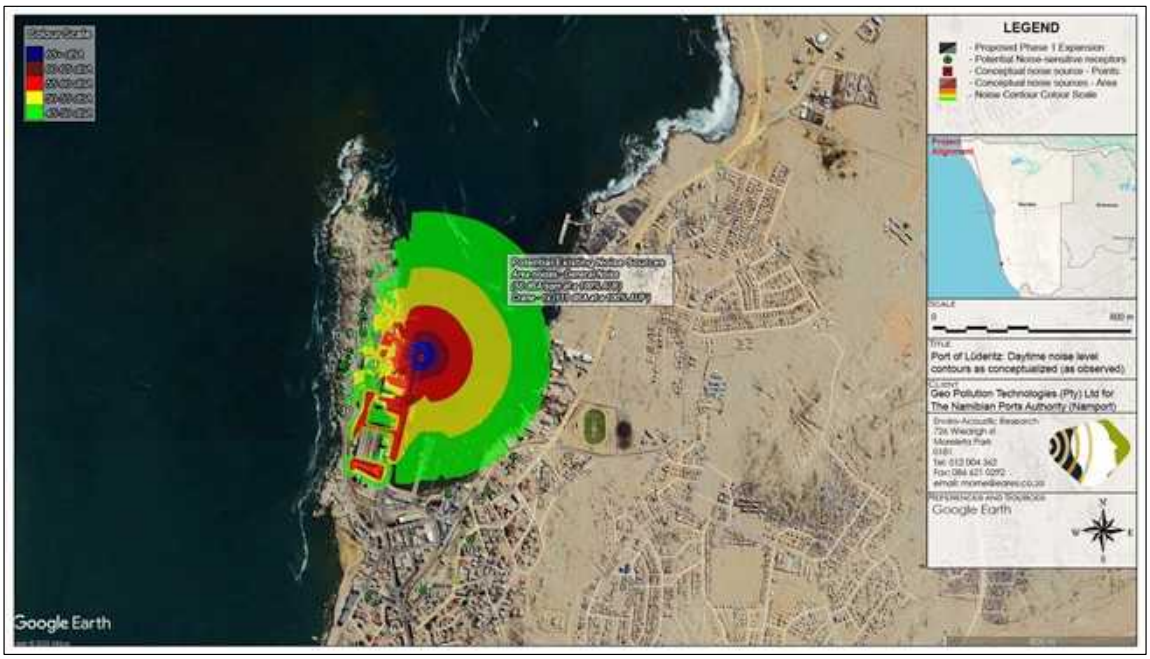


Figure 9-2: Projected daytime noise rating levels relating to the existing operational activities (scenario 1)

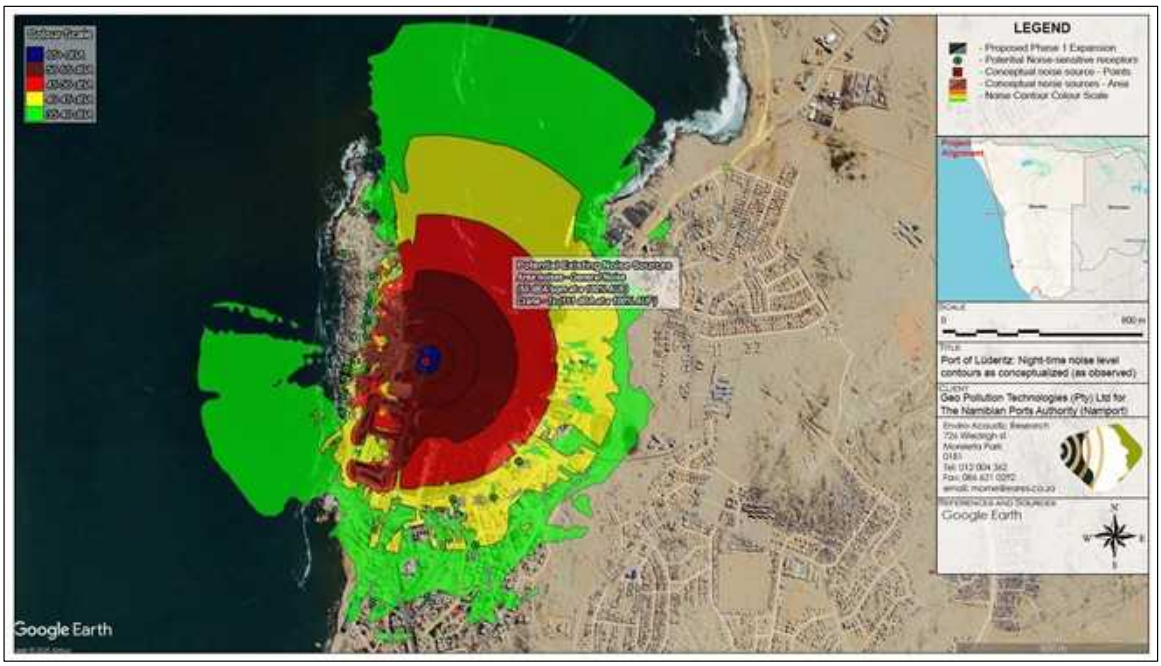


Figure 9-3: Projected night-time noise rating levels relating to the existing operational activities (scenario 1)



Figure 9-4: Conceptual noise-generating activities considered for the construction phase (scenario 2)

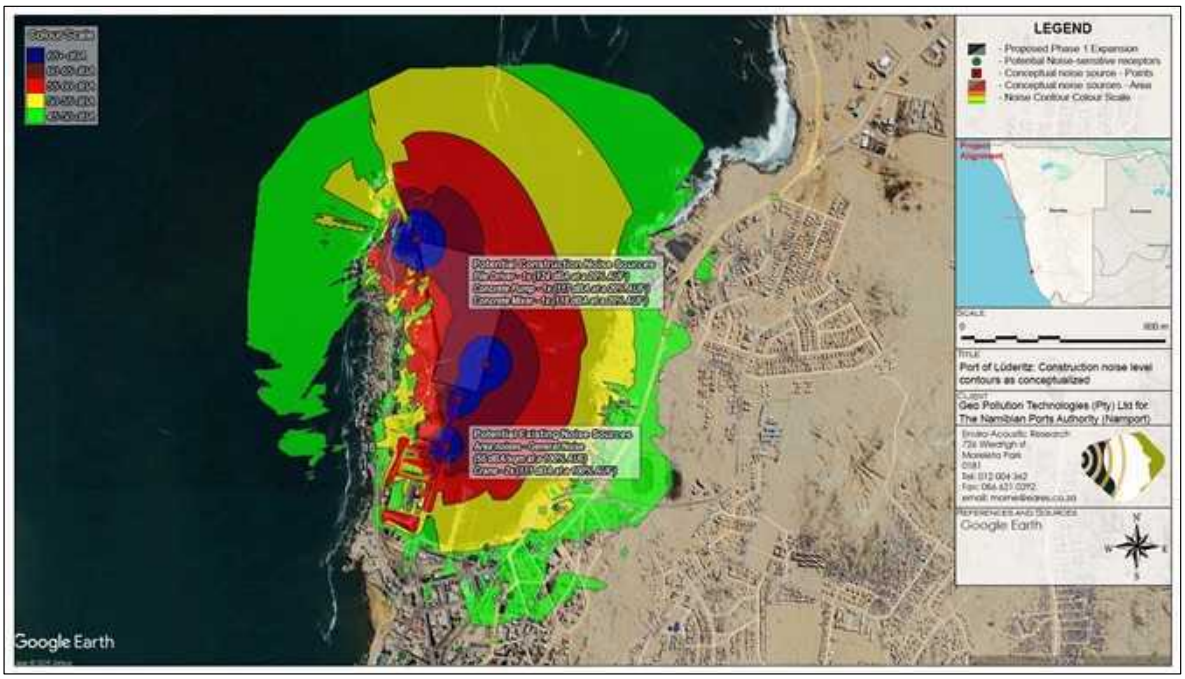


Figure 9-5: Projected cumulative daytime noise rating levels – conceptual construction activities (scenario 2)



Figure 9-6: Conceptual noise-generating activities considered for the operational phase (various scenarios)

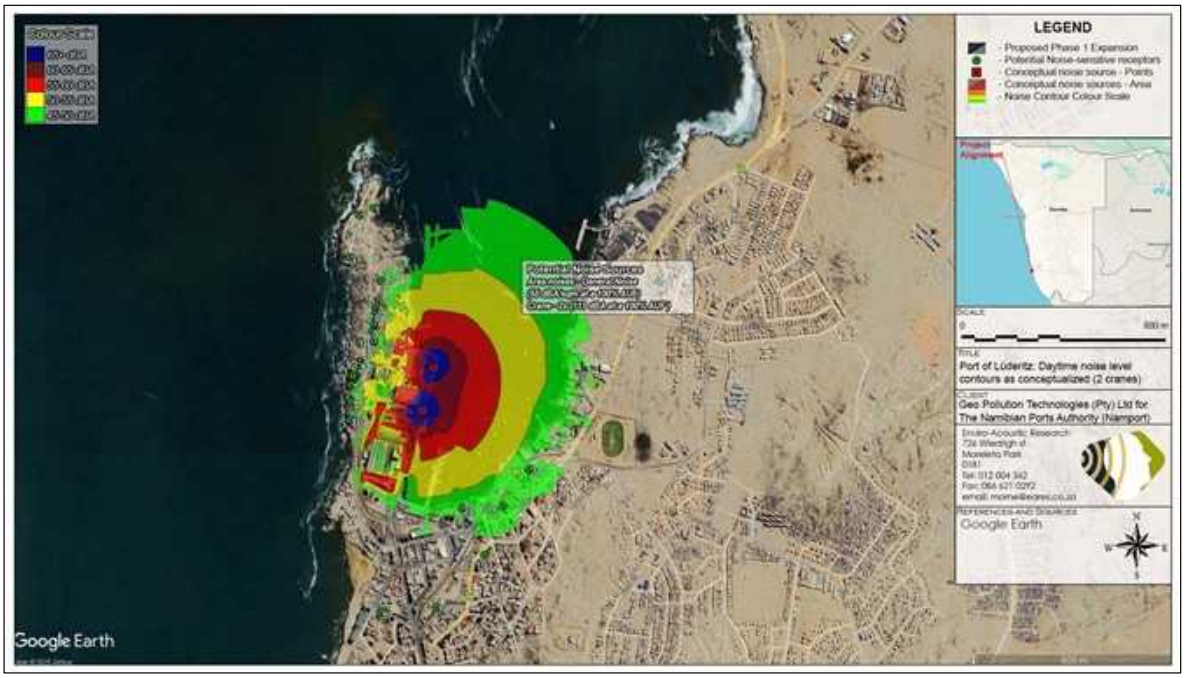


Figure 9-7: Projected cumulative daytime noise rating levels – conceptual operational activities (scenario 3)

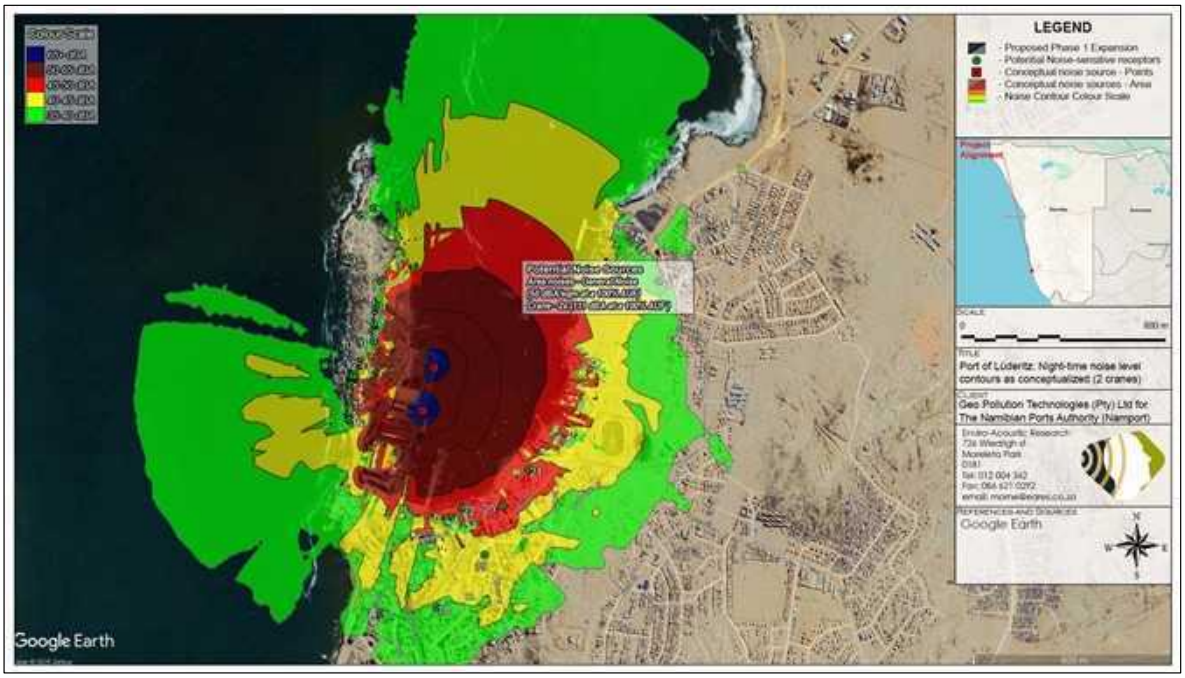


Figure 9-8: Projected cumulative night-time noise rating levels – conceptual operational activities (scenario 3)

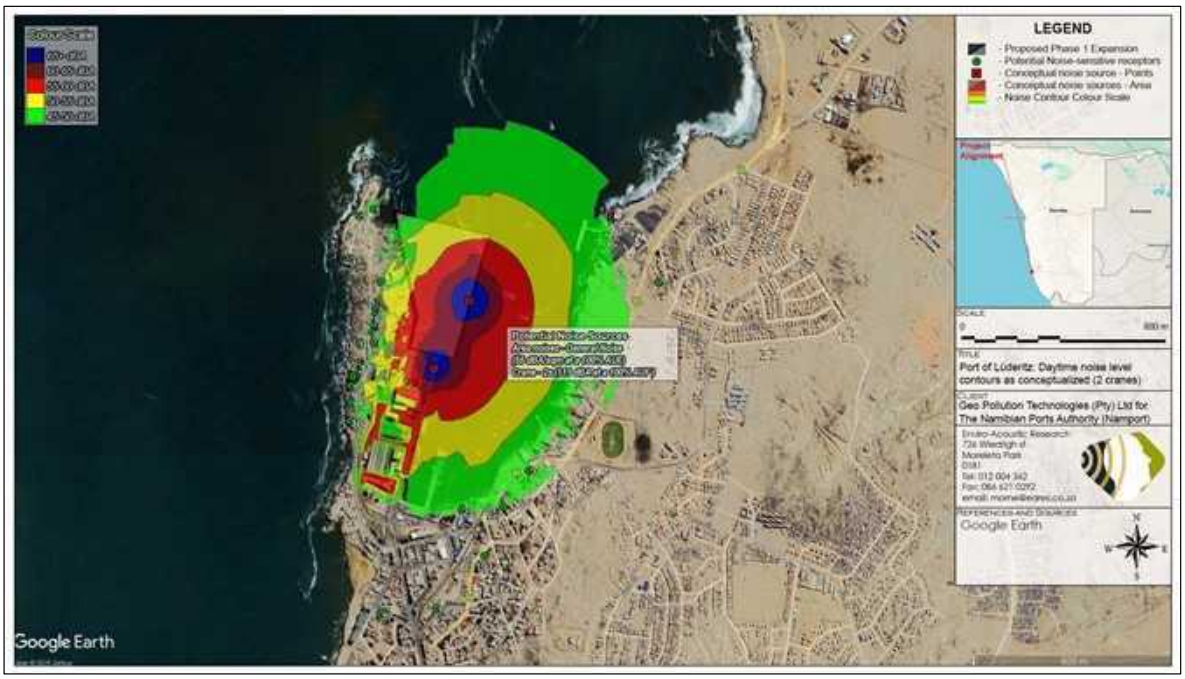


Figure 9-9: Projected cumulative daytime noise rating levels – conceptual operational activities (scenario 4)

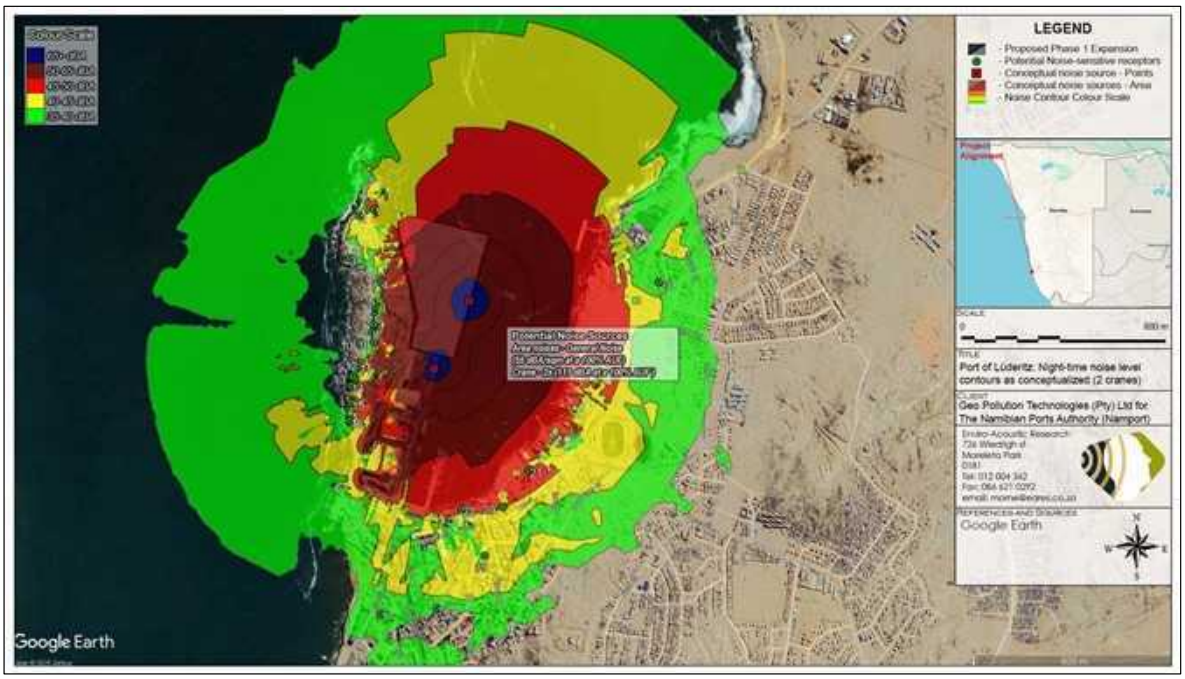


Figure 9-10: Projected cumulative night-time noise rating levels – conceptual operational activities (scenario 4)

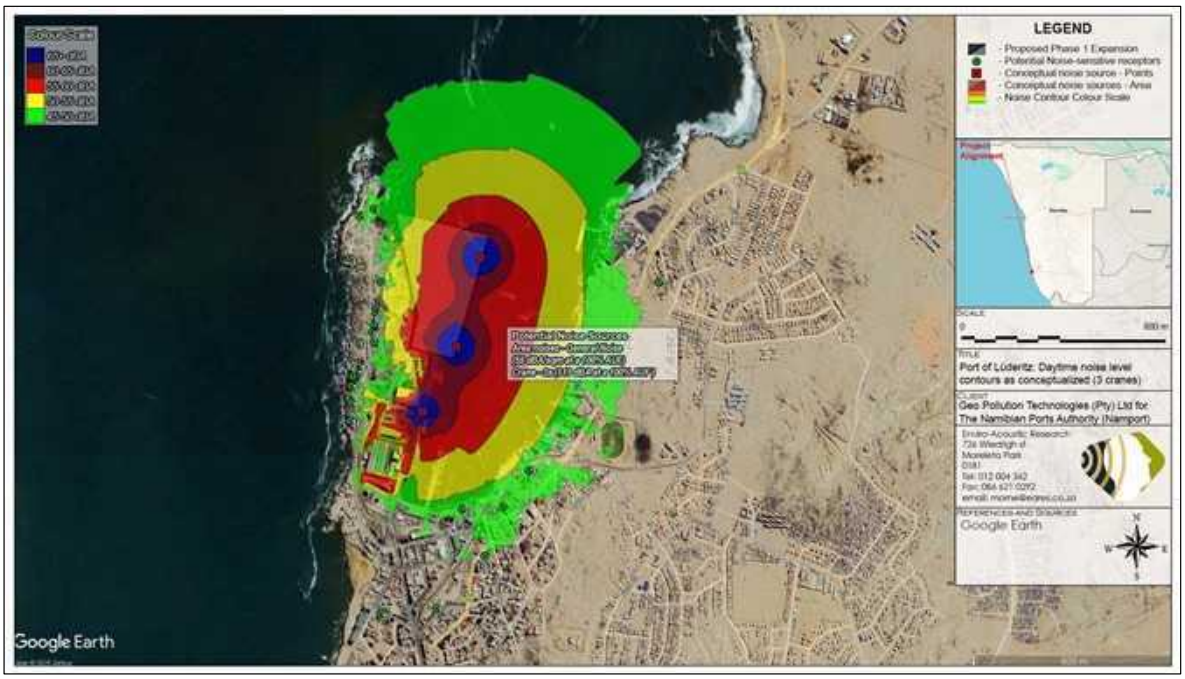


Figure 9-11: Projected cumulative daytime noise rating levels – conceptual operational activities (scenario 5)

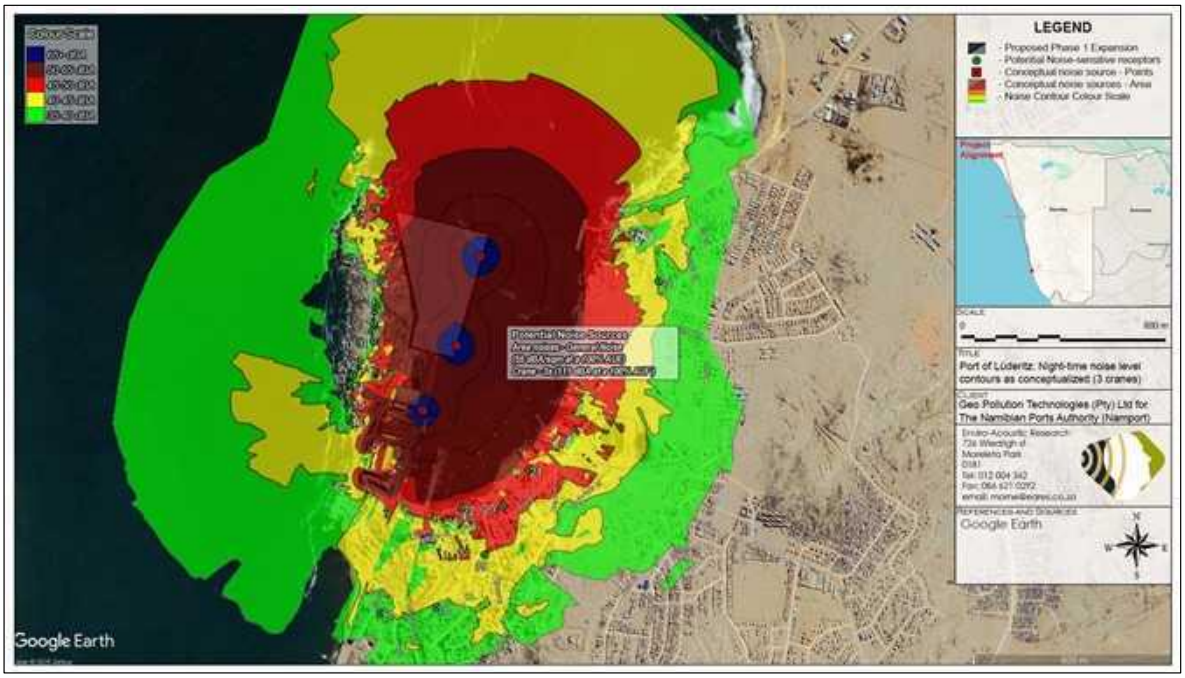


Figure 9-12: Projected cumulative night-time noise rating levels – conceptual operational activities (scenario 5)

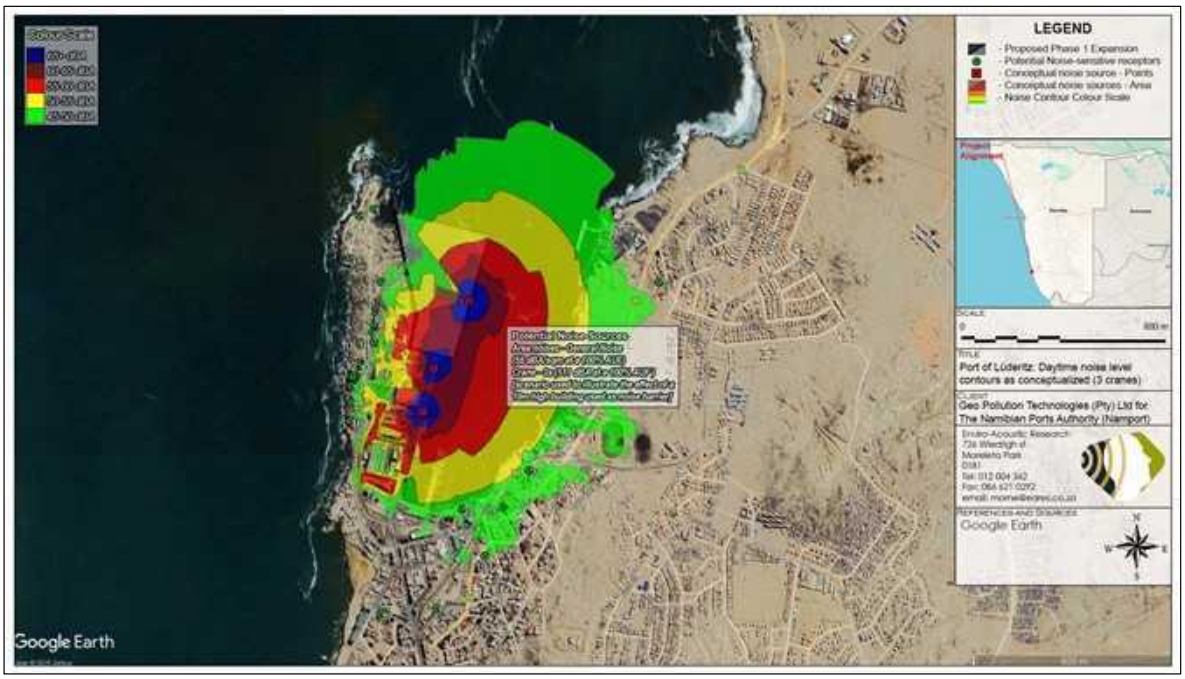


Figure 9-13: Projected cumulative daytime noise rating levels – conceptual operational activities (scenario 6)

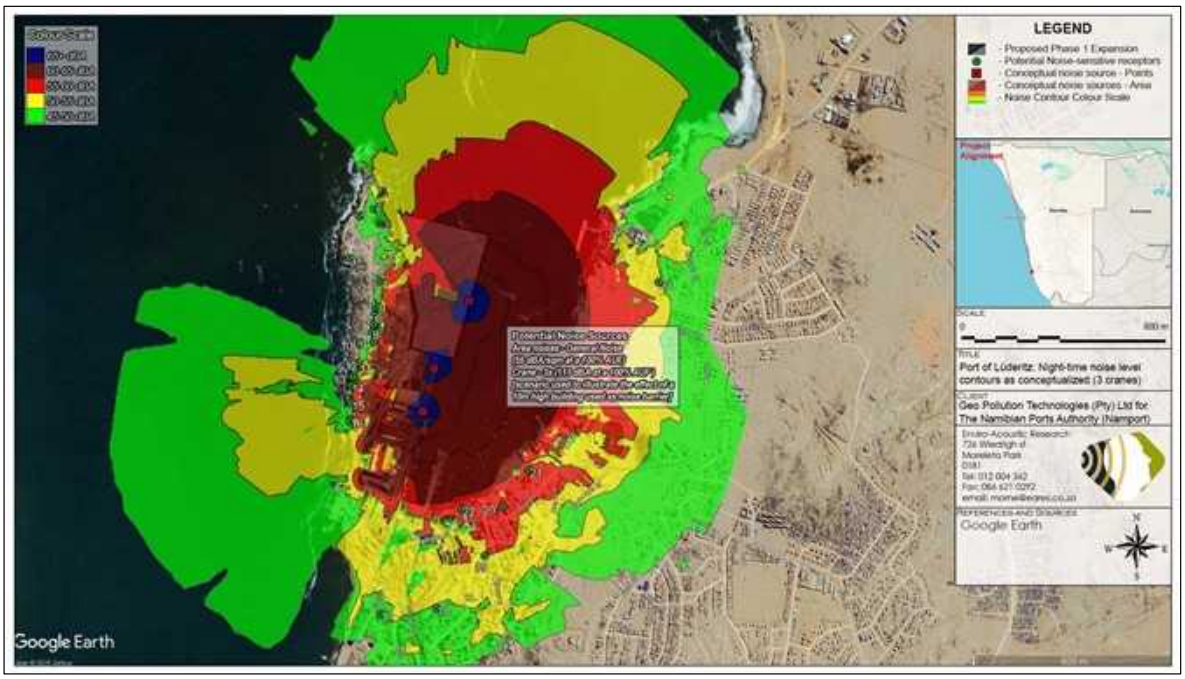


Figure 9-14: Projected cumulative night-time noise rating levels – conceptual operational activities (scenario 6)

10 SIGNIFICANCE OF THE NOISE IMPACT

This assessment considers a potential cumulative scenario, with the noise model considering potential construction and operational activities, cumulatively with existing noise-generating activities.

10.1 CONSTRUCTION PHASE NOISE IMPACT – SCENARIO 2

A noise model was developed for scenario 2 as discussed in **Section 6.1** and conceptualised in **Figure 9-4**. The identified noise-generating activities were modelled, with the conceptual noise level contours depicted in **Figure 9-5**. The night-time scenario was not included, as night-time construction is not recommended. This is because construction activities frequently include impulsive components that would increase annoyance with the noises, and, when coupled with high noise levels, the significance of a noise impact associated with night-time construction activities will be high. It should be noted that, while this assessment does consider pile driving activities, other construction activities could also impact on the closest NSR, though the noise levels will be less. This includes activities such as dredging, formwork, concrete mixing and pumping, compaction of material, impact drilling of bolts, etc. when these activities will occur within 250m from the Shark Island Camping site.

The potential significance of the noise impact for day-time construction activities is defined per NSR in **Appendix C, Table 1**, with the potential significance of the daytime noise impact summarised in **Table 10-1**.

Table 10-1: Impact Assessment: Future Daytime Activities – Scenario 2

Nature:	***Numerous simultaneous construction activities during the day***	
Description of the noise impact	Average fast-weighted daytime sound levels were measured at 45.5 dBA (long-term measurement location), with the various measurements collected at NPSTSL02 (and NPSTSL01 at times) highlighting a relative quiet soundscape. Construction activities will generate very high noise levels, especially when the activities such as pile driving have to take place within 250m from the Shark Island Camp site. It is highly likely to definite that the various construction activities in the proximity of Shark Island Camping site will exceed the recommended IFC noise limit of 55 dBA. Due to the topography, construction activities will result in a significant change in the ambient sound levels at NSR 05 – 10, with the noise level possibly exceeding the 55 dBA IFC noise limit at times. Noise levels would be higher than the IFC recommended noise limit of 70 dBA at the boundary during pile driving and certain construction activities.	
	Without Mitigation	***With Mitigation***

Magnitude (Table 7-2)	Very High (10)	Very High (8)
Duration (Table 7-3)	Short (2)	Short (2)
Extent ($\Delta L_{Aeq,D}$>7dBA) (Table 7-4)	Local (2)	Local (2)
Probability (Table 7-5)	Definite (5)	Probable (3)
Significance of Impact	**High (70) [Shark Island]**	**Low (42) – All NSR**
Status	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	Loss of a natural soundscape, especially at the Shark Island Camping site.	Loss of a natural soundscape, especially at the Shark Island Camping site.
Comments	Scenario with worst-case construction activities, including the existing activities.	
Degree of Confidence	**Medium-High**	
Mitigation:	Measures that could reduce the noise levels as well as the probability of a noise impact occurring may include: • The potential noise levels and construction schedule should be discussed with all NSR staying within 500m from future areas where pile driving will take place. Measures that will be used to reduce noise levels should be highlighted. • Namport should select the use of vibratory pile driving instead of hammer pile driving. If viable, the vibratory hammer should be fitted with a pile drive shroud; • Namport could consider drilling a hole to cast the pile in place instead of pile driving, or predrilling a pilot hole before piling (if viable). The drill could be fitted with a shroud, with noise barrier or acoustic enclosures used around mobile equipment (such as the air compressor or concrete pump); • Namport should select contractors that use newer, quieter equipment. Equipment should be well maintained as per manufacturers requirements, with the engine compartment closed; • Induction training should include an environmental noise component, which should be given to all employees and contractors, highlighting the sensitivity of the area to noise. Sources of noise should be highlighted, especially the potential impact of material handling noises; • Namport could install a real-time noise monitoring system at the Shark Island Camp Site to provide immediate and accurate noise levels to the contractors and Namport. • Namport could investigate the use of squawker reverse alarms instead of tonal reverse alarms within the port area. Namport should highlight the benefit of squawker reverse alarms at the induction training to contractors and other users of the port area. General mitigation measures are also included in **section 11.1** to ensure that annoyance with the project is minimised.	
Cumulative Impacts:	Cumulative impacts were investigated and considered in the assessment.	
Residual Impacts:	Noise levels will decrease once pile driving activities are complete, and, with management, operational noises may be less than construction noises.	

10.2 Operational Phase Noise Impact – Scenario 3, 4, 5 and 6

The impact assessment for the various operational activities discussed in **section 6.2** was conceptualised (see **Figure 9-6** for various potential scenarios), with the potential noise levels discussed in **section 9.2** considering various scenarios:

- Scenario 3 conceptualize potential noise-generating activities associated with two cranes operating simultaneously at the existing berth area, with daytime potential noise levels defined per NSR in **Appendix C, Table 2**, and night-time noise levels defined per NSR in **Appendix C, Table 3**;
- Scenario 4 conceptualize potential noise-generating activities associated with two cranes operating simultaneously (one at the existing berth and a second operating at the new berth area), with daytime potential noise levels defined per NSR in **Appendix C, Table 4**, and night-time noise levels defined per NSR in **Appendix C, Table 5**;
- Scenario 5 conceptualize potential noise-generating activities associated with three cranes operating simultaneously (one at the existing berth and two operating at the new berth area), with daytime potential noise levels defined per NSR in **Appendix C, Table 6**, and night-time noise levels defined per NSR in **Appendix C, Table 7**;
- Scenario 6 conceptualize potential noise-generating activities associated with three cranes operating simultaneously (two at the existing berth and one crane operating at the new berth area, with daytime potential noise levels defined per NSR in **Appendix C, Table 8**, and night-time noise levels defined per NSR in **Appendix C, Table 9**.

The potential significance of the noise impacts associated with these scenarios are defined for operational activities in:

- **Table 10-2** for daytime operational activities; and
- **Table 10-3** for night-time operational activities.

Table 10-2: Impact Assessment: Worst-case daytime operational activities

Nature:	***Numerous simultaneous operational activities during the day***	
Acceptable Rating Level	Average fast-weighted daytime sound levels were measured at 45.5 dBA (long-term measurement location), with the various measurements collected at NPSTSL02 (and NPSTSL01 at times) highlighting a relative quiet soundscape. Operational activities will generate significant noise levels, with the noise levels depending on the number of activities taking place, the type of activity and the location where these activities are taking place. Based on the noise modelling, it is highly unlikely that the various operational activities (for all scenarios) will raise the equivalent daytime noise levels higher than the recommended IFC noise limit of 55 dBA. Operational noise will however be audible to clearly audible at the closest NSR, especially at the Shark Island Camping site, with the projected noise levels likely to change the ambient sound levels (the existing noise level or background noise level). Topography will assist in reducing the noise levels significantly at NSR05 – NSR10. Noise levels would be less than the IFC recommended noise limit of 70 dBA at the boundary during typical operational activities.	
	Without Mitigation	***With Mitigation***

Magnitude (Table 7-2)	Medium (6)	Moderate (6)
Duration (Table 7-3)	Permanent (5)	Permanent (5)
Extent ($\Delta L_{Aeq,D}$>7dBA) (Table 7-4)	Local (2)	Local (2)
Probability (Table 7-5)	Probable (1)	Improbable (1)
Significance of Impact	**Low (26) – All NSR**	**Low (26) – All NSR**
Status	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	Loss of a natural soundscape, especially at the Shark Island Camping site.	Loss of a natural soundscape, especially at the Shark Island Camping site.
Comments	Scenario with numerous operational activities, including the existing activities.	
Degree of Confidence	**Medium-High**	
Mitigation:	The potential significance from future operational noises would be **low** for all evaluated scenarios and additional mitigation measures are not required or recommended. Mitigation measures are recommended for night-time operational activities, which will automatically also reduce the potential daytime noise levels. General mitigation measures are also included in **section 11.2** to ensure that annoyance with the project is minimised.	
Cumulative Impacts:	Cumulative impacts were investigated and considered in the assessment.	
Residual Impacts:	This impact will only disappear after decommissioning and closure is completed.	

Table 10-3: Impact Assessment: Worst-case night-time operational activities

Nature:	***Numerous simultaneous operational activities at night***	
Acceptable Rating Level	Average fast-weighted daytime sound levels were measured at 41.4 dBA (long-term measurement location), with the various measurements collected at NPSTSL02 (and NPSTSL01 at times) highlighting a relative quiet soundscape. Operational activities will generate significant noise levels, with the noise levels depending on the number of activities taking place, the type of activity and the location where these activities are taking place. Based on the noise modelling, it is likely to definite that the various operational activities (for all scenarios) will raise the equivalent night-time noise levels higher than the recommended IFC noise limit of 45 dBA. Operational noise will also be clearly audible at the closest NSR, especially at the Shark Island Camping site, with the projected noise levels likely to change the ambient sound levels (the existing noise level or background noise level). Topography will assist in reducing the noise levels at NSR05 – NSR10. Noise levels would be less than the IFC recommended noise limit of 70 dBA at the boundary during typical operational activities.	
	Without Mitigation	***With Mitigation***
Magnitude (Table 7-2)	High (8)	Medium (6)
Duration	Permanent (5)	Permanent (5)

(Table 7-3)		
Extent ($\Delta L_{Aeq,D}$>7dBA) (Table 7-4)	Regional (3)	Regional (3)
Probability (Table 7-5)	Highly Probable (4)	Possible (2) to Likely (3)
Significance of Impact	**High (60)**	**Medium (42)**
Status	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No loss of resources.	No loss of resources.
Comments	Scenario with numerous operational activities, including the existing activities.	
Degree of Confidence	**Medium-High**	
Mitigation:	The potential significance of the night-time operational noise impact is **high** for the activities as conceptualised for scenarios 3, 4, 5 and 6. This relates to the potential high noise levels generated, complicated due to the close proximity of NSR to the port activities. Additional mitigation measures could be difficult, due to the typical heights associated with loading/unloading activities (as well as the position of the crane), though the following measures could assist in reducing noise levels as well as the probability of a noise impact to occur: • The potential operational noise levels and activities should be discussed with all NSR staying within 500m from port activities. The PoL should initiate a forum or similar mechanism to provide feedback about measured noise levels and noise-reduction measures that were implemented; • Induction training should include an environmental noise component, which should be given to all employees and contractors, highlighting the sensitivity of the area to noise. Sources of noise should be highlighted, especially the potential impact of material handling noises (e.g. skip hitting the hole covers during loading/unloading); • Namport could install a real-time noise monitoring system at the Shark Island Camp Site to provide immediate and accurate noise levels to the contractors and Namport; • Namport must conduct annual noise auditing to assist in classify noise sources, defining the associated noise levels (magnitude of the noise emission levels) and identify the specific measures that could reduce noise levels. Namport should commit to implementing viable noise mitigation measures; • Namport should commit to investigate reasonable and valid noise complaints and implementing viable noise management measures; • Namport should ensure that contractors and port users have appropriate equipment maintenance programmes in place; • Namport could investigate the use of squawker reverse alarms instead of tonal reverse alarms within the port area. Namport should highlight the benefit of squawker reverse alarms at the induction training to contractors and other users of the port area; • Namport should plan the location of infrastructure and transport routes within the expansion area to optimize the noise-reduction effectiveness of walls and buildings. This could include locating loading and unloading activities to allow buildings to act as noise barriers (see also **Figure 11-1**). General mitigation measures are also discussed in **section 11.2** to ensure that annoyance with the project is minimised.	
Cumulative Impacts:	Cumulative impacts were investigated and considered in the assessment.	
Residual Impacts:	This impact will only disappear after decommissioning and closure is completed.	

11 MITIGATION OPTIONS

This study considers the potential noise impact on the surrounding environment due to the operational activities associated with the proposed PoL expansion project. Using conceptual noise models, it was determined that the potential noise impacts associated with the project would be:

- of a **high significance** for daytime construction activities. While this **high significance** might relate to the strict EIA criteria used (with the assumption that the higher noise levels may be considered disturbing or annoying by the closest NSR). Mitigation measures were recommended that could reduce noise levels as well as the probability of noise complaints being registered, which could assist in reducing the significance of the noise impact to **medium**, potentially to **low**;
- of a **low significance** for daytime operational activities associated with the PoL activities (all scenarios as evaluated);
- of a **high significance** for night-time activities associated with the port operational activities. While this **high significance** might relate to the strict EIA criteria used (with the assumption that the higher noise levels may be considered disturbing or annoying by the closest NSR). Mitigation measures were recommended that could reduce noise levels as well as the probability of noise complaints being registered, which could assist in reducing the significance of the noise impact to **medium**, potentially to **low**.

The port expansion project will increase noise levels at the NSR located within 500m from construction and operational activities and noise complaints may develop. The PoL must know that community involvement needs to continue throughout the project. Annoyance is a complicated psychological phenomenon, as with many industrial operations, expressed annoyance with sound can reflect an overall annoyance with the project, rather than a rational reaction to a perceived noise itself.

At all stages, surrounding receptors should be informed about the project, providing them with factual information without setting unrealistic expectations. It is counterproductive to suggest that the activities will be inaudible due to existing high ambient sound levels, or that noise levels will be low (based on the noise assessment). The magnitude of the sound levels will depend on a multitude of variables and will vary from day to day and from place to place with environmental and operational conditions. Audibility is distinct from the sound level, because it depends on the relationship between the sound level from the activities, the spectral character and that of the surrounding soundscape (both level and spectral character).

The project applicant must implement a line of communication (i.e., a help line where complaints could be lodged). All potential sensitive receptors should be made aware of these contact numbers. The PoL should maintain a commitment to the local community (people staying within 1,000 m from construction or operational activities) and respond to noise concerns in an expedient fashion. Sporadic and legitimate noise complaints could be raised. For example, sudden and sharp increases in sound levels could result from mechanical malfunctions or maintenance issues. Problems of this nature can be corrected quickly and it is in PoL's interest to do so.

11.1 CONSTRUCTION PHASE MITIGATION MEASURES

The study considers the potential noise impact on the surrounding environment due to future operational activities at PoL. The potential noise impact would be of a **high significance** during the daytime period (mainly due to noises from pile driving activities within 250m from the Shark Island Camping site). Measures that may assist in reducing the probability of noise impacts occurring are:

- The potential noise levels and construction schedule should be discussed with all NSR staying within 500m from future areas where pile driving will take place. Measures that will be used to reduce noise levels should be highlighted;
- Namport should select the use of vibratory pile driving instead of hammer pile driving. If viable, the vibratory hammer should be fitted with a pile drive shroud;
- Namport could consider drilling a hole to cast the pile in place instead of pile driving, or predrilling a pilot hole before piling (if viable). The drill could be fitted with a shroud, with noise barrier or acoustic enclosures used around mobile equipment (such as the air compressor or concrete pump);
- Namport should select contractors that use newer, quieter equipment. Equipment should be well maintained as per manufacturers requirements, with the engine compartment closed;
- Induction training should include an environmental noise component, which should be given to all employees and contractors, highlighting the sensitivity of the area to noise. Sources of noise should be highlighted, especially the potential impact of material handling noises;
- Namport could install a real-time noise monitoring system at the Shark Island Camp Site to provide immediate and accurate noise levels to the contractors and Namport.
- Namport should investigate the use of white noise alarms (squawkers) instead of tonal reverse alarms on heavy vehicles and fork-lifts operating within the port

area[1819] and consider changes to policies and guidelines for contractors and port users. The advantages of white noise alarms above tonal alarms are;

- It is as safe as a tonal alarm[20].
- Highly audible close to the alarm (or reversing truck)[21].
- It generates a more uniform sound field behind a reversing vehicle[22].
- Greater directional information, workers can locate the source faster.
- Significantly less environmental noise and it creates significantly less annoyance far away.
- When properly installed, white noise alarms of a similar sound power emission level are more likely to comply with the ISO 9533 standard.

11.2 OPERATIONAL PHASE MITIGATION MEASURES

The study considers the potential noise impact on the surrounding environment due to future operational activities at the PoL. The potential noise impact would be of a **high** significance during the night-time periods, yet the implementation of various mitigation measures could assist in reducing this significance. Such measures could include:

- The potential operational noise levels and activities should be discussed with all NSR staying within 500m from port activities. The PoL should initiate a forum or similar mechanism to provide feedback about measured noise levels and noise-reduction measures that were implemented;
- Induction training should include an environmental noise component, which should be given to all employees and contractors, highlighting the sensitivity of the area to noise. Sources of noise should be highlighted, especially the potential impact of material handling noises (e.g. skip hitting the hole covers during loading/unloading);
- Namport could install a real-time noise monitoring system at the Shark Island Camp Site to provide immediate and accurate noise levels to the contractors and Namport;
- Namport must conduct annual noise auditing to assist in classify noise sources, defining the associated noise levels (magnitude of the noise emission levels) and

[18]White Noise Reverse Alarms: http://www.brigade-electronics.com/products.
[19] https://www.constructionnews.co.uk/home/white-noise-sounds-the-reversing-alarm/885410.article - White noise sounds the reversing alarm
[20]https://www.acoustics.asn.au/conference_proceedings/AAS2012/papers/p126.pdf - Which is Safer – Tonal or Broadband Reversing Alarms
[21] http://www.irsst.qc.ca/media/documents/PubIRSST/R-833.pdf - Safety of workers behind heavy vehicles
[22] https://www.vaultintel.com/blog/reversing-beeps-could-be-a-thing-of-the-past
https://brigade-electronics.com/white-sound-reversing-alarms-improving-safety-environment/

identify the specific measures that could reduce noise levels. Namport should commit to implementing viable noise mitigation measures;

- Namport should commit to investigate reasonable and valid noise complaints and implementing viable noise management measures;
- Namport should ensure that contractors and port users have appropriate equipment maintenance programmes in place;
- Namport could investigate the use of squawker reverse alarms instead of tonal reverse alarms within the port area. Namport should highlight the benefit of squawker reverse alarms at the induction training to contractors and other users of the port area;
- Namport should plan the location of infrastructure and transport routes within the expansion area to optimize the noise-reduction effectiveness of walls and buildings. This could include locating loading and unloading activities to allow buildings to act as noise barriers (see also **Figure 11-1**).

11.3 MITIGATION OPTIONS THAT SHOULD BE INCLUDED IN THE EMP AND EA

- All employees and contractors should receive Health and Safety induction that includes an environmental awareness component (noise). This is to allow employees and contractors to realise the potential noise risks that activities (especially night-time activities) pose to the surrounding environment. Users of the port facilities should implement similar requirements within their own induction training programmes;
- The PoI must implement a line of communication (i.e., a helpline where complaints could be lodged). All potential sensitive receptors should be made aware of these contact numbers, or alternative means to communicate issues. PoL should maintain a commitment to the local community and respond to concerns in an expedient fashion. Sporadic and legitimate noise complaints could develop and if valid, should be investigated. Feedback must be provided to the affected stakeholder(s) with details of any steps taken to mitigate the impact (if valid complaint) or preventative steps to minimise this from happening again.
- The PoI must investigate any reasonable and valid noise complaint if registered by a receptor staying within 2,000 m from the plant or active mining area.
- It is recommended that the PoI develop and implement a noise monitoring programme, including a continuous noise monitoring system as well as annual noise auditing.



Figure 11-1: Potential noise management – using project layout to manage noise emissions

12 ENVIRONMENTAL MONITORING PLAN

Environmental Noise Monitoring can be divided into two distinct categories, namely:

- Passive monitoring – the registering of any complaints (reasonable and valid) regarding noise; and
- Active monitoring – the measurement of noise levels at identified locations.

Active environmental noise monitoring is recommended because the projected elevated noise levels at verified NSR are higher than the night-time rating level for the area.

In addition, should a valid complaint (from a stakeholder living within 500 m from port activities) be registered, the applicant must investigate this complaint as per the following sections. It is recommended that the noise investigation is done by an independent acoustic consultant.

It should be noted that this noise monitoring programme may be used as a guideline, as site-specific conditions may require that the monitoring locations, frequency or procedures be adapted.

12.1 MEASUREMENT LOCALITIES AND PROCEDURES

12.1.1 Measurement Localities and Frequencies

It is recommended that an acoustic specialist be appointed to assist with the design of a noise monitoring programme after considering the future mitigation measures to be implemented by the PoL.

It is recommended that a continuous noise monitoring system be implemented at the Shark Island Camping area before construction activities start, with the continuous noise monitoring system potentially relocated once the construction phase proceeds into the operational phase. The exact location of the monitoring system should to identified after considering the layout of infrastructure associated with the expansion project. Potential locations could be near NSR01 for the construction phase, and NSR04 for the operational phase.

When investigating a noise complaint, measurements must be conducted at the location of the person that registered a valid and reasonable noise complaint (staying within 500 m from the expansion project). A second instrument could be deployed simultaneously at the port (near the noise-generating activity associated with the noise complaint).

Annual noise auditing are recommended, which should include short term measurements, identification of major noise sources and if viable, defining the noise emissions of the major noise sources.

12.1.2 Measurement Procedures

Sound pressure level measurements should be collected as defined by ISO 1996 (or an acceptable international noise monitoring protocol (such as BS 4142). When investigating a noise complaint, measurements should be collected during a period or in conditions similar to when the receptor experienced the disturbing noise event. Due to the variability that naturally occurs in noise levels at most locations, it is recommended that semi-continuous measurements are conducted over a period of at least 36 hours, covering at least a full day- (06:00 – 22:00) and two night-time (22:00 – 06:00) periods.

13 RECOMMENDATIONS AND CONCLUSION

This ENIA covers the proposed expansion of the PoL activities in Namibia.

The potential noise levels were calculated using a sound propagation model using six (6) different conceptual scenarios, which determined that the potential noise could be:

- of a **high significance** for daytime construction activities. While this **high significance** might relate to the strict EIA criteria used (with the assumption that the higher noise levels may be considered disturbing or annoying by the closest NSR). Mitigation measures were recommended that could reduce noise levels as well as the probability of noise complaints being registered, which could assist in reducing the significance of the noise impact to **medium**, potentially to **low**;
- of a **low significance** for daytime operational activities associated with the PoL activities (all scenarios as evaluated);
- of a **high significance** for night-time activities associated with the port operational activities. While this **high significance** might relate to the strict EIA criteria used (with the assumption that the higher noise levels may be considered disturbing or annoying by the closest NSR). Mitigation measures were recommended that could reduce noise levels as well as the probability of noise complaints being registered, which could assist in reducing the significance of the noise impact to **medium**, potentially to **low**.

The noise-generation scenarios generally consider noise-generating activities close to the NSR, considering potential cumulative effects from existing port activities. Existing port activities are generally audible at the closest NSR, and the proposed expansion will result in additional activities that would slightly raise the noise levels at the closest NSR. The increase however is not considered a fatal flaw, and it is recommended that the PoL expansion Project be authorised (from a noise impact perspective).

This noise impact assessment is sufficient, but it is recommended that noise monitoring programme be designed for implementation.

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APPENDIX A

Glossary of Acoustic Terms, Definitions and General Information

1/3-Octave Band	A filter with a bandwidth of one-third of an octave representing four semitones, or notes on the musical scale. This relationship is applied to both the width of the band, and the centre frequency of the band. See also definition of octave band.
A – Weighting	An internationally standardised frequency weighting that approximates the frequency response of the human ear and gives an objective reading that therefore agrees with the subjective human response to that sound.
Air Absorption	The phenomena of attenuation of sound waves with distance propagated in air, due to dissipative interaction within the gas molecules.
Alternatives	A possible course of action, in place of another, that would meet the same purpose and need (of proposal). Alternatives can refer to any of the following but are not limited hereto: alternative sites for development, alternative site layouts, alternative designs, alternative processes and materials. In Integrated Environmental Management the so-called "no-go" alternative refers to the option of not allowing the development and may also require investigation in certain circumstances.
Ambient	The conditions surrounding an organism or area.
Ambient Noise	The all-encompassing sound at a point being composed of sounds from many sources both near and far. It includes the noise from the noise source under investigation.
Ambient Sound	The all-encompassing sound at a point being composite of sounds from near and far.
Ambient Sound Level	Means the reading on an integrating impulse sound level meter taken at a measuring point in the absence of any alleged disturbing noise at the end of a total period of at least 10 minutes after such a meter was put into operation. In this report the term Background ambient sound level will be used.
Amplitude Modulated Sound	A sound that noticeably fluctuates in loudness over time.
Applicant	Any person who applies for an authorisation to undertake a listed activity or to cause such activity in terms of the relevant environmental legislation.
Assessment	The process of collecting, organising, analysing, interpreting and communicating data that is relevant to some decision.
Attenuation	Term used to indicate reduction of noise or vibration, by whatever method necessary, usually expressed in decibels.
Audible frequency Range	Generally assumed to be the range from about 20 Hz to 20,000 Hz, the range of frequencies that our ears perceive as sound.
Ambient Sound Level	The level of the ambient sound indicated on a sound level meter in the absence of the sound under investigation (e.g. sound from a particular noise source or sound generated for test purposes). Ambient sound level as per Noise Control Regulations.
Broadband Noise	Spectrum consisting of a large number of frequency components, none of which is individually dominant.
C-Weighting	This is an international standard filter, which can be applied to a pressure signal or to a *SPL* or *PWL* spectrum, and which is essentially a pass-band filter in the frequency range of approximately 63 to 4000 Hz. This filter provides a more constant, flatter, frequency response, providing significantly less adjustment than the A-scale filter for frequencies less than 1000 Hz.
Controlled area (as per National Noise Control Regulations)	a piece of land designated by a local authority where, in the case of- (a) road transport noise in the vicinity of a road- (i) the reading on an integrating impulse sound level meter, taken outdoors at the end of a period extending from 06:00 to 24:00 while such meter is in operation, exceeds 65dBA; or (ii) the equivalent continuous "A"-weighted sound pressure level at a height of at least 1,2metres, but not more than 1,4 metres, above the ground for a period extending from06:00 to 24:00 as calculated in accordance with SABS 0210-1986, titled: "Code of Practice for calculating and predicting road traffic noise", published under Government Notice No. 358 of 20 February 1987, and projected for a period of 15 years following the date on which the local authority has made such designation, exceeds 65 dBA; (b) aircraft noise in the vicinity of an airfield, the calculated noisiness index, projected for a period of 15 years following the date on which the local authority has made such designation, exceeds 65 dBA; or

	(c) industrial noise in the vicinity of an industry- (i) the reading on an integrating impulse sound level meter, taken outdoors at the end of a period of 24 hours while such meter is in operation, exceeds 61 dBA; or (ii) the calculated outdoor equivalent continuous "A"-weighted sound pressure level at a height of at least 1,2 metres, but not more than 1,4 metres, above the ground for a period of 24 hours, exceeds 61 dBA;
dB(A)	Sound Pressure Level in decibel that has been A-weighted, or filtered, to match the response of the human ear.
Decibel (db)	A logarithmic scale for sound corresponding to a multiple of 10 of the threshold of hearing. Decibels for sound levels in air are referenced to an atmospheric pressure of 20 μ Pa.
Diffraction	The process whereby an acoustic wave is disturbed and its energy redistributed in space as a result of an obstacle in its path, Reflection and refraction are special cases of diffraction.
Direction of Propagation	The direction of flow of energy associated with a wave.
Disturbing noise	Means a noise level that exceeds the zone sound level or, if no zone sound level has been designated, a noise level that exceeds the ambient sound level at the same measuring point by 5 dBA or more.
Environment	The external circumstances, conditions and objects that affect the existence and development of an individual, organism or group; these circumstances include biophysical, social, economic, historical, cultural and political aspects.
Environmental Control Officer	Independent Officer employed by the applicant to ensure the implementation of the Environmental Management Plan (EMP) and manages any further environmental issues that may arise.
Environmental impact	A change resulting from the effect of an activity on the environment, whether desirable or undesirable. Impacts may be the direct consequence of an organisation's activities or may be indirectly caused by them.
Environmental Impact Assessment	An Environmental Impact Assessment (EIA) refers to the process of identifying, predicting and assessing the potential positive and negative social, economic and biophysical impacts of any proposed project, plan, programme or policy that requires authorisation of permission by law and that may significantly affect the environment. The EIA includes an evaluation of alternatives, as well as recommendations for appropriate mitigation measures for minimising or avoiding negative impacts, measures for enhancing the positive aspects of the proposal, and environmental management and monitoring measures.
Environmental issue	A concern felt by one or more parties about some existing, potential or perceived environmental impact.
Equivalent continuous A-weighted sound exposure level ($L_{Aeq,T}$)	The value of the average A-weighted sound pressure level measured continuously within a reference time interval *T*, which have the same mean-square sound pressure as a sound under consideration for which the level varies with time.
Equivalent continuous A-weighted rating level ($L_{Req,T}$)	The Equivalent continuous A-weighted sound exposure level *($L_{Aeq,T}$)* to which various adjustments have been added. More commonly used as ($L_{Req,d}$) over a time interval 06:00 – 22:00 (T=16 hours) and ($L_{Req,n}$) over a time interval of 22:00 – 06:00 (T=8 hours). It is a calculated value.
F (fast) time weighting	(1) Averaging detection time used in sound level meters. (2) Fast setting has a time constant of 125 milliseconds and provides a fast reacting display response allowing the user to follow and measure not too rapidly fluctuating sound.
Footprint area	Area to be used for the construction of the proposed development, which does not include the total study area.
Free Field Condition	An environment where there are no reflective surfaces.
Frequency	The rate of oscillation of a sound, measured in units of Hertz (Hz) or kiloHertz (kHz). One hundred Hz is a rate of one hundred times per second. The frequency of a sound is the property perceived as pitch: a low-frequency sound (such as a bass note) oscillates at a

	relatively slow rate, and a high-frequency sound (such as a treble note) oscillates at a relatively high rate.
Greenfield	A parcel of land not previously developed beyond that of agriculture or forestry use; virgin land. The opposite of Greenfield is Brownfield, which is a site previously developed and used by an enterprise, especially for a manufacturing or processing operation. The term Brownfield suggests that an investigation should be made to determine if environmental damage exists.
G-Weighting	An International Standard filter used to represent the infrasonic components of a sound spectrum.
Harmonics	Any of a series of musical tones for which the frequencies are integral multiples of the frequency of a fundamental tone.
I (impulse) time weighting	(1) Averaging detection time used in sound level meters as per South African standards and Regulations. (2) Impulse setting has a time constant of 35 milliseconds when the signal is increasing (sound pressure level rising) and a time constant of 1,500 milliseconds while the signal is decreasing.
Impulsive sound	A sound characterized by brief excursions of sound pressure (transient signal) that significantly exceed the ambient sound level.
Infrasound	Sound with a frequency content below the threshold of hearing, generally held to be about 20 Hz. Infrasonic sound with sufficiently large amplitude can be perceived, and is both heard and felt as vibration. Natural sources of infrasound are waves, thunder and wind.
Integrated Development Plan	A participatory planning process aimed at developing a strategic development plan to guide and inform all planning, budgeting, management and decision-making in a Local Authority, in terms of the requirements of Chapter 5 of the Municipal Systems Act, 2000 (Act 32 of 2000).
Integrated Environmental Management	IEM provides an integrated approach for environmental assessment, management, and decision-making and to promote sustainable development and the equitable use of resources. Principles underlying IEM provide for a democratic, participatory, holistic, sustainable, equitable and accountable approach.
Interested and affected parties	Individuals or groups concerned with or affected by an activity and its consequences. These include the authorities, local communities, investors, workforce, consumers, environmental interest groups and the general public.
Key issue	An issue raised during the Scoping process that has not received an adequate response and that requires further investigation before it can be resolved.
L_{A90}	the sound level exceeded for the 90% of the time under consideration
Listed activities	Development actions that is likely to result in significant environmental impacts as identified by the delegated authority (formerly the Minister of Environmental Affairs and Tourism) in terms of Section 21 of the Environment Conservation Act.
L_{AMin} and L_{AMax}	Is the RMS (root mean squared) minimum or maximum level of a noise source.
Loudness	The attribute of an auditory sensation that describes the listener's ranking of sound in terms of its audibility.
Magnitude of impact	Magnitude of impact means the combination of the intensity, duration and extent of an impact occurring.
Masking	The raising of a listener's threshold of hearing for a given sound due to the presence of another sound.
Mitigation	To cause to become less harsh or hostile.
Negative impact	A change that reduces the quality of the environment (for example, by reducing species diversity and the reproductive capacity of the ecosystem, by damaging health, or by causing nuisance).
Noise	a. Sound that a listener does not wish to hear (unwanted sounds). b. Sound from sources other than the one emitting the sound it is desired to receive, measure or record. c. A class of sound of an erratic, intermittent or statistically random nature.
Noise Level	The term used in lieu of sound level when the sound concerned is being measured or ranked for its undesirability in the contextual circumstances.

