2024

ENVIRONMENTAL SCOPING REPORT

Proposed Construction and Operation of the Solar Power Plant and its Associated Infrastructure to Support the Production of Green Hydrogen at the Remainder of Farm Geluk No. 116, Erongo Region

ECT
ENVIRONAM CONSULTANTS TRADING

For: Elof Hansson Hydrogen Namibia (Pty) Ltd

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ACRONYMS

AIDS Acquired Immuno Deficiency Syndrome

BID Background Information Document

BMA Biodiversity Management Areas

CBD Convention on Biological Diversity

DEA Department of Environmental Affairs

EA Environmental Assessment

EAP	Environmental Assessment Practitioner
EBRD	European Bank Reconstruction and Development
EBSA	Ecological Biologically Significant Areas
EC	Environmental Commissioner
ECC	Environmental Clearance Certificate
EIA	Environmental Impact Assessment
EMA	Environmental Management Act (Act No. 7 of 2007)
EMP	Environmental Management Plan
EP	Equator Principle
EPFI	Equator Principle Financial
ESF	Environmental Social Framework
ESMS	Environmental Social Management System
ESS	Environmental Social Safeguard
GDP	Gross Domestic Product
HIV	Human Immune Virus
I&AP	Interested and Affected Parties
IFC	International Finance Corporation
IUCN	International Union for Conservation of Nature
MAWLR	Ministry of Agriculture Water and Land Reform
MEFT	Ministry of Environment, Forestry and Tourism
ToRs	Terms of References
UNESCO	United Nations Educational, Scientific and Cultural Organization
WB	Walvis Bay

EXECUTIVE SUMMARY

(a) Introduction

Elof Hansson Hydrogen Namibia (Pty) Ltd, a company incorporated in Namibia and its strategic partners intends to develop a green hydrogen manufacturing plant in Namibia. The proposed project will be located in Erongo Region with Walvis Bays earmarked as the port of export. Overall, the production of green hydrogen will consist of; (i) a state-of-the-art photovoltaic solar plant that will power the all-production processes, (ii) a seawater desalination plant that will supply distilled water to the electrolysis plant, (iii) an electrolysis plant that will produce hydrogen (iii) an ammonium synthesis that will produce ammonia and ammonia storage facility.

(b) Statutory requirement

The Namibian Environmental Management Act 2007 (Act No. 7 of 2007) (EMA) and its Environmental Impact Assessment Regulation, Government Gazette 6 February 2012 No. 4878 provides for the sustainable management of the environment and the use of natural resources. The EMA provides a list of activities that may not be undertaken without an Environmental Clearance Certificate (ECC). Each component of the proposed green hydrogen requires an ECC. In consultation with the regulatory authority, the Ministry of Environment Forestry and Tourism (MEFT), it was advised that the EIA should be based on specific distinct components. Consequently, the EIA was divided into the following components (i) Energy generation by solar and its associated linear infrastructure / powerlines (ii) Electrolysis plant and, (iii) seawater desalination plant. This report provides an environmental impact assessment for the proposed solar plant.

(c) Project Description

1.1 The Solar Power Plant

1.1.1 Location

The PV solar farm will be located on desert land, at remainder of Farm Geluk No.116. The farm is situated at coordinates 22.551793°S, 15.34992°E, which is located about 80km north-east of Walvis Bay. The Farm which covers an aerial extent of 7100 ha is owned by Elof Hansson Hydrogen Namibia (Pty) Ltd, the proponent.

1.1.2 Land use

Past activities on the farm were mainly cattle and small stock farming. A Farmstead and supporting infrastructure, such as boreholes, water reservoirs etc. are present on site.

1.2 Linear Infrastructures (Powerlines)

1.2.1 Location

The linear infrastructure will traverse between Farm 58 and the desert site for about 80km. A comprehensive description is provided in Appendix K for route determination.

1.2.2 Powerline Transmission Line

The project will have two (2) transmission lines that will have a servitude of 120m wide separated by a distance of 40m and an outside reserve boundary of 40m on each transmission in line with the NamPower requirements. A service road will be placed in between the transmission lines.

1.3 Substation and Battery Energy Storage System

A substation is a primary feature within any electrical grid. It enables electricity to be transmitted at different voltages, safely and effectively. Besides the substation at the solar Farm, another substation will be constructed at Farm 58 about 80km from the solar Farm which will feed the Battery Energy Storage System (BESS) as well as power the ammonia synthesis and desalination plants. The BESS is necessary to provide electricity during the night / when solar energy is weak. Alternatively, a hydrogen fuel cell concept is considered for supply of electricity overnight.

(d) Project alternatives

The main factor that determined the location of the solar power plant is the amount and quality of sunlight that reaches the site. Farm Geluk 116 has higher solar radiation and longer daylight hours than the locations located in Walvis Bay which are influenced by other factors such as cloud cover, air pollution, seasonal variations and fog (especially in the morning hours).

The sizing of the solar power generation was done in a way that even in months with lowest radiation and shortest days (June/July) there will be enough solar capacity to feed the loads and secure the target output.

1.4 Linear Infrastructures Servitude

The linear infrastructure will traverse between Farm 58 and the desert site for about 80km. To limit the potential environmental impacts, water and hydrogen pipelines will be constructed in one servitude and powerlines in another servitude. The powerlines are meant to join the existing servitude which contains transmission lines for Langer Heinrich Uranium Mine. For areas where topographical and geotechnical constraints make it impossible for a single servitude, minor deviation will be considered. Consequently, route determination of the servitude was influenced by two (2) main factors (i) Topographical and Geotechnical Constraints, mainly the Swakop river crossings and, (ii) Vegetation Cover, mainly the Welwitschia Mirabilis fields.

(e) Environmental Impact Assessment

Potential impacts were identified in accordance to the key Environmental Social Indicators (ESI) and using literature review, site assessment and public participation process. This Chapter describes the potential impacts on the biophysical and socio-economic environments, which may occur due to the proposed activities. These include potential impacts, which may arise during the planning and design phase, potential construction related impacts (i.e., short to medium term) as well as the operational impacts of the proposed development (i.e., long-term impacts).

(f) Conclusion and Recommendation

Most of the construction phase impacts were deemed to have a negative impact without mitigation. However, these were mostly short-term and can be significantly reduced with the mitigation measures.

During the operational phase the impacts of visual; hazardous waste; and ecological impacts were assessed to have a long-term negative effect without mitigation. The impacts will however be significantly reduced when the recommended mitigation measures in the scoping report and environmental management plan (EMP) are implemented.

The impacts on the quality of life of the local communities and on the infrastructure, development is deemed to be positive.

The archaeological and heritage assessment conducted on Farm Geluk, Portion 7 of Farm 58 and Portion 4 of Farm 39 yielded potentially significant heritage resources within the Farm Geluk and surroundings, and site management plans have been proposed. In addition, a chance

find procedures have been outlined should heritage be unearthed during the construction of intended infrastructures for the project.

With the implementation of the recommended mitigation measures in this report as well as in the EMP, the significance of the planning and design, construction and operational phase impacts is likely to be reduced to a Low (negative). It is further extremely important to include an Environmental Control Officer (ECO) on site during the construction phase of the proposed project to ensure that all the mitigation measures discussed in this report and the EMP are enforced.

It is strongly advised that the proponent appoint suitably qualified professionals to design and supervise the construction of the services and other infrastructure. It is also advised to develop and implement a preventative maintenance plan, which shall be monitored and evaluated regularly.

It is noted that where appropriate, these mitigation measures and any others identified by the EC could be enforced as Conditions of Approval in the Environmental Authorisation.

Regulation 15(j) of the EMA, requires that the EAP include an opinion as to whether the listed activity must be authorised and if the opinion is that it must be authorised, any condition that must be made in respect of that authorisation.

Solar powered electricity generation is experiencing rapid growth. A major motivation for deploying solar power is to reduce emissions of carbon dioxide caused by traditional power generation (Turney & Fthenakis, 2011) for the same quantity of energy produced. Although the size of land required by the photovoltaic plant is usually more than fossil fuel plants, the emissions at fossil fuel plants are considerable (air, soil, noise, etc.). Emissions from solar energy are usually negligible to none. Photovoltaic power plant impacts are reversible in the short-term because after decommissioning, the area can be returned to its previous state and become available for other activities. In addition to producing clean energy the power plant can contribute to the promotion of biodiversity, by providing a refuge for plants and animals, in particular smaller animals such as invertebrates.

Another advantage of a photovoltaic power plant over the conventional power plant is that as the lifetime of the solar power plant gets longer, the land transformation per capacity does not change, even when considering the impacts on land use. All high priority impacts are in favour

of solar power displacing traditional power generation while all the harmful impacts from solar power are of low priority (Turney & Fthenakis, 2011).

Based on the evidence produced during the assessment process, it is very unlikely that this project will have any significant negative impacts on the environment. It is therefore recommended that a clearance certificate be issued for the project.

Structure of the Report

Chapter 1: this chapter introduces the proponent and proposed project. It further provides the statutory requirement for the proposed project and its needs and desirability.

Chapter 2: describes the project, its designs, location, requirements, and capacities. The basis of impact assessments is explained in this chapter.

Chapter 3: delineates the national and international policy and regulatory framework governing the project.

Chapter 4: outlines the traditional project alternatives that were considered to ensure impacts are minimised by choosing the desirable project alternatives.

Chapter 5: explains the approach and methodologies used for this study. It describes how the information was gathered and methodology of impact assessment.

Chapter 6: this chapter provides the description of the affected environment. It provides description of the land / terrestrial area and social environment

Chapter 7: this traditional EIA chapter provides a description of the affected marine environment.

Chapter 8: provides a narrative of how various stakeholders were consulted. It includes minutes of various meetings that were held during stakeholder consultation.

Chapter 9: provides a narrative of how impacts were identified at various stages of the EIA.

Chapter 10: This conventional EIA chapter builds on chapter 9 and is the core chapter for informed decision making. It provides an assessment of impact and mitigation measures to reduce impacts.

Chapter 11: also, a tradition EIA chapter which outlines envisaged plans for decommissioning and rehabilitation in the event the project comes to an end.

Chapter 12: provides conclusions and recommendations

Chapter 13: provides a list of reference used

2 INTRODUCTION

Elof Hansson Hydrogen Namibia (Pty) Ltd, the proponent, intends to be amongst the pioneers of green hydrogen manufacturers in Namibia. The company is incorporated in Namibia with strategic international partnerships that are well-vested in the green hydrogen industry. The company plans to construct (i) a state-of-the-art photovoltaic solar plant that will power all production processes, (ii) an electrolysis plant (iii) an ammonium synthesis and storage plant and, (iv) a seawater desalination plant that will supply distilled water to the electrolysis plant (**see Figure 1**).

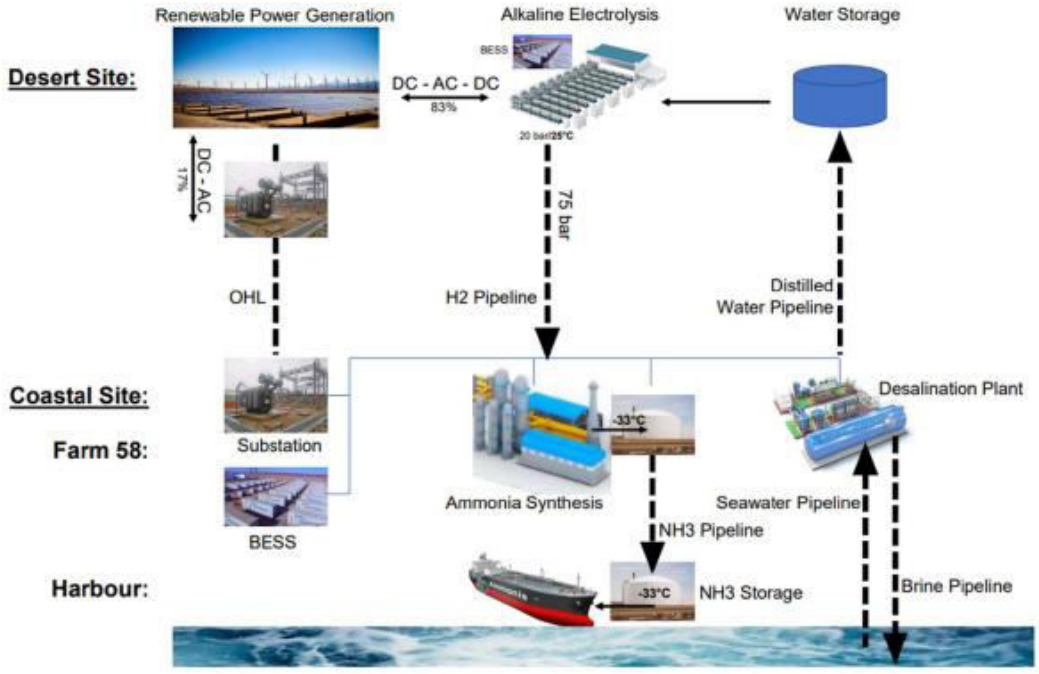

Figure 1. Schematic Illustration of the Green Hydrogen Project

This report provides an environmental impact assessment of the proposed solar power plant and associated infrastructure.

2.1 Scope of Work

The proponent has provided the Terms of Reference for this assignment, which includes providing services of conducting an Environmental and Social Impact Assessment (ESIA) and Environmental Management Plan for the Proposed Construction and Operation of the Solar

Power Plant and its associated infrastructure to support production of the Green Hydrogen and Green Ammonia Project.

The process as prescribed by the Environmental Regulations (2012) covered the following steps, which are reported on in this document as follows:

- Provide a detailed description of the proposed activity;
- Identify all legislation and guidelines that have reference to the proposed project;
- Identify existing environmental (both bio-physical and socio-economic) conditions of the area in order to determine their environmental sensitivity;
- Inform Interested and Affected Parties (I&APs) and relevant authorities of the details of the proposed development and provide them with a reasonable opportunity to participate during the process;
- Consider the potential environmental and social (including biological) impacts of the development, and assess the significance of the identified impacts.
- Outline management and mitigation measures in an Environmental Management Plan (EMP) to minimize and/or mitigate potentially negative impacts.

2.2 Statutory requirement

The protection of the Namibian environment is enshrined in the Namibian constitution under article 95(l). This constitutional provision enabled the enactment of the Environmental Management Act 2007 (Act No. 7 of 2007) (EMA) and its Environmental Impact Assessment Regulations, Government Gazette 6 February 2012 No. 4878. The EMA promotes the sustainable management of the environment and the use of natural resources by establishing principles for decision making on matters affecting the environment. These principles must be applied by Government institutions, private persons, companies, institutions and organizations when planning for activities that may have significant impacts on the environment. The EMA provides for a process of assessment and control of activities which may have significant effects on the environment; and to provide for incidental matters.

Section 27(2)(b) of EMA provides a list of activities that may not be undertaken without and Environmental Clearance Certificate (ECC). Energy generation is a listed activity that may not be undertaken without an ECC as indicated in **Table 1** below.

Table 1. Namibian regulatory requirement applicable to the proposed project

Environmental Impact Assessment Regulation 2012 GRN Gazette No. 4878	
Activity	**Applicability to the project**
1.(a) The construction of facilities for the generation of electricity.	The project will construct a Solar Power Plant for the generation of electricity
1.(b) The construction of facilities for the transmission and supply of electricity.	The project will construct a powerline for the transmission and supply of electricity from the Solar Farm to its substation at Farm 58
9.2 Any process or activity which requires a permit, licence or other form of authorisation, or the modification of or changes to existing facilities for any process or activity which requires an amendment of an existing permit, licence or authorisation or which requires a new permit, licence or authorisation in terms of a law governing the generation or release of emissions, pollution, effluent or waste.	The project will require a generational licence from the Electricity Board / Ministry of Mines and Energy

2.3 The need and desirability of the project

Elof Hansson Hydrogen Namibia (Pty) Ltd is focussed on becoming one of the first Green Hydrogen manufacturers in Namibia. The Project will create thousands of jobs during the 3 year construction period and hundreds of permanent jobs during the operational phase. There will be plenty of work for smaller local companies and subcontractors, hundreds of people will migrate to Walvis Bay, build houses and enjoy an improved livelihood in a growing industrious town. The direct and indirect financial benefits for the Municipality of Walvis Bay will be immensely positive.

In terms of the environment, climate change is one of the most pressing challenges we face. Fossil fuels are the primary cause of global warming. Green hydrogen will reduce greenhouse gas emissions, and subsequently global warming, as a result of its zero emissions. Other indirect benefits include increased ammonia production which is essential to agriculture, since food production shall become increasingly important as the world's population grows.

3 PROJECT DESCRIPTION

3.1 The Solar Power Plant

3.1.1 Location

The PV solar farm will be located on desert land, at remainder of Farm Geluk No.116. The farm is situated at coordinates 22.551793, 15.34992, which is located about 80km north-east of Walvis Bay. The Farm which covers an aerial extent of 7100 ha is owned by Elof Hansson Hydrogen Namibia (Pty) Ltd, the proponent. (see Figure 2 below). The layout of infrastructure footprint on Farm Geluk can be seen in Figure 3.

Figure 2: Locality of Farm Geluk

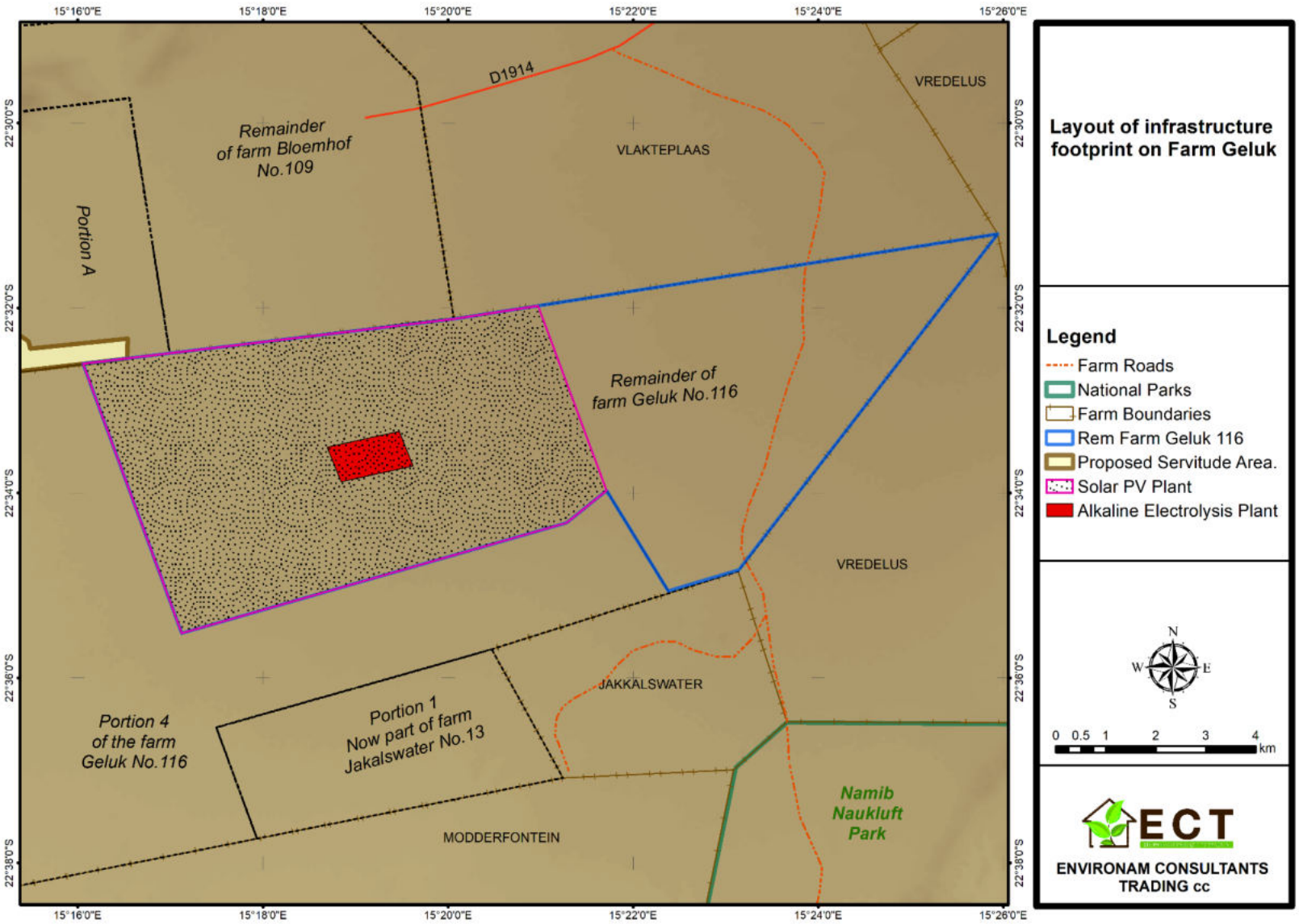

Figure 3: Layout of infrastructure

3.1.2 Land use

Past activities on the farm were mainly cattle and small stock farming. A Farmstead and supporting infrastructure, such as boreholes, water reservoirs etc. are present on site, see Figure 4. These activities have however ceased.

Figure 4. Infrastructure on site

3.2 Linear Infrastructures (Powerlines)

3.2.1 Location

The linear infrastructure will traverse between Farm 58 and the desert site for about 80km See Figure 5 below. A comprehensive description is provided in Appendix K for route determination.

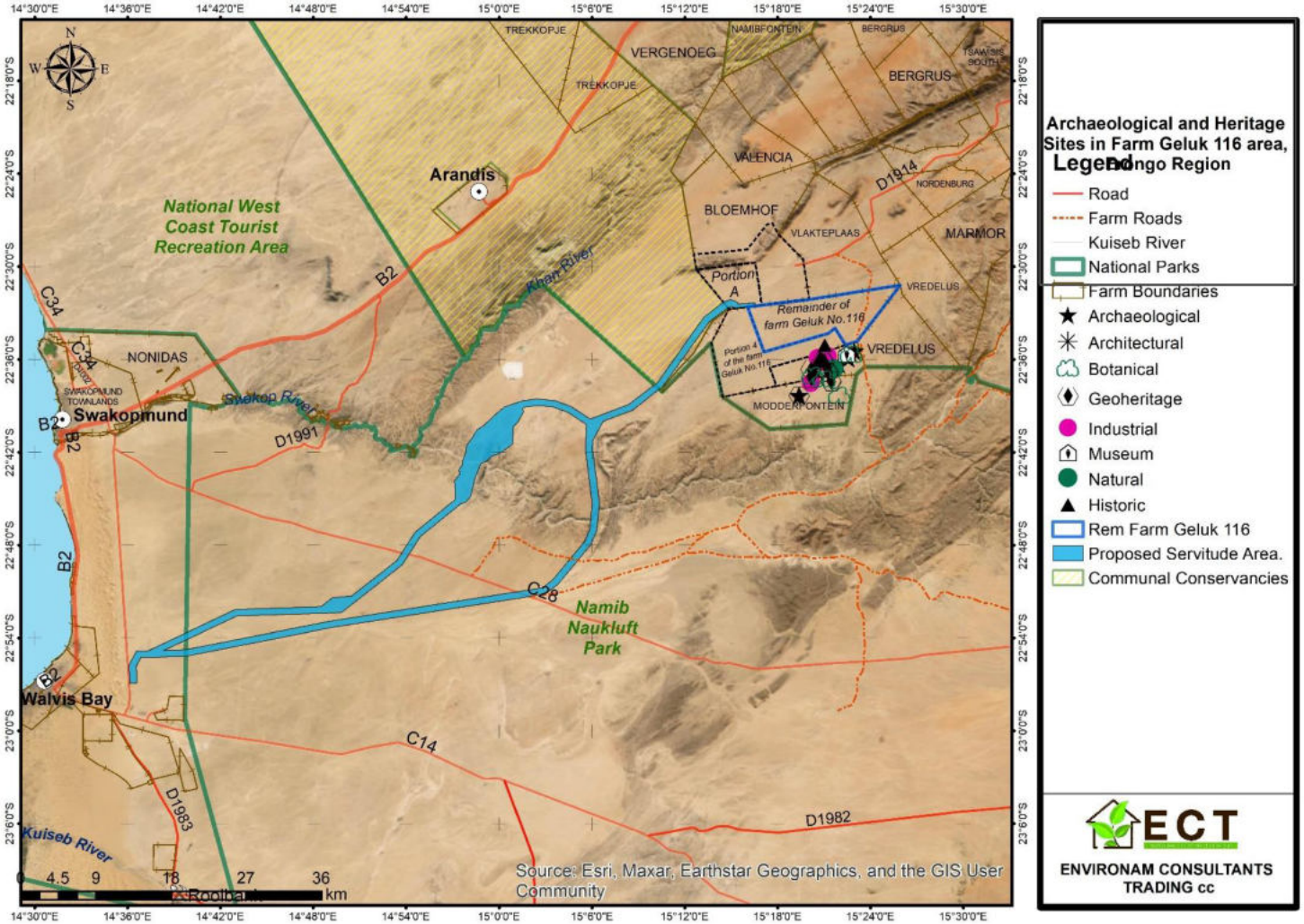

Figure 5. Linear infrastructure route between Farm Geluk and Farm 58

3.2.2 Powerline Transmission Line

The project will have two (2) transmission lines that will have a servitude of 120m wide separated by a distance of 40m and an outside reserve boundary of 40m on each transmission in line with the NamPower requirements. A service road will be placed in between the transmission lines.

3.3 Substation and Battery Energy Storage System

A substation is a primary feature within any electrical grid. It enables electricity to be transmitted at different voltages, safely and effectively. Besides the substation at the solar Farm, another substation will be constructed at Farm 58 about 80km from the solar Farm which will feed the Battery Energy Storage System (BESS) as well as power the ammonia synthesis and desalination plants. The BESS is necessary to provide electricity during the night / when solar energy is weak. Alternatively, a hydrogen fuel cell concept is considered for supply of electricity overnight.

4 POLICY AND REGULATORY FRAMEWORK

4.1 National Regulatory framework

Table 2. Policy and Legal framework governing the project

Policy/Legislation	Provisions	Applicability to the Project
The Namibian Constitution	The Namibian constitution is the supreme law of the country which is committed to sustainable development. Article 95(1) of the Constitution of Namibia states that: - "*The State shall actively promote and maintain the welfare of the people by adopting policies aimed at … The maintenance of ecosystems, essential ecological processes and biological diversity of Namibia and utilization of living natural resources on a sustainable basis for the benefit of all Namibians, both present and future*".	Undertake an Environmental Assessment to protect the environment and maintain the terrestrial ecological process.
The Environmental Management Act (No. 7 of 2007)	The Environmental Management Act (No. 7. of 2007) aims to promote the sustainable management of the environment and the use of natural resources and to provide for a process of assessment and control of activities which may have significant effects on the environment; and to provide for incidental matters. The act provides a list of activities that may not be undertake without an environmental clearance certificate.	The project must abide by the statutory requirement of EMA the EIA regulation. Carry out an EIA and develop an EMP for the project.
EIA Regulations GN 28, 29, and 30 of EMA (2012)	GN 29 Identifies and lists certain activities that cannot be undertaken without an environmental clearance certificate. GN 30 provides the regulations governing the environmental assessment (EA) process.	Activity 1 (a) The generation of electricity. Activity 1 (b) The transmission and supply of electricity.

Policy/Legislation	Provisions	Applicability to the Project
Convention on Biological Diversity (1992)	Article 1 lists the conservation of biological diversity amongst the objectives of the convention.	The project should consider the impact it will have on the biodiversity of the project area.
Nature Conservation Ordinance no 4 of 1975	Chapter 6 provides for legislation regarding the protection of indigenous plants	Indigenous and protected plants have to be managed within the legal confines.
Atmospheric Pollution Prevention Ordinance (No. 11 of 1976).	The Ordinance objective is to provide for the prevention of the pollution of the atmosphere, and for matters incidental thereto.	All activities on the site will have to take due consideration of the provisions of this legislation.
Draft Pollution Control and Waste Management Bill	This Bill serves to regulate and prevent the discharge of pollutants to air and water as well as providing for general waste management. The Bill will repeal the Atmospheric Pollution Prevention Ordinance (11 of 1976) when it comes into force. The Bill also provides for noise, dust or odour control that may be considered a nuisance. Further, the Bill advocates for duty of care with respect to waste management affecting humans and the environment and calls for a waste management licence for any activity relating to waste or hazardous waste management.	Management of waste, and any pollution generated by the project.

