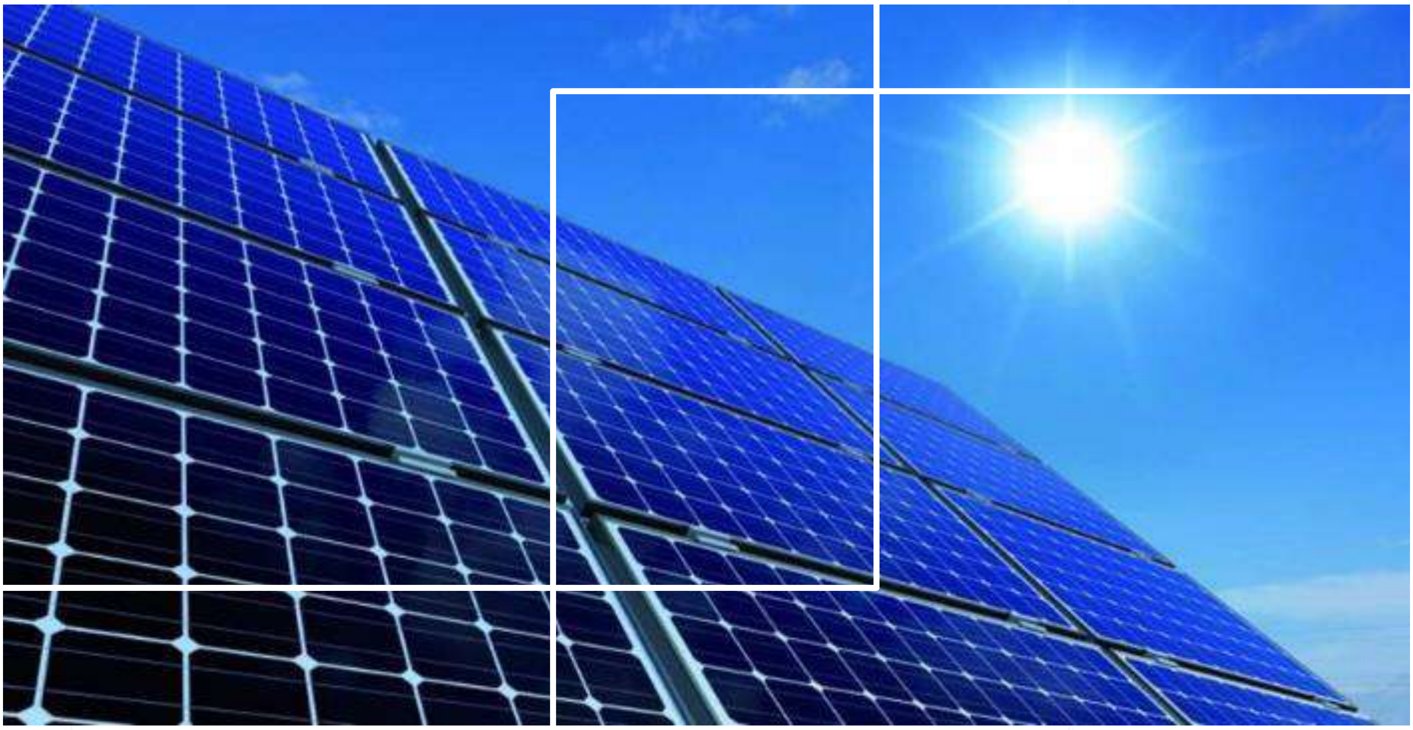

Submitted to: InnoSun Energy Holding (Pty) Ltd
Attention: Mr Pol Jestin

2 Schutzen Street,
Central Windhoek,
P.O. Box 27527,
Windhoek, Namibia

REPORT:

OSONA II – 36 MW SOLAR PV PLANT – SCOPING AND IMPACT ASSESSMENT REPORT

PROJECT NUMBER: ECC-43-418-REP-06-D

REPORT VERSION: REV 01

DATE: 8 DECEMBER 2022

Prepared by:

ECC ENVIRONMENTAL COMPLIANCE CONSULTANCY

TITLE AND APPROVAL PAGE

Project Name:	OSONA II – 36 MW SOLAR PV PLANT – SCOPING AND IMPACT ASSESSMENT REPORT
Client Company Name:	InnoSun Energy Holding (Pty) Ltd
Client Name:	Mr Pol Jestin
Ministry Reference:	221011000065
Authors:	Diaan Hoffman and Stephan Bezuidenhout
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DISCLAIMER

Environmental Compliance Consultancy (ECC) (Reg. No. CC 2013/11401) has prepared this report on behalf of the Proponent. This report has been authored by employees of ECC, who have no material interest in the outcome of this report, nor do any of the ECC team have any interest that could be reasonably regarded as being capable of affecting their independence in the preparation of this report. ECC is independent from the Proponent and has no vested or financial interest in the Project, except for fair remuneration for professional fees rendered which are based upon agreed commercial rates. Payment of these fees is in no way contingent on the results of this report or the assessment, or a record of decision issued by Government. No member or employee of ECC is, or is intending to be, a director, officer, or any other direct employee of the Proponent. No member or employee of ECC has, or has had, any shareholding in the Project. Any personal views or opinions expressed by the writer may not necessarily reflect the views or opinions of Environmental Compliance Consultancy or its client.

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EXECUTIVE SUMMARY

This scoping study has been undertaken by following the requirements of the Environmental Management Act (EMA), No.7 of 2007 and the Environmental Impact Assessment Regulation, No. 30 of 2012, gazetted under the Environmental Management Act, No. 7 of 2007.

The Proponent, InnoSun Energy Holdings is a subsidiary of the InnoVent Group, that originated in France. InnoSun Energy Holding (Pty) Ltd was established in 2012 in Nambia and has already set up the first wind (5 megawatts (MW)) and solar photovoltaic (PV) plants (20 MW) as an independent power producer in Namibia. InnoSun currently has about 100+ MW power plants under development. In 2020 the existing plants generated about 634 GWh of electricity which is equivalent to supplying about 38000 people with power.

The Proponent intends to construct and operate a 36 MW solar photovoltaic PV power plant on farm Osona Commonage No. 65 portion 82, which will be linked to a nearby NamPower substation. The solar plant and associated infrastructure will cover an area of approximately 120 ha. The power will be supplied to the national grid with the aim of trading energy on the Southern African Power Pool (SAPP) where off-take is required (multiple regions). Approval for the generation license was granted by the Electricity Control Board for InnoSun to implement the project. The license is currently heldunder the name Sorexa Sun Energy (Pty) Ltd. Sorexa, is a Special Purpose Vehicle (SPV) project company owned 100% by InnoSun Energy Holdings and the intention is to transfer all documentation into the name of a new Osona II SPV once the company is established and financially operational.

The following are envisioned to be installed and constructed during the construction phase of the project, tracking system with reinforced concrete (RC) foundations, PV solar arrays connected to inverters, cable trenches, building, small warehouse, fencing, medium voltage power lines, low voltage power lines, and transformers.

Through the scoping process and impact assessment, it was found that the significant impacts that may occur during the proposed construction and operational phases of the Project are impacts relating to visual disturbances of the proposed solar plant, the potential to uncover heritage remains, the potential removal of protected and vulnerable plant species, habitat destruction due to the clearing and preparation of about 120 ha of land, habitat fragmentation due to the proposed fence, avifauna impacts, potential removal or displacement of vulnerable or protected wildlife species and the potential soil disturbances due to construction and operational activities.

These impacts have been classified as minor to moderate and should thus be carefully monitored and managed according to the EMP and recommendations or mitigations in the Avifauna specialists' study, to ensure that the significance level of the impact is minimised as far as reasonably possible. With the implementation of best practice methods, national regulations and recommended mitigation measures, the significance of the impacts are expected to be low to minor.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

DEFINITIONS AND ABBREVIATIONS

TERM OR ABBREVIATION	DESCRIPTION
AIDS	Acquired Immune Deficiency Syndrome
COVID19	Corona Virus Disease 2019
dB	Decibel
DC	Direct current
DEA	Directorate of Environmental Affairs
CB	Electricity Control Board
ECC	Environmental Compliance Consultancy
EIA	Environmental Impact Assessment
EMA	Environmental Management Act
EMP	Environmental Management Plan
ESIA	Environmental and Social Impact Assessment
GIS	Geographic Information Systems
GDP	Gross Domestic Product
Ha	Hectares
HIV	Human Immunodeficiency Virus
I&AP	Interested & Affected Parties
IPP	Independent Power Producer
IFC	International Finance Corporation
IUCN	International Union for Conservation of Nature
kV	Kilovolts
kWh	Kilowatt per hour
kWp	Kilowatt peak
m^2	Square meters
MAWLR	Ministry of Agriculture, Water and Land Reform
masl	Meters above sea level
MEFT	Ministry of Environment, Forestry and Tourism
MW	Megawatts
MWh	Megawatts per hour
p.a.	Per annum
PV	Photovoltaic
PPE	Personal Protective Equipment
OSH	Occupational safety and health
SAPP	Southern African Power Pool
SANS	South African National Standards
RC	Reinforced concrete
RH	Relative Humidity
TB	Tuberculosis
Wp	watt peak
WHO	World Health Organisation

1 INTRODUCTION

1.1 BACKGROUND INFORMATION

The purpose of the report is to provide the necessary environmental and social scoping and assessment for the proponent to apply for and obtain an environmental clearance certificate for the construction and operation of Osona II - a 36 megawatt (MW) solar photovoltaic (PV) power plant on farm Osona Commonage No. 65 portion 82, Otjozondjupa Region, Namibia (Figure 1).

Environmental Compliance Consultancy (ECC) has been contracted by InnoSun Energy Holding (Pty) Ltd to conduct an environmental assessment and develop an environmental management plan (EMP), for the proposed construction and operation of Osona II – 36 MW solar photovoltaic power plant near Okahandja, Otjozondjupa Region, Namibia. Consistent with the Environmental Management Act, 2007 and its regulations, an environmental clearance certificate application is hereby submitted to the competent authority being the Ministry of Mines and Energy (MME) and Ministry of Environment, Forestry and Tourism (MEFT) to make a Record of Decision (RoD) with regards to the proposed project.

The 120-ha leased area on farm Osona Commonage No. 65 portion 82 is located to the southwest of Okahandja and is accessible via the D1972 district road (about 19 km) leading off the B1 highway as set out in the location as shown in Figure 1.

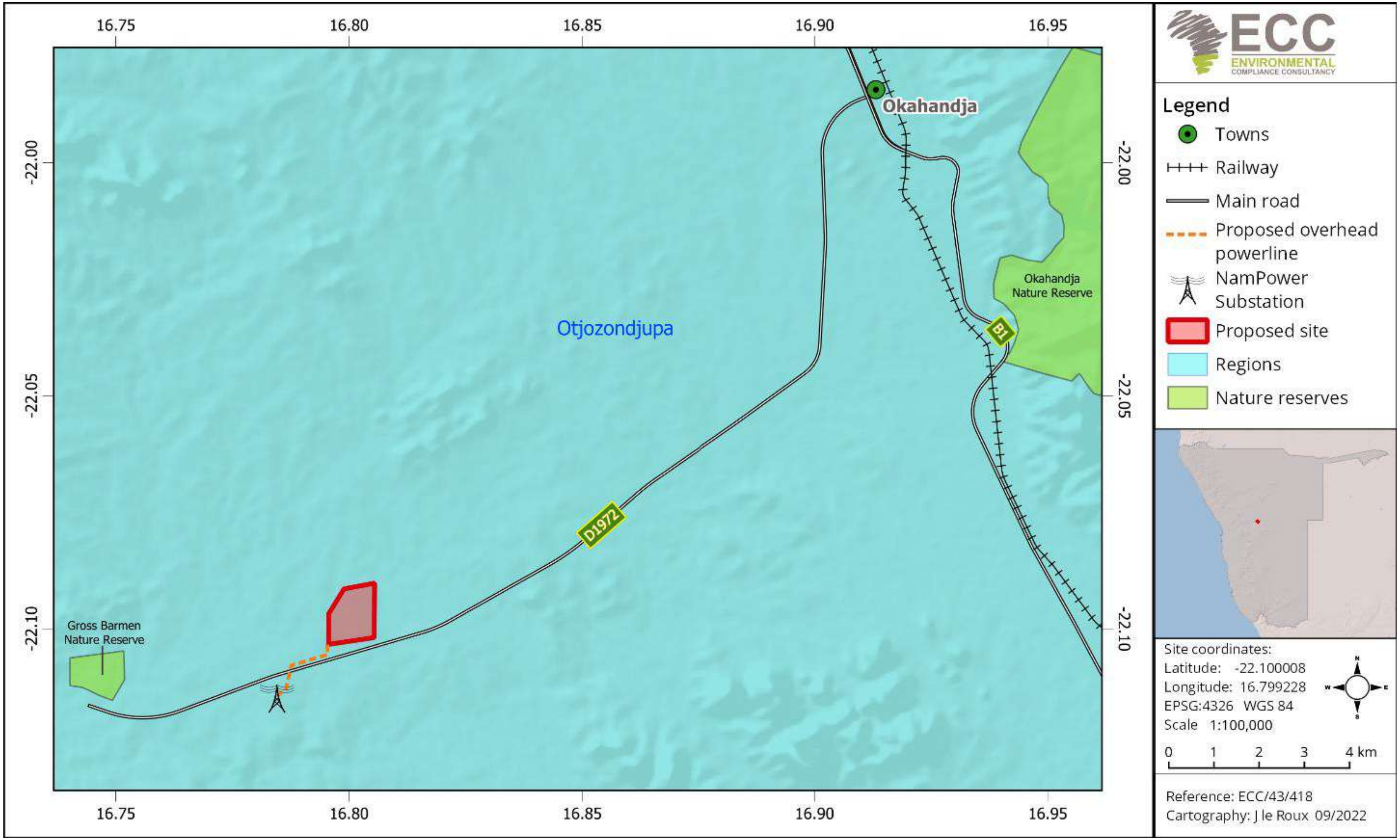

Figure 1 – Locality map of the proposed Project location

1.2 PURPOSE OF THE SCOPING REPORT

An environmental and social impact assessment (ESIA) has been conducted in compliance with the Namibian Environmental Management Act, 2007 and its regulations. This report presents the findings of the ESIA process. In addition to describing the prescribed ESIA process, the report describes the baseline biophysical and socioeconomic environments, provides a project description, findings from the scoping and assessment phases, and presents an environmental management plan (EMP). The scope of the assessment was determined by undertaking an assessment of the proposed Project against the receiving environment, obtained through a desktop review, available site-specific literature, and site reports.

ECC has prepared this report. ECC's terms of reference for the assessment are strictly to identify, assess and address potential effects, whether positive or negative, establish their relative significance, explore alternatives for technical recommendations and identify appropriate mitigation measures.

This report provides information to the public and stakeholders to aid in the decision-making process for the Project. The objectives are to:

- Describe the proposed activity and the site on which the activity is to be undertaken;
- Describe the baseline environment that may be affected by the proposed activity;
- Identify the laws and guidelines that have been considered in the assessment and preparation of this report;
- Provide details of the public consultation process;
- Describe the need and benefits of the proposed activity; and
- Provide a high-level analysis of feasible or unfeasible alternatives that were considered; and
- Provide an assessment of potential impacts identified.

The Ministry of Mines and Energy (MME) and the Ministry of Environment, Forestry and Tourism (MEFT) as the competent authorities, deal with applications for environmental clearance and have determined that an Environmental Management Plan (EMP) be developed to provide a management framework for the planning and implementation of the development. The EMP provides development standards and arrangements to ensure that the potential environmental and social impacts are mitigated, prevented, minimised and/or enhanced as far as reasonably practicable and that statutory requirements and other legal obligations are fulfilled.

1.3 THE PROPONENT OF THE PROPOSED PROJECT

Table 1 – Proponent's details

Company Representative:	Contact Details:
Mr Pol Jestin	InnoSun Energy Holding (Pty) Ltd +264 815551362 2 Schutzen Street, Central Windhoek, P.O. Box 27527, Windhoek pjestin@innosun.org

1.4 ENVIRONMENTAL AND SOCIAL ASSESSMENT PRACTITIONER

Environmental Compliance Consultancy (ECC) (Reg. No. CC 2013/11401) has prepared this report and the EMP on behalf of the Proponent.

This report has been authored by employees of ECC, who have no material interest in the outcome of this report, nor do any of the ECC team have any interest that could be reasonably regarded as being capable of affecting their independence in the preparation of this report. ECC is independent of the Proponent and has no vested or financial interest in the Project, except for fair remuneration for professional fees rendered which are based upon agreed commercial rates. Payment of these fees is in no way contingent on the results of this report or the assessment, or a record of decision issued by the Government.

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1.5 ENVIRONMENTAL REQUIREMENTS

The Environmental Management Act, 2007, and its regulations stipulate that an environmental clearance certificate is required before undertaking any of the listed activities that are identified in the Act and its regulations. Potential listed activities triggered by the Project are provided in Table 2.

Table 2 – Activities potentially triggered by the proposed Project.

Source: Environmental Management Act, 2007, and its regulations

Listed activity	As defined by the regulations of Act	Relevance to the project
Energy generation, transmission and storage activities	1. The construction of facilities for – (a) The generation of electricity (b) the transmission and supply of electricity	A solar PV power plant and associated infrastructure (Tracking System with RC Foundations, PV Solar arrays connected to inverters, cable trenches, building, small warehouse, fencing, Medium Voltage power lines, Low Voltage power lines, and Transformers) will be constructed and installed on-site and cater for a peak demand of 36 MW. A 66kV overhead powerline (2 km in length) will be installed to a nearby substation.
Waste management, treatment, handling and disposal activities	2.2. Any activity entailing a scheduled process referred to in the Atmospheric Pollution Prevention Ordinance, 1976. 2.3 The import, processing, use and recycling, temporary storage, transit or export of waste.	A small septic tank will be installed on-site (operational phase) and portable chemical toilets will be used during the construction phase. Waste generated during the construction phase will be removed by a skip and will be disposed of at the nearest landfill site (Okahandja).
Forestry activities	4. The clearance of forest areas, deforestation, afforestation, timber harvesting or any other related activity that requires authorisation in terms of the Forest Act, 2001 (Act No. 12 of 2001) or any other law.	Vegetation will be cleared for the construction and installation of the solar PV power plant, a small warehouse and associated infrastructure, which will include approximately 120 hectares. Two maintenance access roads approximately 40 m wide.

Listed activity	As defined by the regulations of Act	Relevance to the project
Land use and development activities	5.3 Construction of veterinary protected area or game proof and international boundary fences.	A fence will be constructed around the proposed solar plant for security purposes.
Water resource developments	8.9 Construction and other activities within a catchment area.	The solar PV plant will be constructed near the Swakop river, with a few very minor drainage lines forming within the site and two minor drainage lines running outside of the boundaries of the site.
Hazardous substance treatment, handling and storage	9.2 Any process or activity which requires a permit, licence or other form of authorisation, or the modification of or changes to existing facilities for any process or activity which requires an amendment of an existing permit, licence or authorisation or which requires a new permit, licence or authorisation in terms of a law governing the generation or release of emissions, pollution, effluent or waste.	A small septic tank will be installed for the permanent ablutions that will be constructed.

2 APPROACH TO THE ASSESSMENT

2.1 THE ASSESSMENT PROCESS

The ESIA methodology applied for the Project has been developed using the International Finance Corporation (IFC) standards and models, in particular, Performance Standard 1; 'Assessment and management of environmental and social risks and impacts' (International Finance Corporation, 2017) (International Finance Corporation, 2012), which establishes the importance of:

- Integrated assessment to identify the environmental and social impacts, risks, and opportunities of projects;
- Effective community engagement through disclosure of project-related information and consultation with local communities on matters that directly affect them; and
- The client's management of environmental and social performance throughout the life of the Project.

Furthermore, the Namibian Draft Procedures and Guidance for ESIA and EMP (Republic of Namibia, 2008) as well as the international and national best practice; and over 25 years of combined EIA experience, were also drawn upon in the assessment process.

This impact assessment is a formal process in which the potential effects of the Project on the biophysical, social and economic environments are identified, assessed and reported so that the significance of potential impacts can be taken into account when considering whether to grant approval, consent or support for the Project.

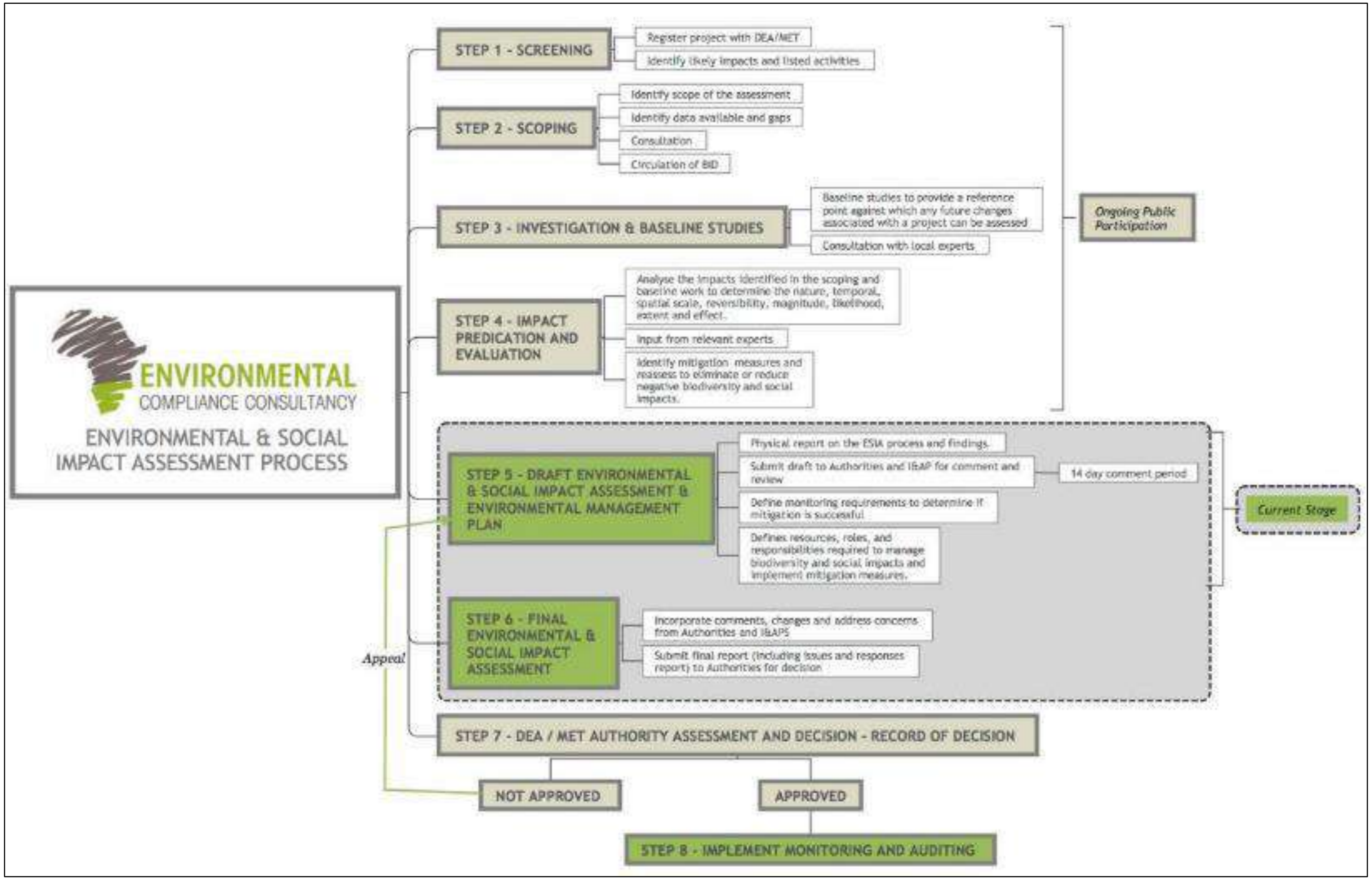

Figure 2 – ECC ESIA method

2.2 SCREENING OF THE PROJECT

The first stages in the ESIA process are to register the Project with the DEA and undertake a screening exercise to determine whether it is considered a listed activity under the Environmental Management Act, No. 7 of 2007 (and associated regulations) and if significant impacts may arise from the Project. The location, scale and duration of Project activities will be considered against the receiving environment.

It was concluded that an ESIA (i.e., scoping report and EMP) is required, as the Project is considered a listed activity and there may be potential for significant impacts to occur.

2.3 SCOPING OF THE ENVIRONMENTAL ASSESSMENT

Where an ESIA is required, the second stage is to scope the assessment. The main aim of this stage is to determine which impacts are likely to be significant (the main focus of the assessment), scope the available data and any gaps which need to be filled, determine the spatial and temporal scope and identify the assessment methodology.

The screening phase of the Project is a preliminary analysis to determine ways in which the Project may interact with the biophysical, social and economic environment. Impacts that are identified as potentially significant during the screening and scoping phases are taken forward for further assessment in the ESIA process. The details and outcomes of the screening process are discussed further in sections 6 and 7.

Subsequently, scoping of the ESIA was undertaken by the EIA team. The scope of the assessment was determined by screening the Project against the receiving environment obtained through a high-level desktop review. Feedback from consultation with the client also informed this process.

2.4 BASELINE STUDIES

Baseline studies are undertaken as part of the scoping stage, which involves collecting all pertinent information from the current status of the receiving environment. This provides a baseline against which changes that occur as a result of the Project can be measured.

The Project's baseline information was obtained through a desktop study, focusing on environmental receptors that could be affected by the proposed Project, verified through site-specific information. The baseline information is covered in section 5.

A robust baseline is required to provide a reference point against which any future changes associated with a project can be assessed, and it allows for suitable mitigation and monitoring actions to be identified. An avian specialist study has also been conducted for the ESIA which can be seen in Appendix E.

The existing environment and social baseline for the Project were collected through various methods:

- Desktop studies;
- Consultation with stakeholders;
- Specialists studies conducted in the general area of the proposed site; and
- Engagement with Interested and Affected Parties (I&APs) - See Appendix C.

2.5 IMPACT PREDICTION AND EVALUATION

Impact prediction and evaluation involve predicting the possible changes to the environment as a result of the development/Project. The recognized methodology was applied to determine the magnitude of impact and whether or not the impact was considered significant and thus warrants further investigation. The impact prediction and evaluation methodology used are presented in section 6 of this report. The findings of the assessment are presented in section 7.

2.6 ESIA CONSULTATION

Public participation and consultation are requirements stipulated in section 21 of the Environmental Management Act, No. 7 of 2007 and associated regulations for a project that needs an environmental clearance certificate. Consultation is a compulsory and critical component in the ESIA process in achieving transparent decision-making and can provide many benefits.

The objectives of the stakeholder engagement process are to:

- Provide information on the Project to I&APs: introduce the overall concept and plan;
- Clarify responsibility and regulating authorities;
- Listen to and understand community issues, concerns and questions;
- Explain the process of the ESIA and the timeframes involved; and
- Establish a platform for ongoing consultation.

2.7 INTERESTED AND AFFECTED PARTIES

Farm Osona Commonage is surrounded by privately owned farms, Gross Barmen hot springs resort (NWR) and plots (See Figure 3). The 120-ha leased area is located to the southwest of Okahandja and is accessible via the D1972 district road (about 19 km) leading off the B1 highway.

The owners of the farms that border the Project site were identified as I&APs, as well as the relevant local authority bodies. Other I&APs were identified through invitations such as newspaper advertisements and site notices.

2.8 SITE NOTICES

A site notice ensures neighbouring properties and stakeholders are made aware of the proposed Project. The notice was set up at the boundary of the proposed site as illustrated in Appendix C.

2.9 NEWSPAPER ADVERTISEMENTS

Notices regarding the Project and associated activities were circulated in three newspapers namely the 'Republikein', Allgemeine Zeitung' and the 'Sun' on the 13th and 20th of September 2022. The purpose of this was to commence the consultation process and enable I&APs to register an interest in the Project. The adverts can be found in Appendix C.

2.10 BACKGROUND INFORMATION DOCUMENT

The background information document presents a high-level description of the Project sets out the ESIA process and when and how consultation is undertaken and provides contact details for further Project-specific inquiries to all registered I&APs. The BID was distributed to all registered and identified I&APs for the Project.

2.11 SUMMARY OF ISSUES RAISED

The initial public participation phase involves the notifications of the Project through media such as; newspaper adverts, direct mail sent to identified I&APs and the display of site notices. No feedback has been received by I&APs.

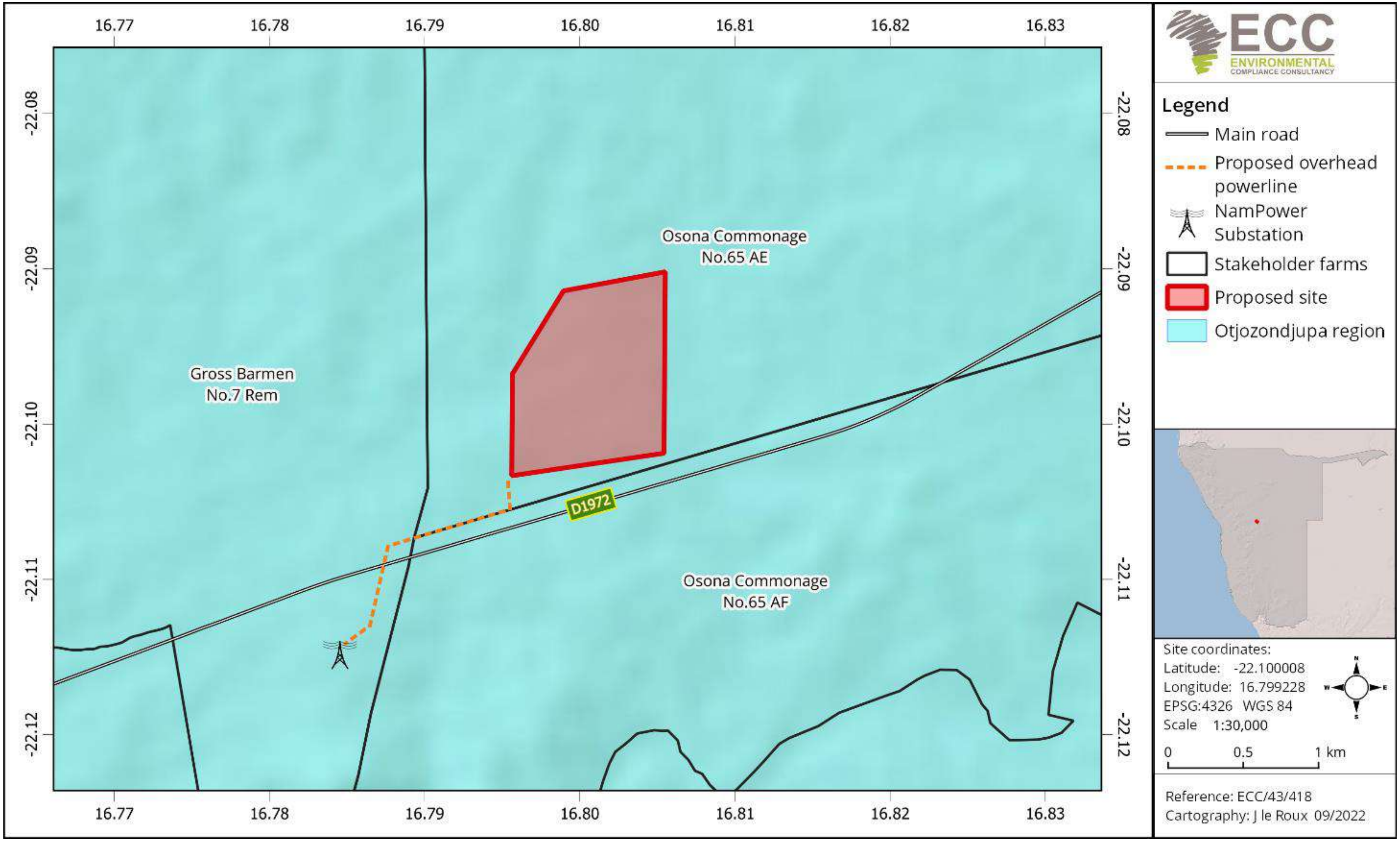

Figure 3 - Map showing the neighbouring farms of Farm Osona Commonage No. 65 portion 82

2.12 DRAFT ESIA AND EMP

This report and EMP for the Project's environmental clearance include an assessment of the biophysical and social environment, which satisfies the requirements of step 5 (Figure 2).

This combined scoping and ESIA report documents the findings of both the scoping and assessment processes and provides stakeholders with the opportunity to comment and continue consultation and forms part of the environmental clearance application. The EMP provides measures to manage the environmental and social impacts of the Project and outlines specific roles and responsibilities to fulfil the plan. This ESIA report focuses on the significant impacts that may arise from the Project as described in step 4 (Figure 2). These impacts are discussed in section 7.

This stage aims to ensure all stakeholders and I&APs have the opportunity to provide final comments on the assessment process, and findings and register their concerns. Should any significant changes arise that were not captured in the scoping report an addendum report will be submitted to the directorate of environmental affairs (DEA) incorporating such comments.

2.13 FINAL ESIA AND EMP

The final Scoping report and associated appendices will be available to all stakeholders on the ECC website www.eccenvironmental.com and will be published on the MEFT website for public access.

The ESIA report and appendices will be formally submitted to the Office of the Environmental Commissioner, DEA as part of the application for an environmental clearance certificate for the Project.

2.14 AUTHORITY ASSESSMENT AND DECISION MAKING

The Environmental Commissioner in consultation with other relevant authorities will assess if the findings of the ESIA presented in the amended ESIA report is acceptable. If deemed acceptable, the Environmental Commissioner will revert to the Proponent with a record of decision and any recommendations.

2.1 MONITORING AND AUDITING

In addition to the EMP being implemented by the Proponent, a monitoring strategy and audit procedure will be determined by the Proponent and competent authority. This will ensure key environmental receptors are monitored over time to establish any significant changes from the baseline environmental conditions caused by project activities.

3 REVIEW OF THE LEGAL ENVIRONMENT

This chapter outlines the regulatory framework applicable to the proposed Project. As stated in section 1, environmental clearance is required for any activity listed in the Government Notice No. 29 of 2012 of the EMA.

3.1 NATIONAL LEGISLATION AND RELEVANT INTERNATIONAL PERFORMANCE STANDARDS

Table 3 - Legal compliance

National regulatory regime	Summary	Applicability to the project
Constitution of the Republic of Namibia of 1990	The Constitution of the Republic of Namibia, 1990 clearly defines the country's position concerning sustainable development and environmental management. Article 95 of the constitution refers that the state shall actively promote and maintain the welfare of the people by adopting policies aimed at the following: *"Maintenance of ecosystems, essential ecological processes and biological diversity of Namibia and utilization of living natural resources on a sustainable basis for the benefit of all Namibians, both present, and future; in particular, the government shall provide measures against the*	The proponent will conform by engaging the local community for the proposed Project by prioritizing local jobs through the different stages of the Project.

National regulatory regime	Summary	Applicability to the project
	dumping or recycling of foreign nuclear and toxic waste on Namibian territory."	
Environmental Management Act, (No. 7 of 2007) and its regulations, including the Environmental Impact Assessment Regulation, 2007 (No. 30 of 2012)	The Act aims to promote sustainable management of the environment and the use of natural resources by establishing principles for decision-making on matters affecting the environment. It sets the principles of environmental management as well as the functions and powers of the minister. The Act requires certain activities to obtain an environmental clearance certificate before project development. The Act states an EIA may be undertaken and submitted for as record of decision as part of the environmental clearance certificate application. The MEFT is responsible for the protection and management of Namibia's natural environment. The Department of Environmental Affairs under the MEFT is responsible for the administration of the EIA process.	The proposed Project triggers the need for environmental assessments before commencement, thus the Environmental scoping report (and EMP) documents the findings of the environmental assessment undertaken for the proposed Project, which will form part of the environmental clearance application. The assessment and report have been undertaken in line with the requirements under the Act and associated regulations.

National regulatory regime	Summary	Applicability to the project
Electricity Act No. 4 of 2007 & its Regulations.	"To establish the Electricity Control Board and provide for its powers and functions; to provide for the requirements and conditions for obtaining licences for the provision of electricity; to provide for the powers and obligations of licensees, and to provide for incidental matters".	The project will be generating and supply renewable energy. The proponent considers and maintains the Act and its regulations together with the breakdown process to apply for the provision of electricity licences. The Proponent should ensure that all requirements from the Electricity Control Board are followed and adhered to.
National policy for Independent power Producers (IPPs) of 2018	The policy outlines the key provisions of MME commitments to encourage private investment in Namibia's power sector and outlines the power market model, pricing regime, procurement approach, and the requirements for the IPPs to develop power generation projects and seek licenses for implementing the projects.	The proposed Project is classified as a medium-size independent power producer project (5 to 100 MW). The proponent takes into consideration, the procedures necessary towards obtaining an independent power producer licence.
Water Act, No. 54 of 1956	Although the Water Resources Management Act, No. 11 of 2013 has been promulgated, it cannot be enacted as the regulations have not been passed – so the Water Act 54 of 1956 is still in effect. This act provides for *"the control, conservation and use of water for domestic, agricultural, urban and industrial purposes; to make provision for the control, in a certain respect*	The Act stipulates obligations to prevent the pollution of water. Should wastewater be discharged, a permit is required. The EMP sets out measures to avoid polluting the water environment. Measures to minimise potential groundwater and surface water pollution are contained in the EMP.

National regulatory regime	Summary	Applicability to the project
	and for the control of certain activities on or in water in certain areas". The Department of Water Affairs within the Ministry of Agriculture Water and Land Reform (MAWLR) is responsible for the administration of the Act.	
Soil Conservation Act, No. 76 of 1969) and the Soil Conservation Amendment Act, No. 38 of 1971)	Makes provision for the prevention and control of soil erosion and the protection, improvement and conservation, improvement and manner of use of the soil and vegetation.	The land will be cleared for the construction/installation of the solar components (solar panels and inverters) and associated infrastructure, which could constitute a risk for soil erosion and disturbances.
The Forestry Act, No. 12 of 2001 as amended by the Forest Amendment Act, No. 13 of 2005	Section 22 and 23 discusses the requirements and protection of vegetation in natural areas. A permit for the cutting, destruction or removal of vegetation that are classified under rare and or protected species; clearing the vegetation on more than 15 hectares on any piece of land or several pieces of land situated in the same locality which has predominantly woody vegetation, or cut or remove more than 500	The necessary permits (for the 120 ha area) should be obtained from the MEFT, where the application should satisfy that the cutting and removal of vegetation will not interfere with the conservation of soil, water or forest resources.

National regulatory regime	Summary	Applicability to the project
	cubic metres of forest produce from any piece of land in a period of one year.	
National Heritage Act, No. 27 of 2004.	The Act provides the provision for the protection and conservation of places and objects with heritage significance.	There might be potential for heritage objects to be found on-site, therefore the stipulations in the Act have been taken into consideration and are incorporated into the EMP. The chance find procedure must be used in the event of identifying potential heritage sites
Nature Conservation Ordinance Act No. 4 of 1975 and its regulations.	“The Act makes provision for the conservation and management of wildlife and regulates fishing in inland waters. The text consists of 91 sections divided into 7 Chapters and completed by 9 Schedules. The Chapters are the following: Preliminary (I); Game Parks and Nature Reserves (II); Wild animals (III); problem animals (IV); Fish in inland waters (V); Indigenous plants (VI); general (VII). The Nature Conservation Board shall be continued under section 3. The Cabinet may appoint Nature Conservator”.	The land will be cleared to accommodate the proposed development, potentially leading to habitat loss, destruction, and fragmentation. The proponent considers the impacts involved, thus impacts magnitude are discussed in this report in section 7 and mitigation measures and rehabilitation in the EMP.
Labour Act, No. 11 of 2007: Regulations relating to the	The Act provides for the regulation of employees’ health and safety in the workplace.	Noise and dust deposition during construction and maintenance are probable disturbances that potentially could impact workers, therefore consideration of operations that could compromise the safety and welfare of workers are accounted for in the EMP. The Proponent will be

National regulatory regime	Summary	Applicability to the project
Health and Safety of Employees at Work (GN 156/1997).		responsible to develop and implement a health and safety management plan.
The Regional Councils Act (No. 22 of 1992)	The Act sets out conditions under which Regional Councils must be elected and administer each delineated region. From a land use and project planning point of view, their duties include, as described in section 28 "to undertake the planning of the development of the region for which it has been established with a view to physical, social, and economic characteristics, urbanisation patterns, natural resources, economic development potential, infrastructure, land utilisation pattern and sensitivity of the natural environment. The main objective of this Act is to initiate, supervise, manage, and evaluate development.	In conjunction with this Act, the proponent should recognise the power vested in the Otjozondjupa Regional Councils as an I&AP and will be consulted during the Environmental Impact Assessment (EIA) process.

Table 4 – Specific permits and licence requirements for the proposed Project

Permit, licence or registration	Relevant authority	Project bearing
Sewage permits	Ministry of Agriculture, Water and Land Reform	Permits related to the sewage system (septic tank) should be obtained.
Permits for the removal of vegetation	Ministry of Environment, Forestry and Tourism	Permits will need to be obtained for the clearing of vegetation in the 120 ha area and for the removal of protected species and for the access roads.
Electricity generation licence	Electricity Control Board (ECB)	The Proponent has already received approval for the generation license from the ECB, as seen in Appendix G. The approval granted to InnoSun allows an installed capacity of 44.876MWp. The License is granted to a project SPV called **Sorexa Sun Energy (Pty) Ltd** (Reg: 2021/0895), owned 100% by InnoSun.

3.2 INTERNATIONAL BEST PRACTICE DOCUMENTS

The following documents apply to this development:

- **IUCN:** Mitigating biodiversity impacts associated with solar and wind energy development guidelines for project developers;
- **BirdLife South Africa:** Best practice guidelines - Birds and Solar Energy Guidelines for assessing and monitoring the impact of solar power generating facilities on birds in southern Africa (Jenkins et al. 2017); and
- **IFC:** Utility-Scale Solar Photovoltaic Power Plants. A Project Developer's Guide.

4 PROJECT DESCRIPTION

4.1 COMPANY BACKGROUND

The Proponent, InnoSun Energy Holdings is a subsidiary of the InnoVent Group, that originated in France. InnoSun Energy Holding (Pty) Ltd was established in 2012 in Nambia and has already set up the first wind (5 MW) and solar PV plants (20 MW) as an independent power producer in Namibia. InnoSun currently has about 100+ MW power plants under development. In 2020 the existing plants generated about 634 GWh of electricity which is equivalent to supplying about 38000 people with power.

InnoSun's vision and mission are: "*Our Vision is to significantly increase Namibia's renewable energy generation capacity, our Mission is to supply our customers with affordable, sustainable power".*

4.2 NEED FOR THE PROJECT

Namibia is a country with very few overcast days throughout the year, thus being ideal for renewable energy sources like solar power. Renewable energy sources are needed to move away from fossil fuel use, especially in light of the current climate crisis. Namibia's revised energy and climate change strategy and plan, presented to the COP26 in Glasgow in mid-November 2021, calls for a significant effort to ramp up the nation's renewable energy, particularly solar energy.

InnoSun Energy Holding (Pty) Ltd, through its project companies, aims to supply renewable, sustainable and affordable power throughout Namibia.

4.3 ALTERNATIVES NEEDED

Best practice environmental assessment methodology calls for consideration and assessment of alternatives to the Project. In terms of the Environmental Management Act, No. 7 of 2007 and its regulations, alternatives considered should be analysed. This requirement ensures that during the design evolution and decision-making process, potential environmental impacts, costs, and technical feasibility have been considered, which leads to the best option(s) being identified.

There were no other readily available and feasible sites, and the current identified location is ideally located next to Innosun's existing Osona 5 MW solar PV plant, and the landowner has provided permission (Appendix D, shows the agreement with the landowner) for the development of the proposed solar plant. The proposed Project is also planned near a NamPower substation, where the solar plant will be linked.

During the ESIA assessment, alternatives will take the form of consideration of optimisation and using eco-friendly solutions to reduce potential impacts.

4.4 BACKGROUND OF THE PROJECT

The Proponent intends to construct and operate a 36 MW solar PV power plant on farm Osona Commonage No. 65 portion 82, which will be linked to a nearby NamPower (Osona) substation. The solar plant and associated infrastructure will cover an area of approximately 120 ha. The power will be supplied to the national grid with the aim of trading energy on the Southern African Power Pool (SAPP) where off-take is required (multiple regions).

The following construction and installations are envisioned during the proposed Project:

- a tracking system with RC foundations;
- PV solar arrays connected to inverters;
- cable trenches;
- building;
- small warehouse;
- fencing;
- medium voltage power lines;
- low voltage power lines; and
- transformers.

The proposed solar PV plant will be linked to the nearby NamPower (Osona) substation with a 66kV overhead powerline (2 km in length), similar to the example in Figure 5.

4.5 PROPOSED INFRASTRUCTURE LAYOUT ON-SITE

A ground-mounted single-axis tracking solar photovoltaic plant with a nominal capacity of approximately 36 000 kWac (36 MW) equivalent to circa. 45MWp is planned to be constructed on farm Osona Commonage No. 65 portion 82.

The site layout of the proposed solar PV power plant can be seen in Figure 6 and 7. The plant will consist of solar components and a small substation that will be linked to a nearby NamPower substation (Osona substation) to the southwest of the site with a 66 kV overhead powerline (2 km in length). The layout of the proposed building can also be seen in Figure 8.

The main technical specifications are as follows (final designs and specifications might change slightly):

- 36 000 kWac (36 MW) nominal capacity;
- Approximately 83000 PV panels;
- Tracker tables with shallow pile foundation (about 1.5 m below ground);
- 7/8 x 5/6 MVA transformers spread evenly across the site (Figure 7);
- Control room/warehouse, about 2500m^2.

- The specific yield will be 2533 kWh/kWp/p.a;
- Annual solar plant output of approximately 114 GWh;
- Modules will include Bi-facial, >540-watt peak (Wp);
- Inverters (centralised, string) will include string inverters >110 kVA each (~800V); and
- A single-axis (east to west) tracker.

The Proponent should also ensure that all Nampower safety requirements and recommendations concerning the construction overhead powerline are followed and adhered to.

Figure 4 also gives a visual overview of the mechanisms of a solar PV plant.

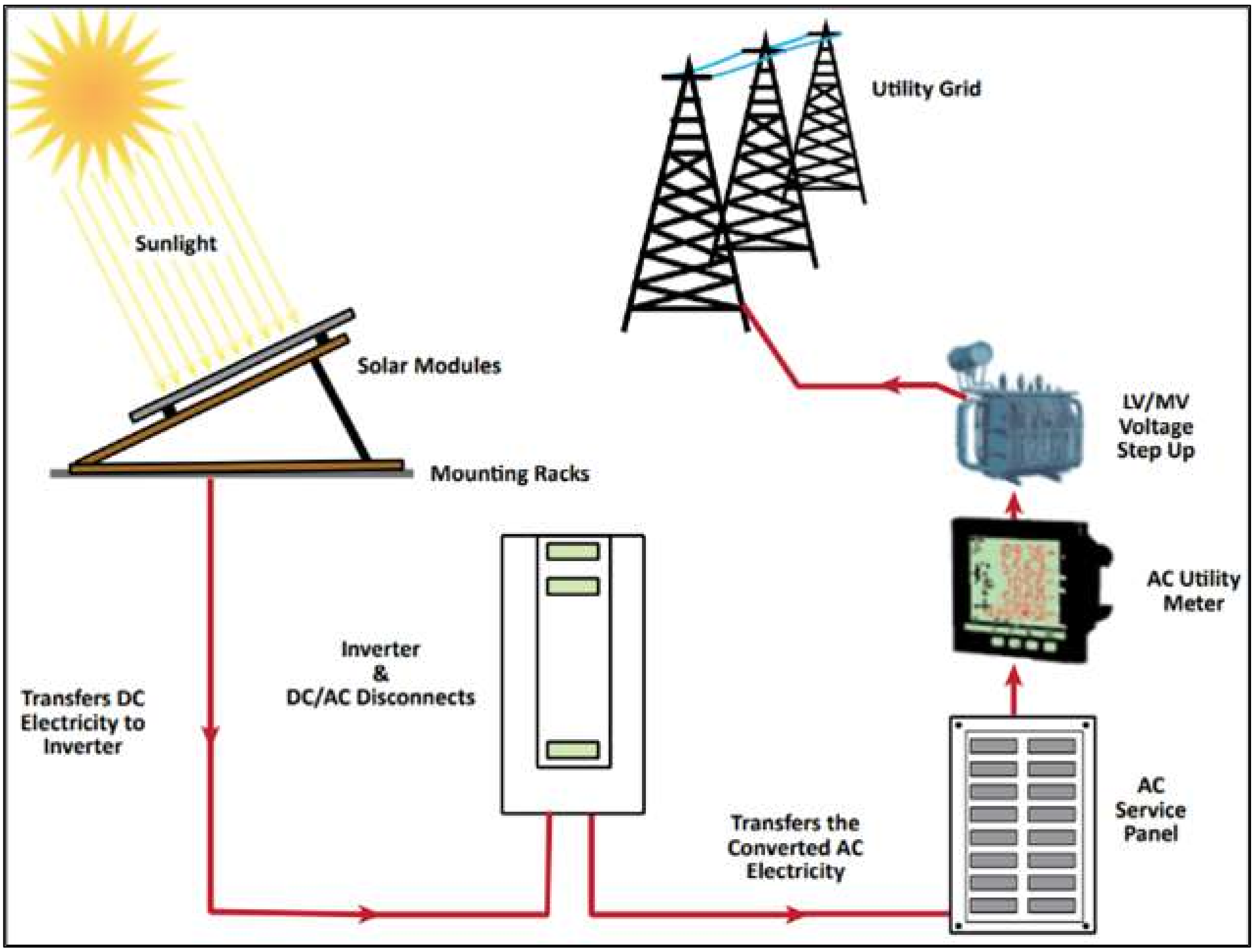

Figure 4 - Overview of a solar PV plant (IFC, 2015)

Figure 5 – Proposed overhead powerline will be similar to the example in the figure.

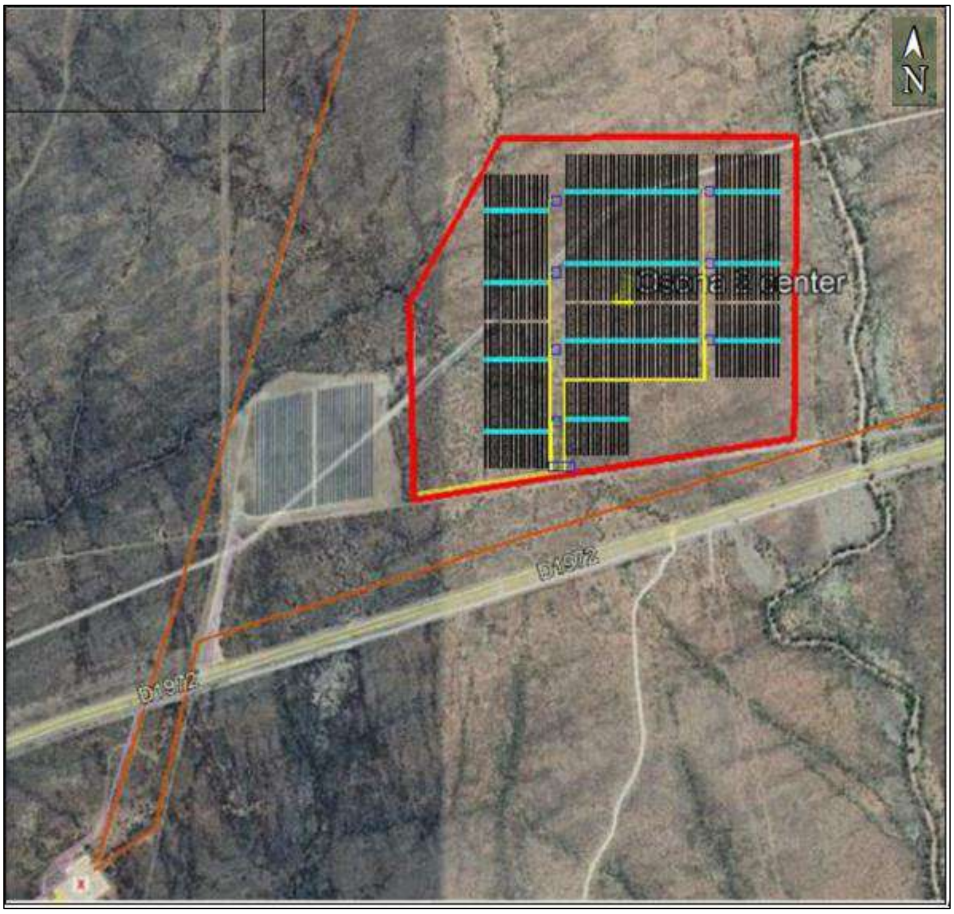

Figure 6 – Proposed preliminary solar layout

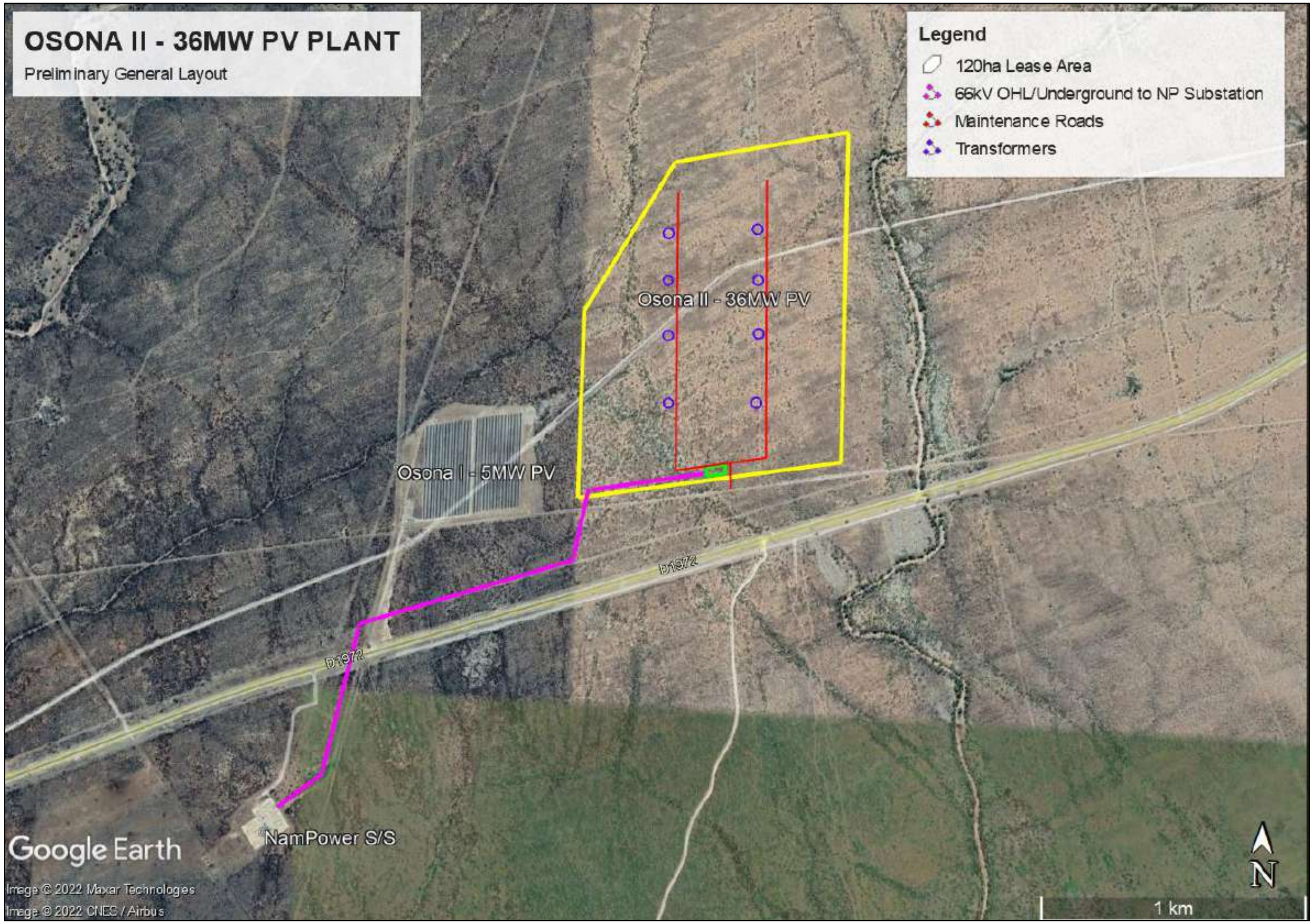

Figure 7 – Proposed preliminary general infrastructure arrangement layout.

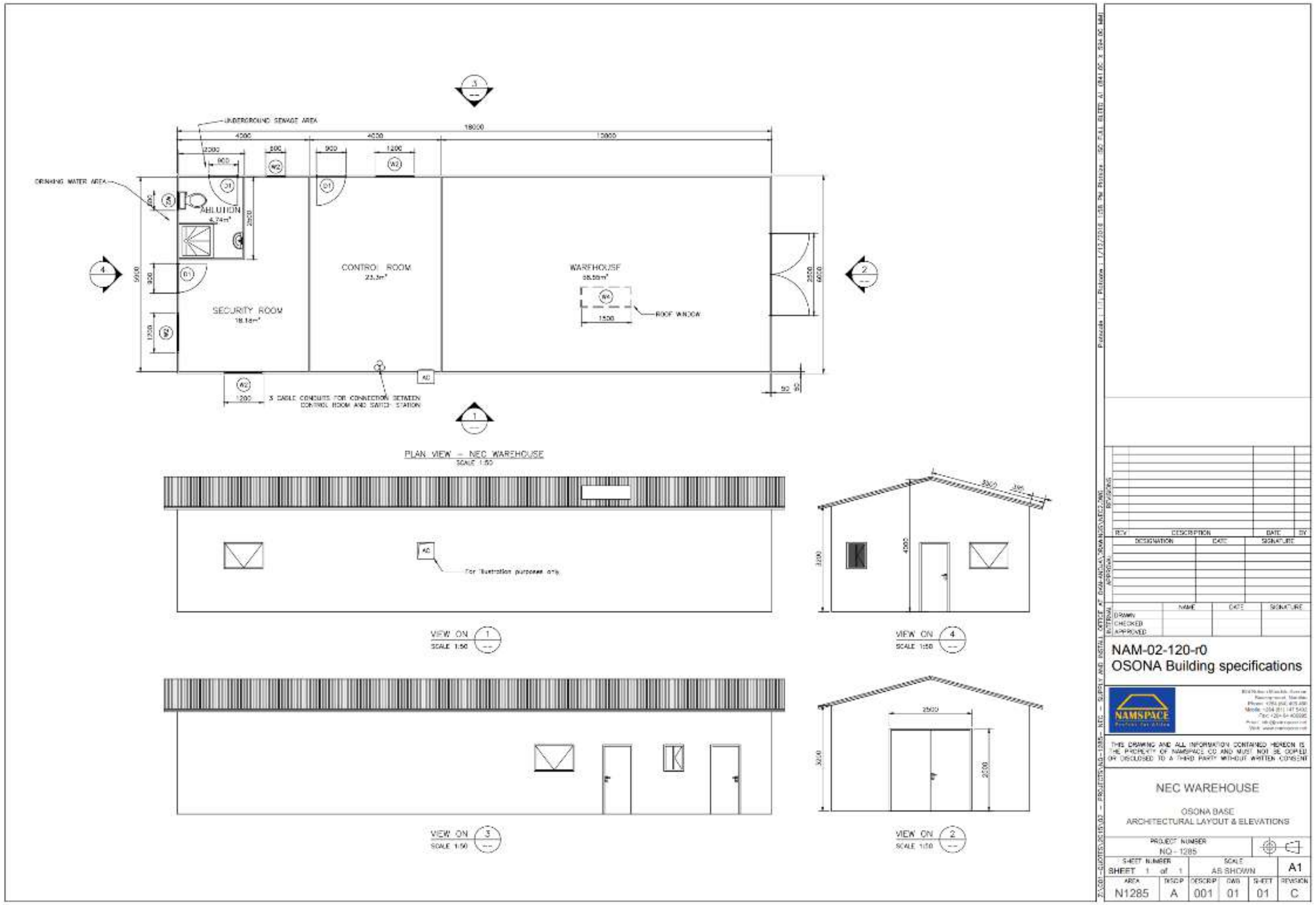

Figure 8 – Proposed building to be constructed on the site.

4.6 PROPOSED STAGE OF THE PROJECT

4.6.1 Development and planning stage

The proposed Project envisions the development, construction and operation of a solar PV power plant (solar panels mounted on steel frames, receiving mast and cabling) and associated infrastructure covering an area of approximately 120 ha. Overhead powerlines will be constructed from the existing NamPower (Osona) substation to the proposed PV power plant (as part of this project).

4.6.2 Construction stage

Vegetation will be cleared for the construction and installation of the solar PV plant and associated infrastructure, which will cover approximately 120 hectares. A 36 MW solar PV power plant will be constructed on-site and a 66 kV overhead powerline (2 km in length) will be constructed as part of the Project from the existing Nampower (Osona) substation nearby to the proposed site to link the solar plant with the power grid to supply renewable energy.

The following are envisioned to be installed and constructed during the construction phase of the project, tracking system with RC foundations, PV solar arrays connected to inverters, cable trenches, building, small warehouse, fencing, medium voltage power lines, low voltage power lines, and transformers.

During the construction phase, the existing road currently running through the site will no longer be used for access to the rest of the farm. The farmer/land owner may want to divert the access to go around the boundary of the proposed site, however, this is not known at this stage as there is alternative access to that area from other farm roads which could mitigate the need for a new road. Two general maintenance access gravel roads approximately 40 m wide, will also be constructed inside the park.

4.6.3 Operational stage

During operation, the power will be supplied to the national grid with the aim of trading energy on the Southern African Power Pool (SAPP) where off-take is required (multiple regions). Other operational activities will mainly involve the maintenance and cleaning of the solar components and associated infrastructure.

4.6.4 Decommissioning stage

The EMP developed for the proposed Project sets out auditable management and rehabilitation actions for the Proponent to ensure careful and sustainable management measures are implemented for their activities in respect of the surrounding environment and community. The proponent will accord to and implement rehabilitation measures towards the Project decommissioning stage as outlined in the EMP.

4.7 UTILITIES

4.7.1 Water supply

Water will be sourced from NamWater's existing supply line near the site. An average maximum usage of 2 m^3 per day is expected during the construction phase of the project and about 500 m^3 per year is expected to be used by the operational staff and for cleaning purposes.

4.7.2 Workers accommodation

The proposed Project is expected to require about 60 workers during the construction phase, most of the workforce will be from local contractors. People employed during the construction phase will be transported from Windhoek or preferably Okahandja to the site.

During the operational phase, it is expected that 10 full-time jobs will be created, of which 5 will be on-site workers, 3 security guards and 2 technicians. Security guards will stay on-site for their shifts, and there will be security on-site 24 hours / day. Technicians will only visit the site during preventative maintenance periods.

4.7.3 Waste management (solid and Effluent Waste)

A small septic tank will be installed on-site (operational phase) and will be managed by the Okahandja municipality. Chemical toilets will be used during the construction phase of the Project. Waste generated during the construction phase will be removed by a skip and will be disposed of at the nearest landfill site (Okahandja). The majority of the waste will be recycled.

5 ENVIRONMENTAL AND SOCIAL BASELINE

5.1 INTRODUCTION

A detailed environmental and socio-economic baseline assessment of the Project is provided in this report. Baseline studies aim to assess possible Project impacts (positive, negative and cumulative), thus ensuring input into the Project designs, which avoid, reduce or mitigate the potentially adverse environmental and social risks. This section provides an overview of the existing biophysical environment through the analysis of the available baseline data regarding the receiving environment. Desktop studies, followed by site verification on the national database are undertaken as part of the scoping process to get information about the current status of the receiving environment. This provides a baseline where changes that occur as a result of the proposed Project can be measured.

5.1 SOCIO-ECONOMIC

The potential social impacts are anticipated to be of low to moderate significance, and those that may transpire shall be confined within the local area: these potential impacts may include the following:

- Jobs will be created as a result of the Project.
- Potential to unearth, damage or destroy undiscovered heritage remains;
- Occupational and community health and safety;
- Potential visual disturbances and impacts to nearby landowners and tourists; and
- Minor disruption to the residents of neighbouring farms, including some potential increase in noise levels during the construction phase.

5.2 ENVIRONMENTAL

The potential environmental impacts are anticipated to be of minor to moderate significance for the proposed Project, and those that may arise shall be contained within the proposed site boundaries, these potential impacts may include the following:

- Disturbance of soil during the construction phase;
- Potential soil erosion within cleared areas;
- Vegetation clearing with regards to the proposed construction on the 120 ha area;
- Avifauna impacts;
- Potential impacts on biodiversity and ecology through habitat fragmentation or habitat loss; and
- Potential disturbance or displacement of protected or vulnerable species.

5.3 BASELINE ENVIRONMENT

5.3.1 Climate

The proposed site area is situated to the southwest of Okahandja in the Otjozondjupa Region, Namibia. The area where farm Osona Commonage No. 65 portion 82 is located has a climate that is characterised by mild summers and cool winters with mean maximum temperatures ranging between 24˚C and 34˚C and mean minimum temperatures ranging between 5˚C to 20˚C. The hottest months of the year are between October and January and the coolest months are in June and July (Bubenzer, 2002 & meteoblue, 2022).

The month with the highest Relative Humidity (RH), has an RH of approximately 70%, and the driest month is approximately 10% RH. The average rainfall in this area during the year is between 300 to 350 mm and rainfall events are limited to the summer months, mainly between December and March. Potential evaporation is between 3000 and 3200 mm per year (Bubenzer, 2002).

Climate and weather data for the proposed site (22.1°S 16.79°E) has been used from Meteoblue. This area has wind speeds between 0 and 28 km/h, where the months of July to November are known to have the strongest winds. Wind can occur any time of the day and the most predominant wind directions for this area are ENE, NE, E and NNE (Figure 10) (meteoblue, 2022).

Namibia in general has on average 300 days a year of clear skies. The average daily solar radiation for this area is between 6-6.2 kWh/m^2 for this part of Namibia, which is high to very high and is thus an ideal location for a solar power plant (Figure 11) (Bubenzer, 2002 & Mendelsohn et al., 2002).