Noise-sensitive development	developments that could be influenced by noise such as: a) districts (see table 2 of SANS 10103:2008) 1. rural districts, 2. suburban districts with little road traffic, 3. urban districts, 4. urban districts with some workshops, with business premises, and with main roads, 5. central business districts, and 6. industrial districts; b) educational, residential, office and healthcare buildings and their surroundings; c) churches and their surroundings; d) auditoriums and concert halls and their surroundings; e) recreational areas; and f) nature reserves. In this report, Noise-sensitive developments are also referred to as a Potential Sensitive Receptor
Octave Band	A filter with a bandwidth of one octave, or twelve semitones on the musical scale representing a doubling of frequency.
Positive impact	A change that improves the quality of life of affected people or the quality of the environment.
Property	Any piece of land indicated on a diagram or general plan approved by the Surveyor-General intended for registration as a separate unit in terms of the Deeds Registries Act and includes an erf, a site and a farm portion as well as the buildings erected thereon
Public Participation Process	A process of involving the public in order to identify needs, address concerns, choose options, plan and monitor in terms of a proposed project, programme or development
Reflection	Redirection of sound waves.
Refraction	Change in direction of sound waves caused by changes in the sound wave velocity, typically when sound wave propagates in a medium of different density.
Reverberant Sound	The sound in an enclosure which results from repeated reflections from the boundaries.
Reverberation	The persistence, after emission of a sound, has stopped, of a sound field within an enclosure.
Significant Impact	An impact can be deemed significant if consultation with the relevant authorities and other interested and affected parties, on the context and intensity of its effects, provides reasonable grounds for mitigating measures to be included in the environmental management report. The onus will be on the applicant to include the relevant authorities and other interested and affected parties in the consultation process. Present and potential future, cumulative and synergistic effects should all be taken into account.
S (slow) time weighting	(1) Averaging times used in sound level meters. (2) Time constant of one [1]second that gives a slower response which helps average out the display fluctuations.
Sound Level	The level of the frequency and time-weighted sound pressure as determined by a sound level meter, i.e. A-weighted sound level.
Sound Power	Of a source, the total sound energy radiated per unit time.
Sound Pressure Level (SPL)	Of a sound, 20 times the logarithm to the base 10 of the ratio of the RMS sound pressure level to the reference sound pressure level. International values for the reference sound pressure level are 20 micropascals in air and 100 millipascals in water. SPL is reported as L_p in dB (not weighted) or in various other weightings.
Soundscape	Sound or a combination of sounds that forms or arises from an immersive environment. The study of soundscape is the subject of acoustic ecology. The idea of soundscape refers to both the natural acoustic environment, consisting of natural sounds, including animal vocalizations and, for instance, the sounds of weather and other natural elements; and environmental sounds created by humans, through musical composition, sound design, and other ordinary human activities including conversation, work, and sounds of mechanical origin resulting from use of industrial technology. The disruption of these acoustic environments results in noise pollution.
Study area	Refers to the entire study area encompassing all the alternative routes as indicated on the study area map.

Sustainable Development	Development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts: the concept of "needs", in particular the essential needs of the world's poor, to which overriding priority should be given; and the idea of limitations imposed by the state of technology and social organisation on the environment's ability to meet present and the future needs (Brundtland Commission, 1987).
Tread braked	The traditional form of wheel brake consisting of a block of friction material (which could be cast iron, wood or nowadays a composition material) hung from a lever and being pressed against the wheel tread by air pressure (in the air brake) or atmospheric pressure in the case of the vacuum brake.
Zone of Potential Influence	The area defined as the radius about an object, or objects beyond which the noise impact will be insignificant.
Zone Sound Level	Means a derived dBA value determined indirectly by means of a series of measurements, calculations or table readings and designated by a local authority for an area. This is similar to the Rating Level as defined in SANS10103:2008.

APPENDIX B

Photos of sound level measurements



Photo B.1: Long-term measurement location NPLTSL00



Photo B.2: Example of short-term measurement location NPSLSL01



Photo B.2: Example of short-term measurement location NPSLSL02



Photo B.2: Example of short-term measurement location NPSLSL03



Photo B.2: Example of short-term measurement location NPSLSL05

APPENDIX C

Calculated conceptual noise rating levels and potential significance

Appendix C, Table 1: Projected worst-case noise rating levels and impact – Conceptual daytime operational activities for scenario 2

Potential Noise-sensitive development / Receptor(s)	Recommended Upper Noise Limit	Potential Ambient Sound Levels (long-term average	Potential Existing Noise Levels (calculated -	Projected Noise Rating Level, Construction phase	Potential change in ambient sound levels	Potential change considering potential	Magnitude / Intensity	Duration	Extent	Probability of Impact Occurring	Significance
NSR01	55.0	45.5	36.7	68.1	22.6	31.4	Very High	Short	Local	Definite	**High**
NSR02	55.0	45.5	36.0	61.0	15.5	25.0	Very High	Short	Local	Highly Probable	Moderate
NSR03	55.0	45.5	28.0	51.0	5.5	23.0	Medium	Short	Local	Possible	**Low**
NSR04	55.0	45.5	47.6	54.5	9.0	6.9	High	Short	Local	Possible	**Low**
NSR05	55.0	45.5	39.7	44.9	0.0	5.2	Low	Short	Local	Improbable	Negligible
NSR06	55.0	45.5	37.6	47.6	2.1	10.0	Low	Short	Local	Improbable	Negligible
NSR07	55.0	45.5	29.6	39.4	0.0	9.8	Low	Short	Local	Improbable	Negligible
NSR08	55.0	45.5	30.1	35.2	0.0	5.1	Low	Short	Local	Improbable	Negligible
NSR09	55.0	45.5	41.2	44.9	0.0	3.7	Low	Short	Local	Improbable	Negligible
NSR10	55.0	45.5	40.8	46.0	0.5	5.2	Low	Short	Local	Improbable	Negligible
NSR11	55.0	45.5	46.4	49.6	4.1	3.2	Low	Short	Local	Improbable	Negligible
NSR12	55.0	45.5	46.8	49.7	4.2	2.9	Low	Short	Local	Improbable	Negligible
NSR13	55.0	45.5	47.0	50.0	4.5	3.0	Low	Short	Local	Possible	**Low**
NSR14	55.0	45.5	50.0	51.9	6.4	1.9	Medium	Short	Local	Possible	**Low**
NSR15	55.0	45.5	47.0	48.6	3.1	1.6	Low	Short	Local	Improbable	Negligible
NSR16	55.0	45.5	44.5	46.8	1.3	2.3	Low	Short	Local	Improbable	Negligible
NSR17	55.0	45.5	37.0	41.2	0.0	4.2	Low	Short	Local	Improbable	Negligible
NSR18	55.0	45.5	37.0	39.9	0.0	2.9	Low	Short	Local	Improbable	Negligible
NSR19	55.0	45.5	43.9	46.2	0.7	2.3	Low	Short	Local	Improbable	Negligible
NSR20	55.0	45.5	46.9	49.4	3.9	2.5	Low	Short	Local	Improbable	Negligible
NSR21	55.0	45.5	48.0	50.8	5.3	2.8	Medium	Short	Local	Possible	**Low**
NSR22	55.0	45.5	48.0	49.9	4.4	1.9	Low	Short	Local	Improbable	Negligible
NSR23	55.0	45.5	35.1	41.9	0.0	6.8	Low	Short	Local	Improbable	Negligible

Appendix C, Table 2: Projected worst-case noise rating levels and impact – Conceptual daytime operational activities for scenario 3

Potential Noise-sensitive development / Receptor(s)	Recommended Upper Noise Limit	Potential Ambient Sound Levels (long-term average - Fast-weighted, low wind	Potential Existing Noise Levels (calculated -	Projected Noise Rating Level, Construction phase	Potential change in ambient sound levels	Potential change considering potential	Magnitude / Intensity	Duration	Extent	Probability of Impact Occurring	Significance
NSR01	55	45.5	36.7	36.7	0.0	0.0	Low	Permanent	Local	Improbable	Negligible
NSR02	55	45.5	36.0	35.7	0.0	0.0	Low	Permanent	Local	Improbable	Negligible
NSR03	55	45.5	28.0	29.8	0.0	1.8	Low	Permanent	Local	Improbable	Negligible

NSR04	55	45.5	47.6	47.6	2.1	0.0	Low	Permanent	Local	Improbable	Negligible
NSR05	55	45.5	39.7	40.1	0.0	0.4	Low	Permanent	Local	Improbable	Negligible
NSR06	55	45.5	37.6	36.7	0.0	0.0	Low	Permanent	Local	Improbable	Negligible
NSR07	55	45.5	29.6	29.7	0.0	0.1	Low	Permanent	Local	Improbable	Negligible
NSR08	55	45.5	30.1	30.1	0.0	0.0	Low	Permanent	Local	Improbable	Negligible
NSR09	55	45.5	41.2	41.3	0.0	0.1	Low	Permanent	Local	Improbable	Negligible
NSR10	55	45.5	40.8	41.6	0.0	0.8	Low	Permanent	Local	Improbable	Negligible
NSR11	55	45.5	46.4	47.3	1.8	0.9	Low	Permanent	Local	Improbable	Negligible
NSR12	55	45.5	46.8	46.9	1.4	0.1	Low	Permanent	Local	Improbable	Negligible
NSR13	55	45.5	47.0	47.0	1.5	0.0	Low	Permanent	Local	Improbable	Negligible
NSR14	55	45.5	50.0	50.7	5.2	0.7	Medium	Permanent	Local	Possible	Low
NSR15	55	45.5	47.0	47.2	1.7	0.2	Low	Permanent	Local	Improbable	Negligible
NSR16	55	45.5	44.5	44.8	0.0	0.3	Low	Permanent	Local	Improbable	Negligible
NSR17	55	45.5	37.0	37.0	0.0	0.0	Low	Permanent	Local	Improbable	Negligible
NSR18	55	45.5	37.0	37.1	0.0	0.1	Low	Permanent	Local	Improbable	Negligible
NSR19	55	45.5	43.9	43.9	0.0	0.0	Low	Permanent	Local	Improbable	Negligible
NSR20	55	45.5	46.9	46.9	1.4	0.0	Low	Permanent	Local	Improbable	Negligible
NSR21	55	45.5	48.0	48.0	2.5	0.0	Low	Permanent	Local	Improbable	Negligible
NSR22	55	45.5	48.0	48.0	2.5	0.0	Low	Permanent	Local	Improbable	Negligible
NSR23	55	45.5	35.1	35.0	0.0	0.0	Low	Permanent	Local	Improbable	Negligible

Appendix C, Table 3: Projected worst-case noise rating levels and impact – Conceptual night-time operational activities for scenario 3

Potential Noise-sensitive development / Receptor(s)	Recommended Upper Noise Limit	Potential Ambient Sound Levels (long-term average	Potential Existing Noise Levels (calculated -	Projected Noise Rating Level, Construction phase	Potential change in ambient sound levels	Potential change considering potential	Magnitude / Intensity	Duration	Extent	Probability of Impact Occurring	Significance
NSR01	45.0	41.4	36.7	36.7	0.0	0.0	Low	Permanent	Regional	Improbable	Negligible
NSR02	45.0	41.4	36.0	35.7	0.0	0.0	Low	Permanent	Regional	Improbable	Negligible
NSR03	45.0	41.4	28.0	29.8	0.0	1.8	Low	Permanent	Regional	Improbable	Negligible
NSR04	45.0	41.4	47.6	47.6	6.2	0.0	Medium	Permanent	Regional	Likely	Moderate
NSR05	45.0	41.4	39.7	40.1	0.0	0.4	Low	Permanent	Regional	Possible	Low
NSR06	45.0	41.4	37.6	36.7	0.0	0.0	Low	Permanent	Regional	Improbable	Negligible
NSR07	45.0	41.4	29.6	29.7	0.0	0.1	Low	Permanent	Regional	Improbable	Negligible
NSR08	45.0	41.4	30.1	30.1	0.0	0.0	Low	Permanent	Regional	Improbable	Negligible
NSR09	45.0	41.4	41.2	41.3	0.0	0.1	Low	Permanent	Regional	Possible	Low
NSR10	45.0	41.4	40.8	41.6	0.2	0.8	Low	Permanent	Regional	Possible	Low
NSR11	45.0	41.4	46.4	47.3	5.9	0.9	Medium	Permanent	Regional	Likely	Moderate
NSR12	45.0	41.4	46.8	46.9	5.5	0.1	Medium	Permanent	Regional	Likely	Moderate
NSR13	45.0	41.4	47.0	47.0	5.6	0.0	Medium	Permanent	Regional	Likely	Moderate
NSR14	45.0	41.4	50.0	50.7	9.3	0.7	High	Permanent	Regional	Highly Probable	High
NSR15	45.0	41.4	47.0	47.2	5.8	0.2	Medium	Permanent	Regional	Likely	Moderate
NSR16	45.0	41.4	44.5	44.8	3.4	0.3	Low	Permanent	Regional	Possible	Low
NSR17	45.0	41.4	37.0	37.0	0.0	0.0	Low	Permanent	Regional	Improbable	Negligible
NSR18	45.0	41.4	37.0	37.1	0.0	0.1	Low	Permanent	Regional	Improbable	Negligible
NSR19	45.0	41.4	43.9	43.9	2.5	0.0	Low	Permanent	Regional	Possible	Low

Appendix C: Calculated conceptual noise levels

NSR20	45.0	41.4	46.9	46.9	5.5	0.0	Medium	Permanent	Regional	Likely	Moderate
NSR21	45.0	41.4	48.0	48.0	6.6	0.0	Medium	Permanent	Regional	Likely	Moderate
NSR22	45.0	41.4	48.0	48.0	6.6	0.0	Medium	Permanent	Regional	Likely	Moderate
NSR23	45.0	41.4	35.1	35.0	0.0	0.0	Low	Permanent	Regional	Improbable	Negligible

Appendix C, Table 4: Projected worst-case noise rating levels and impact – Conceptual daytime operational activities for scenario 4

Potential Noise-sensitive development / Receptor(s)	Recommended Upper Noise Limit	Potential Ambient Sound Levels (long-term average - Fast-weighted, low wind	Potential Existing Noise Levels (calculated -	Projected Noise Rating Level, Construction phase	Potential change in ambient sound levels	Potential change considering potential	Magnitude / Intensity	Duration	Extent	Probability of Impact Occurring	Significance
NSR01	55.0	45.5	36.7	43.8	0.0	7.1	Low	Permanent	Local	Improbable	Negligible
NSR02	55.0	45.5	36.0	41.6	0.0	5.6	Low	Permanent	Local	Improbable	Negligible
NSR03	55.0	45.5	28.0	32.6	0.0	4.6	Low	Permanent	Local	Improbable	Negligible
NSR04	55.0	45.5	47.6	51.1	5.6	3.5	Medium	Permanent	Local	Possible	Low
NSR05	55.0	45.5	39.7	43.0	0.0	3.3	Low	Permanent	Local	Improbable	Negligible
NSR06	55.0	45.5	37.6	40.6	0.0	3.0	Low	Permanent	Local	Improbable	Negligible
NSR07	55.0	45.5	29.6	31.3	0.0	1.7	Low	Permanent	Local	Improbable	Negligible
NSR08	55.0	45.5	30.1	31.5	0.0	1.4	Low	Permanent	Local	Improbable	Negligible
NSR09	55.0	45.5	41.2	39.4	0.0	0.0	Low	Permanent	Local	Improbable	Negligible
NSR10	55.0	45.5	40.8	42.8	0.0	2.0	Low	Permanent	Local	Improbable	Negligible
NSR11	55.0	45.5	46.4	48.1	2.6	1.7	Low	Permanent	Local	Improbable	Negligible
NSR12	55.0	45.5	46.8	43.6	0.0	0.0	Low	Permanent	Local	Improbable	Negligible
NSR13	55.0	45.5	47.0	44.7	0.0	0.0	Low	Permanent	Local	Improbable	Negligible
NSR14	55.0	45.5	50.0	46.8	1.3	0.0	Low	Permanent	Local	Improbable	Negligible
NSR15	55.0	45.5	47.0	45.4	0.0	0.0	Low	Permanent	Local	Improbable	Negligible
NSR16	55.0	45.5	44.5	44.3	0.0	0.0	Low	Permanent	Local	Improbable	Negligible
NSR17	55.0	45.5	37.0	39.0	0.0	2.0	Low	Permanent	Local	Improbable	Negligible
NSR18	55.0	45.5	37.0	35.5	0.0	0.0	Low	Permanent	Local	Improbable	Negligible
NSR19	55.0	45.5	43.9	42.4	0.0	0.0	Low	Permanent	Local	Improbable	Negligible
NSR20	55.0	45.5	46.9	45.4	0.0	0.0	Low	Permanent	Local	Improbable	Negligible
NSR21	55.0	45.5	48.0	46.7	1.2	0.0	Low	Permanent	Local	Improbable	Negligible
NSR22	55.0	45.5	48.0	45.9	0.4	0.0	Low	Permanent	Local	Improbable	Negligible
NSR23	55.0	45.5	35.1	37.9	0.0	2.8	Low	Permanent	Local	Improbable	Negligible

Appendix C, Table 5: Projected worst-case noise rating levels and impact – Conceptual night-time operational activities for scenario 4

Potential Noise-sensitive development / Receptor(s)	Recommended Upper Noise Limit	Potential Ambient Sound Levels (long-term average	Potential Existing Noise Levels (calculated -	Projected Noise Rating Level, Construction phase	Potential change in ambient sound levels	Potential change considering potential	Magnitude / Intensity	Duration	Extent	Probability of Impact Occurring	Significance
NSR01	45.0	41.4	36.7	43.8	2.4	7.1	Low	Permanent	Regional	Possible	Low
NSR02	45.0	41.4	36.0	41.6	0.2	5.6	Low	Permanent	Regional	Possible	Low
NSR03	45.0	41.4	28.0	32.6	0.0	4.6	Low	Permanent	Regional	Improbable	Negligible
NSR04	45.0	41.4	47.6	51.1	9.7	3.5	High	Permanent	Regional	Highly Probable	High
NSR05	45.0	41.4	39.7	43.0	1.6	3.3	Low	Permanent	Regional	Possible	Low
NSR06	45.0	41.4	37.6	40.6	0.0	3.0	Low	Permanent	Regional	Possible	Low
NSR07	45.0	41.4	29.6	31.3	0.0	1.7	Low	Permanent	Regional	Improbable	Negligible
NSR08	45.0	41.4	30.1	31.5	0.0	1.4	Low	Permanent	Regional	Improbable	Negligible
NSR09	45.0	41.4	41.2	39.4	0.0	0.0	Low	Permanent	Regional	Improbable	Negligible
NSR10	45.0	41.4	40.8	42.8	1.4	2.0	Low	Permanent	Regional	Possible	Low
NSR11	45.0	41.4	46.4	48.1	6.7	1.7	Medium	Permanent	Regional	Likely	Moderate
NSR12	45.0	41.4	46.8	43.6	2.2	0.0	Low	Permanent	Regional	Possible	Low
NSR13	45.0	41.4	47.0	44.7	3.3	0.0	Low	Permanent	Regional	Possible	Low
NSR14	45.0	41.4	50.0	46.8	5.4	0.0	Medium	Permanent	Regional	Likely	Moderate
NSR15	45.0	41.4	47.0	45.4	4.0	0.0	Low	Permanent	Regional	Likely	Moderate
NSR16	45.0	41.4	44.5	44.3	2.9	0.0	Low	Permanent	Regional	Possible	Low
NSR17	45.0	41.4	37.0	39.0	0.0	2.0	Low	Permanent	Regional	Improbable	Negligible
NSR18	45.0	41.4	37.0	35.5	0.0	0.0	Low	Permanent	Regional	Improbable	Negligible
NSR19	45.0	41.4	43.9	42.4	1.0	0.0	Low	Permanent	Regional	Possible	Low
NSR20	45.0	41.4	46.9	45.4	4.0	0.0	Low	Permanent	Regional	Likely	Moderate
NSR21	45.0	41.4	48.0	46.7	5.3	0.0	Medium	Permanent	Regional	Likely	Moderate
NSR22	45.0	41.4	48.0	45.9	4.5	0.0	Low	Permanent	Regional	Likely	Moderate
NSR23	45.0	41.4	35.1	37.9	0.0	2.8	Low	Permanent	Regional	Improbable	Negligible

Appendix C, Table 6: Projected worst-case noise rating levels and impact – Conceptual daytime operational activities for scenario 5

Potential Noise-sensitive development / Receptor(s)	Recommended Upper Noise Limit	Potential Ambient Sound Levels (long-term average - Fast-weighted, low wind	Potential Existing Noise Levels (calculated -	Projected Noise Rating Level, Construction phase	Potential change in ambient sound levels	Potential change considering potential	Magnitude / Intensity	Duration	Extent	Probability of Impact Occurring	Significance
NSR01	55.0	45.5	36.7	47.0	1.5	10.3	Low	Permanent	Local	Improbable	Negligible
NSR02	55.0	45.5	36.0	45.1	0.0	9.1	Low	Permanent	Local	Improbable	Negligible
NSR03	55.0	45.5	28.0	33.2	0.0	5.2	Low	Permanent	Local	Improbable	Negligible

NSR04	55.0	45.5	47.6	51.2	5.7	3.6	Medium	Permanent	Local	Possible	**Low**
NSR05	55.0	45.5	39.7	44.4	0.0	4.7	Low	Permanent	Local	Improbable	Negligible
NSR06	55.0	45.5	37.6	40.4	0.0	2.8	Low	Permanent	Local	Improbable	Negligible
NSR07	55.0	45.5	29.6	30.9	0.0	1.3	Low	Permanent	Local	Improbable	Negligible
NSR08	55.0	45.5	30.1	33.2	0.0	3.1	Low	Permanent	Local	Improbable	Negligible
NSR09	55.0	45.5	41.2	44.4	0.0	3.2	Low	Permanent	Local	Improbable	Negligible
NSR10	55.0	45.5	40.8	42.4	0.0	1.6	Low	Permanent	Local	Improbable	Negligible
NSR11	55.0	45.5	46.4	46.9	1.4	0.5	Low	Permanent	Local	Improbable	Negligible
NSR12	55.0	45.5	46.8	48.7	3.2	1.9	Low	Permanent	Local	Improbable	Negligible
NSR13	55.0	45.5	47.0	45.6	0.1	0.0	Low	Permanent	Local	Improbable	Negligible
NSR14	55.0	45.5	50.0	50.9	5.4	0.9	Medium	Permanent	Local	Possible	**Low**
NSR15	55.0	45.5	47.0	44.4	0.0	0.0	Low	Permanent	Local	Improbable	Negligible
NSR16	55.0	45.5	44.5	49.1	3.6	4.6	Low	Permanent	Local	Improbable	Negligible
NSR17	55.0	45.5	37.0	41.9	0.0	4.9	Low	Permanent	Local	Improbable	Negligible
NSR18	55.0	45.5	37.0	38.4	0.0	1.4	Low	Permanent	Local	Improbable	Negligible
NSR19	55.0	45.5	43.9	44.6	0.0	0.7	Low	Permanent	Local	Improbable	Negligible
NSR20	55.0	45.5	46.9	48.1	2.6	1.2	Low	Permanent	Local	Improbable	Negligible
NSR21	55.0	45.5	48.0	48.9	3.4	0.9	Low	Permanent	Local	Improbable	Negligible
NSR22	55.0	45.5	48.0	49.5	4.0	1.5	Low	Permanent	Local	Improbable	Negligible
NSR23	55.0	45.5	35.1	38.8	0.0	3.7	Low	Permanent	Local	Improbable	Negligible

Appendix C, Table 7: Projected worst-case noise rating levels and impact – Conceptual night-time operational activities for scenario 5

Potential Noise-sensitive development / Receptor(s)	Recommended Upper Noise Limit	Potential Ambient Sound Levels (long-term average	Potential Existing Noise Levels (calculated -	Projected Noise Rating Level, Construction phase	Potential change in ambient sound levels	Potential change considering potential	Magnitude / Intensity	Duration	Extent	Probability of Impact Occurring	Significance
NSR01	45.0	41.4	36.7	47.0	5.6	10.3	Medium	Permanent	Regional	Likely	Moderate
NSR02	45.0	41.4	36.0	45.1	3.7	9.1	Low	Permanent	Regional	Likely	Moderate
NSR03	45.0	41.4	28.0	33.2	0.0	5.2	Low	Permanent	Regional	Improbable	Negligible
NSR04	45.0	41.4	47.6	51.2	9.8	3.6	High	Permanent	Regional	Highly Probable	**High**
NSR05	45.0	41.4	39.7	44.4	3.0	4.7	Low	Permanent	Regional	Possible	**Low**
NSR06	45.0	41.4	37.6	40.4	0.0	2.8	Low	Permanent	Regional	Possible	**Low**
NSR07	45.0	41.4	29.6	30.9	0.0	1.3	Low	Permanent	Regional	Improbable	Negligible
NSR08	45.0	41.4	30.1	33.2	0.0	3.1	Low	Permanent	Regional	Improbable	Negligible
NSR09	45.0	41.4	41.2	44.4	3.0	3.2	Low	Permanent	Regional	Possible	**Low**
NSR10	45.0	41.4	40.8	42.4	1.0	1.6	Low	Permanent	Regional	Possible	**Low**
NSR11	45.0	41.4	46.4	46.9	5.5	0.5	Medium	Permanent	Regional	Likely	Moderate
NSR12	45.0	41.4	46.8	48.7	7.3	1.9	High	Permanent	Regional	Likely	Moderate
NSR13	45.0	41.4	47.0	45.6	4.2	0.0	Low	Permanent	Regional	Likely	Moderate
NSR14	45.0	41.4	50.0	50.9	9.5	0.9	High	Permanent	Regional	Highly Probable	**High**
NSR15	45.0	41.4	47.0	44.4	3.0	0.0	Low	Permanent	Regional	Possible	**Low**
NSR16	45.0	41.4	44.5	49.1	7.7	4.6	High	Permanent	Regional	Likely	Moderate
NSR17	45.0	41.4	37.0	41.9	0.5	4.9	Low	Permanent	Regional	Possible	**Low**
NSR18	45.0	41.4	37.0	38.4	0.0	1.4	Low	Permanent	Regional	Improbable	Negligible
NSR19	45.0	41.4	43.9	44.6	3.2	0.7	Low	Permanent	Regional	Possible	**Low**

Appendix C: Calculated conceptual noise levels

NSR20	45.0	41.4	46.9	48.1	6.7	1.2	Medium	Permanent	Regional	Likely	Moderate
NSR21	45.0	41.4	48.0	48.9	7.5	0.9	High	Permanent	Regional	Likely	Moderate
NSR22	45.0	41.4	48.0	49.5	8.1	1.5	High	Permanent	Regional	Likely	Moderate
NSR23	45.0	41.4	35.1	38.8	0.0	3.7	Low	Permanent	Regional	Improbable	Negligible

Appendix C, Table 8: Projected worst-case noise rating levels and impact – Conceptual daytime operational activities for scenario 6

Potential Noise-sensitive development / Receptor(s)	Recommended Upper Noise Limit	Potential Ambient Sound Levels (long-term average - Fast-weighted, low wind	Potential Existing Noise Levels (calculated -	Projected Noise Rating Level, Construction phase	Potential change in ambient sound levels	Potential change considering potential	Magnitude / Intensity	Duration	Extent	Probability of Impact Occurring	Significance
NSR01	55.0	45.5	36.7	38.1	0.0	1.4	Low	Permanent	Local	Improbable	Negligible
NSR02	55.0	45.5	36.0	36.1	0.0	0.1	Low	Permanent	Local	Improbable	Negligible
NSR03	55.0	45.5	28.0	30.0	0.0	2.0	Low	Permanent	Local	Improbable	Negligible
NSR04	55.0	45.5	47.6	48.5	3.0	0.9	Low	Permanent	Local	Improbable	Negligible
NSR05	55.0	45.5	39.7	40.2	0.0	0.5	Low	Permanent	Local	Improbable	Negligible
NSR06	55.0	45.5	37.6	40.7	0.0	3.1	Low	Permanent	Local	Improbable	Negligible
NSR07	55.0	45.5	29.6	32.5	0.0	2.9	Low	Permanent	Local	Improbable	Negligible
NSR08	55.0	45.5	30.1	32.5	0.0	2.4	Low	Permanent	Local	Improbable	Negligible
NSR09	55.0	45.5	41.2	42.6	0.0	1.4	Low	Permanent	Local	Improbable	Negligible
NSR10	55.0	45.5	40.8	44.7	0.0	3.9	Low	Permanent	Local	Improbable	Negligible
NSR11	55.0	45.5	46.4	48.4	2.9	2.0	Low	Permanent	Local	Improbable	Negligible
NSR12	55.0	45.5	46.8	48.7	3.2	1.9	Low	Permanent	Local	Improbable	Negligible
NSR13	55.0	45.5	47.0	49.1	3.6	2.1	Low	Permanent	Local	Improbable	Negligible
NSR14	55.0	45.5	50.0	49.2	3.7	0.0	Low	Permanent	Local	Improbable	Negligible
NSR15	55.0	45.5	47.0	50.7	5.2	3.7	Medium	Permanent	Local	Possible	**Low**
NSR16	55.0	45.5	44.5	46.4	0.9	1.9	Low	Permanent	Local	Improbable	Negligible
NSR17	55.0	45.5	37.0	40.6	0.0	3.6	Low	Permanent	Local	Improbable	Negligible
NSR18	55.0	45.5	37.0	38.3	0.0	1.3	Low	Permanent	Local	Improbable	Negligible
NSR19	55.0	45.5	43.9	42.6	0.0	0.0	Low	Permanent	Local	Improbable	Negligible
NSR20	55.0	45.5	46.9	46.1	0.6	0.0	Low	Permanent	Local	Improbable	Negligible
NSR21	55.0	45.5	48.0	48.9	3.4	0.9	Low	Permanent	Local	Improbable	Negligible
NSR22	55.0	45.5	48.0	46.0	0.5	0.0	Low	Permanent	Local	Improbable	Negligible
NSR23	55.0	45.5	35.1	39.8	0.0	4.7	Low	Permanent	Local	Improbable	Negligible

Appendix C, Table 9: Projected worst-case noise rating levels and impact – Conceptual night-time operational activities for scenario 6

Potential Noise-sensitive development / Receptor(s)	Recommended Upper Noise Limit	Potential Ambient Sound Levels (long-term average	Potential Existing Noise Levels (calculated -	Projected Noise Rating Level, Construction phase -	Potential change in ambient sound levels	Potential change considering potential	Magnitude / Intensity	Duration	Extent	Probability of Impact Occurring	Significance
NSR01	45.0	41.4	36.7	38.1	0.0	1.4	Low	Permanent	Regional	Improbable	**Low**
NSR02	45.0	41.4	36.0	36.1	0.0	0.1	Low	Permanent	Regional	Improbable	**Low**
NSR03	45.0	41.4	28.0	30.0	0.0	2.0	Low	Permanent	Regional	Improbable	**Low**
NSR04	45.0	41.4	47.6	48.5	7.1	0.9	High	Permanent	Regional	Likely	**Medium**
NSR05	45.0	41.4	39.7	40.2	0.0	0.5	Low	Permanent	Regional	Possible	**Low**
NSR06	45.0	41.4	37.6	40.7	0.0	3.1	Low	Permanent	Regional	Possible	**Low**
NSR07	45.0	41.4	29.6	32.5	0.0	2.9	Low	Permanent	Regional	Improbable	**Low**
NSR08	45.0	41.4	30.1	32.5	0.0	2.4	Low	Permanent	Regional	Improbable	**Low**
NSR09	45.0	41.4	41.2	42.6	1.2	1.4	Low	Permanent	Regional	Possible	**Low**
NSR10	45.0	41.4	40.8	44.7	3.3	3.9	Low	Permanent	Regional	Possible	**Low**
NSR11	45.0	41.4	46.4	48.4	7.0	2.0	High	Permanent	Regional	Likely	**Medium**
NSR12	45.0	41.4	46.8	48.7	7.3	1.9	High	Permanent	Regional	Likely	**Medium**
NSR13	45.0	41.4	47.0	49.1	7.7	2.1	High	Permanent	Regional	Likely	**Medium**
NSR14	45.0	41.4	50.0	49.2	7.8	0.0	High	Permanent	Regional	Likely	**Medium**
NSR15	45.0	41.4	47.0	50.7	9.3	3.7	High	Permanent	Regional	Highly Probable	**High**
NSR16	45.0	41.4	44.5	46.4	5.0	1.9	Medium	Permanent	Regional	Likely	**Medium**
NSR17	45.0	41.4	37.0	40.6	0.0	3.6	Low	Permanent	Regional	Possible	**Low**
NSR18	45.0	41.4	37.0	38.3	0.0	1.3	Low	Permanent	Regional	Improbable	**Low**
NSR19	45.0	41.4	43.9	42.6	1.2	0.0	Low	Permanent	Regional	Possible	**Low**
NSR20	45.0	41.4	46.9	46.1	4.7	0.0	Low	Permanent	Regional	Likely	**Medium**
NSR21	45.0	41.4	48.0	48.9	7.5	0.9	High	Permanent	Regional	Likely	**Medium**
NSR22	45.0	41.4	48.0	46.0	4.6	0.0	Low	Permanent	Regional	Likely	**Medium**
NSR23	45.0	41.4	35.1	39.8	0.0	4.7	Low	Permanent	Regional	Improbable	**Low**

End of Report

Appendix D Visual Impact Assessment



LÜDERITZ ROBERT HARBOUR EXPANSION

Visual Impact Assessment

June 2025



VISUAL IMPACT REPORT

Lüderitz Robert Harbour Expansion Project

Lüderitz, Namibia

Submitted to:

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Report Revision No:	*Final*
Date Issued:	25 June 2025
Prepared By:	Graham Young PrLArch, FILASA
Reviewed By:	Graham Young PrLArch, FILASA
Signed:	
Reference:	Lüderitz Harbour Expansion

EXPERTISE OF SPECIALIST

Name:	**GRAHAM A YOUNG** 
Qualification:	BL (Toronto) ML (Pretoria)
Professional Registration:	South African Council for the Landscape Architectural Profession (SACLAP) Reg. No. 87001 Fellow Institute of Landscape Architects of South Africa (FILASA)
Experience in Years:	45 years
Experience	Graham Young is a registered landscape architect with an interest and experience in landscape architecture, urban design, and environmental planning. He holds a degree in landscape architecture from the Universities of Toronto (BL) and Pretoria (ML). He has conducted visual impact assessments in Canada and Africa, where he has spent most of his working life. He has served as President of the Institute of Landscape Architects of South Africa (ILASA) and vice president of the Board of Control for Landscape Architects. He is a Fellow of the ILASA and a professionally registered landscape architect in South Africa (SACLAP). He is Secretary-General for the International Federation of Landscape Architects, Africa Region (IFLA Africa) and Vice President of IFLA (world). He runs his practice, Graham A Young Landscape Architect (GYLA). A speciality is Visual Impact Assessments, for which he has been cited with an Institute of Landscape Architects of South Africa (ILASA) Merit Award (1999). This work also includes landscape characterisation studies, end-use studies for quarries, and computer modelling and visualisation. He has completed over three hundred specialist reports for projects and conducted VIA reviews. He has served as a specialist witness in legal cases involving visual impact issues. Mr Young helped develop the *Guideline for Involving Visual and Aesthetic Specialists in EIA Processes* (Oberholzer 2005) and produced a research document for Eskom, *The Visual Impacts of Power Lines* (2009). In 2011 he produced '*Guidelines for involving visual and aesthetic specialists'* for the Aapravasi Ghat Trust Fund Technical Committee, which manages a World Heritage Site in Mauritius, along with the *Visual Impact Assessment Training Module Guideline Document* for the same client.

DECLARATION OF INDEPENDENCE

I, Graham Young, declare that –

- I am contracted as the Visual Impact Assessment Specialist for the LÜDERITZ ROBERT HARBOUR EXPANSION PROJECT, Lüderitz, Namibia
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant.
- I declare that there are no circumstances that may compromise my objectivity in performing such work.
- I have no, and will not engage in, conflicting interests in the undertaking of the activity.
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing – any decision to be taken with respect to the application by the competent authority; and – the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority.
- All the particulars furnished by me in this form are true and correct; and



Graham A. Young FILASA PrLArch SACLAP Reg. No. 87001

25 June 2025

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ACRONYMS, ABBREVIATIONS AND GLOSSARY

Acronyms & Abbreviations	
CD	Chart datum (the level to which both tidal levels and water depths are reduced).
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
ECO	Environmental Control Officer
EMP	Environmental Management Programme
GYLA	Graham Young Landscape Architect
I&APs	Interested and Affected Parties
NamPort	Namibian Ports Authority
NTLA	Nama Traditional Leaders' Association
OTA	Ovaherero Traditional Authority
PSV	Platform Supply Vessel (is designed for supplying offshore drilling rigs)
SACLAP	South African Council for the Landscape Architectural Profession
VAC	Visual Absorption Capacity
VIA	Visual Impact Assessment

Glossary	
Aesthetic Value	Aesthetic value is the emotional response derived from experiencing the environment, including its natural and cultural attributes. The response can be to either visual or non-visual elements. It can encompass sound, smell, and any other factor that has a substantial impact on human thoughts, feelings, and attitudes (Ramsay, 1993). Thus, aesthetic value encompasses more than the seen view, visual quality, or scenery, and includes atmosphere, landscape character and sense of place (Schapper, 1993).
Aesthetically significant place	A formally designated place visited by recreationists and others for the express purpose of enjoying its beauty. For example, tens of thousands of people visit Table Mountain each year. They come from around the country and even from around the world. By these measurements, one can make the case that Table Mountain (a designated National Park) is an aesthetic resource of national significance. Similarly, a resource that is visited by large numbers who come from across the region is probably of regional

	importance. A place visited primarily by people whose place of origin is local is generally considered to be of local significance. Unvisited places either have no importance or are "no trespass" places. (after New York, Department of Environment 2000).
Aesthetic impact	Aesthetic impact occurs when there is a detrimental effect on the perceived beauty of a place or structure. Mere visibility, even startling visibility of a Project proposal, should not be a threshold for decision-making. Instead, a Project, by its visibility, must interfere with or reduce (i.e., visual impact) the public's enjoyment and/or appreciation of the appearance of a valued resource, e.g., a cooling tower blocks a view from a National Park overlook (after New York Department of Environmental Conservation, 2000).
Cumulative Effects	The summation of effects that result from changes caused by a development in conjunction with the other past, present, or reasonably foreseeable actions.
Landscape Character	The individual elements that comprise the landscape include prominent or eye-catching features such as hills, valleys, forests, trees, water bodies, buildings, and roads. They are generally quantifiable and can be easily described.
Landscape Impact	Landscape effects derive from changes in the physical landscape, which may give rise to changes in its character and how this is experienced (Institute of Environmental Assessment & The Landscape Institute 1996).
Study area	For this report this Project the study area refers to the proposed Project footprint / Project site as well as the 'zone of potential influence' (the area defined as the radius about the centre point of the Project beyond which the visual impact of the most visible features will be insignificant) which is a 3,0km radius surrounding the proposed Project footprint/site.
Project Footprint / Site	For this report, the Project *site/footprint* refers to the actual layout of the Project as described.
Sense of Place (genius loci)	Sense of place refers to the unique value attributed to a specific location or area through the cognitive experience of the user or viewer. *A genius locus* means 'spirit of the place.'
Sensitive Receptors	Sensitivity of visual receptors (viewers) to a proposed development.
Viewshed analysis	The two-dimensional spatial pattern created by an analysis that defines areas which contain all possible observation sites from which an object would be visible. The basic assumption for preparing a viewshed analysis is that the observer's eye height is 1,8 m above ground level.
Visibility	The area from which the Project components would potentially be visible. Visibility depends upon general topography, aspect, tree cover or other visual obstructions, elevation, and distance.
Visual Exposure	Visibility and visual intrusion are rated by distance to indicate the degree of

	intrusion and visual acuity, which is also influenced by weather and lighting conditions.
Visual Impact	Visual effects refer to the changes that occur in the composition of available views due to changes in the landscape, people's responses to these changes, and the overall impact on visual amenity.
Visual Intrusion	The nature of the intrusion of an object on the visual quality of the environment, resulting in its compatibility (absorbed into the landscape elements) or discord (contrasts with the landscape elements) with the landscape and surrounding land uses.
Visual absorption capacity	Visual absorption capacity is defined as the landscape's ability to absorb physical changes without transformation in its visual character and quality. The landscape's ability to absorb change ranges from low-capacity areas, where the location of an activity is likely to cause a visual change in the area's character, to high-capacity regions, where the visual impact of development will be minimal (Amir & Gidalizon, 1990).
Worst-case Scenario	Principle applied where the environmental effects may vary, for example, seasonally or collectively, to ensure the most severe potential effect is assessed.
Zone of Potential Visual Influence	By determining the zone of potential visual influence, it is possible to identify the extent of potential visibility and views which could be affected by the proposed development. Its maximum extent is the radius around an object beyond which the visual impact of its most visible features will be insignificant primarily due to distance.

EXECUTIVE SUMMARY

Introduction

Newtown Landscape Architects (NLA) was commissioned by Geo Pollution Technologies (Pty) Ltd to conduct a Visual Impact Assessment (VIA) of the proposed Lüderitz Robert Harbour Expansion project (the Project). The applicant is the Namibian Ports Authority (NamPort), which operates the port of Lüderitz. It is a state-owned entity, established in 1994.

Project site and Study Area

The two related sites are located within the Port of Lüderitz, which is part of the ǁKaras Region and the !Nami‡Nûs Constituency. Refer to **Figure 1** below. The proposed sites are approximately 18,5 ha in extent and occur within Robert Harbour as illustrated in **Figures 2-1** and **2-2**.

The study area is 3,0km around the centre of the Project sites.

Objective of the Specialist Study

The study aims to document the baseline and ensure that the visual and aesthetic consequences of the proposed Project are understood and rated. The report, therefore, aims to identify scenic resources and visually sensitive receptors. It also aims to identify key concerns or issues relating to potential visual impacts arising from the Project. The significance of the possible effects is then rated.

Terms and Reference

A specialist study is required to establish the visual baseline and to identify potential visual impacts arising from the Project based on the general requirements for a comprehensive VIA. The following terms of reference were established:

- Data collected during a site visit (14-16 May 2025) allows for a description and characterisation of the receiving environment.
- Describe the landscape character, quality and assess the visual resource of the study area.
- Describe the visual characteristics of the components of the Project.
- Identify issues that must be addressed in the impact assessment phase.
- Propose mitigation options to reduce the potential impact of the Project.

Assumptions

The following assumptions and limitations have been made in the study:

- The description of Project components is limited to what has been supplied to the author before the date of completion of this report.
- The Project report uses the concept of ‘worst case scenario’ to identify issues and rate visual impacts.

Findings

The current visual condition of the landscape that may be impacted by the proposed Project has been outlined. The scenic quality of the study area has been rated from low to high within the sub-region's context. The site and its immediate surroundings are in a landscape type rated as moderate. Sensitive viewing areas and landscape types have been identified and mapped, highlighting a high sensitivity to the Project, especially from the nearby Shark Island heritage sites.

The significance of visual impact is rated when considering the worst-case scenario. This scenario includes all Project activities together.

Impacts on views are most significant when viewers are sensitive to landscape changes, and their perceptions are focused on and dominated by those changes. The visual effect of the Project, during both construction and operation, will lead to negative alterations to the visual baseline. These changes would be noticeable from nearby heritage and tourist observation points. The likelihood of a negative visual impact is high.

Construction activities include removing existing infrastructure, conducting 'earthworks' needed for foundations of structures and infrastructure, and dredging to create the base for the reclamation area platforms. These activities would negatively impact the landscape's visual quality and sense of place compared to its baseline.

The impact on the visual environment during the construction phase is assessed as having a very high intensity and would occur over a short term (less than the project's life span). The unmitigated impact would be localised but would extend beyond the site boundary to surrounding areas. The proposed infrastructure would be visible from sensitive heritage viewing areas but would mainly blend into the existing landscape and would not appear out of place from other areas south and east of the Project sites. The impact is most likely, and its significance is predicted to be moderate negative, meaning it could influence decisions, and the effect will not be avoided unless it is mitigated. The implementation of mitigation is required in the sense of 'good housekeeping.'

Operational activities include routine harbour and port functions. Security lighting and other illuminated areas associated with the movement of security vehicles at night are also included. Additionally, maintenance of the Phase 1 and Phase 2 expansion areas is part of the activities. These activities, along with the physical presence of the Project components day and night, contribute to the visual impact.

The impact on the visual environment during the operational phase is assessed to have a very high intensity and would occur over the long-term (for the life of the project). The impact is MOST LIKELY, and its significance is predicted to be HIGH NEGATIVE, i.e. It should influence the decision to not proceed with the Project or require significant modification(s) of the project design/location, etc. (where relevant). The implementation of mitigation is needed, and with time, the impact could reduce to MODERATE NEGATIVE.

Cumulative Effect

The cumulative impact of the proposed Project activities, combined with the existing urban and industrial character of the port, is regarded as of moderate significance, as the Project activities would contribute negatively to the current visual and aesthetic baseline, particularly for sensitive viewing areas.

Opinion of the author

The author believes that the Lüderitz Expansion Project and its related activities should be approved, if mitigation and management measures are effectively implemented, managed, and monitored over the long term (the life of the Project). These measures aim to safeguard the visual aesthetic of the study area, which is also considered a visual resource.

***** NLA *****

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1. INTRODUCTION

1.1 Project Overview and Background

Newtown Landscape Architects (NLA) was commissioned by Geo Pollution Technologies (Pty) Ltd to conduct a Visual Impact Assessment (VIA) of the proposed Lüderitz Robert Harbour Expansion project (the Project). The applicant is the Namibian Ports Authority (NamPort), which operates the port of Lüderitz. It is a state-owned entity, established in 1994.

The VIA focuses on the potential impact of the physical aspects of the proposed Project and ancillary infrastructure (i.e., form, scale, and bulk), as well as their potential impact within the landscape and receptor context.

1.2 Study Area and Project Sites

The two related sites are located within the Port of Lüderitz, which is part of the ǁKaras Region and the !Nami‡Nûs Constituency. Refer to **Figure 1** below. The proposed sites are approximately 18,5 ha in extent and occur within Robert Harbour as illustrated in **Figures 2-1** and **2-2**.

The study area is 3,0km around the centre of the Project sites as illustrated in **Figure 3**.

1.3 Objective of the Specialist Study

The study aims to document the baseline and ensure that the visual and aesthetic consequences of the proposed Project are understood and rated. The report, therefore, aims to identify scenic resources and visually sensitive receptors. It also aims to identify key concerns or issues relating to potential visual impacts arising from the Project. The significance of the possible effects is then rated.

1.4 Terms and Reference

A specialist study is required to establish the visual baseline and to identify potential visual impacts arising from the Project based on the general requirements for a comprehensive VIA. The following terms of reference were established:

- Data collected during a site visit (14-16 May 2025) allows for a description and characterisation of the receiving environment.
- Describe the landscape character, quality and assess the visual resource of the study area.
- Describe the visual characteristics of the components of the Project.
- Identify issues that must be addressed in the impact assessment phase.
- Propose mitigation options to reduce the potential impact of the Project.

1.5 Assumptions, Uncertainties, and Limitations

The following assumptions and limitations have been made in the study:

- The description of Project components is limited to what has been supplied to the author before the date of completion of this report.
- The Project report uses the concept of ‘worst case scenario’ to identify issues and rate visual impacts.

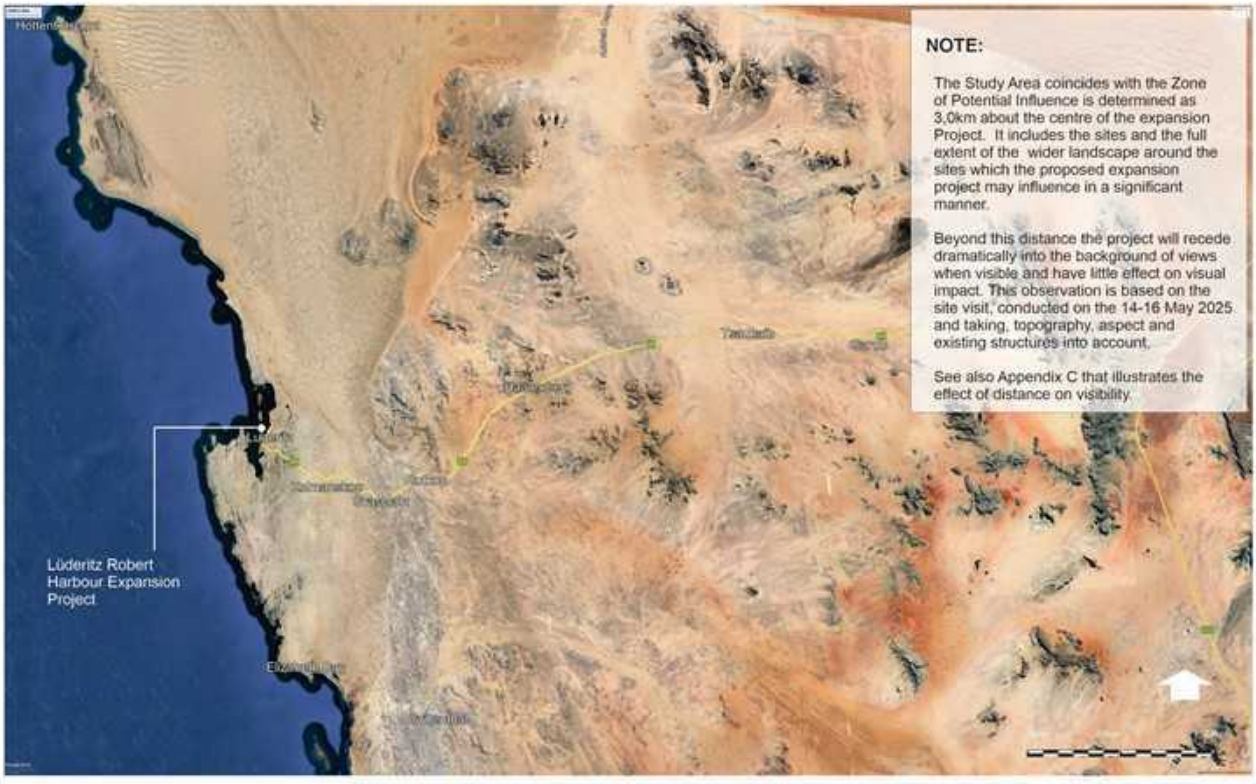


Figure 01: LOCALITY - Lüderitz Robert Harbour Phase 1 and 2 Expansion

2. LEGAL REQUIREMENTS AND GUIDELINES

This report adheres to the following legal requirements and guideline documents.

Environmental Management Act, 2007 and EIA Regulations, 2012

The EIA Regulations, specifically, detail which activities require an Environmental Clearance Certificate (ECC) before they can be undertaken, ensuring a systematic approach to environmental protection is obtained from the Ministry of Environment, Forestry and Tourism (MEFT).

Western Cape Department of Environmental Affairs & Development Planning: Guideline for Involving Visual and Aesthetic Specialists in EIA Processes Edition 1 (CSIR, 2005)

Although the guidelines were specifically compiled for the Province of the Western Cape[1] in South Africa, they provide guidance that is appropriate for any EIA process. The Guideline document also seeks to clarify instances when a visual specialist should get involved in the EIA process.

[1] The Western Cape Guidelines are the only official guidelines for visual impact assessment reports in South Africa and can be regarded as best practice throughout the country and neighbouring States.

3. APPROACH AND METHODOLOGY

3.1 Approach

The assessment of likely effects on a landscape resource and visual amenity is complex since it is determined through a combination of quantitative and qualitative evaluations. When assessing visual impact, the worst-case scenario is taken into consideration. Landscape and visual assessments are separate, although linked, procedures. The landscape, its analysis, and the evaluation of impacts on the landscape all contribute to the baseline for visual impact assessment studies. The assessment of the potential effects on the landscape is conducted as an impact on an environmental resource, i.e. the physical landscape. Visual impacts, on the other hand, are assessed as one of the interrelated effects on people (i.e. the viewers and the impact of an introduced object into a view or scene).

3.1.1 The Visual Resource

Landscape character, landscape quality (Warnock & Brown, 1998), and “sense of place” (Lynch, 1992) are used to evaluate the visual resource i.e. the receiving environment. A qualitative evaluation of the landscape is essentially a subjective matter. In this study, the aesthetic evaluation of the study area is determined by the author's professional opinion, based on site observations and the results of contemporary research in perceptual psychology.

Aesthetic value is the emotional response derived from experiencing the environment, including its natural and cultural attributes. The response is usually to both visual and non-visual elements. It can encompass sound, smell, and any other factor that has a substantial impact on human thoughts, feelings, and attitudes (Ramsay, 1993). Thus, aesthetic value is more than the sum of the factors of the seen view, visual quality, or scenery. It includes atmosphere, landscape character, and sense of place (Schapper, 1993). Refer also to **Appendix A** for further elaboration. Aesthetic value is not easy to measure but it can be assumed that some places, such as declared nature reserves by their very definition, evoke emotional connections with the land due to the already defined importance of the area i.e. that it is declared a nature reserve and by implication is therefore worth saving in its most pristine condition.

Studies for perceptual psychology have shown human preference for landscapes with higher visual complexity, for instance, scenes with water or topographic interest. Based on contemporary research, landscape quality increases where:

- Topographic ruggedness and relative relief increase.
- Water forms are present.
- Diverse patterns of grassland and trees occur.
- Natural landscape increases and manufactured landscape decreases.
- Where land use compatibility increases (Crawford, 1994).

Aesthetic appeal (value) is, therefore, considered high when the following are present (Ramsay, 1993):

- Abstract qualities: such as the presence of vivid, distinguished, uncommon or rare features or abstract attributes.

- Evocative responses: the ability of the landscape to evoke particularly strong responses in community members or visitors.
- Meanings: the existence of a long-standing special meaning to a group of people or the ability of the landscape to convey special meanings to viewers in general.
- Landmark quality: a feature that stands out and is recognised by the broader community.

And conversely, it would be low where:

- Limited patterns of grasslands and trees occur.
- Natural landscape decreases and manufactured landscape increases, causing significant contrast/discord between the natural and cultural landscape.
- And where land use compatibility decreases (Crawford, 1994).

When evaluating the quality of the visual resource for the Project site, both objective and subjective, or aesthetic, factors (as determined by the specialist) associated with the landscape are considered. Many landscapes can be said to have a keen sense of place, regardless of whether they are scenically beautiful. However, where landscape quality, aesthetic value, and a powerful sense of place coincide, the visual resource or perceived value of the landscape is exceptionally high. The criteria listed in **Appendix B** are used to assess landscape quality and sense of place, ultimately determining the aesthetic value of the study area.

3.1.2 Sensitivity of Visual Resource

The sensitivity of a landscape or visual resource refers to the degree to which a landscape type or area can accommodate change arising from development without detrimental effects on its character. Its determination is based on an evaluation of each key element or characteristic of the landscape that is likely to be affected. The assessment will reflect such factors as its “quality, value, contribution to landscape character, and the degree to which the particular element or characteristic can be replaced or substituted” (LIEMA, 2013).

3.1.3 Sense of Place

Central to the concept of a sense of place is that the landscape requires uniqueness and distinctiveness. The primary informant of these qualities is the spatial form and character of the natural landscape, taken together with the cultural transformations and traditions associated with the historic use and habitation of the area. According to Lynch (1992), a sense of place refers to the extent to which a person can recognise or recall a place as distinct from other places, as having a vivid, unique, or at least particular character of its own. Sense of place refers to the exceptional value attributed to a specific location or area through the cognitive experience of the user or viewer. In some cases, the values allocated to the place are similar for a broad spectrum of users or viewers, giving the place a universally recognised and, therefore, strong sense of place.

The study area’s sense of place is derived from the emotional, aesthetic, and visual response to the environment, and, therefore, it cannot be experienced in isolation. The landscape context must be considered. The combination of the natural landscape together with the manufactured structures and features contributes to the sense of place for the study area. It is this combination that defines the study area and establishes its visual and aesthetic identity.

3.1.4 Sensitive Receptors

The sensitivity of visual receptors and viewing areas is dependent on the location and context of the viewpoint, the expectations and occupation or activity of the receptor, or the importance of the view, which may be determined concerning its popularity or numbers of people affected, its appearance in guidebooks, on tourist maps, and in the facilities provided for its enjoyment and references to it in literature or art. Typically, sensitive receptors may include:

- Users of all outdoor recreational facilities, including public rights of way, whose intention or interest may be focused on the landscape, i.e. nature reserves.
- Communities where development results in negative changes in the landscape setting or valued views enjoyed by the community.
- Occupiers of residential/tourist/heritage properties with views negatively affected by the development, i.e. game lodges.
- People travelling through recognised nature reserves or areas of declared scenic beauty (i.e. tourist routes)

Viewing areas, typically from residences and tourist facilities or routes, are generally the most sensitive since views from within these areas are potentially frequent and of long duration.

Other, less sensitive, receptors include:

- People engaged in outdoor sport or recreation (other than appreciation of the landscape, as in landscapes of acknowledged importance or value).
- People travelling through or past the affected landscape in cars or other transport modes, other than recognised areas of scenic beauty.
- People at their place of work.

Landscape sensitivity, on the other hand, relates to the nature and character of the study area's landscape in terms of its potential to accept change (VAC) caused by the proposed development.

For a detailed description of the methodology used to determine the value of a visual resource, refer to **Appendix A**. **Plate 1** below graphically illustrates the visual impact process employed in this Project.

3.1.5 Landscape Effects

The landscape impact of a proposed development is measured as the change to the fabric, character, and quality of the landscape as a resource, caused by the physical presence of the proposed development (LIIEMA, 2013:35). Identifying and describing the nature of change in the landscape brought about by the proposed new development is based on the professional opinion of the author supported by photographic simulations. It is imperative to depict the change to the landscape in as realistic a manner as possible (Van Dortmont, in Lange, 1994) and to identify, describe, and illustrate the likely visual effects. To achieve this, photographic panoramas were taken from key viewpoints and altered using computer simulation techniques to explain the physical nature of the proposed Project in its final form within the landscape setting. The resultant change to the landscape is then potentially observable, and an assessment of the anticipated visual intrusion can be made.

3.1.6 Visual Effects

Visual impacts are a subset of landscape impacts, encompassing the effects on views and visual amenity (LIEMA, 2013:35). These impacts relate to the changes in the composition of available views resulting from landscape alterations, the responses of people to these changes, and the overall effect on visual amenity. Visual impact is therefore measured as the change to the existing visual environment (i.e. views) caused by the intervention and the extent to which that change compromises (negative impact) or enhances (positive impact) or maintains the visual quality of the scene as perceived by people visiting, working or living in the area. This approach reflects the layperson's concerns, which generally are:

- Will I be able to see the new development?
- What will it look like?
- Will the development affect the view in the area, and if so, how?

Landscape and visual impacts do not necessarily coincide. Landscape impacts can occur even in the absence of visual effects, for instance, where a development is wholly screened from available public views, yet nonetheless results in a loss of landscape elements and character contained within a localised area (the site and its immediate surroundings).

3.1.7 Intensity of Visual Impact

The *intensity* of visual impact is determined using visual intrusion, visibility, and visual exposure criteria (Hull and Bishop, 1988), which are qualified by the sensitivity of viewers (visual receptors) towards the proposed development. The severity of visual impact is therefore concerned with:

- The overall impact on the visual amenity, which can range from degradation to enhancement.
- The direct impacts of the development upon views of the landscape through intrusion or obstruction.
- The reactions of viewers who may be affected.

3.1.8 Significance of Visual Impact

A combined quantitative and qualitative methodology, as supplied by the Environmental Practitioner, was used to describe the significance of impacts. Significance of impact is rated as the *consequence* of impact times the *probability* of the effect occurring. Consequence is determined using intensity, spatial scale, and duration criteria. A summary of each of the qualitative descriptions, along with the equivalent quantitative rating scale, is given in **Annexure C**.