Policy/Legislation	Provisions	Applicability to the Project
The Occupational Safety and Health Act No. 11 of 2007;	Safety: A safety risk is a statistical concept representing the potential of an accident occurring, owing to unsafe operation and/or environment. In the working context "SAFETY" is regarded as "free from danger" to the health injury and to properties. Health: Occupational Health is aimed at the promotion and maintenance of the highest degree of physical, mental and social wellbeing of workers in all occupations. This is done by ensuring that all work-related hazards are prevented and where they occur, managed.	During construction, accidents are bound to happen if the working environmental is not safe and healthy. The project should maintain good and healthy standards, at the work place, cleanliness, adequate sanitary facilities, protection against dangerous substances.
Public Health Act No. 36 of 1919	The Act serves to protect the public from nuisance and states that no person shall cause a nuisance or shall suffer to exist on any land or premises owned or occupied by him or of which he is in charge any nuisance or other condition liable to be injurious or dangerous to health.	The developer and contractors are to comply with these legal requirements. The construction of powerlines would cut across public land (desert land). The proponent should ensure that the construction site is off limits from public during construction to avoid injuries/fatalities.
The Ministry of Environment, Forestry and Tourism (MEFT)	MEFT has developed a policy on HIV and AIDS. In addition, it has also initiated a programme aimed at mainstreaming HIV and gender issues into environmental impact assessments.	The proponent and its contractor/s have to adhere to the guidelines provided to manage the aspects of HIV/AIDS. Experience with construction projects has shown that a

Policy/Legislation	Provisions	Applicability to the Project
Policy on HIV & AIDS		significant risk is created when construction workers interact with local communities.
Water Resources Management Act (2004)	This Act provides a framework for managing water resources based on the principles of integrated water resources management. It provides for the management, development, protection, conservation, and use of water resources. Furthermore, any watercourse on/or in close proximity to the site and associated ecosystems should be protected in alignment with the listed principles.	The pollution of water resources should be avoided during construction and operation of the development.
Petroleum Product and Energy Act No, 13 of 1990	This Act provides a framework for handling and distribution of petroleum products which may include purchase, sale, supply, acquisition, possession, disposal, storage or transportation thereof.	During construction, there would be handling of fuel and hydrocarbons for construction vehicles and equipment. Hence the act compels the proponent to handle hydrocarbons safely.
Labour Act No. 6 of 1992	This Act aims to regulate labour in general and includes the protection of the health, safety and welfare of employees. The 1997 Regulations relating to the Health and Safety of employees at work sets out the duties of the employer, welfare and facilities at the workplace, safety of machinery, hazardous substances, physical hazards, medical provisions, construction safety and electrical safety.	Given the employment opportunities presented by the development, compliance with the labour law is essential.
Regional Council Act, 1992 (Act No. 22 of 1992)	The Regional Councils Act legislates the establishment of Regional Councils that are responsible for the planning and coordination of regional	The area is in the jurisdiction of the Walvis Bay Municipality and the Erongo Regional

Policy/Legislation	Provisions	Applicability to the Project
	policies and development. The main objective of this Act is to initiate, supervise, manage and evaluate development at regional level.	Council. All relevant by-laws must be abided to.
Local Authorities Act No. 23 of 1992	The Local Authorities Act prescribes the manner in which a town or municipality should be managed by the Town or Municipal Council.	The development has to comply with the provisions of the Local Authorities Act.
Soil Conservation Act No. 76 of 1969	This act promotes the conservation of soil, prevention of soil erosion.	Improper planning of construction can cause soil degradation and erosion through earth work.
National Heritage Act No. 27 of 2004	The Act makes provision for the protection and conservation of places and objects of heritage significance and the registration of such places and objects. Part V Section 46 of the Act prohibits removal, damage, alteration or excavation of heritage sites or remains, while Section 48 sets out the procedure for application and granting of permits.	Scrapping and excavation may unearth archaeological material.
Electricity Act, 2007 (Act No. 4 of 2007)	The Act provides for the requirements and conditions for obtaining licences for the provision of electricity.	Compliance with this legislation is essential.
International Best Practises	***Precautionary Approach Principle*** This principle is worldwide accepted when there is a lack of sufficient knowledge and information about the possible threats to the environment. ***Polluter Pays Principle*** This principle ensures that proponents take responsibility for their actions. Hence, in cases of pollution, the proponent bears the full responsibility to clean up the environment.	Although not envisioned, the proponent is urged to apply great precaution in an event of uncertainty. In the event of pollution, the proponent shall incur the clean-up cost.

4.2 International Regulatory Framework

4.2.1 The World Bank Environmental and Social Management Framework

"The World Bank (WB) Environmental and Social Framework (ESF) sets out the World Bank's commitment to sustainable development, through a Bank Policy and a set of Environmental and Social Standards (ESS) that are designed to support Borrowers' projects, with the aim of ending extreme poverty and promoting shared prosperity" (World Bank, 2017) [1] (**see Table 3.**)

Table 3. The World Bank Environmental and Social Standards

No	ESS	Description	Requirements
1.	Assessment and Management of Environmental and Social Risks and Impacts	This ESS sets out the borrower's responsibility to identify, assess, manage and monitor environmental and social risks and impacts associated with each stage of the project. Three important annexes form part of this standard and set out specific requirements in more details: - Annex 1: Environmental and Social Assessment - Annex 2: Environmental and Social Commitment Plan (ESCP) - Annex 3: Management of Contractors	a) Use the WB ESF b) Conduct an environmental and social assessment proposed project, including stakeholder engagement c) Undertake stakeholder engagement and disclose appropriate information d) Develop an ESCP and implemented all measures and actions set out in the ESCP e) Conduct monitoring and reporting on environmental and social performance of project against ESS
2.	1. Labour and Working Conditions	This ESS recognizes the importance of employment creation and income generation in the pursuit of poverty reduction and inclusive economic growth. Borrowers can promote sound worker-management relationships	Requirements prescribed for: a) Working conditions and management of worker relationships

[1] International Bank for Reconstruction and Development/World Bank (2017). Environmental and Social Framework

No	ESS	Description	Requirements
		and enhance the development benefits of a project by treating workers in the project fairly and providing safe and healthy working conditions	b) Protecting the work force c) Grievance mechanism d) Occupational Health and Safety e) Contracted Workers f) Community Workers g) Primary Supply workers
3.	2. Resource Efficiency and Pollution Prevention and Management	This ESS recognizes that economic activity and urbanization often generate pollution to air, water, and land, and consume finite resources that may threaten people, eco- system services and the environment at the local, regional, and global levels. It sets out the requirements to address resource efficiency and pollution prevention and management throughout the project life cycle.	Requirements prescribed for: a) Resource efficiency (Energy use, Water use, Raw materials use) b) Pollution prevention and management
4.	3. Community Health and Safety	This ESS recognises that project activities, equipment, and infrastructure can increase community exposure to risks and impacts. Communities that are already subjected to impacts of climate change may experience intensification of impacts due to project activities. It addresses the health, safety, and security risks and impacts on project-affected communities and the corresponding responsibility of Borrowers to avoid or minimize such risks and impacts, with particular attention to vulnerable people	Requirements prescribed for: a) Community health and Safety - Infrastructure and equipment design and safety - Safety of Services - Traffic and road safety - Ecosystem services - Community exposure to health issues - Emergency preparedness and response - Management and safety of hazardous materials

No	ESS	Description	Requirements
			b) Security personnel
5.	4. Land Acquisition, Restrictions on Land Use and Involuntary Resettlement	This ESS applies to permanent or temporary physical and economic displacement resulting from land acquisition or restrictions on land use undertaken or imposed in connection with project implementation. **Objectives:** - To avoid or minimise involuntary resettlement - To avoid forced evictions - To mitigate unavoidable adverse social and economic impacts from land acquisition or restrictions on land use	a) General requirements: - Eligibility classification - Project design - Compensation and benefits for affected persons - Community Engagement - Grievance mechanism - Planning and implementation b) Displacement - Physical displacement - Economic displacement
6.	5. Biodiversity Conservation and Sustainable Management of Living Natural Resources	The requirements of this ESS are applied to all projects that potentially affect biodiversity or habitats, either positively or negatively, directly or indirectly, or that depend upon biodiversity for their success. **Objectives:** - To protect and conserve biodiversity and habitats - To apply the mitigation hierarchy and precautionary approach in the design and implementation - To promote the sustainable management of living natural resources	a) Assessment of risks and impacts b) Conservation of biodiversity and habitats c) Legally protected and internationally recognised areas of high biodiversity value d) Invasive alien species e) Sustainable management of living natural resources

No	ESS	Description	Requirements
		- To support livelihoods of local communities and adoption of practices that integrate conservation needs and development priorities	
7.	6. Indigenous Peoples/Sub-Saharan African Historically Undeserved Traditional Local Communities	This ESS contributes to poverty reduction and sustainable development by ensuring that projects supported by the Bank enhance opportunities for Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities[2] to participate in, and benefit from, the development process in ways that do not threaten their unique cultural identities and well-being	a) Avoidance of adverse impacts b) Mitigation and development benefits c) Meaningful consultation tailored to indigenous peoples/Sub-Saharan African historically undeserved traditional local communities d) Obtain Free Prior and Informed Consent (FPIC) e) Establish grievance mechanism
8.	7. Cultural Heritage	This ESS sets out general provisions on risks and impacts to cultural heritage from project activities. The term 'cultural heritage' encompasses tangible and intangible heritage, which may be recognized and valued at a local, regional, national or global level, as: - Tangible cultural heritage (includes immovable objects, sites, structures, natural features and landscapes that have archaeological,	a) Stakeholder consultation and identification of cultural heritage b) Legally protected cultural heritage areas c) Provisions for specific types of cultural heritage d) Commercial use of cultural heritage

[2] As the applicability of the term "Indigenous Peoples" varies widely from country to country, the Borrower may request the Bank to use an alternative termi- nology for the Indigenous Peoples as appropriate to the national context of the Borrower.

No	ESS	Description	Requirements
		paleontological, historical, architectural, religious, aesthetic or other cultural significance - Intangible cultural heritage (includes practices, representations, expressions, knowledge, skills and cultural spaces associated with that community.	
9.	8. Financial Intermediaries (FIs)	FIs are required to monitor and manage the environmental and social risks and impacts of their portfolio and FI subprojects, and monitor portfolio risk, as appropriate to the nature of intermediated financing. Objectives: - To set out how the FI will assess and manage environmental and social risks and impacts associated with the subprojects it finances - To promote good environmental and social management practices in the subprojects the FI finances - To promote good environmental and sound human resources management within the FI	a) Environmental and social procedures b) Environmental and social policy c) Organisational capacity and competency d) Monitoring and reporting e) Stakeholder engagement
10	9. Stakeholder Engagement and Information Disclosure	This ESS recognizes the importance of open and transparent engagement between the Borrower and project stakeholders as an essential element of international best practice. Effective stakeholder engagement can improve the environmental and social sustainability of projects, enhance project acceptance, and make a significant contribution to successful project design and implementation	a) Stakeholder identification and analysis b) Establish a Stakeholder Engagement Plan c) Provide Information disclosure d) Undertake meaningful consultations e) Continue engagements during project implementation and external reporting

No	ESS	Description	Requirements
			f) Establish and implement a grievance mechanism g) Organisational capacity and commitment

4.3 Equator Principles[3]

The Equator Principles (EP) are used by financial institutions to identify, assess, and manage environmental and social risks when financing projects. The EP apply to all industry sectors globally, to five (5) financial products:

- Project Finance Advisory Services of project capital more than USD10 million
- Project Finance with project capital costs of more than USD10 million
- Project-Related Corporate Loans
- Bridge Loans
- Project-related Refinance, and Project-related Acquisition Finance

Table 4. The Equator Principles

Equator Principle	Description
1. Review and Categorisation	A project proposed for financing is categorised based on the magnitude of potential environmental and social risks and impacts, including those related to Human Rights, climate change, and biodiversity. The Categories are based on the International Finance Corporation (IFC)'s environmental and social categorisation process" - Category A- Projects with significant adverse environmental and social risks that are irreversible or unprecedented - Category B- Projects with potential limited adverse environmental and social risks that are largely reversible and can be addressed through mitigation measures - Category C- Project with minimal or no adverse environmental risks or impacts
2. Environmental and Social Assessment	Clients are required to conduct appropriate assessments to address environmental and social risks and the scale of impacts of the proposed project. The assessment should include measures to minimise, mitigate, compensate/offset for risks and impacts to those affected.
3. Applicable Environmental and Social Standards	The Environmental and Social Assessments should first address compliance with the relevant laws, regulations and permits pertaining to environmental and social issues of the host country.

[3] Equator Principles (2020). Equator Principles EP 4- July 2020. Source: https://equator-principles.com/about-the-equator-principles/

Equator Principle	Description
4. Environmental and Social Management System and Equator Principles Action Plan	For all Category A and Category B projects, clients are required to develop and maintain an Environmental and Social Management System (ESMS) to address issues raised in the assessment process.
5. Stakeholder Engagement	For all Category A and Category B projects, clients are required to demonstrate effective stakeholder engagement as an ongoing process, in a structures and culturally appropriate manner with all affected parties.
6. Grievance Mechanism	As part of the ESMS, for all Category A and B projects, clients are required to establish effective grievance mechanisms that are designed for use by all affected parties
7. Independent Review	For all Category A and B projects, an independent Environmental and Social Consultant will carry out an independent review of the assessment including the ESMPs, ESMS and stakeholder engagement process to assess due diligence and compliance to the EP.
8. Covenants	For all Projects, where a client is not in compliance with its environmental and social covenants, the EPFI will work with the client on remedial actions to bring the Project back into compliance. If the client fails to re-establish compliance within an agreed grace period, the EPFI reserves the right to exercise remedies, including calling an event of default, as considered appropriate.
9. Independent Monitoring and Reporting	To assess Project compliance with the Equator Principles after Financial Close and over the life of the loan, the EPFI will require independent monitoring and reporting
10. Reporting and Transparency	The EPFI will, at least annually, report publicly on transactions that have reached Financial Close and on its Equator Principles implementation processes and experience

4.4 European Bank for Reconstruction and Development (EBRD)

The EBRD is an international financial institution providing project financing for banks, industries and businesses, for both new and existing companies. The EBRD funds come mainly from bilateral donors such as Climate Investment Funds, European Union, Global Environment

Facility and Green Climate Fund. The bank provides direct financial instruments such as loans, equity investments and guarantees[4].

- The EBRD was the first multi-lateral development bank to have an explicit environmental mandate in its charter and has pledged to dedicate 40% of its financing into the Green Economy Transition[5.]

- The EBRD has an Environmental and Social Policy with 10 requirements. All projects financed by the EBRD should be structured to meet the requirements of the policy. The 10 performance requirements of the EBRD are based on the 10 World bank Environmental and Social standards and will hence not be repeated.

4.5 International Finance Corporation (IFC) 6

The IFC is a member of the World Bank Group and is the largest global development institution focused exclusively on the private sector in developing countries.

The performance standards of the IFC are designed to provide guidance on how to identify risks and impacts, and are designed to help avoid, mitigate, and manage risks and impacts as a way of doing business in a sustainable way, including stakeholder engagement and disclosure obligations of the client in relation to project-level activities. For direct investments, IFC requires its clients to apply the Performance Standards to manage environmental and social risks and impacts so that development opportunities are enhanced.

The IFC has eight (8) Performance Standards that should be met throughout the life cycle of the project financed. All the eight (8) performance standards are derived from the on the World Bank's 10 ESS with the exception of ESS9 (Financial Intermediaries) and ESS10 (Stakeholder Engagement and Information Disclosure).

[4] EBRD Sustainability report. Source: www.ebrd.com
[5] Mahmood, M., & Orazalin, N. (2017). Green governance and sustainability reporting in Kazakhstan's oil, gas, and mining sector: Evidence from a former USSR emerging economy. *Journal of cleaner Production*, *164*, 389–397
[6] Source: www.ifc.org

5 PROJECT ALTERNATIVES

Section 1 of Namibian EIA regulation defines “alternatives” as different means of meeting the general purpose and requirements of the activity, which may include alternatives to -

(a) the property on which or location where it is proposed to undertake the activity;
(b) the type of activity to be undertaken;
(c) the design or layout of the activity;
(d) the technology to be used in the activity; and
(e) the operational aspects of the activity;

5.1 Solar Plant Site Alternatives

5.1.1 Solar Power Plant Location

The main factor that determined the location of the solar power plant is the amount and quality of sunlight that reaches the site. Farm Geluk 116 has higher solar radiation and longer daylight hours than the locations located in Walvis Bay which are influenced by other factors such as cloud cover, air pollution, seasonal variations and fog (especially in the morning hours).

The sizing of the solar power generation was done in a way that even in months with lowest radiation and shortest days (June/July) there will be enough solar capacity to feed the loads and secure the target output.

5.2 Linear Infrastructures Servitude

The linear infrastructure will traverse between Farm 58 and the desert site for about 80km. To limit the potential environmental impacts, water and hydrogen pipelines will be constructed in one servitude and powerlines in another servitude. The powerlines are meant to join the existing servitude which contains transmission lines for Langer Heinrich Uranium Mine. For areas where topographical and geotechnical constraints make it impossible for a single servitude, minor deviation will be considered. Consequently, route determination of the servitude was influenced by two (2) main factors (i) Topographical and Geotechnical Constraints, mainly the Swakop river crossings and, (ii) Vegetation Cover, mainly the Welwitschia Mirabilis fields (**see Figure 6 below**).

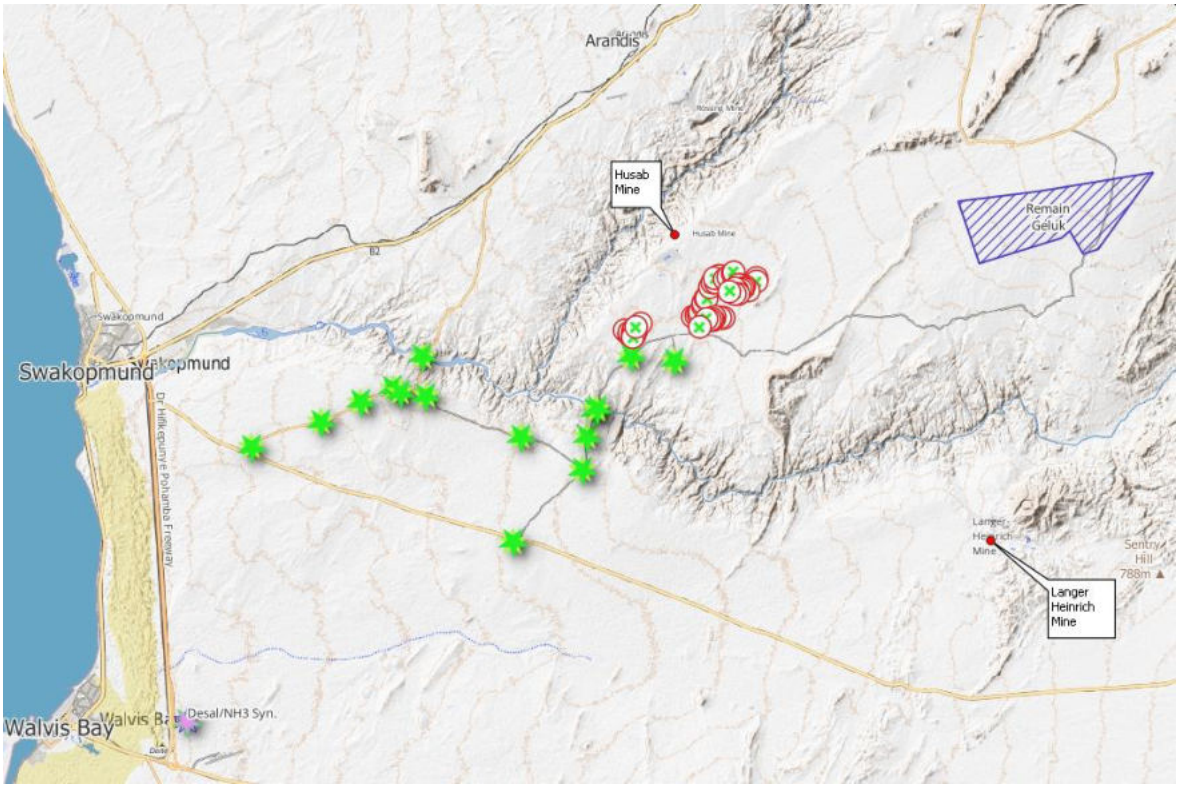

Figure 6. Map indicating occurrence of Welwitschia Mirabilis

A reference line from Farm Geluk to Farm 58 was created as a baseline to inform other alternatives route (see Figure 7 below). Any alternative that performs poorly against the reference line was automatically disregarded. To determine the best alternative of the powerline route, heritage and biodiversity specialist studies were undertaken. These studies were conducted at Farm Geluk, along various alternative routes, and at Farm 58 (see Annexure K).

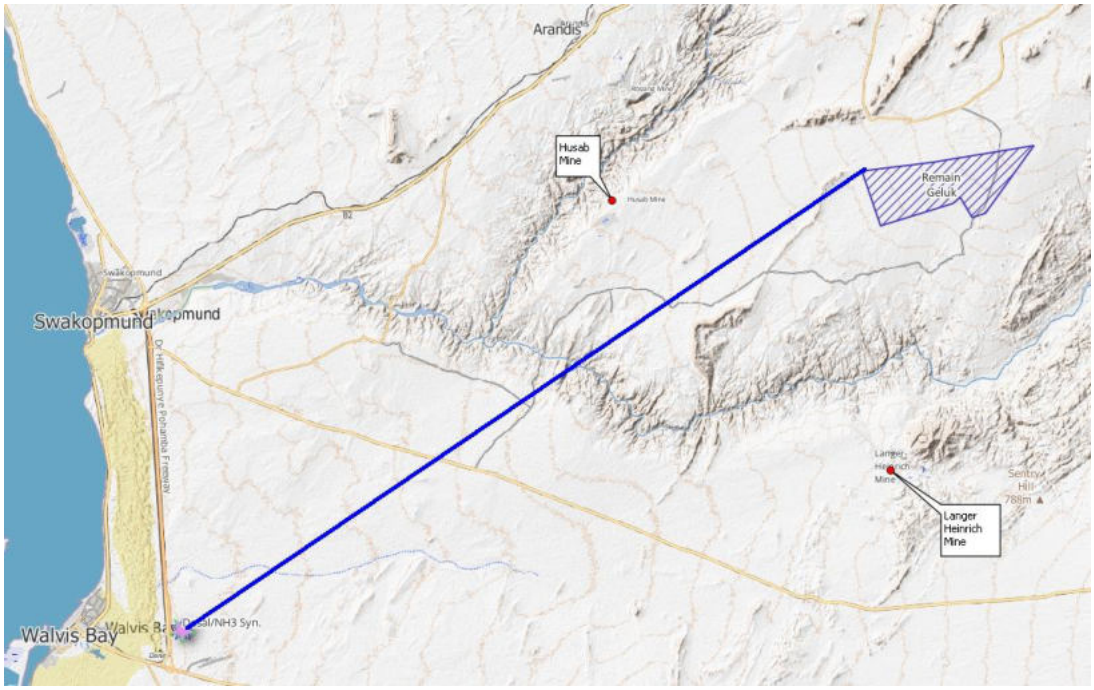

Figure 7. Reference line / Baseline between Farm 58 the solar Farm.

The generated alternative routes were overlaid over the areas along the reference line to determine their performance against topographical and geotechnical constraints and impacts on Welwitschia fields (see Figure 8 below). The area, terrain and topography with green colours in the map below shows undesirable routes.

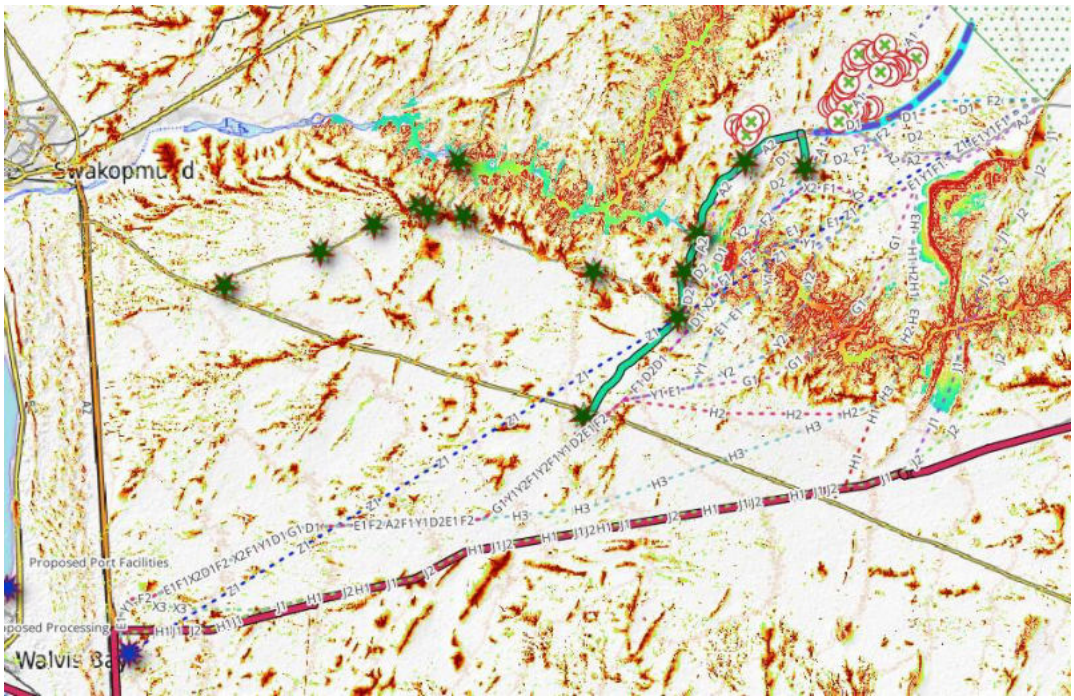

Figure 8. Map indicating constraints and routes considered

Overall, four linear routes were identified for water, hydrogen and electricity. The routes indicated in Figure 9 below, marked as “A” and “B” are targeted for hydrogen and water pipelines, with the routes “C” and” D” targeted for electricity transmission. Route “E” is earmarked for the proposed access road.

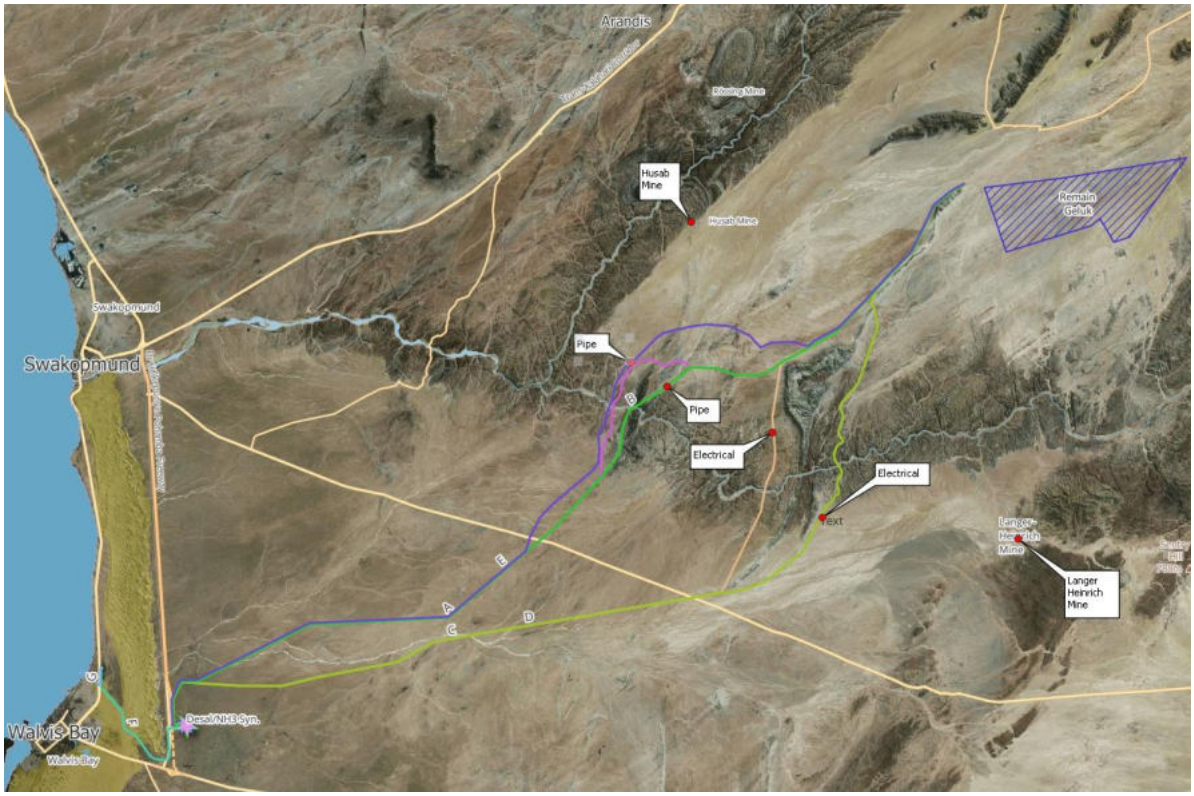

Figure 9. Project Locality with Proposed Linear Routes

The route “E” which represents the proposed road alignment, was selected to act as a service road to the powerlines as well as general access road from Farm 58 (processing site) to the desert facilities. Where the road crosses over the Road C28 from Swakopmund to Windhoek (via Khomas Highland), the road is proposed to follow the existing Welwitschia Drive Road in the Namib Naukluft Park area until the PV Farm at Farm Geluk.

