AVIFAUNAL IMPACT ASSESSMENT

Sunveld Solar PV Facility and BESS

Western Cape Province

February 2024

AfriAvian Environmental
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EXECUTIVE SUMMARY

The Applicant, Sunveld Energy (Pty) Ltd, is proposing the construction of a photovoltaic (PV), and Battery Energy Storage System (BESS) energy facility (known as Sunveld Solar PV Facility and BESS) located on the Remaining Extent of the Farm Kruispad 120, and Remaining Extent of the Farm Doornfontein A 118 situated approximately 7.5km East of Velddrif in the Western Cape Province.

The development area for the PV facility and associated infrastructure will be located on the following properties:

- Remaining Extent of the farm Kruispad 120
- Remaining Extent of the farm Doornfontein 118

A **Project Site** of approximately 2360 ha is being assessed as part of this Environmental Process and the infrastructure associated with the up to 600MW PV facility includes:

- PV modules and mounting structures;
- Inverters and transformers;
- Cabling;
- Battery Energy Storage System (BESS);
- Site and internal access roads;
- Auxiliary buildings (33 kV switch room, gatehouse and security, control centre, office, warehouse, canteen & visitors centre, staff lockers etc.);
- Perimeter fencing and security infrastructure;
- Rainwater tanks;
- Temporary and permanent laydown areas;
- Facility substation.
- Own-build grid connection solution, including on-site substations.

The total **Development Area** is **723 ha** including:

- PV **702ha**,
- BESS 29ha, within the 702ha of PV areas
- Two (2) On-Site Substations **9ha** and
- permanent auxiliary structures (buildings, lay-down areas, and access roads) **12ha**.
- (Mini Subs, Inverters and internal roads are distributed within the PV footprint)
- internal roads 4m wide total 23ha within the 702ha of PV areas

The Sunveld PV Solar Energy Facility (SEF) intends to connect to the National Grid via the existing Aurora Main Transmission Substation (MTS), located approximately 23km south of the proposed facility, by means of two 132kV conductor lines/power lines, capable of evacuating or exporting the electricity output of the 300MVA On-Site Substations.

It must be noted that this application only includes the IPP Portion of the EGI (i.e. the on-site substations) the remainder of the EGI (i.e. those components that will be transferred to Eskom – namely, the Eskom Side of the on-site substations and the Overhead power lines to the Aurora MTS) have been assessed as part of a separate Basic Assessment Process that will be administered by the Western Cape Department of Environmental |Affairs and Development Planning.

AVIFAUNA

The SABAP2 data indicates that a total of 259 bird species could potentially occur within the Broader Area where the Project Site is located – **Appendix 1** provides a comprehensive bird species list. Of these, 135 (52%) species are classified as priority species for solar developments and 20 of these are South African Red Listed species (i.e., Species of Conservation Concern – SCC). Of the 135 priority species, 85 are likely to occur regularly in or near the Project Site, and 33 priority species were recorded during the on-site surveys.

POTENTIAL IMPACTS

The following impacts relative to avifauna have been identified:

Construction Phase

- Displacement due to disturbance associated with the construction of the solar PV facility and associated infrastructure.

Operational Phase

- Displacement due to habitat transformation associated with the presence of the solar PV facility and associated infrastructure.
- Collisions with the solar panels.
- Entrapment and/or entanglement on the perimeter fences in the operational phase.
- Electrocutions at the on-site substations.

Decommissioning Phase

- Displacement due to disturbance associated with the decommissioning of the solar PV facility and associated infrastructure.

Below is a summary of the anticipated impacts of the SEF Project and its associated infrastructure pre- and post-mitigation:

Environmental Parameter	Impact	Significance Rating Pre-Mitigation	Significance Rating Post Mitigation
Avifauna	*Displacement of priority species due to disturbance associated with construction of the PV facility and associated infrastructure.*	High -	Low -
	Displacement due to habitat transformation associated with the presence of the solar PV facility and associated infrastructure	High -	Medium -
	Mortality of priority species due to collisions with solar panels.	Medium -	Low -
	Entanglement of birds in the perimeter fence	Medium -	Low -
	Mortality of priority species due to electrocution at the on-site substations	Medium -	Low -
	Displacement of priority species due to disturbance associated with decommissioning of the PV facility and associated infrastructure.	Medium -	Low -

ENVIRONMENTAL SENSITIVITIES

The Project Site and immediate environment is classified as **HIGH/MEDIUM** sensitivity for avifauna according to the Animal Species Theme. The sensitivity classification is linked to the possible occurrence of Southern Black Korhaan *Afrotis afra* (Globally and Regionally Vulnerable), Black Harrier *Circus maurus* (Globally and Regionally Endangered), African Marsh Harrier *Circus ranivorus* (Regionally Endangered), and Lanner Falcon (Regionally Vulnerable). The Project Site contains confirmed habitat for species of conservation concern (SCC) as defined in the Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial animal species (Government Gazette No 43855, 30 October 2020). SCCs are listed on the IUCN Red List of Threatened Species or South Africa's National Red List website as Critically Endangered, Endangered, Near Threatened or Vulnerable. The Project Site contains suitable habitat for Black Harriers.

The occurrence of SCC at the Project Site was confirmed during the SSV site visits (June and July 2023) with observations of Blue Crane *Grus paradisea* (Globally Vulnerable and Regionally Near Threatened) and Southern Black Korhaan recorded on-site. A Black Harrier was also observed on site on 07 September 2023. Based on the confirmed habitat and the field surveys, the classification of **HIGH** sensitivity for avifauna in the Screening Tool is supported.

The following specific environmental sensitivities have been identified from an avifaunal perspective:

- **Seasonal Pans & Wetlands: High Sensitivity (Solar Panel Exclusion Zones)**

The Project Site and the immediate environment contain drainage lines, pans, wetlands, and dams which are sources of surface water and habitat for a range of bird species. It is necessary to leave open space with no solar panels, for birds utilising this habitat. **The buffer zones as recommended by the Freshwater Specialist should be followed as it will also benefit the avifauna that use this habitat**.

- **Black Harrier Habitat: High Sensitivity (Solar Panel Exclusion Zones)**

The Project Site contains suitable habitat for Black Harrier (Globally and Regionally Endangered). These identified areas should be kept free of solar panels as far as possible to reduce the impacts of habitat loss and species displacement due to disturbance. **The PV 1 and PV 3 Development Areas encroach on the modelled Black Harrier Habitat (Figure 1). However, the PV Development Areas layout was placed in such a way as to minimise fragmentation of large tracts of suitable habitat on site and in the adjacent areas. Further, the solar PV 1 area has been reduced from 241 ha initially, to 51 ha to reduce the impact on Black Harrier habitat. The overall positioning also leaves open corridors of favourable habitat. Therefore, from an avifaunal perspective, the current level of encroachment is deemed acceptable.**

- **Jackal Buzzard Nest: High Sensitivity (Solar Panel Exclusion Zone)**

A 100m Solar Panel Exclusion Zone should be implemented and maintained around the Jackal Buzzard nest located within the Project Site to reduce the risk of species displacement due to disturbance and to reduce the risk of possible collisions with the solar panels.

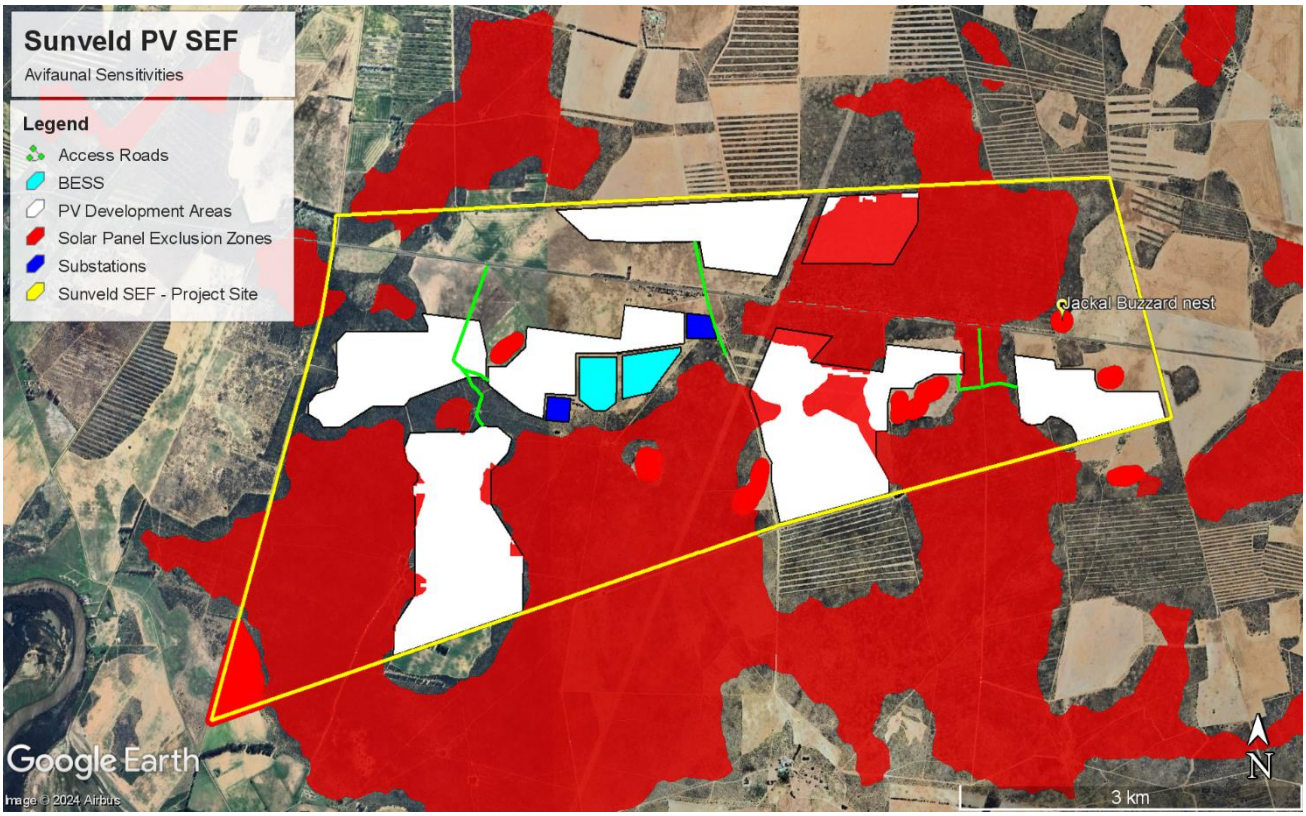

Figure 1: Avifaunal sensitivities identified at the Sunveld PV SEF Project Site. The Sensitive Avifaunal Areas include, suitable Black Harrier habitat, aquatic features, and a Jackal Buzzard nest.

CONCLUSION

The proposed 600 MW Sunveld PV SEF will have anticipated high, medium, and low negative impacts on priority avifauna, which is expected to be reduced to medium and low with appropriate mitigation measures. No fatal flaws were discovered during the investigations. It is recommended that the activity is authorised, on condition that the proposed **mitigation measures** as detailed in the Impact Tables (Section 9 of the report) and the EMPr (Appendix 4) are **strictly implemented**.

CONTENTS

DETAILS OF THE SPECIALISTS

Albert Froneman (Bird and GIS Specialist)

Albert is a registered Professional Natural Scientist with the South African Council of Natural Scientific Professionals (SACNASP) in the field of Zoology and has an M.Sc. in Conservation Biology from the University of Cape Town. He started his career in the natural sciences as a Geographic Information Systems (GIS) specialist at Council for Scientific and Industrial Research (CSIR). In 1998, he joined the Endangered Wildlife Trust where he headed up the Airports Company South Africa – EWT Strategic Partnership, a position he held until he resigned in 2008 to work as a private ornithological consultant. Albert's specialist field is the management of wildlife, especially bird related hazards at airports. His expertise is recognized internationally; in 2005 he was elected as Vice Chairman of the International Bird Strike Committee. Since 2010, Albert has worked closely with Chris van Rooyen in developing a protocol for pre-construction monitoring at wind energy facilities, and he is currently jointly coordinating pre-construction monitoring programmes at several wind farm facilities. Albert also works outside the electricity industry and had done a wide range of bird impact assessment studies associated with various residential and industrial developments.

Megan Loftie-Eaton (Bird Specialist and Ecologist)

Megan is a registered Professional Natural Scientist with the South African Council of Natural Scientific Professionals (SACNASP) in the field of Ecology, and she is a member of the Zoological Society of Southern Africa (ZSSA). Megan is also an Environmental Assessment Practitioner and assists with Environmental Impact Assessments (EIA's), Basic Assessments (BA's) and provides specialist input within the avifaunal and ecological fields. She obtained her BSc in Environmental & Conservation Sciences with distinction through the University of Alberta in Edmonton, Canada. After moving back to South Africa in 2011 she went on to complete her MSc in Zoology (2014) at the University of Cape Town, and her PhD in Biological Sciences (2018), looking at the impacts of bush encroachment on bird distributions in the savanna biome of South Africa. Megan has conducted avifaunal field surveys and has experience with conducting avifaunal impact assessments.

1. INTRODUCTION

The Applicant, Sunveld Energy (Pty) Ltd, is proposing the construction of a photovoltaic (PV), and Battery Energy Storage System (BESS) energy facility (known as Sunveld Solar PV Facility and BESS) located on the Remaining Extent of the Farm Kruispad 120, and Remaining Extent of the Farm Doornfontein A 118 situated approximately 7.5km East of Velddrif in the Western Cape Province.

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A study site of approximately 2360 ha is being assessed as part of this Environmental Process and the infrastructure associated with the up to 600MW PV facility includes:

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- permanent auxiliary structures (buildings, lay-down areas, and access roads) **12ha**.
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- internal roads 4m wide total 23ha within the 702ha of PV areas

The Sunveld Solar PV Facility intends to connect to the National Grid via the existing Aurora Main Transmission Substation (MTS), located approximately 23km south of the proposed facility, by means of two double circuit 132kV conductor lines/power lines, capable of evacuating or exporting the electricity output of both the 300MVA On-Site Substations.

The proposed connection will include an Electrical Grid Infrastructure (EGI) corridor for the two 132kV power lines, from the On-Site Substations to the Aurora MTS. It must be noted that this application only includes the IPP Portion of the EGI (i.e. the on-site substations) the remainder of the EGI (i.e. those components that will be transferred to Eskom – namely, the Eskom Side of the on-site substations and the Overhead power lines to the Aurora MTS) have been assessed as part of a separate Basic Assessment Process that will be administered by the Western Cape Department of Environmental |Affairs and Development Planning.

Please see **Figures 2 and 3** for a map of the proposed Project Site and Development Area of Sunveld PV SEF.

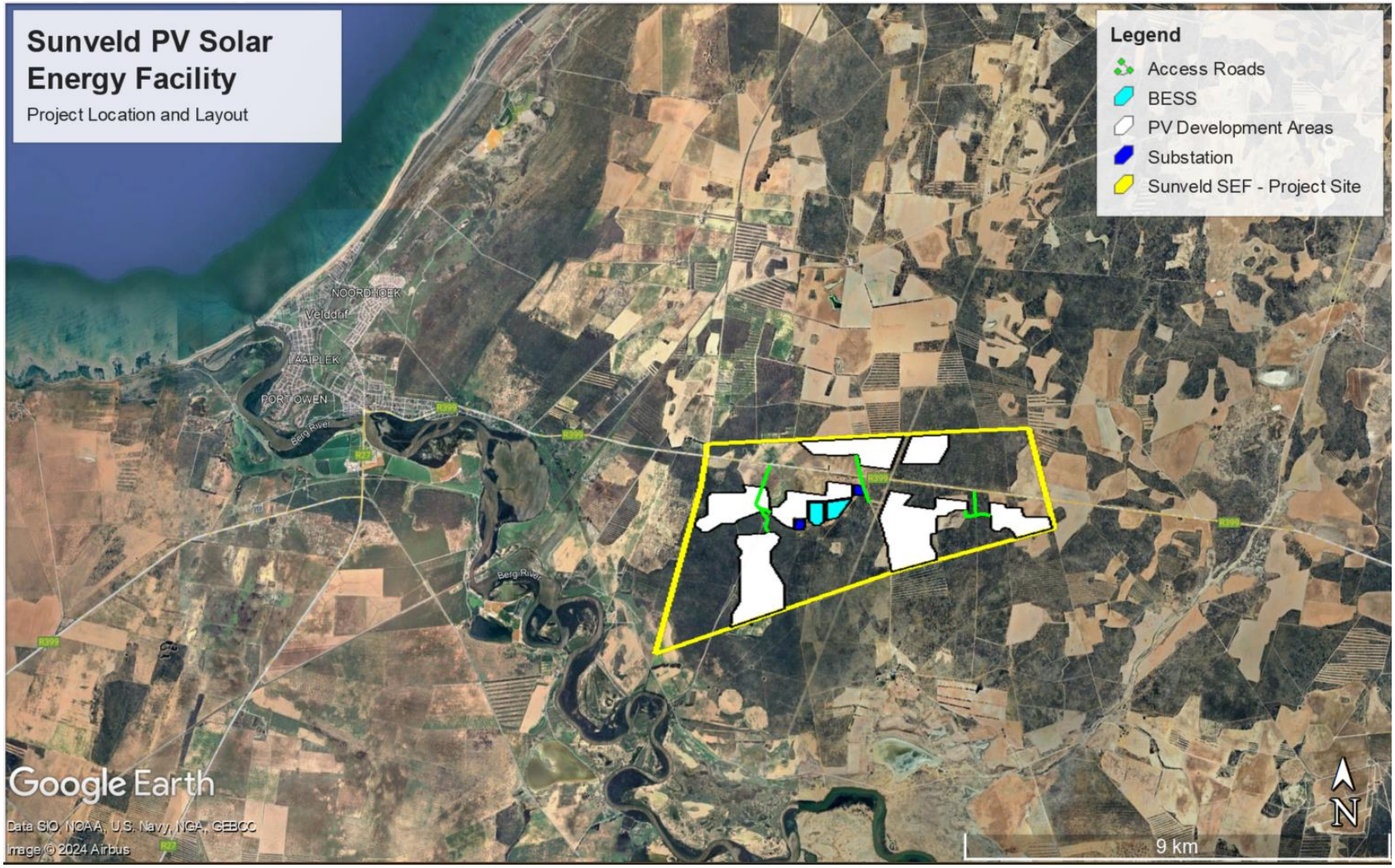

Figure 2: Locality map of the Project Site and Development Area of the proposed 600 MW Sunveld PV SEF.

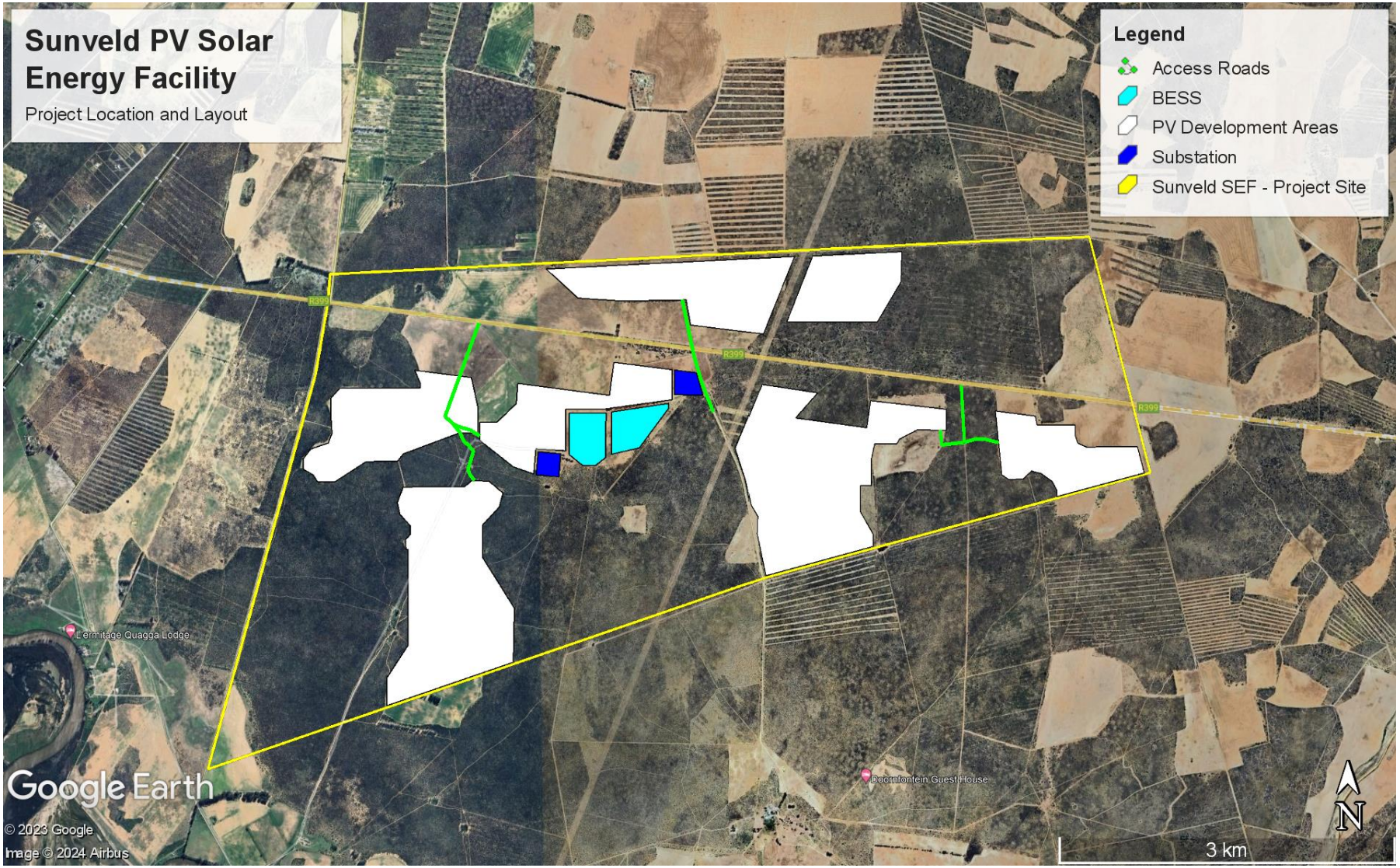

Figure 3: Close-up of the proposed 600 MW Sunveld PV SEF Project Site and Development Area (PV Array Areas).

2 SCOPE OF STUDY

The purpose of the specialist study is to determine the main issues and potential impacts of the proposed project on avifauna based on existing information and field assessments. The scope of the study is as follows:

- Describe the affected environment from an avifaunal perspective.
- Discuss gaps in baseline data and other limitations and describe the expected impacts associated with the solar facilities and associated infrastructure.
- Identify potential sensitive environments and receptors that may be impacted on by the proposed facility and the types of impacts (i.e., direct, indirect, and cumulative) that are most likely to occur.
- Determine the nature and extent of potential impacts during the construction, operational and decommissioning phases.
- Identify 'No-Go' areas, where applicable.
- Summarise the potential impacts of the SEF and its associated infrastructure.
- Recommend mitigation measures for inclusion in the Environmental Management Programme (EMPr) to reduce the expected impacts to acceptable levels.

