March 2021

FINAL ASSESSMENT REPORT

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT OF THE PROPOSED WIND POWER PLANT NEAR LÜDERITZ

ENVIRO DYNAMICS
Environmental Management Consultants

NamPower
Powering the Nation and beyond

PROJECT NAME	Environmental and Social Impact Assessment for the Proposed Wind Park near Lüderitz Namibia
REPORT	Assessment Report
STAGE OF REPORT	Final
PROPONENT	NamPower Enquiries: Eliaser Nghishiyeleke Assistant Engineer: Generation Capital Projects Tel: 264 61 205 2220 E-Mail: eliaser.nghishiyeleke@nampower.com.na
LEAD CONSULTANT	Enviro Dynamics Enquiries: Stephanie van Zyl Tel: (061) 223-336 E-Mail: **stephanie@envirod.com**
DATE OF RELEASE	March 2021
CONTRIBUTORS TO THE REPORT	Stephanie van Zyl, Norman van Zyl

EXECUTIVE SUMMARY

1.1 BACKGROUND

As part of the strategy to fulfil Namibia's energy demand, NamPower is planning to commence with the development of its Lüderitz Wind Power Plant (see the map shown in **Figure i** below. Enviro Dynamics cc has been awarded the contract to perform the Environmental and Social Impact Assessment (ESIA) on behalf of NamPower as an independent Environmental Assessment Practitioner.

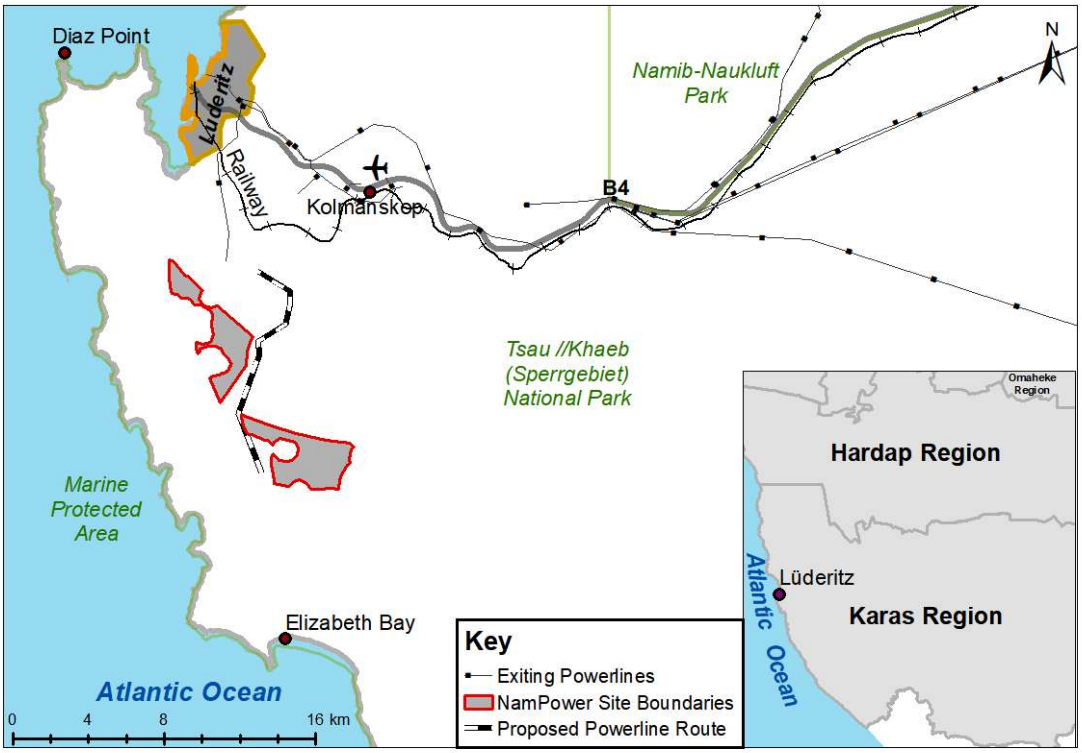

Figure i: ***Locality map of the sites for the proposed NamPower Wind Park near Lüderitz***

The project area of approximately 1648 Ha, comprising of two distinct sites, is located to the south-east of Lüderitz in the Sperrgebiet diamond protection area and Tsau //Khaeb (Sperrgebiet) National Park (TKNP).

The project will consist of [36][1] units of wind turbines on the two sites distributed in the central section of each. Each unit will consist of conical tubular tower type with three (3) blades per rotor, which are 130 - 140m high at blade tip height.

The wind farm is expected to generate approximately 2.6 MW per wind turbine, totalling about 90 MW. This size and number of wind turbines may change depending on the measured wind resource and final turbine supplier.

This proposed location for the Wind Park is being considered among other sites in Namibia. Feasibility studies are currently underway to determine the best site, economically, technically and environmentally.

Terms of Reference

The Consultant shall perform all the necessary requirements of the Environmental Management Act (2007) and its Regulations (2012), as well as of the International Finance Corporation (IFC) in performing this assessment.

Legal requirements

A study was conducted of all the environmental legal requirements which have a bearing on this assessment. This report sets out the applicable parts of applicable legislation, including National legislation and International treaties which Namibia is signatory to. It also sets out the requirements of the International Finance Corporation (IFC) and Equator Principles. The Tsau //Khaeb / (Sperrgebiet) National Development and Management Plan has also been explored since the project area is governed by it. Legal and permit requirements will be carried forward to the Environmental and Social Management Plan (ESMP) for this project.

Public Consultation and Disclosure

The process of soliciting and including public and stakeholder comments and concerns is being conducted in line with the applicable legislation and the IFC standards. Key consultation methods used have included press notices and direct invitations to a public meeting and distribution of electronic information. Focal meetings are ongoing as needed. The outcome of the process is considered positive and concerns raised have being considered throughout the process. No objections have been raised against the project and it is generally considered to be a positive development for Namibia. This report contains the summarised outcome of the consultation process and the Public Consultation Report, as well as

[1] *The number and exact position of the turbines may change depending on the design bases and size of wind turbine selection. The ESIA will consider these potential changes and design the work to accommodate future changes within limits.*

the detailed outcomes. The ESIA and ESMP reports have been distributed to the public and key stakeholders for comments. Further stakeholder engagement during the development has been specified in the ESMP. Engagement with key stakeholders such as the Ministry of Environment, Forestry and Tourism (MEFT), Ministry of Agriculture, Water and Land Reform (MAWLR), Sperrgebiet Diamond Mining (Pty) Ltd (SDM) and Namdeb, the Ministry of Mines and Energy (MME), the Lüderitz Town Council, the //Kharas Regional Council and local community groups is expected to be ongoing.

Screening and scoping

During Scoping, the areas requiring further work were clarified. The potential impacts which are considered insignificant or where adequate information is available were also identified which could be addressed in the Environmental and Social Management Plan (ESMP).

Furthermore, the recommendations for excluding sensitive zones and refining the positions of the proposed Wind Turbine Generators (WTGs) were incorporated to achieve increased environmental sensitivity on the project design. The final impact assessment reported herein was based on this previous work. The work conducted during the more advanced assessment also included the following:

- Updating of the project description to include a layout of the site, proposed location for the turbines (subject to change), and other project details such as vehicle and transport requirements, infrastructure proposals such as sewerage and solid waste management treatment, labour requirements, and accommodation recommendations for the workforce.
- Further fieldwork and study in some of the specialist fields, are as listed in **Table 13**. The overall outcome of each study is also presented below.

Findings of specialist studies during the full impact assessment

Table i: Specialist work findings

FIELD	WORK DONE DURING FULL IMPACT ASSESSMENT	KEY FINDINGS
Bats	A brief bat-monitoring study to confirm the occurrence of bats in the study area.	Thirteen (13) bat species have the potential to occur on the project sites (Error! Reference source not found.**, Appendix G**), two (2) of which, *Eidelon helvum* and *Taphazous mauritianus*, have been confirmed for Lüderitz. According to the study, the Angolan wing-gland bat *Cistugo seabrae* is an endemic of the region. Six (6) of the 13 (~46%) species are considered to be at high risk of fatality due to their flight behaviour. However, the harsh weather conditions on site and lack of roosting and foraging habitat means that large aggregations of bats are unlikely and bat activity levels will likely be low. Due to an uncertainty regarding the occurrence of species on site, the potential fatalities of bats due to collisions with WTGs is rated of medium significance. Pre-construction and post-construction monitoring and adaptive management strategies are therefore recommended.
Vegetation	Confirmed the occurrence of the identified species expected to occur on the two sites by carrying out physical transects. Produced the vegetation impact assessment with recommendations for the ESMP. **Appendix E.**	The study area is a major centre of endemicity in Namibia. Most of the study sites are consistent with the vegetation zones marked "High Biodiversity Importance" in the TKNP Management Plan, with smaller pockets of the Very High Importance Zone. These pockets are to be avoided. The

FIELD	WORK DONE DURING FULL IMPACT ASSESSMENT	KEY FINDINGS
		40MW NamPower Site is mostly a greenfield site, while the 50MW IPP Site is largely disturbed, but with some 100 years of recovery already achieved. The overall potential impact on vegetation is rated High and can be mitigated to Medium by strictly limiting the footprint, avoiding sensitive zones and actively avoiding collateral damage.
Avifauna	Considered the final boundaries of the sites, updated project information and monitoring data acquired on site. Produced the avifauna impact assessment with recommendations for the ESMP. **Appendix F.**	Seventy (70) avifauna species have been identified to occur or to potentially occur at the project site. Four (4) are provisionally considered as priority species, based on their local or global conservation status, their level of endemicity, and their susceptibility to risks posed by wind parks (potential collisions with turbines and power lines). This list is subject to confirmation and revision upon completion of the pre-construction bird monitoring programme. Potential collisions of priority species with turbines and power line conductors has been rated low to medium, due to the area being generally species poor. The impact can be reduced to a low significance with mitigation including the marking of power line conductors, the colour of the turbines and the final placement of turbines.
Brown Hyena	After further project details had been obtained (i.e. waste management, number of vehicles to move on site, etc., and final boundaries of the two sites), produced the impact	The brown hyena is a flagship species in the TKNP and the conservation of the species is of utmost importance. The adjusted site boundaries avoid core denning sites. However,

FIELD	WORK DONE DURING FULL IMPACT ASSESSMENT	KEY FINDINGS
	assessment for brown hyenas with recommendations for the ESMP. **Appendix H.**	they still fall into the territories of at least two, possibly three brown hyena clans. Potential disturbance of the brown hyena related to project activity rates of medium significance. This can be reduced to a low significance if all construction activities take place only when dens are inactive and maintenance work during the operational phase is limited to a minimum when dens are active.
Archaeology	Investigated the occurrence of historical and archaeological finds on the project sites and produced the impact assessment with mitigation should any be found. **Appendix I.**	The LWP project footprint has a low archaeological significance. There are important concentrations of archaeological sites in the same area but these are associated with specific environmental features and conditions. The exposed terrain of the LWP project site has no such features and has little associated archaeological evidence.
Civil Aviation	Consider the final localities and heights of the turbines and re-assess the state of turbines requiring Annex 14 and PANS-OPS assessments. Produced an impact assessment accordingly and provided further requirements. **Appendix K.**	The vicinity of the project to the Lüderitz airport necessitates height restrictions to the WTGs. The necessary PANS-OPS assessment for each turbine that penetrates the Obstacle Surface Limitation should be conducted. Application should be made for the structures from the Namibia Civil Aviation Authority (NCAA) and the height limitations provided.

FIELD	WORK DONE DURING FULL IMPACT ASSESSMENT	KEY FINDINGS
		Keeping within the height restrictions and implementing the civil aviation safety measures provided will eliminate the high aviation safety risk.
Visual Impact Assessment	Evaluated the viewpoints of the sites and conduct a visual impact assessment, followed by recommendations for mitigation. **Appendix J.**	The majority of viewscapes that are valuable to the tourism industry in the Lüderitz area remain unaffected by the project. One visually significant impact has been identified on a section of the potential Kolmanskop to Elizabeth bay tourism route. Colour schemes have been recommended, and the project is to be integrated with the history and development narrative used in the tourism industry.
Socio-economic Impact Assessment	Produced the socio-economic impact assessment and provided recommendations for mitigation of negative impacts and enhancement positive impacts. The assessment is contained in this report, **Section 5 and 8.**	Besides overall positive socio-economic impacts, the key negative socio-economic impact revolves around the housing for the workforce of the development, which cannot be accommodated within the TKNP. The additional housing demand in Lüderitz will increase the pressure on infrastructure and an influx of job seekers may be expected. A recruitment housing strategy needs to be developed in conjunction with the Lüderitz Town Council and the Regional Council.
Carbon footprint study	Considered the climate change risk of the project and the carbon footprint of the project, as well as its contribution to Namibia's carbon footprint. **Appendix M.**	The risk that climate change may have on the project involves increased temperatures influencing the efficiency of equipment and the health of the workforce and sea level rise changes affecting the harbour and subsequently the operations of the project. These risks are all of medium to low

FIELD	WORK DONE DURING FULL IMPACT ASSESSMENT	KEY FINDINGS
		significance and adaptive measures have been recommended to manage them. The project contributes very little to the overall carbon footprint of Namibia, notwithstanding factors such as manufacturing abroad and imports. When compared to conventional power generation projects, wind energy generation offers the benefit of a relatively small carbon footprint. The overall impact is therefore a positive one since conventional non-renewable energy is replaced as a source with renewable energy.
Traffic Impact Assessment	Considered the details of the project, notably the transport requirements, vs. the existing road network and road conditions, and conducted a traffic impact assessment with recommendations for areas requiring design input and traffic interventions. **Appendix L.**	The Kolmanskop road is currently in a satisfactory condition and does not need paving to accommodate the additional traffic during construction. However, a maintenance agreement is recommended to maintain a satisfactory condition of the road. With a traffic management plan being recommended for the transportation of materials and equipment from the harbour to the site, traffic impact is expected to be low.
IFC Standards	Applied the IFC standards to the project and ensure all relevant ones are incorporated. Internal review to follow.	The ESIA is IFC compliant with the pending step of an IFC review to be completed.

FIELD	WORK DONE DURING FULL IMPACT ASSESSMENT	KEY FINDINGS
Cumulative impacts	All the specialist impact assessments are to consider cumulative impacts, i.e. the combined effect of the developments in the SKNP, including the combined effect of the Wind Parks in the SKNP and along the coastal zone.	Relevant details are captured in each specialist study and summarised below.

Cumulative Impact

Even though the project is located in a relatively sensitive area, the expected impacts of the project can remain within limits of acceptable change given its relatively small scale within the TKNP and the biome and sensitivity zones in which it is located. The workforce is also relatively small. Management strategies would have to be targeted and committed to limit this change, particularly those related to limiting footprint and avoiding collateral damage.

However, of greater concern is the effect of this project combined with a range of others either already implemented, approved but not yet implemented, still being considered for authorisation, or others not yet conceived.

Figure ii shows the potential for wind generation projects south of Lüderitz. It shows a significant wind power development potential in the //Kharas Region.

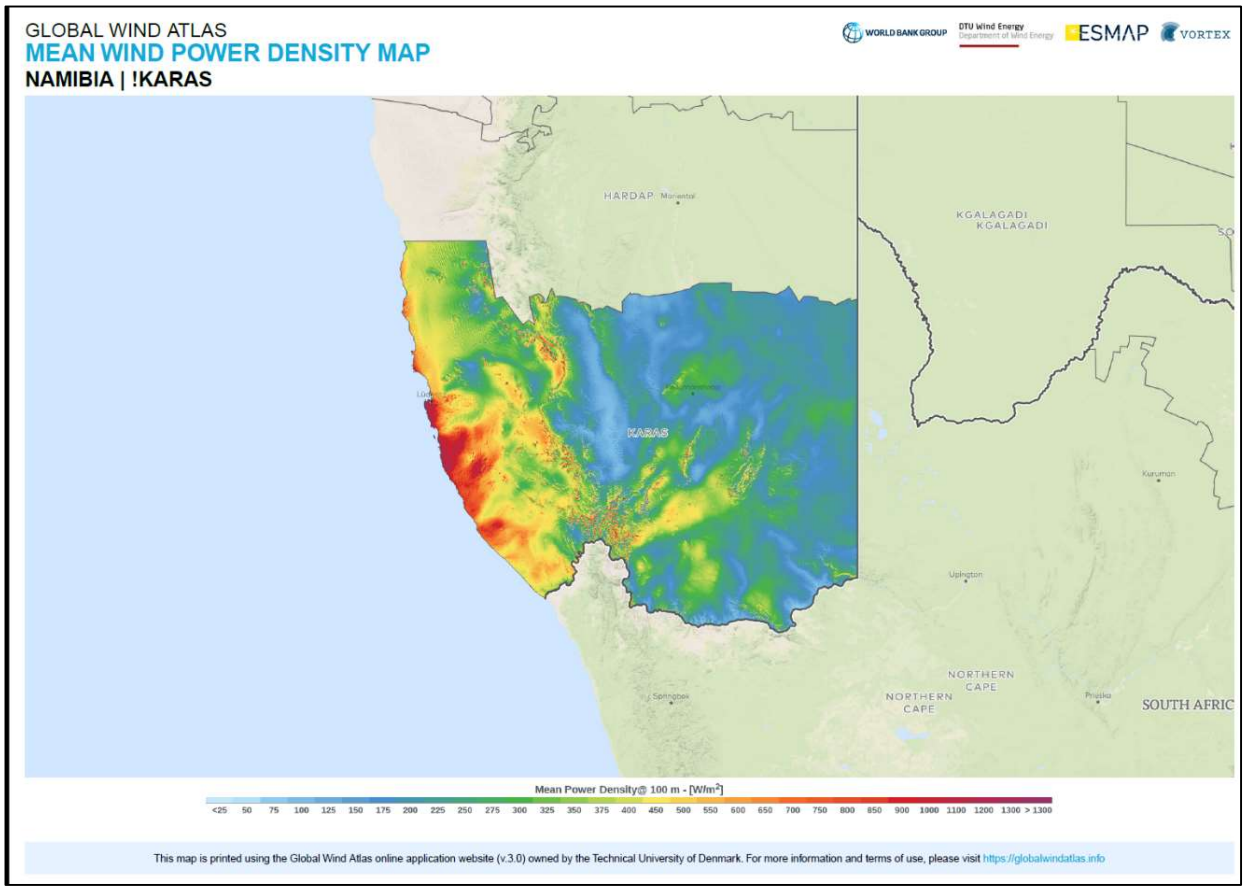

Figure ii: ***Wind potential south of Lüderitz in the //Kharas Region, with red indicating high potential (Global Wind Atlas, 2019).***

It is therefore recommended that a Strategic Environmental Assessment (SEA) be initiated for wind park development in the TKNP and that suitable development areas with limits of acceptable change be identified by a core group of specialists, undergirded by the principles of the TKNP Management Plan, in collaboration with the MEFT. The cumulative impacts and the initiation and funding of such a study should be driven by the Regulator.

Conclusion

The proposed 90MW NamPower wind generation project near Lüderitz will offer increased power security and curb increases in future costs of energy for the country. It will also reduce the need to import ESKOM coal generated electricity followed by a reduced overall carbon footprint. Besides, it will provide a welcome injection into the local and regional economy, in an otherwise strained economic climate.

Notwithstanding this, the project will be developed in a sensitive and unique biophysical setting. With the avoidance of sensitive ecological, technical and physical zones, the impacts expected from the project have been significantly reduced. Key impacts, including those expected on vegetation and the brown hyena are still expected to be significant. Above average commitment is required to manage these impacts and to avoid them from becoming unacceptable. Even though wind turbines normally have a significant impact on avifauna (including bats) particularly due to collisions with turbines, this impact is expected to be low owing to limited suitable habitat and a resulting species poor area. Monitoring should nevertheless continue to confirm these initial findings and to adapt strategies where necessary. The design measures, management regimes and monitoring requirements given in the ESMP are of utmost importance and should be structured into all communications and management platforms related to the project. With this condition in place, it is recommended that Environmental Clearance be granted for the project.

It is further recommended that an SEA be initiated for the development of wind power in the TKNP, with contributions made by all the prospective wind power developers.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ACRONYMS

AMSL	Above Mean Sea Level
DR	District Road
ECB	Electricity Control Board
EHS	Environmental, Health and Social
EMA	Environmental Management Act
EPC	Engineering Procurement Construction
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
IBAs	Important Bird Areas
IUCN	International Union for Conservation of Nature
IFC	International Finance Corporation
IPP	Independent Power Producer
KfW	Kreditanstalt fuer Wiederaufbau
LWP	Lüderitz Wind Project
MAW & LR	Ministry of Agriculture, Water and Land Reform
MEFT	Ministry of Environment, Forestry and Tourism
MME	Ministry of Mines and Energy
MW	Megawatt
NAC	Namibia Airports Company
NDP5	5th National Development Plan
NIRP	National Integrated Resource Plan
NUST	Namibia University of Science and Technology
NCAA	Namibia Civil Aviation Authority
NIMPA	Namibian Island's Marine Protected Area

OLS	Obstacle Limitation Surface
O&M	Operation and Maintenance
OECD	Organisation for Economic Co-operation and Development
SDGs	Sustainable Development Goals
SDM	Sperrgebiet Diamond Mining (Pty) Ltd
TDA	Tourism Development Areas
TKNP	Tsau //Khaeb (Sperrgebiet) National Park (in some older documents and references referred to as Sperrgebeit National Park (SNP))
UNEP	United National Environmental Programme
RVAP	Visual Resource Assessment Procedure
WTG	Wind Turbine Generator

LIST OF APPENDICES

1 INTRODUCTION

1.1 BACKGROUND

As part of the strategy to fulfil Namibia's energy demand, NamPower is planning to commence with the development of its Lüderitz Wind Power Plant, referred to in this document as "the Project". As part of the development, an Environmental and Social Impact Assessment (ESIA) is being conducted.

Enviro Dynamics cc has been awarded the contract to perform this assignment on behalf of NamPower as an independent Environmental Assessment Practitioner.

The site is located to the south-east of the town of Lüderitz in the Sperrgebiet diamond protection area and Tsau //Khaeb (Sperrgebiet) National Park in the //Kharas Region of Namibia (see **Figure 1**).

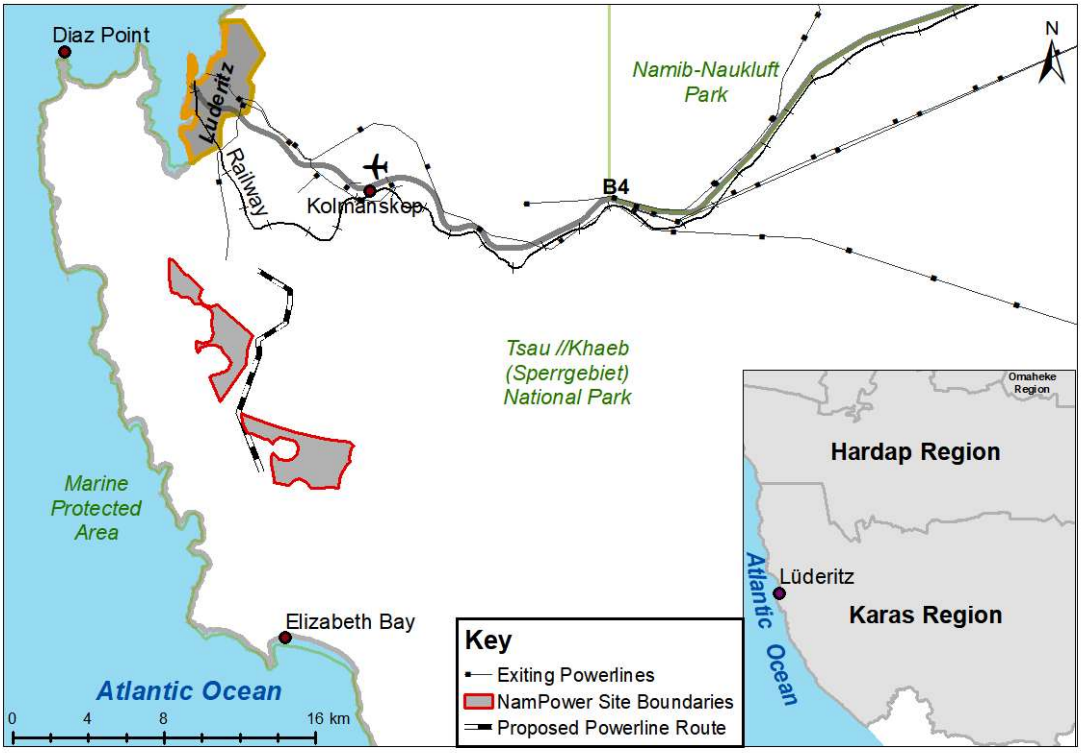

Figure 1: Locality map of the sites for the proposed NamPower Wind Park near Lüderitz

The size of the overall site is approximately 1648 Ha, split in two areas as shown in **Figure 2**. The North-western site will be leased and operated by NamPower, while the south-eastern site will be operated by an Independent Power Producer (IPP). To identify these two separate sites, they are referred to as the 40MW NamPower Site and 50MW IPP Site, respectively.

Figure 2: Sub-sites indicating NamPower and IPP involvement.

1.2 PROCESS UNDERTAKEN SO FAR

Figure 3 below shows the process undertaken so far for the ESIA and where this Assessment Report fits in.

Screening

A screening exercise was done to confirm the validity of the selected site and to iron out no-go zones and sensitivities on it. The screening process is not a part of the formal ESIA, but was initiated in order to avoid impacts on sensitive areas. The details of this process are contained in the Screening Report, Enviro Dynamics (2020).

Scoping

The Scoping process is the formal start of the ESIA and is in line with the requirements of the Environmental Management Act (2007). Its main features are a legal review, a baseline description of available data, the outcome of the consultation process, an impact assessment based on the known data, and Terms of Reference for further specialist ground truthing, to augment information gaps. The Scoping Report (Enviro Dynamics, 2020) contains these findings.

Impact Assessment

The full impact assessment which expands on available data since scoping, is presented in this report.