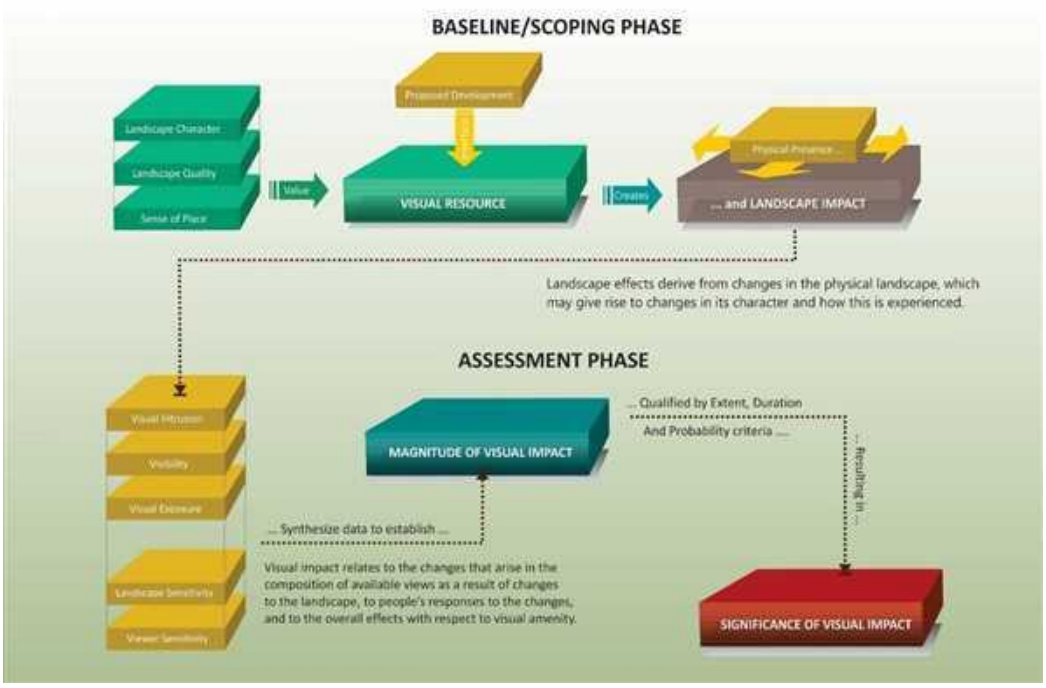


Plate 1: Visual Impact Process

3.2 Methodology

The following method was used:

- Site visit: A field survey was conducted on 14-16 May 2025, during which the study area was visited to the extent that the receiving environment could be documented and adequately described. The climate conditions were mostly sunny with some cloud cover and slight haze.
- Project components: The physical characteristics of the Project components were described and illustrated based on information supplied by the Environmental Assessment Practitioner.
- General landscape characterisation: The visual resource (i.e., receiving environment) was mapped using field surveys, Google Earth imagery, and the Atlas of Namibia. Types of vegetation[2].
- The description of the landscape focused on the nature of the land rather than the response of a viewer (refer to **Appendix A**).
- The character of the landscape was described and rated in terms of its aesthetic appeal using recognised contemporary research in perceptual psychology as the basis, and its sensitivity as a landscape receptor.
- The sense of place of the study area was described in terms of its uniqueness and distinctiveness. The primary informant of these qualities was the spatial form and character of the natural landscape, together with the cultural transformations associated with the historic/current use of the land.
- The potential impact on the visual environment of the proposed Project was identified and rated according to significance rating criteria in **Appendix C**.
- Measures to mitigate the negative impacts of the proposed Project were recommended.

[2] https://atlasofnamibia.online/chapter-6/types-of-vegetation Accessed: 1 March 2024.

4. PROJECT DESCRIPTION

4.1 Project Facilities

The Project consists of two Phases. Phase 1 involves approximately 14 hectares of land reclamation and a 500m quay wall at a -9m chart datum (CD) depth. It is located immediately east of Shark Island and is limited to the high-water mark, which falls within the current legal jurisdiction of the Port of Lüderitz, according to the NamPort Act (Act 3 of 1994). The land reclamation must not touch Shark Island itself. Phase 1 will accommodate five warehouses, areas for stacking container boxes, and a mobile crane. The quay wall will accommodate passenger vessels of up to 100,000 DWT.

Phase two involves the removal of the old concrete and wooden jetty and will be approximately 3 hectares in extent, with a 100m quay wall at a -6m CD depth, a 170m quay wall at a -7m depth, and a 100m quay wall at a -7m CD depth. The quays will accommodate fishing vessels, platform supply vessels (PSVs), and tugboats.

Refer to **Figure 2-1** for the layout and **2-2** for an aerial illustration of the Project components.

4.2 Construction and Operational Timelines

Construction will commence once environmental clearance and all other authorisations are received and contracts awarded. Operations will commence once construction is complete and contracts with port tenants signed.



Figure 2-1: LAYOUT - Lüderitz Robert Harbour Phase 1 and 2 Expansion



Figure 2-2: LAYOUT AERIAL - Lüderitz Robert Harbour Phase 1 and 2 Expansion

5. PROJECT ALTERNATIVES

No project alternatives have been proposed.

6. LANDSCAPE CHARACTER

Lüderitz is a coastal town situated in the ǁKaras Region of southwestern Namibia. It lies along a rocky section of the Atlantic coast where the Namib Desert directly abuts the ocean. The town is situated within the Tsau Khaeb National Park, a formerly restricted area for diamond mining. Founded in the late 19th century during the German colonial era, Lüderitz is renowned for its distinctive German Art Nouveau architecture, its wind-swept coastline, and the nearby ghost towns.

The town retains a strong colonial German influence, with brightly coloured buildings, sharp gables, and ornate facades. Landmarks such as Goerke Haus and the Felsenkirche (a Lutheran church perched on a rocky hill) are good examples (Views 1, 2, and 3 in **Figure 4-1**). The Robert Harbour drives the economy, primarily based on fishing, fish processing, and tourism. It is the centre of tourist and commercial activity for the town. The port serves fishing boats, cargo ships, PSVs, passenger ships, and tourist excursions to nearby islands and coastal areas (Views 4, 5, and 6 in **Figure 4-2**). To its east lies the vast and arid Namib Desert, characterised by ochre-coloured dunes, rock formations, and expansive gravel and sand plains. The desert often sweeps right up to the coast, giving Lüderitz a harsh, stark backdrop.

A series of industrial and fish processing activities line the coastline north of the harbour. Refer to Views 8, and 9 in **Figure 4-3**.

Shark Island, immediately west of the proposed Phase 1 expansion project, was originally a rocky peninsula. It is a protrusion of rugged rock interspersed with gravel and sparse vegetation. A small campsite with a few basic structures, along with the prominent lighthouse, is the main architectural feature. The island is open and exposed, with limited visual obstruction between land, sea, and sky. Its character is primarily defined by its natural starkness.

The Sperrgebiet (Diamond Area 1) is a restricted diamond-mining zone stretching south and east of Lüderitz. Once thriving, it is now largely uninhabited and dotted with abandoned mining infrastructure and ghost towns, such as Kolmanskop.

The Atlantic coast is rugged, with rocky shores, strong winds, and cold Atlantic waters (View 15 in **Figure 4-5**) . Offshore islands, such as Halifax Island, are home to African penguins and various seabirds (Views 14 and 15 in **Figure 4-5**).



Fig 03: VIEWPOINTS - Lüderitz Robert Harbour Phase 1 and 2 Expansion



Figure 04-1: LANDSCAPE CHARACTER - Views 1, 2 and 3

Refer to Figure 3 for location of viewing points



Figure 4-2: LANDSCAPE CHARACTER - Views 4, 5 and 6

Refer to Figure 3 for location of viewing points



Figure 4-3: LANDSCAPE CHARACTER - Views 7, 8 and 9

Refer to Figure 3 for location of viewing points



Figure 4-4: LANDSCAPE CHARACTER - Views 10, 11 and 12

Refer to Figure 3 for location of viewing points



Figure 4-5: LANDSCAPE CHARACTER - Views 13, 14 and 15

Refer to Figure 3 for location of viewing points

7. VISUAL RESOURCE

7.1 Visual Resource Value, Scenic Quality and Landscape Sensitivity

The value of the visual resource and its associated scenic quality (as determined by the scenic quality rating criteria described in **Appendix A**) are primarily derived from the landscape characteristics described above. These are the primary features that give the study area its general characteristics and a sense of place. The sensitivity of the study area's landscape, from a visual perspective, is rated from low (for the immediate harbour area) to high for Shark Island. The value of a visual resource is dependent on its:

- Character (does it contribute to the area's sense of place and distinctiveness?);
- Quality – What condition is the existing landscape in?
- Value – Is the landscape valued by people, the local community, visitors, and is the landscape recognised, locally, regionally, or nationally, and
- Capacity – What scope is there for change (either negative or positive) in the existing landscape character?

When the criteria listed in **Appendix A** are considered and understood within the context of the sub-region, a visual resource value of *moderate* (industrial areas associated with), *low moderate* (urban development and associated infrastructure), and *moderate* for the gravel plains and ephemeral shallow watercourses and *moderate to high* for the rocky outcrops and ridge lines. There are no areas rated *high*.

The Project site occurs within a landscape type rated *moderate.* The landscape surrounding the site, is also rated *moderate* with the rocky outcrops, through with the bulk water line and the electricity powerline pass, rated moderate to high. (View 4 **Figure 4-2**). **Table 1** summarises the various local landscape character types and their consequent sensitivities as defined in Figure 5 below.

Table 1: Value of the Visual Resource
(After: LiEMA 2013)

High	**Moderate**	**Low**
Rocky outcrops associated with nearby islands, Shark Island and the natural coastline.	Robert Harbour and its associated port and tourist activities, residential areas related to the old town of Lüderitz	Industrial and processing areas along the coastline north of the harbour and peripheral to the urban areas
This landscape type is considered to have a *high* value because it is a: A distinct landscape that exhibits a positive character with valued features that combine to give the experience of unity, richness, and harmony. Landscape Sensitivity: It is sensitive to change in general and will be detrimentally affected if change is inappropriately dealt with.	This landscape type is considered to have a *moderate* value because it is a: A typical landscape that exhibits some positive character, but which has evidence of degradation and erosion of features, resulting in areas of mixed character. Landscape Sensitivity: It is potentially sensitive to change in general, and change may be detrimental if inappropriately dealt with.	This landscape type is considered to have a *low* value because it is a: A minimal landscape is generally considered negative, with few, if any, valued features. Landscape Sensitivity: It is not sensitive to change in general and scope for positive enhancement frequently occurs.

7.2 Sense of Place

According to Lynch (1992), a sense of place refers to how well a person recognises or remembers a place as different from other locations, with a vivid, unique, or at least distinctive character of its own. The sense of place for the study area results from a combination of the local landscape character described earlier and its effect on the senses. Lüderitz and its surroundings are characterised by contrast, isolation, and adaptation. It is a place where human settlement survives along a narrow strip of habitable space between the ocean and the desert, shaped by historical resource extraction, colonial occupation, and ongoing environmental extremity.

Wide-open horizons, sparse vegetation, and monochromatic tones—greys, beiges, and rust-browns—dominate the visual landscape. The architecture of Lüderitz, with its faded pastel buildings and German colonial style, creates a stark human contrast against the raw geology (Views 1, 2, and 3 in **Figure 4-1**). The harbour and its commercial and tourist activities are the focal point of the town's economy and tourist attractions (Views 4, 5, and 6 in Figure 4-2 and the nighttime view in Figure 4-3).

Shark Island was originally a peninsula that became an island through harbour development (Views 13, 14 and 15 in **Figure 4-5**). It was the location of a colonial-era concentration camp (1904–1907) during the Herero and Nama genocide under German rule. Today, the island is partly developed as a heritage tourism site. However, it remains largely unmarked, apart from the Nama and Ovaherero Genocide Memorial (View 11 in **Figure 4-4**) and the Adolf Lüderitz Denkmal, which also features colonial memorial plaques (View 12 in **Figure 4-4**). The island carries deep historical trauma and contested memory.

8. LANDSCAPE IMPACT

The preparation and construction activities of both phases of the Project (reclamation earthworks and infrastructure development) will contrast with the existing harbour and landscape character, especially of Shark Island. The study area has a moderate visual absorption capacity (VAC) due to its open sea views; however, it is also limited by topography and existing structures and buildings, as shown in the panoramas in **Figures 4-1** to **4-5**. Disruption of the development area and soil deposition behind the quay walls will contrast with the nature and character of the area, causing landscape and visual disturbance.

The *landscape impact* (i.e. the change to the fabric and character of the landscape caused by the physical presence of the Project) is therefore considered ***high.*** The combined effects of the changes described above, will negatively affect the overall character of the landscape and sensitive viewing areas such as Shark Island and tourist areas associated with the Waterfront. However, visual impact does not necessarily coincide with landscape impact. The visual effect of the project will be assessed and rated in **Chapter 9** below.

9. INTENSITY OF VISUAL IMPACT

Visual impacts refer to the alterations in the available views caused by changes to the landscape, people's reactions to these changes, and the overall effects on visual amenity. Visual impact is therefore assessed as the change to the existing visual environment brought about by a new development, and how that change either diminishes (negative impact), improves (positive impact), or preserves the visual quality of the area.

The impact intensity is assessed based on visual intrusion, visibility, visual exposure, and viewer sensitivity criteria. Once the initial impact intensity is established, it is further refined using spatial, duration, and probability factors to determine the overall significance of the visual impact (see method in **Appendix C**). In assessing the visual impact intensity, the study considers the worst-case scenario, meaning all project components combined, as discussed in **Chapter 4**. The significance of the project's visual impact is examined and rated in **Chapter 11**.

It is expected that visual impacts will occur from activities and infrastructure in both Project phases, namely construction and operation. Activities related to the Project will be visible, to varying extents, from different distances around the Project sites. During the establishment phase, the project's visibility will be affected by preparatory activities, including dredging operations, earthworks, and infrastructure development. During the operational phase, the visibility of the Project will result from the physical presence of project components, both day and night.

Typical issues associated with industrial projects are:

- Who will be able to see the new development?
- What will it look like, and will it contrast with the receiving environment?
- Will the development affect sensitive views in the area, and if so, how?
- What will be the impact of the development during the day and at night?
- What will the cumulative impact be, if any?

9.1 Sensitive Viewers and Locations

The EAP will conduct the public review comment process. However, it is understood, at the writing of this report, that sensitivities towards the project have been expressed by the Nama Traditional Leaders' Association (NTLA) and the Ovaherero Traditional Authority (OTA). They commissioned the Shark Island: An Architectural Reconstruction of a Death Camp (Forensis and Forensic Architecture, 2024) report, which states, amongst other concerns, that "the proposed extension of Lüderitz port in Robert Harbour poses further imminent risk to the [Shark Island Heritage] site. Not only will the development affect Shark Island [visually], but the dredging of nearby waters for the proposed port expansion will very likely disturb the remains of many who died on Shark Island, and whose bodies were thrown into the water." (Forensis and Forensic Architecture, 2024:8)

Figure 5 identifies receptor locations where people are most likely to be sensitive to visual changes resulting from the physical presence of the Project. There are two main areas of concern:

- The Shark Island heritage sites, and
- tourist attractions associated with the harbourfront area.

However, the most sensitive are the Shark Island heritage sites, as shown in the inset in **Figure 5** below.

Views from the Waterfront and surrounding attractions would face the existing harbour. These views would not be as affected by the proposed development, as the proposed activities would be in addition to the harbour's operations and tourist attractions. The Project, therefore, would not appear out of place from these viewpoints, although the scale of the operations could cause concern.

Tourist accommodation on Shark Island is visually screened from the proposed Project, with their orientation facing west, away from the project sites. Tourist accommodation in Lüderitz and east of the harbour would have views that are partially or fully obstructed by buildings and structures. They would not necessarily be adversely affected by the proposed development.

Table 2 identifies receptor locations that are most likely to be sensitive to the Project. The simulation panoramas are illustrated in **Figures 7-1** to **7-8**.

Table 2: Potential Sensitivity - Visual Receptors

High	Moderate	Low
Shark Island Heritage Sites	The Harbourfront and tourist accommodation immediately south of Robert Harbour.	Industrial and residential areas east of the harbour.
Visitors of heritage and tourist attractions whose intention or interest may be focused on the landscape and its historical associations.	People visiting the Harbourfront attractions and/or staying in tourist accommodation and people travelling along the B4 east of the project sites.	Visitors and people working within the study area and travelling along local public roads whose attention may be focused on their work or activity and who, therefore, may be potentially less susceptible to changes in the view

9.2 Visibility and Visual Exposure

The viewshed in **Figure 6** demonstrates the potential visibility of the Project. It shows that the topographical 'bowl' around the Harbour contains views of the Project sites and that the ridgeline along Shark Island blocks views from its western areas, where tourist accommodation is situated. The northern parts of the island, however, remain exposed to close-up views of Phase 1 of the Project. Views from east of Robert Harbour and the Harbourfront area will have unobstructed views of both phases of the Project.

Visual exposure is assessed by determining the visibility of an object, using a distance rating to show the level of intrusion and visual clarity. As the distance between the observer and the object increases, the visual perception of the object decreases exponentially, because changes in form, line, colour, and texture in the landscape become less noticeable at greater distances. Sensitive receptor locations are within the viewshed as described above, and high visual exposure (up to 800m from the receptor to the object) would occur in the northern parts of Shark Island, the Waterfront, and sections of the B4 road east of the harbour. Existing buildings and structures would partially or fully block views from the town to the south of the Project sites.

9.3 Visual Intrusion

Visual intrusion refers to how a project component aligns with or disrupts the ecological and/or cultural aesthetic of the landscape, in relation to the concept of visual absorption capacity (VAC). Visual intrusion varies across the study area, from *high* in the northern parts of Shark Island and areas immediately south and east of the Project sites (refer to the simulations in Figures 7-1 to 7-8) to *low* for receptor areas further south and north of Lüderitz.

In areas with high visual intrusion, project components would appear prominently in views and tend to be highly intrusive, particularly at heritage sites on Shark Island when there is a disjunction between the viewing point and the viewed subject. The adverse impact of the project on views from these locations is regarded as the worst-case scenario (refer to Figures 7-5 to 7-8).

However, considering the nature of the Project, views from the Harbourfront and sites east of the Project would be less intrusive or sensitive, as the project's activities are compatible with existing infrastructure and activities would be observed from locations where harbour and port facilities dominate the view (refer to Figures 7-1 to 7-3).

9.5 Night Lighting

I&APs consistently enhance the impact of night lighting, especially when it can be seen from tourist or residential areas and when the effect would endure throughout the Project's lifetime. The negative impact of night lighting would not pose a significant problem for the Project, as new light sources would appear against an already illuminated horizon and would not be particularly harmful to visitors or residents within the study area. Shark Island heritage sites would most likely operate only during daylight hours, so the effect of night lighting would not be an issue.

Security lighting and sources at high elevations (like on cranes) could contribute to the overall light impact from the port if not properly managed. Therefore, strict management measures, as outlined in Section 10, should be put in place to prevent light spillage beyond the boundaries of the Project sites.

Intensity of Impact

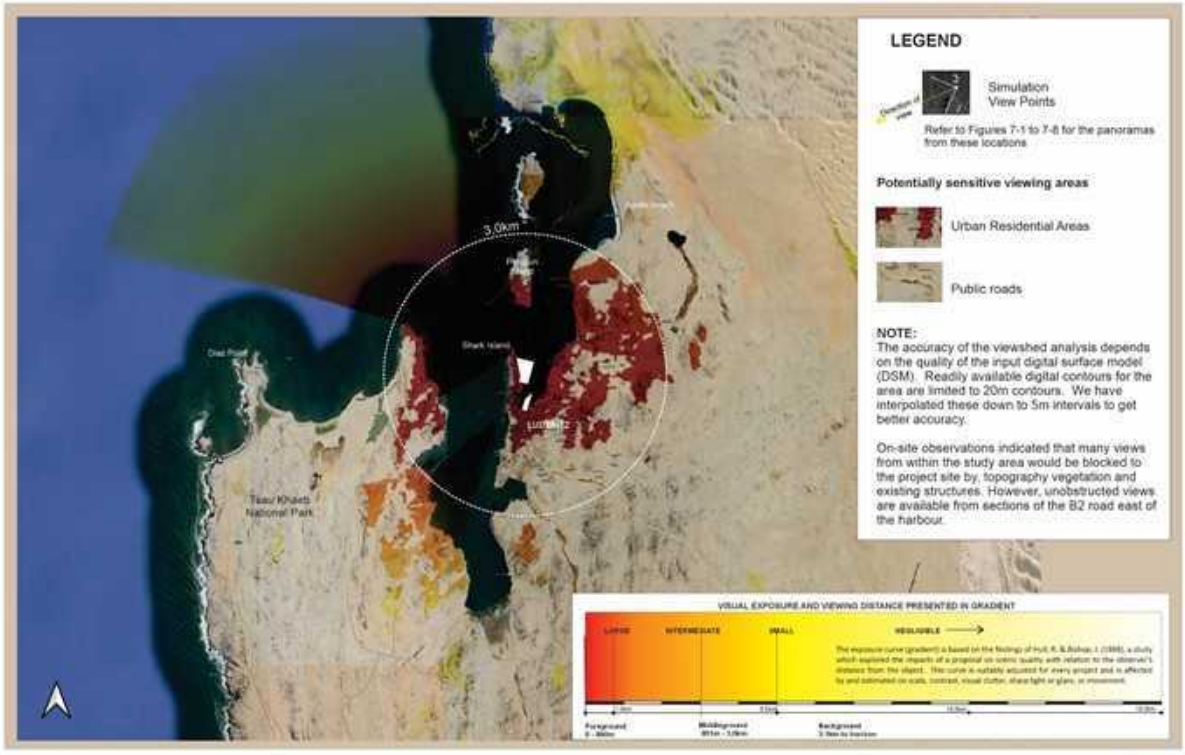


Figure 6: VIEWSHED ANALYSIS - Lüderitz Robert Harbour Phase 1 and 2 Expansion

Intensity of Impact



Figure 7-1: SIMULATION VIEW 2 - Lüderitz Robert Harbour Phase 1 and 2 Expansion

Intensity of Impact



Figure 7-2: SIMULATION VIEW 4 - Lüderitz Robert Harbour Phase 1 and 2 Expansion

Intensity of Impact



Figure 7-3: SIMULATION VIEW 6- Lüderitz Robert Harbour Phase 1 and 2 Expansion

Intensity of Impact



Figure 7-4: SIMULATION VIEW 8 - Lüderitz Robert Harbour Phase 1 and 2 Expansion

Intensity of Impact



Figure 7-5: SIMULATION VIEW 10 - Lüderitz Robert Harbour Phase 1 and 2 Expansion

Intensity of Impact



Figure 7-6: SIMULATION VIEW 11 - Lüderitz Robert Harbour Phase 1 and 2 Expansion

Intensity of Impact



Figure 7-7: SIMULATION VIEW 12 - Lüderitz Robert Harbour Phase 1 and 2 Expansion

Intensity of Impact

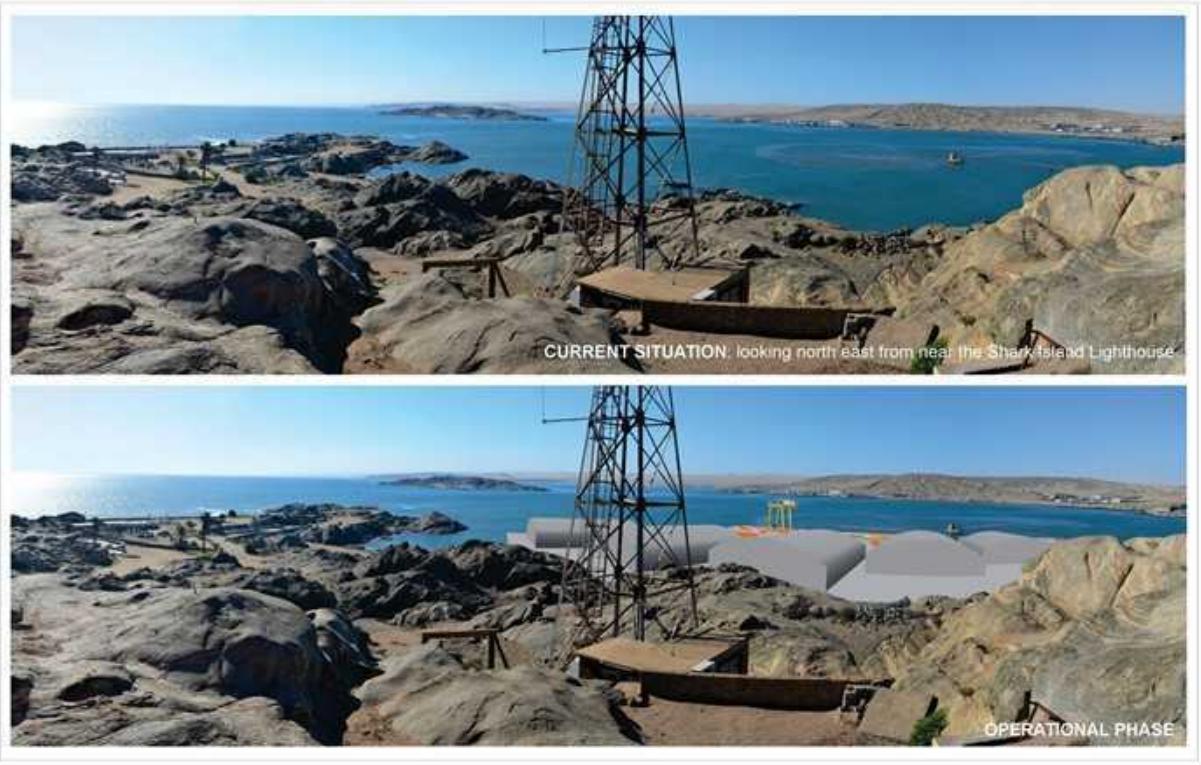


Figure 7-8: SIMULATION VIEW 14 - Lüderitz Robert Harbour Phase 1 and 2 Expansion

9.6 Intensity of Impact

Referring to discussions in previous sections and using the criteria in Appendix B, the intensity of visual impact (worst-case scenario – all Project facilities combined and the effect on the most vulnerable viewing areas), for the sensitive areas illustrated in **Figure 5**, is rated in **Table 3** below for the construction and operational phases of the Project. To assess the intensity of visual impact, four main factors are considered:

- Visual Intrusion: The nature of intrusion or contrast (physical characteristics) of a Project component on the visual quality of the surrounding environment and its compatibility or discord with the landscape and surrounding land use, within the context of the landscape's VAC.
- Visibility: The area or points from which Project components will be visible.
- Visual Exposure: Visibility and visual intrusion, qualified with a distance rating to indicate the degree of intrusion.
- Sensitivity: The sensitivity of visual receptors to the proposed development.

In synthesising the criteria, a numerical or weighting system is avoided. Attempting to attach a precise numerical value to qualitative resources is rarely successful and should not be used as a substitute for reasoned professional judgement (LIEMA 2013).

According to the results tabulated below in **Table 3**, the visual impact is expected to be high during both the construction and operational phases.

Table 3: *Intensity* of impact of the proposed Project (refer also to Appendix C)

High For the northern, heritage Sites of Shark Island	**Moderate** For the Harbourfront and areas east of the sites	**Low** For residential areas in Lüderitz south and east of the sites	**Negligible** For the remainder of the study area
Major loss of or alteration to key elements/features / characteristics of the baseline near the site. i.e. Pre-development landscape or view and/or introduction of elements considered to be uncharacteristic when set within the attributes of the receiving landscape. High scenic quality impacts would result.	Moderate loss of or alteration to key elements/features/ characteristics of the baseline. i.e. Pre-development landscape or view and/or introduction of elements that may be prominent but may not necessarily be substantially problematic when set within the attributes of the receiving landscape. Moderate scenic quality impacts would result	Minor loss of or alteration to key elements/features/ characteristics of the baseline. i.e. Pre-development landscape or view and / or introduction of elements that may not be problematic when set within the attributes of the receiving landscape. Low scenic quality impacts would result.	Very minor loss or alteration to key elements/features/characteristics of the baseline. i.e. Pre-development landscape or view and/or introduction of elements that is not problematic with the surrounding landscape – approximating the 'no change' situation. Negligible scenic quality impacts would result.

10 MITIGATION MEASURES

When considering mitigating measures, three guidelines are evaluated: the measures should be feasible (cost-effective), effective (including the time required for implementation and arrangements for management and maintenance), and acceptable (within the existing landscape and land use policies for the area). To address these, the following principles have been established:

- Mitigation measures should be designed to suit the existing landscape character and needs of the locality. They should respect and build upon landscape distinctiveness.
- It should be recognised that many mitigation measures, especially the establishment of planted screens and rehabilitation, are not immediately effective.

The following general actions are recommended:

10.1 Preparatory Works and Construction Phase

- Construction and dredging activities should be limited to between 06:00 and 18:00 or in conjunction with the Environmental Control Officer.
- Adopt responsible construction practices aimed at strictly containing construction and establishment activities within specifically demarcated areas.
- Building or waste material discarded should be undertaken at an authorised location, which should not be within any sensitive areas.

10.2 Structures, building, and associated infrastructure

- Paint the buildings and structures with colours that reflect and complement the colours of the surrounding landscape, rock, and other structures. See the image below, which is an indicative example of this approach.
- Minimise scale and massing. Break up large expanses of walling or roofing, as in the proposed warehouses, by using a textured effect on the western walls of these structures. This will create areas of light and shade, visually reducing the massing of the walls.
- Consider planting rows of palm trees along the western and northern edges of the warehouse areas. This would also, reduce the scale of the structures when viewed from Shark Island.



(Photo Credit: BLM 2013:198)

10.3 Good housekeeping

- “Housekeeping” procedures should be developed for the Project to ensure that the Project sites and lands adjacent to the Project sites are kept clean of debris, garbage, graffiti, fugitive trash, or waste generated onsite; procedures should extend to control of “track out” of dirt on vehicles leaving the active construction sites.
- Operating activities should be actively maintained during operation.

10.4 Lighting

Light pollution is primarily the result of poor lighting design, which allows artificial light to shine outward and upward into the sky, where it is unwanted, rather than focusing the light downward, where it is needed. Of all the pollutions faced, light pollution is perhaps the most easily remedied. Simple changes in lighting design and installation yield immediate changes in the amount of light spilt into the atmosphere. The following are measures that should be considered in the lighting design of the Project:

- Install light fixtures that provide precisely directed illumination to reduce light “spillage” beyond the immediate surroundings of the site.
- Avoid high pole top security lighting along the periphery of the site, specifically along the western and northern boundaries of Phase 1 and use only lights that are activated on illegal entry to the site.
- Minimise the number of light fixtures to the bare minimum, including security lighting.

11 SIGNIFICANCE OF VISUAL IMPACT

The identification and assessment of environmental impacts is a complex process that involves both quantitative and qualitative descriptions and evaluations. It requires applying scientific measurements and professional judgment to determine the significance of environmental impacts related to the proposed project. The process must consider, among other factors: the purpose and need for the project; the views and concerns of interested and affected parties (I&APs); social and political norms; and the public's interest.

The following tables summarise the *consequences* and *significance* of the visual impact of the Project. These results are based on the worst-case scenario, which considers all aspects of the project together and focuses on the most sensitive viewing areas. The visual impact is rated using the criteria outlined in **Appendix C**.

11.1 Construction Phase

Potential Impacts

Construction activities include removing existing infrastructure, conducting 'earthworks' needed for foundations of structures and infrastructure, and dredging to create the base for the reclamation area platforms. These activities would negatively impact the landscape's visual quality and sense of place compared to its baseline.

The impact on the visual environment during the construction phase is assessed as having a very high intensity and would occur over a short term (less than the project's life span). The unmitigated impact would be localised but would extend beyond the site boundary to surrounding areas. The proposed infrastructure would be visible from sensitive heritage viewing areas but would mainly blend into the existing landscape and would not appear out of place from other areas south and east of the Project sites. The impact is most likely, and its significance is predicted to be moderate negative, meaning it could influence decisions, and the effect will not be avoided unless it is mitigated.

The implementation of mitigation is required in the sense of 'good housekeeping.'

Table 4 Impact Summary – CONSTRUCTION PHASE

Issue: Preparatory works, construction, and lighting		
Description of Impact: Change to the landscape characteristics and key views		
Type of Impact	Direct	
Nature of Impact	Negative	
Phase	Construction	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Very High	Very High
Duration	Low	Low
Extent	Low (Local)	Low (Local)
Consequence	MODERATE	MODERATE
Probability	High	High
Significance	**- Moderate**	**- Moderate**

Degree to which impact can be reversed	*Low: The impact is not reversible unless the project is stopped before construction starts.*	
Degree to which impact may cause irreplaceable loss of resources	*High: Where the activity results in a high adverse effect on the visual resource from highly sensitive viewing areas*	
Degree to which impact can be avoided	*Low: Impact cannot be avoided even through the implementation of mitigation measures.*	
Degree to which impact can be mitigated	*Low: as only good housekeeping and some planning/ management measures could be implemented. These would slightly reduce the impact in the long term.*	
Criteria for potential for cumulative impacts	*A cumulative impact with other port and harbour activities would arise.*	
Monitoring		
	Monitoring or reporting of adherence to the proposed management measures should be conducted by the Environmental Control Officer (ECO) on a bi-weekly basis during the construction phase. This primarily concerns the impacts of poor housekeeping, rather than the visual impacts themselves.	
Cumulative impacts		
Nature of cumulative impacts	The project would introduce activities that already exist in and around the port. Therefore, there is potential for a moderate cumulative effect regarding these activities.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	- Moderate	**- Moderate**

11.2 Operational Phase

Potential Impacts

Operational activities include routine harbour and port functions. Security lighting and other illuminated areas associated with the movement of security vehicles at night are also included. Additionally, maintenance of the Phase 1 and Phase 2 expansion areas is part of the activities. These activities, along with the physical presence of the Project components day and night, contribute to the visual impact.

The impact on the visual environment during the operational phase is assessed to have a very high intensity and would occur over the long-term (for the life of the project). The impact is MOST LIKELY, and its significance is predicted to be HIGH NEGATIVE, i.e. It should influence the decision to not proceed with the Project or require significant modification(s) of the project design/location, etc. (where relevant).

The implementation of mitigation is required, and with time, the impact could reduce to MODERATE NEGATIVE.

Table 5 Impact Summary: OPERATIONAL PHASE

Issue: Established buildings, structures and associated infrastructure and maintenance thereof
Description of Impact: Change to the landscape characteristics and key views

Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Operational	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Very High	High
Duration	High	Moderate
Extent	Low (local)	Low (Local)
Consequence	HIGH	MODERATE
Probability	High	Moderate
Significance	**- HIGH**	**- MODERATE**
Degree to which impact can be reversed	*Low: Where the activity results in a high adverse effect on the visual resource from highly sensitive viewing areas*	
Degree to which impact may cause irreplaceable loss of resources	*High: Impact cannot be entirely avoided; however, with time, the implementation of mitigation measures can reduce the negative effect.*	
Degree to which impact can be avoided	*Low: Only good housekeeping and some planning and management measures could be implemented. These would slightly reduce the impact in the long term.*	
Degree to which impact can be mitigated	*A cumulative effect with other port and harbour activities would arise.*	
Monitoring		
	Monitoring or reporting of adherence to the proposed management measures should be conducted through a bi-annual audit that relates mainly to ecological issues on site and to ensure that light pollution is contained to the site.	
Cumulative impacts		
Nature of cumulative impacts	The project would be a new land-use introduced to the study area that already has existing mining, urbanisation, and power infrastructure. As such, there is potential for minor cumulative effect with respect to these activities.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	- HIGH	**- MODERATE**

11.3 Cumulative Impact

Cumulative landscape and visual effects (impacts) result from additional changes to the landscape or visual amenity caused by the proposed development in conjunction with other developments (associated with or separate from it), or actions that occurred in the past, present or are likely to happen in the foreseeable future. Cumulative effects can also result from the intervisibility of various developments and/or the combined impact of individual components of the proposed development occurring in different locations or over time. The separate impacts of these components or developments may not be significant on their own, but together they can cause an unacceptable level of adverse effect on visual receptors within their combined visual envelopes. Intervisibility depends on factors such as general topography, aspect, other visual obstructions, elevation, and distance, as these influence visual acuity, which is also affected by weather and light conditions (LIEMA (2013)).

The cumulative impact of the proposed Project activities, combined with the existing urban and industrial

character of the port, is regarded as of moderate significance, as the Project activities would contribute negatively to the current visual and aesthetic baseline, particularly for sensitive viewing areas.

10 CONCLUSION

The current visual condition of the landscape that may be impacted by the proposed Project has been outlined. The scenic quality of the study area has been rated from low to high within the sub-region's context. The site and its immediate surroundings are in a landscape type rated as moderate. Sensitive viewing areas and landscape types have been identified and mapped, highlighting a high sensitivity to the Project, especially from the nearby Shark Island heritage sites.

The significance of visual impact is rated when considering the worst-case scenario. This scenario includes all Project activities together.

Impacts on views are most significant when viewers are sensitive to landscape changes, and their perceptions are focused on and dominated by those changes. The visual effect of the Project, during both construction and operation, will lead to negative alterations to the visual baseline. These changes would be noticeable from nearby heritage and tourist observation points. The likelihood of a negative visual impact is high.

Construction activities include removing existing infrastructure, conducting 'earthworks' needed for foundations of structures and infrastructure, and dredging to create the base for the reclamation area platforms. These activities would negatively impact the landscape's visual quality and sense of place compared to its baseline.

The impact on the visual environment during the construction phase is assessed as having a very high intensity and would occur over a short term (less than the project's life span). The unmitigated impact would be localised but would extend beyond the site boundary to surrounding areas. The proposed infrastructure would be visible from sensitive heritage viewing areas but would mainly blend into the existing landscape and would not appear out of place from other areas south and east of the Project sites. The impact is most likely, and its significance is predicted to be moderate negative, meaning it could influence decisions, and the effect will not be avoided unless it is mitigated. The implementation of mitigation is required in the sense of 'good housekeeping.'

Operational activities include routine harbour and port functions. Security lighting and other illuminated areas associated with the movement of security vehicles at night are also included. Additionally, maintenance of the Phase 1 and Phase 2 expansion areas is part of the activities. These activities, along with the physical presence of the Project components day and night, contribute to the visual impact.

The impact on the visual environment during the operational phase is assessed to have a very high intensity and would occur over the long-term (for the life of the project). The impact is MOST LIKELY, and its significance is predicted to be HIGH NEGATIVE, i.e. It should influence the decision to not proceed with the Project or require significant modification(s) of the project design/location, etc. (where relevant). The implementation of mitigation is needed, and with time, the impact could reduce to MODERATE NEGATIVE.

The cumulative impact of the proposed Project activities, combined with the existing urban and industrial character of the port, is regarded as of moderate significance, as the Project activities would contribute negatively to the current visual and aesthetic baseline, particularly for sensitive viewing areas.

Opinion of the author

The author believes that the Lüderitz Expansion Project and its related activities should be approved, if mitigation and management measures are effectively implemented, managed, and monitored over the long term (the life of the Project). These measures aim to safeguard the visual aesthetic of the study area, which is also considered a visual resource.

***** NLA *****

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APPENDIX A: DETERMINING THE VISUAL RESOURCE VALUE OF A LANDSCAPE

To reach an understanding of the effect of development on a landscape resource, it is necessary to consider the different aspects of the landscape as follows:

Landscape Elements and Character

The individual elements that make up the landscape, including prominent or eye-catching features such as hills, valleys, savannah, trees, water bodies, buildings, and roads are generally quantifiable and can be easily described.

Landscape character is therefore the description of the pattern, resulting from combinations of natural (physical and biological) and cultural (land use) factors and how people perceive these. The visual dimension of the landscape reflects how these factors create repetitive groupings and interact to create areas that have a specific visual identity. The process of landscape character assessment can increase appreciation of what makes the landscape distinctive and what is important about an area. The description of landscape character thus focuses on the *nature of the land*, rather than the response of a viewer.

Landscape Value – all-encompassing (Aesthetic Value)

Aesthetic value is the emotional response derived from the experience of the environment with its natural and cultural attributes. The response can be either to visual or non-visual elements and can embrace the sound, smell and any other factor having a strong impact on human thoughts, feelings, and attitudes (Ramsay 1993). Thus, aesthetic value encompasses more than the seen view, visual quality or scenery, and includes atmosphere, landscape character, and sense of place (Schapper 1993).

Aesthetic appeal (value) is considered high when the following are present (Ramsay 1993):

- *Abstract qualities*: such as the presence of vivid, distinguished, uncommon, or rare features or abstract attributes.
- *Evocative responses*: the ability of the landscape to evoke particularly strong responses in community members or visitors.
- *Meanings*: the existence of a long-standing special meaning to a particular group of people or the ability of the landscape to convey special meanings to viewers in general.
- *Landmark quality*: a particular feature that stands out and is recognized by the broader community.

Sense of Place

Central to the concept of a sense of place is that the place requires uniqueness and distinctiveness. The primary informant of these qualities is the spatial form and character of the natural landscape together with the cultural transformations and traditions associated with historic use and habitation. According to Lynch (1992) sense of place "is the extent to which a person can recognize or recall a place as being distinct from other places - as having a vivid, or unique, or at least particular, character of its own". Sense of place is the unique value that is allocated to a specific place or area through the cognitive experience of the user or viewer. In some cases, these values allocated to the place are similar for a wide spectrum of users or viewers, giving the place a universally recognized and therefore, strong sense of place.

Scenic Quality

Assigning values to visual resources is a subjective process. The phrase, “beauty is in the eye of the beholder,” is often quoted to emphasize the subjectivity in determining scenic values. Yet, researchers have found consistent levels of agreement among individuals asked to evaluate visual quality.

Studies for perceptual psychology have shown human preference for landscapes with a higher visual

complexity particularly in scenes with water, over homogeneous areas. Based on contemporary research landscape quality increases when:

- Topographic ruggedness and relative relief increase.
- Where water forms are present.
- Where diverse patterns of grasslands and trees occur.
- Where natural landscape increases and man-made landscape decreases.
- And where land use compatibility increases and land use edge diversity decreases (Crawford 1994).

Scenic Quality - Explanation of Rating Criteria:

(After The Visual Resource Management System, Department of the Interior of the USA Government, Bureau of Land Management)

Landform: Topography becomes more interesting as it gets steeper or more massive, or more severely or universally sculptured. Outstanding landforms may be monumental, as the Fish River or Blyde River Canyon, the Drakensberg or other mountain ranges, or they may be exceedingly artistic and subtle as certain pinnacles, arches, and other extraordinary formations.

Vegetation: (Plant communities) Give primary consideration to the variety of patterns, forms, and textures created by plant life. Consider short-lived displays when they are known to be recurring or spectacular (wildflower displays in the Karoo regions). Consider also smaller scale vegetational features, which add striking and intriguing detail elements to the landscape (e.g., gnarled or wind beaten trees, and baobab trees).

Water: That ingredient which adds movement or serenity to a scene. The degree to which water dominates the scene is the primary consideration in selecting the rating score.

Colour: Consider the overall colour(s) of the basic components of the landscape (e.g., soil, rock, vegetation, etc.) as they appear during seasons or periods of high use. Key factors to use when rating "colour" are variety, contrast, and harmony.

Adjacent Scenery: Degree to which scenery outside the scenery unit being rated enhances the overall impression of the scenery within the rating unit. The distance which adjacent scenery will influence scenery within the rating unit will normally range from 0-8 kilometres, depending upon the characteristics of the topography, the vegetative cover, and other such factors. This factor is generally applied to units which would normally rate very low in score, but the influence of the adjacent unit would enhance the visual quality and raise the score.

Scarcity: This factor provides an opportunity to give added importance to one or all the scenic features that appear to be relatively unique or rare within one physiographic region. There may also be cases where a separate evaluation of each of the key factors does not give a true picture of the overall scenic quality of an area. Often it is several not so spectacular elements in the proper combination that produces the most pleasing and memorable scenery - the scarcity factor can be used to recognize this type of area and give it the added emphasis it needs.

Cultural Modifications: Cultural modifications in the landform / water, vegetation, and addition of structures should be considered and may detract from the scenery in the form of a negative intrusion or complement or improve the scenic quality of a unit.

Scenic Quality Inventory and Evaluation Chart

(After The Visual Resource Management System, Department of the Interior of the USA Government, Bureau of Land Management)

Key factors	Rating Criteria and Score

Landform	High vertical relief as expressed in prominent cliffs, spires, or massive rock outcrops, or severe surface variation or highly eroded formations including major Badlands or dune systems; or detail features dominant and exceptionally striking and intriguing such as glaciers. **5**	Steep canyons, mesas, buttes, cinder cones, and drumlins; or interesting erosional patterns or variety in size and shape of landforms; or detail features which are interesting though not dominant or exceptional. **3**	Low rolling hills, foothills, or flat valley bottoms; or few or no interesting landscape features. **1**
Vegetation and landcover	A variety of vegetative types as expressed in interesting forms, textures, and patterns. **5**	Some variety of vegetation, but only one or two major types. **3**	Little or no variety or contrast in vegetation. **1**
Water	Clear and clean appearing, still, or cascading white water, any of which are a dominant factor in the landscape. **5**	Flowing, or still, but not dominant in the landscape. **3**	Absent, or present, but not noticeable. **0**
Colour	Rich colour combinations, variety, or vivid colour; or pleasing contrasts in the soil, rock, vegetation, water or snow fields. **5**	Some intensity or variety in colours and contrast of the soil, rock, and vegetation, but not a dominant scenic element. **3**	Subtle colour variations, contrast, or interest; generally mute tones. **1**
Influence of adjacent scenery	Adjacent scenery greatly enhances visual quality. **5**	Adjacent scenery moderately enhances overall visual quality. **3**	Adjacent scenery has little or no influence on overall visual quality. **0**
Scarcity	One of a kind; or unusually memorable, or exceedingly rare within region. Consistent chance for exceptional wildlife or wildflower viewing, etc. National and provincial parks and conservation areas *** 5+**	Distinctive, though somewhat like others within the region. **3**	Interesting within its setting, but common within the region. **1**
Cultural modifications	Modifications add favourably to visual variety while promoting visual harmony.	Modifications add little or no visual variety to the area and introduce no discordant elements.	Modifications add variety but are very discordant and promote strong disharmony.

2	**0**	**4**

Scenic Quality (i.e. value of the visual resource)

In determining the quality of the visual resource both the objective and the subjective or aesthetic factors associated with the landscape are considered. Many landscapes can be said to have a strong sense of place, regardless of whether they are scenically beautiful but where landscape quality, aesthetic value and a strong sense of place coincide - the visual resource or perceived value of the landscape is very high.

When considering both objective and subjective factors associated with the landscape there is a balance between landscape character and individual landscape features and elements, which would result in the values as follows:

Value of Visual Resource – expressed as Scenic Quality
(After The Landscape Institute with the Institute of Environmental Management and Assessment (2002))

High	Moderate	Low
Areas that exhibit an incredibly positive character with valued features that combine to give the experience of unity, richness, and harmony. These are landscapes that may be of particular importance to conserve, and which may be sensitive change in general, and which may be detrimental if change is inappropriately dealt with.	Areas that exhibit positive character, but which may have evidence of alteration to /degradation/erosion of features resulting in areas of more mixed character. Potentially sensitive to change in general; again, change may be detrimental if inappropriately dealt with, but it may not require special or particular attention to detail.	Areas generally negative in character with few, if any, valued features. Scope for positive enhancement frequently occurs.

APPENDIX B: METHOD FOR DETERMINING THE *INTENSITY* OF LANDSCAPE AND VISUAL IMPACT

A visual impact study analysis addresses the importance of the inherent aesthetics of the landscape, the public value of viewing the natural landscape, and the contrast or change in the landscape from the Project.

For some topics, such as water or air quality, it is possible to use measurable, technical international or national guidelines or legislative standards, against which potential effects can be assessed. The assessment of likely effects on a landscape resource and on visual amenity is more complex, since it is determined through a combination of quantitative and qualitative evaluations. (The Landscape Institute with the Institute of Environmental Management and Assessment (2002).

Landscape impact assessment includes a combination of objective and subjective judgements, and it is therefore important that a structured and consistent approach is used. It is necessary to differentiate between judgements that involve a degree of subjective opinion (as in the assessment of landscape value) from those that are normally more objective and quantifiable (as in the determination of magnitude of change). Judgement should always be based on training and experience and be supported by clear evidence and reasoned argument. Accordingly, suitably qualified and experienced landscape professionals carry out landscape and visual impact assessments (The Landscape Institute with the Institute of Environmental Management and Assessment (2002),

Landscape and visual assessments are separate, although linked, procedures. The landscape baseline, its analysis and the assessment of landscape effects all contribute to the baseline for visual assessment studies. The assessment of the potential effect on the landscape is carried out as an effect on an environmental resource, i.e. the landscape. Visual effects are assessed as one of the interrelated effects on population.

Landscape Impact

Landscape impacts derive from changes in the physical landscape, which may give rise to changes in its character and from effects to the scenic values of the landscape. This may in turn affect the perceived value ascribed to the landscape. The description and analysis of effects on a landscape resource relies on the adoption of certain basic principles about the positive (or beneficial) and negative (or adverse) effects of change in the landscape. Due to the inherently dynamic nature of the landscape, change arising from a development may not necessarily be significant (Institute of Environmental Assessment & The Landscape Institute (2002)).

Visual Impact

Visual impacts relate to the changes that arise in the composition of available views as a result of changes to the landscape, to people's responses to the changes, and to the overall effects with respect to visual amenity. Visual impact is therefore measured as the change to the existing visual environment (caused by the physical presence of a new development) and the extent to which that change compromises (negative impact) or enhances (positive impact) or maintains the visual quality of the area.

To assess the magnitude of visual impact four main factors are considered.

Visual Intrusion:	The nature of intrusion or contrast (physical characteristics) of a Project component on the visual quality of the surrounding environment and its compatibility/discord with the landscape and surrounding land use.
Visibility:	The area/points from which Project components will be visible.
Visual exposure:	Visibility and visual intrusion qualified with a distance rating to indicate the degree of intrusion.
Sensitivity:	Sensitivity of visual receptors to the proposed development

Visual Intrusion / contrast

Visual intrusion deals with the notion of contextualism i.e. how well does a Project component fit into the ecological and cultural aesthetic of the landscape as a whole? Or conversely what is its contrast with the receiving environment. Combining landform / vegetation contrast with structure contrast derives overall visual intrusion/contrast levels of high, moderate, and low.

Landform / vegetation contrast is the change in vegetation cover and patterns that would result from construction activities. Landform contrast is the change in landforms, exposure of soils, potential for erosion scars, slumping, and other physical disturbances that would be noticed as uncharacteristic in the natural landscape. Structure contrast examines the compatibility of the proposed development with other structures in the landscape and the existing natural landscape. Structure contrast is typically strongest where there are no other structures (e.g., buildings, existing utilities) in the landscape setting.

Photographic panoramas from key viewpoints before and after development are presented to illustrate the nature and change (contrast) to the landscape created by the proposed development. A computer simulation technique is employed to superimpose a graphic of the development onto the panorama. The extent to which the component fits or contrasts with the landscape setting can then be assessed using the following criteria.

- Does the physical development concept have a negative, positive, or neutral effect on the quality of the landscape?
- Does the development enhance or contrast with the patterns or elements that define the structure of the landscape?
- Does the design of the Project enhance and promote cultural continuity, or does it disrupt it?

The consequence of the intrusion / contrast can then be measured in terms of the sensitivity of the affected landscape and visual resource given the criteria listed below. For instance, within an industrial area, a new sewage treatment works may have an insignificant landscape and visual impact; whereas in a *valued* landscape it might be considered to be an intrusive element. (Institute of Environmental Assessment & The landscape Institute (1996)).

Visual Intrusion

High	Moderate	Low	Positive
If the Project: - Has a substantial negative effect on the visual quality of the landscape; - Contrasts dramatically with the patterns or elements that define the structure of the landscape; - Contrasts dramatically with land use, settlement, or enclosure patterns; - Is unable to be 'absorbed' into the landscape.	If the Project: - Has a moderate negative effect on the visual quality of the landscape; - Contrasts moderately with the patterns or elements that define the structure of the landscape; - Is partially compatible with land use, settlement, or enclosure patterns. - Is partially 'absorbed' into the landscape.	If the Project: - Has a minimal effect on the visual quality of the landscape; - Contrasts minimally with the patterns or elements that define the structure of the landscape; - Is mostly compatible with land use, settlement, or enclosure patterns. - Is 'absorbed' into the landscape.	If the Project: - Has a beneficial effect on the visual quality of the landscape; - Enhances the patterns or elements that define the structure of the landscape; - Is compatible with land use, settlement, or enclosure patterns.

Result Notable change in landscape characteristics over an extensive area and/or intensive change over a localized area resulting in major changes in key views.	*Result* Moderate change in landscape characteristics over localized area resulting in a moderate change to key views.	*Result* Imperceptible change resulting in a minor change to key views.	*Result* Positive change in key views.

Visual intrusion also diminishes with scenes of higher complexity, as distance increases, the object becomes less of a focal point (more visual distraction), and the observer's attention is diverted by the complexity of the scene (Hull and Bishop (1988)).

Visibility

A viewshed analysis was carried out to define areas, which contain all possible observation sites from which the development would be visible. The basic assumption for preparing a viewshed analysis is that the observer eye height is 1.8m above ground level. Topographic data was captured for the site and its environs at 10 m contour intervals to create the Digital Terrain Model (DTM). The DTM includes features such as vegetation, rivers, roads and nearby urban areas. These features were 'draped' over the topographic data to complete the model used to generate the viewshed analysis. It should be noted that viewshed analyses are not absolute indicators of the level of significance (magnitude) of the impact in the view, but merely a statement of the fact of potential visibility. The visibility of a development and its contribution to visual impact is predicted using the criteria listed below:

Visibility

High	Moderate	Low
Visual Receptors If the development is visible from over half the zone of potential influence, and/or views are mostly unobstructed and/or most viewers are affected.	*Visual Receptors* If the development is visible from less than half the zone of potential influence, and/or views are partially obstructed and or many viewers are affected	*Visual Receptors* If the development is visible from less than a quarter of the zone of potential influence, and/or views are mostly obstructed and/or few viewers are affected.

Visual Exposure

Visual exposure relates directly to the distance of the view. It is a criterion used to account for the limiting effect of increased distance on visual impact. The impact of an object in the foreground (0 – 800m) is greater than the impact of that same object in the middle ground (800m – 5.0 km) which, in turn is greater than the impact of the object in the background (greater than 5.0 km) of a particular scene.

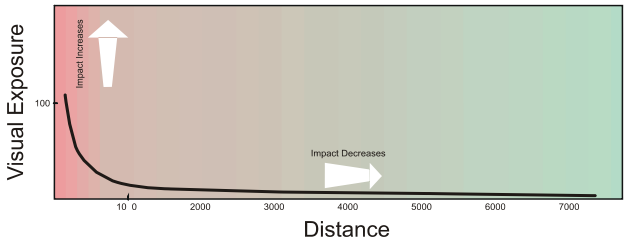
Distance from a viewer to a viewed object or area of the landscape influences how visual changes are perceived in the landscape. Generally, changes in form, line, colour, and texture in the landscape become less perceptible with increasing distance.

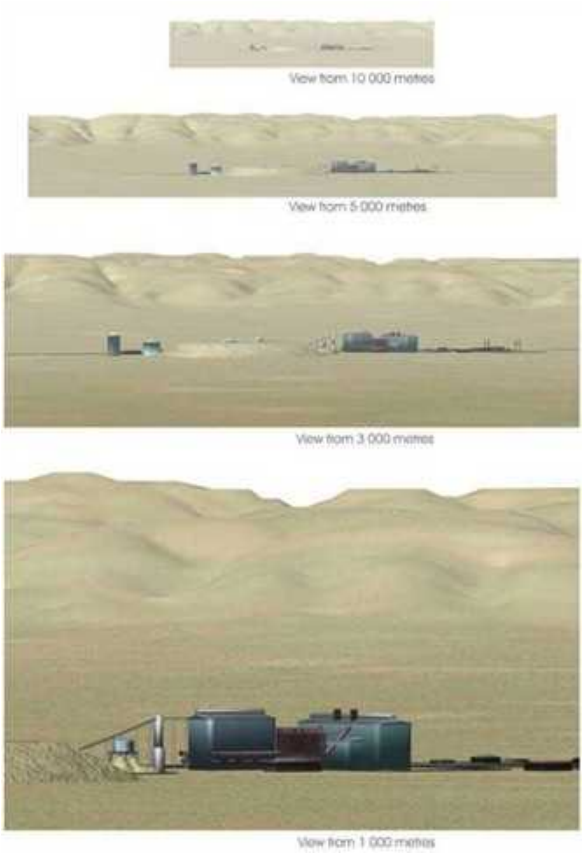
Areas seen from 0 to 800m are considered foreground; foliage and fine textural details of vegetation are normally perceptible within this zone. Areas seen from 800m to 5.0km are considered middle ground; vegetation appears as outlines or patterns. Depending on topography and vegetation, middle ground is sometimes considered to be up to 8.0km. Areas seen from 5.0km to 8.0km and sometimes up to 16km and beyond are considered background. Landforms become the most dominant element at these

distances. Seldom seen areas are those portions of the landscape that, due to topographic relief or vegetation, are screened from the viewpoint or are beyond 16km from the viewpoint. Landforms become the most dominant element at these distances.

The impact of an object diminishes at an exponential rate as the distance between the observer and the object increases. Thus, the visual impact at 1000 m would be 25% of the impact as viewed from 500 m. At 2000 m it would be 10% of the impact at 500 m. The inverse relationship of distance and visual impact is well recognised in visual analysis literature (e.g.: Hull and Bishop (1988)) and is used as an important criteria for the study. This principle is illustrated in the Figures below.

Effect of Distance on Visual Exposure





Sensitivity of Visual Receptors

When visual intrusion, visibility and visual exposure are incorporated, and qualified by sensitivity criteria (visual receptors) the magnitude of the impact of the development can be determined.

The sensitivity of visual receptors and views will be depended on:

- The location and context of the viewpoint.
- The expectations and occupation or activity of the receptor.
- The importance of the view (which may be determined with respect to its popularity or numbers of people affected, its appearance in guidebooks, on tourist maps, and in the facilities provided for its enjoyment and references to it in literature or art).

The most sensitive receptors may include:

- Users of all outdoor recreational facilities including public rights of way, whose intention or interest may be focused on the landscape.
- Communities where the development results in changes in the landscape setting or valued views enjoyed by the community.
- Occupiers of residential properties with views affected by the development.
- These would all be high.

Other receptors include:

- People engaged in outdoor sport or recreation (other than appreciation of the landscape, as in landscapes of acknowledged importance or value).
- People travelling through or past the affected landscape in cars, on trains or other transport routes.
- People at their place of work.

The least sensitive receptors are likely to be people at their place of work, or engaged in similar activities, whose attention may be focused on their work or activity and who therefore may be potentially less susceptible to changes in the view.

In this process more weight is usually given to changes in the view or visual amenity which are greater in scale, and visible over a wide area. In assessing the effect on views, consideration should be given to the effectiveness of mitigation measures, particularly where planting is proposed for screening purposes (Institute of Environmental Assessment & The Landscape Institute (1996).

Sensitivity of Visual Receptors

High	Moderate	Low
Users of all outdoor recreational facilities including public rights of way, whose intention or interest may be focused on the landscape.	People engaged in outdoor sport or recreation (other than appreciation of the landscape, as in landscapes	The least sensitive receptors are likely to be people at their place of work, or engaged in similar activities, whose attention may be

Communities where the development results in changes in the landscape setting or valued views enjoyed by the community. Occupiers of residential properties with views affected by the development.	of acknowledged importance or value). People travelling through or past the affected landscape in cars, on trains or other transport routes.	focused on their work or activity and who therefore may be potentially less susceptible to changes in the view (i.e. office and industrial areas). Roads going through urban and industrial areas

Intensity of the Visual Impact

Potential visual impacts are determined by analysing how the physical change in the landscape, resulting from the introduction of a Project, are viewed and perceived from sensitive viewpoints. Impacts to views are the highest when viewers are identified as being sensitive to change in the landscape, and their views are focused on and dominated by the change. Visual impacts occur when changes in the landscape are noticeable to viewers looking at the landscape from their homes or from parks, and conservation areas, highways and travel routes, and important cultural features and historic sites, especially in foreground views.

The magnitude of impact is assessed through a synthesis of visual intrusion, visibility, visual exposure and viewer sensitivity criteria. Once the magnitude of impact has been established this value is further qualified with spatial, duration and probability criteria to determine the *significance* of the visual impact.