3 OUTLINE OF METHODOLOGY AND INFORMATION REVIEWED

The following information sources were consulted to conduct this study:

- Bird distribution data from the Second Southern African Bird Atlas Project (SABAP2) was obtained (https://sabap2.birdmap.africa/) to ascertain which species occur in the pentads where the proposed Project is located. A pentad grid cell covers 5 minutes of latitude by 5 minutes of longitude (5' × 5'). Each pentad is approximately 9 × 8 km in size. To get a representative impression of the bird species in the area a consolidated dataset was obtained for a total of four (4) pentads some of which intersect and others that are near the Project Site, henceforth referred to as "**the Broader Area**". The four pentad grid cells are: 3245_1810, 3245_1815, 3250_1810 and 3250_1815. To date, a total of 1,234 full protocol checklists (i.e., intensive bird listing surveys lasting at least two hours each) and 622 ad hoc protocol lists (surveys lasting less than two hours but still yielding valuable data) have been completed for the four pentads where the Project Site is located.
- The SABAP2 data was regarded as a reliable reflection of the avifauna that occurs in the Broader Area, but the data was also supplemented with data collected during the on-site surveys and with general knowledge of the area.
- A classification of the vegetation types in the Project Site was obtained from the First Atlas of Southern African Birds (SABAP1) and the National Vegetation Map (2018) compiled by the South African National Biodiversity Institute (Mucina & Rutherford 2006).
- The national threatened status of all priority species was determined with the use of the most recent edition of the Red List Book of Birds of South Africa, Lesotho and Swaziland (Taylor *et al.* 2015), and the latest authoritative summary of southern African bird biology (Hockey *et al.* 2005).
- The global threatened status of all priority species was determined by consulting the latest (2023.1) IUCN Red List of Threatened Species (http://www.iucnredlist.org/).
- The Important Bird and Biodiversity Areas of South Africa (Marnewick *et al.* 2015; http://www.birdlife.org.za/conservation/important-bird-areas) was consulted for information on potentially relevant Important Bird Areas (IBAs).
- An intensive internet search was conducted to source information on the impacts of solar energy facilities on avifauna.
- Satellite imagery (Google Earth © 2023) was used to view the broader area on a landscape level and to help identify bird habitat on the ground.
- The South African National Biodiversity BGIS map viewer was used to determine the locality of the Project Site relative to National Protected Areas.

- The DFFE National Screening Tool was used to determine the assigned avian sensitivity of the Project Site.
- The following sources were consulted to determine the investigation protocol that is required for the site:
    - Procedures for the Assessment and Minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of NEMA when applying for Environmental Authorisation (Gazetted October 2020)
    - Guidelines for the Implementation of the Terrestrial Flora (3c) & Terrestrial Fauna (3d) Species Protocols for EIAs in South Africa produced by the South African National Biodiversity Institute on behalf of the Department of Environment, Forestry and Fisheries (2020).
    - The BirdLife South Africa (BLSA) Guidelines for assessing and monitoring the impact of solar power generating facilities on birds in southern Africa. BirdLife South Africa by Jenkins, A.R., Ralston-Paton, Smit- Robinson, A.H. 2017 (hereafter referred to as the Solar Guidelines) consulted to determine the level of survey effort that is required.
- A SSV survey was conducted on 23 June 2023. The Project Site was inspected with a 4x4 vehicle and on foot. All birds were recorded.
- Priority species were defined as follows:
    - South African Red Data species.
    - South African endemics and near-endemics.
    - Raptors
    - Waterbirds
- The main source of information on the avifaunal diversity and abundance at the Project Site is a pre-construction monitoring programme conducted in June, July, and November 2023, covering the Sunveld PV SEF Project Site, Development Areas, and immediate surroundings.

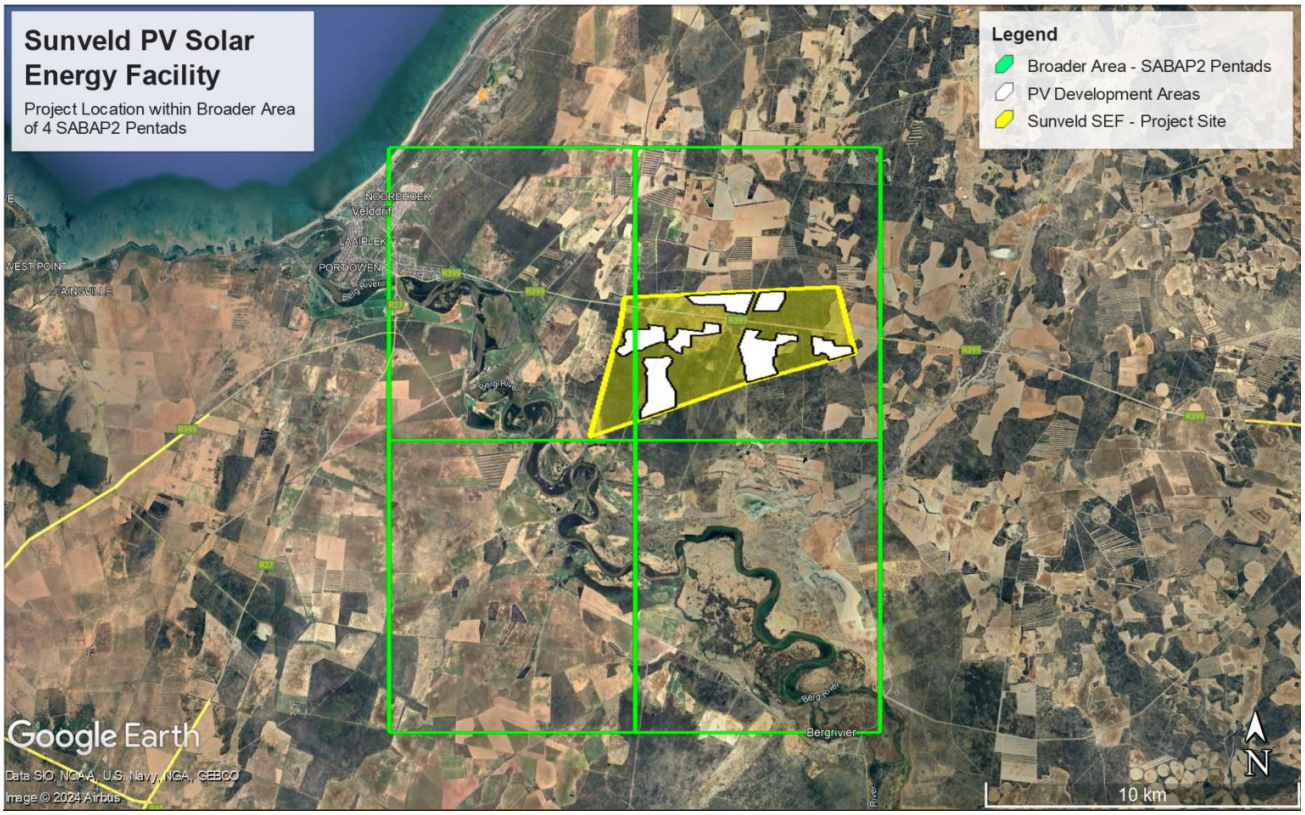

Figure 4: Area covered by the four SABAP2 pentads (Broader Area).

4 ASSUMPTIONS AND LIMITATIONS

This study assumed that the sources of information used in this report are reliable. In this respect, the following must be noted:

- The focus of the study is primarily on the potential impacts of the Project on solar priority species which were defined as follows:
  - South African Red List species
  - South African endemics and near-endemics
  - Waterbirds; and
  - Raptors
- The impact of solar installations on avifauna is a new field of study, with only one published scientific study on the impact of PV facilities on avifauna in South Africa (Visser *et al.* 2018). Strong reliance was therefore placed on expert opinion and data from existing monitoring programmes at solar facilities in the USA where monitoring has been ongoing since 2013. The pre-cautionary principle was applied throughout as the full extent of impacts on avifauna at solar facilities is not presently known.
- The assessment of impacts is based on the baseline environment as it currently exists in the project site.
- Conclusions in this study are based on experience of these and similar species in different parts of South Africa. Bird behaviour can never be entirely reduced to formulas that will be valid under all circumstances.
- The **Project Site** is the area (i.e., the land parcels) within which the Sunveld Solar PV Facility and BESS Development Area will be located (Remaining Extent of the Farm Kruispad 120 and Remaining Extent of the Farm Doornfontein A 118).
- The **Development Area (PV 1 to PV 7)** is the identified area of 723 ha demarcated within the Project Site for consideration in the EIA process where the Sunveld Solar PV Facility and BESS and associated infrastructure is planned to be located.
- The **Broader Area** refers to the area covered by the four (4) SABAP2 pentads within which the Development Area is located (**Figure 4**).

5 LEGISLATIVE CONTEXT

There is no legislation pertaining specifically to the impact of solar facilities and associated electrical infrastructure on avifauna.

5.1 Agreements and Conventions

Table 1 below lists agreements and conventions which South Africa is party to, and which is relevant to the conservation of avifauna[1].

[1] (BirdLife International (2022) Country profile: South Africa. Available from: http://www.birdlife.org/datazone/country/south_africa. Checked: 2022-04-02).

Table 1: Agreements and conventions which South Africa is party to, and which is relevant to the conservation of avifauna.

Convention Name	Description	Geographic Scope
African-Eurasian Waterbird Agreement (AEWA)	The Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA) is an intergovernmental treaty dedicated to the conservation of migratory waterbirds and their habitats across Africa, Europe, the Middle East, Central Asia, Greenland, and the Canadian Archipelago. Developed under the framework of the Convention on Migratory Species (CMS) and administered by the United Nations Environment Programme (UNEP), AEWA brings together countries and the wider international conservation community in an effort to establish coordinated conservation and management of migratory waterbirds throughout their entire migratory range.	Regional
Convention on Biological Diversity (CBD), Nairobi, 1992	The Convention on Biological Diversity (CBD) entered into force on 29 December 1993. It has 3 main objectives: The conservation of biological diversity The sustainable use of the components of biological diversity The fair and equitable sharing of the benefits arising out of the utilization of genetic resources.	Global
Convention on the Conservation of Migratory Species of Wild Animals, (CMS), Bonn, 1979	As an environmental treaty under the aegis of the United Nations Environment Programme, CMS provides a global platform for the conservation and sustainable use of migratory animals and their habitats. CMS brings together the States through which migratory animals pass, the Range States, and lays the legal foundation for internationally coordinated conservation measures throughout a migratory range.	Global
Convention on the International Trade in Endangered Species of Wild Flora and Fauna, (CITES), Washington DC, 1973	CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora) is an international agreement between governments. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival.	Global
Ramsar Convention on Wetlands of International Importance, Ramsar, 1971	The Convention on Wetlands, called the Ramsar Convention, is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.	Global
Memorandum of Understanding on the Conservation of Migratory Birds of Prey in Africa and Eurasia	The Signatories will aim to take co-ordinated measures to achieve and maintain the favourable conservation status of birds of prey throughout their range and to reverse their decline when and where appropriate.	Regional

5.2 National Legislation

5.2.1 Constitution of the Republic of South Africa, 1996

The Constitution of the Republic of South Africa provides in the Bill of Rights that: Everyone has the right –
(a) to an environment that is not harmful to their health or well-being; and

(b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that –
   (i) prevent pollution and ecological degradation;
   (ii) promote conservation; and
   (iii) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.

5.2.2 The National Environmental Management Act 107 of 1998 (NEMA)

The National Environmental Management Act 107 of 1998 (NEMA) creates the legislative framework for environmental protection in South Africa and is aimed at giving effect to the environmental right in the Constitution. It sets out a number of guiding principles that apply to the actions of all organs of state that may significantly affect the environment. Sustainable development (socially, environmentally, and economically) is one of the key principles, and internationally accepted principles of environmental management, such as the precautionary principle and the polluter pays principle, are also incorporated. NEMA also provides that a wide variety of listed developmental activities, which may significantly affect the environment, may be performed only after an environmental impact assessment has been done and authorization has been obtained from the relevant authority. Many of these listed activities can potentially have negative impacts on bird populations in a variety of ways. The clearance of natural vegetation, for instance, can lead to a loss of habitat and may depress prey populations, while erecting structures needed for generating and distributing energy, communication, and so forth can cause mortalities by collision or electrocution.

NEMA makes provision for the prescription of procedures for the assessment and minimum criteria for reporting on identified environmental themes (Sections 24(5)(a) and (h) and 44) when applying for environmental authorisation. The Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial animal species (Government Gazette No 43855, 30 October 2020 is applicable in the case of solar PV developments.

5.2.3 The National Environmental Management: Biodiversity Act 10 of 2004 (NEMBA) and the Threatened or Protected Species Regulations, February 2007 (TOPS Regulations)

The most prominent statute containing provisions directly aimed at the conservation of birds is the National Environmental Management: Biodiversity Act 10 of 2004 read with the Threatened or Protected Species Regulations, February 2007 (TOPS Regulations). Chapter 1 sets out the objectives of the Act, and they are aligned with the objectives of the Convention on Biological Diversity, which are the conservation of biodiversity, the sustainable use of its components, and the fair and equitable sharing of the benefits of the use of genetic resources. The Act also gives effect to CITES, the Ramsar Convention, and the Bonn Convention on Migratory Species of Wild Animals. The State is endowed with the trusteeship of biodiversity and has the responsibility to manage, conserve and sustain the biodiversity of South Africa.

5.3 Provincial Legislation

The Western Cape Nature Conservation Laws Amendment Act, 2000 – This statute provides for the amendment of various laws on nature conservation to transfer the administration of the provisions of those laws to the Western Cape Nature Conservation Board, which includes various regulations pertaining to wild animals, including avifauna.

6 BASELINE ASSESSMENT

6.1 Important Bird Areas

Important Bird and Biodiversity Areas are sites which hold significant populations of threatened, endemic or congregatory (i.e., species that gather in globally significant numbers at a particular site and at a particular time in their life cycle) bird species. IBAs form a network of sites within South Africa and around the world, identified to conserve global and local bird diversity.

The proposed Sunveld PV SEF Project is close to, and partly within, the Berg River Estuary Important Bird Area (IBA) (**Figure 5**).

The Berg River Estuary IBA is located 140 km north of Cape Town. The town of Laaiplek lies directly north of the river mouth, and 6 km upstream is the town of Velddrif. The Berg River forms one of only four perennial estuaries on the arid west coast of southern Africa. The IBA includes only the lower Berg River, but this system is reliant on the management of its catchment, which extends c. 160 km upstream from the river mouth to its source in the Franschhoek and Drakenstein mountains.

IBA trigger species

Globally Threatened species that occur in the IBA are Cape Cormorant, Crowned Cormorant, Lesser Flamingo, African Black Oystercatcher, Black Harrier, and Chestnut-banded Plover. Regionally Threatened species that occur in the IBA are Greater Flamingo, Great White Pelican, Caspian Tern, African Marsh Harrier, Lanner Falcon and Greater Painted-Snipe.

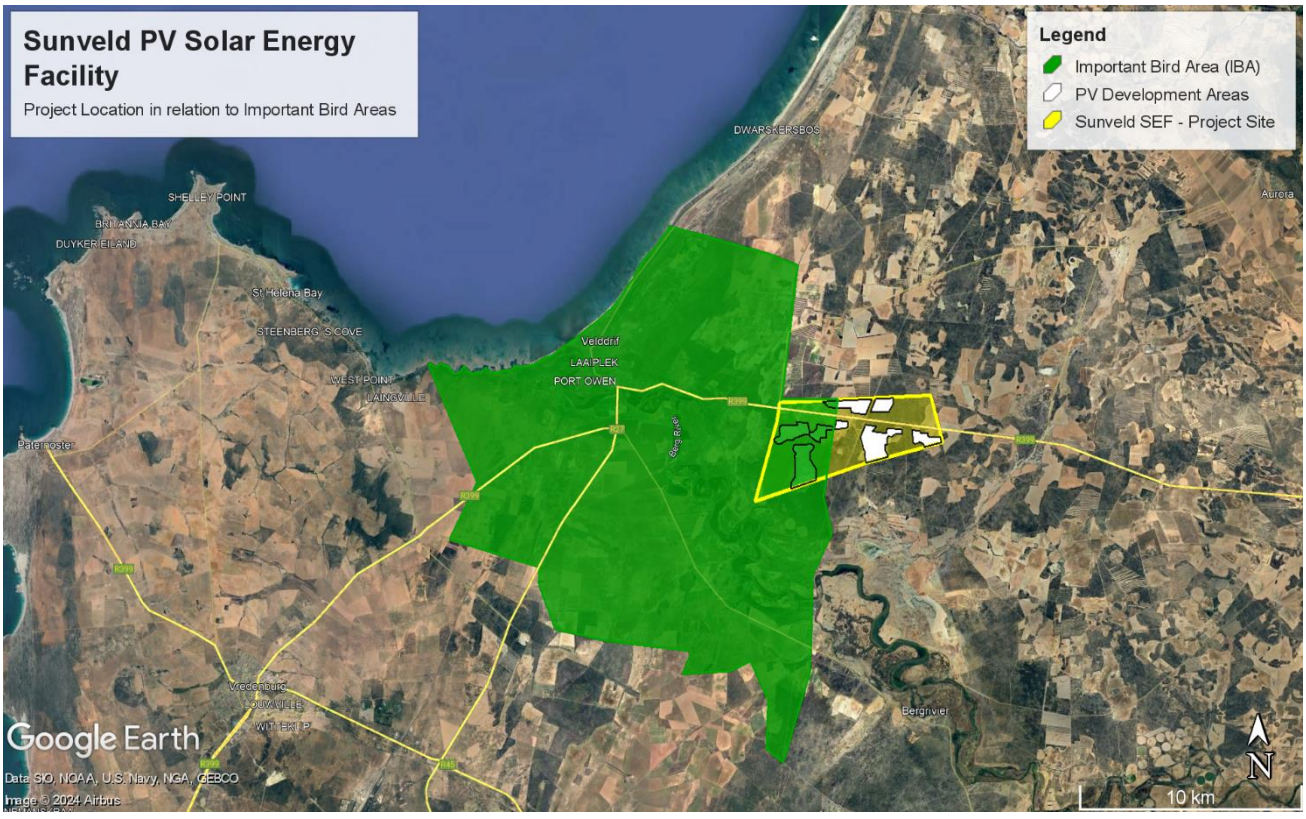

Figure 5: Location of the Berg River Estuary IBA in relation to the proposed Sunveld PV SEF Project.

6.2 DFFE National Screening Tool

The Project Site and immediate environment is classified as **HIGH/MEDIUM** sensitivity for avifauna according to the Animal Species Theme (**Figure 6**). The sensitivity classification is linked to the possible occurrence of Southern Black Korhaan *Afrotis afra* (Globally and Regionally Vulnerable), Black Harrier *Circus maurus* (Globally and Regionally Endangered), African Marsh Harrier *Circus ranivorus* (Regionally Endangered), and Lanner Falcon (Regionally Vulnerable). The Project Site contains confirmed habitat for species of conservation concern (SCC) as defined in the Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial animal species (Government Gazette No 43855, 30 October 2020). SCCs are listed on the IUCN Red List of Threatened Species or South Africa's National Red List website as Critically Endangered, Endangered, Near Threatened or Vulnerable. The Project Site contains suitable habitat for Black Harriers (**Figure 7**).

The occurrence of SCC at the Project Site was confirmed during the SSV site visits (June and July 2023) with observations of Blue Crane *Grus paradisea* (Globally Vulnerable and Regionally Near Threatened) and Southern Black Korhaan recorded on-site. A Black Harrier was also observed on site on 07 September 2023. Based on the confirmed habitat and the field surveys, the classification of **HIGH Sensitivity** for avifauna in the Screening Tool is supported.

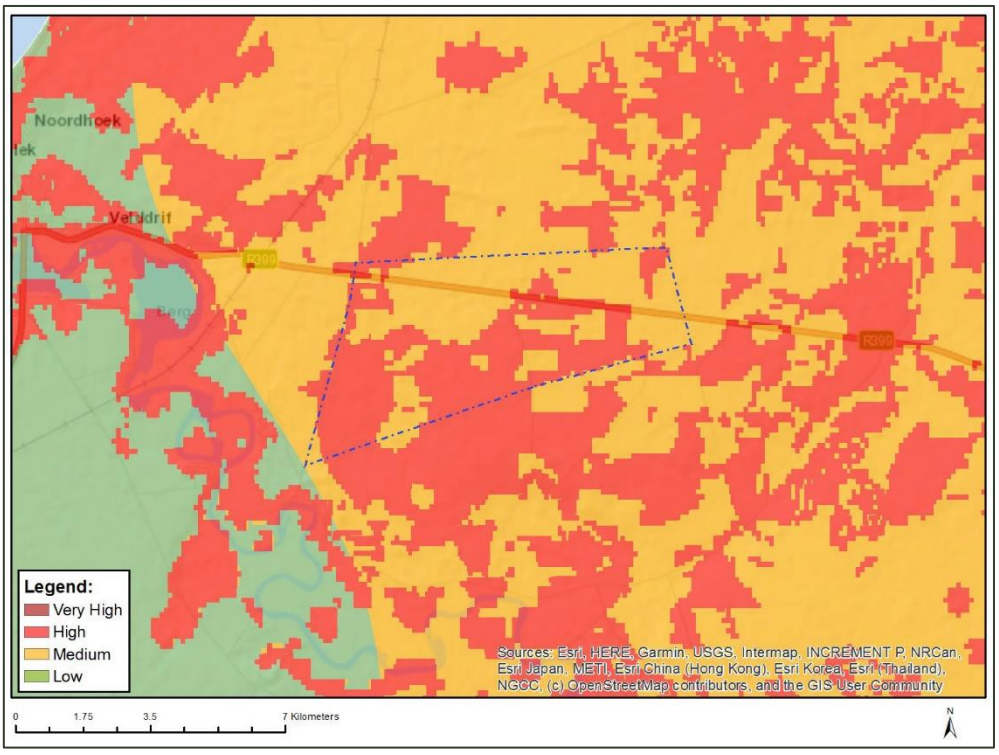

Figure 6: The classification of the Sunveld SEF Project Site according to the Animal Species Theme in the DFFE National Screening Tool. The High and Medium sensitivity classification is linked to the potential occurrence of Black Harrier (Globally and Regionally Endangered), Southern Black Korhaan (Globally and Regionally Vulnerable), Lanner Falcon (Regionally Vulnerable), and African Marsh Harrier (Regionally Endangered).

