Red Sands Photovoltaic 3 (PV3) Facility – Avifauna Impact Assessment

Mgcawu District Municipality, Northern Cape

December 2021

CLIENT

Prepared by:

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Report Name	**Red Sands Photovoltaic 3 (PV3) Facility – Avifauna Impact Assessment**
Client	savannah environmental
Field work (Screening)	**Dr Mahomed Desai** Mahomed Desai has extensive experience in assessing estuarine, freshwater and terrestrial biodiversity. He obtained his M.Sc. in Environmental Engineering and Ph.D. in Ecological Sciences, and is an accredited SASS5 practitioner. Mahomed has over 10 years of experience working with African fauna and flora as a researcher and consultant, through various national and international projects, including those requiring IFC standards. Mahomed has also completed training courses in GIS, stable-isotope analysis, micro-PIXE analysis and deriving energy from waste.
Field Work (Screening)	**Eric Robins** Eric has gained birding experience in the Northern Cape, North West, Mpumalanga and also Gauteng. He is a contributing scientist (No 21137) to the South African Bird Atlas Project 2
Report Writer/Field work	**Dr Lindi Steyn** Dr Lindi Steyn has completed her PhD in Biodiversity and Conservation from the University of Johannesburg. Lindi is a terrestrial ecologist with a special interest in ornithology. She has completed numerous studies ranging from Basic Assessments to Environmental Impact Assessments following IFC standards.
Report Reviewer	**Andrew Husted** Andrew Husted is Pr Sci Nat registered (400213/11) in the following fields of practice: Ecological Science, Environmental Science and Aquatic Science. Andrew is an Aquatic, Wetland and Biodiversity Specialist with more than 12 years' experience in the environmental consulting field.
Declaration	The Biodiversity Company and its associates operate as independent consultants under the auspice of the South African Council for Natural Scientific Professions. We declare that we have no affiliation with or vested financial interests in the proponent, other than for work performed under the Environmental Impact Assessment Regulations, 2017. We have no conflicting interests in the undertaking of this activity and have no interests in secondary developments resulting from the authorisation of this project. We have no vested interest in the project, other than to provide a professional service within the constraints of the project (timing, time and budget) based on the principals of science.

DECLARATION

I, Lindi Steyn, declare that:

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations, and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by the competent authority; and the objectivity of any report, plan, or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of Section 24F of the Act.

Lindi Steyn

Terrestrial Ecologist

The Biodiversity Company

December 2021

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1 Introduction

The Biodiversity Company (TBC) was appointed to undertake a Regime 2 avifaunal assessment for the proposed RED Sands 1 Solar Photovoltaic (PV) facility near Upington, Northern Cape (Figure 1-1).

AGV Projects (Pty) Ltd is proposing the development of a solar PV facility (known as the Red Sands PV3 facility) and associated infrastructure on a site located approximately 22km northeast of Groblershoop, within the !Kheis Local Municipality and the ZF Mgcawu District Municipality in the Northern Cape Province. The project is to be known as Red Sands PV3 and will have a contracted capacity of up to 75MW.

A preferred project site with an extent of ~3380ha and a development area of ~184ha within the project site has been identified by AGV Projects (Pty) Ltd as a technically suitable area for the development of the Red Sands PV3 facility. The development area for the PV facility is located on Portion 19 of the Farm Rooisand 387. The project site is accessible via an existing gravel farm road from an existing main gravel road off the N8 which is located southeast of the project site.

The Red Sands PV3 project site is proposed to accommodate the following infrastructure, which will enable the PV facility to supply a contracted capacity of up to 75MW_{AC}:

- Solar PV array comprising PV modules and mounting structures;
- Inverters and transformers;
- Low voltage cabling between the PV modules to the inverters;
- Fence around the project development area;
- Camera surveillance;
- Internet connection;
- 33kV cabling between the project components and the facility substation;
- 33/132kV onsite facility substation[1];
- Battery Energy Storage System (BESS);
- Site offices and maintenance buildings, including workshop areas for maintenance and storage;
- Laydown areas; and
- Access roads (up to 6m) and internal distribution roads (up to 4m).