For instance, the fact that visual intrusion and exposure diminishes significantly with distance does not necessarily imply that the relatively small impact that exists at greater distances is unimportant. The level of impact that people consider acceptable may be dependent upon the purpose they have in viewing the landscape. A particular development may be unacceptable to a hiker seeking a natural experience, or a household whose view is impaired, but may be barely noticed by a golfer concentrating on his game or a commuter trying to get to work on time (Ittleson *et al.,* 1974).

In synthesising these criteria a numerical or weighting system is avoided. Attempting to attach a precise numerical value to qualitative resources is rarely successful, and should not be used as a substitute for reasoned professional judgement. (Institute of Environmental Assessment and The landscape Institute (1996)).

Intensity (Intensity) of Visual Impact

High	Moderate	Low	Negligible
Total loss of or major alteration to key elements/features/characteristics of the baseline. I.e. Pre-development landscape or view and/or introduction of elements considered to	Partial loss of or alteration to key elements/features/characteristics of the baseline. I.e. Pre-development landscape or view and/or introduction of elements that may be	Minor loss of or alteration to key elements/features/characteristics of the baseline. I.e. Pre-development landscape or view and/or introduction of elements that may not	Very minor loss or alteration to key elements/features/characteristics of the baseline. I.e. Pre-development landscape or view and/or introduction of elements that are not

be totally uncharacteristic when set within the attributes of the receiving landscape. High scenic quality impacts would result.	prominent but may not necessarily be substantially uncharacteristic when set within the attributes of the receiving landscape. Moderate scenic quality impacts would result	be uncharacteristic when set within the attributes of the receiving landscape. Low scenic quality impacts would result.	uncharacteristic with the surrounding landscape – approximating the 'no change' situation. Negligible scenic quality impacts would result.

Cumulative effects

Cumulative landscape and visual effects (impacts) result from additional changes to the landscape or visual amenity caused by the proposed development in conjunction with other developments (associated with or separate to it), or actions that occurred in the past, present or are likely to occur in the foreseeable future. They may also affect the way in which the landscape is experienced. Cumulative effects may be positive or negative. Where they comprise a range of benefits, they may be considered to form part of the mitigation measures.

Cumulative effects can also arise from the intervisibility (visibility) of a range of developments and /or the combined effects of individual components of the proposed development occurring in different locations or over a period of time. The separate effects of such individual components or developments may not be significant, but together they may create an unacceptable degree of adverse effect on visual receptors within their combined visual envelopes. Intervisibility depends upon general topography, aspect, tree cover or other visual obstruction, elevation and distance, as this affects visual acuity, which is also influenced by weather and light conditions. (Institute of Environmental Assessment and The landscape Institute (1996)).

APPENDIX C: SIGNIFICANCE OF ENVIRONMENTAL IMPACTS

Table 1: IMPACT ASSESSMENT CRITERIA

SIGNIFICANCE determination	**Significance = consequence x probability**	
CONSEQUENCE	**Consequence is a function of:** • **Nature and Intensity of the potential impact** • **Geographical extent should the impact occur.** • **Duration of the impact**	
Ranking the NATURE and INTENSITY of the potential impact		
Negative impacts		
Low (L)	The impact has no / minor effect/deterioration on natural, cultural, and social functions and processes. No measurable change. Recommended standard / level will not be violated. (Limited nuisance related complaints).	
Moderate (M)	Natural, cultural, and social functions and processes can continue, but in a modified way. Moderate discomfort that can be measured. Recommended standard / level will occasionally be violated. Various third-party complaints expected.	
High (H)	Natural, cultural, or social functions and processes are altered in such a way that they temporarily or permanently cease. Substantial deterioration of the impacted environment. Widespread third-party complaints expected.	
Very high (VH)	Substantial deterioration (death, illness, or injury). Recommended standard / level will often be violated. Vigorous action expected by third parties.	
Positive impacts		
Low (L) +	Slight positive effect on natural, cultural, and social functions and processes Minor improvement. No measurable change.	
Moderate (M) +	Natural, cultural, and social functions and processes continue but in a noticeably enhanced way. Moderate improvement. Little positive reaction from third parties.	
High (H) +	Natural, cultural, or social functions and processes are altered in such a way that the impacted environment is considerably enhanced /improved. Widespread, noticeable positive reaction from third parties.	
Very high (VH) +	Substantial improvement. Will be within or better than the recommended level. Favourable publicity from third parties.	
Ranking the EXTENT		
Low (L)	Local (confined to within the project concession area and its nearby surroundings).	
Moderate (M)	Regional (confined to the region, e.g. coast, basin, catchment, municipal region, district, etc.).	
High (H)	National (extends beyond district or regional boundaries with national implications).	
Very high (VH)	International (Impact extends beyond the national scale or may be transboundary).	
Ranking the DURATION		
Low (L)	Temporary/short term. Quickly reversible. (Less than the life of the Project).	
Moderate (M)	Medium Term. Impact can be reversed over time. (Life of the Project).	
High (H)	Long Term. Impact will only cease after the life of the Project.	
Very high (VH)	Permanent	
Ranking the PROBABILITY		
Low (L)	Unlikely	
Moderate (M)	Possibly	
High (H)	Most likely	
Very high (VH)	Definitely	
SIGNIFICANCE Description		
	Positive	**Negative**
Low (L)	Supports the implementation of the Project	No influence on the decision.
Moderate (M)	Supports the implementation of the Project	It should have an influence on the decision and the impact will not be avoided unless it is mitigated.
High (H)	Supports the implementation of the Project	It should influence the decision to not proceed with the Project or require significant modification(s) of the project design/location, etc. (where relevant).
Very high (VH)	Supports the implementation of the Project	It would influence the decision to not proceed with the Project.

Table 2: DETERMINING THE CONSEQUENCE

DETERMINING THE CONSEQUENCE					
INTENSITY OF IMPACT = LOW					
DURATION	VH	Moderate	Moderate	High	High
	H	Moderate	Moderate	Moderate	Moderate
	M	Low	Low	Low	Moderate
	L	Low	Low	Low	Moderate
INTENSITY OF IMPACT = MODERATE					
DURATION	VH	Moderate	High	High	High
	H	Moderate	Moderate	High	High
	M	Moderate	Moderate	Moderate	Moderate
	L	Low	Moderate	Moderate	Moderate
INTENSITY OF IMPACT = HIGH					
DURATION	VH	High	High	Very High	Very high
	H	High	High	High	Very High
	M	Moderate	Moderate	High	High
	L	Moderate	Moderate	High	High
INTENSITY OF IMPACT = VERY HIGH					
DURATION	VH	Very high	Very High	Very High	Very high
	H	High	High	Very High	Very high
	M	High	High	High	Very High
	L	Moderate	High	High	Very High
		L	M	H	VH
		EXTENT			

Table 3: DETERMINING THE SIGNIFICANCE

DETERMINING THE SIGNIFICANCE					
PROBABILITY	VH	Moderate	High	High	Very high
	H	Moderate	Moderate	High	Very high
	M	Low	Moderate	High	High
	L	Low	Low	Moderate	High
		L	M	H	VH
		CONSEQUENCE			

APPENDIX D: CRITERIA FOR PHOTO / COMPUTER SIMULATION

To characterize the nature and magnitude of visual intrusion of the proposed Project, a photographic simulation technique was used. This method was used according to Sheppard (in Lange 1994), where a visual simulation is good quality when the following five criteria are met.

Representativeness:	A simulation should represent important and typical views of a Project.
Accuracy:	The similarity between a simulation and the reality after the Project has been realized.
Visual clarity:	Detail, parts and overall contents have to be clearly recognizable.
Interest:	A simulation should hold the attention of the viewer.
Legitimacy:	A simulation is defensible if it can be shown how it was produced and to what degree it is accurate.

To comply with this standard it was decided to produce a stationary or static simulation (Van Dortmont in Lange, 1994), which shows the proposed development from a typical static observation points (Critical View Points).

Photographs are taken on site during a site visit with a manual focus, 50mm focal depth digital camera. All camera settings are recorded and the position of each panoramic view is recorded by means of a GPS. These positions, coordinates are then placed on the virtual landscape (see below).

A scale model of the proposal is built in virtual space, scale 1:1, based on CAD (vector) information as supplied by the architect / designers. This model is then placed on a virtual landscape, scale 1:1, as produced by means of GIS software. The accuracy of this depends on the contour intervals.

The camera views are placed on the points as recorded on the virtual landscape. The respective photographs are overlaid onto the camera views, and the orientation of the cameras adjusted accordingly. The light source is adjusted to suit the view. Each view is then rendered as per the process above.

Appendix E Public Participation Process

Notified Interested and Affected Parties

Name	Organisation/Representative
Aletia Bock	Debmarine Namibia
Alex Gawanab	Seaflower Whitefish Corp
Alexey Zavitaev	Namport
Alpher Sinvula	Imex Commodity Traders
Andries Kok	NamWater
Angelo Isaaks	South Point Ship Agents
Anna Nekuta	Hyphen
Anton Pretorius	Logistics Support Services
Basil Brown	Diego's Sales
Bernnito Mogotsi	Ministry of Defence and Veteran Affairs
Bertrum Eiman	Eiman & NWI Trading cc
Bertus Eksteen	TransNamib
Bessly Makaula	Lüderitz Secondary School
Calvin Sisamu	NamPower
Cassius Shanjengange	Ministry of Education
Cecil Kamupingene	Namport
Christo Horn	Roshpinah Zinc
Christo Witbooi	Skorpion Zinc Mining Company (Pty) Ltd and Gergarub Exploration and Mining (Pty) Ltd
Cornelia-Snerry Mungungu	Debmarine Namibia
Darryl Smith	Kelp Blue Trading
Demi Sylvester	Luderitz Bay Shipping
Desmond Bester	Directorate of Fisheries
Eliaser Ikela	Debmarine Namibia
Elwon de Koker	Dissability/Tourism
Elzevir Gelderbloem	Namport
Erwin Mukumbi	AE Connexions
Ferdie De Villiers	Novaship
Fillemon Aupokolo	NamWater
Fillipus Hedimbi	Namport
Fluksman Samuehl	Lüderitz Waterfront Development Company
Fred Outa	TotalEnergies
Gebhard Shiindi	Coastal Infastructure Terminals
Geldenhuys Johannes	Navy
Gerhard K	Skeleton Coast Trawling
Gloudi de Beer	O&L Group
Gregory Victor	Gregory G. Victor Fishing
Helmut Plietz	A Plietz Engineering Works
Hertha Ekandjo	Transworld Cargo
Howard Head	Alma Marine Trust
Hubert Siljeur	Vivo Energy Namibia

Name	Organisation/Representative
Ingrid Wiesel	Brown Hyena Research Project
Innocent Sinvula	Sturrock Grindrod Maritime
Iwhan Van Wyk	Luderitz Bay Shipping
Jason Burgess	Southern Wolf Tuna Fishing
Jeremy Blood	SLR Consulting (Africa)
Jessica Kemper	Independent Environmental Scientist
Jocelin Pickering	Wilmigmar Fishing
Johan Krüger	Pekranam Logistics
Johann Coetzer	Debmarine Namibia
Jolanda Murangi	NamWater
Jonathan Washinana	Access World Logistics Namibia
Jose Calaca	Blomeha Fishing
Kalsen Neliwa	Marco Fishing
Kenneth Victor	Kenneth Victor Fishing
Lesheni Mweshixwa	Ministry of Defence and Veteran Affairs
Lewis Druker	Coastways Tours Luderitz
Lukas Kufuna	Namport
Luther Mostert	Walvis Bay Ship Chandlers
Manfred Victor	M.T Victor Fishing
Manns Kennedy	Gondwana Diamond Mining
Mara-lee Naris	Prim Fishing
Marie Lemerle	Brown Hyena Research Project
Mario Harris	MMH Building Renovations
Marion Schelkle	Lüderitz Safaris & Tours
Marlon Biwa	Vivo Energy Namibia
Max Khrone	Karanas Investment
Maxine Cloete	Woker Freight Services
Merlyn Claasen	Namibia Wildlife Resorts
Michael Mckenzie	Marco Fishing
Miguel Calaca	Hangana Abalone
Monique De Wee	Skeleton Coast Trawling
Natassia Coetzee	Namibian Revenue Agency
Ockert Sales	Hardcore Logistics
Ockert Theron	Logistics Support Services / I-Logistics
Patrick Van Zyl	Logistics Support Services / I-Logistics
Paul Marubella	Namport
Pertus Siloka	Fisheries Observers Agency
Peter-John Sylvester	Breakwater Diamond Mining
Rassie Erasmus	Benguella Wealth Farming
Rauna Shikwaya	Namport
Renette Ferreira	Eastercliff Fishing

Name	Organisation/Representative
Renette Ferreira	R&FO Fishing
Richard Kennedy	Namport
Robert Hailume	Namibia Wildlife Resorts
Sheldon Husselmann	Hyphen
Solange Strauss	Hydrolec
Stefanus Gariseb	Namport
Suama Kali	Ministry of Home Affairs, Immigration, Safety and Security
Sunday Nelenge	Namibia Wildlife Resorts
Suzette Weyers	Tradeport Namibia Investments
Szacky Nujoma	Nuwal Management Services CC
Taune Hiholiwe	Ministry of Education
Temba Apulile	Access World Logistics Namibia
Theofelus Dos Santos	Skeleton Coast Trawling
Titus K. Paulus	Seaflower Whitefish Corp
Ulf Grünewald	Lüderitz Nest Hotel
Wilhelm Steenkamp	Essenzeit Restaurant
William Korff	Chemvet / Lüderitz Diving
Winfried Henok	Namport
	CIF Namibia Infrastructure Development Forum
	Lüderitz Waterfront Development Company
	NamPower
	TotalEnergies
	TransNamib

Newspaper Advertisements

Youth Central
WHERE IT'S AT

What are your thoughts on the National Youth Development Fund?



Alitha Maria (20)

Cabinet has done really well and should invest some of the funds into YouTube monetisation as we actually have good content creators that can make money from these platforms.



Pia Shousiku (18)

Firstly, the government has done an incredible job proving to the youth of Namibia that they actually care about young people, however, money can be invested in employment so when they graduate they don't wind up on the streets.



Rivaldo Kavanga (23)

It is a great initiative by the government. I believe the government has already planned which sectors it should get into, such as the creative sector and the eco-green sector.

• WILMA IITA

CABINET approved N$257 million for the National Youth Development Fund (NYDF). The allocation forms part of a N$500-million commitment for the 2025/26 financial year, aimed at tackling youth unemployment and promoting entrepreneurship in key sectors including agriculture, green initiatives and manufacturing.

The fund is exclusively for people aged 18 to 35.

What are your thoughts on the youth fund?



Bronwyn Blaauw (21)

I believe the government should invest in sport. We have very good athletes in our country. However, due to a lack of resources, our athletes don't make it to an international level.



Claudius Riruako (23)

This is a good investment that will be empowering the youth. This is the future, we are the future. More of these investments should be made.



Junior Katoma (19)

For the youth this is a very tremendous opportunity and we will be able to see growth. Although I believe in equity, let's help the youth gain employment and empower the future.

PUBLIC PARTICIPATION NOTICE
ENVIRONMENTAL ASSESSMENT: LAND RECLAMATION AND EXPANSION OF THE PORT OF LÜDERITZ, ||KARAS REGION

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The environmental assessment is conducted according to the Environmental Management Act of 2007 and its regulations as published in 2012.

Interested and affected parties are invited to register with the environmental consultant to be provided with the opportunity to share comments, issues or concerns related to the project, for consideration in the EA. Registration, requests for additional information, and comments and concerns should be submitted to Geo Pollution Technologies by 01 September 2025.

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GEO Pollution Technologies

EXTERNAL VACANCY

The Namibia Statistics Agency (NSA) was established in terms of the Statistics Act No. 9 of 2011. The Agency is mandated, amongst others, to constitute the central statistical authority of the State and to collect, produce, analyse, and disseminate official statistics in Namibia.

Namibia Statistics Agency

Position:
Web developer: NHIES Project (Fixed term Contract)

Duty stations:
NSA Head Office, Windhoek

Closing Date: 22 August 2025
More details at: www.nsa.org.na/vacancies

the namibian mOshiwambo

Tuma etumwalaka lyoye efupi nenge "sms" konomola ndji 99902, omanga inoo shanga etumwalaka lyoye, tameka noshitya Oshi opo ihe to landulithako "osms" yoye. Osms kehe ota yi gu N$1.

Sankwasa okwa pula ovanangeshefa koKatima va file oshiwana oshisho

MINISTA womayambulepo eedoolopa noitopolwa yokomikunda James Sankwasa okwa ti ola ninga efimbo opo ovanangeshefa koKamima Mulilo va tameke okushanifa omauwa moshiwana.

Sankwasa okwa li ta popi pefimbo loshoongalele novanangeshefa novakalimo mongulu yoyoongalele yaNgweze Etine.

Pefimbo loshoongalele, Sankwasa okwa popya kuya oshike sha eta a teye po ewiliko lodoolopa laKatima Mulilo, ndee ta pula oshiwana kutya oshike naana sha pumbwa okuningwa po kuyambulwe po odoolopa.

Sankwasa okwa yandja ombedi kovanangeshefa eomodoolopa omo eshi itava wanifa po oinakuwanifa yavo yomoshiwana ndee ta ti oku na oku va fininika va kalele po oshinima osho monakwiiwa.

"Oule wefimbo lile, otwa kala nokutala ovanangeshefa itava shunifa omauwa moshiwana ashike otwa kala ashike itatau shi popi. MoKatima Mulilo omu na unene eemumbwe dihapu odo ovanangeshefa tava dulu okukandula po mouwa woshiwana.

Ondi shi shii kutya opu na vamwe ovo tava ninge osho tava dulu, ashike nee, opu na ovo tava yandje ashike koohandimwe ndee itava yandje koshiwana ashishe," osho a ti ngaho.

Sankwasa okwa yeleka kutya eyandjo lomadu kovanhu vomomudingonoko ovo hava hoolola nali fimanekwe.

"Ohatu fimaneke ovahololi vetu ovo ve tu hoolola mangha inatu ya kovanhu ovo ihava hoolola.

Katu li ominge nomunangeshefa washa oo a hala okutota ongeshefa. Otwa hala ashike shi ningwe pamulandu oo u na okulandulwa," osho weda po ngaho.



Efano: Lugeretzia Koope

OSHIWANA SHAZAMBEZI ... Ovakalimo omafele vomoZambezi novanangeshefa okwa li va holoka koshoongalele sha ningwa kuminista womayambulepo eedoolopa noitopolwa yokomikunda James Sankwasa koKatima Mulilo Etine

Sankwasa ota longifa outanga

the namibian

Omaliudo omudindi woshifo

OVAKALIMO vomeedoolopa otava pandula nokutanga minista James Sankwasa eshi ta ponokele eekamusela damuni shaashi vati di na oulingilingi nokadi na owino.

Ovakalimo moNamibia alishe paife otava pula Sankwasa a kufe moilonga eekamusela dimwe momalelo eedoolopa konima a longifa oveta a kufe moilonga ovanambelewa va hoololwa koKatima Mulilo.

Konima ashike a kufa ovanhu moilonga koKatima, Sankwasa okwa twäkila nokuninga omutilifo kutya ota kufa ovanailonga voshilando pangelo, Ovenduka, moilonga, ta popi "oilonga ya nghundipala".

Ovahololi nava kotokele ovazumganeki ovanaipupulu. Kakele kwaasho, ovahololi nava kotoke vaha tileshi okaana nomeva. Heeno, ehanda lovakalimo unene ngaa meedoolopa oli li mondjila.

Ashike outanga waSankwasa kau shi ekandulepo lomukundu koulingilingi neekamusela dibe na novanhu da hoolola di ye meembelewa damuni paudemokoli.

Sankwasa naye okwa nyika opolitika. RedForce okwe mu handila kutya ota longifa eenghono daye doaministili a potokonone oinima yaye yopaumwene konima ehangano lanyaika lokwoongela eengunga vati kwa li la teta ko omuyakulo aye amuni koKatima shaashi okwa dopa okufuta omayakulo aye.

Ponhele yokukala omawiliki eli nawa, Sankwasa noilyo ikwao inwe yOkabinete ova fa ashike eshina lokolutenda tali faduka po, la kolwa keenghono.

Ohatu shi efele ovauwino neembangu di mone ngee Sankwasa oveta okwe i longifa ngaa mondjila eshi a kufa ovanambelewa va hoololwa moilonga. Eshi sha yela osheshi kutya okwa dopa okulandula omilandu odo di li pauyelele nopauyuki.

Paushili, Sankwasa okwa ningila eekamusela omalundilo akula oulingilingi nonghee nee okwa pumbwa okukwashilipaleka kutya oda pangulwa nokupewa omahandiukilo ponhele yokukufa ashike ovakondjifi vaye papolitika mombelewa.

Ovahololi inava yandja po oinakuwanifa yavo kuSankwasa oo ina hoololwa, mokuunganga novarihu ovo va hoolola va yandje omeva, eendjila, olusheno, va wapaleke odoolopa nokuyandja omayakulo akwao amuni.

Eehanhi 18 modolongo molwoshingulu?

JONAH NDAKALAKO

wokOshakati okwa li a tulwa modoolongo oule wechanhi 18 konima omhangu yopombada oshivike sha dja ko ya ninguluka etokolo lamagestrata olo la londoda ombudi yoshingulu i kale inai adikila sha vali oule womido mbali.

Ndakalako ti okwa dipaya oshingudhi muludi 2022 opo a ongele oshimaliwa shekonakono londodo 10 lamumwaina. Osgomunhu opo ta ningi oshinima shapuka hwotete, Ndakalako okwa li a pulwa e litwale kodolongo kOndangwa.

Omhangu yopombada oya ti kutya oveta otai ti omanhu opo ta myono hwotete a monika ondjo youlunga woshimuna shongushu yoN$500 na pewe ehandukilo modolongo loule wefimbo inali koya pomido mbali.

Okatendo koumbudi woimuna oke shiivike nawa kutya 'oveta yaJerry Ekandjo' shaashi okwa li ka totwa konima minista mukulu woipambele yomeumbo e ka fininika mopaliamente konima kwa li oikombo yaye ya vakwa kofaalama yaye.

Ola ninga efimbo ovatotiveta va tahulule oveta ei ihe li mondjila. Otai hepeke ashike eebepele ashike kapu na okushunifa sha koonakuningwa oihakanwa youmbudi woimuna.

Ndakalako ota ka wedela ashike omwaalu wovanadolongo notashi dulika nokuli a dje mo a ninga osgangala ikukutu.

Presidente ne mu mangulule divadiva.



Efano: La yandjwa

OLWOODI INALI PWA ... Okomisi yaNamibia yokulwifa oulingilingi oya ti olwoodi layo lokududa mo oulingilingi aushe moshilongo inali pwa, natango otai twikile nokulonga oilonga yayo.

Ovanailonga vatatu velelo loshitopolwahoololo shaZambezi va mangwa po

OVANAILONGA vatatu velele loshitopolwahoololo shaZambezi okwa li va mangwa po omutenya wEtine noipofa youlingilingi yotendela ya kwatakanifwa noZambezi Waterfront.

Omupopiliko wokomisi yaNamibia yokulwifa oulingilingi yedina Anti-Corruption Commission (ACC), Josephina Nghituwamata monapulaapulo noNampa Etine, okwa ti ovanailonga ovo vatatu okwa li va teelelika va holoke momhangu yamagestrata moKatima Mulilo Etitano. "Ashike nee, itandi dulu nande okuhololola omaukwatya avo mangha inava holoka momhangu," osho a ti ngaho.

Komanda wopolifi yaNamibia koshitopolwahoololo shaZambezi, komisina Andreas Shilelo naye okwa koleka kutya ovalumenhu vavali nomukainhu umwe ova mangwa po.

"Ovanhu ava vatatu ove li kodolongo yaKatima Mulilo," osho a ti ngaho.

Omakonakono otaa twikile natango moshikumungu omu.

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WEER

BINNELAND: Gedeeltelik bewolk en warm in die verre Suide en verre noordooste, andersins sonnig en warm maar baie warm in die noordweste en sentrale-Noorde.

KUS: Gedeeltelik bewolk en matig met miskolle.

GETYE BY WALVISBAAI: 09:58 L: 16:01 H: 22:37

VOORUITSIGTE

WINDHOEK	05°	26°
RUNDU	08°	31°
OSHAKATI	07°	32°
GOBABIS	04°	26°
MARIENTAL	08°	24°
KEETMANSHOOP	07°	22°
WALVISBAAI	10°	22°
LUANDA	17°	25°
JOHANNESBURG	08°	20°
KAAPSTAD	07°	18°

Melber bedank oor 'Slagter van Lubango'

VAN BL. 1

"Kameraad President, u erkenning van wyle Solomon Hawala het pynlike herinneringe teruggebring aan die donkerste hoofstuk in Swapo se geskiedenis, wat ons sedertdien nie erken en waarvoor ons nie verantwoordelikheid geneem het nie. U het hom geprys as 'n ikoniese figuur van die Namibiese revolusie en verklaar dat u sy lewe wat hy in die nastrewing van vryheid, vrede, eenheid en voorspoed vir alle Namibiese mense gewy het, sal vier. U het aan hom 'n onwrikbare toewyding aan nasionale eenheid toegeskryf, as 'n inspirasie vir toekomstige geslagte.

"Ten spyte van beter wete, het u hom die eer van 'n staatsbegrafnis betoon," het hy gesê. Vir 'n halfeeu, het Melber gesê, het hy oortuig gebly dat solidariteit, vryheid en geregtigheid die leidende beginsels vir die party was.

"Daar was baie geleenthede waar ek, vandat ek bewus geword het van die berugte gate, bekommerd was dat my geloof as 'n verskoning gedien het om nie van Swapo afskeid te neem nie, wat 'n sentrale plek in my lewe gehad het as 'n baken van hoop en optimisme. Die tyd het aangebreek om te erken dat ek myself net soveel geflous het as wat Swapo die mense verraai het," het Melber geskryf.

"As 'n saak van die herstel van persoonlike integriteit, is dit uiteindelik tyd vir my om weg te stap. Wees verseker dat my liefde vir en lojaliteit teenoor Namibië en haar mense wat teen alle verwagtinge veg vir 'n menswaardige en ordentlike lewe, ongeskonde sal bly. Julle kan op my staatmaak dat ek lojaal bly aan die gees van en toewyding aan solidariteit, vryheid en geregtigheid," het hy bygevoeg.



Die gerekende politieke ontleder, prof. Henning Melber. FOTO ARGIEF

Melber het grootgeword in Esslingen am Neckar en Leutkirch in Baden-Württemberg, Duitsland. Hy het in 1967 as tiener en die seun van Duitse immigrante na Namibië verhuis en sy skoolloopbaan in 1970 aan die Duitse Hoër Privaatskool in Windhoek voltooi.

Melber het in 1974 by die Swapo-bevrydingsbeweging aangesluit. Van 1975 tot 1989 is hy verban om Namibië binne te gaan en tot 1993 ook Suid-Afrika. Na Namibië se onafhanklikheid op 21 Maart 1990 het hy na die land teruggekeer. In 2000 het hy na Swede verhuis.

Melber se bedanking volg op president Nandi-Ndaitwah wat postuum nasionale heldestatus en 'n staatsbegrafnis aan die afgetrede luitenant-generaal Dumeni Solomon Hawala toegeken het.

Nandi-Ndaitwah het danksy die magte wat aan haar verleen word deur die Namibiese Grondwet en die wet op die toekenning van nasionale eerbewyse, die staatsbegrafnis vir Hawala aangekondig wat op 11 Augustus dood is. Die begrafnis vind op 6 September op Ongwediva in die Oshanastreek plaas.

"President Nandi-Ndaitwah erken luitenant-generaal (afgetree) Hawala vir sy voortreflike militêre diens, standvastige leierskap en onwrikbare toewyding tot Namibië se bevryding en nasiebou. Sy nalatenskap bly 'n simbool van moed, patriotisme en verbintenis tot die ideale van vryheid en onafhanklikheid," lui die aankondiging.

"Namens die regering en die mense van die Republiek van Namibië, betuig president Nandi-Ndaitwah opregte meegevoel aan die hele bedroefde familie, kamerade en vriende en wens hulle sterkte en vertroosting toe gedurende die tyd van rou."

Swapo se sekretaris-generaal, Sophia Shaningwa het teen druktyd nie op 'n versoek vir kommentaar gereageer nie.

Verlede week het NMH berig regeringsamptenare is verdeeld oor of 'n heldebegrafnis toegestaan moet word aan Solomon 'Jesus' Hawala wat wyd verbind word met beweerde menseregteskendings in Swapo se gevangeniskampe in Angola tydens die bevrydingstryd.

Hawala, wat die bynaam 'Slagter van Lubango' gekry het vir die beweerde gruweldade, word deur baie beskou as een van die sentrale figure in Namibië se oorlog vir onafhanklikheid.

Pauline Dempers, koördineerder van Breaking the Wall of Silence (BWS), het Sondag op die program The Agenda op Network Television (NTV) gesê sy beskou wyle Jesus Hawala nie in isolasie nie.

Volgens Dempers het hy "die bevele uitgevoer waarop Swapo besluit het" en dat die gruweldade wat gedurende die tydperk gepleeg is, gesien moet word in die konteks van breër partyriglyne.

"Ons kan dus nie na Jesus Hawala kyk as hierdie een man wat gekom het om Namibiërs te martel en dood te maak nie. Hierdie optrede was deel van besluite wat geneem is, moontlik deur die sentrale komitee of politburo van Swapo, wat spioene geteiken het.

"Ja, hy was wreed, maar hy het 'n taak uitgevoer," het Dempers gesê.

Sy het ook die vraag gestel indien Hawala onafhanklik opgetree het, waarom wyle stigterspresident Sam Nujoma as opperbevelhebber dan nie sulke misbruike kon stop nie. - republikein@republikein.com.na

NWR in 'operasionele verlamming'

VAN BL. 1

Volgens hulle het 'n onlangse brief van die minister van die omgewing en toerisme Indileni Daniel, aan die NWR-raad hul ergste vrese bevestig.

"Die einste leierskap wat bedoel is om ons maatskappy te lei, dryf dit aktief in die grond in, wat ons volgehoue lewensbestaan en die toekoms van ons gesinne direk bedreig."

PUBLIC PARTICIPATION NOTICE
ENVIRONMENTAL ASSESSMENT: LAND RECLAMATION AND EXPANSION OF THE PORT OF LÜDERITZ, ǁKARAS REGION

Geo Pollution Technologies (Pty) Ltd was appointed by the Namibian Ports Authority (Namport), to undertake an environmental assessment (EA) for a proposed Port of Lüderitz expansion project. The project will entail land reclamation, extension of the existing quay, and replacement of the old concrete jetty in order to create approximately 17 ha of additional port space with associated berthing areas. This will allow for the berthing of additional vessels and increased cargo storage space, and thus increase the much needed cargo handling capacity of the port, without the need for any onshore infrastructure construction. Additional and location information pertaining to the project and proposed operations can be obtained at:

http://www.thenamib.com/projects/projects.html

The environmental assessment is conducted according to the Environmental Management Act of 2007 and its regulations as published in 2012.

Interested and affected parties are invited to register with the environmental consultant to be provided with the opportunity to share comments, issues or concerns related to the project, for consideration in the EA. Registration, requests for additional information, and comments and concerns should be submitted to Geo Pollution Technologies by 01 September 2025.

André Faul / Pierre Botha
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In die minister se brief gedateer 14 Julie 2025 en gerig aan NWR se raadsvoorsitter ambassadeur Haroldt/Urib, het Daniel gesê sy het na 'n vergadering wat op 2 Julie 2025 gehou is, verdere besonderhede versoek rakende verskeie belangrike sake wat bespreek is.

"Ongelukkig het ek nog geen korrespondensie van u kantoor rakende die Sun Karros-ooreenkoms, About Africa-konsessie, Enercon-maatskappy se brandstofooreenkoms, Haliburg-groep en Alensy-ooreenkoms ontvang nie.

"Ek sal dit waardeer om 'n gedetailleerde beskrywing te ontvang van die vordering van gebeure en belangrike ontwikkelings met betrekking tot die bogenoemde maatskappye, wat tot die huidige stand van sake gelei het.

"Onmiddellik, aangesien genoeg tyd verloop het sedert ons vergadering waar ek versoek het dat hierdie inligting dadelik ingedien word," het Daniel in die brief versoek.

Sy noem ook dat dit meer as vier maande is sedert sy die amp as minister aanvaar het.

"In hierdie tydperk het ek geen formele verslae van die raad van direkteure ontvang rakende die bedrywighede, bestuur of finansiele gesondheid van Namibia Wildlife Resorts (NWR) nie. Ek moet my diep teleurstelling uitspreek oor die raad se prestasie en die oënskynlike versuim om sy fidusiêre en toesighoudende verantwoordelikhede uit te voer.

"Tot op hede is die jaarlikse begroting, oudit-verslae of 'n geïntegreerde strategiese sakeplan, fundamentele instrumente wat bedrywighede rig en aanspreeklikheid verseker in ooreenstemming met bestuurs- en regulatoriese raamwerke, nie aan my voorgelê nie.

Die afwesigheid van hierdie dokumente dui nie net op nie-nakoming nie, maar ook op 'n kommerwekkende gebrek aan finansiële en operasionele toesig."

Daniel sê voorts in haar brief dat die maatskappy se prestasie steeds afneem sonder enige sigbare ingryping of strategiese herleiding van die raad.

"Die voortgesette stilte rakende korrektiewe stappe vir uitvoerende onderprestasie, tesame met die kommerwekkende situasie van die maatskappysekretaris wat gelyktydig as besturende direkteur optree, het kommer oor leierskapsdoeltreffendheid en korporatiewe bestuur vererger.

"In die lig van bogenoemde versoek ek hiermee dringend die volgende van die direksie binne tien werksdae vanaf die datum van hierdie korrespondensie: die huidige jaarlikse begroting van die maatskappy, die jongste geouditeerde finansiële state, 'n omvattende geïntegreerde strategiese sakeplan, rekords van raadsbesluite wat maatskappyprestasie aanspreek, verduideliking van uitvoerende rolle en aanstellings en 'n uiteensetting van strategiese belyning tussen NWR se aktiwiteite en die Swapo Party se manifes en implementeringsplan.

Indileni Daniel
MINISTER

"Ek beskou die heersende traagheid asof dit NWR in 'n toestand van operasionele verlamming plaas."

"Ek beskou die heersende traagheid asof dit NWR in 'n toestand van operasionele verlamming plaas. 'n Behoorlike strategiese ommekeer is noodsaaklik, en dit begin met deursigtigheid en verantwoordbaarheid van die raad. Versuim om hierdie bekommernisse aan te spreek, sal verdere betrokkenheid op die hoogste vlak noodsaak om die doeltreffende funksionering van NWR in ooreenstemming met nasionale verwagtinge en beleidsriglyne te verseker," het Daniel gemaan.

Volgens die werknemers skets die minister se brief 'n skrikwekkende prentjie van growwe onbevoegdheid en openlike versuim deur die NWR-raad.

"Ons, die mense wat dag in en dag uit onvermoeid werk, sien die agteruitgang eerstehands. Nou weerspieël die minister se woorde ons angs: sy is diep teleurgesteld in die raad se prestasie en die oënskynlike mislukking om sy fidusiêre en toesighoudende verantwoordelikhede uit te voer. Dit gaan nie net oor korporatiewe bestuur nie; dit gaan oor ons werk, ons pensioene en ons vermoë om ons kinders te voed," het die groep geskryf.

"Ons moet die katastrofiese rol van die finansiële hoof in hierdie finansiële ineenstorting en die direkte impak daarvan op ons bedrywighede en gaste beklemtoon. Ons die personeel aan die voorpunt en oordbestuurders, ly geweldig om basiese voorrade te bekom om doeltreffende diens aan ons gaste te lewer. Bestellings vir aankope, noodsaaklik vir daaglikse bedrywighede, neem weke om deur die finansiële hoof goedgekeur te word. Hierdie blatante ondoeltreffendheid beteken dat ons nie eers basiese noodsaaklikhede vir ons gaste kan verkry nie," sê werknemers.

Hulle het gemaan die operasionele chaos wat direk verband hou met die finansiële hoof se bottelnekke wat veroorsaak word weens gebrek aan optrede, stel nie net NWR se reputasie in gevaar nie, maar "ook die veiligheid van almal op ons eiendomme".

NWR se waarnemende besturende direkteur Brian Masule het Donderdag by navraag vir kommentaar erken hy het die brief gesien. Volgens Masule is dit waarskynlik geskryf deur kritici wat die direksie wil verwyder. Hy het egter beklemtoon dat 'n amptelike reaksie eers uitgereik sal word sodra interne prosedures gevolg is. Masule het Vrydag nie gereageer toe hy vir verdere kommentaar gevra is nie.

Die omgewingsminister het deur haar persoonlike assistent beloof om op vrae te reageer, maar dit is teen druktyd nog nie ontvang nie. - republikein@republikein.com.na

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WEER

BINNELAND: Sonnig en warm in die ǂKharasstreek. Elders sonnig en warm, maar baie warm in die Noorde.

KUS: Gedeeltelik bewolk en matig tot warm met miskolle.

GETYE BY WALVISBAAI: H: 04:56 L: 10:25 H: 16:52

VOORUITSIGTE

WINDHOEK	11°	29°
RUNDU	15°	35°
OSHAKATI	10°	35°
GOBABIS	13°	33°
MARIENTAL	10°	32°
KEETMANSHOOP	12°	27°
WALVISBAAI	10°	17°
LUANDA	20°	25°
JOHANNESBURG	11°	27°
KAAPSTAD	11°	18°



CLOETE KATROL GROOTSTE VIS IN BY VISFEES

Swakopmund-inwoner Vernon Cloete het Saterdag die grootste vis tydens die jaarlikse Hentiesbaai Visfees ingekatrol. "Dit is die eerste keer dat ek 'n vis gevang en 'n prys daarmee gewen het. Dit was 'n groot gesukkel om hierdie een uit te kry, maar ek is baie trots op die vangs." Vernon het sy steenbras van 12,31 kg by Myl 30 gevang het. Volgens Simen Andersen, president van die Namibië Kushengelvereniging en gasheer van die kompetisie, het meer as 350 hengelaars deelgeneem en dit as 'n reusesukses beskryf. "Dis iets besonders wat Hentiesbaai vir die mense van Namibië bring." Beefcor-direkteur Jaco Swanepoel (links) het die wentjek ten bedrae van N$25 000 oorhandig. FOTO VERSKAF

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Renosterboer: Wettiging in horinghandel verg 'n spanpoging

VAN BL. 1

"Ongelukkig, wanneer private eienaars renosters van hul eiendomme verwyder, daal die totale hoeveelheid witrenosterhabitat in Namibië."

Namibië het sedert 2022 altesaam 124 witrenosters na Angola, Suid-Afrika, Zambië en Amerika uitgevoer. Muller se renosters is na Texas uitgevoer en hy het gister bevestig dit gaan baie goed met hulle.

Die Cites-beraad sal van 24 November tot 5 Desember in Oezbekistan plaasvind.

55 AANKLAGTE TEEN HUME

Hume (83), wat daarvan beskuldig word dat hy by 'n internasionale sindikaat betrokke was wat in renosterhoring handel dryf, hou vol hy is onskuldig. Hy het in 'n brief aan sy vriende en familie gesê hy werk sedert 2020 aktief saam met die Suid-Afrikaanse polisiedienS (SAPS) om met die ondersoek te help.

"Gedurende dié tydperk het ek aan elke versoek voldoen en openlik met wetstoepassing geskakel om met hul ondersoeke te help. Dat borgtog onbestrede was, spreek boekdele. Dit weerspieël die staat se vertroue in my bereidwilligheid om die proses met waardigheid te trotseer en ek glo dit beklemtoon hul erkenning van my integriteit en aanspreeklikheid," skryf Hume.

Hy het verlede week saam met vyf medebeskuldigdes, onder wie 'n familielid, sy voormalige prokureurs en sy plaasbestuurder in die landdroshof in Pretoria verskyn op 55 aanklagte wat verband hou met die onwettige handel in renosterhoring. Die aanklagte wissel van bedrog, geldwassery en diefstal, die oortreding van die Wet op Nasionale Omgewingsbestuur en Biodiversiteit 2004 tot rampokkery.

Intussen is nóg 'n renosterboer in Suid-Afrika, Derek Lewitton (55), wat sowat twee jaar gelede in Limpopo in 'n dramatiese klopjag gearresteer is omdat hy glo onwettig in die besit van renosterhorings was, vir eers 'n vry man. Al die aanklagte teen Lewitton, wat in Suid-Afrika gebore is en Amerika grootgeword het, is verlede week in die landdroshof in Namakgale buite Phalaborwa laat vaar.

Lewitton is die eienaar van die Black Rock Rhino-bewaringsoord op die Harmony-plaas buite Gravelotte. - francoise@nmh.com.na


Derek Lewitton is vir eers 'n vry man. FOTO FACEBOOK



John Hume (heel links) saam met sy medebeskuldigdes in die landdroshof in Pretoria. FOTO FACEBOOK

Hof las Chinese sakeman moet opdok

VAN BL. 1

Volgens hofdokumente is haar diens skielik beëindig. In plaas daarvan om met waardigheid te vertrek, het Li vir George opdrag gegee om haar uniform onmiddellik uit te trek. Om haarself te bedek, is sy óf 'n kartonboks óf 'n stuk materiaal oorhandig.

Die afdanking wat in die openbaar gebeur het, het George bloot gestel en verneder gelaat. Regsverteenwoordigers het aangevoer dat die manier van ontslag 'n skending van haar grondwetlike regte op waardigheid en beskerming teen wrede, onmenslike en vernederende behandeling was.

George, verteenwoordig deur regsverteenwoordiger Wilbard Kagola van HS Law, het 'n siviele eis teen Li ingestel en grondwetlike skadevergoeding geëis. Kagola het aangevoer dat die werkgewer se gedrag nie net emosionele en sielkundige skade veroorsaak het nie, maar ook 'n gevaarlike presedent geskep het indien dit nie nagekom word nie.


Itakeya Ruth George FOTO NBC

Regter Thomas Masuku het Vrydag uitspraak gelewer en in George se guns beslis.

"Li Bailong word gelas om N$230 000 weens grondwetlike skadevergoeding te betaal vir die skending van waardigheid en vir [George] aan wrede, onmenslike en vernederende behandeling onderwerp het," het die uitspraak gelui.

Die hof het verder beveel dat Li ook vir George se regskoste moet opdok. Li se teeneis van laster teen haar is van die hand gewys.

In 'n brief aan George ná die uitspraak, het HS Law beklemtoon dat die uitslag die fundamentele belangrikheid van waardigheid in indiensneming herbevestig het. "Die saak is 'n duidelike bevestiging van die grondwetlike beskerming teen vernederende behandeling in die werkplek," het Kagola gesê.

Site Notice



Geo Pollution Technologies

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15 August 2025

To: **The Executive Director**
Ministry of Education, Innovation, Youth, Sport, Arts & Culture
Private Bag 13186, Windhoek

Ministry of Education, Innovation, Youth, Sports, Arts and Culture
Office of the Accounting Officer / Executive Director
19 AUG 2025
RECEIVED

Dear Sir/Madam

Re: **Phase 1 Land Reclamation and Expansion of the Port of Lüderitz, ǁKaras Region**

Lüderitz, historically established as a harbour town, hosts the Port of Lüderitz (Figure 1-1), one of two ports in Namibia. For more than a century, the Port of Lüderitz has been central to the town's economic activities and sustaining of the local community's livelihoods. Recent developments in the oil and gas sector, as well as an increased demand for port services related to the export of bulk metal ores and overall increased port utilisation leading to congestion, have necessitated Namport to investigate options to increase port capacity in Lüderitz. Due to the existing port being locked in by the town, land-based expansion of the port is severely restricted, while water depth and shallow bedrock limits offshore development. Therefore, over the last couple of decades, various studies have been conducted to identify different scenarios for increasing port capacity. These included developing completely new port infrastructure at locations such as North East Point, Angra Point, Shearwater Bay and Dias Point. While the development of a new deep-water port at a location such as Angra Point remains under consideration, expanding the existing port at Robert Harbour turned out to be a necessary option for certain port activities to grow. The Robert Harbour expansion option was thus concluded to be a more feasible option in terms of logistics, financial viability, and time efficiency.

The Namibian Ports Authority (Namport) proposes two phases of expansion of the existing port infrastructure (Figure 1). Phase 1 will entail extending the main quay wall by 500 m and reclaiming of approximately 14 hectares of sea area below the high-water mark (i.e. the existing legal jurisdiction of the Port of Lüderitz) to serve as backup land for the extended quay. Phase 2 will see demolition of the obsolete concrete jetty in the southernmost part of the harbour (Menai Creek), and reclamation of approximately 3 ha of sea area. A new concrete jetty will then be constructed at the north-end of the reclaimed area. The extended quay walls, new jetty and additional backup land will allow for the berthing of additional vessels and increased backup cargo storage space, and thus increase the much needed cargo handling capacity of the port, without the need for any onshore infrastructure construction.

Geo Pollution Technologies (Pty) Ltd, an independent environmental consultant, was appointed by Namport to conduct an environmental assessment for the proposed Phase 1 expansion activity. The environmental assessment's purpose is to identify and address the potential impacts of the expansion on the environment, where the environment includes biophysical, social and economic impacts. The environmental assessment will be accompanied by an environmental management plan (EMP) and will ultimately, depending on the conclusion of the assessment, be submitted to the Ministry of Environment, Forestry and Tourism, to apply for an environmental clearance certificate (ECC). The environmental assessment is conducted in accordance with the Environmental Management Act of 2007 and its regulations as published in 2012.

Authorities, interested and affected parties or neighbours are invited to register with Geo Pollution Technologies to receive further documentation and communication regarding the project and the

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

COPY

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Ministry of Industries, Mines and Energy
Office of the Executive Director
19 AUG 2025
Received
Private Bag 13289
Windhoek
Official

15 August 2025

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Private Bag 13289, Windhoek

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Geo Pollution Technologies (Pty) Ltd, an independent environmental consultant, was appointed by Namport to conduct an environmental assessment for the proposed Phase 1 expansion activity. The environmental assessment's purpose is to identify and address the potential impacts of the expansion on the environment, where the environment includes biophysical, social and economic impacts. The environmental assessment will be accompanied by an environmental management plan (EMP) and will ultimately, depending on the conclusion of the assessment, be submitted to the Ministry of Environment, Forestry and Tourism, to apply for an environmental clearance certificate (ECC). The environmental assessment is conducted in accordance with the Environmental Management Act of 2007 and its regulations as published in 2012.

Authorities, interested and affected parties or neighbours are invited to register with Geo Pollution Technologies to receive further documentation and communication regarding the project and the environmental assessment. A public meeting to present and discuss the project will be conducted in Lüderitz. The details of the meeting will be communicated to registered parties.

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

COPY

Geo Pollution Technologies

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PO BOX 11073 ♦ WINDHOEK ♦ NAMIBIA
E-MAIL: gpt@thenamib.com

15 August 2025

To: **The Executive Director**
Ministry of Agriculture, Fisheries, Water & Land Reform
Private Bag 13184, Windhoek

Dear Sir/Madam

Re: **Phase 1 Land Reclamation and Expansion of the Port of Lüderitz, ǁKaras Region**

Lüderitz, historically established as a harbour town, hosts the Port of Lüderitz (Figure 1 1), one of two ports in Namibia. For more than a century, the Port of Lüderitz has been central to the town's economic activities and sustaining of the local community's livelihoods. Recent developments in the oil and gas sector, as well as an increased demand for port services related to the export of bulk metal ores and overall increased port utilisation leading to congestion, have necessitated Namport to investigate options to increase port capacity in Lüderitz. Due to the existing port being locked in by the town, land-based expansion of the port is severely restricted, while water depth and shallow bedrock limits offshore development. Therefore, over the last couple of decades, various studies have been conducted to identify different scenarios for increasing port capacity. These included developing completely new port infrastructure at locations such as North East Point, Angra Point, Shearwater Bay and Dias Point. While the development of a new deep-water port at a location such as Angra Point remains under consideration, expanding the existing port at Robert Harbour turned out to be a necessary option for certain port activities to grow. The Robert Harbour expansion option was thus concluded to be a more feasible option in terms of logistics, financial viability, and time efficiency.

The Namibian Ports Authority (Namport) proposes two phases of expansion of the existing port infrastructure (Figure 1). Phase 1 will entail extending the main quay wall by 500 m and reclaiming of approximately 14 hectares of sea area below the high-water mark (i.e. the existing legal jurisdiction of the Port of Lüderitz) to serve as backup land for the extended quay. Phase 2 will see demolition of the obsolete concrete jetty in the southernmost part of the harbour (Menai Creek), and reclamation of approximately 3 ha of sea area. A new concrete jetty will then be constructed at the north-end of the reclaimed area. The extended quay walls, new jetty and additional backup land will allow for the berthing of additional vessels and increased backup cargo storage space, and thus increase the much needed cargo handling capacity of the port, without the need for any onshore infrastructure construction.

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

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MINISTRY OF ENVIRONMENT, FORESTRY AND TOURISM
EXECUTIVE DIRECTOR'S OFFICE
19 AUG 2025
Tel: 061-284-2333
Fax: 061 22 9936
Private Bag 13306
WINDHOEK/ NAMIBIA

15 August 2025

To: **The Executive Director**
Ministry of Environment, Forestry and Tourism
Private Bag 13306, Windhoek

Dear Sir/Madam

Re: Phase 1 Land Reclamation and Expansion of the Port of Lüderitz, ǁKaras Region

Lüderitz, historically established as a harbour town, hosts the Port of Lüderitz (Figure 1 1), one of two ports in Namibia. For more than a century, the Port of Lüderitz has been central to the town's economic activities and sustaining of the local community's livelihoods. Recent developments in the oil and gas sector, as well as an increased demand for port services related to the export of bulk metal ores and overall increased port utilisation leading to congestion, have necessitated Namport to investigate options to increase port capacity in Lüderitz. Due to the existing port being locked in by the town, land-based expansion of the port is severely restricted, while water depth and shallow bedrock limits offshore development. Therefore, over the last couple of decades, various studies have been conducted to identify different scenarios for increasing port capacity. These included developing completely new port infrastructure at locations such as North East Point, Angra Point, Shearwater Bay and Dias Point. While the development of a new deep-water port at a location such as Angra Point remains under consideration, expanding the existing port at Robert Harbour turned out to be a necessary option for certain port activities to grow. The Robert Harbour expansion option was thus concluded to be a more feasible option in terms of logistics, financial viability, and time efficiency.

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

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RECEIVED
2025 -08- 19
MINISTRY OF HOME AFFAIRS, IMMIGRATION, SAFETY & SECURITY

15 August 2025

To: **The Executive Director**
Ministry of Home Affairs, Immigration, Safety & Security
Private Bag 13200, Windhoek

Dear Sir/Madam

Re: **Phase 1 Land Reclamation and Expansion of the Port of Lüderitz, ǁKaras Region**

Lüderitz, historically established as a harbour town, hosts the Port of Lüderitz (Figure 1 1), one of two ports in Namibia. For more than a century, the Port of Lüderitz has been central to the town's economic activities and sustaining of the local community's livelihoods. Recent developments in the oil and gas sector, as well as an increased demand for port services related to the export of bulk metal ores and overall increased port utilisation leading to congestion, have necessitated Namport to investigate options to increase port capacity in Lüderitz. Due to the existing port being locked in by the town, land-based expansion of the port is severely restricted, while water depth and shallow bedrock limits offshore development. Therefore, over the last couple of decades, various studies have been conducted to identify different scenarios for increasing port capacity. These included developing completely new port infrastructure at locations such as North East Point, Angra Point, Shearwater Bay and Dias Point. While the development of a new deep-water port at a location such as Angra Point remains under consideration, expanding the existing port at Robert Harbour turned out to be a necessary option for certain port activities to grow. The Robert Harbour expansion option was thus concluded to be a more feasible option in terms of logistics, financial viability, and time efficiency.

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MINISTRY OF WORKS AND TRANSPORT
19 AUG 2025
RECEIVED BY
TIME 09h07
EXECUTIVE DIRECTOR

15 August 2025

To: The Executive Director
Ministry of Works and Transport
Private Bag 13340, Windhoek

Dear Sir/Madam

Re: **Phase 1 Land Reclamation and Expansion of the Port of Lüderitz, ǁKaras Region**

Lüderitz, historically established as a harbour town, hosts the Port of Lüderitz (Figure 1 1), one of two ports in Namibia. For more than a century, the Port of Lüderitz has been central to the town's economic activities and sustaining of the local community's livelihoods. Recent developments in the oil and gas sector, as well as an increased demand for port services related to the export of bulk metal ores and overall increased port utilisation leading to congestion, have necessitated Namport to investigate options to increase port capacity in Lüderitz. Due to the existing port being locked in by the town, land-based expansion of the port is severely restricted, while water depth and shallow bedrock limits offshore development. Therefore, over the last couple of decades, various studies have been conducted to identify different scenarios for increasing port capacity. These included developing completely new port infrastructure at locations such as North East Point, Angra Point, Shearwater Bay and Dias Point. While the development of a new deep-water port at a location such as Angra Point remains under consideration, expanding the existing port at Robert Harbour turned out to be a necessary option for certain port activities to grow. The Robert Harbour expansion option was thus concluded to be a more feasible option in terms of logistics, financial viability, and time efficiency.

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NATIONAL PLANNING COMMISSION
OFFICE OF THE EXECUTIVE DIRECTOR
2025 -08- 19
RECEIVED

15 August 2025

To: **The Executive Director**
National Planning Commission
Private Bag 13356, Windhoek

Dear Sir/Madam

Re: Phase 1 Land Reclamation and Expansion of the Port of Lüderitz, ǁKaras Region

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

COPY

Invitations to Public Meetings

NAMIBIAN PORTS AUTHORITY

E-mail: elzevir@namport.com.na
Enquiries: Elzevir Gelderbloem
Fax: +264 64 2082373
Tel: +264 64 2082337

Head Office
Port of Walvis Bay
P.O. Box 361
Walvis Bay, Namibia

Port of Lüderitz
P.O. Box 836
Lüderitz, Namibia

Directors
Ms. N Hamunyela
(Chairperson)
Mr. J Mouton
(Deputy Chairperson)
Mr. I Tjombonde
Mr. A Kathindi
Ms. V Cloete
Mr. S Ndeunyema

Chief Executive Officer
Mr. A Kanime

Chief Legal Advisor & Company Secretary
Ms. EN Tomas

PER EMAIL

17 September 2025

TO: ALL INTERESTED AND AFFECTED PARTIES (IAPs)
ENVIRONMENTAL IMPACT ASSESSMENT STUDY
PROJECT: PORT OF LÜDERITZ ROBERT HARBOUR EXPANSION

Dear IAP

SUBJECT: INVITATION TO ATTEND THE "PUBLIC CONSULTATION PROCESS" FOR THE ENVIRONMENTAL IMPACT ASSESSMENT STUDY FOR THE PROJECT: PORT OF LUDERITZ ROBERT HARBOUR EXPANSION

I would herewith like to extend an invitation to you to attend this *Public Consultation Process* for the above-mentioned project environmental impact assessment (EIA) study.

In terms of the Environmental Management ACT 7 of 2007, including its regulations, you were identified as an IAP which, as per the ACT regulations, is defined as follows:

"Interested and affected party", in relation to the assessment of a listed activity includes:

a) any person, group of persons or organization interested in or affected by an activity; and
b) any organ of state that may have jurisdiction over any aspect of the activity;

"Public consultation process" means a process referred to in regulation 21, in which potential interested and affected parties are given an opportunity to comment on, or raise issues relevant to, specific matters.

Subsequent to the meetings we had with yourselves in the past that dealt with this subject matter, we have since made significant progress with the EIA studies. Our independent expert consultants have since completed the draft reports of the specialist studies that were conducted as part of the Environmental Impact Assessment (EIA) study process. These specialist studies were the noise, visual, aboveground and underwater heritage assessment studies.

These study reports will now be presented to the public and all Interested and Affected Parties (IAPs) in formal meetings that are scheduled for early October 2025 in Lüderitz. Our appointed consultants, Geo Pollution Technologies (Pty) Ltd, will

The Namibian Ports Authority was established by the Namibian Ports Authority Act, No. 2 of 1994, and is recognised as a public enterprise in terms of the Public Enterprises Governance Act, No. 1 of 2019.

The Standard Conditions of Service of Namport shall apply to all services rendered by it and is available at www.namport.com

NAMIBIAN PORTS AUTHORITY

share with you the details of the planned consultation sessions (refer to the attachments to this letter). Once the relevant experts have presented the findings of these specialist impact studies at the upcoming meetings, they will then open the window for written comments, questions and feedback from everyone.

All these reports, including the feedback and comments from IAPs, will then be used by the consultants to compile the final EIA and EMP reports which will then be submitted to the **Ministry of Environment and Tourism** as well as the **National Heritage Council**, for final consideration.

Finally, your presence and active participation at this session will be greatly valued and appreciated.

Please contact the undersigned should you have any questions or comments in this regard.

Yours Sincerely

Andrew Kanime
CHIEF EXECUTIVE OFFICER

Head Office
Port of Walvis Bay
P.O. Box 361
Walvis Bay, Namibia

Port of Lüderitz
P.O. Box 836
Lüderitz, Namibia

Directors
Ms. N Hamunyela (Chairperson)
Mr. J Mouton (Deputy Chairperson)
Mr. I Tjombonde
Mr. A Kathindi
Ms. V Cloete
Mr. S Ndeunyema

Chief Executive Officer
Mr. A Kanime

Chief Legal Advisor & Company Secretary
Ms. EN Tomas

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18 September 2025

To: Executive Director, Ministry of Education, Innovation, Youth, Sports, Arts & Culture
The Governor, ǁKharas Region
The Mayor, Lüderitz
ǁKharas Regional Council
Lüderitz Town Council
National Heritage Council of Namibia
Nama Traditional Leaders Association
!Aman Traditional Authority
Ovaherero Traditional Authority

Dear Sir/Madam

Meeting: Environmental Impact Assessment Study for the Proposed Port of Lüderitz Robert Harbour Expansion Project

Reference is made to our email with letters of notification for an environmental assessment sent in August 2025, with subject **Environmental Assessments - Lüderitz.** As part of the environmental assessment process, a series of three public meetings will be conducted in Lüderitz. The purpose and content of all three meetings are the same, they are however targeted at different audiences in order to facilitate fruitful discussions with relevant target groups.

You are thus cordially invited to the first of these meetings with meeting details as follows:

Date: 03 October 2025
Time: 09:00
Venue: Turnhalle, Corner of Ring and Klippen Roads, Lüderitz

The meeting will be a platform for Geo Pollution Technologies (Pty) Ltd to provide information regarding the project and the environmental process, as well as to obtain input from the meeting attendees.

Please confirm attendance by Friday 26 September 2025.

Please do not hesitate to contact us for any additional information or clarifications.

Sincerely



Dr. André Faul
Conservation Ecologist

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

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CELL.: (+264-81) 1220082
PO BOX 11073 ♦ WINDHOEK ♦ NAMIBIA
E-MAIL: gpt@thenamib.com

18 September 2025

To: Interested and Affected Parties

Dear Sir/Madam

Public Meeting: Environmental Impact Assessment Study for the Proposed Port of Lüderitz Robert Harbour Expansion Project

Reference is made to our email with letters of notification for an environmental assessment sent in August 2025, with subject **Environmental Assessments - Lüderitz.** As part of the environmental assessment process, a series of two public meetings will be conducted in Lüderitz. The purpose and content of the two meetings are the same. They are however scheduled as to allow the business community, employees, and persons that need to travel, to be able to attend.

You are thus cordially invited to one of the following two meetings with meeting details as follows:

Date: 03 October 2025
Time: 14:30
Venue: Turnhalle, Corner of Ring and Klippen Roads, Lüderitz

Or

Date: 04 October 2025
Time: 10:00
Venue: Turnhalle, Corner of Ring and Klippen Roads, Lüderitz

The meeting will be a platform for Geo Pollution Technologies (Pty) Ltd to provide information regarding the project and the environmental process, as well as to obtain input from the meeting attendees.

Please confirm attendance by Friday 26 September 2025.

Please do not hesitate to contact us for any additional information or clarifications.