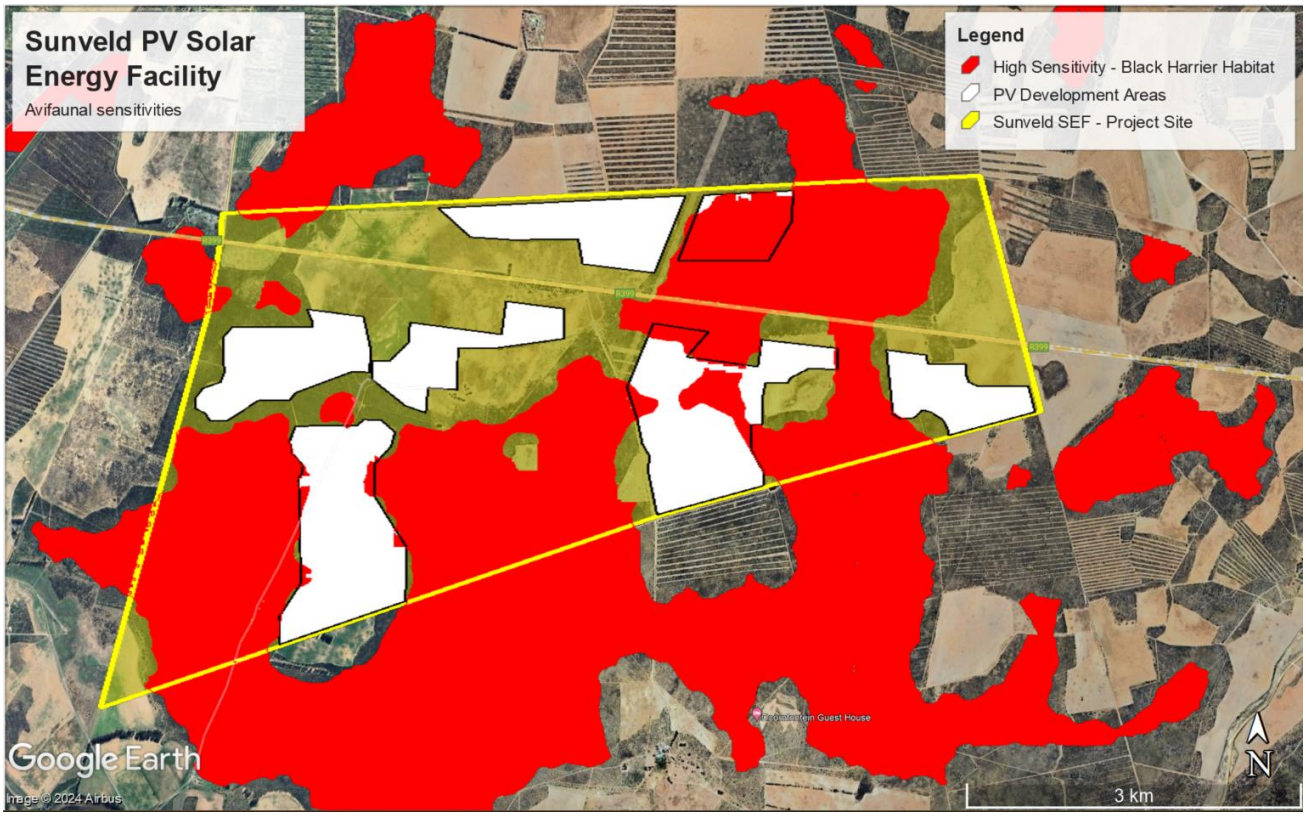

Figure 7: Avifaunal sensitivities (i.e., Black Harrier habitat identified through habitat suitability modelling) at the Sunveld SEF Project Site.

6.3 Protected Areas

According to the South African Protected Areas Database (SAPAD), the Project Site lies within the Cape West Coast Biosphere Reserve (**Figure 8**). There are also several areas identified as Critical Biodiversity Areas (CBAs) or Ecological Support Areas (ESAs) within the Project Site (**Figure 8**).

CBAs are defined as: areas in a natural condition that are required to meet biodiversity targets, for species, ecosystems or ecological processes and infrastructure. The objective of a CBA is to: maintain the area in a natural or near-natural state, with no further loss of natural habitat. Degraded areas should be rehabilitated. Only low-impact, biodiversity-sensitive land uses are appropriate.

ESAs are defined as: areas that are not essential for meeting biodiversity targets, but that play an important role in supporting the functioning of PAs or CBAs and are often vital for delivering ecosystem services. The objective of an ESA is to: maintain the area in a functional, near-natural state. Some habitat loss is acceptable, provided the underlying biodiversity objectives and ecological functioning are not compromised.

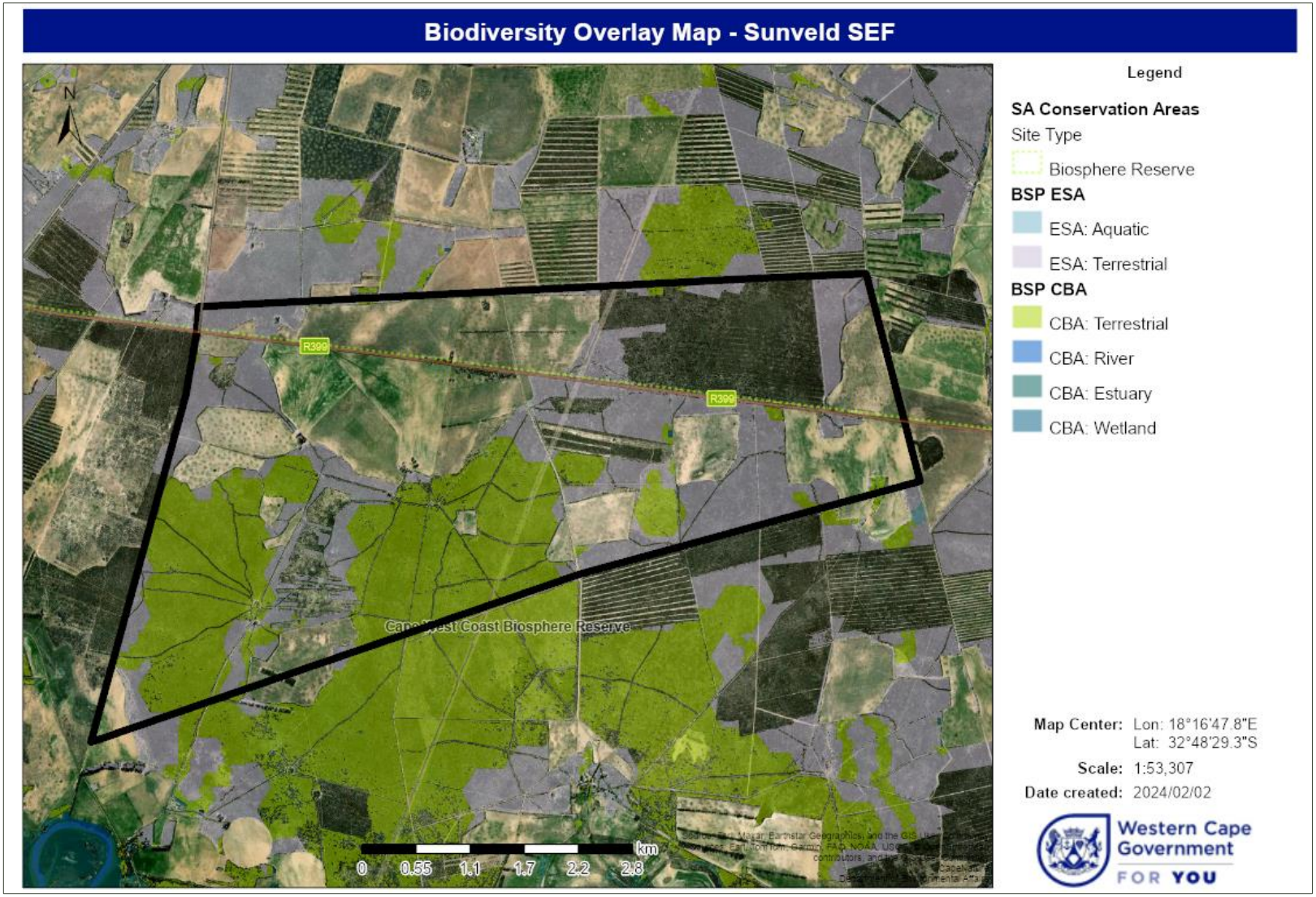

Figure 8: Protected areas, CBAs, and ESAs within and near the Sunveld PV SEF Project Site.

6.4 Biomes and Vegetation Types

The Project Site falls within the Fynbos Biome in the West Strandveld Bioregion (Mucina & Rutherford 2006, VegMap 2018). The terrain in the Project area and surrounds is mostly flat. Rainfall in the area varies from approximately 250 mm to 380 mm and falls almost exclusively in winter. The mean daily maximum and minimum temperatures are 26.6°C and 7.9°C for February and July, respectively. Fog and dew from the nearby Atlantic Ocean contribute to the moisture balance in summer and autumn. Strong southeasterly winds are typical of the summer period, and northerly winds are more frequent in the winter months, especially between May and August.

The main vegetation type within the Project Site is Saldanha Flats Strandveld (**Figure 9**). The Saldanha Flats Strandveld vegetation type is characterized by *Sclerophyllous* shrublands made up of a sparse emergent and moderately tall shrub layer, with an open succulent shrub layer forming the undergrowth. With conspicuous displays of geophytes and annual herbaceous flora in spring.

Whilst the distribution and abundance of the bird species in the project site are typical of the broad vegetation type, it is also necessary to examine bird habitats in more detail as it may influence the distribution and behaviour of priority species. These are discussed in more detail below. The following distinct habitat features from an avifaunal perspective are present in the Project Site:

- Saldanha Flats Strandveld
- Seasonal Pans & Wetlands
- High Voltage Power Lines
- Alien Tees
- Agriculture

The priority species most likely associated with the various bird habitat features are listed in **Table 2 (Section 7)**.

Figure 9: Saldanha Flats Strandveld vegetation at the Project Site.

6.5 Bird Habitat

6.5.1 Saldanha Flats Strandveld

As described above under Section 6.4.

6.5.2 Seasonal Pans & Wetlands

The Project Site lies just north (800m) and east (1.3 km) of the Berg River and its associated estuarine vegetation, salt marshes, reeds, and sedges. These areas provide important habitats for several bird species, especially waterbirds, and waders. The Project Site contains seasonal wetlands/pans that could potentially attract priority species, like waterbirds and the raptors that prey on them, to the area.

6.5.3 High Voltage Power Lines

The 400kV Aurora Juno 1 power line traverses the Project Site. Power lines could provide roosting and nesting habitat for priority species, especially raptors.

6.5.4 Alien Trees

The Project Site contains clumps of alien trees. The trees could attract a variety of bird species for nesting and roosting.

6.5.5 Agriculture

The Project Site contains agricultural fields, mainly canola, wheat, grains, and planted pastures. Some priority species are likely to be associated with the cultivated fields, especially to forage (e.g., raptors and small birds). The Cape Weaver, Large-billed Lark, Blue Crane, and Barn Swallow are some of the priority species that could utilise these areas.

See **Appendix 2 and 5** for a photographic record of the habitat features at the Project Site and immediate surroundings.

7 AVIFAUNA IN THE PROJECT AREA

7.1 Southern African Bird Atlas Project

The SABAP2 data indicates that a total of 259 bird species could potentially occur within the Broader Area where the Project Site is located – **Appendix 1** provides a comprehensive bird species list. Of these, 135 species are classified as priority species for solar developments and 20 of these are South African Red Listed species (i.e., Species of Conservation Concern – SCC). Of the 135 priority species, 85 are likely to occur regularly in or near the Project Site, and 33 priority species were recorded during the on-site surveys (**Table 2**).

Table 2 below lists all the priority species that are likely to occur regularly at or near the Project Site and the possible impact on the respective species by the proposed solar energy facility. The following abbreviations and acronyms are used:

- NT = Near threatened
- VU = Vulnerable
- EN = Endangered
- CR = Critically Endangered

Table 2: Priority species with a medium to high likelihood of regular occurrence at and/or near the Project Site along with their habitat preferences and the associated impacts of the SEF. Red Listed species highlighted in yellow.

Species Name	Scientific Name	SABAP2 Reporting Rate %		Global Conservation Status	Regional Conservation Status	Recorded During Monitoring	Likelihood Of Occurrence	Saldanha Flats Strandveld	Pans & Wetlands	HV Power Lines	Alien Trees	Agriculture	Collisions with Solar Panels	Displacement: Disturbance	Displacement: Habitat Transformation	Entanglement In Fences	Electrocution MV Lines & Substation	Collision MV Lines
		Full Protocol	Ad Hoc Protocol															
African Darter	*Anhinga rufa*	84,60	16,40	-	-		H		x				x					x
African Fish Eagle	*Haliaeetus vocifer*	42,54	3,54	-	-		H		x		x			x	x		x	
African Marsh Harrier	*Circus ranivorus*	38,65	4,34	-	EN		H	x	x					x	x		x	
African Rail	*Rallus caerulescens*	5,27	0,48	-	-		M		x				x					
African Sacred Ibis	*Threskiornis aethiopicus*	90,92	35,05	-	-	x	H		x		x	x	x				x	x
African Swamphen	*Porphyrio madagascariensis*	13,37	0,32	-	-		M		x				x					
Bar-tailed Godwit	*Limosa lapponica*	7,86	0,80	NT	LC		M		x				x					
Black Harrier	*Circus maurus*	6,56	0,16	EN	EN	x	M	x	x		x	x			x		x	
Black Sparrowhawk	*Accipiter melanoleucus*	6,40	0,16	-	-		M	x	x	x	x	x	x	x			x	
Black-headed Heron	*Ardea melanocephala*	50,24	6,27	-	-		H	x	x			x	x				x	x
Black-necked Grebe	*Podiceps nigricollis*	56,32	13,67	-	-		H		x				x					x
Blacksmith Lapwing	*Vanellus armatus*	88,49	21,22	-	-		H		x			x	x					
Black-winged Kite	*Elanus caeruleus*	57,29	7,88	-	-	x	H	x	x	x	x	x		x			x	
Black-winged Stilt	*Himantopus himantopus*	91,98	35,21	-	-		H		x				x					
Blue Crane	*Grus paradisea*	45,38	13,50	VU	NT	x	H	x	x			x	x	x	x	x		x

Species Name	Scientific Name	SABAP2 Reporting Rate %		Global Conservation Status	Regional Conservation Status	Recorded During Monitoring	Likelihood Of Occurrence	Saldanha Flats Strandveld	Pans & Wetlands	HV Power Lines	Alien Trees	Agriculture	Collisions with Solar Panels	Displacement: Disturbance	Displacement: Habitat Transformation	Entanglement In Fences	Electrocution MV Lines & Substation	Collision MV Lines
		Full Protocol	Ad Hoc Protocol															
Booted Eagle	*Hieraaetus pennatus*	6,32	1,29	-	-	x	M	x	x	x	x				x		x	
Cape Bulbul	*Pycnonotus capensis*	64,99	5,63	-	-	x	H	x			x		x		x			
Cape Clapper Lark	*Mirafra apiata*	0,81	0,00	-	-	x	M	x				x	x	x	x			
Cape Shoveler	*Spatula smithii*	54,54	5,14	-	-	x	H		x				x					x
Cape Spurfowl	*Pternistis capensis*	67,67	8,36	-	-	x	H	x				x		x	x			
Cape Teal	*Anas capensis*	83,06	22,03	-	-	x	H		x				x					x
Cape Weaver	*Ploceus capensis*	85,33	15,76	-	-	x	H	x			x		x		x			
Cape White-eye	*Zosterops virens*	59,56	4,66	-	-		H	x			x		x	x	x			
Caspian Tern	*Hydroprogne caspia*	77,55	15,76	-	VU		H		x									
Chestnut-banded Plover	*Charadrius pallidus*	57,54	9,16	-	NT		H		x				x					
Cloud Cisticola	*Cisticola textrix*	1,38	0,00	-	-	x	M	x				x	x	x				
Common Buzzard	*Buteo buteo*	23,26	3,86	-	-		H	x	x	x	x	x					x	
Common Greenshank	*Tringa nebularia*	59,89	10,13	-	-		M		x				x					
Common Moorhen	*Gallinula chloropus*	8,51	0,80	-	-		M		x				x					
Common Ringed Plover	*Charadrius hiaticula*	45,30	4,82	-	-		H		x				x					
Common Sandpiper	*Actitis hypoleucos*	30,63	3,70	-	-		H		x				x					
Curlew Sandpiper	*Calidris ferruginea*	57,54	8,04	NT	LC		H		x				x					

Species Name	Scientific Name	SABAP2 Reporting Rate %		Global Conservation Status	Regional Conservation Status	Recorded During Monitoring	Likelihood Of Occurrence	Saldanha Flats Strandveld	Pans & Wetlands	HV Power Lines	Alien Trees	Agriculture	Collisions with Solar Panels	Displacement: Disturbance	Displacement: Habitat Transformation	Entanglement In Fences	Electrocution MV Lines & Substation	Collision MV Lines
		Full Protocol	Ad Hoc Protocol															
Egyptian Goose	*Alopochen aegyptiaca*	74,72	19,77	-	-	x	H		x		x	x	x				x	x
Fiscal Flycatcher	*Melaenornis silens*	50,49	2,09	-	-	x	H	x				x	x	x	x			
Giant Kingfisher	*Megaceryle maxima*	5,67	0,64	-	-		M		x									
Glossy Ibis	*Plegadis falcinellus*	42,46	5,14	-	-		H		x				x					x
Goliath Heron	*Ardea goliath*	7,37	1,77	-	-		M		x				x					x
Great Crested Grebe	*Podiceps cristatus*	27,88	3,54	-	-		H		x				x					x
Great White Pelican	*Pelecanus onocrotalus*	81,69	13,18	-	VU		H		x				x					x
Greater Flamingo	*Phoenicopterus roseus*	89,63	45,34	-	NT		H		x				x					x
Grey Heron	*Ardea cinerea*	89,47	25,88	-	-		H		x				x					x
Grey Plover	*Pluvialis squatarola*	35,66	3,38	-	-		H		x				x					
Grey Tit	*Melaniparus afer*	8,67	0,00	-	-	x	M	x					x					
Grey-headed Gull	*Chroicocephalus cirrocephalus*	53,00	6,11	-	-		H		x									
Grey-winged Francolin	*Scleroptila afra*	0,41	0,00	-	-	x	M	x				x		x	x			
Hartlaub's Gull	*Chroicocephalus hartlaubii*	86,06	32,48	-	-	x	H		x									
Jackal Buzzard	*Buteo rufofuscus*	53,16	8,68	-	-	x	H	x	x	x	x	x		x	x		x	
Karoo Lark	*Calendulauda albescens*	3,57	0,32	-	-	x	M	x				x	x	x				
Karoo Prinia	*Prinia maculosa*	72,69	7,40	-	-	x	H	x					x	x	x			

Species Name	Scientific Name	SABAP2 Reporting Rate %		Global Conservation Status	Regional Conservation Status	Recorded During Monitoring	Likelihood Of Occurrence	Saldanha Flats Strandveld	Pans & Wetlands	HV Power Lines	Alien Trees	Agriculture	Collisions with Solar Panels	Displacement: Disturbance	Displacement: Habitat Transformation	Entanglement In Fences	Electrocution MV Lines & Substation	Collision MV Lines
		Full Protocol	Ad Hoc Protocol															
Karoo Thrush	*Turdus smithi*	12,72	0,00	-	-		M	x			x		x	x	x			
Kelp Gull	*Larus dominicanus*	90,84	38,26	-	-	x	H		x									
Kittlitz's Plover	*Charadrius pecuarius*	63,86	9,97	-	-		H		x				x					
Lanner Falcon	*Falco biarmicus*	8,02	2,09	-	VU	x	M	x	x	x	x	x	x	x			x	
Large-billed Lark	*Galerida magnirostris*	55,67	6,75	-	-	x	H	x				x	x	x				
Lesser Flamingo	*Phoeniconaias minor*	71,31	28,78	NT	NT		H		x				x					x
Little Egret	*Egretta garzetta*	86,06	19,77	-	-		H		x				x					x
Little Grebe	*Tachybaptus ruficollis*	55,19	8,52	-	-		H		x				x					x
Little Stint	*Calidris minuta*	56,73	9,49	-	-		H		x				x					
Malachite Kingfisher	*Corythornis cristatus*	16,45	1,61	-	-		M		x									
Marsh Sandpiper	*Tringa stagnatilis*	23,10	2,25	-	-		H		x				x					
Peregrine Falcon	*Falco peregrinus*	8,83	0,16	-	-		M		x	x	x	x			x		x	
Pied Avocet	*Recurvirostra avosetta*	67,75	18,81	-	-		H		x				x					
Pied Kingfisher	*Ceryle rudis*	86,79	19,77	-	-		H		x									
Pied Starling	*Lamprotornis bicolor*	55,59	11,41	-	-	x	H	x				x	x	x				
Purple Heron	*Ardea purpurea*	43,60	3,70	-	-		H		x				x					x
Red-billed Teal	*Anas erythrorhyncha*	11,83	1,93	-	-	x	M		x				x					x

Species Name	Scientific Name	SABAP2 Reporting Rate %		Global Conservation Status	Regional Conservation Status	Recorded During Monitoring	Likelihood Of Occurrence	Saldanha Flats Strandveld	Pans & Wetlands	HV Power Lines	Alien Trees	Agriculture	Collisions with Solar Panels	Displacement: Disturbance	Displacement: Habitat Transformation	Entanglement In Fences	Electrocution MV Lines & Substation	Collision MV Lines
		Full Protocol	Ad Hoc Protocol															
Red-knobbed Coot	*Fulica cristata*	45,87	3,54	-	-		H		x				x					x
Red-necked Phalarope	*Phalaropus lobatus*	30,47	6,11	-	-		H		x				x					
Reed Cormorant	*Microcarbo africanus*	84,20	12,22	-	-		H		x				x					x
Rock Kestrel	*Falco rupicolus*	54,30	6,27	-	-	x	H	x	x	x	x	x		x			x	
Ruff	*Calidris pugnax*	42,79	4,34	-	-		H		x				x					
Sickle-winged Chat	*Emarginata sinuata*	0,65	0,00	-	-	x	M	x					x	x	x			
South African Shelduck	*Tadorna cana*	53,65	4,66	-	-		H		x				x					x
Southern Black Korhaan	*Afrotis afra*	34,68	2,09	VU	VU	x	H	x				x	x	x	x	x		x
Southern Double-collared Sunbird	*Cinnyris chalybeus*	81,60	9,65	-	-	x	H	x					x	x	x			
Spotted Eagle-Owl	*Bubo africanus*	36,14	1,45	-	-		H	x			x	x	x	x		x	x	x
Spur-winged Goose	*Plectropterus gambensis*	49,35	5,14	-	-	x	H		x			x	x					x
Three-banded Plover	*Charadrius tricollaris*	46,76	4,34	-	-		H		x				x					
Water Thick-knee	*Burhinus vermiculatus*	5,92	0,64	-	-		M		x				x	x	x			
Western Barn Owl	*Tyto alba*	29,17	1,13	-	-		H	x			x	x					x	x
Western Cattle Egret	*Bubulcus ibis*	32,90	5,95	-	-	x	H	x	x		x	x	x				x	x
Western Osprey	*Pandion haliaetus*	11,99	1,93	-	-		M		x								x	
White-breasted Cormorant	*Phalacrocorax lucidus*	78,61	15,27	-	-		H		x				x					x

Species Name	Scientific Name	SABAP2 Reporting Rate %		Global Conservation Status	Regional Conservation Status	Recorded During Monitoring	Likelihood Of Occurrence	Saldanha Flats Strandveld	Pans & Wetlands	HV Power Lines	Alien Trees	Agriculture	Collisions with Solar Panels	Displacement: Disturbance	Displacement: Habitat Transformation	Entanglement In Fences	Electrocution MV Lines & Substation	Collision MV Lines
		Full Protocol	Ad Hoc Protocol															
White-fronted Plover	*Charadrius marginatus*	20,42	1,77	-	-		H		x				x					
White-winged Tern	*Chlidonias leucopterus*	9,97	0,32	-	-		M		x									
Yellow-billed Duck	*Anas undulata*	72,04	9,97	-	-	x	H		x				x					x
Yellow-billed Kite	*Milvus aegyptius*	49,92	14,95	-	-	x	H	x	x	x	x	x					x	

7.2 Pre-construction Surveys

Pre-construction avifaunal surveys were undertaken at the Sunveld PV SEF Project Site according to a Regime 2 monitoring protocol (i.e., a minimum of two surveys conducted over 6 months) in accordance with the BLSA guidelines for Solar PV developments. Surveys were undertaken on:

- 26 June, 4–11 July 2023 (Survey 1)
- 18–19 November 2023 (Survey 2)

The abundance of priority species (Index of kilometric abundance (IKA) = birds/km) recorded during the transect counts at the Project Site is displayed in **Figure 10**. The locations of priority species recorded at the proposed Sunveld PV SEF–3 sites during transect counts and incidental sightings are displayed in **Figure 11**. See **Appendix 3** for a description of the pre-construction monitoring that took place at the proposed Sunveld PV SEF Project Site.