The solar PV facility is proposed in response to the identified objectives of the national and provincial government and local and district municipalities to develop renewable energy facilities for power generation purposes. It is the developer's intention to bid the Red Sands

1 A 132kV powerline will be assessed through a separate Basic Assessment Process

PV3 Facility under the Department of Mineral Resources and Energy's (DMRE's) Renewable Energy Independent Power Producer Procurement (REIPPP) Programme (or a similar programme), with the aim of evacuating the generated power into the national grid. This will aid in the diversification and stabilisation of the country's electricity supply, in line with the objectives of the Integrated Resource Plan (IRP) with the Red Sands PV3 Facility set to inject up to 75MW into the national grid.

This assessment was deemed a requirement based on information provided by the National Web-Based Environmental Screening Tool (DEA 2021), which demarcated the project site as highly sensitive for the animal environmental theme, the avifauna sensitivity were also rated as medium sensitivity in portion of the project site.

The approach was informed by the Environmental Impact Assessment Regulations. 2014 (GNR 326, 7 April 2017) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA). The approach has taken cognisance of the recently published Government Notices 320 (20 March 2020) in terms of NEMA, dated 20 March and 30 October 2020: "*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 the National Environmental Management Act, 1998, when applying for Environmental Authorisation*" (Reporting Criteria). This is contingent of the PV facility providing electricity output of 20 megawatts (MW) or more.

1.1 Scope of the Assessment

The assessment was achieved according to the above-mentioned legislation and the best-practice guidelines and principles for avifaunal assessment within solar energy facilities as outlined by Birdlife South Africa.

The scope of the avifaunal assessment included the following:

- Description of the baseline avifaunal community;
- Identification of present or potentially occurring Species of Conservation Concern (SCC);
- Sensitivity assessment and map to identify sensitive areas in the project site; and
- Impact assessment, mitigation measures to prevent or reduce the possible impacts.