Sincerely



Dr. André Faul
Conservation Ecologist

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

Appendix F Registered IAPs and Comments Received

Registered Interested and Affected Parties

Name	Organisation
Aina Petrus	
Alexey Zavitaev	Namport
Andrew Kanime	Namport
Anna Nekuta	Hyphen
Cecil Kamupingene	Namport
Christo Witbooi	Skorpion Zinc Mining Company (Pty) Ltd and Gergarub Exploration and Mining (Pty) Ltd
Christof Boois	!Aman Traditional Authority
Cyril Santoni	
Daniel T Frederick	//Kharas Region
Dr. Lima Maartens	LM Environmental Consulting
Dura A Mutota	Namibian Navy
Edward Heal	Kelp Blue Trading
Elwon de Koker	Dissability/Tourism
Elzevir Gelderbloem	Namport
Erbetina Konraad	!Aman Community
Erich Looser	Haus Sandrose
Erwin Mukumbi	AC Connections Trading
Fanuel Shinedima	TotalEnergies
Ferdie De Villiers	Novaship
Fredrika Nassauw	!Aman Traditional Authority
Gloudi de Beer	O&L Group
Helena Antonius	Lüderitz Town Council
Helmut Plietz	A Plietz Engineering Works
Hendrik Frederik	!Aman Traditional Authority
Isaac Musungo	Lüderitz Town Council
Isak Rooi	!Aman Traditional Authority
Jeremy Blood	SLR Consulting (Africa)
Jessica Kemper	Independent Environmental Scientist
JN Toivo	Lüderitz Town Council
Johannes Frederick	!Aman Traditional Authority
Johannes Ortmann	Nama Traditional Leaders Association
Johannes Swartz	!Aman Traditional Authority
Johannes T Swartz	!Aman Traditional Authority
Justine Louw	Lüderitz Town Council
Kaino Enkali	
L Mweshixwa	Namibian Navy
Lazarus Kairabeb	Nama Traditional Leaders Association
Leoné Wolhuter	Skorpion Zinc Mining Company (Pty) Ltd and Gergarub Exploration and Mining (Pty) Ltd
Lucius Murorua	Nama Tradiotional Leaders Association Representative
Lucy Bok	!Aman Traditional Authority
Manfred Anderson	Trans Hex
Melliny Kido	!Aman Traditional Authority

Name	Organisation
Michael Isaacs	Ministry of Industries, MInes and Energy
Miguel Calaca	Hangana Abalone
Mosiena Rooi	!Nami-nus Constituency Office
Otis Daniels	Namibia Media Holdings
Paul Herero	!Aman Community
Paul Marubella	Namport
Randell Beukes	Lüderitz Waterfront Development Company
Rassie Erasmus	Benguella Wealth Farming
Ria van Stade	Directorate Auxiliary Services
Richard Kennedy	Namport
Richie Mutendere	Hyphen
Robyn Christians	SLR Consulting (Africa)
Ruth Nujoma	TotalEnergies
Ruth Sheendelwako	Resident
Saggeus Shimuandi	Etemo
Sheldon Husselmann	Hyphen
Shimwe Ya France	MAVI Geotechnical & Environmental Services
T Peterson	
Theodor Muduva	GIZ
Thomas Shipepe	Samoht Nambuli
TP Kambonde	Lüderitz Town Council
Wenzel Corneliës	!Aman Traditional Authority
Winfried Henok	Namport
Yvan Jacobs	Directorate Auxiliary Services
Zeno Roland Mathias Pack	GIZ
Micheal Kahiriri	Ovaherero Traditional Authority
Mutjinde Katjiua	Ovaherero Traditional Authority
Ovaherero Traditional Authority	Ovaherero Traditional Authority

Minutes of Public Meeting: Lüderitz Port Expansion Project

Date: 03 October 2025
Time: 09:00
Venue: Turnhalle, Lüderitz

Attendance:

Name and Surname	Organisation
Pierre Botha	Geo Pollution Technologies
André Faul	Geo Pollution Technologies
Morné de Jager	Enviro Acoustic Research
Vanessa Maitland	Maritime Archaeologist
Justine Louw	Lüderitz Town Council
Elzevir Gelderbloem	Namport
Wenzel Corneliës	!Aman Traditional Authority
Lucy Bok	!Aman Traditional Authority
Hendrik Frederik	!Aman Traditional Authority
Fredrika Nassauw	!Aman Traditional Authority
Melliny Kido	!Aman Traditional Authority
Isak Rooi	!Aman Traditional Authority
Christof Boois	!Aman Traditional Authority
Johannes Frederick	!Aman Traditional Authority
Cecil Kamupingene	Namport
Alexey Zavitaev	Namport
Johannes T Swartz	!Aman Traditional Authority
Mosiena Rooi	!Nami-nus Constituency Office
JN Toivo	Lüderitz Town Council
TP Kambonde	Lüderitz Town Council
Winfried Henok	Namport
Isaac Musungo	Lüderitz Town Council
Lucius Murorua	Nama Tradiotional Leaders Association Representative
Paul Marubella	Namport
Richard Kennedy	Namport
Randell Beukes	Lüderitz Waterfront Development Company
Helena Antonius	Lüderitz Town Council
Andrew Kanime	Namport

Abbreviations

dB	Decibel
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
GPT	Geo Pollution Technologies
IAP	Interested and Affected Party
LTC	Lüderitz Town Council
MEFT	Ministry of Environment, Forestry and Tourism
NHC	National Heritage Council of Namibia
NTLA	Nama Traditional Leaders Association

Minutes

Dr. André Faul welcomed all parties at the meeting and provided brief introductions and gave an overview of the project and what an environmental impact assessment entails. He then presented the findings of the visual impact assessment and terrestrial archaeology assessment after which he handed over to Ms. Vanessa Maitland to present the findings of the maritime archaeological assessment. Mr. Morné de Jager presented the findings of the noise assessment after which the audience were provided with the opportunity to ask questions.

Mr. [unknown] asked about the timeframe related to a finding during the construction phase [chance find procedure when an archaeological artefact is unearthed]. Specifically how long it will take before work can restart so that it does not hinder development.

Dr. Faul mentioned he is not sure whether there is a specific timeframe coupled to it, but that it will depend on the type of object found. If it is not something particularly important work can probably restart quickly, but if it is for example a mass grave it will take much longer.

Ms. Maitland answered that you can often tell from a picture what an artefact is. So often it can be concluded very fast.

Mr. Botha mentioned that the chances of finding something is very slim as the work will be offshore and a diving exercise was conducted for the maritime assessment and no archaeologically important artefacts were detected.

Mr. Randell Beukes of the Lüderitz Waterfront Development Company expressed his interest in the noise study that was conducted and asked if wind plays a role in noise. The Lüderitz Waterfront Development Company plans a hotel on next to Robert Harbour. He wondered if the wind will increase the noise generated at the harbour at the hotel.

Mr. de Jager stated various factors that affect noise including wind, temperature (day time vs night time), humidity, fog, etc. He explained that when wind has a speed up to 3 m/s, sound waves travelling in the direction the wind is blowing, is refracted downwards and thus increases the noise by up to 5 dB. However, when the wind speed increase above 5 m/s, turbulence start affecting sound waves and this reduces the noise experienced downwind.

Mr. [unknown] asked how long it will be before submission of the report to the MEFT.

Dr. Faul answered that it will depend on the amount of input that will still be received from the public and stated that the reports must also be circulated to registered IAPs for review and commenting. Ideally it should be finalized by end of October/beginning of November.

Ms. Justine Louw of the LTC asked about the impact on the jetty which is under the management of the Lüderitz Waterfront Development Company. She stated it is part of the active tourism corridors in Lüderitz and asked what recommendations are there to mitigate the impact of demolishing the jetty for Phase 2.

Mr. Gelderbloem stated it is not the waterfront jetty that will be demolished. It is the old wooden jetty that is already falling apart that will be replaced.

Chief Johannes Frederick of the !Aman Traditional Authority stated that although they were at first not well informed about the project, they now, having received more information, support the project as the custodians of the area. The questions they had were answered accept one which is the issue of dust. He further said that the project must continue in order to create employment opportunities.

Dr. Faul explained that there are many more aspects than what were addressed in the meeting that will be in the assessment, including dust during construction and operations. He mentioned that dust is already addressed in Namport's operational EMP for the Port of Lüderitz. He further stated that those tenants that will have potential dust causing activities, must also have their own environmental assessments and management plans in which dust prevention must be included.

Chief Frederick also mentioned that in previous discussions between the NTLA and Namport, the issue of noise referred to the impact of noise on the skeletal remains of the ancestors buried at Shark Island rather than how noise will influence other receptors.

Mr. Pierre Botha indicated that the diving survey of Ms. Maitland indicated that no human remains were detected around Shark Island where the development will take place. Noise should thus not impact skeletal remains.

Chief Frederick confirmed that this is the answer that was seeked by the community [i.e. if there are human remains or not]. One of the !Aman Traditional Authority councilors noted that they were present during the diving searches to observe if anything were found and stated that indeed nothing was found.

Ms. Louw asked what the buffer zone [no development zone] around the island will be as referred to in Ms. Maitland findings.

Dr. Faul said that the recommended buffer is about 20 m. There will thus be about 20 m of water between the rocky shore and the port area. The design will ultimately be finalized based on input from the specialists.

Mr. Botha stated that the studies were based on a rough footprint of where the port will be and that final designs will only later be completed.

Ms. Maitland indicated that the underwater topography will also ultimately determine where the reclaimed area's western border will/can be.

Mr. Gelderbloem stated that they can at maximum implement a buffer of 20 m. More than this jeopardises the feasibility of the project as not enough backup land will be available to support port operations.

A question was asked if cruise ships will still be allowed to enter the port or will this be suspended until construction is complete.

Mr. Gelderbloem affirmed that current operations will not be stopped or impacted.

It was asked if the detailed design of the port is not finalized yet and if the LTC can for example still give input on the aesthetics of the new design.

Mr. Gelderbloem confirmed that this is indeed the case. The EIA and EMP will advise on for example the maximum height of the buildings and the proposed colours of the buildings.

A question was asked regarding the duration of the project and when the port expansion will be finalized.

Mr Gelderbloem mentioned that the project is already behind schedule, but the process will not be rushed. All approval processes must first be completed. If construction can commence in 2025 it can be finalized by 2027 to 2028.

Ms. Louw asked if those parties objecting to the development, and those that are pro the development, can meet and find common ground for the project to proceed.

Mr. Gelderbloem said that the current meetings are aimed at precisely that. The consultants [GPT] will finalise the reports with all comments received from IAPs and if they find that the comments are completely negative, than another round of meetings may be required. If the comments are positive, then the submission will be made to the MEFT and the NHC. Also, if the objections are material and holds water, the authorities will not easily approve the project.

Mr. Andrew Kanime, the chief executive officer of Namport, commented that if the studies indicate that there are no human remains under water, the submissions must be made. Consultation cannot go on indefinitely. The specialist studies were already commissioned based on the concerns of IAPs and were not part of the original scope. He reiterated that they will try to find a common ground. Ultimately, the MEFT and NHC will make the decision, but a balanced report must be submitted to them.

Mr. Beukes asked if the potable water supply to Lüderitz was assessed and if a water supply study was conducted.

Dr. Faul indicated that over last years he asked NamWater for their water supply and demand statistics as part of other projects he was involved with. To date there is enough surplus water to supply the project.

Mr. Botha indicated that the groundwater reserves can further be developed if need be, as NamWater only abstract from the edge of the groundwater scheme. He further stated that if more water is required, desalination can also be considered.

Mr. Beukes explained that he is more concerned if the daily demand can be met by the supply from the storage reservoir.

Mr. Gelderbloem indicated that should the water supply be insufficient, a small, portable desalination plant can be used. He also stated that during operations the water demand will not put pressure on the towns supply.

Mr. Lucius Murorua, representing the NTLA, acknowledged that there is overall positive feedback from the community and that they embrace the project. He further stated that he was asked by the NTLA to observe the proceedings of the meetings and he is happy that the custodians of the land [the !Aman] are present and that they have a positive sentiment towards the project. He also reiterated the importance of the LTC to provide input ion the aesthetics when the designs are finalised in order to preserve the memory of Shark Island. He said society has to move forward, but communities must not be alienated. He said he is happy, he has seen the positive sentiment towards the project with his own eyes. He mentioned the !Aman is the custodians of the land and as such they are also the "owners" of Namport which is a national asset. He further noted that all aspects of the project must be harmonized in order move forward in a unified manner.

With no further questions the meeting was adjourned.

Minutes of Public Meeting: Lüderitz Port Expansion Project

Date: 04 October 2025
Time: 14:30
Venue: Turnhalle, Lüderitz

Attendance:

Name and Surname	Organisation
Pierre Botha	Geo Pollution Technologies
André Faul	Geo Pollution Technologies
Morné de Jager	Enviro Acoustic Research
Vanessa Maitland	Maritime Archaeologist
Elzevir Gelderbloem	Namport
Wenzel Cornelius	!Aman Traditional Authority
Otis Daniels	Namibia Media Holdings
Yvan Jacobs	Directorate Auxiliary Services
Fanuel Shinedima	TotalEnergies
Zeno Pack	GIZ
Helmut Plietz	A. Plietz Engineering
Ed Heal	Kelp Blue
Dura A Mutota	Namibian Navy
L Mweshixwa	Namibian Navy
Theodor Muduva	GIZ
Ria van Stade	Directorate Auxiliary Services
Richie Mutendere	Hyphen
Erich Looser	Haus Sandrose
Aina Petrus	
Kaino Enkali	
Andrew Kanime	Namport

Abbreviations

ECC	Environmental Clearance Certificate
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
MEFT	Ministry of Environment, Forestry and Tourism
NHC	National Heritage Council of Namibia

Minutes

Dr. André Faul welcomed all parties at the meeting and provided brief introductions and gave an overview of the project and what an environmental impact assessment entails. He then presented the findings of the visual impact assessment and terrestrial archaeology assessment after which he handed over to Ms. Vanessa Maitland to present the findings of the maritime archaeological assessment. Mr. Morné de Jager presented the findings of the noise assessment after which the audience were provided with the opportunity to ask questions.

Mr. Erich Looser, as a resident in Bismarck Street, asked if any thought has been given to access to the port, as all trucks currently gain access to the port via the main road [Bismarck Street] of Lüderitz.

Dr. Faul mentioned that the transport issue [trucks in town on route to the Port] is an issue that has been looked at a lot in previous studies, especially with the EIA for the transport of manganese ore to the port. Various aspects have been considered and brainstormed to minimize or prevent impacts associated with transport. This included considering other ways of getting to the port, rather than taking Bismarck Street. He further noted that it is a difficult problem to address and an optimal solution could to date not be formalized and implemented. In the Pektranam EIA it was suggested that as long as Bismarck Street has to be used, mitigation measures to reduce noise and traffic impacts can include ensuring responsible driving, maybe removing speed bumps so that trucks don't have to slow down and accelerate, as this is causing more noise, as well as possibly having marshals at the intersections/four-way stops, who can stop oncoming traffic and give right of way to trucks which can come in convoy so that they don't have to stop. Again, a constant speed has less noise than stopping and going. It was also suggested by Pektranam to make use of different routes for going to and from the port to spread the impact in town.

Mr. Elzevir Gelderbloem mentioned that Namport together with the municipality have and are continuing to look at the transport issue. He mentioned there are various options, starting from a truck staging area outside of Lüderitz, and then coming in slowly but surely, to having two routes into town. Another extreme option will be to build a new road which will go around, on the right side of, Lüderitz, but this will cause other impacts and uproots numerous houses. A bridge into the port is also another extreme option. The extreme options are however far in the future. He mentioned that the port expansion will not double the traffic, it will also be a slow gradual increase in the traffic and together with the municipality, they will implement solutions. It will also be a mixture of solutions and not just one.

Mr. Looser asked how the trucks that will bring filling material in, be managed. He mentioned with the previous quay construction it was trucked in from inland.

Mr. Gelderbloem said that for the first quay it was brought in from a quarry behind Kolmanskop, but for the current project it will likely be sediment brought in from offshore dredge material. Using sand from the quarry is however not ruled out and if that option is used, it will have its own small EIA. It is however cheaper to get it from offshore with a dredger.

Dr. Faul noted it may be similar to the container terminal in Walvis Bay which was built with sediment dredged offshore.

Mr. Theodor Muduva noted that not everyone are experts on the technical aspects that was presented, but it shows that the consulting team have touched on all the relevant aspects. He mentioned that various options were presented and asked if the consultants are also recommending certain options or if they were just put on the table until a later stage. He asked if the various concerns from communities have so far been considered or if the consultant just follows their own professional standards as to know what needs to be considered or looked at. The last question he posed was if various environmental standards and regulations are considered, as he has not heard much about it.

Dr. Faul answered that some of the nine options that were shown are likely not viable, but others may in future be considered, should the need for port services grow sufficiently. If they do decide to go forward with any of them, they will require their own environmental assessments.

Mr. Gelderbloem mentioned that the current project just looks at the expansion of the existing port as there is currently no demand or money for building a new port. It may however realize in future if the demand exist.

Dr. Faul then mentioned that the communities are indeed engaged. Both the Nama and Herero communities were notified and invited to participate in the process. The Nama community, specifically the !Aman Traditional Authority, were present at the first meeting. Their concerns and expectations are thus considered.

Mr Gelderbloem mentioned that the specialist assessments which were conducted and presented in the meeting were specifically requested by the communities.

Dr. Faul stated that, due to time constraints, not all environmental legislation and regulations could be discussed. The environmental assessment report will however have a section dedicated to it, with a legal register pertaining to the most important and relevant legislation. Where legislation lacks in Namibia, international best practice or World Bank/World Health Organisation standards are usually recommended.

Mr. Looser said that dust was not mentioned, and said this is also an issue with trucks coming in through town. He also mentioned that one can see the dust accumulating on the buildings.

Dr. Faul mentioned that Namport provides the facilities for tenants, but ultimately the tenants, depending on their type of business, must have their own EIAs/EMPs to which they must adhere. The current tenants transporting mineral ores must have an EIA/EMP and ECC. The same with Pektranam, where the management plan specifically state that all loads must be covered. When trucks leave the storage facilities they must also drive over a rumbling grid to dislodge any stones from between the wheels, etc. He noted that the public is awarded the opportunity by the MEFT to lodge a non-compliance complaint with them, should tenants not adhere to their EMP. The MEFT should then investigate the problem and issue a non-compliance order with a timeframe for corrective action. Should they fail to meet it, their ECC can be withdrawn. He further mentioned that Namport does not have jurisdiction outside the port area and can only focus on what happens in the port. Should a tenant's operations for example cause dust when loading ships during windy conditions, they should either halt operations until conditions approve, or implement additional mitigation measures. If they do not, Namport can take action, as they are then not adhering to the port EMP.

Mr Gelderbloem confirmed that they can take action should a complaint be lodged to them and the MEFT.

Mr. Looser mentioned that he has seen dust buckets around the port and asked if anyone looks at them.

It was confirmed that the dust buckets is Rosh Pinah Zinc and Tradeport's. Mr Gelderbloem confirmed that the tenants handling mineral ore as cargo do have dust monitoring written into their management plans.

Mr. Botha stated that in Walvis Bay tenants are definitely fined when they cause excessive dust. He further noted that in the Pektranam EIA, it was determined at an early stage that the impact of acid rain, as a result of exhaust emissions, can damage the old buildings, some of which are monuments. They are thus considering switching to electric trucks for the last stage of ore transport from outside of Lüderitz to inside the port. They also consider special suspension on the trucks to reduce noise and vibrations.

Mr. Helmut Plietz asked when the port expansion project will start.

Dr. Faul mentioned that the EIA and EMP have to be finalized and approved by Namport before it can be sent to the public for review. After that it can be submitted to the MEFT and NHC. There it will take a few months to get approval or be rejected. A record of decision should thus be available in the early

months of next year and once approved it will go into the tendering process in order to still start construction in 2026.

Mr. Gelderbloem stressed that they will only start once all approvals are in place and hoped that it will still be in 2026.

With no further questions the meeting was adjourned.

Minutes of Public Meeting: Lüderitz Port Expansion Project

Date: 04 October 2025
Time: 10:00
Venue: Turnhalle, Lüderitz

Attendance:

Name and Surname	Organisation
Pierre Botha	Geo Pollution Technologies
André Faul	Geo Pollution Technologies
Morné de Jager	Enviro Acoustic Research
Vanessa Maitland	Maritime Archaeologist
Elzevir Gelderbloem	Namport
Wenzel Corneliës	!Aman Traditional Authority
Lucy Bok	!Aman Traditional Authority
Hendrik Frederik	!Aman Traditional Authority
Fredrika Nassauw	!Aman Traditional Authority
Melliny Kido	!Aman Traditional Authority
Isak Rooi	!Aman Traditional Authority
Christof Boois	!Aman Traditional Authority
Johannes Frederick	!Aman Traditional Authority
Johannes T Swartz	!Aman Traditional Authority
Paul Herero	!Aman Community
Erbetina Konraad	!Aman Community
Andrew Kanime	Namport
Yvan Jacobs	Directorate Auxiliary Services
Erwin Mukumbi	AC Connections Trading
Saggeus Shimuandi	Etemo
Michael Isaacs	Ministry of Industries, MInes and Energy
Ruth Sheendelwako	Resident
Thomas Shipepe	Samoht Nambuli

Abbreviations

EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
GPT	Geo Pollution Technologies
MEFT	Ministry of Environment, Forestry and Tourism
NHC	National Heritage Council of Namibia

Minutes

Dr. André Faul welcomed all parties at the meeting. He provided brief introductions and gave an overview of the project and what an environmental impact assessment entails. He then presented the findings of the visual impact assessment and terrestrial archaeology assessment after which he handed

over to Ms. Vanessa Maitland to present the findings of the maritime archaeological assessment. Mr Morné de Jager presented the findings of the noise assessment after which the audience were provided with the opportunity to ask questions.

Mr Paul Herero as a member of the !Aman community noted that this type of consultations and presentations [i.e. the public meeting] is an eye-opener. He mentioned projects should start this way with consultation first. He mentioned that the community hall maybe can serve as alternative venue so that the community can be better reached and so that they have a better understanding and reception of what is planned. He said the Nama people from the start sought clarity on the project. He asked if there are any further processes to address the concerns of the people and himself. The specialist studies conducted do give answers, but people also want to express their views. He mentioned the Nama people are peaceful people and the negative news [on social media] stating that the Nama People do not want development are false. He noted that the public meetings are useful to reach the rightful audience and said it can also be shared on social media. He further stated that the Turnhalle is perceived as a member based club which may deter people from attending at this venue. He then stated that ecological aspects related to the marine environment and shipping must be taken into account in the assessment and noted that he believes the community supports the project, but wants to be involved in the EIA process.

Mr. Botha mentioned that some baseline and specialist assessments are needed before the public consultation processed and meetings commence in order to have an understanding of the environment. While this was ongoing, GPT and Namport also learnt what the concerns of the people are and thus could commission more studies to address those concerns. He further stated that these type of meetings are usually in school halls, but they are currently occupied for examinations.

Dr. Faul stated that as a consultant they rely on the community to also provide input as to what and how they prefer to get information. He mentioned that they are always willing to accommodate requests as far as is practically possible. He then mentioned that these meetings are not the end of public consultation process. Anyone who needs more information or want further discussions are more than welcome to contact GPT. Furthermore GPT do not have strict deadlines for public consultation. It remains open until the day of submission and even after submission GPT will still provide comments that were received to MEFT.

Chief Frederick mentioned that in previous meetings and as part of the committee that was established, they [the committee] were supposed to establish a page [social media] where information can be shared. Any information received by the traditional authority would then be shared on this page and forwarded to them. Any questions can then also be relayed to GPT via the traditional authority. This is what will then in future be implemented.

It was reaffirmed that the !Aman is the custodians of the land where the port will be developed, but it does not mean the other tribes are excluded.

Mr. Herero stated that he agrees fully that the stories of the history of the Nama must be told and he commended Ms. Maitland for suggesting a scholarship to support such a study.

Thomas Shipepe mentioned that one worry is how the concerns of the community will be addressed and resolved and he stated it is good that Namport is also in attendance. He said they read about the concerns of the traditional authority, but are not sure how they will be dealt with and whether they are of such a nature that the project will be curtailed. If concerns are not addressed, this project will likely not continue.

Mr. Andrew Kanime mentioned that the current presentations on specialist studies are in response to the concerns of the communities. The environmental process followed the law requires that concerns are heard and addressed and a balance report be submitted to the MEFT and NHC. The environmental commissioner and NHC must be satisfied that the concerns are addressed and mitigation measures are sufficient. He suggested that in future the communication channels should be strengthened to make sure communities are reached and engaged. He mentioned if another meeting is requested, it can be considered.

Mr. Botha mentioned one of the problems with public consultation is that some parties who have an interest in a project do not register with the consultant. It is important for them to register otherwise the consultant will not be aware of them or their concerns.

A short discussion ensued regarding the various authorities who represent the communities and through whom target audiences can be reached. The availability of existing EIAs for other projects, which ties in with Namport's EIAs and EMPs, were also discussed.

Ms. Ruth Sheendelwako asked if similar consultations were conducted when Lüderitz harbour's first reclamation project took place and what the results thereof were and what the community concerns were at that stage.

Mr. Gelderbloem mentioned that the first project took place in 1996 which is long before the Environmental Management Act came into force. However, because an international loan was received for the project they needed to do an EIA. It had certain requirements such as trucks were not allowed to drive into port at night and they needed special shocks.

Ms. Ruth mentioned a petition that was handed to Namport a few weeks ago and mentioned that the concerns raised in the petition should also be addressed in the report.

Mr. Kanime said the petition will be considered and all formal submissions must be included in submissions to the MEFT.

Chief Frederick reiterated that the page which the Lüderitz community would have created must be created so that from the traditional authority's side they can share information. From the !Aman Traditional Authority's side they support the project, but since they stay in Bethanie, they need the page to engage with the Lüderitz community, who will be the ones most effected by the port.

It was noted that the Town Council is looking at a radio station which can also be used to share information and all community members are encourage to share all information on social media and with each other, as well as to register with the consultant.

With no further questions the meeting was adjourned.

Comments and Responses Table

E-Mail Correspondence Received

Note: E-mails received solely for the purpose of registration as an I&AP are not included in the comments and responses table. Comments are presented as received with no changes in typing or related errors. Contact details are redacted for privacy reasons.

Comments	Response
From: Dr J Kemper **Date: 19 August 2025**	
In particular, I am concerned about potential environmental impacts during the construction activities of both phases - especially if dredging and/or blasting is envisaged, and how associated noise (especially during blasting) could affect birds nesting on the two harbour islands (Penguin and Seal islands). Dredging harbour muds which probably contain elevated levels of heavy metals (and possibly of chemicals like anti-fouling agents etc), are likely to affect the mariculture ventures nearby, as well as the natural benthic biota associated with the shoreline and the two islands. This, in turn, could affect organisms that feed on these, including other invertebrates, but also higher trophic levels such as waders and oystercatchers. Other potential pollution sources, especially during construction activities, could include plastic/rubbish, oil, cement (and possibly others) that may affect both mariculture and the natural environment downstream. I assume that you will have a specialist assessing the risk that any pollutants that may be released during the construction/reclamation phases may pose, and also trust that there are practical mitigation measures that can be applied to minimise the risk to mariculture and to the natural environment, including the two harbour islands. I hope that there is already a long-term baseline study in place that monitors pollution levels in the existing port, including from manganese and lead loading activities that you could draw on, as well as any baseline studies on heavy metal accumulation in shellfish in the port area (compared to "control" areas outside the port area).	No blasting will be conducted for this project. Dredging will be conducted in line with the existing EIA and EMP for dredging in the Port of Lüderitz. This includes real-time monitoring for increased turbidity and pausing of dredging activities if suspension of sediments exceeds set limits. Long term baselines on water and sediment contamination levels are not available, but with previous dredging exercises, baselines were determined as presented in section 9.6. Dredging of these seabed sediments in the form of periodic maintenance dredging have been ongoing in this area of the port for as long as the port existed to date, on a 5 to 10 year cycle and has been occurring without any issues and in harmony with the existing mariculture industry.
From: Lazarus Kairabeb (Nama Traditional Leaders Association) **Date: 26 August 2025**	
Nama Traditional Leaders Association, herewith put to record that we are an interested party having historical ties with not only the park but Shark Island itself and all areas where mass graves are identified through archaeological site discovery. Please contact Mabos Ortman.	Noted
From: Manfred Anderson **Date: 01 September 2025**	
Thanks for your reply and prospective registration as an I&AP. I will study the in attached bids received and will soon file some input as I&AP. Looking forward to some positive intervention in these worthwhile projects.	Noted
From: Fritz A Katjiruru (Ovaherero Traditional Authority) **Date: 02 October 2025**	
Your email is well received and forwarded to the relevant office for a reply.	Noted

Comments	Response
From: Lenishwa Engelbrecht **Date: 02 October 2025**	
Thank you for your invitation to NHC to participate in the public consultation process for the Environmental Impact Assessment Study for the Port of Lüderitz / Robert Harbour Expansion, scheduled for 3 October in Lüderitz. Unfortunately, due to a high volume of pre-scheduled and prioritized commitments during this period, and with our limited capacity, NHC will not be able to attend the meeting. Please accept my sincere apologies for the delayed response. We remain interested in the project and its outcomes, and we would appreciate receiving any materials (minutes, reports, presentations) that emerge from the consultation process. Should there be another opportunity for engagement at a later date, please do not hesitate to invite us. Thank you for your understanding.	Noted
From: Daniel T Frederick (Manfred Anderson in Copy) **Date: 25 September 2025**	
I wish to register as an interested and affected member of the community in //Kharas Region. Kindly afford me the opportunity to be part of this meeting. Trust that you would not panelize me for late registration. I live in Keetmanshoop and would make the efforts to travel and attend.	Thank you for your mail and I will definitely register you for the project. You are also more than welcome at the meeting. Looking forward to seeing you there.
From: Manfred Anderson (Daniel T Frederick in Copy) **Date: 06 October 2025**	
Kindly let me know the date of the meeting and when submissions will be closing.	The meetings were unfortunately already finalized last week and over the weekend. You are however still welcome to send comments/questions. I would like to finalise the report by latest next week.
From: Daniel T Frederick (Manfred Anderson in Copy) **Date: 06 October 2025**	
This is very much unfortunate as I regarded the meeting as a platform for engagement on issues that are seriously overlooked and in our opinion excluding those who matter and also being denied to be heard. I definitely am definitely disappointed.	It was my impression from your original email, included in the below email trail, that you are aware of the meeting details and the misunderstanding is very unfortunate. I can however guarantee you that we are not excluding anyone or denying anyone to be heard. That is why I have specifically notified, among others, the !Aman TA, the NTLA and the OTA of the environmental assessment process and the meeting details. Once I have finalized the minutes of the meetings, I will circulate it to all registered interested and affected parties. You are then welcome to submit to me, any other aspects that you feel were not addressed, and I can promise you

Comments	Response
	that we will take it into consideration and engage with you further, should there be a need. All reports produced during the assessment process will also be shared for your review and comment. I trust that we can still engage in a fruitful manner to hear and address your comments and concerns.
From: Daniel T Frederick (Manfred Anderson in Copy) **Date: 07 October 2025**	
Thank you for your concideration and encouraging. I surely would be happy to receive the minutes. I will definitely have input or comments.	Noted

Hand Delivered Letter Received 03 October 2025

!AMAN TRADITIONAL AUTHORITY

P.O.BOX 135, Bethanie Namibia:

Tel: 264 63 283 059 / 081 630 6921

amanauthority@gmail.com

October 03, 2025

!Aman Traditional Authority
P.O. Box 135
Bethanie, Namibia
03rd October 2025

To: Dr. André Faul
Conservation Ecologist
Geo Pollution Technologies (Pty) Ltd

Subject: Input on the Environmental Impact Assessment Study for the Proposed Port of Lüderitz Robert Harbour Expansion Project

Dear Dr. Faul,

On behalf of the !Aman Traditional Authority, we wish to thank you for the invitation to participate in the Public Consultation Process for the Environmental Impact Assessment (EIA) study of the proposed Port of Lüderitz Robert Harbour Expansion Project. We acknowledge the importance of this process in ensuring that environmental, social, and cultural factors are thoroughly considered.

The !Aman Traditional Authority recognizes the potential benefits of the proposed project, including economic development and job creation. At the same time, we respectfully submit the following input for consideration:

Environmental Concerns:

Protection of **marine biodiversity and coastal ecosystems** during construction and operation.

Measures to mitigate **noise, dust, and water pollution**, which could affect surrounding communities and natural habitats.

Proper **waste management** strategies to prevent contamination of land and water.

Social and Community Considerations:

Potential impacts on **livelihoods of local communities**, particularly those involved in fishing and small-scale commerce.

Effects on **traffic, safety, and public infrastructure**, which may increase with expanded port operations.

Strategies to ensure that **local communities benefit equitably** from employment and economic opportunities created by the project.

Cultural and Heritage Preservation:

Safeguarding of **historical, archaeological, and underwater heritage sites**, ensuring that no culturally significant areas are adversely affected.

Consultation with Traditional Authorities and local communities regarding **sites of spiritual or cultural importance**.

Recommendations:

Implementation of robust **monitoring and mitigation plans** throughout the project lifecycle.

Active engagement with the !Aman Traditional Authority and local communities during both construction and operation phases.

Consideration of **project alternatives** that minimize environmental and cultural impacts while maximizing benefits for the local population.

We appreciate the opportunity to provide input and look forward to participating in the upcoming consultation meeting on 03 October 2025 at Turnhalle, Lüderitz.

Thank you for your consideration, and we trust that our concerns will be given due attention in the EIA process.

Yours sincerely,

Mr. Johannes Theofilus Swartz
For and on behalf of the !Aman Traditional Authority

!AMAN TRADITIONAL AUTHORITY
P.O. Box 135 BETHANIE
03 OCT 2025
TEL: 063-283059
REPUBLIC OF NAMIBIA

Additional Communication

THE APPROVAL PETITION FOR THE !AMAN TRADITIONAL AUTHORITY FOR THE EXPANSION OF THE ROBERT HARBOUR IN LÜDERITZ (!NAMI-#NUS)

We, the undersigned, respectfully petition NAMPORT for the expansion of the Robert Harbour in LÜDERITZ (!Nami-#Nus). In reference to the engagement held on 08–11 July 2025, the !Aman Traditional Authority witnessed the investigation session carried out on Shark Island. Based on this background, we held clan meetings in Bethanie and Aus where the clan shared the same sentiments with the affected communities and gave us the authorization to approve the expansion of the Robert Harbour in LÜDERITZ (Shark Island).

The !Aman Traditional Authority would like to sincerely apologize if this peaceful demonstration appears as though we do not consider the significance and importance of the foundation of this land and the blood that was shed on this ground.

We stand together with NTTLA and OTA in acknowledging that the matter of the genocide which took place on this ground is not one we take lightly. On the contrary, we honor and respect the sacrifices that were made. The fight for this land during the genocide was a fight for our freedom, our prosperity, and for us as descendants to have land on which we can build a great and prosperous legacy in their honor.

We envision a nation that will make those who died for this cause proud—that they did not die in vain, that all the brutal deaths and murders they endured were not meaningless, but instead gave us the opportunity to live meaningfully on land that honors them.

The !Aman clan, the leaders of our Traditional Authority, and the community at large stand together in writing this petition as direct descendants of those who came before us—those who fought the good fight. We wish to honor this fight by making this soil productive, by unlocking the wealth that is locked up in their bones. The young people and the current generations no longer want to keep these bones silent, but instead ensure that everything

2

we do honors their hardships and gives glory to God Almighty, who ensured that we were not entirely wiped out, and that those who remained have the privilege to be alive and to continue the rich work entrusted to them. We cannot allow the land to remain idle.

Theretofore, it is our mandate and responsibility as the affected descendants of the 1904–1908 Genocide to uplift the communities of LÜDERITZ, Aus, Bethanie, the ǁKharas Region, and Namibia at large. Furthermore, this expansion will create employment, study opportunities for both young and old, and increase the Gross Domestic Product of our economy, while also contributing positively to the international goals of sustainable development.

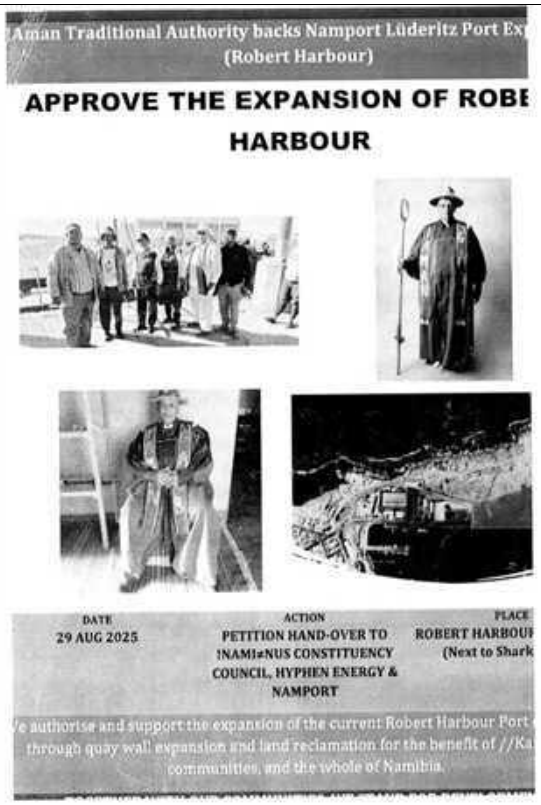
In conclusion, I wish to emphasize that the **!Aman Clan are the rightful custodians of this jurisdiction**, and as such, any development in this area must be carried out in full consultation with the **!Aman Traditional Authority**. Furthermore, I must underscore that the **NTLA** and **OTA** do **not** represent the !Aman Traditional Authority, nor do they speak on behalf of, or have the mandate of, the

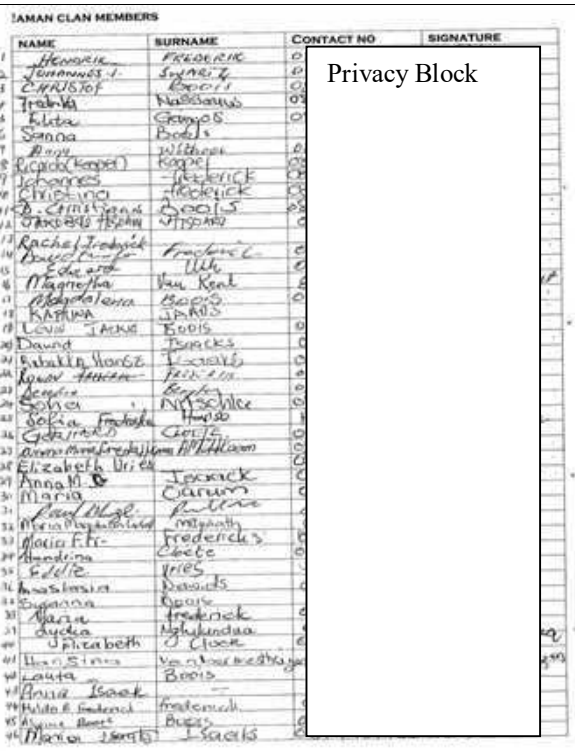
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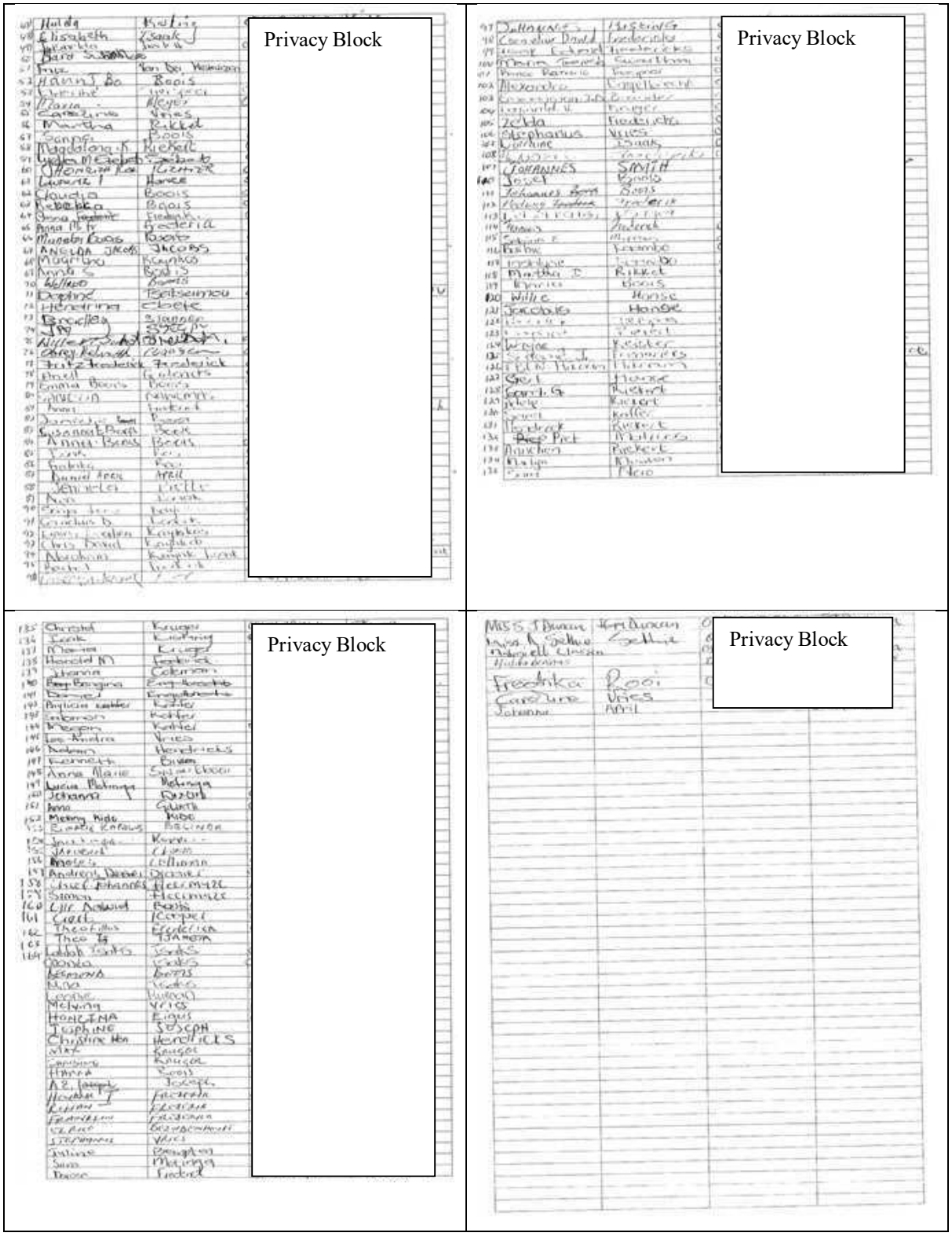
affected descendants of the genocide massacre.

As **descendants of the 1904–1908 Genocide**, our collective desire is that **no one should feel excluded from the Namibian House**. Recognition, inclusion, and justice must be extended to all, especially those whose histories carry deep scars and who continue to seek dignity and rightful representation.

I thank You






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From: Nama Traditional Leaders Association

Received via E-Mail: 26 January 2026

Comment	Response
ENVIRONMENTAL IMPACT ASSESSMENT (EIA) FOR THE PROPOSED PHASE 1 LAND RECLAMATION AND PORT EXPANSION AT LÜDERITZ - FORMAL OBJECTION BY THE NAMA TRADITIONAL LEADERS ASSOCIATION We write in response to the Environmental Impact Assessment (EIA) for the proposed Phase 1 land reclamation and port expansion in Lüderitz, and further to previous submissions made by the Nama Traditional Leaders Association (NTLA). This letter formally reiterates and substantiates, in greater detail, the NTLA's unequivocal position: the proposed port expansion must not proceed in the vicinity of Shark Island and its surrounding waters. Despite the scale, permanence, and extreme sensitivity of the proposed development, the EIA fails to engage with the project's most fundamental and non-mitigable impact: Shark Island and its surrounding waters as a site of genocide, mass burial, and enduring cultural, spiritual, and environmental heritage for the Nama people. The EIA treats Shark Island as a technical constraint rather than as a living landscape of ancestral harm, remembrance, and obligation. This failure constitutes a violation of the collective rights of the Nama people as Indigenous peoples, including their right to self-determination and their right to freely decide how sites of ceremonial, historical, and spiritual significance, particularly a former genocidal concentration camp are protected, managed, and commemorated.	The opening section of the letter is noted and is addressed as part of the comments provided for items 1 to 7 below.
1. Fundamental flaws in the underwater archaeological assessment The underwater archaeological assessment is conceptually, methodologically, and ethically deficient. Its central premise that the absence or non-confirmation of discrete, identifiable human remains would mitigate heritage concerns is fundamentally flawed. Historical, archival, and oral evidence is unequivocal: large numbers of Nama and Ovaherero people who perished at Shark Island were thrown into the sea or walked into the water in desperation to escape the conditions of the concentration camp. The surrounding waters are therefore not adjacent to heritage; they are themselves a burial site and mass grave. The EIA acknowledges high turbidity, strong currents, and severe seabed disturbance, yet paradoxically relies on these very conditions to justify a narrow and inconclusive archaeological survey.	The underwater archaeological assessment was conducted by a very competent and impartial, international maritime archaeology specialist. The statement "*Its* [the underwater archaeological assessment] *central premise that the absence or non-confirmation of discrete, identifiable human remains would mitigate heritage concerns is fundamentally flawed*," is a false conclusion drawn from the report. The report clearly state: *"Diver searches of magnetic anomalies and the Shark Island shoreline revealed no significant archaeological material, but poor visibility and silt cover may have obscured buried objects.* *It is unlikely that human remains will be found off Shark Island due to the high-energy marine environment, the presence of predators and scavengers, and the absence of rapid burial in anaerobic conditions.* ***Despite this, the rocky areas near the shoreline—particularly the bay adjacent to where prisoners were held—may contain buried***

Comment	Response
These conditions are not neutral environmental variables; they are precisely why it is irrelevant whether skeletal remains remain recoverable in an identifiable form. Over more than a century of turbulence, erosion, and industrial intervention, the bodies of genocide victims have become materially incorporated into the marine environment. Sediment, seabed, and water cannot be separated from human remains; they are materially and spiritually entangled. Any assessment framework that recognises "evidence" only in the form of recoverable remains fundamentally misunderstands genocide, burial practices, and heritage. Such logic would render many sites of mass death globally unprotectable. The waters surrounding Shark Island must therefore be recognised as a continuous heritage and memorial landscape, not as an empty or degraded zone available for industrial sacrifice. The archaeological assessment was, by the archaeologist's own admission, inconclusive due to the limitations of the technology deployed during the diving exercise, as confirmed in a meeting with the NTLA immediately thereafter. The assertion that no remains were found and that a 20-metre buffer zone therefore suffices constitutes a denial of historical fact and a profound disrespect to the victims. This is particularly egregious in light of the documented removal of ancestral remains by German authorities for racist experimentation in European institutions. Continued reference to a "lack of evidence" in this context amounts to a form of genocide denial.	***artefacts related to the colonial-era concentration camp or earlier human occupation.*** ***a marine buffer zone (Figure 68) is recommended around the northern end of the island. This would help preserve any artefacts embedded in sediment and protect the underwater extension of the concentration camp landscape.***" In response to the comment by NTLA, the maritime archaeology specialist edited the concluding summary of her report and issued a clarification note as presented at the end of this table. The statement is made that "[illegible]." No suggestion, recommendation or accepted standard is however provided on what the cut-off is for the area to be protected. The water and sediment at Shark Island today, will be further north on the Namibian coastline in a few days. Based on the premise that victims are materially incorporated into the marine environment (i.e. sediment, seabed, and water), no development should thus take place further north of Lüderitz, or in any area along the coast of Namibia and western Africa. The 20 m buffer is not denial, but is the actual recognition of historical fact. Denial would have been no buffer zone at all.
2. Existing land use, cumulative erasure, and disregard of prior research The EIA fails to engage meaningfully with extensive, publicly available research produced by Forensic Architecture and Forensis, undertaken in direct collaboration with the NTLA and the Ovaherero Traditional Authority and previously shared with Namport. This research establishes conclusively that Shark Island functioned as a spatially complex land-sea system of incarceration, forced labour, exposure, and killing; that its rock formations, shorelines, winds, and surrounding waters are carriers of forensic and historical evidence; and that the sea served as a primary site of body disposal and therefore as a mass grave. The limited engagement by Namport and the absence of engagement by its consultants with this body of evidence underscores the narrow and technocratic scope of the EIA. Rather than constituting a good-faith assessment of impacts, the EIA operates as a pro forma instrument aimed at rationalising an	The environmental assessment does not fail to "[illegible]," nor does it rely "*on the island's current* [illegible] or [illegible]." Section 9.8 of the EIA begins with "[illegible] and further states [illegible]." The terrestrial archaeology also states "[illegible]." The report by Forensic Architecture and Forensis was regarded and referenced 11 times in the terrestrial and marine archaeological assessments which form part of

Comment	Response
infrastructure project irrespective of the severity or irreversibility of its harms. The EIA further fails to acknowledge that Shark Island has already been subjected to extensive historical alteration through prior land reclamation and infrastructure development, including reclamation undertaken by Namport in the early 1990s. Research by Forensic Architecture and Forensis demonstrates that the present-day size, shape, and surface of Shark Island do not reflect its form during the period of the concentration camp. Significant portions of the island were terraformed, infilled, reshaped, and physically connected to the mainland, resulting in the destruction or burial of material traces of incarceration and killing. Notably, this research confirms that existing port infrastructure occupies land that once formed part of the concentration camp landscape, contradicting the EIA's implicit treatment of Shark Island as a bounded heritage site external to port operations. Against this backdrop, the EIA's reliance on the island's current footprint as a baseline for impact assessment is fundamentally flawed. By failing to recognise cumulative and irreversible harm already inflicted, the EIA reproduces a logic of erasure rather than mitigation and undermines its credibility as a good-faith heritage assessment.	the complete EIA. However, its focus is on the onshore environment and not offshore where the development takes place. The onshore environment is considered as stated above and the fact that a terrestrial archaeology assessment was commissioned is proof of that. The underwater archaeological study specifically reference Forensis and Forensic Architecture's report in a section titled "[illegible]" Both specialist reports extensively referenced "[illegible]". Given the consideration of the importance of Shark Island and its surrounds, among others, the following are recommended in the assessment: 1. That no construction or access to the onshore environment of Shark Island take place. 2. That a 20 m buffer, as recommended by the specialist maritime archaeologist, be maintained as indicated in Figure 11-1. 3. Namport, together with the various authorities (NHC, LTC, etc.) must work together to protect what remains of Shark Island as a heritage site and implement measures to recognise its past and inform the public and tourists likewise. The terrestrial archaeology assessment further recommended "[illegible]." This is however not incorporated into the EMP as this is not an action that can be taken by the Proponent, but is supported by the Proponent.
3. Sonic and visual impacts The EIA's treatment of noise impacts is inadequate and technocratic. Noise is assessed exclusively through decibel thresholds and residential disturbance, without recognition of sound as a cultural, spiritual, and heritage dimension. Shark Island is a place of mourning, prayer, and ceremonial practice, where Nama descendants gather, often before sunrise, to commune with their ancestors. The proposed expansion would introduce continuous industrial noise from dredging, pile-driving, vessel traffic, and port operations into a landscape that requires solemnity and quiet. These impacts are not mitigable. Historically, sound formed part of the regime of terror imposed at Shark Island. Superimposing industrial noise on this landscape constitutes further desecration. Visual impacts are equally significant. Continued development obstructs sightlines between Shark Island and Lüderitz town, integral to remembrance and historical reckoning. Oral histories record public	The noise assessment indicates that construction noise, which is temporary, will have a higher impact than operational noise. Both construction and operational noise (excessive) producing activities can be scheduled to daytime hours in order to respect "[illegible]". Visual impacts can also be reduced by implementing the measures proposed by the visual impact specialist. It is the consultants' believe that amicable compromise is possible. While the NTLA objects to any development near Shark Island, the !Aman Traditional Authority and many of the !Aman community and local Lüderitz population support the development (!Aman Petition and L and Appendix G), since the //Kharas Region and Lüderitz have high unemployment and poverty levels. The NTLA has made a number of objections against development. These objections are not disregarded, but nowhere does the NTLA indicate the members of the various traditional authorities that supports their views as an

Comment	Response
executions carried out in full view of the town, refuting claims of ignorance regarding the genocide. Nama rituals such as //Goa #Nobos, conducted at sunrise facing east, rely on unobstructed relationships between sea, horizon, wind, and sound. Industrial port infrastructure within this field constitutes a direct violation of Nama spiritual practices.	association. Neither has any input or communication been received from the OTA, who the NTLA and Forensis and Forensic Architecture include in their communication as having the same views as themselves.
4. Failure to recognise intangible, spiritual, and relational heritage The EIA's heritage framework is incompatible with Indigenous understandings of land, sea, and memory. Shark Island is a relational landscape constituted through visual, sonic, atmospheric, spiritual, and historical relationships extending well beyond its present footprint. The proposed 20-metre buffer zone is conceptually meaningless and fails to protect this continuity. The expansion would permanently sever these relationships and represent the culmination of decades of erasure.	In a previous letter received from Forensis and Forensic Architecture, certain demands were made. These are presented here with comments to the demands in brackets: "NTLA, OTA, FA and Forensis strongly object to the planned construction activity. We demand:" "1. An immediate and permanent moratorium on all construction whether on top of or in direct vicinity of Shark Island." **((The boundaries of direct vicinity is vague and clearly left open for own interpretation. Furthermore, no construction activities have occurred on or next to Shark Island, save for projects within the existing commercial harbour.)** "2. A holistic, non-invasive, archaeological study of the entire area of Shark Island and its vicinity, including the surrounding seabed, which constitutes a burial place for many victims of the genocide." **(These have been commissioned and are included in the environmental assessment. International experts with extensive experience in their respective fields have been used.)** "3. Preservation of Shark Island as a Heritage Site in the true meaning of the term, as well as related burial places." **(This is a recommendation of the environmental assessment.)** "The undersigned parties request that the following concrete demands be met:" "4. The development of an alternative plan for the Phase 2 expansion of the Lüderitz Port, as required under the Environmental Management Act and informed by the outcomes of the environmental impact assessment, to be shared with the above parties." **(Alternatives have been considered and are presented in section 7. Based on this alternative assessment, two options were designated as no-go alternatives due to their impact on Shark Island. Even the current location for development which is one of the alternatives in Figure 7-1, was changed to be completely offshore instead of the original onshore component, in order to limit impacts on Shark Island. The environmental assessment states: "*some options like Option 2 and 3 in Figure 7 1 are not considered feasible due to the impact it will have on Shark Island, a site of National Heritage Importance. Similarly, Option 1 as presented in Figure 7 1, is also no longer feasible due to the***

Comment	Response
	***proposed extent of onshore development encroaching on Shark Island.*)"** "5. NTLA and OTA to be included in all forthcoming consultation processes pertaining to this development, in line with international human rights law protecting the rights of indigenous and tribal peoples." **(The NTLA and OTA have been included in all public participation notifications since the commissioning of the project specific environmental assessment in early 2025. They have been allowed the opportunity to provide information, concerns and input and to attend a meeting specifically arranged to meet with them, the National Heritage Council, the Regional Council, the Town Council and Namport).** "6. The full and up to date report on the environmental and cultural impacts of the project be sent to the signed parties." **(The reports were shared on 17 December 2026 and review and commenting on the reports were allowed until 26 January 2026.)** "7. A representative of Namport to attend an event organised by NTLA and OTA in April 2024 in Lüderitz – details will be provided in an invitation to follow." **(Namport attended the meeting.)**
5. Absence of Free, Prior, and Informed Consent (FPIC) The Nama people have never given Free, Prior, and Informed Consent to this development, as required under the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) and the Namibian Constitution. Consultation occurred only after key project decisions had already been taken and cannot be characterised as consent. Treating the NTLA as merely an "interested and affected party" mischaracterises its status as an Indigenous rights-holding authority and as the representative body of descendants of genocide victims	The environmental assessment was conducted in terms of the Environmental Management Act of 2007 and its Regulations of 2012. The term "Interested and Affected Party" is the standard term defined and used in the Act and Regulations to refer to all consulted parties. Furthermore, the environmental impact assessment process is the tool used to engage with all interested and affected parties regarding a listed activity that requires assessment. The term interested and affected party does thus not undermine any party, whether it be an indigenous peoples or a minister in the public sector. We are not aware of any key decisions that have been taken or any approvals that have been obtained for the proposed development. Disclosure of information about risks and impacts, which is the role of the environmental assessment process, is required prior to, and in order to obtain, FPIC. The environmental assessment is thus a tool used to inform and engage with interested and affected parties, including indigenous people, and to assess a specific project, plan or programme. To do this assessment, you will then of course need some information regarding what is planned for the project. This does not mean these plans are final and approved.
6. The EIA failed to address the Socio-economic and Cultural rights The EIA is non-exhaustive in that it fails to address the undisclosed 2011 feasibility study and a previous rejection by the Heritage Council. It further neglects	The feasibility study is not an undisclosed study. It is unfortunate that the NTLA, save for a legal representative, did not attend the meeting specifically arranged to engage with the traditional, regional and local authorities in Lüderitz, regarding the proposed development. The feasibility study's alternatives were addressed at this meeting and in many previous

Comment	Response
to rationalise its findings in light of the structural designs proposed for the port expansion. Despite the evident adverse environmental impacts, the EIA fails to engage with the economic, social, and cultural rights of the communities represented by the NTLA. These rights are integral to human dignity and include, inter alia, compensation for surface rights and meaningful engagement regarding contractual benefits, set-asides, or alternative compensation mechanisms. Furthermore, the EIA is impermissibly divisive in that it fails to acknowledge, or actively suppresses, the NTLA's jurisdiction over ancestral land in the //Kharas Region, arising from customary law and long-established Indigenous governance systems. The uncompensated loss of these rights includes: 6.1 The //Kharas Region, including Shark Island and its subsoil; and 6.2 The territorial sea adjacent to the coast, including its seabed, subsoil, associated resources, and the airspace above its land and territorial sea.	studies. The alternative locations of the feasibility study are also incorporated into this report (Figure 7-1). Furthermore, no application by the Proponent was made with the Heritage Council for consent for the project. Their previous rejection was thus premature and of no-relevance. They have not received all documentation and studies to fairly evaluate the project and reach an objective conclusion. The EIA does not [redacted]. Compensation for surface rights and meaningful engagement regarding contractual benefits, set-asides, or alternative compensation mechanisms are mentioned. The area earmarked for development is within offshore waters that have been placed under jurisdiction of Namport for decades. The statement that compensation for surface rights and meaningful engagement regarding contractual benefits, set-asides, or alternative compensation mechanisms are required for this particular development (even for the "airspace above"), infers that for each and every development within the //Kharas Region, whether it be development of a shopping centre in Keetmanshoop, or a residential house in Lüderitz, compensation for surface rights and meaningful engagement regarding contractual benefits, set-asides, or alternative compensation mechanisms are required. At no point does the EIA fail to acknowledge Traditional Authorities. It does however not recognise the NTLA as having jurisdiction over ancestral land since the NTLA is an association and not the Traditional Authority. Furthermore, the !Aman Traditional Authority, is the custodian of the Lüderitz area. This has also been confirmed by the representative of the NTLA to the public meetings in Lüderitz. The !Aman have been engaged with and have attended the public meetings in Lüderitz.
7. Clear position and demand The NTLA reiterates its position that the proposed Lüderitz port expansion constitutes an existential threat to Shark Island as a site of genocide remembrance. The NTLA formally demands that Namport halt the proposed expansion and cease all related reclamation, dredging, and construction activities in and around Shark Island and its surrounding waters. Alternatively, the NTLA calls upon Namport to pursue accommodation and common ground through good-faith, substantive engagement on compensation for surface rights and related compensatory and reparative measures, including meaningful and enforceable contractual set-asides for communities under the auspices of the NTLA.	The [redacted] is noted and are addressed in the responses provided above. It is however again stated that the !Aman Traditional Authority, is the custodian of the Lüderitz area. This has also been confirmed by the representative of the NTLA to the public meetings in Lüderitz. To quote from the minutes of the meeting held on 03 October 2026 as accepted by the attendees of the meeting as being an accurate representation of the meeting: Mr. Lucius Murorua, representing the NTLA, acknowledged that there is **overall positive feedback** from the community and that they **embrace the project**. He further stated that he was asked by the NTLA to observe the proceedings of the meetings and he is **happy that the custodians of the land [the !Aman] are present and that they have a positive sentiment towards the project**. He also reiterated the importance of the LTC to provide input on the

Comment	Response
	aesthetics when the designs are finalised in order to preserve the memory of Shark Island. He said **society has to move forward, but communities must not be alienated**. He said he is happy, he **has seen the positive sentiment towards the project** with his own eyes. He mentioned the **!Aman is the custodians of the land and as such they are also the "owners" of Namport which is a national asset**. He further noted that all aspects of the project must be harmonized in order move forward in a unified manner. It furthermore seems as if compensation will resolve the problems posed by the NTLA. This in itself is a major concern and places a question mark on the real objectives of the NTLA objections.
Please find attached to this submission: Forensic Architecture Report Namport CEO Letter National Heritage Council Rejection Letter Failure to do so will compel the NTLA to pursue national and international legal, heritage, and human rights remedies.	Attachments included in Appendix G.