The powerline is proposed to also follow the access road as set out above, however, to diverge from the road in order to cross over the Swakop River. The pipelines, road and electricity routes converge when entering the communal land along the mountain range to the centre of Farm Geluk. The route “D” was found to be the least favourable and has subsequently been discarded, see Figure 4 for the narrowed down options.

5.3 No project alternative

The “no-go” option is the alternative of not implementing the project, foregoing all the socio-economic that the project would have brought. This alternative is triggered when the potential impacts are severe or in cases where the potential impact are not fully understood and believed to be catastrophic. However, this alternative is good for the environmental, as the environment will continue to be in its pristine state.

6 STUDY APPROACH / METHODOLOGY

6.1 Literature Review

A wide range of literature was used to gather information on the terrestrial environment baseline. All technical description of proposed activities were provided by the proponent. Figure 10 illustrates the workflow for the ESIA, which was developed in accordance with the ESIA's Terms of Reference.

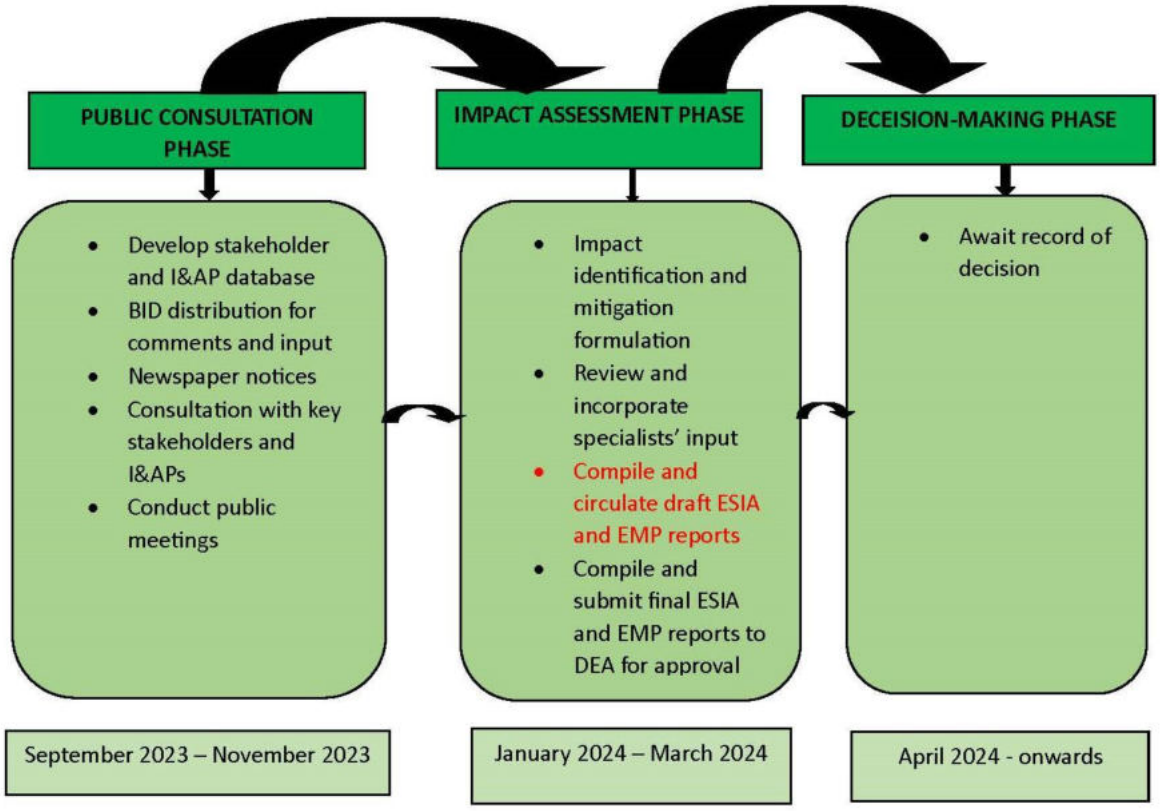

Figure 10. Proposed workflow for the ESIA

6.2 Site Assessment

The study took a blended approach, where project engineers and environmentalist undertook a desktop study to determine the project feasibility. The desktop study was followed with ground truthing. Additionally, a Biodiversity, Socio-Economic, and Heritage and Archaeological studies were commissioned.

6.3 Impact Assessment

The criteria used to assess the impacts and the method of determining their significance is outlined below. This process conforms with international best practices and the Environmental Impact Assessment Regulations of Environmental Management Act, 2007 (Government Gazette No. 4878) EIA regulations.

6.3.1 Impact Type

Following the impact determination, the impacts are classified into two categories; positive and negative impacts.

Table 5. Impact Type

Impact type	**0**	No Impact
	+VE	Positive
	-VE	Negative

6.3.2 Probability of occurrence

All potential impacts are analysed to determine their likelihood of occurrences after proposed mitigation measures / residual effect are applied.

Table 6. Likelihood of occurrence

Likelihood occurrence	1	Improbable (Low likelihood)
	2	Low probability
	3	Probable (Likely to occur)
	4	Highly Probable (Most likely)
	5	Definite (Impact will occur irrespective of the applied mitigation measure)

6.3.3 Confidence level

The level of confidence residual effect[7] predictions which depends on the degree of uncertainty associated with the basis of understanding project interaction with the environment, available data/information, and the effectiveness of proposed mitigation. The confidence is determined under three levels Low, Medium and High (**Table 7**). When the uncertainty associated with the residual effect prediction increases, the level of confidence in the prediction becomes lower.

For example, the confidence level of uncertainty residual effect of noise, dust, vegetation disturbances and land degradation impacts by construction activities are high. However, the confidence level of uncertainty residual effect of excavating activities on the impact to heritage / archaeological resources is lower, as well as the confidence of the impact of seabed construction.

Table 7. Confidence level

Confidence level	L	1	Low	The uncertainty residual effect maybe well understood, but the impact severity is not known. Precautional approach mitigation measures based on literatures / world best practises are developed to reduce the impact significance to low levels.
	M	2	Medium	The uncertainty residual effect is partially understood with available information and practical mitigation measures with monitoring program to reduce the impact significance to low levels.
	H	3	High	The uncertainty residual effect is well understood and practical mitigation measures are developed to mitigate the impact significance to low levels.

6.3.4 Impact Significance

The residual effect prediction of the impacts were rated under 5 categories; negligible=1, Low=2, Medium=3, High=4 and Severe=5.

[7] Residual impacts refer to those environmental effects predicted to remain after the application of mitigation outlined

Table 8. Risk Rating

1	**Negligible** (Based on the available information, the potential impact is found to not have a significant impact)	N
2	**Low** (The presence of the impact's magnitude is expected to be temporal or localized, that may not require alteration to the operation of the project	L
3	**Medium** (This impact is probable, limited in scale, expected to be of short term / temporary, can be avoided, managed and or mitigated with simple mitigation measures.	M
4	**High** (The impact is definite, mostly predictable, temporal, can be local, regional or national and in long term and reversible. These are impacts that may affect human rights, lands, natural resources, traditional livelihood, critical ecosystem services. The severity of these impact are more limited than sever impacts.	H
5	**Severe** (The impact is definite, it has significant adverse impacts on human population and or / the environment which are of large-scale magnitude and or spatial extend such as large geographic area, large number of people or transboundary nature. The impact duration is long term, permanent and often irreversible. Impacts include displacement of human, destruction of critical ecological systems and or cultural and heritage sites etc. The impact could have a no-go implication unless the project is re-designed or proper mitigation can practically be applied.	S

6.3.5 Duration of Impacts

Under these criteria, the impact is analysed based on the time the impact will last. During construction, most of the impact are immediate and short term.

Table 9. Impact duration

Duration	1	Immediate
	2	Short-term (0-5 years)
	3	Medium-term (5-15 years)
	4	Long-term (more than 15 years)
	5	Permanent

6.3.6 Geographical Scale

The impact is further analysed based on its geographical scale or spatial extent. For example, noise pollution from construction activities will be site specific, while aesthetic impact caused by the pipeline traversing a distance of 80km will be local. Positive impacts such as potential government revenue through taxes and levies will be national, and employment will mainly be regional.

Table 10. Geographical extend of impact

Scale	1	Site specific
	2	Local
	3	Regional
	4	National
	5	International

6.3.7 Risk Assessment

The impact significance was determined using a risk matrix **(Table 11 below).** A five-by-five matrix was used where the impact severity was categorised and assigned scores from 1 to 5 as follows: Improbable=1, Low=2, Medium=3, High=4 and Severe=5. Similarly, the likelihood was assigned scores as follows; improbable=1, Low Likely=2, Probable=3, High Probability=4, Definite=5. The impact rating was determined by multiplying the impact severity and likelihood.

Table 11. Risk assessment matrix[8]

LIKELIHOOD						
	5 Definite	5 Low	10 Medium	15 High	20 Severe	25 Severe
	4 High Probability	4 Low	8 Medium	12 High	16 High	20 Severe
	3 Probable	3 Low	6 Medium	9 Medium	12 High	15 High
	2 Low	2 Low	4 Low	6 Medium	8 Medium	10 Medium
	1 Improbable	1 Negligible	2 Low	3 Low	4 Low	5 Low
		1 Negligible	**2 Minor**	**3 Medium**	**4 High**	**5 Severe**
		IMPACT SEVERITY / CONSEQUENCE				
		Negligible	Low	Medium	High	Severe

6.3.8 Mitigation Hierarchy

Best practises call for mitigation measures to follow a mitigation hierarchy that favours (i) avoidance of potential adverse impacts, and where avoidance is not possible, then (ii) minimization and reduction; where adverse residual impacts remain, then (iii) mitigation measures need to be applied, and, as a last resort, (iv) measures to offset impacts that cannot be appropriately mitigated.

According to EIS regulations, the objectives mitigations are to;

- Find environmental ways of doing thing
- Promote environmental benefits of the project
- Avoid, Minimise or remedy negative impacts and
- Ensure that residual negative impacts are within acceptable levels,

Further, during consideration of the mitigation measure, the following mitigation hierarchy was followed;

[8] Risk Management Guideline for the BC Public Sector (Province of British Columbia Risk Management Branch and Government Security Office 2012)

- Avoid the negative impact through preventative means,
- Minimise the negative impacts to acceptable low levels and,
- If the above two are not possible, remedy or compensate the impact.

7 DESCRIPTION OF THE AFFECTED TERRESTRIAL ENVIRONMENT

7.1 Site Description

Portion 7 of Farm 58 is part of Walvis Bay townlands, zoned for heavy industrial. Currently, there is no development on Farm 58. However, the surrounding land has been allocated to various entities aiming to operate heavy industrial activities. The site is 200,0592 ha in extent **see Figure 11** below for locality map. Farm 58 is generally a flat sandy desert land (**see Figure 12**).

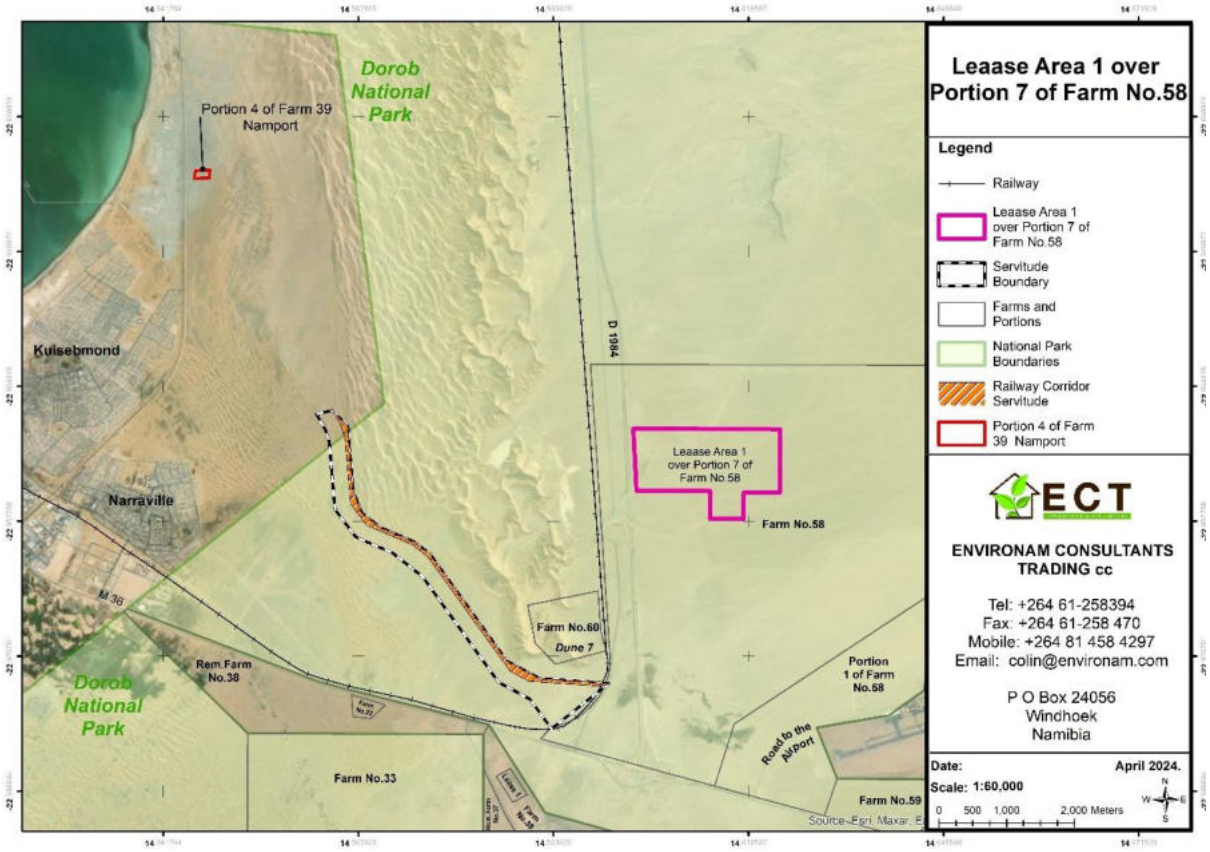

Figure 11. Locality map of Portion 7 of Farm 58

Figure 12. Portion 7 of Farm 58, Substation and BESS Project site

7.2 Climatic Conditions

7.2.1 Namib Desert

Namibia's Namib Desert extends from the Uniab River in the north to Lüderitz in the south along its coastal plain. Approximately 80 to 200 kilometers inland from the Atlantic coast lies the Namib Escarpment. A cold current, the Benguela Current, flows along the south west African coast and suppresses rainfall over the desert. However, it provides fog approximately 100 kilometers inland. Rainfall is sparse and highly unpredictable in the Namib Desert. The ecoregion's mean annual rainfall ranges from 5 millimeters in the west to 85 millimeters along its eastern edge. In coastal areas, rainfall ranges from 2 to 20 millimeters a year, and fog occurs more than 180 days a year.

Due to the Benguela Current, the air temperature is low. The annual rainfall increases from 20 to 50 millimeters up to about 50 kilometers inland. Although fog is still important to desert organisms, it only occurs about 40 days a year. Further inland, fog is rare, and rainfall reaches a maximum of 85 millimeters annually. With temperatures fluctuating from below 0°C to above 50°C on a daily and seasonal basis, there is a sharp rise in temperature and a sharp increase in variability (Oneearth, 2024).

7.2.2 Walvis Bay

Walvis Bay is a coastal town, whose weather conditions is influenced by the cold Benguela Current of the Atlantic Ocean and a hot dry weather of the Namib Desert. Like other coastal towns in Namibia, the area receives little to no rain, has relatively lower temperatures, less radiation and sunshine, strong eastern winds, high humidity and frequent fog. A summary of the environmental setting is shown in Table 12 below.

Table 12. The environmental Setting of Walvis Bay and the surrounding areas.

Environmental Aspects	**Description**
Temperature	Average Max 24^0C in March and 19^0C in September Average Min 16^0C in Feb and 9^0C in August
Rainfall	The coastal areas receive little rainfall, with Walvis Bay having an average annual rainfall of 15mm.
Fog	Desert life is more supported by fog other than rainfall. About 146 fog-day are recorded at Walvis Bay. These records are only made when ground visibility is reduced to 1000 m or less.
Wind	Strong Easterly wind of up to 100m/hour
Sunshine	The entire coast of Namibia has an average of 5-7 hours of sunshine per year.

7.3 Topography and Drainage

Fam Geluk and a large part of the proposed powerline corridor route is located in the Central Namib Desert, on the so-called Namib Platform that stretches from the Kuiseb River to the Brandberg. This study area is mainly found in the catchment of the Swakop River Catchment, where surface drainage is by means of tributaries, or small washes towards the Swakop River. In the upper reaches isolated mountains with gentle foothills and sand/gravel plains characterizes the topography, which become increasingly steep and rugged and intensely dissected towards the Swakop and Khan River. The area can be classified as a water deficit area with annual evaporation exceeding the mean annual rainfall by far. Summer rainfall dominates precipitation in the form of thundershowers and seasonal run off events might occur in the form of flash floods.

The Walvis Bay area is flat and receive little to no rainfall, hence there is no influence of drainage. About 14km south of the project site lies the famous Kuiseb River, whose flow is influence by inland rainfall and pours into the Atlantic Ocean. The river plain is flat and sloping toward the Atlantic Ocean in the west. Generally, there are no permanent water bodies in the Namib Desert. The Kuiseb River is an Ephemeral River that only flows when the inland receives good above average rainfall.

7.4 Geology and soils

The Namib Desert is mainly made up of sand deposit and is home to sand dunes. It has a vast array of landscapes and scenery, and a huge sense of wilderness, novel to tourist and highly accessible compared to most extreme desert ecosystems. In general, much of the desert areas do not have much of soil but exposed bedrocks of Precambrian metamorphites such as mica schists, quartzites and marbles. This is mostly linked to wind erosion. Arable soils are limited to river valleys and flood plains.

With respect to the Walvis Bay area, the soils at the town vary as a result of the diverse geology of the region, and the increase in aridity from the east to west. According to the Walvis Bay Urban Structural plan (2022), soils throughout the area are typically thin, saline and poorly developed. This is basically a function of the arid/desert climate and the relatively slow rates of weathering. Soils within this region are becoming increasingly eroded as a result of vegetation loss and off-road vehicle traffic. Along the coastal belt, soils consist of either littoral sands of Aeolian origin (for example, the dune fields between Swakopmund and Walvis Bay, and south of Walvis Bay), or halomorphic soils often associated with gypsum or salt deposits. Halomorphic soils are rich in salts as a result of evaporation, and the deposition of wind-blown salt of marine origin.

The geological framework of most of the project area consists of intense faulting and folded Damara rocks, before being covered by sedimentary deposits at places. The geological formations in the Farm Geluk area consists mainly of surficial deposits (quaternary sediments), however formations comprising of conglomerate, schist, marble and quartzite with intrusive granite and alaskite are also observed in the area. Karoo age dolerite bodies are common in the area in the form of dykes and sills. Lineament mapping done at a large scale shows major structural direction in a N-S and E-W orientation. These structures are often associated with dolerite intrusion.

The proposed pipeline corridors running from Farm Geluk to Farm 58 are mainly underlain by granitic gneiss, granitic pegmatite, quartz-biotite schist, marble, dolomite and quartzite of the Karibib and Rossing Formations (Swakop Group). As Farm 58 is approached (south westward), the pipeline corridor routes are further underlain by surficial deposits.

The dominant geology in the Walvis Bay area is associated with the Kalahari and Namib Sands (Kalahari Group).

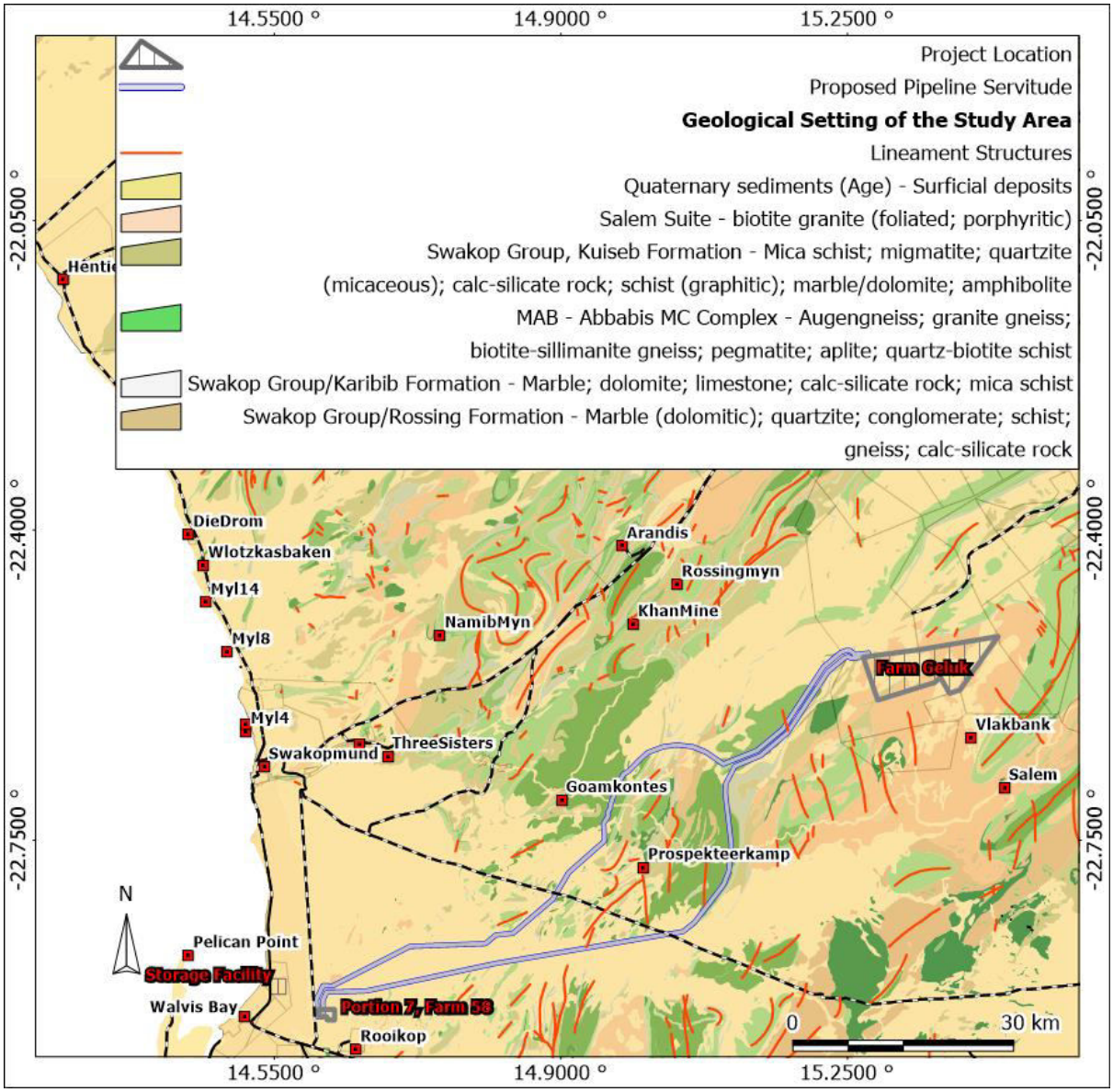

Figure 13. Geological overview of the area

7.5 Hydrogeology of the Area

In general, fractured aquifers in the Swakop Group of the Damara Sequence have minimal groundwater potential. The carbonates, or limestones and marbles, have a moderate potential, and high yields can be found at carefully chosen targets such karstified contact zones and fracture zones. The quantity of rainfall, along with the ensuing weathering and recharging determines this. Alluvial sediments of the Khan and Swakop ephemeral rivers provide another good aquifer and a source of water.

According to the Department of Water Affairs (DWA) database (although outdated), approximately 73 boreholes are located within a 20km radius of Farm Geluk. Groundwater in the project area is found mainly along geological structures (secondary porosity) and in the lower parts of the riverbeds (primary porosity). The majority of the boreholes were drilled to depths of less than 50m below ground level (mbgl). A number of wells are present in the area, tapping the relatively shallow groundwater. Recorded water levels ranges from 0mbgl (springs) to 30mbgl. The boreholes generally produce less than 5m3/h, but careful borehole placement on geological structures may produce higher yielding boreholes.

On the other hand, no boreholes exist within a 5km radius along the proposed pipeline corridor routes, and no boreholes exists at the coastal sites (i.e. Farm 58 and the storage facility site at the Northport). See Figure 14 for the hydrogeological map.

The study area does not fall within a groundwater control area; however, groundwater remains the property of the government of Namibia. This means that government controls the exploration and usage of it.

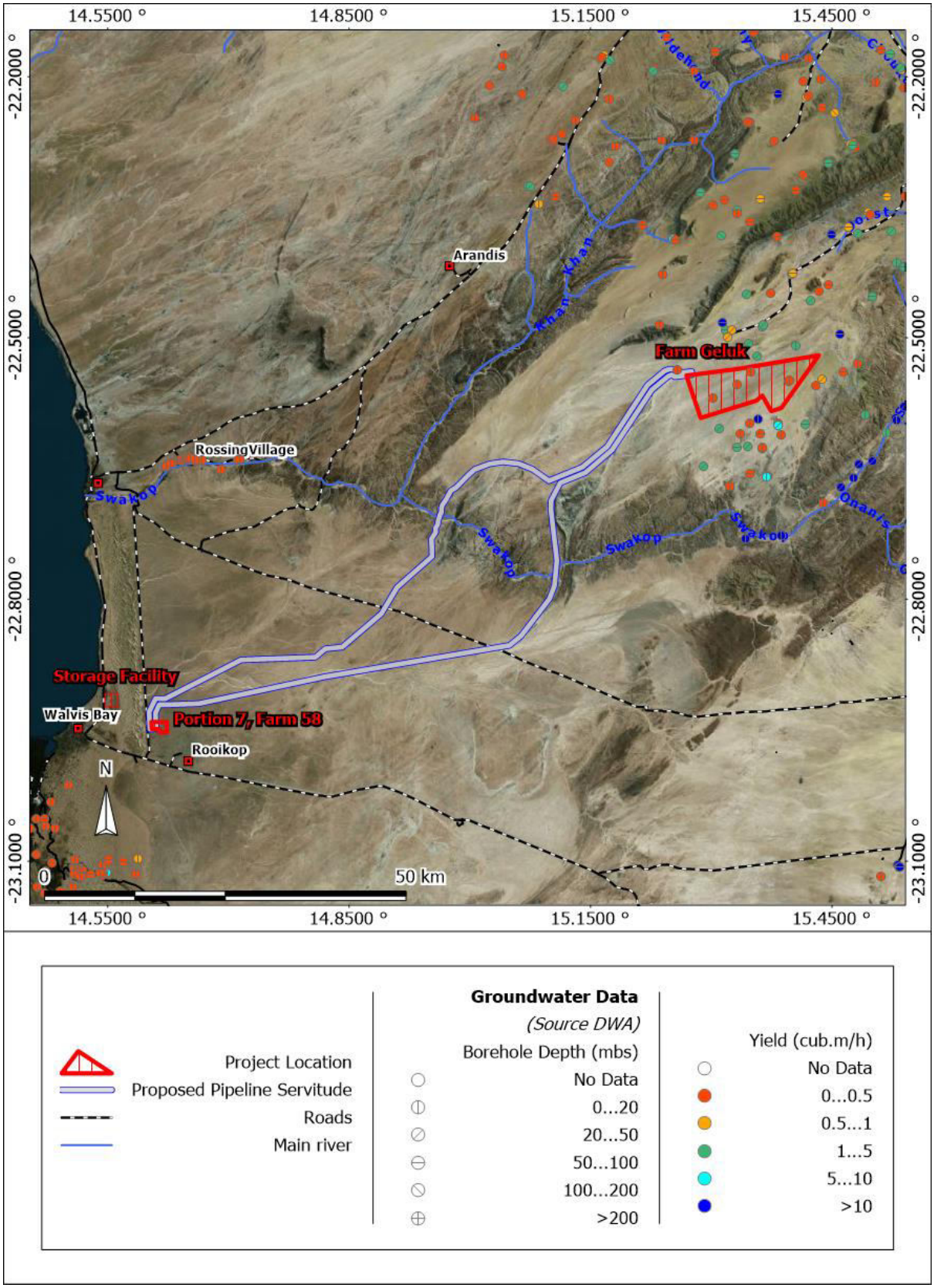

Figure 14. Hydrogeological map of project area

7.6 Biodiversity

A biodiversity specialist study (Cunningham, 2024) was commissioned for this ESIA. A detailed assessment report is attached as **Annexure H** of this report. A synopsis of the study and outcomes is provided in this and subsequent chapters.

A literature review was conducted to determine the actual as well as potential vertebrate fauna and flora associated with the general area commonly referred to as the Southern Namib or Southern Desert (Giess 1971, Mendelsohn et al. 2002). This area is bordered inland by the Central Namib or Central Desert (Giess 1971, Mendelsohn et al. 2002).