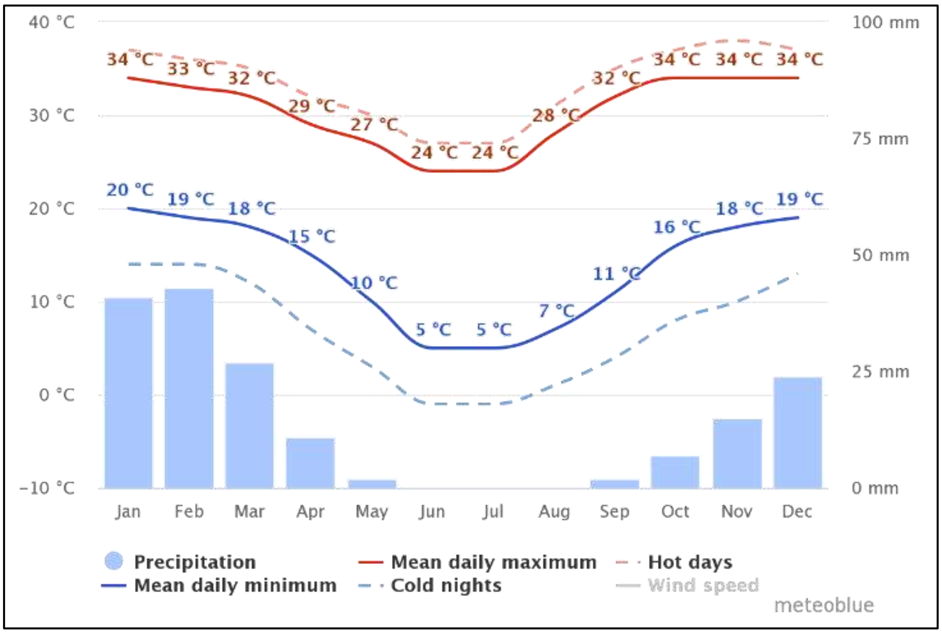

Figure 9 - Yearly climate overview for the area near and surrounding the proposed site (Meteoblue,2022)

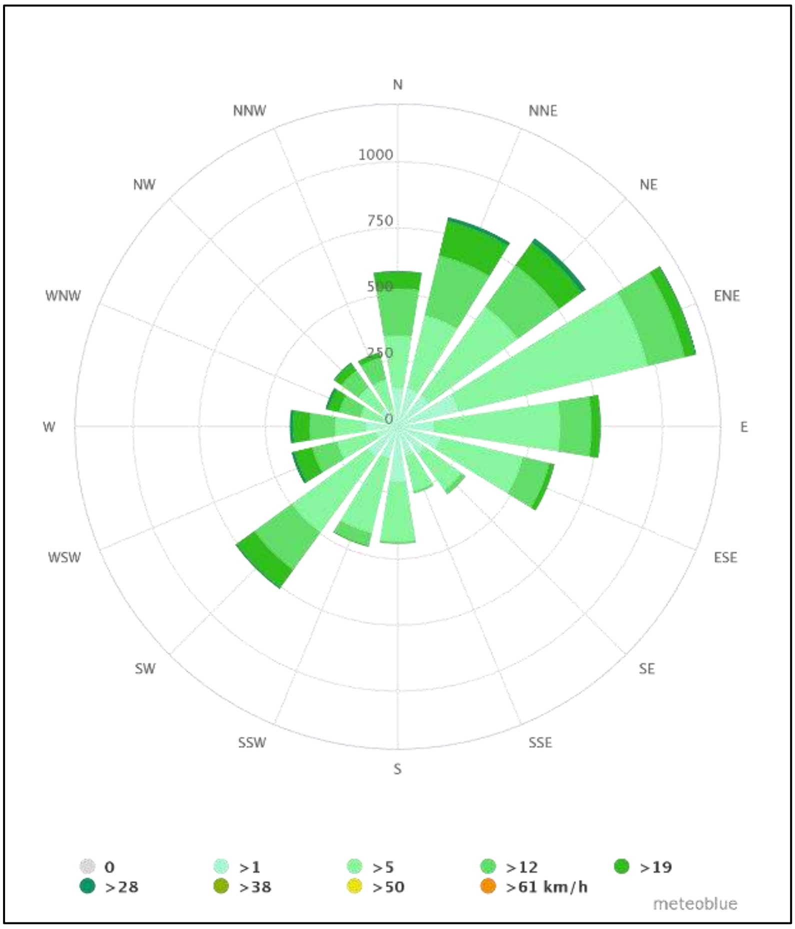

Figure 10 - Average wind speed and wind direction for the area near and surrounding the proposed site (Meteoblue,2022)

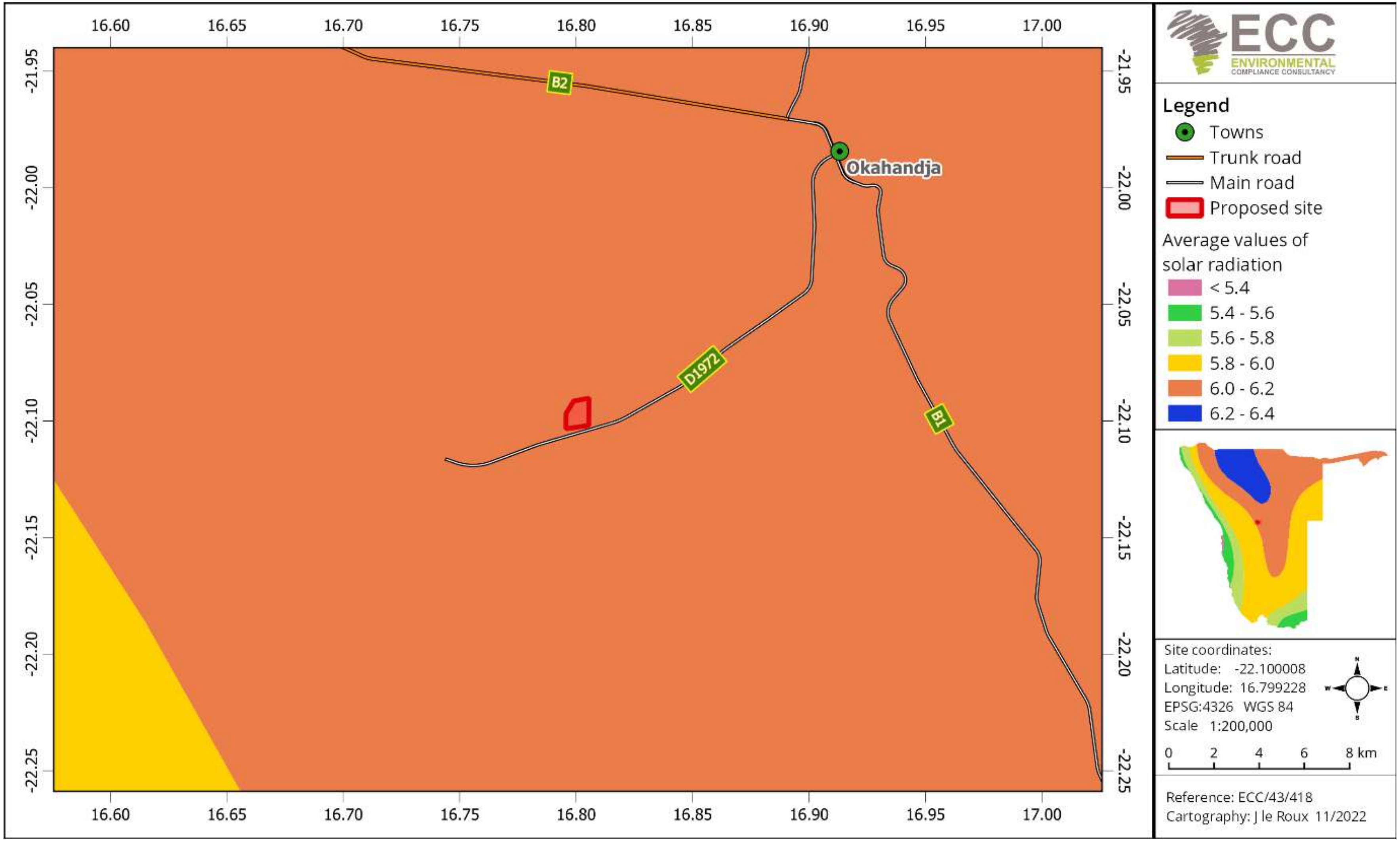

Figure 11- Average values of solar radiation of the area near and surrounding the proposed site.

5.3.2 Vegetation

Vegetation in Namibia is strongly influenced by rainfall. The proposed Project site is situated within the highland shrubland vegetation cover. The plant diversity and tallest trees are most lush in the north-eastern parts of the country and contrast sparser and shorter to the west and south of the country. This gradient is not simple as factors such as soil types, landscape and human impacts may also influence the vegetation. The plant diversity (more than 500 species) for this area is very high and the dominant vegetation structure on farm Osona is dense shrubland and falls within the Savanna biome (Mendelsohn et al. 2002). This area also has moderate plant endemism with between 6 to 15 species (Bubenzer, 2002 & Mendelsohn et al., 2002).

A list of plant species that have been found or sampled in the general area of Okahandja and the proposed site has been provided by the National Botanical Research Institute (NBRI) as seen in Appendix E. In area three (3) endemic species (*Petalidium lanatum, Plectranthus dinteri and Ondetia linearis*), one (1) near-endemic species (*Sporobolus nebulosus*) and 2 protected species (*Aloe hereroensis* (also CII) and *Faidherbia albida*).

In addition to the species provided by NBRI the following protected/endemic species have also been observed on-site or near the site: *Boscia albitrunca, Albizia anthelmintica, Vechellia erioloba and Aloe littoralis.*

5.3.3 Fauna

The overall terrestrial diversity for the proposed site and surrounding areas is moderate to high compared to other parts of the country (Bubenzer, 2002, IUCN, 2022, Mendelsohn et al., 2002, Gibon, 2022 & Stuart and Stuart, 2015).

Amphibians: This area has a low to moderate frog diversity of between 8 and 11 species (Bubenzer, 2002 & Mendelsohn et al., 2002).

Reptiles: The reptile diversity of this area is high with between 71 and 80 species, with between 17 to 20 endemic species; the number of observed lizard species for this area is high with between 32 to 35 different species of which six (6) to eight (8) species are endemic. The snake diversity is also high with the number of species between 35 and 39 (nine (9) to ten (10) endemic species). (Bubenzer, 2002 & Mendelsohn et al., 2002).

Furthermore, all tortoise species, rock monitors and pythons (dwarf and rock pythons) that might potentially be encountered within the Project site boundaries are protected under the Nature Conservation Ordinance No. 4 of 1975.

Mammals: The mammal diversity of the area is about 61 to 75 species with three (3) to four (4) species that are classified as endemic. Various protected or threatened mammal species may occur on the Project site of which two (2) are classified as near threatened (Striped leaf-nosed bat, Brown Hyena) and five (5) are classified as vulnerable (Cheetah, Hartmann's Mountain Zebra, Leopard, Pangolin, Black-footed cat) according to the IUCN red list of threatened species. Some of these species are also listed in the CITES appendices (i.e., pangolin).

Avifauna: The area within and surrounding the proposed site has an overall high bird diversity of up to approximately 310 species that could potentially be encountered, with a moderate to high endemism (between six (6) to seven (7) species) (Mendelsohn et al., 2002 & Oberprieler and Cillié, 2008 & Gibbon, 2022).

Most bird species in Namibia fall under Schedule 4: Protected Game within the Namibian Conservation Ordinance No. 4 of 1975, except for the following excluded species: Weavers, Sparrows, Mousebirds, Redheaded Quela, Bulbul, and Pied crow as well as 19 huntable game bird species identified in Schedule 6 of the Nature Conservation Ordinance (Nature Conservation Ordinance No. 4 of 1975).

A large number of migratory bird species may only pass through Namibia, thus some of the species might be rare to encounter during the year, but could potentially be found within the farm boundaries. Surface water on or near the proposed site (rainy season) might attract various water birds (either resident or migratory).

A specialist study conducted by African Conservation Services summarized the following important information from their site visits (26-28 July 2022, 10-13 October 2022 and 28-30 November 2022) and a thorough desktop study of the area. Please refer to the full specialist study in Appendix E.

Sensitive habitats

“According to the baseline and scoping of bird habitats and species, the study area is potentially sensitive in terms of avifauna, especially when viewed in the broader context of lying on the extensive, ephemeral Swakop River system, which is regarded as a potential bird movement corridor for aquatic and other birds between the nearby Gross Barmen wetlands, two large dams on the river, and inland and to the coast. As mentioned above, this corridor is of local and regional significance, and probably also of national significance. Although nest sites in the trunks of larger trees for (near-endemic) cavity breeders are regarded as sensitive, no critical habitats were identified (African Conservation Services, 2022).”

Sensitive species

“A total of 241 bird species has been recorded in the study area and surrounds, representing 36% of the 676 species currently recorded in Namibia. This species richness is regarded as relatively high. The bird checklist for the study area includes 16 (7%) species that are currently classed as Threatened in Namibia (Simmons et al. 2015, Brown et al. 2017), of which nine (56%

of the total) are also Globally Threatened. The checklist also includes seven species (3%) that are near-endemic to Namibia (including two with Red Data status), and at least three Red Data species with migrant status. Other (non-Red Data) migrant species have also been recorded in the area."

"During the site visits, evidence of active or past breeding by birds was recorded/reported in the study area for several species, of particular importance being the potential for cavity breeders, mainly in shepherd's tree *Boscia albitrunca* trunks (this group of birds would include Damara Red-billed Hornbill, Monteiro's Hornbill, Rüppell's Parrot and Violet Wood Hoopoe – all near-endemic to Namibia) (African Conservation Services, 2022)."

Priority species

"Risk assessment and mitigation efforts are directed towards priority species, namely those that have a high biological significance, i.e. primarily Red Data species (including any with migrant status) and/or endemic or near-endemic species.

A total of 28 priority bird species have been short-listed from a total of 55 potential priority species, as a focal group identified as being at higher risk to potential impacts resulting from the proposed project (including power line). This short-listing takes into account the probability of the species occurring in the study area and surrounds. However, due to the high species numbers and the difficulty in predicting the species likely to be impacted, the full priority list needs to be taken into account, focusing on the groups of birds likely to be at risk rather than individual species; and the precautionary principle should prevail.

The 28 priority species comprise 10 high-priority species (6 Red Data / 4 near-endemic / 1 Palearctic migrant), in the groups of five raptor species, one aquatic species and four other terrestrial species; and 18 non-Red Data / non-near-endemic priority species, in the groups of six raptors, eight aquatic species (as examples) and four other terrestrial species (African Conservation Services, 2022)."

5.3.4 Hydrology

The proposed site falls over the Okahandja groundwater basin and is within the Swakop catchment area (Bubenzer, 2002 & Mendelsohn et al., 2002). The main and most important ephemeral drainage line in the general area is the Swakop River to the south of the site that feeds the Von Bach and Swakoppoort dams, responsible for supplying Okahandja and the capital city, Windhoek, with water. Although not as important as perennial rivers, well-vegetated ephemeral drainage lines are still viewed as important habitats for a variety of vertebrate fauna in the general area.

According to the Namibian Monitoring Information System & Hydrological Map of Namibia (https://na-mis.com/), the site falls over rock bodies with little groundwater potential. The groundwater vulnerability in this area is considered to be low, but the Swakop River to the south of the site lies over a porous aquifer with high vulnerability. The groundwater recharge within this area is considered to be low (<0.5 % of the total average rainfall). Groundwater in this area is generally of good and excellent quality (Group A and B) and the abstraction rate of this area is low.

There are some very minor drainage lines that seem to form within the proposed site, but it is not seen as a major or minor drainage line, as seen in Figure 12.

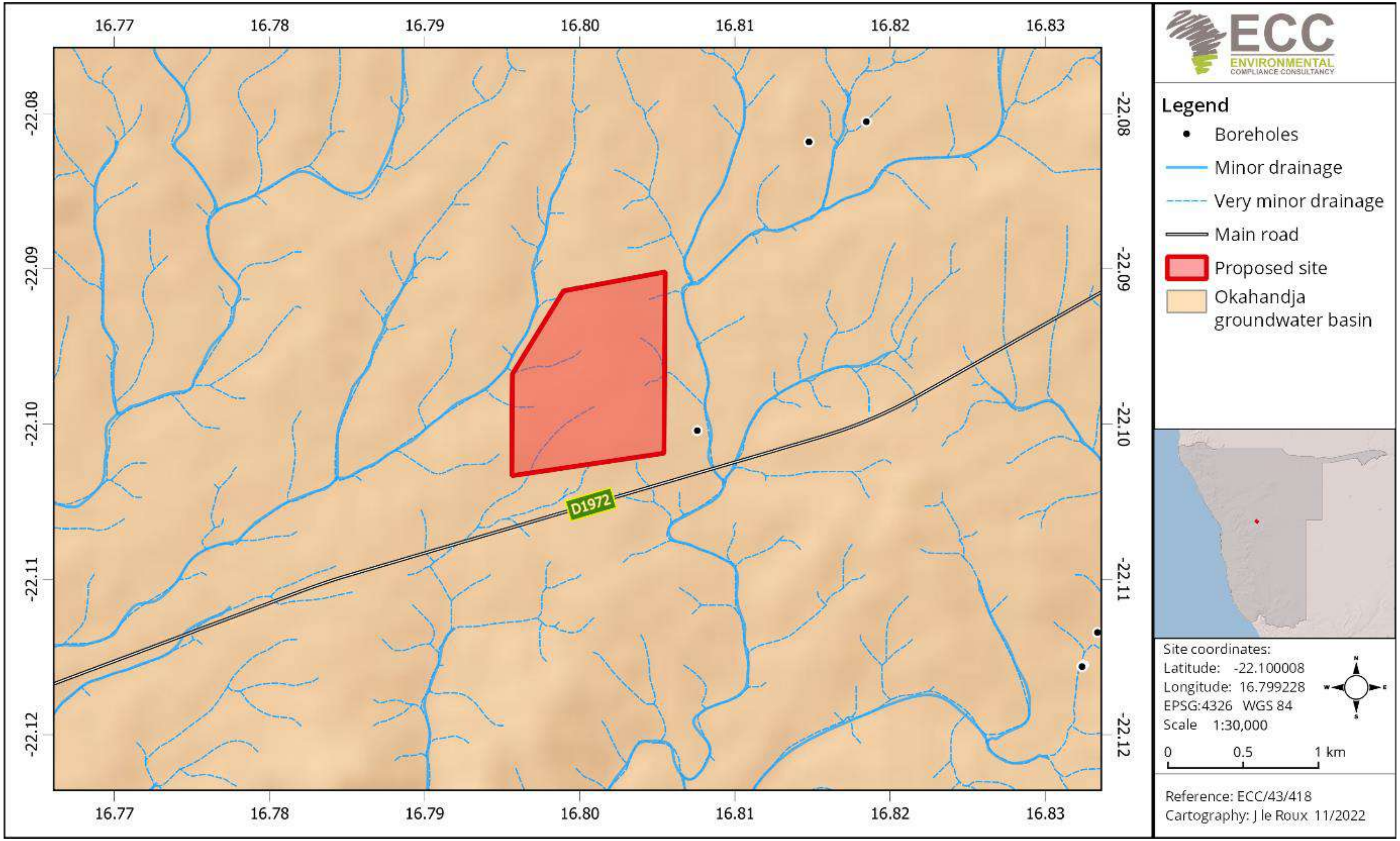

Figure 12 - Hydrology map for the proposed solar plant and surrounding areas.

5.3.5 Soil, geology and topography

Namibia can be divided into two broad geological provinces, one covering the western parts and the other in the east. The western parts consist of a variety of geological formations of different ages and compositions and formed under very diverse environmental conditions – some were formed in the depths of primaeval oceans, others as a result of the movement of the earth's crust or because of collisions or volcanic eruptions. Most of these formations are exposed in the west as rugged landscapes of mountains, hills, valleys and plains with sparse vegetation, providing an interesting insight into Namibia's geological past.

In eastern Namibia, the formations are covered with deposits of a much more recent past (Mendelsohn et al., 2002). The deposits are loose, aeolian of origin, sandy and unconsolidated. On the surface the east of Namibia appears monotonous and uniform, covered with dense vegetation in the north and decreasing to the south. Most of the knowledge about these sediments has been derived from water abstraction boreholes, rare outcrops and underlying formations exposed along drainage lines and around isolated pans.

The topography of the proposed site is relatively flat and uniform, with a slight variation in elevation between 1266 and 1275 meters above sea level (masl) throughout the site. The elevation on-farm Osona differs a bit more from approximately 1300 meters above sea level to less than 1250 masl. The surface geology appears to be smooth, with some drainage lines the entire landscape has a gentle gradient dipping from northeast to southwest (Figure 13).

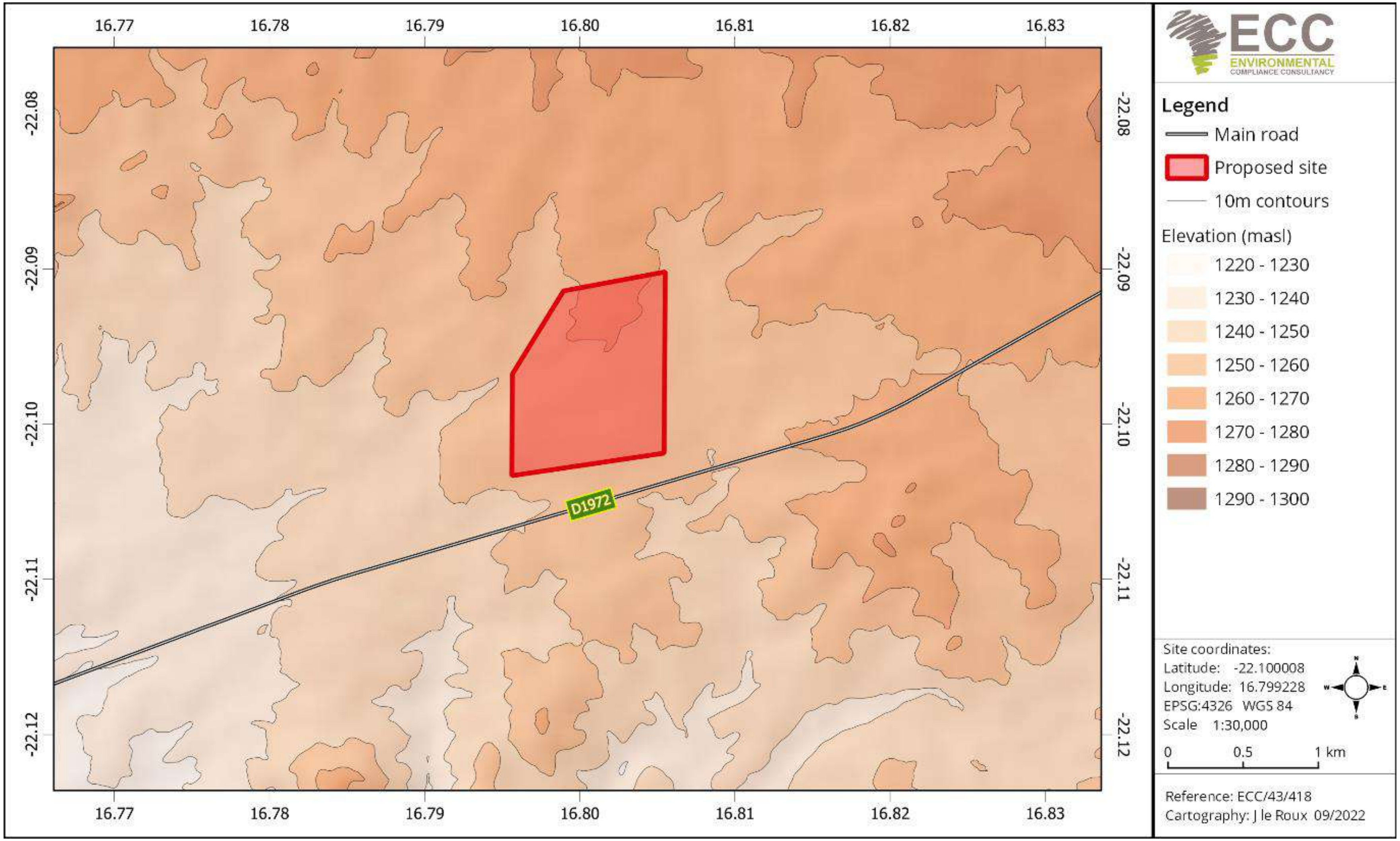

Figure 13 - shows the elevation on and around the proposed solar plant area

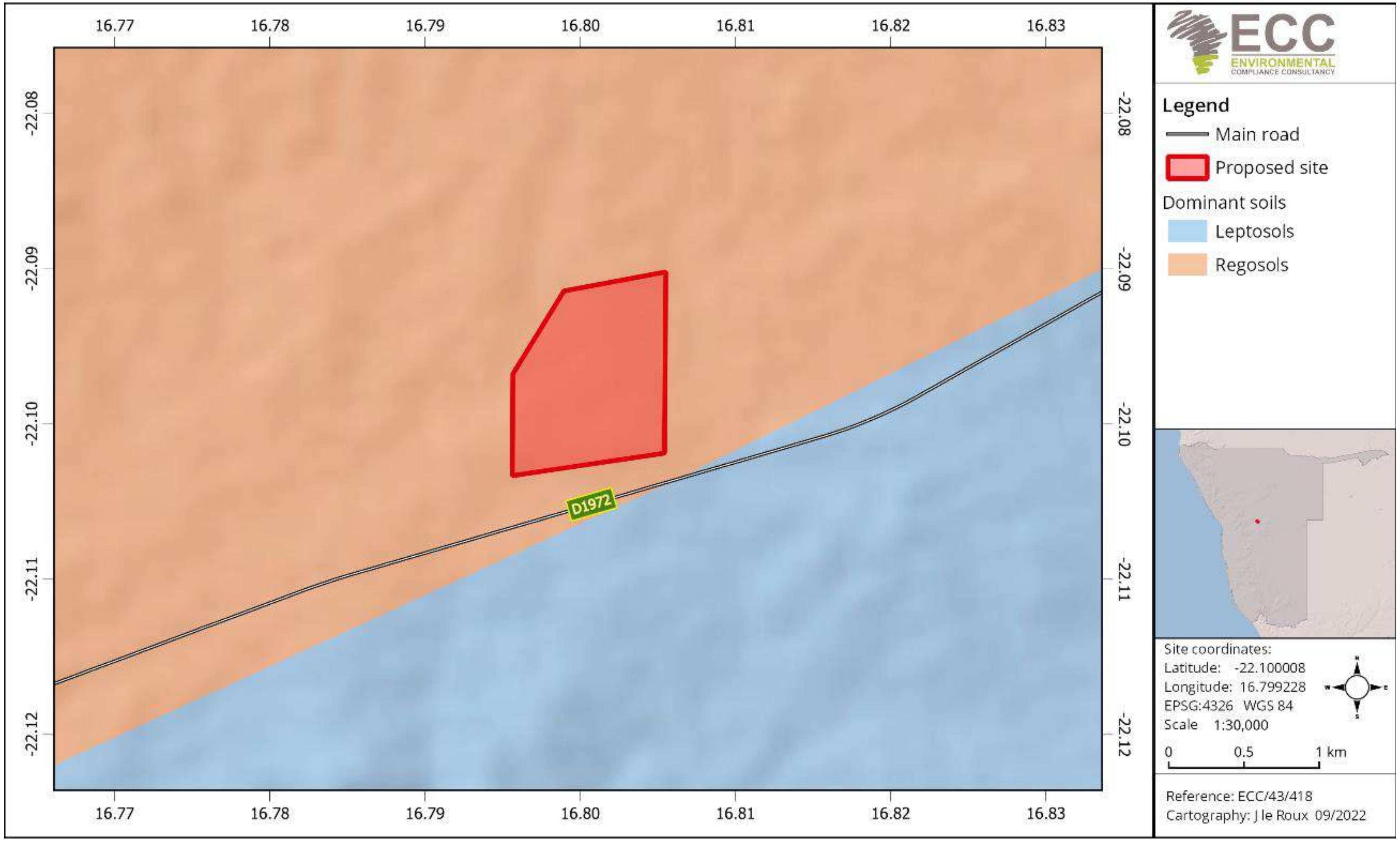

Figure 14 - Soil map of the area surrounding the proposed site

The geology within the farm boundaries consists of the Khomas Group, which forms part of the Damara Supergroup and Gariep Complex and the area is largely covered by Regosols soils (Buzenher, 2002). The rock types of this area consist of Metamorphic sedimentary rocks (i.e., Schists) (Buzenher, 2002).

The dominant soils found within and surrounding the farm boundary include eutric Regosols and lithic Leoptosols to the south of the site (Figure 14). Namibian soils vary a great deal, variations occur on a broad scale but there is even a great deal of variability at a local level.

The first part of the soil name provides information on the properties of the soil, namely: The first part of the soil name denotes soil properties. Eutric soils are fertile with high base saturation, whereas lithic represent very thin or shallow soils. The second name reflects the conditions and processes which have led to the formation of the soils (Mendelsohn et al., 2002).

Regosols are medium to fine-textured soils of actively eroding landscapes. These soils are not as shallow as Leptosols but never reach depths of more than 50 cm. This type of soil cannot provide vegetation with sufficient minerals or water (Mendelsohn et al., 2002).

Leptosols are typically formed in areas that are actively eroding, especially in hilly or undulating areas which cover a large part of the southern and north-western parts of Namibia. This type of soil is coarse-textured and offers limited depth due to the presence of hard-rock, highly calcareous or cemented layer within 30cm of the surface. Leptosols are the shallowest soils in Namibia and often contain gravel, this soil has a low water-holding capacity. Water run-off and water erosion can be very high in these areas if heavy rainfall occurs (Mendelsohn et al., 2002).

5.4 SOCIO-ECONOMIC ENVIRONMENT

Otjozondjupa Region is clustered into seven constituencies (Grootfotein, Okahandja, Omatako, Okakarara, Otavi, Otjiwarongo and Tsumkwe). The region's capital town is Otjiwarongo. Local authorities govern the towns in a form of municipalities. Otjozondjupa Region occupies 105 460 km^2 of Namibia's 824 292 km^2 total surface area and lies approximately 330 km northeast of the central Khomas Region. To the west and northwest, the region is boarded by Erongo and Kunene regions and Kavango East and Kavango west are northeast and Omaheke region to the southeast. Otjozondjupa is amongst six regions that predominantly have a larger male population (51.5%) than females (NSA, 2014).

Namibia is one of the least densely populated countries in the world (2.8 people per km^2). Vast areas of Namibia are still without people, in contrast to some dense concentrations, such as the central-north and along the Kavango River.

The projected total population for Otjozondjupa Region was 158 237, making up 6.6 % of the country's population and an annual growth rate of 0.6 % in 2018 (NSA, 2018). In the

Otjozondjupa region approximately 54% of all people live in an urban area and 46 % in rural areas in 2011. Otjiherero is the most spoken language (27 % of all households). The average household size is 3.9 people and the literacy rate is 83 % for people older than 15 (NSA, 2017). Living in an urban environment implies better living conditions – in the Otjozondjupa Region 95 % of all households have access to safe water, only 39 % have no proper ablution facilities, 56 % have electricity for lighting and 56 % of the population depend on open fires to prepare food (NSA, 2011).

The urban population pyramid for Namibia shows a very clear dominance of the age group 20 to 35 as well as for infants (0 to 4 years of age) (Figure 15). As the majority of people in the Otjozondjupa Region are living in an urban area. The majority of Namibia's population is young, as most of them are within the child-bearing age range (NSA 2014).

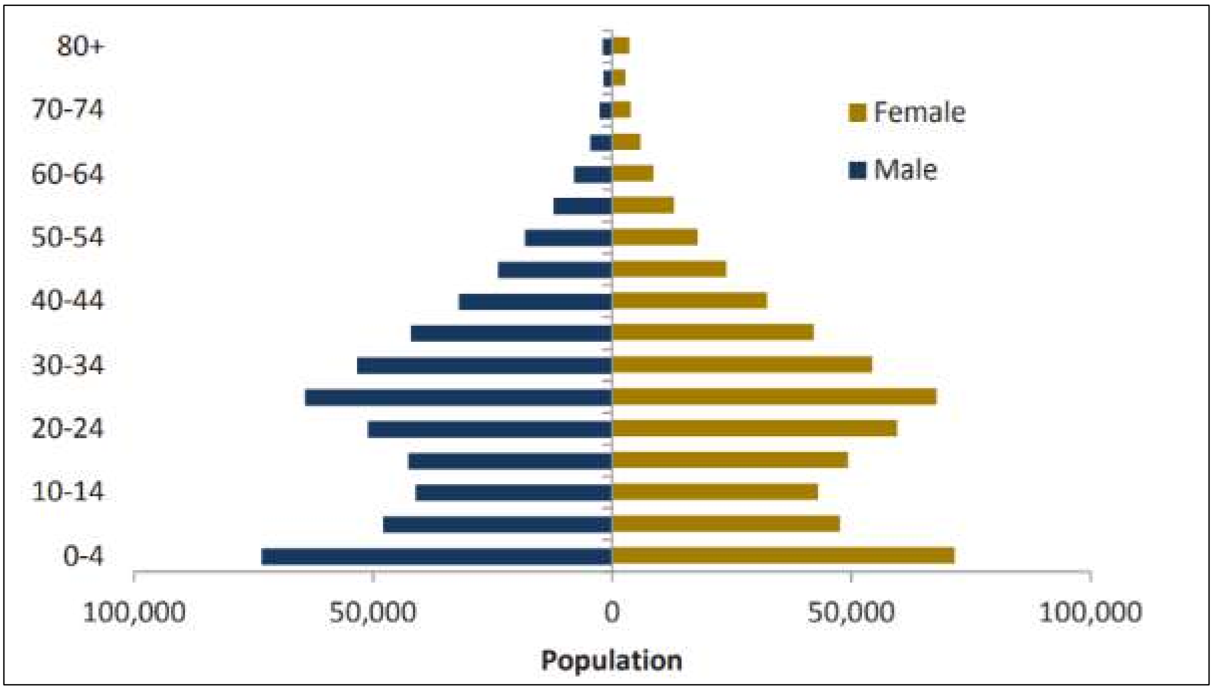

Figure 15 - 2015 urban population pyramid of Namibia (NSA 2014)

5.4.1 Governance

Since independence in 1990, Namibia is led by a democratically elected and stable government to date through three organs of government and functions(legislative, executive, and judiciary). The country was ranked 5th out of 54 African countries in the Ibrahim Index of African Governance in 2015 and subsequently ranked 4th out of 54 African countries in 2017 for indicators including the quality of governance and the government's ability to support human development; sustainable economic opportunity; rule of law and human rights; and development of smart information and communication technology to access information for socio-economic growth (National Planning Commission, 2017).

As a result of sound governance and stable macroeconomic management, Namibia has experienced rapid socio-economic development. Namibia has achieved the level of 'medium human development and ranks 125th on the Human Development Index out of

188 countries (NPC, 2020). Globally, Namibia was ranked 43rd out of 168 countries in 2018 on the Global Peace Index, as was therefore considered one of the most peaceful countries in the world (NPC, 2020).

5.4.2 Employment

In 2018, 53.4 % of all working Namibians were employed in the private sector and 21.5 % by the state. State-owned enterprises employ 7.6 % Namibians and private individuals 16.6 %. Wages and salaries represented the main income source of 47.4 % of households in Namibia. Agriculture (combined with forestry and fishing) as an economic sector has the most employees – 23 % of all employed persons in Namibia work in this sector. Agriculture is also the sector that employs the most informal workers in Namibia, calculated at 87.6 %. Wages of employees in the agriculture sector are lower than all other sectors except for workers in accommodation and food services and domestic work in private households (NSA, 2019).

Low education levels affect employability and prevent many households to earn a decent income. Of all people employed in Namibia, 63.5 % are not higher qualified than junior secondary level (Grade 10 and lower). In total 11.8 % of all people employed had no formal education. In total 29.1% of all people employed are within the category “elementary occupation” and 15.2 % in the category “skilled agriculture” (NSA, 2019).

Overall, the rate for unemployment is estimated at 33.4 % for Namibia, using the broad definition of unemployment. More than 60 % of the population is over 15 years of age and about one-third of the total population can be regarded as part of the labour force. The unemployment rate in rural and urban areas is almost the same – 33.4 % in urban areas and 33.5 % in rural areas (NSA, 2019). The youth group also ranks high in unemployment levels, even though many Namibia youth complete post-secondary education. In 2018 the unemployment level was at 59.6 % for those aged 15-19, 57 % for those aged 20-24, and 42.3 % for 25-29-year-olds (NSA, 2018).

According to the Socio-Economic impact Assessment of COVID-19 in Namibia by the United Nations Namibia (2020), there has been an estimated increase in unemployment from 33.4 % to 34.5 % and through a best-case scenario, it is also estimated that poverty will increase from 17.2 % to 19.5 % due to a drop in the domestic GDP (United Nations Namibia 2020).

5.4.3 Economy

In the Otjozondjupa Region, 61.7 % of all households depend on salaries and wages as their main income source, 2.6 % of households depend on subsistence farming as the main income whilst 9.9 % derive incomes from business activities, non-farming activities and pension (NSA, 2018).

The figure for informal-employed people is also lower (44.2 %) as people are employed in a wider range of secondary and tertiary economic sectors such as administration, security, services and accommodation and food service activities (NSA, 2018).

Guest farms, museums, craft shops, game parks/reserves and private game farms, and other tourism-related economic activities further drive economic activities in Otjozondjupa Region. Income and employment through tourism are growing, subsequently.

Gross Barmen resort and spa (owned and operated by Namibian Wildlife Resorts (NWR)) is situated next to (west) the proposed site and is a popular resort for both Namibians and international tourists. “The main attraction of the resort is the health and hydro medical spa center. This centre is featuring thermal springs and provide a full range of treatments and massages. It is perfect for health activities for relaxation. The nearby dam attracts more than 150 different species of birds making it a hotspot for bird watching. The Von Bach Dam outside of Okahandja is a significant attraction for water sports enthusiasts and anglers. A treat in a desert-like country”(NWR, n.d).

Since 2016, Namibia has recorded slow economic growth, registering an estimated growth of only 1.1 % in 2016. The primary and secondary industries contracted by 2.0 % and 7.8 % respectively. During 2017 the economy contracted by 1.7 %, 0.7 % and 1.9 % in the first, second and third quarters respectively (NSA, 2019). Despite the more positive expectations, the economy retracted to average growth of not more than 1 % annually since 2017.

During the second quarter of 2020 the domestic economy contracted by 11.1%, which is the largest contraction since 2013; but, the Bank of Namibia (BoN) predicts that the Gross Domestic Product (GDP) could grow by 1.9 % in 2021 and by 2.8 % in 2022. The impact assessment also showed that 96.5% of tourism businesses have been affected by COVID-19 in 2020, the manufacturing and construction sectors contracted by 9.2 % and 5.7 % respectively and there was also a 2 % to 3 % decline in net export (United Nations Namibia 2020).

5.4.4 Health

Since independence in 1990, the health status of Namibia has increased steadily with a remarkable improvement in access to primary health facilities and medical infrastructure. Despite the progress, the World Health Organization (WHO) in 2015 recommended strategic priorities of the health system in Namibia which include improved governance, an improved health information system, emergency preparedness, risk reduction and response, preventative health care and the combating of HIV/AIDS and TB (WHO, 2016).

HIV/AIDS remains a major reason for low life expectancy and is one of the leading causes of death in Namibia. There is a high HIV prevalence among the whole population, but since the peak in 2002 (15,000 new cases of HIV per year, and 10 000 yearly deaths due to AIDS) the epidemic started to stabilise (UNICEF, 2011). Although new infections, as well as fatalities, halved during the next decade, life expectancy for females returned to pre-independence levels but for males, it did not reach pre-independence levels yet. HIV/AIDS remains the leading cause of death and premature mortality for all ages, killing up to half of all males and females aged 40 - 44 years in 2013 (IHME, 2016).

Tuberculosis (TB) is a leading killer of people infected by HIV/AIDS, and Namibia has a high burden – in 2018, 35 % of people diagnosed with TB were infected with HIV. The country is included among the top 30 high-burden TB countries in the world, with an estimated incidence rate of 423 per 100 000 people and 60 fatalities per 100 000 people in 2018 (retrieved from www.mhss.gov.na).

Over the period 2000 to 2013 significant rises were observed for stroke, ischemic heart diseases, diabetes, and depressive disorders, but HIV/AIDS remained the top cause of premature mortality. Over the same period, significant decreases were observed for diarrheal diseases, neonatal conditions, and malaria. Risk factors are key drivers of premature mortality, and social ills were identified as the leading factor for death – particularly unsafe sex and alcohol and drug abuse. TB and malaria are compounded by the AIDS epidemic, and the risk of contracting malaria and TB is 15 % greater if a person is also infected with HIV, with a risk of 50 % higher to die as a result (IHME, 2016).

As of the beginning of 2020 the coronavirus disease (COVID-19), a communicable respiratory disease, causes illness in humans at a pandemic scale and has resulted in an increasing number of deaths worldwide. The viral outbreak is adversely affecting various socio-economic activities globally, and with reports of the increasing number of people testing positive, it is anticipated that this may have significant impacts on the operations of various economic sectors in Namibia too. The disease caused many countries to enter a state of emergency and lockdown mode, with dire economic consequences.

Furthermore, COVID-19 has also resulted in a loss of learning and socialising opportunities for children in Namibia and there was a lack of access to school feeding programs and parents had to provide or find alternative care for children. There has also been a 6 % increase in health workers across Namibia as a result of the pandemic (United Nations Namibia 2020). The Namibian economy remains confined, following the aftermath of COVID-19. Hence, development partners, public and private sectors need the commitment to explore new approaches in order to revive the fragile economy (NSA,2019). By the end of October 2022, Namibia has recorded 4,080 deaths due to COVID-19, most of these deaths occurred in 2021, as a result of the Delta and Omnicron variants.

5.4.5 Cultural heritage

From the Namibian GIS data and information from the Atlas of Namibia, there are no heritage sites within the proposed site with regards to the following periods: records from 1.8 million to 10000 years ago, 10000 to 2000 years ago or within the last 2000 years (Bubenzer, 2002 & Mendelsohn et al., 2002). Regardless, there is potential to unearth heritage sites.

6 IMPACT IDENTIFICATION & EVALUATION METHODOLOGY

6.1 INTRODUCTION

This section outlines ECCs method to identify and evaluate impacts arising from the Project. The findings of the assessment are presented in section 7.

The evaluation and identification of the environmental and social impacts require the assessment of the Project characteristics against the baseline characteristics, ensuring all potentially significant impacts are identified and assessed. The significance of an impact is determined by taking into consideration the combination of the sensitivity and importance/value of environmental and social receptors that may be affected by the Project, the nature and characteristics of the impact, and the magnitude of potential change. The magnitude of change (the impact) is the identifiable changes to the existing environment that may be negligible, low, minor, moderate, high, or very high; temporary/short term, long-term or permanent; and either beneficial or adverse.

This chapter provides the following:

- Details on the assessment guidance used to assess impacts;
- Lists the limitations, uncertainties and assumptions with regard to the assessment methodology;
- Details how impacts were identified and evaluated and how the level of significance was derived; and
- Details of how mitigation was applied in the assessment and how additional mitigation was identified.

6.2 ASSESSMENT GUIDANCE

The following principal documents were used to inform the assessment method:

- International Finance Corporation standards and models, in particular, performance standard 1: ‘Assessment and management of environmental and social risks and impacts (International Finance Corporation, 2012 and 2017).
- Namibian Draft Procedures and Guidance for EIA and EMP (Republic of Namibia, 2008).

6.3 LIMITATIONS, UNCERTAINTIES AND ASSUMPTIONS

The following limitations and uncertainties associated with the assessment methodology were considered in the assessment phase:

Some of the limitations included the uncertainty to what extent the ecosystem and species will be influenced by the clearing of land and associated disturbances.

Peer-reviewed studies, specialist study and best practice documents have been used to make assumptions on the severity of some of the impacts associated with the Project as well as to determine what mitigation measures might be most efficient.

Where uncertainties exist, a cautious approach has been applied, allowing the worst-case scenario for potential impacts to be identified. Where limitations and uncertainties exist, assumptions have been made and applied during the assessment process.

6.4 ASSESSMENT METHODOLOGY

The ESIA methodology applied to this assessment has been developed by ECC using the International Finance Corporation (IFC) standards and models, in particular, performance standard 1: 'Assessment and management of environmental and social risks and impacts (International Finance Corporation, 2017); Namibian Draft Procedures and Guidance for EIA and EMP (Republic of Namibia, 2008); international and national best practice; and over 25 years of combined ESIA experience. The methodology is set out in Figure 16 and Figure 17.

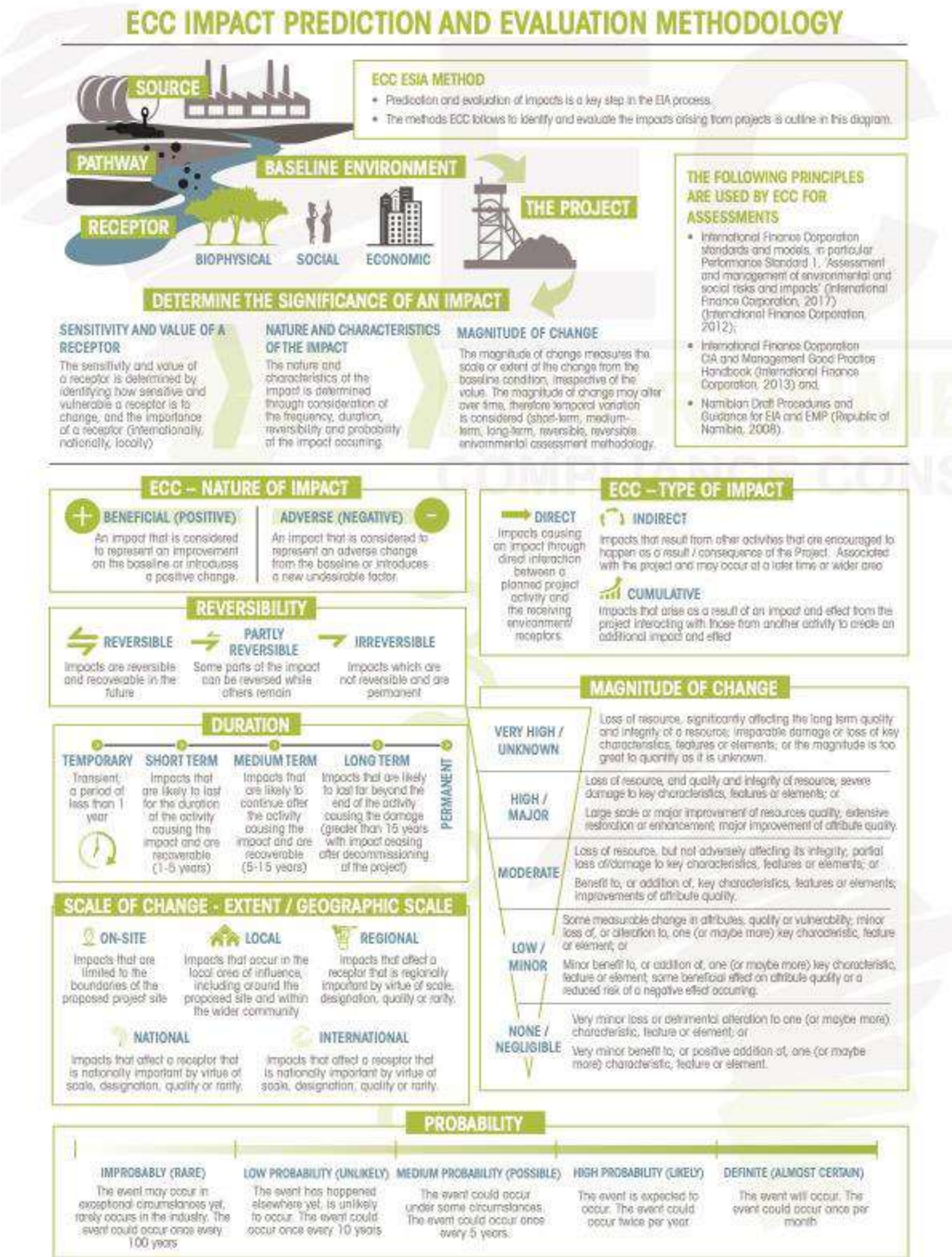

Figure 16 – ECC ESIA methodology based on IFC standards

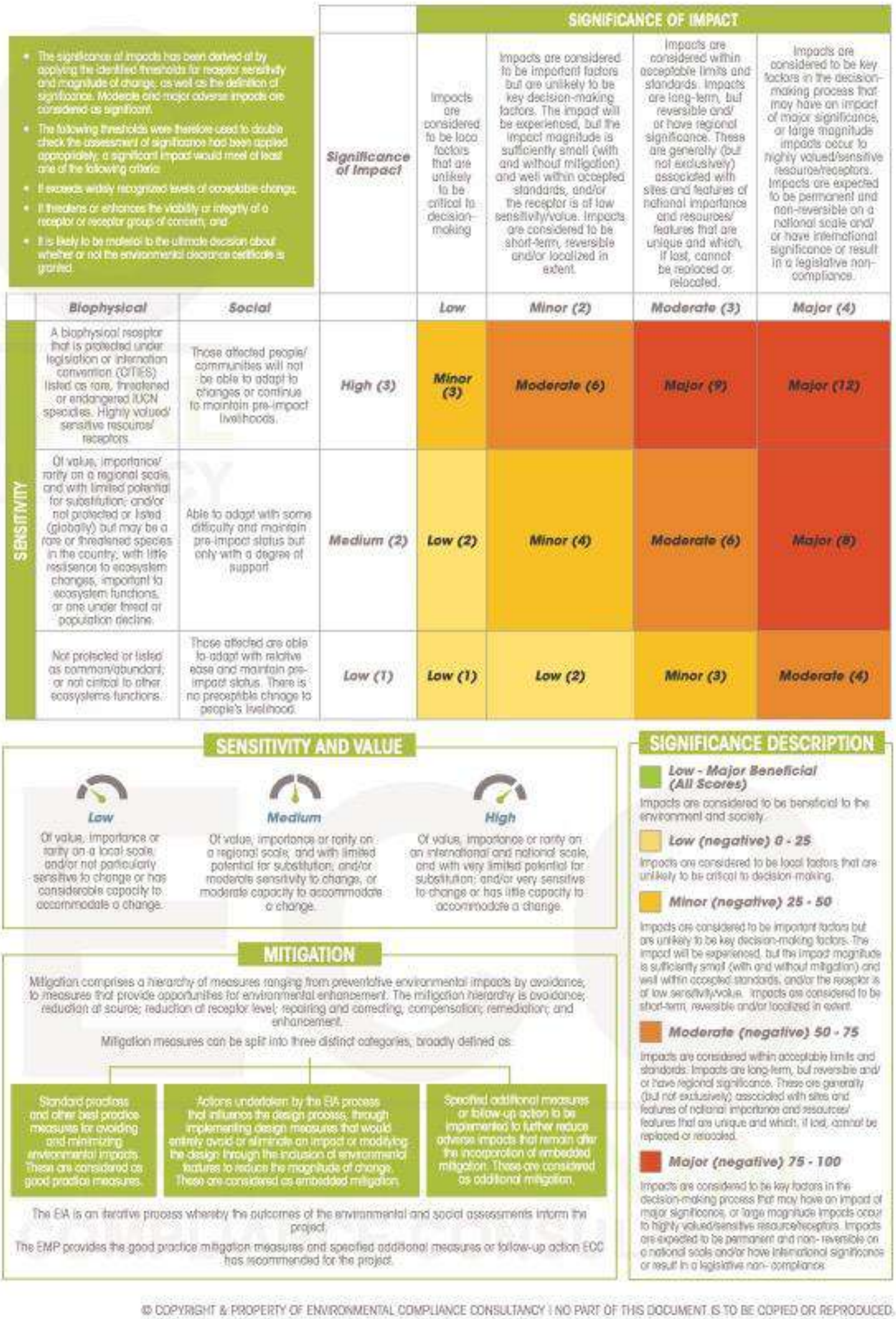

Figure 17 – ECC ESIA methodology based on IFC standards

6.5 MITIGATION

Mitigation comprises a hierarchy of measures ranging from preventative environmental impacts by avoidance, to measures that provide opportunities for environmental enhancement. The mitigation hierarchy is avoidance; reduction at source; reduction at receptor level; repairing and correcting; compensation; remediation; and enhancement.

Mitigation measures can be split into three distinct categories, broadly defined as:

1. Actions are undertaken by the ESIA process that influences the design process, through implementing design measures that would entirely avoid or eliminate an impact, or modifying the design through the inclusion of environmental features to reduce the magnitude of change. These are considered as embedded mitigation.
2. Standard practices and other best practice measures for avoiding and minimising environmental impacts. These are considered as good practice measures.
3. Specified additional measures or follow-up action to be implemented, in order to further reduce adverse impacts that remain after the incorporation of embedded mitigation. These are considered as additional mitigation.

The ESIA is an iterative process whereby the outcomes of the environmental assessments inform the Project.

The EMP (Appendix A) provides the good practice measures and specified additional measures or follow-up action.

Embedded mitigation and good practice mitigation was taken into account in the assessment. Additional mitigation measures will be identified when the significance of impact requires it and causes the impact to be further reduced. Where additional mitigation is identified, a final assessment of the significance of impacts (residual impacts) will be carried out, taking into consideration the additional mitigation.

7 IMPACT ASSESSMENT FINDINGS & MITIGATION

This Chapter presents the findings of the EIA for the Project as per the EIA process, scope and methodology set out in sections 2 and 6. A range of potential impacts has been identified that may arise as a result of the Project. This EIA report aims to focus on the significant impacts that may arise as a result of the Project. This section therefore only considers the significant impacts and or those that may have specific interest to the community and stakeholders and a summary of these significant impacts is discussed further in this section.

When undertaking the assessment exercise, the design of the Project and best practice measures were considered to ensure the likely significant effects and any required additional mitigation measures were identified. A summary of the potential impacts and mitigation or control measures are discussed below.

The following topics were considered during the scoping phase:

- Groundwater;
- Soils and topography;
- Landscape (visual impacts, sense of place);
- Socioeconomics (employment, health and safety, and land use);
- Noise;
- Biodiversity and ecology;
- Avian impacts;
- Vegetation clearing;
- Air quality (dust emissions); and
- Cultural heritage.

For each potential significant impact, a summary is provided which includes the activity that would cause an impact; the potential impacts; embedded or best practice mitigation (stated where required or available); the sensitivity of receptor that would be impacted; the severity, duration and probability of impacts; the significance of impacts before mitigation and after mitigation measures are applied.

Figure 18 shows a visual overview of the potential impacts associated with solar PV plants.

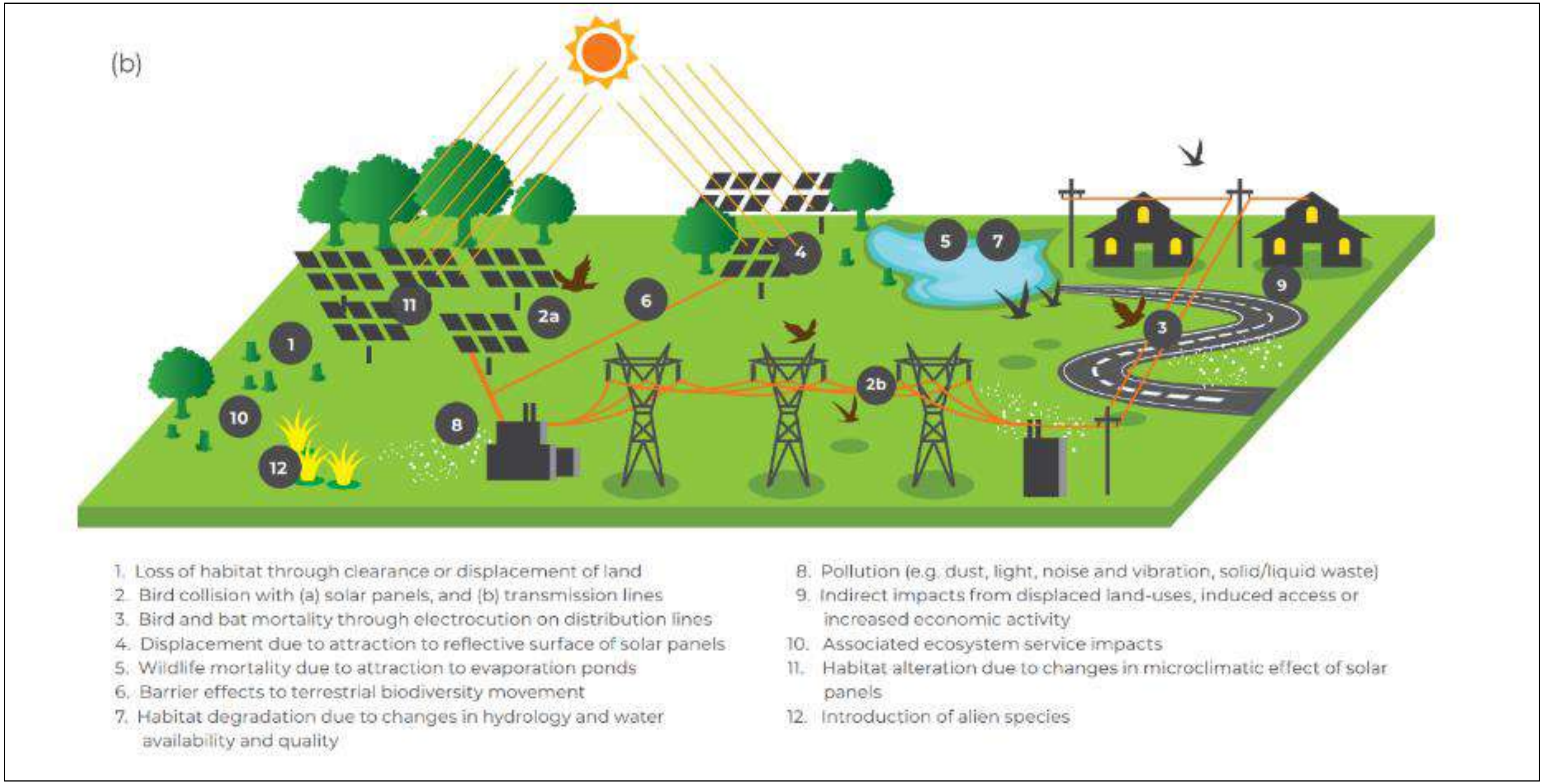

Figure 18 – Visual overview of potential impacts associated with solar PV plants (Bennun et al. 2021)

7.1 IMPACTS NOT CONSIDERED SIGNIFICANT

As a result of an iterative development process, mitigation has been incorporated and embedded into the Project, thereby designing out potential environmental and social impacts or reducing the potential impact so that it is not significant. Best practice has also played a role in avoiding or reducing potential impacts. The EMP provides best practice measures, management and monitoring for all impacts.

Impacts that have been assessed as not being significant are summarised in Table 5 below and not discussed further.

The listed impacts below are non-significant and do not render any threat to the environment in a way that adversely challenges its resilience of it to continue in its modified form.

Table 5 – Non-significant impacts

Environment or social topic	Potential impact	Summary of preliminary assessment findings
Air Quality	Potential for dust generation during the construction phase of the project.	During the construction phase, vegetation will be cleared which will expose the bare ground and thus increase the potential for dust generation on-site. An increase in vehicle traffic to the Project site transporting building materials (i.e., solar components) will also potentially contribute to dust generation. Excavation activities might also discharge dust and marginally affect the ambient air quality of the vicinity. This impact is expected to occur mainly during the construction phase of the Project. Recommended mitigation measures in the EMP will need to be followed and adhered to, to reduce this potential impact as far as reasonably possible. By following the mitigation measures the potential impact is expected to be non-significant.
Noise	Potential for noise generation during the construction phase of the project.	There is the potential for an increase in noise during the construction phase, due to construction activities, an increase in vehicles and an increase in people in the area. Increased noise levels are only expected during normal daytime working hours. Recommended mitigation measures in the EMP will need to be followed and adhered to, to reduce this potential impact as far as reasonably possible. By following the mitigation measures the potential impact is expected to be non-significant.
Occupational health and safety	Potential accidents, incidents or death occurring during the construction and	Labour Act, No. 11 of 2007: Regulations relating to the Health and Safety of Employees at Work (GN 156/1997) should be adhered to. The Proponent will be responsible to develop an occupational health and safety management plan for the Project.

Environment or social topic	Potential impact	Summary of preliminary assessment findings
	maintenance of the solar plant	The majority of health and safety risks will be associated with the construction phase of the Project, thus the Proponent must adhere to all recommended mitigation measures and the health and safety management plan for the site (to be developed by the Proponent). All PPE recommendations should be followed, safety procedures adhered to and a health and safety officer/site foreman should be on-site to provide appropriate supervision of all work carried out.
Fire Risk - environment	Potential of fire starting due to construction activities. This might have an impact on the environment and biodiversity.	During the construction phase, there will be a risk of accidental fires, due to machinery and an increase in people in the vicinity. This impact is unlikely if all recommended mitigation measures are followed and adhered to.
Fire Risk - community	Potential of fire starting due to construction activities. This might have an impact on the local community (i.e., burning of neighbouring farmers' land).	During the construction phase, there will be a risk of accidental fires, due to machinery and an increase in people in the vicinity. This impact is unlikely if all recommended mitigation measures are followed and adhered to.
Waste management - Visual	A potential increase in general solid and construction waste during	During the construction phase, there is the potential for an increase in waste generation due to all materials brought to the site (i.e, packaging), general building materials and the increase in people on-site. This might be a visual disturbance for nearby farm owners, lodges/ resorts or people using the D1972.

Environment or social topic	Potential impact	Summary of preliminary assessment findings
(General solid and construction waste)	the construction phase might be unsightly.	This impact is expected to be non-significant if the recommended mitigations are followed on-site. The Proponent will need to develop a waste management plan to counter the impact of waste dispersal on and surrounding the site.
Waste management - Biodiversity (General solid and construction waste)	Potential increase in general solid and construction waste during the construction phase. This might potentially kill or harm wildlife (entanglement or choking risk).	The potential increase in waste on-site (especially packaging and other smaller waste items) might be a potential choking or entanglement risk for local fauna and related ecosystems and ecosystem services. This impact is expected to be non-significant if the recommended mitigations are followed on-site. The proponent will need to develop a waste management plan to counter the impact of waste dispersal on and surrounding the site.
Increased people/foot traffic in the immediate vicinity. (Construction phase)	Potential increased people/foot traffic in the immediate vicinity (Construction phase), might potentially cause conflict with neighbouring farm owners	The potential risk of negative social interactions to occur between the workforce and the public, is due to the increase of people in the area (about 60 workers during the construction phase). An internal Health and Safety Management Plan will be developed by the client to address this topic and the mitigation measures provided.
Poaching	Potential poaching incidents due to increased people/foot traffic in the immediate vicinity (Construction phase).	Due to the increase of people in the area during the construction phase, there is the potential for poaching incidents (i.e., killing of animals for consumption/collection of veld food (tortoises, frogs, birds and eggs), killing animals like pangolins for their scales or harvesting protected plant species). This impact is expected to be non-significant if the recommended mitigations are followed on-site.

Environment or social topic	Potential impact	Summary of preliminary assessment findings
Soil quality	Potential soil contamination from chemicals or hydrocarbons spilt during construction and maintenance	Due to the expected increase in vehicles and heavy vehicles on site, there is the potential for hydrocarbon leaks. The chemical toilets that will be used during the construction phase are also a potential spill hazard that might have an impact on soil quality (i.e., alter soil chemistry or kill microorganisms). This potential impact is expected to be non-significant, but the recommended mitigation measures should be followed.
Soil erosion	Potential soil erosion due to the clearing of 120 ha of vegetation.	Due to the 120 ha cleared area, there is the potential for soil erosion as a result of intense weather events (i.e., strong winds and thunderstorms resulting in surface runoff). Mitigation measures will be critical to implement to manage this potential risk, which reduces risk to low.
Groundwater	Potential groundwater contamination from chemicals or hydrocarbons spilt during construction and maintenance	Due to the expected increase in vehicles and heavy vehicles on site, there is the potential for hydrocarbon leaks. The chemical toilets that will be used during the construction phase are also a potential spill hazard that might have an impact on groundwater quality. This potential impact is expected to be non-significant, but the recommended mitigation measures should be followed.
Sewage Waste	Potential nutrient enrichment of groundwater due to sewage or chemical spills from the septic tank	On-site sewage disposal systems/septic tanks need to be effectively cleaned and maintained. There is the potential for nutrient enrichment of groundwater. Specifications in EMP should be closely followed.

Environment or social topic	Potential impact	Summary of preliminary assessment findings
Powerline Construction	The construction and excavation of holes (for pylons) could potentially impact reptiles, mammals, and birds in the surrounding areas/habitat.	Due to the construction of the overhead powerlines, there will be vehicles in the field as well as the excavation of holes for the installation of wood pylons that might potentially have an impact on reptiles, mammals, and birds in the surrounding areas/habitat. This impact is expected to be of low significance, but the recommended mitigation measures for the EMP should still be followed.

7.2 SIGNIFICANT ISSUES TO BE ADDRESSED

Table 6 - List of potentially significant impacts scoped into the assessment

Environment or social topic	Potential impact	Summary of preliminary assessment findings
Job creation	Beneficial impact by the creation of potential direct and indirect job opportunities during the proposed project.	The Project is expected to create full-time and part-time job opportunities during the construction phase and operational phases of the Project.
Vegetation	Potential damage or removal of protected plant species when the proposed 120 ha are cleared.	The proposed area that is planned to be clear is approximately 120 ha which equates to about 120 rugby fields. With this size of land area cleared there is the potential to disturb or damage protected plant species. The small-order streams might also have some unique species.
Visual disturbance	The solar plant might be a potential visual disturbance to nearby landowners	The proposed Project is a potential visual disturbance (i.e., structures and reflection of light) for nearby farm owners, lodges/resorts or people using the D1972.
Habitat Fragmentation	Potential habitat fragmentation and loss due to the removal of about 120 ha and changes in the environment.	The movement of wildlife might potentially be impacted by the clearing of 120 ha of vegetation and the construction of the solar plant and fencing which will act as a barrier.
Wildlife/Vegetation	Potential habitat destruction when the proposed 120 ha are cleared.	The proposed area that is planned to be clear is approximately 120 ha which equates to about 120 rugby fields. Thus, 120 ha of natural habitat will be lost and altered.

Environment or social topic	Potential impact	Summary of preliminary assessment findings
Avifauna	Potential avifauna collision risk with the reflective surfaces of the solar panels, the proposed 66kV overhead powerline.	There is the potential for avifauna collision with solar components (reflective surface of solar panels and as a result of the potential "lake effect" of solar panels) and associated infrastructure (powerline to solar plant). This area has various species that might collide with solar panels, power lines or associated infrastructure. The avifauna specialist study in appendix E describes the potential impacts and associated mitigation measures.
Wildlife	Potential disturbance or displacement of protected or vulnerable species	The construction, clearing and excavation activities have the potential to disturb, harm or kill birds, reptiles and mammals in the area, this might include some protected species.
Heritage	Potential to unearth, damage or destroy undiscovered heritage remains.	Due to the clearing of the proposed 120 ha of land, there is the potential to unearth undiscovered heritage remains.
Soil	Potential soil disturbances as a result of the ground preparation and construction of the solar plant.	The proposed 120 ha area that will be cleared for the solar plant is expected to result in soil disturbances. Excavation to construct a solar plant could potentially disturb soil profile and construction activities might cause soil compaction in the area. The rerouting of the existing route and the construction of two 40 m wide maintenance roads will also cause additional soil compaction/disturbances.

7.3 SCOPING ASSESSMENT FINDINGS

When undertaking the scoping exercise, the design of the Project and best practice measures were considered to ensure the likely significant effects and any required additional mitigation measures were identified. A summary of the potential impacts and mitigation or control measures were discussed

Tables 7 to 14 set out the findings of the scoping assessment phase. Activities that could be the source of an impact have been listed, followed by receptors that could be affected. The pathway between the source and the receptor has been identified where both are present. Where an activity or receptor has not been identified, an impact is unlikely, thus no further assessment or justification is provided. Where the activity, receptor and pathway have been identified, a justification has been provided documenting if further assessment is required or not required.

Due to the nature and localised scale of the proposed construction activities and proposed operational activities, and the environmental context of the site, the potential environmental and social effects are expected to be minor to moderate. The only areas where uncertainty remained during the scoping phase were the potential visual disturbances, effects on vegetation removal, Avian impacts, potential disturbances or displacement of biodiversity and impacts on soil (soil disturbances and soil erosion). Further consideration of the potential impacts on biodiversity and the environment was therefore undertaken and results are presented in sections 7.5 and 7.6.

7.4 SOCIAL IMPACTS

7.4.1 Job creation

According to the Socio-Economic Impact Assessment of COVID-19 in Namibia by the United Nations Namibia (2020), there has been an estimated increase in unemployment from 33.4% to 34.5% and through a best-case scenario, it is also estimated that poverty will increase from 17.2% to 19.5% due to a drop in the domestic GDP (United Nations Namibia 2020). The Otjozondjupa region has an estimated unemployment number of 17 585 people (NSA, 2017). The national value and sensitivity of employment are thus considered to be high as it is of importance to the country and the local economy.