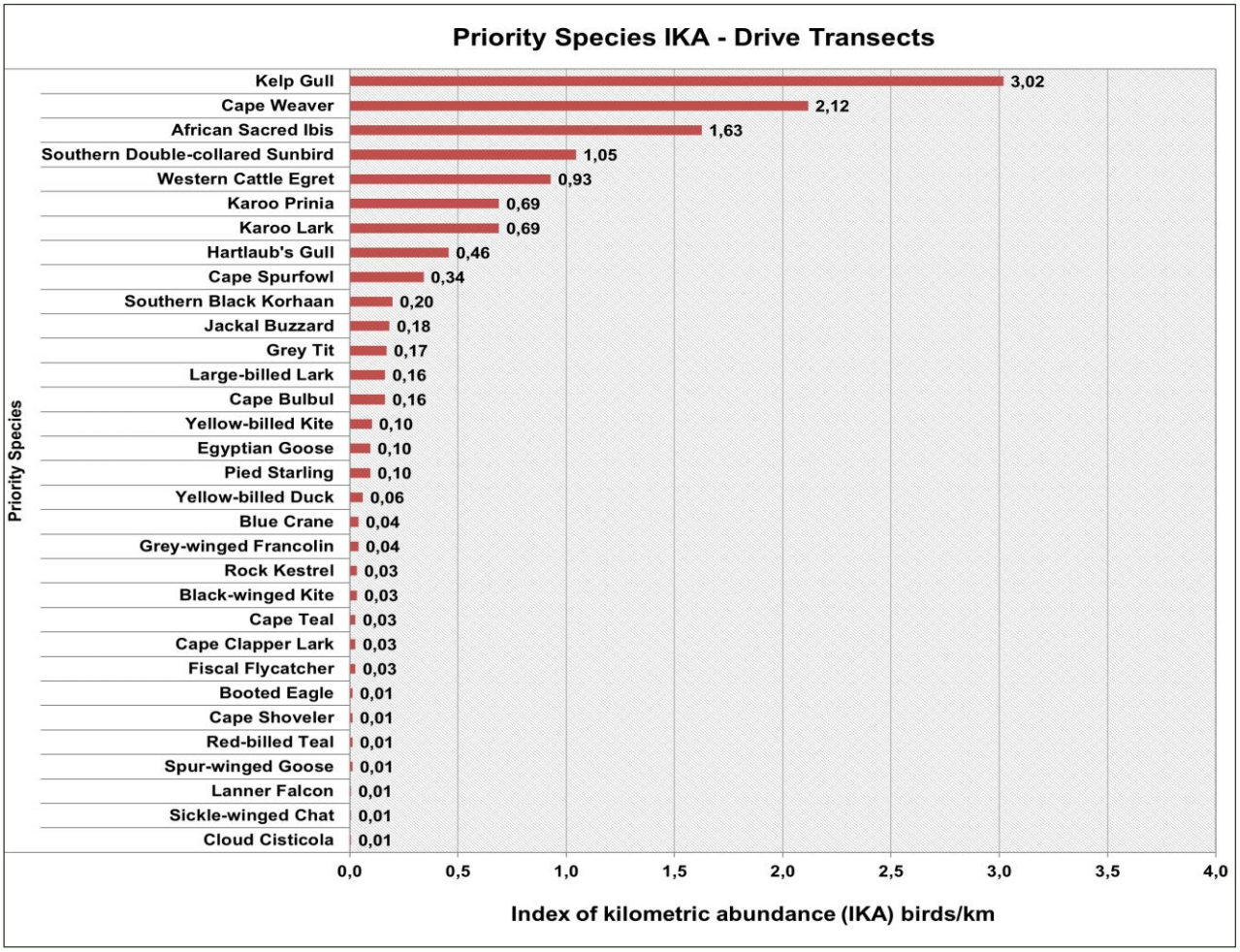

Figure 10: IKA for solar priority species recorded during drive transect counts at the Sunveld PV SEF site during two on-site surveys (July and November 2023).

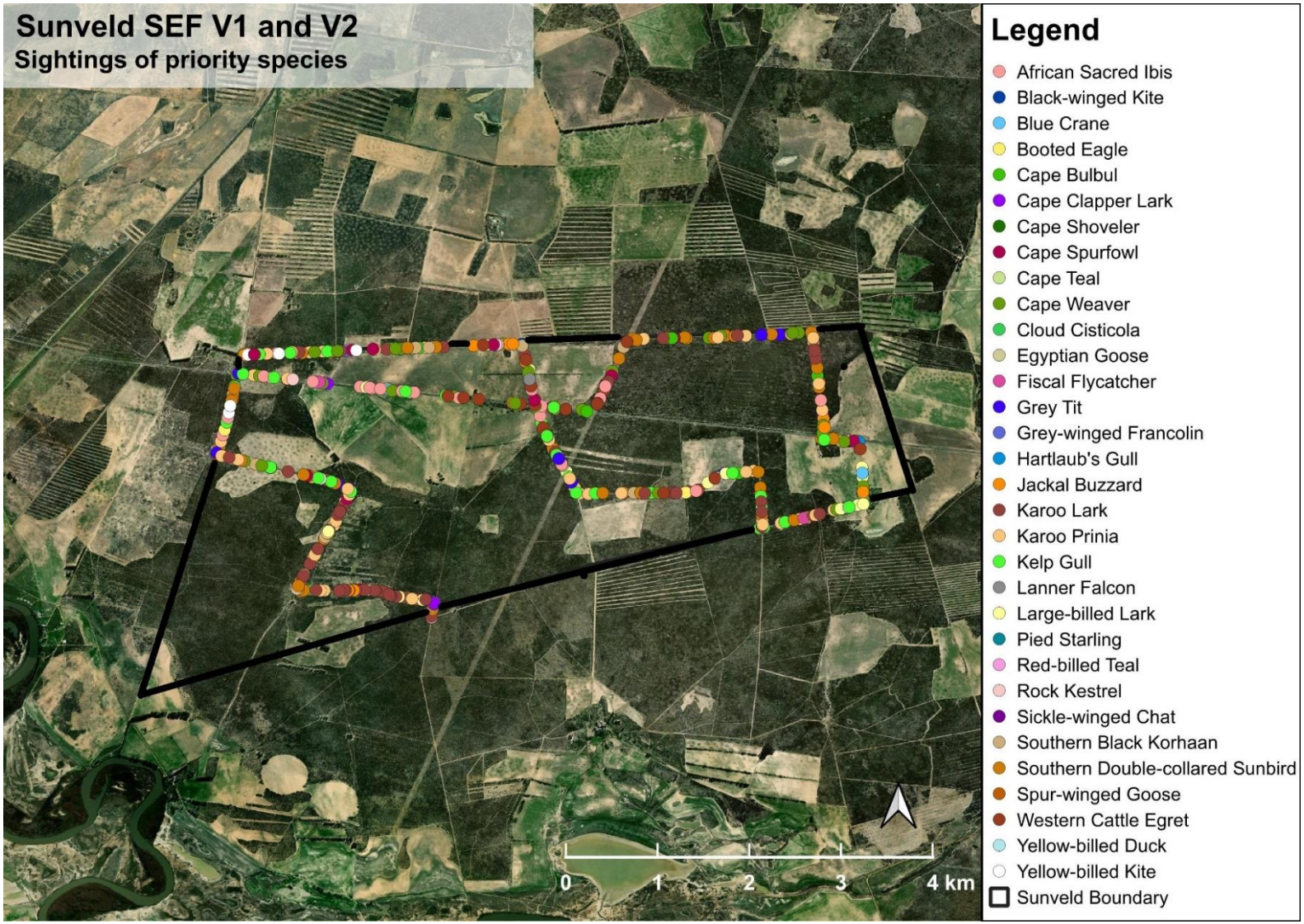

Figure 11: The locations of priority species recorded at the proposed Aberdeen SEFs 1–3 sites during transect counts and incidental sightings.

8 IMPACT ASSESSMENT

A literature review reveals a scarcity of published, scientifically examined information regarding large-scale PV plants and birds. The reason for this is mainly that large-scale PV plants are a relatively recent development. The main source of information for these types of impacts are from compliance reports and a few government-sponsored studies relating to recently constructed solar plants in the south-west United States. In South Africa, one published scientific study has been completed on the impacts of PV plants in a South African context (Visser *et al.* 2018).

In summary, the main impacts of PV plants on avifauna which have emerged so far include the following:

- Displacement due to disturbance associated with the construction of the solar PV plant and associated infrastructure
- Displacement due to habitat transformation associated with the construction of the solar PV plant and associated infrastructure
- Collisions with the solar panels
- Entrapment in perimeter fences

8.1 Introduction

Increasingly, human-induced climate change is recognized as a fundamental driver of biological processes and patterns. Historic climate change is known to have caused shifts in the geographic ranges of many plants and animals, and future climate change is expected to result in even greater redistributions of species (National Audubon Society 2015). In 2006 WWF Australia produced a report on the envisaged impact of climate change on birds worldwide (Wormworth, J. & Mallon, K. 2006). The report found that:

- Climate change now affects bird species' behaviour, ranges, and population dynamics;
- Some bird species are already experiencing strong negative impacts from climate change;
- In future, subject to greenhouse gas emissions levels and climatic response, climate change will put large numbers of bird species at risk of extinction, with estimates of extinction rates varying from 2 to 72%, depending on the region, climate scenario and potential for birds to shift to new habitat.

Using statistical models based on the North American Breeding Bird Survey and Audubon Christmas Bird Count datasets, the National Audubon Society assessed geographic range shifts through the end of the century for 588 North American bird species during both the summer and winter seasons under a range of future climate change scenarios (National Audubon Society 2015). Their analysis showed the following:

- 314 of 588 species modelled (53%) lose more than half of their current geographic range in all three modelled scenarios.
- For 126 species, loss occurs without accompanying range expansion.
- For 188 species, loss is coupled with the potential to colonize new areas.

Climate sensitivity is an important piece of information to incorporate into conservation planning and adaptive management strategies. The persistence of many birds will depend on their ability to colonize climatically suitable areas outside of current ranges and management actions that target climate change adaptation.

South Africa is among the world's top 10 developing countries required to significantly reduce their carbon emissions (Seymore *et al.* 2014), and the introduction of low-carbon technologies into the country's compliment of power generation will greatly assist with achieving this important objective (Walwyn & Brent 2015). Given that South Africa receives among the highest levels of solar radiation on earth (Fluri 2009; Munzhedi *et al.* 2009), it

is clear that solar power generation should feature prominently in future efforts to convert to a more sustainable energy mix in order to combat climate change, also from an avifaunal impact perspective. However, while the expansion of solar power generation is undoubtedly a positive development for avifauna in the longer term in that it will help reduce the effect of climate change and thus habitat transformation, it must also be acknowledged that renewable energy facilities, including solar PV facilities, in themselves have some potential for negative impacts on avifauna.

A literature review reveals a scarcity of published, scientifically examined information regarding large-scale PV plants and birds. The reason for this is mainly that large-scale PV plants are a relatively recent phenomenon. The main source of information for these types of impacts are from compliance reports and a few government-sponsored studies relating to recently constructed solar plants in the south-west United States. In South Africa, only one published scientific study has been completed on the impacts of PV plants in a South African context (Visser *et al.* 2018).

8.2 Impacts Associated with the SEF

8.2.1 Impact Trauma (Collisions with Solar Panels)

This impact refers to collision-related fatality i.e., fatality resulting from the direct contact of the bird with a project structure(s). This type of fatality has been occasionally documented at solar projects of all technology types (McCrary *et al.* 1986; Hernandez *et al.* 2014; Kagan *et al.* 2014). In some instances, the bird is not killed outright by the collision impact, but succumbs to predation later, as it cannot avoid predators due to its injured state.
Sheet glass used in commercial and residential buildings has been well established as a hazard for birds. When the sky is reflected in the sheet glass, birds fail to see the building as an obstacle and attempt to fly through the glass, mistaking it for empty space (Loss *et al.* 2014). Although very few cases have been reported it is possible that the reflective surfaces of solar panels could constitute a similar risk to avifauna.

An extremely rare but potentially related problem is the so-called “lake effect” i.e., it seems possible that reflections from solar facilities' infrastructure, particularly large sheets of dark blue photovoltaic panels, may attract birds in flight across the open desert, who mistake the broad reflective surfaces for water (Kagan *et al.* 2014)[2]. The unusually high percentage of waterbird mortalities at the Desert Sunlight PV facility (44% of recorded mortalities) may support the “lake effect” hypothesis (West 2014). Although in the case of Desert Sunlight, the proximity of evaporation ponds may act as an additional risk increasing factor, in that birds are both attracted to the water feature and habituated to the presence of an accessible aquatic environment in the area. This may translate into the misinterpretation of diffusely reflected sky or horizontal polarised light source as a body of water. However, due to limited data it would be premature to make any general conclusions about the influence of the lake effect or other factors that contribute to fatality of water-dependent birds. The activity and abundance of water-dependent species near solar facilities may depend on other site-specific or regional factors, such as the surrounding landscape (Walston *et al.* 2015). However, until such time that enough scientific evidence has been collected to discount the “lake effect” hypothesis, it must be considered as a potential source of impacts.

Weekly mortality searches at 20% coverage were conducted at the 250MW, 1300ha California Valley Solar Ranch PV site (Harvey & Associates 2014a and 2014b). According to the information that could be sourced from the internet (two quarterly reports), 152 avian mortalities were reported for the period 16 November 2013

[2] This could either result in birds colliding directly with the solar panels or getting stranded and unable to take off again because many aquatic bird species find it very difficult and sometimes impossible to take off from dry land e.g., grebes and cormorants. This exposes them to predation, even if they do not get injured through direct collisions with the panels.

– 15 February 2014, and 54 for the period 16 February 2014 – 15 May 2014, of which approximately 90% were based on feather spots which precluded a finding on the cause of death. These figures give an estimated unadjusted 1 030 mortalities per year, which is obviously an underestimate as it does not include adjustments for carcasses removed by scavengers and missed by searchers. The authors stated clearly that these quarterly reports do not include the results of searcher efficiency trials, carcass removal trials, or data analyses, nor does it include detailed discussions. In a report by the National Fish and Wildlife Forensic Laboratory (Kagan *et al.* 2014), the cause of avian mortalities was estimated based on opportunistic avian carcass collections at several solar facilities, including the 550MW, 1 600ha Desert Sunlight PV plant. Impact trauma emerged as the highest identifiable cause of avian mortality, but most mortality could not be traced to an identifiable cause.

Walston *et al.* (2015) conducted a comprehensive review of avian fatality data from large scale solar facilities (all technology types) in the USA. Collision as cause of death (19 birds) ranked second at Desert Sunlight PV plant and California Valley Solar Ranch (CVSR) PV plant, after unknown causes. Cause of death could not be determined for over 50% of the fatality observations and many carcasses included in these analyses consisted only of feather spots (feathers concentrated together in a small area) or partial carcasses, thus making determination of cause of death difficult. It is anticipated that some unknown fatalities were caused by predation or some other factor unrelated to the solar project. However, they found that the lack of systematic data collection and standardization was a major impediment in establishing the actual extent and causes of fatalities across all projects.

The only scientific investigation of potential avifaunal impacts that has been performed at a South African PV facility was completed in 2016 at the 96MW Jasper PV solar facility (28°17′53″S, 23°21′56″E) which is located on the Humansrus Farm, approximately 4 km south-east of Groenwater and 30km east of Postmasburg in the Northern Cape Province (Visser *et al.* 2019). The Jasper PV facility contains 325 360 solar panels over a footprint of 180 hectares with the capacity to deliver 180 000 MWh of renewable electricity annually. The solar panels face north at a fixed 20° angle, reaching a height of approximately 1.86 m relative to ground level with a distance of 3.11 m between successive rows of panels. Mortality surveys were conducted from the 14th of September 2015 until the 6th of December 2015, with a total of seven mortalities recorded among the solar panels which gives an average rate of 0.003 birds per hectare surveyed per month. All fatalities were inferred from feather spots. Extrapolated bird mortality within the solar field at the Jasper PV facility was 435 birds/yr (95% CI 133 - 805). The broad confidence intervals result from the small number of birds detected. The mortality estimate is likely conservative because detection probabilities were based on intact birds, and probably decrease for older carcasses and feather spots. The study concluded inter alia that the short study period, and lack of comparable results from other sources made it difficult to provide a meaningful assessment of avian mortality at PV facilities. It further stated that despite these limitations, the few bird fatalities that were recorded might suggest that there is no significant collision-related mortality at the study site. The conclusion was that to fully understand the risk of solar energy development on birds, further collation, and analysis of data from solar energy facilities across spatial and temporal scales, based on scientifically rigorous research designs, is required (Visser *et al.* 2018).

Kosciuch *et al.* (2020) analysed the results from fatality monitoring studies at 10 photovoltaic solar facilities across 13 site years in the Sonoran and Mojave Deserts Bird Conservation Region in California and Nevada in the USA. They found no evidence of mass mortality related to the lake effect despite the occurrence of water-obligate birds, which rely on water for take-off and landing, occurring at 90% (9/10) of site-years in the Sonoran and Mojave Deserts Bird Conservation Region. However, until such time that enough scientific evidence has been collected to discount the “lake effect” hypothesis completely, it must be considered as a potential source of impact.

The results of the available literature lack compelling evidence of collisions as a cause of large-scale mortality among birds at PV facilities. However, it is clear from this limited literature survey that the lack of systematic and standardised data collection is a major problem in the assessment of the causes and extent of avian

mortality at all types of solar facilities, regardless of the technology employed. Until statistically tested results emerge from existing compliance programmes and more dedicated scientific research, conclusions will inevitably be largely speculative and based on professional opinion.

Based on the lack of evidence to the contrary, it is not foreseen that collisions with the solar panels at the PV facility will be a significant impact. The priority species which would most likely be potentially affected by this impact are mostly small birds which forage between the solar panels, and possibly raptors which prey on them, or forage for insects and reptiles between the PV panels, e.g., Rock Kestrel (i.e., if they are not completely displaced due to the habitat transformation). Due to the absence of large permanent waterbodies at or close to the Development Area, it is unlikely that waterbirds will be attracted to the solar arrays due to the "lake effect".