Clarification from Maritime Archaeologist



CONTRACT MARITIME ARCHAEOLOGIST

Vanessa Maitland

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Date: 03 February 2025

Re: Response to concerns regarding the Underwater Heritage Impact Assessment for the Namport Quay Extension

Thank you for the submission outlining concerns regarding the Underwater Heritage Impact Assessment (UHIA) undertaken for the proposed Namport Quay Extension at Shark Island, Lüderitz. The historical suffering and loss endured by Nama and Ovaherero people at Shark Island are well documented and are fully acknowledged as part of the broader Environmental Impact Assessment context.

The UHIA was commissioned as a specialist technical study in support of the EIA process, with the specific purpose of assessing the likelihood of encountering underwater cultural heritage resources within the defined development footprint. It was not intended, nor is it able, to determine historical truth, adjudicate questions of genocide, or assess moral or memorial significance. These matters are established through historical, archival, and oral sources and fall within the remit of heritage governance and policy, rather than archaeological method.

The assessment identifies the marine environment surrounding Shark Island as highly dynamic, characterised by strong currents, high turbidity, mobile sediments, and extensive biological activity. These conditions significantly reduce the probability that discrete, identifiable human remains would survive in a recoverable form over extended periods, particularly in the absence of rapid burial in anaerobic conditions. This conclusion is based on well-established principles of marine taphonomy and does not negate the historical reality of deaths that occurred at or near the site.

To avoid any potential misinterpretation, the Summary of the UHIA has been clarified to state explicitly that the absence of recoverable archaeological evidence must not be interpreted as evidence of absence or as an indication of lack of heritage significance. Non-recovery reflects environmental processes and methodological limitations inherent to underwater archaeology. Accordingly, the assessment identifies rocky nearshore areas and sheltered inlets as zones of higher archaeological potential and recommends precautionary management measures should any material of potential heritage significance be encountered during development activities.

The buffer zones and management measures proposed in the UHIA are practical heritage management tools, developed in accordance with current professional standards, to guide monitoring and response during construction. They are not intended to define the spatial or conceptual limits of historical memory, cultural significance, or memorial recognition. In the

event that archaeological material or human remains are encountered, work would cease and the appropriate heritage authorities would be notified in accordance with applicable legislation and established protocols.

The concern raised that the waters surrounding Shark Island form part of a broader memorial or burial landscape associated with the colonial-era concentration camp is recognised as serious and significant. However, the formal recognition and management of such landscapes extend beyond the scope of a Phase 1 Underwater Heritage Impact Assessment and fall within the mandate of the relevant heritage authorities and decision-making bodies. These matters are more appropriately addressed through heritage policy, stakeholder consultation, and the EIA decision-making process.

The UHIA was undertaken in good faith, in accordance with professional and ethical standards, and with due recognition of the sensitivity of the site. It does not deny historical events, nor does it seek to diminish their significance. Its role is technical and precautionary, and it should be read and applied within that context.

Yours sincerely,

Vanessa Maitland
Maritime Archaeologist
ASAPA No. 326

Appendix G Other Correspondence and Documentation

Additional Communication and Correspondence Received in Relation to the Port Expansion Project

Petition in Favour of Port Expansion: 06 November 2025

Ruth Sheendelwako

Petition Initiator – Lüderitz Residents Support the Port Expansion

Lüderitz,

Namibia

06 November 2025

To:

The Chief Executive Officer

Namibia Ports Authority Namport

Walvis Bay

Namibia

Cc:

Geo Pollution Technologies (EIA Consultants);

Ministry of Environment, Forestry and Tourism;

Office of the Governor – //Karas Region;

Office of the Chief –! Aman Traditional Authority (Bethanie);

Lüderitz Town Council

Subject: Submission of Petition – Lüderitz Residents Support the Port Expansion

Dear Sir,

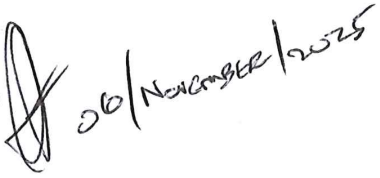
On behalf of the residents of Lüderitz, I hereby submit the attached petition and online signatures in support of Namport's proposed expansion of the Port of Lüderitz (Robert Harbor).

Our community supports this development, provided it remains guided by responsible environmental management, transparency, and continued inclusion of Lüderitz residents in the process. We commend Namport's commitment to a comprehensive Environmental Impact Assessment (EIA) as part of ensuring sustainable growth.

This petition signed online reflects the collective voice of Lüderitz residents and supporters who believe that progress and preservation can go hand in hand.

Thank you for your leadership and continued engagement with the community.

Yours sincerely,



Ruth Sheendelwako

Petition Initiator

On behalf of the Residents of Lüderitz and Supporters

Cell: +264812880582

kepawaruth@gmail.com

Petition **07 October 2025**

Luderitz , Namibia

Theme 'Lüderitz Residents Support Responsible Port Expansion and Environmental Preserving Our Heritage While Building Our Future'

To: The Chief Executive Officer

Namibia Ports Authority (Namport)

Cc: Geo Pollution Technologies (EIA Consultants); Ministry of Environment, Forestry and Tourism; Office of the Governor //Karas Region; Office of the Chief !Aman Traditional Authority (Bethanie) ; Lüderitz Town Council

Petition Statement

We, the undersigned residents of Lüderitz, wholeheartedly support the proposed expansion of the Port of Lüderitz (Robert Harbor). Our support is anchored in the understanding that the expansion of the port be guided by the current principles and guidelines that aim to preserve and protect, while advocating for economic progress.

Background

Lüderitz stands as one of Namibia's oldest and most historically significant coastal towns, a living testament to resilience, diversity, and the enduring relationship between people and sea. Our fishing industry, tourism, and new energy opportunities have made Lüderitz a focal point for Namibia's sustainable growth.

However, growth must always be guided by knowledge, participation, and environmental responsibility. That is why we commend Namport's decision to commission a comprehensive EIA before expanding the port ensuring that development aligns with our environmental obligations and community aspirations.

We the residents of Luderitz support the call by the Chief of the Aman Traditional Authority (Bethanie) who urged all Namibians to participate actively and lend their voices to this process. His call reinforces that this project is not for a few, but for the collective benefit of Namibia.

We therefore Recommend the following - Our Commitments and Requests

• We support Namport's EIA process — as a proactive measure to assess, prevent, and manage any potential environmental or social impacts associated with the port expansion.

• We affirm that Lüderitz's heritage is not being destroyed. Instead, the assessments ensure that our town's unique identity, its architecture, marine environment, cultural significance is preserved and integrated into future development.

• We call for continued transparency and inclusion of the Lüderitz residents, fisherfolk, youth, and business owners should continue to be informed and included in decision-making and progress updates.

• We request opportunities for skills development and employment for the Karas residents. As part of this project, Namport and partners should priorities local training, job creation, and procurement to empower Lüderitz residents and ensure long-term community benefits.

• We support collaboration between Namport, Geo Pollution Technologies, and the !Aman Traditional Authority. This partnership demonstrates respect for both traditional leadership and local governance, and ensures that the process benefits the wider Namibian community.

• While we remain committed to conducting the Environmental Impact Assessment (EIA) responsibly and sustainably, we express our support for the proposed port expansion. We believe this initiative is a necessary step forward and one that promises to stimulate economic growth, strengthen key sectors, and create much-needed employment opportunities for our communities. Progress and sustainability can go hand in hand, and we the Luderitz residents advocate for a future that balances both.

Our Vision

This petition reflects our collective belief that Lüderitz can be a national model for how development, environmental care, and heritage preservation can work hand in hand. The expansion of the Port of Lüderitz, represents a rare opportunity to modernize our economy without compromising the character of our beloved town.

Call to Action

We, the residents of Lüderitz and concerned Namibians, encourage everyone to sign this online petition to show their support for responsible development. Together, let us ensure that Lüderitz continues to thrive as a beacon of Namibia's maritime history, and as a forward-looking town ready to embrace a sustainable and inclusive future.

Signed by:

The Residents of Lüderitz and Supporters Nationwide

NameCityStatePostal CodeCountrySigned On
Ruth SheendelwakoRosh Pinah""Namibia2025-10-07
Tresia Menette ShikwamangaWindhoek""Namibia2025-10-07
Scharlotte KotzeWindhoek""Namibia2025-10-07
Venomusheko Mununga"""""Namibia2025-10-07
Manuel Kadhikwa"""""Namibia2025-10-07
Shipola Maria ShihepoOshikango""Namibia2025-10-07
Carol Van Wyk"""""Namibia2025-10-07
MARTIN PETRUS"""""Namibia2025-10-07
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Lee Garises"""""Namibia2025-10-07
Josephat Ashipala"""""Namibia2025-10-07
Zyndall JansenWalvis Bay/Luderitz""Namibia2025-10-07
Hellena Eelu"""""Namibia2025-10-07
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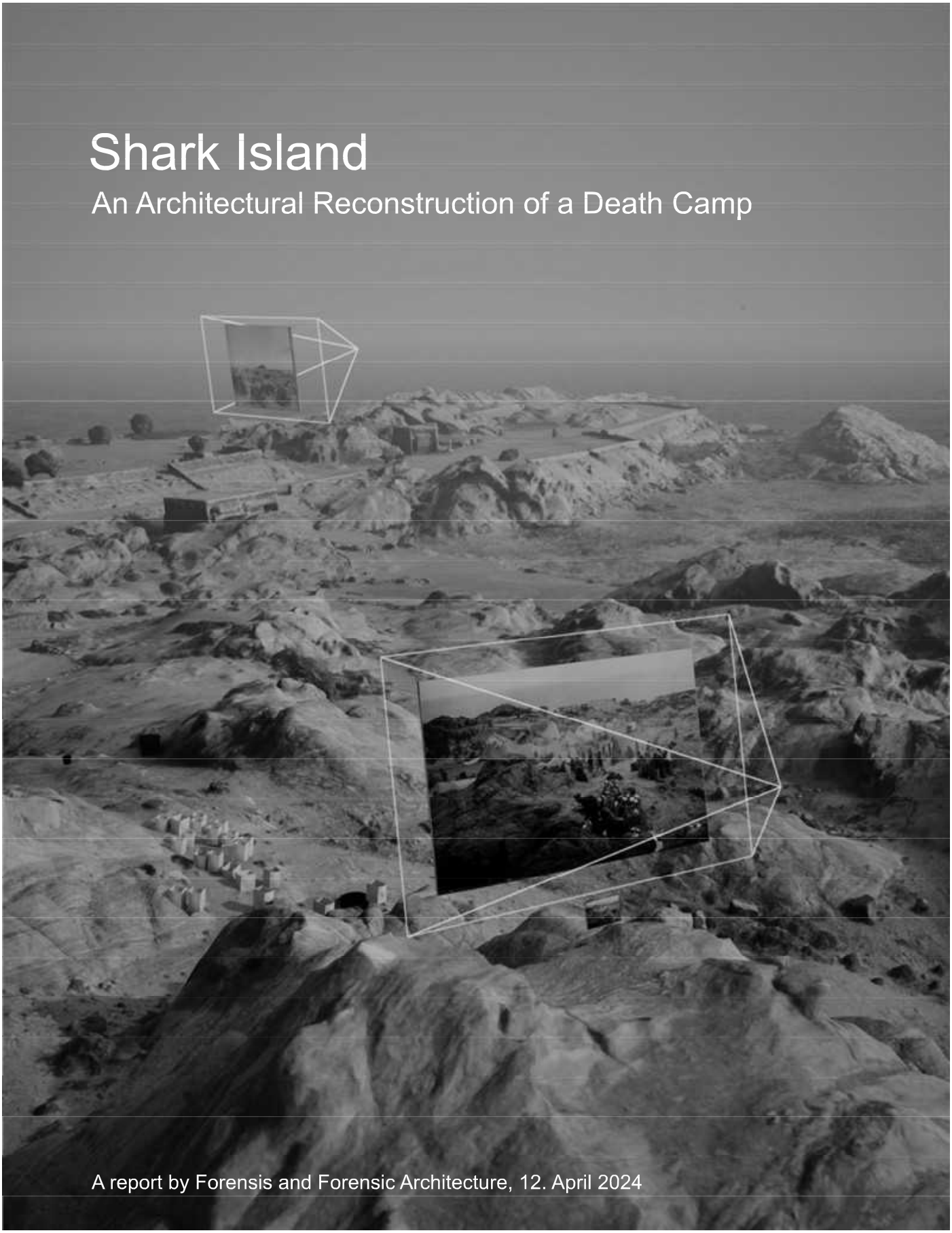
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Ansune Smith""""Namibia2025-10-14
Rozanne HanekomWindhoek""Namibia2025-10-14
Augustinus Kandimba UpiteOshikango""Namibia2025-10-15
Leonard Andreas""""Namibia2025-10-15
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Johanna Amukugo""""Namibia2025-10-22
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Maria MbudhiWindhoek""Namibia2025-10-22
John Ananias""""Namibia2025-10-22
Martie DurrantLydenburg""South Africa2025-10-22
Rashadi Amunjera""""Namibia2025-10-22
Ruth Swartbooi""""Namibia2025-10-22
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Rochelle Kruger""""Namibia2025-10-22
Hendrina Fortuin""""Namibia2025-10-22
Lea Apulile""""Namibia2025-10-23
Abed HaimbodiLüderitz""Namibia2025-10-23
Gerd KesslerWindhoek""Namibia2025-10-26
Hafeni Paulus""""Namibia2025-11-02
Enricho ErrolWindhoek""Namibia2025-11-05
La Vee""""Namibia2025-11-06

Forensis and Forensic Architecture Report


Shark Island
An Architectural Reconstruction of a Death Camp
A report by Forensis and Forensic Architecture, 12. April 2024

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1. Introduction

This introductory text is a lightly edited version of remarks made by Gaob Johannes Isaack, chairperson of the Nama Traditional Leaders Association (NTLA), on the occasion of the event "Inherited Testimonies — German Colonial Genocide in Namibia," [1] held at Haus der Kulturen der Welt in Berlin on the 3rd of December 2023.

The Nama Traditional Leaders Association is a body corporate comprising all recognized traditional Nama Chiefs [...]. Its objectives are to promote traditional practices, customs, history and cultural heritage of the Nama people in the Republic of Namibia and those in the diaspora.

In light of its objectives, the NTLA and the Ovaherero Traditional Authority has for a long time discussed how best the sanctity of Shark Island, which will form the greater body of what will be presented today, must be protected. Unfortunately, with the dawn of independence, the story of Shark Island disappeared from the official narrative. After 33 years of independence Shark Island continues to be a tourist destination where visitors may freely walk on sacred ground and wine and dine on the bones of the heroes and heroines who started the earliest resistance against colonial occupation in Namibia.

Shark Island is unique in the sense that it was not only a concentration camp. It was actually a Death Camp. It is also unique because it bears testimony to an unprecedented event [in Namibia], namely the large-scale murder and cruel death of a human group of people. Memorializing Shark Island will go a long way in satisfying the desire to honour those who died and as a means to examine the past and address contemporary issues. It can promote social recovery and healing. It must be a place of contemplation, a place of remembrance and a place which warns that such acts of genocide should never happen again.

The NTLA and OTA consider this a long-term project and therefore foresees that its implementation will be incremental. I want to repeat myself and emphasise the deep painful experiences of so many unsung heroes and heroines' whose blood waters this island, my message goes out to the young ones of the day, you are the leaders of tomorrow and we want to do the best we can to carry over the history which will start at Shark Island and we want to make sure that it is not contaminated by systems of knowledge embedded in the conventional sociology about the writings on slavery and colonialism.

One of the most profound consequences of the colonial experience has been how the socio-political, cultural and economic assault of the colonies, has led to what sometimes seems to be an unbridgeable cultural gap between the nationals that were beneficiaries of colonisation, and those that were the victims of colonial assault. The era of colonial pillage and plunder led to the relative stagnation and quick decline of traditional cultural pursuits in the colonies. Shark Island and many similar places in the rest of the country where German imperialists had their concentration camps, are places of extreme tragedies and unparalleled human suffering at the time, yet little is known of this history.

[1] Isaack, Gaob Johannes. Speech held at 'Inherited Testimonies', Haus der Kulturen der Welt, 3.12.2023. See: https://www.hkw.de/programme/events/inherited-testimonies

The efforts which will be reflected here, epitomises the inflection point from which revealing messages, regarding the experiences of those harsh conditions of my people, and that of the Ovaherero folk, will emerge. It is my hope that the research process upon which we embarked, will lead to a new historiography and decolonized knowledge production. It is also my hope that the latter should be less tainted by the post-colonial biases of the current scholarship on people of colour. I think this should also give due consideration to the socio-psychological factors derived from lived experiences and effects of colonialism on the social agency of my people. Such knowledge, in my view, is required to help address the present conditions of my people, which to a great extent are a product of colonial history. By "addressing", I mean healing the wounds and stigmas, and improving my people's conditions in every respect — including their psychological well-being, education, political voice and power, economic ability to satisfy material needs, and rights such as access to natural resources. This is of course believing, in the long run, that knowledge derived from this exercise may add significant value to the process of decolonization of this knowledge.

I want to submit that we put effort behind overcoming the epistemological biases of scientific disciplines dominated by universities, scholars, and bodies of knowledge anchored in the Global North. By this I mean, our heritage is supposed to provide clues to our past and how we have evolved. Such information should help us examine our history and traditions, and enable us to develop an awareness about ourselves and why we are the way we are. Knowing well that western civilization and culture has precariously contaminated the traditional values of our people, I want to maintain that our predecessors had established, well before the advent of colonialism, a pattern of home-grown political systems, governance processes and generally acceptable institutional rule-making arrangements, such that there was progression in the pace of civilization of our country and self-styled tempo of technological development. The 1858 Hoachanas Treaty for the different Nama groupings signifies one such convention.

It delights me to know that new networks are doing rounds in the community of social movement literature, working on ontological pluralism and post-colonial thought, highlighting the costly psychological impact of colonialism upon both the colonised and coloniser. These critiques clearly illuminate how colonial exploitation facilitated the wealth of European societies. They envision a future of global racial equality and redistributive socioeconomic systems; projecting a world beyond empire episteme – Du Bois, Fanon, and Cabral are among those thinkers, who believed in new postimperial forms and modes of self-actualization, in which racial and cultural differences would flourish rather than be denigrated, erased, and replaced by Europe's so-called civilization. It is common knowledge that postcolonial thought criticises the culture of empire, and we agree to the extent that it aims to introduce new orders to cultivate new knowledge and ways of representing the world and histories that circumvent or transcend, rather than authorise or sustain imperialistic ways of knowing. Production of new knowledge should take us beyond the current epistemic limits, and inculcate a sense of seeking transcendence, something beyond the colonial epistemes. It is only opportune that this event is hosted by the House of the Cultures of the World, which embodies critical thinking about how we create knowledge and narratives through different forms of expression.

2. Scope of Analysis

Forensis and Forensic Architecture (FA) have worked with the Nama Traditional Leaders Association (NTLA) and the Ovaherero Traditional Authority (OTA) and the Centre of Archaeology at Staffordshire University (CoA) to study sites related to the 1893 genocide of the Witbooi Nama, and different stages of the 1904-1908 genocide perpetrated against the Ovaherero and Nama by the German Colonial Army.

The NTLA and the OTA are traditional representative bodies of the Nama and Ovaherero people respectively, advocating for the preservation and celebration of the traditional customs, practices, history, and cultural legacy of their people both within Namibia and among the diaspora. The CoA is a renowned research facility specialised in novel techniques to the investigation of the recent and ancient past, in particular of the Holocaust and other genocides, and to missing persons investigations across the world.

As part of its overall research, FA and Forensis teams analysed available cartographic and photographic evidence, conducted fieldwork and solicited testimonies related to the concentration camp in Shark Island, Lüderitz, between 1905-1908 in order to:

- Locate and outline the extent of the concentration camp on Shark Island;
- Reconstruct the architecture of the concentration camp;
- Locate events or experiences recorded in the oral history transmitted by descendants of genocide victims;
- Determine whether extensions of existent port infrastructure in the bay[2] will infer on the former concentration camp area;
- Identify evidence of burial places in Lüderitz related to the genocide period, and assess the likelihood of those graves being those of the camp's inmates;
- Survey these burial places with a team of archaeologists using ground penetrating radar (GPR), to identify the potential presence of graves.

[2] See chapter 4.1. for a more comprehensive description of planned changes to the port adjacent to Shark Island.

3. Summary

This investigation is the first to employ a precise digital reconstruction of the Shark Island concentration camp. Using advanced spatial analysis we were able to trace relations between sources unconnected until now and meld oral histories with archival footage, allowing for the most accurate model of the death camp to date. In a second step, we traced the burial sites of camp inmates in different locations around Lüderitz.

The spatial model of the island revealed the function of several structures visible in archival photographs, including the execution chamber, a field hospital and guard posts. Additionally, the model visualises how the natural architecture of the rocks – shaped by wind and waves – determined the camp's modes of use and inhabitation.

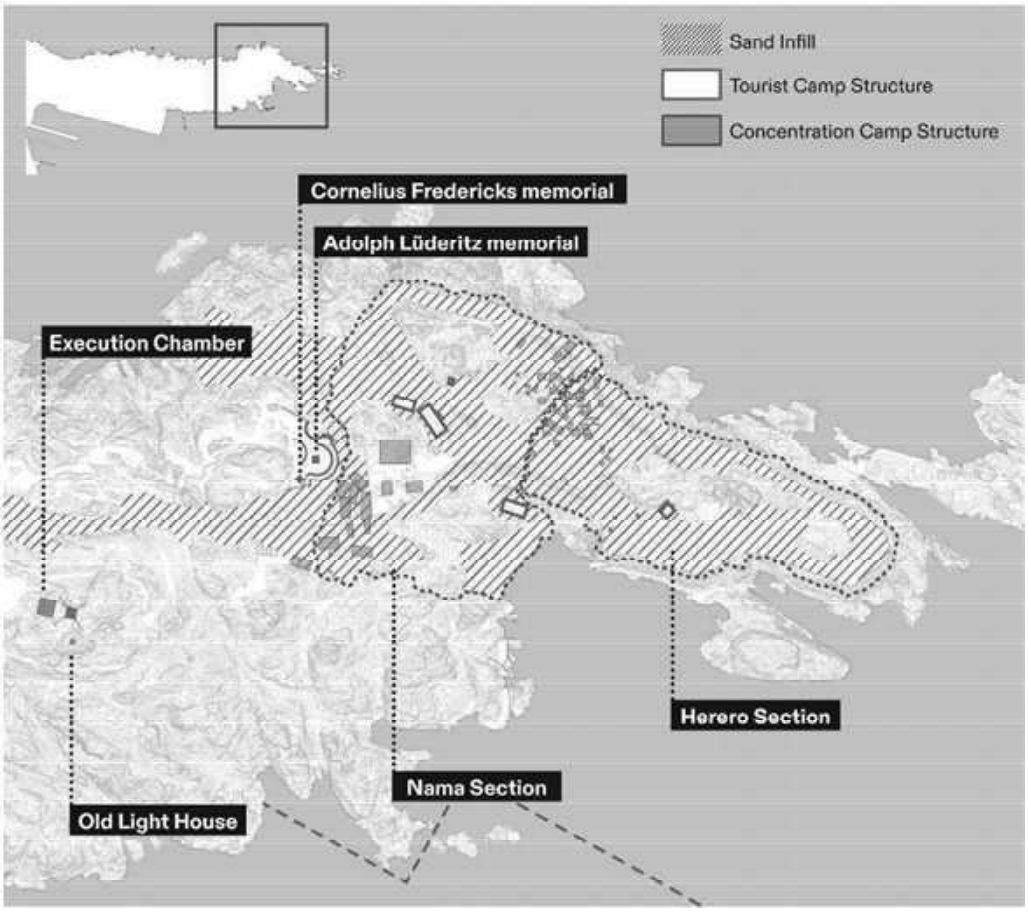


Figure 1. Map with structures and sections of the concentration camp on Shark Island as well as an overview of terraformation such as sand infill. FA/Forensis, 2024.

Our research allowed us to locate images of the concentration camp and thereby identify buildings marked on archival maps and mentioned in oral histories.



Figure 2. A photomatch of an archival image from Shark Island with our 3D reconstruction of the island, allowing us to place the execution chamber (here seen behind the red lighthouse) within the model and thus to determine its precise location. FA/Forensis, 2024.

The techniques employed were even able to identify markings in rocks stemming from forced labour that are depicted in archival photos and still traceable in the contemporary geography of Shark Island.

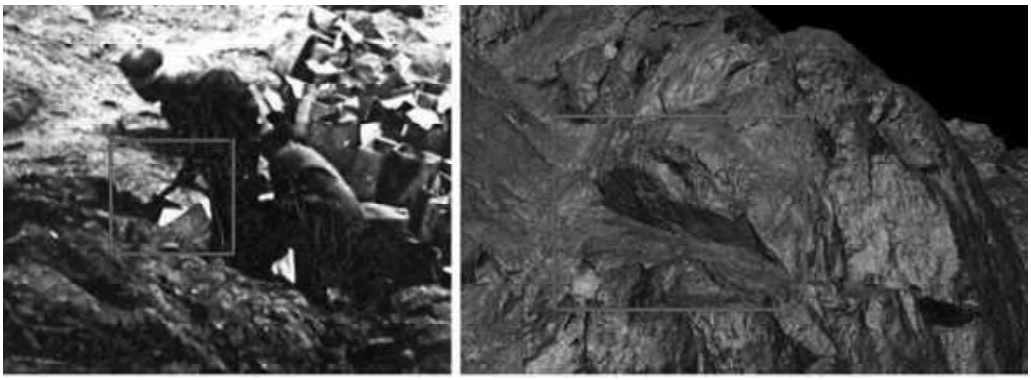


Figure 3. An inmate holding an axe in the archival photograph (Left). A human-made incision is visible today on the same rock the person with the axe was standing on (Right). FA/Forensis, 2024.

As a result of this research, our investigation arrived at the following findings:

I. Present-day infrastructure, including tourist facilities, monuments of German perpetrators, roads, residential development and port infrastructure have been built over the former concentration camp, compromising it as a place of historical significance.
II. The proposed extension of Lüderitz port in Robert Harbour poses further imminent risk to the site. Not only will the development affect Shark Island, but the dredging of nearby waters for the proposed port expansion will very likely disturb the remains of many who died on Shark Island, and whose bodies were thrown into the water.
III. Around Lüderitz, unmarked graves exist that are very likely the interments of deceased inmates of Shark Island. Within at least one of these burial locations, several internments are likely to be mass graves. Infrastructure designed to connect the port to the surrounding desert runs the risk of destroying these unmarked burial sites.

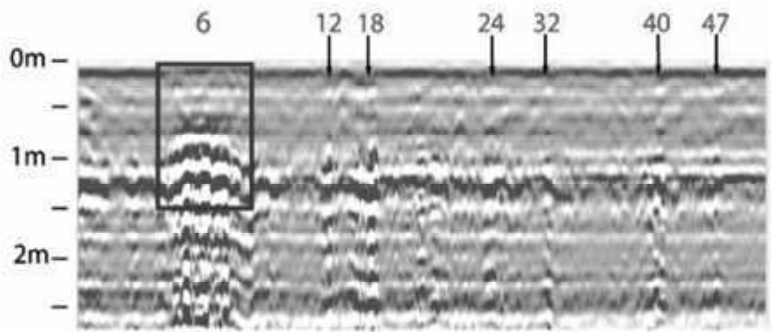


Figure 4. Data from the ground penetrating radar collected in Radford Bay outside Lüderitz. Feature 6 indicates a mass grave; the other features indicate individual graves. Centre of Archaeology at Staffordshire University and FA/Forensis, 2024.

4. Background

4.1. Historical and political context

Shark Island – today a peninsula – is located in the harbour of the Namibian town Lüderitz in the Karas region of Southern Namibia. The Shark Island concentration camp existed between March 1905 and April 1907 on the northern tip of the island. Set up by the German Schutztruppe, it served as a labour and extermination camp for Herero and Nama inmates captured during the German genocide of these communities.

Formerly known as Angra Pequena, Lüderitz was named so after the German merchant Adolf Lüderitz, who bought land from Nama Captain Joseph Frederiks II in 1883. This was the first land sale in what would later become Lüderitzland. !Nami#Nûs is the name of this ancestral Nama land in Khoekhoe Nama language.

After the 1904 and 1905 extermination orders, issued by the German imperial army against Ovaherero and Nama, concentration camps were established across German South West

Africa. Shark Island was initially opened as a camp primarily for the Ovaherero inmates whose forced labour was exploited to build critical infrastructure for the colony, including the Lüderitz-Aus railway. The Nama inmates arrived later in 1906.

Shark Island became the most notorious concentration camp in the colony due to its extremely harsh environment weaponized against its inmates. Freezing temperatures and a lack of shelter from tough winds and fog exacerbated the already dire and unsanitary living conditions and scarce food rations leading to outbreaks of typhoid and scurvy.

It is estimated that between 1,000-3,000 people perished in the Shark Island concentration camp,[3] most of them through hyperthermia and diseases as well as exhaustion due to excruciating physical labour building railroad tracks and the harbour, or as servants for White settlers. Uniquely brutal intimidation strategies in the camp included rape and various forms of torture, poisoning, medical experiments, and public executions. Captive women were forced to boil and scrape the heads of dead inmates which were then shipped off to Germany for pseudo-scientific research purposes.

Among the inmates that perished on Shark Island was resistance fighter and leader of the Nama !Aman people Cornelius Fredericks, who was decapitated on the island on 16 February 1907 and his skull sent to Germany.

When the camp was closed in April 1907, inmates were transferred to a so-called 'Burenkamp' in Radford Bay.

Even today, not all of the burial sites of the victims are known. According to oral history, the inmates who died on the island were thrown into the sea to be eaten by sharks or buried in shallow graves along the beach becoming food for hyenas. However, inmates who were executed with poison were buried in unknown locations off the island. Historical accounts refer to several locations of mass graves around the town.

During the concentration camp's operation and after its closure, Shark Island was terraformed, thus, the rock structure reshaped. At a later stage, the island was connected with the mainland to become a peninsula. Buildings, including luxury residences, were built on its south western side. Today, the north part of the peninsula where the camp was located serves as a tourist campsite. Sand has been filled into the gaps between the rocks to level the surface for tents and vans. Sanitary facilities were added. Almost no traces of the concentration camp structures are left today.

Soon, a foreseen extension of the port in Lüderitz will further impose changes upon the site. A large-scale hydrogen production project with related desalination and ammonia plants are planned around Lüderitz harbour. The small existing port operated by the state-owned enterprise Namport is planned to be expanded along the eastern side of Shark Island, invading the area of the former concentration camp. This development will also block the

[3] Erichsen, Casper and Olusoga, David (2010). *The Kaiser's Holocaust: Germany's Forgotten Genocide and the Colonial Roots of Nazism*. Faber & Faber; Zimmerer, Jürgen; Zeller, Joachim (2003). *Völkermord in Deutsch-Südwestafrika: Der Kolonialkrieg 1904–1908*. Berlin: Links.

view of the island from the city, robbing the city of the historical visual link to the island and robbing visitors of an understanding of how such atrocities were committed in full view of the town's citizenry. Roads and infrastructure will traverse the plain around Radford Bay, one of the areas we have investigated for likely mass and individual graves of Shark Island inmates, leading to a large zone with solar panels and wind turbines in the desert of the Sperrgebiet National Park. The project is supposed to be realised through investments amounting to 10 billion US dollars, the equivalent of the Namibian GDP, and is carried out by the Hyphen joint venture, under the responsibility of the German Enertrag company.[4]

4.2. The site

The site has a complex rock morphology shaped by water and strong wind. The western side of the island – the one facing the open Atlantic ocean – bears the brunt of the waves, and is typified with steep and bare rock faces. The centre part of the island is typified by distinct, protruding rock formations with smooth faces sculpted by the westerly wind which blows strong mainly in the afternoons and evenings. The relation between the rock, the water and the wind defines the 'architecture of the island.' Areas closer to the eastern edge of the island are relatively protected, the water calmer, and the coast line even has a number of bays and small beaches. This structure of the rock defines the modes of the site's use and inhabitation. The built structures made to accommodate the inmates were largely flimsy tent structures and huts that offered little privacy and protection against the harsh environmental conditions of the island. Individual rocks divided the island into zones – separate Nama and Herero zones as well as zones where inmates were forced to work, as well as an administration and command and control zone where the guards were located. The rock formation also offered a natural stage set to those looking at the ocean from Lüderitz. This is why public executions were undertaken on the eastern side of the island facing the city.



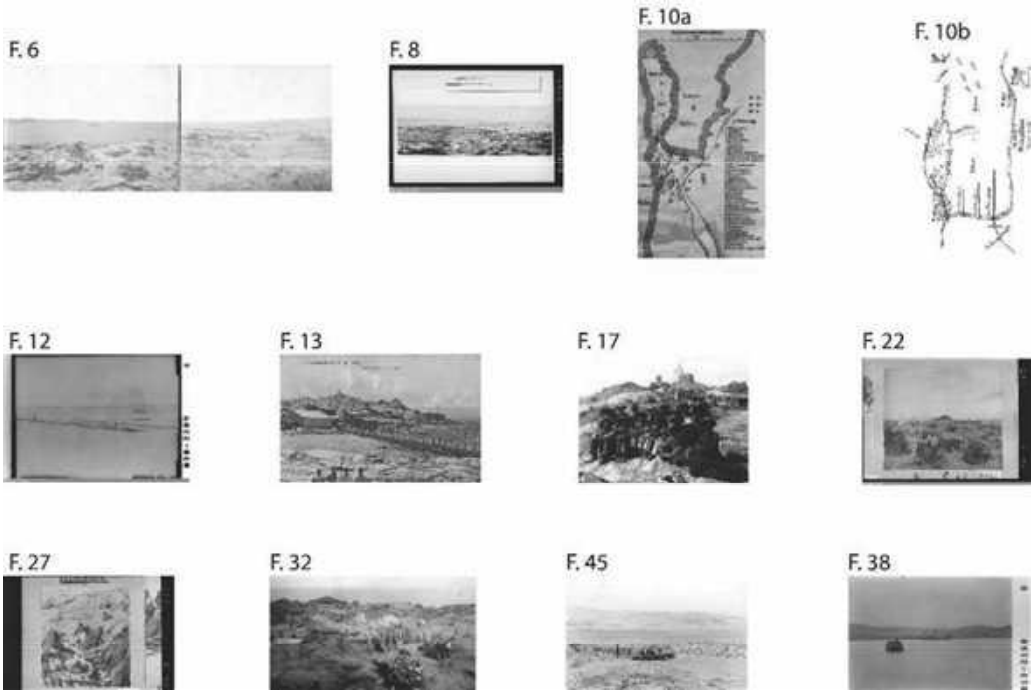
Figure 5. Drone photograph of Shark Island seen from North-East. FA/Forensis 2024.

[4] Enertrag SE is a Germany-based renewable energy company specialising in solar and wind power as well as gas. They operate plants globally, from Uruguay to Ghana. Some of their projects have been critiqued for a lack of transparency and public participation processes.

5. Materials Used in Analysis

5.1. List of archival photographs and maps

Figure 6, 7. Namibia Scientific Society, 1904.
Figure 8. Koloniales Bildarchiv Universität Frankfurt, n.d.
Figure 10a. National Archive Namibia, 1905.
Figure 10b. Archive of the Rhenish Mission Society, 1910.
Figure 12. Koloniales Bildarchiv Universität Frankfurt, 1907.
Figure 13. Verlag Swakopmunder Buchhandlung, 1905.
Figure 17. Erichsen, Angel of Death, 2005, p.124
Figure 22. Koloniales Bildarchiv Universität Frankfurt, n.d.
Figure 27. Koloniales Bildarchiv Universität Frankfurt, 1905.
Figure 32. National Archive Namibia, 1906.
Figure 45. National Archive Namibia, 1906.
Figure 38. Koloniales Bildarchiv Universität Frankfurt, 1907.



4.2. List of aerial and satellite imagery

Figure 11a. Surveyor General Office Namibia, 1965
Figure 11b. Surveyor General Office Namibia, 1984.
Figure 11c. Google Satellite, 2023.

5.2. Contextualisation of material

The analysis was based upon a variety of material types gathered from public and private sources in Namibia and Germany. Among these are archival photographs, maps and documents covering the period from the 1850s to the present. These are derived from a number of archives, including: the Namibian National Archives, the Colonial Image Archive of Frankfurt University, the Rhenish Mission Archive Wuppertal, Deutsche Kolonialschule Archive Kassel, the Übersee-Museum Bremerhaven and the German Federal Archive.

There are few photos from Shark Island concentration camp itself since the Schutztruppe was closely guarding the premises and did not allow for extensive documentation. While the camp was visible from the city, its rock topography shielded some parts of the camp hidden from view. There was very restricted access for guests from the outside. Some of the photos were taken by a German officer, Lieutenant von Düring, likely dating to the fall of 1905. We established this date since the camp, which opened in 1905, was seen to be in operation and General Lothar von Trotha, who left German South-West Africa in early November that year, is visible in some of the photos from the series — possibly just before his departure from the colony. While Düring was a member of the military, these photos seem to have been meant for private use. Yet they enforce the same dehumanising gaze that permeates the military occupation overall. In addition to photos of mainly women and children dying in the camp, Düring also took a pornographic image of a young naked Herero woman on Shark Island.[5] Like the other photos, it is a testament to the horrors, humiliation and total control faced by the inmates. Other photos of the island come from private collections or from commercial publishers that disseminated them as postcards.

Current and historic maps, satellite and aerial images were sourced from Google Earth, Google Maps and the Namibian Surveyor General. Ground-level photographs and drone shots were taken by the researchers during their site visit in Namibia.

6. Methodology

Forensic Architecture and Forensis employed the following methodologies to establish the exact locations of these photos and create a granular cartography of the Shark Island concentration camp.

6.1. Cartographic regression and aerial/satellite image analysis

Cartographic regression refers to the process of using historic surveys, maps and aerial photographs overlaid on contemporary imagery in order to track changes in the territory and landscape over time. Cartographic regression is increasingly being used in archaeological surveys as a means to evaluate the probable locations of cultural resources.

[5] Gewald, J. B. (2003). The Herero genocide: German unity, settlers, soldiers, and ideas. In K. -A. R. Bechhaus-Gerst M. (Ed.), Die (koloniale) Begegnung: AfrikanerInnen in Deutschland (1880-1945), Deutsche in Afrika (1880-1918) (pp. 109-127). Frankfurt am Main: Peter Lang, p. 125.

We geo-referenced all aerial images and maps using a Geographic Information System (GIS) software. This allowed us to cross-reference satellite images with aerial photographs of Lüderitz over the years in order to ascertain information regarding changes to the terrain.

Since the events studied happened decades before the advent of aerial surveys, the investigation relies on archival cartographic material from the period. While those maps are often inaccurate according to modern standards, they contain valuable information of the extent of the mapped areas and landmarks of interest at the time.

6.2. Fieldwork and site documentation

In September 2023, FA, Forensis and the CoA travelled to Namibia to undertake field research in Lüderitz. This was to inform our understanding of the contexts in which the investigation is carried out. To this end, we visited the known and suspected sites of several camps and graves, specifically Shark Island, Radford Bay and the former 'Burenkamp.'

6.3. Situated testimony

Working with Nama and Ovaherero community members and oral historians, we employed a technique we refer to as 'situated testimony'. This involves testimony delivered while a witness experiences an immersive 3D model. The model can be built using CAD software or based on the re-configuration of a navigable game engine. The witness furnishes the bare model with elements such as structures or people as far as their memory allows them.

In relation to a genocide perpetrated almost 120 years ago, the testimonies are based on oral traditions, though also in this case witnesses were able to offer more precise descriptions of events when "located" within a 3D environment. During our field research in September 2023, we recorded testimonies from oral historians, descendants of genocide victims and leaders from traditional authorities. They spoke on the conditions in the camps, the architectural and natural constitutions of the camps and surrounding areas, as well as burial rites and the grave sites.

6.4. Geolocation

Geolocation is the practice of establishing exactly where a photo was captured. An image can be geolocated by studying its content, by comparing it to others, or by looking at clues outside of the image, such as who shared it, or where it was found. We located the images we included in this research on multiple GIS platforms based on satellite images.

During our field research, we further employed ground truthing to connect the results from our technical analysis of the graves and concentration camps to the conditions on the ground.

6.5. Photogrammetry

Photogrammetry is the art, science, and technology of obtaining reliable information about physical objects and the environment through processes of recording, measuring, and

interpreting photographic images and patterns. During our field research in Lüderitz, we conducted a drone survey of Shark Island forming the basis of the 3D model outlined below.

6.6. Photomatching

Photomatching is the process of matching found still images or video to the corresponding 3D world, and thus measurement space. This step followed our photogrammetry process, as outlined above. We matched several archival photos to the current geology of the island.

6.7. 3D reconstruction

In our analysis, digital models are more than mere 3D representations of real-world locations — we use 3D models as analytic or operative devices. Models help us to understand the location of images, camera positions or events in relation to one another. They also allow us to conduct new analyses based on spatial relations, including fields of vision, and the location and dimensions of structures. In doing so, models also allow us to conduct new analyses based on the spatial relations of structures to their surroundings. Our 3D reconstructions were built using the open-source 3D computer graphics and animation software Blender and the 3D computer graphics games engine Unreal Engine.

Using historical photographs, aerial images and photogrammetry we built accurate and geo-referenced 3D models of the topography of Shark Island. This model has been used to create for the first time a detailed topographic map of the island with a 25 cm resolution.

6.8. Ground Penetrating Radar

Ground penetrating radar (GPR) is a technique for the identification and investigation of buried remains. GPR functions by recording reflections or attenuations of electromagnetic (radar) signals that are continuously emitted from a roving antenna. These reflections or attenuations are affected by the physical properties of the subsurface and any buried features within it. The reflections are then recorded and visualised in 2D profiles and 3D data plots called timeslices that can be analysed to determine the presence, size, and nature of buried remains.[6]

7. Reconstruction of Shark Island and the Concentration Camp

7.1. Perimeters of the concentration camp

The image below is the oldest traceable archival photograph of Shark Island, here visible on the right side, dating back to the late 19th century. The only visible building on the island is the pyramid-shaped structure which can be seen clearer on later photographs (see Fig. 7).

[6] See full report here: Colls, Kevin and Mitchell, William (2024). A non-invasive forensic investigation of the slave cemeteries sites in Lüderitz and Swakopmund, Namibia. Centre of Archaeology at Staffordshire University.

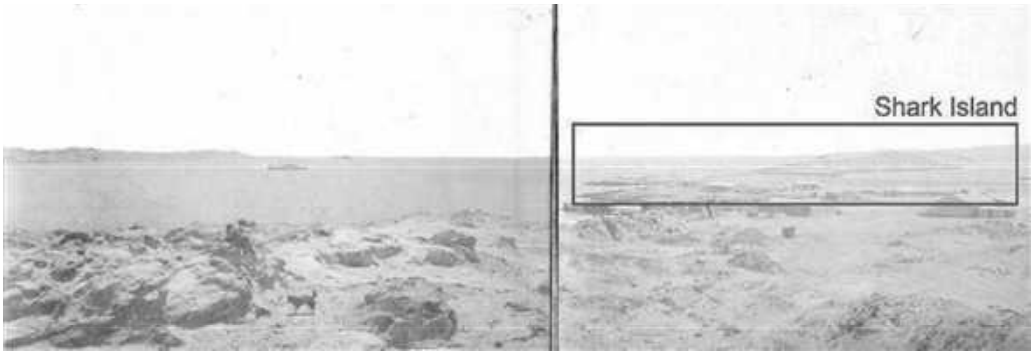


Figure 6. Photo likely dating to the late 19th century with Shark Island on the top right and buildings in the harbour of Lüderitz in the foreground. Namibia Scientific Society.

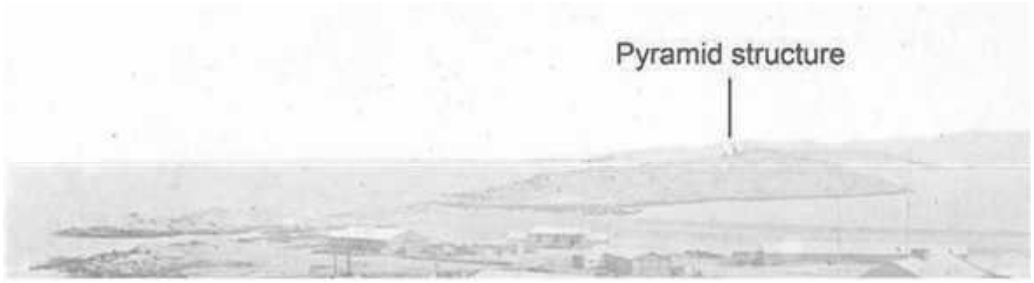


Figure 7. Close-ups depicting the increasing number of buildings on Shark Island and the bridge connecting the island to the mainland.

Later images dated to around 1904, show various buildings at the island's entrance and a bridge connecting it to the mainland.

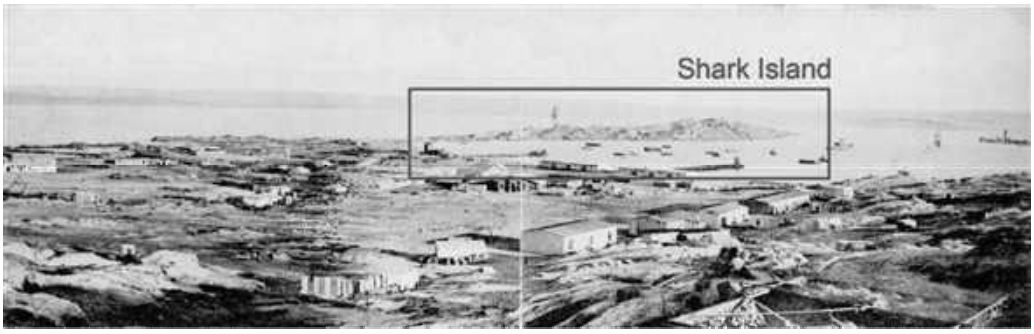


Figure 8. Photo likely dating to 1904 of 'Lüderitzbucht: Panorama der Stadt (DSWA)' ['Lüderitz Bay: panorama of the city (German South West Africa)'] with Shark Island visible in the centre. Koloniales Bildarchiv Universität Frankfurt.

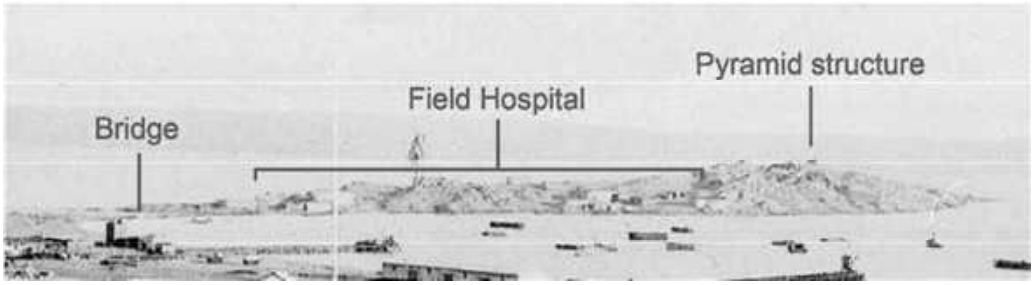
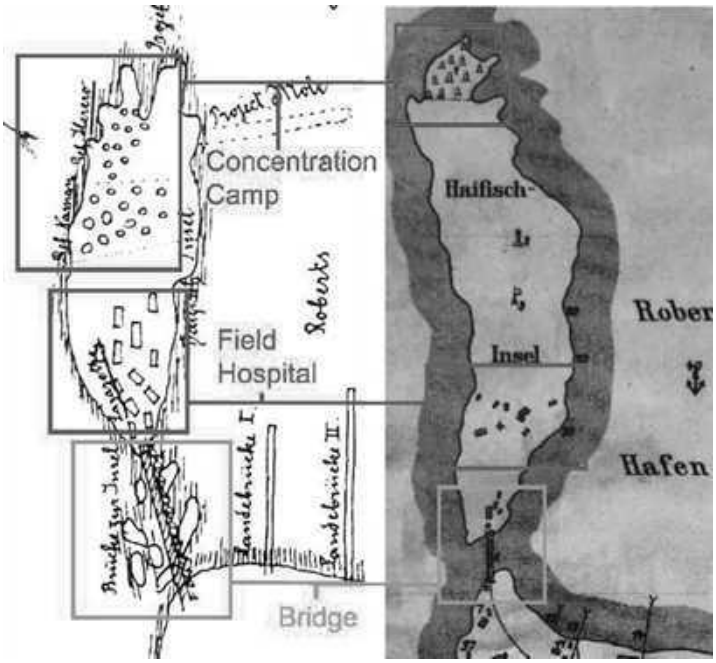


Figure 9. Close-up of Figure 8 depicting the increasing number of buildings on Shark Island and the bridge connecting the island to the mainland.

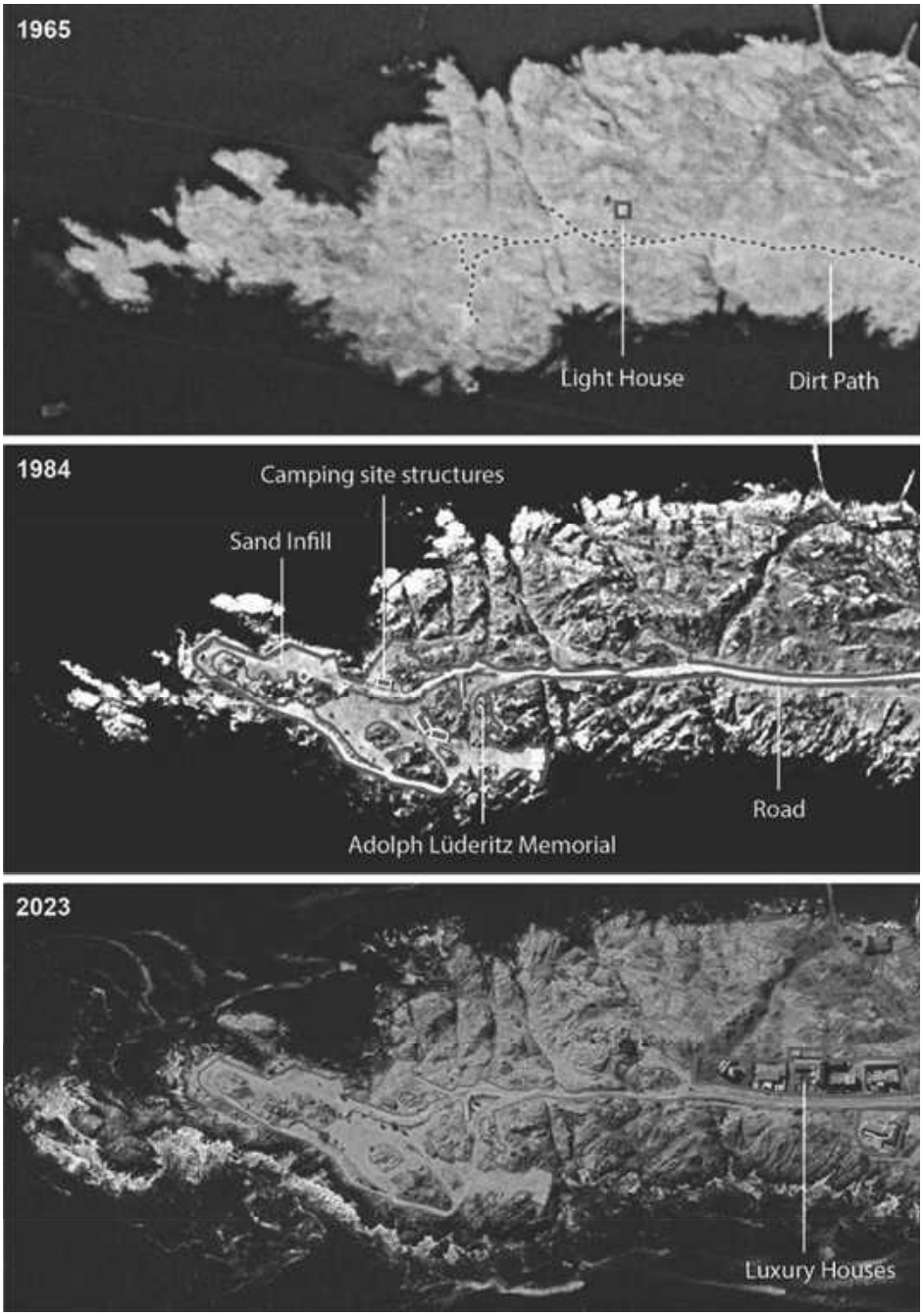
The point of departure for our reconstruction of Shark Island and its concentration camp during the period of the genocide were two historical maps depicting the peninsula during its operational period as a concentration camp. Figure 10a is a hand drawn map by a local missionary, Emil Laaf; the producer of Figure 10b is unknown. Both of these maps depict the island connected to the mainland via a bridge and both place the concentration camp at the tip of the island while the German field hospital is located at the entrance.

We were able to corroborate the location of areas marked in these maps by geolocating and analysing archival imagery from different sections of the camp.



Figures 10a, b. The map on the left, drawn by Missionary Emil Laaf in 1906 and cropped here for comparison, shows a rough sketch of the concentration camp. Archive of the Rhenish Mission Society. The right map, published in 1910, seems to be depicting Lüderitz when Shark Island concentration camp was operational, as indicated by the tent drawings at the tip of the island. National Archive Namibia.

7.2. Alterations to the island



Figures 11a-c. These aerial and satellite images of Shark Island show the concentration camp site's alterations between 1965 and 2023.

Today, the northern part of the island, where according to historical maps the concentration camp was located, is a tourist camping site (Fig. 11). All the buildings pertaining to the concentration camp have disappeared. The southern part of the island forms part of the port and residential buildings stretch along the street reaching over from the mainland.

By analysing aerial photographs and satellite imagery over time, it becomes apparent that drastic landscape alterations happened between 1965 and 1984, during the height of South Africa's colonisation of Namibia and the apartheid era, possibly in the mid-1970s.

In the aerial image from 1965, the rock formation on the northern part of the island seems fairly intact, with only a narrow dirt path leading to it. The Shark Island lighthouse is also visible in this image. In 1977, an old European cemetery was transferred from the northern part of Lüderitz to Shark Island and the human remains were placed alongside memorial plaques for the German 'pioneer' Heinrich Vogelsang and Adolf Lüderitz.[7]

In the aerial image from 1984, extensive landscaping changes are visible. The narrow path has turned into a road and large sections of the northern part of the island have been flattened by sand infills while various memorials commemorating the perpetrators of the genocide were erected. Sanitary facilities for the camping site that are still intact today become visible.

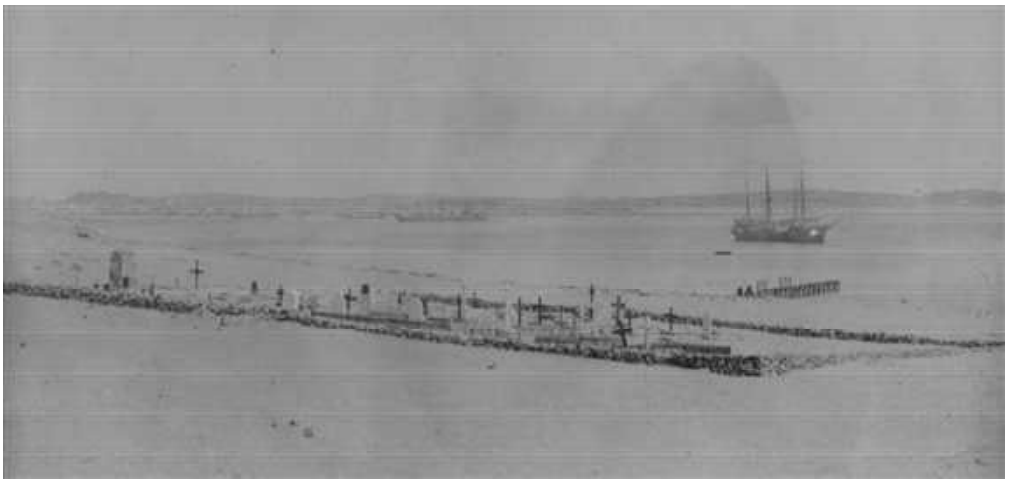


Figure 12. Photo captioned "Lüderitzbucht 1907 / Alter Friedhof am Roberthafen" ['Lüderitz Bay 1907 / Old cemetery at Robert Harbour"]. Koloniales Bildarchiv Universität Frankfurt.

From 1984 to the present day not much has been added to the northern part of the island except a small monument remembering Cornelius Fredericks, the Nama leader who was detained and decapitated on the island in February 1907. However, luxurious residential buildings have been erected in other parts of the island.

[7] In 1883, Heinrich Vogelsang led the first German expedition to Lüderitz, then called Angra Pequena. Adolf Lüderitz was a merchant from Bremen, Germany, who financed said mission and later bought a sizable amount of land in the area under dubious circumstances, defrauding Nama Captain Joseph Fredriks II about the size of the plot.

7.3. Position of field hospital

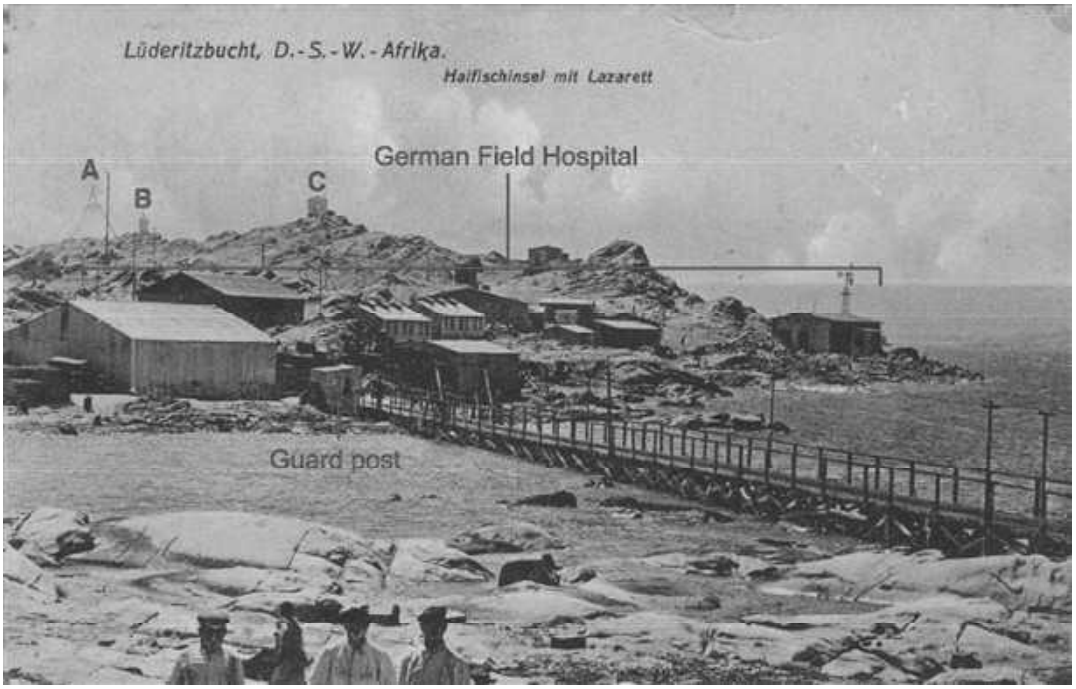


Figure 13. Postcard titled 'Lüderitzbucht, D.S.W. Afrika, Haifischinsel mit Lazarett' ('Lüderitz Bay, German-South-West Africa, Shark Island with hospital'). It was published in German South West Africa by a German bookstore in 1905. Verlag Swakopmunder Buchhandlung.

The image above depicts the entrance to the island which was then connected to the mainland only through a wooden bridge. Visible in the forefront of this image is 'Feld Lazarett XII,' the German field hospital. This photograph corroborates the location of the field hospital marked in the two hand draw maps (Fig. 10). By 3D-modelling and placing all the visible structures in this image within the Blender 3D software environment, we were then able to cross reference these structures and identify their functions according to the tags from the map below (Fig. 14).

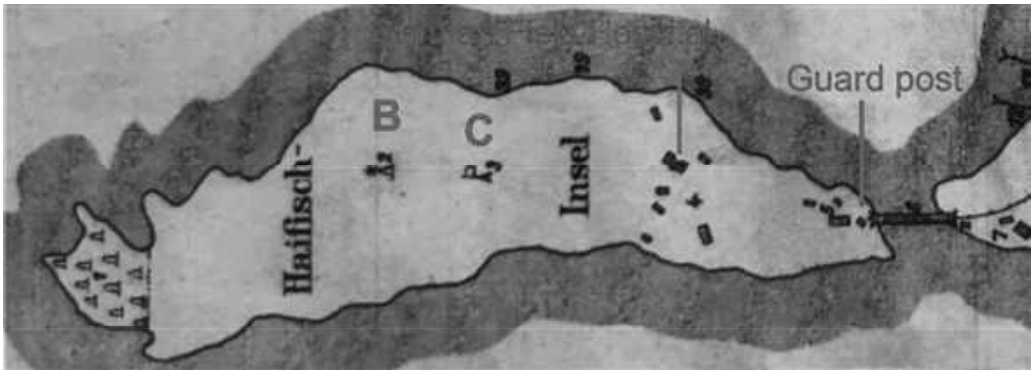


Figure 14. Rotated excerpt from the map in Figure 10 with building structures marked red. FA/Forensis, 2024.