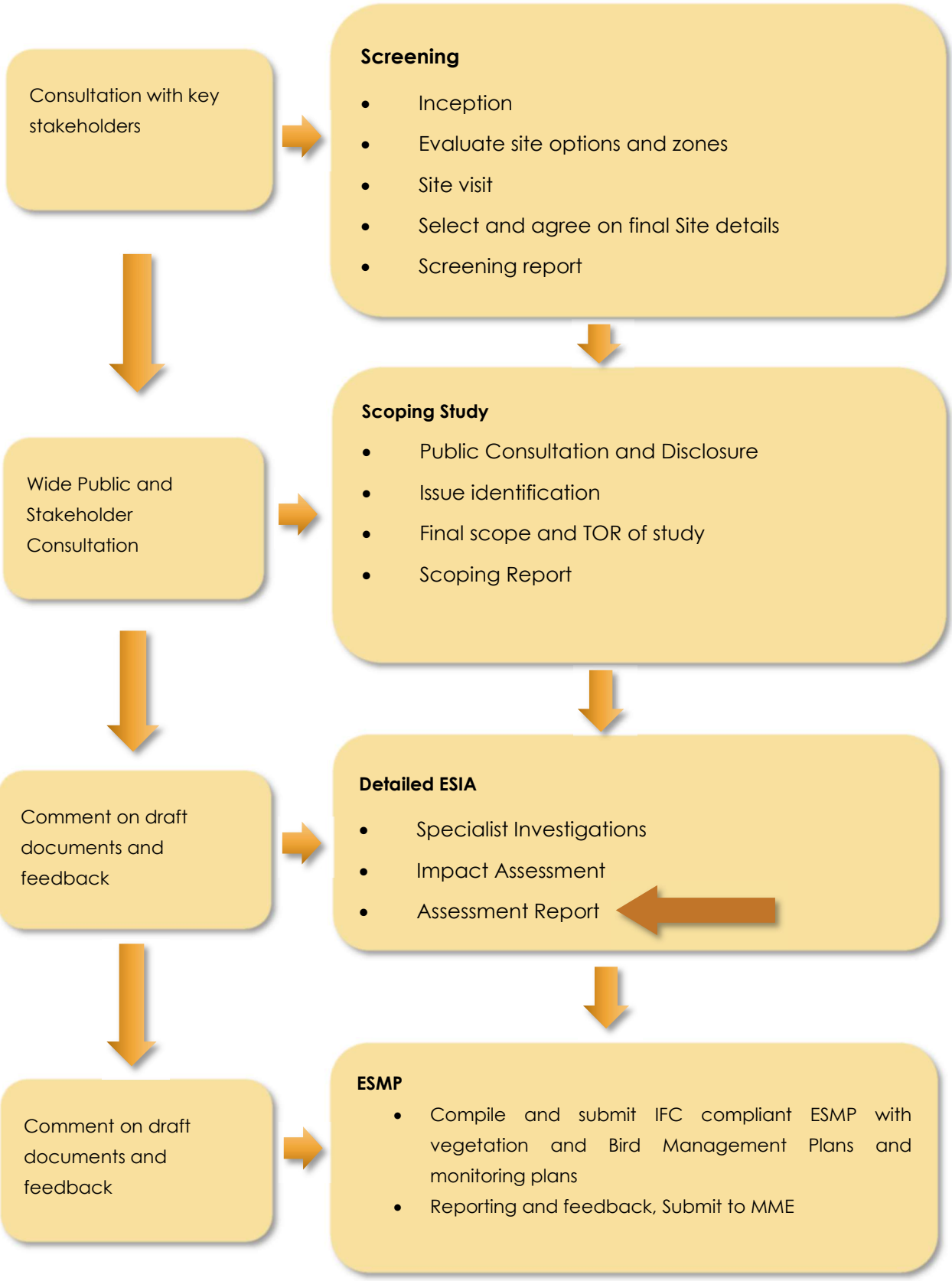

Figure 3: ***Diagrammatic summary of the ESIA process followed.***

1.3 TERMS OF REFERENCE FOR THE FULL IMPACT ASSESSMENT

The Scoping Report contains significant deskwork, which clarified the areas where further work is required. It also clarifies where sufficient information is available to determine potential impacts that should be managed through the ESMP. The potential impacts which were considered insignificant or where adequate information is available include the following:

- Potential hydrological impacts including erosion and potential transport of pollutants via surface and underground water. These impacts will be included in the ESMP without further work required.
- Potential impacts on invertebrates, amphibians and reptiles. The impacts on these species have been identified specifically without further work required. Management actions are included in the ESMP to mitigate these impacts.
- Potential shadow flicker. This potential impact is considered negligent on this project and does not require further consideration.
- Potential noise impact on human receptors. This potential impact is considered negligent and does not require further consideration.

Further work required for the full ESIA included the following:

- Consideration to the recommendations provided during the screening phase and refinement of the boundaries of the two sites to avoid sensitive areas.
- Updating of the project description to include refined locations for the turbines (subject to change), and other project details such as vehicle and transport requirements, infrastructure proposals such as sewerage and solid waste management treatment, labour requirements, and accommodation recommendations for the workforce. These details assisted the ESIA team to review and update the impact assessment and provide specific mitigation measures.
- Further fieldwork and study in some of the specialist areas, as set out in the table below.

Table 1: Terms of Reference for further specialist work

Specialist field	**Work required**	**Authority and Legislation (also See Section 4)**
Vegetation and Habitat	Confirm the occurrence of the so-far identified species expected to occur on the two sites by carrying out physical transects. Produce the vegetation	Ministry of Environment, Forestry and Tourism (MEFT) Nature Conservation Ordinance (1975)

Specialist field	Work required	Authority and Legislation (also See Section 4)
	impact assessment with recommendations for the ESMP. Produce a Critical Habitat Assessment.	Forestry Act (2001) Parks and Wildlife Management Bill (2001) Tsau//Khaeb (Sperrgebiet) Management Plan International Finance Corporation (IFC)
Avifauna	Consider the final boundaries of the sites, updated project information and monitoring data acquired on site. Produce the avifauna impact assessment with recommendations for the ESMP.	Ministry of Environment, Forestry and Tourism Nature Conservation Ordinance of 1975 Marine Resources Act No. 27 of 2000 Tsau //Khaeb (Sperrgebiet) Management Plan IFC
Brown Hyena	After further project details have been obtained (i.e. waste management, number of vehicles to move on site, etc., and final boundaries of the two sites), produce the impact assessment for brown hyenas with recommendations for the ESMP.	Ministry of Environment, Forestry and Tourism Nature Conservation Ordinance of 1975 Tsau //Khaeb (Sperrgebiet) Management Plan IFC
Archaeology	Investigate the occurrence of historical and archaeological finds on the project sites and produce the impact assessment with mitigation should any be found.	National Heritage Council National Heritage Act (2004) Tsau//Khaeb (Sperrgebiet) Management Plan
Civil Aviation	Consider the final localities and heights of the turbines and re-assess the state of turbines requiring Annex 14 and PANS-OPS assessments. Produce an impact assessment accordingly.	Civil Aviation Authority (CAA) Namibian Civil Aviation Technical Standards. International Civil Aviation Organisation (ICAO)

Specialist field	Work required	Authority and Legislation (also See Section 4)
Visual Impact Assessment	Evaluate the viewpoints of the sites and conduct a visual impact assessment, followed by recommendations for mitigation.	Basic Principles of Landscape and Visual Impact Assessment for Sponsors of Development of the Shetland Islands Council (Shetland Islands Council, 2006). US Army Corps of Engineers (Henderson, 1988).Visual Resources Assessment Procedure (VRAP) for US Army Corps of Engineers. IFC Principles
Socio-economic Impact Assessment	Obtain updated information on the state of the Lüderitz economy and population. Consider the workforce accommodation scenarios and other information received from the proponent. Produce the socio-economic impact assessment and provide recommendations for mitigation for negative impacts and enhancement positive impacts.	Ministry of Regional and Local Government and Housing (Housing and Infrastructure, settlement issues, procurement) Town Council of Lüderitz (Housing and Infrastructure, settlement issues)
Carbon footprint study and Climate Change Risk Assessment	Consider the details of energy to be used and generated during the construction and operational phases of the project and translate this into a carbon impact assessment with measures for mitigation and enhancement to optimise a positive footprint.	MEFT United Nations Framework on Climate Change (1995) IFC Principles
Traffic Impact Assessment	Consider the details of the project notably the transport requirements, vs. the existing road network and road conditions and conduct a traffic impact assessment with recommendations for areas requiring design input and traffic interventions.	Roads Authority Roads Ordinance 12 of 1972
IFC Standards	These standards should be studied and the relevant ones incorporated into the	IFC

Specialist field	Work required	Authority and Legislation (also See Section 4)
	specialist impact assessments and the ESMP.	
Cumulative impacts	The specialist investigations need to consider the cumulative impact of this project combined with other projects on the SKNP and the coastal area.	MEFT Environmental Management Regulations (2012)

These specialist impact assessments have now been completed and are presented in this report, i.e. the Assessment Report.

1.4 THIS REPORT

In order to meet the requirements of the Namibian Environmental Management Regulations (2012), this report sets out the following:

1) Introduction to the Assessment Report and the Environmental Assessment Practitioners (EAPS) conducting this ESIA **(Section 1).**

2) Detailed description of the proposed Wind Park **(Section 2).**

3) Description of the need and desirability of the proposed project and identified potential alternatives, including their comparative assessment **(Section 3).**

4) Description of the legal requirements, focussing on those environmentally related, of the project **(Section 4).**

5) Description of the geographical, physical, biological, social, economic and cultural aspects of the environment and how they may be affected by the project **(Section 5).**

6) Summary of the Public Consultation Process **(Section 6).**

7) Summary of the composite sensitivities and recommendations made to avoid impact **(Section 7).**

8) Description of the significant issues identified, with an indication of the extent to which they could be addressed through the adoption of mitigation measures **(Section 8).**

9) Conclusions and Recommendations **(Section 9).**

1.5 THE ENVIRONMENTAL ASSESSMENT PRACTITIONERS (EAPS) AND SPECIALISTS ON THE TEAM

Norman and Stephanie van Zyl are qualified and experienced EAPs, each with more than 20 years of experience in development related work. They both have experience with ESIAs for wind parks and they have conducted significant work in the project area (i.e. Elizabeth Bay). Their CVs are attached as **Appendix A**. The specialists that are involved in this assignment are as follows:

Dr. Jessica Kemper	Birds
Ms. Kate MacEwan	Bats
Dr. Ingrid Wiesel	Brown Hyena
Ms. Coleen Mannheimer	Vegetation
Dr. John Kinahan	Archaeology
Mr. Norman van Zyl	Visual Resources
Ms. Stephanie van Zyl	Socio-economic
Dr. Kevin Tarr-Graham	Carbon Footprint
Mr. Günther Spengel	Civil Aviation
Mr. Greg van Toorn	Traffic
Dr. Peter Tarr	Internal Review (IFC Compliance)

2 THE PROPOSED WIND PARK

2.1 INTRODUCTION

The NamPower Wind project is a proposed alternative energy development based on wind electricity generation. NamPower is committed to supporting and achieving the government objectives as set out in the national planning policies, and in particular the National Integrated Resource Plan (NIRP) and the 5th National Development Plan (NDP5).

Considering Namibia's ideal conditions and achieving the government objectives set out in NIRP and NamPower' strategic roadmap to expand the penetration of renewable within the energy mix; wind power plants are considered ideal for providing energy at competitive tariffs in Namibia. NamPower's business case and motivation for the project is further expanded on in its Fact Sheet **(Appendix B).**

The 40MW NamPower plant will comprise of an estimated 16 turbine locations, and the 50MW IPP plant, an estimated 20 turbine locations. The planned power plant lifetime is 25 years.

2.2 DETAILS OF THE PROJECT

Details of wind turbine generators (WTGs)

The project will consist of 36 units of wind turbines on two sites distributed in the central section of each site.

A preliminary WTG was selected as part of a micro-siting study. The final wind turbine choice will be based on optimizations (turbine placement layout and Energy Yield Assessment (EYA)) by the Original Equipment Manufacturer (OEM) or Engineering Procurement Construction (EPC)Contractor. Each unit will consist of conical tubular tower type with 3 blades rotors, with diameters of 80-160m and hub heights of 80-120m (see **Figure 4** below).

The typical total footprint of each WTG will be approximately 4,000m^2 during construction and each unit is equipped with the following:

- Foundation
- Crane pad
- Hardstand (Blade and other components storage)
- Tower laydown area
- Crane assembly area

During operation, the total footprint reduces to approximately 2,300m^2. Depending of the land use requirement, the technical team recommends to leave the crane pad and hardstand intact in case replacement of major components is required. The need for this and the risk of not allowing for it needs to be considered for the Environmental Management Plan, recognising the high conservation importance of vegetation in the study area.

Power generation

The wind farm is expected to generate approximately 2.6 MW per WTG. This size and number of WTGs may change depending on the measured wind resource and final turbine supplier.

The electrical power produced from each WTG will be transformed to 33 kV and transmitted to the site intake substation via an internal grid system.

Figure 4: ***Photographs of similar turbines (existing turbines Lüderitz – Ombepo Project)***

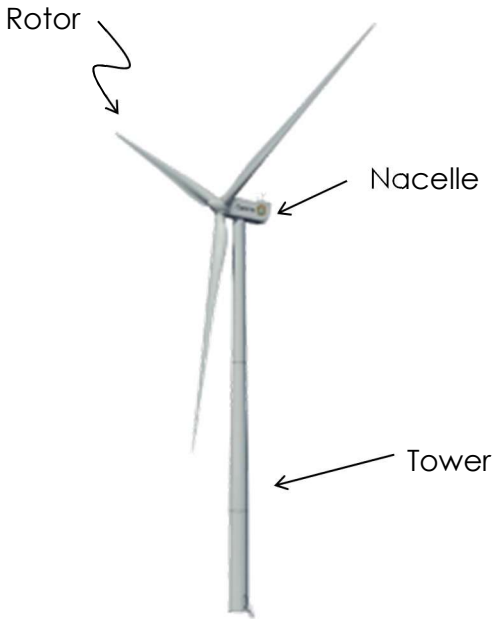

Figure 5: **Parts of Wind Turbine Generator**

Figure 6: **Wind Turbine Installation**

Site layout

An indicative layout of the 40MW NamPower Site with WTG positions, internal access road network and buildings/parking/laydown area are depicted in **Figure 7**. A similar arrangement will be made for the 50MW IPP Site. While the exact placement of the wind turbines is likely to change depending on the preferences of the contractor, IPP and detailed conditions on site, this layout provides an indication of the set-up on site. The layout will consist of the turbines, the internal access roads leading to individual turbine sites, and pre-fabricated office and workshop.

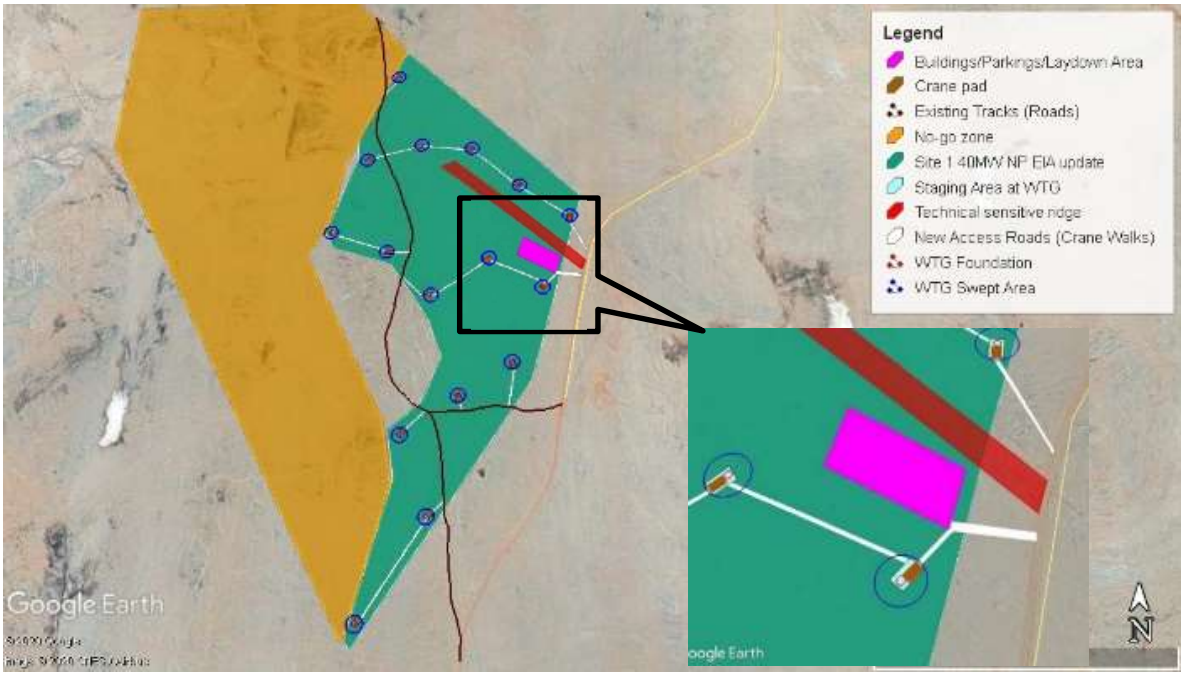

Figure 7: Indicative site layout for the 40MW NamPower Site.

Road network

Simple gravel construction roads will be sufficient for the construction and maintenance of the project. The roads will be constructed according to the road requirements given by the manufacturer of the specific wind turbine to accommodate movement of special vehicles only on prepared road areas.

Power lines and substation

- a site substation building, this will include warehouse storage and some office facilities;

- overhead 132 kV transmission line from a site substation to the Diaz Substation or NamPower Namib Substation [2];
- an overhead power line between the 40 MW and the 50 MW sites; and
- internal cabling (overhead or underground) for collecting power from each wind turbine to the site substation and for internal reticulation.

Figure 8 indicates the possible new transmission connections required for the project. The new 132 kV transmission line will be constructed by the typical mono-pole steel type structure **(Figure 9)** with:

- One foundation
- A height of approximately 17,4m.
- Four stay wires to each pole.
- Conductors configured from 13m to 15,2m height.
- A centreline distance 180m between poles.

The 132 kV transmission lines from the two wind park sites will have a servitude of 22m, but only an estimated 6m strip will be cleared of vegetation for access during construction. This strip is expected to recover over time, except where a specific maintenance activity or breakdown occurs. Where the line will run parallel to the Diaz line, the servitude will be 39m, although the area between the lines will not be cleared of vegetation.

Even though bush clearing is not necessary in this environment, the power line construction team will have to be very alert to remove only the vegetation that is absolutely necessary. Areas that are particularly sensitive to disturbance have been marked in the ESMP.

[2] The route from the Diaz substation to the Namib substation has been covered in a previous EIA, which will require an amended Environmental Clearance Certificate (ECC).

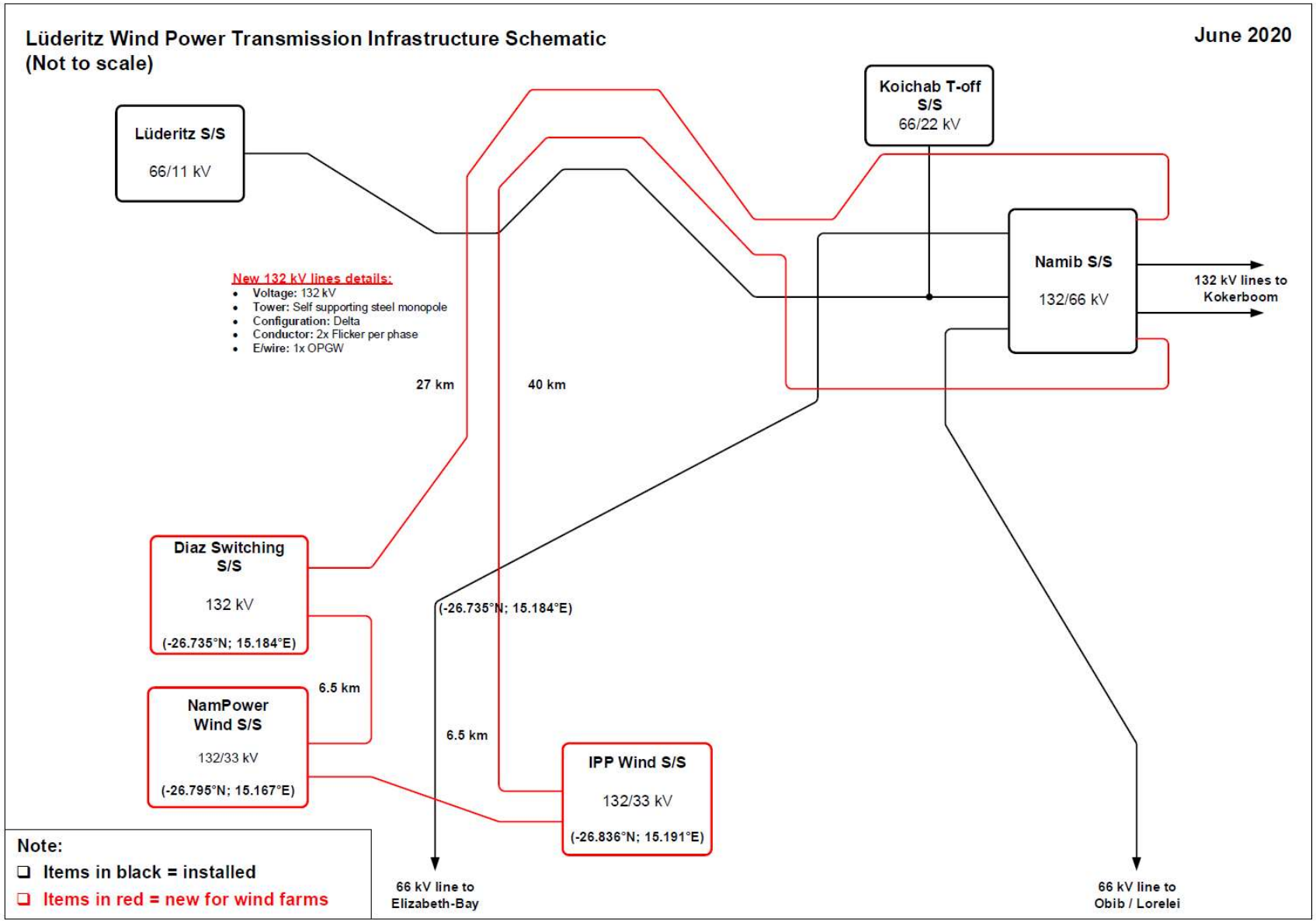

Figure 8: Transmission Infrastructure Schematic

All the components for the powerline construction (steel structure, conductors, and insulators, etc.) will be transported to site by road on low-bed trailers.

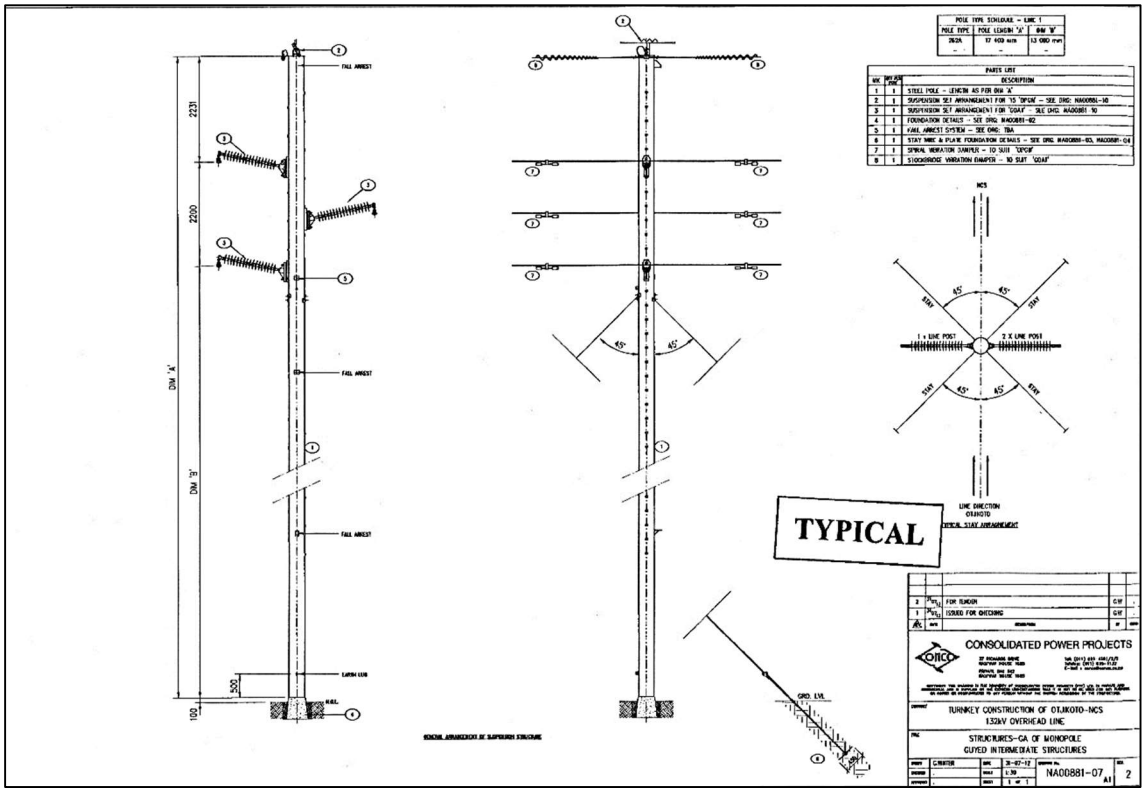

Figure 9: Typical steel structure of the new 132kV line.

The construction teams can make use of the existing gravel roads in the vicinity to the Elizabeth mine, the Lüderitz airport, and the old Lüderitz substation site to directly access most of the transmission line route without creating new roads.

There are limited access tracks directly off the B4 road. These are likely to be at:

- the crossing of the line over the B4 road (north and south) and
- about halfway between the B4 crossing and the airport (north).

The contractor should only use these access points and not create new roads.

From here materials will be transported along the line via old tracks serving the existing transmission line.

During construction, the structures will either be erected using a crane to place the pre-assembled tower into a 1.8m hole or by building up the tower from its foundation section by section; the latter will probably happen in less accessible terrain.