A field survey was conducted between 22 and 26 January 2024 to determine the vertebrate fauna (e.g., reptiles, amphibians, mammals, and birds) and flora (trees >1m in height; grasses and other important flora) at the proposed Green Hydrogen Project area (Farm No 58 [Walvis Bay] & Farm No 116 [Usakos]) roughly between Walvis Bay and Usakos. This survey was preceded by a review of the historical reports of the vertebrate fauna and flora known/expected to occur in the general area as conducted by various authors (e.g., Cunningham 2006, 2007, 2010, 2011, 2013, 2019, 2021 Griffin 2005a, Henschel et al. 2000, Henschel et al. 2011, Kavari 2007).

This field survey was conducted to confirm vertebrate fauna and flora species at the proposed development sites – i.e., Farm No 58 (Walvis Bay) and Farm Geluk No 116 (Usakos area)

7.6.1 Fauna

7.6.1.1 Reptile Diversity

Reptile diversity known and/or expected to occur in the general area – i.e., Walvis Bay coastal area to Farm Geluk in the Usakos area – is presented in **Table 1 of Annexure H**.

Approximately 261 species of reptiles are known or expected to occur in Namibia thus supporting approximately 30% of the continent's species diversity (Griffin 1998a). At least 22% or 55 species of Namibian lizards are classified as endemic. The occurrence of reptiles of "conservation concern" includes about 67% of Namibian reptiles (Griffin 1998a).

At least 63 species of reptiles are expected to occur in the general area with 38 species being endemic – i.e., 60.3% endemic. Two species expected to occur in the area (*Stigmochelys pardalis* and *Varanus albigularis*) are classified as vulnerable and protected game although both, especially *S. pardalis*, probably only occasionally passes through the general area as a vagrant and not expected to occur permanently in the area due to the overall arid conditions. *Pelomedusa subrufa* is only expected to occur in drainage lines in the area (e.g., Khan, Kuiseb, Swakop and Tumas Rivers and their tributaries) with suitable habitat – i.e., long lasting water holes. *Lycophidion capense* and *Lycophidion namibianum* only marginally occur in the Namib-Naukluft Park (Griffin 1998a) and potentially could occur in the general area.

The 63 species expected to occur in the general area consist of at least 19 snakes (2 thread snakes, 1 quill snouted and 16 typical snakes) of which 9 species (47.4%) are endemic, 1 tortoises, 1 terrapin, 19 lizards of which 11 species classified as endemic (57.9% endemic), 1 plated lizard, 1 monitor, 2 agamas, 1 chameleon and 17 geckos of which 15 species classified as endemic (i.e., 88.2% endemic).

As reptiles are generally understudied animals; occur at low densities in such marginal habitat, many more species are expected to occur in the general area than confirmed during the fieldwork. However, except for *Pedioplanis husabensis* associated with specific habitat and geology in the general area (i.e., Husab area), no reptiles are exclusively associated with the Green Hydrogen Project area.

During the rapid site assessment only 3 reptile species were confirmed from the various development areas (*Trachylepis acutilabris*, *Meroles reticulatus* and *Phelsuma (Rhoptropus) afer* (Figures 4-6)) while a total of 34 species have been confirmed from the general area by Cunningham (2007, 2010a,b, 2011a,b, 2013, 2014, 2019, 2021, 2023) (See Table 1). The low number of species is probably due to the extreme dry conditions experienced throughout the areas surveyed (e.g., neighbouring Farm Bloemhoff received a total of 2mm of rainfall during 2023 – A. de Man *Pers. com.*) as well as overall low densities in these marginal habitats (i.e., coastal salt pan habitat in the Ammonia Storage Plant and sparsely vegetated gypsum/gravel plains in the Farm 58 area are low biodiversity areas).

7.6.1.2 Amphibian Diversity

Amphibian diversity known and/or expected to occur in the general Green Hydrogen Project area (Walvis Bay to Usakos) (literature study only), is presented in **Table 7 of Annexure H**. The dry sandy coastal desert (Namib) and saline coastal areas are poor habitat for amphibians (Cunningham & Jankowitz 2010). Although the ephemeral Khan, Kuiseb and Swakop Rivers reach the sea in the Walvis Bay and Swakopmund areas, they seldom flow with temporary freshwater pools being rare close to the coast.

At least 7 species of amphibians can occur in suitable habitat in the general area (Du Preez and Carruthers 2009). The area is underrepresented, with 3 toads and 1 species each for rain, rubber, sand and platanna known and/or expected to occur in the area (i.e., potentially could be found in the area). Of these, 3 species are endemic (Poyntonophrynus dombensis, Poyntonophrynus hoeschi and Phrynomantis annectens) (Griffin 1998b) – i.e., high level (42.9%) of amphibians of conservation value from the general area. The IUCN (2023) classifies all the species as least concern.

The most important species are the 3 endemics although they are widespread throughout Namibia and not specifically associated with the Green Hydrogen Project area. Overall suitable habitat for amphibians in the general area is viewed as the ephemeral Khan, Kuiseb, Swakop and Tumas Rivers and their various tributaries. Temporary pools after localised rainfall events could potentially serve as habitat for amphibians throughout the area. None of the unique/important amphibian species are exclusively associated with the proposed development area.

7.6.1.3 Mammal Diversity

Mammal diversity known and/or expected to occur in the general Green Hydrogen Project area (Walvis Bay to Usakos) (literature study only), is presented in T**able 8 of Annexure H**.

The most important species from the general area are the Namibian wing-gland bat (*Cistugo seabrai*) listed as endemic and rare; Littledale's whistling rat (*Protomys littledalei namibensis*) – of which the subspecies "*namibensis*" is known to occur in the ephemeral river courses in the "Swakopmund area" Griffin (2003) – listed as endemic; brown hyena (*Parahyaena brunnea*) and leopard (*Parthera pardus*) listed as near threatened and vulnerable (population trends decreasing), respectively by the IUCN (2023). However, leopard and spotted hyena are

only expected to occasionally pass through the area as the general area is not viewed as favoured habitat.

According to Griffin (1998c) habitat alteration and overutilization are the two primary processes threatening most mammals in Namibia. However, none of the mammal species expected and/or observed/confirmed during the fieldwork is exclusively associated with the Green Hydrogen Project areas.

7.6.1.4 Avian Diversity

Bird diversity known and/or expected to occur in the general Project area (Walvis Bay to Usakos) (literature study only), is presented in **Table 11 of Annexure H**. The most important endemic birds known/expected to occur in the general area are Gray's lark, dune lark and Herero chat. Gray's lark is one of the species with the most restricted range in Namibia (Simmons 1998a). Furthermore, Simmons *et al.* (2015) list 2 species as critically endangered (great crested grebe, Cape gannet), 7 species as endangered (Cape cormorant, bank cormorant, black stork, white-backed vulture, martial eagle, tawny eagle, Ludwig's bustard), 6 species as vulnerable (great white pelican, greater flamingo, lesser flamingo, secretary bird, lappet-faced vulture, Hartlaub's gull) and 8 species as near threatened (black-necked grebe, crowned cormorant, Verreaux's eagle, peregrine falcon, kori bustard, African black oystercatcher, chestnut-banded plover, Damara tern).

However, the most important bird known to occur (and breed) along the coast is the Damara tern (*Sterna balaenarum*) classified as near endemic and near threatened under Namibian legislation (Simmons *et al.* 2015) and least concern (population trend decreasing with 2,200-5,700 mature individuals due to increased recreation and construction pressure on breeding grounds) by the IUCN (2023). With 98% of the Damara tern breeding population being in Namibia (Braby 2010a, Braby 2010b; Braby 2011; Crawford and Simmons 1997); very low inter-colony dispersal rates with only 70 known colonies (Braby 2011); the importance of the general area cannot be stressed enough. Furthermore, the Caution Reef breeding colony (~13 to 120 nests since 1994) closer to Swakopmund is viewed as the third largest known breeding colony (Braby 2011).

Disturbance and urbanisation, especially off-road vehicles, impact on breeding success and consequently pose the biggest threat to Damara terns along the Namibian coast (Braby *et al.* 2001, Braby 2011, Braby and Braby 2002). Although Damara tern potentially could breed on the salt pan (Ammonia Storage Plant) and the sandy/gravel gypsum plains (Farm 58 area), this has not yet been recorded and neither are these areas the quiet undisturbed habitat the birds prefer. Abovementioned indicates the importance of the general coastal areas although not specifically related to the Green Hydrogen Project area, although the Ammonia Storage Plant and associated pipelines to Farm 58 developments east of the Dune 7 area, are within this important bird habitat

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7.6.2 Flora

7.6.2.1 Tree and Shrub Diversity

It is estimated that at least 55 species of larger trees and shrubs (>1m in height) occur in the general area (Mannheimer and Curtis 2018) (**Table 13 of Annexure H**).

The various developments fall within 3 vegetation types – i.e., Southern Namib (Port & Farm 58 developments), Central Namib (water & hydrogen pipelines) and the Semi-desert and Savannah Transition Zone (Escarpment area) (Giess 1971).

During the fieldwork, a total of 28 species of larger trees/shrubs were identified throughout the various proposed Green Hydrogen development areas and a total of 365 when including other smaller species <1m in height (e.g., *Aloe* spp., etc.). The bare saline coastal pan site had only 1 species (i.e., *Salsola* spp. on the dune hummocks to the east) followed by the Farm 58 area with only 3 species while the Pipeline route had 22 species (28 species when including other species – e.g., *Aloe asperifolia*, *Calicorema capitata*, *Ectadium* spp., *Galenia africana*, *Sesuvium sesuvioides*, *Zygophyllum clavatum*) and the Farm Geluk area, 20 species (22 species when including other species – e.g., *Aloe asperifolia*, *Aloe namibensis*).

The most important species confirmed from the various proposed Green Hydrogen Project sites are viewed as *Acanthosicyos horridus* (!Nara: Protected F, N-end), *Aloe asperifolia* (Protected NC), *Aloe namibensis* (Protected NC), *Aloidendron (Aloe dichotoma) dichotomum* (quiver tree: Protected F, NC, C2, N-end and classified as vulnerable by the IUCN 2023), *Commiphora saxicola* (rock corkwood: end) as well as the unique *Welwitschia mirabilis* (welwitschia: Protected F, NC, C2). Other important species are the larger *Acacia erioloba* (camel thorn) specimens used by the endangered lappet-faced vultures as nesting sites.

7.6.2.2 Grass Diversity

It is estimated that up to 56 grasses – 28 to 39 species – (Müller 1984 [28 spp.], Müller 2007 [41 spp.], Van Oudshoorn 2012 [39 spp.]) occur in the general Project area. Table 14 of Annexure G indicates the grasses known and/or expected to occur in the general area and are derived from 1Müller (1984), 2Müller (2007) and 3Van Oudtshoorn (2012).

According to various authors, a total of 56 species of grass potentially occurs in the general area (Table 14) although between 28 and 41 species are indicated by Müller (1984, 2007) specifically from Namibia. Three endemic grasses are expected to occur in the general area and include *Eragrostis omahekensis*, *Pennisetum foermeranum* and *Stipagrostis damarensis* with *S. damarensis* only occurring in the central and northern Namib in dry river courses (Burke 2005, Müller 2007). However, none are exclusively associated with the proposed development areas.

During the fieldwork, no grass species were observed in the coastal and Farm 58 areas, while only 3 and 4 species were observed along the pipeline and Farm Geluk areas, respectively. The general area was very dry, accounting for the low number and abundance of grasses observed throughout.

7.6.2.3 Other species

Other species observed throughout the proposed development area included the following herbs, *Acanthopsis disperma, Asparagus spp. Cleome suffruticosa, Kleinia longiflora, Mesumbryanthemum barkli, Sesuvium sesuvioides, Zygophyllum simplex*, etc.

The only invasive alien species observed throughout the Project area were *Nicotiana glauca* (wild tobacco) and *Prosopis* spp. (mesquite spp.) associated with the Swakop River – heavy infestation of *Prosopis* spp. – i.e., along the pipeline route – and close to the Farm Geluk homestead area. These species should be eradicated when located in the various proposed development areas.

7.7 Heritage and Archaeological Resource

Development activities such as mining, factories and power plants in a given area can have negative implications on archaeological, cultural and heritage resources/sites found within the same vicinity as the construction. In correlation with this, The National Heritage Act (No. 27

of 2004) was established as a legal instrument for the protection and conservation of this heritage resource. Archaeological remains in Namibia are protected under the National Heritage Act (27 of 2004) and National Heritage Regulations (Government Notice 106 of 2005).

A heritage and archaeological impact assessment was conducted for the proposed project. The assessment carried out utilised both field surveying of the site and desktop studies to gain a deeper understanding of the study area. A ground survey of the project area was carried out in January 2024. The findings were further augmented through research carried out at the National Archives in Windhoek. This section contains a summary of Dr Mowa (2024) archaeological specialist assessment of the project area (Annexure J).

The primary purpose of the heritage impact assessment survey was to locate and assess fragile/ endangered archaeological sites within the spectrum of the project area where the above-proposed project is envisaged. Second, it is intended to identify the heritage significance of possible sites and resources to assess their vulnerability and estimate the extent of possible impacts and mitigation measures if required.

7.7.1 Archaeological Setting and Observations

The western parts of Namibia have a rich and well-studied archaeological record of human settlement spanning the last one million years.2 Within the central Namib Desert which includes EPL 5796 and the proposed Hope and Gorob Mine, archaeological remains occur as a thinly scattered distribution of stone artefacts and related material dating mainly to within the last 150 000 years, the last Interglacial (130 000 to 115 000 yrs BP) being particularly well represented (see Figure 15). This was a period of elevated humidity in southwestern Africa and was followed by consistently unstable climatic conditions. During the last few thousand years human occupation of the central Namib was characterized by the use of small basecamps at temporary water sources, more sustained residence being possible only at the coast and at a small number of sites. Early colonial era occupation of the Namib was similarly limited by water supplies, but small relatively successful settlements were established in some places.

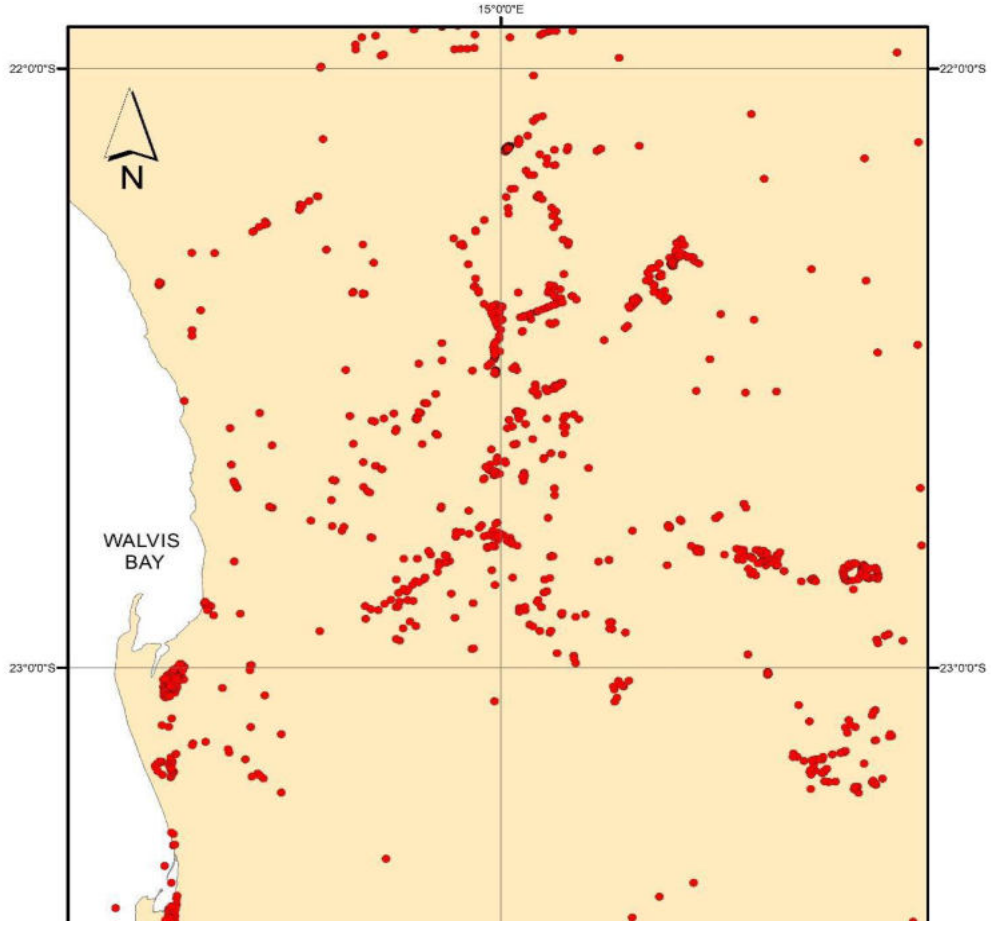

Figure 15. Regional archaeological setting with known archaeological sites

The Erongo archaeological complexes cover three periods, namely the Holocene, precolonial and colonial periods. Walvis Bay has had contact with seafarers since the early 1800s when whalers and sailors would frequent the bay for trading purposes with the locals living near the Kuiseb delta. According to Kinahan (2001), whalers would wait in the Bay for the locals to arrive from the other side of the dune with their livestock for trading. However, evidence of human settlement along the dune suggests a more temporary/transhuman settlement, a more permanent settlement can be traced to the early and mid-eighteenth century at Khis-//gubus (a waterhole). The site Thompson visited in 1786 (Khaeros) both with Khis-//gubus has well-preserved track prints of animals such as zebras, elephants, and cattle, indicative of human settlement.

Furthermore, excavations took place in a rock shelter near Mirabib (the site which is an inselberg made of granite located north of Kuiseb River) where different stratigraphic layers were found which indicate climatic changes over time.

Other excavations and discoveries include the Eremitalapa remains in the pellets of the gravel plains. Such animal remains suggest that the dunes of the Namib once intersected with the Khuiseb River during the Holocene period. Owl pellets were also discovered in the Hennops Cave. Microfauna from both Mirabib and Hennops indicate climatic oscillations over time, (Sandelowsky, 1983). Most archaeological finds in Walvis Bay are traced to the dunes east of the marsh and northern parts of the Khuiseb Delta. A site sandwiched between Wortel and Khisa//gubus within barchan dunes revealed detailed footprints of juvenile and adult humans with their cattle and dogs. Studying the tracks both in terms of precision and direction, archaeologists suggest that this possibly could be part of the herd of livestock that was frequently transported to the Bay for trading purposes in the 18th and 19th centuries (Kinahan, 1996). According to Raven-Hart (1967) Since the dawn of European trade endeavours in spices to the Far East, the entire coast of Southern Africa engaged in trade with the Europeans; often trading livestock for inferior iron or piece of metal, it was indeed an unfair trade resulted in locals being swindled. To make ends meet after being left without livestock southern African natives would resort to thievery, a common conduct successive European seafarers observed Raven-Hart (1967).

The present town of Usakos located in the Erongo Region was founded in 1900 primarily during the construction of the railway linking Swakopmund and Windhoek and Otavi.

During the subsequent years, it grew and became a small town, it has various historical buildings dating back to the colonial era, such as the old municipal building of 1908, the railway station, the old historic church etc. However, the town is approximately 90 kilometres away to the north of Farm Geluk thus proposed development will in no way remotely affect some of the heritage associated with the town.

Nonetheless, farm Geluk is envisioned to host solar farms, there is a limited archaeological and historical record of the farm, however like most of Namibia, the farm during the German colonial period was allocated to European settlers (Maletzky, 2023).

7.7.2 Localized heritage context on Farm Geluk

Farm Geluk has belonged to Mr Maletzky since 2004, after purchasing the farm from the previous owner. According to Mr Maletzky (2024 pers. comm), to the east, almost 20 kilometres from the proposed site solar farm locality, is a historic train station, in addition to

tombstones indicative of the presence of burial sites left during the German colonial period. The railway line is probably the first attempt by the German colonial government to construct a railway line connecting Swakopmund to Windhoek via Otjimbigwe. Such railway lines possess inherent historic virtues and are thus heritage sites in their own right, however, the railway line is 20 kilometres to the east of the proposed solar farm site on Farm Geluk according to Mr Maletzky.

7.7.3 Archaeological Heritage around Farm Geluk

In 2022 a comprehensive survey was carried out (Nankela 2022), among others the objective of this survey was to establish the archaeological and historical heritage of Farm Jakkalswater and the neighbouring farms in the area. Even though previous heritage resources had been established within the area both archaeological and historical by Dr Kinahan (Kinahan 2012), this field survey by Dr Nankela confirmed the presence of an established wealth of archaeological, historical and natural heritage. In essence a wealth of archaeological heritage exists in the form of evidence of grass seed exploitation which predominantly is confined to desert and semi desert environment. Second, Pre and Post Colonial historical significance in the form of remnants of railway line and railway station at Pforte. Evidences recorded and confirmed at both Jakkalswater Farm and some part of the Pforte are in form of infantry entrenchments, artillery earthworks, access tracks between such features, remains of heliograph signaling posts, ruins of railway station buildings, human remains, dumps of spent ammunition; earthworks, historic waterpoints including human remains in presumably dating from the first world war now kept in the museum (Nankela 2022). Mrs Valerie Geldenhuys the owner of Farm Jakkalswater indicated to the heritage specialist that Jakkalswater has been a site of both historic and archaeological research with visitation by researcher from Cologne University. A place of natural wonder appreciation with natural rock sculptures in the form of animals aesthetically attracting tourist in addition to its prestine unmolested natural environment. She and other farmers (i.e. Jakkalsdans, Wustenquell) for these reasons and the heritage documented report highlighting the wealth of heritage on the farm resent and are not in favour of any development near their farm including solar installation at Farm Geluk.

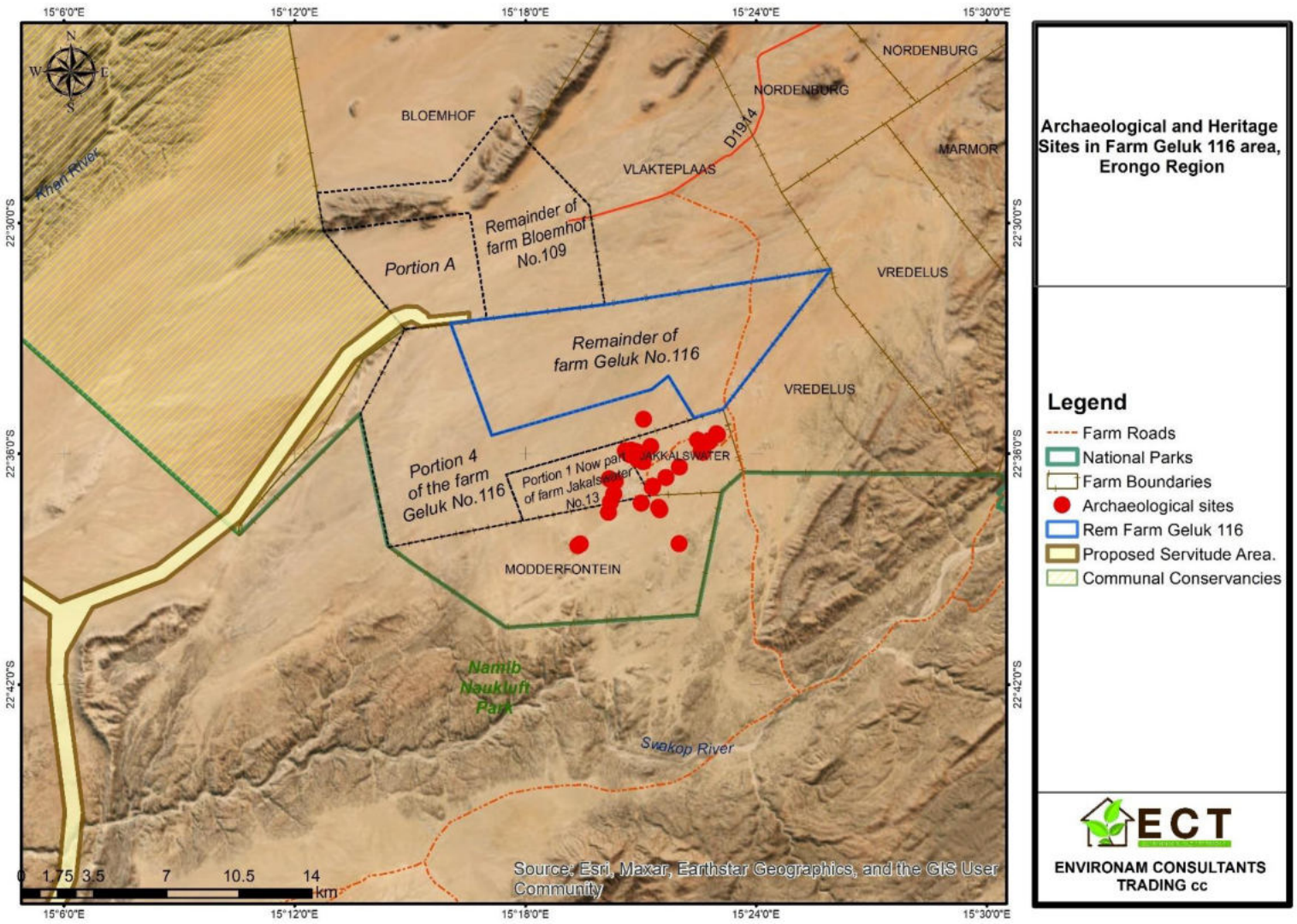

Figure 16. Map indicating archaeological, geoarchaeological and colonial and war heritage resources including burial sites and within Farm Jakkalswater, Modderfontein and Portion 4 of Farm Geluk.

According Nankela (2022) a cave shelter housing more than 85 well preserved rock painting been recorded on farm Geluk in close proximity to Jakalswater Farm. The motifs are figurative in content and depict mainly stylized human and animal representations in various shades (red, brown, black, white and orange). Stylistic analysis indicates that the paintings belong to Hunter-Gatherer tradition and have been executed in fine line technique, in various scenes such as hunting, religiously and social gatherings with clear relations to each other. The animal figures are depicted naturalistically - with some isolated while others in groups with clear relations to each other.

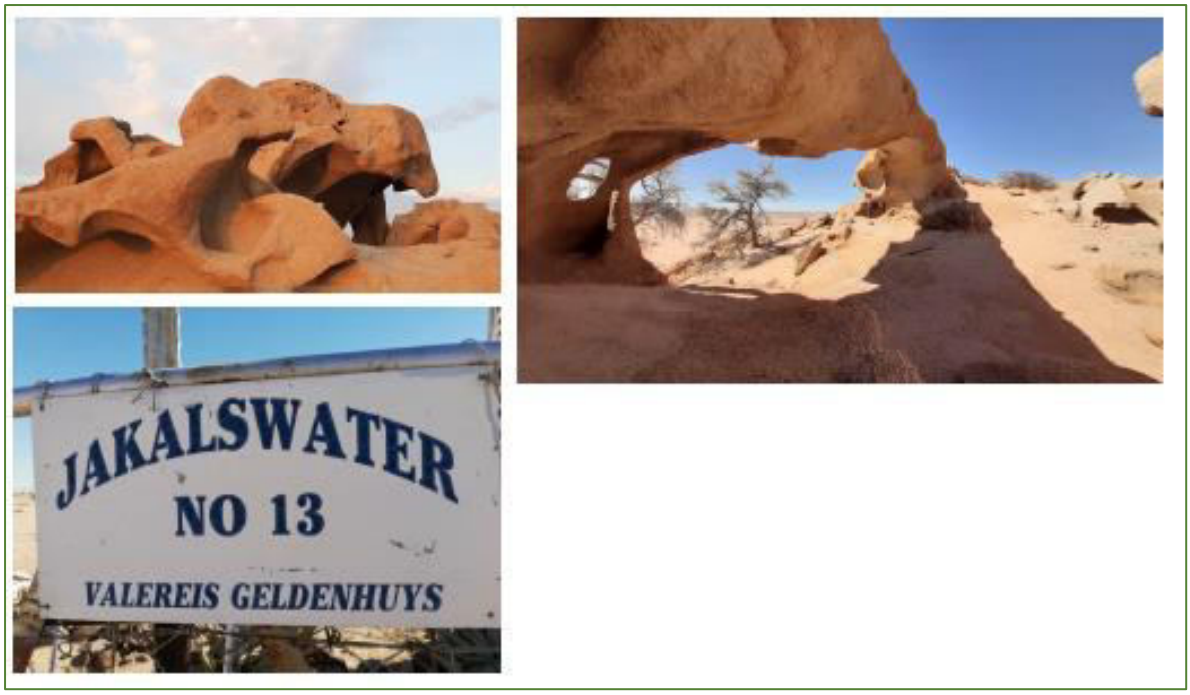

Figure 17. Archaeogeological heritage in the form of natural rock sculptures unique to Farm Jakkalswater no 13 (Source: Valeries Geldenhuys, 2024)

Figure 18. First World War 1 war Memorial unique to Farm Jakkalswater no 13 (Source: Valeries Geldenhuys, 2024)

7.7.4 The Heritage of Walvis Bay

The discovery and history of Walvis Bay by Europeans are believed to date back to 1487 during the exploration by Bartholomeus Diaz, however indigenous peoples traversed the coast including Walvis Bay for thousands of years prior. Centuries later after Diaz, Walvis Bay was claimed by Great Britain in the 1800s. During this period Walvis Bay was predominantly used as a harbour and trading post for sea fearers. Ships would frequent the harbour for fishing the rich resources offshore. American whalers would often surround the bay during the whaling season which lasted almost two years harvesting oil from whales, they exchanged European goods for Livestock (Kinahan 2001). As such this assessment was cognisant of such potential sightings of heritage in the form of whale bones from the precolonial era within the surveyed coastal area. Nevertheless, yielded none of such heritage within the boundary of the Farm Portions proposed for Green Hydrogen development.