In Figure 14, the original labelling of the map reveals buildings matching the locations of structures tagged B and C within our model and the photograph: a lighthouse and a signal station. While the structure tagged A, a pyramid-shaped steel beacon, is also visible in other archival photographs from the period, its function is not clear.

Through interviews with descendants of Shark Island victims, it was established that the structure tagged D, right at the entrance to the island and on the left side of the wooden bridge, is most likely the guards' post (Fig. 13).

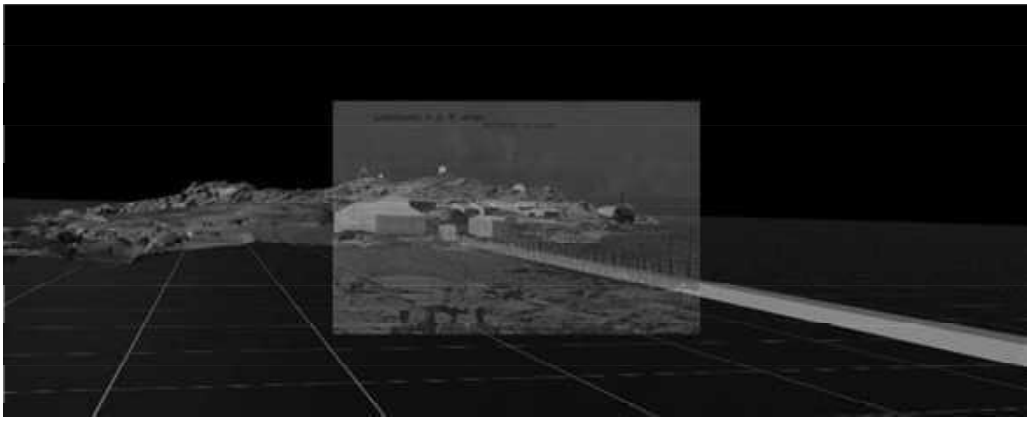


Figure 15. A photomatch of the postcard in Figure 13 within our 3D reconstruction of the island, allowing us to place the buildings within the model. FA/Forensis, 2024.

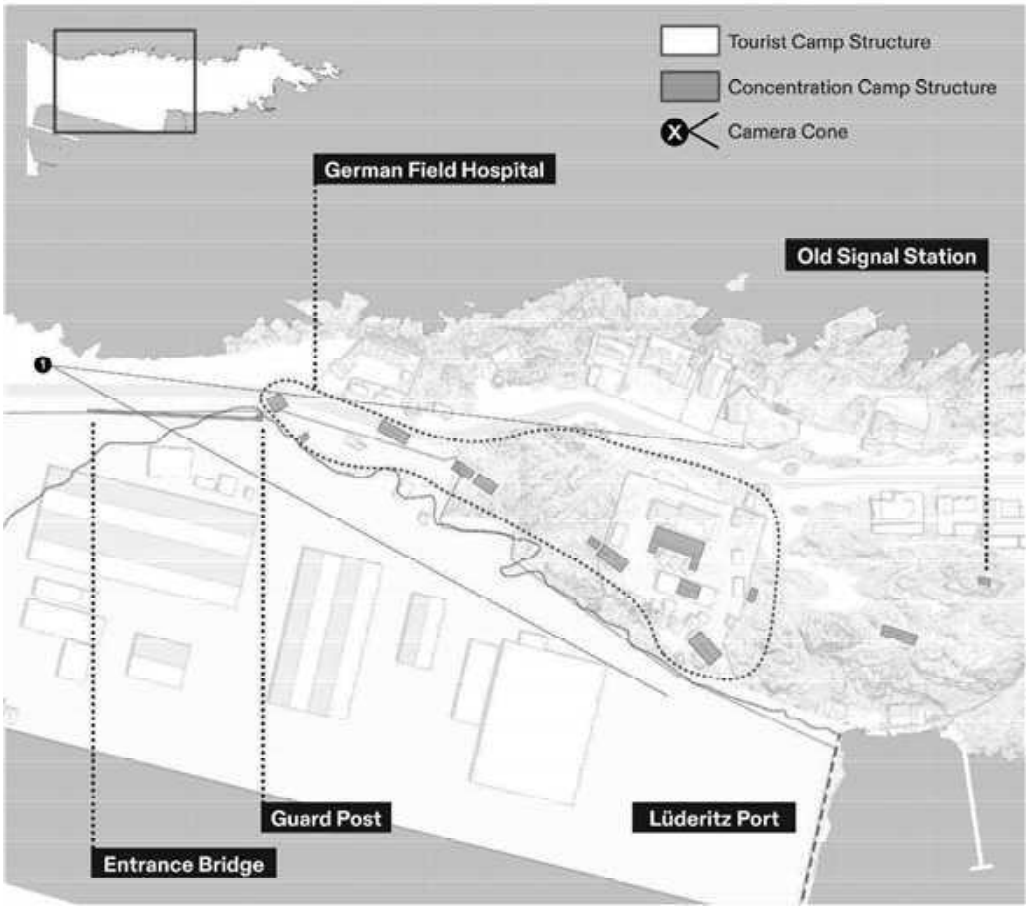


Figure 16. Map illustrating the structures on Shark Island seen in the archival photo Figure 13. FA/Forensis, 2024.

7.4. Position of execution chamber



Figure 17. A retouched photo of Nama inmates in Shark Island, likely dating to late 1906. Distinct camp structures are visible in the background. Taken from: Erichsen, Angel of Death, 2005, p. 124.

This archival photograph depicts a group of about 20 Witbooi Nama inmates — recognizable by their clothing and hats — in the foreground and three distinct structures in the back, alongside two temporary tent-like structures most probably housing inmates interned on the island.

The Pyramid shape structure (tagged A) and the lighthouse (tagged B) on its left side were identifiable in Figure 13. An additional structure (tagged C) is visible in Figure 17 directly behind the pyramid.

Using our topographical 3D model, we established the exact location of the camera and placed it within the 3D environment of the software Blender using the method described above as photomatching (see page 14). During this process geological features were put in accordance with both the 3D model and the archival image.

According to testimonies of descendants, structure C was used as an execution room. The descendants believe that in this building the skulls of Herero and Nama were scraped by other inmates in order to be sent to Germany.

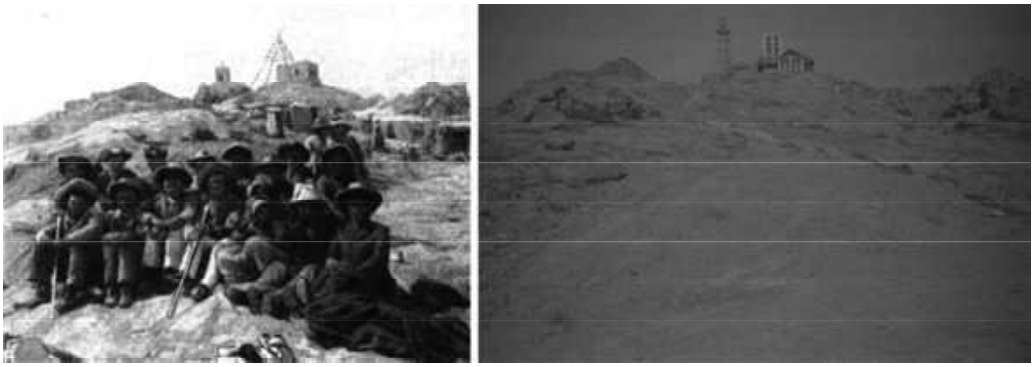


Figure 18. The same view is captured in the archival photograph (Left), and in the image taken by Forensic Architecture in September 2023 from the same area (Right).

As a next step, all the major structures visible in this photograph were modelled in detail and placed at their exact locations within the 3D model. As a result it became clear that the three structures visible on the top of this image used to stand very close to where the lighthouse is located now.



Figure 19. Zooming in on both photos shows that the execution chamber (Left) stood on the same rock as the red lighthouse does today (Right).

Similarly, in their testimonies, descendants of Shark Island victims stated that oral history professes that there had been a building used for executions and for scraping skulls “where the lighthouse stands today.” We identified this building as structure C.

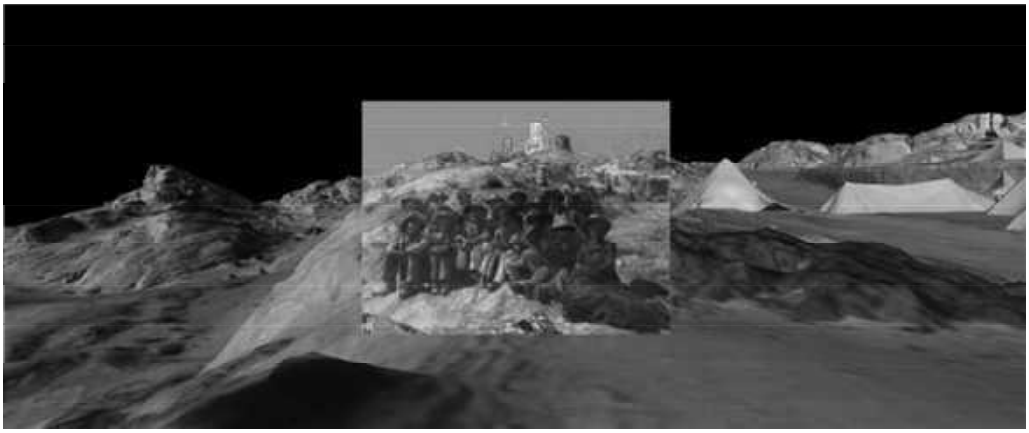


Figure 20. A photomatch of Figure 17 within our 3D reconstruction of the island, allowing us to place the execution chamber within the model and thus to determine its precise location. FA/Forensis, 2024.

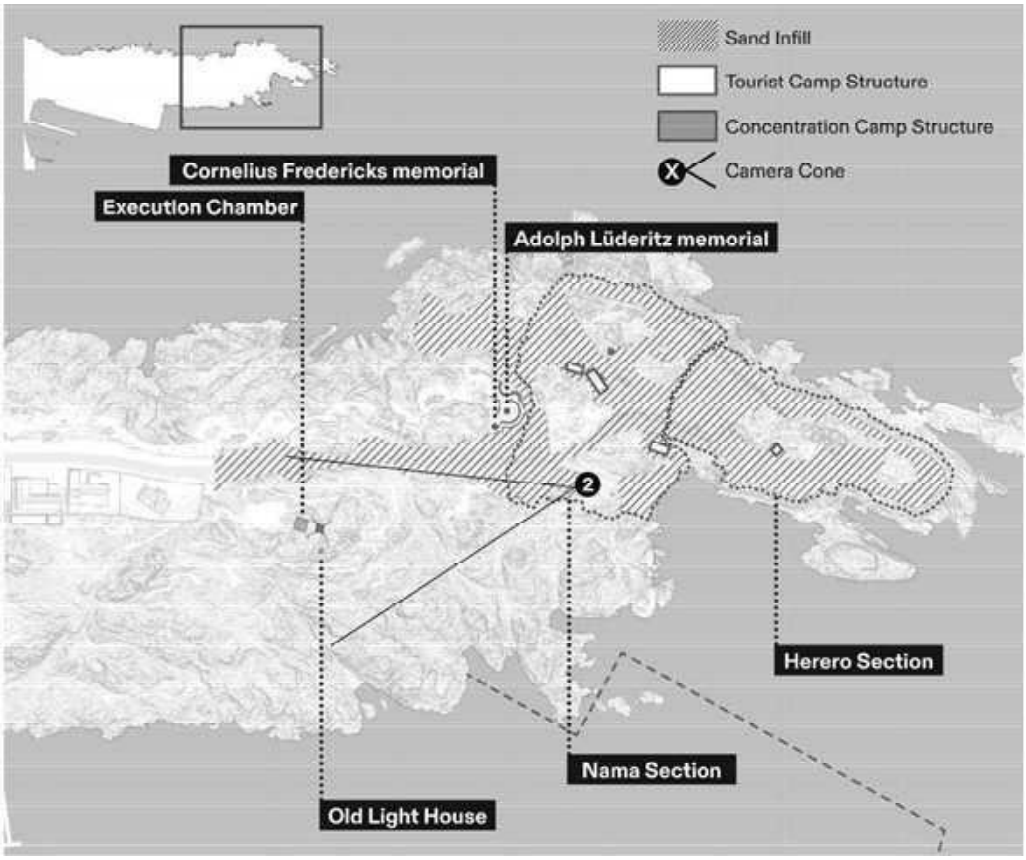


Figure 21. Map illustrating the structures on Shark Island seen in the archival photo Figure 17 in addition to the structures and terraformation realised for the tourist campsite. FA/Forensis, 2024.

7.5. Position of Herero camp structures



Figure 22. Photo of the Shark Island concentration camp titled 'Haifischinsel : Lager der gefangenen Herero und Hottentotten: Hereropontok' ('Shark island: Camp of the Herero and Nama - Herero Pontok'), n.d., Lt. v. Düring, Koloniales Bildarchiv Universität Frankfurt.

This archival photograph shows the Herero section of the camp. We identified at least 21 temporary structures in this image which are most probably self-made housing structures for the inmates. The absence of people in the image suggests that inmates were possibly outside of the camp performing forced labour.

We geo-located this image through the distinct rock formations visible in this section of the camp. The rock at the centre of the image is clearly identifiable on the island today as seen in Figure 23.



Figure 23. Image taken by Forensic Architecture in September 2023 capturing the same view as Figure 22.

What becomes immediately clear is that most of the area visible in the archival photograph has been terraformed and covered in sand, flattening the area for vehicles, tourist tents and amenities.

We used the aforementioned rock as an anchor point in order to precisely place the archival photo's camera angle within the 3D environment. The location of the camera is on the upper part of the island and close to the area marked by Map A as the Herero area.



Figure 24. Structures visible in the archival photograph are placed within the 3D model, thus showing the extent of the sand infill. The marking visualises the same rock standing out in both images.

We modelled the visible structures, placed them in our model and found that most of the concentration camp structures visible in the foreground of this image would be buried beneath at least 130 cm of sand infill. Archaeological excavation in this area could reveal crucial remnants related to the conditions of the camp and its operation.

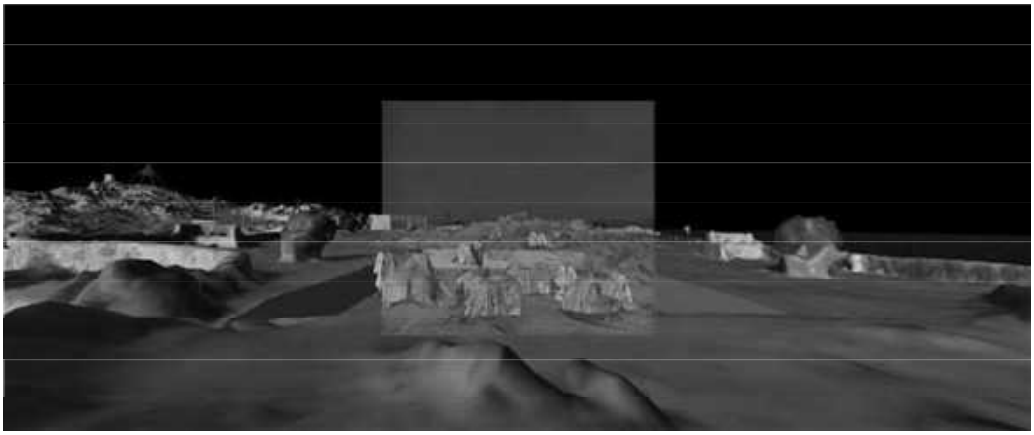


Figure 25. The view from Figure 22 is placed within our 3D reconstruction of the island allowing us to calculate the sand infill and locate the Herero section of the camp. FA/Forensis, 2024.

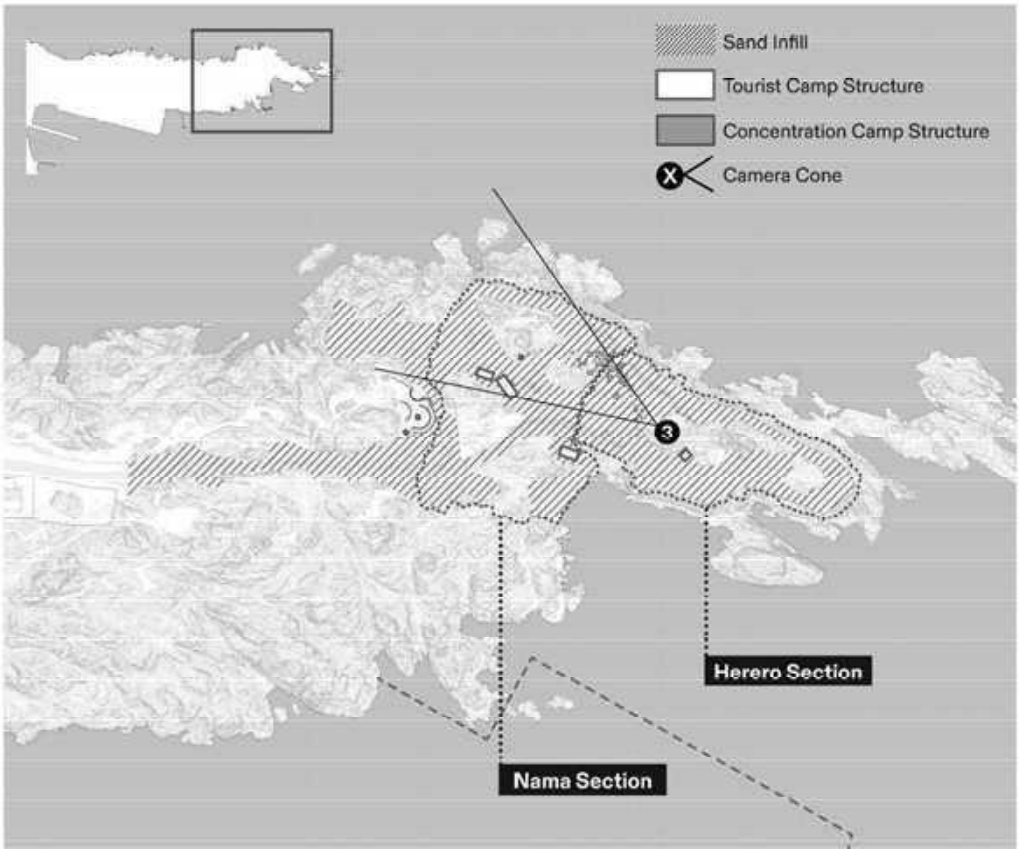


Figure 26. Map illustrating the structures on Shark Island seen in the archival photo Figure 22 and visualising the different sections of the concentration camp. FA/Forensis, 2024.

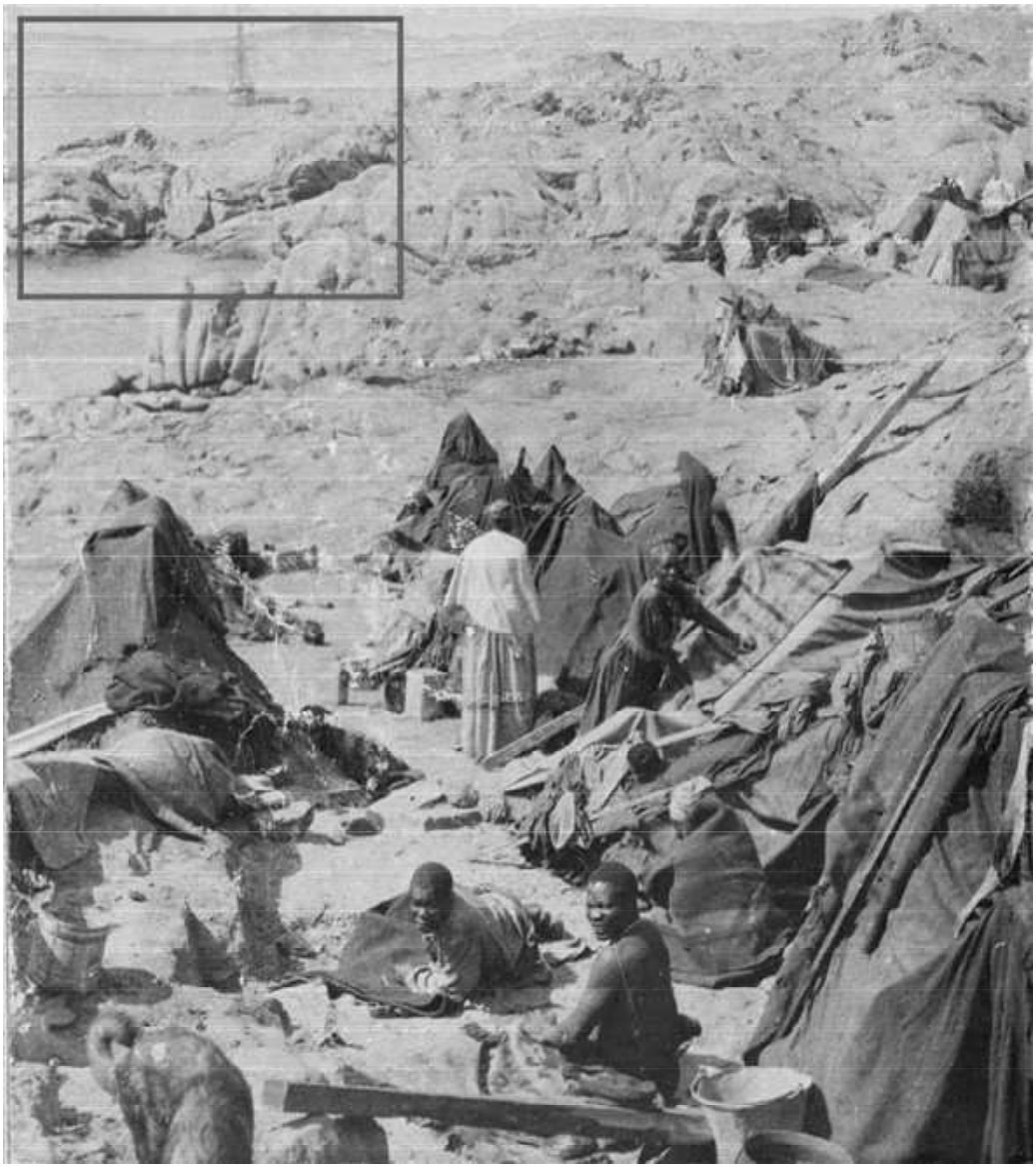


Figure 27. Photo, likely dating to 1905, of Herero inmates in the concentration camp surrounded by tent structures offering little protection. The red marking captures a distinct rock we used to locate the image. Koloniales Bildarchiv Universität Frankfurt.

This archival photograph comes from the album of Lieutenant von Düring and likely dates to October 1905. Düring captioned the image, 'Shark Island: Herero inmates,' and it depicts another side of the camp's Herero section.

We identified 9 temporary structures in this photograph. Further, we geolocated this image by referencing a distinct rock on the upper left side of this image, marked by a cross.

28

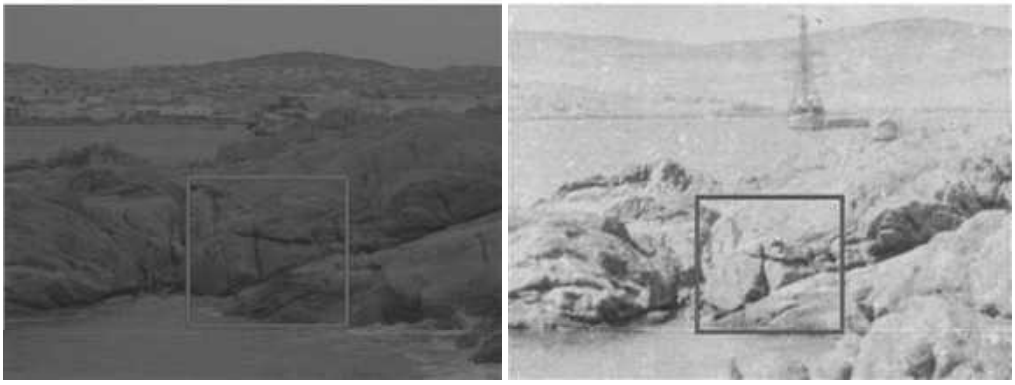


Figure 28. A rock with a distinct shape is marked both in the archival photograph and in an Image taken by Forensic Architecture in September 2023 from the same area.

Using this rock as an anchor point and placing the camera within our model, we realised the view captured in this image is blocked today. We found the location of this camera by digitally removing the structure and the sand infill.

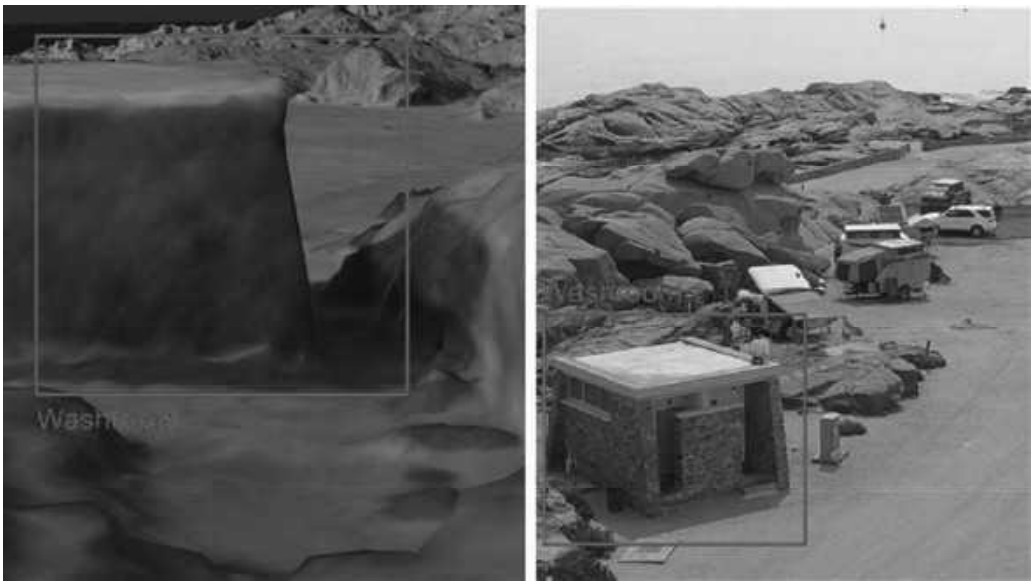


Figure 29. The image on the left captures the same camera angle as in the archival photograph within the 3D software environment. The structure blocking the view is the washroom visible on the image on the right.

The structure blocking this view is one of the contemporary camping site washrooms, positioned exactly where inmates stand in the archival image. This finding suggests another important location for further archeological investigations.

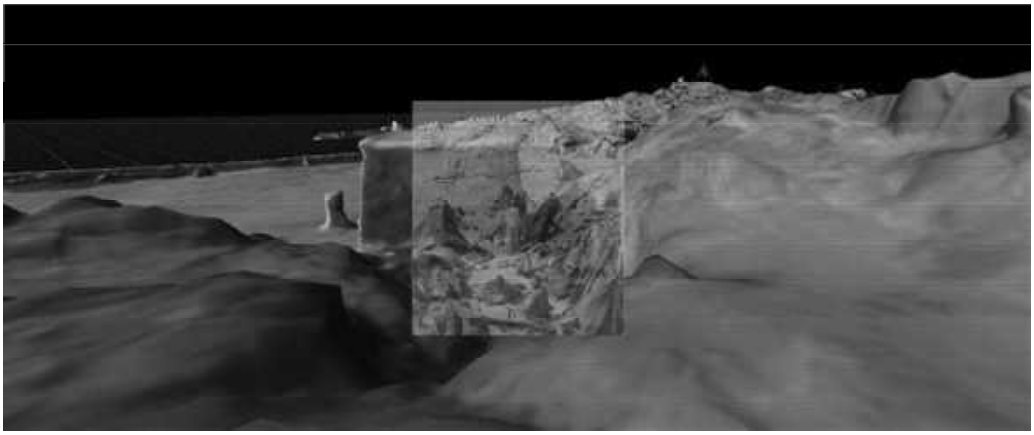


Figure 30. The archival photo Figure 27 is placed within our 3D reconstruction of the island allowing us to locate the Herero section of the camp. FA/Forensis, 2024.

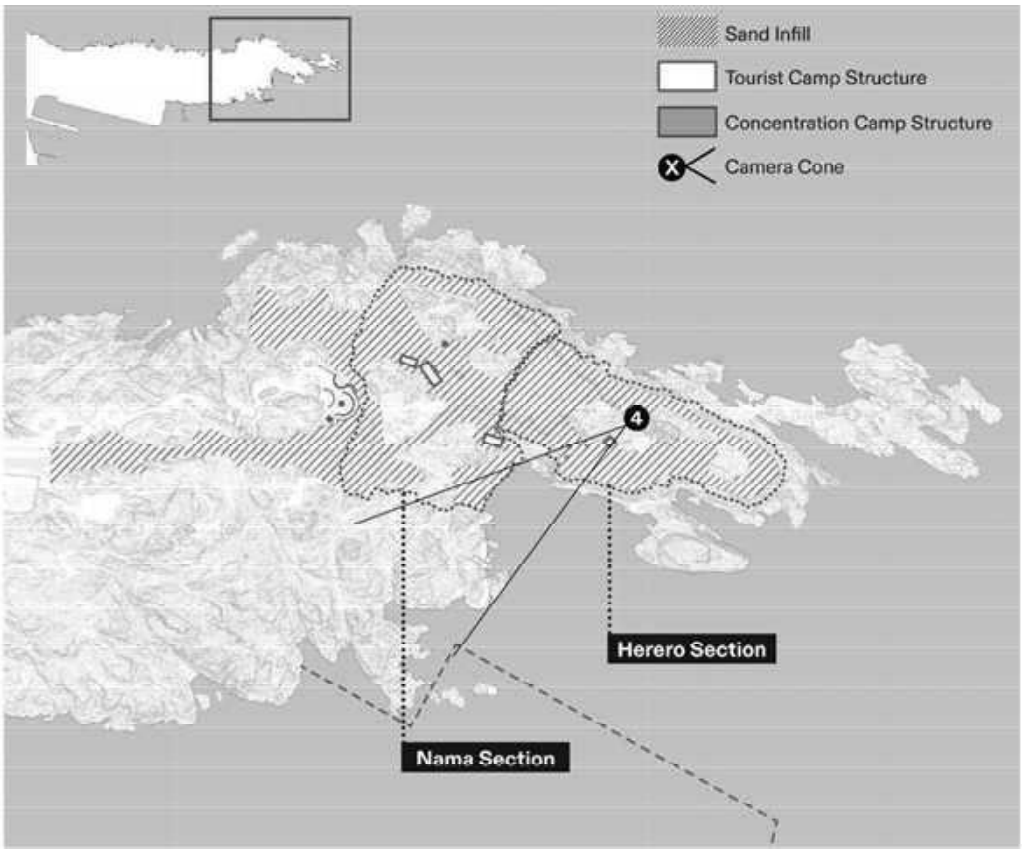


Figure 31. Map illustrating the structures on Shark Island seen in the archival photo Figure 27 and visualising the different sections of the concentration camp. FA/Forensis, 2024.

7.6. Position of Nama camp structures and evidence of forced labour



Figure 32. Photo of the Nama section of the concentration camp depicting inmates conducting physical labour. National Archives Namibia, 1906.

This image, likely dating to 1906, mainly shows the Nama area of the concentration camp. Parts of the Herero section are visible in the upper right corner. The temporary structures in the Nama area seem to be military tents and distinguish themselves from the structures in the Herero areas.

Similar to other photomatches, in order to locate the camera within our 3D model, we looked for recognizable rocks and used them as anchor points.



Figure 33. The same rock marked in the archival photograph and within the 3D model environment. FA/Forensis, 2024.

After modelling the visible structures in the archival photograph and placing them within our 3D model, it became evident that almost the entirety of this visible section of the camp falls within the heavily landscaped part of the island. Most of the structures of the Herero section

in this image on the upper right corner are completely buried beneath sand infills but also the geology on the Nama section has been gravely altered.

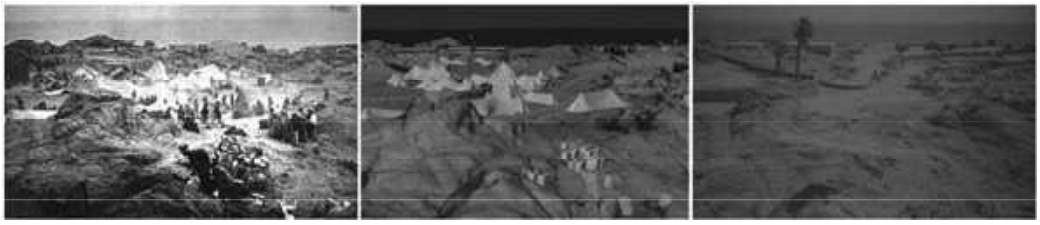


Figure 34. The same view captured in the archival photograph (Left), is visible within the 3D software environment (Center), and in the image taken by Forensic Architecture in September 2023 from the same area (Right).

The inmates of Shark Island were mostly forced to work outside of the camp, for instance building railroad tracks for the line from Lüderitz to Aus or in the construction of the harbour. However, inmates were also involved in egregious labour projects on the island itself, such as the erection of a pier in close proximity to the camp. According to the work diary of construction technician Richard Müller, this project failed due to the high casualty rates of inmates and consequently a lack of labour force.[8] To provide building material for this project inmates were forced to break rock with pickaxes and sometimes even explode stones with dynamite.

The woman in the foreground of the picture appears to be breaking rocks with an axe. Several buckets filled with stones are visible close to her. By geolocating the position of this woman on the island and identifying the rock she is standing on, we were able to find clear traces of human-made incisions on this rock. Likely these are traces of the movement she is seen undertaking in this image from 1906. The image below shows a 3D scanned image of this specific rock and traces of forced labour on it.

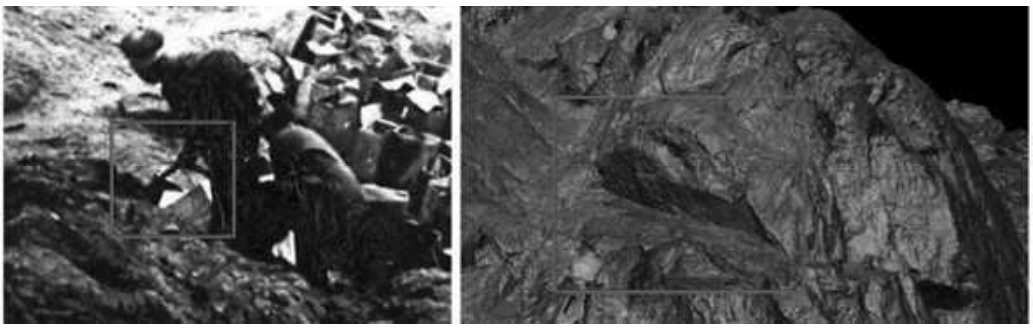


Figure 35. An inmate holding an axe in the archival photograph (Left). A human-made incision is visible on the same rock the woman with an axe is standing on (Right). FA/Forensis, 2024.

[8] Müller, Richard. Arbeitstagebuch, Dec. 24, 1906. Kaiserliches Hafenbauamt. National Archives Namibia.

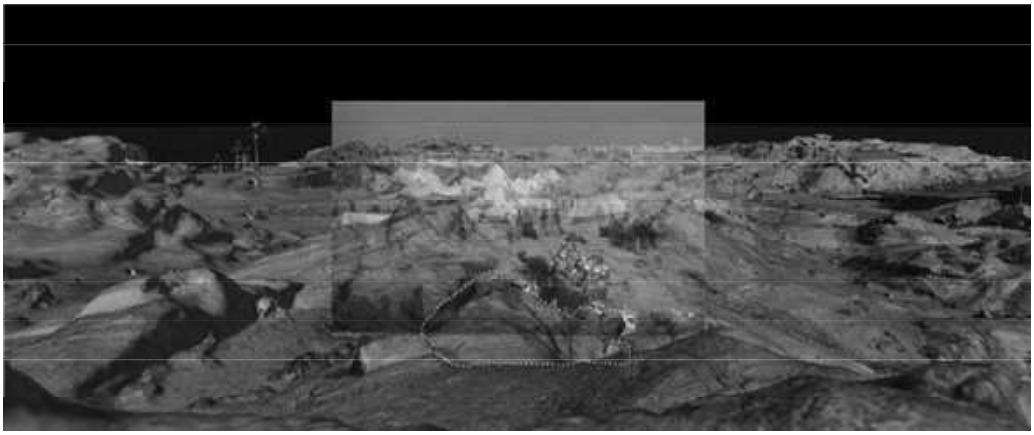


Figure 36. The archival photo Figure 32 is placed within our 3D reconstruction of the island allowing us to locate the Nama section of the camp. The distinctive rock from Figure X is outlined in white. FA/Forensis, 2024.

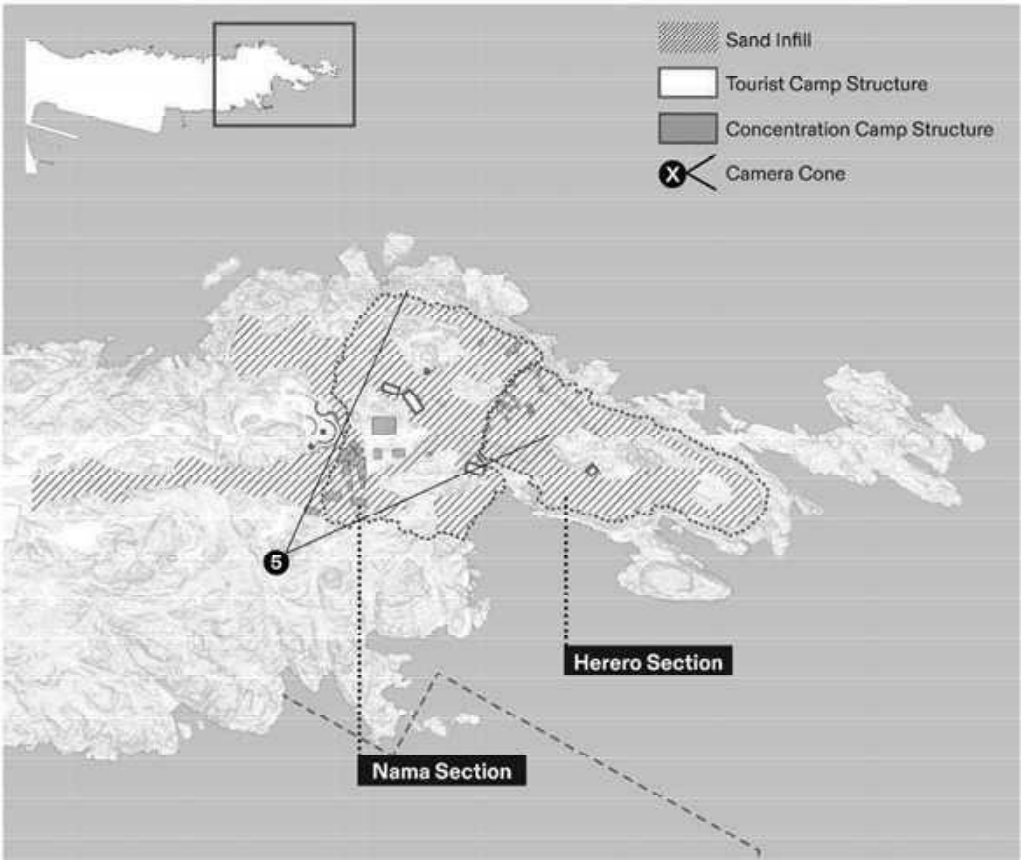


Figure 37. Map illustrating the structures on Shark Island seen in the archival photo Figure 32 and visualising the different sections of the concentration camp. FA/Forensis, 2024.

7.7. Position of the Lenz camp

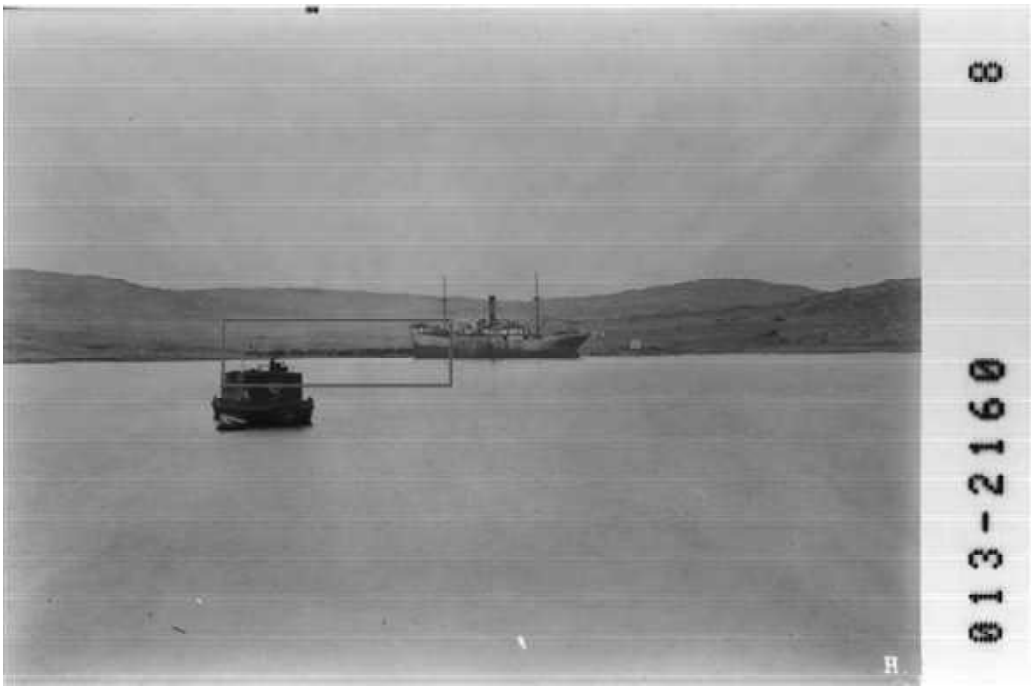


Figure 38. Photo of Lüderitz harbour with the Lenz labour camp marked by the red frame. The Dunbeth wreck is at the centre of the image. Koloniales Bildarchiv Universität Frankfurt, 1907.

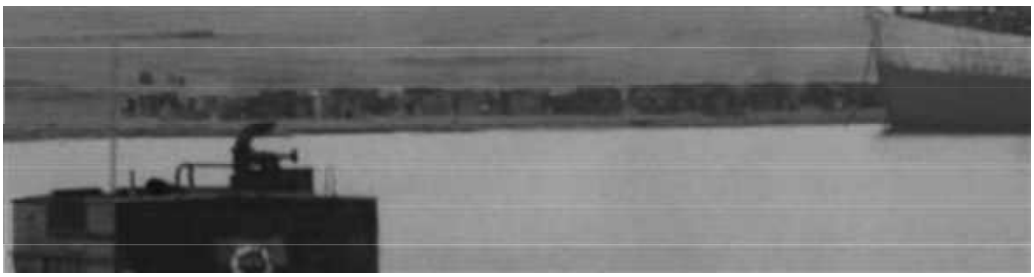


Figure 39. Close-up of the Lenz labour camp in the harbour of Lüderitz. FA/Forensis, 2024.

On the hand drawn Map by missionary Laaf at the beginning of this report (Fig. 10), another camp run by the railway company Lenz is labelled as 'Captured Hereros,' next to the stranded Dunbeth ship. The archival photograph above is taken from Shark Island on July 14, 1907 and appears to capture a rare image of the Lenz camp and the wreck alongside it.[9]

[9] The ship was stranded on June 6, 1906 and stayed in the harbour until 1910 adding another indication to the photo's date.



Figure 40. The same view, captured in the archival photograph (Left) and within the 3D model environment allowing us to place the camp on the map (Right).

By placing the camera cone of the photo (Fig. 38) within our 3D model we were able to establish the exact location of the Lenz Camp which corresponds roughly with what is visible on the hand drawn Map by missionary Laaf.



Figure 41. The camera angle of Figure 38 placed within our 3D model. The red box marks the position of the Lenz Camp. FA/Forensis, 2024.

7.8. Findings

Our analysis has revealed the following findings:

I. The spatial model reveals the precise extent and spatial layout of the former concentration camp (Fig. 42);
II. The testimonies and the matching of archival photos to the current island geography allowed the identification of the function of several structures visible in archival photographs, including the structure reportedly used for public executions, guard posts, the field hospital, the lighthouse, a signal station as well as the Nama and Ovaherero sections of the camp. Further, we identified Lenz Camp, another concentration camp, within Robert Bay.
III. Extensive terraformation has taken place on the island, such as sand infill that raised the ground level for the benefit of roads, car parking and flat camping areas.
IV. Present day infrastructure that we mapped on the island, such as a tourist campsite, monuments, residential buildings and port developments have been built on top of or very close to the former concentration camp.

Our findings demonstrate that the infrastructure for the tourist camp, such as roads or sanitary facilities, are situated directly on top of the former concentration camp, thus an area of archaeological, historical, religious and emotional significance.

The current usage of the site desecrates a space that should be dedicated to preserving the memory of the victims and survivors of the crimes committed here as well as the resistance fighters battling this oppression. Rather than allowing for remembrance and prayer, the site currently confronts visitors with the commotion of holiday-goers, loud music, laughter, and the smell of barbeque.

The proposed extension of Lüderitz port in Robert Harbour poses an imminent risk of further desecrating the heritage site directly and indirectly, as well as disturbing maritime burial places within the jurisdiction of Namport and adjacent waters. This would further and irreversibly compromise the island as a place of historical significance and prevent additional archeological research needed on the underwater burial sites of camp inmates. Noise from the port will permanently affect the experience of being in this site, preventing solemn contemplation. The view from the city to the former camp and vice versa, situating the atrocities committed here within its local context, will be disrupted if new buildings are constructed on the eastern side of the island.

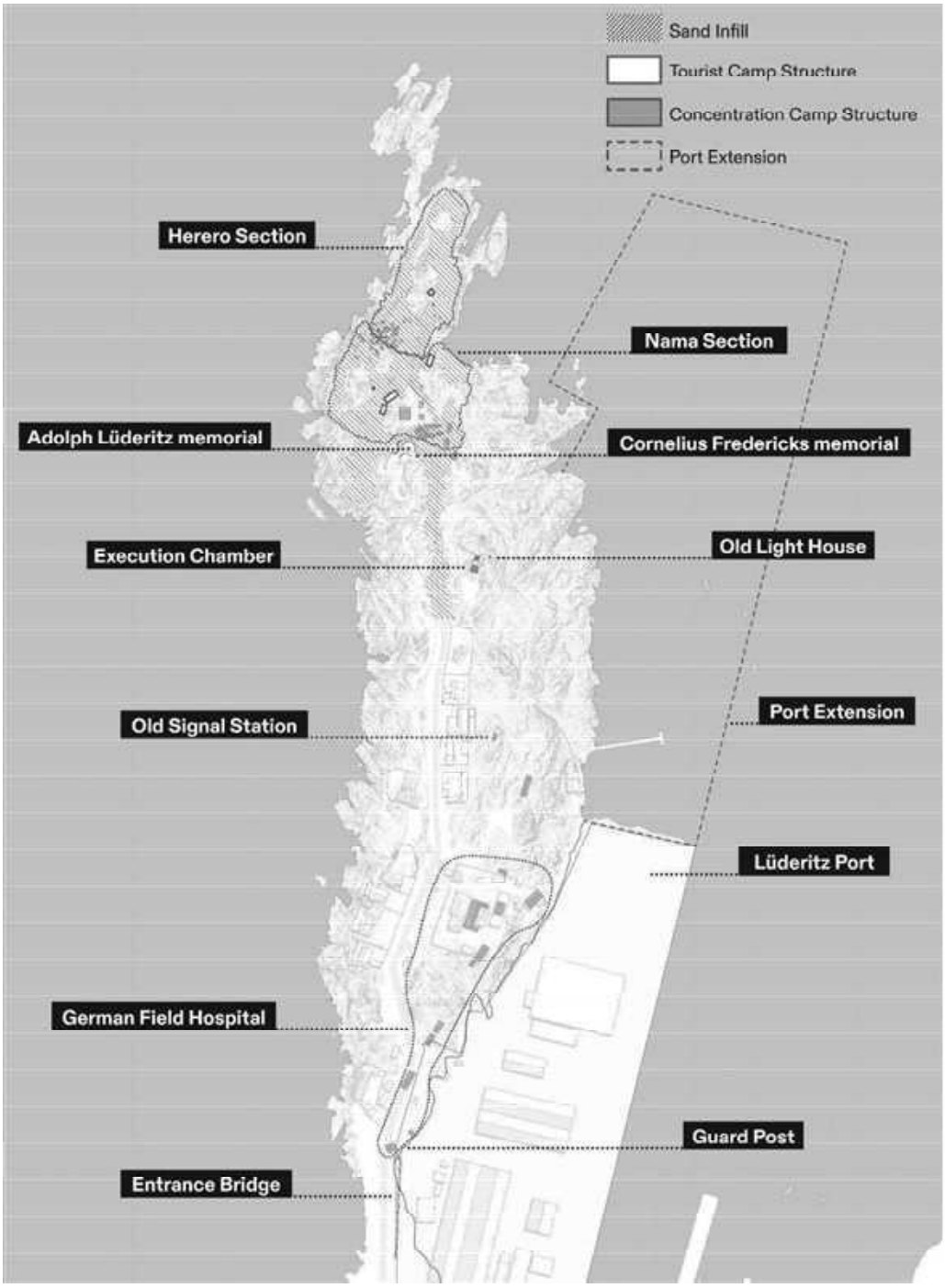


Figure 42a. Spatial analysis by Forensis/FA reveals how key sites of the concentration camp have been overbuilt and how the proposed port extension threatens to further disrupt and continue the erasure of traces.

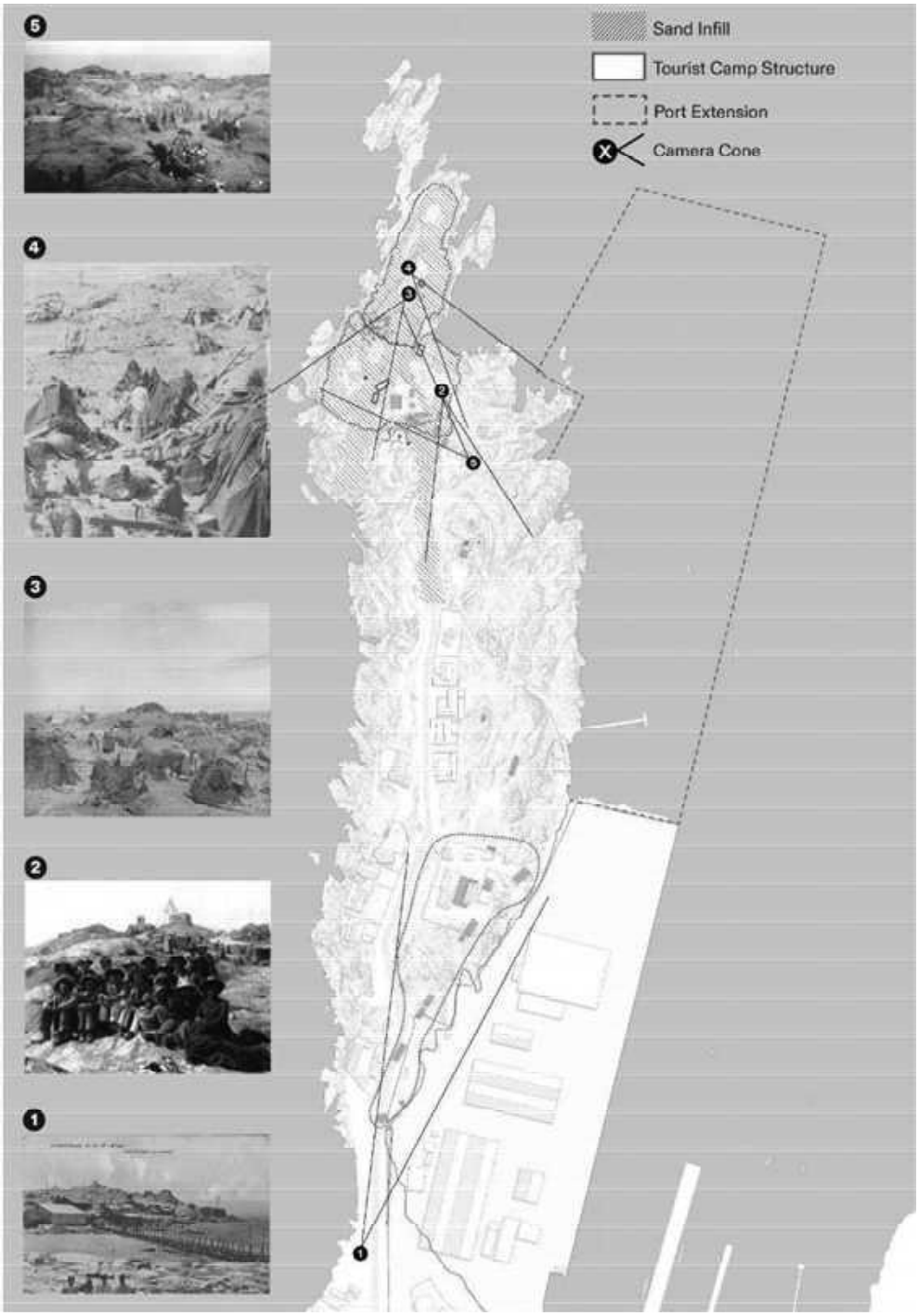


Figure 42b. Exact locations of archival photographs camera cones used for the reconstruction of Shark Island concentration camps

8. Localization of Unmarked Graves

Thousands of Herero and Nama inmates died in Shark Island concentration camp. Yet, until this day, the burial sites of the victims are unclear. Evidence points to multiple areas around Lüderitz as possible sites of burial.[10] Some of them lie in the Sperrgebiet, the area sealed-off for diamond mining since 1908 which is now slated to be used for the Hyphen Energy project. In the testimonies we collected, it was mentioned multiple times that bodies of inmates were simply thrown into the sea off Shark Island. This is substantiated by written reports, such as a South African transport rider, Leslie Cruikshank Bartlet, stating in 1905 that he saw 'corpses of women prisoners washed up on the beach between Lüderitzbucht and the cemetery.'[11] It is thus highly likely that the shallow waters around the island are graves to victims of the German-made genocide. We were moreover able to gather substantial evidence for the presence of inmates' graves in Radford Bay, which is the area that we will be concentrating on in the following.

Multiple historic sources reference inmates dying or being laid to rest on beaches around Radford Bay. For instance, a soldier passing through Lüderitz in 1906 writes that upon arrival he 'perceived nearly 500 native women lying on the beach, all bearing indications of being slowly starved to death. Every morning and towards evening four women carried a stretcher containing about four or five corpses, and they also had to dig the graves and bury them.'[12] This is the first sight he records in Lüderitz. Since he is coming from South Africa, Radford Bay's beach close to Burenkamp is the first part of town he would encounter.



Figure 43. A drone photograph capturing the unmarked graves of victims of Shark Island close to Radford Bay. FA/Forensis 2024.

[10] In Lüderitz Burenkamp we were able to identify a cemetery on historic maps and locate it in the current geography. Together with geo-referenced photomatches these processes show the existence of graves in these areas. We have excluded it from this report since we weren't able to conduct a GPR survey in the area.
[11] Union of South Africa, Report on the Natives of South-West Africa.
[12] Erichsen, Casper W. (2005). 'The angel of death has descended violently among them': Concentration camps and prisoners-of-war in Namibia, 1904-08. Leiden: African Studies Centre, p.80.

Close to Radford Bay (Fig. 43), a memorial next to several sand mounds honors the Nama and Herero victims of the genocide. During restoration works of the railways adjacent to this site, human remains were discovered which were then reburied in Lüderitz. Oral history points to the mounds as traces of graves of victims from the Shark Island concentration camp and others around Lüderitz. We have looked for archival images of this area during the genocide period.

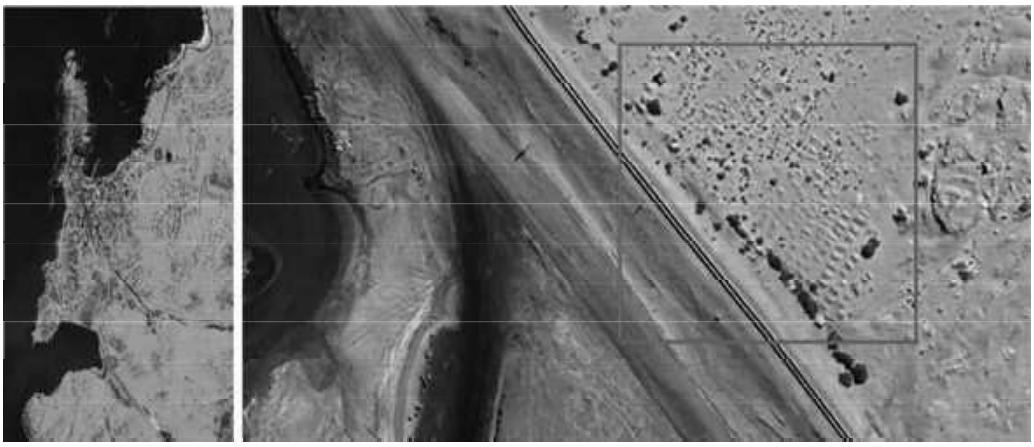


Figure 44. A Contemporary satellite image of Radford Bay, Lüderitz. The marking shows the site where mounds are visible today. FA/Forensis, 2023.

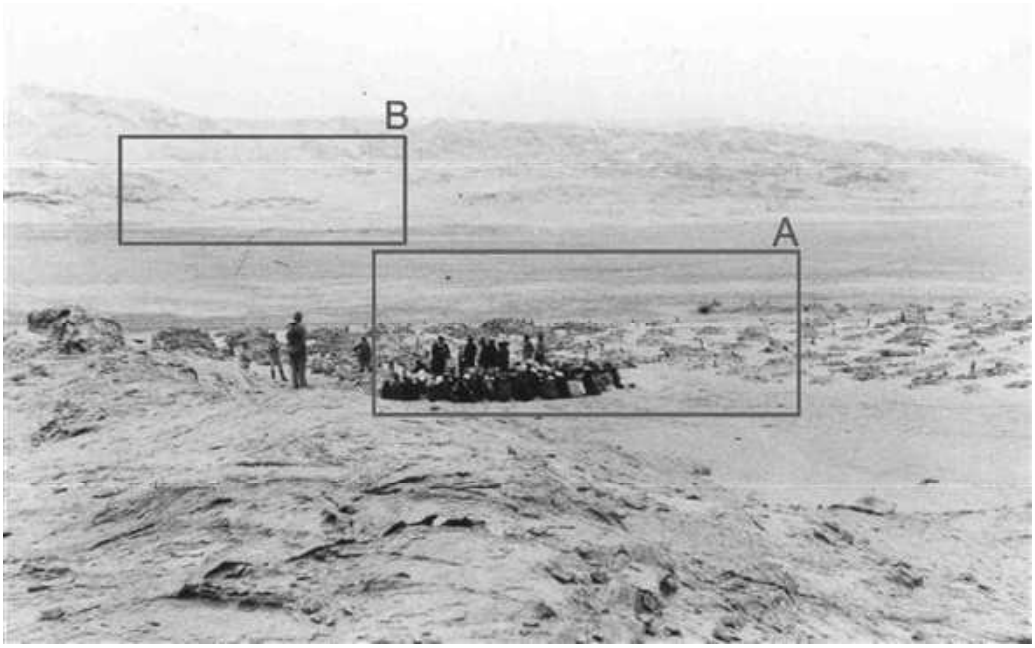


Figure 45. A photo, likely from 1906, labelled by the archive as, 'Burial of Shark Island concentration camp victims near Lüderitzbucht',' shows the burial ceremony in Radford Bay. The markings indicate different grave zones. National Archives Namibia.

The archival photo (Fig. 45), likely dating to 1906, shows inmates conducting a burial in an area we identified as a plain behind Radford Bay outside of Lüderitz, the same site as Figure 44. The people visible in the centre of this image seem to be Nama, based on their clothing and head scarfs.

The burial might be staged for the photo since no other written or visual material from Lüderitz points to ritualised burials for inmates at that time. Rather, different sources point to them being disposed of in mass and individual graves dug daily by other inmates.

A closer look at the image reveals that the mounds vary in size. On the right side (Frame A) of the picture are smaller ones, indicating they might be individual graves. However, bigger mounds are visible on the left side of this image indicating that these might be mass graves.