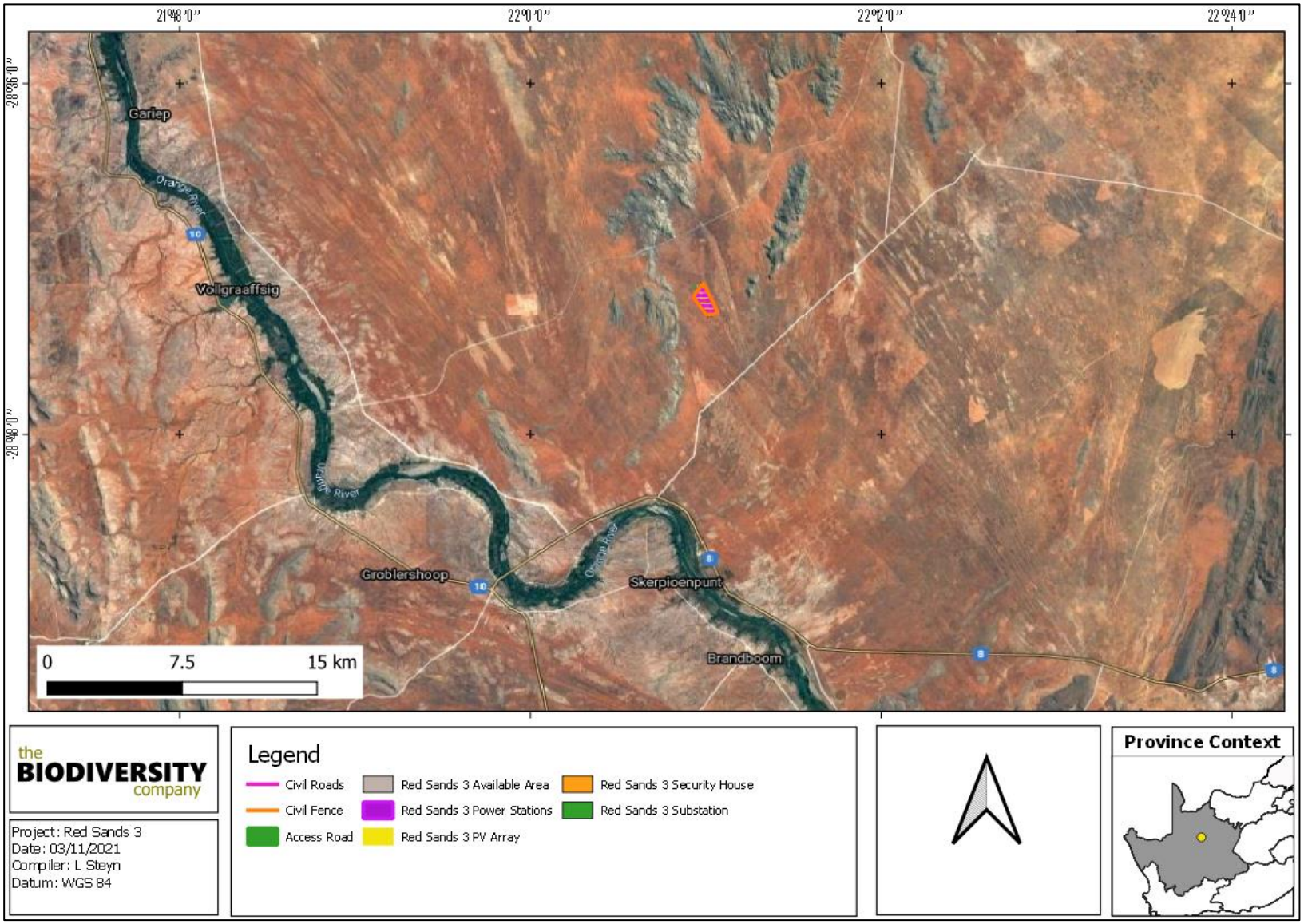

Figure 1-1 Proposed project location.