Priority species with a medium to high probability of regular occurrence at the Project Site which could potentially be impacted due to collisions with the solar panels are the following:

Species name	***Scientific name***	**Full protocol**	**Ad hoc protocol**
African Darter	*Anhinga rufa*	84,60	16,40
African Rail	*Rallus caerulescens*	5,27	0,48
African Sacred Ibis	*Threskiornis aethiopicus*	90,92	35,05
African Swamphen	*Porphyrio madagascariensis*	13,37	0,32
Bar-tailed Godwit	*Limosa lapponica*	7,86	0,80
Black Sparrowhawk	*Accipiter melanoleucus*	6,40	0,16
Black-headed Heron	*Ardea melanocephala*	50,24	6,27
Black-necked Grebe	*Podiceps nigricollis*	56,32	13,67
Blacksmith Lapwing	*Vanellus armatus*	88,49	21,22
Black-winged Stilt	*Himantopus himantopus*	91,98	35,21
Blue Crane	*Grus paradisea*	45,38	13,50
Cape Bulbul	*Pycnonotus capensis*	64,99	5,63
Cape Clapper Lark	*Mirafra apiata*	0,81	0,00
Cape Shoveler	*Spatula smithii*	54,54	5,14
Cape Teal	*Anas capensis*	83,06	22,03
Cape Weaver	*Ploceus capensis*	85,33	15,76
Cape White-eye	*Zosterops virens*	59,56	4,66
Chestnut-banded Plover	*Charadrius pallidus*	57,54	9,16
Cloud Cisticola	*Cisticola textrix*	1,38	0,00
Common Greenshank	*Tringa nebularia*	59,89	10,13
Common Moorhen	*Gallinula chloropus*	8,51	0,80
Common Ringed Plover	*Charadrius hiaticula*	45,30	4,82
Common Sandpiper	*Actitis hypoleucos*	30,63	3,70
Curlew Sandpiper	*Calidris ferruginea*	57,54	8,04
Egyptian Goose	*Alopochen aegyptiaca*	74,72	19,77
Fiscal Flycatcher	*Melaenornis silens*	50,49	2,09
Glossy Ibis	*Plegadis falcinellus*	42,46	5,14
Goliath Heron	*Ardea goliath*	7,37	1,77
Great Crested Grebe	*Podiceps cristatus*	27,88	3,54
Great White Pelican	*Pelecanus onocrotalus*	81,69	13,18
Greater Flamingo	*Phoenicopterus roseus*	89,63	45,34

Species name	*Scientific name*	Full protocol	Ad hoc protocol
Grey Heron	*Ardea cinerea*	89,47	25,88
Grey Plover	*Pluvialis squatarola*	35,66	3,38
Grey Tit	*Melaniparus afer*	8,67	0,00
Karoo Lark	*Calendulauda albescens*	3,57	0,32
Karoo Prinia	*Prinia maculosa*	72,69	7,40
Karoo Thrush	*Turdus smithi*	12,72	0,00
Kittlitz's Plover	*Charadrius pecuarius*	63,86	9,97
Lanner Falcon	*Falco biarmicus*	8,02	2,09
Large-billed Lark	*Galerida magnirostris*	55,67	6,75
Lesser Flamingo	*Phoeniconaias minor*	71,31	28,78
Little Egret	*Egretta garzetta*	86,06	19,77
Little Grebe	*Tachybaptus ruficollis*	55,19	8,52
Little Stint	*Calidris minuta*	56,73	9,49
Marsh Sandpiper	*Tringa stagnatilis*	23,10	2,25
Pied Avocet	*Recurvirostra avosetta*	67,75	18,81
Pied Starling	*Lamprotornis bicolor*	55,59	11,41
Purple Heron	*Ardea purpurea*	43,60	3,70
Red-billed Teal	*Anas erythrorhyncha*	11,83	1,93
Red-knobbed Coot	*Fulica cristata*	45,87	3,54
Red-necked Phalarope	*Phalaropus lobatus*	30,47	6,11
Reed Cormorant	*Microcarbo africanus*	84,20	12,22
Ruff	*Calidris pugnax*	42,79	4,34
Sickle-winged Chat	*Emarginata sinuata*	0,65	0,00
South African Shelduck	*Tadorna cana*	53,65	4,66
Southern Black Korhaan	*Afrotis afra*	34,68	2,09
Southern Double-collared Sunbird	*Cinnyris chalybeus*	81,60	9,65
Spotted Eagle-Owl	*Bubo africanus*	36,14	1,45
Spur-winged Goose	*Plectropterus gambensis*	49,35	5,14
Three-banded Plover	*Charadrius tricollaris*	46,76	4,34
Water Thick-knee	*Burhinus vermiculatus*	5,92	0,64
Western Cattle Egret	*Bubulcus ibis*	32,90	5,95
White-breasted Cormorant	*Phalacrocorax lucidus*	78,61	15,27
White-fronted Plover	*Charadrius marginatus*	20,42	1,77
Yellow-billed Duck	*Anas undulata*	72,04	9,97

8.2.2 Entrapment and/or Entanglement in Fences

Visser *et al.* (2018) recorded a fence-line fatality (Orange River Francolin *Scleroptila gutturalis*) resulting from the bird being trapped between the inner and outer perimeter fence of the facility. This was further supported by observations of large-bodied birds unable to escape from between the two fences (e.g., Red-crested Korhaan *Lophotis ruficrista*) (Visser *et al.* 2018). Considering that one would expect the birds to be able to take off in the lengthwise direction (parallel to the fences), it seems possible that the birds panicked when they were approached by observers and thus flew into the fence.

Potentially, a too-close parallel configuration of double-fenced perimeters can cause fatalities, particularly of larger terrestrial birds, by way of entrapment, and especially if disturbed by people. This risk remains low, however, with Visser et al. (2019) tentatively presenting a fatality rate of 0.002 birds per km per month from this risk factor, although qualifying that the single documented fatality was inadequate for robust extrapolations. Owls and Secretarybirds are also prone to getting entangled in barbed wire fences (personal observation).

It is not foreseen that entrapment of solar priority species in perimeter fences will be a significant impact at the PV Facility. However, a single perimeter fence is recommended to reduce the risks of entrapment. To reduce the risks of entanglement, it is recommended that at least the top two barbed strands should be replaced with smooth wire and the spacing between at least the top two wires should be increased (to a minimum of 30cm). Ensuring that the wires are correctly tensioned will also reduce the entanglement risks. The solar priority species which could potentially be affected by this impact are most likely medium to large terrestrial species, and large owls. The impact is rated as low pre- and post- mitigation.

It is not foreseen that entrapment of priority species in perimeter fences will be a significant impact at the PV facility. The priority species which could potentially be affected by this impact are most likely medium to large terrestrial species such as bustards, korhaan and owls.

Priority species with a medium to high probability of regular occurrence at the Project Site which could potentially be impacted due entrapment/entanglement are the following:

Species name	***Scientific name***	**Full protocol**	**Ad hoc protocol**
Blue Crane	*Grus paradisea*	45,38	13,50
Cape Spurfowl	*Pternistis capensis*	67,67	8,36
Grey-winged Francolin	*Scleroptila afra*	0,41	0,00
Southern Black Korhaan	*Afrotis afra*	34,68	2,09
Spotted Eagle-Owl	*Bubo africanus*	36,14	1,45
Western Barn Owl	*Tyto alba*	29,17	1,13

8.2.3 Displacement Due to Habitat Transformation

Ground-disturbing activities affect a variety of processes, including soil density, water infiltration rate, vulnerability to erosion, secondary plant succession, invasion by exotic plant species, and stability of cryptobiotic soil crusts. These processes have the ability – individually and together – to alter habitat quality, often to the detriment of wildlife, including avifauna. Any disturbance and alteration to the desert landscape, including the construction and decommissioning of utility-scale solar energy facilities, has the potential to increase soil erosion. Erosion can physically and physiologically affect plant species and can thus adversely influence primary production and food availability for wildlife (Lovich & Ennen 2011).

Solar energy facilities require substantial site preparation (including the removal of vegetation) that alters topography and, thus, drainage patterns to divert the surface flow associated with rainfall away from facility infrastructure. Channelling runoff away from plant communities can have dramatic negative effects on water availability and habitat quality in arid areas. Areas deprived of runoff from sheet flow support less biomass of perennial and annual plants relative to adjacent areas with uninterrupted water-flow patterns (Lovich & Ennen 2011).

The activities listed below are typically associated with the construction and operation of solar facilities and could have direct impacts on avifauna through the transformation of habitat (County of Merced 2014):

- Preparation of solar panel areas for installation, including vegetation clearing, grading, cut and fill;
- Excavation/trenching for water pipelines, cables, fibre-optic lines, and the septic system;
- Construction of piers and building foundations;
- Construction of new dirt or gravel roads and improvement of existing roads;
- Temporary stockpiling and side-casting of soil, construction materials, or other construction wastes;
- Soil compaction, dust, and water runoff from construction sites;
- Degradation of water quality in drainages and other water bodies resulting from project runoff;
- Maintenance of fire breaks and roads; and
- Weed removal, brush clearing, and similar land management activities related to the ongoing operation of the project.

These activities could have an impact on birds breeding, foraging, and roosting in or in close proximity through transformation of habitat, which could result in temporary or permanent displacement.

In a study comparing the avifaunal habitat use in PV arrays with adjoining managed grassland at airports in the USA, DeVault *et al.* (2014) found that species diversity in PV arrays was reduced compared to the grasslands (37 vs 46), supporting the view that solar development is generally detrimental to wildlife on a local scale.

To identify functional and structural changes in bird communities in and around the development footprint, Visser *et al.* (2018) gathered bird transect data at the 180 hectares, 96MW Jasper PV solar facility in the Northern Cape, representing the solar development, boundary, and untransformed landscape. The study found both bird density and diversity per unit area was higher in the boundary and untransformed landscape, however, the extent therefore was not considered to be statistically significant. This indicates that the PV facility matrix is permeable to most species. However, key environmental features, including available habitat and vegetation quality are most likely the overriding factors influencing species' occurrence and their relative density within the development footprint. Her most significant finding was that the distribution of birds in the landscape changed, from a shrubland to open country and grassland bird community, in response to changes in the distribution and abundance of habitat resources such as food, water and nesting sites. These changes in resource availability patterns were detrimental to some bird species and beneficial to others. Shrubland specialists appeared to be negatively affected by the presence of the PV facility. In contrast, open country/grassland, and generalist species, were favoured by its development (Visser *et al.* 2018).

As far as displacement, either completely or partially (reduced densities) due to habitat loss is concerned, it is highly likely that the same pattern of reduced avifaunal densities will manifest itself at the proposed PV facility. In addition, ground nesting species, those that utilise low shrubs for nesting, and some raptors are also likely to be impacted by the habitat transformation, as it will result in reduced prey availability and accessibility.

Priority species with a medium to high probability of regular occurrence at the Project Site which could be negatively affected by displacement due to habitat loss are the following:

Species name	***Scientific name***	**Full protocol**	**Ad hoc protocol**
African Fish Eagle	*Haliaeetus vocifer*	42,54	3,54
African Marsh Harrier	*Circus ranivorus*	38,65	4,34
Black Harrier	*Circus maurus*	6,56	0,16
Blue Crane	*Grus paradisea*	45,38	13,50

Species name	*Scientific name*	Full protocol	Ad hoc protocol
Booted Eagle	*Hieraaetus pennatus*	6,32	1,29
Cape Bulbul	*Pycnonotus capensis*	64,99	5,63
Cape Clapper Lark	*Mirafra apiata*	0,81	0,00
Cape Spurfowl	*Pternistis capensis*	67,67	8,36
Cape Weaver	*Ploceus capensis*	85,33	15,76
Cape White-eye	*Zosterops virens*	59,56	4,66
Fiscal Flycatcher	*Melaenornis silens*	50,49	2,09
Grey-winged Francolin	*Scleroptila afra*	0,41	0,00
Jackal Buzzard	*Buteo rufofuscus*	53,16	8,68
Karoo Prinia	*Prinia maculosa*	72,69	7,40
Karoo Thrush	*Turdus smithi*	12,72	0,00
Peregrine Falcon	*Falco peregrinus*	8,83	0,16
Sickle-winged Chat	*Emarginata sinuata*	0,65	0,00
Southern Black Korhaan	*Afrotis afra*	34,68	2,09
Southern Double-collared Sunbird	*Cinnyris chalybeus*	81,60	9,65
Water Thick-knee	*Burhinus vermiculatus*	5,92	0,64

8.2.4 Displacement Due to Disturbance

As far as disturbance is concerned, it is likely that all the avifauna, including all the priority species, will be temporarily displaced in the footprint area, either completely or more likely partially (reduced densities) during the construction phase, due to the disturbance associated with the construction activities e.g., increased vehicle traffic, and short-term construction-related noise (from equipment) and visual disturbance.

At the PV facility, the priority species which would be most severely affected by disturbance would be raptors, ground nesting species, and those that utilise low shrubs for nesting.

Priority species with a medium to high probability of regular occurrence at the Project Site which could be negatively affected due to disturbance associated with the PV Facility include:

Species name	*Scientific name*	Full protocol	Ad hoc protocol
African Fish Eagle	*Haliaeetus vocifer*	42,54	3,54
African Marsh Harrier	*Circus ranivorus*	38,65	4,34
Black Sparrowhawk	*Accipiter melanoleucus*	6,40	0,16
Black-winged Kite	*Elanus caeruleus*	57,29	7,88
Blue Crane	*Grus paradisea*	45,38	13,50
Cape Clapper Lark	*Mirafra apiata*	0,81	0,00
Cape Spurfowl	*Pternistis capensis*	67,67	8,36
Cape White-eye	*Zosterops virens*	59,56	4,66
Cloud Cisticola	*Cisticola textrix*	1,38	0,00
Fiscal Flycatcher	*Melaenornis silens*	50,49	2,09
Grey-winged Francolin	*Scleroptila afra*	0,41	0,00
Jackal Buzzard	*Buteo rufofuscus*	53,16	8,68

Species name	*Scientific name*	Full protocol	Ad hoc protocol
Karoo Lark	*Calendulauda albescens*	3,57	0,32
Karoo Prinia	*Prinia maculosa*	72,69	7,40
Karoo Thrush	*Turdus smithi*	12,72	0,00
Lanner Falcon	*Falco biarmicus*	8,02	2,09
Large-billed Lark	*Galerida magnirostris*	55,67	6,75
Pied Starling	*Lamprotornis bicolor*	55,59	11,41
Rock Kestrel	*Falco rupicolus*	54,30	6,27
Sickle-winged Chat	*Emarginata sinuata*	0,65	0,00
Southern Black Korhaan	*Afrotis afra*	34,68	2,09
Southern Double-collared Sunbird	*Cinnyris chalybeus*	81,60	9,65
Spotted Eagle-Owl	*Bubo africanus*	36,14	1,45
Water Thick-knee	*Burhinus vermiculatus*	5,92	0,64

8.3 Impacts Associated with the On-site Substation & Internal Medium Voltage Network

8.3.1 Electrocution of priority species in the substation yards

Medium voltage electricity poles could potentially pose an electrocution risk to raptors. Electrocution refers to the scenario where a bird is perched or attempts to perch on the electrical structure and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components (van Rooyen 2000). The electrocution risk is largely determined by the design of the electrical hardware. **In the case of the proposed Sunveld PV SEF all 33kV lines will be placed underground therefore they pose no risk to avifauna in terms of electrocutions or collisions.**

Electrocutions within the proposed substations are possible, however, the likelihood of this impact on the more sensitive Red List priority species is remote, as these species are unlikely to regularly utilise the infrastructure within the substation yard for perching or roosting. The hardware within the proposed substation yard is too complex to warrant any mitigation for electrocution at this stage. It is recommended that if on-going impacts are recorded once operational, site-specific mitigation (insulation) be applied reactively. This is an acceptable approach because Red List priority species are unlikely to frequent the substation and be electrocuted.

Priority species with a medium to high probability of regular occurrence at the Project Site which could be at risk of electrocution in the substations are the following:

Species name	*Scientific name*	Full protocol	Ad hoc protocol
African Fish Eagle	*Haliaeetus vocifer*	42,54	3,54
African Marsh Harrier	*Circus ranivorus*	38,65	4,34
African Sacred Ibis	*Threskiornis aethiopicus*	90,92	35,05
Black Harrier	*Circus maurus*	6,56	0,16
Black Sparrowhawk	*Accipiter melanoleucus*	6,40	0,16
Black-headed Heron	*Ardea melanocephala*	50,24	6,27
Black-winged Kite	*Elanus caeruleus*	57,29	7,88
Booted Eagle	*Hieraaetus pennatus*	6,32	1,29
Common Buzzard	*Buteo buteo*	23,26	3,86

Species name	*Scientific name*	Full protocol	Ad hoc protocol
Egyptian Goose	*Alopochen aegyptiaca*	74,72	19,77
Jackal Buzzard	*Buteo rufofuscus*	53,16	8,68
Lanner Falcon	*Falco biarmicus*	8,02	2,09
Peregrine Falcon	*Falco peregrinus*	8,83	0,16
Rock Kestrel	*Falco rupicolus*	54,30	6,27
Spotted Eagle-Owl	*Bubo africanus*	36,14	1,45
Western Barn Owl	*Tyto alba*	29,17	1,13
Western Cattle Egret	*Bubulcus ibis*	32,90	5,95
Western Osprey	*Pandion haliaetus*	11,99	1,93
Yellow-billed Kite	*Milvus aegyptius*	49,92	14,95

9. IMPACT ASSESSMENT RATINGS

9.1 Construction Phase

The tables below summarise the potential impacts on avifauna of the proposed Sunveld PV SEF Project. Please refer to **Appendix 5** for the Impact Rating Methodology.

Table 3: Displacement of priority species due to disturbance associated with construction of the PV plant and associated infrastructure – Impact Rating.

Issue	Displacement of priority species	
Description of impact		
Displacement of priority species due to disturbance associated with construction of the PV plant and associated infrastructure		
Type of impact	Direct	
Nature of impact	Negative	
Phases	Construction	
CRITERIA	**WITHOUT MITIGATION**	**WITH MITIGATION**
Intensity	High	Medium
Duration	Short term	Short term
Extent	Whole site and nearby surroundings	Part of site/property
Consequence	Medium	Low
Probability	High	High
Significance	**Medium -**	**Low -**
Degree to which impact can be reversed	Reversable. If mitigation measures are strictly implemented.	
Degree to which impact may cause irreplaceable loss of resources	Medium	

Degree to which impact can be mitigated	Medium to High	
Mitigation Actions		
• The buffer zones as recommended by the Freshwater Specialist should be followed. In addition, water troughs (if any) located within the PV footprint should be relocated outside the project area to ensure the continued availability of this water source to avifauna. • Activity should as far as possible be restricted to the footprint of the infrastructure. • Measures to control noise and dust should be applied according to current best practice in the industry. • The construction of new roads should be kept to a minimum as far as practical and maximum use should be made of existing access roads. • Access to the rest of the property must be restricted. • The recommendations of the Ecological and Botanical specialist studies must be strictly implemented, especially as far as limitation of the construction footprint is concerned		
Monitoring		
The following monitoring is recommended:	None	
Cumulative Impacts		
Nature of cumulative impacts	Displacement of avifauna due to disturbance associated with the construction of the Sunveld PV SEF Project will be a feature of all other proposed renewable energy projects within a 30km radius around the Sunveld PV SEF Project. There are 15 approved renewable energy projects within the 30km radius.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium -	Low -

9.2 Operational Phase

Table 4: Displacement of priority species due to habitat transformation associated with construction of the PV plant and associated infrastructure – Impact Rating.

Issue	**Displacement of priority species**	
Description of impact		
Displacement of priority species due to habitat transformation associated with construction of the PV plant and associated infrastructure		
Type of impact	Direct	
Nature of impact	Negative	
Phases	Construction	
CRITERIA	**WITHOUT MITIGATION**	**WITH MITIGATION**
Intensity	High	High
Duration	Long term	Long term
Extent	Local area	Whole site
Consequence	High	Medium
Probability	High	High
Significance	**High -**	**Medium -**

Degree to which impact can be reversed	Partially reversable. If mitigation measures are strictly implemented.	
Degree to which impact may cause irreplaceable loss of resources	High	
Degree to which impact can be mitigated	Medium	
Mitigation Actions		
• The construction of new roads should be kept to a minimum as far as practical and maximum use should be made of existing access roads. • Access to the rest of the property must be restricted. • The recommendations of the Ecological and Botanical specialist studies must be strictly implemented, especially as far as limitation of the construction footprint is concerned.		
Monitoring		
The following monitoring is recommended:	None	
Cumulative Impacts		
Nature of cumulative impacts	Displacement of avifauna due to habitat transformation associated with the presence of the Sunveld PV SEF Project will be a feature of all other proposed renewable energy projects within a 30km radius around the Sunveld PV SEF Project. There are 15 approved renewable energy projects within the 30km radius.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	High -	Medium -

Table 5: Mortality of priority species due to collisions with the solar panels – Impact Rating.

Issue	**Mortality of priority species**	
Description of impact		
Mortality of priority species due to collisions with the solar panels		
Type of impact	Direct	
Nature of impact	Negative	
Phases	Operational	
CRITERIA	**WITHOUT MITIGATION**	**WITH MITIGATION**
Intensity	Low	Low
Duration	Long term	Long term
Extent	Local area	Local area
Consequence	Low	Low
Probability	Possible	Possible
Significance	**Low -**	**Low -**

Issue	Mortality of priority species	
Degree to which impact can be reversed	Low	
Degree to which impact may cause irreplaceable loss of resources	High	
Degree to which impact can be mitigated	Very low	
Mitigation Actions		
No mitigation is required due to the low significance of this impact.		
Monitoring		
The following monitoring is recommended:	None	
Cumulative Impacts		
Nature of cumulative impacts	Mortality due to collisions with the solar panels will be a feature of all other proposed SEF projects within a 30km radius around the Sunveld PV SEF Project. There are 15 approved renewable energy projects within the 30km radius.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Low -	Low -

Table 6: Entanglement of birds in the perimeter fence – Impact Rating.

Issue	Mortality of priority species	
Description of impact		
Entanglement of birds in the perimeter fence		
Type of impact	Direct	
Nature of impact	Negative	
Phases	Operational	
CRITERIA	**WITHOUT MITIGATION**	**WITH MITIGATION**
Intensity	Medium	Medium
Duration	Long term	Long term
Extent	Local	Local
Consequence	Medium	Medium
Probability	High	Low
Significance	**Medium -**	**Low -**
Degree to which impact can be reversed	Partially reversable if mitigation measures are strictly implemented.	
Degree to which impact may cause irreplaceable loss of resources	High	

Issue	Mortality of priority species	
Degree to which impact can be mitigated	Medium	
Mitigation Actions		
The following measures are recommended	• Replace at least the top two barbed strands with smooth wire to eliminate the risk of entanglement. • Increasing the spacing between at least the top two wires (to a minimum of 30cm) and ensuring they are correctly tensioned will also reduce the entanglement risk. • A single (instead of double) perimeter fence should be used if possible.	
Monitoring		
The following monitoring is recommended:	None	
Cumulative Impacts		
Nature of cumulative impacts	Mortality due to entanglement in perimeter fences associated with the SEF Projects will be a feature of all other proposed renewable energy projects within a 30km radius around the Sunveld PV SEF Project. There are 15 approved renewable energy projects within the 30km radius.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium -	Low -

Table 7: Electrocution of priority species in the on-site substations – Impact Rating.

Issue	Mortality of power line sensitive avifauna	
Description of Impact		
Electrocution of priority species in the on-site substations		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Operation	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	High	High
Duration	Long-term	Long-term
Extent	Local area, far beyond site	Part of site/property
Consequence	Medium	Medium
Probability	High	Medium
Significance	High -	Low -
Degree to which impact can be reversed	The impact can be reversed to a certain extent through natural recruitment.	
Degree to which impact may cause irreplaceable loss of resources	It is expected that the electrocution impact will not cause irreplaceable losses through mortality, as it is likely to be	

	a rare event, and can be virtually eliminated with mitigation.	
Degree to which impact can be mitigated	The impact could be well mitigated through the insulation of live components and a raptor friendly pole design.	
Mitigation Actions		
The following measures are recommended	Due to the complicated design of the substation hardware, pro-active mitigation is not a practical option. Instead, the situation must be monitored, and should electrocutions of priority species be recorded, reactive mitigation could be applied in the form of insulation of live components.	
Monitoring		
The following monitoring is recommended:	None	
Cumulative Impacts		
Nature of cumulative impacts	Electrocution mortality associated with substations will be a feature of all other proposed renewable energy projects within a 30km radius around the Sunveld PV SEF Project. There are 15 approved renewable energy projects within the 30km radius.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	High -	Low -

9.3 Decommissioning Phase

Table 8: Displacement of priority species due to disturbance associated with decommissioning of the PV facility and associated infrastructure.