No concrete will be used in the structure foundation as well as on the stays to secure the structure.

The conductors will be strung using heavy-duty mechanical winches.

Water and waste water

One water tank and one septic tank is contemplated at each sub-site for the construction of the facility and for site office use. A refilling strategy for the water tank still needs to be determined. The site office will have 2x10,000ℓ water tanks and a 6,000ℓ conservancy tank for waste water. A total of approximately 35,000m^3 water will be required during the construction period.

Two 10,000ℓ water tanks and a 3,000ℓ septic tank will be needed for the operational phase. Approximately 1,000m^3 will be required per annum during the operational period.

Solid waste

Table 2 indicates the categories of waste expected during construction and operation. Estimated quantities of waste expected is given where known.

Table 2: Waste types during construction and operation

	Construction	***Operation***
General	Paper, plastics, tins, glass.	Approximately 4 tonnes per annum.
Recyclable	Paper, plastics, glass, tins. If there is an opportunity to recycle, then items will be separated on site.	Limited quantities of paper, plastics, glass, tins. If there is an opportunity to recycle, then items will be separated on site.
Hazardous	Cement bags, oils, oil rags/ hydrocarbon contaminated materials.	Hazardous waste (oils, oil rags/ hydrocarbon contaminated materials etc.) approximately 1.5 tonnes per annum.

Power requirements on site

A diesel generator (<500kVA) is envisaged for own supply during the entire construction period. During operation there will be a back-up diesel generator for auxiliary supply during power supply failure from the grid. Diesel consumption is not expected to exceed 1,200ℓ per annum during operation.

2.3 PROJECT TIMELINE

The project will be constructed over a period of twelve (12) to eighteen (18) months. Construction should be planned such that foundations are completed before the low wind period on site (June – August). This will allow working at heights during these low wind conditions. It is envisaged to start with construction by end of 2021. The operational life cycle of the project will be for 25 years.

2.4 CONSTRUCTION AND OPERATION PROCESS

Construction process

- The internal access roads and platforms for the wind turbines will be constructed first, then followed by the turbine and crane foundations.
- The sections of the wind turbines will be moved to site from the harbour, from where the goods will arrive from the manufacturer (unknown at this

stage) to Namibia via the Lüderitz harbour. From the harbour the components will be transported to site via rail and/or road.

- The tower sections will be assembled on site.
- The nacelle will be installed on the top of the tower and the rotor with blades will be connected to it.
- The substation buildings and storage facilities, followed by the internal cabling will be the last items on the programme.
- Once the overhead transmission line is built, and the electrical equipment in the site substation (power transformers, GIS, metering panels, etc.) is installed, commissioning works will start.

These steps will take place in parallel, such that commissioning can commence when the turbines have been erected.

NamPower estimates that the project will require the following:

- One 600~700-tonne main crawler crane and 2 or 3 hydraulic cranes (50 to 100 tons).
- Heavy equipment such as excavators, bulldozer, graders, compactors, and construction trailers are required during construction and transportation.

The operation processes

Apart from unplanned outages, plant operation will be continuous, i.e. 24 hours per day, 365 days per year. Planned maintenance could take place on individual turbines and will not affect the total plant. The 132kV incomer feeder could require an annual one-day outage or once every few years depending on choice of technology.

2.5 THE WORKFORCE

Table 3 below shows that there will be an average of 140 employees working on the project during construction per month. Depending on the construction progress, the number of people involved in construction will however vary between around 70 to 100 people, of which some 50% will be un-skilled workers.

It is estimated that between 10 to 15 people will be required for the Operation and Maintenance (O&M) period of the wind power plant.

Table 3: Manpower estimates for the Lüderitz Wind Power Project

Category	Monthly average	% of total
Total Project employees	140	0
Project employees who are Namibian citizens	67	48
Skilled employees	66	47.2
Citizens from local community	11	8
Unskilled employees	74	52.8
On-site based employees[3]	113	80.9
Offsite based employees	27	19.1

2.6 PROJECT ASPECTS COVERED BY THIS ESIA

The ESIA will address the facilities required and the activities that will possibly take place on the site. These can include the following:

- The internal access and service roads;
- The transmission line from the site up to the nearest proposed substation (Diaz Substation) at the proposed Diaz Wind Park;
- The internal power network, which may include overhead power lines;
- The platforms and foundations for the wind turbines;
- The wind turbines;
- The substation, offices and storage facilities on site;
- The construction processes and resources required; and
- The movement of materials to the site.

3 NAMPOWER SITE SELECTION EFFORTS

3.1 PROJECT RATIONALE

The rationale for the Project can be summarised as follows:

[3] On-site vs. offsite employees refer to those working on the site, vs those working on the project at remote locations e.g. Windhoek. No employees will be accommodated on-site.

- Ensuring security of supply in line with NamPower's Corporate and Strategic Business Plan.
- To expand the penetration of renewable energy projects within the energy mix.
- To harness Namibia's ideal conditions for wind power plants especially at certain coastal areas.
- Providing energy at competitive tariffs.
- Using alternative energy sources to augment the mix of sources that would increase the sustainability of energy supply.

The objectives of the Project are therefore to:

- Reduce the overall NamPower tariff to the customer by introducing the most affordable "new-build" renewable energy to the Namibian grid;
- Supporting renewable commitments prescribed in the Renewable Energy Policy and National Energy Policy; and
- Providing renewable energy outside of the typical solar PV dispatch profile.

Further considerations to the rationale of the project are contained in the Fact Sheet **(Appendix B).**

The no-project alternative may therefore have the following consequences:

- Loss of the opportunity to reduce the overall NamPower electricity tariff.
- Reduced growth in the wind energy sector.
- Reduced support in the renewable energy sector, which is contrary to the Country's current policies.
- Increased or sustained reliance on the non-renewable energy market.

The opportunities for positive impacts as reported on in the impact assessment, including job creation, supported livelihoods, and an economic injection into the local community and national economy will be unexploited in the no-project scenario.

3.2 SITE ALTERNATIVES

In order to ensure that the location was suitable for the project, a 2018 Site Selection Report, **Appendix C**, considered the wind resource at various locations in Namibia. Efforts to develop a regional wind atlas for Namibia, under the auspices of the National Wind Resource Assessment Programme (NWRAP), of NamPower in

collaboration with the Polytechnic of Namibia (now renamed to "Namibia University of Science and Technology" – NUST), yielded the following results:

Table 4: NWRAP Preliminary results (Appendix C)

Site Location	Average Wind Speed [m/s]	Mean Power Density [W/m2]	Power Ranking
Lüderitz	6.8	445.7	1
Terrace Bay	6.2	255.1	2
Warmbad	5.8	214.0	3
Kanas	6.0	196.8	4
Amperbo	5.8	167.8	5
Walvis Bay	4.7	162.8	6
Schlip	5.6	157.2	7
Gobabeb	4.4	133.9	8
Helmeringhausen	5.1	133.4	9
Okanapehuri	5.0	126.8	10
Karabib	4.6	122.4	11

As may be seen from the results, although preliminary, Lüderitz has the best wind resource of all the areas considered.

A site selection process followed, for which the following criteria were used in a multi-criteria decision-making process. The proposed areas of interest were initially selected based on the available wind resource on-site, using high-level satellite data. This is detailed in the site selection report attached as **Appendix C** where the following evaluation criteria were considered:

- Wind Resource;
- Peak Generation;
- Transmission Interconnection;
- High-level Environmental Impact;
- Land Availability and Location; and
- Proximity to airports (to avoid aerodrome restrictions).

Fifteen (15) potential wind sites were identified and a simplified process was used to determine the weighting of the key scoring criteria as well as actual scoring of each site. Two (2) sites were identified as fatally flawed based on sensitive environmental areas as well as being key tourist destinations.

Elizabeth Bay, the current location, was identified as the preferred site. Other sites were also favourable and are being investigated by NamPower. It can be noted that the different sites differ in wind regime and thus could complement each other due to their respective peak production months being in summer and winter,

respectively. The site selection report recommended that the current site be investigated for further development.

A more detailed analysis was conducted for four (4) of the sites including the current one. This included:

- micro-siting to produce a provisional energy yield assessment at the sites;
- techno-economic feasibility taking into account the development costs, transmission infrastructure, etc.;
- consideration of site-specific conditions and restrictions such as:
    - other known developments in the area, including a buffer zone to reduce the wake-effect on the planned adjacent developments;
    - MEFT Zoning map;
    - Namdeb Exclusion Zone;
    - known hyena den sites (Dr. Ingrid Wiesel);
    - known bird flight corridors (Dr. Jessica Kemper);
    - plant footprint optimization in order to minimize the environmental impact and area utilization; and
    - compliance with aerodrome restrictions as regulated by the relevant bodies (NAC, NCAA).

The current ESIA process considers these aspects in further detail. During screening and scoping the ESIA Team was able to identify sensitivities on site, which lead to adjustments of the site boundaries, and relocating some of the turbine positions. No-go areas were identified. These recommendations were spelt out in the Screening and Scoping Reports of this ESIA process (see **Section 7**). The resulting detailed impact assessment conducted in this report is based on an area that significantly avoids sensitivities.

4 LEGAL REQUIREMENTS

The Scoping Report contains a detailed legal review and the summary thereof, with implications for the project is provided in this section (**Table 5** below). The specialists and the lead consultants covered all these requirements in their work. The right column describes how this was done.

Table 5: Legal requirements for Namibia concerning the project.

LEGISLATION/GUIDELINE/ POLICY	RELEVANT PROVISIONS	APPLICATION TO PROJECT
NATIONAL LEGISLATION AND GUIDELINES		
Environmental Management Act (7 of 2007) and EMA Regulations GN 28-30 (GG 4878) (February 2012)	• The ESIA is conducted based on the required steps and requirements in these regulations. • The listed activities in the act to be covered include: o The generation of electricity 1) (a). o The construction of facilities for the transmission and supply of electricity 1) (b). o The manufacturing, storage, handling or processing of a hazardous substance defined in the hazardous Substances Ordinance, 1974. 9) (1). o The storage and handling of dangerous goods, including petrol, diesel, liquid petroleum gas or paraffin, in containers with a combined capacity of more than 30 cubic meters at any one location 9) (4). o The construction of masts of any material or type and of any height,10) (1) j.	Conduct public participation, scoping report, ESIA (this report) and ESMP as part of the ESIA process as described in the act.
Diamond Act 13 of 1999 **Sperrgebiet Delimitation Proclamation 11 of 1920**	Entry permits into the Sperrgebiet required in terms of Part V of the act. Land restricted as falling under a Mining Licence and in the restricted Sperrgebiet area, as the case with the project area, require scrutiny by the Licence holder, to exclude areas to be potentially mined.	Entry permits to be specified in the ESMP. Practical implications of access restrictions, including goods and equipment to be considered for the project. Restricted areas to be mined in future are excluded from the project sites. See the screening Report for this project.

LEGISLATION/GUIDELINE/POLICY	RELEVANT PROVISIONS	APPLICATION TO PROJECT
NATIONAL LEGISLATION AND GUIDELINES		
Labour Act 11 of 2007	The Health and Safety regulations GN 156/1997 (GG 1617) to this act prescribe conditions at the workplace, and inter alia deal with the following.	These regulations prescribe Health and safety issues at the workplace, including construction and electrical safety and the requirement is to be included in the ESMP.
The Hazardous Substances Ordinance 14 of 1974	Provides for the control of substances which may cause ill-health to human beings and regulates the respective classes of hazardous materials.	Sound waste management practices and hazardous substance handling and storage to be included in the ESMP.
Forestry Act No 27 of 2004	Provision for the protection of various plant species	Some species that occur in the area are protected under the Forestry Act. To be identified by the Vegetation Specialist and included in the Vegetation Specialist Study for inclusion in the ESMP.
Biodiversity convention (1992)	Identification and protect of species of conservation concern.	Covered in the Avifauna, Vegetation and Brown Hyena specialist Reports, based on known species of conservation concern in the area.
National Heritage Act No 27 of 2004	To provide for the protection and conservation of places and objects of heritage significance and the registration of such places and objects.	All heritage resources are to be identified and either protected or removed/mitigated with a permit from the National Monuments Council. Council, before any development may take place The archaeology specialist identified such sites as discussed in the Archaeological specialist report.
Civil Aviation Regulations (CARS) Government Gazette No: 2467 (02/01/2001)	Read in conjunction with Annex14 of the International Civil Aviation Organisation Standards	Specialist study conducted to determine the requirements for determining the Obstacle Limitation Surface (OLS) for this particular project.

LEGISLATION/GUIDELINE/ POLICY	RELEVANT PROVISIONS	APPLICATION TO PROJECT
NATIONAL LEGISLATION AND GUIDELINES		
The atmospheric Pollution Prevention Ordinance 11 of 1976 (revised in 2006)	Part 1V deals with dust – any person carrying on an activity which is liable to cause a nuisance to persons residing in the vicinity or to cause dust pollution to the atmosphere shall take steps to prevent such dust.	There will only be dust during construction of the wind park, and the project is located far away from any residents. Dust control measures are to be included in the ESMP.
Roads Ordinance 12 of 1972	Provides for standards for the construction of roads, access, etc. (Section 63), according to required standards.	Traffic Impact specialist study conducted determining the impact on roads. Proposed roads designs and accesses to be submitted to the Roads Authority.
Marine Resources Act 27 of 2000 and Regulations	Various marine bird species are protected by this act, including on land (Section 18 (1)(b)).	The Avifauna Specialist study determined the potential impact on protected bird species.
Public Health Act 36 of 1919 and amendments	Provisions for the prohibition of nuisance (Section 122) to prevent infectious disease; sewerage facilities to be constructed to avoid danger to health; prevention of pollution of water sources, prohibition against overcrowded dwellings, with adequate lighting and ventilation general prevention of disease.	Health Certificate from the Ministry of Health and Social Services (area falls outside the jurisdiction of the Lüderitz Local Authority). To be included in the EMP.
MEFT Management & Development Plan for Tsau //Khaeb (Sperrgebiet) National Park **IUCN Protected Area Management Categories.**	The Tsau //Khaeb (Sperrgebiet) National Park was proclaimed in 2008 (Management Plan is attached in **Appendix D**.)	The management zones of the Plan need to correlated with the proposals of this project. These were scrutinised during screening and the sites adjusted to fit the Plan. The proposed land use namely utilising resources fits the management zone (Managed Resources Protected Area) applicable to the study area. This IUCN Category requires the protection of remaining habitats and species. This was considered by the

LEGISLATION/GUIDELINE/ POLICY	RELEVANT PROVISIONS	APPLICATION TO PROJECT
NATIONAL LEGISLATION AND GUIDELINES		
		Vegetation, Avifauna and fauna specialists **(Appendices E-H).** The management requirements are to be included in the ESMP. Approval for land use to be granted by MEFT.
IFC Performance Standards on Social and Environmental Sustainability IFC Environmental, Health and Safety Guidelines for Wind Energy Equator Principles	Performance Standard (PS) 1: Social and Environmental Assessment and Management Systems PS 2 Labour and working conditions PS 3 Pollution Prevention and Abatement PS 4: Community Health, Safety and Security. PS 5: Land Acquisition and Involuntary Resettlement Ps6: Biodiversity Conservation and Sustainable Resource Management PS 7: Indigenous Peoples	Ensuring the management of environmental and social performance throughout the life cycle of the project, including an Environmental Management System (EMS) during operations. [4] The requirement for a human resources policy (PS 2) to be included in the ESMP. Pollution prevention measures to be included in the ESMP. Requirements to be included in the ESMP. Not applicable to this project. Covered by Vegetation, Avifauna and Fauna Specialist Studies, including a Critical Habitat Study, Longitudinal Bird Impact Study, proving that no viable alternative site exists, and Management effort achieving net gains of relevant biodiversity values. No indigenous, marginalized or vulnerable groups identified that are

4

LEGISLATION/GUIDELINE/ POLICY	RELEVANT PROVISIONS	APPLICATION TO PROJECT
NATIONAL LEGISLATION AND GUIDELINES		
		at risk of being affected due to this project.
	PS 8: Cultural Heritage Independent Review	Covered by the Archaeological Impact Assessment **(Appendix I).** Independent Review checking the above requirements included. MEFT reviews the application for the ECC.
	Covenants – commitments to comply with all applicable laws, to provide periodic reporting and reviews and to decommission the facilities.	The requirement for covenants to be included in the ESMP. Include the ongoing requirement in the ESMP.
	Independent Monitoring and Reporting	The requirement to annually report the implementation of the equator principles to be included in the ESMP. The requirement for monitoring and reporting on the project to be included in the ESMP.
	Public Reporting	The Equator Principles include a requirement that progress with implementation of the Environmental Management System get published at least annually. This requirement is to be included in the ESMP.

The list of legal requirements informed the specialists' work and the requirements have been included in the ESMP.

5 ENVIRONMENTAL AND SOCIAL BASELINE

The relative wealth of information gleaned from secondary information and other projects in the area provided a solid understanding of the study area. Information gaps could be identified fairly easily and formed the basis for the detailed specialist studies. Whereas the Scoping study only contained available information, this report

also includes the results of the ground-truthing summarised. The specific specialist studies referred to, below, have detailed information.

5.1 BASELINE OVERVIEW

The project site is located on the wider Lüderitz Peninsula environment. The rocky peninsula landscape, the climate influenced by the Atlantic current and desert aridity and the unique animal and plant life established there as a result, all contribute to this unique setting. Furthermore, the unusual legal conditions imposed by the Government of Namibia through the Diamond Act have protected the Sperrgebiet from unchecked degradation. Inside the renowned Sperrgebiet - the restricted Diamond Area 1 - the project is located in the newly established Tsau //Khaeb (Sperrgebiet) National Park. IUCN Conservation guidelines apply to the park in general and to the project area, which makes the affected environment of particular environmental significance.

While the site is just inside the restricted area, it is not unspoiled or pristine as the mystique of the Sperrgebiet suggests to most. The Germans were active there during colonial days, as has been Consolidated Diamond Mines (CDM) now known as Namdeb, who have conducted decades of mining activity. This also applies to some of the study terrain, while other parts are relatively pristine. The botanical specialist study provides details of where the pristine vs. degraded zones are on site (Section 5.5). In most areas, recovery is well underway, with plants re-established and covering previous activity. Tracks from various periods are present throughout the study area. Evidence of exploration, construction and borrow pits are apparent.

5.2 CLIMATE

5.2.1 GENERAL

The Namibia climate context is a dry west and south-west, i.e. the Namib Desert. The study area falls within this zone. The main factors influencing the rainfall pattern are the cold ocean current offshore (the Benguela current) and the prevailing winds (western and eastern winds). Winds from the west are dry while winds from the east cross 4000km before reaching Namibia.

The annual median rainfall ranges between 15 and 70 mm, is highly unpredictable and rainfall events are equally likely in all months of the year. Much of the small amount of rain comes in the southwest of Namibia as cold fronts from the Cape in winter. This results in the vegetation being dominated by succulents which are also adapted to the foggy conditions.

Table 6 below provides some temperature and rainfall averages describing the Lüderitz climate (data of 1961 to 1990).

Table 6: Temperature and rainfall averages for Lüderitz (Source: Namibia Meteorological data)

Average maximum temperature ◦C	37.5
Months with highest average maximum temperature	December to March
Average daily mean ◦C	15.7
Average minimum temperature ◦C	12.1
Months with lowest average minimum temperature	June to August
Average annual precipitation ◦C	17mm
Months of precipitation received	February to September

This general description about the climate is elaborated on as necessary for each of the specialist topics.

5.2.2 WIND

The technical reports for this project provide detailed information on the wind conditions. However, it is important to note the effect of the wind conditions in the area, a dominant feature affecting the landscape.

The eroding power and practical limitations caused by the wind and resulting wind-driven sand cannot be ignored. Physical components of the project will likely be affected by this, and construction and operation working hours influenced by windy days. Other practical considerations include extra stringent measures to constrain waste and stockpiles on site. The Operation and Maintenance (O&M) regime for maintaining the turbine towers and other infrastructure will however need to account for sand erosion, which in turn influences the overall footprint of the project.

These sensitivities have been noted in the Scoping Report and appropriate management measures included in the Environmental and Social Management Plan.

5.3 PHYSICAL GEOGRAPHY

The physical geography of the site determines:

- the visual landscape of the wind park, which determines the potential visual impact of the facility; and
- the potential features to be considered during siting to minimise construction impact.

These two aspects of the physical geography of the terrain are discussed below.

5.3.1 VISUAL LANDSCAPE

The full Visual Impact Assessment is contained in **Appendix J.** The Scoping process identified the following sets of sensitive viewpoints **(Table 7).**

Table 7: Potential viewpoint catalogue

Viewpoint No	Viewpoint Name
1	The Town of Lüderitz.
2	The national heritage town of Kolmanskop.
3	The southern point of Second Lagoon including Radford Bay.
4, 5, 6, 7	Sections of District Road D0773: up to the cul-de-sac at the coastline.
8, 9	Sections of District Road D0701: section from chainage 4 km to the intersection with DR0773.
10	Sections District Road D0701: section from the intersection with DR0773 to Diaz Point.
11, 12, 13, 14, 15, 16	The potential tourist route from Kolmanskop to Elizabeth Bay.
6, 7	Grosse Bucht area.

The viewpoint catalogue is presented in **Figure 10.**

Figure 10: Areas of potential visibility

This eventual list drawn up during scoping was then refined during the full assessment stage. This was achieved by assessing each of the potential viewpoints in terms of visibility of each of the transmission line, 40MW NamPower, and 50MW IPP Wind Parks. The line of sight towards the centre of each of the Wind Parks were assessed in terms of large obstacles by means of Google Earth relief tools. These obstacles may consist of:

1. Large hills or ridges near the viewpoint.
2. Large hills near the wind park.
3. Steep convex slopes near the viewpoint.

The analysis of the total list of potential viewpoints is available in the specialist report.

Visibility from viewpoints at Lüderitz, Kolmanskop and the Lüderitz peninsular tourist routes (viewpoints 1 to10) rate mostly invisible with only four viewpoints of potentially low visibility. Most sections of the potential tourist route from Kolmanskop to Elizabeth Bay (viewpoints 11 to 16) rate "high potential in visibility" to "visible".

5.3.2 PHYSICAL LANDSCAPE

The area can best be described as undulating hills of metamorphic rock with sandy inlays. **Figure 12** and **Figure 13** below give an indication of the topographical features of both sites. The physical terrain on site offers both opportunities of areas more favourable and others less so for construction. The degree to which clearing, earthworks and general site construction effort will be required and the resulting scarring and damage to the habitat can be avoided by closely considering the "lay of the land". Recommendations were made in the Screening Report, for NamPower to consider avoiding construction impact on steeper ridges **(Figure 11).** An organic approach was recommended instead of a typical grid layout. This will reduce the costs of site construction and general effort needed. It is acknowledged, however, that technical considerations also influence the siting of turbines, for instance the wind velocity conditions at a micro level which increase the effectiveness of the turbines.

Recommendations were made in the Screening and Scoping Reports and these were taken on board (see details in **Section 7)** . Details of determining exact positions of WTGs considering technical and biophysical aspects will be done during final design. Follow-up recommendations to this extent will be included in the ESMP.

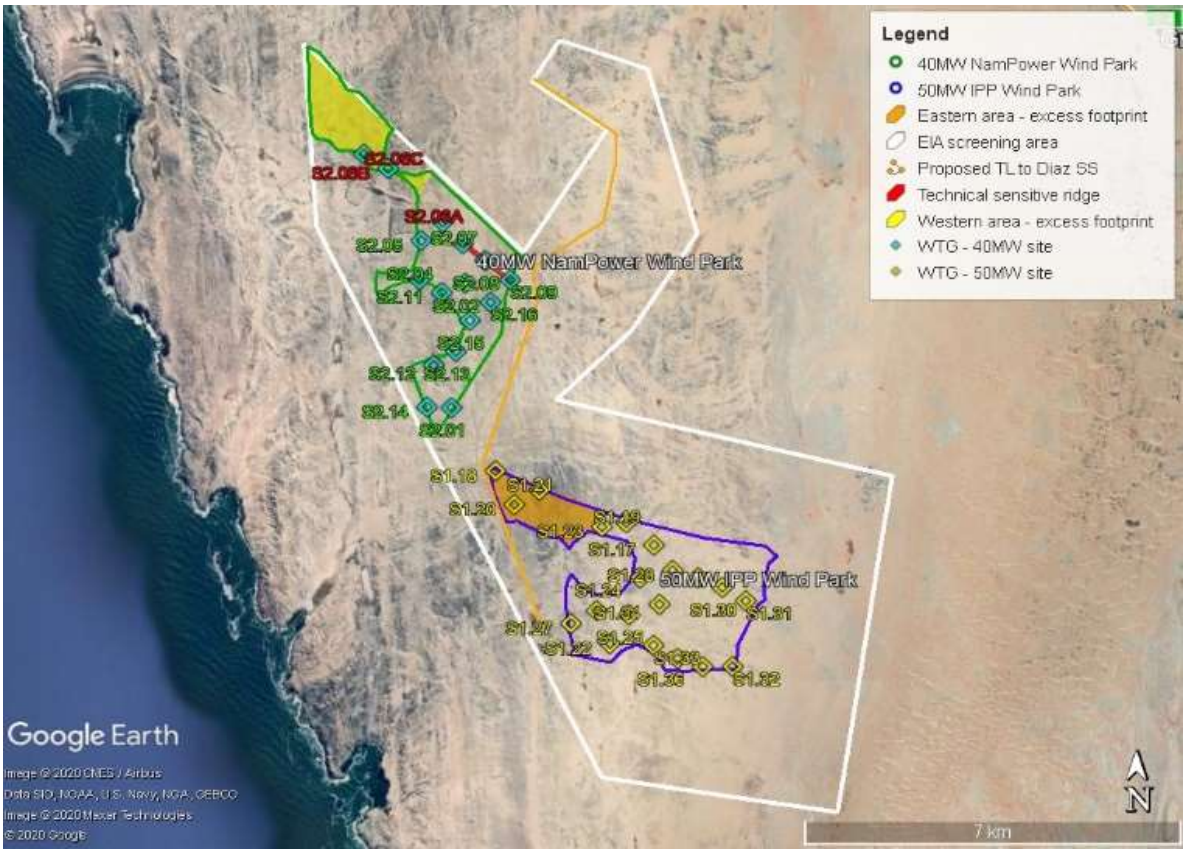

Figure 11: Physical terrain and principles for placement of pylons

Figure 12: ***Topographical features of the north-western 40MW NamPower Site, including a prominent ridge to the north, and an otherwise relatively flat terrain with seepage lines draining the area.***

Figure 13: ***Topographical features of the south-eastern 50MW IPP site***

5.4 HYDROLOGY

5.4.1 SURFACE HYDROLOGY

As noted, the annual average rainfall is 17 mm. The highest rainfall recorded over a 24-hour period is 31 mm (Enviro Dynamics/Interconsult, Update 2018). Drainage channels formed are therefore not well developed, save for paleo-channels that were formed historically when rainfall was more substantial.