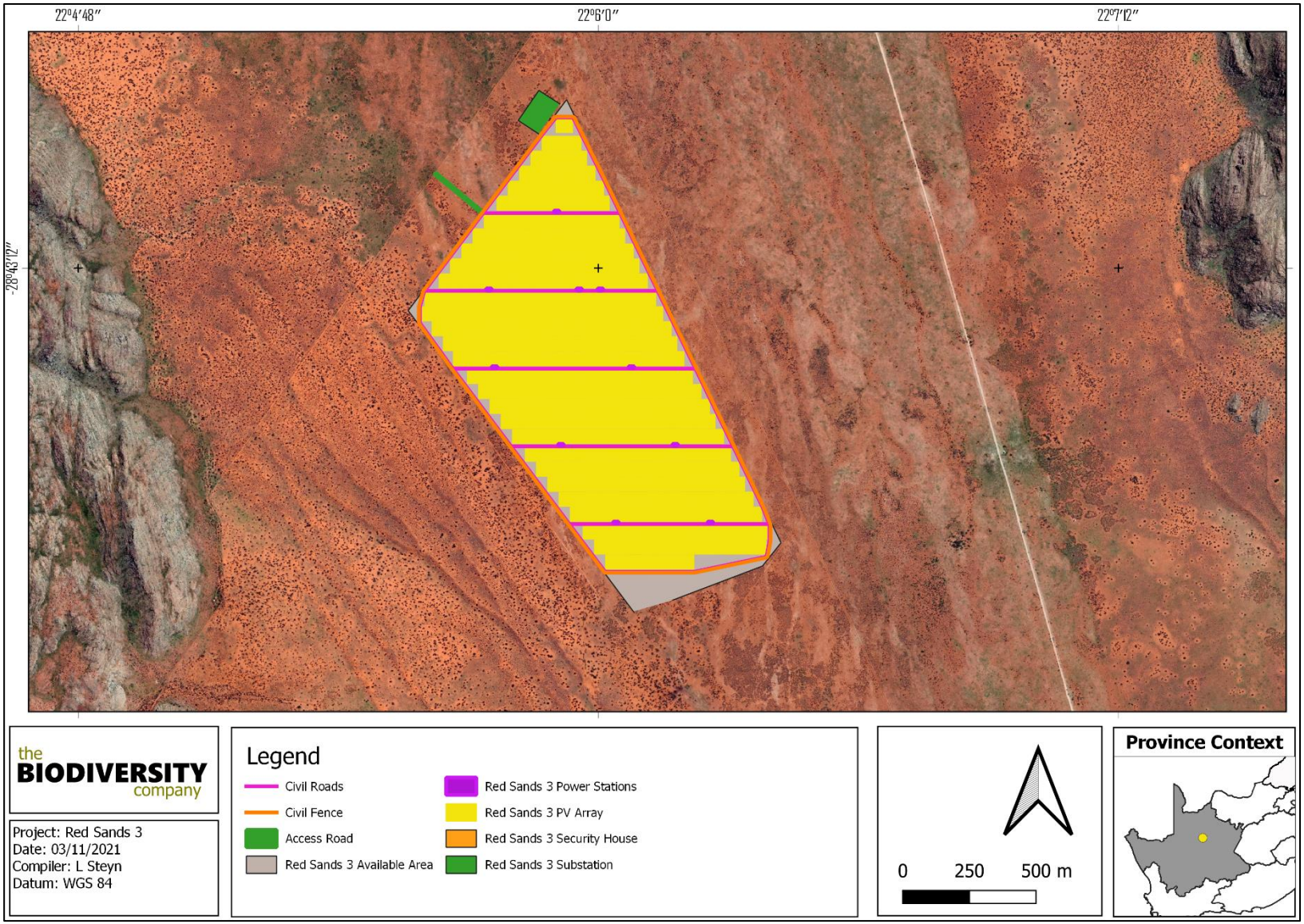

Figure 1-2 Proposed project site

2 Key Legislative Requirements

The legislation, policies and guidelines listed below are applicable to the current project in terms of biodiversity and ecological support systems. The list below, although extensive, is not exhaustive and other legislation, policies and guidelines may apply in addition to those listed below (Table 2-1).

Table 2-1 A list of key legislative requirements and guidelines

Region	Legislation and Guidelines
International	Convention on Biological Diversity (CBD, 1993)
	The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES 1973)
	The Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention, 1979)
National	Constitution of the Republic of South Africa (Act No. 108 of 1996)
	NEMA
	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 the National Environmental Management Act, 1998, GNR 320 of Government Gazette 43310 (March 2020)
	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 the National Environmental Management Act, 1998, GNR 1150 of Government Gazette 43855 (October 2020)
	The National Environmental Management: Protected Areas Act (Act No. 57 of 2003)
	The National Environmental Management: :Biodiversity Act (Act No. 10 of 2004) (NEMBA), Threatened or Protected Species Regulations
	The National Environmental Management: Waste Act, 2008 (Act 59 of 2008);
	The Environment Conservation Act (Act No. 73 of 1989)
	National Protected Areas Expansion Strategy (NPAES)
	Natural Scientific Professions Act (Act No. 27 of 2003)
	National Biodiversity Framework (NBF, 2009)
	National Spatial Biodiversity Assessment (NSBA)
	National Heritage Resources Act, 1999 (Act 25 of 1999)
	Alien and Invasive Species Regulations and Alien and Invasive Species List 2020, published under NEMBA
	South Africa's National Biodiversity Strategy and Action Plan (NBSAP)
	Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983)
	White Paper on Biodiversity
	South African National Biodiversity Institute (SANBI). 2020. *Species Environmental Assessment Guideline. Guidelines for the implementation of the Terrestrial Fauna and Terrestrial Flora Species Protocols for environmental impact assessments in South Africa*. South African National Biodiversity Institute, Pretoria. Version 1.2020.
	Best practice guidelines for avifaunal impact studies at solar developments, compiled by BirdLife South Africa (BLSA) in 2017 (Jenkins *et al*., 2017)
Provincial	Northern Cape Nature Conservation act no. 9 of 2009
	Northern Cape Planning and Development Act no. 7 of 1998
	Northern Cape Critical Biodiversity Area 2017

3 Assumptions and Limitations

The following assumptions and limitations should be noted for the assessment:

- Information relating to project activities, spatial data and infrastructure locations for the proposed development was obtained from information provided by the client. The potential impacts and recommendations described in this report apply specifically to the provided information;
- Although considerable time has been spent to ensure that information utilised in this report is verified. It is assumed that all third-party information utilised in the compilation of this report is correct at the time of compilation (e.g., spatial data, online databases, and species lists);
- Being an extremely remote area, the birds were unusually “skittish” and could have influenced the species observed;
- The survey area were very dry -a 5 year drought have been ongoing in the area;
- A screening assessment was conducted in the winter, this was not a full assessment.

4 Methodologies

4.1 Desktop Assessment

The following resources were consulted during the desktop assessment and for the compilation of the expected species list:

- Hockey *et al*. (2005), Roberts Birds of Southern Africa (seventh end.). The primary source for species identification, geographic range, and life history information;
- Sinclair and Ryan (2010), Birds of Africa. Secondary source for identification;
- South African Bird Atlas Project (SABAP 2). Full protocol atlassing data from relevant pentads used to construct expected species list; and
- Taylor *et al*. (2015), Eskom Red Data Book of Birds of South Africa, Lesotho, and Swaziland. Used for conservation status, nomenclature, and taxonomical ordering.