Issue	**Displacement of priority species**	
Description of impact		
Displacement of priority species due to disturbance associated with decommissioning of the PV facility and associated infrastructure.		
Type of impact	Direct	
Nature of impact	Negative	
Phases	Decommissioning	
CRITERIA	**WITHOUT MITIGATION**	**WITH MITIGATION**
Intensity	High	Medium
Duration	Short term	Short term
Extent	Whole site and nearby surroundings	Part of site/property
Consequence	Medium	Low
Probability	High	High
Significance	**Medium -**	**Low -**

Issue	Displacement of priority species	
Degree to which impact can be reversed	Reversable. If mitigation measures are strictly implemented.	
Degree to which impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be mitigated	Low	
Mitigation Actions		
• Decommissioning activity should be restricted to the immediate footprint of the infrastructure. • Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species. • Measures to control noise and dust should be applied according to current best practice in the industry.		
Monitoring		
The following monitoring is recommended:	None	
Cumulative Impacts		
Nature of cumulative impacts	Displacement due to disturbance associated with the decommissioning activities will be a feature of all other proposed renewable energy projects within a 30km radius around the Sunveld PV SEF Project. There are 15 approved renewable energy projects within the 30km radius.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium -	Low -

A comparison between pre-and post-mitigation phases is shown in Table 9 below.

Table 9: Comparison of impacts on environmental parameters pre- and post-mitigation.

Environmental Parameter	Impact	Significance Rating Pre-Mitigation	Significance Rating Post Mitigation
Avifauna	*Displacement of priority species due to disturbance associated with construction of the PV facility and associated infrastructure.*	High -	Low -
	Displacement due to habitat transformation associated with the presence of the solar PV facility and associated infrastructure	High -	Medium -
	Mortality of priority species due to collisions with solar panels	Medium -	Low -
	Entanglement/entrapment of birds in the perimeter fence	Medium -	Low -
	Mortality of priority species due to electrocution in the on-site substations	Medium -	Low -
	Displacement of priority species due to disturbance associated with decommissioning of the PV facility and associated infrastructure.	Medium -	Low -

9.4 No-Go Impact Assessment

The no-go option will result in no additional impacts on avifauna and will result in the ecological status quo being maintained, which will be to the advantage of the avifauna. However, no fatal flaws were identified during the investigations.

9.5 Environmental Sensitivities

The following specific environmental sensitivities have been identified from an avifaunal perspective:

- **Seasonal Pans & Wetlands: High Sensitivity (Solar Panel Exclusion Zones)**

The Project Site and the immediate environment contain drainage lines, pans, wetlands, and dams which are sources of surface water and habitat for a range of bird species. It is necessary to leave open space with no solar panels, for birds utilising this habitat. **The buffer zones as recommended by the Freshwater Specialist should be followed as it will also benefit the avifauna that use this habitat**.

- **Black Harrier Habitat: High Sensitivity (Solar Panel Exclusion Zones)**

The Project Site contains suitable habitat for Black Harrier (Globally and Regionally Endangered). These identified areas should be kept free of solar panels as far as possible to reduce the impacts of habitat loss and species displacement due to disturbance. **The PV 1 and PV 3 Development Areas encroach on the modelled Black Harrier Habitat (Figure 12). However, the PV Development Areas layout was placed in such a way as to minimise fragmentation of large tracts of suitable habitat on site and in the adjacent areas. The solar PV 1 area was reduced from 241 ha initially to 51 ha to reduce the impact on Black Harrier habitat. Its position also leaves open corridors of favourable habitat. Therefore, the current level of encroachment is deemed acceptable from an avifaunal perspective**

- **Jackal Buzzard Nest: High Sensitivity (Solar Panel Exclusion Zone)**

A 100m Solar Panel Exclusion Zone should be implemented and maintained around the Jackal Buzzard nest located within the Project Site to reduce the risk of species displacement due to disturbance and to reduce the risk of possible collisions with the solar panels.

See the **Figure 12** below for the avifaunal sensitivities identified in and near the Project Site and PV Development Areas.

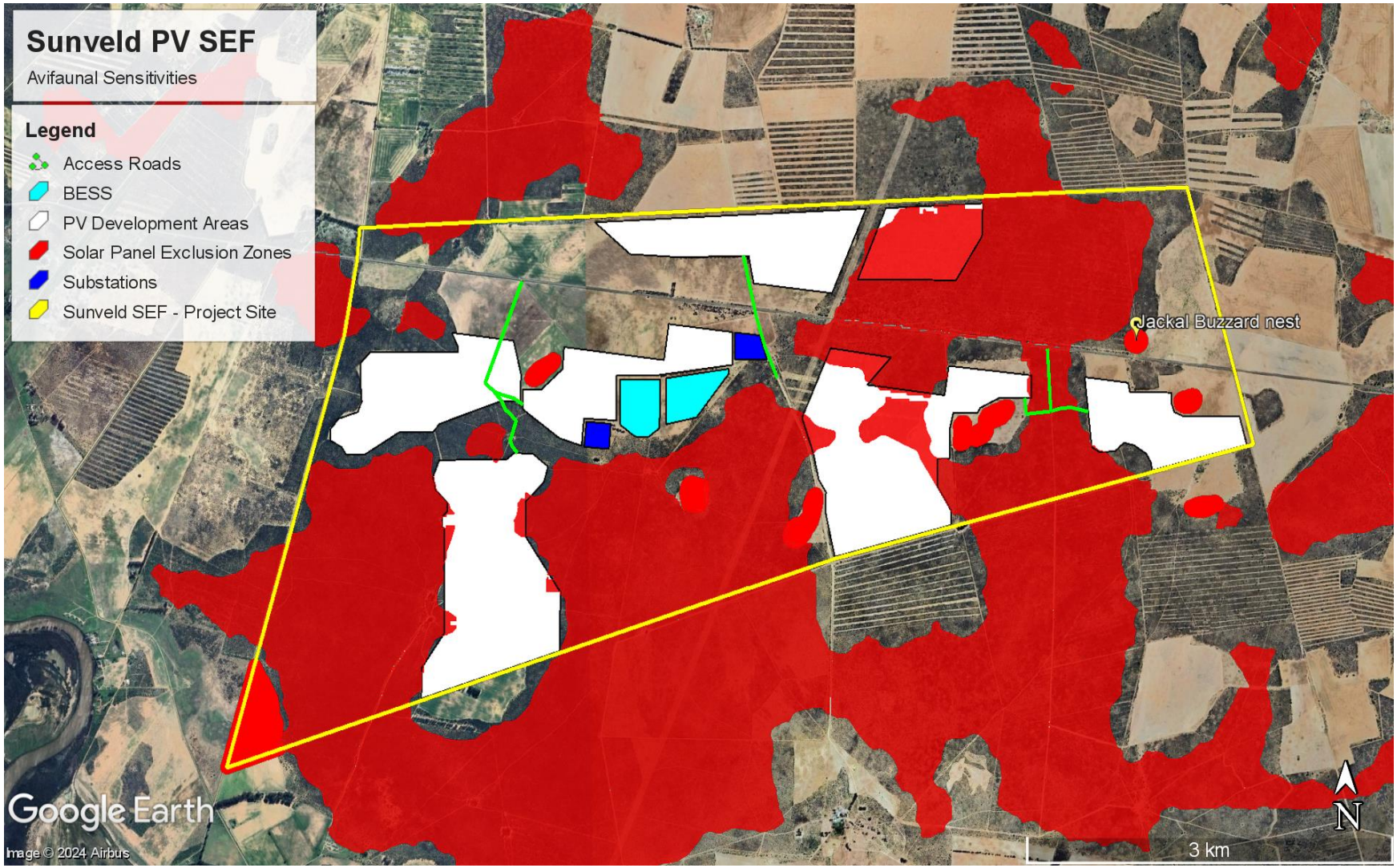

Figure 12: Avifaunal sensitivities identified at the Sunveld PV SEF Project Site. The Sensitive Avifaunal Areas include, suitable Black Harrier habitat, aquatic features, and a Jackal Buzzard nest.

10 CUMULATIVE IMPACTS

Cumulative effects are commonly understood to be the combined impacts from different projects that result in significant change in an area, which could be larger than the sum of all the individual impacts. The assessment of cumulative effects therefore needs to consider all renewable energy projects within a 30 km radius that have received an Environmental Authorisation at the time of starting the EIA process for the proposed Sunveld PV SEF. There are currently fifteen (15) other renewable energy projects authorised, operational, or in process, within a 30 km radius of the proposed Sunveld PV SEF (**Figure 13**).

The total affected land parcel area taken up by authorised and/or planned renewable energy projects within the 30 km radius is approximately 155 km² (15,500 ha). The total affected land parcel area affected by the Sunveld PV SEF equates to approximately 23.6 km² (2,362 ha) – note however that the Development Area is 7.09 km² (709 ha). The combined land parcel area affected by authorised renewable energy developments within the 30 km radius, including the proposed Sunveld PV SEF, thus equals approximately 178.6 km² (17,860 ha). The proposed Sunveld PV SEF land parcel area thus represents ~13.2% and the Development Area ~4%. The contribution of the proposed Sunveld PV SEF to the cumulative impact is thus anticipated to be **low to medium** after mitigation.

The total area within the 30 km radius around the proposed project equates to about 2475 km² (247,500 ha) of similar habitat (i.e., a mixture of Strandveld shrubland, agriculture, and human settlements). The total combined size of the land parcels potentially affected by renewable energy projects will equate to ~7 % of the available similar habitat in the 30 km radius. Assuming that all the projects are constructed, the cumulative impact of all the proposed renewable energy projects is estimated to be **medium**. The actual physical footprint of the renewable energy facilities will also be much smaller than the land parcel areas themselves. Furthermore, several of these projects must still be subject to a competitive bidding process where only the most competitive projects will win a power purchase agreement required for the project to proceed to construction.

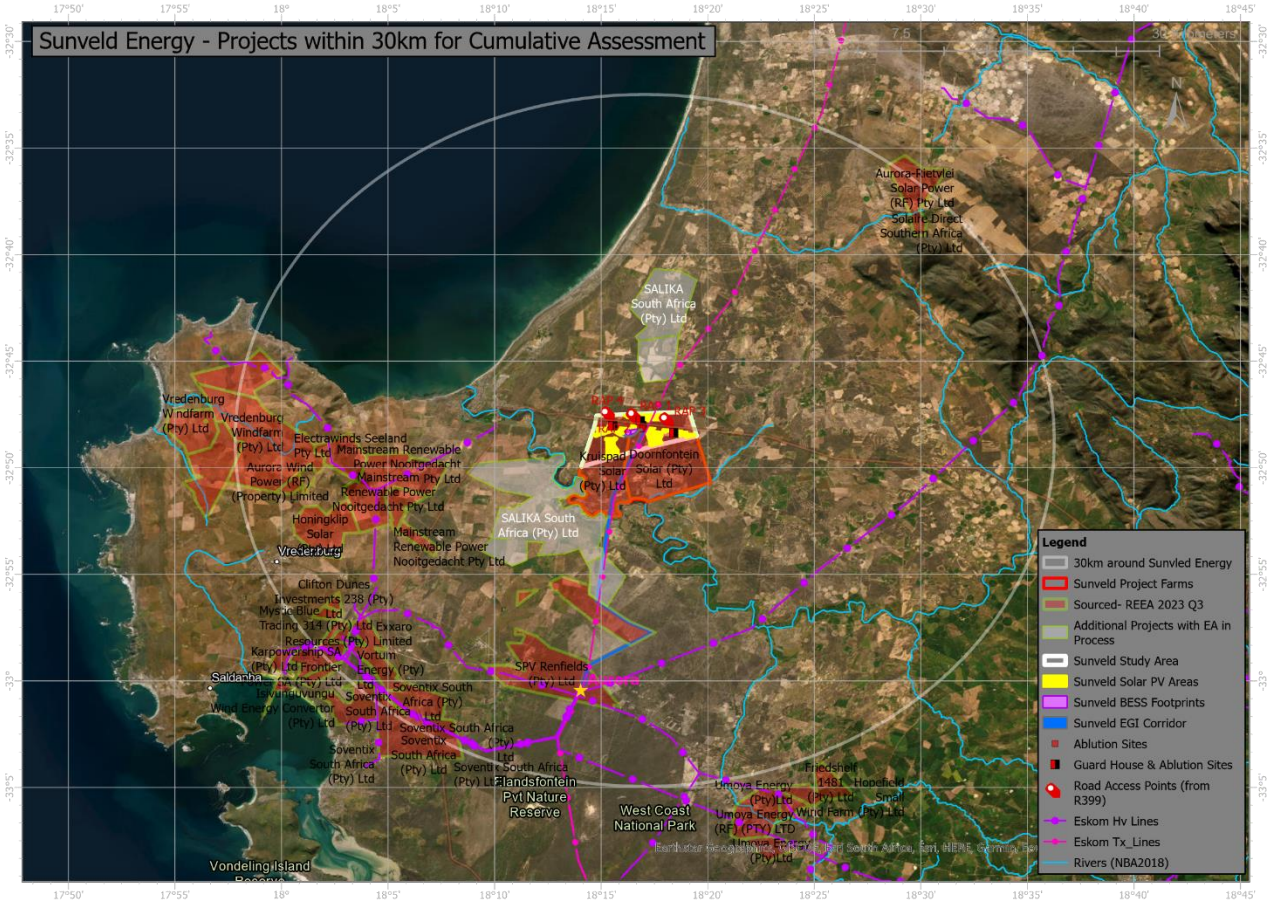

Figure 13: Other renewable energy projects within a 30km radius of the proposed Sunveld PV SEF.

Table 10: Cumulative Impacts Rating.

Issue:	**Cumulative impacts of SEF Projects on Avifauna**	
Description of Impact		
• Displacement due to disturbance associated with the construction of the solar PV facilities and associated infrastructure. • Displacement due to habitat transformation associated with the presence of the solar PV facilities and associated infrastructure. • Collisions with the solar panels. • Entanglement in perimeter fences. • Electrocutions in the on-site substations. • Displacement due to disturbance associated with the decommissioning of the solar PV facilities and associated infrastructure		
Nature of cumulative impacts	All impacts associated with the SEF Projects and associated infrastructure will be a feature of all other proposed renewable energy projects within a 30km radius around the Sunveld PV SEF Project. There are 15 approved renewable energy projects within the 30km radius.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium -	**Medium -**

11 ENVIRONMENTAL MANAGEMENT PROGRAMME

For each anticipated impact, management recommendations for the design, construction, and operational phase (where appropriate) are included in the project EMPr (**Appendix 4**).

12 CONCLUSION

The proposed 600 MW Sunveld PV SEF will have anticipated high, medium, and low negative impacts on priority avifauna, which is expected to be reduced to medium and low with appropriate mitigation. No fatal flaws were discovered during the investigations. It is therefore recommended that the activity is authorised, on condition that the proposed **mitigation measures** as detailed in the Impact Tables (Section 9 of the report) and the EMPr (**Appendix 4**) are **strictly implemented**.

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APPENDIX 1: SABAP2 SPECIES LIST FOR THE BROADER AREA

Species Name	Scientific Name	Full Protocol Reporting Rate	Ad Hoc Protocol Reporting Rate
Acacia Pied Barbet	*Tricholaema leucomelas*	65,80	5,95
African Black Duck	*Anas sparsa*	0,49	0,00
African Black Swift	*Apus barbatus*	6,40	0,64
African Darter	*Anhinga rufa*	84,60	16,40
African Dusky Flycatcher	*Muscicapa adusta*	0,24	0,00
African Fish Eagle	*Haliaeetus vocifer*	42,54	3,54
African Harrier-Hawk	*Polyboroides typus*	2,19	0,00
African Hoopoe	*Upupa africana*	53,48	4,02
African Marsh Harrier	*Circus ranivorus*	38,65	4,34
African Openbill	*Anastomus lamelligerus*	0,16	0,00
African Oystercatcher	*Haematopus moquini*	1,54	0,32
African Palm Swift	*Cypsiurus parvus*	0,08	0,00
African Paradise Flycatcher	*Terpsiphone viridis*	1,05	0,16
African Pied Wagtail	*Motacilla aguimp*	0,08	0,00
African Pipit	*Anthus cinnamomeus*	26,66	2,09
African Rail	*Rallus caerulescens*	5,27	0,48
African Red-eyed Bulbul	*Pycnonotus nigricans*	0,49	0,00
African Reed Warbler	*Acrocephalus baeticatus*	1,54	0,16
African Sacred Ibis	*Threskiornis aethiopicus*	90,92	35,05
African Snipe	*Gallinago nigripennis*	0,65	0,00
African Spoonbill	*Platalea alba*	66,29	10,77
African Stonechat	*Saxicola torquatus*	60,53	8,20
African Swamphen	*Porphyrio madagascariensis*	13,37	0,32
Alpine Swift	*Tachymarptis melba*	19,21	1,29
American Golden Plover	*Pluvialis dominica*	1,30	0,48
Ant-eating Chat	*Myrmecocichla formicivora*	6,89	0,80
Arctic Tern	*Sterna paradisaea*	0,16	0,00
Banded Martin	*Riparia cincta*	18,80	1,45
Bank Cormorant	*Phalacrocorax neglectus*	0,41	0,16
Barn Swallow	*Hirundo rustica*	38,82	10,45
Bar-tailed Godwit	*Limosa lapponica*	7,86	0,80
Bar-throated Apalis	*Apalis thoracica*	2,51	0,80
Black Crake	*Zapornia flavirostra*	1,54	0,16
Black Harrier	*Circus maurus*	6,56	0,16
Black Sparrowhawk	*Accipiter melanoleucus*	6,40	0,16
Black Stork	*Ciconia nigra*	0,24	0,00
Black-chested Snake Eagle	*Circaetus pectoralis*	0,16	0,00

Species Name	Scientific Name	Full Protocol Reporting Rate	Ad Hoc Protocol Reporting Rate
Black-crowned Night Heron	*Nycticorax nycticorax*	41,65	2,57
Black-headed Canary	*Serinus alario*	1,70	0,16
Black-headed Gull	*Chroicocephalus ridibundus*	0,08	0,00
Black-headed Heron	*Ardea melanocephala*	50,24	6,27
Black-necked Grebe	*Podiceps nigricollis*	56,32	13,67
Blacksmith Lapwing	*Vanellus armatus*	88,49	21,22
Black-winged Kite	*Elanus caeruleus*	57,29	7,88
Black-winged Stilt	*Himantopus himantopus*	91,98	35,21
Blue Crane	*Grus paradisea*	45,38	13,50
Blue-billed Teal	*Spatula hottentota*	0,08	0,00
Bokmakierie	*Telophorus zeylonus*	80,88	10,77
Booted Eagle	*Hieraaetus pennatus*	6,32	1,29
Brimstone Canary	*Crithagra sulphurata*	0,97	0,00
Brown-throated Martin	*Riparia paludicola*	67,42	8,84
Burchell's Coucal	*Centropus burchellii*	0,97	0,00
Cape Batis	*Batis capensis*	0,08	0,00
Cape Bulbul	*Pycnonotus capensis*	64,99	5,63
Cape Bunting	*Emberiza capensis*	3,97	0,96
Cape Canary	*Serinus canicollis*	30,96	2,09
Cape Clapper Lark	*Mirafra apiata*	0,81	0,00
Cape Cormorant	*Phalacrocorax capensis*	54,05	14,31
Cape Gannet	*Morus capensis*	0,16	0,00
Cape Grassbird	*Sphenoeacus afer*	0,89	0,00
Cape Long-billed Lark	*Certhilauda curvirostris*	1,13	0,16
Cape Longclaw	*Macronyx capensis*	8,51	0,96
Cape Penduline Tit	*Anthoscopus minutus*	1,70	0,16
Cape Robin-Chat	*Cossypha caffra*	67,83	4,50
Cape Shoveler	*Spatula smithii*	54,54	5,14
Cape Sparrow	*Passer melanurus*	92,30	22,67
Cape Spurfowl	*Pternistis capensis*	67,67	8,36
Cape Teal	*Anas capensis*	83,06	22,03
Cape Turtle Dove	*Streptopelia capicola*	79,58	9,97
Cape Wagtail	*Motacilla capensis*	92,87	19,61
Cape Weaver	*Ploceus capensis*	85,33	15,76
Cape White-eye	*Zosterops virens*	59,56	4,66
Capped Wheatear	*Oenanthe pileata*	68,31	17,04
Cardinal Woodpecker	*Dendropicos fuscescens*	5,75	0,32
Caspian Plover	*Charadrius asiaticus*	2,51	0,16
Caspian Tern	*Hydroprogne caspia*	77,55	15,76

Species Name	Scientific Name	Full Protocol Reporting Rate	Ad Hoc Protocol Reporting Rate
Chat Flycatcher	*Melaenornis infuscatus*	0,08	0,00
Chestnut-banded Plover	*Charadrius pallidus*	57,54	9,16
Chestnut-vented Warbler	*Curruca subcoerulea*	20,91	2,57
Cloud Cisticola	*Cisticola textrix*	1,38	0,00
Common Buzzard	*Buteo buteo*	23,26	3,86
Common Greenshank	*Tringa nebularia*	59,89	10,13
Common House Martin	*Delichon urbicum*	0,57	0,16
Common Moorhen	*Gallinula chloropus*	8,51	0,80
Common Ostrich	*Struthio camelus*	3,97	2,41
Common Quail	*Coturnix coturnix*	2,92	0,00
Common Redshank	*Tringa totanus*	1,05	0,32
Common Ringed Plover	*Charadrius hiaticula*	45,30	4,82
Common Sandpiper	*Actitis hypoleucos*	30,63	3,70
Common Shelduck	*Tadorna tadorna*	0,41	0,16
Common Starling	*Sturnus vulgaris*	87,68	16,40
Common Swift	*Apus apus*	0,41	0,16
Common Tern	*Sterna hirundo*	35,49	3,05
Common Waxbill	*Estrilda astrild*	10,62	0,48
Crowned Cormorant	*Microcarbo coronatus*	0,73	0,32
Crowned Lapwing	*Vanellus coronatus*	47,65	2,09
Curlew Sandpiper	*Calidris ferruginea*	57,54	8,04
Damara Canary	*Serinus leucolaema*	0,00	0,16
Diederik Cuckoo	*Chrysococcyx caprius*	0,73	0,32
Domestic Duck	*Anas platyrhynchos domestica*	14,67	1,45
Domestic Goose	*Anser anser domesticus*	16,45	3,22
Dusky Sunbird	*Cinnyris fuscus*	1,78	0,00
Egyptian Goose	*Alopochen aegyptiaca*	74,72	19,77
Eurasian Curlew	*Numenius arquata*	14,83	0,96
Eurasian Whimbrel	*Numenius phaeopus*	47,49	3,86
European Bee-eater	*Merops apiaster*	23,83	3,70
European Roller	*Coracias garrulus*	0,00	0,16
Familiar Chat	*Oenanthe familiaris*	12,32	0,48
Fiery-necked Nightjar	*Caprimulgus pectoralis*	8,83	0,00
Fiscal Flycatcher	*Melaenornis silens*	50,49	2,09
Fork-tailed Drongo	*Dicrurus adsimilis*	0,08	0,00
Giant Kingfisher	*Megaceryle maxima*	5,67	0,64
Glossy Ibis	*Plegadis falcinellus*	42,46	5,14
Goliath Heron	*Ardea goliath*	7,37	1,77
Great Crested Grebe	*Podiceps cristatus*	27,88	3,54