Today, the only run-off that could occur would be from the rocky faces of exposed gneiss and granites, which will quickly be absorbed into the sandy inlays or sand filled drainage channels. The time span required for the surface transport of contaminants from the study area to surrounding pans may exceed the natural breakdown. Wind transport and dispersion of contaminated soils may very well prevent concentration at any one spot.

5.4.2 SUB-SURFACE HYDROLOGY

It is known that the Lüderitz area is void of significant groundwater resources, based on what has been discovered so far. No springs exist in the area that support wildlife or humans in the study area. Despite the unlikelihood of a groundwater source being found in the area, the project per se is not considered a high potential polluter of groundwater and standard pollution prevention measures specified in the ESMP will be sufficient to deal with this concern.

Furthermore, the project team will endeavour to avoid existing drainage lines, which could transport pollutants to nearby pans and depressions.

5.5 BOTANICAL SENSITIVITY

5.5.1 BACKGROUND

The southern Namib Desert comprises the Namibian section of the Succulent Karoo Biome, which is regarded as a global hotspot of biological diversity (Myers et al. 2000), including both plants and animals, and is extremely sensitive in terms of near-endemic, endemic and protected plant and animal species. It is important in global as well as regional and national terms.

Because of these sensitives and a lack of site-specific data, a specialist study was undertaken to ground-truth and verify the current understanding of the project area. This would assist in refining the no-go areas, more accurately defining sensitive areas and refining vegetation management actions. The botanical specialist report is attached as **Appendix E**. An overview of the work executed follows hereafter.

5.5.2 SPECIALIST WORK OVERVIEW

Over 30% of plants that occur in the Namibian section of the Desert Biome are believed to be endemic to that area making it a major centre of endemicity in Namibia (Maggs et al. 1998). An assessment by Burke and Mannheimer (2004) indicated that the Sperrgebiet hosts nearly 25% of the plant species known to occur in Namibia. It is therefore a national biodiversity hotspot. Elevated areas such as mountains and koppies are known to harbour many species of conservation concern. They are sensitive to environmental disturbance, some more than others.

According to the 2020 Management Plan for the TKNP (MEFT 2020) the broader study site falls into two biodiversity importance zones (***Figure 14***):

- The 40MW NamPower north-western site falls into a "VERY HIGH" biodiversity importance zone.

- The 50MW IPP south-eastern site falls into "HIGH" biodiversity importance zone.

Figure 14:Recent biodiversity importance zoning of the screening area and surrounds; Grey = "VERY HIGH"; Pink = "HIGH" (Burke 2020), these separated by a "LOW" biodiversity importance zone following the Kolmanskop-Elizabeth Bay road. The purple line separates the SPECIAL VALUE management zone (west of the line) from the MANAGED RESOURCE management zone (east of the line) in the TKNP management plan. The red area was marked by Mannheimer as a likely very high sensitivity area during screening and this was subsequently excluded from the project site. The green and yellow boundaries indicate the adjusted boundaries. The white line represents the overall study area for the purposes of the ESIA.

"VERY HIGH" Biodiversity Importance zone, generally consistent in structure and species with the Lüderitz Peninsula dwarf-shrubland of Burke 2006* (Figure 14*, grey zone).

This habitat comprises rocky ridges, outcrops and sandy valleys of the Lüderitz Peninsula and areas directly to the south and east. Vegetation is predominantly low, often succulent, shrubs and perennial herbs. The habitat is approximately 238 km^2 in extent (around 1,1% of the Sperrgebiet). Forty-three (43) species were found here, of which more than half are endemic or near-endemic to Namibia. Of the ten (10) endemic species, all are range-restricted (including four (4) of the species that are protected), nine (9) are park endemics, and five (5) are protected. *Lithops optica* (**Figure 15**) is of special concern because it is already becoming rarer on the peninsula due to illegal collecting. *Euphorbia verruculosa* **(Figure 16**) has a patchy distribution and is also of high concern. Of the 17 near-endemic species, five (5) are protected species.

Figure 15: Lithops optica

Figure 16: Euphorbia verruculosa

Table 1 in Appendix E summarises the species of conservation concern, i.e. those that have range and/or protected status.

Rocky ridges, outcrops, and koppies, provide specialised micro-habitat for species of high concern, such as *Lithops and Conophytum.*

The VERY HIGH biodiversity importance zone encompasses the SPECIAL VALUE management zone of the TKNP management plan. The 40MW NamPower Site lies within this VERY HIGH biodiversity importance zone, but outside the SPECIAL VALUE management zone ***(Figure 14).***

"HIGH" Biodiversity Importance zone, generally consistent with the Lüderitz Plain dwarf-shrubland of Burke 2006 (Figure 17, 19 and 20)

This habitat, approximately 155 km^2 (around 0.7% of the Sperrgebiet) in area, is characterised by sandy areas with small hummocks. The plains are interspersed with

rocky and quartz outcrops. Twenty-seven (27) species were found or are expected here, of which more than 60% are endemic or near-endemic. Of the 9 endemic species, all are range restricted, and four (4) are protected species. Of the nine (9) near-endemic species, five (5) are protected species.

Here, also, diversity is higher on rocky ridges, outcrops and koppies, and some species of conservation concern only occur there.

The 50MW IPP Site lies in this zone.

Figure 17: Low outcrops and ridges carrying a higher plant species diversity punctuate the sandy-gravel plains in the Lüderitz Plain dwarf-shrubland.

The broader study area comprises about 15% of the VERY HIGH biodiversity importance zone, with the 40MW NamPower Site, a greenfield area of around 4.5 km^2, occupying about 2% of that area. The broader area also comprises about 14% of the HIGH biodiversity importance zone, much of which has undergone around 100 years of recovery subsequent to very high diamond mining impacts in the past, with the 50MW IPP Site occupying around 4.8% of that zone. It is neither a greenfield site, nor a brownfield site, rather falling somewhere between the two, covering about 7.5 km^2.

The recent fieldwork found that most of the area occupied by the presently proposed 40MW NamPower Site was more consistent with the HIGH biodiversity importance zone than with the VERY HIGH zone within which it presently falls.

A large part of the study area in this zone has undergone a very long period of recovery after strip-mining for diamonds. The area may be regarded as disturbed, but there has been significant recovery, because plants (many of conservation concern) have established themselves in wind-blown sands and rock crevices. There is also an undisturbed rocky koppie **(Figure 19)** which should be a designated no-go area.

Figure 19: The large, undisturbed rocky koppie within the 50MW IPP site should be designated a no-go area.

Figure 18: A quartz ridge in the sandy-gravel plains in the Lüderitz Plain dwarf-shrubland. These ridges are noted for carrying important species, such as Lithops, which are not easily visible.

Figure 20 indicates, in red, the suggested no-go areas as indicated by field work within the Very High, and High biodiversity importance zone areas, as well as areas along the power line route where special care should be taken. The Low biodiversity importance zone that follows the Kolmanskop-Elizabeth Bay road was found to be punctuated with sensitive areas. Both the 40MW NamPower Site and the 50MW IPP Site largely avoid the Very High biodiversity zone, although some effort will still have to be made to avoid impacts on rocky ridges and outcrops within the both zones as far as possible.

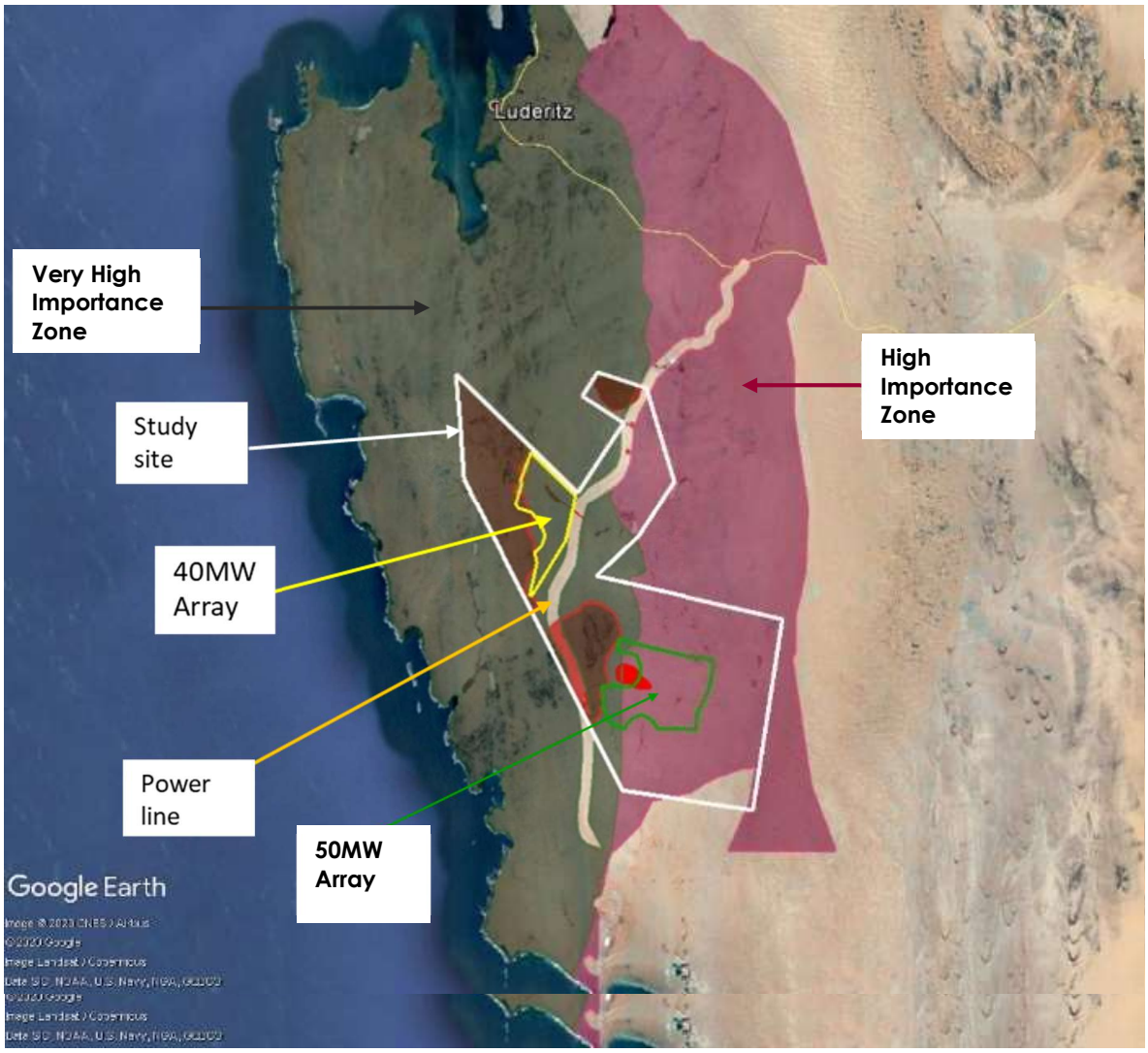

Figure 20: indicates, in red, the suggested no-go areas within the Very High, and High biodiversity importance zone areas as indicated by field work.

5.6 FAUNAL SENSITIVITY

5.6.1 INVERTEBRATES

The area is zoned as a low sensitivity area for invertebrates, with a range of 31 to 40 species recorded in the study area (Mendelsohn et. al., 2003). During the fieldwork in the area done for the Diaz Wind Park, insect diversity was also found to be very low. (Enviro Dynamics/Interconsult, Update 2018).

The impact of the Wind Park, control building and power line is likely to have a negligible effect on the invertebrate fauna of the area.

The basis of the vegetation and topography, coupled with meteorological patterns create the basis for the habitat of the area. Therefore, although invertebrate diversity is relatively low, habitat should be protected as far as possible. This forms an integral part of the ESMP.

5.6.2 AMPHIBIANS

Only the Desert Rain Frog *Breviceps macrops* is expected to occur in the study area (Pallet, 1995; Channing & Griffin, 1993, quoted in (Interconsult/Enviro Dynamics, Update 2018)). This localised, endemic species occurs throughout the coastal zone of the Sperrgebiet and survives by utilising fog precipitation for its moisture requirements. As the study area is relatively winnowed and is generally a harsh area, the frog population is likely to be very low.

Given the limited nature of the sites compared to the habitat size of this frog species population, this project is unlikely to contribute significantly to the reduction of the habitat of this species. Conserving habitat is nevertheless an overall goal.

5.6.3 REPTILES

The TKNP as a whole has a high diversity of reptiles, which is typical of arid areas. The study area is zoned as one of medium faunal sensitivity in relation to reptiles, with a range of 41 to 50 species expected to occur there (Mendelsohn et al., 2003).

(Enviro Dynamics/Interconsult, Update 2018) lists 14 species as being endemic to the region, with Western Rock Skink *Trachylepis sulcata nigra* – used to be *Mabuya sulcata nigra*. This species is restricted to the Lüderitz area and occurs in rocky areas and gullies.

A number of species of reptiles were observed on the Diaz site, including several species of lizards, a snake and a species of tortoise.

An insignificant impact on the reptile population and habitat resulting from the project is expected. Reptile habitat is expected to be affected and the Consultants have worked with the project team to avoid this as far as possible. It is also likely that reptiles will be encountered during the construction phase, and poaching especially of sought-after species such as chameleons and tortoises is a possibility. The many-horned adder *(Bitis cornuta)* and the Karoo girdled lizard *(Karusosaurus polyzonus)* are also prized in collector circles and therefore prone to being caught and smuggled. Some provision should be made in the ESMP for this.

No further work was required to gain information on the occurrence of reptiles, invertebrates and amphibians in the area and the necessary measures have been included in the ESMP.

5.7 AVIFAUNA (BIRDS)

Specific avifauna species are at risk to collide with the wind turbines; therefore, it was necessary to cover this specialist field in depth. The complete avifauna specialist study is attached as **Appendix F**.

5.7.1 HABITATS

Sensitive habitats of the project area for birds were considered during the screening and scoping phases, explained below and depicted in **Figure 21**, and zones excluded as a result.

The area is characterised by extremely dry conditions, strong winds and sparse, low vegetation on a mosaic of flat to undulating sandy to gravelly plains that are interspersed by rocky outcrops and ridges. Some of the ridge systems are steep and incised with narrow gullies. Vegetation cover becomes sparser along a west to east gradient.

A few seepage lines run through the project area. There may be a trickle of brackish surface or subsurface water along them in years of below-average rainfall, which may flow strongly in wetter seasons. They may then empty into natural or man-made (e.g. depressions created by previous mining activities) ephemeral pans. These seepage lines may provide habitats to birds not normally associated with arid environments.

The coastline adjacent to the project area has a more diverse array of habitats, including a vegetated wetland at Second Lagoon, mudflats, a mixture of sandy and rocky beaches and bays, and hosts a far more diverse and abundant avifauna than the actual project area, which is located at least 3 km from the coastline.

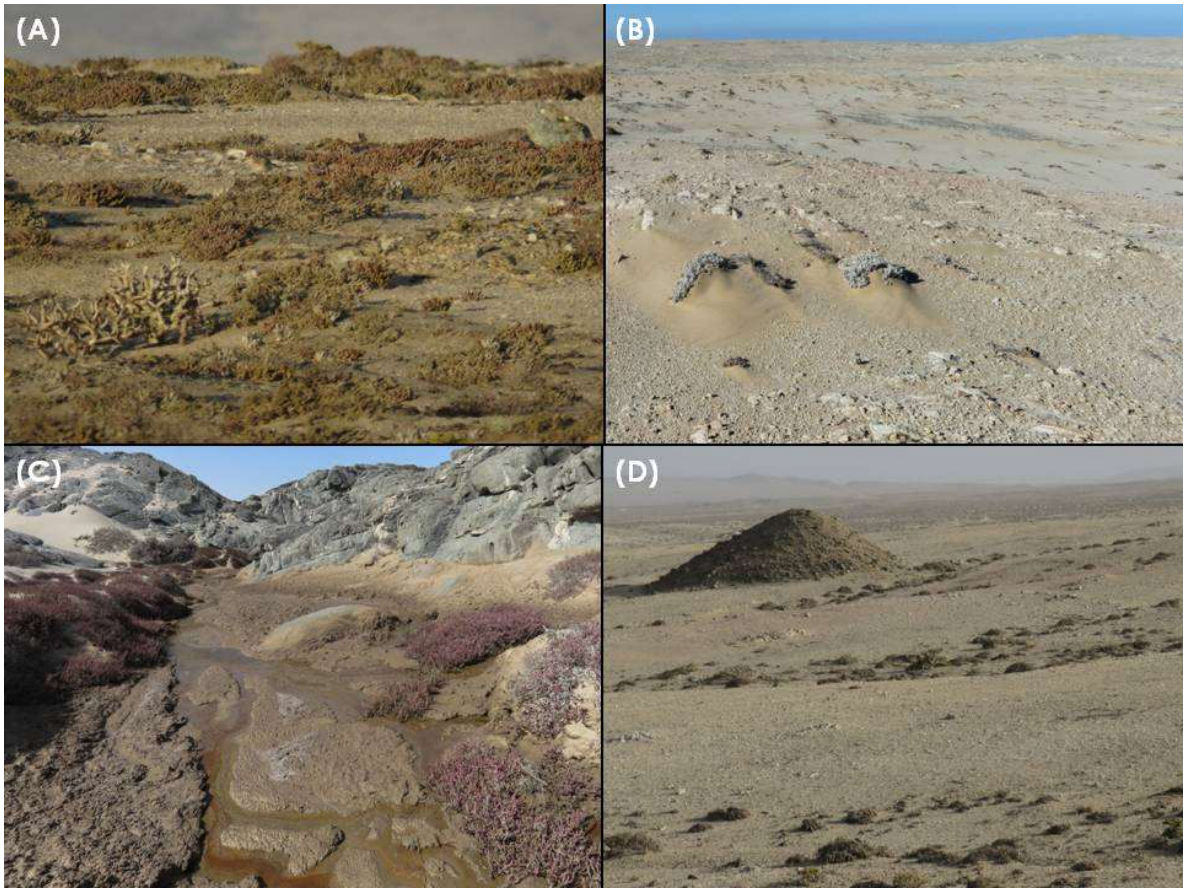

Figure 21: Some habitats in the project area (A) fairly well vegetated terrain in the central portion of Site 1; (B) sparsely vegetated gravel plain at the eastern extreme of Site 2; (C) seepage line carrying surface water (excluded from direct project area); (D) some evidence of (small scale) past mining activities.

5.7.2 PROTECTED AREAS

Conservation efforts of the TKNP, positively affects the habitat of avifauna as there is an aim for long-term integrity of biodiversity. Some land degradation from comparatively small-scale past mining activities is evident in the general area, including in the project area itself, especially on the 50MW IPP Site **(Figure 21 D).**

The project area is part of one of Namibia's 19 globally Important Bird Areas, the Sperrgebiet IBA (Barnes 1998), which comprises the entire TKNP. It qualifies as a global IBA because of the number of globally threatened, range-restricted and/or biome-restricted avifauna using the area - largely desert-adapted species with specialised abilities to survive in such arid, hot and/or windswept conditions. On the marine side, the Lüderitz Bay Islands IBA (consisting of Seal, Penguin and Halifax islands) and the Possession Island IBA are located roughly 12 km and 18 km from the project area, respectively (Barnes 1998).

Namibia's only marine protected area, the Namibian Islands' Marine Protected Area (NIMPA), was proclaimed in 2009. The NIMPA does not directly fall within the project area (which, at its closest, is 3.3 km inland from the shore) and covers vastly

different habitats to those found on and immediately adjacent to the project area. The NIMPA does, however, serve as a marine extension of the TKNP which it directly borders in the general area in which the project area is located.

5.7.3 WIND PARKS AND BIRDS

Electricity generation through wind power generally is considered to be less harmful to the environment than traditional technologies that involve fossil fuels. However, wind turbines in sensitive areas have the potential to be detrimental to birds (see, for example, Drewitt and Langston 2006, 2008, Krijgsveld et al. 2009, Sovacool 2009, Gove et al. 2013 for reviews, cited in the specialist study, **Appendix F**). Carefully choosing the location of wind parks (and individual turbines) is therefore vital to balance the advantages gained from wind energy generation with the risks posed to birds - and to therefore guarantee the sustainability of such projects.

There are three (3) main ways in which birds can be affected, namely:

- mortality caused by collision with turbines or power lines;
- disturbance and / or displacement; and
- habitat loss and fragmentation.

5.7.4 MORTALITY CAUSED BY COLLISION WITH TURBINES OR POWER LINES

Birds may be killed when colliding with an unexpected or poorly visible obstacle, such as wind turbines (particularly with moving rotor blades, but also with turbine towers or nacelles), wind masts and associated guy ropes, or power lines. They may also collide by getting caught up in the draft created by rotating blades. Artificial lighting may contribute to making such obstacles less visible by blinding or disorientating travelling birds. Not all birds are equally susceptible to collisions with wind park infrastructure. The following groups of birds tend to be at greatest risk of getting injured or killed:

- large and heavy-bodied birds that cannot change course swiftly to avoid obstacles (e.g. bustards, geese);
- long-distance travellers (e.g. flamingos);
- species that tend to travel in flocks (e.g. flamingos, sandgrouses, sparrow-larks);
- birds with a narrow field of binocular vision (e.g. owls);
- species that spend much time on the wing and/or fly at high speeds (e.g. swallows, swifts, some raptors);
- night-active (nocturnal) birds (e.g. owls, various migrating species);
- birds that habitually soar, i.e. potentially use the same wind resource as wind turbines (e.g. raptors, storks); and
- aerial hunters or species with aerial displays (e.g. some raptors, insectivores, some larks).

Some types of habitats or landscapes are more likely to attract birds than others, and wind parks in such attractive "hotspot" areas, thus pose a greater collision risk. Such landscapes include prominent ridges and steep slopes that are exploited by soaring birds, or water bodies such as lakes or rivers (or, in a local desert context, seepage lines and pans) with an associated insect fauna that is pursued by insectivores such as swallows and swifts. Prevailing weather conditions such as thick fog or strong headwinds that force birds to fly lower could exacerbate collision risk.

5.7.5 DISTURBANCE AND / OR DISPLACEMENT

The construction of wind parks, presence, operation and maintenance of wind turbines and the decommissioning of wind park infrastructure may cause varying degrees of disturbance to birds that use the site for roosting, foraging or breeding. Disturbance is generated through human presence, noise, vibration and artificial lights in an area that was previously undisturbed by such activities. As a result, birds may change their activity patterns at the site (e.g. abandon nests, forego breeding) or move to an alternate, undisturbed site, either temporarily or permanently.

5.7.6 HABITAT LOSS AND FRAGMENTATION

Habitat damage and / or habitat loss during construction - and possibly during decommissioning - is inevitable and may be (a) permanent, depending on the fragility and hence recovery potential of the habitats affected, and (b) extensive, depending on the design and extent of the wind park and associated infrastructure such as access roads. Birds with narrow distribution ranges or those with specific habitat needs that may not be met elsewhere are most at risk, especially if they are already threatened with extinction or already face habitat loss elsewhere. The loss of certain bird species or species groups could also have a knock-on effect, with other parts of the food web also being affected (Thaker et al. 2018). To reduce these risks to birds (and, by extension, to other components of the ecosystem), it is therefore essential that biodiversity hotspots, or areas that are unique and therefore irreplaceable are avoided when choosing the location for a wind park.

As mentioned, sensitive habitats for birds have been avoided and reduced during the screening and scoping phases. Potential flight paths, wetlands, rocky outcrops and ridges have been excluded from the sites where possible.

5.7.7 AVIFAUNA

The avifauna associated with the project area is considered species-poor. It has not been well studied in the past and comparatively little data on species composition and abundance are available, in part because of the remoteness of the area and its restricted access. For this reason, a bird monitoring programme has been introduced (see Section 5.7.9). So far, 37 species have been confirmed to occur in the area. An additional 33 species potentially use the area in some way, be it as a roosting, feeding or breeding site, or as part of their flight path during migration or

nomadic movements. Only a few resident species appear to be present throughout the year in this dry, hostile landscape (Cape Crow, Gray's Lark, Pied Crow, Rock Kestrel and Tractrac Chat). Bird species richness, diversity, abundance / density and breeding productivity appear to be largely dictated by local and / or regional rainfall patterns and therefore can vary greatly between seasons and between years. Occasional episodes of strong wind from the east, which usually occur during the winter months, sometimes cause birds to be displaced from further inland, to habitats in the project area that they are not normally associated with.

Of the 70 species that have been identified to occur or to potentially occur at the project site, four (4) species are provisionally considered as priority species, based on their local or global conservation status, their level of endemicity, and their susceptibility to risks posed by wind parks. This list is subject to confirmation and revision upon completion of the bird monitoring programme.

5.7.8 PRIORITY BIRD SPECIES

5.7.8.1 Ludwig's Bustard

These are large, heavy-bodied birds with poor manoeuvrability. They are particularly vulnerable to collision with power lines (e.g. Shaw 2011, Simmons et al. 2015, Scott and Scott 2016). This is the suspected primary cause for the species' decline and its current listing as globally and locally Endangered (IUCN 2020, Simmons et al. 2015). Ludwig's Bustards are nomadic in response to rainfall - and therefore to food availability. They occur in the general area in most years, even in some years with poor rainfall, and breeding has been recorded near the project area and on the Lüderitz Peninsula. It is unclear whether Ludwig's Bustards necessarily breed at or near localities that they have used in previous years, but there is some evidence that this may be the case (J Kemper pers. obs.). Although the number of Ludwig's Bustards observed in the general area so far is relatively small (probably fewer than 20 individuals per year on the Lüderitz Peninsula; J Kemper pers. obs.), large flocks of up to about 100 individuals have been recorded elsewhere (Simmons et al. 2015), and it is not implausible for similarly large numbers occurring on or near the project area following exceptional rainfall events. No Ludwig's Bustards have been noted during the bird monitoring programme so far (although one set of fresh tracks was recorded), and it is likely that bustards are currently distributed further east where recent good rainfalls would ensure better food availability than is currently the case in the project area and vicinity.