7.7.5 Field Observations and Findings

A Farmstead, animal drinking trough, borehole, and potential burial site were found a kilometre away from the Project area on Farm Geluk. The remaining structures include a small one-door shack which is enclosed by a fence. Outside the fence, adjacent to the structure is a potential burial site (Figure 20). Within the same vicinity are structures that indicate the area was or is currently being utilized to supply water to animals within the farm, however, the structures seem not to have been utilized by the time this field assessment was carried out.

The potential burial site is significant, the piles of stones are typical of ancient burial traditions in central Namibia. Upon enquiry, Mr Maletzky however indicated that he discovered the pile of stone when he purchased the farm 20 years ago. It is not clear however what it is for. Mr Maletzky leans towards the assumption that it is a marker either a trig beacon or the likes erected by authorities. He equally emphasised that there is a hole near this farm structure which collects water during the rainy season, it is vital to him in this arid area that he has named it ‘’Lake Otjikoto” in reference to its unique similarity to the original Lake Otjikoto near Tsumeb.

Mr Maletzky`s homestead was established almost 45 years ago on farm Geluk, which is a semi-desert with isolated plants but significant grassland for adapted desert wild animals to survive on. It was also established that within farm Geluk there is a rock shelter with paintings near

border with Farm Jakkalswater however Mr Maletzky is not aware of this rock shelter host to 85 painting figures in this area.

Figure 19. Farm Geluk envisioned for Solar Farm, and existing homestead on farm

Figure 20. Farmstead (Left Picture), Animal drinking trough and Borehole (Middle), Potential burial site (Right)

Figure 21. Portion 7 of Farm 58 landscape (Left Picture), black smooth stones that dominate the landscape (Middle Picture), A Memorial monument vandalised with graffiti in honour of the late Nathanael Maxwilili about 2,7 kilometres south-west of Portion (Right Picture).

Figure 22. Portion 4 of Farm 39 landscape (Left Picture) and organic materials findings such as tiny bones within Portion 4 (Left Picture).

Figure 23. Map indicating the position of suspected heritage sites within Farm Geluk 116, established during the field assessment

Site 1 (22.55179°S, 15.349920°E): Homestead with probable burial site.

A Farmstead, animal drinking trough, borehole, and potential burial site were found within Farm Geluk. The remaining structures include a small one-door shack which is enclosed by a fence. Outside the fence, adjacent to the structure is a potential burial site (Figure 20). Within the same vicinity are structures that indicate the area was recently utilized to supply water to animals within the farm, however, the structures seem not to have been utilized by the time this field assessment was carried out.

Site 2 (22.556375°S, 15.352328°E): Potential Hunting blinds

A series of short horizontally stratified remnants of granite rock outcrops, approximately rises to about one meter in height and about 10 to 20 meters in length each. These might probably have been utilised by the precolonial community as hunting blinds considering the desktop archaeology of the local context.

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7.8 Socio-Economic Environment

7.8.1 National Economic Overview

Namibia, characterized by arid conditions, grapples with challenges despite its wealth in mineral resources, fisheries, widespread livestock production, and a growing urban population. Since gaining independence in 1990, Namibia successfully reduced the proportion of people living below the poverty line by half, reaching 17.4% in 2015/16 (NSA, 2017).

Despite its relatively small population, Namibia faces high inequality, both rural and urban poverty, low educational achievements, a shortage of technical skills, a substantial housing backlog, and elevated youth unemployment. The Fifth National Development Plan 2017/18 – 2021/22 (NDP5) aims for rapid industrialization while focusing on sustainable development pillars: Economic Progression, Social Transformation, Environmental Sustainability, and Good Governance.

Namibia experienced an economic slowdown with its slowest growth recorded at an estimated 1.1 percent in 2016. This deceleration was attributed to weakened performances in the primary, secondary, and tertiary industries. Specifically, the primary and secondary sectors contracted by 2.0 percent and 7.8 percent, respectively, while the tertiary sector exhibited slow growth of 3.9 percent (NPC, 2018).

However, during the period from 2017 to 2021, Namibia's domestic economy faced contractions of 1.0%, 0.8%, and a significant 8.0% in 2017, 2019, and 2020, respectively. In 2021, the economy rebounded, achieving a growth rate of 2.7%, recovering from the severe 8.0% decline, marking its most substantial contraction in 2020. The noteworthy contraction in 2020 was primarily attributed to global, regional, and domestic economic disruptions induced by the COVID-19 pandemic (NSA Annual National Accounts, 2021).

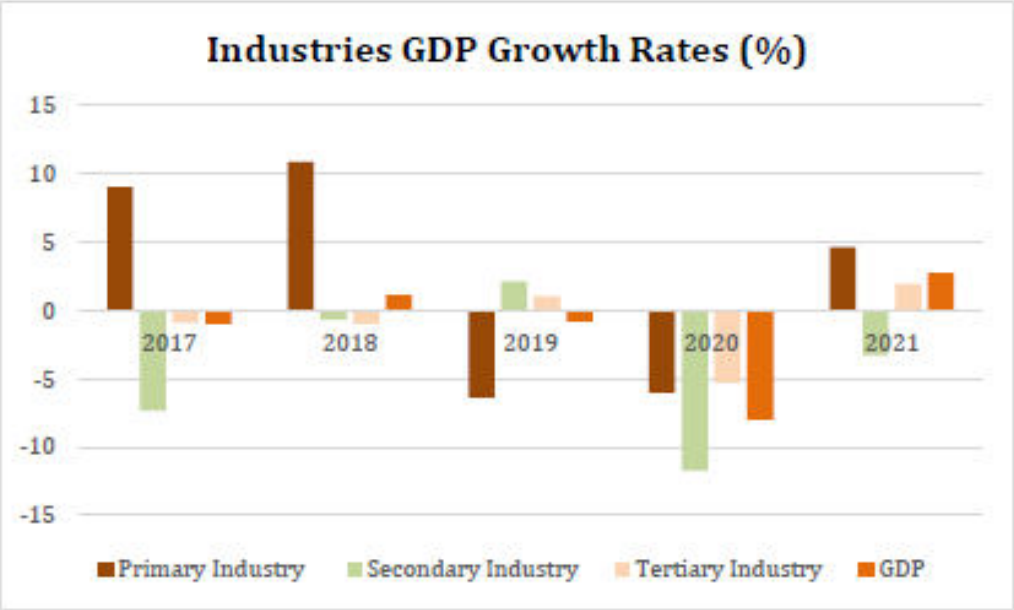


Figure 24. Industries GDP Growth Rate, NSA Annual National Accounts 2021

In the first quarter of 2022, Namibia's domestic economy displayed robust quarter-on-quarter growth, reaching 5.3%. This marked a significant recovery from the 4.9% decline observed in the corresponding quarter of 2021, according to the United Nations Development Programme (UNDP) report in 2022.

However, the positive economic trajectory faces a looming threat from the ongoing Russia-Ukraine conflict. This conflict is expected to impede the slow recovery from the COVID-19 pandemic for several African nations, including Namibia. The conflict introduces an additional layer of disruption as countries work to overcome the lingering effects of the global pandemic, resulting in economic setbacks.

The economic repercussions of the Russia-Ukraine conflict extend to Africa, causing trade disruptions and challenges in global food and oil supply. This, in turn, contributes to an escalation in food and fuel prices. Namibia, heavily reliant on imports for food consumption, especially cereals like wheat and maize, is vulnerable to a threat to its food security. Conflict-induced supply disruptions have led to a rapid increase in food prices, particularly affecting low-income households. These households, lacking the financial means to shift to alternative food sources, bear the brunt of inflationary pressures. This information is substantiated by the NSA Annual National Accounts 2021, providing a comprehensive understanding of the

economic challenges posed by the conflict and its impact on Namibia's food security and inflation rates.

Namibia's Gross Domestic Product (GDP) is a key indicator of the country's economic performance and overall economic health. GDP measures the total value of all goods and services produced within the borders of Namibia over a specific period. It offers crucial insights into the size and growth rate of the economy, serving as a vital tool for policymakers, investors, and analysts. The performance growth rates of economic sectors in the first quarter of 2023 indicate how much each sector has expanded or contracted compared to the corresponding period in the previous year. Namibia has an emerging significant Green Energy investment which has the potential to boost the national and local energy.

7.8.2 Namibia's Population Demography

On 13th March 2024 the Namibian Statistic Agency released a preliminary report that gives the provisional results from the 2023 Population and Housing Census (PHC) of Namibia. According to the Media release, the presented result are provisional and will be used as provisional figures until the final results are released by October 2024. The final results may differ slightly from the statistics presented in the preliminary report.

The population demographic results are summarised below:

- The Namibia population figure from the 2023 PHC is 3.02 million people
  - The population has increased by 909,324 people from the 2.1 million people recorded in 2011, constituting an annual intercensal growth rate of 3.0% per annum. This rate is double what was observed in the previous intercensal period (2001 to 2011 which was 1.4% per annum) and is the highest observed since independence (see Figure 23). At this rate, by the year 2050 the population of Namibia would be over 6 million, under ceteris paribus.

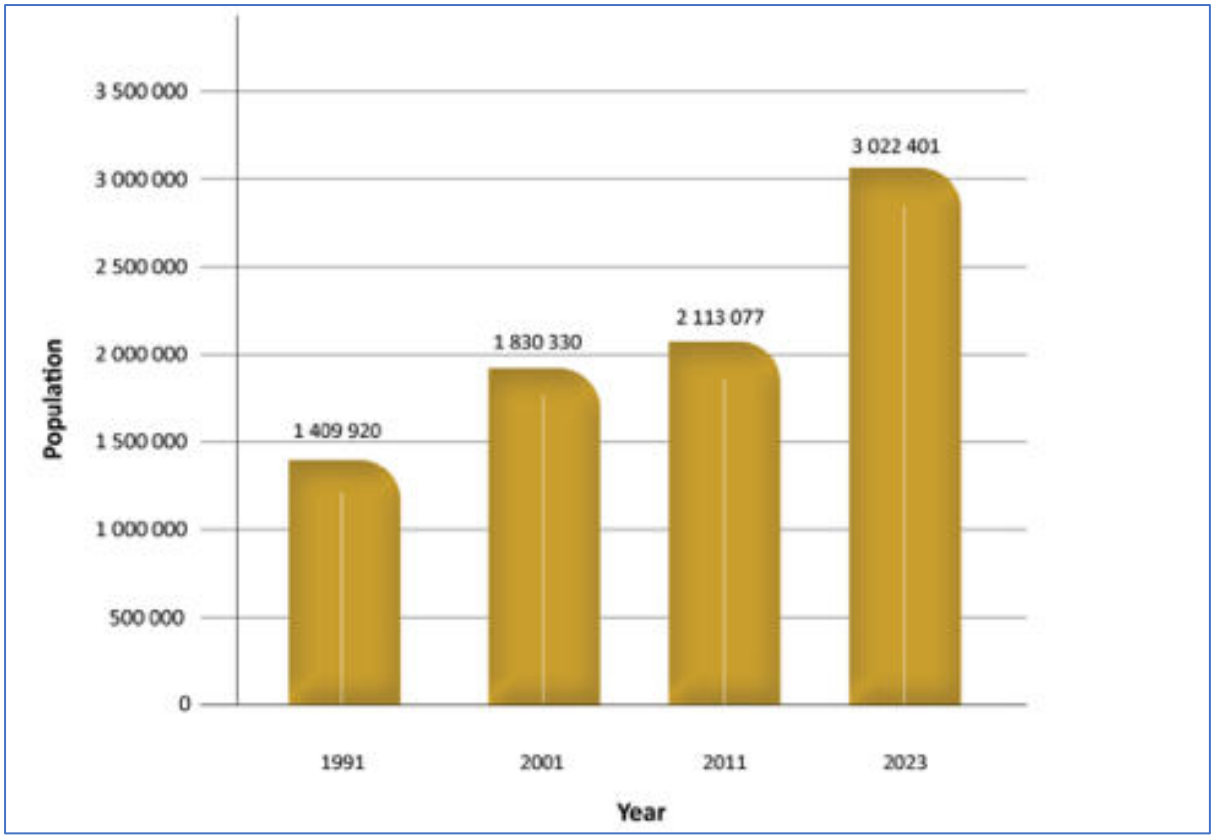


Figure 25. Trend of the Namibia Population

- Females make up a greater proportion of the population in the 2023 PHC as has been the trend for the past four censuses.
- The population is growing, at an increasing rate compared with previous censuses.
- Khomas region remains the most populous region in Namibia with a population of 494,729 people. Ohangwena region closely follows as the second most populous region with a population count of 337,729 people. These two regions are respectively four and three times bigger than the size of the least populous region, the Omaheke Region. Omusati is the third most populous region, with a population count of 326,671 people and these are similar trends as observed in the 2011 census.
- Erongo region is the fifth populous region, whose population in 2011 was 150 809 and grew to 240 206 representing 59.3 % change and 7.9% of the total population.
- //Kharas region and Erongo region recorded the smallest household size of 3.1 people per household while the largest household size was recorded in Kavango East and

Kavango West Regions, with a household size of 5.3 and 5.5 respectively. In nine out of the 14 regions, households had less than four members, on average.

- Average household size, which has been on the decline since 1991, is 3.8 persons per household.
    - The total number of households has grown by 291,500 (representing a 62.7% increase) over the 464,839 households enumerated in 2011. Household size decreased by 0.6 persons per household from 4.4 in the 2011 census.
- The region with the highest population density is Ohangwena with 31.5, persons per square kilometre, followed by Oshana region with 26.7 persons per square kilometre, and Khomas region with 13.4 persons per square kilometre. //Kharas Region, Hardap, and Kunene represent the most sparsely populated regions with 0.7 and 1.0 persons per square kilometre respectively (see Figure 26).

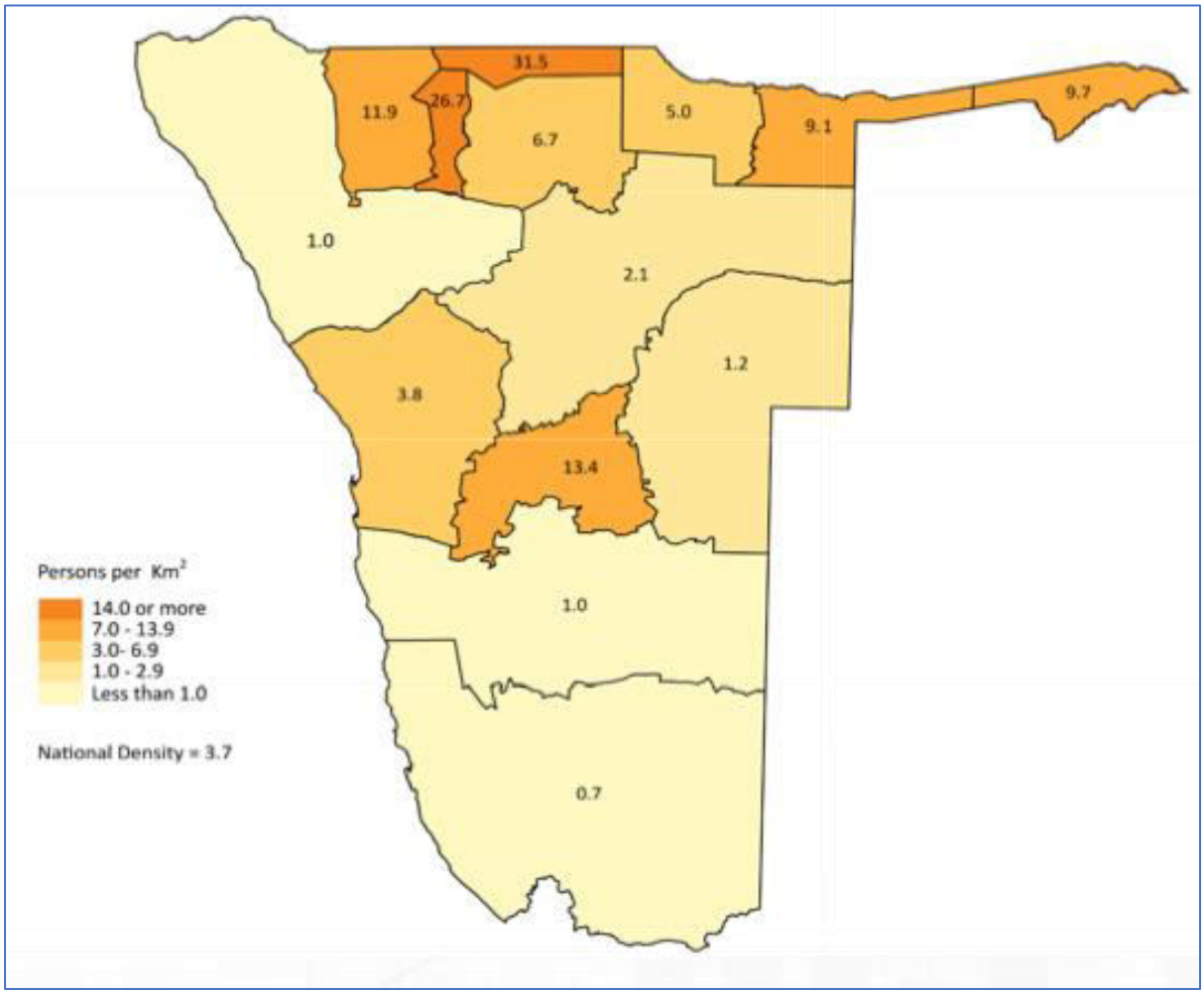


Figure 26. Namibian Regional Population Density

I. Urbanisation

It is observed that from 2011, urban population increased from 903 434 to 1,494,992 people in 2023 while the rural population increased from 1,209 643 in 2011 to 1,527,409 in 2023. This represent 65.5 and 26.3 percent increase in urban and rural population respectively (see Figure 27).

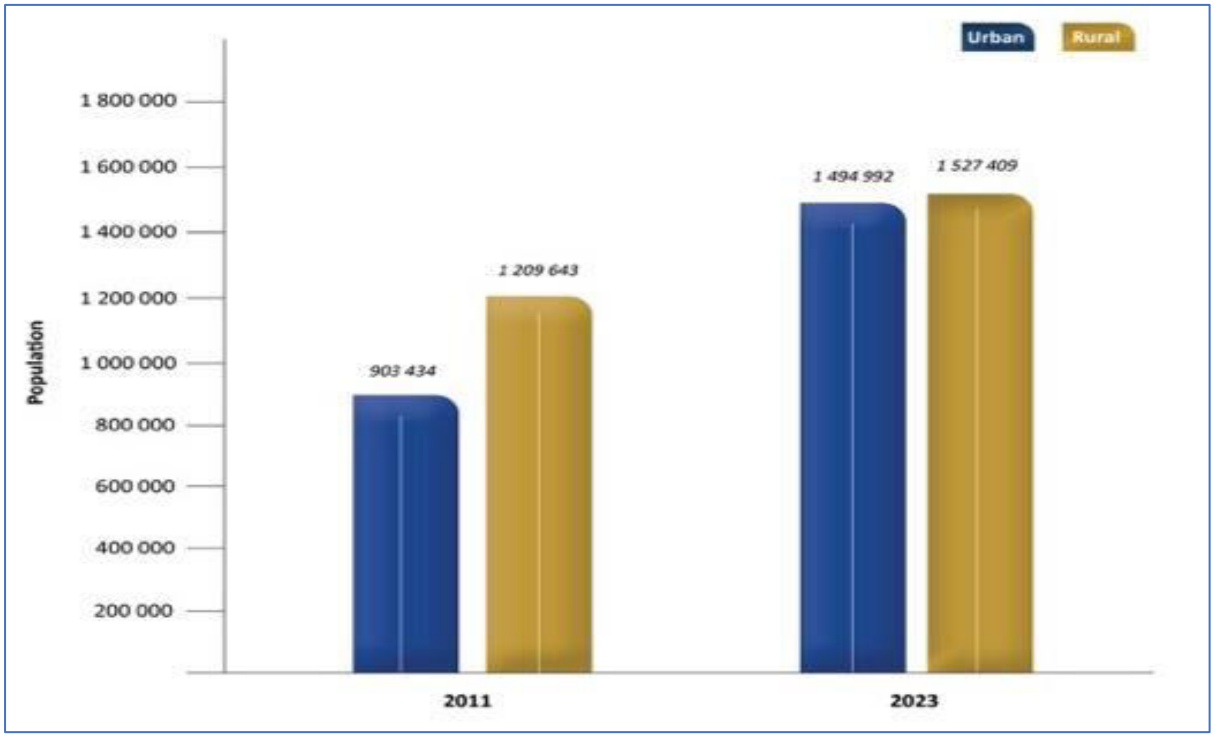


Figure 27. Namibia urban and rural population trend

II. Regional Populations of Namibia

The regional distribution of the population for 2023 is similar to the distribution for 2011, where Khomas remains the region with the highest population (494,605) while Omaheke remains the region with the least population (102,881) (see Figure 28).

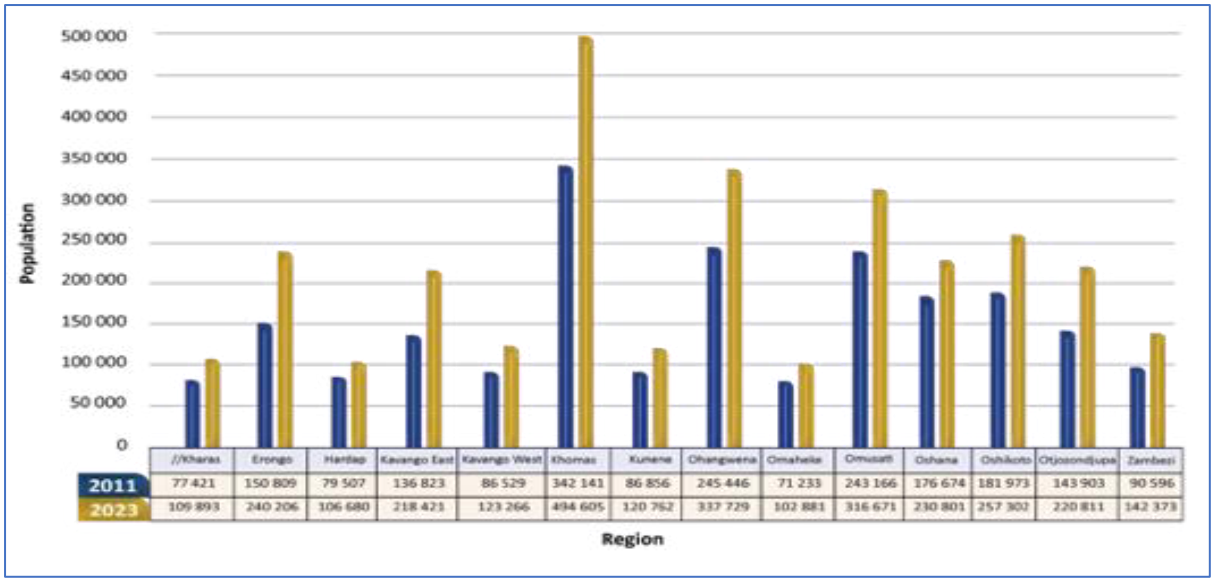


Figure 28. Population distribution by region, Namibia 2011 and 2023 Censuses

7.8.3 Demographic Overview of the Erongo Region

The Erongo Region, comprising seven constituencies: Omaruru, Karibib, Daures, Arandis, Swakopmund, Walvis Bay Rural, and Walvis Bay Urban (NSA, 2014) is a dynamic region reflecting diverse population characteristics.

Figure 29. Map of Erongo Region

The following table shows the population trend of Erongo region, in which the project will be located.

Table 13. Population of Erongo Region, 2023

No	Town	Population
1.	Walvis Bay	102,704
2.	Swakopmund	75,921
3.	Arandis	5,726
4.	Henties Bay	7,569
5.	Usakos	5 094
6.	Karibib	6,938
7.	Omaruru	10,670
	Total	**240,206**

The following sections below contains extracts from the SandSea (2024) specialist study about the socio-economic implications of the project (Annexure I). The assessment conducted evaluated the following social and economic areas:

Employment and Job Creation:

- ***Objective:*** Examine the project's impact on local employment and job creation, recognizing the proximity to urban centres (Walvis Bay and Swakopmund) and assessing opportunities for community members within the Erongo Region.
- ***Metrics:*** Evaluate the number of jobs generated, types of employment, and opportunities for local community members, considering the accessibility of the project site.
- ***Analysis:*** Assess the project's contribution to job openings in the local community, taking into account the location's accessibility and potential collaboration with nearby urban centres.

Income Levels and Economic Growth:

- ***Objective:*** Measure the effect of the project on income levels of local residents and overall economic growth, considering the proximity to Walvis Bay and Swakopmund.
- ***Metrics:*** Changes in average income, GDP growth, and the contribution of the project to the local and regional economy.
- ***Analysis:*** Determine if the project leads to improved income levels for nearby communities and stimulates economic growth, acknowledging the influence of the project's location.

Infrastructure Development and Accessibility:

- ***Objective:*** Examine the project's role in infrastructure development and accessibility in the area, particularly with respect to the existing infrastructure in Walvis Bay and Swakopmund.
- ***Metrics:*** Investments in infrastructure, such as roads, utilities, and
- ***Analysis:*** Assess how the project contributes to infrastructure development and accessibility, leveraging the existing infrastructure of Walvis Bay and Swakopmund to enhance the quality of life for its employees.

Access to Education and Healthcare Services:

- ***Objective:*** Investigate how the project influences access to education and healthcare services, recognizing the proximity to educational and healthcare facilities.
- ***Metrics:*** Changes in the availability and quality of education and healthcare facilities.

- ***Analysis:*** Determine if the project enhances access to education and healthcare services, leveraging the proximity to Walvis Bay and Swakopmund, and addressing the unique challenges of the area.

Community Well-Being and Social Isolation:

- ***Objective:*** Gauge the overall well-being and quality of life of the employees, considering the proximity potential social dynamics.
- ***Metrics:*** Health and safety measures, community satisfaction, and living conditions, with attention to any potential social dynamics.
- ***Analysis:*** Evaluate whether the project enhances the well-being of the community and addressing potential social dynamics.

Stakeholder Engagement and Communication in Remote Areas:

- ***Objective:*** Assess the effectiveness of stakeholder engagement and communication and ensuring meaningful engagement.
- ***Metrics:*** Stakeholder engagement activities, community feedback, and communication strategies.
- ***Analysis:*** Evaluate how well the project addresses the communication challenges and maintain positive relationships with stakeholders.

7.8.4 The Town of Walvis Bay

Based on the information at hand, Walvis Bay constituency's population during the 2023 census was found to be 102,704. Generally, the population distribution reflects disparities in income at the town, with several suburbs standing in for varying income brackets.

Approximately 6% of the population lives in high-income neighborhoods, and approximately 16% lives in middle-class areas. About 42% of people live in low-income neighborhoods, and roughly 36% live in backyard shacks. The older housing areas of the Central Business District (CBD) and Narraville in the north-east of Walvis Bay are classified as middle-income housing areas. These neighbourhoods typically have a household size of around 2 persons on average.

On the other hand, the high-income suburbs in Walvis Bay are primarily located near the lagoon, such as Meersig and the Lagoon. These areas are characterized by affluent residents and have a similar average household size of 2 persons. Additional high-income suburbs

include Langstrand, Dolphin Beach, and Aphrodite Beach, situated to the north of Walvis Bay between the beach and the coastal B2 road from Swakopmund. These suburbs mainly consist of holiday homes, commercial business apartments, and are often owned by absentee owners.

In Walvis Bay, the low-income neighborhoods are Kuisebmund and Tutaleni. Due to Kuisebmund's many single-family homes, which permit the construction of "backyard shacks," at least one-third of the population lives in these shacks. The monthly income of a household in Kuisebmund's shack dwellers was N$2,000, while that of a household in Meersig was N$20,000.

Walvis Bay has experienced significant industrial and port-related growth, leading to an influx of skilled and unskilled workers. With expected increases in uranium mining activity, regional trade, and ongoing rural-urban migration, the town's growth is unlikely to decline in the near future. There is a high demand for new serviced land, especially for low-cost housing, with approximately 90 new townships or 100ha needed by 2030.