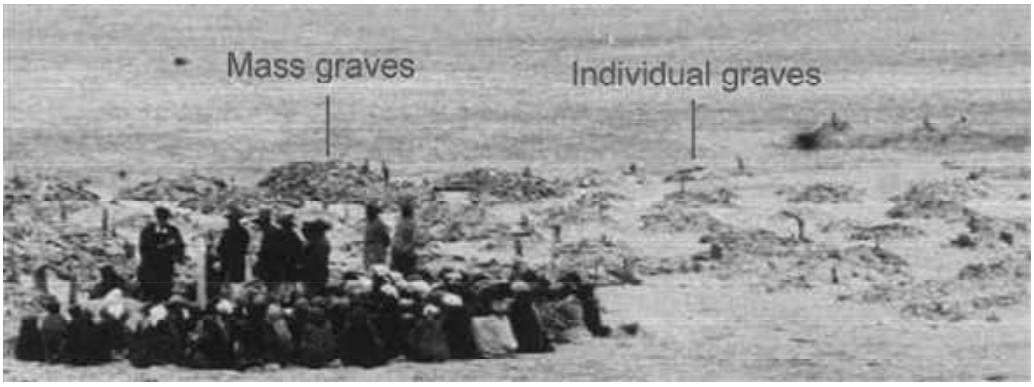


Figure 46. A zoom-in (Frame A) of Figure 45, suggests the presence of individual graves at the right of the image and mass graves on the left side.

We were able to geolocate this image to the aforementioned area (Fig. 44) by once again using a rock, visible on the left side of the image, as an anchor to photomatch its location within our 3D model. Throughout this process, it became evident that sand mounds on this site are the same as the ones visible in the archival photograph. Moreover, we can see that the railway tracks pass right above some of the graves in this image, corroborating that the human remains found on this site might be coming from these graves.



Figure 47. The same rock captured in the archival photograph (Fig. 45), is visible within the image taken by Forensic Architecture in September 2023 from the view (Right). FA/Forensis, 2024.

We were able to identify a potential burial site also in the background (Frame A) of the archival photograph. We visited this location in Lüderitz and found sand mounds very similar to the ones in the first location here as well.

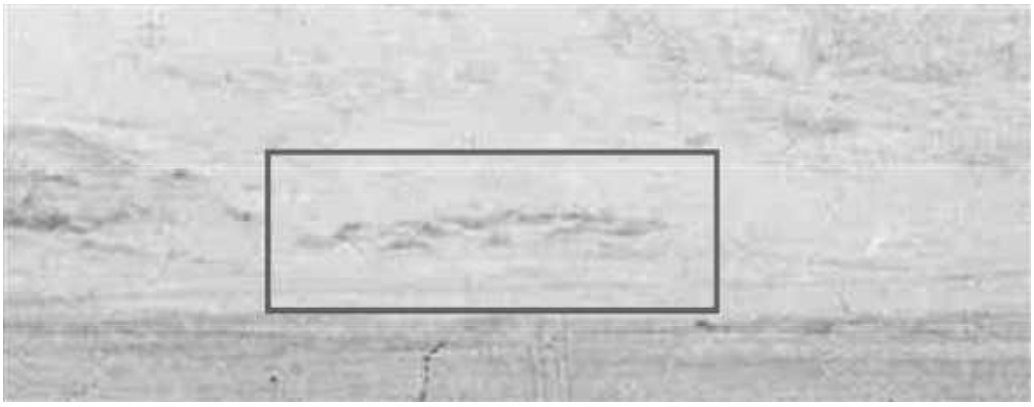


Figure 48. A zoom-In (Frame B) of Figure 45, indicates what appear to be graves in the background.

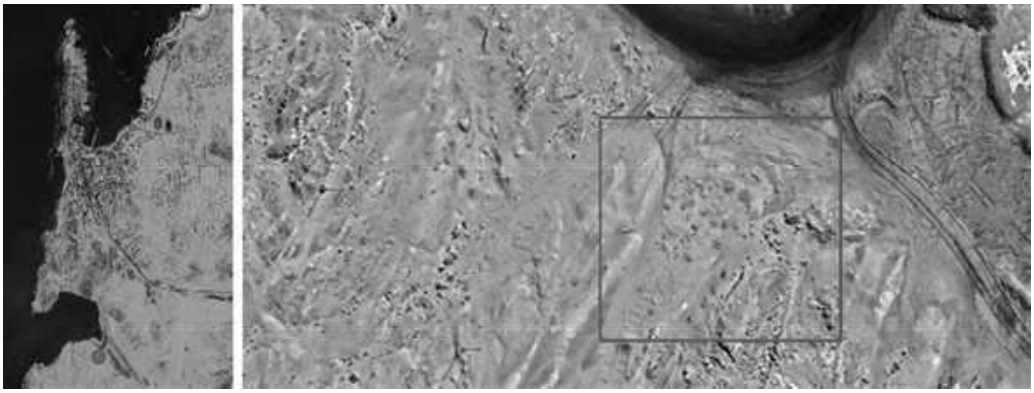


Figure 49. A Contemporary satellite image of Radford Bay, Lüderitz. The marking shows the second site where mounds are visible today. FA/Forensis, 2023.

8.1. GPR Survey

To further corroborate the existence of graves in the area, we collaborated with forensic archeologists from the Centre of Archaeology at Staffordshire University. The team of Prof. Caroline Sturdy Colls conducted a series of non-invasive investigations at the two sites mentioned in the previous section.[13]

A mix of forensic walkover investigation, Ground Penetrating Radar (GPR), UAV photogrammetry, and Global Positioning System (GPS) was employed to identify potential burial sites and map subterranean evidence.

Smaller survey areas were selected for both sites to undertake the GPR investigation. The location of these areas was chosen based on analysis of the visual and textual material and analysis of the site topography, taphonomy, and the presence of visible remains.

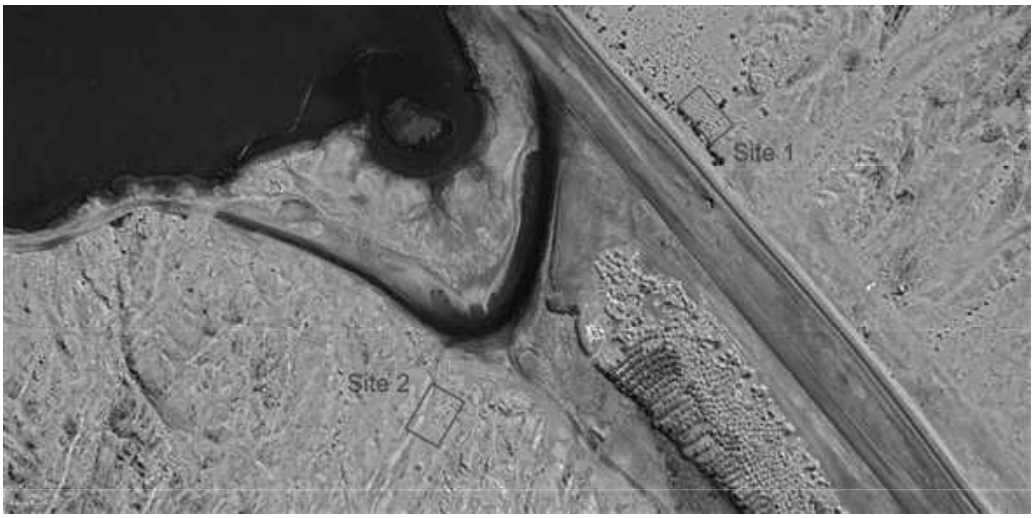


Figure 50. The locations of the survey sites in Lüderitz. Centre of Archaeology at Staffordshire University and FA/Forensis, 2024.

[13] Colls, Kevin and Mitchell, William (2024). ~~A non-invasive forensic investigation of the slave cemeteries sites in Lüderitz and Swakopmund~~, Namibia. Centre of Archaeology at Staffordshire University.

8.1.1. Site 1

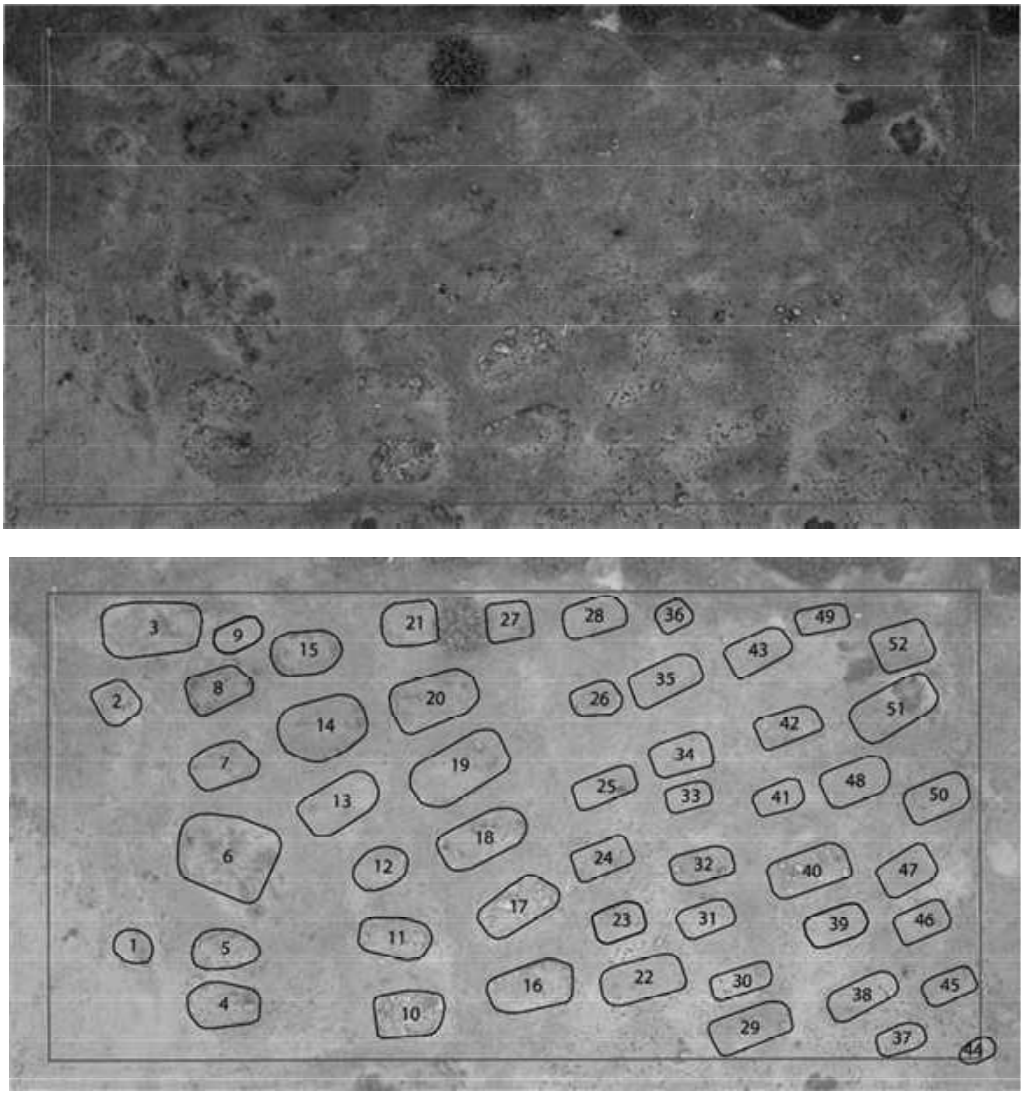


Figure 51. The detailed aerial image of the survey grid (top) shows the visible sand mounds and the feature numbers assigned to each (bottom). Centre of Archaeology at Staffordshire University and FA/Forensis, 2024.

The survey area for site 1 measures 30m by 15m, characterised by an uneven terrain of dry sand with sporadic vegetation. Within this area, 52 distinct sand mounds were observed. The survey successfully identified significant buried features, providing insights into both visible and concealed remnants at this site. Due to the abundance of visible mounds, only a representative section of this site will be elaborated upon here, encapsulating the results of the GPR survey.

The green line below indicates a section cut through the survey area at 6.5m, and it runs through seven visible sand mounds. Subterranean disturbances are detected at these locations, ranging from depths of 0.10m to 0.90m, followed by a change in geophysical response at 1m depth. Analysis suggests a high likelihood that the features along this profile represent individual graves, with feature 6 (blue box) potentially indicative of a mass grave due to its larger size. Strong signals around 1m depth may signify coffins, partially decomposed human remains, buried artefacts, or burial wrappings.

These features demonstrate a clear correlation between subterranean data and visible sand mounds on the surface.

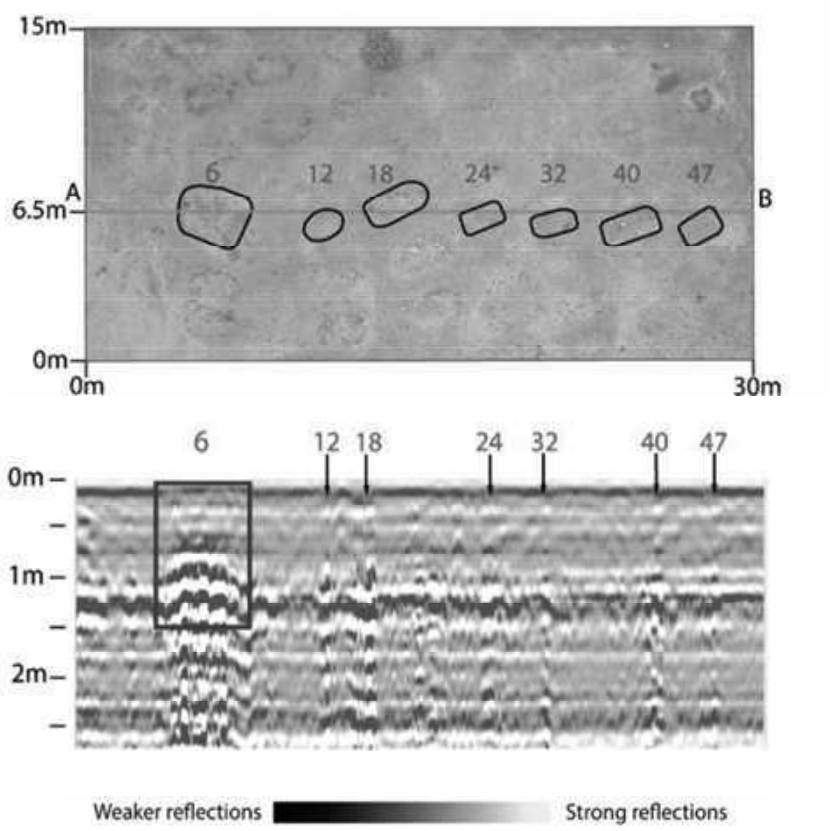


Figure 52. GPR data for features 6, 12, 18, 24, 32, 40, 47. Centre of Archaeology at Staffordshire University and FA/Forensis, 2024.

The green line below indicates a section cut through the survey area at 12.5m, and it runs through three visible sand mounds. The data suggest the presence of graves even in areas devoid of visible mounds above ground, such as feature "53" in the provided image.

Moreover what is important for feature “15” (yellow box) and “52” (blue box), is that although both of them each have one visible sand mound, the data from this section line shows two

anomalies present in each of these locations, suggesting the presence of two graves beneath each sand mound.

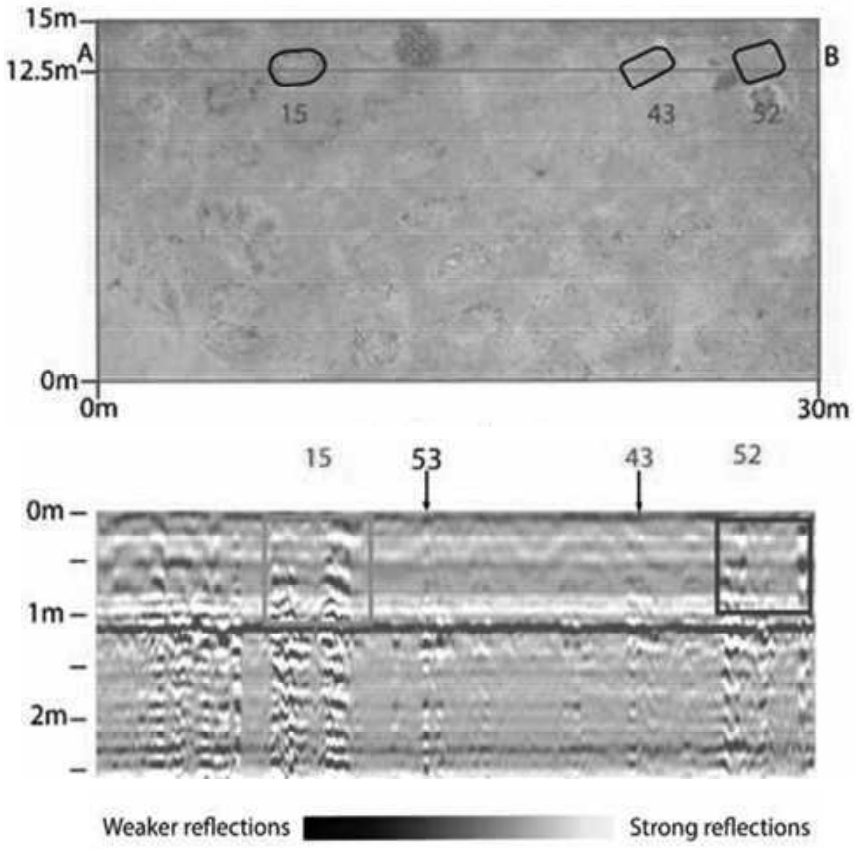


Figure 53. GPR data for features 15, 43, 52, 53. Centre of Archaeology and FA/Forensis, 2024.

8.1.2. Site 2

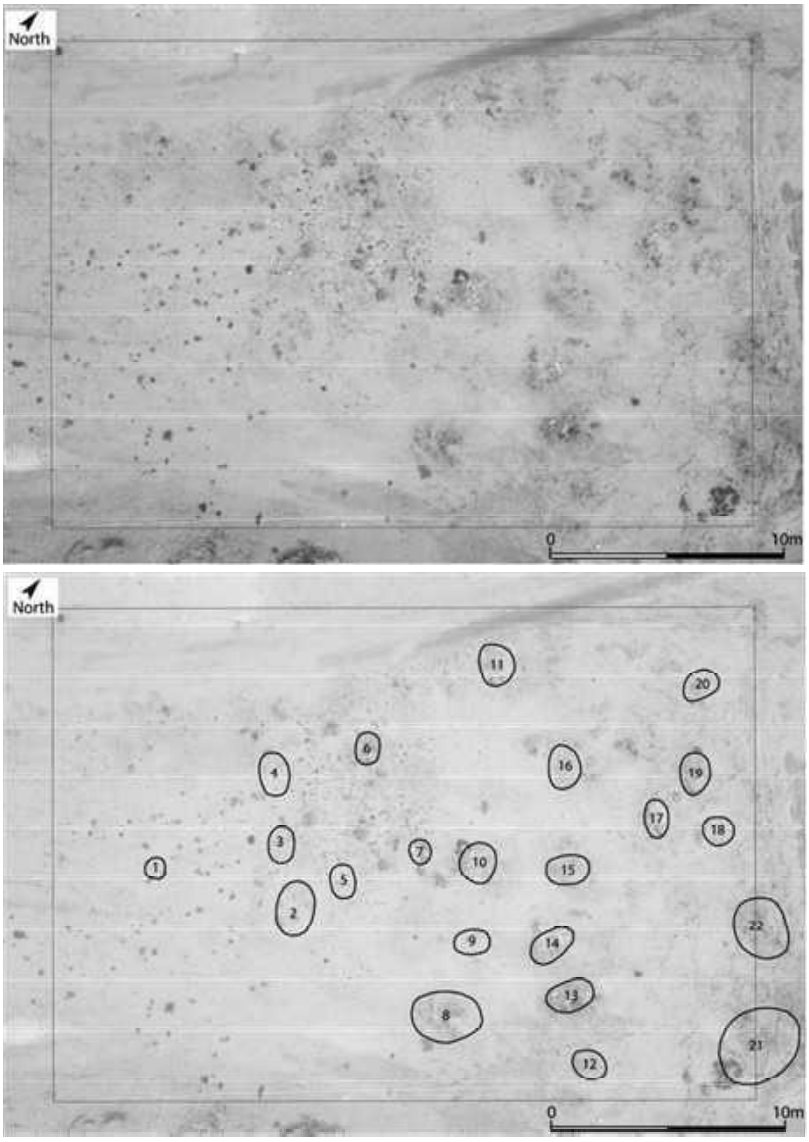


Figure 54. The detailed aerial image of the survey grid showing the visible sand mounds (left) and the feature numbers assigned to each (right). Centre of Archaeology and FA/Forensis, 2024.

The survey area for site 2 measures 30m by 19.5m, with a similar topography of dry sand sloping from southwest to northeast. As depicted in the provided image, we identified 22 visible sand mounds in this survey area. The survey successfully identified significant buried features, providing insights into both visible and concealed remnants at this site. Due to the abundance of visible mounds, only a representative section of this site will be elaborated upon here, encapsulating the results of the GPR survey.

The green line in Figure 42 indicates a section cut through the survey area at 10m, and it runs through three visible sand mounds. In this case all three features indicate anomalies below ground. The data beneath feature 3 and 18 are similar to what was observed in the previous survey area indicating a high possibility that these are graves. However, although a pit-like anomaly is observed in the vicinity of feature 7, further investigations need to take place in order to confirm it being a grave. This anomaly could be the result of natural geology or a pit or grave-like feature that is backfilled with stones rather than sand.

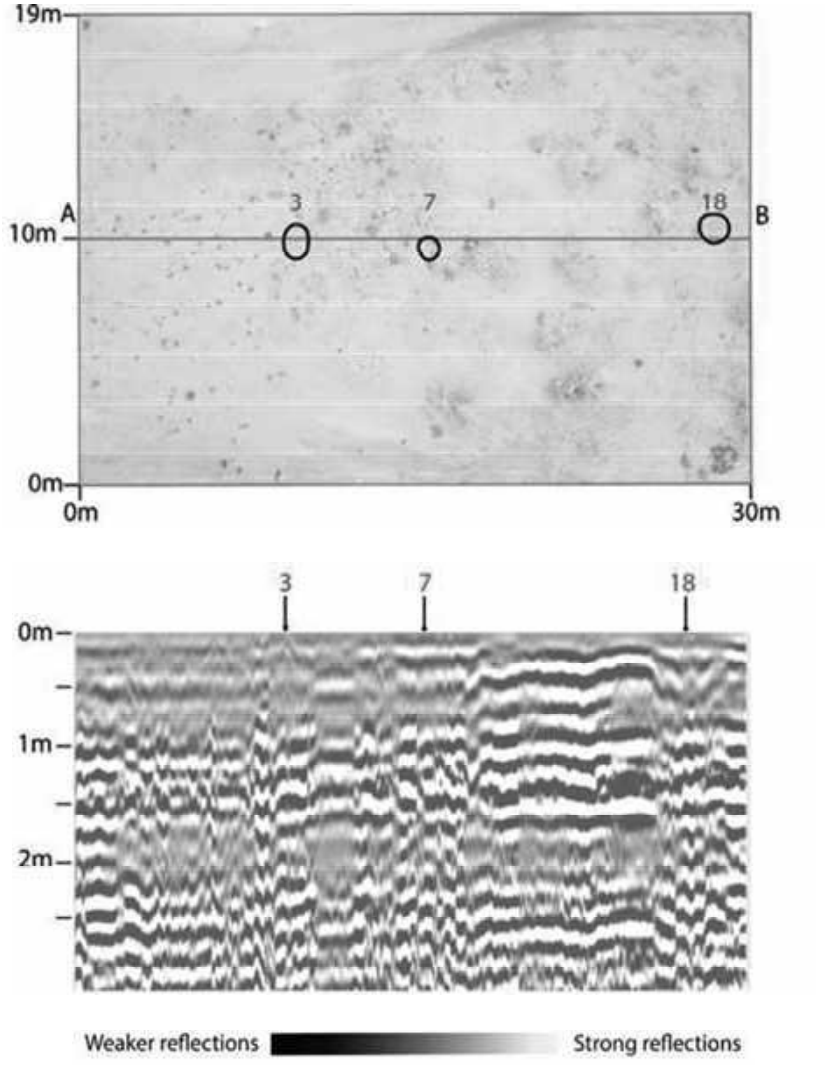


Figure 55. GPR data for features 3, 7, 18. Centre of Archaeology and FA/Forensis, 2024.

The green line in Figure 43, indicates a section cut through the survey area at 3m, and it runs through three visible sand mounds.The GPR data in this section demonstrates that not all visible sand mounds are graves. The interpretation of data presented below indicates that feature 13 may be formed from wind blown sand covering a natural geological outcrop. The visible rocks on the surface of this mound also appear to be bigger and different in form than the ones in other locations at both sites.

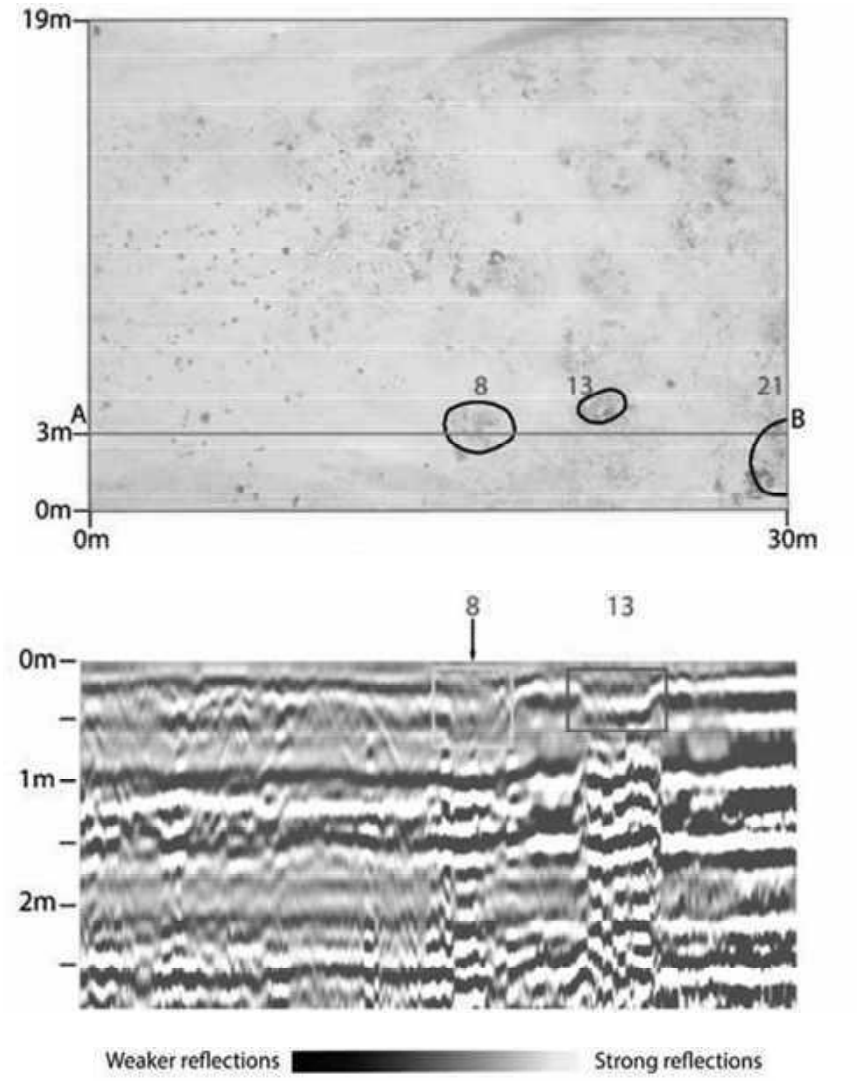


Figure 56. GPR data for features 8, 13, 21. Centre of Archaeology and FA/Forensis, 2024.

8.2. Findings

Our analysis has revealed the following findings:

I. In two identified sites our analysis of all available data proves with high likelihood the presence of graves.
II. Based on archival imagery analysis and in-depth interviews and testimony collection with descendants of survivors from Shark Island as well as oral historians, the identified graves have a high probability of containing human remains of Nama and Herero inmates killed in the Shark Island concentration camp.
III. Ground-penetrating radar (GPR) analysis of the identified sites indicate both individual and mass graves.
IV. In survey area 1, the GPR data confirms the likelihood that all 52 recorded mounds relate to anomalies beneath the ground and that these can be interpreted as graves. Of these, three are larger than the others that are likely to be mass graves (features 6, 19 and maybe 3). The analysis also suggests that at least 5 other graves are present but without visible mounds on the surface. Therefore the total number of identified graves in this area would be 58 graves, with three showing indications of being larger than the rest.
V. In survey area 2, the GPR data confirms the likelihood that at least 4 recorded mounds relate to anomalies beneath the ground and that these can be interpreted as graves. However the data suggest that up to 6 more graves might be present in this area.

9. Recommendations

9.1. Shark Island

Our findings show that the extensive terraforming and the geological alteration that Shark Island has undergone substantially compromised it as a place of historical significance. The tourist camp’s infrastructure, such as roads or sanitary facilities, are situated directly on top of the former concentration camp, thus, of an area of archaeological, historical, religious and emotional significance.

We recommend preserving the entire island and the waters surrounding it, including the geology with its traces of forced labour. Further research in the form of archeological surveys is needed to better understand the living and working conditions in the concentration camp. Lastly, the site needs to be dedicated to remembrance, honoring the victims and survivors of the genocide and the resistance fighters that battled the oppression by the German Imperial power.

9.2. The port and the seabed surrounding Shark Island

The proposed extension of Lüderitz port in Robert Harbour poses an imminent risk of further desecrating the heritage site directly and indirectly, as well as disturbing maritime burial places within the jurisdiction of Namport and adjacent waters. Noise from the port will permanently affect the experience of being in this site, preventing solemn contemplation. The view from the city to the former camp and vice versa, situating the atrocities committed here within its local context, will be disrupted if new buildings are constructed on the eastern side of the island.

Written and oral testimonies speak to the presence of human remains in the waters around Shark Island extending beyond the low water mark. Many inmates who were killed or died in the camp were never buried, but thrown into the waters now within Namport's jurisdiction. The terraforming, quay wall construction and land reclamation, including the dredging of material from the seabed close to Shark Island, entailed by the present plans for a port expansion form a serious risk of disturbing human remains and burial places. These sites are protected under Namibia's Burial Place Ordinance 27 of 1966.[14]

To ensure the holistic preservation of Shark Island as a Heritage Site in the true meaning of the term, Forensis and FA recommend an immediate and permanent moratorium on all construction on top of or in direct vicinity of Shark Island. Moreover, we recommend a holistic, non-invasive archaeological study of the seabed surrounding the island, which constitutes a burial place for many victims of the genocide.

9.3. Burial Sites

The GPR survey of the two sites discussed in the previous sections strongly suggests the presence of graves in both locations. This clearly indicates the urgency to seal off and preserve these areas and their immediate surroundings, while further forensic and archeological investigations are being conducted. Currently most of these protected grave sites are in poor condition and subject to erosion if immediate conservation measures are not undertaken.

In line with the archaeological assessment by the Centre of Archaeology at Staffordshire University, Forensis and FA recommend the full archeological study of the sites, expanding the size and scope of the analysis already carried out. This expansion both includes the increase in size of the GPR-survey area (as the sites analysed only represent a small sample of the overall area that likely contains graves) and scope, including community-led excavations confirming the presence of buried human remains and providing further insight into the circumstances surrounding their death.

[14] Burial Place Ordinance, OG 2728, Republic of Namibia (1966). https://www.lac.org.na/laws/annoSTAT/Burial%20Place%20Ordinance%2027%20of%201966.pdf

About Forensic Architecture and Forensis

Forensic Architecture (FA) is a research agency, based at Goldsmiths, University of London. FA's Berlin-based sister agency Forensis e.V. was founded to expand upon this work[15]. The teams include architects, scientists, academics, journalists, technology experts and other specialised professionals and experts. Forensic Architecture undertakes advanced architectural and media research on behalf of international prosecutors, human rights organisations, as well as political and environmental justice groups. Since 2011, FA have published more than ninety investigations worldwide including in Pakistan, Indonesia, Myanmar, Guatemala, Mexico, Chile, Brazil, the US, UK, Germany, Turkey, Ukraine and Greece.

Our investigations employ pioneering techniques in spatial and architectural analysis, open-source investigation, digital modelling, and immersive technologies, as well as documentary research, situated interviews, and academic collaboration. Findings from our investigations have been presented in national and international courtrooms, parliamentary inquiries, and exhibitions at some of the world's leading cultural institutions and in international media, as well as in citizen's tribunals and community assemblies.

FA's case files have been submitted as evidence in national legal processes across the world, including in Israeli courts. The agency's findings have also been submitted or presented in international jurisdictions including the European Court of Human Rights and the UN General Assembly, and in national courtrooms, parliamentary inquiries, and truth commissions around the world.

Forensic Architecture has been recognised for its work in the field of journalism with a Peabody Award for Digital and Interactive Storytelling (2021), the European Cultural Foundation (ECF) Princess Margriet Award for Culture (2018), the Designboom Design Prize for Social Impact (2019), and a Peabody-Facebook Futures of Media Award for Interactive Storytelling (2017). FA director Eyal Weizman is a life fellow of the British Academy and recipient of an MBE for 'services to architecture'. He is a member of the Technology Advisory Board of the International Criminal Court in The Hague and is on the board of the Centre for Investigative Journalism.

Forensis is the co-recipient of the "Daphne Caruana Galizia Prize for Journalism 2023" for the investigation on the Pylos Shipwreck.

More information on our casework available at: www.forensic-architecture.org & https://counter-investigations.org

[15] References to 'FA' throughout this document should be understood to refer jointly to the activities, and findings, of FA and Forensis together.

NTLA Nomination to Declare Shark Island as World Heritage Site: 11 March 2025

13 February 2024

Lüderitz Port Extension endangering sites of the 1904–1908 genocide

To whom it may concern,

Re: urgent need for an immediate moratorium on all planned construction in the immediate vicinity of Shark Island, and archaeological study and preservation of Shark Island and related sites.

We write in light of two years of research conducted with and for the **Nama Traditional Leaders' Association (NTLA)** and the **Ovaherero Traditional Authority (OTA)**. That research, conducted by Forensis and Forensic Architecture (FA), examined key sites of historical relevance to the 1904-08 genocide perpetrated by German colonial troops against the Nama and Ovaherero indigenous peoples.

As part of this research, Forensis and FA have conducted archaeological analysis on Shark Island, the site of a concentration camp run by the German colonial administration between 1905-1908. During this period, Ovaherero and Nama prisoners were subjected to detention, brutal intimidation, forced labour, torture, sexual abuse and execution. As such, Shark Island is a place of utmost historical and cultural significance, not only for the descendant communities but for the Namibian society as a whole, and one that must be preserved in its entirety for generations to come.

Shark Island and its surroundings are within the ancestral lands of the Nama people. As historical inhabitants and stewards of this land, the Nama people, represented by the NTLA, are entitled to exercise their right to free, prior and informed consent as defined in the United Nations Declaration on the Rights of Indigenous Peoples. As such, the Nama are entitled access to the full and up to date plans for all construction on this land and the relevant studies and reports for any of these projects. Thus far, NTLA has not been consulted.

We hope that this letter paves the way for a relationship of transparency between Namport and the NTLA and OTA, and we hope to identify together a fair and just course of action regarding all infrastructural development planned on ancestral Nama land. No development should be taking place at the expense of the memory and dignity of the victims of the genocide.

1

Research Findings

Our team has gathered new testimonies from descendants of genocide victims, archival materials, historical aerial imagery, contemporary drone footage, and colonial records.

Our findings to date reveal the following:

1- Present-day infrastructure, including tourist facilities, roads, residential development and port infrastructure have been built atop the former concentration camp, irreversibly compromising it as a place of historical significance.
2- **The proposed extension of Lüderitz port in Robert Harbour, poses an imminent risk of further desecrating the heritage site directly and indirectly, as well as disturbing burial places within the jurisdiction of Namport and adjacent waters.**
3- In collaboration with archaeologists, the team has identified and surveyed unmarked graves linked to the genocide perpetrated against the Ovaherero and Nama, located on the outskirts of Lüderitz. These burial places are within areas slated for development by Hyphen, whose activities related to green hydrogen production and export are among the main motivations for the port expansion.

Impact of proposed construction plans

Informed by the research findings, we believe an immediate moratorium is needed for the following reasons:

1- Cultural impact

The port expansion will interfere with the ability of the Nama and Ovaherero peoples to commemorate the site of the former concentration camp. It will do so by:

a. Interfering with the ability for peaceful memorialisation on the Island due to high levels of noise and visual pollution. The port's structure is likely to pose a heavy physical and visual presence on the Island immediately adjacent to where the former concentration camp was located, and where descendants commemorate their ancestors.
b. Posing a high risk to damage the Island, its future memorial structures, and its burial places due to the handling of highly toxic and flammable materials. The descendants of Shark Island's victims are unable to accept any amount of risk to the site or the burial places on and around the Island.
c. Blocking the line of sight of the Island, particularly the sites of the former camps, from the town centre. Descendants of Shark Island prisoners testify that their

ancestors were executed on a high point of the island, adjacent to the lighthouse (see centre of map, Figure 1) - a brutal and intentional act of public humiliation and intimidation of the indigenous population. This line of sight is therefore central to the Heritage Site of Shark Island and as such must be preserved to retain the site's historical and cultural value.

We highlight Namport's obligations towards the protection and conservation of heritage sites under the National Heritage Act.

2- Destruction of potential underwater human remains & gravesites

Written and oral testimonies speak to the likely presence of human remains in the waters around Shark Island extending beyond the mean low water mark. Many prisoners that were killed or died in the camp were never buried, but instead thrown into the waters now within Namport's jurisdiction. Therefore, there is a credible and substantial risk that human remains lie within the bounds of the proposed expansion.

The terraforming, quay wall construction and land reclamation (including the dredging of material from the seabed close to Shark Island), entailed by the present plans run a serious risk of disturbing human remains and burial places. These sites are protected under Namibia's Burial Place Ordinance 27 of 1966.[1]

Demands

Based on the outlined concerns, NTLA, OTA, FA and Forensis strongly object to the planned construction activity. We demand:

1. **An immediate and permanent moratorium on all construction whether on top of or in direct vicinity of Shark Island.**
2. **A holistic, non-invasive, archaeological study of the entire area of Shark Island and its vicinity, including the surrounding seabed, which constitutes a burial place for many victims of the genocide.**
3. **Preservation of Shark Island as a Heritage Site in the true meaning of the term, as well as related burial places.**

[1] Burial Place Ordinance Law 27 of 1966: https://www.lac.org.na/laws/annoSTAT/Burial%20Place%20Ordinance%2027%20of%201966.pdf

The undersigned parties request that the following concrete demands be met:

4. **The development of an alternative plan for the Phase 2 expansion of the Lüderitz Port, as required under the Environmental Management Act and informed by the outcomes of the environmental impact assessment, to be shared with the above parties.**
5. **NTLA and OTA to be included in all forthcoming consultation processes pertaining to this development, in line with international human rights law protecting the rights of indigenous and tribal peoples.**
6. **The full and up to date report on the environmental and cultural impacts of the project be sent to the signed parties.**
7. **A representative of Namport to attend an event organised by NTLA and OTA in April 2024 in Lüderitz – details will be provided in an invitation to follow.**

NTLA, OTA, FA and Forensis have begun to inform stakeholders, decision makers and human rights organisations on national and international level regarding the planned construction and reserve the right to further intervene in this process. We have also shared our research findings with local and international media outlets and journalists.

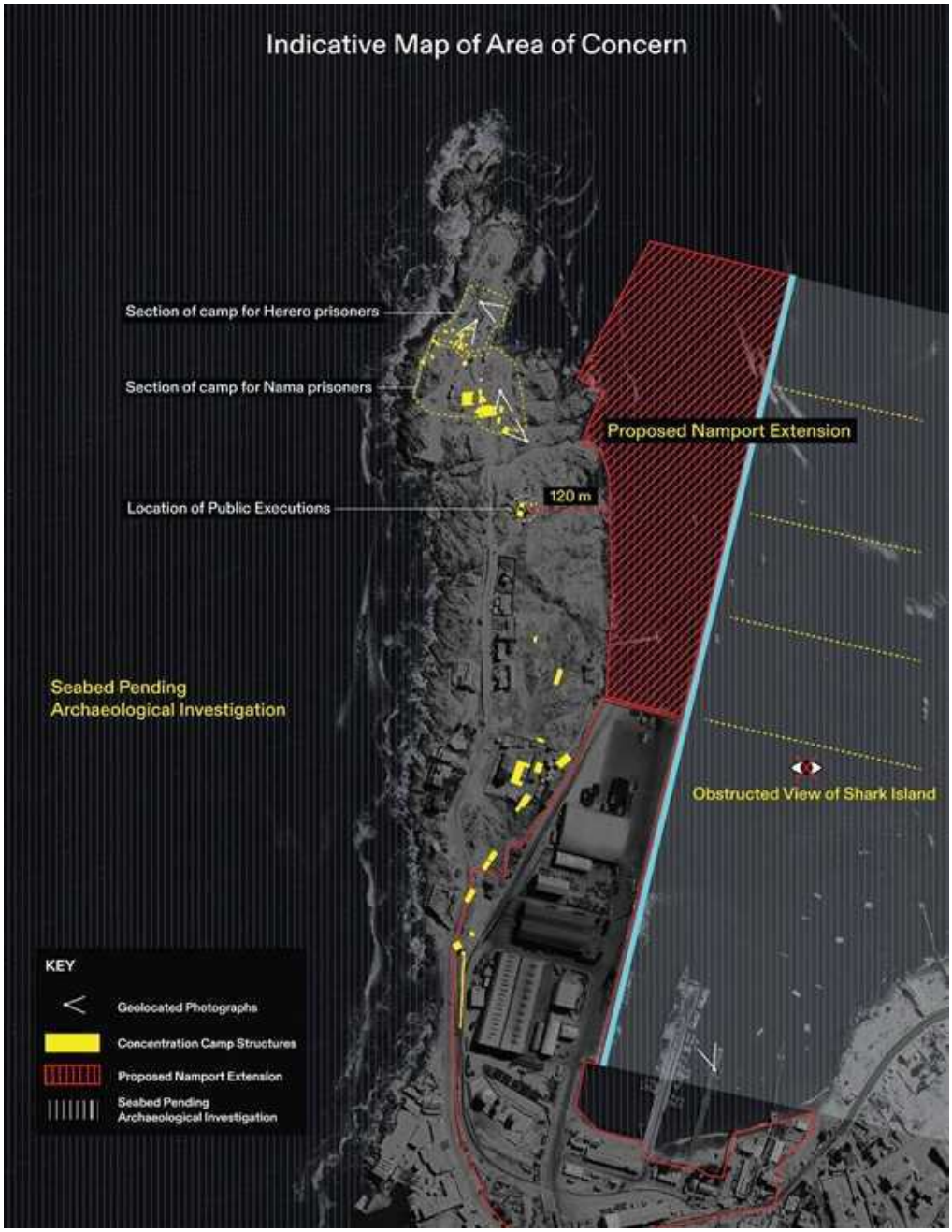


Fig. 1 - Spatial analysis by Forensis/FA reveals how key sites of the concentration camp have been overbuilt and how the proposed port extension threatens to further disrupt and continue the erasure of traces.

5



Fig. 2 - Camp infrastructure visible on Shark Island in archival images retrieved from the Namibian Scientific Society, showing the view from the bay and part of Lüderitz towards Shark Island.



Fig. 3- Using precise 3D models and plans released by Geo Pollution Ltd. of the Namport extension, the 700m extension with potential build-up infrastructure for storage and processing disturbs the line of sight onto the island.

6



Fig. 2 - Forensis/FA have confirmed known and identified new mass graves around Radford Bay that likely hold the human remains of executed prisoners from Shark Island concentration camp (marked as site 1,2 & 3). Many more sites are suspected in adjacency (marked in tainted red on the map) to these sites of which only a small sample was analysed by forensic archaeologists.

7

About Forensis and FA

Forensic Architecture (FA) is a research agency, based at Goldsmiths, University of London since 2011. Forensis was founded in 2021 in Berlin by members of FA, as a not-for-profit association (e.V.). The two agencies work for and in collaboration with individuals and communities affected by human rights violations, to support their demands for justice, reparations and accountability.

Our investigations employ cutting-edge techniques in spatial and architectural analysis, open-source investigation, digital modelling, immersive technologies, as well as documentary research, interviews and academic collaboration. Our findings have been presented in national and international courtrooms, truth commissions, parliamentary inquiries in Germany and around the world, and exhibitions at world-leading cultural institutions and in international media.

We sincerely thank you for considering the issues raised herein and look forward to hearing from you. We hope to receive a response on this urgent matter within 14 days.

Sincerely yours,

Paramount Chief Mutjinde Katjiua, Ovaherero Traditional Authority

Sima Luipert, Nama Traditional Leaders Association

Eyal Weizman, Forensic Architecture/Forensis

Letter from European Center for Constitutional and Human Rights: 26 January 2026

NAMA TRADITIONAL LEADERS ASSOCIATION
PO Box 2097, Keetmanshoop, Namibia
Enquiries: Maboss Johannes Ortmann
Email: maboss.ortmann@gmail.com
Mobile: +264 81 438 1393

The Director National Heritage Council
Ms. Erica Ndalikokule
52 Robert Mugabe Avenue
Windhoek, Namibia

Date: 11th March 2025

Dear Ms Ndalikolule

RE: NOMINATION OF SHARK ISLAND AS A WORLD HERITAGE SITE

The aforementioned subject matter bear's reference.

The Nama Traditional Authorities Association (NTLA) comprises of the ten Nama Traditional Authorities, legally gazetted in terms of the Traditional Authorities Act, 2000 (No 25 of 2000).

The main objectives of the NTLA are to promote unity amongst the Nama community, upliftment of their socio-economic conditions and to correct historic injustices. The fight for restorative justice for GENOCIDE committed against the Nama and the Ovaherero by the German Colonial power has remains a core issue for the Nama and Ovaherero leadership. The right to self-participation during the negotiations between the governments of Namibia and Germany has been key human right which the Nama leadership has been fighting for, but were sadly excluded.

It is against the aforesaid that the NTLA hereby nominate Shark Island situated on the southwestern coast of Namibia as a world heritage site. Shark Island also known as the "Death Camp" was opened as a concentration camp in 1905 at the height of the German Genocide against the Nama and the Ovaherero peoples and closed in 1907.

I am attaching herewith as annexure A- full historical background of the Shark Island Concentration camp, and a research report which was conducted by Forensic Architecture (FA), and link to the Shark Island documentary also produced by FA.

Furthermore, I would like to bring to your attention Namport's aggressive pursuit to extend the current harbor in Luderitz which is adjacent to Shark Island. The extension of the harbor will have a negative impact on the historical, heritage and cultural significance of the sacred site.

Shark Island and its surroundings are within the ancestral lands of the Nama people. As historical inhabitants and stewards of this land, the Nama people, represented by the NTLA, are entitled to exercise their rights to free, prior and informed consent as defined in the United Nations Declaration on the Rights of Indigenous Peoples. It is at this very Shark Island that over 4000 Nama and Ovaherero people died in the most horrific circumstances. Some were decapitated, some died

of extreme weather conditions, others simply worked to death. Many more ran in the cold Atlantic waters and were eaten by the sharks.

Hence on the bottom of the Atlantic Ocean surrounding Shark Island lies our ancestors. It is against aforesaid and for more obvious reasons that we further request that as per the best practice a buffer zone be set up around the surroundings of Shark Island. Further we request the National Heritage Council, once again, to implement the Cabinet Directive that Namibia Wildlife Resorts stop its tourism activities on Shark Island. Your office will appreciate that this is a long outstanding directive which has not been executed with the due diligence it deserves

Dear Ms. Ndalikolule, please be assured of our highest regard for your office, as we continue to work together to find a solution to this painful heritage.

Please do not hesitate to contact me personally at **+264 81 438 1393.**

Yours faithfully

JOHANNES ORTMANN

COO/ PROJECT COORDINATOR

Letter from Forensic Architecture: 26 January 2026

EUROPEAN CENTER FOR CONSTITUTIONAL AND HUMAN RIGHTS

ECCHR e.V., ZOSSENER STR. 55-58, 10961 BERLIN, GERMANY

Chief Executive Officer: Mr. Andrew Kanime
The Namibian Ports Authority (Namport)
No. 17, Rikumbi Kandanga Road
Walvis Bay, Namibia

EUROPEAN CENTER FOR
CONSTITUTIONAL AND
HUMAN RIGHTS e.V.

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VORSTAND:
DIETER HUMMEL
ALBERT KONCSEK
LOTTE LEICHT
TOBIAS SINGELNSTEIN

GENERALSEKRETÄR:
WOLFGANG KALECK

Berlin, 26.01.2026

RE: Support for the Formal Objection of the Nama Traditional Leaders Association (NTLA) to the Proposed Phase 1 Land Reclamation and Port Expansion at Lüderitz

Dear Mr Kanime,

ECCHR is an independent, non-profit legal and educational organization dedicated to enforcing civil and human rights worldwide. It was founded in 2007 to protect and enforce the rights guaranteed by the Universal Declaration of Human Rights, as well as other human rights declarations and national constitutions, through legal means. Together with those affected and partners worldwide, ECCHR uses legal means to end impunity for those responsible for torture, war crimes, sexual and gender-based violence, corporate exploitation and fortressed borders.

Since 2018, ECCHR has worked with the Nama Traditional Leaders Association and other groups representing the Ovaherero on reparations and justice for the genocide and other crimes committed during German occupation and colonialism of then German South-West Africa. Together, we have made submissions to different Special Rapporteurs and other human rights mechanisms of the United Nations and conducted other advocacy initiatives in Germany and Namibia in order to advance the full recognition of the crimes committed and reparations for the affected communities and descendants of victims.

In 2022, we introduced our long-standing partners, Forensic Architecture and Forensis to the NTLA to conduct joint research on the history of the genocide and other sites and events of importance to Nama resistance against colonial oppression, dispossession and exploitation. Until today, they have carried out investigations on Shark Island, Swakopmund, Hornkranz and other locations.

Drawing on this extensive body of research,

- we express our full and unequivocal support for the submission made by the Nama Traditional Leaders Association (NTLA) regarding the Environmental Impact Assessment (EIA) for the proposed Lüderitz port expansion;
- we support the NTLA's objection to the proposed Phase 1 land reclamation and port expansion at Lüderitz.

We are concerned that the current EIA process does not adequately involve the NTLA as an indigenous group and custodian of Shark Island and its surrounding land and water in order to get their Free, Prior and Informed Consent as demanded by International Law.

Sincerely,

Anne Schroeter

Forensic Architecture is a multidisciplinary research group based at Goldsmiths, University of London, that uses architectural techniques and technologies to investigate cases of state violence and violations of human rights around the world.

Goldsmiths, University of London
8 Lewisham Way
London SE14 6NW
United Kingdom

forensic-architecture.org

London, 26 January 2026

To: André Faul
Geo Pollution Technologies (Pty) Ltd
PO Box 11073
Windhoek, Namibia

Re: Support for the Formal Objection of the Nama Traditional Leaders Association (NTLA) to the Proposed Phase 1 Land Reclamation and Port Expansion at Lüderitz

Forensic Architecture (FA) is an investigative research agency based at Goldsmiths, University of London. The agency undertakes advanced spatial and media research into cases of human rights violations, working with communities affected by political violence, human rights organisations, international prosecutors, and environmental justice groups. Our research has been admitted as evidence before courts and tribunals around the world—including in the United States, United Kingdom, Germany, Greece, Israel, Colombia, and Guatemala—and our investigations have been submitted to the International Court of Justice, European Court of Human Rights, and presented before the United Nations General Assembly.

Since 2022, Forensic Architecture and our partner organisation Forensis has worked in close partnership with the Nama Traditional Leaders Association (NTLA). Under their leadership, our research process has been grounded in community expertise, oral histories, and cultural knowledge. The interdisciplinary team I have led has carried out multi-year investigations into key sites of colonial genocide across Namibia, including Shark Island, Swakopmund, Hornkranz and other locations central to the history of violence and dispossession. In my capacity as Advanced Researcher and Researcher-in-Charge of this portfolio of projects, I have applied my expertise in spatial analysis and environmental reconstruction to support the NTLA's heritage claims and ensure the technical robustness of our findings.

Forensic Architecture [redacted]

Drawing on this extensive body of research, I write to express our full and unequivocal support for the submission made by the Nama Traditional Leaders Association (NTLA) regarding the Environmental Impact Assessment (EIA) for the proposed Lüderitz port expansion.

Based on this long-term, collaborative research relationship and our full confidence in the NTLA's standing as the Traditional Authority representing descendants of genocide survivors, FA strongly supports the NTLA's objection to the proposed Phase 1 land reclamation and port expansion at Lüderitz. In my capacity as Researcher-in-Charge and

We are concerned that the current EIA process does not adequately reflect the historical, spatial and cultural significance of Shark Island and its surrounding waters, nor the established rights of the NTLA.

Given the gravity of these concerns and the irreversibility of potential harm, FA supports the NTLA's call for all reclamation, dredging, and construction activities in this area to be halted.

Should Namport seek alternative pathways, we also support the NTLA's demand for meaningful, good-faith engagement grounded in Free, Prior and Informed Consent and in reparative, enforceable mechanisms. We reiterate that any development affecting this landscape must proceed only with the NTLA's full and informed consent.

Sincerely,

Agata Nguyen Chuong
Researcher-in-Charge

On behalf of Forensic Architecture

Correspondence Prior to onset of the Environmental Assessment Process for the Phase 2 Port Expansion Project

-------- Forwarded Message --------

Subject: Namport Extension Shark Island

Date: Mon, 29 Jan 2024 17:07:56 +0000

From: Jasper Julius Humpert <[redacted]>

To:[redacted], Agata Nguyen Chuong <[redacted]>, Ashkan Cheheltan <[redacted]>, Tobechukwu Onwukeme <[redacted]>, [redacted]

To whom this may concern,

I am writing to you as part of the research and investigation team from Forensic Architecture, Goldsmiths College, University of London and its Berlin-based sister agency Forensis (here in CC).

As a joint investigative research agency, we research together with and on behalf of victim communities suffering human rights abuses through state, corporate and environmental acts of violence. As an internationally acclaimed human rights research group our work has featured prominently in international and national courts, parliamentary inquiry committees around the globe and different cultural forums.

I am getting in touch with you as we have carried out critical research activities together with our partner organisations NTLA and OTA, representing the Nama and Ovaherero nations in Namibia, with specific attention to colonial sites of atrocities in Lüderitz. Our research has focused on the in-depth forensic and archaeological analysis of the former concentration camp operated by German colonial troops on Shark Island. Using spatial research techniques we have located the precise locations of former camp infrastructure as well as located sites of burial and mass graves around Shark Island linked to the concentration camp.

These sites represent important cultural heritage and need urgent protection. We are aware of the ongoing planning of the Namport extension as well as the environmental impact assessment that is being carried out by your organisations. The planned constructions are putting these sites in significant danger and risk destruction, obstruction and the further reinforcement of a disputed status quo on how the heritage sites are dealt with. As far as we and our partners are concerned there has not been any attempt of genuine consultation of the relevant communities regarding this project.

I am writing to you to kindly request a statement and all relevant information regarding the protection of endangered heritage sites linked to planning permissions and the timeline as well as processes of participation within the environmental impact assessments.

Forensic Architecture and Forensis remain available for conversation to be informed about the precautionary measures and community engagement planned in relation to the port extension.

We are looking forward to hearing from you.

Best,

Jasper Julius Humpert *(he/him)*

Research - Communications
FORENSIS // INVESTIGATIVE COMMONS

[redacted]

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4 Marien Ngouabi Street
Windhoek
Namibia

Tel: Int +264 61 223356
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LEGAL ASSISTANCE CENTRE

Toni Hancox (Director)

Corinna van Wyk
Chloe Ashley Brandt

Recipient of the UNICEF Maurice Pate Human Rights Award – 1997
JP Karuaihe Human Rights Excellence Award – 2008, 2010, 2014, 2016 and 2020 and Social Responsibility Award – 2013

21 June 2024 Our Ref: GH_cultural / heritage rights_cjvw

NAMPORTS AUTHORITY
Executive Committee
Namibia

Attention: **Mr Elzevir W. Gelderbloem** Pr. Eng. (Namport) <Elzevir@namport.com.na>

Dear Sir

Namport - Urgent request for specific items

We act herein on behalf of NTLA, OTA, FA, Forensis (referred to as “our clients” hereinafter).

We have been instructed to respond to your reply of 14 February 2024 to a letter addressed on 13 February 2024. While our clients understand that you are in the process of conducting environmental and heritage studies, our clients remain extremely concerned that the existing and new research on Shark Island, along with the likely impact this expansion will have on the cultural and environmental character of Shark Island have largely not been acknowledged. We also wanted to bring to your attention that our clients have still not received any of the requested documents from their correspondence dated 13 February 2024 letter.

We are instructed to reiterate the principle demands of NTLA, OTA, FA, and Forensis:

An immediate and permanent moratorium on all construction whether on top of or in direct vicinity of Shark Island.

Furthermore, we are also instructed to request on an urgent basis, which we hereby do, the following from Namport:

a. The Archaeological / Heritage study which Andre Faul from Geo Pollution Technologies said was to be completed by February 2024.
b. Confirmation that the NTLA and OTA are included in all forthcoming decision-making processes, not just as an interested/affected party for the impact assessments but as decision making parties with full transparency to all plans and discussions on the planned port expansion.
c. All and any environmental impact assessments conducted to date and in the future.
d. All up to date construction plans and drawings.

Trustees of the Legal Assistance Trust:
Clement Daniels (Chairperson) Norman Tjombe Taamba Iithete
Tangeni Amupadhi Toni Hancox (ex officio) Gladice Pickering

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e. Minutes from all previous community consultation meetings.
f. The development of an alternative plan for the Phase 2 expansion of the Lüderitz Port, as required under the Environmental Management Act and informed by the outcomes of the environmental impact assessment, to be shared with the above parties.
g. All previously published documents shared publicly and with the registered interested and affected parties.
h. A response to the statement shared in this article, claiming that the Luderitz Port expansion is envisaged as a temporary measure **before** the larger new port facility at Angra Point is completed, rendering this expansion unnecessary.

Furthermore, the history of Shark Island is well known, and documentation published in this report, available since 12 April, affirms and reinforces what the affected communities and descendants of the genocide victims and survivors have informed us about the atrocities that were carried out at Shark Island. We note that you attended the event in April organised by NTLA, which summarised these findings and addressed the importance of preserving this site.

From a cultural heritage perspective alone, no further study needs to be conducted to conclude that construction immediately adjacent to the island followed by the operation of heavy machinery and toxic materials there would be unacceptable for any cultural heritage site and for the communities which claim it. As we mentioned in our clients previous letter, also includes the disturbance and desecration of underwater human remains adjacent to the island.

Kindly respond to our correspondence urgently and include a detailed address to this demand for a moratorium on construction as well as to our clients requests for the above items within 7 days of date hereof.

It is our wish and intention to resolve this matter amicably however, should we not receive a comprehensive and affirmative response to our demand and requested items we will refer this matter to the Office of the Ombudsman for further investigation.

We sincerely hope that this will not necessary.

Best regards,

Trustees of the Legal Assistance Trust:
Clement Daniels (Chairperson) Norman Tjombe Taamba Iithete
Tangeni Amupadhi Toni Hancox (ex officio) Gladice Pickering

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JP Karuaihe Human Rights Excellence Award – 2008, 2010, 2014, 2016 and 2020 and Social Responsibility Award – 2013



Corinna van Wyk
Project Coordinator (Land, Environment and Development (LEAD)
Legal Practitioner
Legal Action Center

Trustees of the Legal Assistance Trust:
Clement Daniels (Chairperson) Norman Tjombe Taamba Iithete
Tangeni Amupadhi Toni Hancox (ex officio) Gladice Pickering

Appendix H 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 250 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	:	24
Nationality	:	Namibian
Position	:	Environmental Scientist
Specialisation	:	Environmental Toxicology
Languages	:	Afrikaans – speaking, reading, writing – excellent
		English – speaking, reading, writing – excellent

EDUCATION AND PROFESSIONAL STATUS:

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

First Aid Class A	EMTSS, 2017, OSH-Med 2022
Basic Fire Fighting	EMTSS, 2017, OSH-Med 2022

PROFESSIONAL SOCIETY AFFILIATION:

Environmental Assessment Professionals of Namibia (Environmental Assessment Practitioner)

AREAS OF EXPERTISE:

Knowledge and expertise in:

- Environmental Impact Assessments
- Environmental Management Plans
- Public Participation
- 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:	+250
Research Reports & Manuals:	5
Conference Presentations:	1