5.7.8.2 Greater and Lesser Flamingos

Two (2) species of flamingo occur in fluctuating numbers in bays and pans around the Lüderitz area. Greater Flamingos are more likely to be found there throughout the years, while numbers of Lesser Flamingos fluctuate more widely. Short-distance movements of both species between local bays and pans are well-documented (including the use of the "short-cut" flight corridor between Second Lagoon and Grossebucht; excluded from the project sites). Information on long-distance

movements, however, is lacking, and their flight routes from the Lüderitz area to their southern African breeding grounds (Etosha Pan in Namibia and Sua Pan in Botswana for both species, as well as Kamfers Dam in South Africa in the case of the Lesser Flamingo; Simmons et al. 2015) are unknown, although it is assumed that they predominantly travel along the coast to Walvis Bay before heading inland. There is, however, some circumstantial evidence that Lesser Flamingos might travel between Lüderitz and Kamfers Dam using a direct inland route that could potentially cross the project area. It is also not known how fixed the route of these long-distance flight paths may be and how routes may vary between years. Long-distance movements seem to occur predominantly at night and may involve large flocks, making these birds vulnerable to collisions. No flamingos have been recorded during the bird monitoring programme so far.

5.7.8.3 Gray's Lark

These small, cryptically-coloured and insectivorous larks are endemic to the barren habitats of the greater Namib Desert and occur from southern Angola to just south of Lüderitz (Simmons et al. 2015). The species is not considered threatened, although an increasing transformation of their habitats further north may pose a threat in future. The Gray's Lark is a resident breeding species in the project area and, as a shy ground nester, is at risk of disturbance and displacement from the project site. This, together with the envisaged loss of habitat potentially impacting the local population, qualifies this range-restricted species to be considered as high-risk. Gray's Larks have been recorded regularly during the bird monitoring programme, most prominently on the northern site.

5.7.8.4 Nocturnally active birds

Little information is available on the presence, abundance and habitat use of nocturnally active birds in the area. This would include species that may actively use the project area at night for roosting, foraging or breeding (e.g. owls), as well as species that may undertake long-distance travels across the area at night, without necessarily using the project area *per se* (e.g. flamingos and other migrating birds that predominantly travel at night).

5.7.8.5 Coastal birds

Of the 11 coastal seabird species that regularly breed and travel along the coast of Namibia, including in the general coastal area bordering the project site, eight species are locally and / or globally threatened and most are endemic to southern Africa. Considering the proximity of the project area to the coast, these (except of course for the flightless African Penguin) could be considered high-risk species. However, observations of coastal bird movement suggest that these species tend to stick to the coastline when travelling and seldom venture inland (J Kemper pers. obs.). The (non-threatened) Kelp Gull is perhaps an exception; as an opportunistic scavenger it sometimes patrols further inland in search of carcasses, but probably not more than a few kilometres from the coastline. On extremely rare occasions,

young individuals of Cape Cormorant have been noted as far as 25 km from the coast, probably after becoming disorientated in foggy conditions (J Kemper pers. obs.). Although no colonies of Damara Terns are found in the project area, solitary breeding pairs may occasionally be found nesting some kilometres inland from the coast (Braby et al. 2001).

Some coastal birds that commute along the coast may use "shortcuts" between bays by travelling across headlands. This has been observed on numerous occasions for a number of species on the Lüderitz Peninsula between Second Lagoon and Grossebucht (J Kemper pers. obs.).

5.7.9 BIRD MONITORING PROGRAMME

In accordance with "best practice" international guidelines (Jenkins et al. 2015), a 12-month bird monitoring programme was commissioned by NamPower in November 2019. Monitoring commenced in December 2019 and will be completed in November 2020.

Kemper reports that the only priority species recorded during the first six-month of the monitoring period was the resident Gray's Lark; no bustards or flamingos were noted. Two (2) sightings of a globally "vulnerable" and breeding near-endemic coastal bird, the Damara Tern, in the same area and in consecutive months were surprising. It is possible that the sightings were of the same individual and that this individual was breeding. It is possible that the Damara Tern(s) were nesting in the area at the time, but this probably would have involved one isolated nest, rather than a breeding colony. Raptors, apart from the resident Rock Kestrel, are usually rare in the general area, and the observation of two (2) individuals of Black-chested Snake-Eagle (recorded in January 2020 and February 2020 respectively) was also rather unexpected. No Rock Kestrels were seen during the monitoring period, although they are known to regularly patrol the general area just north of the 40MW NamPower Site.

5.8 BROWN HYENA

Background

The brown hyena is a flagship and key indicator species of the TKNP. The Consultant's team was aware of its habitat in the vicinity of the project site, therefore a specialist study focussing on this species was considered necessary (see **Appendix H**). It is the only resident large carnivore found along the southern Namib Desert coast and it is an important link between the terrestrial and marine ecosystem. Large carnivores such as the brown hyena show ecological stress before other species are affected due to their large home ranges, low reproductive rate and enormous sized areas that are required to sustain populations. The TKNP is one of only four (4) areas where viable brown hyena populations are left, which highlights the importance of protecting this environment.

Brown hyenas are a highly social species. In the southern Namib Desert, they live in groups (clans) of up to six (6) adult animals. These clans are female-bonded and clan members are usually related. Cubs are raised in dens, which are the social meeting point of all clan members, who otherwise forage solitarily within their clearly defined and defended territory.

Brown hyenas with their unique social structure are threatened by disturbance (e.g. habitat fragmentation and destruction, disturbance, direct and indirect mortality). These effects are caused by various construction activities and to a lesser degree activity during operations.

Initial screening indicated that core activity areas of brown hyenas were infringed upon by the proposed wind farm sites **(Figure 22).** Changes were made to the boundaries to exclude these zones and the adapted site boundaries have subsequently been amended.

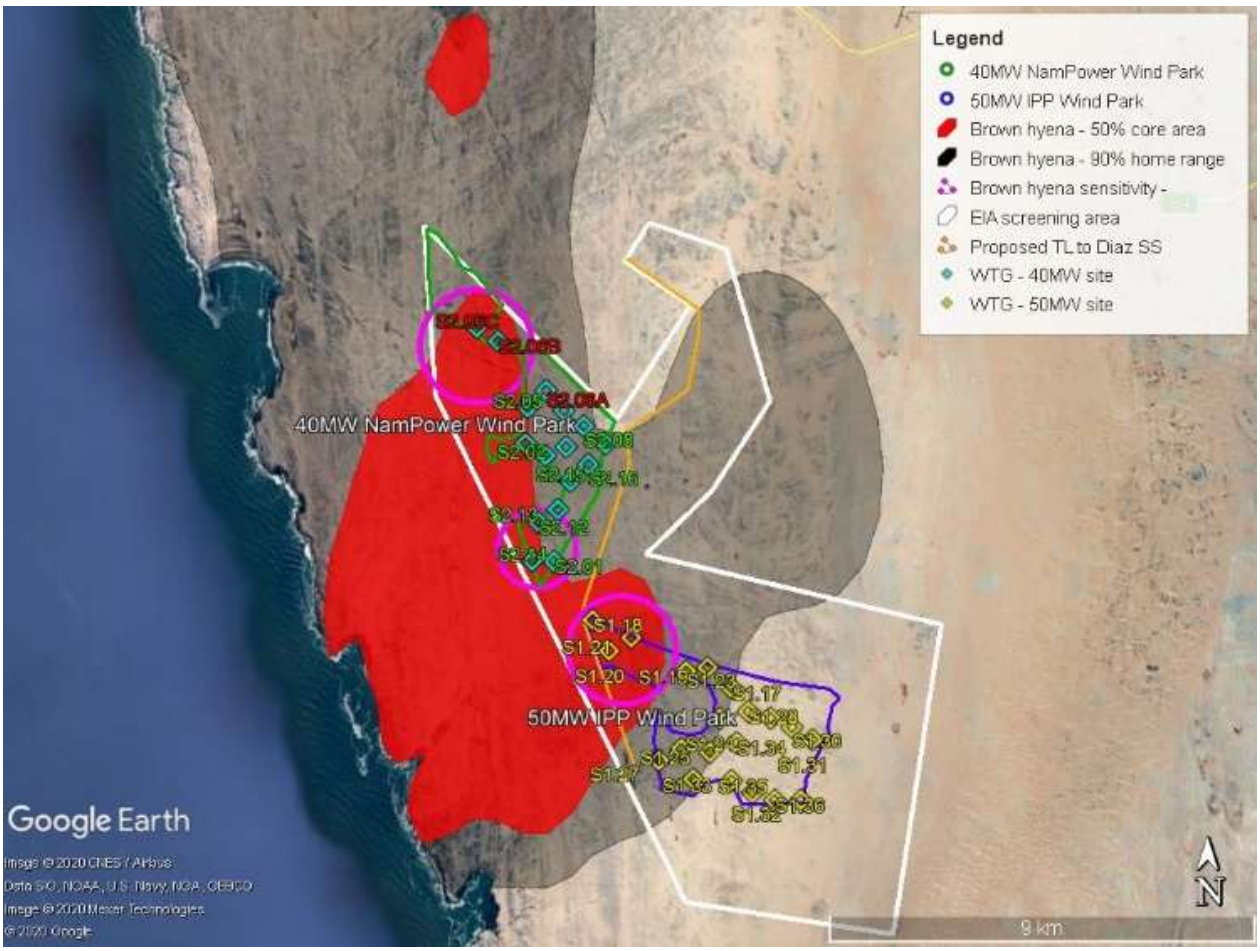

Figure 22: Brown Hyena no-go zones identified during screening

Post-adjustment of the site boundaries, which avoid core denning sites, the proposed two wind farm areas still fall into the territories of at least two (2), possibly three (3) brown hyena clans **(Figure 23).** Movement data of possibly two (2) adjoining inland clans are not available at this stage. The movement zones for the Peninsula Clan, Atlas Bay Clan and E-Bay Clan core areas are shown in the specialist report, which clearly indicate areas of concern.

The northern area (40MW NamPower Site) has important resting sites in the rocky areas, which form part of a movement corridor and includes one natal den site and a second just outside the site boundaries. The two (2) natal dens and associated resting sites for the breeding female are situated in the southern part of the site. Any disturbance of these dens during the construction and operational phase would have to be closely monitored. All construction activities should only take place when dens are inactive and maintenance work during the operational phase should be limited to a minimum when dens are active.

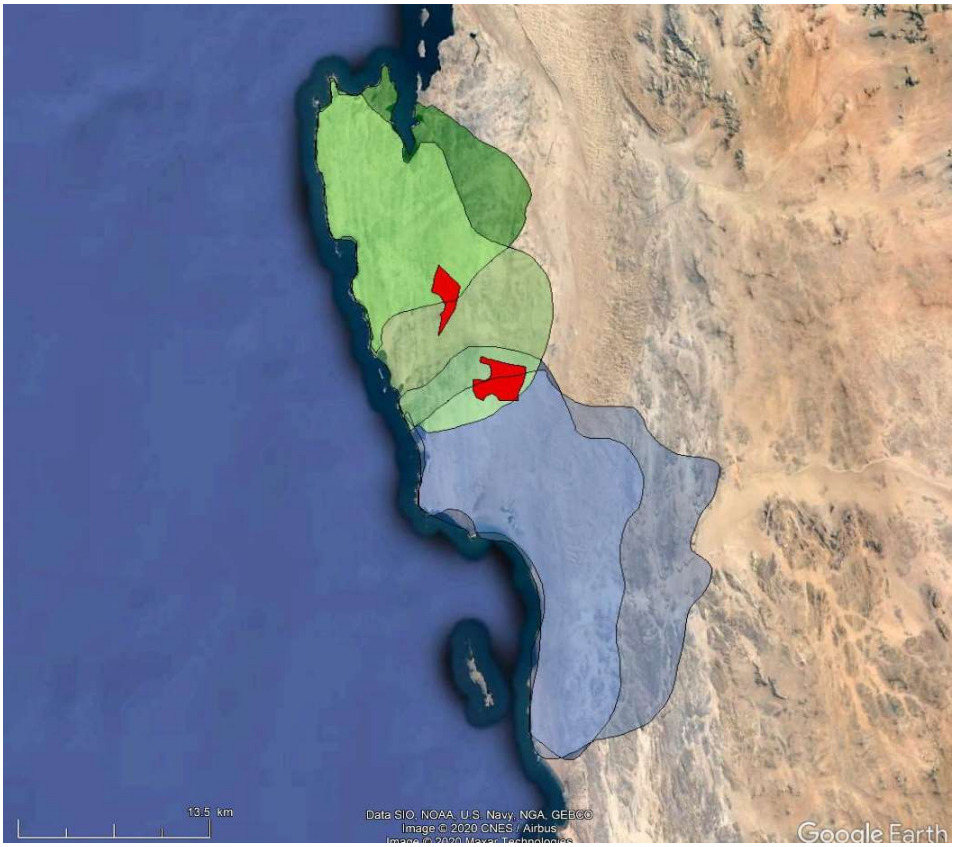

Figure 23: Home ranges of the two brown hyena clans (green = Peninsula/Atlas Bay Clan, blue = E-Bay Clan) and the proposed Lüderitz Wind Power Plant in red

Parts of the southern area (50MW IPP Site) serve as an important movement corridor. The territory boundary between the two coastal and at least one inland brown hyena clan is located within the 50MW IPP Site. Night-time, dusk and dawn activity of brown hyenas on the 50MW IPP Site is high due to the abovementioned location of the territory boundary. The disturbance of the entire area may fragment the hyena clans' territories and may lead to a reduction in territory size of the affected clans during the construction phase.

Furthermore, increased traffic during construction and operation phase may lead to road-mortalities on the main gravel road, and mitigation strategies such as speed limits and daytime driving restrictions should be implemented.

5.9 BATS

Bats have generally been recognised as being sensitive in terms of potential collisions with turbines. A specially desktop study with some fieldwork has been undertaken to frame the discussion on bats **(Appendix G).**

Bat important habitats are considered mainly in terms of their roosting or foraging potential. There may also be specialised features that promote movement and migration, e.g. linear corridors or features particularly important to conservation important or rare species. The specialist classifies the study area as having no areas of high sensitivity, only medium and low and has the following additional comments:

- Rocky outcrops/ extruding rock may have some bat activity on warm, low wind speed nights.
- Potential bat migration routes in this region are historically unknown.
- There are only ephemeral rivers and seasonal ponds and salt pans in the region. Even though they are scarce and mostly ephemeral, water and wetland areas are very important for bats because they provide drinking and foraging opportunities for bats.
- Caves are potential roosts for large congregations of bats. However, there are no known caves in the project vicinity. However, the specialist points out that, the coastal rocky areas between 3 – 5km from the site could host unknown caves, albeit unlikely to be very large ones.

Thirteen (13) bats have the potential to occur on the project sites, two (2) of which, *Eidelon helvum* and *Taphazous mauritianus*, have been confirmed for Lüderitz. According to the study, the Angolan wing-gland bat *Cistugo seabrae* is an endemic of the region. Six (6) of the 13 species are considered to be at high risk of fatality due to their flight behaviour. However, the harsh weather conditions on site and lack of roosting and foraging habitat means that large aggregations of bats are unlikely and bat activity levels will likely be low.

Whilst some bat research has been conducted in Namibia, there is very little or nothing around Lüderitz. There is an active citizen science biodiversity monitoring project called Atlasing in Namibia, however, even the bat records in that data base show nothing near Lüderitz.

From 12 months of monitoring that the specialist conducted in 2012/ 2013 at a site in the Succulent Karoo ecoregion 290km south east of Lüderitz, near Alexander Bay, South Africa, four species were confirmed: *M. natalensis, T. aegyptiaca, R. capensis* and *N. capensis*, bat activity is mostly at 10m above ground level, with 80% less activity at 80m above ground level, 95% of activity occurs during wind speeds under 7.5 m/s and very little bat activity occurs when temperatures were below 8.5°C. This work confirms that bat activity is likely to be limited given the prevailing weather conditions on site.

The avifauna specialist performed driven transects (using a handheld Wildlife Acoustic EM3 bat detector on five (5) warm, low wind nights (see **Figure 24**). These transects were performed outside of the NamPower study areas due to night access restrictions beyond the Kolmanskop security gate. Therefore, they cannot confirm bat species presence on site but they do confirm that bats do fly in and around the Lüderitz area, especially close to specific habitat features, such as open water

sources, abandoned buildings (at Kolmanskop) and rocky outcrops. Only the rocky outcrops are found on the study sites and therefore, bat activity is expected to be lower on site compared with closer to the town. However, on-site bats monitoring would need to be conducted to confirm this.

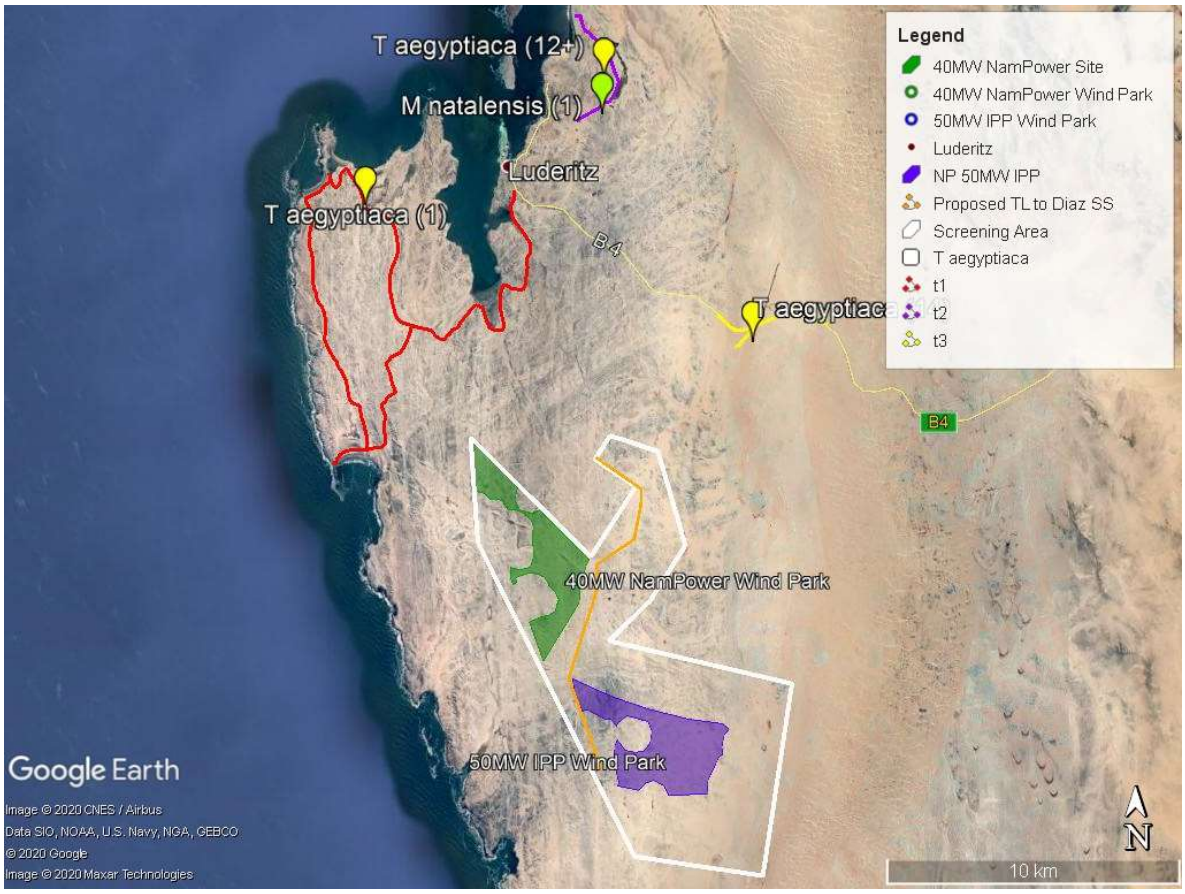

Figure 24: Overview of all Driven Transects

5.10 ARCHAEOLOGY

An archaeological impact assessment was conducted, involving a desk study of previous work in the area, and followed by ground truthing at the specific study sites **(Appendix I**).

Figure 25 indicates the known distribution of archaeological sites prior to the fieldwork stage in relation to the outline of the Lüderitz Wind Park project area of Interest.

Previous archaeological surveys of the Lüderitz area have revealed the presence of thinly distributed occupation evidence along the Atlantic shoreline and in the exposed granite-gneiss terrain immediately south of Lüderitzbucht. The precincts of Lüderitz town also contain a number of archaeological sites as well as several proclaimed National Monuments. There are scattered remains of historical mining activity throughout the area between Lüderitzbucht and Elizabeth Bay.

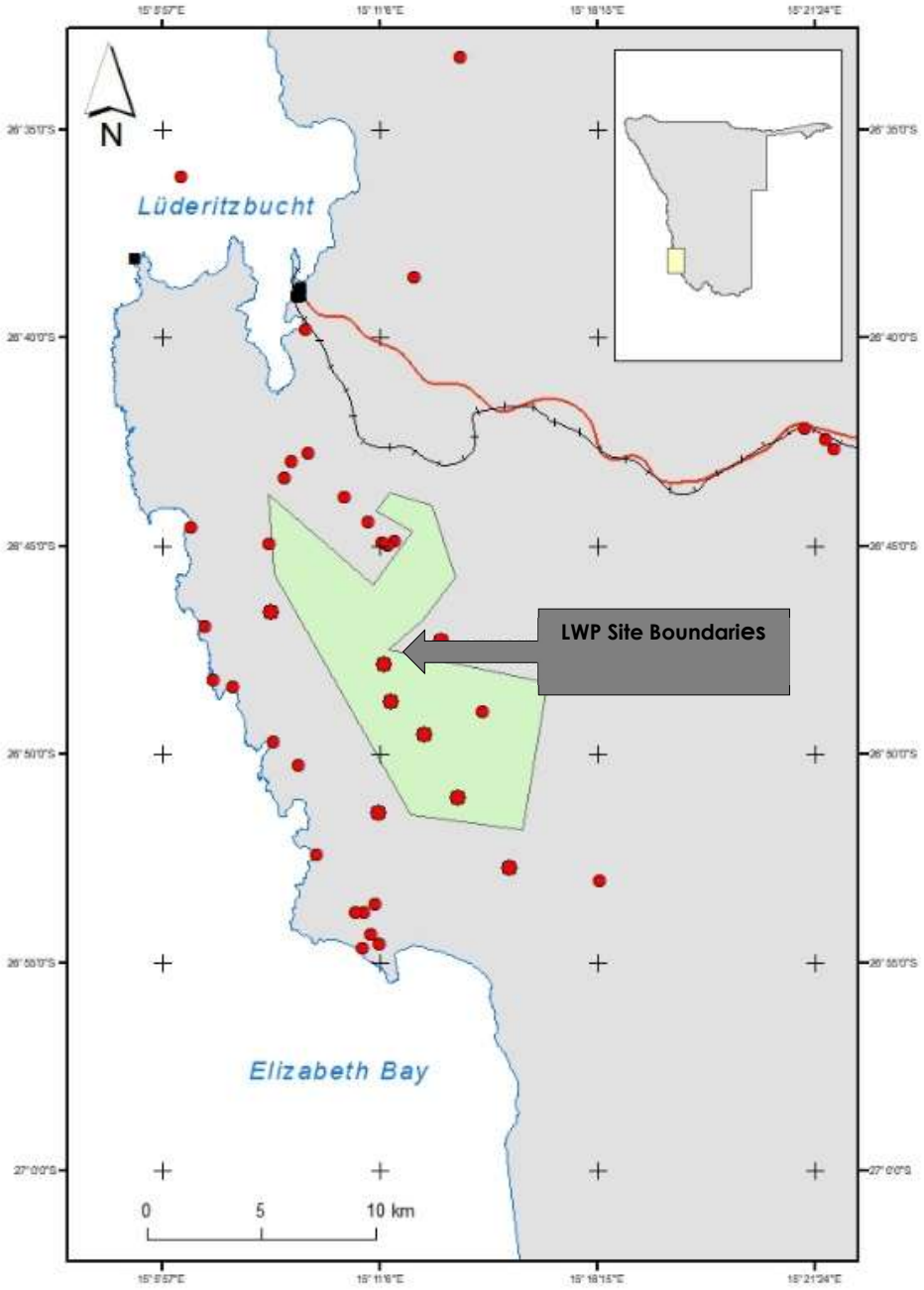

***Figure 25:** The distribution of archaeological sites in relation to the LWP project site. Red symbols represent undifferentiated archaeological sites, while black squares represent proclaimed National Monument sites. The site boundaries refer to the initial site investigated during the ESIA, which have been narrowed down for the specific wind park localities.*

The archaeological sites located along the Atlantic shoreline mainly comprise shell middens, some of considerable size, especially on the northern beaches of Elizabeth Bay. Two of these middens have been excavated and dated, providing valuable evidence for the exploitation of marine resources following the mid-Holocene marine transgression. The Elizabeth Bay shell middens are dated to within the last 4000 years and this is the most likely age of other sites immediately inland.

Inland archaeological sites in the area between Lüderitzbucht and Elizabeth Bay are not dated but probably form part of the same occupation episode as the coastal shell middens. The inland sites comprise small localized scatters of stone artefact debris and the remains of scattered shelters constructed from loose stone and in one case pieces of whalebone. The Elizabeth Bay shell midden sites are probably linked to a small but persistent freshwater spring about 5km inland.

Although historical sites are mainly concentrated at Lüderitzbucht (including Kolmanskop) and at the historical diamond-workings on the northern side of Elizabeth Bay, there are numerous scattered historical sites in-between.