Six public secondary schools are located in Walvis Bay: three are in Kuisebmond, one in Narraville, and two in Walvis Bay Central. Walvis Bay Central has three public primary schools, Narraville has one, and Kuisebmond has five. A population of 100,000 people should have 10 secondary schools and 25 primary schools, under the Ministry of Education's requirements. Given the needs of population expansion, there is currently an underabundance of schools, which needs to be rectified in future planning. The operational tertiary institutions in Walvis Bay include the International University of Management (IUM), Namibia University of Science and Technology, and Namibia Maritime Fisheries Institute (NAMFI).

7.8.4.1 Roads and Traffic

Walvis Bay is a key freight national transportation node due to the location of the Port of Walvis Bay. In addition to transhipment traffic, fuel and the flow of containerized freight, major uptick in break bulk and bulk traffic is expected. Arguably the most important driver of changed traffic conditions in Walvis Bay relates to the expected increase in trucks due to the exportation of bulk commodities. The current commodity price indicators suggest that a medium-term recovery of commodity process is likely to result in additional mining activity in Namibia with resultant increases in freight movement.

7.8.4.2 Transport and Communication

Government has made significant investment over the last 20 years in transport infrastructure in support of establishing Walvis Bay as a logistical hub within SADC. A functional and efficient transport and logistics sector is the backbone and key to success in this endeavor.

The Walvis Bay Corridor is a network of transport corridors mainly comprising the Port of Walvis Bay (Namibia's largest commercial port), the Trans-Kalahari Corridor, the Trans-Caprivi Corridor, the Trans-Cunene Corridor, and the Trans-Oranje Corridor. The commercial harbour offers a range of terminal facilities that can handle bulk, containerized, frozen and dry cargo. The Walvis Bay International Airport is the second largest airport, as well as one of two international airports in Namibia.

The transport and communication industry in Namibia comprise the transport, storage as well as the post and telecommunication subsectors. The industry saw the largest growth in the sector of about 7,88% annually, producing a GDP of about N$6,12 billion in 2016, and contributed about 8,89% to the GDP of the sector.

Among the subsectors of the industry, the transport subsector saw the highest production in 2016 where it produced a GDP of about N$2,68 billion and contributed about 43,83% to the industry. The post and telecommunications subsector produced the second highest GDP in 2016 and contributed about 41,33% to the industry. The subsector saw the highest growth among the subsectors, growing significantly fast at a rate of 10,85% annually over the period. Transport and communication contributed about N$4.44 billion (or 5.5% of total GDP) to the Namibian economy in 2011

7.8.4.3 Port of Walvis Bay

As a major logistics and transhipment center, the Port of Walvis Bay facilitates international trade by serving as a gateway for imports and exports. It provides efficient handling, storage, and distribution services for a wide range of goods, including containers, bulk commodities, and vehicles. Strategically located half way down the coast of Namibia, with direct access to principal shipping routes, Walvis Bay is a natural gateway for international trade to and from the SADC region to Europe, the Americas and the Far East. Through the Walvis Bay Corridors, the infrastructure and location of the Port make it suitable to serve SADC import – export bound sea-borne cargo. The Port is linked to Namibia's air, rail and road network, making it

ideally placed to service landlocked countries in Southern Africa, especially through the arteries of the Walvis Bay Corridor Group.

The port's operations support Namibia's export-oriented industries, enabling them to access global markets and generate revenue. The port is a significant source of employment, directly and indirectly, for the local community. It creates jobs in various sectors, including port operations, cargo handling, warehousing, transportation, and ancillary services. The employment opportunities provided by the port contribute to economic livelihoods, household incomes, and the overall socio-economic well-being of the region.

The Port of Walvis Bay plays a crucial role in promoting economic diversification in Namibia. It supports a range of industries, such as mining, manufacturing, agriculture, and fisheries, by providing efficient logistics and export opportunities. By facilitating the export of diverse products, the port contributes to reducing dependence on specific sectors and fostering a more balanced and resilient economy. The Port of Walvis Bay generates significant revenue for Namibia through various means. It collects fees, tariffs, and duties related to port operations and cargo handling. The revenue generated by the port contributes to the national treasury and supports government initiatives and public services.

The port also contributes to the tourism sector in Namibia. It serves as a popular destination for cruise ships, attracting tourists and boosting local businesses related to tourism. The port's scenic location, nearby attractions, and tourism infrastructure create opportunities for job creation and economic activities in the tourism sector.

The natural bay provides deep water anchorage and Namport maintains the harbour area to enable large vessels to moor. With its recent substantial infrastructural investment in the new container terminal and port automation, it has expanded its cargo-handling facilities, enabling it to provide more efficient and effective port and related services for Namibia.

7.8.5 Livelihoods in the Region

Namibia, despite being classified as a high middle-income country, grapples with significant income inequality, ranking among the highest in the world with a Gini coefficient of 0.59. The upper bound poverty line in Namibia defines individuals who cannot afford to spend more than N$520.80 per month on basic needs.

Rural areas in the region experience considerably higher poverty rates, with 25.1% of the rural population categorized as poor and 15.9% as severely poor, in contrast to 8.6% and 4.8% respectively in urban areas. The rural constituencies of Duares, Walvis Bay Rural, and Omaruru have the highest poverty rates. Poverty serves as a significant driver of migration from rural to urban areas. In terms of non-financial aspects of deprivation like access to healthcare, education, and employment, the Erongo region generally fares better.

The Erongo Region ranks amongst the least impoverished regions in Namibia, with a poverty rate of 4.4% and a severe poverty rate of 1.1% in 2016, as compared to the respective national rates of 17.4% and 10.7% (NSA, 2017). Namibia's 20 least deprived constituencies in 2011, five were in the Erongo Region: Omaruru, Walvis Bay Rural, Arandis, Swakopmund and Walvis Bay Urban. The Erongo Region coastal towns rely heavily on tourism. COVID-19 interrupted most businesses abruptly for most of 2020 and 2021. Many businesses, employees and their families suffered losses in income, jobs and livelihoods. The Project should make a positive contribution to improving livelihoods. Generally, the main source of income for most households (67.5%) in the region comes from salaries and wages, followed by business activities (non-farming) (12.6%), pensions (7.6%) and cash remittances (3.7%) (NSA, 2019).

The Erongo Region has a higher number of individuals between the ages of 15 and 65 actively participating in the labour force compared to other regions in Namibia. Within the employed population, 40.9% are engaged in informal employment, such as working in private households, agriculture, or fishing, without access to social protections like a pension scheme, medical aid, or social security.

The region also faces challenges in youth unemployment, with an unemployment rate of 36.8% among individuals aged 15-34 years. Interestingly, youth unemployment rates are slightly higher among men (37%) compared to women (36.5%), despite the general population showing a higher unemployment rate for young males (44%) compared to young females (48.5%). These statistics indicate limited opportunities for youth in the region.

7.8.6 Economic Landscape and Industries

In 2011, the Erongo Region was characterized by a diverse industrial landscape. Major industries included manufacturing (13.8%), mining and quarrying (11.7%), agriculture,

forestry, and fishing (11.5%), construction (9.5%), human health and social work (2.5%), and hospitality (4.5%) (NSA, 2014).

Gender imbalances in various industries were evident, such as the mining and quarrying sector, where males constituted about 90% of the workforce. Likewise, the fishing and agriculture sector exhibited a male majority of around 74%, potentially influenced by a higher number of females working in onshore fish processing factories (NSA, 2014).

7.8.7 National Parks and Tourism sector

Namibia boasts a collection of national parks and reserves, managed by the Ministry of Environment, Forestry, and Tourism (MEFT). These protected areas showcase the country's remarkable natural beauty, safeguarding its unique ecosystems and diverse wildlife. According to the World Travel and Tourism Council, the travel and tourism industry made a significant contribution to Namibia's economy in 2019. It accounted for approximately 14.7% of the country's GDP and provided employment opportunities for about 15.4% of the total workforce (Mbuende, 2023).

However, the Covid-19 pandemic had a severe impact on the global tourism sector, including Namibia. Travel restrictions, lockdown measures, and safety concerns led to a significant decline in international tourist arrivals in 2020. Despite these challenges, Namibia saw a promising recovery in international tourist arrivals from January to December 2021, regaining 37.81% of the lost market from 2020. This indicates a gradual restoration of confidence and renewed interest in visiting the country's attractions.

Looking ahead to 2022, Namibia experienced continued international arrivals, suggesting a positive trajectory for the recovery of the tourism sector. The gradual easing of travel restrictions and the implementation of health and safety protocols likely played a role in attracting tourists back to the country. The resilience and appeal of Namibia's natural wonders, wildlife, and cultural heritage continue to attract visitors, offering promising signs for the country's economy, job creation, and the overall well-being of local communities reliant on tourism-related activities (Mbuende, 2023).

One prominent national park is the Namib-Naukluft National Park (NNNP), situated primarily within the Erongo and Hardap regions. This expansive park spans approximately 49,768 square

kilometers and encompasses the Namib Desert, Naukluft Mountains, and the Tsauchab River. Its location along the Atlantic coastline makes it a significant conservation area in Africa.

The Namib-Naukluft National Park (NNNP) lies south-east of Walvis Bay and is home to one of the world's strangest plants, the Welwitchia. This unique plant can reach a venerable age of more than a thousand years, surviving on the moist air from the ocean. It only has two leaves which the desert winds separate in strands. In this area the landscape varies from expansive gravel plains interspersed with granite island mountains north of the Kuiseb River to the vast dune sea of the Namib Desert to the south of the Kuiseb River. Herds of gemsbok (oryx) and springbok, mountain zebra, baboons and klipspringers as well as flocks of ostrich, roam the plains. offers a range of activities for tourists to enjoy its awe-inspiring landscapes. Visitors can explore the mesmerizing dunes, including the renowned Dune 45 and "Big Daddy," which provide breath taking views, especially during sunrise and sunset. Guided walks, 4x4 desert drives, hot air balloon rides, and scenic flights over the dunes are among the popular activities available.

To accommodate tourists, the park provides campsites and lodges within its boundaries and nearby areas. The Sesriem area serves as the primary entrance and offers tourist facilities such as accommodation, a fuel station, a convenience store, and a restaurant. All tourists are required to obtain a valid entry permit to access NNNP, and those planning to camp within the park must obtain a camping permit in addition to the entry permit.

Mitigating potential negative and maximizing positive outcomes impacts emanating from the proposed development would require responsible and sustainable practices, thorough impact assessments, and meaningful consultation and collaboration with the local communities and stakeholders. Balancing economic development with the preservation of natural and cultural heritage is crucial for maintaining the appeal of the area as a tourist destination.

7.8.8 Employment in the Region

Unemployment still hampers most of the developing world and Namibia is no exception. According to the newspaper article by Mbuende, T. (2023), it is expected that Namibia will continue to face high unemployment rates. Analysts at Trading Economics and global macro models predict that the youth unemployment rate in Namibia is projected to reach approximately 47.4%. This forecast suggests that consumer spending growth may be limited in a small country like Namibia, leading to reduced prospects for discretionary consumer

categories. The mentioned statistic indicates that more than half of Namibia's economically active population is likely to remain unemployed, which can have significant social, political, and economic consequences. The consequences of high unemployment include social exclusion, increased crime rates, economic hardship, loss of human capital, and social instability. Addressing this issue comprehensively and effectively is crucial to mitigate the negative impacts it has on society. The World Trade Economics reported in 2023, that the unemployment rate in Namibia decreased to 20.80% in 2022 compared to 21.30% in 2021.

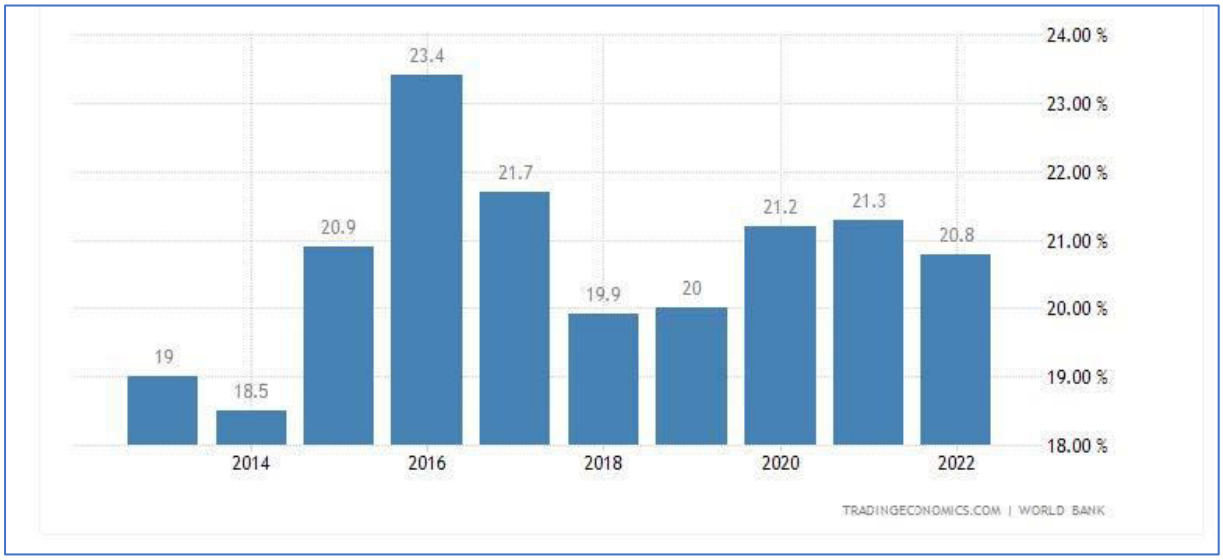


Figure 30. Unemployment rate in Namibia (NSA, 2023)

The proposed development is likely to increase the job opportunities in the area and region at large. The Construction phase of the project will provide job opportunities, of which atleast 80% are expected to be unskilled and semi-skilled people and can be sourced from the unemployed labour force of the nearby communities.

The principle of maximising local employment creation will be applied by identifying suitable construction contractors in the region. It is highly likely that suitable construction contractors would be identified in Walvis Bay and other towns within the region for the construction of the infrastructure. The region is well-supplied with competent small and medium enterprise (SME) construction companies to conduct the proposed development. The project would also give rise to indirect economic benefits through the procurement of materials, goods and local services.

The local economies of the nearby communities are also expected to benefit from the project. A percentage of moneys derived from salaries and wages earned by construction workers is likely to be spent in the region. The monies spent in region would create substantial flows of revenue within local communities, thus acting as a catalyst for growth in the local and regional economy.

In addition, procurement of construction materials, goods and services would have beneficial downstream economic impacts by stimulating demand up the supply chain. The more goods and services procured from local SMEs or enterprises in the area, the greater the project's contribution to the growth of the local economy.

It is therefore recommended that, where feasible, contractors employ local labour by recruiting from local communities; and that procurement of materials, goods and services from local suppliers be encouraged.

7.8.9 Main Findings

The socio-economic study conducted on the proposed project has provided valuable insights into the potential impacts and implications on the local communities and the broader region.

In terms of employment, the project is expected to create both skilled and unskilled job opportunities during the construction and operational phases. Priority must be given to hiring local communities, while ensuring compliance with Affirmative Action Acts. Measures such as training, skills upgrading, and promoting home ownership will enhance the socio-economic benefits for the workforce.

The study highlighted the potential challenges of in-migration and housing. Project-induced migration, particularly during the construction phase, may exert pressure on local infrastructure and housing stock. However, by engaging with key stakeholders, planning recruitment strategies, and investing in affordable housing, the impacts of in-migration can be managed and reduced.

The economic impacts of the project are expected to be positive, with direct and indirect contributions to national income and employment. Through royalties, taxes, and increased economic activity, the project will generate revenue for the government and stimulate economic growth in the region.

It is essential to recognize and address potential negative impacts, such as poaching, littering, and social issues related to alcohol and drug abuse. By implementing measures such as wildlife conservation programs, waste management strategies, and comprehensive awareness and education initiatives, these impacts can be mitigated.

In conclusion, the socio-economic assessment indicates that the proposed project has significant potential to contribute to the local, regional and national economy, create employment opportunities, and support community development. However, it also highlights the importance of proactive management and mitigation measures to minimize negative impacts and ensure sustainable socio-economic outcomes. By engaging with stakeholders, adopting responsible practices, and investing in the well-being of the workforce and local communities, the project can maximize its positive contributions and foster long-term socio-economic benefits for all stakeholders involved.

8 STAKEHOLDER CONSULTATION

In terms of Section 21 of the EIA Regulations a call for public consultation with all I&APs during the EIA process is required. This entails consultation with members of the public and providing them an opportunity to comment on the proposed project. The Public Consultation Process does not only incorporate the requirements of Namibia's legislation, but also takes account of national and international best practises.

A public consultation meeting was held at the Walvis Bay Municipal Side Hall on 13 December 2023. The meeting invitations were widely publicized in local newspapers namely: The Namib Times, Windhoek Observer and Confidente. Additionally, a site notice was erected at the site, as well as through direct communication with pre-identified key stakeholders. See Table 14 below for a summary of the issues raised at the public consultation meeting of 13 December 2023. Also see Figure 31 for pictures of the public consultation meeting.

The surrounding farm owners subsequently engaged the consultants to provide their input, an extension of the comment period was given to the farm owners until 22 March 2024. The records of engagement are attached in Annexure D of the report.

The second phase of the Public Consultation Process involved the lodging of the Draft Environmental and Social Impact Assessment Report (DESIAR) to all registered I&AP for comment. Registered and potential I&APs were informed of the availability of the DESR for public comment. I&APs were given time until 6 May 2024 to submit comments or raise any issues or concerns they may have with regard to the proposed project.

The surrounding farm owners requested an extension to the above date. As in the first round of the public consultation process, the farmers were given an extension to submit their input until 13 May 2024. The detailed issues and response trail from the public consultation is contained in Annexure D of the EIA report.

The comments and input received during this period are incorporated in the Final Environmental and Social Impact Assessment Report that is submitted to the Environmental Commissioner together with the application for an Environmental Clearance Certificate.

Table 14: Summary of issues raised at the public meeting

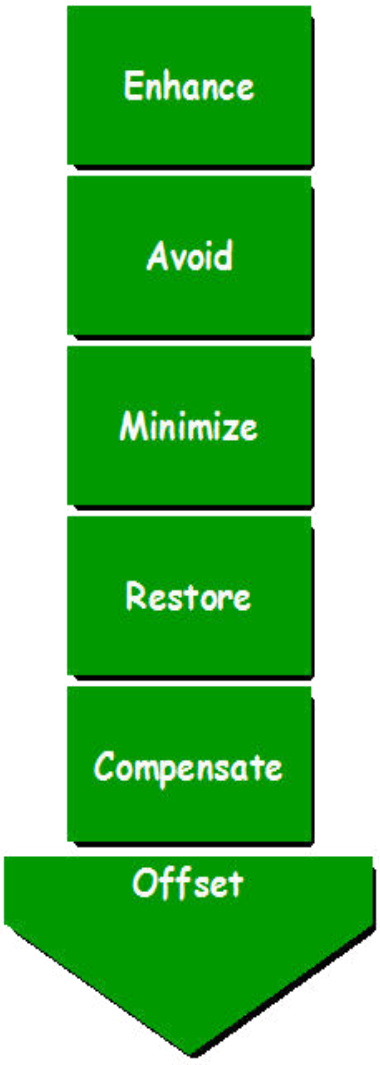
COMMENT/ QUESTION BY	QUESTION/ COMMENT	RESPONDENT	RESPONSE
Lovisa Hailaula – Walvis Bay Municipality	• Which route will the pipelines follow from Farm 58 to the port area?	CP Namene	• The linear infrastructure between Farm 58 and the port area will follow a defined servitude under the newly constructed (underway) interchange, where it follows the existing railway line around Dune 7 before it proceeds in a north-westerly direction towards Namport's north port.
Lovisa Hailaula – Walvis Bay Municipality	• Advised to check with Namport if the target area is not a restricted maritime site. • Ensure the development does not conflict with Mariculture activities in the area. • Perhaps you can access reports on dredging from Namport. • What is the baseline amount for chlorine?	I Mundjulu	• The input is noted. The project will ensure to avoid conflict with restricted zones and consult relevant entities in the process. As for disinfection the project will look at the best solution such as the use of chlorine, sodium metabisulphite (SMBS) etc.
Jesaya Andreas – Walvis Bay Municipality	• Brine is a product of desalination, have you taken that into consideration?	CP Namene	• The release of brine back into the sea is a listed activity and form a critical part of the assessment. Hence, the commissioning of a marine ecology study as part of this assignment.

COMMENT/ QUESTION BY	QUESTION/ COMMENT	RESPONDENT	RESPONSE
Jesaya Andreas – Walvis Bay Municipality	• There is a moratorium on the construction of desalination plants. Do you not foresee this as a problem?	I Mundjulu	• We are not aware of that; however, it will be looked into as part of the due diligence.
Lovisa Hailaula – Walvis Bay Municipality	• Many projects have been approved for Farm 58; however, they are not taking off.	S Nujoma	• We cannot speak for others; however, we are ready for implementation once all approvals are granted. As they say the proof is in the pudding.
Nataniel Thobias – Municipality of Walvis Bay	• Are you considering Health and Safety impacts? Didn't hear any mention of it.	CP Namene	• Health and Safety impacts will form a critical part of the assessment and has been mentioned in the presentation.

Figure 31. Pictures of Public Consultation Meeting

9 MITIGATION HIERACHY

The mitigation hierarchy is a tool aimed at helping to manage biodiversity risk, and is commonly applied in Environmental Impact Assessments. The most common reference point for banks providing project finance is mitigation measures; this provides the financial institutions with information on how environmental and social risks will be managed (See Figure 32 below). These cover avoidance, minimization, restoration and compensation amongst other things. It is possible and considered sought after to enhance the environment by ensuring that positive gains are included in the proposed activity or project. If negative impacts occur then the hierarchy indicates further steps.



Impact avoidance: This step is most effective when applied at an early stage of project planning. It can be achieved by:

- not undertaking certain projects or elements that could result in adverse impacts;
- avoiding areas that are environmentally sensitive; and
- putting in place preventative measures to stop adverse impacts from occurring.

Impact minimization: This step is usually taken during impact identification and prediction to limit or reduce the degree, extent, magnitude, or duration of adverse impacts. It can be achieved by:

- scaling down or relocating the proposal;
- redesigning elements of the project; and
- taking supplementary measures to manage the impacts

Restoration: This step is taken to improve degraded or removed ecosystems following exposure to impacts that cannot be completely avoided or minimized. Restoration tries to return an area to the original ecosystem that occurred before impacts. Restoration is frequently needed towards the end of a project's life-cycle, but may be possible in some areas during operation.

Impact compensation: This step is usually applied to remedy unavoidable residual adverse impacts. It can be achieved by:

- rehabilitation of the affected site or environment, for example, by habitat enhancement;
- restoration of the affected site or environment to its previous state or better; and
- replacement of the same resource values at another location (off-set), for example, by wetland engineering to provide an equivalent area to that lost to drainage or infill. Offsets are often complex and expensive; it is therefore preferable to pay attention to earlier steps in the mitigation hierarchy.

Figure 32. Mitigation Hierarchy

10 IDENTIFICATION OF KEY ENVIRONMENTAL IMPACT

Potential impacts were identified in accordance to the key Environmental Social Indicators (ESI) and using literature review, site assessment and public participation process. This Chapter describes the potential impacts on the biophysical and socio-economic environments, which may occur due to the proposed activities. These include potential impacts, which may arise during the planning and design phase, potential construction related impacts (i.e., short to medium term) as well as the operational impacts of the proposed development (i.e., long-term impacts).

The assessment of potential impacts will help to inform and confirm the selection of the preferred project plan and design to be submitted to MEFT: DEA for consideration. In turn, MEFT: DEA's decision on the environmental acceptability of the proposed project and the setting of conditions of authorisation (should the project be authorised) will be informed by this chapter, amongst other information contained in this Report.

The baseline and potential impacts that could result from the proposed development are described and assessed with mitigation measures recommended. Finally, comment is provided on the potential cumulative impacts.

10.1 Planning Phase

During the planning and design phase consideration is given to aspects such as surface and groundwater; land use; fauna and flora; existing infrastructure; traffic; safety and security; visual and sense of place impacts. Competent authorities were also consulted to be informed about the proposed project to ensure that the project is acceptable.

Table 15. Project Planning

No.	Impact	Planning question	Desired Outcome
1.	Project acceptance	Is the project accepted by relevant authority?	Yes, Walvis Bay Municipality availed land for Presentation of project to the MME & MEFT
2.	Human displacement and	Will the project require displacement of people?	No.

	any other negative social impact	Disturb grazing or any agricultural area	
3.	Project beneficial	Is the project relevant and beneficial to the country?	Yes.
4.	Project Objection	Has the project been objected by relevant authority / local communities?	No.

10.1.1 Surface and Groundwater

Fam Geluk and a large part of the proposed powerline corridor route is located in the Swakop River Catchment, where surface drainage is by means of tributaries, or small washes towards the Swakop River. Sections of the powerline corridor may also be influenced by the Khan River catchment. Summer rainfall dominates precipitation in the form of thundershowers and seasonal run off events might occur in the form of flash floods.

This has potential to put the surface and ground water resources in the area at risk of pollution. This is likely to happen in the absence of a well designed and constructed storm water drainage infrastructure. Poorly constructed and maintained service infrastructure in general may also lead to seepage of waste water into nearby waterways and water bodies. Uncontrolled solid waste management is another potential pollutant of the surface water.

10.1.2 Land Use Change

The portion earmarked for the construction of the solar power plant on Farm Geluk is relatively undeveloped with a significant cover of vegetation. Solar power plants require a large piece of land for setting up the modules and the related equipment such as inverters, this results in the land clearance and disturbance which may result in species death and habitat loss, but also exacerbates other threatening processes, particularly in fragmented landscapes. Similarly, there is mounting evidence showing that linear infrastructures can increase habitat loss and fragmentation (Kirschbaum and Stanley, 2018; Claireau et al., 2019; Ng et al., 2020). The time required for the land to recover from the effects of the development after decommissioning may also be a factor in determining the significance of impact on soil fertility for example.

10.1.3 Fauna and Flora (Biodiversity)

It is estimated that at least 55 species of larger trees and shrubs (>1m in height) occur in the general area (Mannheimer and Curtis 2018). During the fieldwork, a total of 28 species of larger trees/shrubs were identified throughout the various proposed development areas and a total of 365 when including other smaller species <1m in height (e.g., *Aloe* spp., etc.). The bare saline coastal pan site had only 1 species (i.e., *Salsola* spp. on the dune hummocks to the east) followed by the Farm 58 area with only 3 species while the powerline route had 22 species (28 species when including other species – e.g., *Aloe asperifolia*, *Calicorema capitata*, *Ectadium* spp., *Galenia africana*, *Sesuvium sesuvioides*, *Zygophyllum clavatum*) and the Farm Geluk area, 20 species (22 species when including other species – e.g., *Aloe asperifolia*, *Aloe namibensis*). The project areas will be cleared substantially to make way for the development and the installation of bulk infrastructure services, however where necessary large trees, and in particular protected trees must be incorporated into the design and layout of the development.

Construction activities of the solar plant with its associated infrastructure may result in the alteration of the development area's habitat and thus potentially disturb existing habitats (flora, fauna, and avifauna). This can result in the displacement of exclusion of species particularly threatened, endemic, or endangered species which may be present within the project sites and immediate surroundings. Other potential impacts on the biodiversity at the project sites can emanate from improper management of the project sites, which can include improper conduct and housekeeping practices by workers (i.e. hunting of animals, discharge of hazardous waste to land, etc.).

10.1.4 Service Infrastructure Impacts

Other crucial infrastructures such as sewer reticulation and storm water management systems will also form part of the engineering designs of the project. The proponent will appoint the engineering company that will design and supervise the installation of the engineering services.

The proposed development will make use of added infrastructure specifically regarding electricity and water. This additional demand is expected to be fairly Medium-Low. It is recommended that electricity demand for the operations be met with the same technology utilised in generation. The plant operations are not water intensive; however, a negligible amount of water may be required to wash the panels.

By applying a series of the mitigation measures as proposed for the development it is believed that any potential impacts can be significantly reduced. The water volumes and electrical demands for the project is not expected to have a significant negative impact on the infrastructure, especially since they will be derived from green technology. It is critical that any service infrastructure be designed and construction supervised by a qualified and registered engineering professional.

10.1.5 Traffic Impacts

There will be movement of traffic during both construction and operational phase of the project. Due to the nature of the development and the land use, vehicles that will frequent the area would mostly consist of vehicles used by project workforce, and is not expected to be significant.

10.1.6 Visual and Sense of Place Impacts

The proposed area which is intended for the photovoltaic power plant development is currently vacant and undeveloped farmland, which is away from the eyesight of the nearby road users and tourists in the area. However, neighbouring farms bordering the site are expected to see the development.