4.2 Field Assessment

The winter screening field survey was undertaken during 24th – 25th of June 2021, while the summer survey was undertaken from 15th to 19th of November 2021 to determine the presence of SCC. Effort was made to cover all the different habitat types within the limits of time and access. Areas surrounding the project site were also surveyed, this included areas on the Orange river (approximately 12 km away but could still have an impact on water birds moving between major water sources) and some of the nearby ridges (Figure 4-1).

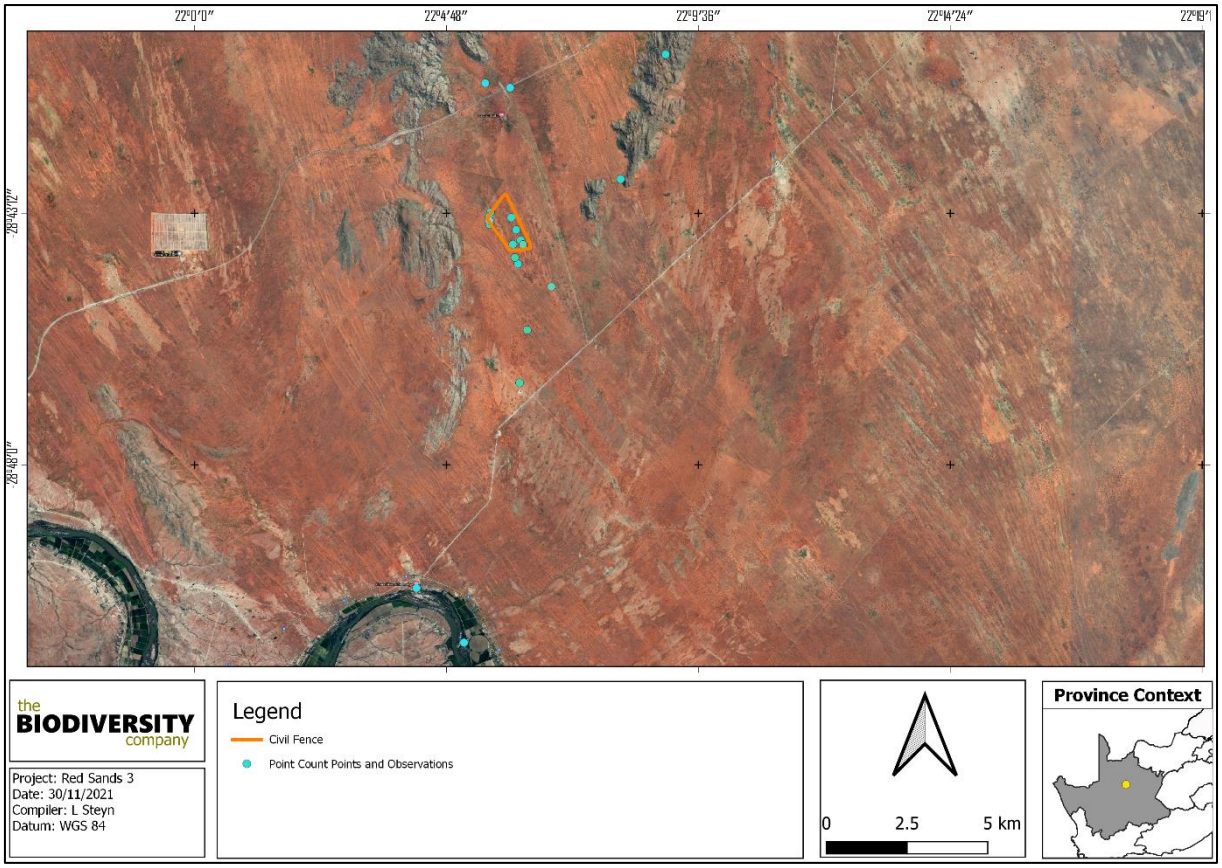

Figure 4-1 Map illustrating the field survey area

Sampling consisted of standardized point counts as well as random diurnal incidental surveys and vantage point surveys. Standardized point counts (following Buckland *et al.* 1993) were conducted to gather data on the species composition and relative abundance of species within the broad habitat types identified. Each point count was run over a 5 min period. The horizontal detection limit was set at 50 m. At each point the observer would document the date, start time, and end time, habitat, numbers of each species, detection method (seen or heard), behaviour (perched or flying) and general notes on habitat and nesting suitability for conservation important species. To supplement the species inventory with cryptic and illusive species that may not be detected during the rigid point count protocol, diurnal incidental searches were conducted. This involved the opportunistic sampling of species between point count periods, river scanning and road cruising.