DIRECT EMPLOYMENT: CONSTRUCTION

Approximately 60 workers will be required during the construction phase. The Proponent will employ local people mostly where it will be deemed feasible to do so. The majority of the workforce will be from appointed contractors. The beneficial impact of creating temporary jobs is expected to result in a temporary impact with a low magnitude of change. A minor beneficial impact on the community and economy is therefore expected.

DIRECT EMPLOYMENT: OPERATION

Approximately 10 permanent jobs will be created in the operational stage as a direct result of the Project, with the anticipated creation of downstream jobs such as goods services, and contractor works expected throughout the lifespan of the Project. The magnitude of change during operation is considered as low but has long-term effects thereby resulting in a minor beneficial impact on the community and economy.

Table 7 - Impacts related to beneficial socio-economic impacts

ASPECT	Socio-economic	
Description of activity	Construction works - general	
Description of impact	Creation of jobs in the local community.	
Assessment of impact	**Receptor**	Community Job seekers Local economy
	Effect/description of magnitude	Beneficial Direct Partially Reversible Regional Short Term Reversible
	Value of sensitivity	High
	Magnitude of change	Minor
	Significance of impact prior to mitigation	Beneficial Minor (9)
Description of activity	Operations of the proposed project	
Description of impact	Creation of 10 permanent jobs	
Assessment of impact	**Receptor**	Community Job seekers Local economy
	Effect/description of magnitude	Beneficial Direct Irreversible Regional Long Term Reversible

ASPECT	Socio-economic	
	Value of sensitivity	High
	Magnitude of change	Minor
	Significance of impact prior to mitigation	Beneficial Minor (9)
Impact management/control measures	• Maximise local employment and local business opportunities; • Enhance the use of local labour and local skills as far as reasonably possible; and • Ensure that goods and services are sourced from the local and regional economy as far as reasonably possible.	

7.4.2 Visual disturbances

The proposed Project will be a potential visual disturbance (i.e., structures and reflection of light) for nearby farm owners, lodges/resorts (i.e., NWR Gross Barmen Resort) or people using the D1972.

The magnitude of change on the local landowners and tourists (visual disturbances) with regards to the construction of the 36 MW solar plant on a 120-ha area is considered to be moderate because about 120 ha of natural habitat will be developed and converted. The sensitivity of the receptor is rated as medium because the sense of place of local landowners/lodges/tourists will be influenced by this development and will add to the already existing visual disturbances (Osona substation and 5MW solar plant). But it is not expected to be severe and is not expected to have a significant impact on the local landowner/lodges/tourists as the solar plant is planned to be constructed on a relatively flat surface and the infrastructure will not be very high where it will be visible for great distances. The significance of the impact has thus been classified as minor (Table 8) and with the implementation of recommended mitigation measures, the significance of the impact is expected to be low.

Table 8 - Impacts related to potential visual disturbances

ASPECT	SOCIO-ECONOMIC	
Description of activity	Construction of the 36 MW solar plant and associated infrastructure.	
Description of impact	Potential visual disturbances to nearby Landowners and/or lodges.	
	Receptor	**Community and Tourists**

<table>
<tr><th>ASPECT</th><th colspan="2">SOCIO-ECONOMIC</th></tr>
<tr><td rowspan="4">Assessment of impact</td><td>Effect/description of magnitude</td><td>Adverse
Cumulative (5 MW solar plant and Osona substation)
Irreversible
Moderate
Permanent
Local
Possible</td></tr>
<tr><td>Value of sensitivity</td><td>Medium</td></tr>
<tr><td>Magnitude of change</td><td>Moderate</td></tr>
<tr><td>Significance of impact prior to mitigation</td><td>Minor (4)</td></tr>
<tr><td>Impact management/control measures</td><td colspan="2">– Light disturbances should be minimised;
– Lighting on-site is to be sufficient for safety and security purposes;
– Maintain complaints register on-site to record any complaints;
– Lighting should not be a nuisance for any residents/camps or lodges surrounding the site;
– Neighbouring farmhouses and buildings should be considered during construction, to prevent reflective light disturbances;
– Neighbours should be informed of construction activities and the potential duration of activities;
– The solar PV plant should blend in with the surrounding environment as far as reasonably practicable; and
• Ensure that international best practice methods are considered for the construction of the solar PV plant.</td></tr>
<tr><td>Residual impact after mitigation</td><td colspan="2">Low (2)</td></tr>
</table>

7.4.3 Heritage

During the clearing of 120 ha of land and with the construction and installation of the solar plant there is the potential to unearth, damage or destroy undiscovered heritage remains.

The magnitude of change concerning heritage finds/disturbances are considered to be moderate. The sensitivity of the receptor is rated as high, because archaeological/heritage findings can be essential to local communities or could form an important part of the heritage/archaeology of Namibia. But, it is expected to be unlikely to uncover heritage/archaeological remains in this area. The significance of the impact has thus been classified as minor (Table 9) and with the implementation of recommended mitigation measures, the significance of the impact is expected to be low.

Table 9 - Impacts related to potential unearthing or damage to undiscovered heritage remains.

ASPECT	HERITAGE	
Description of activity	Clearing of 120 ha of land and the construction and installation of the 36MW solar plant.	
Description of impact	Due to the clearing of the proposed 120 ha of land, there is the potential to unearth on undiscovered heritage remains.	
Assessment of impact	**Receptor**	**HERITAGE**
	Effect/description of magnitude	Adverse Direct Irreversible Moderate Permanent On-site Unlikely
	Value of sensitivity	High
	Magnitude of change	Moderate
	Significance of impact prior to mitigation	Minor (3)
Impact management/control measures	• Implement a Chance Find Procedure • Raise awareness about possible heritage finds • Report all finds that could be of heritage importance • In case archaeological remains are to be uncovered, cease activities and the site manager has to assess and demarcate the area • Project manager to visit the site and determine whether work can proceed without damage to findings, mark exclusions boundary and inform ECC with the GPS position • If needed, further investigation has to be requested for a professional assessment and the necessary protocols of the Chance Find Procedure have to be followed, • An archaeologist will evaluate the significance of the remains and identify appropriate action, (record and remove; relocate or leave premises, depending on the nature and value of the remains), • Inform the police if the remains are human,	

ASPECT	HERITAGE
	• Obtain appropriate clearance or approval from the competent authority, if required, and recover and remove the remains to the National Museum or National Forensic Laboratory as directed.
Residual impact after mitigation	**Low (2)**

7.5 IMPACTS ON BIODIVERSITY

7.5.1 Impacts related to vegetation clearing

The proposed Project will involve the clearing of 120 ha of vegetation to make way for the solar components, associated infrastructure and access roads. Construction activities at ground-mounted solar plant sites usually involve vegetation clearing, excavation of soil and roots, stripping of topsoils, soil compaction and grading of the land to create a level ground surface (Beatty et al. 2017). Vegetation in the area (i.e., larger trees) that play an important part within the local habitat (i.e., ground and cavity-nesting birds in the area) is often removed, pesticides are sometimes used to get rid of unwanted plants or weeds and the area is often covered with gravel. These practices are usually used to accommodate convenient construction, and operations of the plant and even for easy access, but according to Beatty et. al. (2017) and Macknick et al. (2013), there are alternatives where vegetation could be incorporated into solar plant design.

According to Patton et al. (2013), solar plant developments have the potential to impact a variety of ecological resources in the areas where they occur. A direct impact includes habitat removal (120 ha of natural habitat removed) and indirect impacts on vegetation include the changes in temperature, soil moisture, hydrological conditions, ecosystem function, reduced diversity, habitat destruction, the spread of invasive species and changes in community structure. Impacts sustained during the construction phase of the project could potentially continue throughout the lifespan of the project (i.e., several decades) and these changes (direct and indirect) could then result in both short and long-term changes in plant species distribution, abundance and species composition (Patton et al. 2013).

The following ecosystem functions could also be impacted according to Beatty et al. (2017):

- Wildlife cover;
- Forage;
- Travel corridors;
- Trophic relationships;
- Mycorrhizal associations;
- Nutrient cycling;
- Soil retention; and
- Carbon sequestration.

The following habitat and ecological issues could arise due to the clearing of vegetation:
Habitat destruction: This refers to the process where the natural habitat is disturbed or changed to the point where it cannot support the native species of the area anymore. Biodiversity that usually formed part of the landscape could potentially be killed or displaced, which could result in a reduction in species abundance. Habitat loss and destruction are some of the leading drivers of biodiversity loss.

Ecosystem alteration: This refers to the process where the natural landscape is altered, for example, the natural vegetation cover is removed and a non-natural landscape (i.e., bare ground is not natural in this part of Namibia) is present after the impact or change. This, in turn, changes the ecosystem (i.e., loss or disturbance of ecosystem) of the area cleared, which could change the species composition and impact ecosystem functioning.

Habitat Fragmentation: Fences are erected mainly to define land/farm boundaries, to control access to farms/sites or keep wildlife or livestock within farm boundaries or in the case of the solar plant to protect against theft and damage from wildlife. Fences can severely impact the movement of wildlife especially larger mammals, because of this, fences create a fragmented landscape (Boone & Thompson Hobbs 2004). The potential negative wildlife impacts associated with fences include wildlife entanglement, shortened/disrupted migratory routes, restricted or eliminated access to important resources, certain species might increase in numbers and damage vegetation or have a negative impact on the ecosystem as a whole (inbalance), habitat loss and potentially reducing the carrying capacity of the land (Boone & Thompson Hobbs 2004).

The magnitude of change on vegetation (damage or removal of protected species) with regards to the clearing of vegetation is considered to be moderate because about 120 ha of vegetation will be cleared. The sensitivity of the receptor is rated as medium to high because although there are protected species in the area they are not solely associated with the proposed site. There is also a few very minor drainage lines forming within the the proposed site, these habitats are more sensitive and might have unique species. The significance of the impact has thus been classified as Moderate (Table 10) and with the implementation of recommended mitigation measures, the significance of the impact is expected to be Minor.

The magnitude of change on the local ecosystem (habitat destruction) with regards to the clearing of vegetation is considered to be moderate because about 120 ha of natural habitat will be removed. The sensitivity of the receptor is rated as medium because the ecosystem will be altered and natural habitat destroyed, and some species might be displaced due to this change; But, it is not expected to be too severe and is not expected to have a significant impact on ecosystem functioning within the local area. The significance of the impact has thus been classified as moderate (Table 11) and with the implementation of recommended mitigation measures, the significance of the impact is expected to be minor.

The magnitude of change on the local ecosystem (habitat fragmentation) with regards to the construction and installation of a fence around the proposed site is expected to be moderate because about 120 ha of natural habitat will be removed and fenced off (approximately 4.42 km of fencing). The sensitivity of the receptor is rated as medium because the ecosystem will be altered and animal movements might be impacted. The significance of the impact has thus been classified as moderate (Table 12) and with the implementation of recommended mitigation measures, the significance of the impact is expected to be minor.

Table 10 - Impacts related to clearing of vegetation

ASPECT	VEGETATION	
Description of activity	Clearing of about 120 ha of vegetation to make way for the proposed solar plant.	
Description of impact	Potential damage or removal of protected plant species when the proposed 120 ha are cleared.	
Assessment of impact	**Receptor**	**Vegetation**
	Effect/description of magnitude	Adverse Cumulative (about 64 ha area cleared to the west and southwest) Irreversible Moderate Permanent On-site Definite
	Value of sensitivity	Medium
	Magnitude of change	Moderate
	Significance of impact prior to mitigation	Moderate (6)
Impact management/control measures	• Do not use herbicides to manage plants on-site as far as reasonably possible; • Plant native vegetation between solar components, " with acceptable characteristics within engineering constraints" (i.e., grass and small shrubs) (Beatty et al., 2017); • Ensure that vegetation clearing permits are in place before clearing starts; • A professional botanist or ecologist should be on-site to identify any protected or threatened species and advise a way forward (possibly relocate some species); • Appropriate permits should be obtained for the removal of any protected species;	

ASPECT	VEGETATION
	• Relocate protected/sensitive species to a suitable habitat if recommended by the professional; • Check for any active bird nests; and • Control all alien/invasive species on-site.
Residual impact after mitigation	**Minor (4)**

Table 11 - Impacts related to habitat destruction

ASPECT	BIODIVERSITY	
Description of activity	Potential habitat destruction when the proposed 120 ha area cleared	
Description of impact	Potential habitat destruction and impacts on ecosystem functioning due to the clearing of 120 ha of vegetation and ground preparations.	
Assessment of impact	**Receptor**	**Biodiversity**
	Effect/description of magnitude	Adverse Cumulative (about 64 ha area cleared to the west and southwest) Irreversible Moderate Permanent On-site Almost Certain
	Value of sensitivity	Medium
	Magnitude of change	Moderate
	Significance of impact prior to mitigation	Moderate (6)
Impact management/control measures	• Keep or plant native vegetation between solar components (if larger rows are planned between components); • Try to limit the amount of vegetation that is cleared (especially larger trees), to limit habitat loss, where possible (Smit, 2012); • Use grazing from livestock or manual labour, but not chemicals, to control vegetation on-site; • Try to keep some natural habitat intact; • Ensure efficient planning, in order to reduce disturbances in areas that do not form part of the planned construction area; • Reseed native grasses between solar components; and	

ASPECT	BIODIVERSITY
	• Plant native vegetation on-site where possible.
Residual impact after mitigation	**Minor (4)**

Table 12 - Impacts related to habitat fragmentation

ASPECT	BIODIVERSITY	
Description of activity	Potential habitat fragmentation when the proposed 120 ha area is fenced off.	
Description of impact	Potential habitat fragmentation and loss due to the removal of about 120 ha and change in the environment and the proposed security fencing	
Assessment of impact	**Receptor**	**Biodiversity**
	Effect/description of the magnitude	Adverse Cumulative (5 MW solar park fenced off and game farms in the area) Irreversible Moderate Permanent Local Possible
	Value of sensitivity	Medium
	Magnitude of change	Moderate
	Significance of impact prior to mitigation	**Minor (4)**
Impact management/control measures	• All wildlife (Birds, mammals and reptiles) harmed or killed in the fences should be recorded, with a description, species name, date and photos ; • Choose an appropriate fence that will be wildlife-friendly (as far as reasonably possible), i.e., fences without sharp wire spikes (especially concerning avifauna, that might get "hooked" during flight); • Wildlife deterrent gadgets/methods could be used on fences to ensure that wildlife sees the fences or is deterred away from it; and	

ASPECT	BIODIVERSITY
	• Wires used for fencing should have poles/droppers at regular intervals or bird deterrents to ensure that wildlife can see infrastructure.
Residual impact after mitigation	**Low (2)**

7.5.2 Avifauna collisions and Impacts

The development of solar PV plants usually involves the clearing of large areas of land, which usually has numerous solar panels stacked close to each other. These large arrays of panels might potentially confuse waterbirds into thinking it is a waterbody/wetland (known as the "lake effect", which might lead to potential collisions (Jenkins et al. 2017).

Bird collisions with solar PV plants are relatively understudied and very little information is available on bird mortality rates. But Jenkins et al. (2017) mentioned bird collisions ("lake effect") are "emerging as a significant impact factor" at a site where continuous mortality monitoring is taking place. A study conducted in the Northern Cape at one of South Africa's largest solar plants (96 MWp), noted eight (8) fatalities over three months. The "extrapolated mortality" for the 96MWp solar plant has been identified at about 4.5 birds per MWp per year. This study recorded no collisions of threatened bird species (Visser et al. 2019). A study conducted in the United States estimated the collision rate at about 2.49 birds per MW per year, when evaluating the "results from fatality monitoring studies at 10 photovoltaic solar facilities across 13 site-years in California and Nevada" (Kosciuch et al, 2020).

According to Smit (2012), PV panels are less reflective than Concentrated Solar Power (CSP) panels and are thus expected to not be a major risk for collisions (i.e., compared to that of large windows or other reflective surfaces).

The specialist study by African Conservation Services, (2022) in Appendix E described gives the following detail on priority species for the project.

Details of priority species

"(Species confirmed during field visits in 2022 are indicated by asterisk; local abundance indicated on a scale of 1-4).

10 high priority species (6 Namibian Red Data [3 also Globally Endangered] / 4 near-endemic to Namibia / 1 Palearctic migrant), in the groups:

5 raptor species (no nesting activity recorded as yet)

- White-backed Vulture (Critically Endangered, also Globally Critically Endangered; resident, with long-distance movements, especially in juveniles; power line-prone; local abundance 2/4);
- Lappet-faced Vulture (Endangered, also Globally Endangered; resident, with extensive movements in non-breeding birds; power line-prone; local abundance 1/4);
- *Martial Eagle (Endangered, also Globally Endangered; resident; power line-prone; local abundance 3/4);
- Tawny Eagle (Endangered; power line-prone; local abundance 3/4); and
- Common (Steppe) Buzzard (Palearctic migrant; power line-prone; local abundance 4/4).

1 aquatic species (power line-prone)

- Great White Pelican (Vulnerable; sedentary, nomadic; power line-prone; local abundance 4/4).

4 other (non-raptor) terrestrial species

- *Rüppell's Parrot (Near Threatened; near-endemic to Namibia; nomadic; cavity breeder; power line-prone; local abundance 2/4);
- *Damara Red-billed Hornbill (near-endemic to Namibia; cavity breeder; power line-prone; local abundance 3/4);
- *Monteiro's Hornbill (near-endemic to Namibia; nomadic; cavity breeder; power line-prone; local abundance 3/4); and
- *White-tailed Shrike (near-endemic to Namibia; highly territorial; local abundance 3/4).

18 non-Red Data / non-near-endemic priority species, in the groups:

6 raptor species (all power-line prone):

- Black-chested Snake Eagle (resident, nomadic; power line-prone);
- Brown Snake Eagle (resident, nomadic; power line-prone);
- *Pale Chanting Goshawk (sedentary, with local movements; electrocution-prone);
- *Southern White-faced Owl (resident; power line-prone);
- *Western Barn Owl (resident; breeding reported in area 2022; power line-prone); and
- Pearl-spotted Owlet (resident; cavity-breeder; powerline-prone)

8 aquatic species (examples):

- *White-breasted Cormorant (sedentary, nomadic; collision-prone);
- *Reed Cormorant (resident, nomad; partial migrant; collision-prone);
- African Darter (sedentary, with local movements; collision-prone); and
- Species that land on water (and could potentially mistake solar PV panels for expanses of water, especially in poor light): African Black Duck, *White-backed Duck (resident, nomadic) Cape Teal (nomadic, partially migrant), Red-billed Teal (resident, nomadic); *Little Grebe (resident, with local movements)

4 other (non-raptor) terrestrial species;

- *Red-crested Korhaan (sedentary; ground-nester; collision-prone);
- *Double-banded Sandgrouse (sedentary; ground-nester; collision-prone; breeding recorded at 5 MW solar PV site 2022);
- Namaqua Sandgrouse (resident, nomadic or migratory; ground-nester; collision-prone);
- *Red-billed Spurfowl (sedentary; ground-nester; collision-prone).

Other (mostly non-priority) species with the potential to cause impacts on infrastructure

Several other (mostly non-priority) bird species have the potential to impact on infrastructure, including on solar PV arrays and power line structures, through their perching, nesting and other activities, e.g.

- *Greater Striped Swallow (breeding intra-African migrant);
- *Red-billed Buffalo Weaver;
- *Sociable Weaver;
- Rock Dove (Feral Pigeon), *Speckled (Rock) Pigeon; and
- Cape Sparrow, House Sparrow, *Cape Wagtail".

In the specialist study by African Conservation Services, (2022) from pages 57 to 69 the following impacts and mitigation measures are described in detail. These mitigation measures should be closely followed and adhered to in addition to the EMP.

Refer to the Potential impact (Significance) and (Residual impact after mitigation) as well as the mitigation measures for each impact below (African Conservation Services 2022):

Physical/human disturbance of birds (minor (4) to moderate(6)) and (minor (4));

"Mitigation recommendations

Construction phase

Avoidance:

- Scheduling: adapting the timing of construction activities to avoid disturbing birds during sensitive periods, e.g. during breeding seasons; for the near-endemic cavity breeders (Rüppell's Parrot, Damara Red-billed Hornbill, Monteiro's Hornbill) the main breeding season falls from January-March.
- Before construction starts, the proposed solar PV site and the proposed power line route should be inspected for any signs of bird nesting activity. Disturbance of nesting/chick-rearing birds should be avoided.

  Minimisation:
- Abatement controls to reduce noise disturbance created during construction.
- Operational controls to manage and regulate contractor activity, such as:
  - A speed limit should be strictly enforced.

- Exclusion fencing should be erected around identified sensitive areas, if required (e.g. pre-identified active nesting sites).
- Anti-poaching measures should be strictly enforced, with zero tolerance, and this should be emphasised during induction to contractors; offenders should be prosecuted.
- Ongoing awareness should be promoted about the value of biodiversity and the negative impacts of disturbance, especially to breeding birds, and of poaching and road mortality (African Conservation Services, 2022)."

Direct and indirect modification/loss/destruction of bird habitat (moderate (6) to major (8)) and (moderate (6));

"Mitigation recommendations

Avoidance and minimisation:

- Micro-siting: where possible, the unnecessary destruction of habitat or degradation of the environment, including sensitive habitats such as cavity-nesting locations should be avoided. The final layout of project infrastructure should avoid designated sensitive areas, e.g. identified active nest sites. If practical, the tree with the recently active hornbill nest just north of the study site (22.09015S 16.80208E) should be protected.

Construction phase

Restoration and rehabilitation:

- Repair of degradation or damage to biodiversity features and ecosystem services from project-related impacts that cannot be completely avoided and/or minimised, e.g. by restoration of temporary-use and lay down areas as soon as reasonably practicable after construction activities are complete.

Operational phase

Minimisation:

- Abatement controls to reduce emissions and pollutants (erosion, dust, waste) created during construction; wastewater management and water conservation measures.
- Operational controls to manage and regulate contractor activity, such as exclusion fencing around sensitive areas (e.g. pre-identified active nest sites), designated machinery and lay-down areas, minimisation of vegetation loss and disturbance to soil; managing the timing of vegetation control activities at suitable intervals.
- Ongoing awareness should be promoted about the value of biodiversity and the negative impacts of habitat destruction.
- As a possible offset, investigate the use of artificial nesting boxes as an alternative option for cavity-breeding birds (Figure 27); contact the Namibia Bird Club for advice on ideal type and placement localities for boxes, and possible further involvement with monitoring of nesting activity (https://www.namibiabirdclub.org/)(African Conservation Services, 2022)."

Creation of novel (artificial) habitats and resources that could attract birds; this impact could also lead to negative impacts on infrastructure, caused by bird nesting, perching and other activities (Minor (2)) and (Minor (2));

“Mitigation Recommendations:

Construction phase

Avoidance:

- Ensure strict and effective waste management (including of food) during construction activities, to discourage an unnatural increase in scavenging species such as Pied Crow.
- Avoid creating new habitats with open water, e.g. accumulations of storm water/open water/run-off, that may attract birds.

Operational phase

Minimisation:

- Monitoring is essential to identify (potential) problem areas (see Section 8 below); any movement of hitherto unrecorded species onto or beneath the solar panel structures should be monitored; and any resulting negative impacts (e.g. entrapment of korhaans or spurfowl/francolins in fences; predation), should be addressed accordingly.
- Bird perching or nesting activities on solar infrastructure may become a problem (e.g. by causing fouling of the solar panels), and adaptive management measures may be required (such as anti-perch measures, e.g. spanning a low wire across the perching area). Nesting activities should be discouraged early in the cycle, before any eggs are laid; the Ministry of Environment, Forestry and Tourism (MEFT) should be contacted for specific guidelines for dealing with such problems.
- Numerous actions/devices have been developed to deter birds from an area (WEST 2014; Walston et al. 2015, UNEP/CMS 2015; Jenkins et al. 2017). In terms of solar PV arrays, these deterrents could include habitat management, control of prey populations, anti-perching devices, nest-proofing, netting or other enclosures, scaring or chasing (e.g. with trained dogs), bio-acoustic or visual deterrence. The desirability and effectiveness and such deterrents would need to be considered on a case-by-case basis, using an adaptive management approach.
- Should any nesting or other activity by crows on power supply structures cause disruptions of the power supply, consult with the MEFT for appropriate measures to discourage and manage such activities, e.g. by removing nests at a stage when this is acceptable (African Conservation Services, 2022).”

Bird electrocutions on power line infrastructure (Minor (4)) and Low (2));

“Mitigation recommendations

The mitigation measures below are already standard procedure for most pole structures, but are mentioned for the sake of completeness.

Construction phase

Minimisation:

- A standard mitigation for electrocutions in Namibia is to "gap" the earth wire near the top of the pole, i.e. the earth wire on each power line pole should stop at least 300 mm below the lowest phase to provide an air space safety gap, in order to reduce the electrocution risk (see existing 22 kV power line for example of such "gapping").

- On strain structures where "jumper" wires are used, at least the centre jumper should be insulated, using PVC piping or LPDE pipe. Jumpers should be offset where possible.
- Transformer/switchgear structures should be designed in such a way that they are not attractive as bird perches/ nesting sites; selected live components should be insulated (e.g. using PVC piping or LDPE pipe; Figure 28).
- Any stay wires should also be "gapped" by the use of an insulator.

Operational phase

Minimisation:

- The need for reporting power line incidents should be stressed, and reporting procedures clarified (see Section 8, Monitoring below) (African Conservation Services, 2022)."

Bird collisions with infrastructure such as solar PV panel arrays and fencing (Minor (4)) and Low (2));

"Mitigation recommendations

Project design phase

Avoidance:

- In order to reduce the chances of the panels being mistaken for sheets of water, minor modifications could be made to the panel design (e.g. by means of applying visual cues: see Operational phase: minimisation, below), but at this stage this should rather be considered as an adaptive mitigation, to be retro-fitted once there is a recorded need.
- As with the existing 5 MW solar PV plant, the panels should be arranged in rows with gaps as large as possible in between the rows, to help reduce the effect of a 'solid mass of water.
- The solar PV area should be fenced with predator-proof fencing, to reduce indirect predation of any bird collision species (if injured and still alive), and also to prevent the removal of any carcass material by mammalian scavengers before it is recorded.
- As far as possible the use of outdoor lighting at the solar facility should be minimised (Jenkins et al. 2017). Research indicates that lights can attract and confuse migrating birds (Gehring et al. 2009; Manville 2005, 2009, 2013). Some insectivorous birds may also be attracted to lights. Security lighting should be kept to the minimum, and directed downward and away from the PV panels if possible.
- The solar PV panels themselves should not be directly illuminated. Non-reflective surfaces (e.g. anti-reflective coating) should be used if possible.

Operational phase

Minimisation:

- If monitoring results indicate that bird collisions are taking place on the solar panels, adaptive mitigations could include the retrofitting of visual cues to existing panels (Kagan et al. 2014). Such minor modifications to the panel design could reduce the chances of the panels being mistaken for sheets of water. These visual cues may include

UV-reflective or solid (white) contrasting bands spaced no further than 28 cm from each other. This arrangement has been shown to significantly reduce the number of small passerine birds hitting expanses of windows on commercial buildings. Non-polarising white tape used around and/or across panels (grid partitioning) can also minimise reflection, which can attract aquatic insects (and thus avian predators), as it mimics reflective surfaces of waterbodies (Horvath et al. 2010; Bennun et al. 2021).

- In extreme cases of repeated collisions by night-flying (aquatic) birds (e.g. ducks, grebes), the situation should be reassessed in terms of the possibility of tilting the solar panels to a non-horizontal position when in standby mode (at night) (Walston et al. 2015, UNEP/CMS 2015, Jenkins et al. 2017), taking into account technical constraints. This mitigation would be possible with the proposed panel design.
- Monitoring of any potentially negative impacts is considered essential (see Section 8 below). Should the results show that such impacts, including injuries and/or mortalities of birds are taking place, adaptive mitigation measures would need to be investigated, if necessary on a species-specific basis.
- If monitoring results indicate that bird collisions are taking place on the perimeter fencing of the solar project, systematic fence marking may be utilised to reduce avian collisions with fences (Jenkins et al. 2017). Markings should be at an appropriate height to be visible to birds flying at or above the height of the solar panels (African Conservation Services, 2022).”; and

Bird collisions with power line infrastructure (moderate(6)) and (minor (4))

“Project design phase

Avoidance & minimisation:

- At this stage, no marking of power lines is recommended, but it should become mandatory should monitoring results indicate the necessity. The avifauna specialist can be consulted for advice on the design (see Figure 29 for example).
- The need for fitting any mitigation for collisions on stay wires (e.g. marking with vibration dampers) should also be based adaptively on monitoring results.

Operational phase

Minimisation:

- The need for reporting power line incidents should be stressed, and reporting procedures clarified (see Section 8.2 below). Should monitoring indicate that collisions are still taking place despite the above marking, further mitigation would need to be investigated (African Conservation Services 2022).”

7.5.3 Disturbance and displacement of potentially vulnerable and protected species

The construction of solar PV facilities usually involves the clearing of large areas of land and for the proposed Project the proposed area is about 120 ha; this equates to the clearing of about 120 rugby fields. With such an aerial extent of the disturbance, there is the possibility of potentially impacting protected, sensitive, or vulnerable species. This clearing usually tends to “destroy, degrade, fragment or otherwise displace” species (avifauna habitat loss is especially a concern) (Jenkins et al. 2017).

According to Patton et al. (2013), all new proposed solar energy plants (construction and operation) have the potential to impact wildlife (Mammals, birds, reptiles and amphibians), and the extent of the impact will depend on the following factors:

- Size of area/habitat to be disturbed;
- The nature of the disturbance (i.e., long-term/permanent alteration due to construction on the 120 ha area);
- Wildlife occupying the area; and
- Timing of the construction phase and activities” relative to the crucial life stages of wildlife (i.e., breeding season)”.

Potential disturbances on wildlife include (Patton et al. 2013):

- Behavioural disturbance;
- Harassment;
- Nest abandonment;
- Territory adjustments;
- Reduction in carrying capacity;
- Genetic isolation;
- Uptake of toxic materials (during construction);
- Reproductive impairment; and
- Increased predation rates.

The magnitude of change on protected, sensitive, endangered or threatened wildlife species with regards to potential disturbances or displacement (as a result of the proposed Project) is moderate, as there are a few protected species in the area and according to African Conservation Services, (2022), various endangered, threatened or rare bird species found in the area, or breeding/nesting birds might also be found/present on-site. The sensitivity has been rated high because various of the species mentioned in this document are listed under Appendix I and Appendix II of CITES, the Nature Conservation Ordinance 4 of 1975, listed as endangered or threatened by the IUCN and are sensitive to habitat destruction. None of the wildlife species known/expected to occur in the area is however exclusively associated with the proposed solar plant site.

The significance of the impact has thus been classified as moderate (Table 13) and with the implementation of recommended mitigation measures, the significance of the impact is expected to be minor.

Table 13 - Impacts related to the potential disturbance or displacement of vulnerable or protected species

ASPECT	BIODIVERSITY	
Description of activity	Vegetation clearing and construction activities	
Description of impact	Potential disturbance or displacement of protected or vulnerable species.	
Assessment of impact	**Receptor**	**Biodiversity (Mammals, Reptiles, Avifauna and amphibians)**
	Effect/description of magnitude	Adverse Direct Irreversible Moderate Permanent On-site Likely
	Value of sensitivity	High
	Magnitude of change	Moderate
	Significance of impact prior to mitigation	Moderate (6)
Impact management/control measures	• Preconstruction monitoring is recommended to determine the presence of any threatened or protected species; • Keep some of the natural habitat on-site intact where possible; • Professional ecologists should evaluate the site for any potential endangered or protected species before clearing of vegetation starts (i.e., endangered vultures breeding in trees on-site); • Plant native vegetation between solar components, that will not influence/impact the solar panels (i.e., native grasses); • Do not use pesticides on-site as far as reasonably possible; • Use livestock to naturally control vegetation on-site where possible; • The breeding season of wildlife should be considered for construction activities (i.e., ground-nesting birds and cavity-nesting birds). • Regular toolbox talks with construction workers and operational staff on the importance of biodiversity mitigation measures; and • Strict rules should be implemented on-site to prevent any poaching, harming, collection or killing of wildlife.	

ASPECT	BIODIVERSITY
Residual impact after mitigation	**Minor (4)**

7.6 IMPACTS ON THE ENVIRONMENT

7.6.1 Soil disturbances

A few factors can contribute to the overall effect(s) of soil disturbance in a specific project area and can include the degree of the disturbance, the amount of change in a certain soil property and the extent to which that change occurs, the pattern of disturbances (i.e., evenly, patches etc) and the location of proposed area relative to other "resource values" (i.e., streams, heritage sites, sensitive habitats and riparian zones) (Napper et al. 2009).

The proposed Project will include vegetation clearing, excavation, ground preparations and other construction activities that might potentially disturb the natural soil environment on the proposed site. Some of the common causes of soil disturbances from solar energy projects include (Patton et al. 2013):

- **Soil compaction:** This occurs when soil is compressed (i.e., heavy machinery or vehicles in the field), thus resulting in increased densities due to reduced pore spaces. During wet conditions (rainy season) soils are more vulnerable to compaction.
- **Soil horizon mixing:** This usually occurs during construction activities such as excavations and backfilling, this disturbs the soil profile and displaces topsoil. Due to these changes soils are more prone to erosion because stabilizing matrices are removed (i.e., desert pavement and biological crust). This also impacts vegetation in the area, by influencing optimum conditions for native plants and making way for invasive species.
- **Soil contamination:** This could occur due to machinery and vehicles (i.e., fuels and oils) used on site**.** Some solar plant sites use herbicides (weed control) and chemicals for dust control that could potentially contaminate soils. Soil contamination could then impact wildlife (ingestion and inhalation), water quality and vegetation. Other impacts include the reduction in carbon-fixing qualities of soil (removal of "biological soil crust") and the potential release of soil-borne diseases/toxins.

The following impacts could occur as a result of disturbed soils (Patton et al. 2013):

- **Soil Erosion:** This occurs when substantial amounts of soil are lost due to natural dominant eroding agents like wind and surface water runoff. The clearing of vegetation, soil stockpiling, vehicle and machinery use and excavating on project sites might significantly increase the vulnerability of soils.

- **Sedimentation:** Wind and water erosion are usually responsible for sediments making their way to streams, dams and other natural surface water sources.

Sedimentation can have various negative impacts on natural or man-made waterways, for example increasing the potential severity of floods and blocking drainages or navigation channels and sediments that remain suspended in surface water can degrade water quality.

The magnitude of change in the soil environment is expected to be moderate because it is approximately 120 ha of soil that might be disturbed as a result of construction activities and this, in turn, could indirectly impact vegetation, water resources, wildlife and microorganisms. The sensitivity of the receptor is rated as medium because soil plays an important part in ecosystem functioning. The significance of the impact has thus been classified as moderate (Table 14) and with the implementation of recommended mitigation measures, the significance of the impact is expected to be Minor.

Table 14 - Impacts related to the potential soil disturbances

ASPECT	**SOIL**	
Description of activity	Construction and operational activities	
Description of impact	Potential soil disturbances during the construction phase of the Project.	
Assessment of impact	**Receptor**	**Soil**
	Effect/description of magnitude	Adverse Direct Partly reversible Moderate Permanent On-site Definite
	Value of sensitivity	Medium
	Magnitude of change	Moderate
	Significance of impact prior to mitigation	Moderate (6)
Impact management/control measures	• Try to keep soil disturbances to a minimum, for example only prepare the soil/ground as required for the construction of the solar plant (i.e., foundations); • Prevent driving with heavy vehicles in the field and use existing access roads as far as reasonably possible; • Prevent soil compaction as far as reasonably possible;	

ASPECT	SOIL
	• Do not leave the ground bare (i.e., replant natural grasses or smaller plant species); • Recommended storing and retaining topsoil and sub-soil removed from the construction areas for later use during reestablishment (i.e., when construction work is done); • Use native and non-invasive species for "landscaping and rehabilitation works"; • For the rehabilitation of disturbed areas use "soil, mulch and vegetation debris (that contain natural seed stock)" to facilitate natural revegetation; • Use "manual methods (e.g. hoeing or hand-pulling)" for the clearing of vegetation, where possible to limit soil disturbance; and • Soil erosion and sedimentation control measures should be implemented.
Residual impact after mitigation	**Minor (4)**

8 CONCLUSION

Through the scoping process and impact assessment, it was found that the significant impacts that may occur during the proposed construction and operational phases of the Project are impacts relating to visual disturbances of the proposed solar plant, the potential to uncover heritage remains, the potential removal of protected and vulnerable plant species, habitat destruction due to the clearing and preparation of about 120 ha of land, habitat fragmentation due to the proposed fence, avifauna impacts, potential removal or displacement of vulnerable or protected wildlife species and the potential soil disturbances due to construction and operational activities.

These impacts have been classified as minor to moderate and should thus be carefully monitored and managed according to the EMP and recommendations/mitigations in the Avifauna specialists' study, to ensure that the significance level of the impact is minimised as far as reasonably possible.

With the implementation of best practice methods, national regulations and recommended mitigation measures, the significance of the impacts is expected to be low to minor.

Furthermore, the potential impacts with regards to waste generation, increased traffic or people in the vicinity of the proposed site, occupational health and safety, noise, air quality, fire risk, groundwater and soil contamination, soil erosion and sewerage waste are expected to be of low to minor significance. But these areas should still be managed according to the EMP to ensure that the Proponent complies with the relevant legislation, international standards and best practices.

9 REFERENCES

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APPENDIX A – ENVIRONMENTAL MANAGEMENT PLAN

APPENDIX B – BACKGROUND INFORMATION DOCUMENT

APPENDIX C – PUBLIC CONSULTATION

innosun
Sustainable power for Africa

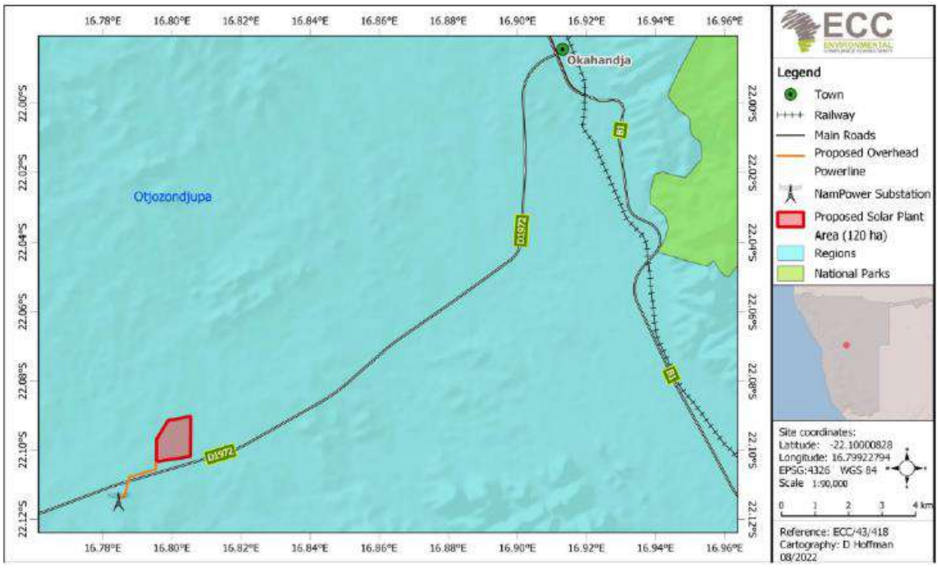
NOTICE OF AN ENVIRONMENTAL ASSESSMENT FOR THE PROPOSED CONSTRUCTION AND OPERATION OF OSONA II – 36 MW SOLAR PHOTOVOLTAIC POWER PLANT NEAR OKAHANDJA, OTJOZONDJUPA REGION, NAMIBIA.

Environmental Compliance Consultancy CC (ECC) hereby gives notice to the public that an application for an environmental clearance certificate in accordance with the Environmental Management Act, No. 7 of 2007 will be made for the proposed 36 MW solar PV power plant. Members of the public are invited to register as an Interested and Affected Party (IAP) and provide input into the environmental clearance certificate application process:

Applicant:	**InnoSun Energy Holding (Pty) Ltd**
Environmental Assessment Practitioner (EAP):	**Environmental Compliance Consultancy**
Location:	**Otjozondjupa Region, Namibia**
Project ID:	**ECC-43-418**

Proposed Project Activity: The Proponent, InnoSun Energy Holding (Pty) Ltd intends to construct and operate a 36 megawatt (MW) solar photovoltaic (PV) power plant on farm Osona Commonage No. 65 portion 82, which will be linked to a nearby NamPower substation. The solar plant and associated infrastructure will cover an area of approximately 120 ha.

Proposed Project Area: Otjozondjupa Region, Namibia



I&AP Registration: The purpose of the registration period is to introduce the proposed project and to allow Interested and Affected Parties (I&APs) to register and comment on the Background Information Document (BID), to ensure that potential issues and concerns are brought forward so that they can be considered and assessed during the assessment process.

I&APs and stakeholders can register for the project at: https://eccenvironmental.com/download/the-proposed-osona-ii-36mw-solar-pv-power-plant-near-okahandja-otjozondjupa-region-namibia/

The team at ECC will maintain contact with all registered I&APs to engage and keep them informed as the ESIA process develops. ECC will also provide registered I&APs input opportunities and review periods throughout the assessment process.

ECC ENVIRONMENTAL COMPLIANCE CONSULTANCY

Contact: Mr JS Bezuidenhout or Mrs J Mooney
Environmental Compliance Consultancy
Registration Number CC/2013/11404
PO Box 91193, Klein Windhoek
Tel: +264 81 669 7608
E-mail: info@eccenvironmental.com
Website: www.eccenvironmental.com/projects

	
Coordinates:	**22°6'31" S, 16° 47'18" E**

innosun

NOTICE OF AN ENVIRONMENTAL ASSESSMENT FOR THE PROPOSED CONSTRUCTION AND OPERATION OF OSONA II – 36 MW SOLAR PHOTOVOLTAIC POWER PLANT NEAR OKAHANDJA, OTJOZONDJUPA REGION, NAMIBIA.

Environmental Compliance Consultancy CC (ECC) provides this notice to the public that an application for an environmental clearance certificate in terms of the Environmental Management Act, No. 7 of 2007 will be made for the proposed 36 MW solar PV power plant. Members of the public are invited to register as an Interested and Affected Party (IAP), are invited to provide input into the environmental clearance certificate application process.

Applicant:	**InnoSun Energy Holding (Pty) Ltd**
Environmental Assessment Practitioner (EAP):	**Environmental Compliance Consultancy**
Location:	**Otjozondjupa Region, Namibia**

Project: Proposed construction and operation of Osona II – 36 MW solar photovoltaic power plant near Okahandja, Otjozondjupa Region, Namibia.

Proposed Activities: The Proponent, InnoSun Energy Holding (Pty) Ltd intends to construct and operate a 36 megawatts (MW) solar photovoltaic (PV) power plant on farm Osona Commonage No. 65 portion 82, which will be linked to a nearby NamPower substation. The solar plant and associated infrastructure will cover an area of approximately 120 ha.

Purpose of the review and registration period: The purpose of the review and registration period is to introduce the proposed Project and to allow registered Interested and Affected Parties (I&APs) to comment on the Background Information Document (BID) to ensure that all issues and concerns are brought forward, captured and considered further in the assessment.

The registration period is effective from **13 September to 27 September 2022.** I&APs and stakeholders are required to register for the Project at: https://eccenvironmental.com/download/the-proposed-osona-ii-36mw-solar-pv-power-plant-near-okahandja-otjozondjupa-region-namibia/

The team at ECC will then maintain contact with all registered I&APs to keep them informed and engaged as the ESIA process develops, ECC will also provide registered I&APs relevant documents to review during the assessment process.

Environmental Compliance Consultancy
Registration Number: CC/2013/11404
Members: Mr JS Bezuidenhout or Mrs J Mooney
PO Box 91193, Klein Windhoek
Tel: +264 81 669 7608 | E-mail: info@eccenvironmental.com
Website: www.eccenvironmental.com/projects | Project ID: ECC-43-418-ADT-05-D

BANNERMAN

NOTICE OF ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

ASEC

ENVIRONMENTAL IMPACT ASSESSMENT (SCOPING REPORT AND EIA & EMP) FOR THE ENVIRONMENTAL CLEARANCE CERTIFICATE FOR THE TEMPORARY WATER PIPELINE FROM THE RÖSSING PIPELINE VIA GOANIKONTES TO THE ETANGO MINE SITE DURING CONSTRUCTION

Bannerman Mining Resources (Namibia) (Pty) Ltd herewith gives notice in terms of the Environmental Management Act, 7 of 2007 and Regulation 21 of the Environmental Impact Assessment (EIA) Regulations (January 2012), of their proposed construction of a temporary water pipeline from the Rössing pipeline to the Etango Project site area during construction **(see map below)**.
Prior to implementing the proposed Project, an EIA process will be conducted. An application for environmental clearance certificate (ECC) will be submitted to the relevant Component Authority (Ministry of Agriculture, Water and Land Reform) who will review and forward the application to the Ministry of Environment, Forestry and Tourism (Environmental Commissioner) in terms of the above-mentioned regulations. This advertisement forms part of the EIA public participation process.

Applicant:
Bannerman Mining Resources (Namibia) (Pty) Ltd

Nature and location of the proposed activity:
Permanent water supply for the Etango Project will come from NamWater in the form of desalinated water for the processing and domestic requirements. However, during the construction phase of the Etango Project, water will be sourced temporarily from the Rössing pipeline for approximately 2 years. The section from the Rössing pipeline to Farm Weizenberg will be buried and left to replace the existing aging current pipeline to the farms in the Swakop River. The remaining part will be above-ground and be removed after the permanent pipeline has been commissioned.
The adjacent figure shows the location of the temporary pipeline.
The pipeline will be made of high-density polyethylene (or HDPE) plastic and will have a 160mm outside diameter. The total length of the temporary water pipeline will be approximate 25km.

Independent Environmental Assessment Practitioner:
A. Speiser Environmental Consultants CC (ASEC) has been appointed by Bannerman as the independent Environmental Assessment Practitioner to undertake the EIA process for the proposed project.

Contact Person:	Alexandra Speiser	or	Werner Ewald Tel: 064 416 200
E-mail:	amspeiser@yahoo.com	or	wewald@bannermanresources-na.com

Registration to receive notifications / information and opportunity to comment:
To register as an interested and affected party for the proposed Project, please submit your name and contact details to ASEC by e-mail, or by contacting Werner Ewald. A Background Information Document (BID) is available for a review and comment period from **06th September to 06th October 2022**. Electronic copies of the BID are available on request from ASEC as per above details. Focus group meetings with I&APs have already started, but further meetings will be scheduled on request.
If you would like your comments to be addressed in the EIA Report please submit them to ASEC by no later than **06th October 2022**.

THE DUTCH REFORMED CHURCH OUTJO, NAMIBIA

VACANCY: MINISTER

N.G.Kerk Outjo is located in northwest Namibia. This is a rural town with many challenges but has the potential to grow steadily, with approximately 387 confirmed and 102 baptized members as well as visitors. The community makes their living mainly from agriculture, various businesses, hunting and tourism. The oldest private school in Namibia is also based here in Outjo. We as a community pray and trust in our Lord to send us a dedicated child of God who will lead our congregation.

The following are the most important to us as a community

Relationships - we have active cell groups, care groups, farm districts, outreach and youth ministries. Within our community we are fortunate enough to have various ministries who work fulltime within the impoverished and needy areas.

Worship & Outside Services - these are valued as extremely important functions within our community.

Compensation - we trust in the Lord that we will operate and negotiate within the guidelines of the heat office of the church.

Applications - we hereby invite any qualified minister from our church body who may feel drawn to join our team here in Outjo to send us a CV of a maximum of three (3) pages and three (3) contactable references to ngoutjo@iway.na before **20 September 2022.**

Only shortlisted candidates will be contacted.

For more information – Lukas Holtzhausen (Chariman) + 264 81 127 2571 or the church office phone/Faks nr + 264 67 313 152, Sell nr +264 81 876 8717

The church holds the right to not appoint an applicant

USAID | NAMIBIA
FROM THE AMERICAN PEOPLE

THE UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT (USAID)

Has the following vacancy as detailed below: -

Please note that applications must be submitted electronically via the **Electronic Recruitment Application (ERA)** system, by **midnight Monday September 19, 2022**, to be considered.

Interested applicants should visit the USAID Namibia Website at

http://na.usembassy.gov/embassy/jobs/
to apply for this vacancy

Project Management Specialist – Health N$ 752,325 – N$1,052,274 (FSN – 12)

Basic Functions of the Job

The USAID Project Management Specialist (Health) fills a key technical and management role. The position will act as a Deputy and support the USAID Health Office Director or acting Director in managing all aspects of the Health Office portfolio, provide coverage support for the Director as needed, assist in supporting the team in preparing HIV and health security deliverables, and serve as the point person for identifying, tracking and coordinating emerging risks to the health system (drought, COVID-19, food insecurity). In the absence of the Health Office Director, the Specialist will provide guidance and mentoring of the entire Health Office Staff.

Under the leadership of the USAID Project Management Specialist (Health), USAID/PEPFAR will ensure continued, meaningful engagement with the government of Namibia and other stakeholders throughout the development and implementation of risk responses to health security threats. The Specialist will help ensure that the USAID Namibia programs are effectively prepared to respond quickly to emerging risks and that program activities and resources are used to maximum benefit for the people of Namibia while ensuring that all other USAID programs are maintained.

Working collaboratively with the USAID/Namibia team and the PEPFAR interagency team, the USAID Project Management Specialist (Health) will also take the lead (for USAID) in developing funding proposals related to identified risks to sustaining HIV epidemic control such as drought, food insecurity, and other emerging health security threats like COVID-19. The USAID Project Management Specialist (Health) will play an important interagency role in ensuring communication and coordination in identifying, tracking, preventing, and evaluating health security risks that could jeopardize the gains made toward HIV/AIDS epidemic control.

FOR FURTHER INFORMATION: The complete position description listing all the duties and responsibilities and application requirements may be obtained on our website: https://na.usembassy.gov/embassy/jobs/)

EQUAL EMPLOYMENTOPPORTUNITY: USAID Namibia provides equal opportunity and fair and equitable treatment in employment to all people without regard to race, color, religion, sex, national origin, age, disability, political affiliation, marital status, or sexual orientation. The Department of State also strives to achieve equal employment opportunity in all personnel operations through continuing diversity enhancement programs.

The EEO complaint procedure is available to individuals who believe they have been denied equal opportunity based upon the listed EEO complaints. Individuals with such complaints should avail themselves of the appropriate grievance procedures, remedies for prohibited personnel practices, and/or courts for relief.

8 Republikein Sun AZ Allgemeine Zeitung Market Watch TUESDAY 20 SEPTEMBER 2022

Scombrus Fishing

No 8, 6th Street East, Walvis Bay, Namibia
P.O. Box 5981, Walvis Bay, Namibia
www.scombrus.com.na

Scombrus is a proudly Namibian fishing company in the Mid-water Fishery.

Scombrus Fishing (Pty) Ltd. is an established player in the Namibian Midwater Fishery with proven record of sustainable and efficient fishing operations. The company owns and operates a Midwater Freezer vessel with sufficient capacity to produce more than 25,000 tons of final product per annum. Scombrus Fishing aims to create maximum employment opportunities for Namibians and to contribute to the economic and social well-being of the Namibian nation. It is therefore our pleasure to invite suitably qualified Namibians to apply for the following positions.

Vacancies:

1) Class 1 and 2 marine navigation officers
2) Class 1 and 2 marine engineers
3) Marine electrical engineers with at least 8 years sea-going service experience
4) Marine refrigeration engineers with at least 8 years sea-going service experience
5) Trawl masters
6) Production managers
7) Ship's doctor
8) International sales consultant

For more information on these vacancies and how to apply, please visit our website at www.scombrus.com.na

Please note: Only short-listed candidates will be contacted.

Closing date:
Friday, 30 September 2022

Cavemafishing

No 9, 4th Street East, Walvis Bay, Namibia
P.O. Box 3915, Walvis Bay, Namibia
www.cavema.com.na

Cavema Fishing (Pty) Ltd is an established Namibian fishing company operating in the Mid-water pelagic sector. The company was created as a joint venture between two Namibian quota holders, namely Camoposatu Investment (Pty) Ltd and Vernier Investment (Pty) Ltd, in an effort to optimize efficiencies and fishing capacity through the pooling of quota resources. The shareholding structure of the firm reflects Namibian beneficial ownership, which is in line with the national drive for industry Namibianization and demonstrates commitment towards empowering previously disadvantaged Namibians. As a proud equal opportunity employer, we would like to invite suitably qualified candidates to apply for the following vacancies:

Vacancies:

1) Class 1 and 2 marine navigation officers
2) Class 1 and 2 marine engineers
3) Marine electrical engineers with at least 8 years sea-going service experience
4) Marine refrigeration engineers with at least 8 years sea-going service experience
5) Trawl masters
6) Production managers
7) Ship's doctor

For more information on these vacancies and how to apply, please visit our website at www.cavema.com.na

NB: Only short-listed candidates will be contacted.

Closing date:
Friday, 30 September 2022

WECKE & VOIGTS

SUPERSPAR THE GROVE

Bakery Manager

Position Overview

The position entails a strong capacity for understanding and navigating complex systems and identifying linkages, gaps and opportunities within them, to effectively support the day-to-day operations and the profitability of the Bakery Department. The purpose of the position is to effectively plan, control and monitor the performance of stock/production to ensure that it operates at an optimal level as per budget target requirements. Manage staff in matters relating to health and safety regulations, dress code and policy. Do overall maintenance checks on equipment. Ensure stock levels, quality and pricing meets the demand of customer. Arranging for promotions and specials with suppliers. Identify and minimise risks and ensure optimum capacity and functioning all within the regulations, policies, and processes of the business.

Main Areas of Responsibility
- Targets and Profitability
- Manage Stock
- Pricing and POS
- Hygiene & Housekeeping
- Staff Management
- Customer Management
- Organisational Systems
- Manufacturing Process
- Equipment Handling
- Cold Chain Management
- Sanitation Management
- Human Resource Management
- General Management
- Legislation Ingredients & Recipes

Skills / Competencies
- Analytical Skills
- Problem Solving Skills
- Communication Skills
- Time & Priority Management
- Negotiation Skills
- Coaching Skills
- Organising Skills
- Collaboration Skills
- Production Skills

Knowledge
- Marketing Trends
- Retail
- Product Knowledge
- Ordering & Stock Rotation

Personal Attributes
- Leadership Ability
- Customer minded
- Team Player
- Detail Orientation
- Positive Attitude
- Growth Potential

Education & Experience
- Grade 12 (NQF 4)
- Tertiary qualification in Hospitality or relevant field.
- Minimum of 5 years' experience in Bakery production.
- Minimum of 3 years' experience in staff management.

In the absence of required tertiary education, the following is required.
- Grade 12 (NQF 4)
- 8 Years' experience in Bakery production.
- Minimum of 3 years' experience in staff management.

Literacy
- Exceptional interpersonal as well as verbal and written communication skills.
- Computer literacy: Strong Microsoft Office and stock systems skills.
- Strong facilitating and presentation skills.
- Numeric Literacy: Advanced calculations and proficient in accounting principles and able to understand and interpret figures/budgets.

Closing Date: 26 September 2022 at 17:00
Please apply and view more details via www.jobportunities.net
Or scan the QR code with your smartphone
Preference will be given to Namibian Citizens
Please note only shortlisted candidates will be contacted

Vacancy

Interested persons should visit
http://careers.standardbank.com/standimg/Careers/index.html
for more information on the following vacancy:

Specialist: Investor Relations

Closing date: 30 September 2022

www.standardbank.com.na

@StandardbankNa   Standard Bank Namibia   standardbank_namibia

Standard Bank *IT CAN BE.*

innosun

NOTICE OF AN ENVIRONMENTAL ASSESSMENT FOR THE PROPOSED CONSTRUCTION AND OPERATION OF OSONA II – 36 MW SOLAR PHOTOVOLTAIC POWER PLANT NEAR OKAHANDJA, OTJOZONDJUPA REGION, NAMIBIA.

Environmental Compliance Consultancy CC (ECC) provides this notice to the public that an application for an environmental clearance certificate in terms of the Environmental Management Act, No. 7 of 2007 will be made for the proposed 36 MW solar PV power plant. Members of the public are invited to register as an Interested and Affected Party (IAP), are invited to provide input into the environmental clearance certificate application process.

Applicant:	**InnoSun Energy Holding (Pty) Ltd**
Environmental Assessment Practitioner (EAP):	**Environmental Compliance Consultancy**
Location:	**Otjozondjupa Region, Namibia**

Project: Proposed construction and operation of Osona II – 36 MW solar photovoltaic power plant near Okahandja, Otjozondjupa Region, Namibia.

Proposed Activities: The Proponent, InnoSun Energy Holding (Pty) Ltd intends to construct and operate a 36 megawatts (MW) solar photovoltaic (PV) power plant on farm Osona Commonage No. 65 portion 82, which will be linked to a nearby NamPower substation. The solar plant and associated infrastructure will cover an area of approximately 120 ha.

Purpose of the review and registration period: The purpose of the review and registration period is to introduce the proposed Project and to allow registered Interested and Affected Parties (I&APs) to comment on the Background Information Document (BID) to ensure that all issues and concerns are brought forward, captured and considered further in the assessment.

The registration period is effective from **13 September to 27 September 2022.** I&APs and stakeholders are required to register for the Project at: https://eccenvironmental.com/download/the-proposed-osona-ii-36mw-solar-pv-power-plant-near-okahandja-otjozondjupa-region-namibia/

The team at ECC will then maintain contact with all registered I&APs to keep them informed and engaged as the ESIA process develops, ECC will also provide registered I&APs relevant documents to review during the assessment process.

Environmental Compliance Consultancy
Registration Number: CC/2013/11404
Members: Mr JS Bezuidenhout or Mrs J Mooney
PO Box 91193, Klein Windhoek
Tel: +264 81 669 7608 | E-mail: info@eccenvironmental.com
Website: www.eccenvironmental.com/projects | Project ID: ECC-43-418-ADT-05-D

A BRIGHTER OPPORTUNITY FOR YOUR TOMORROW

VACANCIES

Namdeb's alluvial mining operations offer unique challenges for professionals who wish to be part of an of a world-class operation. With established open-cast, coastal and dredge mining operations as well as a variety of new technology-driven projects, Namdeb offers developmental opportunities unmatched at most other mining operations. We are thus challenging individuals who can think outside the box to join our dynamic team in contributing towards the development and implementation of new generation mining technology.

Applications are invited for the following position:

- **HEAD: SAFETY, HEALTH & OPERATIONAL RISK MANAGEMENT – Band 5**
- **Closing Date: 27 September 2022**

The Challenge:

The Head: Safety, Health & Operational Risk is responsible for managing, leading, supporting, implementing and coordinating Namdeb's, Risk, Safety and Health policies, procedures, technical standards, management plans and associated processes aligned to Group standards on site. The incumbent will provide assurance to its stakeholders by monitoring, and reporting on Company Performance, Risk, Safety and Health performance on and off site, including the Namdeb Hospital and Emergency Response through the balanced scorecard process.

Minimum Requirements for the Position:

- Chartered Accountant (CA), Certified Internal Auditor (CIA), BCom (Hons) or relevant Degree in Engineering, Mining, Metallurgy and Geology, with extensive site experience and exposure to risk/safety management.
- Eight (8) to Ten (10) years' post qualification experience of which Five (5) should be in a managerial role in any of the technical disciplines, with extensive knowledge on corporate governance, risk management and internal controls.

Technical Competencies:

- Strong project management skills with the ability to operate within a multi-disciplinary team;
- Sound strategic & long term planning experience;
- Operational management experience at senior level of running a mining/processing function, with demonstrated track record of performance;
- Strong analytical, interpretation and communication skills;
- Sound understanding and experience of controls, governance and risk management principles with hands-on operational risk management experience;
- Experience in reporting to senior management and Audit Committee with the ability to influence;
- Pro-activeness and the ability to work independently;
- Ability to work under pressure with a diversified portfolio whilst meeting deadlines;
- Environmental awareness and thorough operational knowledge of mining, financial and auditing principles.

Comprehensive packages are negotiable and preference will be given to applicants from designated groups in terms of the Namibian Affirmative Action Act. Interested candidates should forward curriculum vitaes with supporting documents to hr.recruitment@namdeb.com

www.namdeb.com

NAMDEB

+264 81 669 7608
info@eccenvironmental.com
www.eccenvironmental.com

ECC Ref: ECC-43-418-LET-03-D
13 September 2022

Identified Stakeholder and Potentially Interested Party for:
The proposed construction and operation of Osona II – 36 MW solar photovoltaic power plant near Okahandja, Otjozondjupa Region, Namibia.

Dear Sir or Madam:

RE: NOTIFICATION OF ENVIRONMENTAL ASSESSMENT FOR THE PROPOSED CONSTRUCTION AND OPERATION OF OSONA II – 36 MW SOLAR PHOTOVOLTAIC POWER PLANT NEAR OKAHANDJA, OTJOZONDJUPA REGION, NAMIBIA.

Environmental Compliance Consultancy (ECC) has been contracted by InnoSun Energy Holding (Pty) Ltd to conduct an environmental assessment and develop an environmental management plan (EMP) for the Project in terms of the Environmental Management Act, No. 7 of 2007.

This letter is intended to engage potentially Interested and Affected Parties (I&APs) for the project and provides a communication channel to ECC whilst the ESIA is ongoing. You have been identified as an interested or affected party and therefore ECC wishes to inform you of how you can interact with the ESIA.

The Proponent, InnoSun Energy Holding (Pty) Ltd intends to construct and operate a 36 megawatts (MW) solar photovoltaic (PV) power plant on farm Osona Commonage No. 65 portion 82, which will be linked to a nearby NamPower substation. The solar plant and associated infrastructure will cover an area of approximately 120 ha.

Public participation is an important part of the ESIA process, as it allows the I&APs to obtain information about the proposed project and provide feedback. Communication with the I&APs occurs at various stages throughout a project lifecycle including:

- Advertising in newspapers; public notice boards (completed);
- Distributing a Background Information Document (BID) to identified I&APs; available online at (https://eccenvironmental.com/projects/)
- Registered I&APs will also be informed of the available draft scoping report for a review period, during which period I&APs will have the opportunity to review the draft document and raise any issues or concerns, and

ENVIRONMENTAL COMPLIANCE CONSULTANCY CC
PO BOX 91193 WINDHOEK, NAMIBIA
MEMBERS: J L MOONEY & JS BEZUIDENHOUT
REGISTRATION NUMBER: CC/2013/11404

- I&APs who wish to register as such must do so on the ECC website as per the link provided below: https://eccenvironmental.com/download/the-proposed-osona-ii-36mw-solar-pv-power-plant-near-okahandja-otjozondjupa-region-namibia/

If you are unable to complete the registration form online, please contact us via email for assistance. info@eccenvironmental.com

ECC values community input and participation in our projects and we look forward to working with you as the project develops.

Should you have any questions or require additional information please do not hesitate to contact either of us.

Yours sincerely,

Stephan Bezuidenhout
Environmental Compliance Consultancy
Office: +264 81 669 7608
Email: info@eccenvironmental.com

Jessica Bezuidenhout Mooney

APPENDIX D – LEASE AGREEMENT (EXTRACT)

GRANT OF A RIGHT TO CONCLUDE A LEASE AND/OR SERVITUDE AGREEMENT:
For: Osona 2 – Solar PV Plant
DATED: 04/04/2022

INNOSUN ENERGY HOLDING (PROPRIETARY) LIMITED (Registration No. 2012/0550) of 2 Schützen Street, P.O. Box 27527, Windhoek, Namibia (**"the Tenant"**) conducts business as a renewable energy generator. The Tenant develops, finances, builds, operates and maintains commercial wind and solar powered generation facilities.

MR. BASIL BEAN [redacted] Okahandja (**"the Landlord"**) owns certain immoveable property known as **"Osona Commonage 65 Portion 82"** in the **Osona** area (**"the Property"**), at which the Tenant wishes to operate a Solar Park by installing solar panels on a portion of **120 ha** at the Property illustrated on Annexure "B" attached hereto (**"the Site(s)"**) (the more precise location and surface area of the Site(s) to be identified by the Tenant in consultation with the Landlord upon the undertaking of further surveys and investigations at the Property).

To give effect to the aforegoing, the Tenant wishes to lease the Site(s) on the Property and the incidental use of the Property from the Landlord and the Landlord is willing to grant such rights to the Tenant. By reason of the Property and/or the Site(s) constituting a portion of agricultural land and the rights being granted by the Landlord to the Tenant exceeding a period of 10 years, and the Landlord being desirous of granting such rights over a portion of the Property rather than all of the Property in excess of 10 years, the prior consent of the Minister of Agriculture is required to the conclusion of a lawful, binding lease agreement between the Landlord and the Tenant in terms of the Subdivision of Agricultural Land Act, No. 70 of 1970 and the prior consent of the Minister of Lands & Resettlement is required to the conclusion of a lawful, binding lease agreement between the Landlord and the Tenant in terms of the Agricultural (Commercial) Land Reform Act No 6 of 1995 as far as the controlling interest in the Tenant is held by a "foreign national" as defined in the Agricultural (Commercial) Land Reform Act No 6 of 1995 and the agreement of lease exceeds the period of 10 years.

gm AUI PJ dB.

1/15

APPENDIX E – NBRI LIST & AVIFAUNA SPECIALISTS STUDY

APPENDIX F – ECC CVS

APPENDIX G – ECB GENERATION LICENSE APPROVAL

ELECTRICITY CONTROL BOARD

GENERATION LICENCE

G–210-171022-25

Issued to

SOREXA SUN ENERGY (PTY) LTD

(Registration number: (2021/0895)

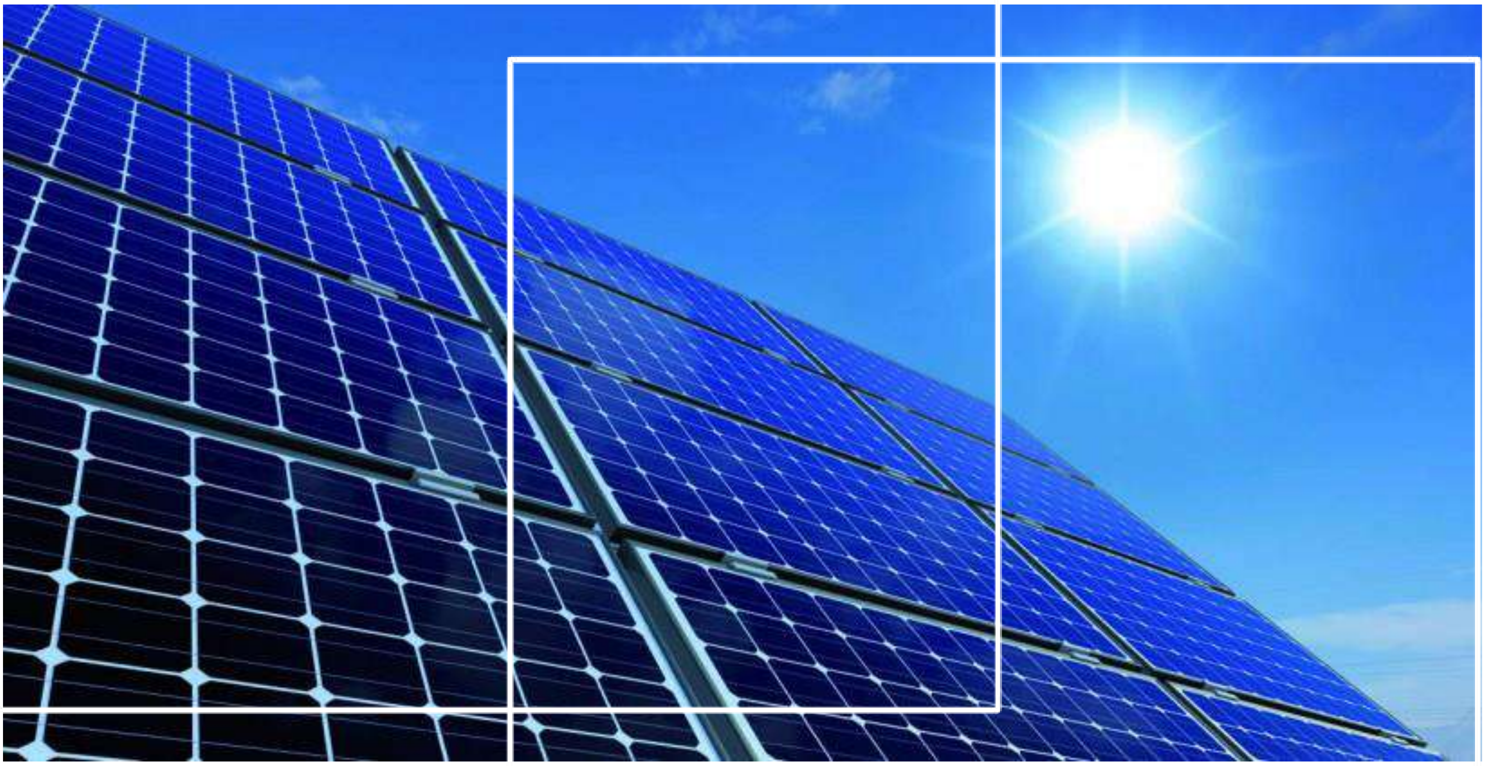
The ELECTRICITY CONTROL BOARD, in exercise of the powers conferred by section 20 (8) of the Electricity Act, 2007, and upon approval to grant a Generation Licence by the Minister in terms of section 20(6), hereby issues a Generation Licence to **SOREXA SUN ENERGY (PTY) LTD** to generate electricity through Solar PV at Osona, near Okahandja in the Otjozondjupa for the purpose of enabling a supply to be offered by suppliers to customers subject to the conditions as imposed by the Minister and set out in this Licence and the Electricity Act, 2007.