The findings of the fieldwork yielded the distribution of archaeological sites within the project area. The site locality co-ordinates are listed in *Appendix 2* of the specialist report **(Appendix I).**

The archaeological sites located within the project area are undated but probably relate to the occupation of the Elizabeth Bay shell middens and represent hunting forays into the surrounding desert. The sites also include some remains of activities connected with recent mining operations and related settlement at Kolmanskop and Elizabeth Bay. However, none of these sites are archaeologically significant.

From the specialist report the following is concluded:

> " *Available archaeological evidence comprising field observations at the two LWP sites themselves as well as the results of earlier investigations in the Lüderitz area indicates that the LWP project footprint has a low archaeological significance. There are important concentrations of archaeological sites in the same area but these are associated with specific environmental features and conditions. At Elizabeth Bay, for example, very large shell middens are associated with a rich concentration of inter-tidal fauna on outcropping rocks, within reach of a reliable source of fresh water approximately 5km inland. Similar combinations of food and water resources are found at Bogenfels and Hottentot Bay. The exposed terrain of the LWP project site has no such features and has little associated archaeological evidence*."

5.11 CIVIL AVIATION

A Civil Aviation Specialist was involved to determine potential interferences of the envisaged turbine objects with the operations of the nearby Lüderitz airport. The assessment done for this purpose is attached as **Appendix K.** The purpose of the Annex 14 Obstacle Limitation Surfaces (OLS) is to define the volume of airspace that

should be ideally kept free or safeguarded from obstacles, and to take the necessary measures to ensure the safety of aircraft, and thereby the passengers and crews aboard them, while taking-off or landing, or while flying in the vicinity of an airport.

During the screening and scoping phase, it was determined that a part of the project area may potentially interfere with the civil aviation affairs at the Lüderitz airport (see **Figure 26**).

For the current environmental assessment, the Annex 14 OLS study determined for each of the two Wind Park sites the maximum allowable height of any structure before a per obstacle full Annex 14 study is required (**Figure 26**).

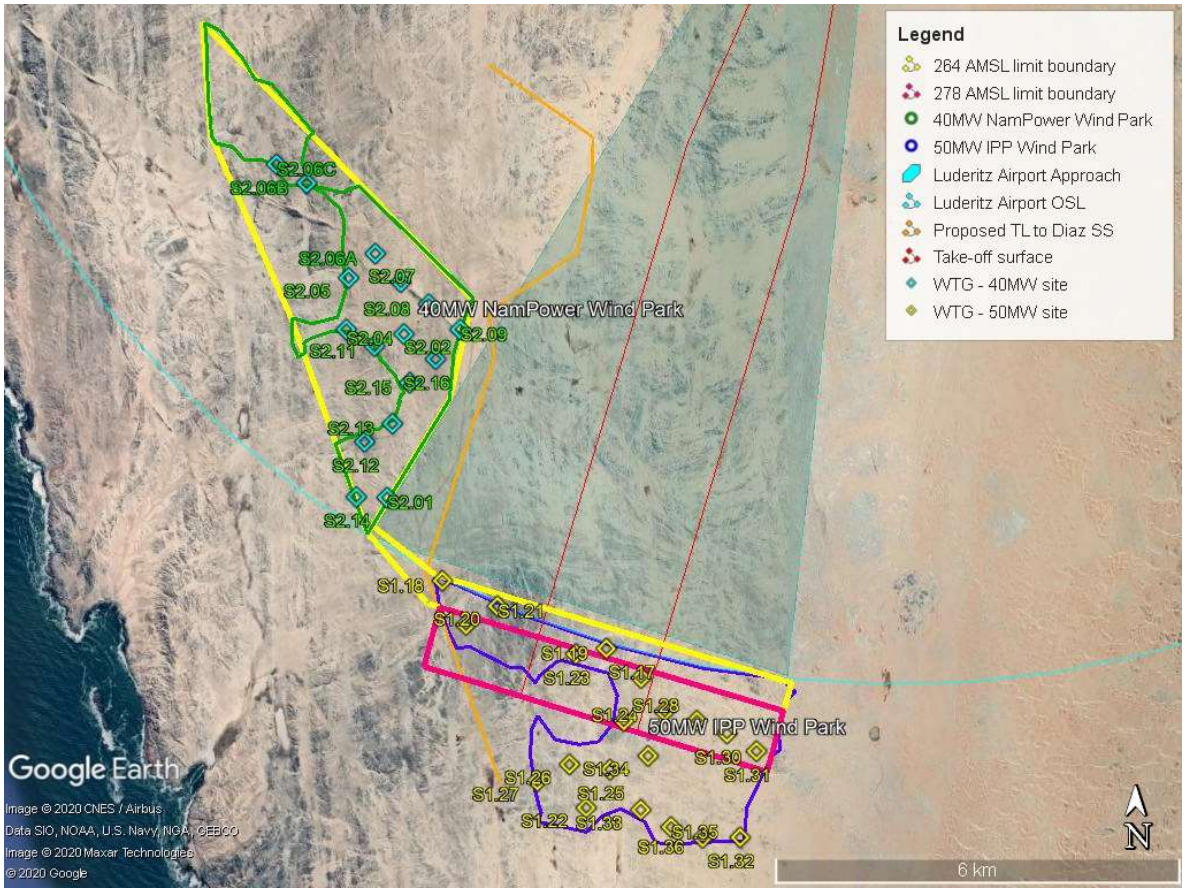

Figure 26: Civil Aviation obstacle height boundaries that will trigger Annex 14.

The following recommendations are put forward for Civil Aviation Safety purposes (details are given in the specialist report):

a. All obstacles within the proposed 40MW NamPower Site are to be limited to the maximum elevation of 264m (Above Mean Sea Level (AMSL);

b. All obstacles within the proposed **50MW IPP Site** and bounded by the given coordinates are to be limited to the maximum elevation of **264m AMSL;**

c. All obstacles within the proposed **50MW IPP Site** and bounded by the area with the given coordinates are to be limited to the maximum elevation of **278m AMSL;**

d. Obstacles which lie outside of the OLS are not limited to a maximum elevation AMSL but authorisation will still need to be obtained from the Namibia Civil Aviation Authority (NCAA).

Further mitigation recommendations are being made in the specialist report and these are being included in the ESMP.

5.12 SOCIO-ECONOMIC BASELINE

The areas where the socio-economic profile may be affected by this project will be addressed herein, including key indicators such as income, jobs, poverty indicators, as well as land use activities in the area and noise levels, which is a key issue generally on wind parks.

5.12.1 SALIENT SOCIO-ECONOMIC INDICATORS

Table 8 below indicates the key demographic and socio-economic indicators of the //Karas Region in which the project site is located. The population is relatively small, and the density is very low, at below 1 person per km. The population is relatively literate and there is limited migration to other regions, with most people employed there at mines, the fishing industry, local and regional Government, and the tourism industry. Most people earn their income through salaries, but there is currently a high unemployment rate (**Figure 27**), which is expected to have risen due to the current effect of the COVID-19 measures and the general economic slump. Poverty is noticeable in the number of people living in makeshift housing (25.2%). Yet, a relatively large percentage of the population have access to basic services including safe drinking water and sanitation, and most have medical facilities in close proximity. The health of the people in the region is also fairly good, as a large proportion having no records of chronic illnesses.

Table 8: Key socio-economic indicators (sources: National Statistics Agency, 2015/2016; Namibia Statistics Agency , 2016) [5]

Karas Population size	85 759 Male 50.5% Female 49.5%
Literacy rate[6]	96.1%
Usual residence in Karas Region	89.2%

[5] All statistics are given as estimated for 2016

[6] Defined as the ability to read and write with understanding in any language for the population 15 and above

Source of income	Salaries 74.4% Old age pension 11%
Housing type	Detached and semi-detached 47.1% Schacks 25.2% Other 27.7%
Sources of energy used for cooking	48.2% Electricity 26.2 % gas 25.2% wood
Population with access to safe water	79.4%
Population with no toilet	25%
Distance to health facilities	80% within a distance of 5km
Population with no chronic illnesses	86.5%
Population with high blood pressure	7.9%

Figure 27: Unemployment rate in Namibia from 1999-2019 (Plecher, 2020)

5.12.2 LÜDERITZ

The closest settlement to the proposed project site is the coastal town of Lüderitz, and will be more directly affected by the activities than the region.

Population, Housing and Settlement

The town is divided into three residential areas: Lüderitz Town itself and the two neighbourhoods of Nautilus (medium-density) and Benguela (high-density). Expansion of the town is constrained by the Atlantic Ocean on one side and the Sperrgebiet on all the other sides. The steep, rocky terrain in generally unsuitable for development.

The population is currently estimated at 15,137 (World Population Review, 2020)[7]. In 2010 local officials estimated the population to be 25,000 (Pers Comm Sheefeni, 2010). If the data is correct, it points to a declining population, which can possibly be ascribed to the reduced activity mainly in the mining sector. The current unemployment rate for Lüderitz is not available, but it is expected to be higher due to recent retrenchments in the town in the mining and other sectors due to low economic activity.

Housing supply for the affluent population is expected to meet demand, since job opportunities have significantly diminished in the last couple of years. Low income housing is in demand, with a significant proportion of the population not being able to afford housing or even serviced land. This and because land available for development is scarce, income settlement is mainly through 'backyard squatting', with consequent densification of poorer neighbourhoods (similar to patterns in the other coastal towns of Swakopmund and Walvis Bay). This has greatly overtaxed infrastructure, with sewerage reticulation facing particular problems.

People come to this town because of the possibilities of working in the fishing industry, but employment opportunities are limited. The main forms of livelihood are full-time salaried work in the fishing and associated industries, Namdeb (has recently retrenched due to declining mining industry), the Town Council, Government, domestic work, small business enterprises, piecework and state pensions. Those without work live on handouts from family and friends, and activities of sex work and drug sales are also reported.

In 2007, the community perceived the main problems causing poverty in Lüderitz to be unemployment, shortage of housing, voicelessness, bribery and corruption, alcohol and drug abuse, HIV/AIDS and lack of water and electricity provision (National Planning Commission, 2007). These statements, although made some time ago are expected to still be relevant.

The most common diseases in the Lüderitz area include pneumonia, diarrhoeal diseases, skin diseases, tuberculosis, other respiratory diseases, and ear diseases (SIAPAC, 2001).

The town is linked by a tar road to Keetmanshoop, 342 kilometres to the west, a railway line to Keetmanshoop (albeit under-utilised), air services, daily passenger service between Lüderitz and Keetmanshoop, local taxis, and harbour sea links with Walvis Bay and ports in South Africa. The Lüderitz airport has a small airport west of the town near Kolmanskop capable of landing small aeroplanes, with a medium-sized asphalt runway and a smaller gravel runway.

[7] It is preferred to get such data from the Lüderitz Town Council, but such data is currently not available.

Lüderitz is supplied with water from the Koichabpan Water Scheme situated approximately 100 kilometres east of the town. The current demand for water in the town is close to the maximum capacity of the pipeline, therefore the scheme will need to be expanded. Electricity is available through the national grid supplied via two 132kV power lines from Keetmanshoop.

5.12.3 LAND USE ACTIVITIES

The sites are in a historically restricted diamond area, land use has similarly been restricted to diamond mining, the historic mining towns of which Kolmanskop is the closest to the site, which is a world-renowned tourism destination, and limited tours to Elizabeth Bay and Bogenvels.

Tourism may increase into the area in future. The Tourism Development Plan for the Tsau //Khaeb (Sperrgebiet) National Park of the Ministry of Environment, Forestry and Tourism (MEFT) has demarcated zones for tourism development, which are referred to as Tourism Development Areas (TDA's). The project site falls within the Coastal and Mining History Tourism Development Area (see **Figure 28**). It is located along the northern section of the Atlantic coastline directly south of Lüderitz. This TDA has a high energy coastline which is a rich marine environment. There are three unique and quite distinct attractions; being the Lüderitz Peninsula, Kolmanskop Ghost Town and the coastal landscape further south with its rich diamond mining history.

The project site, being close to Elizabeth Bay, is also en-route to the tourism destinations further to the South, including Pomona and Bogenvels. The site itself contains no particular tourist attractions, and is not implicated in terms of siting. However, visual impact and how the site fits into the tourism landscape has been considered (see **Subsection 5.3.2**).

The workforce, because of rules laid down in the Park Management Plan, cannot be accommodated onsite. Accommodation arrangements will have to be made in Lüderitz town.

Specific restrictions for the construction period will be considered, including the accommodation of the workforce, the siting of laydown areas, procurement aspects, etc., and are included in the ESMP.

The Park Management Plan also has management zones as shown in **Figure 29** below. The Wind Park Sites fall within the Managed Resources Use zone. In terms of the Management Plan, this is defined in the following manner (see **Table 9**):

Figure 28: Coastal and Mining History Tourism Development Area (Source: MEF&T, 2019)

Table 9: Definition of the Managed resource protected area zone in the Tsau//Khaeb (Sperrgebiet) National Park Management Plan

Zones	Activities	Specific application in the Management Plan
• Managed Resource Protected areas	• Managed mainly for the sustainable use of natural resources, e.g. fishing, mining. • Managed to ensure long term protection and maintenance of biological diversity while providing at same time a sustained flow of natural products and services to meet local and national development needs e.g. mining.	Marine diamond areas. Coastal and Orange River mining areas. Base metal mining areas (Skorpion). Aquaculture (restricted to ponds in MA1). Irrigation agriculture (restricted to Hohenfels) Gas abstraction, piping, etc.

The proposed Wind Park fits the above description and is suited in the zone. This general principle of utilising resources, such as wind, in a sustainable manner is portrayed in the above description. It is particularly the construction phase which could disturb the land use vision for the area. Construction activities in particular need to be managed in terms of potential disturbances (visual and noise) to the surrounding land use (the road potentially used in future as a corridor to tourism destinations further in the south). These matters are addressed in the ESMP.

The brown zone in **Figure 29** below, namely the Development and Infrastructure zone, benefits the project for the routing of the new transmission line. As may be seen on the figure, the proposed route follows this corridor.

Figure 29: Park Management zones near the project sites

5.12.4 NOISE

Potential noise is a significant concern on most wind parks. The single greatest complaint about wind parks is the noise factor.

Advice in this regard is gained from what is learnt on other projects:

"The noise is a combination of two factors, mechanical noise and blade noise. The mechanical noise is created by the gearing and generator and is audible from 100 m. The primary noise comes from the blade, created by the compression of air and the impact of the compressed air against the turbine. The combined noise for a single turbine (typical) has been measured at 99.8 dB and is audible under still (low wind) conditions at 1 km, though distances of 1.5 km have been reported." (Interconsult, Update 2018).

The IFC's Environmental, Health, and Safety Guidelines for Wind Energy (IFC, 2017), provide guidelines to suggest when noise may require further modelling. Sensitive receptors are to be identified within a 2km radius. From research of other guidelines, this is considered to be conservative, with other guidelines given at 1.5 km and as close as 500 m. At the study site there are no human receptors anywhere near this range. Lüderitz is 12.5 km and Elizabeth Bay, 5.5 km from the closest boundary of the sites respectively. Kolmanskop (8.5 km away from the nearest point of the sites) is the closest tourism destination.

Sensitive receptors besides humans to be considered are birds and brown hyena's. The potential impact of noise on these receptors should be considered in the specialist studies. For the brown hyena, denning sites should be used as the reference point for consideration in the siting of the turbines (see Section 5.8).

Construction noise should be considered in the ESMP, of which blasting activities are expected to be the most significant. For blasting a permit is required from the Ministry of Mines and Energy (MME).

5.12.5 ROAD INFRASTRUCTURE AND TRAFFIC CONDITIONS

A Traffic Impact Assessment has been conducted for this project **(Appendix L).** In order to identify the impact on road infrastructure and traffic flow created by the additional traffic load on the roads, the baseline conditions need to be established. These are summarised in this section and more fully described in the Specialist's report.

Existing Road network

Major Roadways in the vicinity of the proposed development area are as follows:

- B4: National Road between Lüderitz and Keetmanshoop, paved with one lane per direction of travel, a posted speed limit of 120 km/h with gravel shoulders on both sides of the road. The typical cross section consists of 3.4 m wide lanes with 2 m wide gravel shoulders.
- Kolmanskop Access Road to Sperrgebiet National Park, gravel road, 8 m wide, no posted speed limit.

The traffic volumes along the B4 and the Kolmanskop Access Road are low and is well within the capacity of these roads. Due to the low traffic volumes along the surrounding road network it is expected that the road network will continue to operate at acceptable levels-of-service during the background conditions.

The roads in the site vicinity are in a fair condition and due to the low traffic volumes no major maintenance/improvements will be required in the near future, in view of accommodating the Wind Park development activities.

There are several suitable access positions and the specific access positions will be evaluated and confirmed during the assessment phase of the project.

Important questions that were answered by the Traffic Impact specialist are a) whether the existing road infrastructure would need to be upgraded in order to accommodate the additional traffic load, especially during construction; and b) what would be the impact on traffic flow with the expected abnormal vehicles expected, especially during construction. These answers are unpacked in the specialist report, and a summary provided in the impact assessment section of this report (**Section 8**).

5.13 CLIMATE CHANGE AND CARBON FOOTPRINT

These topics were considered in further detail in order to answer questions related to the contribution of the project to climate change, and the risk of the project resulting from climate change, as well as its calculated carbon footprint overall and when compared to other power generating projects. The full contents of these studies are contained in **Appendix M**, of which a short summary follows in this section, followed by the applicable impact assessments included in **Section 8.**

5.13.1 CLIMATE CHANGE RISK

Human-induced climate change is one of the most complex and serious challenges confronting the world today. Even though climate change may have natural causes, human actions are believed to also affect it. They increase the retention of

solar radiation within the atmosphere, raise the temperature and destabilise the global climate system.

On average, the world is currently ~2.05°C warmer on land 0.83°C warmer in oceans and 1.16°C Land and Ocean as at the end of March 2020.

> *" Without further commitments and action to reduce greenhouse gas emissions, the world is unlikely to meet the Paris Agreement Targets or National Commitments of 1.5°C above the preindustrial climate. …To meet the 1.5°C the world needs to reach net zero carbon by 2050. If unabated a 4°C world would be one of unprecedented heat waves, severe drought, and major floods in many regions, with serious impacts on ecosystems and associated services. The difference between 1.5°C and 2°C is an unpleasant situation for millions who will be exposed and risk of 10cm more of sea level rise, increased food crop failure (rice, maize, wheat), exposure to extreme weather events (droughts, floods), increase of 50% more exposed to water shortages, significant increased risk to fisheries and increase in those being dragged into poverty "*[8].

The Specialist provides the following summary for the project area climate baseline:

> "The climate in the location of the project area is typically cool, dry and windy with very low precipitation throughout the year.
>
> Extreme weather events are not characteristic of the region and the project site in particular and those that have taken place do not appear to have had a significant impact apart from droughts impacting fresh water supply.
>
> Temperatures across all of Africa are projected to increase over the 21st Century (across all seasons) and the warning is anticipated to exceed the global mean annual temperature increase, which is projected to be approximately 3.4°C by 2100" [9].

Overall, it is projected that the area in which the project is situated is likely to get hotter and drier with increasingly variable precipitation as a result of climate change. Additionally, storm surges along the coast may become more common given projected increases in severe weather events and sea level rise. This has potential to impact port facilities and their efficient operation.

5.13.2 CARBON FOOTPRINT

The Carbon Footprint Specialist completed a desktop assessment of international and national climate change literature; reviewing of relevant NamPower Lüderitz

---

[8] Climate change adaptation in the context of capital project development can be thought of as activities to avoid, minimise or mitigate the business risks arising from extreme weather events and/or gradual changes in climate. Adaptation measures include altering physical design of the mine site or infrastructure, implementation business procedures, and altering operating patterns.

http://www.ncdc.noaa.gov/cag/time-series/global National Centre for Environmental Information

9 The IPCC warns that if global society continues to emit greenhouse gases at current rates, the average global temperature could rise by 2.6–4.8°C by 2100. The IPCC's Fifth Assessment Report - What's in it for Africa.

Wind Power Plant documentation and other Enviro Dynamics specialist study reports.

GHG Emissions in Namibia

The only publicly available detailed inventory of Namibia's national GHG emissions was published in 2018 as part of Namibia's 3rd National Communication to the United Nations Framework Convention on Climate Change (UNFCCC), cited in the specialist report. The GHG emissions from 2014 to 2017 had been calculated using the Intergovernmental Panel on Climate Change (IPCC) 2006 guidelines for GHG emissions inventories.

Namibia's national emissions were estimated to be 20.41 million tCO_2e in 2016 **(Figure 30)** and the vast majority of emissions arose from land use change and forestry and agriculture (73%). The energy sector accounted for 22% of emissions in 2016 (4.07 million tCO_2e).

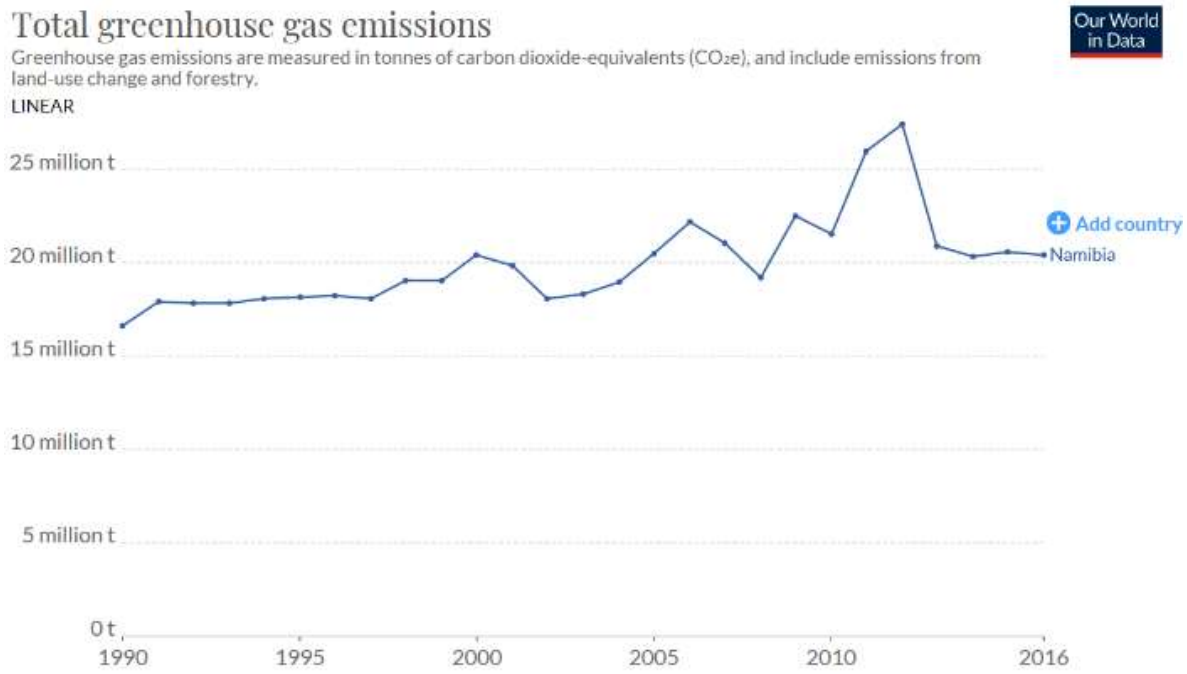

Figure 30 Trend of Namibia's CO_2e Emissions

The specialist report provides estimations of how the proposed wind power plant will contribute to these emissions in Namibia and **Section 8** includes the impact assessment in this regard.

6 PUBLIC CONSULTATION

The Scoping Report with the Public Consultation Report provides the details of how public consultation was conducted on this project and spells out the plans and prerequisites for continued consultation beyond the ESIA.

Comments and concerns were invited from the authorities, involved organisations and the public. This invitation was done during the meetings held and requested in the Background Information Documents distributed electronically.

Two (2) consultation meetings were held in Lüderitz on 27 February 2020 for this purpose, at 15h00 and 18h00. The afternoon meeting was attended by some of the authority representatives in Lüderitz, while the public consultation meeting scheduled for 18h00 was attended by officials and members of the public. A focal meeting (a short information sharing session by Enviro Dynamics) was held in Windhoek to accommodate the Managing Director of Sperrgebiet Diamond Mining (Pty) Ltd. The minutes of these meetings are contained in the Public Consultation Report.

The following Issues and Responses Trail (**Table 10**) is a summary of the comments and concerns raised. They were incorporated into the assessment phase and the ESMP. The table below refers to the specific sections in this document and in the specialist reports where they have been addressed.

Table 10: Issues and Response Trail

Item No.	ISSUE	RESPONSE
1.	Reliable power supply benefit (in terms of response to the existing Lüderitz Electricity supply and distribution shutdowns challenge).	The existing Lüderitz electricity distribution challenge relates to the presence of a single power supply line from the existing power station (Namib Substation) into the town. A further discussion pertaining to this challenge is to be taken up directly between the Lüderitz Town Council and the NamPower Transmission Business Unit for common grounds.
2.	Strategic approach and consideration to the cumulative effects of wind parks in Namibia.	Use the TKNP Management Plan. Consider cumulative impacts for each site. Refer to response provided in Section 9.3.
3.	Potential humming sound of the turbines and its effects.	Refer to Section 5.12.4 and 5.8.

Item No.	ISSUE	RESPONSE
4.	Namdeb and Sperrgebiet Diamond Mining (Pty) Ltd (SDM) should be consulted.	Included on the Stakeholder list, meetings were held with both parties.
5.	Consider archaeological sites in the area.	Refer to Section 5.10.
6.	Consult the guiding documents for prospecting in park areas by the MEFT.	National Policy on Mining and Prospecting in Namibia consulted. Even though the document identifies sensitive areas especially from a vegetation point of view, it is aimed at targeting areas to be excluded from Mining/Prospecting. However, the sensitive areas mentioned have been covered in this report. Refer especially to the Botanical Impact Assessment **(Appendix F).**
7.	Consider access of equipment and staff to the area, which is a challenge because of high security restrictions.	NamPower needs to consider this aspect in conjunction with Namdeb and SDM. Refer to the ESMP.
8.	Engage the Lüderitz Town Council in public involvement.	The Background Information Documents were sent to them, as agreed[10], for further dissemination.
9.	Involve Ministry of Mines and Energy (MME): Diamond Affairs for restricted area in Lüderitz, in entire development of sites.	Noted by NamPower. The MME Diamond Affairs will be considered as a direct Stakeholder.
10.	Socio-economic community benefits (including, employment, training, and others).	• Locals to be considered for lower level (unskilled and semi-skilled) labours during Construction Phase.