Species Name	Scientific Name	Full Protocol Reporting Rate	Ad Hoc Protocol Reporting Rate
Great Egret	*Ardea alba*	3,97	1,13
Great White Pelican	*Pelecanus onocrotalus*	81,69	13,18
Greater Crested Tern	*Thalasseus bergii*	61,02	6,59
Greater Flamingo	*Phoenicopterus roseus*	89,63	45,34
Greater Kestrel	*Falco rupicoloides*	1,38	0,00
Greater Sand Plover	*Charadrius leschenaultii*	2,43	0,16
Greater Striped Swallow	*Cecropis cucullata*	7,29	0,96
Grey Heron	*Ardea cinerea*	89,47	25,88
Grey Plover	*Pluvialis squatarola*	35,66	3,38
Grey Tit	*Melaniparus afer*	8,67	0,00
Grey-backed Cisticola	*Cisticola subruficapilla*	23,26	1,77
Grey-backed Sparrow-Lark	*Eremopterix verticalis*	6,08	0,16
Grey-headed Gull	*Chroicocephalus cirrocephalus*	53,00	6,11
Grey-winged Francolin	*Scleroptila afra*	0,41	0,00
Groundscraper Thrush	*Turdus litsitsirupa*	0,08	0,00
Gull-billed Tern	*Gelochelidon nilotica*	0,65	0,48
Hadada Ibis	*Bostrychia hagedash*	80,06	13,99
Hamerkop	*Scopus umbretta*	0,41	0,00
Hartlaub's Gull	*Chroicocephalus hartlaubii*	86,06	32,48
Helmeted Guineafowl	*Numida meleagris*	79,90	14,95
House Sparrow	*Passer domesticus*	75,53	8,84
Hybrid Duck	*Anas hybrid*	0,08	0,00
Hybrid Mallard	*Anas hybrid*	1,05	1,29
Indian Peafowl	*Pavo cristatus*	0,16	0,00
Intermediate Egret	*Ardea intermedia*	2,27	0,80
Jackal Buzzard	*Buteo rufofuscus*	53,16	8,68
Karoo Chat	*Emarginata schlegelii*	0,32	0,16
Karoo Lark	*Calendulauda albescens*	3,57	0,32
Karoo Prinia	*Prinia maculosa*	72,69	7,40
Karoo Scrub Robin	*Cercotrichas coryphoeus*	72,37	6,59
Karoo Thrush	*Turdus smithi*	12,72	0,00
Kelp Gull	*Larus dominicanus*	90,84	38,26
Kittlitz's Plover	*Charadrius pecuarius*	63,86	9,97
Klaas's Cuckoo	*Chrysococcyx klaas*	12,24	0,96
Lanner Falcon	*Falco biarmicus*	8,02	2,09
Large-billed Lark	*Galerida magnirostris*	55,67	6,75
Lark-like Bunting	*Emberiza impetuani*	4,38	0,16
Laughing Dove	*Spilopelia senegalensis*	79,74	10,61
Layard's Warbler	*Curruca layardi*	0,32	0,00

Species Name	Scientific Name	Full Protocol Reporting Rate	Ad Hoc Protocol Reporting Rate
Lesser Flamingo	*Phoeniconaias minor*	71,31	28,78
Lesser Honeyguide	*Indicator minor*	4,38	0,00
Lesser Kestrel	*Falco naumanni*	0,97	0,32
Lesser Sand Plover	*Charadrius mongolus*	0,49	0,16
Lesser Swamp Warbler	*Acrocephalus gracilirostris*	26,58	2,09
Levaillant's Cisticola	*Cisticola tinniens*	75,77	8,52
Little Bittern	*Ixobrychus minutus*	0,81	0,00
Little Egret	*Egretta garzetta*	86,06	19,77
Little Grebe	*Tachybaptus ruficollis*	55,19	8,52
Little Rush Warbler	*Bradypterus baboecala*	24,47	2,73
Little Stint	*Calidris minuta*	56,73	9,49
Little Swift	*Apus affinis*	47,65	5,95
Little Tern	*Sternula albifrons*	4,62	0,32
Long-billed Crombec	*Sylvietta rufescens*	18,56	0,32
Ludwig's Bustard	*Neotis ludwigii*	1,38	0,16
Maccoa Duck	*Oxyura maccoa*	2,67	0,16
Malachite Kingfisher	*Corythornis cristatus*	16,45	1,61
Malachite Sunbird	*Nectarinia famosa*	49,11	2,73
Mallard	*Anas platyrhynchos*	50,49	2,41
Marsh Sandpiper	*Tringa stagnatilis*	23,10	2,25
Martial Eagle	*Polemaetus bellicosus*	0,24	0,00
Mountain Wheatear	*Myrmecocichla monticola*	0,08	0,00
Namaqua Dove	*Oena capensis*	50,41	8,04
Namaqua Sandgrouse	*Pterocles namaqua*	1,54	0,00
Neddicky	*Cisticola fulvicapilla*	1,46	0,48
Olive Thrush	*Turdus olivaceus*	0,97	0,00
Pale Chanting Goshawk	*Melierax canorus*	2,59	0,00
Pearl-breasted Swallow	*Hirundo dimidiata*	29,01	1,77
Peregrine Falcon	*Falco peregrinus*	8,83	0,16
Pied Avocet	*Recurvirostra avosetta*	67,75	18,81
Pied Crow	*Corvus albus*	89,79	40,51
Pied Kingfisher	*Ceryle rudis*	86,79	19,77
Pied Starling	*Lamprotornis bicolor*	55,59	11,41
Pink-backed Pelican	*Pelecanus rufescens*	0,16	0,16
Pin-tailed Whydah	*Vidua macroura*	17,10	0,32
Plain-backed Pipit	*Anthus leucophrys*	0,32	0,16
Purple Heron	*Ardea purpurea*	43,60	3,70
Quailfinch	*Ortygospiza atricollis*	0,16	0,16
Red Knot	*Calidris canutus*	0,65	0,16

Species Name	Scientific Name	Full Protocol Reporting Rate	Ad Hoc Protocol Reporting Rate
Red-backed Shrike	*Lanius collurio*	0,16	0,00
Red-billed Quelea	*Quelea quelea*	0,73	0,00
Red-billed Teal	*Anas erythrorhyncha*	11,83	1,93
Red-capped Lark	*Calandrella cinerea*	32,33	1,61
Red-eyed Dove	*Streptopelia semitorquata*	80,79	12,06
Red-faced Mousebird	*Urocolius indicus*	56,48	3,86
Red-knobbed Coot	*Fulica cristata*	45,87	3,54
Red-necked Phalarope	*Phalaropus lobatus*	30,47	6,11
Red-winged Starling	*Onychognathus morio*	0,57	0,16
Reed Cormorant	*Microcarbo africanus*	84,20	12,22
Rock Dove	*Columba livia*	57,13	7,23
Rock Kestrel	*Falco rupicolus*	54,30	6,27
Rock Martin	*Ptyonoprogne fuligula*	67,34	6,59
Rosy-faced Lovebird	*Agapornis roseicollis*	0,08	0,00
Ruddy Turnstone	*Arenaria interpres*	2,35	0,32
Ruff	*Calidris pugnax*	42,79	4,34
Sand Martin	*Riparia riparia*	0,57	0,80
Sanderling	*Calidris alba*	3,24	0,64
Sandwich Tern	*Thalasseus sandvicensis*	31,12	5,79
Secretarybird	*Sagittarius serpentarius*	1,78	1,13
Sickle-winged Chat	*Emarginata sinuata*	0,65	0,00
South African Shelduck	*Tadorna cana*	53,65	4,66
Southern Black Korhaan	*Afrotis afra*	34,68	2,09
Southern Boubou	*Laniarius ferrugineus*	0,24	0,00
Southern Double-collared Sunbird	*Cinnyris chalybeus*	81,60	9,65
Southern Fiscal	*Lanius collaris*	85,01	25,72
Southern Grey-headed Sparrow	*Passer diffusus*	2,92	0,48
Southern Masked Weaver	*Ploceus velatus*	53,32	4,34
Southern Pochard	*Netta erythrophthalma*	0,32	0,00
Southern Red Bishop	*Euplectes orix*	53,81	6,43
Speckled Mousebird	*Colius striatus*	1,30	0,16
Speckled Pigeon	*Columba guinea*	86,95	13,02
Spotted Eagle-Owl	*Bubo africanus*	36,14	1,45
Spotted Flycatcher	*Muscicapa striata*	0,08	0,00
Spotted Thick-knee	*Burhinus capensis*	45,30	1,61
Spur-winged Goose	*Plectropterus gambensis*	49,35	5,14
Streaky-headed Seedeater	*Crithagra gularis*	4,54	0,16
Terek Sandpiper	*Xenus cinereus*	0,32	0,00
Three-banded Plover	*Charadrius tricollaris*	46,76	4,34

Species Name	Scientific Name	Full Protocol Reporting Rate	Ad Hoc Protocol Reporting Rate
Verreaux's Eagle	*Aquila verreauxii*	0,08	0,00
Water Thick-knee	*Burhinus vermiculatus*	5,92	0,64
Wattled Starling	*Creatophora cinerea*	6,08	0,00
Western Barn Owl	*Tyto alba*	29,17	1,13
Western Cattle Egret	*Bubulcus ibis*	32,90	5,95
Western Osprey	*Pandion haliaetus*	11,99	1,93
Whiskered Tern	*Chlidonias hybrida*	3,65	0,00
White Stork	*Ciconia ciconia*	2,03	0,00
White-backed Duck	*Thalassornis leuconotus*	0,16	0,00
White-backed Mousebird	*Colius colius*	65,07	4,02
White-breasted Cormorant	*Phalacrocorax lucidus*	78,61	15,27
White-faced Whistling Duck	*Dendrocygna viduata*	0,65	0,00
White-fronted Plover	*Charadrius marginatus*	20,42	1,77
White-necked Raven	*Corvus albicollis*	5,02	0,00
White-rumped Sandpiper	*Calidris fuscicollis*	0,89	0,16
White-rumped Swift	*Apus caffer*	17,59	0,80
White-throated Canary	*Crithagra albogularis*	26,01	1,45
White-throated Swallow	*Hirundo albigularis*	55,19	4,50
White-winged Tern	*Chlidonias leucopterus*	9,97	0,32
Wilson's Phalarope	*Phalaropus tricolor*	1,94	0,80
Wood Sandpiper	*Tringa glareola*	3,48	0,16
Yellow Bishop	*Euplectes capensis*	7,70	0,96
Yellow Canary	*Crithagra flaviventris*	70,75	7,56
Yellow-billed Duck	*Anas undulata*	72,04	9,97
Yellow-billed Kite	*Milvus aegyptius*	49,92	14,95
Yellow-billed Stork	*Mycteria ibis*	1,70	0,16
Zitting Cisticola	*Cisticola juncidis*	3,00	0,48

APPENDIX 2: HABITAT FEATURES AT THE PROJECT SITE

Figure 1: Saldanha Flats Strandveld vegetation at the Project Site.

Figure 2: Natural pan at the Project Site.

Figure 3: High voltage power line at the Project Site.

Figure 3: Alien trees at the Project Site.

Figure 3: Agricultural field (planted pasture) at the Project Site.

APPENDIX 3: PRE-CONSTRUCTION MONITORING

Pre-construction avifaunal surveys were undertaken at the Sunveld PV SEF Project Site according to a Regime 2 monitoring protocol (i.e., a minimum of two surveys conducted over 6 months) in accordance with the BLSA guidelines for Solar PV developments. Surveys were undertaken on:

- 26 June, 4–11 July 2023 (Survey 1)
- 18–19 November 2023 (Survey 2)

Monitoring was conducted in the following manner:

- One (1) drive transect with a length of 24.4 km was identified within the Project Site.
- Two monitors recorded all birds on both sides of the transect. The observers stopped at regular intervals to scan the environment with binoculars. The drive transects were surveyed three times per sampling session.
- The following variables were recorded:
    - Species
    - Number of birds
    - Date
    - Start time and end time
    - Estimated distance from transect
    - Wind direction
    - Wind strength (estimated Beaufort scale)
    - Weather (sunny; cloudy; partly cloudy; rain; mist)
    - Temperature (cold; mild; warm; hot)
    - Behaviour (flushed; flying-display; perched; perched-calling; perched-hunting; flying-foraging; flying-commute; foraging on the ground) and
    - Co-ordinates (priority species only)

Figure 1 below indicates the locations of the drive transect where monitoring took place.

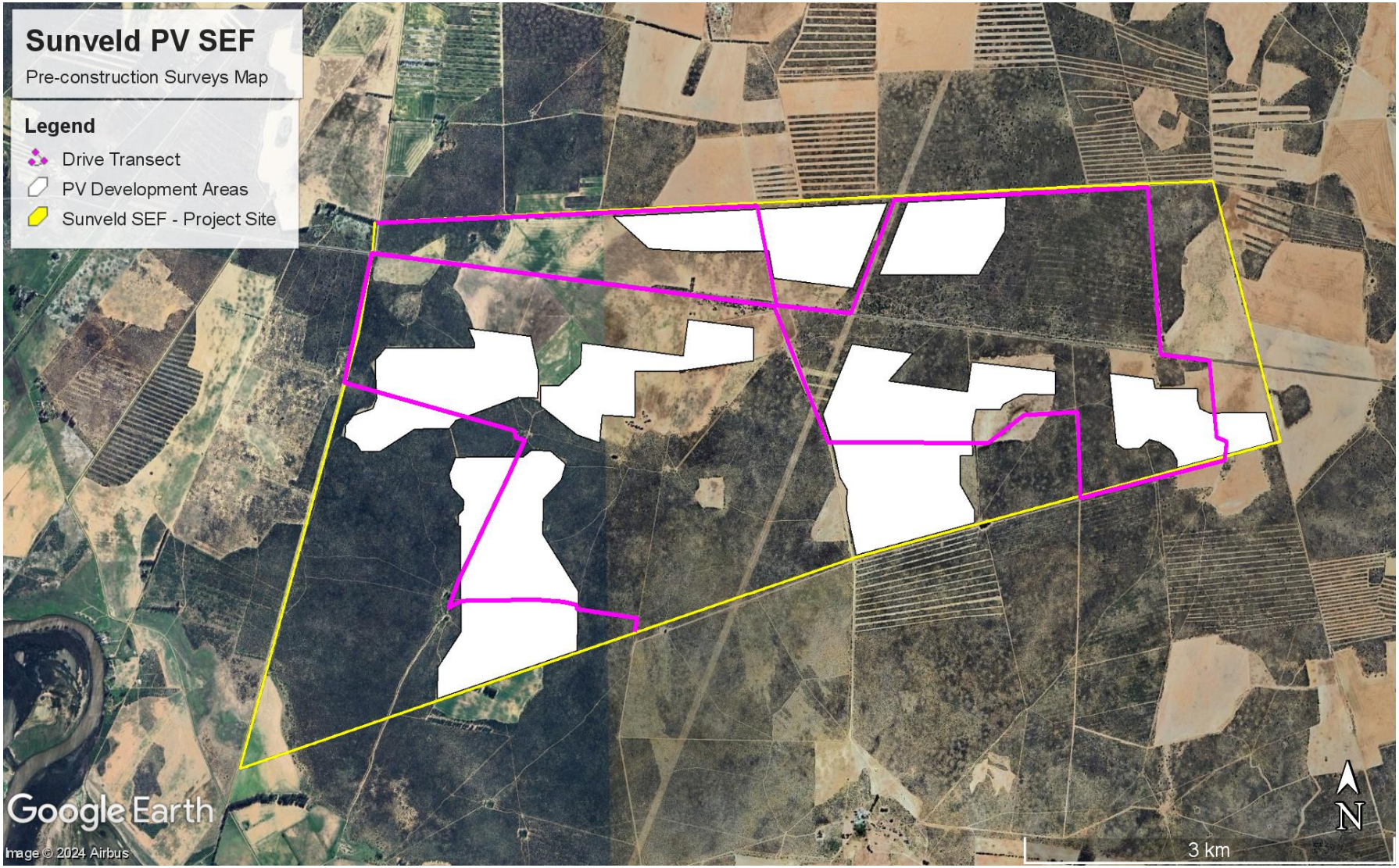

Figure 1: Area where monitoring took place, indicating the locations of the drive transects and the PV Development Areas.

APPENDIX 4: ENVIRONMENTAL MANAGEMENT PROGRAMME

Management Plan for the Planning and Design Phase

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
AVIFAUNA: ENTRAPMENT					
Entrapment/entanglement of medium and large terrestrial birds between/on the perimeter fences, leading to mortality.	Prevent mortality of avifauna	1. A single perimeter fence should be used[3]. 2. Replace at least the top two barbed strands with smooth wire to reduce entanglement risks, increasing the spacing between at least the top two wires (to a minimum of 30cm), and ensuring they are correctly tensioned will also reduce the entanglement risks	Design the facility with a single perimeter fence.	Once-off during the planning phase.	Project Developer
AVIFAUNA: DISPLACEMENT					
Displacement of avifauna due to disturbance during construction activities.	Prevent displacement of avifauna	1. Construction activity should be restricted to the immediate footprint of the infrastructure as far as possible. 2. Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of solar priority species.	As indicated	Once-off during the planning phase.	Project Developer

[3] If a fence is used consisting of an outer diamond mesh fence and inner electric fence with a separation distance of approximately 100 mm or less, it should not pose any risk of entrapment for large terrestrial species and can be considered a single fence.

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
		3. Measures to control noise and dust should be applied according to current best practice in the industry. 4. Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum as far as practical.			

Management Plan for the Construction Phase

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
AVIFAUNA: DISTURBANCE					
The noise and movement associated with the construction activities at the development footprint will be a source of disturbance which would lead to the displacement of avifauna from the area	Prevent unnecessary displacement of avifauna by ensuring that contractors are aware of the requirements of the Construction Environmental Management Programme (CEMPr.)	A site-specific CEMPr must be implemented, which gives appropriate and detailed description of how construction activities must be conducted. All contractors are to adhere to the CEMPr and should apply good environmental practice during construction. The CEMPr must specifically include the following: 1. No off-road driving; 2. Maximum use of existing roads, where possible; 3. Measures to control noise and dust according to latest best practice; 4. Restricted access to the rest of the property;	1. Implementation of the CEMPr. Oversee activities to ensure that the CEMPr is implemented and enforced via site audits and inspections. Report and record any non-compliance. 2. Ensure that construction personnel are made aware of the impacts relating to off-road driving. 3. Construction access roads must be demarcated clearly. Undertake site inspections to verify. 4. Monitor the implementation of noise control mechanisms via site inspections and record	1. On a daily basis 2. Monthly 3. Monthly 4. Monthly 5. Monthly	1. Contractor and ECO 2. Contractor and ECO 3. Contractor and ECO 4. Contractor and ECO 5. Contractor and ECO

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
		5. Strict application of all recommendations in the botanical specialist report pertaining to the limitation of the footprint.	and report non-compliance. 5. Ensure that the construction area is demarcated clearly and that construction personnel are made aware of these demarcations. Monitor via site inspections and report non-compliance.		

Management Plan for the Operational Phase

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
AVIFAUNA: DISPLACEMENT DUE TO HABITAT TRANSFORMATION					
Total or partial displacement of avifauna due to habitat transformation associated with the vegetation clearance and the presence of the solar PV plants and associated infrastructure.	Prevent unnecessary displacement of avifauna by ensuring that the rehabilitation of transformed areas is implemented by an appropriately qualified rehabilitation specialist, according to the recommendations of the botanical specialist study.	1. Develop a Habitat Restoration Plan (HRP). 2. Monitor rehabilitation via site audits and site inspections to ensure compliance. 3. Record and report any non-compliance.	1. Appointment of rehabilitation specialist to develop HRP. 2. Site inspections to monitor progress of HRP. 3. Adaptive management to ensure HRP goals are met.	1. Once-off 2. Once a year 3. As and when required	1. Project Developer 2. Facility Environmental Manager 3. Project Developer and Facility Operational Manager
AVIFAUNA: ELECTROCUTION					
Electrocution of avifauna in the substation yards	Prevent mortality of avifauna due to electrocutions	Due to the complicated design of the substation hardware, pro-active mitigation is not a practical option.	As indicated.	Reactively as required.	Project Developer

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
		Instead, the situation must be monitored, and should electrocutions of priority species be recorded, reactive mitigation could be applied in the form of insulation of live components.			

APPENDIX 5: SITE SENSITIVITY VERIFICATION

RECONNAISSANCE REPORT
(IN TERMS OF PART B OF THE ASSESSMENT PROTOCOLS PUBLISHED IN GN 320 ON 20 MARCH 2020 AND GN 43855 ON 30 OCTOBER 2020)

INTRODUCTION

Prior to commencing with the specialist assessment in accordance with Appendix 6 of the National Environmental Management Act (Act 107 of 1998, as amended) (NEMA) Environmental Impact Assessment (EIA) Regulations of 2014, a site sensitivity verification (SSV) was undertaken to confirm the current land use and environmental sensitivity of the proposed project area as identified by the National Web-Based Environmental Screening Tool (Screening Tool). NEMA makes provision for the prescription of procedures for the assessment and minimum criteria for reporting on identified environmental themes (Sections 24(5)(a) and (h) and 44) when applying for environmental authorisation. The Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial animal species (Government Gazette No 43855, 30 October 2020 is applicable in the case of solar PV developments.