ELECTRICITY CONTROL BOARD

Gottlieb Hinda
Chairman

Pinehas Mutota
Acting Chief Executive Officer

NOT VALID WITHOUT LICENCE CONDITION



Submitted to: InnoSun Energy Holding (Pty) Ltd
Attention: Mr Pol Jestin

2 Schutzen Street,
Central Windhoek,
P.O. Box 27527,
Windhoek, Namibia

REPORT ON:

OSONA II – 36 MW SOLAR PV PLANT – ENVIRONMENTAL MANAGEMENT PLAN

PROJECT NUMBER:	ECC-43-418-REP-07-D
REPORT VERSION:	REV 01
DATE:	8 DECEMBER 2022

Prepared by:

TITLE AND APPROVAL PAGE

Project Name:	OSONA II – 36 MW SOLAR PV PLANT – ENVIRONMENTAL MANAGEMENT PLAN
Client Company Name:	InnoSun Energy Holding (Pty) Ltd
Client Name:	Mr Pol Jestin
Ministry Reference:	221011000065
Authors:	Diaan Hoffman and Stephan Bezuidenhout
Status of Report:	Final submitted to MME and MEFT
Project Number:	ECC-43-418-REP-07-D
Date of issue:	8 December 2022
Review Period	N/A

ENVIRONMENTAL COMPLIANCE CONSULTANCY CONTACT DETAILS:

We welcome any enquiries regarding this document and its content. Please contact:

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Email: info@eccenvironmental.com

DISCLAIMER

Environmental Compliance Consultancy (ECC) (Reg. No. CC 2013/11401) has prepared this report on behalf of the Proponent. This report has been authored by employees of ECC, who have no material interest in the outcome of this report, nor do any of the ECC team have any interest that could be reasonably regarded as being capable of affecting their independence in the preparation of this report. ECC is independent from the Proponent and has no vested or financial interest in the Project, except for fair remuneration for professional fees rendered which are based upon agreed commercial rates. Payment of these fees is in no way contingent on the results of this report or the assessment, or a record of decision issued by Government. No member or employee of ECC is, or is intending to be, a director, officer, or any other direct employee of the Proponent. No member or employee of ECC has, or has had, any shareholding in the Project. Any personal views or opinions expressed by the writer may not necessarily reflect the views or opinions of Environmental Compliance Consultancy or its client.

Please note at ECC we care about lessening our footprint on the environment; therefore, we encourage that all documents are printed double sided.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

DEFINITIONS AND ABBREVIATIONS

ABBREVIATIONS	DESCRIPTION
dB	Decibel
ECC	Environmental Compliance Consultancy
EIA	Environmental Impact Assessment
EMA	Environmental Management Act, No. 7 of 2007 and its regulations
EMP	Environmental Management Plan
IFC	International Finance Corporation
km	kilometre
MAWLR	Ministry of Agriculture, Water and Land Reform
MEFT	Ministry of Environment Forestry and Tourism
MME	Ministry of Mines and Energy
MSB	Modified Single Buyer
MSDS	Material Safety Data Sheet
MW	Megawatts
OSH	Occupational Safety and Health
PPE	Personal Protective Equipment
PV	Photovoltaic
SANS	South African National Standards
SHE	Safety Health Environmental

1 INTRODUCTION

1.1 BACKGROUND TO THE PROPOSED PROJECT

Environmental Compliance Consultancy (ECC) has been contracted by InnoSun Energy Holding (Pty) Ltd, to conduct an environmental assessment and develop an environmental management plan (EMP), for the proposed construction and operation of Osona II – 36 megawatts (MW) solar photovoltaic (PV) power plant near Okahandja, Otjozondjupa Region, Namibia. Consistent with the Environmental Management Act, 2007 and its regulations, an environmental clearance certificate application is hereby submitted to the competent authority being the Ministry of Mines and Energy (MME) and Ministry of Environment, Forestry and Tourism (MEFT) to make a Record of Decision (RoD) with regards to the proposed project.

The purpose of the report is to provide the necessary environmental and social scoping and assessment for the proponent to apply for and obtain an environmental clearance certificate for the construction and operation of Osona II - a 36 MW solar PV power plant on farm Osona Commonage No. 65 portion 82, Otjozondjupa Region, Namibia. The 120-ha leased area on farm Osona Commonage No. 65 portion 82 is located to the southwest of Okahandja and is accessible via the D1972 district road (about 19 km) leading off the B1 highway. The location is shown in Figure 1.

1.2 ENVIRONMENTAL REGULATORY REQUIREMENTS

This EMP has been developed by following the requirements of the Environmental Management Act, No. 7 of 2007 and its regulations (EMA).

Legislation that should be adhered to include the following mentioned in table 1.

National regulatory regime	Relevance to the Project
Constitution of the Republic of Namibia of 1990	Social protection
Atmospheric Pollution Prevention Ordinance 11 of 1976	Social and Biophysical landscape protection
Environmental Management Act, No. 7 of 2007 and its regulations, including the Environmental Impact Assessment Regulations, No. 30 of 2012	Environmental Management
Electricity Act No. 4 of 2007 & its Regulations.	Project-related
National policy for Independent power Producers (PPs) of 2018	Project-related
Soil Conservation Act, No. 76 of 1969 and the Soil Conservation Amendment Act, No. 38 of 1971	Biophysical protection
Water Act, No. 54 of 1956	Water source protection
The Forestry Act, No. 12 of 2001 as amended by the Forest Amendment Act, No. 13 of 2005	Vegetation protection
Nature Conservation Ordinance Act No. 4 of 1975 and its regulations.	Biodiversity protection
Labour Act, No. 11 of 2007 and regulations relating to the Health and Safety of employees at Work (No. 156 of 1997)	Social protection
National Heritage Act, No. 27 of 2004.	Heritage protection
The Regional Councils Act (No. 22 of 1992)	Project-related
Draft Pollution Control; and Waste Management Bill (1999)	Biophysical landscape protection

National regulatory regime	Relevance to the Project
Hazardous Substances Ordinance No. 14 of 1974	Biophysical landscape protection
Ifc Standards	**Possible Relevance**
Performance Standard 1	Assessment and Management of Environmental and Social Risks and Impacts
Performance Standard 4	Community Health, Safety, and Security

1.3 PURPOSE OF THE EMP

This EMP provides a logical framework, proposed mitigation measures and management strategies for the activities associated with the proposed Project, in this way ensuring that the potential environmental and social impacts are mitigated and minimised as far as practically possible and that statutory and other legal obligations are adhered to and fulfilled. Outlined in the EMP are the protocols, procedures and roles and responsibilities to ensure that management arrangements are effectively and appropriately implemented.

This EMP forms an appendix to the environmental scoping report and impact assessment and has been based on the findings of the assessment; therefore, the environmental scoping report should be referred to for further information on the proposed Project, assessment methodology, applicable legislation, and assessment findings.

This EMP is a live document and shall be reviewed at predetermined intervals, or updated when the scope of work alters, or when further data or information can be added. All personnel working on the Project will be legally required to comply with the standards set out in this EMP.

The scope of this EMP includes all activities carried out during the construction and operational stages of the Project.

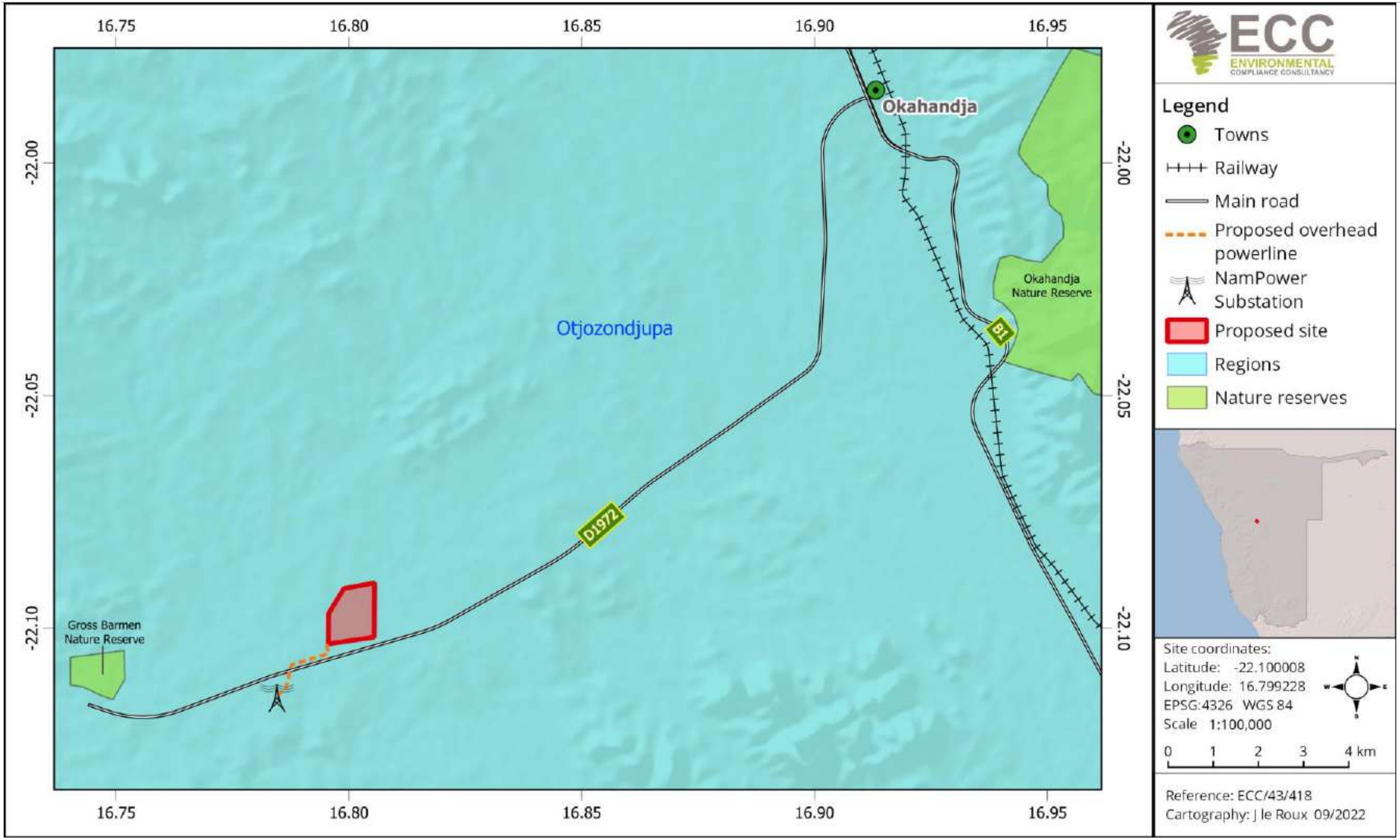

Figure 1 - Locality map showing the location of the proposed Osona II solar PV power plant.

1.4 Management of this EMP

The Proponent will hold the environmental clearance certificate for the proposed Project and shall be responsible for the implementation and management of this EMP. Before the commencement of the Project, this EMP shall be reviewed, amended as required and approved for implementation. The implementation and management of this EMP and thus the monitoring of compliance shall be undertaken through daily duties and activities as well as monthly inspections.

This report presents the EMP and has been undertaken in terms of the requirements of the EMA of 2007 and its regulations.

1.5 Limitations, uncertainties and assumptions of this EMP

This EMP does not include measures for compliance with statutory occupational health and safety requirements. This will be provided in the safety management plan to be developed by the Proponent. The Proponent should also ensure that all Nampowers safety requirements and recommendations with regards to the overhead powerline are followed and adhered to, as well as any requirements or recommendations as set out by the Electricity Control Board (ECB).

Where there is any conflict between the provisions of this EMP and any contractor's obligations under their respective contracts, including statutory requirements (such as licences, Project approval conditions, permits, standards, guidelines, and relevant laws), the contract and statutory requirements are to take precedence provided they are not in conflict with any environmental law or will in any way damage the environment beyond the limits set in the final approved EMP.

The information contained in this EMP has been based on the Project description as provided in the environmental scoping report.

1.6 Environmental and social assessment practitioner

Environmental Compliance Consultancy (ECC) (Reg. No. CC 2013/11401) has prepared this EMP on behalf of the Proponent.

This report has been authored by Employees of ECC, who have no material interest in the outcome of this report, nor do any of the ECC team have any interest that could be reasonably regarded as being capable of affecting their independence in the preparation of this report. ECC is independent of the Proponent and has no vested or financial interest in the Project, except for fair remuneration for professional fees rendered which are based upon agreed commercial rates. Payment of these fees is in no way contingent on the results of this report or the assessment, or a record of decision issued by the Government. No member or employee of ECC is or is intending to be, a director, officer, or any other direct Employee of

Proponent. No member or employee of ECC has or has had, any shareholding in the Project/Proponent.

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Tel: +264 81 669 7608
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2 PROJECT MANAGEMENT PERSONNEL

The Proponent shall provide a Project team to oversee the completion of current construction and proposed operational activities, which shall be composed of the Proponent's personnel and contractors. A nominated role shall be identified to ensure the management and implementation of this EMP throughout the Project is carried out, which shall be supported by the Proponent.

2.1 ORGANISATIONAL STRUCTURE, ROLES AND RESPONSIBILITIES

The Proponent shall be responsible for:

- Ensuring all members of the Project team, including contractors, comply with the procedures set out in this EMP
- Ensuring that all persons are provided with sufficient training, supervision, and instruction to fulfil this requirement
- Ensuring that any persons allocated specific environmental responsibilities are notified of their appointment and confirm that their responsibilities are clearly understood

Contractors shall be responsible for ensuring and demonstrating that all personnel employed by them are compliant with this EMP, and meet the responsibilities listed above

The key personnel and environmental responsibilities of each role throughout the Project life are presented in Table 1.

Table 1 - Roles and responsibilities

Role	Responsibilities and duties
General Manager (Proponent)	– Responsible for ensuring compliance with this EMP; – Ensuring employees understand and comply with the requirements of this EMP; – Ensuring that all personnel are provided with enough training, supervision, and instruction to fulfil this requirement; – Ensuring compliance with this EMP including overseeing the day-to-day activities during operations, and routine and non-routine maintenance works during operations; – Ensure the environmental policy is communicated to all personnel; – Responsible for providing the required resources (including financial and technical) to complete any required tasks; – Responsible for the management, maintenance and revisions of this EMP; – Maintain community issues and concerns register and keep records of complaints and responses provided;

Role	Responsibilities and duties
	– Maintain an up-to-date register(s) of employees who have completed the site induction; – Ensuring that best environmental practice is undertaken throughout the operations of the solar PV plant; – Notifying relevant regulatory authorities as soon as possible if serious environmental incidents occur. – Being responsible for all management plans and environmental monitoring; and – Receiving and responding to environment-related complaints received from the public or other stakeholders.
Foreman (Appointed HSE responsible person)	– The site manager/foreman will be responsible for the implementation of the EMP for the proposed solar PV plant. The foreman will be available, as required, throughout the operation of the solar plant and is responsible for the following roles: – Bearing authority and independence to demand reasonable steps as required to avoid or minimise unintended or adverse environmental impacts, and failing the effectiveness of such steps, to direct that relevant construction activities be ceased immediately should an adverse impact on the environment be likely to occur; – Weekly checklists must be completed by the foreman and findings submitted to the general manager; – Monthly EMP checklists must be completed by the foreman. Findings are to be submitted to the general manager; – Provisioning of environmental awareness/management training and inductions; – Ensuring that best environmental practice is undertaken throughout the operations of the solar plant; – Timely distribution of any relevant environmental documentation, including revisions to this EMP to all staff; – Responsible for being compliant with and adhering to this EMP at all times; – Ensuring they have undertaken a site induction and are conversant with the requirements of this EMP; and – Reporting of any operations and conditions that deviate from the EMP or any non-compliant issues or accidents to the Proponent.
Employees/ Contractors as well as visitors where applicable	– Any contractors hired for operation or maintenance activities at the solar plant shall be compliant with this EMP, and shall be responsible for the following: – Undertaking activities by following this EMP as well as relevant policies, procedures, management plans, statutory requirements, and contract requirements;

Role	Responsibilities and duties
	– Implementing appropriate environmental and safety management measures; – Reporting environmental issues, including actual or potential environmental incidents and hazards, to the Proponent; and – Ensuring appropriate corrective or remedial action is taken to address all environmental hazards and incidents reported by employees and subcontractors.

2.2 Employment

The Proponent and all contractors shall comply with the requirements of the Republic of Namibia Regulations for Labour, Health and Safety, and any amendments to these regulations. The following shall be complied with:

- In liaison with local government and community authorities, the Proponent shall ensure that local people have access to information about job opportunities and are considered first for construction/maintenance contract employment positions;
- The number of job opportunities shall be made known together with the associated skills and qualifications;
- The maximum length of time the job is likely to last shall be indicated;
- Foreign workers with no proof of permanent legal residence shall not be hired;
- Every effort shall be made to recruit from the group of unemployed workers living in the surrounding area; and
- Every employee hired must be provided with a valid employment contract stating, the position hired for, the hourly remuneration offered.

3 COMMUNICATION AND TRAINING

It is important that regular communication is maintained with all the stakeholders and that stakeholders are made aware of potential impacts and how to minimise or avoid them. This section sets out the framework for communication and training in relation to the EMP.

3.1 COMMUNICATIONS

The foreman/site manager shall communicate any environmental issues to the Project team through the following means (as and when required):

- Site induction;
- Internal and external audits and site inspections;
- Toolbox talks, including instruction on incident response procedures; and
- Briefings on key Project-specific environmental issues.

This EMP shall be distributed to the Project team including any contractors and personnel working on the site to ensure that the environmental requirements are adequately communicated. Key activities and environmentally sensitive operations shall be briefed to workers and contractors.

During the construction and operational activities, communication amongst the management team shall include discussing any complaints received and actions to resolve them, any inspections, audits or non-conformance with this EMP, and any objectives or target achievements.

3.2 ENVIRONMENTAL EMERGENCY AND RESPONSE

The general manager and the foreman are the primary contact persons in the event of an environmental emergency. The general manager has the authority and independence to request reasonable steps be taken to avoid or minimise unintended or adverse environmental impacts and failing the effectiveness of such steps, to direct that relevant actions be ceased immediately should an adverse environmental impact be anticipated.
In the event of an incident that requires emergency services, the following services should be contacted.

Table 2 - Emergency contact details

Town	Ambulance	Police	Fire brigade
Okahandja	+264 (62) 50-3030	+264 (62) 1-0111	+264 (62) 50-1051

All employees need to be made aware of emergency procedures and what to do in the event of an emergency. This must be included in the training of employees. Regular documented drills also need to be carried out to ensure the competence of all employees in different emergencies.

3.3 COMPLAINTS HANDLING AND RECORDING

The Proponent shall maintain a complaint register that will detail the name and contact details of the complainant, the date and time of the complaint, the nature of the complaint, the appropriate action is taken to resolve issues, and the date of complaint handover. The Proponent shall be responsible for nominating the correct personnel to coordinate and resolve the issue.

Any complaints received verbally shall be recorded as per above and the information shall be given to the Proponent who is responsible for the management of complaints and will provide a written response to the complainant.

The workforce shall be informed about the complaints register, its location and the person responsible, to refer residents or the public who wish to lodge a complaint. The complainant shall be informed in writing of the results of the investigation and action to be taken to rectify or address the matter(s). Where no action is taken, the reasons why are to be recorded in the register.

The complaints register shall be kept for the facility and will be available for government or public review upon request.

3.4 SITE INDUCTION

All personnel involved in the Project shall be inducted to the site with a specific environment and social awareness training component. The environment and social awareness training shall ensure that personnel are familiar with the principles of this EMP, the environment and social aspects and impacts associated with their activities, the procedures in place to control these impacts and the consequences of departure from these procedures. The Proponent shall ensure a register of completed training is maintained.

The site induction should include, but not be limited to the following:

- A general site-specific induction that outlines:
    - What is meant by “environment” and “social”;
    - What are the environmental risks and impacts of the solar plant;
    - What can be done to mitigate against such impacts; and
    - Why the environment needs to be protected and conserved
- The inductee's role and responsibilities concerning implementing the EMP;

- The site environmental rules;
- Details of how to deal with, and who to contact if environmental problems do occur;
- Basic vegetation clearing principles and species ID sheets;
- Focal themes such as compliance, reporting of accidents and incidents, good housekeeping and standard procedures for waste management;
- The potential consequences of non-compliance with this EMP and relevant statutory requirements; and
- The roles of responsible people for the Project.

4 REPORTING, COMPLIANCE AND ENFORCEMENT

4.1 ENVIRONMENTAL INSPECTIONS AND COMPLIANCE MONITORING

4.1.1 DAILY COMPLIANCE MONITORING

A copy of this EMP shall be accessible, up-to-date, and on-site throughout the Project and shall be available upon request. It is the responsibility of the foreman/site manager to enforce the provisions of this EMP and ensure this EMP is complied with by all personnel daily throughout the facility. Daily, weekly and monthly inspections will be undertaken. Any environmental problems or risks identified shall be notified to the foreman and actioned as soon as is reasonably practicable.

4.1.2 MONTHLY COMPLIANCE MONITORING

Monthly inspections shall be undertaken by the general manager to check that the standards and procedures set out in this EMP are being complied with. Any non-conformance shall be recorded, including the following details: a brief description of non-conformance, the reason for the non-conformance, the responsible party, the result (consequence), the corrective action taken and any necessary follow up measures required.

4.1.3 REPORTING

There shall be a requirement to ensure that any incident or non-compliance, including any environmental issue, failure of equipment or accident, is reported to the general manager.

4.2 RELEVANT PERMITS & BEST PRACTICE

Table 3 outlines some of the important permit applications concerning the proposed Project and the following best practice documents apply to this development:

- **IUCN:** Mitigating biodiversity impacts associated with solar and wind energy development guidelines for Project developers;
- **BirdLife South Africa:** Best practice guidelines - Birds and Solar Energy Guidelines for assessing and monitoring the impact of solar power generating facilities on birds in southern Africa; and
- **IFC:** Utility-Scale Solar Photovoltaic Power Plants. A Project Developer's Guide.

Table 3 - Project-related permit/registration requirements

Permit, licences or registration	Relevant authority	Project bearing
Sewage permits	Ministry of Agriculture, Water and Land Reform	Permits related to the sewage system should be obtained.
Permits for the removal of vegetation	Ministry of Environment, Forestry and Tourism	Permits will need to be obtained for the clearing of vegetation in the 120 ha area and for the removal of protected species.
Electricity generation licence	Electricity Control Board (ECB)	The Proponent has already received approval for the generation license from the ECB, as seen in Appendix G. The approval granted to InnoSun allows an installed capacity of 44.876MWp. The License is granted to a project SPV called **Sorexa Sun Energy (Pty) Ltd** (Reg: 2021/0895), owned 100% by InnoSun.

The best practice management measures that will be complied with across the site are listed in Table 4.

Table 4 – A list of environmental best practice measures to be implemented during the construction and maintenance phases of the project.

ENVIRONMENTAL ASPECT	BEST PRACTICE REQUIREMENT
Pollution Prevention Control	– Equipment to be maintained and serviced regularly; – Refuelling at designated locations; – Spill kits are available where the risk of loss of containment is identified; – Bunds to be at least 110% of the volume of the container (if applicable); and – Good housekeeping.
Solid Waste Management	– Good housekeeping (no littering); – Designated waste collection areas around the site and one central location; – Bins labelled; – Waste to be separated and kept clean and tidy; and – Waste bins are emptied on regular basis.
Ground Contamination	– Refuelling will be undertaken in designated areas with spill kits available; – Chemical management enforced on site (if applicable); and

ENVIRONMENTAL ASPECT	BEST PRACTICE REQUIREMENT
	– Good housekeeping.
Energy Efficiency	– Equipment to be maintained and serviced regularly; and – Turn off equipment when not in use.
Air Quality	– Maintenance of roads; – Turn off equipment when not in use; and – Equipment to be maintained and serviced regularly.

4.3 Non-compliance

Where it has been identified that works are not compliant with this EMP, the Proponent shall employ corrective actions so that the works return to being compliant as soon as possible. In instances where the requirements of the EMP are not upheld, a non-conformance and corrective action notice shall be produced. The notice shall be generated during the inspections and the general manager shall be responsible for ensuring a corrective action plan is established and implemented to address the identified shortcoming.

A non-compliance event or situation, for example, is considered if:

- There is evidence of a contravention of this EMP and associated indicators or objectives;
- The foreman or the contractor has failed to comply with corrective or other instructions issued by the manager or qualified authority; or
- The foreman or contractor fails to respond to complaints from the public.

Activities shall be stopped in the event of a non-compliant event identified until corrective action(s) has been completed.

4.4 INCIDENT REPORTING

The general manager must ensure that an accident and incident (including minor or near-miss) reporting system is maintained by the foreman so that all applicable statutory requirements are covered. For any serious incident involving a fatality, or permanent disability, the incident scene must be left untouched until witnessed by a representative of the police. This requirement does not preclude immediate first aid being administered and the location being made safe.

The foreman must investigate the cause of all work accidents and significant incidents and must provide the results of the investigation and recommendations on how to prevent a recurrence of such incidents. A formal root-cause investigation process should be followed.

4.4.1 DISCIPLINARY ACTION

This EMP is a legally binding document and non-compliance with it shall result in disciplinary action being taken against the perpetrator(s). Such action may take the form of (but is not limited to):

- Fines/penalties;
- Legal action;
- Monetary penalties imposed by the Proponent on the contractor;
- Withdrawal of licence(s); and
- Suspension of work.

The disciplinary action shall be determined according to the nature and extent of the transgression / non-compliance, and penalties are to be weighed against the severity of the incident.

5 ENVIRONMENTAL AND SOCIAL MANAGEMENT

5.1 ENVIRONMENTAL PERFORMANCE MEASUREMENT

Section 5 provides a register of environmental risks and issues, which identifies mitigation and monitoring measures, as well as roles responsible. This register will be subject to regular review by the manager and updated when necessary.

5.2 OBJECTIVES AND TARGETS

Environmental protection is the responsibility of management and if management is environmentally aware, it motivates all employees and their associated business partners, customers and suppliers to think and act in a more environmentally responsible manner. Environmental objectives and targets have been developed so that activities on the proposed site can minimise potential impacts on the environment, as far as reasonably practicable.

Environmental objectives for the Project are as follows:

- Zero pollution incidents;
- Sustainable resource use (water);
- Application of the waste management hierarchy;
- A safe working environment for employees; and
- Use natural resources effectively and efficiently.

5.3 REGISTER OF ENVIRONMENTAL RISKS AND ISSUES

An environmental review of the proposed Project has been completed to identify all the commitments and agreements made within the environmental scoping report. From this, a schedule of environmental commitments and risks has been produced (Table 5), which details deliverables including measures identified for the prevention of damage to the environment during the Project’s lifetime.

Table 5 provides a register of environmental risks and issues, which identifies mitigation and monitoring measures, as well as the responsible person. This register will be subject to regular review by the manager and updated when necessary. The general manager will use this register to undertake monthly inspections to ensure the Project is compliant with this EMP.

Table 5 - Environmental risks and issues, and mitigation and monitoring measures

Task activity/ equipment	Impact identified	Mitigation control measures	Monitoring requirements	Responsibility
Job creation, skills development and business opportunities	Beneficial socio-economic impacts on a local and regional scale	– Maximise local employment and local business opportunities; – Enhance the use of local labour and local skills as far as reasonably possible; and – Ensure that goods and services are sourced from the local and regional economy as far as reasonably possible.	Monthly, annually	Site foreman/ general manager
General construction completion and operational activities	Dust generation during the construction phase, future maintenance/construction and operational activities.	To minimise the potential for dust generation the following management measures should be implemented, as required: – Vehicles must adhere to speed limits to avoid producing excessive dust; – Vehicles and machinery should be maintained to limit exhaust fume emissions; – Use surfaces that minimise dust accumulation and facilitate effective cleaning; – Where an effect is profound, ensure dust suppression measures are in place; and – Employees to use and wear the appropriate PPE.	Daily	Site foreman/ general manager
	Noise generation	The Labour Act, No. 11 of 2007 and Regulations relating to the Health and Safety of Employees at Work (GN 156/1997) should be closely followed for occupational noise exposure, specifically focusing on chapter 6. Section 197 ((1) Subject to sub-regulations	Daily	Site foreman/ general manager

Task activity/ equipment	Impact identified	Mitigation control measures	Monitoring requirements	Responsibility
		(2) and (3), no employer shall require or permit an employee to work in an environment in which he or she is exposed to an equivalent noise level equal to or exceeding 85 dB(A)) and Schedule 3(2) Noise Regulations (regulation 197). The SANS standard for environmental daytime noise is 45 dBA (outdoors) and 35 dBA (indoors) in a rural district. The EMP should be closely followed to ensure that the noise generated stays below these limits, as far as reasonably practicable. – Avoid noise-generating activities that could impact other users of the area by ensuring noisy activities are limited; avoid hammering on metal that generates intermittent noise, especially at night, and ensure appropriate measures are put in place to rectify noise complaints should they occur; – The Proponent should develop a health and safety management plan that takes into account noise generation; and – Ensure that procedures for receiving complaints from nearby land users or residents are in place and responded to timeously.		
	Employee health and safety.	– Health and Safety management plan should be developed and implemented on-site by the Proponent;	Daily	Site foreman/ general manager

Task activity/ equipment	Impact identified	Mitigation control measures	Monitoring requirements	Responsibility
		– The Labour Act, No. 11 of 2007 and Regulations relating to the Health and Safety of Employees at Work (GN 156/1997) should be adhered to; – Appropriate PPE should be used for relevant tasks on-site; – Safety induction training sessions should be given to all technicians and field staff before the commencement of their shifts (i.e., staff conducting electrical works or maintenance); – Risk identification and suitable prevention measures should be employed within the power plant area to eliminate potential impacts; – Frequent maintenance of all equipment and daily inspections done; – Occupational Incidents and accidents on-site should be reported to the division: Occupational Safety & Health (OSH) at the Ministry of Labour, Industrial Relation and Employment Creation, by using form F.5; – Emergency contact details should be readily accessible to contact relevant services during an emergency; – No unauthorized use of equipment should be allowed; – In the unlikely event of a death occurring within site boundaries from occupational negligence or otherwise from a "freak accident event", the area should be secured and all personnel removed from the scene;		

Task activity/ equipment	Impact identified	Mitigation control measures	Monitoring requirements	Responsibility
		– A root cause analysis into the event shall be undertaken as soon as practicably possible; – Counselling should be provided to the witnesses and other personnel members who may have been impacted by the event. – Appropriate safety signs should be added near dangerous areas or equipment; and – Employees should be made aware of all possible health and safety risks.		
	Fire management	– Development of a fire management system through the process of risk identification and assessment; – Developing site-specific work procedures as part of the fire management system; – Induction on fire prevention and toolbox talks; – Control and reduce the potential risk of fire by segregating and safe storage of flammable materials; – Avoid potential sources of ignition for example, by prohibiting smoking in and around areas where chemicals/fuel is stored; – Ensure suitable fire-extinguishing equipment is accessed immediately and conveniently whenever necessary. This can include pails of water, buckets of sand, or portable extinguishers;	Daily	All Staff members

Task activity/ equipment	**Impact identified**	**Mitigation control measures**	**Monitoring requirements**	**Responsibility**
		– For field fires, appropriate fire fighting equipment should be available on-site; – Emergency contact details should be readily available on-site; – Fires made for a “braai”/BBQ within the site area during construction should be monitored and put out to prevent the risks of causing a field fire (applicacable to contractor camps on-site, if any); and – Ensure key personnel are trained to manage an emergency fire situation.		
	Potential visual disturbances	– Light disturbances should be minimised; – Lighting on-site is to be sufficient for safety and security purposes; – Maintain complaints register on-site to record any complaints; – Lighting should not be a nuisance for any residents/camps or lodges surrounding the site; – Neighbouring farmhouses and buildings should be considered during construction, to prevent reflective light disturbances; – Neighbours should be informed of construction activities and potential duration of activities; – The solar PV plant should blend in with the surrounding environment as far as reasonably practicable; and	Monthly/ annually	Site foreman/ general manager

Task activity/ equipment	Impact identified	Mitigation control measures	Monitoring requirements	Responsibility
		– Ensure that international best practice methods are considered for the construction of the solar PV plant.		
	Site safety and security	– The site should be well secured to prevent theft or vandalism and unauthorized entrance to the premises; – Security fence should be well maintained; – Contractors and staff should be informed in writing of the consequences when breaking laws or rules; – Ensure that all Nampower safety requirements and recommendations with regards to the overhead powerline are followed and adhered to; – Contractors or staff should not trespass on private land; – Security systems should be well maintained; – All employees should be regularly updated about the safety procedures; and – Emergency contact details should be readily available on-site.	Daily, Monthly and annually	Site foreman/ general manager
Biodiversity	Potential habitat destruction and disturbance of wildlife.	– Keep or plant native vegetation between solar components (if larger rows are planned between components); – Try to limit the amount of vegetation that is cleared (especially larger trees), to limit habitat loss (where possible); – Use grazing from livestock or manual labour, but not chemicals, to control vegetation on-site;	Daily, Monthly, yearly	Site foreman/ general manager

Task activity/ equipment	Impact identified	Mitigation control measures	Monitoring requirements	Responsibility
	Potential Habitat Fragmentation (Fence).	– Try to keep some natural habitat intact; – Ensure efficient planning, in order to reduce disturbances in areas that do not form part of the planned construction area; – Reseeding native grasses between solar components (if possible); – Planting native vegetation on-site where possible; – Holes excavated for pylons should be covered/fenced off during the night or periods when no construction is taking place; – All wildlife (Birds, mammals and reptiles) harmed or killed in the fences should be recorded, with a description, species name, date and photos ; – Choose an appropriate fence that will be wildlife-friendly (as far as reasonably possible), i.e., fences without sharp wire spikes (especially concerning avifauna, that might get "hooked" during flight); – Wildlife deterrent gadgets/methods could be used on fences to ensure that wildlife sees the fences or is deterred away from it; and – Wires used for fencing should have poles/droppers at regular intervals or bird deterrents to ensure that wildlife can see infrastructure.		

Task activity/ equipment	Impact identified	Mitigation control measures	Monitoring requirements	Responsibility
	The possible encountering of biodiversity on-site	The Nature Conservation Ordinance Act No. 4 of 1975 and its regulations, Controlled Wildlife Products and Trade Act 9 of 2008 and the Animals Protection Act 71 of 1962 should be closely followed with regard to any encounters with wildlife within site boundaries. – No living organism should be removed from the site by anyone other than by a professional/registered animal handler, pest control company, SPCA, MEFT/MAWLR or relevant rehabilitation or wildlife organisations; – No living organism shall be poached/consumed/harmed or killed for illegal purposes (i.e., illicit trade of pangolins for scales); – Prevent the killing of perceived dangerous species (e.g. snakes); the collection of veld foods (e.g. giant bullfrog, tortoise, monitor lizard); any form of poaching (e.g. setting of snares for birds and ungulates, etc.). – Police and MEFT should be notified of any poaching incident involving sensitive or protected species or if such an animal is found on someone within or surrounding the Project site; – If snares or poaching equipment is found in the field, it should be removed and destroyed; – Fences should be monitored for potential snares and traps;	Daily, weekly	All staff members

Task activity/ equipment	Impact identified	Mitigation control measures	Monitoring requirements	Responsibility
		– Wildlife encountered on-site should be ethically treated; – Nests discovered on infrastructure within the Project site area should not be removed or destroyed if it is not clear that there are no eggs or chicks in the nests; – Nests/eggs/birds should be identified by a professional and action could be taken depending on advice or instruction given by the professional; – Pesticides and herbicides should not be used as far as reasonably possible; – If there is no other possibility the relevant pesticides/herbicides/chemicals should be used by a professional/registered pest control company and the MSDS of the substance used should be closely followed; – Invasive plant species should be removed and their spread should be prevented; and – Waste on-site should be well managed and removed from the site to prevent animals (i.e. rodents, snakes, scorpions etc) from breeding/living on-site.		
	Potential displacement or harm of	– Preconstruction monitoring is recommended to determine the presence of any threatened or protected species; – Keep some of the natural habitat on-site intact, where possible;	Daily	Site foreman/ general manager

Task activity/ equipment	Impact identified	Mitigation control measures	Monitoring requirements	Responsibility
	threatened or protected species	– Professional ecologists should evaluate the site for any potential endangered or protected species (i.e., endangered vultures breeding in trees on-site); – Plant native vegetation between solar components, that will not necessarily influence/impact the solar panels (i.e., native grasses); – The breeding season of wildlife should be considered for construction activities (i.e., ground-nesting and cavity-nesting birds); – Check for any active bird nests during construction; – Regular toolbox talks with construction workers and operational staff on the importance of biodiversity mitigation measures; and – Strict rules should be implemented on-site to prevent any poaching, harming, collection or killing of wildlife;		
	Potential Avifauna Impacts	The following mitigations as discussed in the specialist study by African Conservation Services (2022) (Appendix E in the Scoping report) should be closely followed and adhered to: Physical/human disturbance of birds (African Conservation Services 2022): **Construction phase** *Avoidance:* o Scheduling: adapting the timing of construction activities to avoid disturbing birds during sensitive periods, e.g. during	Daily, Monthly	Site foreman/ general manager

Task activity/ equipment	Impact identified	Mitigation control measures	Monitoring requirements	Responsibility
		breeding seasons; for the near-endemic cavity breeders (Rüppell's Parrot, Damara Red-billed Hornbill, Monteiro's Hornbill) the main breeding season falls from January-March. o Before construction starts, the proposed solar PV site and the proposed power line route should be inspected for any signs of bird nesting activity. Disturbance of nesting/chick-rearing birds should be avoided. *Minimisation*: o Abatement controls to reduce noise disturbance created during construction. o Operational controls to manage and regulate contractor activity, such as: ▪ A speed limit should be strictly enforced. ▪ Exclusion fencing should be erected around identified sensitive areas, if required (e.g. pre-identified active nesting sites). ▪ Anti-poaching measures should be strictly enforced, with zero tolerance, and this should be emphasised during induction to contractors; offenders should be prosecuted. o Ongoing awareness should be promoted about the value of biodiversity and the negative impacts of disturbance, especially to breeding birds, and of poaching and road mortality.		

Task activity/ equipment	Impact identified	Mitigation control measures	Monitoring requirements	Responsibility
		Direct and indirect modification/loss/destruction of bird habitat (African Conservation Services 2022): *Avoidance and minimisation*: ○ Micro-siting: where possible, the unnecessary destruction of habitat or degradation of the environment, including sensitive habitats such as cavity-nesting locations should be avoided. The final layout of project infrastructure should avoid designated sensitive areas, e.g. identified active nest sites. If practical, the tree with the recently active hornbill nest just north of the study site (22.09015S 16.80208E) should be protected. **Construction phase** *Restoration and rehabilitation:* ○ Repair of degradation or damage to biodiversity features and ecosystem services from project-related impacts that cannot be completely avoided and/or minimised, e.g. by restoration of temporary-use and lay down areas as soon as reasonably practicable after construction activities are complete. **Operational phase**		

Task activity/ equipment	Impact identified	Mitigation control measures	Monitoring requirements	Responsibility
		Minimisation: ○ Abatement controls to reduce emissions and pollutants (erosion, dust, waste) created during construction; wastewater management and water conservation measures. ○ Operational controls to manage and regulate contractor activity, such as exclusion fencing around sensitive areas (e.g. pre-identified active nest sites), designated machinery and lay-down areas, minimisation of vegetation loss and disturbance to soil; managing the timing of vegetation control activities at suitable intervals. ○ Ongoing awareness should be promoted about the value of biodiversity and the negative impacts of habitat destruction. ○ As a possible offset, investigate the use of artificial nesting boxes as an alternative option for cavity-breeding birds (Figure 27); contact the Namibia Bird Club for advice on ideal type and placement localities for boxes, and possible further involvement with monitoring of nesting activity (https://www.namibiabirdclub.org/).		

Task activity/ equipment	Impact identified	Mitigation control measures	Monitoring requirements	Responsibility
		Creation of novel (artificial) habitats and resources that could attract birds; this impact could also lead to negative impacts on infrastructure, caused by bird nesting, perching and other activities (African Conservation Services 2022): **Construction phase** *Avoidance:* o Ensure strict and effective waste management (including of food) during construction activities, to discourage an unnatural increase in scavenging species such as Pied Crow. o Avoid creating new habitats with open water, e.g. accumulations of storm water/open water/run-off, that may attract birds. **Operational phase** *Minimisation:* o Monitoring is essential to identify (potential) problem areas (see Section 8 below); any movement of hitherto unrecorded species onto or beneath the solar panel structures should be monitored; and any resulting negative impacts (e.g. entrapment of korhaans or		

Task activity/ equipment	Impact identified	Mitigation control measures	Monitoring requirements	Responsibility
		spurfowl/francolins in fences; predation), should be addressed accordingly. ○ Bird perching or nesting activities on solar infrastructure may become a problem (e.g. by causing fouling of the solar panels), and adaptive management measures may be required (such as anti-perch measures, e.g. spanning a low wire across the perching area). Nesting activities should be discouraged early in the cycle, before any eggs are laid; the Ministry of Environment, Forestry and Tourism (MEFT) should be contacted for specific guidelines for dealing with such problems. ○ Numerous actions/devices have been developed to deter birds from an area (WEST 2014; Walston et al. 2015, UNEP/CMS 2015; Jenkins et al. 2017). In terms of solar PV arrays, these deterrents could include habitat management, control of prey populations, anti-perching devices, nest-proofing, netting or other enclosures, scaring or chasing (e.g. with trained dogs), bio-acoustic or visual deterrence. The desirability and effectiveness and such deterrents would need to be considered on a case-by-case basis, using an adaptive management approach.		

Task activity/ equipment	Impact identified	Mitigation control measures	Monitoring requirements	Responsibility
		○ Should any nesting or other activity by crows on power supply structures cause disruptions of the power supply, consult with the MEFT for appropriate measures to discourage and manage such activities, e.g. by removing nests at a stage when this is acceptable. Bird electrocutions on power line infrastructure (African Conservation Services 2022): The mitigation measures below are already standard procedure for most pole structures, but are mentioned for the sake of completeness. **Construction phase** *Minimisation:* ○ A standard mitigation for electrocutions in Namibia is to "gap" the earth wire near the top of the pole, i.e. the earth wire on each power line pole should stop at least 300 mm below the lowest phase to provide an air space safety gap, in order to reduce the electrocution risk (see existing 22 kV power line for example of such "gapping"). ○ On strain structures where "jumper" wires are used, at least the centre jumper should be insulated, using PVC		

Task activity/ equipment	Impact identified	Mitigation control measures	Monitoring requirements	Responsibility
		piping or LPDE pipe. Jumpers should be offset where possible. o Transformer/switchgear structures should be designed in such a way that they are not attractive as bird perches/ nesting sites; selected live components should be insulated (e.g. using PVC piping or LDPE pipe; Figure 28). o Any stay wires should also be "gapped" by the use of an insulator. **Operational phase** *Minimisation:* o The need for reporting power line incidents should be stressed, and reporting procedures clarified (see Section 8, Monitoring below). Bird collisions with infrastructure such as solar PV panel arrays and fencing (African Conservation Services 2022): **Project design phase** *Avoidance:* o In order to reduce the chances of the panels being mistaken for sheets of water, minor modifications could be made to the panel design (e.g. by means of applying visual		

Task activity/ equipment	Impact identified	Mitigation control measures	Monitoring requirements	Responsibility
		cues: see Operational phase: minimisation, below), but at this stage this should rather be considered as an adaptive mitigation, to be retro-fitted once there is a recorded need. ○ As with the existing 5 MW solar PV plant, the panels should be arranged in rows with gaps as large as possible in between the rows, to help reduce the effect of a solid mass of water. ○ The solar PV area should be fenced with predator-proof fencing, to reduce indirect predation of any bird collision species (if injured and still alive), and also to prevent the removal of any carcass material by mammalian scavengers before it is recorded. ○ As far as possible the use of outdoor lighting at the solar facility should be minimised (Jenkins et al. 2017). Research indicates that lights can attract and confuse migrating birds (Gehring et al. 2009; Manville 2005, 2009, 2013). Some insectivorous birds may also be attracted to lights. Security lighting should be kept to the minimum, and directed downward and away from the PV panels if possible.		

Task activity/ equipment	Impact identified	Mitigation control measures	Monitoring requirements	Responsibility
		○ The solar PV panels themselves should not be directly illuminated. Non-reflective surfaces (e.g. anti-reflective coating) should be used if possible. **Operational phase** *Minimisation*: ○ If monitoring results indicate that bird collisions are taking place on the solar panels, adaptive mitigations could include the retrofitting of visual cues to existing panels (Kagan et al. 2014). Such minor modifications to the panel design could reduce the chances of the panels being mistaken for sheets of water. These visual cues may include UV-reflective or solid (white) contrasting bands spaced no further than 28 cm from each other. This arrangement has been shown to significantly reduce the number of small passerine birds hitting expanses of windows on commercial buildings. Non-polarising white tape used around and/or across panels (grid partitioning) can also minimise reflection, which can attract aquatic insects (and thus avian predators), as it mimics reflective surfaces of waterbodies (Horvath et al. 2010; Bennun et al. 2021).		

Task activity/ equipment	Impact identified	Mitigation control measures	Monitoring requirements	Responsibility
		o In extreme cases of repeated collisions by night-flying (aquatic) birds (e.g. ducks, grebes), the situation should be reassessed in terms of the possibility of tilting the solar panels to a non-horizontal position when in standby mode (at night) (Walston et al. 2015, UNEP/CMS 2015, Jenkins et al. 2017), taking into account technical constraints. This mitigation would be possible with the proposed panel design. o Monitoring of any potentially negative impacts is considered essential (see Section 8 below). Should the results show that such impacts, including injuries and/or mortalities of birds are taking place, adaptive mitigation measures would need to be investigated, if necessary on a species-specific basis. o If monitoring results indicate that bird collisions are taking place on the perimeter fencing of the solar project, systematic fence marking may be utilised to reduce avian collisions with fences (Jenkins et al. 2017). Markings should be at an appropriate height to be visible to birds flying at or above the height of the solar panels.		

Task activity/ equipment	Impact identified	Mitigation control measures	Monitoring requirements	Responsibility
		Bird collisions with power line infrastructure (African Conservation Services 2022): **Project design phase** *Avoidance & minimisation:* ○ At this stage, no marking of power lines is recommended, but it should become mandatory should monitoring results indicate the necessity. The avifauna specialist can be consulted for advice on the design (see Figure 29 for example). ○ The need for fitting any mitigation for collisions on stay wires (e.g. marking with vibration dampers) should also be based adaptively on monitoring results. **Operational phase** *Minimisation:* ○ The need for reporting power line incidents should be stressed, and reporting procedures clarified (see Section 8.2 below). Should monitoring indicate that collisions are still taking place despite the above marking, further mitigation would need to be investigated."		

Task activity/ equipment	Impact identified	Mitigation control measures	Monitoring requirements	Responsibility
	Potential removal of protected plant species The potential introduction of alien vegetation	– Use existing roads for access to avoid new tracks as far as reasonably possible; – Minimise clearance areas through proper planning of the construction/operational activities; – Protected plant species should not be removed, without the relevant permission or permits; – Construction vehicles should not drive in the field or create new tracks, without evaluating the plant species within that area; – Route new tracks around established and protected trees, and clumps of vegetation; – Large trees or shrubs should be evaluated for breeding birds (especially for protected species, for example, whiteback vultures) before being removed to make way for the solar plant; – A professional botanist or ecologist should be on-site to identify any rare, endangered, threatened and protected species (the following protected, endemic or near-endemic species could potentially be found on-site, *Boscia albitrunca, Albizia anthelmintica, Vechellia erioloba and Aloe littoralis, Faidherbia albida, Aloe hereroensis, Sporobolus nebulosus, Petalidium lanatum, Plectranthus dinteri and Ondetia linearis)*; – During toolbox talks and induction sessions, highlight to workers that the removal of significant plants should be avoided;	Daily, Monthly	Site foreman/ general manager

Task activity/ equipment	Impact identified	Mitigation control measures	Monitoring requirements	Responsibility
		– Where possible rescue and relocate plants of significance; – Plant native vegetation between solar components, " with acceptable characteristics within engineering constraints" (i.e., grass and small shrubs), where possible; – Use grazing from animals/livestock or manual labour, and not chemicals, to control vegetation on-site; – Promote revegetation of cleared areas upon completion of construction activities; – All Project equipment arriving on-site from an area outside of the Project or coming from an area of known weed infestations (not present on the Project site) should have an internal weed and seed inspection completed before such equipment is used; – Ensure contractors receive induction on preventing the spread of alien weed; – Ensure the potential introduction and spread of alien plants is prevented; – Ensure the correct removal of alien invasive vegetation and prevent the establishment and spread of alien invasive plants; – Eradicate weeds and alien species as soon as they appear; and – Ensure workers are aware of alien species and weeds.		

Task activity/ equipment	Impact identified	Mitigation control measures	Monitoring requirements	Responsibility
Heritage	Potential heritage discovery	– Implement a Chance Find Procedure – Raise awareness about possible heritage finds – Report all finds that could be of heritage importance – In case archaeological remains are to be uncovered, cease activities and the site manager has to assess and demarcate the area – Project manager to visit the site and determine whether work can proceed without damage to findings, mark exclusions boundary and inform ECC with the GPS position – If needed, further investigation has to be requested for a professional assessment and the necessary protocols of the Chance Find Procedure have to be followed, – An archaeologist will evaluate the significance of the remains and identify appropriate action, (record and remove; relocate or leave premises, depending on the nature and value of the remains), – Inform the police if the remains are human, – Obtain appropriate clearance or approval from the competent authority, if required, and recover and remove the remains to the National Museum or National Forensic Laboratory as directed.	Daily	All staff/ general manager

Task activity/ equipment	Impact identified	Mitigation control measures	Monitoring requirements	Responsibility
Emergency Incidents	Soil and water contamination due to inadequate control or accidental release of hazardous substances on site	During the construction and maintenance phases of the Project, the following should be taken into consideration. **Storage** – Separate hazardous and non-hazardous chemicals from each other; – Label chemicals appropriately; – Chemicals with different hazard symbols should not be stored together - clear guidance on the compatibility of different chemicals can be obtained from the Materials Safety Data Sheets (MSDS) which should be readily available; – Store chemicals in a dedicated, enclosed, and secure facility with a roof and a paved/concrete floor. – Consider the feasibility of substituting hazardous chemicals with less hazardous alternatives. **Spills** The spill kits with the following items as a minimum should be made available on site (If any large fuel or chemical tanks are on-site during the construction or operational phases of the Project): – All up-to-date MSDS, readily available	Daily	All staff members

Task activity/ equipment	Impact identified	Mitigation control measures	Monitoring requirements	Responsibility
		– Absorbent materials; – Shovels; – Heavy-duty plastic bags; – Protective clothing (e.g., gloves and overalls); – Major servicing of equipment shall be undertaken offsite or within appropriately equipped workshops; – For small repairs and required maintenance activities all reasonable precautions to avoid oil and fuel spills must be taken (e.g., spill trays, impervious sheets); – Provision of adequate and frequent training on spill management, spill response and refuelling must be provided to all onsite staff; – No refuelling is to take place within 50 meters of groundwater boreholes, surface water bodies or streams; – Vehicles and machinery are to be regularly serviced to minimise oil and fuel leaks; and – All major petroleum product spills (spill of more than 200 litres per spill) should be reported to the Ministry of Mines and Energy (MME) on Form PP/11 titled “Reporting of major petroleum product spill’.		

Task activity/ equipment	Impact identified	Mitigation control measures	Monitoring requirements	Responsibility
		The following points, therefore, apply to all areas on the site: – Assess the situation for potential hazards; – Do not come into contact with the spilt substance until it has been characterised and necessary personal protective equipment (PPE) is provided; and – Isolate the area as required. **The following measures are to be implemented in response to a spill:** – Spills are to be stopped at the source as soon as possible (e.g., close valve or upright drum); – Spilt material is to be contained to the smallest area possible using a combination of absorbent material, earthen bunds or other containment methods; – Spilt material is to be recovered as soon as possible using appropriate equipment. In most cases, it will be necessary to excavate the underlying soils until clean soils are encountered; – All contaminated materials recovered after a spill, including soils, absorbent pads and sawdust, are to be disposed of at an appropriately licenced facility; and		

Task activity/ equipment	Impact identified	Mitigation control measures	Monitoring requirements	Responsibility
		– A written incident report must be submitted to the general manager.		
Groundwater and surface water pollution	Possible nutrient enrichment of groundwater due to leakage of sewage into the groundwater	– The sewage system needs to be well maintained at all times; – Need to carefully investigate the sewage system regularly to look for leakages; – The sewage system and chemical toilets need to be cleaned/pumped regularly by the relevant authority or company with the appropriate permits in place; and – Groundwater needs to be monitored and tested to ensure that there is no contamination if a leak occurred.	Daily/weekly/ monthly	Site foreman/ general manager
	Water usage on-site	– A water-wise mindset should be adopted on-site; – Water leakages or pipe bursts should be fixed or reported as soon as possible; – Eco-friendly and low water-use equipment should be used; and – Activities that require a lot of water (cleaning of solar components etc.) should be monitored to ensure that water is not wasted.	Daily/weekly/ monthly	Site foreman/ general manager
Soil	Potential soil erosion during heavy precipitation or	– Follow and adhere to the Soil Conservation Act, No. 76 of 1969 and the Soil Conservation Amendment Act, No. 38 of 1971; – Indigenous vegetation could be planted to prevent erosion;	Monthly, annually	Site foreman/ general manager

Task activity/ equipment	Impact identified	Mitigation control measures	Monitoring requirements	Responsibility
	strong winds on-site.	– Rock beds could also be used to prevent erosion on the gentle slopes around infrastructure (if there are any gentle slopes post-construction); and – An erosion control plan should be developed and implemented on-site due to the extent of land to be cleared.		
	Potential soil disturbances	– Follow and adhere to the Soil Conservation Act, No. 76 of 1969 and the Soil Conservation Amendment Act, No. 38 of 1971; – Try to keep soil disturbances to a minimum, for example only prepare the soil/ground as required for the construction of the solar plant (i.e., foundations); – Prevent driving with heavy vehicles in the field and use existing access roads as far as reasonably possible; – Prevent soil compaction; – Do not leave the ground bare (i.e., replant natural grasses or smaller plant species); – Store and retain topsoil and sub-soil removed from the construction areas for later use during reestablishment (i.e., when construction work is done); – Use native and non-invasive species for “landscaping and rehabilitation works”;	Daily, monthly	Site foreman/ general manager

Task activity/ equipment	Impact identified	Mitigation control measures	Monitoring requirements	Responsibility
		– For the rehabilitation of disturbed areas use "soil, mulch and vegetation debris (that contain natural seed stock)" to facilitate natural revegetation; – Use "manual methods (e.g. hoeing or hand-pulling)" for the clearing of vegetation, where possible to limit soil disturbance; and – Soil erosion and sedimentation control measures should be implemented.		
Waste management	Possible sewage discharge runs the risk of pathogen /disease transmissions and odours.	– Ensure toilets are always clean and dry; – Provide adequate sanitary facilities, including clean water, soap, and disposable paper towels; – Ensure suitable personal protective equipment that may include waterproof/abrasion-resistant gloves, footwear, eye, and respiratory protection; – Face visors are particularly effective against splashes when working with sewage; and – Install an impermeable hardstand in areas of high-risk contamination to prevent ground infiltration by pollutants.	Daily	All staff members
	Environmental pollution (littering	– Waste management should be handled in accordance with the International Finance Corporation (IFC) standards as follows:	Daily/Weekly	All staff members

Task activity/ equipment	Impact identified	Mitigation control measures	Monitoring requirements	Responsibility
	and poor storage of solid waste)	– Implement a waste management plan (from "cradle to grave" methodology) covering all aspects of waste generated on-site; – Training and toolbox talk about the importance of waste management; – Ensure a high standard of housekeeping within site and farm boundaries; – Solid waste shall be stored in an appointed area in covered, tip-proof metal drums/skips for collection and disposal to an approved waste management site; – The waste storage areas shall always be kept clean and tidy; – Storage of domestic waste on site may result in the attraction of unwanted scavengers and should be removed as soon as it is feasible; – Implement the waste management hierarchy across the site: avoid, reuse, recycle, then the disposal; – Return packaging of hazardous and non-hazardous materials (wherever possible), such as empty bags for reuse; – Solid wastes should be deposited/emptied regularly. – See the material safety data sheets available from suppliers for disposal of contaminated products and empty containers; – Liaise with the governing body (municipality/council) regarding the waste and handling of hazardous waste (if any);		

Task activity/ equipment	Impact identified	Mitigation control measures	Monitoring requirements	Responsibility
		– Hydrocarbon and chemical contaminated solids have the potential to cause contamination to the soil, ground and or surface water, thus correct storage and disposal methods are required.		

6 DECOMMISSIONING

In the event that the solar plant is closed (and if ownership is not transferred), the Proponent and the new owner should mutually agree on the way ahead for the site and the infrastructure on-site. After decommissioning / refurbishment (if required) at the Plants Design Life, the PV panels will be recycled according to international standards. If the new owner has no use or plan for the site or buildings on-site the Proponent will be responsible to remove all equipment or any other materials from the site. If infrastructure is removed during decommissioning it is recommended that the Proponent implement a rehabilitation plan for the site, to ensure that the site is safe and that no further degradation to the site can occur.

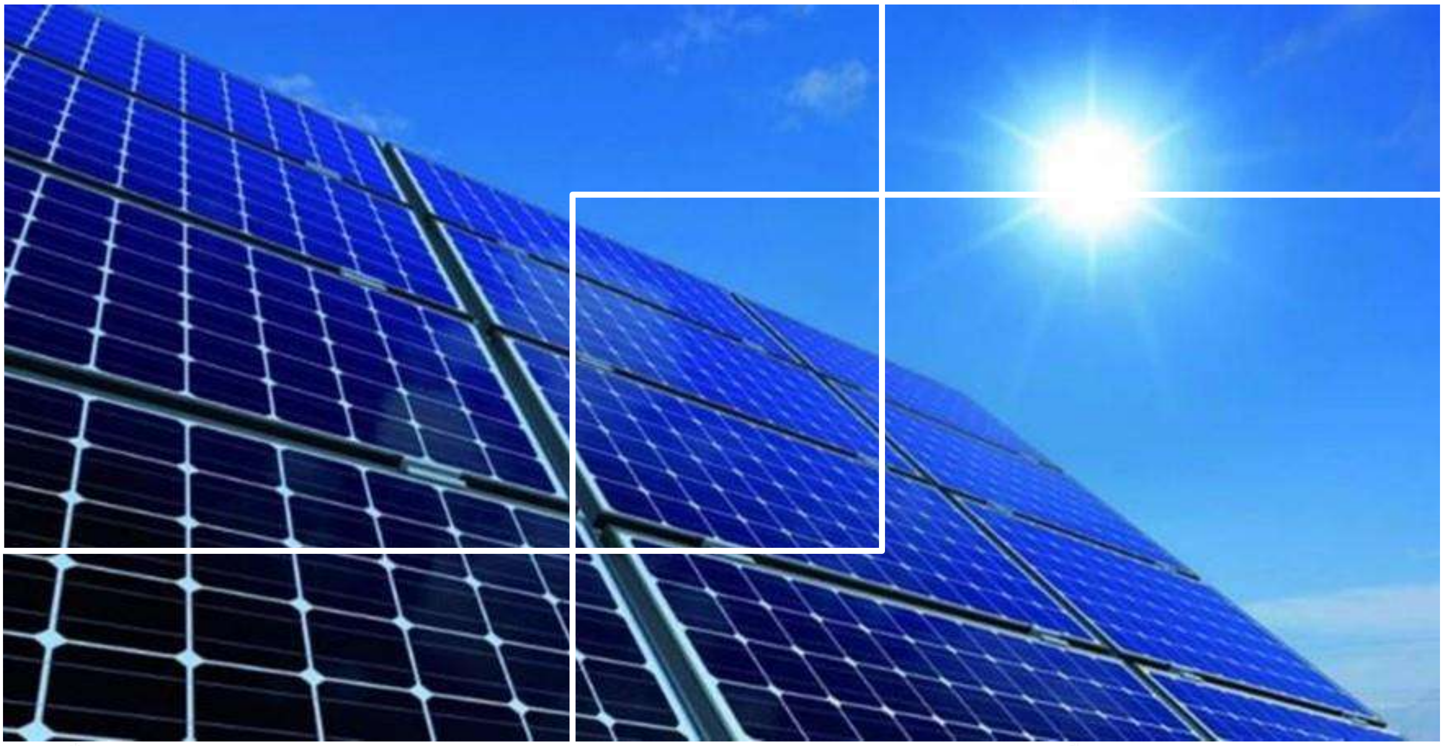
7 IMPLEMENTATION OF THE EMP

The proposed solar PV plant’s construction and operation work will be carried out in compliance with the relevant regulations. Minor to moderately significant impacts are anticipated and management and mitigation measures are in place to eliminate or reduce the severity of potential impacts.

This EMP:

A. Has been prepared according to a contract with the proponent;
B. Has been prepared based on information provided to ECC up to November 2022;
C. Is for the sole use of the proponent, for the sole purpose of an EMP;
D. Must not be used (1) by any person other than the Proponent or (2) for a purpose other than an EMP; and
E. Must not be copied without the prior written permission of ECC.

ECC has prepared the EMP based on information provided by the Proponent, and the environmental scoping report conducted for (Pty) Ltd and the proposed solar PV plant on farm Osona Commonage No. 65 portion 82.



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Windhoek, Namibia

REPORT:

BACKGROUND INFORMATION DOCUMENT FOR OSONA II – 36 MW SOLAR PHOTOVOLTAIC POWER PLANT NEAR OKAHANDJA, OTJOZONDJUPA REGION, NAMIBIA.

PROJECT NUMBER:	ECC-43-418-BID-04-D
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TITLE AND APPROVAL PAGE

Project Name:	Background information document for Osona II – 36 MW solar photovoltaic power plant near Okahandja, Otjozondjupa Region, Namibia.
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DISCLAIMER

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1 BACKGROUND INFORMATION DOCUMENT

1.1 PURPOSE OF THIS DOCUMENT

Environmental Compliance Consultancy (ECC) has been contracted by InnoSun Energy Holding (Pty) Ltd to conduct an environmental assessment and develop an environmental management plan (EMP), for the proposed construction and operation of Osona II – 36 MW solar photovoltaic power plant near Okahandja, Otjozondjupa Region, Namibia. Consistent with the Environmental Management Act, 2007 and its regulations, an environmental clearance certificate application will be submitted to the competent authority being the Ministry of Mines and Energy (MME) and Ministry of Environment, Forestry and Tourism (MEFT) to make a Record of Decision (RoD) with regards to the proposed project.

The purpose of this Background Information Document (BID) is to provide Interested and Affected Parties (I&APs) a background to the proposed Project and to invite I&APs to register as part of the assessment process.

All those who register as an I&AP will be kept informed throughout the process. Registration provides a platform for participants to submit comments, concerns, or recommendations regarding the proposed project. This BID includes the following information:

- The proposed project and location
- The necessity of the project, benefits or adverse impacts anticipated
- The alternatives within the project that will be considered and assessed
- How the assessment process works
- The public participation process and how to become involved
- Next steps and the way forward

1.2 DESCRIPTION OF THE PROPOSED PROJECT

The Proponent intends to construct and operate a 36 megawatts (MW) solar photovoltaic (PV) power plant on farm Osona Commonage No. 65 portion 82 (Figure 1), which will be linked to a nearby NamPower substation. The solar plant and associated infrastructure will cover an area of approximately 120 ha.

The proposed Project is located within the Okahandja District, in the Otjozondjupa Region. The 120-ha leased area is located to the southwest of Okahandja and is accessible via the D1972 district road leading off the B1 highway as set out in Figure 1.

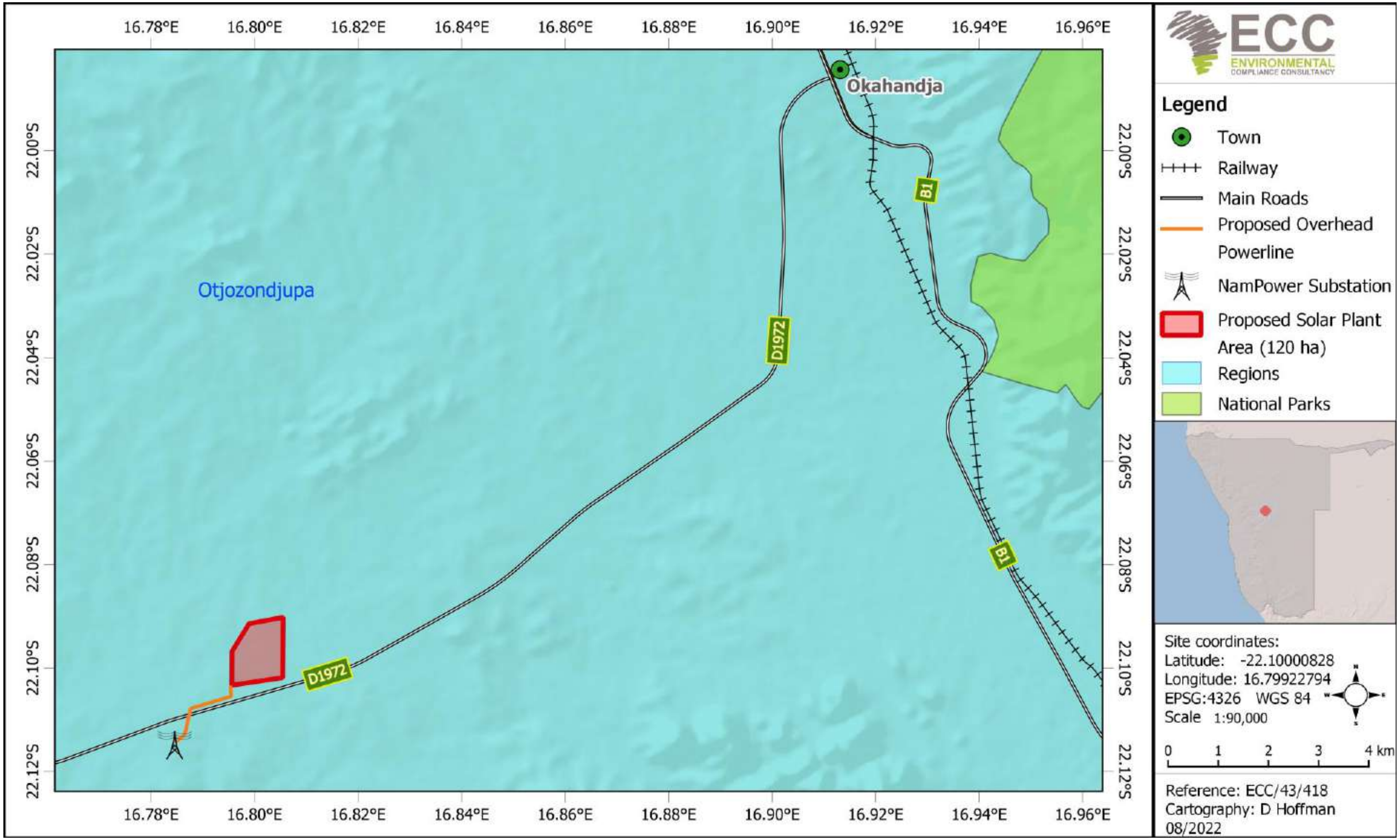

Figure 1 – Site locality map

1.3 NEED FOR THE PROJECT

Namibia is a country with very few overcast days throughout the year, thus being ideal for renewable energy sources like solar power. The proposed solar PV plant will supply renewable energy and contribute to the growth in the renewable energy sector of Namibia. The proponent aims to supply renewable, sustainable, and affordable power.