4.2.1 Data analysis

Point count data was arranged into a matrix with point count samples in rows and species in columns. The table formed the basis of the various subsequent statistical analyses. This data was first used to distinguish similarities / differences in the species composition between the two identified avifaunal habitats, the matrix was converted into a Bray-Curtis dissimilarity matrix. The data was subject to fourth root transformation to downscale the contribution of very abundant species while upscaling the influence of less abundant species. However, the effect was negligible and ultimately the raw data proved more informative. Thirdly, raw count data was converted to relative abundance values and used to establish dominant species and calculate the diversity of each habitat. The Shannon Diversity Index (H') was the metric used to estimate diversity. Lastly, present, and potentially occurring species were assigned to 13 major trophic

guilds loosely based on the classification system developed by González-Salazar *et al.* (2014). Species were first classified by their dominant diet (carnivore, herbivore, granivore, frugivore, nectarivore, omnivore), then by the medium upon / within which they most frequently forage (ground, water, foliage, air) and lastly by their activity period (nocturnal or diurnal).

4.3 Site Ecological Importance

The different habitat types within the assessment area were delineated and identified based on observations during the field assessment as well as available satellite imagery. These habitat types were assigned Site Ecological Importance (SEI) categories based on their ecological integrity, conservation value, the presence of species of conservation concern and their ecosystem processes. The determination of the SEI was in accordance with the method described in the Species Environmental Assessment Guideline (SANBI, 2020).

Site Ecological Importance (SEI) is a function of the Biodiversity Importance (BI) of the receptor (e.g., SCC, the vegetation/fauna community or habitat type present on the site) and Receptor Resilience (RR) (its resilience to impacts).

BI is a function of Conservation Importance (CI) and the Functional Integrity (FI) of the receptor as follows. The criteria for the CI and FI ratings are provided in Table 4-1 and Table 4-2, respectively.

Table 4-1 Summary of Conservation Importance (CI) criteria

Conservation Importance	Fulfilling Criteria
Very High	Confirmed or highly likely occurrence of CR, EN, VU or Extremely Rare or Critically Rare species that have a global extent of occurrence (EOO) of < 10 km^2. Any area of natural habitat of a CR ecosystem type or large area (> 0.1% of the total ecosystem type extent) of natural habitat of an EN ecosystem type. Globally significant populations of congregatory species (> 10% of global population).
High	Confirmed or highly likely occurrence of CR, EN, VU species that have a global EOO of > 10 km^2. IUCN threatened species (CR, EN, VU) must be listed under any criterion other than A. If listed as threatened only under Criterion A, include if there are less than 10 locations or < 10 000 mature individuals remaining. Small area (> 0.01% but < 0.1% of the total ecosystem type extent) of natural habitat of EN ecosystem type or large area (> 0.1%) of natural habitat of VU ecosystem type. Presence of Rare species. Globally significant populations of congregatory species (> 1% but < 10% of global population).
Medium	Confirmed or highly likely occurrence of populations of NT species, threatened species (CR, EN, VU) listed under Criterion A only and which have more than 10 locations or more than 10 000 mature individuals. Any area of natural habitat of threatened ecosystem type with status of VU. Presence of range-restricted species. > 50% of receptor contains natural habitat with potential to support SCC.
Low	No confirmed or highly likely populations of SCC. No confirmed or highly likely populations of range-restricted species. < 50% of receptor contains natural habitat with limited potential to support SCC.
Very Low	No confirmed and highly unlikely populations of SCC. No confirmed and highly unlikely populations of range-restricted species. No natural habitat remaining.

Table 4-2 Summary of Functional Integrity (FI) criteria

Functional Integrity	Fulfilling Criteria
Very High	Very large (> 100 ha) intact area for any conservation status of ecosystem type or > 5 ha for CR ecosystem types. High habitat connectivity serving as functional ecological corridors, limited road network between intact habitat patches. No or minimal current negative ecological impacts with no signs of major past disturbance.