Site preparation activities will include the installation of arrays and the various project components, including transmission cables, access roads and internal road network, storage buildings, etc. These activities will result in land clearance, ground levelling, excavations, and grading. From the start of construction activities, visual changes will occur from the modified ground surface and the presence of construction equipment and machinery in the area (i.e. excavators, trucks, front end loaders, compactors, and others).

The nearby road users and individuals who frequent the area on a regular basis may experience a change in their sense of place of the area. Therefore, the aesthetics quality of the new structures has to be pleasing and designed to blend in with the natural surrounds.

10.2 Construction Phase

The construction phase of the solar power plant and associated infrastructure will include earth works such as site levelling, digging, trenching, concrete and material transportation. Some areas will require blasting to break the bedrocks. The key potential impacts identified includes:

- Employment creation during construction

- Risks of occupation health and safety during construction
- General Land degradation
- Noise and Vibration
- Air and dust pollution
- Impacts on biodiversity (fauna and flora)
- Waste generation and pollution
- Surface and groundwater
- Heritage and archaeology

10.3 Operational Phase

Generally, potential impacts associated with the solar plant during operation include:

- Environmental monitoring and evaluation;
- impact on human health;
- waste management;
- visual;
- and social.

The solar plant will undergo general maintenance which is not anticipated to cause harm to the environment. The above ground powerlines however, could impact animal movement in the project area.

11 ENVIRONMENTAL IMPACT ASSESSMENT

11.1 Social Environment

11.1.1 Employment Creation and skill transfer

The socio-economic assessment indicates that the proposed project has significant potential to contribute to the local and national economy, create employment opportunities, and support community development. However, it also highlights the importance of proactive management and mitigation measures to minimize negative impacts and ensure sustainable socio-economic outcomes. By engaging with stakeholders, adopting responsible practices, and investing in the well-being of the workforce and local communities, the project can maximize its positive contributions and foster long-term socio-economic benefits for all stakeholders involved.

Summary of Impact: Minimize negative impacts and ensure sustainable socio-economic outcomes	
Key mitigations 1. Provisions should be made in all tender documentation and contractors' agreements which will require contractors to prove the consideration of local labour. 2. Tenders and Contractors Agreements should be drafted to ensure that contractors employ Namibian nationals, in particular the local communities, as part of the unskilled and semi-skilled workforce. 3. Goods and services should be sourced locally, where available. 4. The recruitment process should be gender inclusive, i.e., qualified women should be given an equal opportunity, where possible. 5. Consult with members of the Ministry of Environment, Forestry and Tourism (Namib Naukluft Park's management) to ensure that the objectives of the park are considered in all aspects of project management. 6. As per the requirements of the Namib Naukluft National Park's management plan of 2013, the developer must ensure that any actions and decisions relating to this park are in accordance with the park management plan. 7. Poaching should be strictly prohibited and all employees be informed of penalties and/or consequences of such misconduct. 8. An HIV/AIDS policy should be adopted by the contractors and the developer for both the construction and operational phases. Initiatives should be implemented with regards to raising awareness on HIV/AIDS.	
Without Mitigation	**With Mitigation**

Impact type	Probability	Severity	Extent	Duration	Significance	Confidence	Impact type	Probability	Severity	Extent	Duration	Significance	Confidence
+ve	Definite	Low	National	Long term	High	High	+ve	Definite		National	Project life	High	High
Quantitative assessment							**Quantitative assessment**						
	5	1	4	4	4	3		5	1	4	4	4	3

Monitoring Program

Aspect to Monitor	**Frequency**	**Responsibility**	**How**
1. Employment contract 2. Training and capacity building programs 3. Workshop and Training attendance registers 4. Employees certificate of attendance 5. Keeping records of the number, amount, and country of origin of contractors is an important part of the project management process. 6. Contractors should provide information on the number of Namibians they employ. 7. Keep records of the number of employees, it is also necessary to keep track of their salaries. Salary expenditures are a good indicator of how much money employees will spend locally, regionally, and nationally. 8. Report on how and where operational costs were spent, as well as what goods and services were used locally, regionally, and nationally. 9. Records of complaints received from the surrounding land users and communities, as well as feedback on how it was addressed should be kept.	Bi-Annual	Site Environmental Officer Labour inspector	Employment records On-site inspection and interviews with employees

10. The Health and Wellness Coordinators should compile health overview reports of the workforce.			

11.1.2 Land Use and Property Values

Solar plants require land for installation, which can impact local land use patterns and property values.

Summary of Impact: Local land use patterns and property values													
Key mitigations 1. Careful site selection to minimize impact on land or wildlife habitats.													
Without Mitigation							**With Mitigation**						
Impact type	Probability	Severity	Extent	Duration	Significance	Confidence	Impact type	Probability	Severity	Extent	Duration	Significance	Confidence
-ve	Probable	Low	Local	Medium term	Medium	High	+ve	Definite	Low	Local	Long term	Low	High
Quantitative assessment							**Quantitative assessment**						
	3	1	2	4	3	3		1	1	2	5	2	3
Monitoring Program													
Aspect to Monitor				**Frequency**			**Responsibility**				**How**		
1. Monitor property values 2. Sensitive areas avoided 3. Rehabilitation of affected areas – e.g., tracks, etc.; 4. No new sites disturbed; and 5. Effectiveness of control measures.				Bi-Annual			Site Environmental Officer				Physical inspections Keep track on property market		

11.2 Visual Impact / Glare and glint

The proposed area which is intended for the photovoltaic power plant development is currently vacant and undeveloped farmland, which is away from the eyesight of the nearby road users and tourists in the area. However, neighbouring farms bordering the site are expected to see the development.

Site preparation activities will include the installation of arrays and the various project components, including transmission cables, access roads and internal road network, storage buildings, etc. These activities will result in land clearance, ground levelling, excavations, and grading. From the start of construction activities, visual changes will occur from the modified ground surface and the presence of construction equipment and machinery in the area (i.e. excavators, trucks, front end loaders, compactors, and others).

The nearby road users and individuals who frequent the area on a regular basis may experience a change in their sense of place of the area. Therefore, the aesthetics quality of the new structures has to be pleasing and designed to blend in with the natural surrounds.

The potential for glare associated with non-concentrating photovoltaic systems which do not involve mirrors or lenses is relatively limited. PV solar panels are designed to reflect as little sunlight as possible (generally around 2% of the light received; Spaven Consulting 2011), resulting in negligible glare. The reason for this is that PV panels are designed to absorb as much solar energy as possible in order to generate the maximum amount of electricity or heat. The panels will not generally create noticeable glare compared with an existing roof or building surfaces.

Summary of Impact: Loss of natural scenic and aesthetic value
Key mitigations 1. Ensure good house keeping 2. Piles of excavated sand must be well stored 3. Rehabilitate the excavated area back to its natural state 4. Cordon off construction equipment to avoid being seen

5. Encourage more 'green' technologies within the architectural designs and building materials of the development in order to minimise the visual prominence of such a development within the more natural surrounding landscape.
6. Natural colours and building materials such as wood and stone should be incorporated.
7. Where feasible, implement solar farm vegetation screening:
   - Screen should comprise of varying native species appropriate to the area and of varying height to soften not block the view of the site.
   - Breaks in the screen, reflecting natural breaks in existing remnants would be appropriate.
   - Planting should be undertaken as soon as practical in the construction process depending on the season, as it will take time for the plants to establish and become effective as a screen. Seasonal requirements for planting should also be considered.
   - The screen should be maintained for the operational life of the solar farm.

Without Mitigation							**With Mitigation**						
Impact type	Probability	Severity	Extent	Duration	Significance	Confidence	Impact type	Probability	Severity	Extent	Duration	Significance	Confidence
-ve	Probable	Medium	Site Specific	Long term	Medium	High	-ve	Low	Low	Site Specific	Immediate	Low	High
Quantitative assessment							**Quantitative assessment**						
	3	3	1	4	3	3		2	2	1	1	2	3

Monitoring Program

Aspect to Monitor	**Frequency**	**Responsibility**	**How**
1. Solid waste generation and management 2. Rehabilitation of excavated areas 3. Monitor visual impact of project	Bi-weekly	Site Environmental Officer	Physical observation, complaints from neighbours or general public

11.3 General Waste and Pollution Control

General waste during construction includes, building rubbles, household waste such as plastic and equipment parts. Other waste generated is likely to include empty storage containers and packaging, general litter, by-products of any vehicle maintenance (including petroleum products,

coolants, degreasing agents, sediment, rubber particles, detergents), and other hazardous materials. All waste should be disposed of in line with the national waste management directives.

Summary of Impact: General littering and solid waste pollution

Key mitigations

1. Ensure good house keeping
2. Ensure a waste management plan aimed at minimizing the production of all wastes.
3. Provide dustbins and ensure waste segregation and should be disposed at designated site.
4. Waste management hierarchy (prevention, reduction, re-use, recycling, disposal) should be encouraged.
5. Designate a storage area for building rubbles.
6. Provide labelled household waste drums for household solid waste.
7. The construction site should be kept tidy at all times. All domestic and general construction waste produced on a daily basis should be cleaned up and contained daily.
8. No waste may be buried, burned or disposed to land on site, outside of an approved waste disposal facility.
9. Waste containers (bins) should be emptied regularly and removed from site to an approved (municipal) waste disposal site.
10. All recyclable waste needs to be taken to the nearest recycling depot.
11. A sufficient number of separate waste containers (bins) for hazardous and domestic/general waste must be provided on site. These should be clearly marked as such.
12. Construction labourers should be sensitized to dispose of waste in a responsible manner and not to litter.
13. No waste may remain on site after the completion of the project.

Without Mitigation							**With Mitigation**						
Impact type	Probability	Severity	Extent	Duration	Significance	Confidence	Impact type	Probability	Severity	Extent	Duration	Significance	Confidence
-ve	Probable	Low	Site specific	Short term	Low	High	-ve	Low probability	Low	Site specific	Immediate	Low	High
Quantitative assessment							**Quantitative assessment**						
	3	1	1	2	2	3		2	1	1	1	2	3
Monitoring Program													

Aspect to Monitor	Frequency	Responsibility	How
1. Solid waste generation and management 2. Rehabilitation of excavated areas 3. Labelled waste drums and skip bins	Bi-weekly	Site Environmental Officer	Physical observation, complaints from neighbours or general public

11.4 Hazardous Waste

Leakages and spillages from construction vehicles, equipment and machinery utilised during the construction phase may occur. Waste such as contaminated soil, litter, empty cans of engine oil will also be generated. Hydrocarbons and other hazardous materials will be stored at some project sites during construction. The site where grease, oils, lubricant and fuel are handled requires to be properly designed to avoid soil contamination that may consequently contaminate surface and groundwater. While solar energy is considered a clean energy source, the disposal of solar panels can have environmental impacts.

Summary of Impact: Pollution of the environment with hazardous waste
Key mitigations 1. Vehicles must be well serviced to avoid oil spills and excessive emissions 2. Fuelling of site-based equipment such as excavators must be done on containment structures. 3. Parked construction vehicles and machines must be provided with drip trays. 4. Maintenance and washing of construction vehicles should take place only at a designated workshop area. 5. The workshop area should be lined with concrete. 6. The workshop should have an oil-water separator for collection of run-off from washing. 7. Oil filters should be stored in marked containers that allow oil to drain but not escape from storage. 8. Spilled concrete (wet or dry) should be treated as hazardous waste and disposed of in the appropriate hazardous waste containers. 9. All hazardous substances (e.g., fuel etc.) or chemicals should be stored in a specific location on an impermeable, bunded surface. 10. Hazardous waste to be handled by trained personnel only and disposed of at an appropriately licensed facility off-site. 11. Spill management kits, Personal Protective Equipment (PPE) and relevant emergency procedures should be available at the workshop and storage facilities. 12. Any spills should immediately be contained and cleaned up and the contaminated soil appropriately disposed of. The receiving environment should then be remediated where necessary to prevent the spill from entering drainage lines and/or nearby streams.

13. Encourage recycling programs for end-of-life panels.													
Without Mitigation							**With Mitigation**						
Impact type	Probability	Severity	Extent	Duration	Significance	Confidence	Impact type	Probability	Severity	Extent	Duration	Significance	Confidence
-ve	Probable	Low	Site Specific	Immediate	Medium	High	-ve	Low	Low	Site Specific	Immediate	Low	High
Quantitative assessment							**Quantitative assessment**						
	3	1	1	2	3	3		2	1	1	1	2	3
Monitoring Program													
Aspect to Monitor					**Frequency**		**Responsibility**				**How**		
1. Service record of construction vehicles, equipment and machineries. 2. Storage area for hydrocarbons and chemicals 3. Bunded fuel and chemical storage area 4. Drip trays 5. Designated drums for hazardous waste					Weekly		Site Environmental Officer				Develop a hazardous waste management plan Physical observation of contaminated areas		

11.5 Occupational Health and Safety

Job opportunities leads to new social relationship which exposes workers to substance abuse and diseases such as HIV and AIDS. Furthermore, the working environmental is an isolated environment that need to cater for all health emergencies for the employees. Exposure to excess noise and dust could impact employees hearing ability and lung related disease respectively thus damaging their health. During construction, employees

are prone to safety risks such as injuries from construction machinery and equipment, thus it is critical to ensure an adequate health and safety plan.

Summary of Impact: Injuries and health risks to employees during working hours	
Key mitigations 1. Provide awareness to the employees on dangers of HIV/AIDS, alcohol and drug abuse. 2. Provide awareness and knowledge about snakes and snakebites.. 3. Ensure availability of snake catchers onsite. 4. Provide condoms on site. 5. Develop a health and safety plan / policy. 6. All employees must go through a health and safety induction. 7. Only licensed employees should be allowed to operate specialized vehicles and equipment 8. All construction vehicles must have a rotating flashing light installed for visibility. 9. Ensure that all vehicles are well serviced and roadworthy. 10. All employees must be provided with adequate Personal Protective Equipment (PPE). 11. No employee must be allowed to be at a work station without adequate PPE. 12. Provide sufficient and adequately stocked first aid kits. 13. Provide adequate gender sensitive ablution facilities. 14. Provide clean drinking water. 15. Erect warning signs at designated sites to alert public of potential dangers. 16. Trucks carrying sand and aggregate must be covered to avoid material flying off. 17. Abide by the Occupational Health and Safety and Labour Act of Namibia and other statutory requirement such as International Labour Practise (ILO). 18. Employees must undergo an occupational health and first aid course. 19. Train employees on the possible health hazards to avoid potential risks. 20. Cordon off the construction areas / sites to avoid unauthorised entry of persons and animals. 21. Cameras will be strategically installed all over the solar park, in order to provide 24/7 online security and fire protection information.	
Without Mitigation	**With Mitigation**

Impact type	Probability	Severity	Extent	Duration	Significance	Confidence	Impact type	Probability	Severity	Extent	Duration	Significance	Confidence
-ve	High	Low	Local	Short term	High	High	-ve	Low	Low	Local	Short term	Low	High
Quantitative assessment							**Quantitative assessment**						
	4	3	2	2	12	3	-ve	2	2	2	2	4	3

Monitoring Program

Aspect to Monitor	**Frequency**	**Responsibility**	**How**
1. Poof of HIV-AIDS and substance abuse awareness raising 2. Condoms on sites 3. Health and safety plans 4. Induction attendance registers 5. Valid driver's licences for designated drivers 6. Rotating flashing lights on heavy and construction vehicles 7. Roadworthy vehicles 8. Personal Protective Equipment 9. Sufficient and adequately stocked First Aid Kit 10. Emergency health facilities 11. Ablution facilities 12. Warning signs at designated areas 13. First aid training attendance register of employees 14. Construction area fenced off / Cordoned off 15. Security and monitoring cameras	Monthly / Quarterly	Site Environmental Officer Random check by designated law environmental / health inspector	Site inspection checklist through physical observation, Random interviews with employees

11.6 Noise and Vibration

An increase of ambient noise levels at the construction site is expected due to construction activities. Noise pollution due to heavy-duty equipment and machinery will be generated.

Breaking rock from the bedrock at some development areas will require the use of explosives. Although this will be site specific, the shock vibration could cause damage to surrounding properties and if not communicated properly, it could be noise nuisance to people (this could be applicable to tourist camping in area around Swakop River). Overall, this impact is expected to be temporary and localised.

Summary of Impact: Noise pollution and vibration could be a nuisance to the local environment. Blasting may cause vibration and flying rocks which could be a safety hazard to workers.	
Key mitigations 1. Ensure the use of construction vehicles and equipment that emit reduced noise levels. 2. Ensure proper maintenance is conducted on vehicles to ensure the reduction of noise emission. 3. Construction staff should be equipped with ear protection equipment. 4. Audio equipment (if any) should not be played at levels considered intrusive by others. 5. Discourage unnecessary hooting. 6. Discourage excessive revving and idling of vehicles. 7. Switch off vehicle engines when not in use. 8. No employees must be exposed to noise levels above the 85dB (A) limit over a period of 8 hours. Should the noise level be higher than 85dB (A), the employer must implement a hearing conservation program such as noise monitoring; 9. Warn public and employees on blasting times.	
Without Mitigation	**With Mitigation**

Impact type	Probability	Severity	Extent	Duration	Significance	Confidence	Impact type	Probability	Severity	Extent	Duration	Significance	Confidence
-ve	Probable	Low	Local	Short term	Medium	High	-ve	Low probability	Low	Site specific	Immediate	Low	High
Quantitative assessment							**Quantitative assessment**						
	3	2	2	2	3	3		2	2	1	1	2	3
Monitoring Program													
Aspect to Monitor					**Frequency**		**Responsibility**				**How**		
1. Record of speeding incidences 2. Record of vehicle service records 3. Complaints of excessive noise from employees and general public					Daily		Site Environmental Officer				Physical observation, complaints from neighbours or general public		

11.7 Dust Pollution

Construction phase normally comprises a series of different operations including land clearing, topsoil removal, road grading, material loading and hauling, stockpiling, grading, bulldozing, compaction, etc., with particulate matter the main pollutants of concern from these activities. The extent of dust emissions would vary substantially from day to day depending on the level of activity, the specific operations, and the prevailing meteorological conditions, and how close these activities are to potential receptors. Dust pollution might be worse during the winter months when strong winds occur. Dust is regarded as a nuisance as it reduces visibility, affects the human health and retards plant growth.

Summary of Impact: Blasting, digging and excavation, crushing, stock, transportation of aggregate and sand, piling of aggregate on site, movement of vehicles and heavy machinery on site will produce excessive dust. which is a, (i) safety risk due to reduced visibility and health hazard to workers

Key Mitigation measure

1. Apply appropriate dust suppression measures when dust generation is unavoidable, e.g. dampening with water, particularly during prolonged periods of dry weather.
2. Spray water on stock piles of aggregate and rock dust
3. Movement of heavy vehicles must strictly be confined to designated construction areas.
4. Adhere to stipulated speed limits.
5. Do not excavate and/or offload sand during heavy winds.
6. Trucks carrying sand must be properly covered.
7. Sand stock piles must be covered or regularly sprayed with water.
8. Dust suppression methods should be used to all haul roads and access roads in order to reduce dust emissions. A 75% efficiency (CE) in the control of vehicle-entrained dust is recommended.
9. Cement and concrete must be mixed with concrete mixers and not manually in the open.
10. Cement bags must be stored and disposed of properly.

Without Mitigation							**With Mitigation**						
Impact type	Probability	Severity	Extent	Duration	Significance	Confidence	Impact type	Probability	Severity	Extent	Duration	Significance	Confidence
-ve	Probable	Low	Site specific	Short-Term	Medium	High	-ve	Low	Low	Site specific	Short-Term	Low	High
Quantitative assessment							**Quantitative assessment**						
	3	2	1	2	3	3		2	2	1	2	2	3
Monitoring Program													
Aspect to Monitor					**Frequency**		**Responsibility**				**How**		

1. Dust monitoring	Weekly	Site Environmental Officer	Physical observations

11.8 Ecological Impacts

All developments change, or are destructive to, the local fauna and flora to some or other degree. Assessing potential impacts is occasionally obvious, but more often difficult to predict accurately. Such predictions may change depending on the scope of the development – i.e., development, once initiated, and may have a different effect on the fauna as originally predicted. Thus, continuing monitoring of such impacts during the development phase(s) is imperative. Faunal and floral impacts from the proposed project development is expected to be localised.

Fauna and Flora Impacts

(Note: All references to tables and figures in this section are in relation to Annexure H)

Summary of Impact: Disruption/destruction of the habitat and thus consequently flora and fauna associated directly with the development. clearing of land, particularly of tall trees; increased human presence resulting in illegal hunting.
Key Mitigation Measures for Flora 1. Limit clearing of vegetation to those areas within the footprint of construction, minimise open areas and reduce the frequency of disturbance. 2. Disturbance of areas outside the designated working zone is not allowed. 3. No vegetation should be removed outside the designated project area. 4. Avoid well vegetated Swakop/Tumas ephemeral drainage lines; rocky outcrops (especially white geology areas), throughout the entire area. 5. Identify protected and unique species (i.e., *Aloe spp., Commiphora saxicola* (rock corkwood), *Hoodia gordonii, Lithop* spp., *Welwitschia mirabilis* (welwitschia), etc.). Other important species are the larger *Acacia erioloba* (camel thorn) specimens used by the endangered lappet-faced vultures as nesting sites before the commencement of development activities in areas where these occur and avoid. 6. Prevent and discourage the collecting of firewood (e.g., Swakop River) as dead wood has an important ecological role. Such collecting of firewood, especially for economic reasons, often leads to abuses – e.g., chopping down of live and/or protected tree species such as Acacia erioloba, etc. which is a good quality wood. 7. Avoid the removal and damage of bigger trees (especially protected species (i.e., Acacia erioloba (camel thorn), *Faidherbia albida* (ana tree), etc. – during developments – including the development of access routes – as these serve as habitat for a myriad of fauna. 8. Implement a policy of "no tolerance" towards the existing invasive alien plant species (e.g., *Nicotiana glauca, Prosopis* spp. – heavy infestations

observed in the Swakop River area) in the general area. This should include the removal and destruction of these species throughout the proposed development areas. Such activity would be beneficial to the overall ecology of the area, especially the Swakop River area where most of these aliens currently occur.

9. Rehabilitation of the disturbed areas – i.e., initial development access route "scars" and associated tracks, as well as temporary accommodation sites. Preferably workers should be transported in/out to the construction sites daily to avoid excess damage to the local environment (e.g., wood collection, poaching, etc.). Such rehabilitation would not only confirm the various development companies' environmental integrity, but also show true local commitment to the environment.
10. Limit development – i.e., keep to the bare minimum – in the drainage lines or within 50m of these drainage lines to preserve the associated riparian flora (and associated fauna).
11. Educate/inform contractors on protected species to avoid and the consequences of damaging such species. Liaise with MEFT to provide this service.
12. Investigate the idea of employing a qualified environmental officer (EO) during the construction phase to ensure appropriate conduct by contractor(s).
13. Avoid the use of herbicides for plant/weed control throughout the areas.
14. Employ an ecologist for advice on the best route(s)/sites, etc. prior to construction – i.e., assist with the final alignment.

Tracks

New proposed main access route(s)

15. These track(s) should avoid the *Acacia erioloba* (camelthorn) with lapped-faced vulture nest sites (See Table 12; Figures 14-15). Also avoid other sensitive areas – e.g., *Salsola* dune hummocks, along drainage lines, rocky outcrops, etc. (See Section 5). This would minimise the effect on localised potentially sensitive habitats in the area.

All tracks

16. Avoid driving randomly through the area (i.e., enforce "track discipline"), but rather stick to permanently placed roads/tracks – especially during the construction phase. This would minimise the effect on localised potentially sensitive flora/habitats in the area.
17. Stick to speed limits of maximum 30km/h as this would result in less dust pollution potentially affecting flora. Speed humps could also be used to ensure the speed limit.
18. Implement erosion control. – i.e., avoid constructing tracks up steep gradients; incorporate erosion furrows (runoff sites) and humps along tracks to channel water off the tracks to minimise erosion problems; cross drainage lines at right angles, etc. The area(s) towards & adjacent the drainage line(s) are easily eroded, and further development may exacerbate this problem. Avoid construction within 50m of the main drainage line(s) to minimise erosion problems as well as preserving the riparian associated flora and fauna.

Farm 58 Developments

19. Avoid disturbance of rocky ridges & small vegetated ephemeral drainage lines on northern/northeastern boundary.

Farm Geluk Developments

20. Avoid disturbances on the rocky ridges with patches of *Aloidendron (Aloe dichotoma) dichotomum* and *A. asperifolia* and small vegetated ephemeral drainage lines in the northern/northeastern parts of the proposed development area (See Figure 39).

21. Avoid using chemicals to keep the PV Plant area clear of vegetation but rather use indigenous sheep (e.g., Damara sheep) to keep the vegetation short.

Vulture nests

22. Avoid the lapped-faced vulture nest sites (See Table 12; Figures 14-15). These vultures are listed as endangered by the IUCN (2023) with an estimated world population of only 5,700 birds and a decreasing population trend. Disturbances could result in nests being abandoned further adding to the demise of this species.

Hyena latrines

23. Brown hyena latrines are important for social and territorial purposes and should be avoided (See Table 10; Figure 12).

Key Mitigation Measures for Fauna

24. Limit the development to actual sites to be developed and avoid affecting adjacent areas, especially well vegetated Swakop/Tumas ephemeral drainage lines; rocky outcrops (especially white geology areas), throughout the entire area.
25. Avoid development & associated infrastructure in sensitive areas – e.g., well vegetated ephemeral drainage lines; rocky outcrops (especially white geology areas); small drainage lines with *Welwitschia mirabilis* plants; lapped-faced vulture nesting sites; rocky outcrops; brown hyena latrines, etc. – in the proposed development area (See Sections 4 & 5; Tables 10 & 12). This would minimise the negative effect on the local environment especially unique features serving as habitat to various vertebrate fauna species.
26. Remove (e.g., capture) unique and sensitive fauna, especially sedentary and slow-moving reptiles (e.g., Namaqua chameleon, etc.) before commencing with the development activities and/or species serendipitously located during this period and relocate to a less sensitive/disturbed sites in the immediate area.
27. Prevent and discourage the setting of snares (poaching), illegal collecting of veld foods, indiscriminate killing of perceived dangerous species (e.g., snakes, etc.) and collecting of wood (e.g., Swakop River area) as this would diminish and negatively affect the local fauna – especially during the development phase(s).
28. Attempt to avoid the destruction of bigger trees during the development phase(s) – especially with the development of access & pipeline routes – as these serve as habitat for a myriad of fauna.
29. Rehabilitation of the disturbed areas – i.e., initial development access route "scars" and associated tracks as well as associated development infrastructures. Preferably workers should be transported in/out to the construction sites daily to avoid excess damage to the local environment (e.g., pollution, wood collection, poaching, etc.). Such rehabilitation would not only confirm the company's environmental integrity, but also show true local commitment to the environment.

30. Prevent domestic pets – e.g., cats & dogs – accompanying the workers during the construction phase as cats decimate the local fauna and interbreed & transmit diseases to the indigenous African wild cat found in the area. Dogs often cause problems when bonding on hunting expeditions thus negatively affecting the local fauna. The indiscriminate and wanton killing of the local fauna by such pets should be avoided at all costs.
31. Initiate a suitable waste removal system (i.e., remove to Swakopmund/Walvis Bay and not store on site) as this often attracts wildlife – e.g., baboons, black-backed jackal, crows, gulls, etc. – which may result in human-wildlife conflict issues.
32. Educate/inform contractors and staff on protected species (See Tables 1-16) to avoid and the consequences of illegal collection of such species.
33. Investigate the idea of employing an Environmental Officer during the construction phase(s) to ensure compliance and minimise the overall impact on the fauna and the environment.

Tracks

New proposed main access route(s)

34. These track(s) should avoid the lapped-faced vulture nesting tree sites (See Table 12; Figures 14-15). Also avoid other sensitive areas – e.g., *Salsola* dune hummocks, along drainage lines, rocky outcrops, etc. (See Section 5). This would minimise the effect on localised potentially sensitive habitats in the area.

All tracks

35. Avoid driving randomly through the area (i.e., enforce "track discipline"), but rather stick to permanently placed roads/tracks – especially during the construction phase. This would minimise the effect on localised potentially sensitive habitats in the area.

36. Stick to speed limits of maximum 30km/h as this would result in fewer faunal road mortalities. Speed humps could also be used to ensure the speed limit. Lower speeds would also minimise dust pollution.

37. Implement erosion control. – i.e., avoid constructing tracks up steep gradients; incorporate erosion furrows (runoff sites) and humps along tracks to channel water off the tracks to minimise erosion problems; cross drainage lines at right angles, etc. The area(s) towards & adjacent the drainage line(s) are easily eroded, and further development may exacerbate this problem. Avoid construction within 50m of the main drainage line(s) to minimise erosion problems as well as preserving the riparian associated flora and fauna.

Farm 58 Developments

38. Avoid disturbance of rocky ridges & small vegetated ephemeral drainage lines on northern/northeastern boundary.

Farm Geluk Developments

39. Avoid disturbances on the rocky ridges with patches of *Aloidendron (Aloe dichotoma) dichotomum* and *A. asperifolia* and small vegetated ephemeral drainage lines in the northern/northeastern parts of the proposed development area (See Figure 39).