1.4 CONSTRUCTION AND OPERATIONAL PHASES

The following are envisioned during the proposed Project:

- Tracking System with RC Foundations;
- PV Solar arrays connected to inverters;
- Cable trenches;
- Building;
- Small warehouse;
- Fencing;
- Medium Voltage power lines;
- Low Voltage power lines; and
- Transformers.

1.5 CONSIDERATION OF ALTERNATIVES

Best practice environmental assessment methodology calls for consideration and assessment of alternatives to a proposed project. In a project such as this one, it is difficult to identify alternatives to satisfy the need of the proposed Project; the proponent already leases this part of the farm, and it is ideally located next to (western side) their existing 5 MW solar PV plant.

During the assessment, alternatives will consider optimisation and using eco-friendly solutions to reduce potential impacts.

2 THE ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT PROCESS

The assessment for the proposed project is being conducted by ECC and will be undertaken in terms of the Environmental Management Act, 2007 and its regulations. The process followed for this assessment is set out in the flowchart in Figure 2.

ECC has been contracted by InnoSun Energy Holding (Pty) Ltd as the independent Environmental Assessment Practitioner (EPA) to facilitate the entire assessment process. Prior to the start of the proposed project, an environmental clearance certificate is required in terms of the Environmental Management Act, 7 of 2007 and the associated EIA Regulations.

A final decision relating to the above-mentioned application will be made by Ministry of Environment, Forestry and Tourism (MEFT): Department of Environmental Affairs (DEA).

The related environmental process will include:

1. Screening phase (completed)
2. Scoping phase which includes baseline and specialist studies.
3. Assessment phase which includes impact prediction and evaluation of alternatives, assigning mitigation measures and developing monitoring and conceptual rehabilitation plans. This phase culminates in the drafting of the assessment report and draft Environmental Management Plan (EMP) and submission to the appropriate competent authorities

The main objectives of the assessment are to:

a) Provide information describing the proposed construction and operational activities;
b) Provide an independent environmental and social assessment of the activities associated with the proposed project; and
c) Develop management and mitigation measures associated with any identified potential impacts where necessary.

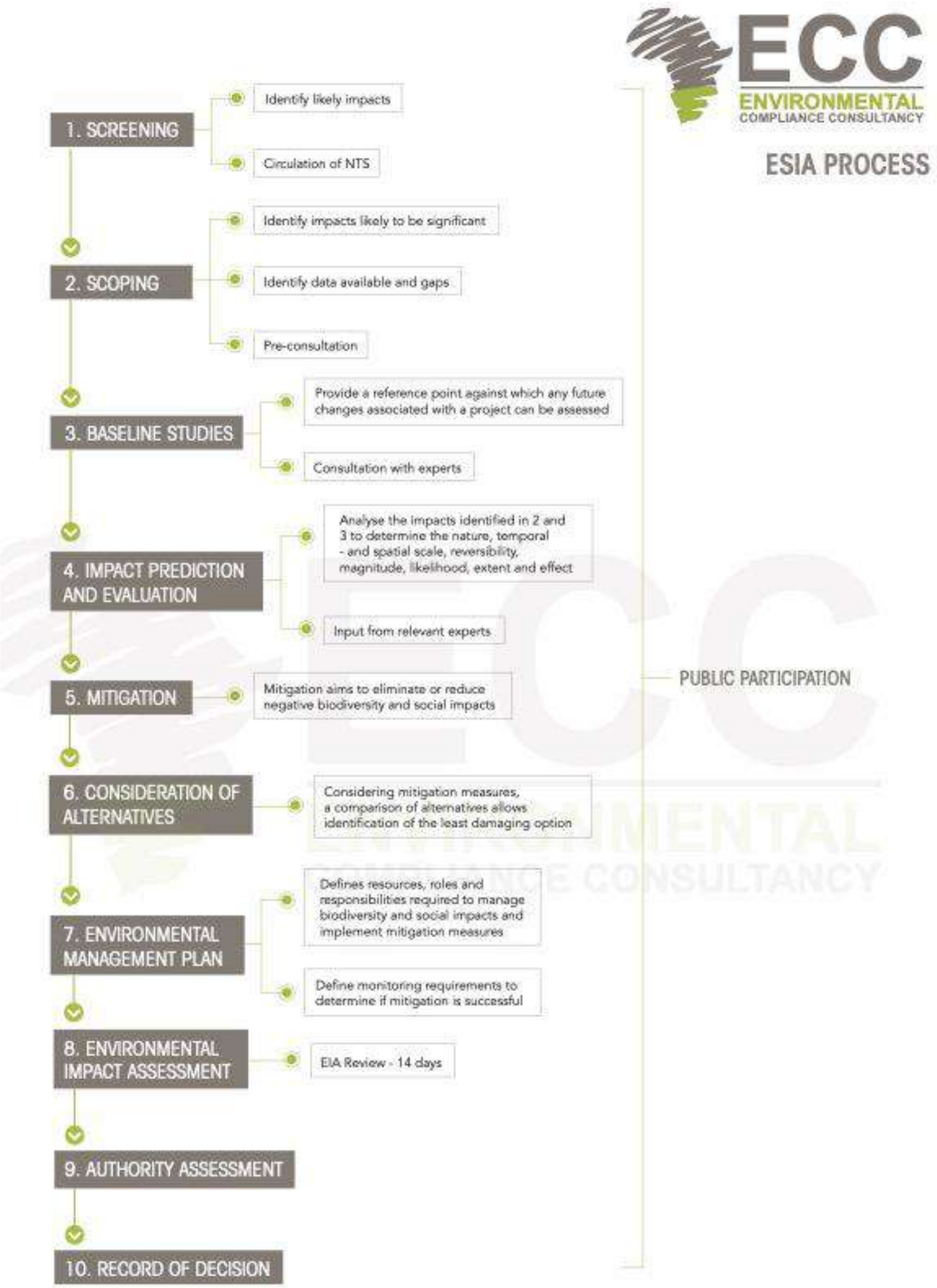

Figure 2 - Flowchart of the environmental and social assessment process

2.1 SCREENING

A review of the planned project was undertaken and the screening findings against the listed activities was conducted; the findings of which are summarised in Table 1.

Table 1- Listed activities triggered by the proposed project

LISTED ACTIVITY	EIA SCREENING FINDING
ENERGY GENERATION, TRANSMISSION AND STORAGE ACTIVITIES (1.a) The construction of facilities for the generation of electricity; (1.b) The construction of facilities for the transmission and supply of electricity;	• A solar PV power plant and associated infrastructure will be constructed and installed on-site and cater for a peak demand of 36 MW. • A 66kV overhead powerline (1.8 km in length) will be installed to a nearby substation.
WASTE MANAGEMENT, TREATMENT, HANDLING AND DISPOSAL ACTIVITIES (2.1) The construction of facilities for waste sites, treatment of waste and disposal of waste. (2.3) The import, processing, use and recycling, temporary storage, transit, or export of waste.	• A small septic tank will be installed on-site (operational phase) and portable chemical toilets will be used during the construction phase. • Waste generated during the construction phase will be removed by a skip and will be disposed of at the nearest landfill site (Okahandja).
FORESTRY ACTIVITIES (4.) The clearance of forest areas, deforestation, a-forestation, timber harvesting or any other related activity that requires authorisation in term of the Forest Act, 2001 (Act No. 12 of 2001) or any other law.	• Vegetation will be cleared for the construction and installation of the solar PV power plant and ablution facilities (Toilet), which will include approximately 120 hectares.
HAZARDOUS SUBSTANCE TREATMENT, HANDLING AND STORAGE (9.2) Any process or activity which requires a permit, licence or other form of authorisation, or the modification of or changes to existing facilities for any process or activity which requires an amendment of an existing permit, licence or authorisation or which requires a new permit, licence or authorisation in terms of a law governing the generation or release of emissions, pollution, effluent, or waste.	• A small septic tank will be installed for the permanent ablutions that will be constructed

2.2 SCOPING

The scoping phase is directed towards defining the range and nature of anticipated potential impacts that may have significance to the biophysical and social environments at the scale of the proposed operations. The appropriate available data and the literature are identified forming the starting point for the assessment of the required baseline and specialist studies that may be required for assessment of the project impacts.

2.3 BASELINE STUDIES

The assessment will focus on the environmental receptors that could be affected by the proposed project. ECC will also engage with stakeholders, I&APs and the proponents to seek input into the assessment. The baseline studies chapter is broken into three sections, the baseline context, environmental (physical and biological), and social (including economic).

Desktop studies as well as all available field surveys and specialist studies from the project area will be used to help define the baseline. These studies also give a further indication of whether any local or regional future developments could impact the project or vice versa.

Lastly, the socio-economic section of the baseline studies helps to gain information on the governance, demographic profile, social stratification (employment, education, infectious disease), occupation and livelihood (economic activities, employment rates) and access to services.

2.4 STAKEHOLDER ENGAGEMENT

The public and key stakeholders receive invitations to register as I&APs. After the presentation of the proposed project and assessment process through the defined public consultation process, a period of time for input will be granted for the Environmental Assessment Practitioner (EAP) to receive any additional concerns or comments from registered I&AP's. All feedback from the initial public consultation process will be incorporated into the scoping report.

2.5 SCOPING REPORT

The scoping report will be drafted and made available to the registered I&APs for comment before being submitted to the competent authority and MEFT. The scoping report will contain a description of the project and the biophysical and socio-economic environments, the specialist and baseline studies, and a stakeholder engagement section.

2.6 ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT PHASE

2.6.1 POTENTIAL IMPACTS

The potential social and economic impacts should be considered with due regard to the nature and scale of the proposed operations its location within the broader ecological, commercial and social environments. The potential environmental and social impacts that have been anticipated may include the following:

- Jobs will be created as a result of the project;
- Potential to unearth, damage or destroy undiscovered heritage remains;
- Occupational health and safety;
- Potential visual disturbances to nearby landowners;
- Minor disruption to the residents of neighbouring farms, including some potential increase in dust and noise levels during the construction phase;
- Disturbance of soil during the construction phase;
- Potential soil erosion within cleared areas;
- Potential groundwater and soil contamination from chemicals or hydrocarbons spilt during construction and maintenance;
- Potential sewage or chemical spills from the septic tank and portable chemical toilets;
- Vegetation clearing with regards to the proposed construction on a 120 ha area;
- Potential avifauna collision risk with the reflective surfaces and overhead powerlines;
- Potential impacts on biodiversity and ecology through habitat fragmentation or habitat loss;
- Potential disturbance or displacement of protected or vulnerable species; and
- Waste management.

2.6.2 DRAFT ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

An EMP shall be developed for the proposed project setting out auditable management actions for the project to ensure careful and sustainable management measures are implemented for their activities in respect of the surrounding environment and community. The EMP becomes the legally binding commitment upon approval of the EMP and issuing of the environmental clearance certificate. Environmental clearance certificates are issued for a period of 3 years and renewal is subject to compliance with the provisions and conditions of the environmental clearance certificate.

3 THE WAY FORWARD – PUBLIC PARTICIPATION

Public participation is an important part of the assessment process. It allows you, the public and stakeholders to raise concerns or provide valuable local environmental knowledge that can benefit the assessment process as well as aid the planning process for the scoping phase of the defined assessment process. At this phase ECC will perform the following:

- Prepare and submit the application for the environmental clearance certificate in the prescribed manner
- Identify relevant key stakeholders, authorities, municipalities, environmental groups and interested or affected members of the public, hereafter referred to as I&APs
- Carry out a public consultation process in accordance with Regulation 21 of the EMA 2007 including:
    - Distribute the BID for the proposed Osona II Project (this document)
    - Advertise the environmental application and call for registration of I&APs in two national newspapers
    - Open the project I&AP register and record all comments of I&APs and present both comments and responses provided by ECC, in the comments and responses report, which will be included in the scoping report and submitted with the application
- Prepare a scoping report and provide it to registered I&APs for comment
- Submit the scoping report and the I&AP comments to the competent authority and Environmental Commissioner for a record of decision

Your request for registration as an I&AP as well as any comments on the BID or Project must be submitted in writing and can be emailed using the details in the contact us section below. Registration as an I&AP for the project can be completed online on ECCs website on the projects page, or by using this link: https://eccenvironmental.com/projects/

Registration as an I&AP should be submitted on or before: **27 September 2022**.

We welcome any enquiries regarding this document and its content. Please contact:
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At ECC we make sure all information is easily accessible to the public.
Follow our social platforms online to be kept up to date.

SPECIES	ENDEMISM	PROTECTED	IUCN1	IUCN2
Tetragonia calycina Fenzl				
Alternanthera nodiflora R.Br.				
Gomphrena celosioides Mart. [1]				
Hermbstaedtia odorata (Burch.) T.Cooke var. odorata				
Barleria lancifolia T.Anderson subsp. lancifolia				
Petalidium lanatum (Engl.) C.B.Clarke	Endemic			
Aloe hereroensis Engl. var. lutea A.Berger		Protected		
Androcymbium roseum Engl.				
Combretum apiculatum Sond. subsp. apiculatum				
Momordica humilis (Cogn.) C.Jeffrey				
Cyperus laevigatus L.				
Fimbristylis ferruginea (L.) Vahl				
Eriospermum rautanenii Schinz				
Croton gratissimus Burch. var. gratissimus				
Rhigozum trichotomum Burch.				
Ornithogalum seineri (Engl. & K.Krause) Oberm.				
Plectranthus dinteri Briq.	Endemic			
Abutilon hirtum (Lam.) Sweet var. hirtum				
Pavonia senegalensis (Cav.) Leistner				
Marsilea unicornis Launert				
Sesamum capense Burm.f.				
Polygonum plebeium R.Br.				
Eragrostis porosa Nees				
Schmidtia kalahariensis Stent				
Sporobolus festivus Hochst. ex A.Rich.				
Sporobolus ioclados (Trin.) Nees				
Sporobolus nebulosus Hack.	Near Endemic			
Sporobolus tenellus (Spreng.) Kunth				
Stipagrostis hirtigluma (Steud. ex Trin. & Rupr.) De Winter subsp. patula (Hack.) De Winter				
Stipagrostis hochstetteriana (Beck ex Hack.) De Winter var. hochstetteriana				
Stipagrostis uniplumis (Licht.) De Winter var. uniplumis				
Urochloa brachyura (Hack.) Stapf				
Azima tetracantha Lam.				
Jamesbrittenia canescens (Benth.) Hilliard var. seineri (Pilg.) Hilliard				
Jamesbrittenia tenella (Hiern) Hilliard				
Manulea conferta Pilg.				
Peliostomum leucorrhizum E.Mey. ex Benth.				
Selago alopecuroides Rolfe				
Atriplex suberecta I.Verd.				
Galeomma stenolepis (S.Moore) Hilliard				
Melanthera marlothiana O.Hoffm.				
Ondetia linearis Benth.	Endemic			
Sonchus asper (L.) Hill subsp. asper				
Sonchus oleraceus L.				
Acacia luederitzii Engl. var. luederitzii				
Acacia senegal (L.) Willd. var. rostrata Brenan				
Crotalaria argyraea Welw. ex Baker				
Faidherbia albida (Delile) A.Chev.		Forestry Protected		
Melolobium macrocalyx Dummer var. longifolium Dummer				
Neorautanenia mitis (A.Rich.) Verdc.				

Environmental and Social Impact Assessment for the proposed Innosun Osona II - 36 MW, 120 ha Solar PV Power Plant, Okahandja, Otjozondjupa Region, Namibia

Avifauna baseline/scoping and assessment study

Prepared by:

African Conservation Services cc

Prepared for:

Environmental Compliance Consultancy

December 2022

Name of project	**Environmental and Social Impact Assessment for the proposed InnoSun Osona II - 36 MW, 120 ha Solar PV Power Plant, Okahandja, Otjozondjupa Region, Namibia** **Avifauna baseline/scoping and assessment study**
Principal client	InnoSun Energy Holding (Pty) Ltd PO Box 86524, Windhoek, Namibia
Lead Environmental Assessment Practitioner	Environmental Compliance Consultancy (ECC) PO Box 91193, Klein Windhoek, Namibia Email: stephan@eccenvironmental.com; diaan@eccenvironmental.com Tel. +264 81 262 7872 / +264 81 669 7608 Representatives: Stephan Bezuidenhout; Diaan Hoffman
Sub-consultant	African Conservation Services cc PO Box 2604, Swakopmund, Namibia Email: ecoserve@iway.na Tel: 064 404 866 / 081 284 5130 Representatives: Dr Ann Scott and Mike Scott
Report date	Draft 1: 17 October 2022 Draft 2: 5 December 2022

Expertise and declaration of independence

We, African Conservation Services cc, as the appointed independent avifauna specialist for the Environmental and Social Impact Assessment: amendment for the proposed Environmental and Social Impact Assessment for the proposed InnoSun Osona II - 36 MW, 120 ha Solar PV Power Plant, Okahandja, Otjozondjupa Region, hereby declare that we:

- have acted as the independent specialist in this Environmental Clearance Certificate application;
- have expertise and experience in conducting the avifauna specialist report relevant to this application;
- have performed the work relating to the application in an objective manner;
- regard the information contained in this report as it relates to our specialist input/study to be true and correct;
- do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the EIA (amendment);
- declare that there are no circumstances that may compromise our objectivity in performing such work;
- have no, and will not engage in, conflicting interests in the undertaking of the activity;
- have no vested interest in the proposed activity proceeding;
- undertake to disclose to the applicant and the competent authority all material information in our possession that reasonably has or may have the potential of influencing the decision of the competent authority; and that
- all the particulars furnished by us in this specialist input/study are true and correct.

Name of specialist: African Conservation Services cc

HA Scott RM Scott

Date: 5 December 2022

Executive summary

Introduction and study area

Innosun Energy Holding (Pty) Ltd (Innosun) proposes to construct a 36 MW, 120 ha utility-scale solar photovoltaic (PV) plant focussing on the commercial production of renewable energy. The proposed locality is 2.5 km north-east of the NamPower Osona Substation, 17 km south-west of Okahandja in the Otjozondjupa Region, Namibia. InnoSun has already built a 5 MW solar PV plant in the close vicinity of the proposed project. Environmental Compliance Consultancy (ECC) has been appointed by Innosun as the independent Environmental Assessment Practitioner (EAP) to undertake the Environmental and Social Impact Assessment (ESIA) process for the proposed development. The present avifauna baseline/scoping and assessment study forms part of the above ESIA.

The study area lies within the Acacia Tree-and-shrub Savanna Biome, with an average annual rainfall of 250-300 mm and relatively warm average annual temperatures of 20-22°C. The landscape type is classed as the Khomas Hochland Plateau region, with rolling hills in the west. The vegetation is Highland Shrubland with dominant vegetation structure shrubs and low trees, with grass, but bush encroached.

Proposed infrastructure

The use of monocrystalline bi-facial solar PV technology is proposed, similar to that of the existing 5 MW solar PV array. The PV modules will be placed on PV trackers that track from east to west throughout the day. At night the tables are horizontal, in "stow" position.

The proposed 66 kV transmission power line will consist of a wooden five-pole structure, with three conductors suspended in horizontal configuration, and no optic ground wire (OPGW) running above the conductors. Stay wires will be used at the bend points and on the strain poles (only). The pole height is 13 m and span length ~200-220 m. The line will for the main part run parallel to the 66 kV Von Bach-Osona 1 steel monopole structure, which is higher (20.6 m), with an OPGW running at the top of the structure.

Approach and methodology

The avifauna study is based on widely accepted and comprehensive best practice guidelines for assessing and monitoring the impact of solar power generating facilities on birds in southern Africa, compiled by BirdLife South Africa and recently updated (Jenkins et al. 2017). In line with international best practice, the above authors propose a multi-tiered approach that includes a preliminary avifaunal assessment; more intensive data collection; impact assessment; and monitoring.

According to the above guidelines, a solar development with a footprint of 120 ha would be classed as of medium size (i.e. 30-150 ha). As the avifauna is also regarded as of medium-high sensitivity, with relatively high bird species richness, and lying close to a bird movement corridor (i.e. the large, ephemeral Swakop River system [see below] that is of local and regional significance, and also [probably] of national significance). An adaptive approach to monitoring, based on Regime 2, was therefore followed. This protocol involves pre-construction monitoring for a two-day period, repeated at least 2-3 times over six months (or at greater intensity if monitoring results should indicate a need). The above monitoring follows standardised protocols, as recommended above, that can be repeated to provide comparable data sets, and used for measuring change. Three pre-construction monitoring sessions took place, namely on 26-28 July 2022, 10-13 October 2022 and 28-30 November 2022. The results supplement the desk-top study, and feed into the final impact assessment.

According to the above international best practice, a hierarchical approach to mitigation is recommended, comprising four steps in sequence. Implementing this hierarchy is an iterative (rather than a linear) process, that involves ongoing monitoring, feedback and adaptive management. Avoidance and minimisation measures prevent or reduce impacts, whereas restoration and offset measures attempt to remedy impacts that have already taken place.

Sensitive habitats

According to the baseline and scoping of bird habitats and species, the study area is potentially sensitive in terms of avifauna, especially when viewed in the broader context of lying on the extensive, ephemeral Swakop River system, which is regarded as a potential bird movement corridor for aquatic and other birds between the nearby Gross Barmen wetlands, two large dams on the river, and inland and to the coast. As mentioned above, this corridor is of local and regional significance, and probably also of national significance. Although nest sites in the trunks of larger trees for (near-endemic) cavity breeders are regarded as sensitive, no critical habitats were identified.

Sensitive species

A total of 241 bird species has been recorded in the study area and surrounds, representing 36% of the 676 species currently recorded in Namibia. This species richness is regarded as relatively high. The bird checklist for the study area includes 16 (7%) species that are currently classed as Threatened in Namibia (Simmons et al. 2015, Brown et al. 2017), of which nine (56% of the total) are also Globally Threatened. The checklist also includes seven species (3%) that are near-endemic to Namibia (including two with Red Data status), and at least three Red Data species with migrant status. Other (non-Red Data) migrant species have also been recorded in the area.

During the site visits, evidence of active or past breeding by birds was recorded/reported in the study area for several species, of particular importance being the potential for cavity breeders, mainly in shepherd's tree *Boscia albitrunca* trunks (this group of birds would include Damara Red-billed Hornbill, Monteiro's Hornbill, Rüppell's Parrot and Violet Wood Hoopoe – all near-endemic to Namibia).

Priority species

Risk assessment and mitigation efforts are directed towards priority species, namely those that have a high biological significance, i.e. primarily Red Data species (including any with migrant status) and/or endemic or near-endemic species.

A total of 28 priority bird species have been short-listed from a total of 55 potential priority species, as a focal group identified as being at higher risk to potential impacts resulting from the proposed project (including power line). This short-listing takes into account the probability of the species occurring in the study area and surrounds. However, due to the high species numbers and the difficulty in predicting the species likely to be impacted, the full priority list needs to be taken into account, focussing on the groups of birds likely to be at risk rather than individual species; and the precautionary principle should prevail.

The 28 priority species comprise 10 high-priority species (6 Red Data / 4 near-endemic / 1 Palearctic migrant), in the groups of five raptor species, one aquatic species and four other terrestrial species; and 18 non-Red Data / non-near-endemic priority species, in the groups of six raptors, eight aquatic species (as examples) and four other terrestrial species.

Details of priority species

(Species confirmed during site visits in 2022 are indicated by asterisk; local abundance indicated on a scale of 1-4).

10 high priority species (6 Namibian Red Data [3 also Globally Endangered] / 4 near-endemic to Namibia / 1 Palearctic migrant), in the groups:

- **5 raptor species** (no nesting activity recorded as yet)

   - White-backed Vulture (Critically Endangered, also Globally Critically Endangered; resident, with long-distance movements, especially in juveniles; power line-prone; local abundance 2/4)
   - Lappet-faced Vulture (Endangered, also Globally Endangered; resident, with extensive movements in non-breeding birds; power line-prone; local abundance 1/4)
   - *Martial Eagle (Endangered, also Globally Endangered; resident; power line-prone; local abundance 3/4)
   - Tawny Eagle (Endangered; power line-prone; local abundance 3/4)
   - Common (Steppe) Buzzard (Palearctic migrant; power line-prone; local abundance 4/4)
- **1 aquatic species (power line-prone)**
   - Great White Pelican (Vulnerable; sedentary, nomadic; power line-prone; local abundance 4/4)
- **4 other (non-raptor) terrestrial species**
   - *Rüppell's Parrot (Near Threatened; near-endemic to Namibia; nomadic; cavity breeder; power line-prone; local abundance 2/4)
   - *Damara Red-billed Hornbill (near-endemic to Namibia; cavity breeder; power line-prone; local abundance 3/4)
   - *Monteiro's Hornbill (near-endemic to Namibia; nomadic; cavity breeder; power line-prone; local abundance 3/4)
   - *White-tailed Shrike (near-endemic to Namibia; highly territorial; local abundance 3/4)

18 non-Red Data / non-near-endemic priority species, in the groups:

- **6 raptor species (all power-line prone)**
   - Black-chested Snake Eagle (resident, nomadic; power line-prone)
   - Brown Snake Eagle (resident, nomadic; power line-prone)
   - *Pale Chanting Goshawk (sedentary, with local movements; electrocution-prone)
   - *Southern White-faced Owl (resident; power line-prone)
   - *Western Barn Owl (resident; breeding reported in area 2022; power line-prone)
   - Pearl-spotted Owlet (resident; cavity-breeder; power line-prone?)
- **8 aquatic species (examples)**
   - *White-breasted Cormorant (sedentary, nomadic; collision-prone)
   - *Reed Cormorant (resident, nomad; partial migrant; collision-prone)
   - African Darter (sedentary, with local movements; collision-prone)
   - Species that land on water (and could potentially mistake solar PV panels for expanses of water, especially in poor light): African Black Duck, *White-backed Duck (resident, nomadic) Cape Teal (nomadic, partially migrant), Red-billed Teal (resident, nomadic); *Little Grebe (resident, with local movements)
- **4 other (non-raptor) terrestrial species**
   - *Red-crested Korhaan (sedentary; ground-nester; collision-prone)
   - *Double-banded Sandgrouse (sedentary; ground-nester; collision-prone; breeding recorded at 5 MW solar PV site 2022)
   - Namaqua Sandgrouse (resident, nomadic or migratory; ground-nester; collision-prone)
   - *Red-billed Spurfowl (sedentary; ground-nester; collision-prone)

Other (mostly non-priority) species with the potential to cause impacts on infrastructure

Several other (mostly non-priority) bird species have the potential to impact on infrastructure, including on solar PV arrays and power line structures, through their perching, nesting and other activities, e.g.

- *Greater Striped Swallow (breeding intra-African migrant)
- *Red-billed Buffalo Weaver
- *Sociable Weaver
- Rock Dove (Feral Pigeon), *Speckled (Rock) Pigeon
- Cape Sparrow, House Sparrow, *Cape Wagtail

Potential impacts

The above 28 priority bird species are potentially at risk to the following five main impacts, rated as follows:

- Physical/human disturbance of birds (resulting in avoidance/displacement); this could include road mortalities and/or poaching during construction
  - Rated as minor-moderate, and minor post-mitigation
- Direct and indirect modification/loss/destruction of bird habitat (resulting in avoidance/ displacement)
  - Rated as moderate-major, and moderate post-mitigation
- Creation of novel (artificial) habitats and resources that could attract birds; this impact could lead to negative impacts on infrastructure, caused by bird nesting, perching and other activities
  - Rated as minor, no mitigation proposed as yet (adaptive management)
- Bird electrocutions on power line infrastructure (including by streamers of excrement)
  - Rated as minor, and low post-mitigation
- Bird collisions with infrastructure such as solar panel arrays, fences, guyed masts and associated power line infrastructure
  - Solar PV: rated as minor, and low post-mitigation
  - Power line: rated as moderate, and minor post-mitigation

Mitigation and monitoring

Recommendations are made for mitigation and monitoring for the Environmental Monitoring Plan. The recommendations include post-construction monitoring. An adaptive approach to mitigation is recommended, dependent on the ongoing feeding of the results of monitoring into management strategies.

It is considered that the effective application of the above mitigation should help reduce the impacts of the proposed development. However, ongoing monitoring is regarded as essential.

Table of contents

List of figures

List of tables

Abbreviations, acronyms, units and glossary of terms

AEWA	African-Eurasian Migratory Waterbird Agreement
CBD	Convention on Biological Diversity
CMS	Convention on Migratory Species
Critical Habitat	Critical habitats are areas with high biodiversity value, including (i) habitat of significant importance to Critically Endangered and/or Endangered species; (ii) habitat of significant importance to endemic and/or restricted-range species; (iii) habitat supporting globally significant concentrations of migratory species and/or congregatory species; (iv) highly threatened and/or unique ecosystems; and/or (v) areas associated with key evolutionary processes (IFC 2012, p37)
ECC	Environmental Clearance Certificate
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
Endemic	Occurring within a restricted range
	Endemic status categories:
	E = endemic, NE = near-endemic, sA = southern Africa, Nam = Namibia
ESIA	Environmental and Social Impact Assessment
IBA	Important Bird and Biodiversity Area
IUCN	International Union for Conservation of Nature
	IUCN Red List categories:
	LC Least Concern
	NT Near Threatened
	VU Vulnerable
	EN Endangered
	CE Critically Endangered
	EW Extinct in the Wild
	EX Extinct
	GT Globally Threatened
kV	Kilovolt
MEFT	Ministry of Environment, Forestry and Tourism
MW	Megawatt
NNF	Namibia Nature Foundation
OPGW	Optical ground wire; a wire that includes communication functions provided by the incorporated optical fibers in addition to the existing overhead ground (earth) wire, which protects the transmission cables from lightning strikes and secures current flow in case of cable fault (https://www.lscns.com)
Pentad	A 5-minute x 5-minute coordinate grid super-imposed over the continent for spatial reference; nine pentads make up one Quarter Degree Square
PV	photovoltaic
QDS	Quarter Degree Square
Residency categories:	
	R = resident, N = nomadic, M = migrant, V = vagrant; R = rare
SABAP	Southern African Bird Atlas Project (SABAP1 & SABAP2)
SDG	(United Nations) Sustainable Development Goals

1 Introduction

Innosun Energy Holding (Pty) Ltd (Innosun) proposes to construct a 36 MW, 120 ha utility-scale solar photovoltaic (PV) plant focussing on the commercial production of renewable energy. The proposed locality is north-east of the NamPower Osona Substation, south-west of Okahandja in the Otjozondjupa Region, Namibia (Figure 1). InnoSun has already built a 5 MW solar PV plant in the close vicinity of the area of interest for the prospective 36 MW solar PV project.

Environmental Compliance Consultancy (ECC) has been appointed by Innosun as the independent Environmental Assessment Practitioner (EAP) to undertake the Environmental and Social Impact Assessment (ESIA) process for the proposed development. The present avifauna baseline/scoping and assessment study forms part of the above ESIA.

Figure 1. Locality map for the proposed Osona II - 36 MW utility-scale solar photovoltaic (PV) plant for the commercial production of renewable energy north-east of the NamPower Osona Substation, south-west of Okahandja in the Otjozondjupa Region, Namibia; also showing trunk roads, large rivers and dams, and existing power lines in the area (see legend; based on a Google Earth map).

2 Terms of reference

2.1 Introduction

The aim of the avifauna baseline/scoping and assessment study is to identify and assess potential environmental impacts of the proposed 36 MW solar photovoltaic (PV) plant and any associated power line structures in terms of avifauna, and to make mitigation and monitoring recommendations for the Environmental Management Plan (EMP).

The approach will follow standard guidelines for assessing and monitoring the impact of solar power generating facilities on birds in southern Africa, as recommended by Jenkins et al. (2017).

According to the above protocols and based on the medium footprint size of its solar array (120 ha) and the anticipated medium-high avifaunal sensitivity of the area, the study will follow a Regime 2 assessment (i.e. for class 30-150 ha). This approach would include at least 2-3 pre-construction monitoring sessions over six months, as part of the scoping and assessment.

2.2 Desk-top assessment

The study will be based on a desk-top assessment of the bird habitats and their likely avifauna and their sensitivity in terms of the proposed development. Any proposed alternatives will also be considered and assessed.

The best available data sources (both published and unpublished literature, including existing pre-feasibility studies for the project and other EIA studies) will be used to establish the baseline conditions, also making use of local knowledge (e.g. bird atlas data, local birders who are familiar with the study area), if available. Gaps in baseline data will be identified if applicable.

The study site will be characterised in terms of:

- the avifauna habitats present, and their sensitivities
- an inclusive list of bird species likely to occur there
- sensitivities of the bird species and the identification of priority species, based on criteria such as conservation (Red Data) status, endemism, residency/seasonality/movements, recorded breeding, abundance etc.
- known and potential sensitivities of the bird species to identified impacts (see below)
- any obvious, highly sensitive, "no-go" areas or aspects to be avoided by the development from the outset.

2.3 Site visits

An initial one-day site visit will be conducted to provide a preliminary assessment, which will be combined with the first pre-construction assessment (see below). The aims of the site visit will be to:

- define the study area
- characterise the study site (as above)
- provide an initial estimation of likely impacts of the proposed solar energy facility
- plan and carry out basic structured and repeatable data collection (including road/power line transects, walked transects, fixed-point surveys and checklist surveys) on which to base the impact assessment report and provide a baseline against which further (and post-construction) monitoring can be compared
- determine whether or not any further level of baseline data collection is necessary, and detail the nature and scale of such work.

As a minimum, the first site visit will be repeated twice over the following six months, using the same data collection methods; this will constitute the second and third pre-construction site visits.

2.4 Impact assessment

The study will determine the impact on the avifauna and its habitats of the various changes that may be caused by the construction, operation and decommissioning of the solar PV plant, including its power supply structures, on the ecosystems in question including, but not limited to:

- Human disturbance of birds (resulting in avoidance/displacement)
- Direct and indirect modification/loss/destruction of bird habitat (resulting in avoidance/displacement)
- Creation of novel (artificial) habitats and resources for birds
- Electrocution of birds on power line structures
- Bird collisions with infrastructure such as solar panel arrays, fences, guyed masts and associated power line structures

The impacts will be assessed according to standard procedures, as provided by the client.

Possible cumulative impacts associated with existing power line infrastructure in the area will be investigated (including monitoring results to date), as well as any other related activities currently taking place in the environment.

Information gaps will be identified, and an indication of confidence in the prediction will be provided.

2.5 Recommendations

Recommendations will be provided for the mitigation of impacts on avifauna and its habitats, together with a monitoring plan, for inclusion in the Environmental Management Plan (EMP).

- The recommendations will include at least three post-construction site visits covering six months, following the same methods as in the pre-construction monitoring.

3 Legislation, conservation agreements, best practice standards and guidelines

The Avifauna Impact Assessment is conducted in accordance with, and ensuring compliance with, the following legal requirements, agreements, and best practice standards and guidelines (Table 1).

Table 1: Legislation, conservation agreements, best practice standards and guidelines for the avifauna impact assessment
*Key biodiversity-related international agreements considered relevant to renewable energy development (Bennun et al. 2021)

3.1 Namibian environmental legislation	
Namibian Constitution, 1990	Environmental conservation is entrenched in the Namibian Constitution (1990, Article 95, Promotion of the Welfare of the People), in terms of which the State shall actively promote and maintain the welfare of the people by adopting, *inter alia,* policies aimed at the following: (l) maintenance of ecosystems, essential ecological processes and biological diversity of Namibia and utilization of living natural resources on a sustainable basis for the benefit of all Namibians, both present and future … The above description would include the promotion of sustainable renewable energy developments, including the use of solar power generating systems.
Namibian Environmental Management Act, 2007 (Act no. 7 of 2007)	The Environmental Impact Assessment (EIA) process in Namibia is governed and controlled by the Environmental Management Act (EMA), 2007 and the EIA Regulations 30 of 2012 (Anon. 2012), which are administered by the office of the Environmental Commissioner through the Department of Environment Affairs (DEA) of the Ministry of Environment, Forestry and Tourism (MEFT). The above Act requires the full consideration of biodiversity (including birds), habitat and landscape parameters, values and criteria as part of the environmental assessment processes. Under this legislation, activities that may not be undertaken without an Environmental Clearance Certificate (ECC) include energy generation, transmission and storage activities.
Namibian Nature Conservation Ordinance of 1975	The study area is about 5.8 km east of a relatively small (106.5 ha), formally protected area (including a wetland of 3.5 ha), the Gross Barmen Hot Springs, proclaimed under the above Nature Conservation Ordinance of 1975. The conservation of terrestrial birds in Namibia is governed by the Nature Conservation Ordinance of 1975. It is envisaged that the above Ordinance will eventually be replaced by the (draft) Parks and Wildlife Management Bill (2005). The list of Specially Protected Birds according to this Bill is based on the Namibian Red Data Book (Simmons et al. 2015), and the Namibian Red Data categories in the latter document are used in the present report, together with those of a recent update (Brown et al. 2017).

3.2 International conservation agreements	
Convention on Biological Diversity (CBD) Post-2020 Biodiversity Framework*	Namibia is a signatory to the international Convention on Biological Diversity (CBD). The CBD is the overarching multilateral environmental agreement for biodiversity, with 196 Parties comprising nearly all the world's countries (Bennun et al. 2021). The CBD's post-2020 global biodiversity framework will build on the Strategic Plan for Biodiversity 2011–2020 and sets out an ambitious plan to implement broad-based action to bring about a transformation in society's relationship with biodiversity and to ensure that, by 2050, the shared vision of living in harmony with nature is fulfilled.
United Nations Framework Convention on Climate Change (UNFCCC)	Since 1995, Namibia has been a signatory to the United Nations Framework Convention on Climate Change (UNFCCC) as a Non-Annex I party (NAI). As party to the convention, Namibia is obliged to prepare and submit National Communications (NCs) and in addition Biennial Updated Reports (BURs) (http://www.met.gov.na/services/national-communications-and-biennial-update-reports/238/). The adoption of the Paris Climate Change Agreement (2015; under the above convention) has also brought home the need for low-carbon development based on environmentally-friendly technologies.
Convention on the Conservation of Migratory Species of Wild Animals (CMS)*	The Convention on the Conservation of Migratory Species of Wild Animals (CMS) is an intergovernmental treaty with global remit (Bennun et al. 2021). CMS lists a number of migratory species that are susceptible to solar (and wind) impacts for which parties to the convention have agreed increased protection. CMS convenes the Energy Task Force, a dedicated multi-stakeholder platform that works towards reconciling renewable energy developments with the conservation of migratory species. A number of other relevant agreements and memorandums under the CMS umbrella include the Agreement on the Conservation of African-Eurasian Migratory Birds (AEWA) and the Memorandum of Understanding on the Conservation of Migratory Birds of Prey in Africa and Eurasia (Raptors MOU). Namibia is classed as a range state for AEWA but, although guided by its principles, is not yet a contracting party to this international agreement. Guidelines for the sustainable deployment of renewable energy technologies in terms of migratory bird species (Van der Winden et al. 2015) have been commissioned by the Secretariats of the Convention on Migratory Species and the AEWA Agreement on behalf of the CMS Family and BirdLife International, through the UNDP/GEF/ BirdLife Migratory Soaring Birds Project. According to the above authors, habitat loss and habitat degradation are considered to be the main impacts of bioenergy technology on migratory bird species.
United Nations Sustainable Development Goals (SDGs)*	Seventeen United Nations Sustainable Development Goals (SDGs) were adopted by all UN Member States in 2015, as part of the 2030 Agenda for Sustainable Development, which set out a 15-year plan to achieve the Goals (Bennun et al. 2021). SDGs relevant to renewable energy and biodiversity include: GOAL 7: Affordable and Clean Energy - Ensure access to affordable, reliable, sustainable and modern energy GOAL 13: Climate Action - Take urgent action to combat climate change and its impacts

	GOAL 15: Life on Land - Sustainably manage forests, combat desertification, halt and reverse land degradation, halt biodiversity loss
Important Bird and Biodiversity Areas (IBAs)	The BirdLife International Important Bird and Biodiversity Area (IBA) Programme aims to identify, monitor and protect a global network of IBAs for the conservation of the world's birds and other wildlife (Barnes 1998; Simmons et al. 1998b; Simmons et al. 2001; Kolberg 2015). These areas were initially known as Important Bird Areas. IBAs are thus sites of international significance for the conservation of birds at the Global, Regional (Continental) or Sub-regional (southern African) level, selected according to a set of four criteria based on globally threatened species, restricted-range species, biome-restricted species and congregations (Kolberg 2015). However, not all IBAs receive official protection. The nearest IBAs to the study site are the Namib-Naukluft Park (NNP; 135 km to the south-west); the Waterberg Plateau Park (190 km to the north-east); and a series of coastal IBAs (~260 km to the south-west).
3.3 Best practice standards and guidelines for birds and solar energy	
World Bank Environmental and Social Framework (World Bank 2016); International Finance Corporation Performance Standards on Environmental and Social Sustaina-bility (IFC 2012)	The World Bank Environmental and Social Framework (ESF) sets out the World Bank's commitment to sustainable development, through a Bank Policy and a set of Environmental and Social Standards (ESS) that are designed to support Borrowers' projects, with the aim of ending extreme poverty and promoting shared prosperity (World Bank 2015). The ESF includes the Environmental and Social Standards, which set out the requirements that apply to Borrowers. These include: *ESS1 Assessment and Management of Environmental and Social Risks and Impacts*: sets out the Borrower's responsibilities for assessing, managing and monitoring environmental and social risks and impacts associated with each stage of a project supported by the Bank through Investment Project Financing (IPF), in order to achieve environmental and social outcomes consistent with the Environmental and Social Standards (ESSs). *ESS6 Biodiversity Conservation and Sustainable Management of Living Natural Resources*: recognises that protecting and conserving biodiversity and sustainably managing living natural resources are fundamental to sustainable development; it recognises the importance of maintaining core ecological functions of habitats, including forests, and the biodiversity they support. The objectives include: • To protect and conserve biodiversity and habitats; • To apply the mitigation hierarchy and the precautionary approach in the design and implementation projects that could have an impact on biodiversity; and • To promote the sustainable management of living natural resources. The World Bank Environmental, Health, and Safety (EHS) Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP; World Bank 2016). The World Bank Group Environmental, Health and Safety Guidelines are endorsed by the International Finance Corporation (IFC) Performance Standards on Environmental and Social Sustainability (https://www.ifc.org;

	IFC 2012) and by the Equator Principles (July 2020), a global financial industry benchmark for determining, assessing and managing environmental and social risk in projects (www.equator-principles.com).
World Bank Environmental, Health, and Safety Guidelines for Electric Power Transmission and Distribution (World Bank 2007); Utility-Scale Solar Photovoltaic Power Plants. A Project Developer's Guide. International Finance Corporation (IFC 2015)	The EHS Guidelines for Electric Power Transmission and Distribution include information relevant to power transmission (including environmental issues) between a generation facility and a substation located within an electricity grid, in addition to power distribution from a substation to consumers located in residential, commercial, and industrial areas. The above guidelines recommend prevention and control measures to minimise avian collisions and electrocutions, including: • Aligning transmission corridors to avoid Critical Habitats* (IFC 2012; World Bank 2016); • Considering the installation of underground transmission and distribution lines in sensitive areas (e.g. critical* natural habitats); • Installing visibility enhancement objects such as marker balls, bird deterrents, or diverters; • Maintaining 1.5 m spacing between energised components and grounded hardware or, where spacing is not feasible, covering energised parts and hardware; and • Retrofitting existing transmission or distribution systems by installing elevated perches, insulating jumper loops, placing obstructive perch deterrents (e.g. insulated "V's"), changing the location of conductors, and / or using raptor hoods. The guidelines recommend that environmental monitoring programmes for this sector should be implemented to address all activities that have been identified to have potentially significant impacts on the environment during normal operations and upset conditions (also see above [World Bank 2015]). *Critical Habitats: defined as areas with high biodiversity value, including (i) habitat of significant importance to Critically Endangered and/or Endangered species; (ii) habitat of significant importance to endemic and/or restricted-range species; (iii) habitat supporting globally significant concentrations of migratory species and/or congregatory species; (iv) highly threatened and/or unique ecosystems; and/or (v) areas associated with key evolutionary processes (IFC 2012, p37). Futher guidance for project developers for utility-scale solar photovoltaic power plants is provided by IFC (2015).
Other, related best practice guidelines	• The bird monitoring for the solar PV power component of the present project is based on the BLSA best practice guidelines for solar projects (Jenkins et al. 2017), which are based on international best practice and are now mandatory in South Africa. These comprehensive guidelines are updated regularly. • The above guidelines are supported by a recent update by the IUCN and The Biodiversity Consultancy of international guidelines for solar (and wind) energy development, which emphasises the use of the mitigation hierarchy (Bennun et al. 2021). • The International Dark-Sky Association has compiled guidelines for reducing the impacts of light pollution (see www.darksky.org), which may impact on night-flying birds.

4 Project description and context

A description of the proposed 36 MW, 120 ha solar photovoltaic (PV) power plant and associated infrastructure is provided below.

4.1 Photovoltaic power generation

Photovoltaics is a method of generating electrical power by converting solar radiation into direct current electricity using semiconductors that exhibit the photovoltaic effect (see Figure 2). The photovoltaic effect is the process of converting light (photons) to electricity (voltage).

Photovoltaic power generation uses solar panels composed of several solar cells connected in series containing a photovoltaic material.

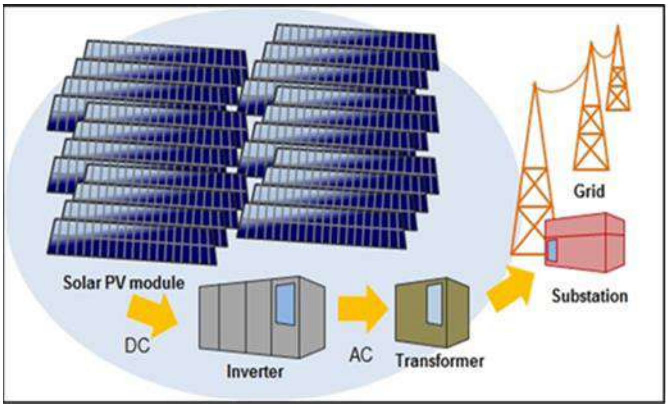

Figure 2. Schematic illustration of photovoltaic (PV) power generation process.

4.2 Location of the proposed project

The location of the proposed solar PV power plant is on a 120 ha portion of farm Osona Commonage No. 65 portion 82, 17 km south-west of Okahandja on the M87/D1972 road and adjacent to the east side of the existing InnoSun 5 MW solar PV development, 2.5 km north-east of the NamPower Osona Substation (Figure 1 above and Figure 3).

4.3 Proposed construction components/activities (also see below and Figure 4)

- Tracking system with RC foundations
- PV solar arrays connected to inverters
- Cable trenches
- Building
- Small warehouse
- Fencing
- Medium voltage power lines
- Low voltage power lines
- Transformers
- Clearing of vegetation entirely for the construction and installation of the solar PV power plant and above facilities

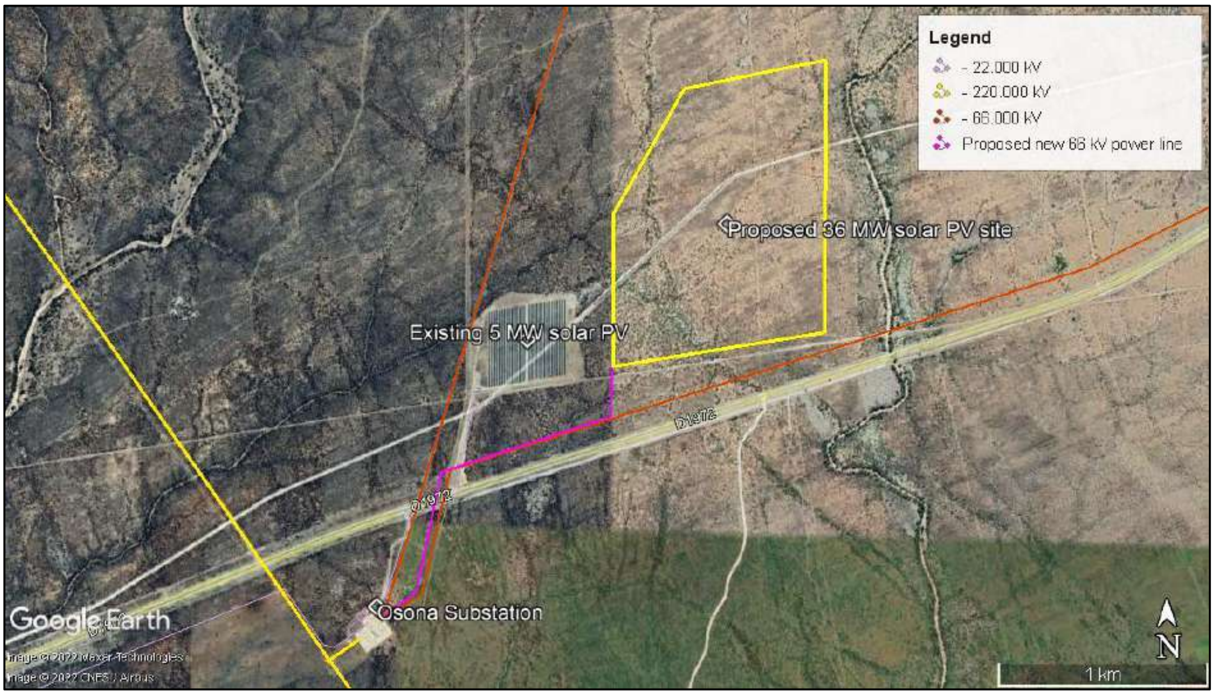

Figure 3. Location of the proposed 36 MW, 120 ha solar PV power plant (yellow), and existing power lines (see legend) and proposed 66 kV power line (pink) south-west of Okahandja and north-east of the NamPower Osona Substation (based on a Google Earth image).

4.4 Associated support structures

Construction camp: on site

Roads: existing site access road

Fencing: the entire site will be fenced in to prevent unauthorised access (Figure 4f).

4.5 Water supply

Surface water bodies on the project site: none

Average maximum water usage estimated: circa. 2 m^3/day sourced from the NamWater existing supply line

Annual water requirement: *circa* 500 m^3/year for cleaning and operational staff

Waste water effluent stream created: none

4.6 Modules and solar arrays

Total area (footprint) required for the 36 MW solar PV power plant: 120 ha.

Design: the use of monocrystalline bi-facial technology is proposed for the PV power plant (see Figure 4a-e for examples of this structure on the existing 5 MW solar PV array). The PV modules will be placed on PV trackers that track from east to west throughout the day. The tables are horizontal during the night in "stow" position; this allows for least wind resistance (pers. comm. A Delle Donne; InnoSun O&M Manager 2022).

Figure 4 a-f. Examples of tracking bifacial solar modules at the existing 5 MW solar PV development (a-e), also showing electrified security fencing (f).

4.7 Proposed power line structure

To connect the proposed PV power plant with the existing NamPower Osona Substation, a new overhead 66 kV transmission power line is planned (see Figure 3 for proposed route).

The proposed power line structure is illustrated (Figure 5) and described below.

Total length of power line: 1.9 km

Servitude: Apart from its own servitude/corridor for the first ~240 m from the solar PV site, the proposed power line will be constructed in a servitude parallel to that of the westernmost section of the existing 66 kV Von Bach-Osona 1 line, up to the Osona Substation (Figure 6).

Pole structures: The proposed structure is the same as for the existing 66 kV Ongeama-Okahandja line, and consists of a wooden five-pole structure (known as a Kamerad), with three conductors suspended in horizontal configuration, and no optic ground wire (OPGW) running above (or below) the conductors (Figure 5). Earthing is provided on the pole structures. Stay wires will be used at the bend points and on the strain poles (only). A wooden H-pole structure is envisaged where the proposed power line joins a step-down structure (e.g. at a substation). The conductors are level with the poles (i.e. not suspended) on bend points/strain poles and step-down points.

Standard pole height: 13 m (above ground)

Span length between poles: average ~200-220 m

Structure heights: the parallel 66 kV Von Bach-Osona 1 steel monopole structure is higher (20.6 m) than the proposed structure, with three conductors in delta configuration; an OPGW running at the top of the structure; stay wires at bend points and on strain poles; and span length between poles average ~235 m (Figure 6 a-b).

4.8 Other existing power line structures in the area

Examples of other existing power line structures in the area are shown in Figure 6. These include the following:

- 220 kV Van Eck-Omburu 1 steel lattice tower/pylon
- 66 kV Von Bach Booster 1-Osona steel monopole
- 66 kV Ongeama-Okahandja wooden five-pole (Kamerad)
- 11 kV distribution line running from the existing 5 MW solar plant office to the Osona Substation: "A-frame" wooden monopole design (with OPGW running below conductors)

4.9 Proposed work force

Construction phase: 60 construction workers

Operational phase: 2 permanent employees + 3 security personnel from an outsourced company

4.10 Potential anticipated environmental impacts, in terms of avifauna

The potential environmental and social impacts that have been anticipated (in terms of avifauna) may include the following:

- Potential avifauna collision risk with the reflective surfaces and overhead power lines
- Potential impacts on biodiversity and ecology through habitat fragmentation or habitat loss
- Potential disturbance or displacement of protected or vulnerable species

Figure 5 a-b. Examples of proposed wooden five-pole (Kamerad) power line structures showing standard pole (existing 66 kV Ongeama-Okahandja power line in the study area) (a); and bend-point/strain pole with stay wires (b).

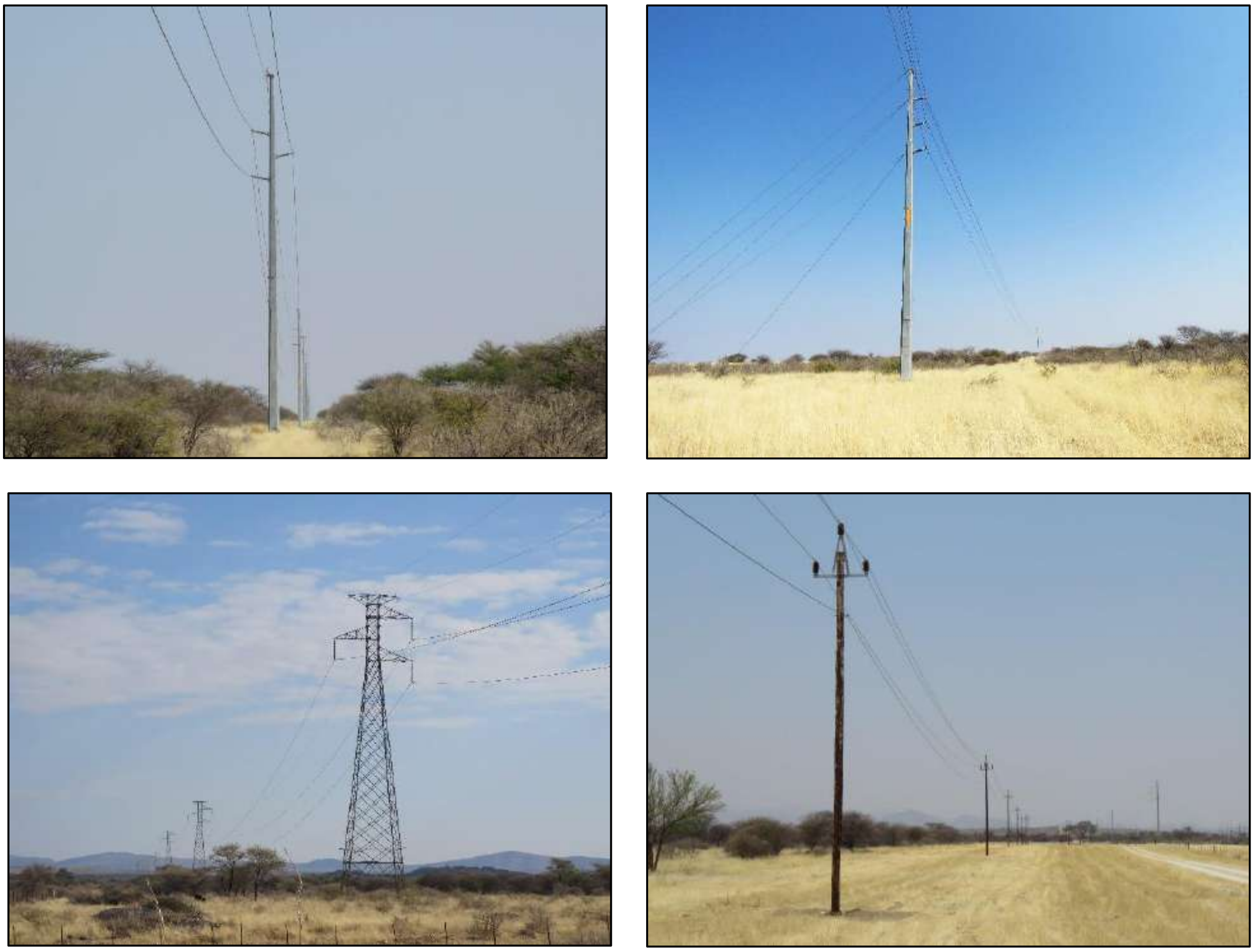

Figure 6 a-d. Examples of existing power line structures in the study area: 66 kV steel monopole (a) and strain structure (b); 220 kV lattice tower/pylon (c); and 11 kV A-frame structure (d).

5 Approach and methodology

Avifaunal input to the ESIA was requested in the form of a baseline/scoping and assessment study to provide an understanding of the potential risks to birds with the construction of the proposed solar PV plant and associated infrastructure, and to serve as a basis for recommendations for the mitigation of such risks and for the monitoring programme for the EMP.

The study included a desktop study, supplemented by site visits on 26-28 July 2022, 10-13 October 2022 and 28-30 November 2022.

The methodology used for the impact assessment is described in Section 7.1 below.

5.1 Desk-top study

Potential sensitivities of the avifaunal environment and its avifauna were scoped as follows.

Two sources of bird distribution data were used to compile a bird checklist, to provide a baseline for the assessment. The primary data, for the first Southern African Bird Atlas Project (SABAP1; Harrison et al. 1997), were gathered during 1987-1991. SABAP1 data are recorded on a quarter degree square (QDS) basis and are extremely comprehensive, although the information dates back to 1991. SABAP1 data are available on the Environmental Information Service (EIS; www.the-eis.com; EIS 2022) and the Namibian Biodiversity Database (NBD; www.biodiversity.org.na).

A follow-up Southern African Bird Atlas Project (SABAP2) was initiated in South Africa in 2007 and in Namibia in 2012 (http://sabap2.adu.org.za). This information comprises more recent distribution data, on a finer scale (in units termed pentads, or 5-minute x 5-minute coordinates; nine pentads make up one QDS). Although the data collected to date for Namibia are still patchy and not yet as extensive in places as those for SABAP1, the present study area is well represented. It is, however, considered advisable to use a combination of SABAP1 and SABAP2 data in order to achieve a balance between long term and shorter term data.

The bird checklist for the study (Appendix 1) is based primarily on SABAP1 data for two QDSs (2216BB and 2216BA; Figure 7) that include the whole of the study area. The above list was supplemented by available SABAP2 full protocol (FP) data, mainly for two pentads considered representative for the study area (2205_1640 [18 full protocol cards], 2205_1645 [3 FP cards; Figure 7). For the above SABAP1 and SABAP2 sources (see above), presence/absence of species is indicated to provide a broad measure of abundance (Appendix 1). The above data were supplemented by on-site observations, including during monitoring.

Other sources of information include the Environmental Information Service (see above), the Red Data Book for Birds in Namibia (Simmons et al. 2015) and a more recent update (Brown et al. 2017); relevant texts on Important Bird and Biodiversity Areas in Namibia (Simmons et al. 1998; Kolberg 2015); other published sources (e.g. Hockey et al. 2005; Chittenden et al. 2016); the global International Union for the Conservation of Nature (IUCN) Red Data list for birds (www.iucnredlist.org; IUCN 2022); data from existing monitoring initiatives in the greater study area, primarily of power lines (by the NamPower/NNF Strategic Partnership; EIS 2022); input from local birders; and both the authors' 35+ years of experience of working together on and observing birds in southern Africa, including in Namibia. Relevant aspects of the avifauna study completed by the authors for the proposed Encroacher Bush Biomass Power Project in Namibia (Anon. 2018a) were also considered.

Potential sensitivities of the avifaunal environment were assessed according to standard criteria, i.e. in the context of major topographical features and vegetation habitats; wetland habitats including ephemeral rivers; and protected area status (EIS 2022) and Critical Habitats (IFC 2012; UNEP/CMS 2015; World Bank 2016; see Section 3.3). Avifaunal habitats that are limited/sensitive in the present context were identified and investigated, including potential sites for cavity-nesting species in the trunks of large trees.

Potential sensitivities of the bird species were assessed in terms of standard criteria identified for "priority species" that include bird species richness (number of species), and abundance (based on presence/absence for the above sources per QDS and per pentad; see above); the most recent Red Data status, both on a national scale (Simmons et al. 2015; Brown et al. 2017) and global scale (IUCN 2022; see above); uniqueness or endemism/near-endemism to Namibia (i.e. having ≥90% of their global population in this country; Simmons et al. 2015; Brown et al. 2017); residency/nomadism/ migrant status (with the focus on Red Data species; Chittenden et al. 2016); any recorded breeding in the area (focussing on priority species); known sensitivity of species/groups to collisions with overhead structures; and other ecological aspects. As mentioned above, the NamPower/Namibia Nature Foundation (NNF) Strategic Partnership database (EIS 2022) was also consulted for relevant power line incidents on record in the vicinity of the study area.

Gaps in baseline data were identified where applicable, and an indication of the confidence levels is provided. Recommendations were made for future work in terms of the ESIA process.

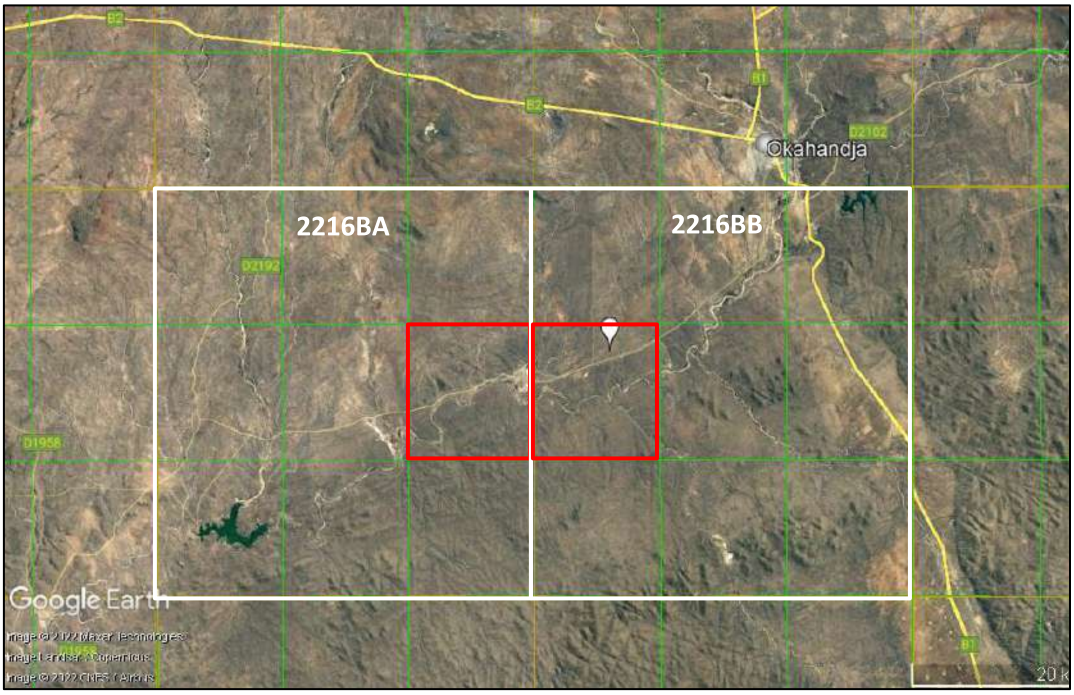

Figure 7. The bird atlas data for the study area are based on SABAP1 data for two quarter degree squares (QDSs; white blocks), and available SABAP2 data for two pentads (red blocks: 2205_1640 [left] and 2205_1645 [right]) that include or are in close proximity to the study site (based on a Google Earth image).

5.2 Data collection

The desk-top study is supported by three site visits (see below).

The findings of the first two above site visits have been incorporated in the final impact assessment; the results of the final visit will be taken into account before construction.

5.2.1 Initial site visit

The initial site visit took place on 26-28 July 2022, in winter.

This visit provided an opportunity for an initial/preliminary assessment of the likely avifauna and habitats in the area, and potential impacts. This was combined with the first pre-construction monitoring session, where the activities included in the design of a proposed site-specific survey and monitoring programme for the solar PV aspects (see 5.2.2 and 5.2.3 below) were confirmed and carried out.

5.2.2 Pre-construction monitoring (solar PV assessment)

Approach

The approach to the solar PV assessment is based on the comprehensive BirdLife South Africa best practice guidelines for assessing and monitoring the impact of solar power generating activities on birds in southern Africa (Jenkins et al. 2017). This approach is supported by more recent (international) guidelines for solar (and wind) energy developers (Bennun et al. 2021).

In line with international best practice, Jenkins et al. (2017) propose a tiered assessment process that includes:

- Preliminary avifaunal assessment
- Data collection (including baseline data collection/pre-construction monitoring)
- Impact assessment
- Further monitoring (a repetition of baseline data collection, plus collection of mortality data).

Recommended assessment regimes

Table 2 provides a summary of the recommended assessment regimes in relation to proposed solar energy technology, project size and likely risk (Jenkins et al. 2017).

Table 2. Recommended avian assessment regimes in relation to proposed solar energy technology, project size and known impact risks (Jenkins et al. 2017).

Type of technology[1]	Project size[2]	Avifaunal sensitivity[3]		
		Low	Medium	High
All solar developments except CSP power tower	Small (<30 ha)	Regime 1	Regime 1	Regime 2
	Medium (30-150 ha)	Regime 1	Regime 2	Regime 2
	Large (>150 ha)	Regime 2[4]	Regime 2	Regime 3
CSP power tower	All	Regime 3		

KEY:

Regime 1: One site visit (peak season); minimum 1-5 days.