The details of the SSV are noted below:

Date of Site Visit	26 June 2023
Supervising Specialist Name	Albert Froneman
Professional Registration Number	MSc Conservation Biology (SACNASP Zoological Science Registration number 400177/09)
Specialist Affiliation / Company	AfriAvian Environmental

SITE SENSITIVITY VERIFICATION

The following methods and information sources were used to compile this report:

- Bird distribution data from the Second Southern African Bird Atlas Project (SABAP2) was obtained (https://sabap2.birdmap.africa/) to ascertain which species occur in the pentads where the proposed Project is located. A pentad grid cell covers 5 minutes of latitude by 5 minutes of longitude (5' × 5'). Each pentad is approximately 9 × 8 km in size. To get a representative impression of the bird species in the area a consolidated dataset was obtained for a total of four (4) pentads some of which intersect and others that are near the Project Site, henceforth referred to as “the Broader Area”. The four pentad grid cells are: 3245_1810, 3245_1815, 3250_1810 and 3250_1815. To date, a total of 1,234 full protocol checklists (i.e., intensive bird listing surveys lasting at least two hours each) and 622 ad hoc protocol lists (surveys lasting less than two hours but still yielding valuable data) have been completed for the four pentads where the Project Site is located.
- The SABAP2 data was regarded as a reliable reflection of the avifauna that occurs in the Broader Area, but the data was also supplemented with data collected during the on-site surveys and with general knowledge of the area.
- A classification of the vegetation types in the Project Site was obtained from the First Atlas of Southern African Birds (SABAP1) and the National Vegetation Map (2018) compiled by the South African National Biodiversity Institute (Mucina & Rutherford 2006).
- The national threatened status of all priority species was determined with the use of the most recent edition of the Red List Book of Birds of South Africa, Lesotho and Swaziland (Taylor *et al.* 2015), and the latest authoritative summary of southern African bird biology (Hockey *et al.* 2005).
- The global threatened status of all priority species was determined by consulting the latest (2023.1) IUCN Red List of Threatened Species (http://www.iucnredlist.org/).
- The Important Bird and Biodiversity Areas of South Africa (Marnewick *et al.* 2015; http://www.birdlife.org.za/conservation/important-bird-areas) was consulted for information on potentially relevant Important Bird Areas (IBAs).

- An intensive internet search was conducted to source information on the impacts of solar energy facilities on avifauna.
- Satellite imagery (Google Earth © 2023) was used to view the broader area on a landscape level and to help identify bird habitat on the ground.
- The South African National Biodiversity BGIS map viewer was used to determine the locality of the Project Site relative to National Protected Areas.
- The DFFE National Screening Tool was used to determine the assigned avian sensitivity of the Project Site.
- The following sources were consulted to determine the investigation protocol that is required for the site:
    - Procedures for the Assessment and Minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of NEMA when applying for Environmental Authorisation (Gazetted October 2020)
    - Guidelines for the Implementation of the Terrestrial Flora (3c) & Terrestrial Fauna (3d) Species Protocols for EIAs in South Africa produced by the South African National Biodiversity Institute on behalf of the Department of Environment, Forestry and Fisheries (2020).
    - The BirdLife South Africa (BLSA) Guidelines for assessing and monitoring the impact of solar power generating facilities on birds in southern Africa. BirdLife South Africa by Jenkins, A.R., Ralston-Paton, Smit- Robinson, A.H. 2017 (hereafter referred to as the Solar Guidelines) consulted to determine the level of survey effort that is required.
- A SSV survey was conducted on 23 June 2023. The Project Site was inspected with a 4x4 vehicle and on foot. All birds were recorded.
- Priority species were defined as follows:
    - South African Red Data species.
    - South African endemics and near-endemics.
    - Raptors
    - Waterbirds

OUTCOME OF SITE RECONNAISSANCE

➢ **Natural Environment**

The Project Site falls within the Fynbos Biome in the West Strandveld Bioregion (Mucina & Rutherford 2006, VegMap 2018). The terrain in the Project area and surrounds is mostly flat. Rainfall in the area varies from approximately 250 mm to 380 mm and falls almost exclusively in winter. The mean daily maximum and minimum temperatures are 26.6°C and 7.9°C for February and July, respectively. Fog and dew from the nearby Atlantic Ocean contribute to the moisture balance in summer and autumn. Strong southeasterly winds are typical of the summer period, and northerly winds are more frequent in the winter months, especially between May and August.

The main vegetation type within the Project Site is Saldanha Flats Strandveld (**Figure 1**). The Saldanha Flats Strandveld vegetation type is characterized by *Sclerophyllous* shrublands made up of a sparse emergent and moderately tall shrub layer, with an open succulent shrub layer forming the undergrowth. With conspicuous displays of geophytes and annual herbaceous flora in spring.

Figure 1: Saldanha Flats Strandveld vegetation in the Project Site.

The Project Site lies just north (800m) and east (1.3 km) of the Berg River at its associated estuarine vegetation, salt marshes, reeds, and sedges. These areas provide important habitats for several bird species, especially waterbirds, and waders.

The Project Site also contains seasonal wetlands/pans that could potentially attract priority species, like waterbirds and the raptors that prey on them, to the area (**Figure 2**).

Figure 2: Natural pan in the Project Site.

Whilst the distribution and abundance of the bird species in and near the Project Site is mostly associated with natural vegetation, it is also necessary to examine the anthropogenic modifications to the environment that have relevance for birds.

- **Modified Environment**

The following avifaunal-relevant anthropogenic habitat modifications were recorded within the Project Site:

- **High Voltage Power Lines:** The 400kV Aurora Juno 1 power line traverses the Project Site (**Figure 3**). Power lines could provide roosting and nesting habitat for priority species, especially raptors.
- **Alien Trees:** The Project Site contains clumps of alien trees (**Figure 4**). The trees could attract a variety of bird species for nesting and roosting.
- **Agriculture:** The Project Site contains agricultural fields, mainly canola, wheat, grains, and planted pastures (**Figure 5**). Some priority species are likely to be associated with the cultivated fields, especially to forage (e.g., raptors and small birds). The Cape Weaver, Large-billed Lark, Blue Crane, and Barn Swallow are some of the priority species that could utilise these areas.

Figure 3: High voltage power line in the Project Site.

Figure 4: Alien trees in the Project Site.

Figure 5: Agricultural field in the Project Site.

- **DFFE Screening Tool**

The Project Site and immediate environment is classified as **HIGH/MEDIUM** sensitivity for avifauna according to the Animal Species Theme (**Figure 6**). The sensitivity classification is linked to the possible occurrence of Southern Black Korhaan *Afrotis afra* (Globally and Regionally Vulnerable), Black Harrier *Circus maurus* (Globally and Regionally Endangered), African Marsh Harrier *Circus ranivorus* (Regionally Endangered), and Lanner Falcon (Regionally Vulnerable). The Project Site contains confirmed habitat for species of conservation concern (SCC) as defined in the Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial animal species (Government Gazette No 43855, 30 October 2020). SCCs are listed on the IUCN Red List of Threatened Species or South Africa's National Red List website as Critically Endangered, Endangered, Near Threatened or Vulnerable. The Project Site contains suitable habitat for Black Harriers (**Figure 7**).

The occurrence of SCC at the Project Site was confirmed during the SSV site visits (June and July 2023) with observations of Blue Crane *Grus paradisea* (Globally Vulnerable and Regionally Near Threatened) and Southern Black Korhaan recorded on-site. A Black Harrier was also observed on site on 07 September 2023.

Based on the confirmed habitat and the field surveys, the classification of **HIGH** sensitivity for avifauna in the Screening Tool is supported.

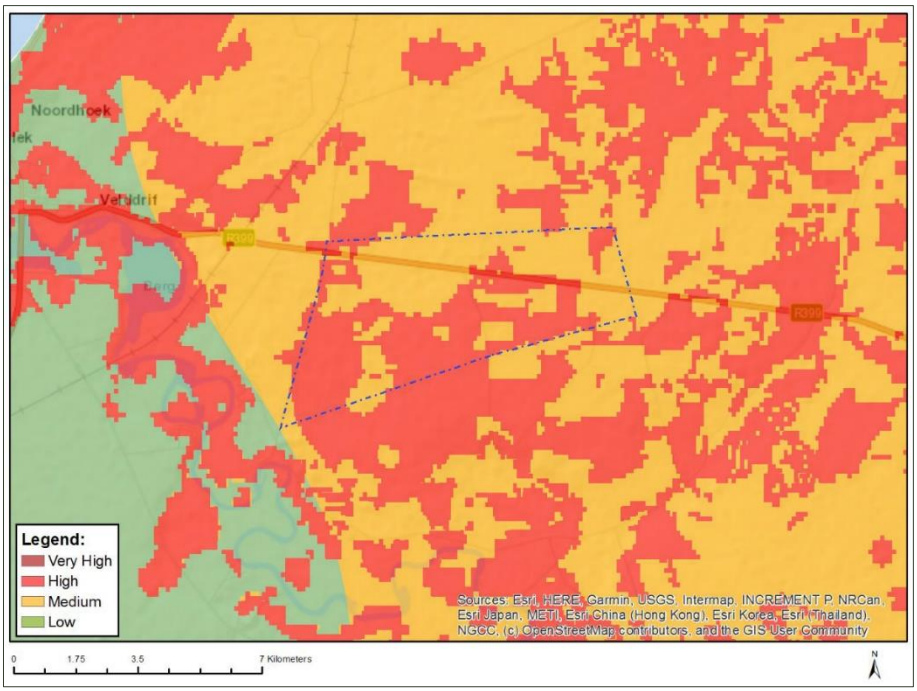

Figure 6: The classification of the Sunveld SEF Project Site according to the Animal Species Theme in the DFFE National Screening Tool. The High and Medium sensitivity classification is linked to the potential occurrence of Black Harrier (Globally and Regionally Endangered), Southern Black Korhaan (Globally and Regionally Vulnerable), Lanner Falcon (Regionally Vulnerable), and African Marsh Harrier (Regionally Endangered).

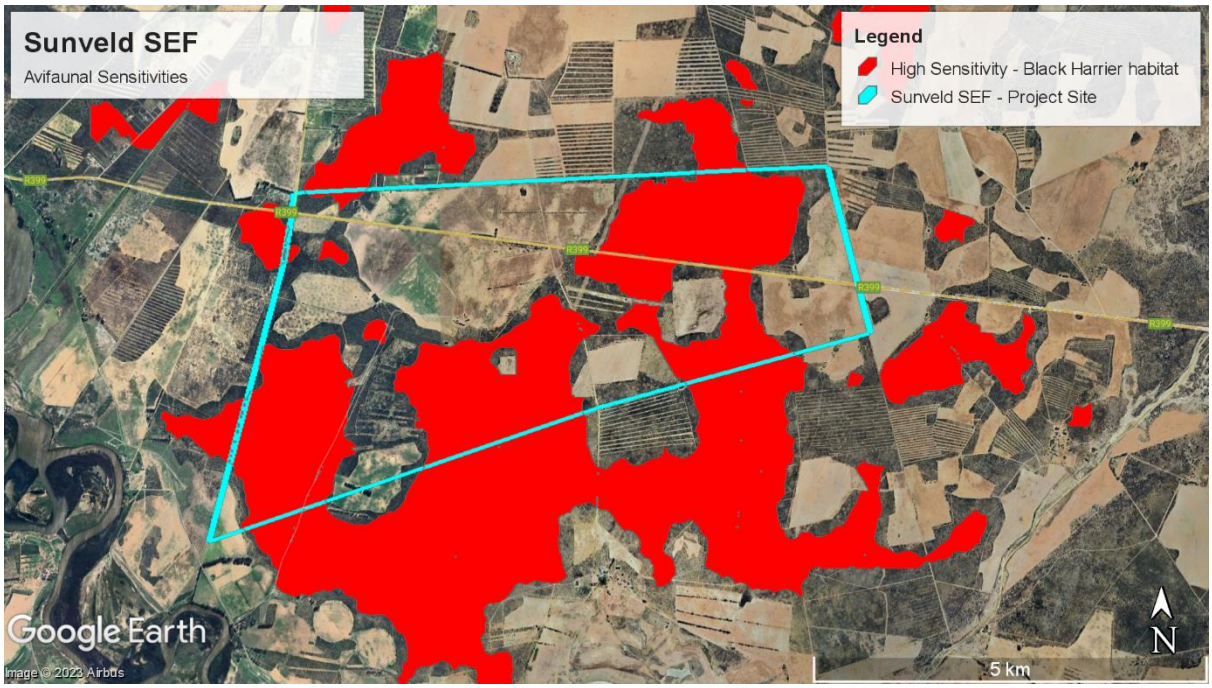

Figure 7: Avifaunal sensitivities (i.e., Black Harrier habitat identified through habitat suitability modelling) at the Sunveld SEF Project Site.

- **Avifauna**

The SABAP2 data indicates that a total of 259 bird species could potentially occur within the Broader Area where the Project Site is located – **Appendix 1** provides a comprehensive bird species list. Of these, 135 species are classified as priority species for solar developments and 20 of these are South African Red Listed species (i.e., Species of Conservation Concern – SCC). Of the 135 priority species, 85 are likely to occur regularly in or near the Project Site, and 33 priority species were recorded during the on-site surveys.

CONCLUSION

The occurrence of SCC at the Project Site was confirmed during the SSV Site Visits (June and July 2023) with observations of Blue Crane *Grus paradisea* (Globally Vulnerable and Regionally Near Threatened) and Southern Black Korhaan recorded on-site. A Black Harrier was also observed on site on 07 September 2023. Based on the confirmed habitat, the SABAP2 data, and the field surveys, the classification of **HIGH SENSITIVITY** for avifauna in the Screening Tool is supported.

APPENDIX 6: IMPACT RATING METHODOLOGY

The criteria used to assess both the impacts and the method of determining the significance of the impacts is outlined in below. This method complies with the method provided in the EIA guideline document (GN. 654 of 2010). Part A provides the definitions of the criteria and the approach for determining impact consequence (combining intensity, extent, and duration). In Part B, a matrix is applied to determine this impact consequence. In Part C, the consequence rating is considered together with the probability of occurrence to determine the overall significance of each impact. Lastly, the interpretation of the impact significance is provided in Part D.

The specialists are also required to include a comment on the following, the degree to which the impact:

- Can be reversed;
- May cause irreplaceable loss of resources; and
- Can be avoided, managed, or mitigated.

Part A provides the definition for determining impact consequence (combining intensity, extent, and duration) and impact significance (the overall rating of the impact). Impact consequence and significance are determined from Part B and C. The interpretation of the impact significance is given in Part D. This methodology is utilised to assess both the incremental and cumulative project related impacts.

Impact Rating Methodology

PART A: DEFINITIONS AND CRITERIA		
Definition of SIGNIFICANCE		**Significance = consequence x probability**
Definition of CONSEQUENCE		**Consequence is a function of intensity, extent, and duration**
Criteria for ranking of the INTENSITY of environmental impacts	**VH**	Severe change, disturbance, or degradation. Associated with severe consequences. May result in severe illness, injury, or death. Targets, limits, and thresholds of concern continually exceeded. Habitats or ecosystems of high importance for maintaining the persistence of species or habitats that meet critical habitat thresholds. Substantial intervention will be required. Vigorous/widespread community mobilization against project can be expected. May result in legal action if impact occurs.
	H	Prominent change, disturbance, or degradation. Associated with real and substantial consequences. May result in illness or injury. Targets, limits, and thresholds of concern regularly exceeded. Habitats or ecosystems which are important for meeting national/provincial conservation targets. Will definitely require intervention. Threats of community action. Regular complaints can be expected when the impact takes place.
	M	Moderate change, disturbance, or discomfort. Associated with real but not substantial consequences. Targets, limits, and thresholds of concern may occasionally be exceeded. Habitats or ecosystems with important functional value in maintaining biotic integrity. Occasional complaints can be expected.
	L	Minor (Slight) change, disturbance, or nuisance. Associated with minor consequences or deterioration. Targets, limits, and thresholds of concern rarely exceeded. Habitats and ecosystems which are degraded and modified. Require only minor interventions or clean-up actions. Sporadic complaints could be expected.
	VL	Negligible change, disturbance, or nuisance. Associated with very minor consequences or deterioration. Targets, limits, and thresholds of concern never exceeded. Species or habitats with negligible importance. No interventions or clean-up actions required. No complaints anticipated.

	VL+	Negligible change or improvement. Almost no benefits. Change not measurable/will remain in the current range.
	L+	Minor change or improvement. Minor benefits. Change not measurable/will remain in the current range. Few people will experience benefits.
	M+	Moderate change or improvement. Real but not substantial benefits. Will be within or marginally better than the current conditions. Small number of people will experience benefits.
	H+	Prominent change or improvement. Real and substantial benefits. Will be better than current conditions. Many people will experience benefits. General community support.
	VH+	Substantial, large-scale change or improvement. Considerable and widespread benefit. Will be much better than the current conditions. Favourable publicity and/or widespread support expected.
Criteria for ranking the DURATION of impacts	**Very Short term**	Very short, always less than a year or may be intermittent (less than 1 year). Quickly reversible.
	Short term	Short-term, occurs for more than 1 but less than 5 years. Reversible over time.
	Medium term	Medium-term, 5 to 10 years.
	Long term	Long term, between 10 and 20 years. Likely to cease at the end of the operational life of the activity or because of natural processes or by human intervention.
	Very long term/ permanent	Very long, permanent, +20 years. Irreversible. Beyond closure or where recovery is not possible either by natural processes or by human intervention.
Criteria for ranking the EXTENT of impacts	**Site**	A part of the site/property. Impact is limited to the immediate footprint of the activity and within a confined area.
	Whole site	Whole site. Impact is confined to within the project area and its nearby surroundings.
	Beyond site	Beyond the site boundary, affecting immediate neighbours.
	Local	Local area, extending far beyond site boundary.
	Regional/ national	Regional/National. Impact may extend beyond district or regional boundaries with national implications.

PART B: DETERMINING CONSEQUENCE – APPLIES TO POSITIVE OR ADVERSE IMPACTS

		EXTENT				
		Site	**Whole site**	**Beyond the site, affecting neighbours**	**Local area, extending far beyond site**	**Regional/ National**
INTENSITY = VL						
DURATION	**Very long term /permanent**	**Low**	**Low**	**Medium**	**Medium**	**Medium**
	Long term	**Very Low**	**Low**	**Low**	**Medium**	**Medium**
	Medium term	**Very Low**	**Low**	**Low**	**Low**	**Medium**
	Short term	**Very low**	**Very Low**	**Low**	**Low**	**Low**

	Very short term	Very low	Very Low	Very Low	Very Low	Low
INTENSITY = L						
DURATION	Very long term /permanent	Low	Medium	Medium	High	High
	Long term	Low	Medium	Medium	Medium	High
	Medium term	Low	Low	Medium	Medium	Medium
	Short term	Very low	Low	Low	Medium	Medium
	Very short term	Very low	Very low	Low	Low	Low
INTENSITY = M						
DURATION	Very long term /permanent	Medium	Medium	High	High	Very High
	Long term	Low	Medium	Medium	High	High
	Medium term	Low	Medium	Medium	Medium	High
	Short term	Low	Low	Medium	Medium	Medium
	Very short term	Very low	Low	Low	Low	Medium
INTENSITY = H						
DURATION	Very long term /permanent	Medium	High	High	Very High	Very High
	Long term	Medium	Medium	High	High	Very High
	Medium term	Low	Medium	Medium	High	High
	Short term	Low	Medium	Medium	Medium	High
	Very short term	Very low	Low	Low	Medium	Medium
INTENSITY = VH						
DURATION	Very long term /permanent	Medium	High	Very High	Very High	Very High
	Long term	Medium	High	High	Very High	Very High
	Medium term	Medium	Medium	High	High	Very High
	Short term	Low	Medium	Medium	High	High
	Very short term	Low	Low	Medium	Medium	Medium

PART C: DETERMINING SIGNIFICANCE - APPLIES TO POSITIVE OR ADVERSE IMPACTS							
PROBABILITY (of exposure to impacts)	Definite/ Continuous	VH	Very Low	Low	Medium	High	Very High
	Probable	H	Very Low	Low	Medium	High	Very High
	Possible/ frequent	M	Very Low	Very Low	Low	Medium	High
	Conceivable	L	Insignificant	Very Low	Low	Medium	High
	Unlikely/ improbable	VL	Insignificant	Insignificant	Very Low	Low	Medium
			VL	L	M	H	VH
			CONSEQUENCE				

PART D: INTERPRETATION OF SIGNIFICANCE	
Significance	Decision guideline

Very High	**Very High +**	Represents a key factor in decision-making. Adverse impact would be considered a potential fatal flaw unless mitigated to lower significance.
High	**High +**	These beneficial or adverse impacts are considered to be very important considerations and must have an influence on the decision. In the case of adverse impacts, substantial mitigation will be required.
Medium	**Medium +**	These beneficial or adverse impacts may be important but are not likely to be key decision-making factors. In the case of adverse impacts, mitigation will be required.
Low	**Low +**	These beneficial or adverse impacts are unlikely to have a real influence on the decision. In the case of adverse impacts, limited mitigation is likely to be required.
Very Low	**Very Low +**	These beneficial or adverse impacts will not have an influence on the decision. In the case of adverse impacts, mitigation is not required.
Insignificant		Inconsequential, not requiring any consideration.

Additional criteria that are taken into consideration in the impact assessment process to further describe the impact and support the interpretation of significance in the impact assessment process include:

- the degree to which impacts may cause irreplaceable loss of resources;
- the degree to which impacts can be avoided;
- the degree to which impacts can be reversed;
- the degree to which the impacts can be mitigated; and
- the extent to which cumulative impacts may arise from interaction or combination from other planned activities or projects is tabulated below.

ADDITIONAL ASSESSMENT CRITERIA		
Criteria for DEGREE TO WHICH AN IMPACT CAN BE REVERSED	**IRREVERSIBLE**	Where the impact cannot be reversed and is permanent.
	PARTIALLY REVERSIBLE	Where the impact can be partially reversed and is temporary.
	FULLY REVERSIBLE	Where the impact can be completely reversed.
Criteria for DEGREE OF IRREPLACEABLE RESOURCE LOSS	**NONE**	Will not cause irreplaceable loss.
	LOW	Where the activity results in a marginal effect on an irreplaceable resource.
	MEDIUM	Where an impact results in a moderate loss, fragmentation or damage to an irreplaceable receptor or resource.
	HIGH	Where the activity results in an extensive or high proportion of loss, fragmentation or damage to an irreplaceable receptor or resource.
Criteria for DEGREE TO WHICH IMPACT CAN BE AVOIDED	**NONE**	Impact cannot be avoided, and consideration should be given to compensation and offsets.
	LOW	Impact cannot be avoided but can be mitigated to acceptable levels through rehabilitation and restoration.
	MEDIUM	Impact cannot be avoided, but the significance can be reduced through mitigation measures.
	HIGH	Impact can be avoided through the implementation of preventative mitigation measures.
Criteria for the DEGREE TO WHICH IMPACT	**NONE**	No mitigation is possible or mitigation even if applied would not change the impact.
	LOW	Some mitigation is possible but will have marginal effect in reducing the impact significance rating.

CAN BE MITIGATED	**MEDIUM**	Mitigation is feasible and will may reduce the impact significance rating.
	HIGH	Mitigation can be easily applied or is considered standard operating practice for the activity and will reduce the impact significance rating.
Criteria for POTENTIAL FOR CUMULATIVE IMPACTS	**UNLIKELY**	Low likelihood of cumulative impacts arising.
	POSSIBLE	Cumulative impacts with other activities or projects may arise.
	LIKELY	Cumulative impacts with other activities or projects either through interaction or in combination can be expected.