[10] *The Background Information Document was considered an adequate form of consultation. The community leaders would peruse the document and share this with their communities.*

Item No.	ISSUE	RESPONSE
		• Skill transfer and lower level labours onsite training for site specific tasks during Construction Phase. • Refer to Section 2.5 and the ESMP.
11.	Consider alternative sites offshore, along the coast.	Noted.
12.	National electricity need.	Noted.
13.	Effects on the cost of electricity.	Project will curb tariff increases, but will not cause an increase per se.
14.	Social responsibility of the project.	Noted. Jobs created, tax revenue created, and electricity secured. No one is negatively affected by the project.
15.	Access to SDM through the north-western site to the coast and to re-mine existing dumps, movement of equipment vs. local electricity distribution lines.	Included in the ESMP.

This draft report was circulated to the stakeholder list of all those who registered as Interested and Affected parties at the outset and during the process. The details in this regard are contained in the Public Consultation Report.

7 COMPOSITE SENSITIVITIES AND RECOMMENDATIONS

The initial determination of the sensitivities on the project sites, lead the Consultants to make the recommendations to NamPower summarised in this section.

There are a number of sensitivities about the project area which the Team became aware of. The following list of sensitivities were identified **(Figure 31):**

- a buffer zone proposed to protect birds using the identified flight corridors;
- dens and movement of the brown hyenas;
- rocky areas, ridges and seepage lines; and
- the Lüderitz Peninsula Dwarf Shrubland zone identified from available data possibly infringing on the site.

These zones overlap with one another and highlight the composite sensitivity of two main areas on the two sites **(Figure 32).**

Recommendations were made to NamPower to adapt the boundaries and WTGs accordingly and the outcome of the new site layouts is shown in **Figure 33.**

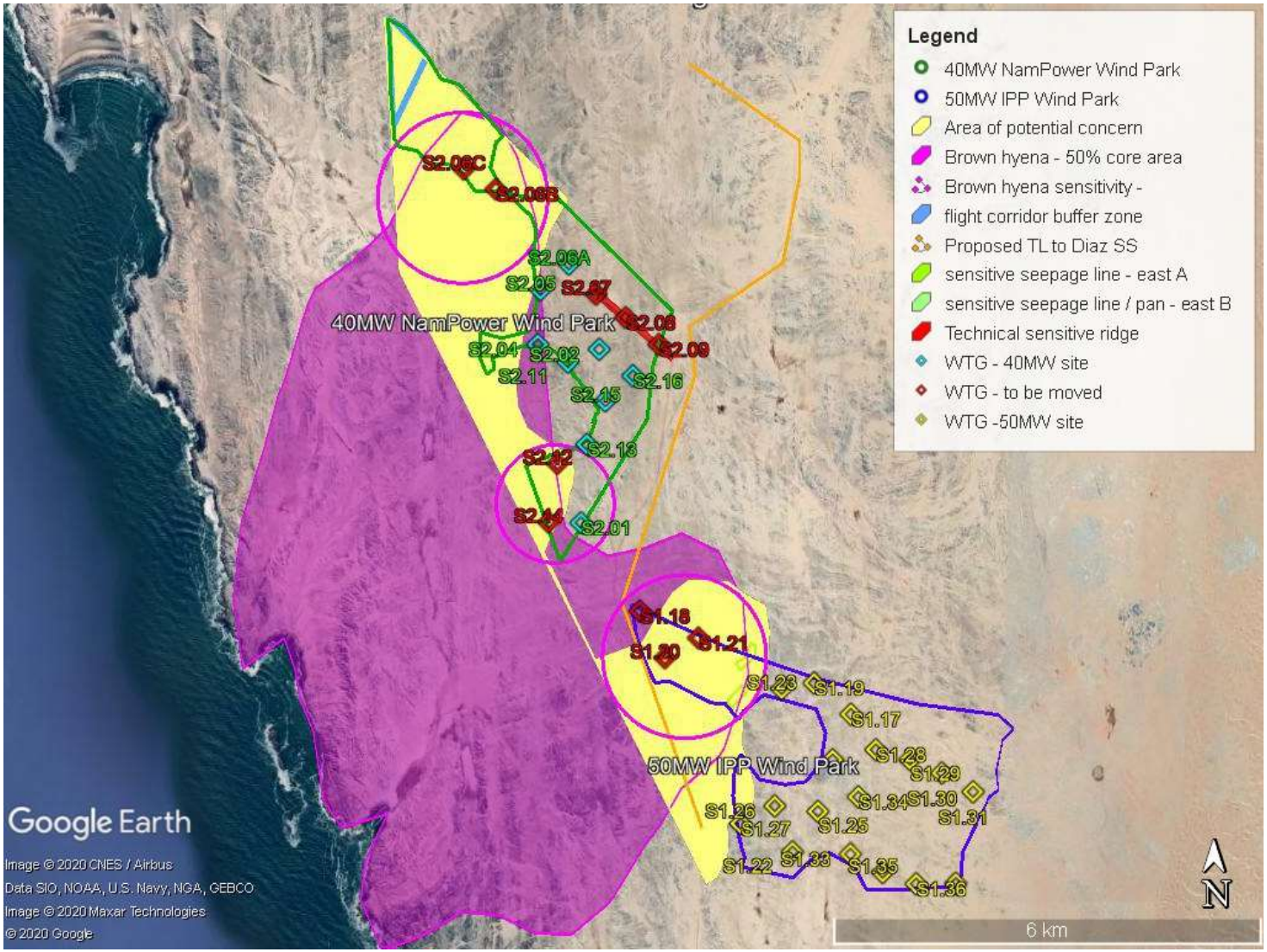

Figure 31: Environmental sensitivities with spatial implications (Acronyms used: WTG- Wind Turbine Generators, TL- Transmission Lines).

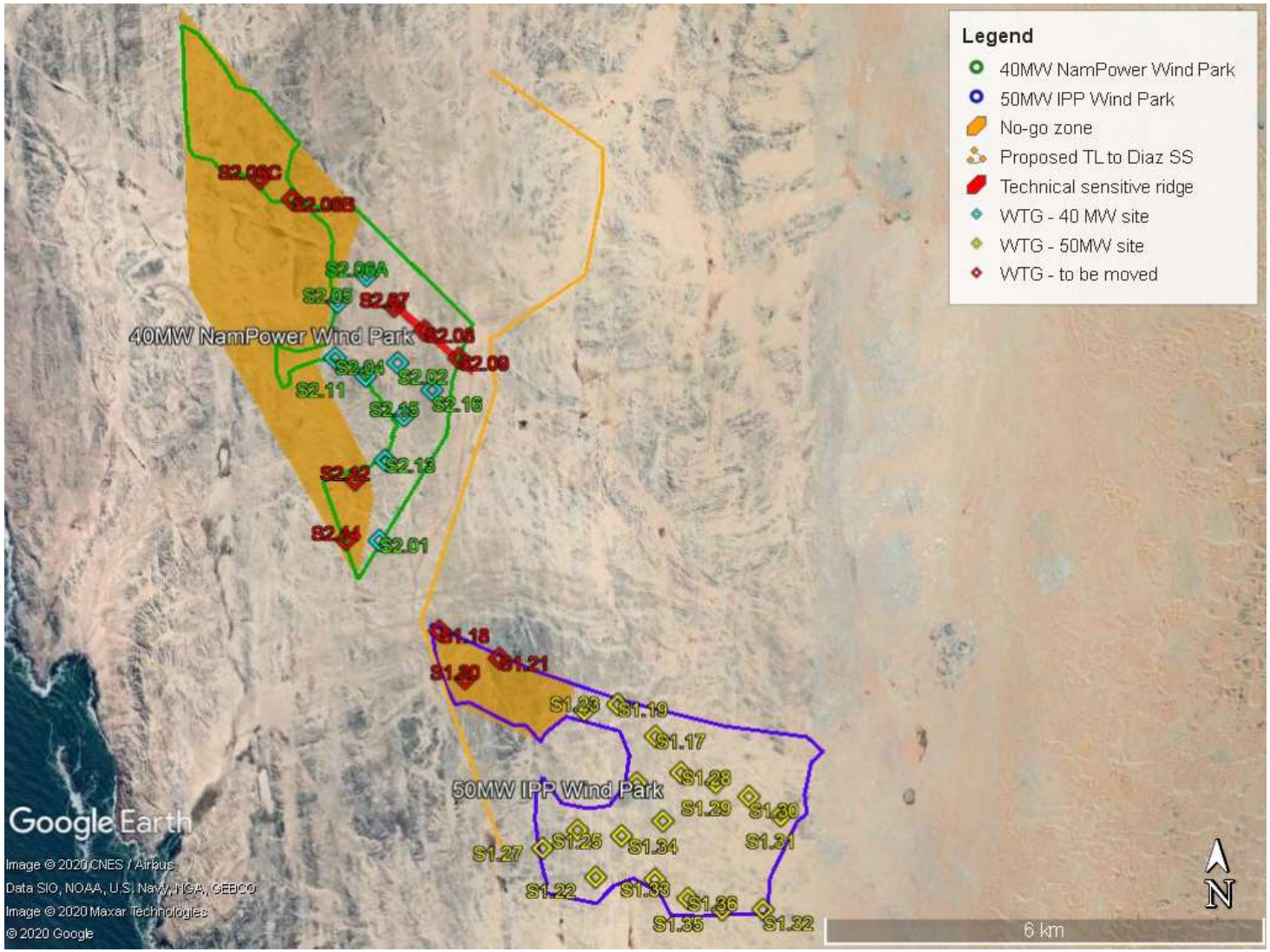

Figure 32: Proposed no-go zones.

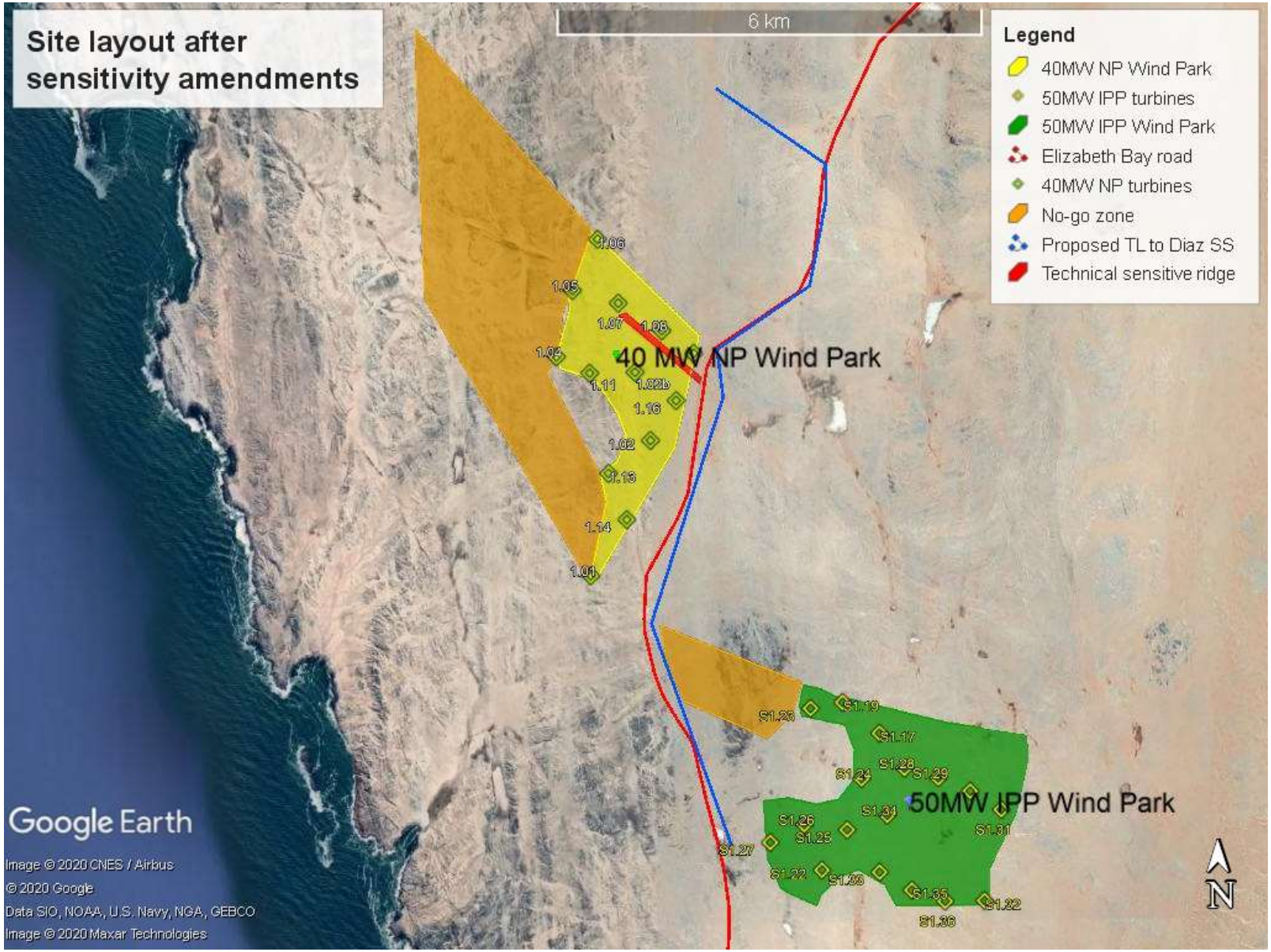

Figure 33: Adapted layout of site boundaries and WTG positions following screening recommendations.

8 IMPACT ASSESSMENT

Since the initial impact assessment during the scoping phase, the site layout has been adjusted as explained in the previous section. The assessment provided hereafter is based on the assumption that the sensitive zones have been excluded. It is also based on an improved understanding of the sites following ground-truthing.

Potential impacts which could be completely assessed during scoping; rated as low significance and for which standard mitigation is available have been carried forward to the ESMP. The aim of this assessment is to elaborate on matters of central importance. The specialist studies in the appendices may be consulted for further details on their impacts.

The impact assessment is combined herein for the Wind Park Sites and the power line. The impact assessment is generally similar for both project components, but where there are differences, these are provided.

Table 11 below provides the criteria used for the significance assigned to each potential impact.

Table 11: Impact assessment criteria used

DESCRIPTION	
Nature	Reviews the type of effect that the proposed activity will have on the relevant component of the environment and includes "what will be affected and how".
Extent	Geographic area. Indicates whether the impact will be within a limited area (on site where construction is to take place); local (limited to within 15 km of the area); regional (limited to ~100 km radius); national (limited to the coastline of Namibia); or international (extending beyond Namibia's boarders).
Duration	Whether the impact will be temporary (during construction only), short term (1-5 years), medium term (5-10 years), long term (longer than 10 years, but will cease after operation) or permanent.
Intensity	Establishes whether the magnitude of the impact is destructive or innocuous and whether or not it exceeds set standards, and is described as none (no impact); low (where natural/ social environmental functions and processes are negligibly affected); medium (where the environment continues to function but in a noticeably modified manner); or high (where environmental functions and processes are altered such that they temporarily or permanently cease and/or exceed legal standards/requirements).

DESCRIPTION	
Probability	Considers the likelihood of the impact occurring and is described as uncertain, improbable (low likelihood), probable (distinct possibility), highly probable (most likely) or definite (impact will occur regardless of prevention measures).
Significance	Significance is given before and after mitigation. Low if the impact will not have an influence on the decision or require to be significantly accommodated in the project design, Medium if the impact could have an influence on the environment which will require modification of the project design or alternative mitigation (the route can be used, but with deviations or mitigation) High where it could have a "no-go" implication regardless of any possible mitigation (an alternative route should be used).
Status of the impact	A statement of whether the impact is positive (a benefit), negative (a cost), or neutral. Indicate in each case who is likely to benefit and who is likely to bear the costs of each impact.
Degree of Confidence	Is based on the availability of specialist knowledge and other information.

Table 12 below presents an evaluation matrix adopted for the impact assessment, including the key impacts identified and their final assessment, based on the criteria provided above.

Table 12: Impact assessment table

PROJECT ASPECT	IMPACT STATUS/ NATURE	EXTENT	DURATION	INTENSITY	PROBABILITY	DEGREE OF CONFIDENCE	SIGNIFICANCE		
							PRE-MITIGATION	MITIGATION/ ENHANCEMENT (ELABORATED ON IN THE ESMP)	POST-MITIGATION
CONSTRUCTION PHASE[11]									
Overall implementation of the project	Positive Increased power security for the country and curb increase in future cost of energy.	National	Long term	High	Definite	High	High	N/A	. N/A
	Positive Reduced need to import ESKOM coal generated electricity followed by reduced overall carbon footprint.	International	Long term	High	Definite	High	High	Continue replacing greener energy with energy generated from non-renewables where feasible.	High

[11] The activities of the construction phase are similar to the operation phase. Therefore, the impact assessment for the former also applies to the latter phase.

PROJECT ASPECT	IMPACT STATUS/ NATURE	EXTENT	DURATION	INTENSITY	PROBABILITY	DEGREE OF CONFIDENCE	SIGNIFICANCE		
							PRE-MITIGATION	MITIGATION/ ENHANCEMENT (ELABORATED ON IN THE ESMP)	POST-MITIGATION
	Positive Contribution to job security, livelihoods and economic spinoffs in the region and Lüderitz	Regional	Short term	Medium	Definite	High	Low	Local first policy	Low to medium
	Increased pressure on infrastructure, housing and land availability.	Local	Medium term	High	Highly probable	High	Medium	Locals first policy – local residents continue living in existing housing with minimum additional housing required.	Low
	Negative Physical destruction of vegetation, including species of conservation concern	Local (only around turbine footprint locations, access roads, laydown areas etc.)	Long term	High	Definitive	High	High	Implement recommendations in the screening report, i.e. avoid the highly sensitive zones. Limit activity footprint and limit movement to designated areas only. Implement and monitor the Vegetation Management Plan.	Medium

PROJECT ASPECT	IMPACT STATUS/ NATURE	EXTENT	DURATION	INTENSITY	PROBABILITY	DEGREE OF CONFIDENCE	SIGNIFICANCE		
							PRE-MITIGATION	MITIGATION/ ENHANCEMENT (ELABORATED ON IN THE ESMP)	POST-MITIGATION
Excavation, blasting (required more on the ridges where Gneiss is shallow), clearance, transport and construction activities	Negative Decline in populations of park endemic plant species and others of high concern (Those listed in red in **Table 1, Appendix E**).	International	Permanent	High (where vegetation is damaged)	Definitive	High	High	Keep collateral damage to a minimum. Implement and monitor the Vegetation Management Plan.	Medium
	Negative Loss of important limited plant habitats.	Local (where vegetation n is damaged)	Permanent	High	Definitive	High	High	Implement recommendations in the screening report, i.e. avoid the highly sensitive zones. Limit activity footprint and limit movement to designated areas only. Implement and monitor the Vegetation Management Plan.	Medium

PROJECT ASPECT	IMPACT STATUS/ NATURE	EXTENT	DURATION	INTENSITY	PROBABILITY	DEGREE OF CONFIDENCE	SIGNIFICANCE		
							PRE-MITIGATION	MITIGATION/ ENHANCEMENT (ELABORATED ON IN THE ESMP)	POST-MITIGATION
	Negative Collisions with construction infrastructure, including during periods of poor visibility (fog or at night) result in injuries and mortalities of birds.	Local[2]	Temporary	Low to Medium	Uncertain	Low	Low to Medium	Keep construction footprint to a minimum.	Low
	Negative Use of artificial light when operating at night causes night-active birds to collide with construction infrastructure. And disorientation and / or diversion from or avoidance of foraging	Local	Temporary	Low to Medium (if birds are permanently displaced)	Possible/probable	Medium	Low to Medium	Avoid the use of bright, skyward-orientated lighting. Mark top of large cranes with low-intensity red light.	Low

PROJECT ASPECT	IMPACT STATUS/ NATURE	EXTENT	DURATION	INTENSITY	PROBABILITY	DEGREE OF CONFIDENCE	SIGNIFICANCE		
							PRE-MITIGATION	MITIGATION/ ENHANCEMENT (ELABORATED ON IN THE ESMP)	POST-MITIGATION
	/ breeding areas or travel pathways.								
	Negative Moving machinery / vehicles inadvertently destroy eggs or kill chicks from ground nests.	Local[2]	Temporary	Low	Probable	Low to Medium	Low to Medium	Keep construction footprint to a minimum. Keep an eye out for ground nests and mark their position to avoid accidental destruction. Ask bird specialist for advice on protocols regarding particular nests.	Low
	Negative Off-road operation of heavy machinery and vehicles, and temporary storage of turbine and crane components during	Local[3]	Long term to Permanent	Medium	Definite	High	Medium	Keep construction footprint to a minimum. Use existing roads / tracks as far as possible.	Low to Medium

PROJECT ASPECT	IMPACT STATUS/ NATURE	EXTENT	DURATION	INTENSITY	PROBABILITY	DEGREE OF CONFIDENCE	SIGNIFICANCE		
							PRE-MITIGATION	MITIGATION/ ENHANCEMENT (ELABORATED ON IN THE ESMP)	POST-MITIGATION
	assembly causes bird habitat damage / destruction.							Stick to designated tracks. Consider implementing a post-construction habitat restoration programme.	
	Negative Oil, fuel, chemical or wastewater spills cause (a) direct contamination of birds or (b) pollution of substrates such as seepage lines, therefore damaging bird habitats / food chains.	Local	Temporary to Short term	Low to Medium	Improbable	Medium	Low to Medium	Establish effluent management and spill contingency plans and ensure that protocols therein are strictly observed.	Low
	Negative Discarded materials / litter, e.g. plastic	Local	Temporary to Short term	Low to Medium	Probable (prevailing strong winds can make	High	Low to Medium	Establish litter management plan and ensure that protocols	Low

PROJECT ASPECT	IMPACT STATUS/ NATURE	EXTENT	DURATION	INTENSITY	PROBABILITY	DEGREE OF CONFIDENCE	SIGNIFICANCE		
							PRE-MITIGATION	MITIGATION/ ENHANCEMENT (ELABORATED ON IN THE ESMP)	POST-MITIGATION
	packaging, cable ties etc. pose entanglement, trapping and ingestion risks (and therefore a direct or indirect mortality risk) to birds, as well as a source of disturbance / displacement (e.g. of birds spooked by large sheets of plastic tumbling through their habitat).				containment of litter more difficult)			therein are strictly observed.	
	Negative Impacts on the brown hyena territory boundaries (Habitat loss and fragmentation), as it can lead to long term	Regional	Long term	Medium	Highly probable	High	Medium	Move wind turbine locations in 50 MW IPPLWP are moved further north-east if possible. No access/maintenance roads to pass through	Medium

PROJECT ASPECT	IMPACT STATUS/ NATURE	EXTENT	DURATION	INTENSITY	PROBABILITY	DEGREE OF CONFIDENCE	SIGNIFICANCE		
							PRE-MITIGATION	MITIGATION/ ENHANCEMENT (ELABORATED ON IN THE ESMP)	POST-MITIGATION
	changes in clan distribution, mating success and ultimately also influences local brown hyena survival.							the existing movement corridor area. If this is not possible, human activities limited to daylight hours, with no activity at dusk, dawn and night.	
	Negative Loss of denning habitat.	Limited to local	Permanent	Medium to high	Highly probable	High	Medium	Avoid construction activity when dens are active.	Low
	Negative Disturbance of brown hyenas by workers during construction phase and during maintenance work in operational phase.	Limited to 50MWIPP site	Temporary	Medium	Highly Probable	High	Medium	Staff should be made aware of wildlife in the area and should adhere to strict behavioural rules when encountering carnivores and other wildlife. A set of rules (e.g. no feeding, no leaving of food remains, no chasing of wildlife etc.) should be	Low

PROJECT ASPECT	IMPACT STATUS/ NATURE	EXTENT	DURATION	INTENSITY	PROBABILITY	DEGREE OF CONFIDENCE	SIGNIFICANCE		
							PRE-MITIGATION	MITIGATION/ ENHANCEMENT (ELABORATED ON IN THE ESMP)	POST-MITIGATION
								developed together with researchers and staff should be briefed on a regular basis.	
	Negative Disturbance and/or mortality of brown hyenas through increased traffic on the main and maintenance roads.	Local to regional	Permanent	Medium to high	Probable	High	Medium	Traffic limited to daylight hours and if traffic minimized at dusk and dawn and no traffic at night.	Low to medium
	Negative (for sensitive receptors) Negative: visually significant impact of construction activities on a section of the potential Kolmanskop	Local	Temporary	Medium	Definite	Low	Medium	Keep construction activities geographically focussed, not along the entire route section affected. Remove all structures during decommissioning.	Low

PROJECT ASPECT	IMPACT STATUS/ NATURE	EXTENT	DURATION	INTENSITY	PROBABILITY	DEGREE OF CONFIDENCE	SIGNIFICANCE		
							PRE-MITIGATION	MITIGATION/ ENHANCEMENT (ELABORATED ON IN THE ESMP)	POST-MITIGATION
	to Elizabeth bay tourism route.								
	Negative Traffic congestion in Lüderitz from the harbour due to abnormal loads, inability of existing roadway capacity to accommodate heavy vehicles.	Local	Short term	High	Definite	High	Medium	Traffic Management Plan during construction Designs of internal roads to Roads Authority standards.	Low
Construction of concrete foundations for turbines, crane pads, crane assembly areas, access roads, transmission line	Negative Removal and fragmentation of natural habitat, leading to the destruction of habitat and the displacement of associated biota such	Local[3]	Long term to Permanent	Medium	Definite	High	Medium	Keep construction footprint to a minimum. Use existing roads / tracks as far as possible. Stick to designated tracks.	Low to Medium