Regime 2: Pre- and post-construction; minimum 2-3 x 3-5 days over 6 months (including peak season); carcass searches (post-construction).

Regime 3: Pre- and post-construction; minimum 4-5 x 4-8 days over 12 months, carcass searches.

[1] Different technologies may carry different intrinsic levels of risk, which should be taken into account in impact significance ratings.

[2] For multi-phased projects, the aggregate footprint of all the phases should be used. At 3ha per MW, Small = < 10 MW, Medium = 10-50 MW, Large = > 50MW.

[3] The avifaunal sensitivity is based on the number of priority species present, or potentially present, the regional, national or global importance of the affected area for these species (both individually and collectively), and the perceived susceptibility of these species (both individually and collectively)

to the anticipated impacts of development. For example, an area would be considered to be of high avifaunal sensitivity if one or more of the following is found (or suspected to occur) within the broader impact zone: 1) avifaunal habitat (e.g. a wetlands, nesting or roost sites) of regional or national significance, 2) a population of a priority species that is of regional or national significance, and/or 3) a bird movement corridor that is of regional or national significance, and 4) a protected area and/or Important Bird and Biodiversity Area. An area would be considered to be of medium avifaunal sensitivity if it does not qualify as high avifaunal sensitivity, but one or more of the following is found (or suspected to occur) within the broader impact zone 1) avifaunal habitat (e.g. a wetland, nesting or roost sites) of local significance, 2) a locally significant population of a priority species, 3) a locally significant bird movement corridor. An area would be considered to be of low avifaunal sensitivity if it is does not meet any of the above criteria.

[4] Regime 1 may be applied to some large sites, but only in instances where there is abundant existing data to support the assessment of low sensitivity.

5.2.3 Pre-construction monitoring programme

As mentioned above, the footprint for the proposed main solar PV site is estimated at 120 ha. According to the above guidelines, a solar development of this size would be classed as medium (i.e. 30-150 ha).

The bird species richness (237 species recorded since 1987; SABAP1 & 2) is regarded as relatively high (see Section 6.2.1 below). The study site lies close to a bird movement corridor (i.e. the large, ephemeral Swakop River system) that is of local significance, and also of regional and (probably) national significance. On the above corridor, the Gross Barmen wetlands (3.5 ha and within a protected area) lie ~5.5 km to the west of the site, with a diversity of aquatic bird species, and likely regular movements north-east and south-west along the riverine corridor. The habitat at the study site itself is bush encroached, and there is relatively little human disturbance in the area at present. The avifauna is thus regarded as of medium-high sensitivity. An (adaptive) approach to monitoring, based on Regime 2, was therefore followed.

The approach involved pre-construction monitoring for a two-day period, repeated three times over six months (or at greater intensity if monitoring results should indicate a need).

The first pre-construction monitoring session took place on 26-28 July 2022, the second session on 10-13 October 2022 and the third and final session on 28-30 November 2022. Although the third session was after initial submission of the ESIA for public review, the results were incorporated in the final layout and EMP where relevant, and in the final draft of the present report.

The above monitoring follows standardised protocols, as recommended above (Jenkins et al. 2017) that can be repeated to provide comparable data sets, and used for measuring change. The pre-construction monitoring layout and routes for the project are shown in Figure 8 below, with further details in Table 3.

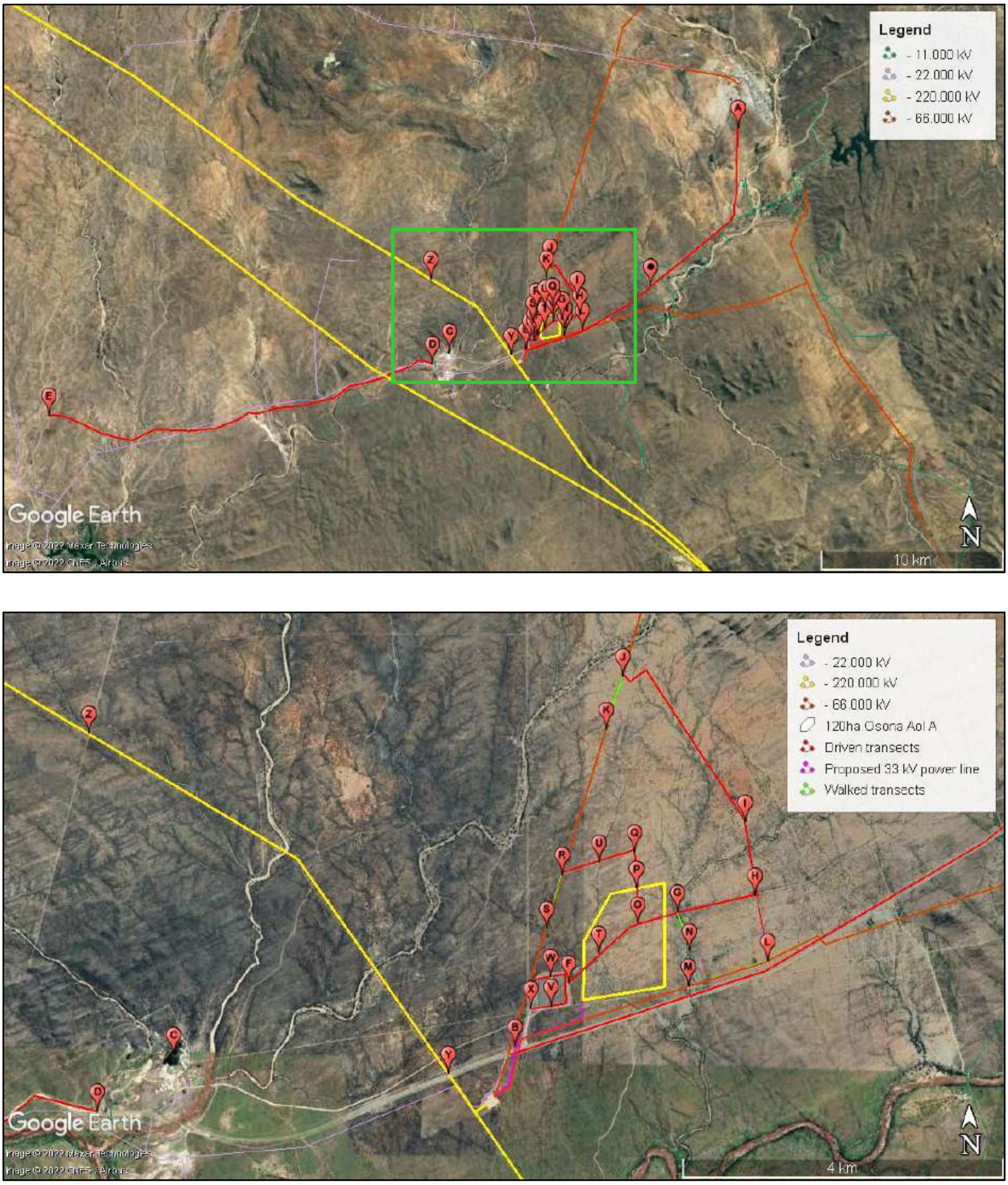

Figure 8 a & b (detail). Pre-construction monitoring layout and monitoring routes for the project, including walked transects, driven transects, a focal point count and three fixed point count sites (see Table 3 below for explanation of alphabetical codes; based on a Google Earth image).

Table 3. Pre-construction monitoring layout and routes*

**See Figure 8 above for maps and route/point codes*

Route/ point code*	Description	Distance (km) / effort	Point	GPS coordinates S	GPS coordinates E
Driven transects					
A-B	Drive 1: Okahandja to 5 MW solar PV gate	18.8	A	21.998090	16.901622
			B	22.108696	16.788116
D-E	Drive 2: Gross Barmen to T-junction D1972	22.8	D	22.115799	16.736478
			E	22.141438	16.528176
F-H	Drive 3a: Gravel road to T-junction	2.7	F	22.101397	16.793821
			H	22.091613	16.816398
H-I	Drive 3b: T-junction to farm windmill	0.9	H	22.091613	16.816398
			I	22.083415	16.815185
H-L	Drive 4: T-junction S to 66 kV power line (Ong-Oka)	0.8	H	22.091613	16.816398
			L	22.098994	16.817939
I-J	Drive 5: Farm windmill N to 66 kV power line (Ong-Oka)	2.6	I	22.083415	16.815185
			J	22.067061	16.800399
O-P	Drive 6a: Track N to edge of 36 MW solar PV	0.4	O	22.094825	16.802208
			P	22.090821	16.802049
P-Q-R	Drive 6b: 36 MW edge N to 66 kV power line (Ong-Oka)	1.4	P	22.090821	16.802049
			Q	22.086760	16.801806
			R	22.089245	16.793057
X-X	Drive 7: Perimeter 5 MW solar PV	1.6	X	22.104266	16.789254
Y-Z	Drive 8: 220 kV power line (Van Eck-Omb 1)	3.8	Y	22.111572	16.779199
			Z	22.073366	16.735868
	TOTAL	**55.8 km**			
Walked transects					
G-N	Walk 1: River S	0.5	G	22.093513	16.807023
			N	22.097860	16.808456
J-K	Walk 2a (alt. N): 66 kV power line N-S (Ong-Oka)	0.7	J	22.067061	16.800399
			K	22.073038	16.798411
R-S	Walk 2b (alt. S): 66 kV power line N-S (Ong-Oka)	0.7	R	22.089245	16.793057
			S	22.095321	16.791176
L-M	Walk 3: 66 kV power line (VonB Booster 1-Oso)	1.0	L	22.098994	16.817939
			M	22.101788	16.808330
V-W-V	Walk 4: Walk between 5 MW solar PV panels (up and down)	0.7	V	22.104036	16.791685
			W	22.100690	16.791637
B-X	Walk 5: Existing 22 kV power line, gate – 5 MW office	0.5	B	22.108696	16.788116
			X	22.104266	16.789254

Route/ point code*	Description	Distance (km) / effort	Point	GPS coordinates S	GPS coordinates E
	TOTAL	4.1 km			
Counts					
D	Fixed point count 1: Gross Barmen stream	15 min.	D	22.115799	16.736478
I	Fixed point count 2: Farm windmill	15 min.	I	22.083415	16.815185
O	Fixed point count 3: Road through study site	15 min.	O	22.094825	16.802208
H	Fixed point count 4: T-junction east of study site	15 min.	H	22.091613	16.816398
C	Focal point count 1: Gross Barmen (main) wetland	Total count	C	22.109433	16.745794

Monitoring activities comprised:

- Checklist (SABAP2) full protocol surveys for two pentads covering the main project site area (2205_1645) and Gross Barmen to the west (2205_1640; see Figure 7), with supplementary *ad hoc* recording in other relevant pentads;
- Absolute and relative abundance estimates and measures for small terrestrial birds (and including any larger terrestrial birds and raptors):
  - Walked linear transect surveys (4 surveys, maximum total 4.1 km but as specified for each monitoring session)
  - Driven linear transect surveys (8 survey routes, maximum total 55.8 km but as specified); note that, within the study site, these surveys are supplemented by short, random walk-ins of ≤100 m, every ≤1/km)
- Collision mortalities related to any existing infrastructure, e.g. power lines, guyed lattice masts or fencing:
  - As part of the above driven surveys, representative sections of the servitudes of the existing 220 kV Van Eck-Kuiseb, 66 kV Von Bach Booster 1-Osona and 66 kV Ongeama-Okahandja transmission power lines were surveyed. The existing 11 kV line from the 5 MW solar plant to the security gate on the D1972 road was also included. Parts of the servitude for the new replacement section of 66 kV power line (parallel to that of the existing 66 kV Von Bach Booster 1-Osona line) were also surveyed. A check was made in these areas for signs of recent bird interactions, and for any live birds including nesting activity.
- Four fixed point counts were completed, i.e. two points on a road, within the study site and to the east of the site; at the Gross Barmen outflow stream area/D1972 road; and at a farm windmill just east of the main study site; counts were done for 15 minutes, for all species (and numbers of birds, as specified)
- Total bird counts at focal wetlands and/or congregational/roost sites:
  - One focal point count (all species and numbers) for the Gross Barmen wetland
- Evidence of breeding at any focal nest locations, or any signs of breeding activity including or nests; a check for cavity-breeding nest sites in a sample area (± 30 larger trees)

- Details of any other (relevant) incidental sightings of priority species.

Two observers were used for all monitoring activities except walked surveys, when one observer was used.

Where possible, control (reference) sites/transects/sections were included in the study area as part of a Before-After-Control-Impact (BACI) approach to collect comparable data as a baseline, to enable a subsequent distinction to be made between effects likely attributable to the solar development and those stemming from other factors.

5.2.4 Post-construction monitoring

The guidelines (Jenkins et al. 2017) recommend that post-construction monitoring should effectively duplicate the baseline data collection work. This will provide an indication of any differences in avian use and abundance at the facility after construction. Surveys for collisions around the solar PV arrays should be conducted. Ancillary power infrastructure, perimeter fences and evaporation ponds should also be regularly checked for fatalities. Fatality rate estimates should take into account carcass persistence, searcher efficiency, and areas not searched

The recommended post-construction monitoring programme could thus be based on a repetition of the above pre-construction monitoring protocols, covering a two-day period, with the addition of carcass searches and repeated at least three times over six months (or longer, if indicated). Certain trials are also recommended (see Section 8 below). The power line surveys should include the above existing power lines already surveyed during the baseline, and the new 66 kV line (which will run in parallel, mainly, with an existing 66 kV line).

5.3 Assumptions, limitations and information gaps

- Renewable energy development, including solar PV developments, is still relatively new to Namibia. Experiences in other parts of the world suggest that, like many other energy sources, solar power may have impacts on birds; however, the nature and implications of these effects are still poorly understood (DeVault et al. 2014; Jenkins et al. 2017; Visser et al. 2019; Bennun et al. 2021).
- Recent findings at solar facilities in North America suggest that collision mortality impacts at solar PV plants may be underestimated, particularly in terms of collision trauma with PV panels; there is growing evidence that this may be associated with polarised light pollution and/or with waterbirds mistaking large arrays of PV panels as wetlands (the so-called "lake effect") (Jenkins et al. 2017; P Werstein Vargos de Matas [KfW Development Bank] pers. comm. 2021). It is therefore assumed that this factor could potentially impact on the avifauna in the present development too.
- A major limitation to the assessment and mitigation of potential impacts of such developments is the lack of representative long-term monitoring data regarding recorded impacts of solar PV structures, especially in the Region, including Namibia. However, it was possible to incorporate the results of dedicated monitoring at the adjacent existing 5 MW solar plant (Anon. 2017, 2018b, 2019, 2020). Ongoing monitoring is however, considered essential as far as possible.
- The avifauna of the greater study area (including Gross Barmen to the west) is relatively well atlassed. It is assumed that the above, and other, sources of information including personal observations provide an acceptable indication of the species that may be expected to occur in the area throughout the seasonal and inter-annual cycles.
- The difficulty in obtaining confirmed records of bird flight paths is a further limitation to the assessment of the potential impacts of any new structure, including the proposed solar PV facility. However, records of power line collisions in the greater area do provide an indication of

some of the bird species active in the area that have the potential to become involved in impacts relating to overhead structures. However, this area is relatively under-surveyed due to bush encroachment.

- A major limitation to the assessment and mitigation of potential impacts of power line structures is the lack of representative long-term data on power line incidents throughout Namibia. Available data (2009-2020) from the NamPower/Namibia Nature Foundation Strategic Partnership (EIS 2022) were consulted in this respect; the data for the study area are relatively sparse (with a low sampling effort, due to bush encroachment), but the data for greater area provide a perspective on the high potential for power line collisions in areas that have been well monitored.

In all cases where there is uncertainty, the precautionary principle should apply until such time as further data become available.

6 Description of the receiving environment

6.1 Avifaunal environment

The proposed solar PV project is located in the Otjozondjupa Region in Central Namibia, some 17 km south-west of Okahandja (Figure 1, 7).

6.1.1 Climate

The average annual rainfall for the greater study area is 250-300 mm.

Average annual temperatures are relatively warm, i.e. 20-22°C. Temperatures close to 40°C were measured during the monitoring in October 2022.

The dominant wind direction is from the east, with wind speeds averaging 5-15 km per hour (Mendelsohn et al. 2002). Wind speeds of 22 km/hr were measured during October 2022.

6.1.2 Major topographical features and vegetation habitats

Topographical features

The study area falls within the Acacia Tree-and-shrub Savanna Biome (Mendelsohn et al. 2002).

The landscape type is classed as the Khomas Hochland Plateau region, with rolling hills in the west with many summit heights equivalent (EIS 2022). The area borders on Central Western Plains landscape in the north-west. The altitude for the study area is ~1,270 m.

A major topographical feature in the greater area is the deeply incised, ephemeral Swakop River system, including its tributaries, running from the east to reach the Atlantic Ocean in the west (Figure 1, 9). Its main tributary, the Khan River lies to the north of the study site. The river system is largely dry, but there are a few perennial pools that attract birds. Rainfall events are rare and episodic (the most recent being in February 2022).

On the Swakop River, the Von Bach Dam lies 20 km to the north-east of the study site, with the Swakoppoort Dam 29 km to the south-west of the study site. The above large, open-water expanses provide aquatic habitats that are fairly limited in this arid landscape, linked by the river.

The Swakop River system is therefore regarded as a bird movement corridor for aquatic and other birds that is of local and regional significance, and probably also of national significance.

Vegetation habitats

Within the Acacia Tree-and-shrub Savanna Biome, the vegetation habitat in the study area is classed as Highland Shrubland, bordering on Thornbush Shrubland in the north (Mendelsohn et al. 2002).

The dominant vegetation structure is shrubs and low trees, in its natural state classed as follows:

Tree cover 11-25%, height 2-5 m

Shrub cover 11-25%, height 1-2 m

Dwarf shrub cover 2-10%, height <0.5 m

Grass cover 26-50%, height <0.5 m

However, the habitat is heavily bush encroached at present, and fairly dense in parts.

Dominant taller tree/shrub species include several *Acacia* species, and shepherd's tree *Boscia albitrunca*.

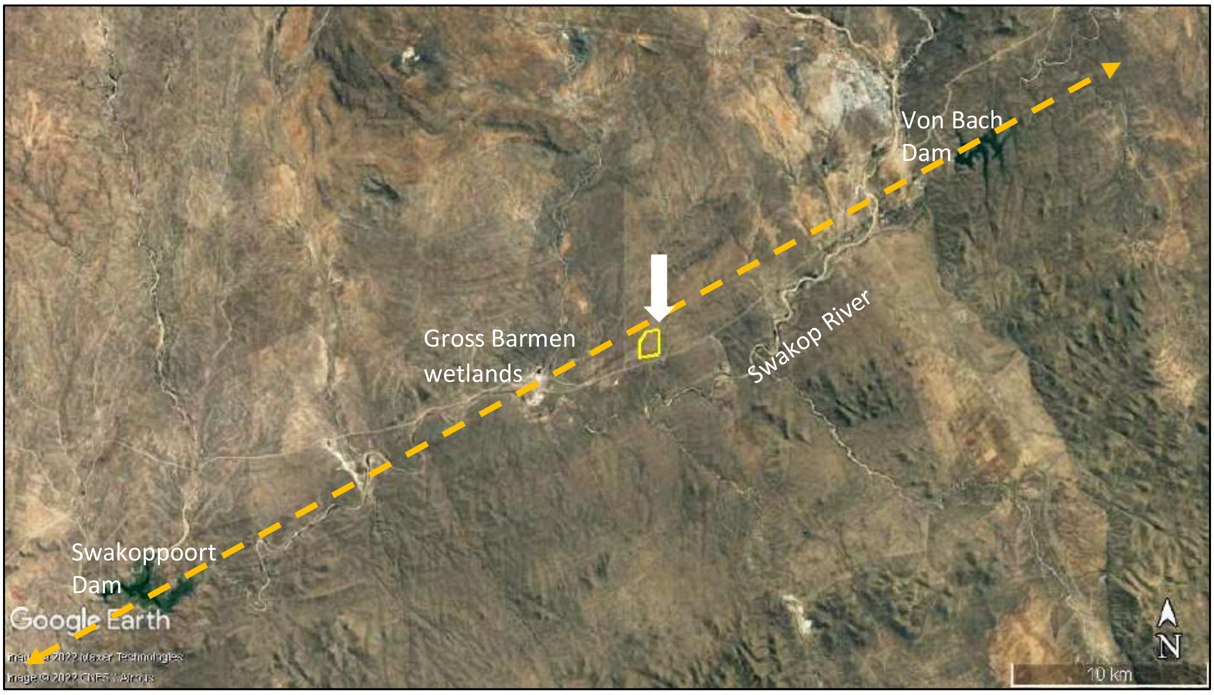

Figure 9. The study area lies on the Swakop River system, an important movement corridor (yellow line) linking aquatic habitats that include the Von Bach Dam in the north-east, the Swakoppoort Dam in the south-west and the Gross Barmen wetlands just east of the study site, with other wetland habitats including the coast in the west (based on a Google Earth map).

6.1.3 Habitats in the proposed study area, in relation to birds

Habitats available to birds in the study area are illustrated in Figure 10-14 below.

The main habitat type in the area is flat with shrubs, scattered larger trees and grass (Figure 10a-b). Due to bush encroachment, much of this habitat is fairly dense and thorny. A broad gravel road bisects the area from east to west and provides access for ground-dwelling species (Figure 10 c).

Apart from nesting sites in the tree canopy and branch forks, in bushes and on the ground, some of the larger trees (in particular shepherd's tree *Boscia albitrunca*) also provide potential opportunities for cavity-nesting bird species (Figure 10d-f).

Ephemeral drainage lines are an important feature of the area, in particular the (dry) river to the east of the study site, with its thick riverine bush (Figure 11a-b). Another, smaller drainage line runs from north to south through the western part of the study site.

Three small, shallow ephemeral pans lie just to the north of the study site (22.090517S / 16.802056E and northwards), which have the potential to hold water for limited periods.

A windmill with accessible open water is also an attractant to a diversity of bird species in this area, with evidence of old nests of Red-billed Buffalo Weavers on the structure (Figure 11c).

Some 5.5 km west of the study site, the Gross Barmen wetland attracts a further diversity of aquatic bird species (Figure 11d-e). The varied habitats include a large, shallow, vegetated wetland (3.5 ha) and its (ephemeral) run-off to the south-west.

Running south of the study area from east to west, the large ephemeral Swakop River (Figure 9, 11f) provides a link and corridor between two large dams, the Von Bach in the north-east and the Swakoppoort in the south-west. Two circular pivot irrigation developments lie to the east, that are also a bird attractant (e.g. to Egyptian Goose).

Shallower, ephemeral drainage lines may also be linked to potential bird movement corridors. Occasional flooding conditions on the Swakop River are likely to bring an influx of food for birds, and to attract nomadic species including waterbirds.

Further habitats in the area include isolated rocky outcrops and, further afield, low hills/mountains (Figure 12a-d). Such high, rocky habitats have the potential to attract raptor species, providing favourable conditions for uplift together with nesting habitats.

Finally, the existing solar PV array and associated infrastructure (including fences, security structures and power lines) have created a number of artificial habitats that have proven to be attractive to birds by providing safety from some (mammalian) predators; shelter; and perching, feeding and nesting opportunities (Figure 13a-e).

As waterbirds are considered potentially sensitive to solar PV developments, in terms of the possibility of mistaking the solar arrays for bodies of water (see Section 7.2 below), existing open-water habitats in the area were also considered during the present assessment, as they have the potential to attract aquatic birds to and through the area. The proximity of such water bodies may increase the risk of impacts, as some bird species may already become accustomed to using such habitats in the area.

Although nesting sites for cavity-breeders in the trunks of larger trees (including dead trees) are regarded as sensitive, no critical habitats (as defined in IFC 2012; World Bank 2016) were identified.

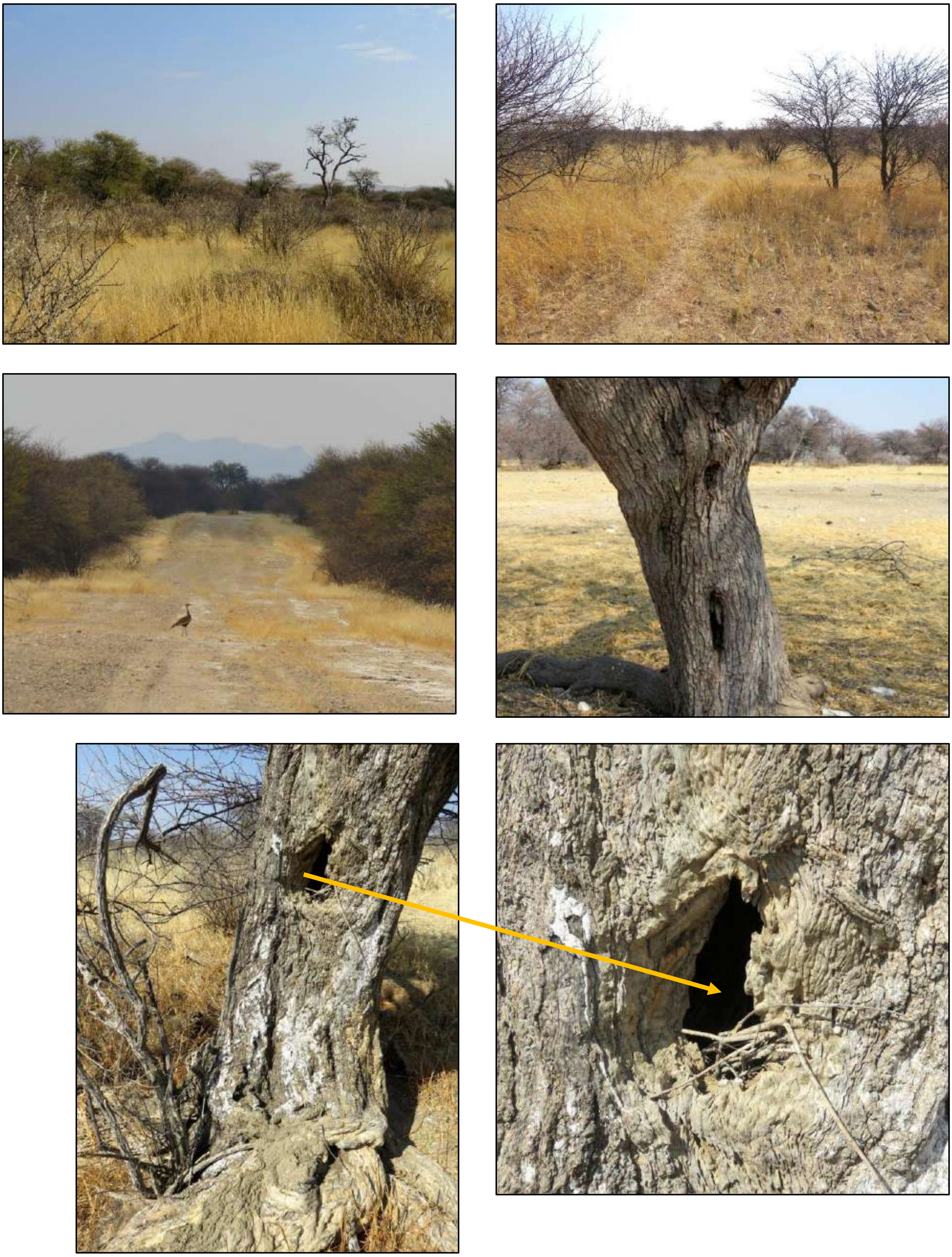

Figure 10 a-f. The main habitat type in the area is flat with shrubs, scattered larger trees and grass, much of it fairly dense and thorny due to bush encroachment (a-c); some of the larger trees provide opportunities for cavity-nesting bird species, including *Acacia* spp. (d); however, only very few sites were recorded that showed signs of having been used recently for breeding, such as this one in a *Boscia albitrunca* tree (e-f).

Figure 11 a-f. Aquatic habitats include the (dry) river to the east of the study site, with thick riverine bush (a-b); a windmill structure with accessible open water(c); the Gross Barmen wetlands system with its diversity of aquatic bird species (d), and its run-off to the south-west (e); and the large Swakop River system (f), providing a major link and corridor between two large dams.

Figure 12 a-d. Further habitats include isolated rocky outcrops/hills (a-c) and, further afield, low mountains (d), all with the potential to attract raptor species, providing favourable conditions for uplift, and breeding habitats.

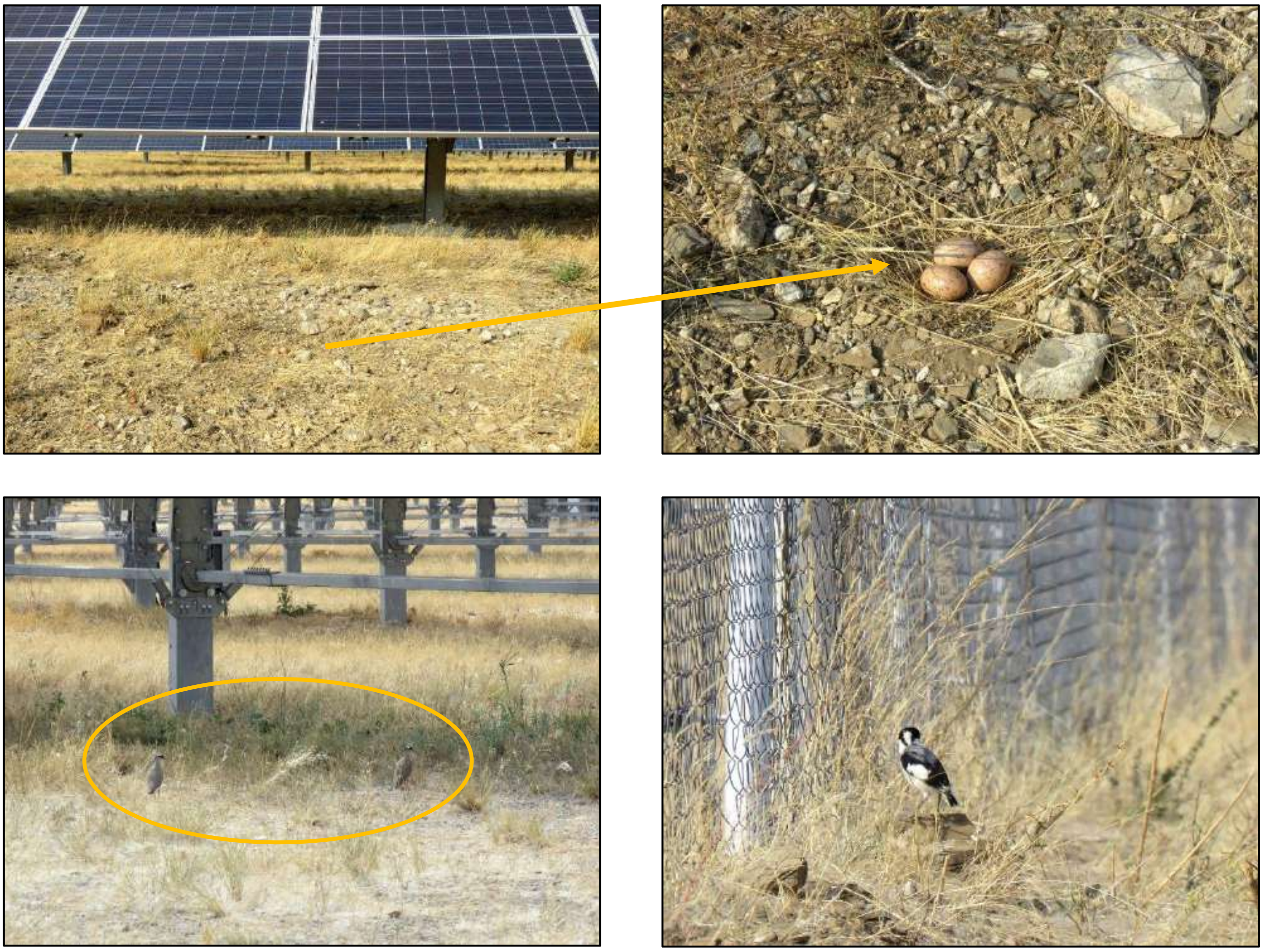

Figure 13 a-d. The existing 5 MW solar PV arrays have created a number of artificial habitats that are attractive to birds by providing safety from (some) predators, and feeding and nesting opportunities: a nest of Double-banded Sandgrouse was observed in July 2022 (a-b); Crowned Lapwing (circled) are attracted to the short vegetation beneath the solar PV panels (c); a near-endemic White-crowned Shrike using fenced-in habitats inside the solar PV array area (d).

Figure 14 a-e. The infrastructure associated with the existing solar PV plant has created further artificial habitats that are used by birds for perching, feeding and nesting opportunities: evidence of bird perching on the panels (a) and of feeding on prey on the panels (b); African Pipit perching on security fencing (c); Rock Martin nest on security structure (d); Pale Chanting Goshawk perching on power line structure (e).

6.1.4 Protected area status

The study area is about 5.8 km east of a relatively small (106.5 ha), formally protected area (including a wetland of 3.5 ha), the Gross Barmen Hot Springs, proclaimed under the above Nature Conservation Ordinance of 1975; however, the area is not identified as a Critical Habitat in terms of specified criteria (IFC 2012; World Bank 2016) or Critical Biodiversity Area and Ecological Support Area (UNEP/CMS 2015; see Section 3.3 above). The formally protected areas nearest to the study site are the extensive Namib-Naukluft Park (135 km to the south-west) and the smaller Waterberg Plateau Park (190 km to the north-east; Figure 15). Several freehold communal conservancies lie within a 15 km radius of the study site, with the Ovitoto Communal Conservancy 35 km to the east.

Through its Important Bird and Biodiversity Area (IBA; initially known as Important Bird Area) Programme, BirdLife International aims to identify, monitor and protect a global network of IBAs for the conservation of the world's birds and other wildlife (Barnes 1998; Simmons et al. 1998; Simmons et al. 2001; Kolberg 2015; www.birdlife.org.za/conservation/important-bird-areas). IBAs are thus sites of international significance for the conservation of birds at the Global, Regional (Continental) or Sub-regional (southern African) level, selected according to a set of four criteria based on globally threatened species, restricted-range species, biome-restricted species and congregations (Kolberg 2015); however, not all IBAs receive official protection. IBAs are home to a large number of bird species and individuals, with regular movements among such habitats.

The Namib-Naukluft Park is an IBA (N011), as well as the Waterberg Plateau Park (N008). Further to the west, five more IBAs form a chain on the coast: Cape Cross Lagoon IBA (N010) in the north; then Mile 4 Saltworks (IBA N012); the 30 Km-Beach: Walvis-Swakopmund (N013); Walvis Bay (N014; also a proclaimed Ramsar site or site of international importance for the conservation of birds) and, further south, Sandwich Harbour (N015).

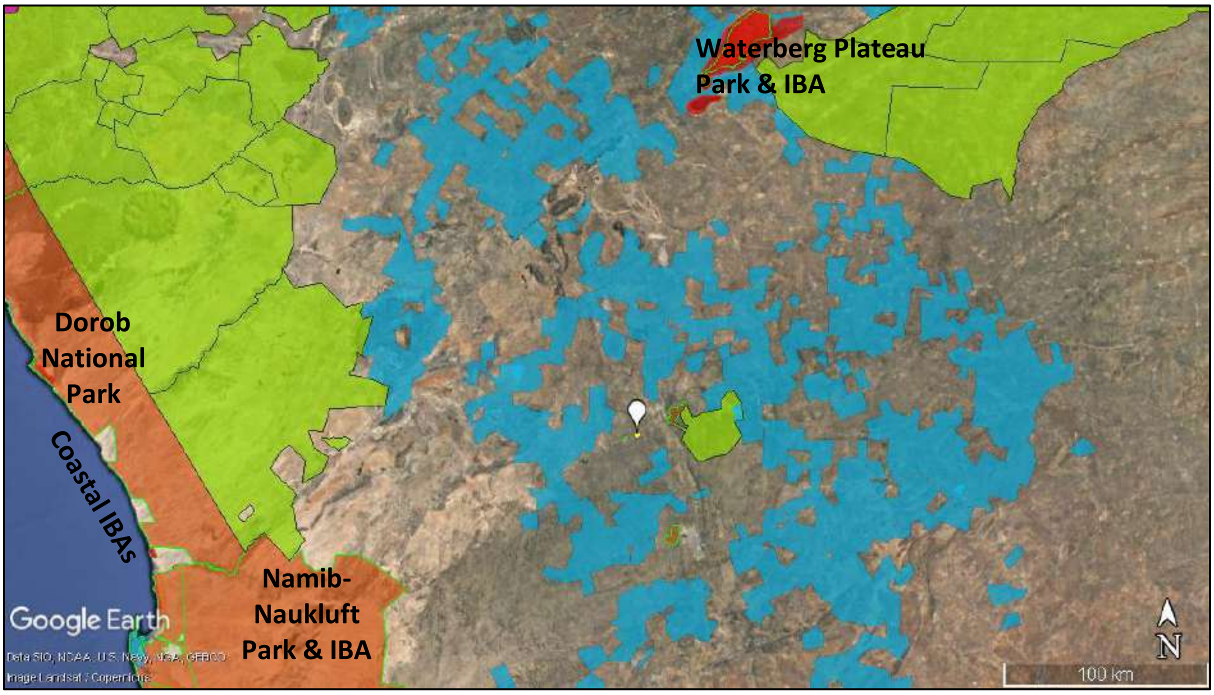

Figure 15. Location of the study area (white marker) in relation to conservation areas (brown = national parks; blue= freehold conservancies; green = communal conservancies; red/blue = Important Bird Areas (and Ramsar site on the coast) (based on a Google earth map generated on the EIS 2022).

6.2 Sensitivities in terms of bird species

Due to the number of species involved, risk assessment and mitigation efforts are directed towards **priority bird species**, defined as species that have a high biological significance, i.e. primarily Red Data species (including those with migrant status) and/or endemic or near-endemic species; and including raptors, waterbirds, large terrestrial species and other groups that are collision-sensitive.

Sensitivities of the bird species in the area are discussed below, according to the above relevant criteria. The discussion is based on the overall checklist of bird species compiled for the greater study area, focussing on the potential priority species (as indicated in bold in Appendix 1) that have been recorded.

Aspects that have been confirmed during recent site visits (including pre-construction monitoring, 26-28/7/22 and 10-13/10/22) are also included (see Section 6.2.8 below, and Appendix 3 for details of monitoring results).

6.2.1 Bird species richness and abundance

Species richness refers to the numbers of species in a community.

Based mainly on both SABAP1 and SABAP2 data, as well as personal observations, a total of 241 bird species has been recorded for the overall study area (Appendix 1). This represents 36% of the 676 species currently recorded in Namibia (Brown et al. 2017). This species richness is regarded as relatively high (i.e. >230 species; EIS 2022).

During the first site visit (July 2022) a total of 66 species was recorded, with 65 species on the second visit (October 2022) and 61 species on the third visit (November 2022). Overall, 97 species were recorded in the study site and greater area; the study added four species to the existing total.

Other monitoring results are included in Section 6.2.8 below.

6.2.2 Red Data status

The checklist for the study area includes a total of 16 (7% of 241 species) species that are currently classed as Threatened in Namibia (Brown et al. 2017), of which nine (56% of the total) are also Globally Threatened (IUCN 2022; Appendix 1).

The Red Data species are all regarded as priority species, as follows (*observed on site 2022):

Critically Endangered

- White-backed Vulture (also Globally Critically Endangered)
- Cape Vulture (also Globally Endangered)

Endangered

- *Martial Eagle (also Globally Endangered)
- Lappet-faced Vulture (also Globally Endangered)
- Steppe Eagle (also Globally Endangered; Palearctic migrant)
- Tawny Eagle
- Saddle-billed Stork
- *Violet Woodhoopoe (also Namibian near-endemic, see below; suspected record)

Vulnerable

- *African Fish Eagle (also Globally Near Threatened)
- Greater Flamingo ([partial] intra-African migrant)
- Great White Pelican

Near Threatened

- Red-footed Falcon (also Globally Vulnerable)
- Maccoa Duck (also Globally Vulnerable)
- Kori Bustard (also Globally Near Threatened)
- *Rüppell's Parrot (also Namibian near-endemic, see below)
- Verreauxs' Eagle

6.2.3 Endemism

Endemism, or having a limited distribution due to restricted habitat requirements, renders populations more vulnerable to threats. The conservation of endemic species is a special responsibility of the country or region in which they occur. In Namibia, 15 species are near-endemic, and one species is fully endemic. Many more species are endemic or near-endemic to the southern African sub-region.

Within the study area, seven species (3% of the total) are classed as near-endemic to Namibia (Appendix 1). This level of endemism (44% of the total for Namibia) is relatively high (EIS 2022).

The seven near-endemic species are also regarded as priority species, as follows:

- *Violet Woodhoopoe (also Endangered, see above; suspected record)
- *Rüppell's Parrot (also Near Threatened, see above)
- *Damara Red-billed Hornbill
- *White-tailed Shrike
- *Monteiro's Hornbill
- Rockrunner
- Carp's Tit

Some of the priority species recorded in the study area that are endemic/near-endemic to s Africa:

- *Double-banded Sandgrouse (nomadic; breeding confirmed)
- Namaqua Sandgrouse
- *Red-crested Korhaan
- Northern (Southern) Black Korhaan

6.2.4 Residency, nomadism and migrant status (priority species)

Although many species on the bird checklist are resident, nomadic movements are common during at least some stages of the lives of many, due to changing environmental conditions. Both short-distance and longer bird movements are possible. Nomadic/migrant habits result in high mobility and consequently increase the risk of impacts such as collisions on overhead structures.

Migrant and/or nomadic species of potential concern are indicated in Appendix 1.

The bird checklist includes at least three Red Data species with some form of migrant status, as well as three more raptors (together forming 3% of the total; Appendix 1); however, other non-Red Data, non-endemic nomadic/migrant species may also be at risk to these impacts.

The above migrant species include:

- Steppe Eagle (Endangered, also Globally Endangered; Palearctic migrant)
- Greater Flamingo (Vulnerable; [partial] intra-African migrant)
- Red-footed Falcon (Near Threatened, also Globally Vulnerable; Palearctic migrant)
- Common (Steppe) Buzzard (Palearctic migrant)
- Lesser Kestrel (Palearctic migrant)

- Western Osprey (Palearctic migrant)

Many of the above-mentioned priority species are nomadic at times, including:

- White-backed Vulture (Critically Endangered, also Globally Critically Endangered)
- Cape Vulture (Critically Endangered, also Globally Endangered)
- Lappet-faced Vulture (Endangered, also Globally Endangered; juveniles make extensive movements)
- Greater Flamingo (Vulnerable; [partial] intra-African migrant)
- Great White Pelican (Vulnerable)
- Kori Bustard (Near Threatened, also Globally Near Threatened)
- Maccoa Duck (Near Threatened; also Globally Vulnerable)
- *Rüppell's Parrot (near-endemic to Namibia, also Near Threatened)
- *Monteiro's Hornbill (near-endemic to Namibia)
- Namaqua Sandgrouse (near-endemic to southern Africa)
- Augur Buzzard, Black-chested Snake Eagle, Brown Snake Eagle, Black-winged Kite

6.2.5 Breeding species

Available nesting habitats include large trees (some with cavities), shrubs, on the ground and on infrastructure.

Breeding has been recorded for the following species in the study area in 2022:

- Double-banded Sandgrouse (active nest near 5 MW solar PV panels)
- Rock Martin (active nest on security structure)
- Western Barn Owl (nesting activity reported in windmill structure: B Bean pers. comm. 2022)
- Red-billed Buffalo Weaver (old nests in trees and windmill structure; active nesting at Ggross Barmen)
- White-browed Sparrow-Weaver and Masked Weaver (old nests in trees/bushes)
- Signs of past nesting activity by cavity breeders, e.g. in *Boscia albitrunca* tree trunks (see Figure 10 e-f); this group would include hornbills, Rüppell's Parrot, wood hoopoes
- Striated Heron, White-breasted Cormorant, Egyptian Goose (juveniles at Gross Barmen wetlands)

Some 30 large trees (mainly *Boscia*, and some *Acacia*) were investigated in terms of identifying potential nest sites for cavity breeding birds: only a few trees had potential/suitable cavity sites, with very few of these showing signs of recent use (see Figure 10e-f). However, recently active sites, e.g. just north of the study area (22.09015S 16.80208E; Figure 10e-f) should preferably not be disturbed.

No nesting activity of large raptors, including vultures, is known in the greater area (B Bean, B Galloway, A Delle Donne pers. comm. 2022).

6.2.6 Sensitivity to collisions and other power line impacts

Bird species may be sensitive, in varying degrees, to power line impacts such as collision, electrocution and/or disturbance and habitat destruction.

Power line incidents on record for Namibia

The NamPower/Namibia Nature Foundation Strategic Partnership (http://www.nnf.org.na/project/nampowernnf-partnership/13/5/5.html) has documented wildlife and power line incidents from 2009 to the end of 2020, involving some 848 individuals (EIS 2022). Due to the difficulty of obtaining records in bush-encroached areas (especially in the northern and north-eastern parts of the country), low reporting rates and the high scavenging rates in general, it is likely that the incidents observed are an under-estimate.

Most of the incidents (90%) have taken the form of collisions (761 individuals; Figure 16); however, electrocution (10%) is also an ongoing concern. The collision incidents recorded throughout the country have involved mostly flamingos (39%) and bustards/korhaans (27%). A further 11% have involved other waterbirds, while 10% have involved raptors, mainly vultures as well as eagles, snake-eagles and owls.

The incidence of Red Data power line-sensitive bird species per QDS in the greater study area is indicated in Figure 17. This sensitivity in the study area itself (QDS 2216BB; with 13 species potentially at risk) is regarded as relatively high. Recorded power line incidents throughout the greater study area are also shown in Figure 17.

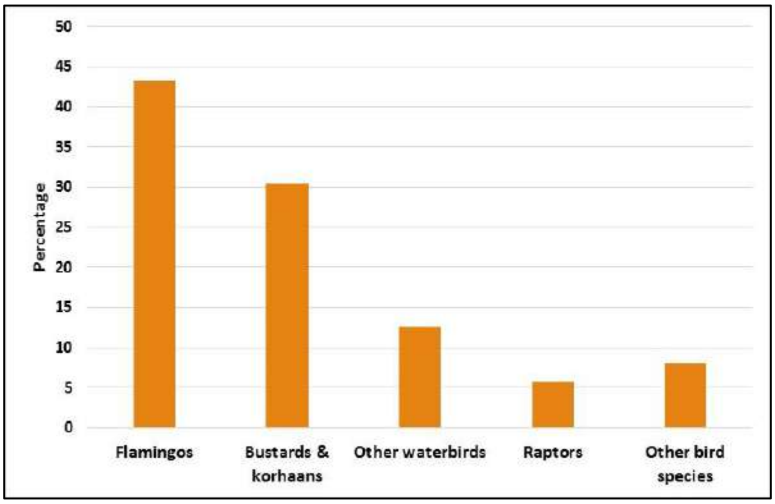

Figure 16. Percentages of birds involved in power line collision incidents in Namibia, 2009-2020 (n = 761 individuals; NamPower/NNF Strategic Partnership data 2020; EIS 2022).

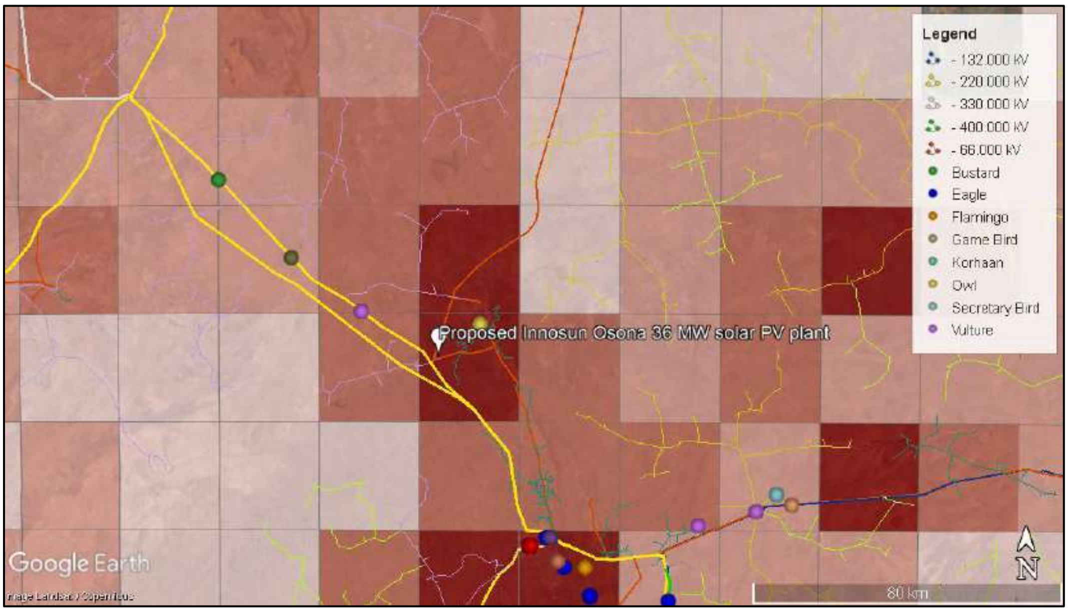

Figure 17. Percentages of collision-sensitive Red Data bird species in the greater study area (sensitivity ranges from low [light pink] to moderate [darker pink] to high [red]); recorded bird and power line incidents are also indicated (NamPower/NNF Strategic Partnership data) (Google Earth map generated on the EIS 2022).

High mobility of bird species, e.g. among ephemeral food sources, may render groups such as bustards and korhaans more prone to power line interactions. Flamingos and other waterbirds are also particularly susceptible to collisions due to their habit of flying at night or under conditions of poor light, in groups and at speed.

Existing power lines of a variety of designs in the area were surveyed during the present study, but no bird incidents were found. Recorded power line incidents throughout the greater study area are shown in Figure 16; however, the area is likely to be under-sampled due to bush encroachment. Illustrated examples of incidents (Figure 18) include collisions of Lappet-faced Vulture, Kori Bustard and Damara Red-billed Hornbill; and an electrocution of Western Barn Owl (NamPower/NNF Strategic Partnership database, EIS 2022).

Note that sections of some of the existing transmission and distribution lines in Namibia area have already been fitted with markers in order to increase visibility to birds, as a mitigation for avoiding collisions. Mitigations for electrocution are also standard practice.

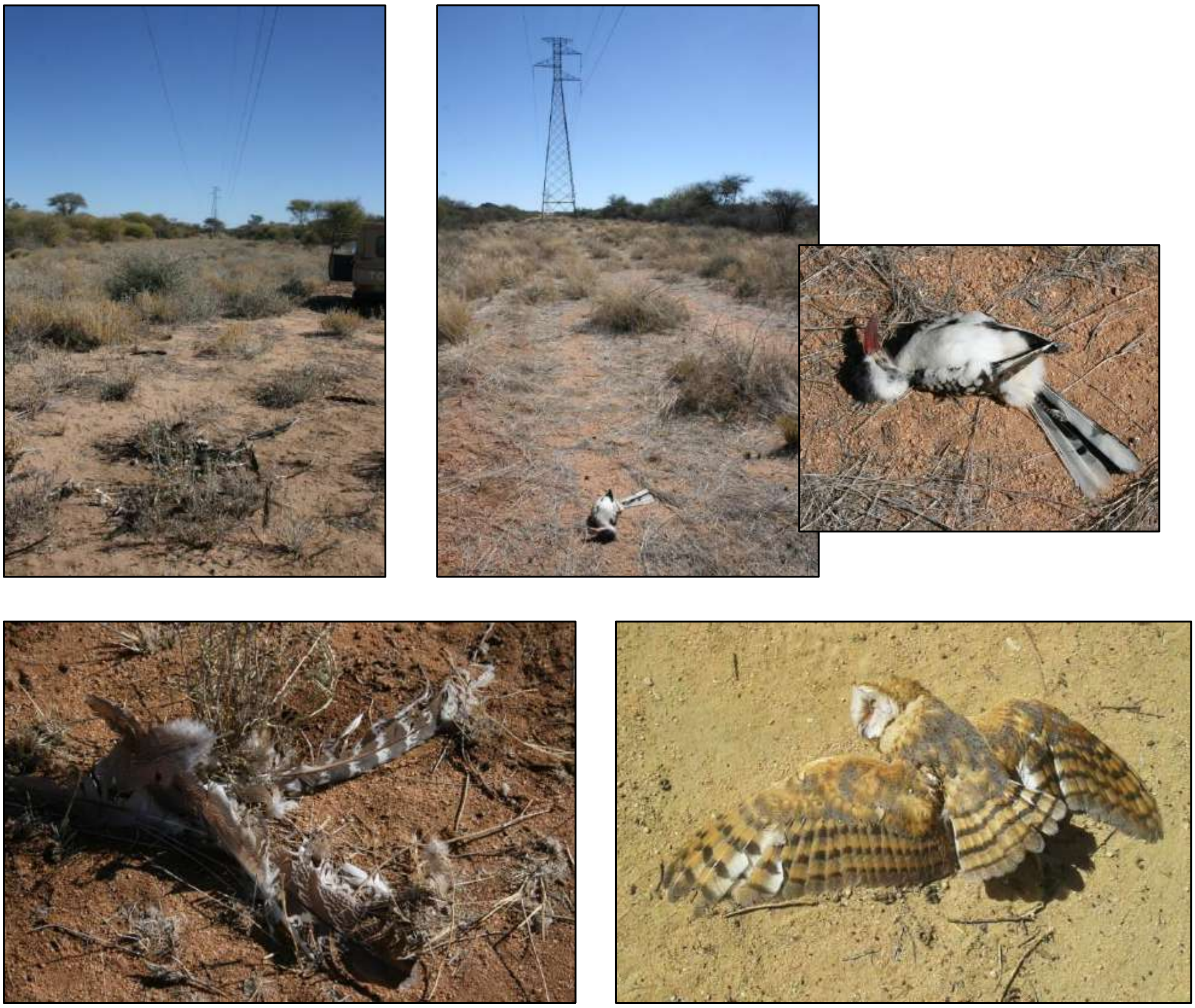

Figure 18 a-e. Examples of power line collision incidents recorded in the greater study area: Lappet-faced Vulture (a), Damara Red-billed Hornbill (b-c), Kori Bustard (d) (photos P Cunningham); and Western Barn Owl electrocution (photo S Amukena) (NamPower/NNF Strategic Partnership database; EIS 2022).

Apart from the priority species mentioned above, other groups of birds in the area are also susceptible to power line interactions. These include:

Other, non-Red Data raptor species (all Least Concern/Secure)

- *African Hawk-eagle
- Augur Buzzard
- Black-chested Snake Eagle, Brown Snake Eagle
- *Pale Chanting Goshawk, Gabar Goshawk
- Greater Kestrel, Rock Kestrel
- Black-winged Kite
- *Western Barn Owl, *Southern White-faced Owl, Spotted Eagle-Owl, African Scops Owl, Pearl-spotted Owlet

Other aquatic bird species, especially nomadic/migrant species, e.g.

- *White-breasted Cormorant
- *Reed Cormorant
- African Darter
- African Black Duck
- *Common Moorhen
- *Three-banded Plover

6.2.7 Potential movements/flyways

Bird flight paths and flyways are likely to vary, depending on current environmental conditions, and are not always easily predicted.

Aquatic habitats may become important at different times, especially if and when these systems hold water. Nomadic species may move around, taking advantage of ephemeral food sources. High mobility of bird species may render them more prone to impacts with overhead structures, including power lines. Existing data for recorded power line incidents (see above; Figure 17, 18) do provide some indication of bird flyways that intersect power line servitudes in the area, including for bustards, raptors and hornbills.

Lappet-faced Vultures have been tracked in Namibia by Vultures Namibia and the Ministry of Environment, Forestry and Tourism (MEFT). The results for 29 individuals indicate some (but limited) movement over the study area (Figure 19; www.movebank.org).

Satellite tracking of Ludwig's Bustards in the Northern Cape, South Africa (Shaw 2013) is considered to highlight the high susceptibility of this group of large birds to collisions with overhead lines.

Aquatic species such as flamingos and other waterbirds are known to move inland after good rains, in order to breed in Botswana and, occasionally, Etosha National Park. Available collision data indicate that these birds appear to use rivers and drainage lines as flyways at times, also possibly for navigation, e.g. on possible flight paths between the coast and inland. Although some satellite tracking of Greater Flamingo and Lesser Flamingo has taken place in southern Africa (McCullogh et al. 2003; Pretorius et al. 2020), the details of their flight paths on such migratory routes within Namibia have not yet been confirmed.

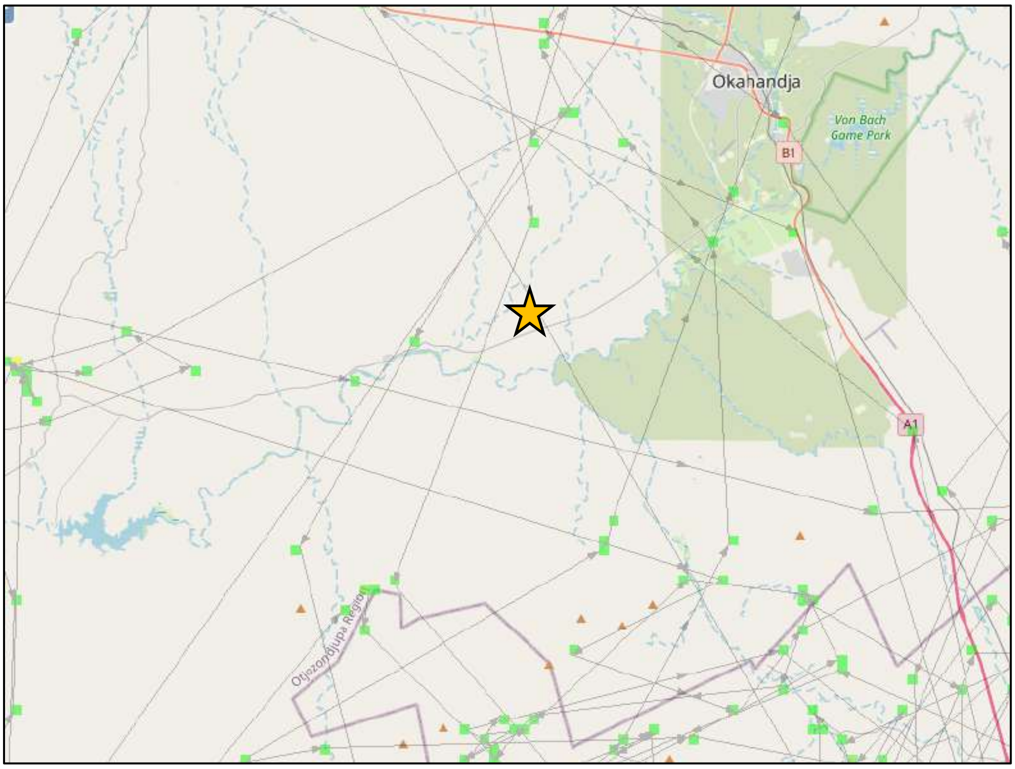

Figure 19. Results of satellite tracking of 29 Lappet-faced Vultures show limited movement over the study area (green dots = satellite fixes; grey lines = direct routes between fixes; data: Vultures Namibia and the Ministry of Environment, Forestry and Tourism; www.movebank.org).

6.2.8 Results of the pre-construction monitoring sessions (26-28/7/22, 10-13/10/22 and 28-30/11/22), based on the following activities:

The results of three pre-construction monitoring sessions in 2022 are summarised in Table 4 and Table 5 below (see Appendix 3 for details). The results should be interpreted with caution, as the full annual spectrum of seasons was not covered and the data are sparse, in places; the mean values do, however, serve as a baseline for further monitoring, against which change can be measured.

Sighting localities for some of the bird species observed in the greater study area in July 2022, October 2022 and November 2022 are shown in Figure 20-21 below, and illustrated in Figure 22-24 below.

Table 4. Summary of weather conditions recorded in the Osona II study area, July-November 2022.

Parameter	Jul 2022	Oct 2022	Nov 2022
Temperature (°C)	16.0-34.8	18.9-38.9	20.3-40.3
Wind speed (km/hr)	7.2-18.0	2.1-29.5	3.2-15.4
Wind direction	E, W	NE, E	NE, E

Table 5. Summary of bird monitoring data recorded in the Osona II study area, July-November 2022.

	Jul 2022		Oct 2022		Nov 2022		MEAN & SD
Full protocol checklists							
Total species per pentad	A	B	A	B	A	B	
(A = 2205_1645: study site; B = 2205_1640: Gross Barmen)	42	35	41	32	30	37	
Total species for above two pentads	66		65		55		62 (SD 5.0)
Walked transects (x4)							
Km	2.9		4.2		2.9		
No. birds	13		5		20		
No. species	8		5		13		
No. birds/km	4.5		1.2		6.9		4.2 (SD 2.3)
Driven transects (x7-8)							
Km	52		55.8		52		
No. birds	45		34		96		
No. species	9		10		28		
No. birds/km	0.9		0.6		1.9		1.1 (SD 0.6)
Focal point counts (x1: Gross Barmen wetland)							
No. birds	75		43		72		63.3 (SD 14.4)
No. species	12		7		7		8.7 (SD 2.4)
Fixed point counts (x4)							
1 Gross Barmen stream							
No. birds	25		31		12		22.7 (SD 7.9)
No. species	13		12		9		11.3 (SD 1.7)
2 Windmill							
No. birds	-		57		62		59.5 (SD 2.5)

	Jul 2022	Oct 2022	Nov 2022	MEAN & SD
No. species	8	15	10	11 (SD 2.9)
3 Kudu crossing				
No. birds	-	3	1	2 (SD 1.0)
No. species	-	3	1	2 (SD 1.0)
4 T-junction east of site				
No. birds	-	-	4	
No. species	-	-	3	
Power line surveys (included in above walked and driven transects)				
Capacity (kV)	66 + 66	66 + 66 + 220 + 22	66 + 66	
Distance	1.7	6.8	1.7	
Bird incidents	-	-	-	

Further (qualitative) data:

- Evidence of breeding (N = nests, J = juveniles)

  July 2022: Double-banded Sandgrouse (N), Rock Martin (N), Western Barn Owl (report of N); hornbill (old N), White-browed Sparrow-Weaver (old N), Red-billed Buffalo Weaver (old N)

  Striated Heron (J), White-breasted Cormorant (J)

  October 2022: no signs of breeding activity recorded

  November 2022: Active nesting of Red-billed Buffalo-Weaver (Gross Barmen)

  No nesting activity of large raptors, including vultures, is known in the greater area (B Bean, B Galloway, A Delle Donne pers. comm. 2022).

- Priority species recorded:

  July 2022:

    Martial Eagle, African Harrier-Hawk, Pale Chanting Goshawk; Western Barn Owl

    Rüppell's Parrot, Damara Hornbill, suspected Damara/Red-billed Hornbill hybrid, Yellow-billed Hornbill

    Red-crested Korhaan, Double-banded Sandgrouse, Red-billed Spurfowl

    White-breasted Cormorant (also over-flying study area from west to east)

  October 2022:

    African Fish Eagle, Pale Chanting Goshawk, Southern White-faced Owl (new species record for area)

    Rüppell's Parrot, (suspected) Violet Wood Hoopoe, Damara Hornbill (also Yellow-billed Hornbill, Grey Hornbill, Common Scimitarbill)

    Red-crested Korhaan, Red-billed Spurfowl

  November 2022:

    Pale Chanting Goshawk, Southern White-faced Owl (fresh pellets)

    Damara Hornbill, suspected Damara/Red-billed Hornbill hybrid, Monteiro's Hornbill, Yellow-billed Hornbill, African Grey Hornbill

    Red-billed Spurfowl

- Species using artificial solar PV panel habitats, including for perching/nesting:

July 2022: White-tailed Shrike, Double-banded Sandgrouse (N), Crowned Lapwing, African Pipit, Rock Martin (N), Great Sparrow, Rock Martin

October 2022: Crowned Lapwing, Short-toed Rock Thrush, African Hoopoe, Lilac-breasted Roller

November 2022: Crowned Lapwing

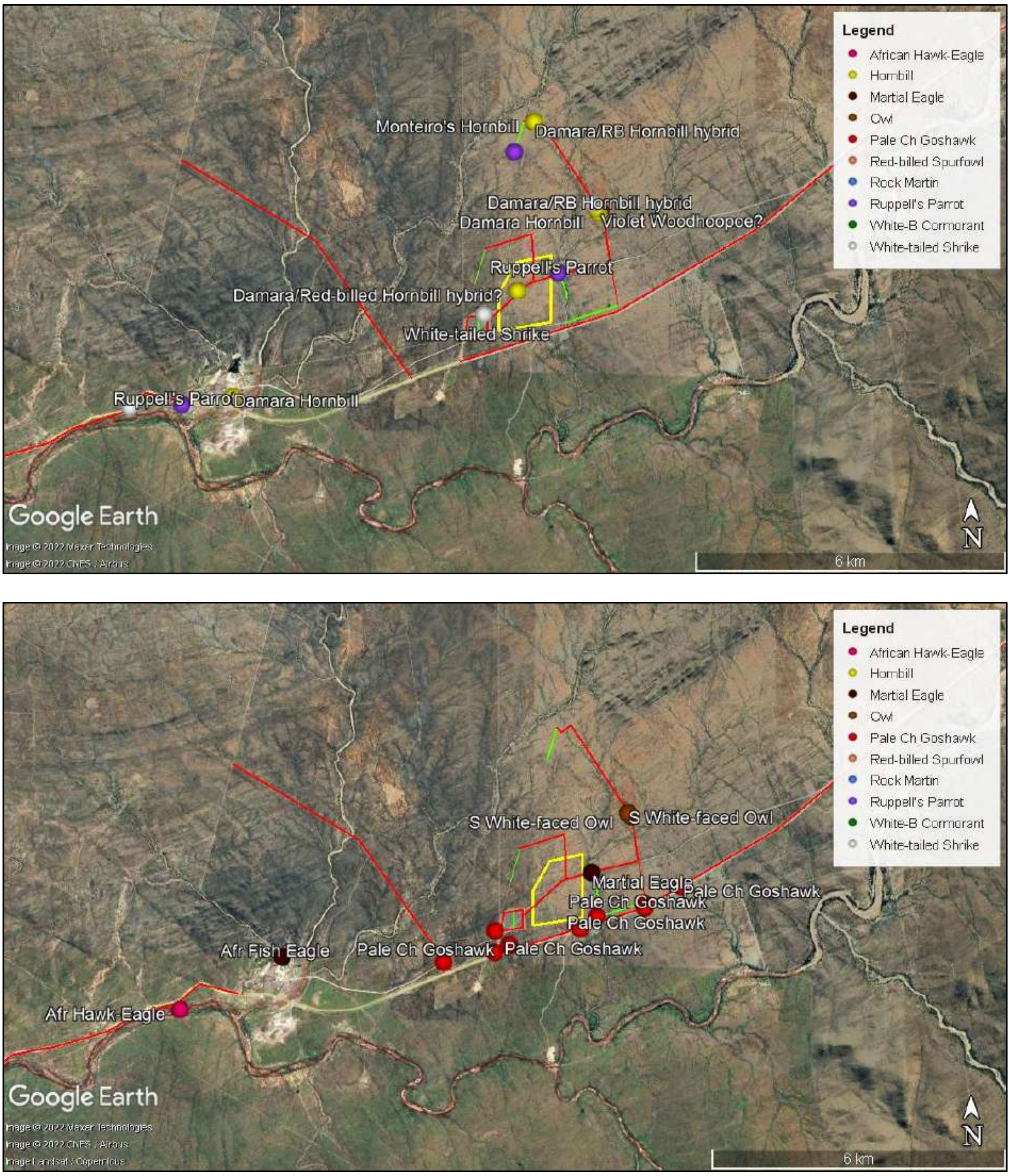

Figure 20 a-b. Sighting localties for some of the bird species observed in the greater study area in July 2022, October 2022 and November 2022: Namibian near-endemic species (a); and raptors (b).