40. Avoid electrified fencing around the PV Plant area and/or lift the bottom strand 30cm off the ground to avoid electrocuting tortoises, monitor lizards, etc.
41. Avoid using chemicals to keep the PV Plant area clear of vegetation but rather use indigenous sheep (e.g., Damara sheep) to keep the vegetation short.

Vulture nests

42. Avoid the lapped-faced vulture nesting tree sites (See Table 12; Figures 14-15). These vultures are listed as endangered by the IUCN (2023) with an estimated world population of only 5,700 birds and a decreasing population trend. Disturbances could result in nests being abandoned further adding to the demise of this species.

Hyena latrines

43. Brown hyena latrines are important for social and territorial purposes and should be avoided (See Table 10; Figure 12).

Without Mitigation							**With Mitigation**						
Impact type	Probability	Severity	Extent	Duration	Significance	Confidence	Impact type	Probability	Severity	Extent	Duration	Significance	Confidence
-ve	Definite	Low	Local	Permanent	High	High	-ve	Definite	Low	Local	Permanent	Medium to Low	High
Quantitative assessment							**Quantitative assessment**						
	5	2	2	1	4	3		5	2	2	1	4	3

Monitoring Program

Aspect to Monitor	**Frequency**	**Responsibility**	**How**
Construction Phase 1. Sensitive areas avoided; 2. Illegal capture/use/collection of vertebrate fauna & flora; 3. Rehabilitation of affected areas – e.g., tracks, etc.; 4. No new sites disturbed; and 5. Effectiveness of control measures. Operational Phase	Weekly	Site Environmental Officer	Physical observations Report of poaching

6. Erosion control; 7. Illegal capture/use/collection of vertebrate fauna & flora; and 8. Vertebrate fauna mortalities. Decommissioning Phase 9. All tracks/roads rehabilitated; 10. All development sites rehabilitated; 11. Erosion control; 12. Illegal capture/use/collection of vertebrate fauna & flora; and 13. Vertebrate fauna mortalities.			

11.8.1 Construction Phase – Vertebrate fauna

Environmental aspect	Vertebrate fauna	**Phase**	Construction
Description: Certain habitats are viewed as sensitive with unique species.			
Mitigation: Sensitive habitats – i.e., 1) Swakop & Tumas Rivers (well vegetated ephemeral drainage lines), 2) "light coloured" geology potentially serving as habitat to the endemic and range restricted Husab sand lizard (rocky areas), 3) *Welwitschia mirabilis* dominated areas (Welwitschia Flats), 4) 30km coast between Walvis Bay & Swakopmund (Palearctic birds foraging areas); 5) lappet-faced vulture breeding sites, and			

6) brown hyena latrines – should be avoided. Off road driving should be prohibited throughout the area. The poaching and killing of perceived dangerous vertebrate fauna – e.g., snakes and carnivores – and the destruction of large trees (e.g., *Acacia erioloba* individuals) should be prohibited. Remove and relocate slow moving species, especially reptiles (e.g., Namaqua chameleon). Rehabilitate all disturbed areas - e.g., tracks/development sites, etc.

11.8.2 Operational Phase – Vertebrate fauna

Environmental aspect	**Vertebrate fauna**	**Phase**	**Operation**
Description: Certain habitats are viewed as sensitive with unique species.			
Mitigation: Sensitive habitats – i.e., 1) Swakop & Tumas Rivers (well vegetated ephemeral drainage lines), 2) "light coloured" geology potentially serving as habitat to the endemic and range restricted Husab sand lizard (rocky areas), 3) *Welwitschia mirabilis* dominated areas (Welwitschia Flats), 4) 30km coast between Walvis Bay & Swakopmund (Palearctic birds foraging areas); 5) lappet-faced vulture breeding sites, and 6) brown hyena latrines – should be avoided.			

Off road driving should be prohibited throughout the area. The poaching and killing of perceived dangerous vertebrate fauna – e.g., snakes and carnivores – and the destruction of large trees (e.g., *Acacia erioloba* individuals) should be prohibited. Off road driving should be prohibited throughout the area. The poaching and killing of perceived dangerous vertebrate fauna – e.g., snakes and carnivores – should be prohibited. Remove and relocate slow moving species, especially reptiles (e.g., Namaqua chameleon).

11.8.3 Decommissioning/Rehabilitation Phase – Vertebrate fauna

Environmental aspect	Vertebrate fauna	**Phase**	Decommissioning
Description: Certain habitats are viewed as sensitive with unique species.			
Mitigation: Recreate habitats that are favourable to unique species should these have been damaged and/or destroyed during the construction and operational phases – i.e., replant vegetation to recreate the original habitat to lure species (colonisers).			

11.8.4 Construction Phase – flora

Environmental aspect	Flora	**Phase**	Construction
Description: Certain habitats are viewed as sensitive with unique species.			
Mitigation:			

Sensitive habitats – i.e., 1) Swakop & Tumas Rivers (well vegetated ephemeral drainage lines), 2) “light coloured” geology potentially serving as habitat to the endemic and range restricted Husab sand lizard (rocky areas), 3) *Welwitschia mirabilis* dominated areas (Welwitschia Flats), and 4) *Accacia erioloba* (large specimens with lappet-faced vulture nests). Off road driving should be prohibited throughout the area. Collection/removal of unique species (e.g., *Aloe* spp., *Commiphora saxicola*, *Hoodia gordonii*, *Lithop* spp., *Welwitschia mirabilis*, etc.) be prohibited. The removal of large trees, especially protected species (e.g., *Acacia erioloba* individuals), should be avoided. Removal and use of dead trees for firewood should be prohibited as this could lead to exploitation as well as affect ecological processes (e.g., dead wood serves as habitat to a myriad of vertebrate/invertebrate species). Rehabilitate all disturbed areas - e.g., tracks/development sites, etc.

11.8.5 Operational Phase – flora

Environmental aspect	Flora	**Phase**	Operation
Description: Certain habitats are viewed as sensitive with unique species.			
Mitigation: Sensitive habitats – i.e., 1) Swakop & Tumas Rivers (well vegetated ephemeral drainage lines),			

2) “light coloured” geology potentially serving as habitat to the endemic and range restricted Husab sand lizard (rocky areas), 3) *Welwitschia mirabilis* dominated areas (Welwitschia Flats), and 4) *Accacia erioloba* (large specimens with lappet-faced vulture nests). Off road driving should be prohibited throughout the area. Collection/removal of unique species (e.g., *Aloe* spp., *Commiphora saxicola*, *Hoodia gordonii*, *Lithop* spp., *Welwitschia mirabilis*, etc.) be prohibited. Removal and use of dead trees for firewood should be prohibited as this could lead to exploitation as well as affect ecological processes (e.g., dead wood serves as habitat to a myriad of vertebrate/invertebrate species).

11.8.6 Decommissioning/Rehabilitation Phase – flora

Environmental aspect	Flora	**Phase**	Decommissioning
Description: Certain habitats are viewed as sensitive with unique species.			
Mitigation: Recreate habitats that are favourable to unique species should these have been damaged and/or destroyed during the construction and operational phases – i.e., replant vegetation to recreate the original habitat to lure species (colonisers).			

11.9 Heritage and Archaeological Resource

The western parts of Namibia have a rich and well-studied archaeological record of human settlement spanning the last one million years. One of the major components of the heritage records confirmed in Jakkalswater Farm 220 and surrounding farms is the dispersed archaeological sites with incompletely investigated well preserved evidence relating to opportunistic Hunter-Gatherer occupation during the last two thousand years. These are manifested in the good concentrations of Late Stone Age surface scatters such as debris of lithic artefacts including flakes,

abundant pottery fragments, rock shelters with well-preserved sediments attesting human occupation, scatter of fragmented ostrich eggshell and some beads, hunting blinds features, well preserved rock paintings and hearth in some rock shelters as well as seed diggings. The sites are widely distributed across granite landforms including those recorded on the foot-slopes of these features and within large boulders which provide shelter, open air caves, in gravel plains and along dry riverbeds.

Summary of impact

1. Confine developments to the designated project sites, and proposed linear route.
2. Ensure that the development and its activities does not encroach beyond the northern, southern, western and eastern boundaries of Farm Geluk No. 116. This will be considered “no-go areas”.
3. The development should avoid encroaching onto any identified heritage sites on Farm Geluk, or beyond.
4. Heritage sites within Farm Geluk 116 `s proposed 50m buffer zone should be observed.
5. Workers must be trained on the possible find of archaeological material in the area.
6. Establish a “Chance Find Procedure” throughout the project development where if any archaeological finding (Heritage (rock painting and drawings), human remains or artefacts) is encountered;
7. If such remains or objects with archaeological, cultural and historical values are uncovered, work should be stopped and site should be barricaded off.
8. The relevant authorities (i.e. the local police and National Heritage Council of Namibia) should be contacted immediately.
9. The activity must be stopped immediately and the operation manager of that activity be informed;
10. The manager must ensure the cordoning off the area with a danger tape and take appropriate records and pictures
11. The manager must immediately report the findings to the National Museum (+264 61 276800) or the National Forensic Laboratory (+264 61 240461).

Without Mitigation							**With Mitigation**						
Impact type	Probability	Severity	Extent	Duration	Significance	Confidence	Impact type	Probability	Severity	Extent	Duration	Significance	Confidence
-ve	Probable	Low	Local	Short term	Medium	High	-ve	Probable	Low	Site specific	Immediate	Low	High
Quantitative assessment							**Quantitative assessment**						
	3	2	2	2	3	3		3	2	1	1	2	3

Monitoring Program			
Aspect to Monitor	**Frequency**	**Responsibility**	**How**
14. Reported Heritage Material	Weekly	Site Environmental Officer	Physical observations

12 DECOMMISSIONING AND REHABILITATION

The proposed development has an expected lifespan of more than 50 years. In general, the impacts associated with the decommissioning phase will be similar to that of the construction phase. The Environmental Management Plan for this phase must be reviewed at the time of decommissioning to cater for changes made to the development. At the end of its useful life, the plant will be completely dismantled so as to restore the area to *ante operam* conditions. Each production unit will be uninstalled; therefore, the following waste will be produced:

- Panels: aluminium, glass, cells and polymer waste;
- Electricity lines: copper and metallic elements;
- Pipes;
- Supporting structures: metallic elements;

Unless these materials are disposed of properly, they can cause irreversible damage to the environment (surface and underground water, vegetation and animals), as well as to human health due to pollution of aquifers for example, and the deterioration of environmental conditions.

A full decommissioning plan should be developed within the first 24 months of operation; however, the following management actions are recommended as a minimum:

- Reusable, recyclable and scrapable components will be selected.
    - Disposal will consist of disassembling the modules and sending them to a suitable recycling platform which will carry out the following recovery work:
        - recovery of aluminium frames;
        - recovery of glass material;
        - recovery of cells;
        - decommissioning of the polymer material covering the cells.
    - The electricity lines of all the systems such as lighting will be removed by carrying out only the absolute necessary excavation work.
    - Copper from electricity cables and windings as well as other metallic parts will be sent to specialised centres for recovery and recycling.
    - Appliances such as inverters, control panels and transformers will be disassembled and sent to specialised companies for disposal.

- Piping and electrical drawpits will be removed by excavating a set size excavation and the original situation will be restored using the excavated material.
- The exposed parts of the photovoltaic module supporting structures will be removed mechanically, whereas the foundation piles sunk into the ground will be extracted.

13 CONCLUSIONS AND RECOMMENDATIONS

13.1 Conclusions

Most of the construction phase impacts were deemed to have a negative impact without mitigation. However, these were mostly short-term and can be significantly reduced with the mitigation measures.

During the operational phase the impacts of visual; hazardous waste; and ecological impacts were assessed to have a long-term negative effect without mitigation. The impacts will however be significantly reduced when the recommended mitigation measures in the scoping report and environmental management plan (EMP) are implemented.

The impacts on the quality of life of the local communities and on the infrastructure, development is deemed to be positive.

The archaeological and heritage assessment conducted on Farm Geluk, Portion 7 of Farm 58 and Portion 4 of Farm 39 yielded potentially significant heritage resources within the Farm Geluk and surroundings, and site management plans have been proposed. In addition, a chance find procedures have been outlined should heritage be unearthed during the construction of intended infrastructures for the project.

With the implementation of the recommended mitigation measures in this report as well as in the EMP, the significance of the planning and design, construction and operational phase impacts is likely to be reduced to a Low (negative). It is further extremely important to include an Environmental Control Officer (ECO) on site during the construction phase of the proposed project to ensure that all the mitigation measures discussed in this report and the EMP are enforced.

It is strongly advised that the proponent appoint suitably qualified professionals to design and supervise the construction of the services and other infrastructure. It is also advised to develop and implement a preventative maintenance plan, which shall be monitored and evaluated regularly.

It is noted that where appropriate, these mitigation measures and any others identified by the EC could be enforced as Conditions of Approval in the Environmental Authorisation.

Regulation 15(j) of the EMA, requires that the EAP include an opinion as to whether the listed activity must be authorised and if the opinion is that it must be authorised, any condition that must be made in respect of that authorisation.

Solar powered electricity generation is experiencing rapid growth. A major motivation for deploying solar power is to reduce emissions of carbon dioxide caused by traditional power generation (Turney & Fthenakis, 2011) for the same quantity of energy produced. Although the size of land required by the photovoltaic plant is usually more than fossil fuel plants, the emissions at fossil fuel plants are considerable (air, soil, noise, etc.). Emissions from solar energy are usually negligible to none. Photovoltaic power plant impacts are reversible in the short-term because after decommissioning, the area can be returned to its previous state and become available for other activities. In addition to producing clean energy the power plant can contribute to the promotion of biodiversity, by providing a refuge for plants and animals, in particular smaller animals such as invertebrates.

Another advantage of a photovoltaic power plant over the conventional power plant is that as the lifetime of the solar power plant gets longer, the land transformation per capacity does not change, even when considering the impacts on land use. All high priority impacts are in favour of solar power displacing traditional power generation while all the harmful impacts from solar power are of low priority (Turney & Fthenakis, 2011).

Based on the evidence produced during the assessment process, it is very unlikely that this project will have any significant negative impacts on the environment. It is therefore recommended that a clearance certificate be issued for the project.

14 REFERENCES

1. Turney, D & Fthenakis, V., 2011. Environmental impacts from the installation and operation of large-scale solar power plants. Renewable and Sustainable Energy Reviews 15 (2011) 3261– 3270.
2. Ahmed, M., W. H. Shayya, D. Hoey and J. Al-Handaly, (2001), "Brine disposal from reverse osmosis desalination plants in Oman and United Arab Emirates", Desalination, Vol., 133, pp. 135-147
3. Befesa Desalination Developments Ghana Limited (2011), Environmental Impact Statement on Proposed Seawater Reverse Osmosis Desalination Plant at Nungua, Accra
4. Benguela Current Convention, 2014., State of the Marine Ecosystem Report
5. Bianchi, G., Carpenter, K.E., Roux, J.-P., Molloy, F.J., Boyer, D., Boyer, H.J., 1999. FAO species identification guide for fishery purposes. Field guide to the Living Marine Resources of Namibia, 256 pp.
6. Bode, M., Kreiner, A., van der Plas, A. K., Louw D. C., Horaeb, R., Auel, H., *et al*., 2014. Spatio-Temporal Variability of Copepod Abundance along the 20°S Monitoring Transect in the Northern Benguela Upwelling System from 2005 to 2011. PLoS ONE 9(5): e97738. https://doi.org/10.1371/journal.pone.0097738
7. Boyd, A. J., 1987. The oceanography of the Namibian shelf. PhD Thesis. University of Cape Town. 295 pp
8. Boyd, A.J., Oberholster, G.P.J., 1994. Currents off the west and south coasts of South Africa. S. Afr. Shipping News and Fish. Ind. Rev. 49, 26-28.
9. Branch, G.M., Griffiths, C.L., Branch, M.L., Beckley L.E., 2010. Two Oceans - A Guide to the Marine Life of Southern Africa. David Philip, Cape Town, pp 456.
10. Brüchert, V., Currie, B., Peard, K. R., Lass, U., Endler, R., Dübecke, A., et al. (2006). "Biogeochemical and physical control on shelf anoxia and water column hydrogen sulphide in the Benguela coastal upwelling system off Namibia," in Past and Present Water Column Anoxia (Dordrecht: Springer), 161–193.
11. Campbell, E. E., 1993. Coastal geomorphology, dunes, beach fauna and flora and seaweeds of Namibia. In Environmental Data Workshops for Oil Contingency Planning. Centre for Marine Studies. University of Cape Town.
12. Carr, M. E., Kearns, E. J., 2003. Production regimes in four Eastern Boundary Current Systems. Deep Sea Res., Part II 50 (22-26), 3199-3221.

13. Chapman, P., Shannon, L.V., 1985. The Benguela Ecosystem. Part II. Chemistry and related processes. Oceanography & Marine Biology: An Annual Review 23, 183-251.
14. Crawford, R. J. M. 2007. Food, fishing and seabirds in the Benguela upwelling system. Journal of Ornithology. 148, 253-260
15. Currie B, Utne-Palm, A. C., Salvanes, A. G. V., 2018. Winning ways with Hydrogen Sulphide on the Namibian Shelf. Front. Mar. Sci. 5:341. doi: 10.3389/fmars.2018.00341
16. Davies, S., Hjort, A., Boyer, D., Boyer, H., 2015. Benguela Current Large Marine Ecosystem: State of the Marine Environment, 2014. 1st Edition. Benguela Current Commission, Swakopmund, Namibia
17. Duncombe Rae, C.M., 2005. A demonstration of the hydrographic partition of the Benguela Upwelling System at 26°40'. Afr. J. Mar. Sci. 27, 617-628
18. Emeis, K.-C., Brüchert, V., Currie, B., Endler, R., Ferdelman, T., Kiessling, A., Leipe, T., Noli-Peard, K., Struck, U., Vogt, T., 2004. Shallow gas in shelf sediments of the Namibian coastal upwelling ecosystem. Continental Shelf Research 24, 627-642.
19. Erasmus, V. N., Currie, B., Roux, J.-P., *et al*., 2021. Predatory species left stranded following the collapse of the sardine Sardinops sagax (Pappe, 1854) stock off the northern Benguela upwelling system: A review, Journal of Marine Systems (2018), https://doi.org/10.1016/j.jmarsys.2021.103623
20. Gammelsrod, T., Bartholomae, C. H., Boyer, D. E., Fillipe, V.L.L., O'Toole, M. J., 1998. Intrusion of warm surface water along the Angolan-Namibia coast in February-March 1995: The 1995 Benguela Niño. S. Afr. J. Mar. Sci. 19:41-56
21. Hansen, F. C., Cloete, R.R., Verheye, H. M. V., 2005 Seasonal and spatial variability of dominant copepods along a transect off Walvis Bay (23°S), Namibia. Afr J Mar Sci 27(1): 55–63
22. Hart, T. J., and Currie, R. I. (1960). The Benguela Current. Discovery Reports, University Press.
23. Hoepner T. and Lattemann S., (2002), "Chemical impacts from seawater desalination plants a case study of the northern Red Sea", Desalination, Vol. 152, pp.133–140
24. Kainge, P., S. P. Kirkman, V. Estevão, C. D. Van Der Lingen, U. Uanivi, J. N. Kathena, A. Van Der Plas, et al. 2020. Fisheries Yields, Climate Change, and Ecosystem-based Management of the Benguela Current Large Marine Ecosystem." In Environmental Development. doi: 10.1016/j. envdev.2020.100567
25. Kirkman, S.P., Oosthuizen, W.H., Meyer, M.A., Kotze, P.G.H., Roux, J-P. Underhill L.G., 2007, Making sense of census and dealing with missing data: trends in pup counts of Cape fur seal

Arctocephalus pusillus pusillus for the period 1972-2004, African Journal of Marine Science, 29(2),

26. Kirkman, S.P., Yemane, D., Oosthuizen, W.H., Meyer, M.A., Kotze, P.G.H, Skrypzeck, H., Vaz Velho, F., Underhill, L.G., 2012. Spatio-temporal shifts of the dynamic Cape fur seal population in southern
27. Louw, D.C., van der Plas, A. K., Mohrholz, V., Wasmund, Junker, T., Eggert, A., 2016. Seasonal and interannual phytoplankton dynamics and forcing mechanisms in the Northern Benguela upwelling system. Journal of Marine Systems, 157: 124-134,
28. Ludynia, K., 2007. Identification and characterization of foraging areas of seabirds in upwelling systems: biological and hydrographic implications for foraging at sea. PhD thesis, University of Kiel, Germany.
29. Lynam, C.P., Gibbons, M.J., Axelsen, B.A., Sparks, C.A.J., Coetzee, J., Heywood, B.G., Brierley, A.S., 2006. Jelly Fish overtake fish in a heavily fished ecosystem. Curr. Biol. 16, 492–493.
30. Lynne J. Shannon *et al.,* (2004), Simulating anchovy–sardine regime shifts in the southern Benguela ecosystem; Ecological Modelling 172 pp 269–281
31. Makhado, A., Braby, R. J., Dyer, B. M., Kemper, J., Mcinnes, A., Desmond, T., Crawford, R. J. M., (2021). Seabirds of the Benguela Ecosystem: Utilisation, Long-Term Changes and Challenges. In "Birds - Challenges and Opportunities for Business, Conservation and Research.
32. Mendelsohn J, Jarvis A, Roberts C & T Robertson., (2002) Atlas of Namibia. A portrait of the land and its people. David Philip Publishers
33. Ministry of Fisheries and Marine Resource 2012, 2013, Sardine Survey Report
34. Ministry of Fisheries and Marine Resources (MFMR), 2018. Current Status Report: National Overview for Marine Spatial Planning & Knowledge Baseline for Namibia's 1st Marine Spatial Plan. MFMR, Windhoek: Namibia.
35. Mohamed A. D. et al., (2012), Environmental Impacts of Seawater Desalination: Arabian Gulf Case Study, International Journal of Environmental and Sustainability, Vol. 1 No 3, pp. 22-37
36. Mohrholz, V., Bartholomae, C. H., van der Plas, A. K., Lass, L. U., 2007. The seasonal variability of the northern Benguela undercurrent and its relation to the oxygen budget on the shelf. Continetal Shelf Research, 8: 424-441
37. Molloy, F., Reinikainen T., (Eds), 2003. Namibia`s Marine Environment. Directorate of Environmental Affairs, Ministry of Environment & Tourism, Namibia, 160 pp.

38. Monteiro, P.M.S., van der Plas, A.K., Melice, J.-L., Florenchie, P., 2008. Interannual hypoxia variability in a coastal upwelling system: ocean-shelf exchange, climate and ecosystem-state implications. Deep Sea Res. I 55, 435–450
39. Namibian Statically Agency., (2011) Namibia Population and Housing Census Main Report.
40. Nelson, G., 1989. Poleward motion in the Benguela area. In: Poleward Flows along Eastern Ocean Boundaries. Neshyba et al. (eds) New York; Springer, 110-130 (Coastal and Estuarine Studies 34).
41. Nelson, G., Hutchings, L., 1983. The Benguela Upwelling area. Prog. Oceanogr. 12, 333-356.
42. Nyabakken, J. W., 1997. Marine Biology: An Ecological Approach, 4th edition. Addison-Wesley Educational Publishers
43. Ohde, T., Dadou, I. (2018). Seasonal and annual variability of coastal sulphur plumes in the northern Benguela upwelling system. PLoS ONE 13:e0192140. doi: 10.1371/journal.pone.0192140
44. Paterson, J., Yates, O., Holtzhausen, H., Reid, T., Shimooshili, K., Yates, S., Sullivan, B.J., Wanless, R.M., 2017. Seabird mortality in the Namibian demersal longline fishery and recommendations for best practice mitigation measures. Oryx 53 (2), 300–309.
45. Pitcher, G. C., Aguirre-Velarde, A., Breitburg, D., Cardich, J., Carstensen, J., Conley, D. J., Dewitte, B., Engel, A., Espinoza-Morriberón, D., Flores, G., Garçon, V., Graco, M., Grégoire, M., Gutiérrez, D., Hernandez-Ayon, J. M., Huang, H. H. M., Isensee, K., Jacinto, M. E., Levin, L., Lorenzo, A., Machu, E., Merma, L., Montes, I., SWA, N., Paulmier, A., Roman, M., Rose, K., Hood, W., Rabalais, N. N., Salvanes, A. G. V., Salvatteci, R., Sánchez, S., Sifeddine, A., Tall, A. W., van der Plas, A. K., Yasuhara, M., Zhang, J., Zhu, Z. Y., 2021. System controls of coastal and open ocean oxygen depletion. Progress in Oceanography, 197
46. Report of the Environmental and Social Impact Assessment Trekkopje Desalination Project Erongo Region Namibia (2008)
47. Robertson, T., Jarvis, A., Mendelsohn, J., Swart, R., 2012. Namibia's coast: ocean riches and desert treasures: Directorate of Environmental Affairs, Ministry of Environment and Tourism, Windhoek
48. Rouault, M., Illig, S., Lübbecke, J., Koungue, R. A. I., 2018. Origin, development and demise of the 2010–2011 Benguela Niño, Journal of Marine Systems, Volume 188, 2018, 39-48

49. Roux JP, Braby RJ, Best PB (2015) Does disappearance mean extirpation? The case of right whales off Namibia. Mar Mammal Sci 31:1132–1152
50. Roux, J-P., P. B. Best and P. E. Stander. 2001. Sightings of southern right whales (Eubalaena
51. Sakko, A. L. 1998. The influence of the Benguela upwelling system on Namibia's marine biodiversity. *Biodiversity and Conservation* 7 (4). 419 433
52. Shannon, L.V., 1985. The Benguela Ecosystem. Part 1: Evolution of the Benguela physical features and processes. Oceanography & Marine Biology: An Annual Review 23, 105-182.
53. Shannon, L.V., Boyd, A.J., Brundrit, G.B., Taunton-Clark, J., 1986. On the existence of an El Niño type of phenomenon in the Benguela system. J. Mar. Res., 44(3): 495-520.
54. Shillington, F.A., Reason, C. J. C., Duncombe Rae, C. M., Florenchie, P., Penven, P., 2006. Large scale physical variability of the Benguela Current Large Marine Ecosystem (BCLME). In. Benguela: Predicting a Large Marine Ecosystem. Shannon, V., Hempel, G., Malanote-Rizzoli, P., Moloney, C., Woods, J., (Ed). Elsevier
55. Snelgrove, P.V.R., Butman, C.A., 1994. Animal-sediment relationships revisited: cause versus effect. Oceanography & Marine Biology: An Annual Review 32, 111-177.
56. Stander, D., H and de Decker, H. A. B., 1969. Some physical and biological aspects of an oceanographic anomaly off South West Africa in 1963. Investigational Reports of the Marine Research Laboratory of South Africa. 81. 46p
57. Steffani, N., Sedick, S., Rogers, J., Gibbons, M. J. 2015. Infaunal Benthic Communities from the Inner Shelf off South western Africa Are Characterised by Generalist Species. PLoS ONE 10 (11)
58. The ecosystem approach to fisheries., (2003), FAO Technical Guidelines for Responsible Fisheries. No. 4, Suppl. 2. Rome, FAO.. 112 p.
59. Timonin, A.G., Arashkevich, E.G., Drits, A.V., Semenova, T.N., 1992 Zooplankton dynamics in the northern Benguela ecosystem, with special reference to the copepod Calanoides carinatus. In Benguela Trophic Functioning. Payne, A. I. L., Brink, K. H., Mann, K. H. and R. Hilborn (Eds). S. Afr. J. mar. Sci. 12, 545–560.
60. Verheye, H. M. V., Lamont, T., Hugget, J. A., Kreiner, A., Hampton, I., 2016. Plankton productivity of the Benguela Current Large Marine Ecosystem (BCLME). Environmental Development Journal 17. 75-92

61. Weeks, S.J., Currie, B., Bakun, A., Peard, K.R., 2004. Hydrogen sulphide eruptions in the Atlantic Ocean off southern Africa: implications of a new view based on SeaWiFS satellite imagery. Deep-Sea Research I 51,153-172.
62. Wickens, P.A., York, A. E.,1997. Comparative population dynamics of fur seals. Marine Mammal Science. 13: 241-292
63. Wolfgang Fennel 1999 Theory of the Benguela Upwelling System Journal of physical oceanography Vol. 29
64. Yates, M.G., Goss-Custard, J.D., McGrorty, S.M., Lakhani, Dit Durrell, S.E.A., Levit, Clarke, R.T., Rispin, W.E., Moy, I., Yates, T., Plant, R.A., Frost, A.J., 1993. Sediment characteristics, invertebrate densities and shorebird densities on the inner banks of the Wash. J. Appl. Ecol. 30: 599– 614.
65. Zettler, M. L.,Bochert, R., Pollehne, F., 2009. Macrozoobenthos diversity in an oxygen minimum zone off northern Namibia. Mar Biol. 156:1949–1961.