PROJECT ASPECT	IMPACT STATUS/ NATURE	EXTENT	DURATION	INTENSITY	PROBABILITY	DEGREE OF CONFIDENCE	SIGNIFICANCE		
							PRE-MITIGATION	MITIGATION/ ENHANCEMENT (ELABORATED ON IN THE ESMP)	POST-MITIGATION
poles, office buildings etc.	as birds and their food sources.							Consider implementing a post-decommissioning habitat restoration programme for entire affected area.	
Movement of the workforce and easier access by the public in the project area.	Negative Illegal harvesting of plants for ornamental purposes or fuelwood (including species of conservation concern).	Local	Long term	High	High	Medium	Medium	The workforce will not be permitted to live on site or move away from the construction site. Strict measures in the ESMP, e.g. training, workforce management, penalties, the public not to have uncontrolled access without guides.	Low
Erection of infrastructure such as transmission line pylons, turbine structures, and	Negative Bird mortalities and injuries caused by collisions with construction infrastructure, including	Local (if it impacts small numbers of non-threatened, widespread,	Temporary	Low	Probable	Medium	Medium	Low to Moderate	Low to medium

PROJECT ASPECT	IMPACT STATUS/ NATURE	EXTENT	DURATION	INTENSITY	PROBABILITY	DEGREE OF CONFIDENCE	SIGNIFICANCE		
							PRE-MITIGATION	MITIGATION/ ENHANCEMENT (ELABORATED ON IN THE ESMP)	POST-MITIGATION
use of heavy machinery such as cranes.	in periods of poor visibility (fog or at night). Collision risk for night-active birds could be exacerbated by bright, skyward-orientated lighting during construction activities being performed at night that may disorientate birds travelling at night.	resident bird species); International (if significant number of globally threatened species are impacted).							
	Negative Disturbance of Brown hyena denning.	Regional	Medium term	Medium/high	Highly probable	High	High	Incorporating recommended no-go and sensitive zones into final design of individual turbine placement Camera trap monitoring to use as ID catalogue of resident hyenas.	Medium

PROJECT ASPECT	IMPACT STATUS/ NATURE	EXTENT	DURATION	INTENSITY	PROBABILITY	DEGREE OF CONFIDENCE	SIGNIFICANCE		
							PRE-MITIGATION	MITIGATION/ ENHANCEMENT (ELABORATED ON IN THE ESMP)	POST-MITIGATION
	Negative Disturbance and/or mortality of brown hyenas through increased traffic.	Regional	Medium term	High	Probable	High	High	Enforcement of a strict speed limit. Awareness raising with drivers. Limit traffic to daylight hours.	Low
Waste and water management	Negative Human-wildlife conflict if waste is not disposed properly and if sewage water leaks because of poor sewage management; the same applies to fresh water. Water is a limiting resource and sewage water may contain pathogens that could harm animals; poor waste management	Limited	Temporary to short term	High	Highly Probable	High	Medium	Proper water and effluent management, fix leaking tanks, taps, etc. immediately, avoid standing water, ensure there is no standing or leaking effluent.	Low

PROJECT ASPECT	IMPACT STATUS/ NATURE	EXTENT	DURATION	INTENSITY	PROBABILITY	DEGREE OF CONFIDENCE	SIGNIFICANCE		
							PRE-MITIGATION	MITIGATION/ ENHANCEMENT (ELABORATED ON IN THE ESMP)	POST-MITIGATION
	can attract scavenging species and may also increase the risk of other impacts (road mortality, conflict with humans etc.).								
Environmental conditions including existing and predicted increasing high temperatures and extreme weather events (causing risks to the project)	Negative Heatstroke and dehydration followed by potential community dissatisfaction and reduced productivity during summer months.	Local	Long term	High	Possible	High	Medium	Prevent working under hot temperatures, Provide cool water for all on-site staff, Change working hours to avoid hottest part of the day, Provide PPE and sun protection.	Low
	Negative Extreme weather events, rising sea levels prevent ships from docking and delivery of	On-site	Short term	High	Likely	High	Medium	More regular maintenance of infrastructure Implement control measures and controls to warn and alter operating procedures.	Low

PROJECT ASPECT	IMPACT STATUS/ NATURE	EXTENT	DURATION	INTENSITY	PROBABILITY	DEGREE OF CONFIDENCE	SIGNIFICANCE		
							PRE-MITIGATION	MITIGATION/ ENHANCEMENT (ELABORATED ON IN THE ESMP)	POST-MITIGATION
	wind turbines, blades and stock items.								
OPERATIONAL PHASE									
Existence of transmission line pylons and turbines	Negative Collision with wind turbines (rotor blades, nacelles and towers), including during periods of poor visibility (fog, sand storms or at night) result in injuries and mortalities of birds. This includes direct collision events and mortalities from injuries sustained when caught in the suction draft of	Local	Long term	Low to Medium	Uncertain	Low	Low to Medium	Keep number of turbines and layout footprint to a minimum. Keep turbine layout clustered to present a more visible obstacle and avoid placing solitary turbines. Avoid the use of bright, skyward-orientated lighting. Mark turbine towers and blades to make them more visible.	Low

PROJECT ASPECT	IMPACT STATUS/ NATURE	EXTENT	DURATION	INTENSITY	PROBABILITY	DEGREE OF CONFIDENCE	SIGNIFICANCE		
							PRE-MITIGATION	MITIGATION/ ENHANCEMENT (ELABORATED ON IN THE ESMP)	POST-MITIGATION
	moving rotor blades. Priority species such as flamingos and bustards are particularly prone to such collisions.							Keep lighting associated with wind turbines to a minimum. Consider installing radar devices to act as early warning systems that temporarily shut down turbines during times of high bird activity.	
	Negative Collisions with transmission lines or wire stays, and / or electrocution by transmission lines cause injuries and mortalities; priority species such as	Local[2]	Long-term	Low to Medium	Uncertain	Low to Medium	Low to Medium	Equip transmission line with Raptor Clamp™ / OWL bird flight averting devices (or similar devices) to make them more visible to birds at night. Keep transmission line footprint to a minimum.	Low

PROJECT ASPECT	IMPACT STATUS/ NATURE	EXTENT	DURATION	INTENSITY	PROBABILITY	DEGREE OF CONFIDENCE	SIGNIFICANCE		
							PRE-MITIGATION	MITIGATION/ ENHANCEMENT (ELABORATED ON IN THE ESMP)	POST-MITIGATION
	bustards and flamingos are particularly prone to such collisions.								
	Bat fatalities due to collision with turbines while foraging or migrating.	Site specific	Long term	High	Highly probable	Medium	Medium	Construction and operational monitoring and adaptive management.	Low
	Negative Structures affect civil aviation safety within the Lüderitz airport airspace.	Local	Long term	Medium	Highly Probable	High	High	Conduct the necessary PANS-OPS assessment for each mast that penetrates the Obstacle Surface Limitation to establish the impact. Apply for approval of structures from the civil aviation authority. Keep to the height limitations provided.	Low

PROJECT ASPECT	IMPACT STATUS/ NATURE	EXTENT	DURATION	INTENSITY	PROBABILITY	DEGREE OF CONFIDENCE	SIGNIFICANCE		
							PRE-MITIGATION	MITIGATION/ ENHANCEMENT (ELABORATED ON IN THE ESMP)	POST-MITIGATION
	Negative Visually significant impact on a section of the potential Kolmanskop to Elizabeth bay tourism route.	Local	Long Term	Medium	Highly probable	High	High to Medium	Investigate paint patterns for turbines that are broken from a lower viewpoint and form coherent safety patterns from an aircraft viewpoint. Because the impact is only occasional during tourist activity and only for a minor section of the route, integrate the Wind Parks as a feature of the tourist attraction. Place new transmission lines to the opposite side of the existing transmission line from the road. Use neutral colours on the structures with a blue basis (e.g. grey).	Medium to Low

PROJECT ASPECT	IMPACT STATUS/ NATURE	EXTENT	DURATION	INTENSITY	PROBABILITY	DEGREE OF CONFIDENCE	SIGNIFICANCE		
							PRE-MITIGATION	MITIGATION/ ENHANCEMENT (ELABORATED ON IN THE ESMP)	POST-MITIGATION
Noise, movement and temporary occupation of an otherwise undisturbed habitat	Negative Disturbance of birds using flight corridors, resulting in additional energy costs to migrating birds, forced to alter their flyways.	International	Temporary	Medium	Highly Probable	Low to Medium	High	Keeping construction times as short as possible.	Low
	Negative Noise disturbance of brown hyenas.	Limited	Permanent	High	Highly probable	High	Medium	Noise damping designs.	Low
Maintenance of turbine towers and access roads	Negative Disturbance of Brown hyenas, their territory and their territory boundary north and east of the proposed wind farm area	Local to regional	Medium term	Medium	Definite	High	Medium	Incorporating recommended no-go and sensitive zones into final maintenance planning. Camera trap monitoring.	Medium / low

PROJECT ASPECT	IMPACT STATUS/ NATURE	EXTENT	DURATION	INTENSITY	PROBABILITY	DEGREE OF CONFIDENCE	SIGNIFICANCE		
							PRE-MITIGATION	MITIGATION/ ENHANCEMENT (ELABORATED ON IN THE ESMP)	POST-MITIGATION
	(habitat fragmentation)								
	Negative Effects of maintenance operations on denning behaviour (disturbance).	Regional	Medium term	Medium/high	Highly probable	High	High	Incorporating recommended no-go and sensitive zones into final maintenance planning. Camera trap monitoring. ID catalogue of resident hyenas.	Medium
	Negative Disturbance and/or mortality of brown hyenas through increased traffic.	Regional	Medium term	High	Probable	High	High	Enforcement of a strict speed limit. Awareness raising with drivers. Limit traffic to daylight hours.	Low
Management Plan of the Tsau//Khaeb (Sperrgebiet) National Park	Negative Conflict with the conservation.	Local	Long term	Medium	Probable	High	Medium	Include the Management Plan in the Environmental Management Plan, by	Low

PROJECT ASPECT	IMPACT STATUS/ NATURE	EXTENT	DURATION	INTENSITY	PROBABILITY	DEGREE OF CONFIDENCE	SIGNIFICANCE		
							PRE-MITIGATION	MITIGATION/ ENHANCEMENT (ELABORATED ON IN THE ESMP)	POST-MITIGATION
	objectives of the Management Plan.							giving preference to conservation initiatives.	
Environmental conditions including existing and predicted increasing high temperatures and extreme weather events (causing risks to the project)	Negative Reduction of the efficiency of certain types of equipment and wind turbines.	On - site	Temporary	High	Possible	High	Medium	Review and adjust if possible, the operational temperatures of equipment Increase maintenance schedule and prevent slow/shut downs. Investigate the suitability of selected turbines in hot temperatures and consider turbine types designed for hotter climates.	Low
	Negative Extreme weather events, rising sea levels prevent ships from docking and delivery of	On-site	Short term	High	Likely	High	Medium	More regular maintenance of infrastructure Implement control measures and controls to warn and alter operating procedures.	Low

PROJECT ASPECT	IMPACT STATUS/ NATURE	EXTENT	DURATION	INTENSITY	PROBABILITY	DEGREE OF CONFIDENCE	SIGNIFICANCE		
							PRE-MITIGATION	MITIGATION/ ENHANCEMENT (ELABORATED ON IN THE ESMP)	POST-MITIGATION
	wind turbines, blades and stock items.								

9 CONCLUSIONS AND RECOMMENDATIONS

9.1 SCREENING AND SCOPING

This Draft Scoping Report contains significant desktop work which has clarified the areas where further work is required, and where sufficient information is available to determine potential impacts and to manage the impacts in the ESMP. The potential impacts which are considered insignificant or where adequate information is available include the following:

- Potential hydrological impacts including erosion and potential transport of pollutants via surface and underground water. These impacts will be included in the ESMP without further work required.
- Potential impacts on invertebrates, amphibians and reptiles. Besides general habitat destruction which needs to be limited practically, focussed impacts on some reptiles have been identified, which needs to be managed during the implementation of the ESMP. No further studies are required in this regard.
- Potential shadow flicker. This potential impact is considered as negligent on this project and does not require further consideration.
- Potential noise impact on human receptors. This potential impact is considered negligent and does not require further consideration.

Furthermore, the recommendations for excluding sensitive zones and refining the positions of the proposed WTG's provided in the Screening and Scoping Reports were incorporated to achieve increased environmental sensitivity on the project design. The final impact assessment reported on in this document was based on this previous work. The work conducted during the more advanced assessment also included the following:

- Updating of the project description to include a layout of the site, proposed location for the turbines (subject to change), and other project details such as vehicle and transport requirements, infrastructure proposals such as sewerage and solid waste management treatment, and labour requirements, and accommodation recommendations for the workforce.
- Further fieldwork and study in some of the specialist fields, were as follows in **Table 13**. The overall outcome of each study is also presented below.

9.2 FINDINGS OF SPECIALIST STUDIES

Table 13: Specialist work findings

FIELD	WORK DONE DURING FULL IMPACT ASSESSMENT	KEY FINDINGS
Bats	A brief bat-monitoring study to confirm the occurrence of bats in the study area.	Thirteen (13) bat species have the potential to occur on the project sites (Error! Reference source not found. **in Appendix G**), two (2)of which, *Eidelon helvum* and *Taphazous mauritianus*, have been confirmed for Lüderitz. According to the study, the Angolan wing-gland bat *Cistugo seabrae* is an endemic of the region. Six of the 13 species are considered to be at high risk of fatality due to their flight behaviour. However, the harsh weather conditions on site and lack of roosting and foraging habitat means that large aggregations of bats are unlikely and bat activity levels will likely be low. Due to an uncertainty regarding the occurrence of species on site, the potential fatalities of bats due to collisions with WTG's rated of medium significance. Pre-construction and post-construction monitoring and adaptive management strategies are therefore recommended.
Vegetation	Confirmed the occurrence of the identified species expected to occur on the two sites by carrying out physical transects. Produce the vegetation impact assessment with recommendations for the ESMP. **Appendix E.**	The study area is a major centre of endemicity in Namibia. Most of the study sites are consistent with the vegetation zones marked "High Biodiversity Importance" in the TKNP Management Plan, with smaller pockets of the Very High Importance Zone. These pockets are to be avoided. The

FIELD	WORK DONE DURING FULL IMPACT ASSESSMENT	KEY FINDINGS
		40MW NamPower Site is mostly a greenfield site, while the 50MW IPP Site is largely disturbed, but with some 100 years of recovery already achieved. The overall potential impact on vegetation is rated High and can be mitigated to Medium by strictly limiting the footprint, avoiding sensitive zones and actively avoiding collateral damage.
Avifauna	Considered the final boundaries of the sites, updated project information and monitoring data acquired on site. Produced the avifauna impact assessment with recommendations for the ESMP. **Appendix F.**	Seventy avifauna species that have been identified to occur or to potentially occur at the project site. **Four (4)** are provisionally considered as priority species, based on their local or global conservation status, their level of endemicity, and their susceptibility to risks posed by wind parks (potential collisions with turbines and power lines). This list is subject to confirmation and revision upon completion of the pre-construction bird monitoring programme. Potential collisions of priority species with turbines and power line conductors has been rated low to medium, due to the area being generally species poor. The impact can be reduced to a low significance with mitigation including the marking of power line conductors, the colour of the turbines and the final placement of turbines.
Brown Hyena	After further project details had been obtained (i.e. waste management, number of vehicles to move on site, etc., and final boundaries of the two sites), produced the impact assessment for brown hyenas with recommendations for the ESMP. **Appendix H.**	The brown hyena is a flagship species in the TKNP and the conservation of the species is of utmost importance. The adjusted site boundaries avoid core denning sites. However, they still fall into the territories of at least two, possibly three brown hyena clans.

FIELD	WORK DONE DURING FULL IMPACT ASSESSMENT	KEY FINDINGS
		Potential disturbance of the brown hyena related to project activity rates of medium significance. This can be reduced to a low significance if all construction activities take place only when dens are inactive and maintenance work during the operational phase is limited to a minimum when dens are active.
Archaeology	Investigated the occurrence of historical and archaeological finds on the project sites and produced the impact assessment with mitigation should any be found. **Appendix I.**	The LWP project footprint has a low archaeological significance. There are important concentrations of archaeological sites in the same area but these are associated with specific environmental features and conditions. The exposed terrain of the LWP project site has no such features and has little associated archaeological evidence.
Civil Aviation	Consider the final localities and heights of the turbines and re-assess the state of turbines requiring Annex 14 and PANS-OPS assessments. Produced an impact assessment accordingly and provided further requirements. **Appendix K.**	The vicinity of the project to the Lüderitz airport necessitates height restrictions to the WTGs. The necessary PANS-OPS assessment for each mast that penetrates the Obstacle Surface Limitation should be conducted. Application should be made for the structures from the civil aviation authority and the height limitations provided. Keeping within the height restrictions and implementing the civil aviation safety measures provided will eliminate the high aviation safety risk.

FIELD	WORK DONE DURING FULL IMPACT ASSESSMENT	KEY FINDINGS
Visual Impact Assessment	Evaluated the viewpoints of the sites and conduct a visual impact assessment, followed by recommendations for mitigation. **Appendix J.**	The majority of viewscapes that are valuable to the tourism industry in the Lüderitz area remain unaffected by the project. One visually significant impact has been identified on a section of the potential Kolmanskop to Elizabeth bay tourism route. Colour schemes have been recommended, and the project is to be integrated with the history and development narrative used in the tourism industry.
Socio-economic Impact Assessment	Produced the socio-economic impact assessment and provided recommendations for mitigation of negative impacts and enhancement positive impacts. The assessment is contained in this report, **Section 5 and 8.**	Besides overall positive socio-economic impacts, the key negative socio-economic impact revolves around the housing for the workforce of the development, which cannot be accommodated within the TKNP. The additional housing demand in Lüderitz will increase the pressure on infrastructure and an influx of job seekers may be expected. A recruitment housing strategy needs to be developed in conjunction with the Lüderitz Town Council and the Regional Council.
Carbon footprint study	Considered the climate change risk of the project and the carbon footprint of the project as well as its contribution to Namibia's carbon footprint. **Appendix M.**	The risk that climate change may have on the project involves increased temperatures influencing the efficiency of equipment and the health of the workforce and sea level rise changes affecting the harbour and subsequently the operations of the project. These risks are all of medium to low significance and adaptive measures have been recommended to manage them. The project contributes very little to the overall carbon footprint of Namibia, notwithstanding factors such as manufacturing abroad and imports. When compared to

FIELD	WORK DONE DURING FULL IMPACT ASSESSMENT	KEY FINDINGS
		conventional power generation projects, wind energy generation offers the benefit of a relatively small carbon footprint. The overall impact is therefore a positive one since conventional non-renewable energy is replaced as a source with renewable energy.
Traffic Impact Assessment	Considered the details of the project, notably the transport requirements, vs. the existing road network and road conditions, and conducted a traffic impact assessment with recommendations for areas requiring design input and traffic interventions. **Appendix L.**	The Kolmanskop road is currently in a satisfactory condition and does not need paving to accommodate the additional traffic during construction. However, a maintenance agreement is recommended to maintain a satisfactory condition of the road. With a traffic management plan being recommended for the transportation of materials and equipment from the harbour to the site, traffic impact is expected to be low.
IFC Standards	Applied the IFC standards to the project and ensure all relevant ones are incorporated. Internal review to follow.	The ESIA is IFC compliant with the pending step of an IFC review to be completed.
Cumulative impacts	All the specialist impact assessments are to consider cumulative impacts, i.e. the combined effect of the developments in the SKNP, including the combined effect of the Wind Parks in the SKNP and along the coastal zone.	Relevant details are captured in each specialist study and summarised below.

9.3 CUMULATIVE IMPACT

Even though the project is located in a relatively sensitive area, the expected impacts of the project can remain within limits of acceptable change given its relatively small scale within the TKNP and the biome and sensitivity zones in which it is located. The workforce is also relatively small. Management strategies would have to be targeted and committed to limit this change, particularly those related to limiting footprint and avoiding collateral damage.

However, of greater concern is the effect of this project combined with a range of others either already implemented, approved but not yet implemented, still being considered for authorisation, or others not yet conceived. **Figure 34** provides an indication of known projects currently being considered.

Figure 34: Known planned wind park developments south of Lüderitz. (Sources: Interconsult/ED, 2015)

Figure 34 shows the potential for wind generation projects south of Lüderitz. It shows a significant wind power development potential in the //Karas Region.

Should the full potential be developed piece meal, some considerations include:

- Accommodation of workforce, and related issues including transport and housing impacts.

- Security protocols and daily access into the restricted area, access during night time (in case of breakdowns). Control of personnel within the restricted area.
- Deteriorating traffic flow and road conditions resulting from harbour imports, trucks to site, and conditions of roads.
- Impact on tourism and sense of place resulting from increased intensity of activity and visual impact
- Increased pressure on facilities, housing, roads, sewerage, water demand, electricity demand, waste disposal sites and other infrastructure in Lüderitz.
- Harmonisation with goals, objectives and principles of the TKNP Management Plan.
- Indirect impacts related to supporting industries being established.
- Impact on the integrity of the ecology, habitat and biodiversity of the TKNP.
- Impact on the topographical integrity of the TKNP.

While these issues may be manageable on an individual project basis and are being assessed for each project independently, resulting in relatively acceptable change expected for each, this may well not be the case if projects are considered jointly. It is therefore recommended that a Strategic Environmental Assessment (SEA) be initiated for wind park development in the TKNP and that suitable development areas with limits of acceptable change be identified by a core group of specialists, undergirded by the principles of the TKNP Management Plan, in collaboration with the MEFT. The individual developer such as NamPower could contribute toward such a study, commensurate their contribution to the cumulative footprint. Each individual developer can however not be held responsible for assessing these cumulative impacts and the initiation and funding of such a study should therefore be driven by the regulator.

9.4 CONCLUSION

The proposed 90MW wind generation project near Lüderitz (40MW NamPower Wind Park and 50MW IPP Wind Park) will offer increased power security and curb increases in future costs of energy for the country. It will also reduce the need to import ESKOM coal generated electricity followed by a reduced overall carbon footprint. It will also provide a welcome injection into the local and regional economy, in an otherwise strained economic climate.

Notwithstanding this, the project will be developed in a sensitive and unique biophysical setting. With the avoidance of sensitive ecological, technical and physical zones, the impacts expected from the project have been significantly

reduced. Key impacts, including those expected on vegetation and the brown hyena are still expected to be significant. Above average commitment is required to manage these impacts and to avoid them from becoming unacceptable. Even though wind turbines normally have a significant impact on avifauna (including bats) particularly due to collisions with turbines, this impact is expected to be low owing to limited suitable habitat and occurrence of species at risk. Monitoring should nevertheless continue to confirm these initial findings and to adapt strategies where necessary. The design measures, management regimes and monitoring requirements given in the ESMP are of utmost importance and should be structured into all communications and management platforms related to the project. With this condition in place, it is recommended that Environmental Clearance be granted for the project.

It is further recommended that an SEA be initiated for the development of wind power in the TKNP, with contributions made by all the prospective wind power developers.

10 BIBLIOGRAPHY

Burke, A., (2006). *The Sperrgebiet. Managing its biodiversity*. Enviroscience, Oranjemund and Namibia Nature Foundation, Windhoek.

Burke, A. & Mannheimer, C.A., (2004). *Plant species of the Sperrgebiet* (Diamond Area 1). *Dinteria* 29: 79-109.

Central Bureau of Statistics, (2004). *2001 Population and Housing Census: karas Region. Basic analysis and Highlights.* Windhoek: National Planning Commission.

Dudley, N., (2008). *Guidelines for Applying Protected Area Management Categories.* Gland, Switzerland: IUCN.

Enviro Dynamics and Interconsult, (Update 2018). *ESIA for the proposed Diaz Windpark near Luderitz.* Windhoe. Unpublished Report.

Global Wind Atlas, (2019). Wind Energy Data. https://globalwindatlas.info/. Accessed October 2020.

International Finance Corporation, (2006). *International Finance Corporation's Performance Standards* on Social & Environmental Sustainability.

International Finance Corporation, (2017). *Environmental, Health and Safety Guidelines for Wind Energy* . The World Bank Group.

Government of Namibia, (2007). *Environmental Management Act.* Windhoek: Government Gazette.

Maggs, G.L., Craven, P. & Kolberg H., (1998). Plant species richness, endemism and genetic resources in Namibia. *Biodiversity and Conservation* 7: 435–446.

Mannheimer, C.A., (2011). *Proposed Aeolus Windfarm. Specialist Vegetation Study*. Unpublished report for Enviro Dynamics.

Mannheimer, C.A., (2011). *Critical Habitat Assessment for Diaz Wind Farm*. Unpublished report for Enviro Dynamics.

Mendelsohn et. al., (2003). *Atlas of Namibia.* Cape Town: David Phillip Publishers.

Ministry of Environment and Tourism, (2001). *The Sperrgebiet Land Use Plan* (2nd Draft). Sperrgebiet Consortium, Windhoek.

Ministry of Environment and Tourism, (2013-2018). *Management Plan.* Tsau //Khaeb (Sperrgebiet) National Park. MET, Windhoek.

Ministry of Environment and Tourism, (2019). *The Tourism Development Plan for Tsau //Khaeb (Sperrgebiet) National Park 2019 to 2028*. MET, Windhoek.

Namibia Meteorological Services, (2015). *Weather data for Namibia for selected weather stations.* Retrieved 11 22, 2015, from http://www.meteona.com/attachments/035_Namibia_Long-term_Climate_Statistics_for_Specified_Places[1].pdf

National Planning Commission. (2007). *Karas Regional Poverty Profile*. Windhoek: Solitaire Press.

National Statistics Agency. (2015/2016). *Namibia Household and Expenditure Survey* . Windhoek. Namibia Statistics Agency .

Namibia Statistics Agency, (2016). *Namibia Inter-censal DEmographic Survey* . Windhoek. Namibia Statistics Agency.

Plecher, H. (2020). *Namibia Unemployment rate*. Retrieved 05 01, 2020, from Statista: https://www.statista.com/statistics/808804/unemployment-rate-in-namibia/

SIAPAC, (2001). *Environmental Impact Assessment of the proposed Wind Park at Luderitz.* Windhoek: Unpublished.

Republic of Namibia, (2007). *Karas Regional Poverty Profile*. Windhoek: National Planning Commission.

Smardon, C.S., (1988), *Visual Assessment Procedure for US Army Corps of Engineers*. Department of the Army.

World Population Review, (2020). *Population of Cities in Namibia (2020)*. Retrieved 05 01, 2020, from World Population Review: https://worldpopulationreview.com/countries/namibia-population/cities/