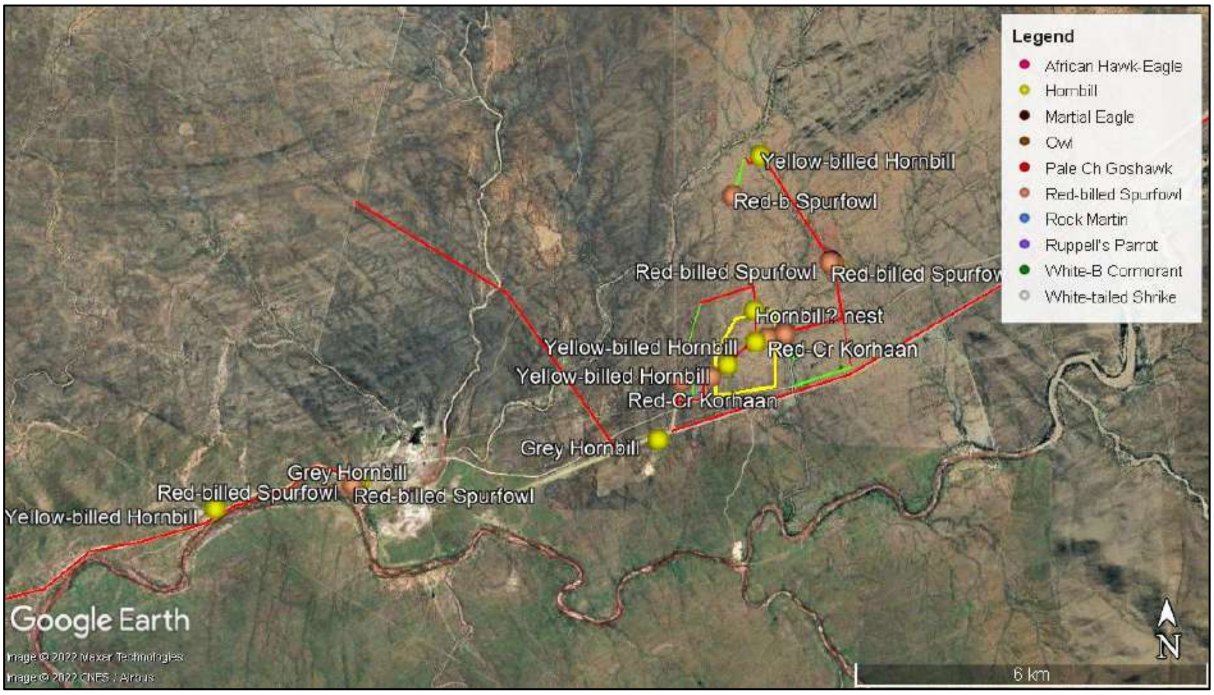

Figure 21. Sighting localties for some of the other terrestrial bird species observed in the greater study area in July 2022, October 2022 and November 2022.

Figure 22 a-d. Some of the raptor species recorded in the greater study area: Pale Chanting Goshawk, perching on a 66 kV power line structure (a); African Hawk-eagle, circling above the Swakop River habitats (b); African Fish Eagle, Gross Barmen wetland (c); Southern White-faced Owl (d; new species record for the area).

Figure 23 a-d. Some of the aquatic bird species recorded in the greater study area (at the Gross Barmen wetlands): White-breasted Cormorant, including juveniles (a); Striated Heron (juvenile (b): White-backed Duck (c); and Little Grebe (Dabchick) (d).

Figure 24 a-f. Some of the other terrestrial bird species recorded in the greater study area: four species near-endemic to Namibia: White-tailed Shrike (a); Ruppell's Parrot on left (with Cape Starling) (b); Damara Red-billed Hornbill (c); Monteiro's Hornbill (d); and Red-crested Korhaan (e); and African Pipit (f).

6.3 Species at risk

6.3.1 Introduction

As mentioned above, risk assessment and mitigation efforts are directed towards priority species, namely those that have a high biological significance, i.e. primarily Red Data species (including any with migrant status) and/or endemic or near-endemic species.

Twenty-eight priority species have been identified as being potentially at higher risk in terms of the proposed project (including power line; Table 6). The species are described in more detail in Section 6.3.2 below. A short list of the priority species is provided in Appendix 2.

The 28 priority species comprise:

- 10 high priority species (6 Red Data / 4 near-endemic / 1 Palearctic migrant), in the groups:
  - 5 raptors
  - 1 aquatic species
  - 4 other terrestrial species
- 18 non-Red Data / non-near-endemic priority species, in the groups:
  - 6 raptors
  - 8 aquatic species (examples)
  - 4 other terrestrial species

Species groups at risk

Raptors play a key ecological role in ecosystems, being predators at the top of food webs. As a group they are prone to power line interactions, including collision, electrocution and disturbance/habitat modification. They are long-lived and relatively slow to reproduce and to replace themselves, and are already impacted by poisoning, habitat loss and energy supply interactions. Apart from nine Red Data species, at least 13 other raptor species have been recorded in the greater study area.

Waterbirds are particularly susceptible to collisions due to their habit of flying at night or under conditions of poor light, in groups and at speed. It is possible that some waterbirds (especially those that land on water, e.g. ducks, grebes) may mistake large solar arrays for waterbodies in poor light, and try to land on such surfaces (see discussion on impacts below).

Larger (cursorial/striding) terrestrial species such as korhaans and bustards, and spurfowl/francolins are also collision-prone.

The study area supports a number of **cavity-breeders**, including species near-endemic to Namibia. A recent study (Pattinson et al.) has shown that cavity-nesters such as hornbills are particularly vulnerable to the effects of climate change and warns that, if temperatures continue to rise, as part of climate change, Yellow-billed Hornbills at their study site in the Kalahari Desert, Northern Cape in South Africa will no longer be able to breed successfully by 2027 – resulting in local extinction. The nest sites of cavity-breeders (e.g. in the trunks of larger trees, limited in the present context) are particularly sensitive to habitat destruction.

A final group of bird species has the potential to **impact on infrastructure**, by their perching, nesting and/or other activities; examples of such species are provided.

Table 6. Full list of priority species identified as being potentially at risk in terms of the proposed project (including power line)

KEY:

Priority status *(see Appendix 1 for scientific names of species)*

- **RDB status** (indicated in red): Red Data Book/conservation status (Simmons et al. 2015; Brown *et al*. 2017; indicated in red) CR = Critically Endangered, EN = Endangered, VU = Vulnerable, NT = Near Threatened (remaining species LC = Least Concern/Secure); G = global status
- **Endemism** (indicated in green): NamNE 90% = Namibian near-endemic (>90% of population); s Afr = southern Africa
- **Residency/migrant status** (for priority species; indicated in blue): res = resident; nom = nomadic; mig = migrant; Afr = African; Pal = Palearctic; non-br = non-breeding

Atlas records

- **SABAP1:** QDS 2216BB (Study site) and 2216BA (Gross-Barmen) (total 238 spp; source: Southern African Bird Atlas Project 1 [SABAP1] data that was published as Harrison *et al.* [1997]; accessed at the Namibia Biodiversity Database (NDB) web site, https://biodiversity.org.na, on Mar 5 12:11:40 2022; and on the EIS (EIS 2022; www.the-eis.com)
- **SABAP2:** Pentads 2205_1640 (Study site; 3 full protocol cards) and 2205_1640 (Gross Barmen; 18 full protocol cards) (total 183 spp; source: http://sabap2.adu.org.za; and including personal observations)

Pers. obs. 2022: personal observations during site visits; 1 = 22/7/22; 2 = 26-27/7/22; 3 = 10-13/10/22; 4 = 28-30/11/22

Other records: (recent) records for the greater area, including power line incidents (PL), *ad hoc* sightings/reports etc.

Potential impact: D = disturbance; H = habitat modification/destruction; C = collisions on infrastructure, including on power lines (CS = collisions on solar PV panels); E = electrocutions on power line structures; N = impacts caused by creation of novel habitats (for perching, nesting etc.)

Probability (also taking into account local abundance): D = definite, H = high; M = moderate; L = low; I = improbable

*Species confirmed on site/in the study area in 2022
Species marked bold are identified as being at higher priority and at higher risk to potential impacts from the project

Common group	Common species	Priority status	Other sensitivities	Atlas records		Pers. obs 2022	Other records	Potential impact	Prob
				SABAP 1	SABAP 2				
1. Priority (Red Data / near-endemic / migrant) species with the potential to be impacted by the proposed development									
1.1 Raptors (including aquatic raptors)									
Vulture	**White-backed**	CR, G CR	Raptor; resident, movements; power line-prone	1	1			D C E	L/M
Vulture	Cape	CR, G EN	Raptor; resident, movements; power-line prone	1				C E	I
Vulture	**Lappet-faced**	EN, G EN	Raptor; resident, movements; power line-prone	1				D C E	L/M
***Eagle**	**Martial**	EN, G EN	Raptor; resident; power line-prone	2	1	2		D C E	L/M
Eagle	Steppe	EN, G EN	Raptor; power line-prone	1				D, C, E	I

Common group	Common species	Priority status	Other sensitivities	Atlas records		Pers. obs 2022	Other records	Potential impact	Prob
				SABAP 1	SABAP 2				
Eagle	**Tawny**	EN	Raptor; power line-prone	1	2			D C E	L/M
*Eagle	African Fish	VU, G NT	Raptor; aquatic; resident; power line-prone	1	1	3		C	L
Falcon	Red-footed	NT, G VU, Pal mig	Raptor; power line-prone	1				C	I
Eagle	Verreaux's	NT	Raptor; resident; power line-prone	1	1			E	I
Buzzard	**Common (Steppe)**	Pal mig	Raptor; power line-prone	2	2			D C E	L/M
Kestrel	Lesser	Pal mig	Raptor; power line-prone	1				D C E	I
Osprey	Western	Pal mig	Raptor; aquatic; power line-prone	1	1			C E	I
1.2 Other aquatic species									
Stork	Saddle-billed	EN	Aquatic; resident; power line-prone	1	1			C	I
Flamingo	Greater	VU, part Afr mig	Aquatic; nomadic, nocturnal flier; power line-prone	1				C/CS	L
Pelican	**Great White**	VU	Aquatic; sedentary/nomadic; power line-prone	2	2			C/CS E	L/M
Duck	Maccoa	NT, G VU	Aquatic; resident/nomadic; power line-prone	2				C/CS	L
1.3 Other terrestrial species									
*Wood Hoopoe	Violet	EN, NamNE	Cavity breeder	1	1	3 (?)		D H C E	L
Bustard	Kori	NT, G NT	Large terrestrial; sedentary, movements; power line-prone; ground nester	1				D, C	L
***Parrot**	**Rüppell's**	NT, NamNE	(Nomadic); power line-prone; cavity breeder	3		2, 3		D H C E	M
***Hornbill**	**Damara Red-billed**	NamNE	Power line-prone; cavity breeder	2	1	2, 3, 4		D H C E	M
***Hornbill**	**Monteiro's**	NamNE	Nomadic; power line-prone; cavity breeder	2	1	4		D H C E	M
Rockrunner	-	NamNE	Sedentary; nests on or close to the ground	2				D H	I
***Shrike**	**White-tailed**	NamNE	Resident; highly territorial	2	1	2		D H	M
Tit	Carp's	NamNE	Cavity breeder	2		2?		D H	L
2. Non-Red Data / non-near-endemic (Namibia) priority species with the potential to be impacted by the proposed development									
2.1 Raptors									
Buzzard	Augur		Raptor; resident, nomadic; power line-prone	2				D C E	L

Common group	Common species	Priority status	Other sensitivities	Atlas records		Pers. obs 2022	Other records	Potential impact	Prob
				SABAP 1	SABAP 2				
Eagle	**Black-chested Snake**		Raptor; resident, nomadic; power line-prone	2	2			D C E	M
Eagle	**Brown Snake**		Raptor; resident, nomadic; power line-prone	2	2			D C E	L/M
Eagle-Owl	Spotted		Raptor; resident; power line-prone	1				D C E	L
Goshawk	Gabar		Raptor; resident; power line-prone	2	1			D C E	L
***Goshawk**	**Pale Chanting**		Raptor; sedentary, movements; electrocution-prone	2	2	2, 3, 4		D C E	M
*Hawk-eagle	African		Raptor; resident, sedentary; power line-prone	1	1	2		D C E	L
Kestrel	Greater		Raptor; sedentary, movements	2				D C E	L
Kestrel	Rock		Raptor; resident	2	1			D C E	L
Kite	Black-winged		Raptor; nomadic	2	1			D C E	L
Owl (Scops-Owl)	African Scops		Raptor; resident	2				D H E	L
***Owl**	**Southern White-faced**		Raptor; resident; power line-prone	-	-	3, 4 (new record)		D C E	L-M
***Owl**	**Western Barn**		Raptor; resident; power line-prone	2	1	2	Br	D C E	M
Owlet	**Pearl-spotted**		Raptor; resident	2	2			D H C E	L/M
2.2 Aquatic species (examples)									
***Cormorant**	**White-breasted**		Aquatic; sedentary, nomadic	2	1	2		CP	
***Cormorant**	**Reed**		Aquatic; resident, nomad, partial migrant	2	1	2, 3, 4		CP	
Darter	African		Aquatic; sedentary, local movements	2	1			CP	
Duck	African Black		Aquatic; resident; lands on water	1	1			CS	
*Duck	White-backed		Aquatic; lands on water	2	1	2, 3, 4		CS	
Teal	Blue-billed		Aquatic; lands on water	2	1			CS	
Teal	Cape		Aquatic; lands on water	2	1			CS	
Teal	Red-billed		Aquatic; lands on water	2	1			CS	

Common group	Common species	Priority status	Other sensitivities	Atlas records		Pers. obs 2022	Other records	Potential impact	Prob
				SABAP 1	SABAP 2				
*Grebe	Little		Aquatic; resident, local movements; lands on water	2	1	2, 3, 4		CS	
Coot	Red-knobbed		Aquatic	2	1	2		CS	
2.3 Other terrestrial species									
Korhaan	Northern (Southern) Black	End s Afr	Sedentary; power line-prone; ground nester	1				D H C E	I
***Korhaan**	**Red-crested**	NE s Afr	Sedentary; power line-prone; ground nester	2	2	1?, 2, 3		D H C E	L/M
***Sandgrouse**	**Double-banded**	NE s Afr	Sedentary; power line-prone; ground nester	1	1	2; Br		D C	M
Sandgrouse	**Namaqua**	End s Afr	Sedentary; power line-prone; ground nester	2	2			C	M
Francolin	Orange River		Sedentary; power line-prone; ground nester	1				H C	I
***Spurfowl**	**Red-billed**	NE S Afr	Sedentary; power line-prone; ground nester	2	2	2, 3, 4		H C	L/M
Spurfowl	Swainson's		Sedentary; power line-prone; ground nester		1			H C	I
3. Species with the potential to impact on infrastructure (examples)									
Dove (Pigeon)	Rock (Feral)		Nest sites include on infrastructure	2				N	M
*Pigeon	Speckled (Rock)		Nest sites include on infrastructure	2	1	2		N	M
Sparrow	Cape		Nest sites include on infrastructure	2				N	M
Sparrow	House		Nest sites include on infrastructure	2	1			N	M
*Swallow	Greater Striped	Br intra-Afr mig	Nest sites include on infrastructure	2	2	3, 4		N	M
*Wagtail	Cape		Nest sites include on infrastructure	2	1	2		N	M
*Weaver	Red-billed Buffalo		Nest sites include on infrastructure	2	2	2, old nest sites; 4 (nests)		N-M	M
Weaver	Sociable		Nest sites include on infrastructure	1		4		N-I	I

6.3.2 Details of priority bird species

Due to the high species richness of the study area, 28 priority bird species have been short-listed from a total of 55 potential priority species (Table 6), as a focal group identified as being at higher risk to potential impacts resulting from the proposed project (including power line). This short-listing takes into account the probability of the species occurring in the study area and surrounds (using local abundance for 2 QDSs and 2 pentads, on a scale of 4). A short list of the high priority species is provided in Appendix 2. However, due to the high species numbers and the difficulty in predicting those likely to be impacted, the full priority list needs to be taken into account, focussing on the groups of birds likely to be at risk rather than individual species; and the precautionary principle should prevail.

As mentioned above, the short-listed priority bird species may be summarised in the following groups:

- 10 high priority species (6 Red Data / 4 near-endemic / 1 Palearctic migrant), in the groups:
  - 5 raptors
  - 1 aquatic species
  - 4 other terrestrial species
- 18 non-Red Data / non-near-endemic priority species, in the groups:
  - 6 raptors
  - 8 aquatic species (examples)
  - 4 other terrestrial species

The details of the potential priority species and their sensitivities are mentioned below (* = pers. obs. 2022; "power line-prone" indicates a susceptibility to collisions, electrocutions and/or other impacts associated with power line structures; local abundance on a scale of 1-4 [2 QDSs + 2 pentads]).

6.3.2.1 10 high priority species (6 Namibian Red Data [3 also Globally Endangered] / 4 near-endemic to Namibia / 1 Palearctic migrant), in the groups:

- **5 raptors** (no nesting activity recorded as yet, also see Section 5.2.1 above)
  - **White-backed Vulture** (Critically Endangered, also Globally Critically Endangered; resident, with long-distance movements, especially in juveniles; power line-prone; local abundance 2/4)
  - **Lappet-faced Vulture** (Endangered, also Globally Endangered; resident, with extensive movements in non-breeding birds; power line-prone; local abundance 1/4)
  - ***Martial Eagle** (Endangered, also Globally Endangered; resident; power line-prone; local abundance 3/4)
  - **Tawny Eagle** (Endangered; power line-prone; local abundance 3/4)
  - **Common (Steppe) Buzzard** (Palearctic migrant; power line-prone; local abundance 4/4)
- **1 aquatic species (power line-prone)**
  - **Great White Pelican** (Vulnerable; sedentary, nomadic; power line-prone; local abundance 4/4)
- **4 other (non-raptor) terrestrial species**
  - ***Rüppell's Parrot** (Near Threatened; near-endemic to Namibia; nomadic; cavity breeder; power line-prone; local abundance 2/4)

- ***Damara Red-billed Hornbill** (near-endemic to Namibia; cavity breeder; power line-prone; local abundance 3/4)
- ***Monteiro's Hornbill** (near-endemic to Namibia; nomadic; cavity breeder; power line-prone; local abundance 3/4)
- ***White-tailed Shrike** (near-endemic to Namibia; highly territorial; local abundance 3/4)

6.3.2.2 18 non-Red Data / non-near-endemic priority species, in the groups:

- **6 raptors (all power-line prone)**
  - Black-chested Snake Eagle (resident, nomadic; power line-prone)
  - Brown Snake Eagle (resident, nomadic; power line-prone)
  - *Pale Chanting Goshawk (sedentary, with local movements; electrocution-prone)
  - *Southern White-faced Owl (new record for area; resident; power line-prone)
  - *Western Barn Owl (resident; breeding reported in area 2022; power line-prone)
  - Pearl-spotted Owlet (resident; cavity-breeder; power line-prone?)
- **8 aquatic species (examples)**
  - *White-breasted Cormorant (sedentary, nomadic; collision-prone)
  - *Reed Cormorant (resident, nomad; partial migrant; collision-prone)
  - African Darter (sedentary, with local movements; collision-prone)
  - Species that land on water (and could mistake solar PV panels for expanses of water)
    African Black Duck, *White-backed Duck (resident, nomadic)
    Cape Teal (nomadic, partially migrant), Red-billed Teal (resident, nomadic)
    *Little Grebe (resident, with local movements)
- **4 other (non-raptor) terrestrial species**
  - *Red-crested Korhaan (sedentary; ground-nester; collision-prone)
  - *Double-banded Sandgrouse (sedentary; ground-nester; collision-prone; breeding recorded at 5 MW solar PV site 2022)
  - Namaqua Sandgrouse (resident, nomadic or migratory; ground-nester; collision-prone)
  - *Red-billed Spurfowl (sedentary; ground-nester; collision-prone)

6.3.2.3 Other (mostly non-priority) species with the potential to cause impacts on infrastructure

Several other (mostly non-priority) bird species have the potential to impact on infrastructure, including on solar PV arrays and power line structures, through their perching, nesting and other activities. Examples include:

- *Greater Striped Swallow (breeding; intra-African migrant)
- *Red-billed Buffalo Weaver
- *Sociable Weaver
- Rock Dove (Feral Pigeon), *Speckled (Rock) Pigeon
- Cape Sparrow, House Sparrow, *Cape Wagtail

6.3.3 Distribution of some sensitive species

Examples of the local distribution of some of the more common potentially sensitive species with regard to the proposed solar PV development are provided in Figure 25 (a-f) below. These records are based on the more recent SABAP2 data (only), as at August 2022.

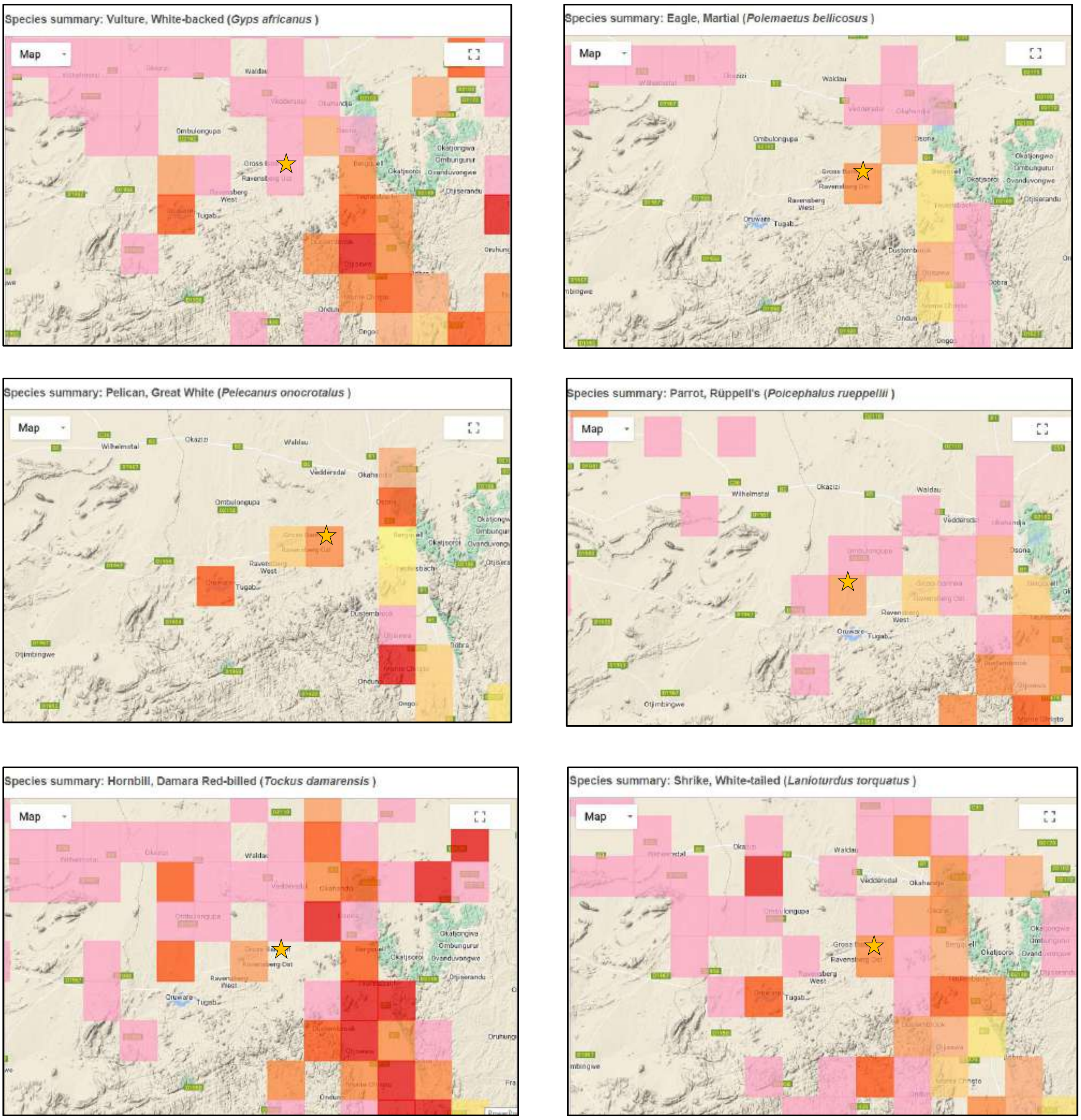

Figure 25 a-f. Examples of the local distribution of some of the more common potentially sensitive species with regard to the proposed solar PV development, based on the more recent SABAP2 data, August 2022 (only; distribution frequencies range from light [low] to dark [high]; star = study area);

a: White-backed Vulture; b: Martial Eagle; c: Great White Pelican;
d: Rüppell's Parrot; e: Damara Red-billed Hornbill; f: White-tailed Shrike.

7 Impact description and assessment and mitigation recommendations

7.1 Impact identification and evaluation methodology

Introduction

This section outlines Environmental Compliance Consultancy (ECC) method to identify and evaluate impacts arising from the Project. The findings of the impact assessment are presented in Section 7.2.

The evaluation and identification of the environmental and social impacts require the assessment of the project characteristics against the baseline characteristics, ensuring all potentially significant impacts are identified and assessed. The significance of an impact is determined by taking into consideration the combination of the sensitivity and importance/value of environmental and social receptors that may be affected by the project, the nature and characteristics of the impact, and the magnitude of potential change. The magnitude of change (the impact) is the identifiable changes to the existing environment that may be negligible, low, minor, moderate, high, or very high; temporary/short term, long-term or permanent; and either beneficial or adverse.

This section provides the following:

- Details the assessment guidance used to assess impacts;
- Lists the limitations, uncertainties and assumptions with regards to the assessment methodology;
- Details how impacts were identified and evaluated and how the level of significance was derived; and
- Details how mitigation was applied in the assessment and how additional mitigation was identified.

Assessment guidance and methodology

The ESIA methodology applied to this assessment has been developed by ECC using the following principal documents:

- International Finance Corporation (IFC) standards and models, in particular, performance standard 1: 'Assessment and management of environmental and social risks and impacts' (International Finance Corporation 2012 and 2017);
- Namibian Draft Procedures and Guidance for EIA and EMP (Republic of Namibia, 2008);
- International and national best practice; and
- Over 25 years of combined ESIA experience.

The methodology is set out in Figure 26a-b below.

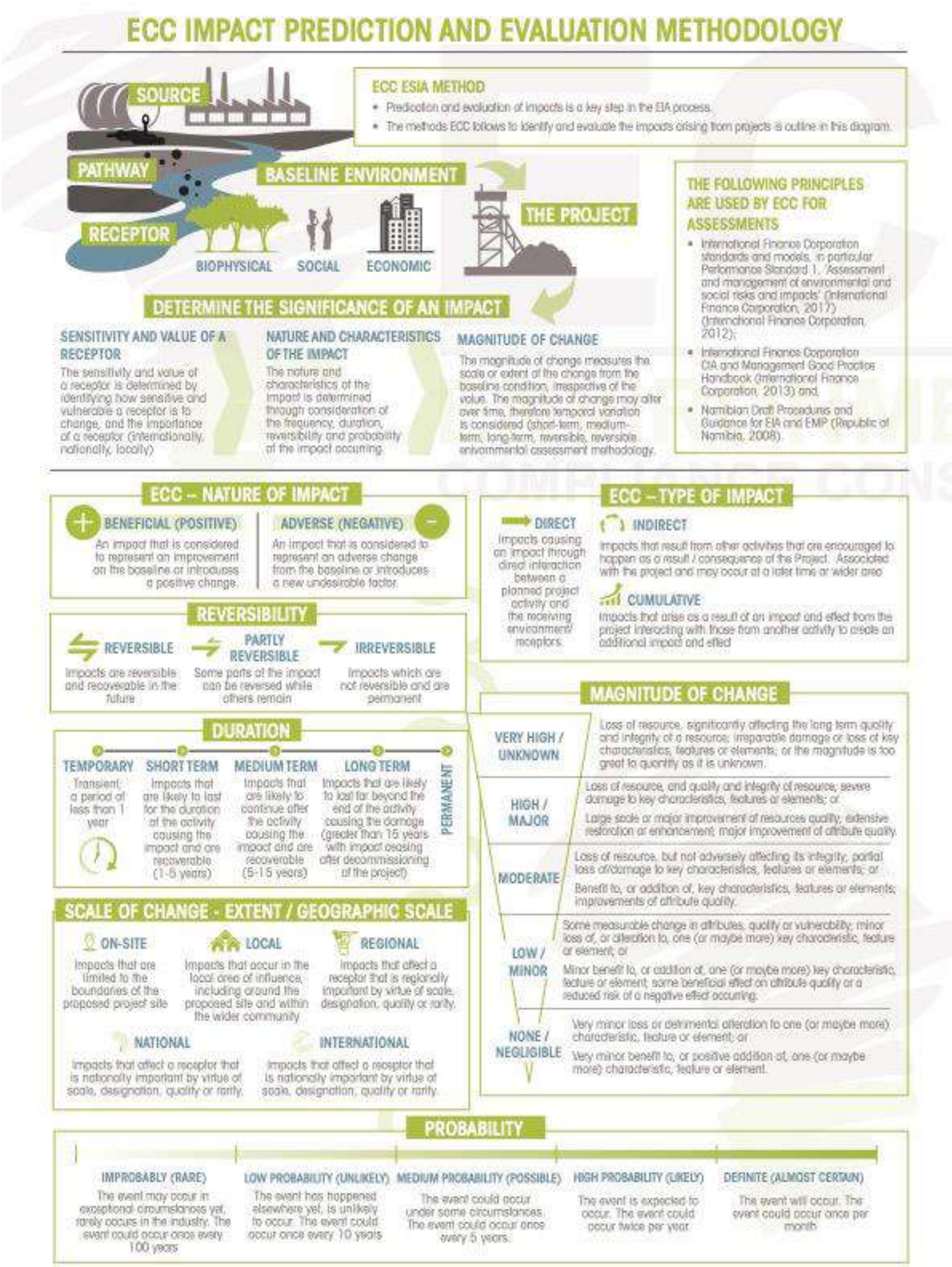

Figure 26a. Environmental Compliance Consultancy (ECC) ESIA methodology based on IFC standards.

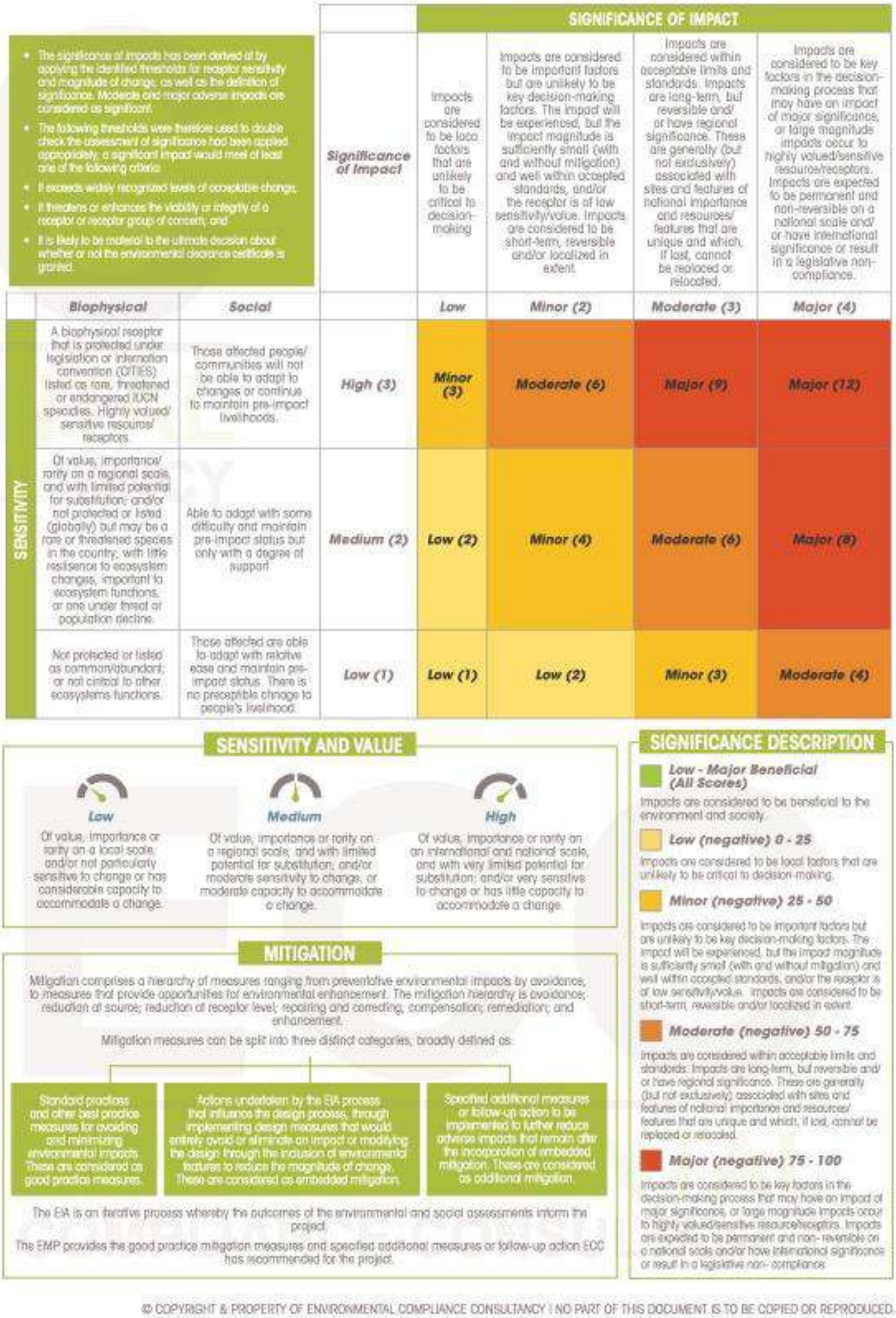

Figure 26b. Environmental Compliance Consultancy (ECC) ESIA methodology based on IFC standards.

Mitigation methodology

Mitigation comprises a hierarchy of measures ranging from preventative mitigation of environmental impacts by avoidance, to measures that provide opportunities for environmental enhancement. The application of the mitigation hierarchy is supported by international best practice (e.g. Bennun et al. 2021). The mitigation hierarchy comprises the following steps: avoidance; reduction at source; reduction at receptor level; repairing and correcting; compensation; remediation; and enhancement.

Mitigation measures can be split into three distinct categories, broadly defined as:

- Actions undertaken by the ESIA process that influence the **design process**, through implementing design measures that would entirely avoid or eliminate an impact, or modifying the design through the inclusion of environmental features to reduce the magnitude of change. These are considered as **embedded mitigation**.
- Standard practices and other best practice measures for avoiding and minimising environmental impacts. These are considered as **good practice measures**.
- Specified additional measures or follow-up action to be implemented, in order to further reduce adverse impacts that remain after the incorporation of embedded mitigation. These are considered as **additional mitigation**.

The ESIA is an iterative process, whereby the outcomes of the environmental assessments inform the project.

Embedded mitigation and good practice mitigation were taken into account in the assessment. Additional mitigation measures will be identified when the significance of impact requires it and causes the impact to be further reduced. Where additional mitigation is identified, a final assessment of the significance of impacts (residual impacts) will be carried out, taking into consideration the additional mitigation.

7.2 Impact description, assessment and management/mitigation recommendations

Five potential impacts have been identified for the project, namely:

- Physical/human disturbance of birds (resulting in avoidance/displacement); this could include road mortalities and/or poaching during construction
- Direct and indirect modification/loss/destruction of bird habitat (resulting in avoidance/ displacement)
- Creation of novel (artificial) habitats and resources that could attract birds; this impact could also lead to negative impacts on infrastructure, caused by bird nesting, perching and other activities
- Bird electrocutions on power line infrastructure (resulting in injury/death of birds)
- Bird collisions with infrastructure such as solar panel arrays, fences, guyed masts and associated power line structures

The above impacts are described and assessed below. Note that, due to certain uncertainties regarding the recorded specifics of impacts of solar developments on birds, especially in the Region, the precautionary principle should apply.

Details of the priority species that could become affected by the above impacts are included in Table 4 (and Section 6.3.2) above.

7.2.1 Background: impacts of solar energy

Solar energy can have positive impacts on the environment, primarily through helping mitigate global climate change. However, renewable energy should be developed with sensitivity to the receiving environment if it is to be environmentally sustainable (Jenkins et al. 2017).

The overall environmental impacts of solar energy developments globally are poorly understood (Tsoutsos et al. 2005; Gunerhan et al. 2009; Lovich and Ennen 2011; Turney and Fthenakis 2011; Hernandez et al. 2014), as are the specific impacts of solar plants on birds (RSPB 2011; De Vault et al. 2014; Jenkins et al. 2017). Unlike wind energy development, there is presently no clear pattern in the types of birds negatively affected by solar plants, and solar collision casualties recorded to date include a wide variety of avian guilds (McCrary 1986; Kagan et al. 2014). However, there are growing indications that waterbirds may be attracted to solar PV facilities in mistaking the hardware for expanses of open water (see below), and that at least some of the larger, more mobile bird species considered prone to collision with wind turbines, may also be prone to solar-based impacts (McCrary 1986; Kagan et al. 2014).

Although there are few studies of the impacts of utility-scale photovoltaic (PV) facilities on birds (Jenkins et al. 2017; McAlister 2019), especially in the region, a recent study that assessed the impacts of such a facility on birds in the Northern Cape, South Africa (Visser et al. 2019) reports how one of South Africa's largest PV facilities (96MW, 180 ha) has altered bird communities: bird species richness and density within the PV facility tended to be lower than on the boundary and in adjacent untransformed land; however, the recorded evidence of bird collisions was considered to be low (see Section 7.1.4 below).

In line with the development of solar power, electricity transmission and distribution grids are also expanding rapidly worldwide, with significant recorded negative impacts on biodiversity and, in particular, on birds; however, some information gaps on impacts still need to be addressed (Bernardino et al. 2018).

The impacts of power line structures on avifauna and recommended mitigation measures are well documented, both globally and for the southern African subregion (e.g. Bevanger 1994, 1998; Lehman et al. 2007; Jenkins et al. 2010; Prinsen et al. 2011; Scottish Natural Heritage 2016; Simmons et al. 2015; Bernardino et al. 2018; Shaw et al. 2018; Bernardino et al. 2019; D'Amico et al. 2019; Gális, Ševčík 2019; Shaw et al. 2021.). Impacts include disturbance of birds, habitat modification/ destruction, collisions and electrocutions on infrastructure. Of these, bird collisions on power line infrastructure are one of the major concerns.

Cumulative impacts are defined as those impacts that result from the successive, incremental and/or combined effects of existing, planned and/or reasonably anticipated future human activities in combination with project development impacts (Bennun et al. 2021). They may arise from multiple projects in one sector (such as solar or wind energy) and/or due through pressures from many sectors and sources (sometimes referred to as "aggregated" or "in-combination" impacts). Cumulative impacts can be highly significant for sensitive species and ecosystem services, but are often overlooked (Bennun et al. 2021). Although recorded mortalities may be in low numbers, the cumulative impacts of such negative interactions over the entire lifespan of the development are an important consideration. Sensitive species that are already under threat, including Red Data and endemic species, raptors, waterbirds and other migrants/nomadic species, are at particular risk to such cumulative effects.

7.2.2 Impact description, assessment and management/mitigation recommendations

The potential impacts of the proposed solar PV facility and 66 kV power line are described below, together with recommended mitigations measures. Note that the impacts during the decommissioning phase are likely to be similar to those during construction, and are therefore not discussed separately.

7.2.2.1 Physical/human disturbance of birds

Physical/human disturbance can potentially impact on birds during both the construction and operational phases, thereby affecting the presence or foraging and/or breeding success of key species (Jenkins et al. 2017).

During the construction phase, vehicle and human activity on the site is at a peak, with high levels of disturbance. Once operational, the amount of disturbance should decrease.

Further forms of disturbance include road mortality and poaching of birds (and of eggs). Once operational, these sources of mortality should decrease.

Table 7. Summary of the impact assessment: Physical/ human disturbance of birds

Description of activity	Receptor	Description of impact	Effect of impact/ description of magnitude	Value/ sensitivity	Magnitude of change	Significance	Residual impact after mitigation
Human noise and activity during construction and operational activities; including poaching/ road kills	Raptors (e.g. White-backed Vulture, Martial Eagle) Other terrestrial birds, including Namibian near-endemic species (e.g. Ruppell's Parrot, Damara Red-billed Hornbill, White-tailed Shrike) *In particular, any birds that are breeding/ rearing young	Birds are displaced temporarily or permanently from the site; reduction of breeding success; poaching/ road kills may result in loss of chicks/ injury/ mortality of birds	Nature of impact: adverse Type of impact: direct; cumulative Reversibility: partly reversible Duration: medium term-permanent Scale/extent: on-site/local Probability: definite	Medium	Moderate (loss of resource, but not affecting its integrity)	Minor-moderate (4-6)	Minor (4)

Mitigation recommendations

Construction phase

Avoidance:

- Scheduling: adapting the timing of construction activities to avoid disturbing birds during sensitive periods, e.g. during breeding seasons; for the near-endemic cavity breeders (Rüppell's Parrot, Damara Red-billed Hornbill, Monteiro's Hornbill) the main breeding season falls from January-March.
- Before construction starts, the proposed solar PV site and the proposed power line route should be inspected for any signs of bird nesting activity. Disturbance of nesting/chick-rearing birds should be avoided.

Minimisation:

- Abatement controls to reduce noise disturbance created during construction.
- Operational controls to manage and regulate contractor activity, such as:
  - A speed limit should be strictly enforced.
  - Exclusion fencing should be erected around identified sensitive areas, if required (e.g. pre-identified active nesting sites).
  - Anti-poaching measures should be strictly enforced, with zero tolerance, and this should be emphasised during induction to contractors; offenders should be prosecuted.
- Ongoing awareness should be promoted about the value of biodiversity and the negative impacts of disturbance, especially to breeding birds, and of poaching and road mortality.

7.2.2.2 Direct and indirect modification/loss/destruction of bird habitat

Solar developments can potentially affect birds by destroying or degrading large areas of habitat, and may result in avoidance/displacement of sensitive bird species (Jenkins et al. 2017).

In many cases, solar PV facilities have involved the complete removal of vegetation from the inclusive footprint of the installed plant (Lovich and Ennen 2011; DeVault et al. 2014). It is this tendency to destroy, degrade, fragment or otherwise displace birds from large areas of natural habitat that has stimulated most concern to date about the implications for avifauna of large-scale solar PV development (Lovich and Ennen 2011; RSPB 2011; UNEP/CMS 2015), particularly in relation to species with restricted ranges and very specific habitat requirements (including Namibian near-endemic species).

Any removal or disturbance of natural vegetation will result in a change to the habitat available to the birds in the area, potentially impacting on their ability to breed, forage and roost in the vicinity. Larger trees are particularly vulnerable to habitat destruction.

A large concentration of solar plant developments may also lead to increased levels of fragmentation and barrier effects to terrestrial species, particularly if the sites are fenced (Bennun et al. 2021).

Some technologies may deplete and/or pollute ground water. Chemical pollution may result from measures taken to keep the PV panels clean, such as the use of dust suppressants (Lovich and Ennen 2011; Jenkins et al. 2017). It is assumed that the above and other habitat impacts (e.g. impacts on groundwater sources, potential soil erosion from water runoff) will be dealt with in the general EMP, and they are therefore not discussed further.

Table 8. Summary of the impact assessment: Direct and indirect modification/loss/destruction of bird habitat

Description of activity	Receptor	Description of impact	Effect of impact/ description of magnitude	Value/ sensitivity	Magnitude of change	Significance	Residual impact after mitigation
Destruction or degradation of large areas of bird habitat during construction	Smaller terrestrial birds (e.g. near-endemic Ruppell's Parrot, Damara Red-billed Hornbill, Monteiro's Hornbill, White-tailed Shrike) may be impacted by loss of breeding/nursery habitats, in particular cavity-nesting habitats (on *Boscia albitrunca* trees) Ground-nesting birds, e.g. korhaans, spurfowl, sandgrouse	Birds are displaced temporarily or permanently from the site; unnatural stress on territorial species, due to competition for alternative territories; reduction of breeding success	Nature of impact: adverse Type of impact: direct; cumulative Reversibility: partly reversible Duration: permanent Scale/extent: on-site/ local Probability: definite	Medium	Moderate (loss of resource, but not affecting its integrity)	Moderate-major (6-8)	Moderate (6)

Mitigation recommendations

Avoidance and minimisation:

- Micro-siting: where possible, the unnecessary destruction of habitat or degradation of the environment, including sensitive habitats such as cavity-nesting locations should be avoided. The final layout of project infrastructure should avoid designated sensitive areas, e.g. identified active nest sites. If practical, the tree with the recently active hornbill nest just north of the study site (22.09015S 16.80208E) should be protected.

Construction phase

Restoration and rehabilitation:

- Repair of degradation or damage to biodiversity features and ecosystem services from project-related impacts that cannot be completely avoided and/or minimised, e.g. by restoration of temporary-use and lay down areas as soon as reasonably practicable after construction activities are complete.

Operational phase

Minimisation:

- Abatement controls to reduce emissions and pollutants (erosion, dust, waste) created during construction; wastewater management and water conservation measures.

Figure 27. Example of an artificial nesting box for cavity breeders (Namibia Bird Club).

- Operational controls to manage and regulate contractor activity, such as exclusion fencing around sensitive areas (e.g. pre-identified active nest sites), designated machinery and lay-down areas, minimisation of vegetation loss and disturbance to soil; managing the timing of vegetation control activities at suitable intervals.
- Ongoing awareness should be promoted about the value of biodiversity and the negative impacts of habitat destruction.
- As a possible offset, investigate the use of artificial nesting boxes as an alternative option for cavity-breeding birds (Figure 27); contact the Namibia Bird Club for advice on ideal type and placement localities for boxes, and possible further involvement with monitoring of nesting activity (https://www.namibiabirdclub.org/).

7.2.2.3 Creation of novel (artificial) habitats and resources that could attract birds; this impact could also lead to negative impacts on infrastructure, caused by bird nesting, perching and other activities

A further potential impact of solar PV developments is the attraction of novel species to an area by the artificial provision of otherwise scarce resources – for example perches, nest sites and shade (DeVault et al. 2014; Jenkins et al. 2017). Potentially positive impacts of solar energy projects on birds include the use of the various raised structural components of these developments as artificial nesting and roosting sites by a suite of otherwise tree-nesting species (Lovich and Ennen 2011; Hernandez et al. 2014).

It is considered that the ultimate impact of this phenomenon – in terms of the effect of inflated numbers of some species on the overall species composition in the vicinity of the development area, and the possible need for management or removal of these nests by the developer – is difficult to predict (Jenkins et al. 2017). An adaptive management approach is therefore required.

The provision of large areas of shade; vegetation flushes due to water run-off from cleaning solar panels; and fencing that deters mammalian predators could prove to be attractive to species, including ground-nesters. Although this impact is potentially positive, it could also have negative indirect impacts, e.g. entrapment in fences if the bird is startled; and predation. Negative impacts may be experienced on solar PV panels through fouling from perching birds.

The provision of artificial habitats/resources such as power line poles and other structures could also result in negative impacts on the power supply (i.e. flash-overs) caused by bird nesting, perching and other activities (including "streamers" of excrement). Crow nests on power line structures may also contain pieces of wire, which could cause outages. Neither Cape Crow nor Pied Crow has been recorded in the overall study area; however, these species (particularly Pied Crow) may be attracted by new food sources, e.g. food waste associated with construction workers.

Table 9. Summary of the impact assessment: Creation of novel (artificial) habitats and resources that could attract birds

Description of activity	Receptor	Description of impact	Effect of impact/ description of magnitude	Value/ sensitivity	Magnitude of change	Significance	Residual impact after mitigation
Creation of novel (artificial)	Species that may take up roosting and/or nesting	Birds are attracted to and may occupy new	Nature of impact: beneficial or adverse	Low	Minor	Minor (2)	Minor (2)

Description of activity	Receptor	Description of impact	Effect of impact/ description of magnitude	Value/ sensitivity	Magnitude of change	Significance	Residual impact after mitigation
habitats and resources that could attract birds	beneath or on the solar PV structures, including ground-nesters (such as Double-banded Sandgrouse, Namaqua Sandgrouse, Crowned Lapwing); species that perch on infrastructure (raptors, e.g. Pale Chanting Goshawk; owls; African Pipit). Non-priority species, that may impact on infrastructure (solar PV and/or power line structures) by means of perching, nesting or other activities (e.g. Cape Crow and Pied Crow; Rock Dove (Feral Pigeon), Speckled (Rock) Pigeon; Cape Sparrow, House Sparrow, Cape *Wagtail. Priority species that may interact with infra-structure (especially power line structures) (e.g. raptors may perch or nest on power line infrastructure (but not necessarily cause negative impacts; however, such activities could result in	habitats, temporarily or permanently, at or near the site; open water is an attractant; this impact could also lead to negative impacts on infrastructure, caused by bird nesting, perching and other activities	Type of impact: direct, cumulative Reversibility: partly reversible Duration: long term Scale/extent: on-site/ local Probability: medium				

Description of activity	Receptor	Description of impact	Effect of impact/ description of magnitude	Value/ sensitivity	Magnitude of change	Significance	Residual impact after mitigation
	electrocution of birds: see 7.2.2.4 below).						

Mitigation recommendations

Construction phase

Avoidance:

- Ensure strict and effective waste management (including of food) during construction activities, to discourage an unnatural increase in scavenging species such as Pied Crow.
- Avoid creating new habitats with open water, e.g. accumulations of storm water/open water/run-off, that may attract birds.

Operational phase

Minimisation:

- Monitoring is essential to identify (potential) problem areas (see Section 8 below); any movement of hitherto unrecorded species onto or beneath the solar panel structures should be monitored; and any resulting negative impacts (e.g. entrapment of korhaans or spurfowl/francolins in fences; predation), should be addressed accordingly.
- Bird perching or nesting activities on solar infrastructure may become a problem (e.g. by causing fouling of the solar panels), and adaptive management measures may be required (such as anti-perch measures, e.g. spanning a low wire across the perching area). Nesting activities should be discouraged early in the cycle, before any eggs are laid; the Ministry of Environment, Forestry and Tourism (MEFT) should be contacted for specific guidelines for dealing with such problems.
- Numerous actions/devices have been developed to deter birds from an area (WEST 2014; Walston et al. 2015, UNEP/CMS 2015; Jenkins et al. 2017). In terms of solar PV arrays, these deterrents could include habitat management, control of prey populations, anti-perching devices, nest-proofing, netting or other enclosures, scaring or chasing (e.g. with trained dogs), bio-acoustic or visual deterrence. The desirability and effectiveness and such deterrents would need to be considered on a case-by-case basis, using an adaptive management approach.
- Should any nesting or other activity by crows on power supply structures cause disruptions of the power supply, consult with the MEFT for appropriate measures to discourage and manage such activities, e.g. by removing nests at a stage when this is acceptable.

7.2.2.4 Bird electrocutions on power line infrastructure

An electrocution occurs when a large bird is perched or attempts to perch on an electrical structure and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components.

An electrocution could also be caused should a large bird perch on top of a tower and send down a "streamer" of excrement that could hit a conductor, thereby bridging the gap between an earthed and a live component.

Electrocution impacts on the main/suspension pole structure of the present wooden five-pole design (including on "jumper wires" at bend points or on strain poles) are possible, if the structure is earthed and the earthing is within reach of the bird. However, on the associated transformer structures, the risk of electrocution is relatively higher where it is possible for a bird to touch live and earthed components simultaneously.

The electrocution risk is increased if the bird is large (e.g. raptors, pelicans), in view of the relative size of the wingspan, for instance 2.8 m in the case of a Lappet-faced Vulture. The risk is also greater if the structure or bird is wet or damp (e.g. from fog or rain).

Table 10. Summary of impact assessment: Bird electrocutions on power line infrastructure

Description of activity	Receptor	Description of impact	Effect of impact/ description of magnitude	Value/ sensitivity	Magnitude of change	Significance	Residual impact after mitigation
An electrical short circuit, caused when a large bird is perched or attempts to perch on an electrical structure (e.g. transformer/ step-down structure) and physically bridges the air gap between live components and/or live and earthed components (including by means of "streamers" of excrement)	Larger raptors (e.g. White-backed Vulture, Martial Eagle); also smaller raptors (e.g. Western Barn Owl, Pearl-spotted Owlet) Perching, larger aquatic species (e.g. Great White Pelican) Other terrestrial birds that may perch on transformer structures (e.g. Rüppell's Parrot, Damara Red-billed Hornbill, Monteiro's Hornbill)	Electrocution of birds is caused by bird nesting, perching and other activities on an electrical structure, which creates a novel structure and attracts birds to high-risk areas; the impact usually results in mortality of individual birds.	Nature of impact: adverse Type of impact: direct, cumulative Reversibility: irreversible Duration: permanent Scale/extent: on-site/ local Probability: low	Medium	Minor	Minor (4)	Low (2)

Mitigation recommendations

The mitigation measures below are already standard procedure for most pole structures, but are mentioned for the sake of completeness.

Construction phase

Minimisation:

- A standard mitigation for electrocutions in Namibia is to "gap" the earth wire near the top of the pole, i.e. the earth wire on each power line pole should stop at least 300 mm below the lowest phase to provide an air space safety gap, in order to reduce the electrocution risk (see existing 22 kV power line for example of such "gapping").
- On strain structures where "jumper" wires are used, at least the centre jumper should be insulated, using PVC piping or LPDE pipe. Jumpers should be offset where possible.
- Transformer/switchgear structures should be designed in such a way that they are not attractive as bird perches/ nesting sites; selected live components should be insulated (e.g. using PVC piping or LDPE pipe; Figure 28).
- Any stay wires should also be "gapped" by the use of an insulator.

Operational phase

Minimisation:

- The need for reporting power line incidents should be stressed, and reporting procedures clarified (see Section 8, Monitoring below).

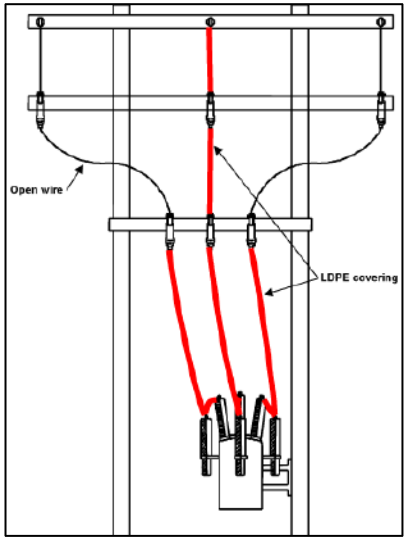

Figure 28. Example of use of Low Density Polyethylene (LDPE) pipe on "jumpers" to insulate selected live components of transformer and switch gear structures.

7.2.2.5 Bird collisions with infrastructure such as solar panel arrays, fencing and associated power line infrastructure

Birds may be injured or killed by colliding with solar PV panels and other infrastructure, including fences or power lines.

Bird collisions with infrastructure such as solar PV panel arrays and fencing

According to Jenkins et al. (2017), recent findings at solar PV facilities in North America suggest that collision mortality impacts at solar PV plants may be underestimated, particularly in terms of collision trauma with solar PV panels; this could possibly be associated with polarised light pollution and/or with waterbirds mistaking large arrays of solar PV panels for wetlands (the so-called "lake effect"; Horvath et al. 2009; Lovich and Ennen 2011; Chock et al. 2020). Due to this misperception, such birds may land on the hard panel surfaces and die on impact, become injured, or are unable to take off from terrestrial surfaces and ultimately die of exposure, or become preyed upon. This effect has emerged as a significant impact factor at one solar site in the

United States where mortality monitoring is ongoing (H.T. Harvey and Associates 2014; Kagan et al. 2014; Walston et al. 2016). Collisions are also possible on associated fencing, especially if a bird is startled.

Although there are few studies of the impacts of utility-scale photovoltaic (PV) facilities on birds (Jenkins et al. 2017; McAlister 2019), especially in the region, a recent study that assessed the impacts of such a facility on birds in the Northern Cape, South Africa (Visser et al. 2019) reported only eight fatalities during three months of surveys of the solar field for bird carcasses and other signs of collisions. The extrapolated mortality for the facility was 435 (95% CI 133–805) birds per year (4.5 bird fatalities·MW^{-1}·yr^{-1}; 95% CI, 1.5–8.5). No threatened species were impacted by the PV facility, but it was concluded that further data are required to better understand the risk of PV solar energy developments on birds. This finding is supported by McAlister (2019), who also cites that DeVault et al. (2014) observed no obvious evidence for bird casualty in terms of collision risk caused by solar panels, despite conducting 515 bird surveys at solar PV sites.

Artificial lighting may impact on night-flying or migrant birds, especially in terms of causing disorientation and/or collisions on structures. Aquatic bird species (e.g. flamingos, grebes, ducks) usually fly at night, and fall into this group. New forms of lighting in areas that were previously unlit may exacerbate the problem of collisions, and also affect movement patterns and corridors. It has been found that nocturnally migrating birds (small passerines, in this case) may become attracted to an isolated pool of diffused light (G Martin pers. comm.). When there is no moon, plus low fog, the birds could also become attracted to an illuminated, reflective array of solar panels; perhaps becoming disorientated because they are used to following visual clues such as the moon.

Unfortunately, not much monitoring data is available for Namibia, or for the region. What is helpful, is that there were no reports of bird collisions in the available monitoring reports for the existing adjacent 5 MW plant (A Delle Donne pers. comm. 2022; Anon. 2017, 2018b, 2019, 2020). Also, the incidence of nocturnally flying species that are known to be collision-prone (e.g. flamingos) is low in this area.

Due to the uncertainties associated with predicting this type of impact, a precautionary approach is required that makes provision for adaptive management.

Table 11. Summary of impact assessment: Bird collisions with infrastructure such as solar PV panel arrays and fencing

Description of activity	Receptor	Description of impact	Effect of impact/ description of magnitude	Value/ sensitivity	Magnitude of change	Significance	Residual impact after mitigation
Waterbirds may mistake large arrays of solar PV panels for wetlands (the so-called "lake effect"); this may be due to the	Aquatic bird species that land on the water (e.g. Great White Pelican) Other such aquatic species include African Black Duck, White-backed Duck, Cape Teal, Red-billed Teal, Little	Due to the misperception of mistaking the solar arrays for wetlands, such aquatic birds may land on the hard panel surfaces and die on impact,	Nature of impact: adverse Type of impact: direct, cumulative Reversibility: irreversible Duration: permanent Scale/extent: on-site Probability: low	Medium	Minor	Minor (4)	Low (2)

Description of activity	Receptor	Description of impact	Effect of impact/ description of magnitude	Value/ sensitivity	Magnitude of change	Significance	Residual impact after mitigation
effects of polarised light pollution on the solar PV panels	Grebe); especially nocturnally flying species	become injured, or are unable to take off from terrestrial surfaces and ultimately die of exposure, or become preyed upon; artificial lighting may impact on night-flying or migrant birds, especially in terms of causing disorientation and/or collisions on structures					

Mitigation recommendations

Project design phase

Avoidance:

- In order to reduce the chances of the panels being mistaken for sheets of water, minor modifications could be made to the panel design (e.g. by means of applying visual cues: see Operational phase: minimisation, below), but at this stage this should rather be considered as an adaptive mitigation, to be retro-fitted once there is a recorded need.
- As with the existing 5 MW solar PV plant, the panels should be arranged in rows with gaps as large as possible in between the rows, to help reduce the effect of a solid mass of water.
- The solar PV area should be fenced with predator-proof fencing, to reduce indirect predation of any bird collision species (if injured and still alive), and also to prevent the removal of any carcass material by mammalian scavengers before it is recorded.
- As far as possible the use of outdoor lighting at the solar facility should be minimised (Jenkins et al. 2017). Research indicates that lights can attract and confuse migrating birds (Gehring et al. 2009; Manville 2005, 2009, 2013). Some insectivorous birds may also be attracted to lights. Security lighting should be kept to the minimum, and directed downward and away from the PV panels if possible.
- The solar PV panels themselves should not be directly illuminated. Non-reflective surfaces (e.g. anti-reflective coating) should be used if possible.

Operational phase

Minimisation:

- If monitoring results indicate that bird collisions are taking place on the solar panels, adaptive mitigations could include the retrofitting of visual cues to existing panels (Kagan et al. 2014). Such minor modifications to the panel design could reduce the chances of the panels being mistaken for sheets of water. These visual cues may include UV-reflective or solid (white) contrasting bands spaced no further than 28 cm from each other. This arrangement has been shown to significantly reduce the number of small passerine birds hitting expanses of windows on commercial buildings. Non-polarising white tape used around and/or across panels (grid partitioning) can also minimise reflection, which can attract aquatic insects (and thus avian predators), as it mimics reflective surfaces of waterbodies (Horvath et al. 2010; Bennun et al. 2021).
- In extreme cases of repeated collisions by night-flying (aquatic) birds (e.g. ducks, grebes), the situation should be reassessed in terms of the possibility of tilting the solar panels to a non-horizontal position when in standby mode (at night) (Walston et al. 2015, UNEP/CMS 2015, Jenkins et al. 2017), taking into account technical constraints. This mitigation would be possible with the proposed panel design.
- Monitoring of any potentially negative impacts is considered essential (see Section 8 below). Should the results show that such impacts, including injuries and/or mortalities of birds are taking place, adaptive mitigation measures would need to be investigated, if necessary on a species-specific basis.
- If monitoring results indicate that bird collisions are taking place on the perimeter fencing of the solar project, systematic fence marking may be utilised to reduce avian collisions with fences (Jenkins et al. 2017). Markings should be at an appropriate height to be visible to birds flying at or above the height of the solar panels.

Bird collisions with power line infrastructure

Bird collisions are also possible on associated power line infrastructure.

A collision occurs when a bird in mid-flight does not see the overhead cables or structures (including conductors and/or earth/optical ground wires [OPGWs]) until it is too late to take evasive action. These impacts could take place on any parts of the power line, but are more likely in sections where the line crosses flight paths/corridors or flyways, such as water courses/drainage lines or ridges. The habitat in the eastern part of the proposed power line servitude is particularly uneven, with deep drainage lines and higher sections.

Collisions may also take place on stay wires (which are usually also included on strain poles/bend points), for instance when a bird is flushed from its position on the ground, and on other associated structures. Collisions may take place even during the construction phase, once the conductors have been strung although not yet energised, but occur mainly during the operational phase. Environmental conditions, including topography, vegetation and climatic factors (e.g. strong winds, dust, rain, fog), may strongly affect both exposure to collision risk, and susceptibility to collision (Jenkins et al. 2010).

Recent research has highlighted the fact that the most susceptible groups to collision mortality on power lines are large, long-lived and slow-reproducing birds, often habitat specialists with hazardous behavioural traits (especially flight height and flocking flight), with high spatial exposure to collision risk with power lines, and with unfavourable conservation status (Jenkins et al. 2010; Bernardino et al. 2018 and authors cited therein; D'Amico et al. 2019).

The collision risk is believed to be increased by factors that include a large wingspan and low manoeuvrability, nomadic/migrant habits, flying in groups, flying in low light (e.g. flamingos and other waterbirds), territorial or courtship behaviour, juvenile inexperience and predation. Predominantly, the above collision-prone group comprises large terrestrial or wetland species (Jenkins et al. 2010). The concern about bustard collisions is particularly high, both regionally and globally (e.g. Shaw et al. 2013, 2018; Silva et al. 2022). Gregarious species (such as vultures) are generally thought to be more vulnerable than species with solitary habits (Bernardino et al. 2018).

A further contributory factor to bird collisions is the occurrence of a visual "blind spot" when flying forwards, which has been demonstrated in some groups of birds, including bustards (and korhaans), vultures, snake-eagles and storks (Martin & Shaw 2010; Martin 2011); while searching for food on the ground, or observing conspecifics, these birds thus fail to see overhead structures such as power lines in their path, especially cables.

Collisions may occur when birds cross power lines in their local, daily movements between breeding/ nesting or roosting sites, and foraging areas (or between foraging areas); often such regular flights may take place at dawn and/or dusk (Bernardino et al. 2018). High mobility and nomadism, especially in habitats with ephemeral resources, may render bird species prone to power line interactions. In the present study, groups such as bustards are particularly susceptible to collisions due to their nomadic habits.

An additional collision risk that applies to the present study is the configuration and close proximity of adjacent power lines (of different structures and heights) in the same area, e.g. where the proposed 66 kV line will run in parallel, close to the existing 66 kV line. The lines are of different heights thus, although this increases the visual barrier, the physical barrier to a bird in flight (and thereby, the cumulative impact) is also increased. The risk is greater when an earth and/or OPGW run above the conductors (as in the case of the existing 66 kV steel monopole structure), as these cables are usually thinner and less visible.

The marking of wires is currently regarded as the most widespread and recommended measure for reducing bird collisions on power line infrastructure (Barrientos 2011, 2012; Bernardino et al. 2019). However, as yet no high-risk collision zones and/or regular flyways have been identified on the relative short (1.9 km) servitude of the proposed 66 kV power line and therefore no marking is recommended at this stage; Should monitoring results indicate a need, the relevant sections can be retro-fitted with a suitable device, e.g. Viper Live Bird Flapper ("Viper"; manufactured by PLP).

Table 12. Summary of impact assessment: Bird collisions with power line infrastructure

Description of activity	Receptor	Description of impact	Effect of impact/ description of magnitude	Value/ sensitivity	Magnitude of change	Significance	Residual impact after mitigation
Overhead cables or structures (including conductors and/ or	The majority of the (larger) priority species (Table 4) are prone to	A collision occurs when a bird in mid-flight does not see	Nature of impact: adverse Type of impact: direct, cumulative	Medium	Moderate	Moderate (6)	Minor (4)

Description of activity	Receptor	Description of impact	Effect of impact/ description of magnitude	Value/ sensitivity	Magnitude of change	Significance	Residual impact after mitigation
earth/ optical ground wires [OPGWs]) obstruct the passage of a bird in mid-flight until it is too late to take evasive action	power line collisions. These include the following groups: – raptors – large terrestrial bird species – waterbirds	the overhead cables or structures until it is too late to take evasive action. A collision usually results in injury or mortality.	Reversibility: irreversible Duration: permanent Scale/extent: on-site/local Probability: medium				

Collisions on power line infrastructure

Project design phase

Avoidance & minimisation:

- At this stage, no marking of power lines is recommended, but it should become mandatory should monitoring results indicate the necessity. The avifauna specialist can be consulted for advice on the design (see Figure 29 for example).
- The need for fitting any mitigation for collisions on stay wires (e.g. marking with vibration dampers) should also be based adaptively on monitoring results.

Operational phase

Minimisation:

- The need for reporting power line incidents should be stressed, and reporting procedures clarified (see Section 8.2 below). Should monitoring indicate that collisions are still taking place despite the above marking, further mitigation would need to be investigated.

Figure 29. Example of power line marking device: Viper Live Bird Flapper (Viper), used as a mitigation for bird collisions (made in South Africa).

7.4 Summary of impact assessment

Potential impacts from the development may be summarised as follows:

- Physical/human disturbance of birds (resulting in avoidance/displacement); this could include road mortalities and/or poaching during construction
  - Rated as minor-moderate, and minor post-mitigation
- Direct and indirect modification/loss/destruction of bird habitat (resulting in avoidance/ displacement)
  - Rated as moderate-major, and moderate post-mitigation
- Creation of novel (artificial) habitats and resources that could attract birds; this impact could lead to negative impacts on infrastructure, caused by bird nesting, perching and other activities
  - Rated as minor, no mitigation proposed as yet (adaptive management)
- Bird electrocutions on power line infrastructure (including by streamers of excrement)
  - Rated as minor, and low post-mitigation
- Bird collisions with infrastructure such as solar panel arrays, fences, guyed masts and associated power line infrastructure
  - Solar PV: rated as minor, and low post-mitigation
  - Power line: rated as moderate, and minor post-mitigation

8 Monitoring recommendations

The following monitoring initiatives should be conducted by Innosun in collaboration with and with the support of the avifauna specialist, and any other relevant partners. If possible, the above monitoring activities should be aligned with any such activities at the existing 5 MW solar PV plant.

Recommended post-construction monitoring protocol for the solar PV plant (Jenkins et al. 2017)

Approach

- For a project of this size (Regime 2), post-construction monitoring is regarded as essential to:
  - determine the actual impacts of the solar energy facility (SEF);
  - determine if additional mitigation is required at the SEF; and
  - learn about impacts and improve future assessments.
- Post-construction monitoring can be divided into three categories:
  - habitat classification;
  - quantifying bird numbers and movements (replicating baseline/pre-construction data collection); and
  - estimating bird mortalities, which has three components:
    - estimation of searcher efficiency and carcass persistence rates;
    - carcass searches; and
    - data analysis incorporating systematically collected data from the two points above.

Methods

- The solar PV structure should be monitored in the form of searching the ground between arrays of solar panels, and checking on the panels themselves. <u>The searches should be done on foot, as far as practical</u>.
- The search area should be defined and consistently applied throughout monitoring.
- A minimum of 20-30% of the solar hardware should be methodically searched for fatalities, with a search interval informed by carcass persistence trials and objective monitoring. Fences and other infrastructure that may pose a risk to wildlife (e.g. any open water bodies) should also be regularly checked. Any evidence of mortalities or injuries within the remaining area should be carefully recorded and included in reports as incidental finds.
- Both mortalities and live birds should be monitored; these would include any species that appear to be attracted to the area, or nesting activity. If there is a need, camera traps could be used to document the occurrence and behaviour of sensitive species, such as waterbirds and/or raptors.
- Based on standard trials (see Jenkins et al. 2017), observed mortality rates should be adjusted to account for searcher efficiency (which can change seasonally depending on vegetative condition of the site), scavenger removal and the proportion of the facility covered by the monitoring effort. Some of these factors may change seasonally due to the breeding season of scavengers and whether visibility of the survey area changes through the year.

Duration and scope

- Post-construction monitoring should be started as soon as the facility becomes operational, bearing in mind that the effects of a SEF may change over time.
- The duration and scope of post-construction monitoring should be informed by the outcomes of the previous year's monitoring, and should be reviewed annually. The findings and

recommendations of the post-construction monitoring report should be included in the updated Environmental Management Programme (EMP).

- Post-construction monitoring of bird abundance and movements and fatality surveys should span at least 2-3 years, to take inter-annual variation into account. However, if significant problems are found or suspected, the post-construction monitoring should continue as needed in conjunction with adaptive management, taking into account the risks related to the particular site and species involved.

Power line monitoring

- The power line surveys should include the existing transmission and distribution lines in the vicinity of the study site (as surveyed in the pre-construction monitoring) and the new 66 kV line. The methods should follow the existing protocols for power line surveys (including collaboration with the relevant utility).

Reporting

- The need for reporting any incidents should be stressed, and reporting procedures should be clarified. All bird mortalities should be recorded on a standardised form, with the GPS coordinates and structure involved and other details, and photographs of the carcass (including head and beak), structure and point of impact if possible (also see Jenkins et al. 2017). For any collision incidents on the solar panels, the presence/absence of (low) fog the night before, and the moon phase should be noted, to investigate any climatic patterns.
- Post-construction monitoring reports should be produced on a quarterly basis, with an annual review report. Ongoing review of results is essential, with a view to recommendations for adaptive management.

9 Conclusion

According to the baseline and scoping of bird habitats and species, the study area is potentially sensitive in terms of avifauna, especially when viewed in the broader context of its situation on the extensive, ephemeral Swakop River system, which is regarded as a bird movement corridor for aquatic and other birds between two large dams, the nearby Gross Barmen wetlands and inland and to the coast, that is of local and regional significance, and probably also of national significance.

A total of 241 bird species has been recorded in the study area and surrounds, representing around 36% of the 676 species currently recorded in Namibia. This species richness is regarded as relatively high. The bird checklist for the study area includes 16 (7%) species that are currently classed as Threatened in Namibia (Simmons et al. 2015, Brown et al. 2017), of which nine (56% of the total) are also Globally Threatened. The checklist also includes seven species (3%) that are near-endemic to Namibia, and at least three Red Data species with migrant status. Other (non-Red Data) migrant species have also been recorded in the area.

Risk assessment and mitigation efforts are directed towards priority species, namely those that have a high biological significance, i.e. primarily Red Data species (including any with migrant status) and/or endemic or near-endemic species.

A total of 28 priority bird species have been short-listed from a total of 55 potential priority species, as a focal group identified as being at higher risk to potential impacts resulting from the proposed project (including power line). This short-listing takes into account the probability of the species occurring in the study area and surrounds. However, due to the high species numbers and the difficulty in predicting the species likely to be impacted, the full priority list needs to be taken into account, focussing on the groups of birds likely to be at risk rather than individual species; and the precautionary principle should prevail.

The 28 priority species comprise:

- 10 high priority species (6 Red Data / 4 near-endemic / 1 Palearctic migrant), in the groups:
  - 5 raptors
  - 1 aquatic species
  - 4 other terrestrial species
- 18 non-Red Data / non-near-endemic priority species, in the groups:
  - 6 raptors
  - 8 aquatic species (examples)
  - 4 other terrestrial species

Several other (mostly non-priority) bird species have the potential to impact on infrastructure, including on solar PV arrays and power line structures, through their perching, nesting and other activities.

With the above number of priority species, potential impacts on birds should therefore form an important component of the assessment of the construction of the proposed solar PV facility and its associated infrastructure. Cumulative impacts are also an important consideration, including the increase in infrastructure in the study area, and the combined effects of other human activities.

The 28 priority bird species are potentially at risk to the following five main impacts, rated as follows:

- Physical/human disturbance of birds (resulting in avoidance/displacement); this could include road mortalities and/or poaching during construction

  - Rated as minor-moderate, and minor post-mitigation
- Direct and indirect modification/loss/destruction of bird habitat (resulting in avoidance/ displacement)

- Rated as moderate-major, and moderate post-mitigation

- Creation of novel (artificial) habitats and resources that could attract birds; this impact could lead to negative impacts on infrastructure, caused by bird nesting, perching and other activities
  - Rated as minor, no mitigation proposed as yet (adaptive management)
- Bird electrocutions on power line infrastructure (including by streamers of excrement)
  - Rated as minor, and low post-mitigation
- Bird collisions with infrastructure such as solar panel arrays, fences, guyed masts and associated power line infrastructure
  - Solar PV: rated as minor, and low post-mitigation
  - Power line: rated as moderate, and minor post-mitigation

Recommendations are made for mitigation and monitoring for the Environmental Monitoring Plan. Structured post-construction is regarded as essential. An adaptive approach to mitigation is recommended, dependent on the feeding of the results of ongoing monitoring into management strategies. The effective application of the above mitigation should help reduce the impacts of the proposed development. However, ongoing monitoring is considered essential.

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Appendix 1: Checklist of bird species recorded within the Innosun Osona 36 MW solar PV power plant area, Otjozondjupa Region

KEY:
Priority status (species names in bold)
- **RDB status** (indicated in red): Red Data Book/conservation status (Simmons et al. 2015; Brown *et al*. 2017; indicated in red) CR = Critically Endangered, EN = Endangered, VU = Vulnerable, NT = Near Threatened (remaining species LC = Least Concern/Secure); G = global status
- **Endemism** (indicated in green): NamNE 90% = Namibian near-endemic
- **Residency/migrant status** (for priority species; indicated in blue): res = resident; nom = nomadic; mig = migrant; Afr = African; Pal = Palearctic; non-br = non-breeding

SABAP1: QDS 2216BB (Study site) and 2216BA (Gross-Barmen) (total 232 spp; source: Southern African Bird Atlas Project 1 [SABAP1] data that was published as Harrison *et al.* [1997]; accessed at the Namibia Biodiversity Database (NDB) web site, https://biodiversity.org.na, on Mar 5 12:11:40 2022; and on the EIS (EIS 2022; www.the-eis.com)
SABAP2: Pentads 2205_1645 (Study site; 3 full protocol) and 2205_1640 (Gross Barmen; 18 full protocol; total 183 spp; source: http://sabap2.adu.org.za; and including personal observations
Other records: (recent) records for the greater area, including personal observations during site visits (1 = 22/7/22; 2 = 26-28/7/22; 3 = 10-13/10/22; 4 = 28-30/11/22); power line incidents (PL), *ad hoc* sightings/reports etc.

TOTAL: 241 species

Common group	Common species	Genus	Species	Priority status	2216BB	2216BA	2205_1645	2205_1640	Other records
Babbler	Southern Pied	*Turdoides*	*bicolor*		√	√			4
Barbet	Acacia Pied	*Tricholaema*	*leucomelas*		√	√	√	√	2, 3, 4
Batis	Pririt	*Batis*	*pririt*		√	√	√	√	2, 3, 4
Bee-eater	European	*Merops*	*apiaster*		√			√	
Bee-eater	Swallow-tailed	*Merops*	*hirundineus*		√	√	√	√	3, 4
Bishop	Southern Red	*Euplectes*	*orix*					√	
Bittern	Dwarf	*Ixobrychus*	*sturmii*			√			
Bittern	Little	*Ixobrychus*	*minutus*			√		√	
Bokmakierie	-	*Telophorus*	*zeylonus*		√	√			
Brubru	Brubru	*Nilaus*	*afer*		√	√	√	√	3, 4
Bulbul	African Red-eyed	*Pycnonotus*	*nigricans*		√	√	√	√	1, 2, 3, 4
Bunting	Cape	*Emberiza*	*capensis*		√				

Common group	Common species	Genus	Species	Priority status	2216BB	2216BA	2205_1645	2205_1640	Other records
Bunting	Cinnamon-breasted	*Emberiza*	*tahapisi*		√	√		√	
Bunting	Golden-breasted	*Emberiza*	*flaviventris*		√	√	√	√	2
Bunting	Lark-like	*Emberiza*	*impetuani*		√	√		√	
Bustard	**Kori**	*Ardeotis*	*kori*	NT, G NT, nom	√				PL inc 2013
Buzzard	**Augur**	*Buteo*	*augur*	Res, nom	√	√			
Buzzard	**Common (Steppe)**	*Buteo*	*buteo*	Pal mig	√	√	√	√	
Camaroptera	Grey-backed	*Camaroptera*	*brevicaudata*		√	√			3
Canary	Black-throated	*Crithagra*	*atrogularis*		√	√		√	
Canary	White-throated	*Crithagra*	*albogularis*		√	√			
Canary	Yellow	*Crithagra*	*flaviventris*		√	√	√	√	
Chat	Ant-eating	*Myrmecocichla*	*formicivora*		√	√			
Chat	Familiar	*Oenanthe*	*familiaris*		√	√	√	√	3
Cisticola	Grey-backed	*Cisticola*	*subruficapilla*		√	√			
Cisticola	Rattling	*Cisticola*	*chiniana*				√	√	
Cisticola	Zitting	*Cisticola*	*juncidis*		√	√	√	√	
Coot	Red-knobbed	*Fulica*	*cristata*		√	√		√	2
Cormorant	Reed	*Microcarbo*	*africanus*		√	√		√	2, 3, 4
Cormorant	White-breasted	*Phalacrocorax*	*lucidus*		√	√		√	2 (J)
Crake	Baillon's	*Zapornia*	*pusilla*					√	
Crake	Black	*Zapornia*	*flavirostra*			√		√	
Crombec	Long-billed	*Sylvietta*	*rufescens*		√	√		√	2
Cuckoo	African	*Cuculus*	*gularis*		√				
Cuckoo	Black	*Cuculus*	*clamosus*		√				
Cuckoo	Diederik	*Chrysococcyx*	*caprius*		√	√		√	
Cuckoo	Great Spotted	*Clamator*	*glandarius*		√	√			
Cuckoo	Jacobin	*Clamator*	*jacobinus*			√		√	
Darter	African	*Anhinga*	*rufa*		√	√		√	

Common group	Common species	Genus	Species	Priority status	2216BB	2216BA	2205_1645	2205_1640	Other records
Dove (Turtle-Dove)	Ring-necked (Cape Turtle)	*Streptopelia*	*capicola*		√	√	√	√	1, 2, 3, 4
Dove (Wood-dove)	Emerald-spotted	*Turtur*	*chalcospilos*			√			
Dove	Laughing	*Spilopelia*	*senegalensis*		√	√	√	√	1, 2, 3, 4
Dove	Namaqua	*Oena*	*capensis*		√	√		√	1, 2, 3, 4
Dove (Pigeon)	Rock (Feral)	*Columba*	*livia*	Alien	√				
Drongo	Fork-tailed	*Dicrurus*	*adsimilis*		√	√	√	√	1, 2, 3, 4
Duck	African Black	*Anas*	*sparsa*			√		√	
Duck	Fulvous Whistling	*Dendrocygna*	*bicolor*			√			
Duck	Knob-billed	*Sarkidiornis*	*melanotos*					√	
Duck	**Maccoa**	*Oxyura*	*maccoa*	NT, G VU; res + nom	√	√			
Duck	White-backed	*Thalassornis*	*leuconotus*		√	√		√	2, 3, 4
Duck	White-faced Whistling	*Dendrocygna*	*viduata*	Nom					4 (new record)
Eagle	**African Fish**	*Haliaeetus*	*vocifer*	VU, G NT; res	√			√	3
Eagle	**Black-chested Snake**	*Circaetus*	*pectoralis*	Res, nom	√	√	√	√	
Eagle	**Brown Snake**	*Circaetus*	*cinereus*	Res, nom	√	√	√	√	
Eagle	**Martial**	*Polemaetus*	*bellicosus*	EN, G EN; res	√	√	√		2
Eagle	**Steppe**	*Aquila*	*nipalensis*	EN, G EN, Pal mig	√				
Eagle	**Tawny**	*Aquila*	*rapax*	EN	√		√	√	
Eagle	**Verreaux's**	*Aquila*	*verreauxii*	NT; res		√		√	
Eagle-Owl	**Spotted**	*Bubo*	*africanus*	Res	√				
Egret	Great	*Ardea*	*alba*			√		√	
Egret	Intermediate (Yellow-billed)	*Ardea (Egretta)*	*intermedia*		√	√		√	4
Egret	Little	*Egretta*	*garzetta*			√		√	

Common group	Common species	Genus	Species	Priority status	2216BB	2216BA	2205_1645	2205_1640	Other records
Egret	Western Cattle (Cattle)	*Bubulcus*	*ibis*		√	√		√	4
Eremomela	Burnt-necked	*Eremomela*	*usticollis*		√	√		√	
Eremomela	Yellow-bellied	*Eremomela*	*icteropygialis*		√	√	√	√	4
Falcon	**Red-footed**	*Falco*	*vespertinus*	NT, G VU, Pal mig	√				
Finch	Red-headed	*Amadina*	*erythrocephala*		√	√	√	√	2, 3
Firefinch	Red-billed	*Lagonosticta*	*senegala*					√	
Fiscal	Southern (Common)	*Lanius*	*collaris*		√	√	√		
Flamingo	**Greater**	*Phoenicopterus*	*roseus*	VU; part Afr mig; nom	√				
Flycatcher (Paradise-Flycatcher)	African Paradise	*Terpsiphone*	*viridis*		√				
Flycatcher	Chat	*Melaenornis*	*infuscatus*		√				
Flycatcher	Marico	*Melaenornis*	*mariquensis*		√	√	√	√	2, 3, 4
Flycatcher	Spotted	*Muscicapa*	*striata*		√			√	
Francolin	Orange River	*Scleroptila*	*gutturalis*			√			
Go-away-bird	Grey	*Crinifer*	*concolor*		√	√	√	√	1, 2, 3, 4
Goose	Egyptian	*Alopochen*	*aegyptiaca*		√	√		√	1, 2, 4
Goshawk	**Gabar**	*Micronisus*	*gabar*	Res	√	√		√	
Goshawk	**Pale Chanting**	*Melierax*	*canorus*	Sed, movements	√	√	√	√	1, 2, 3, 4
Grebe	Little	*Tachybaptus*	*ruficollis*		√	√		√	2, 3, 4
Greenshank	Common	*Tringa*	*nebularia*		√			√	1
Guineafowl	Helmeted	*Numida*	*meleagris*		√	√	√	√	2, 3
Hamerkop	Hamerkop	*Scopus*	*umbretta*		√	√		√	
Hawk-Eagle	**African**	*Aquila*	*spilogaster*	Res, sed		√	√		2
Heron (Night-Heron)	Black-crowned Night	*Nycticorax*	*nycticorax*		√	√		√	
Heron	Black-headed	*Ardea*	*melanocephala*		√	√		√	

Common group	Common species	Genus	Species	Priority status	2216BB	2216BA	2205_1645	2205_1640	Other records
Heron	Striated (Green-backed)	*Butorides*	*striata*			√		√	2
Heron	Grey	*Ardea*	*cinerea*		√	√		√	
Heron	Purple	*Ardea*	*purpurea*		√	√			
Heron	Squacco	*Ardeola*	*ralloides*		√			√	
Hoopoe	African	*Upupa*	*africana*		√	√		√	2, 3, 4
Hornbill	African Grey	*Lophoceros*	*nasutus*		√	√	√	√	3, 4
Hornbill	**Damara Red-billed (Red-billed)**	*Tockus*	*damarensis*	NamNE	√	√		√	2, 3, 4 PL inc 2013
Hornbill	**Monteiro's**	*Tockus*	*monteiri*	NamNE	√	√		√	4
Hornbill	Southern Yellow-billed	*Tockus*	*leucomelas*		√	√	√	√	2, 3, 4
Ibis	African Sacred	*Threskiornis*	*aethiopicus*					√	
Indigobird	Village	*Vidua*	*chalybeata*					√	
Jacana	African	*Actophilornis*	*africanus*		√			√	2
Kestrel	**Greater**	*Falco*	*rupicoloides*	Sed, movements	√	√			
Kestrel	**Lesser**	*Falco*	*naumanni*	Pal mig		√			
Kestrel	**Rock**	*Falco*	*rupicolus*	Res	√	√		√	
Kingfisher	Pied	*Ceryle*	*rudis*					√	
Kite	Black-winged	*Elanus*	*caeruleus*	Nom	√	√		√	
Korhaan	**Northern (Southern) Black**	*Afrotis*	*afra*		√				
Korhaan	**Red-crested**	*Lophotis*	*ruficrista*		√	√	√	√	1?, 2. 3
Lapwing	Blacksmith	*Vanellus*	*armatus*		√	√	√	√	1, 2, 3, 4
Lapwing	Crowned	*Vanellus*	*coronatus*		√	√	√	√	1, 2, 3, 4
Lark	Dusky	*Pinarocorys*	*nigricans*					√	
Lark	Fawn-colored	*Calendulauda*	*africanoides*		√		√		2
Lark	Monotonous	*Mirafra*	*passerina*		√			√	
Lark	Red-capped	*Calandrella*	*cinerea*						2; new record

Common group	Common species	Genus	Species	Priority status	2216BB	2216BA	2205_1645	2205_1640	Other records
Lark	Rufous-naped	*Mirafra*	*africana*				√		
Lark	Sabota	*Calendulauda*	*sabota*		√	√	√	√	2
Lovebird	Rosy-faced	*Agapornis*	*roseicollis*		√	√		√	3, 4
Martin	Brown-throated	*Riparia*	*paludicola*		√	√			1, 2
Martin	Common House	*Delichon*	*urbicum*		√			√	
Martin	Rock	*Ptyonoprogne*	*fuligula*		√	√	√	√	2 (N), 3. 4
Moorhen	Common	*Gallinula*	*chloropus*		√	√	√	√	2, 3, 4
Mousebird	Red-faced	*Urocolius*	*indicus*		√	√	√		
Mousebird	White-backed	*Colius*	*colius*					√	
Nightjar	Fiery-necked	*Caprimulgus*	*pectoralis*		√				
Nightjar	Freckled	*Caprimulgus*	*tristigma*			√		√	
Osprey	**Western**	*Pandion*	*haliaetus*	Pal mig	√			√	
Ostrich	Common	*Struthio*	*camelus*			√			
Owl (Scops-Owl)	**African Scops**	*Otus*	*senegalensis*	Res	√	√			
Owl	**Southern White-faced**	*Ptilopsis*	*granti*	Res					3, 4 (pellets); new record
Owl	**Western Barn**	*Tyto*	*alba*	Res	√	√		√	2 (N); PL elec. 2013
Owlet	**Pearl-spotted**	*Glaucidium*	*perlatum*	Res	√	√	√	√	
Painted-snipe	Greater	*Rostratula*	*benghalensis*					√	
Parrot	**Rüppell's**	*Poicephalus*	*rueppellii*	NT, NamNE (nom)	√	√	√		2, 3
Pelican	**Great White**	*Pelecanus*	*onocrotalus*	VU; sed, nom	√	√	√	√	
Pelican	Pink-backed	*Pelecanus*	*rufescens*					√	
Pigeon	Speckled (Rock)	*Columba*	*guinea*		√	√		√	2
Pipit	African	*Anthus*	*cinnamomeus*		√		√	√	2, 3, 4?
Plover	Kittlitz's	*Charadrius*	*pecuarius*		√				
Plover	Three-banded	*Charadrius*	*tricollaris*		√	√		√	2, 3

Common group	Common species	Genus	Species	Priority status	2216BB	2216BA	2205_1645	2205_1640	Other records
Pochard	Southern	*Netta*	*erythrophthalma*			√		√	
Prinia	Black-chested	*Prinia*	*flavicans*		√	√	√	√	1, 2, 3, 4
Pytilia	Green-winged	*Pytilia*	*melba*		√	√	√	√	
Quailfinch	(African)	*Ortygospiza*	*atricollis*			√		√	
Quelea	Red-billed	*Quelea*	*quelea*		√	√	√	√	2, 3, 4
Rockrunner	**-**	Aechaetops	*pycnopygius*	NamNE	√	√			
Roller	European	*Coracias*	*garrulus*		√				
Roller	Lilac-breasted	*Coracias*	*caudatus*		√	√	√	√	2, 3, 4
Roller	Purple	*Coracias*	*naevius*			√	√	√	2, 3, 4
Ruff	-	*Calidris*	*pugnax*		√			√	
Sandgrouse	**Double-banded**	*Pterocles*	*bicinctus*			√		√	2 (N)
Sandgrouse	**Namaqua**	*Pterocles*	*namaqua*	(End s Afr)	√	√	√	√	
Sandpiper	Common	*Actitis*	*hypoleucos*		√	√		√	
Sandpiper	Wood	*Tringa*	*glareola*		√	√		√	
Scimitarbill	Common	*Rhinopomastus*	*cyanomelas*		√	√		√	3, 4
Scrub Robin	Kalahari	*Cercotrichas*	*paena*		√	√	√	√	2, 3, 4
Shelduck	South African	*Tadorna*	*cana*		√	√			2
Shoveler	Cape	*Spatula*	*smithii*			√		√	
Shrike	Crimson-breasted	*Laniarius*	*atrococcineus*		√	√	√	√	2, 3, 4
Shrike	Lesser Grey	*Lanius*	*minor*		√	√	√	√	
Shrike	Red-backed	*Lanius*	*collurio*		√	√		√	
Shrike	Southern White-crowned	*Eurocephalus*	*anguitimens*		√	√			
Shrike	**White-tailed**	*Lanioturdus*	*torquatus*	NamNE	√	√	√		1, 2
Sparrow	Cape	*Passer*	*melanurus*		√	√			
Sparrow	Great	*Passer*	*motitensis*		√	√	√	√	2, 3, 4
Sparrow	House	*Passer*	*domesticus*	Alien	√	√		√	

Common group	Common species	Genus	Species	Priority status	2216BB	2216BA	2205_1645	2205_1640	Other records
Sparrow	Southern Grey-headed	*Passer*	*diffusus*		√	√	√	√	2, 3
Sparrow-Lark	Grey-backed	*Eremopterix*	*verticalis*				√	√	
Sparrow-Weaver	White-browed	*Plocepasser*	*mahali*		√	√	√	√	1, 2 (old N), 3, 4
Spoonbill	African	*Platalea*	*alba*		√			√	
Spurfowl	Red-billed	*Pternistis*	*adspersus*		√	√	√	√	2, 3, 4
Spurfowl	Swainson's	*Pternistis*	*swainsonii*					√	
Starling	Burchell's	*Lamprotornis*	*australis*		√	√		√	2, 3, 4
Starling	Cape (Cape Glossy)	*Lamprotornis*	*nitens*		√	√	√	√	1, 2, 3, 4
Starling	Pale-winged	*Onychognathus*	*nabouroup*		√	√		√	1, 2, 3, 4
Starling	Violet-backed	*Cinnyricinclus*	*leucogaster*					√	
Starling	Wattled	*Creatophora*	*cinerea*		√	√	√	√	
Stilt	Black-winged	*Himantopus*	*himantopus*		√	√		√	
Stint	Little	*Calidris*	*minuta*		√	√			
Stork	Abdim's	*Ciconia*	*abdimii*		√				
Stork	**Saddle-billed**	*Ephippiorhynchus*	*senegalensis*	EN; res				√	
Stork	Yellow-billed	*Mycteria*	*ibis*					√	
Stork	White	*Ciconia*	*ciconia*		√				
Sunbird	Dusky	*Cinnyris*	*fuscus*		√	√		√	
Sunbird	Marico	*Cinnyris*	*mariquensis*		√	√		√	
Sunbird	Scarlet-chested	*Chalcomitra*	*senegalensis*		√	√		√	
Swallow	Barn	*Hirundo*	*rustica*		√	√		√	
Swallow	Greater Striped	*Cecropis*	*cucullata*		√	√	√	√	3, 4
Swallow	Lesser Striped	*Cecropis*	*abyssinica*						3 (new record)
Swallow	Pearl-breasted	*Hirundo*	*dimidiata*			√			
Swallow	South African Cliff	*Petrochelidon*	*spilodera*		√			√	
Swallow	White-throated	*Hirundo*	*albigularis*		√	√		√	
Swamphen	African (Purple)	*Porphyrio*	*madagascariensis*		√	√		√	

Common group	Common species	Genus	Species	Priority status	2216BB	2216BA	2205_1645	2205_1640	Other records
Swift	African Palm	*Cypsiurus*	*parvus*		√	√	√	√	2, 3, 4
Swift	Alpine	*Tachymarptis*	*melba*			√		√	
Swift	Bradfield's	*Apus*	*bradfieldi*		√	√		√	
Swift	Common	*Apus*	*apus*		√		√	√	3
Swift	Little	*Apus*	*affinis*		√	√	√	√	4
Swift	White-rumped	*Apus*	*caffer*		√	√	√	√	3, 4
Tchagra	Black-crowned	*Tchagra*	*senegalus*			√			
Tchagra	Brown-crowned	*Tchagra*	*australis*		√			√	3
Teal	Blue-billed (Hottentot)	*Spatula*	*hottentota*		√	√		√	
Teal	Cape	*Anas*	*capensis*		√	√		√	
Teal	Red-billed	*Anas*	*erythrorhyncha*		√	√		√	
Tern	White-winged	*Chlidonias*	*leucopterus*					√	
Thick-knee	Spotted	*Burhinus*	*capensis*		√	√			
Thick-knee	Water	*Burhinus*	*vermiculatus*					√	
Thrush	Groundscraper	*Turdus*	*litsitsirupa*		√	√	√	√	2, 3, 4
Thrush	Short-toed Rock	*Monticola*	*brevipes*		√	√	√	√	2, 3
Tit	Ashy	*Melaniparus*	*cinerascens*		√	√	√		
Tit	Cape Penduline	*Anthoscopus*	*minutus*		√			√	
Tit	**Carp's**	*Melaniparus*	*carpi*	NamNE	√	√			
Turnstone	Ruddy	*Arenaria*	*interpes*			√			
Vulture	**Cape**	*Gyps*	*coprotheres*	CR, G EN	√				
Vulture	**Lappet-faced**	*Torgos*	*tracheliotos*	EN, G EN; res, movements	√				PL inc. 2013
Vulture	**White-backed**	*Gyps*	*africanus*	CR, G CR	√		√		
Wagtail	Cape	*Motacilla*	*capensis*		√	√		√	2, 4
Warbler (Reed-Warbler)	African Reed	*Acrocephalus*	*baeticatus*		√	√		√	

Common group	Common species	Genus	Species	Priority status	2216BB	2216BA	2205_1645	2205_1640	Other records
Warbler (Titbabbler)	Chestnut-vented	*Curruca*	*subcoerulea*		√	√		√	3, 4
Warbler	Garden	*Sylvia*	*borin*		√				
Warbler	Great Reed	*Acrocephalus*	*arundinaceus*					√	
Warbler	Lesser Swamp	*Acrocephalus*	*gracilirostris*					√	
Warbler	Sedge	*Acrocephalus*	*schoenobaenus*					√	
Warbler	Willow	*Phylloscopus*	*trochilus*		√				
Waxbill	Black-faced	*Brunhilda*	*erythronotos*		√	√		√	2, 3
Waxbill	Blue	*Uraeginthus*	*angolensis*		√	√		√	4
Waxbill	Common	*Estrilda*	*astrild*		√	√		√	3
Waxbill	Violet-eared	*Granatina*	*granatina*		√	√	√	√	2, 3
Weaver	Chestnut	*Ploceus*	*rubiginosus*		√	√	√	√	
Weaver (Masked-Weaver)	Lesser Masked	*Ploceus*	*intermedius*		√	√		√	
Weaver (Buffalo-Weaver)	Red-billed Buffalo	*Bubalornis*	*niger*		√	√		√	2 (old N), 3, 4
Weaver (Finch)	Scaly-feathered	*Sporopipes*	*squamifrons*		√	√	√	√	3
Weaver	Sociable	*Philetairus*	*socius*		√				4
Weaver	Southern Masked	*Ploceus*	*velatus*		√	√	√	√	2, 3
Wheatear	Capped	*Oenanthe*	*pileata*			√	√		
Wheatear	Mountain	*Myrmecocichla*	*monticola*		√	√			
Whydah	Long-tailed Paradise	*Vidua*	*paradisaea*		√			√	
Whydah	Pin-tailed	*Vidua*	*macroura*					√	
Whydah	Shaft-tailed	*Vidua*	*regia*		√	√	√	√	
Wood Hoopoe	Green	*Phoeniculus*	*purpureus*		√	√		√	
Wood Hoopoe	**Violet**	*Phoeniculus*	*damarensis*	EN, NamNE	√			√	3?
Woodpecker	Bearded	*Dendropicos*	*namaquus*		√	√			
Woodpecker	Cardinal	*Dendropicos*	*fuscescens*		√	√			

Common group	Common species	Genus	Species	Priority status	2216BB	2216BA	2205_1645	2205_1640	Other records
Woodpecker	Golden-tailed	*Campethera*	*abingoni*			√		√	
Wren-Warbler	Barred	*Calamonastes*	*fasciolatus*		√	√	√	√	4
Subtotals					**189**	**169**	**76**	**172**	**98 (4 new records)**
					232		**183**		
					237				
TOTAL					**241**				

Appendix 2: Short list of potential priority species

See Appendix 1 (above) for key to codes.

Common group	Common species	Priority status	Other sensitivities	Atlas records		Pers. obs 2022	Potential impact	Prob
				SABAP 1	SABAP 2			
1. Priority (Red Data / near-endemic / migrant) species with the potential to be impacted by the proposed development								
1.1 Raptors (including aquatic raptors)								
Vulture	White-backed	CR, G CR	Raptor; resident, movements; power line-prone	1	1		D C E	L/M
Vulture	Lappet-faced	EN, G EN	Raptor; resident, movements; power line-prone	1			D C E	L/M
*Eagle	Martial	EN, G EN	Raptor; resident; power line-prone	2	1	2	D C E	L/M
Eagle	Tawny	EN	Raptor; power line-prone	1	2		D C E	L/M
Buzzard	Common (Steppe)	Pal mig	Raptor; power line-prone	2	2		D C E	L/M
1.2 Aquatic species								
Pelican	Great White	VU	Aquatic; sedentary, nomadic; power line-prone	2	2		C E	L/M
1.3 Other terrestrial species								
*Parrot	Rüppell's	NT, NamNE	(Nomadic); power line-prone; cavity breeder	2		2, 3	D H C E	M
*Hornbill	Damara Red-billed	NamNE	Power line-prone; cavity breeder	2	1	2, 3, 4	D H C E	M
*Hornbill	Monteiro's	NamNE	Nomadic; power line-prone; cavity breeder	2	1	4	D H C E	M
*Shrike	White-tailed	NamNE	Resident; highly territorial	2	1	2	D H	M
2. Non-Red Data / non-near-endemic (Namibia) priority species with the potential to be impacted by the proposed development								
2.1 Raptors								
Eagle	Black-chested Snake		Raptor; resident, nomadic; power line-prone	2	2		D C E	M
Eagle	Brown Snake		Raptor; resident, nomadic; power line-prone	2	2		D C E	L/M
*Goshawk	Pale Chanting		Raptor; sedentary, movements; power line-prone	2	2	2, 3, 4	D C E	M
*Owl	Southern White-faced		Raptor; resident; power line-prone	-	-	3 (4) (new record)	D C E	L-M
*Owl	Western Barn		Raptor; resident; power line-prone; breeding recorded	2	1	2	D C E	M

Common group	Common species	Priority status	Other sensitivities	Atlas records		Pers. obs 2022	Potential impact	Prob
				SABAP 1	SABAP 2			
Owlet	Pearl-spotted		Raptor; resident	2	2		D H C E	L/M
2.2 Aquatic species (examples)								
*Cormorant	White-breasted		Aquatic; sedentary, nomadic	2	1	2	C	L
*Cormorant	Reed		Aquatic; resident, nomad, partial migrant	2	1	2, 3	C	L
Darter	African		Aquatic; sedentary, local movements	2	1		C	L
Duck	African Black		Aquatic; resident	1	1		CS	L
*Duck	White-backed		Aquatic; resident, nomadic	2	1	2, 3, 4	CS	L
Teal	Cape		Aquatic; nomadic, partial migrant	2	1		CS	L
Teal	Red-billed		Aquatic; resident, nomadic	2	1		CS	L
*Grebe	Little		Aquatic; resident, local movements	2	1	2, 3, 4	CS	L
2.3 Other terrestrial species								
*Korhaan	Red-crested	NE s Afr	Sedentary; power line-prone; ground nester	2	2	1?, 2, 3	D H C E	L/M
*Sandgrouse	Double-banded	NE s Afr	Sedentary; power line-prone; ground nester; breeding recorded at 5 MW solar site	1	1	2; Br	D C	M
Sandgrouse	Namaqua	End s Afr	Resident, nomadic, migratory; power line-prone; ground nester	2	2		C	M
*Spurfowl	Red-billed	NE S Afr	Sedentary; power line-prone; ground nester	2	2	2, 3, 4	H C	L/M
3. Species with the potential to impact on infrastructure (examples)								
Dove (Pigeon)	Rock (Feral)			2			N	M
*Pigeon	Speckled (Rock)			2	1	2	N	M
Sparrow	Cape			2			N	M
Sparrow	House			2	1		N	M
*Swallow	Greater Striped	Br intra-Afr mig		2	2	3, 4	N	M
*Wagtail	Cape			2	1	2	N	M
*Weaver	Red-billed Buffalo			2	2	2, 4;old nests	N-M	L-M
*Weaver	Sociable			1			N-I	I

Appendix 3: Results of pre-construction monitoring

1. 26-28 July 2022

2. 10-13 October 2022

3. 28-30 November 2022

1 Checklist surveys

SABAP2: Pentad 2205_1645 (study site) and 2205_1640 (Gross Barmen) (full protocol data)

Pentad 2200_1645 (study site N); 2200_1650 (Okahandja S) (*ad hoc* data)

Active/recent breeding including nests (N), juveniles (J); old nests (O)

Species	Jul 2022				Oct 2022				Nov 2022			
	2205_1645	2205_1640	2200_1645	2200_1650	2205_1645	2205_1640	2200_1645	2200_1650	2205_1645	2205_1640	2200_1645	2200_1650
Babbler, Southern Pied											√	
Barbet, Acacia Pied	√				√	√			√	√		
Batis, Pririt	√		√		√				√		√	
Bee-eater, Swallow-tailed					√				√	√	√	
Brubru					√				√		√	√
Bulbul, African Red-eyed	√	√				√				√		
Bunting, Golden-breasted		√										
Cameroptera, Grey-backed					√							
Chat, Familiar						√						
Coot, Red-knobbed		√										
Cormorant, Reed		√				√				√		
Cormorant, White-breasted	√	√ J										
Crombec, Long-billed	√											
Dove, Laughing		√				√		√		√		
Dove, Namaqua				√		√		√	√			

Species	Jul 2022				Oct 2022				Nov 2022			
	2205_1645	2205_1640	2200_1645	2200_1650	2205_1645	2205_1640	2200_1645	2200_1650	2205_1645	2205_1640	2200_1645	2200_1650
Dove, Ring-necked (Turtle)	√	√			√	√			√	√	√	
Drongo, Fork-tailed	√		√	√	√			√	√	√	√	√
Duck, White-backed		√				√				√		
Duck, White-faced Whistling										√		
Eagle, African Fish						√						
Eagle, Martial	√											
Egret, Cattle												√
Egret, Intermediate (Yellow-billed)										√		
Eremomela, Yellow-billed									√			
Finch, Red-headed	√	√			√							
Flycatcher, Chat								√				
Flycatcher, Marico	√				√			√	√			
Go-away-bird, Grey	√	√	√		√	√		√	√	√		
Goose, Egyptian		√		√ J								√
Goshawk, Pale Chanting	√				√				√			√
Grebe, Little		√				√				√		
Guineafowl, Helmeted	√					√	√					
Hawk-Eagle, African		√										
Heron, Striated		√ J										
Hoopoe, African	√				√	√					√	
Hornbill, African Grey					√	√				√		
Hornbill, Damara Red-billed		√			√					√		
Hornbill, Damara/ Southern Red-billed *hybrid*	√?								√		√	

Species	Jul 2022				Oct 2022				Nov 2022			
	2205_1645	2205_1640	2200_1645	2200_1650	2205_1645	2205_1640	2200_1645	2200_1650	2205_1645	2205_1640	2200_1645	2200_1650
Hornbill, Monteiro's											√	
Hornbill, Southern Yellow-billed	√	√	√		√	√			√			
Jacana, African		√										
Korhaan, Red-crested	√				√							
Lapwing, Blacksmith		√				√				√		
Lapwing, Crowned	√				√				√			
Lark, Fawn-coloured	√											
Lark, Sabota	√											
Lovebird, Rosy-faced						√				√		
Martin, Brown-throated	√											
Martin, Rock	√ N	√			√	√				√		√
Moorhen, Common		√				√				√		
Owl, Southern White-faced					√		√				Pellets	
Owl, Western Barn	√ N											
Parrot, Rüppell's		√	√		√							
Pigeon, Speckled		√										
Pipit, African	√				√				?			
Plover, Three-banded		√				√						
Prinia, Black-chested	√				√	√			√	√		
Quelea, Red-billed	√	√			√	√			√			
Roller, Lilac-breasted	√	√			√				√	√		√
Roller, Purple	√							√				√
Sandgrouse, Double-banded	√ N											
Scimitarbill, Common					√				√			
Scrub Robin, Kalahari	√		√		√				√		√	

Species	Jul 2022				Oct 2022				Nov 2022			
	2205_1645	2205_1640	2200_1645	2200_1650	2205_1645	2205_1640	2200_1645	2200_1650	2205_1645	2205_1640	2200_1645	2200_1650
Shelduck, South African		√										
Shrike, Crimson-breasted	√				√			√	√	√		√
Shrike, White-tailed	√		√									
Sparrow, Great	√				√				√	√		
Sparrow, Southern Grey-headed	√		√		√							
Sparrow-Weaver, White-browed	√ O	√ O	√	√		√		√	√	√		√
Spurfowl, Red-billed	√	√			√	√	√		√	√		
Starling, Burchell's		√				√				√		
Starling, Cape	√	√		√	√			√	√	√	√	√
Starling, Pale-winged		√				√				√		
Sunbird (unidentified)									√	√		
Swallow, Greater Striped					√				√	√		√
Swallow, Lesser Striped						√						
Swift, African Palm		√				√				√		
Swift, Common								√				
Swift, Little										√		
Swift, White-rumped						√						√
Tchagra, Black-crowned					√							
Thrush, Groundscraper		√			√	√				√		
Thrush, Short-toed Rock	√				√	√						
Vulture (unidentified)											√	
Wagtail, Cape		√								√		
Warbler, Chestnut-vented	√		√		√				√	√		
Warbler, Rufous-eared									?			

Species	Jul 2022				Oct 2022				Nov 2022			
	2205_1645	2205_1640	2200_1645	2200_1650	2205_1645	2205_1640	2200_1645	2200_1650	2205_1645	2205_1640	2200_1645	2200_1650
Waxbill, Black-faced	√				√							
Waxbill, Blue										√		
Waxbill, Common						√						
Waxbill, Violet-eared	√		√		√							
Weaver, Red-billed Buffalo		√ O			√					√		
Weaver, Scaly-feathered					√							
Weaver, Sociable										√		
Weaver, Southern Masked	√							√				
Wood Hoopoe, Violet					√ ?							
Wren-Warbler, Barred									√		√	
Subtotal	**42**	**35**	**11**	**5**	**41**	**32**	**3**	**12**	**30**	**37**	**14**	**13**
	65				**61**				**53**			
TOTAL	**66**				**65**				**61**			
	84											
	97											

*No nests known for vultures/eagles in the area (B Bean, B Galloway, A Delle Donne pers. comm. 2022)

2 Walked transects

Species	Jul 2022					Oct 2022							Nov 2022				
	1 26/7	2a* 27/7	3** 27/7	4 26/7	Tot	1 11/10	2a* 11/10	2b* 12/10	3** 11/10	4 12/10	5*** 12/10	Tot	1 29/11	2a* 29/11	3** 29/11	4 28/11	Tot
Barbet, Pied													1				1
Batis, Pririt													1				1
Brubru						1						1	1				1

Species	Jul 2022					Oct 2022							Nov 2022				
	1	**2a***	**3****	**4**	**Tot**	**1**	**2a***	**2b***	**3****	**4**	**5*****	**Tot**	**1**	**2a***	**3****	**4**	**Tot**
	26/7	**27/7**	**27/7**	**26/7**		**11/10**	**11/10**	**12/10**	**11/10**	**12/10**	**12/10**		**29/11**	**29/11**	**29/11**	**28/11**	
Camaroptera Grey-backed						1						1					
Dove, Ring-necked													1				1
Drongo, Fork-tailed													1				1
Eremomela, Yellow-bellied													1				1
Eagle, Martial	1				1												
Flycatcher, Marico	1				1												
Go-away-bird, Grey													2				2
Goshawk, Pale Chanting			1		1				1			1					
Lapwing, Crowned				2	2												
Parrot, Rüppell's		2			2												
Prinia, Black-chested	1				1								3				3
Sandgrouse, Double-banded				1 nest	1												
Scimitarbill, Common													1		2		3
Shrike, Crimson-breasted													2				2
Spurfowl, Red-billed							1					**1**					
Sunbird (unidentified)													**1**				**1**
Warbler, Chestnut-vented						1						**1**	**2**				**2**
Waxbill, Violet-eared	4				**4**												
Unidentified																**1**	**1**
Total birds/(species)	**7 (4)**	**2 (1)**	**1 (1)**	**3 (2)**	**13 (8)**	**3 (3)**	**1 (1)**	**0**	**1 (1)**	**0**	**0**	**5 (5)**	**17 (12)**	**0**	**2 (1)**	**1 (1)**	**20 (13)**
Total km	**0.5**	**0.7**	**1.0**	**0.7**	**2.9**	**0.5**	**0.7**	**0.7**	**1.1**	**0.7**	**0.5**	**4.2**	**0.5**	**0.7**	**1.0**	**0.7**	**2.9**
Birds/km					**4.5**							**1.2**					**6.9**

*Also existing 66 kV Ongeama-Okahandja power line survey (wooden five-pole);

**Also existing 66 kV Von Bach Booster 1-Osona power line survey (steel monopole)

***Also existing 22 kV power line between office and gate

3 Driven transects

Species	Jul 2022								Oct 2022									Nov 2022							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**Tot**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Tot**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**Tot**
Batis, Pririt																						1			1
Bee-eater, Swallow-tailed																			1			2			3
Brubru																		1				1			2
Cormorant, White-breasted			2					**2**																	
Dove, Ring-necked																						1			1
Drongo, Fork-tailed																		3	2			1			6
Egret, Cattle																		6							6
Goose, Egyptian	1							**1**										25							25
Goshawk, Pale Chanting	1							**1**	1	14							15	2							2
Guineafowl, Helmeted			25					**25**																	
Hawk-Eagle, African		1						**1**																	
Hornbill, African Grey																			**2**						**2**
Hornbill, Damara Red-billed																			2			4 *Hy			6
Hornbill, Monteiro's																						2			2
Hornbill, Yellow-billed		2						**2**		3							3			4					4
Korhaan, Red-crested										1	3						4								
Lapwing, Crowned							4	**4**							2		2							2	2
Lovebird, Rosy-faced																			2						2
Martin, Rock																		3							3

Species	Jul 2022								Oct 2022									Nov 2022							
	1	2	3	4	5	6	7	Tot	1	2	3	4	5	6	7	8	Tot	1	2	3	4	5	6	7	Tot
Owl, Southern White-faced													1				1					?			1
Pipit, African							1	**1**							1		1				1?				1
Roller, Lilac-breasted															1		1	2	1						3
Roller, Purple																		1							1
Scrub Robin, Karoo											1				1		2								
Shrike, Crimson-breasted																		2							2
Shrike, White-tailed		4			3		1	**8**																	
Sparrow, Great															2		2								
Sparrow-weaver, White-browed																		7	5						12
Spurfowl, Red-billed										2	1						3			1					1
Starling, Burchell's																			1						1
Starling, Cape																		1	1						2
Swallow, Greater Striped																		2							2
Swift, White-rumped																		1							1
Unidentified (small)																								1	1
Warbler, Chestnut-vented																			1						1
Total birds/(species)	**2 (2)**	**7 (3)**	**27 (2)**	**0**	**3 (1)**	**0**	**6 (2)**	**45 (9)**	**1**	**20**	**5**	**0**	**1 (1)**	**0**	**7 (5)**	**0**	**34 (10)**	**56 (13)**	**18 (10)**	**5 (2)**	**1 (1)**	**13 (8)**	**0**	**3 (2)**	**96 (28)**
Total km	**18.8**	**22.8**	**3.6**	**0.8**	**2.6**	**1.8**	**1.6**	**52.0**	**18.8**	**22.8**	**3.6**	**0.8**	**2.6**	**1.8**	**1.6**	**3.8**	**55.8**	**18.8**	**22.8**	**3.6**	**0.8**	**2.6**	**1.8**	**1.6**	**52.0**
Birds/km								**0.9**									**0.6**								**1.9**

Driven transects on study site (No. 3-6): supplemented by random walk-ins, at least ≤100 m inwards, at least ≤1/km

*Hy = possibly hybrid Damara and Red-billed Hornbill?

4 Counts: Focal point

Gross Barmen wetland (species & no.)

Species	27/7/22	10/10/22	11/22
Coot, Red-knobbed	2		
Cormorant, Reed	19	1	2
Cormorant, White-breasted	4		
Eagle, African Fish		1	
Duck, White-backed	14	10	21
Duck, White-faced Whistling			1
Egret, Intermediate (Yellow-billed)			1
Goose, Egyptian	4		
Grebe, Little	10	11	10
Heron, Striated	1		
Jacana, African	1		
Lapwing, Blacksmith	2	2	3
Moorhen	14	16	34
Plover, Three-banded	2	2	
Shelduck, South African	2		
TOTAL Birds (species)	**75 (12)**	**43 (7)**	**72 (7)**

5 Counts: Fixed point

Species	Jul 2022		Oct 2022			Nov 2022			
	1. G Barmen stream 28/7/22 (species & no.)	2. Windmill 26/7/22 (species)	1. *G Barmen stream 13/10/22 (species & no.)	2. Windmill 11/10/22 (species & no.)	3. Kudu Crossing 11/10/22 (species & no.)	1. *G Barmen stream 13/10/22 (species & no.)	2. Windmill 11/10/22 (species & no.)	3. Kudu Crossing 11/10/22 (species & no.)	4. T-junction east of study site (species & no.)
Barbet, Acacia Pied					1		1	1	
Batis, Pririt					1				
Bulbul, African Red-eyed		√							
Bunting, Golden-breasted	2								
Dove, Laughing			1						
Dove, Namaqua			5				1		
Dove, Ring-necked			1	1		1			1
Drongo, Fork-tailed	1								
Finch, Red-headed	2	√		5					
Flycatcher, Marico				1					
Go-away-bird, Grey	1		1	1		3	1		
Hornbill, African Grey			**1**						
Hornbill, Damara				**2**		**1**	**1 *Hy**		
Lapwing, Crowned							2		
Lapwing, Blacksmith	4		2						
Parrot, Rüppell's	2								
Plover, Three-banded	3								
Prinia, Black-chested		√	1	2	1	1			1
Quelea, Red-billed	2	√		31			50		
Scimitarbill, Common				3					
Scrub Robin, Karoo				1					
Shrike, Crimson-breasted						1			

Species	**Jul 2022**		**Oct 2022**			**Nov 2022**			
	1. G Barmen stream 28/7/22 (species & no.)	**2. Windmill 26/7/22 (species)**	**1. *G Barmen stream 13/10/22 (species & no.)**	**2. Windmill 11/10/22 (species & no.)**	**3. Kudu Crossing 11/10/22 (species & no.)**	**1. *G Barmen stream 13/10/22 (species & no.)**	**2. Windmill 11/10/22 (species & no.)**	**3. Kudu Crossing 11/10/22 (species & no.)**	**4. T-junction east of study site (species & no.)**
Sparrow, Southern Grey-headed		√		3					
Sparrow-Weaver, White-browed	2					1			
Spurfowl, Red-billed	**1**		**13**			**2**	**1**		
Starling, Burchell's	1		1						
Starling, Cape	3								
Swallow, Greater Striped						2	2		
Swallow, Lesser Striped			2						
Swift, African Palm			1						
Swift, White-rumped			2						
Thrush, Groundscraper				2					
Thrush, Short-toed Rock		√							
Tit (unidentified)	1								
Vulture (unidentified)							1		
Warbler, Chestnut-vented									2
Waxbill, Black-cheeked				1					
Waxbill, Violet-eared		√		2					
Weaver, Red-billed Buffalo				1					
Weaver, Sociable						1			
Weaver, Southern Masked		√							
Wood Hoopoe, Violet				1?					
Wren-warbler, Barred							1		
TOTAL Birds	**25**	**-**	**31**	**57**	**3**	**12**	**62**	**1**	**4**
TOTAL Species	**13**	**8**	**12**	**15**	**3**	**9**	**10**	**1**	**3**

*Practically dry October 2022 & November 2022; *Hy = possibly hybrid Damara and Red-billed Hornbill?

6 Localities of priority species, including incidental sightings

Common names	S	E	
Jul 2022			
Cormorant, White-breasted	22.09351	16.80708	River crossing (flying east)
Cormorant, White-breasted	22.109433	16.745794	Gross Barmen wetland
Eagle, Martial	22.09351	16.80708	River crossing
Goshawk Pale Chanting	22.108363	16.788161	5 MW gate
Goshawk, Pale Chanting	22.10186	16.80839	66 kV power line (S)
Goshawk, Pale Chanting	22.098994	16.817939	66 kV power line (22/7/22)
Goshawk, Pale Chanting	22.1044514	16.788064	66 kV power line (22/7/22)
Goshawk, Pale Chanting	22.110813	16.778911	220 kV power line (22/7/22)
Hawk-Eagle, African	22.11679	16.72523	D1972 road
Hornbill, Damara	22.116282	16.744425	G Barmen gate
Hornbill, Red-billed/Damara hybrid?	22.09667	16.79926	Freeway road
Hornbill, Yellow-billed*	22.12115	16.71295	D1972 road
Hornbill, Yellow-billed	22.083415	16.815185	Windmill
Hornbill, Yellow-billed	22.06651	16.803021	Freeway road?
Korhaan, Red-crested	22.10042	16.79492	Drive - freeway
Martin, Rock	22.108363	16.788161	5 MW gate: nest
Owl, Barn	22.083415	16.815185	Windmill: breeding
Parrot, Rüppell's	22.073038	16.798411	66 kV power line (N)
Parrot, Rüppell's	22.115799	16.736478	Fixed point GB stream
Sandgrouse, Double-banded	22.100968	16.789994	5 MW solar array, NW 2nd row
Shrike, White-tailed	22.10028	16.79286	Inside 5 MW fence
Shrike, White-tailed	22.08114	16.81359	Aloe Koppie
Shrike, White-tailed	22.11679	16.72523	D1972 road

Common names	S	E	
Shrike, White-tailed	22.115799	16.736478	Fixed point GB stream (22/7/22)
Spurfowl, Red-billed	22.083415	16.815185	Windmill
Spurfowl, Red-billed	22.115799	16.736478	Fixed point GB stream
Example of cavity nest	22.09013	16.80202	*Boscia* tree
*Not all Yellow-billed Hornbill localities are indicated			
Oct 2022			
Eagle, African Fish	22.108957	16.745599	Gross Barmen wetland
Hornbill, Damara	22.082797	16.814581	Windmill
Hornbill, Grey	22.109967	16.786102	Perched on power line
Hornbill, Grey	22.116073	16.735854	Gross Barmen stream
Goshawk, Pale Chanting	22.09618	16.82536	Perched on power line
Goshawk, Pale Chanting	22.106877	16.790932	Perched on power line
Korhaan, Red-crested	22.094338	16.804185	Freeway road
Korhaan, Red-crested	22.093808	16.807132	River
Owl, Southern White-faced	22.08256	16.81463	N of windmill
Parrot, Rüppell's	22.093249	16.806881	River
Scimitarbill, Common	22.082555	16.814845	N of windmill
Spurfowl, Red-billed	22.093737	16.807015	River
Spurfowl, Red-billed	22.07256	16.79853	Power line walk N
Spurfowl, Red-billed	22.116073	16.735854	Gross Barmen stream
Spurfowl, Red-billed	22.116073	16.735854	W of Gross Barmen stream
Wood Hoopoe, Violet	22.082555	16.814845	N of windmill
Nov 2022			
Goshawk, Pale Chanting	22.10004	16.81792	66 kV steel
Goshawk, Pale Chanting	22.10389	16.80509	66 kV steel

Common names	S	E	
Hornbill, African Grey	22.116073	16.735854	D Gross Barmen stream
Hornbill, Damara	22.153	16.576	T-junction D1972 road
Hornbill, Damara/Red-billed hybrid	22.08216	16.81437	Drive windmill to 66 kV N
Hornbill, Damara/Red-billed hybrid	22.06692	16.80237	Drive windmill to 66 kV N
Hornbill, Monteiro's	22.06692	16.80237	Drive windmill to 66 kV N
Hornbill, Yellow-billed	22.09862	16.79704	Freeway road
Hornbill, Yellow-billed	22.094825	16.802208	O Kudu crossing
Owl, Southern White-faced (pellets)	22.08256	16.81463	N of windmill
Spurfowl, Red-billed	22.093513	16.807023	G River
Spurfowl, Red-billed	22.082797	16.814581	I Windmill
Spurfowl, Red-billed	22.116073	16.735854	D Gross Barmen stream

CURRICULUM VITAE

STEPHAN BEZUIDENHOUT

Name of Consultant:	Stephan Bezuidenhout
Position / Profession:	Managing Member & Senior Environmental Practitioner
Date of Birth:	11 April 1989
Nationality:	Namibian
Email:	stephan@eccenvironmental.com
Website:	www.eccenvironmental.com
Contact:	+264 81 262 7872

TERTIARY EDUCATION:

University of Pretoria:	**2011 – 2012**	Postgraduate Degree in Environmental Management and Analysis
University of Stellenbosch:	**2007-2010**	Bachelor of Applied Science

Professional Associations:

- Environmental Assessment Professional Association of Namibia (EAPAN)
- FSC Environmental Chamber
- Namibia Chamber of Environment (NCE)
- Namibia Charcoal Association (NCA)
- Namibia Biomass Industry Group (N – BIG)

PROFILE:

ECC's proudly Namibian Principal leads the ECC team as the lead Environmental Practitioner with a strong and dedicated environmental background. Mr Bezuidenhout has leading practical experience in Identifying and applying legislative requirements to proposed projects. Identifying impacts and mitigations for projects within different sectors, including mining, energy, agriculture, and construction.

KEY AREAS OF EXPERTISE:

Environmental Management & Environmental (and social) Impact Assessments (EIAs) (ESIAs)	-	Compiling EIA Reports and EMPs Coordinate, and review specialist studies Review EIA reports Environmental Management Systems (EMS) Public Participation & Stakeholder Management
Agriculture and Ecology	-	Aftercare, rehabilitation & restoration methodology & implementation Forest Stewardship Council (FSC) implementation and compliance
Project Management	-	Management of teams through Southern Africa for various projects

LANGUAGES:

	Read	Write	Speak
English	Excellent	Excellent	Excellent
Afrikaans	Excellent	Excellent	Excellent

SUMMARY OF EXPERIENCE AND CAPABILITY:

Since 2010, Stephan has been working as an environmental assessment practitioner. Stephan has a strong ecological background and has gained more than ten years' experience in the environmental industry. As a lead practitioner, Stephan has successfully driven environmental impact assessments and compliance assessments within Southern Africa. His hands on and practical experience and knowledge of international standards, such as FSC, IFC and World Bank standards allows Stephan to advise his clients and teams constructively and effectively.

PROJECT EXPERIENCE

PROJECT	DATE	ROLE
Department of Water Engineering (working on a catchment management project for the Municipality of Stellenbosch)	2011 - 2012	Intern at Aurecon South Africa
375 km 26-inch natural gas installation for SASOL & ROMPCO Mozambique representing Worley Parsons (Pty) LTD. South Africa	2013 - 2015	Environmental Coordinator and Manager
Soil Remediation and Commissioning report of NGALA Camp for Isondlo Project Support (IPS) (Pty) Ltd Gauteng, South Africa	2015	Lead consultant and project manager
Abengoa Solar SA, Xina Solar One 200 MW CSP Trough Northern Cape, South Africa	2015 - 2017	Environmental Control Officer during construction phase
Abengoa Solar SA Paulputs CSP (Pty) Ltd. 150 MW CSP Trough Northern Cape, South Africa	2015 - 2017	Environmental Assessment Practitioner during EIA Process
Konkoonsies II PV Solar Energy Facility, On-site substation and a 132kV power line Northern Cape, South Africa	2015 - 2017	Environmental Assessment Practitioner during EIA process
Abengoa Solar SA, Kaxu Solar One 100MW Concentrating Solar Plants (CSP) Trough	2015 - 2017	Environmental Control Officer during commissioning and rehabilitation phases
Jumbo Charcoal FSC Group Scheme Management	2015 - 2020	Team member
Kunene Regional Counsel sustainable water supply Pipeline and Ancillary works	2017 - 2018	Lead Environmental Assessment Practitioner managing the EIA process (including stakeholder engagement, PPP and report review).
ESIA application for B2Gold Namibia 10.8 megawatt PV solar upgrade to the B2Gold Power Plant	2017 - 2018	Lead Environmental Assessment Practitioner managing the EIA process (including stakeholder engagement, PPP and report review).
Best Practice Guide: Environmental Principles for Mining in Namibia	2017 - 2019	Team member
EIA application for various exploration activities for Votorantim Metals Namibia Pty Ltd	2018 - Present	Lead Environmental Assessment Practitioner managing the EIA process (including stakeholder engagement,

		PPP and report review).
The FSC National Forest Stewardship Standard of Namibia	2018-2020	Part of the working group who compiled the National Standard for Forest Stewardship Council (FSC) in Namibia allowing for a higher rate of certification and improved compliance
ESIA application for Otjiwarongo Wastewater Treatment and Bulk Water Supply	2019	Lead Environmental Assessment Practitioner managing the EIA process (including stakeholder engagement, PPP and report review).
ESIA for the Wastewater Treatment facilities for Gondwanan Collection	2019	Lead Environmental Assessment Practitioner managing the EIA process (including stakeholder engagement, PPP and report review).
MAWF permit application for Water Abstraction and Discharge for Gondwanan Collection	2019	Lead Environmental Assessment Practitioner managing the EIA process (including stakeholder engagement, PPP and report review)
Development of the Erongo Rocks Adventure Lodgein the Erongo Region, Nakambale Adventure Lodgein the Oshana Region and Okavango River Adventure lodge in the Kavango Region, Namibia.	2019	Lead Environmental Assessment Practitioner managing the EIA process (including stakeholder engagement, PPP and report review)
Proposed Otjikoto agricultural project, Otjozondjupa Region, Namibia	2020	Lead Environmental Assessment Practitioner managing the EIA process (including stakeholder engagement, PPP and report review)
Construction of Paratus Telecommunication (Pty) Ltd base transceiver station and associated infrastructure in Swakopmund	2020	Lead Environmental Assessment Practitioner managing the EIA process (including stakeholder engagement, PPP and report review)
A pilot sustainable water supply project by means of desalination, powered by solar to supplement water supply for Walvis Bay, Namibia	2020	Lead Environmental Assessment Practitioner managing the EIA process (including stakeholder engagement, PPP and report review)
A charcoal & briquette processing and packaging facility in Otjiwarongo, Otjozundjupa Region, Namibia	2020	Lead Environmental Assessment Practitioner managing the EIA process (including stakeholder engagement, PPP and report review)
Proposed Mechanized Bush Thinning Operations and Construction of a Biomass Processing (Charcoal Burning Retort System), Storage and Packaging Plant on Farm Gai Kaisa No. 159, Otjozondjupa Region, Namibia	2020	Lead Environmental Assessment Practitioner managing the EIA process (including stakeholder engagement, PPP and report review)
Charcoal and briquette processing, packaging, and storage facility in outjo	2021	Lead Environmental Assessment Practitioner managing the EIA process (including stakeholder engagement, PPP and report review)
Engaged by Afritin Mining Namibia (Pty) Ltd to	2021	Lead Environmental Assessment

undertake the ESIA and Environmental Management Plan (EMP)		Practitioner managing the EIA process (including stakeholder engagement and PPP and report review)
Project Wings - engaged by Headspring Investments (Pty) Ltd to undertake the Environmental, Social and Impact Assessment and Environmental Management Plan	2021	Lead Environmental Assessment Practitioner managing the EIA process (including stakeholder engagement and PPP and report review)
Application for an Environmental Clearance Certificate for Twin Hills Gold Project	2021	Lead Environmental Assessment Practitioner managing the EIA process (including stakeholder engagement and PPP and report review)
Undertake an ESIA and an Environmental Management Plan (EMP) for the stage 2 expansion of the pilot tin processing plant on Mining Licence (ML) 134, held by Uis Tin Mining Company	2021	Lead Environmental Assessment Practitioner managing the EIA process (including stakeholder engagement and PPP and report review)

PUBLICATIONS

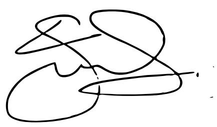
N.S., et al., Some ecological side-effects of chemical and physical bush clearing in a southern African rangeland ecosystem, Southern African Journal of Botany (2015), http://dx.doi.org/10.1016/j.sajb.2015.07.012

The FSC National Forest Stewardship Standard of Namibia (Draft V 4). Co-authored by S Bezuidenhout, P Cunningham, A Ashby, F Detering, W Enslin & D Honsbein

CERTIFICATION

I, the undersigned, certify that to the best of my knowledge and belief, these data correctly describe me, my qualifications, and experience.

DATE: 11/ 11 / 21



FULL NAME OF CONSULTANT

JACOBUS STEPHAN BEZUIDENHOUT

CURRICULUM VITAE

Diaan Hoffman

Name of Consultant:	Diaan Hoffman
Position / Profession:	Junior Ecologist and emerging Environmental Practitioner
Date of Birth:	19 May 1996
Nationality:	Namibian
Professional Memberships:	EAPAN No. 213
Email:	diaan@eccenvironmental.com
Website:	www.eccenvironmental.com
Contact:	+264 81 467 4294

QUALIFICATIONS:

University of Stellenbosch:	**2015 – 2018**	BSc Conservation Ecology

PROFILE:

Highly accomplished professional with experience as an environmental consultant. An out-the-box thinker, passionate about high-quality service in fast-paced environments. Excellent planning and execution ability, able to lead and collaborate with teams to deliver beyond expectations.

KEY AREAS OF EXPERTISE:

Environmental (and social) Impact Assessments (EIAs) (ESIAs)	-	Compiling EIA Reports and EMPs Public Participation & Stakeholder Management
Conservation		Small mammal sampling and parasite analysis. In-depth knowledge of biodiversity and Ecology.

LANGUAGES:

	Read	Write	Speak
English	Excellent	Excellent	Excellent
Afrikaans	Excellent	Excellent	Excellent

SUMMARY OF EXPERIENCE AND CAPABILITY:

Since 2019, Diaan has been working as an environmental assessment practitioner. In 2021 he started working as a junior ecologist assisting with the rangeland management and the FSC standard in Namibia. Diaan has a good biodiversity and ecology background.

PROJECT EXPERIENCE

PROJECT	DATE	ROLE
ENAEX EIA: Assisting with application for Environmental Clearance Certificate (ECC)	2019 - 2020	Team member
Bulk Mining Explosives: Updating EMP and application for renewal of ECC.	2019-2020	Team member
Sand Miners Association: Assisting with the writing of the EIA, EMP and creating of Maps	2019 - 2020	Team member
Okapana (TOTAL) Service Station CC: Conducting and assisting with the whole EIA process.	2019 - 2020	Team member
Walvis Bay Salt Refiners: Measuring Environmental Noise and assisting with the report writing.	2019-2020	Team member
Jumbo Charcoal FSC Group Scheme management.	2021 - Present	Team member
Jumbo Charcoal: writing of EMP	2021	Team member
EMCON: Creating Maps and Baseline sections for ESIA	2021	Team member
Nexus Charcoal: Conducting and assisting with the whole ESIA process.	2021	Team member
Etosha Charcoal: writing of EMP	2021	Team member
FSC Mapping and rangeland management	2021- Present	Team member
GIS Mapping: Using QGIS to produce maps for various projects.	2021-2022	Team member
Uis Afrititn EPLs: Conducting and assisting with the whole ESIA process.	2021	Team member
Paratus ESIA: Conducting and assisting with the whole ESIA process.	2021	Team member
Gmundner ESIA: Conducting and assisting with the whole ESIA process.	2021 -2022	Team member
!Uris Amendment: Conducting and assisting with the Amendment	2021 -2022	Team member
Maxwell 13 MW Solar plant ESIA: Conducting and assisting with the whole ESIA process.	2021-2022	Team member
Retort Charcoal Amendment: Conducting and assisting with the Amendment	2022	Team member
Retort Charcoal Compliance reports	2022	Team member
InnoSun 36 MW Solar plant ESIA: Conducting and assisting with the whole ESIA process.	2022-Present	Team member
Yucca Exploration ESIA: Conducting and assisting with the whole ESIA process.	2022-Pesent	Team member

CERTIFICATION:

I, the undersigned, certify that to the best of my knowledge and belief, these data correctly describe me, my qualifications, and experience.

DATE: 23/08/2022

____

Diaan Philip Hoffman

“Small herd of what appears to be Hartmann’s Mountain Zebra on 29/11/22, in the dry river to the east of the study site (22.097860S 16.808456E)”. Observed by African Conservation Services.