Functional Integrity	Fulfilling Criteria
High	Large (> 20 ha but < 100 ha) intact area for any conservation status of ecosystem type or > 10 ha for EN ecosystem types. Good habitat connectivity with potentially functional ecological corridors and a regularly used road network between intact habitat patches. Only minor current negative ecological impacts with no signs of major past disturbance and good rehabilitation potential.
Medium	Medium (> 5 ha but < 20 ha) semi-intact area for any conservation status of ecosystem type or > 20 ha for VU ecosystem types. Only narrow corridors of good habitat connectivity or larger areas of poor habitat connectivity and a busy used road network between intact habitat patches. Mostly minor current negative ecological impacts with some major impacts and a few signs of minor past disturbance. Moderate rehabilitation potential.
Low	Small (> 1 ha but < 5 ha) area. Almost no habitat connectivity but migrations still possible across some modified or degraded natural habitat and a very busy used road network surrounds the area. Low rehabilitation potential. Several minor and major current negative ecological impacts.
Very Low	Very small (< 1 ha) area. No habitat connectivity except for flying species or flora with wind-dispersed seeds. Several major current negative ecological impacts.

BI can be derived from a simple matrix of CI and FI as provided in Table 4-3

Table 4-3 Matrix used to derive Biodiversity Importance (BI) from Functional Integrity (FI) and Conservation Importance (CI)

Biodiversity Importance (BI)		Conservation Importance (CI)				
		Very high	**High**	**Medium**	**Low**	**Very low**
Functional Integrity (FI)	**Very high**	Very High	Very High	High	Medium	Low
	High	Very High	High	Medium	Medium	Low
	Medium	High	Medium	Medium	Low	Very Low
	Low	Medium	Medium	Low	Low	Very Low
	Very low	Medium	Low	Very Low	Very Low	Very Low

The fulfilling criteria to evaluate RR are based on the estimated recovery time required to restore an appreciable portion of functionality to the receptor as summarised in Table 4-4.

Table 4-4 Summary of Resource Resilience (RR) criteria

Resilience	Fulfilling Criteria
Very High	Habitat that can recover rapidly (~ less than 5 years) to restore > 75% of the original species composition and functionality of the receptor functionality, or species that have a very high likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a very high likelihood of returning to a site once the disturbance or impact has been removed.
High	Habitat that can recover relatively quickly (~ 5–10 years) to restore > 75% of the original species composition and functionality of the receptor functionality, or species that have a high likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a high likelihood of returning to a site once the disturbance or impact has been removed.
Medium	Will recover slowly (~ more than 10 years) to restore > 75% of the original species composition and functionality of the receptor functionality, or species that have a moderate likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a moderate likelihood of returning to a site once the disturbance or impact has been removed.
Low	Habitat that is unlikely to be able to recover fully after a relatively long period: > 15 years required to restore ~ less than 50% of the original species composition and functionality of the receptor functionality, or species that have a low likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a low likelihood of returning to a site once the disturbance or impact has been removed.
Very Low	Habitat that is unable to recover from major impacts, or species that are unlikely to remain at a site even when a disturbance or impact is occurring, or species that are unlikely to return to a site once the disturbance or impact has been removed.

Subsequent to the determination of the BI and RR, the SEI can be ascertained using the matrix as provided in Table 4-5.

Table 4-5 Matrix used to derive Site Ecological Importance from Receptor Resilience (RR) and Biodiversity Importance (BI)

Site Ecological Importance		Biodiversity Importance (BI)				
		Very High	High	Medium	Low	Very Low
Receptor Resilience (RR)	Very Low	Very High	Very High	High	Medium	Low
	Low	Very High	Very High	High	Medium	Very Low
	Medium	Very High	High	Medium	Low	Very Low
	High	High	Medium	Low	Very Low	Very Low
	Very High	Medium	Low	Very Low	Very Low	Very Low

Interpretation of the SEI in the context of the proposed development activities is provided in Table 4-6.

Table 4-6 Guidelines for interpreting Site Ecological Importance in the context of the proposed development activities (SANBI, 2020)

Site Ecological Importance	Interpretation in relation to proposed development activities
Very High	Avoidance mitigation – no destructive development activities should be considered. Offset mitigation not acceptable/not possible (i.e., last remaining populations of species, last remaining good condition patches of ecosystems/unique species assemblages). Destructive impacts for species/ecosystems where persistence target remains.
High	Avoidance mitigation wherever possible. Minimisation mitigation – changes to project infrastructure design to limit the amount of habitat impacted, limited development activities of low impact acceptable. Offset mitigation may be required for high impact activities.
Medium	Minimisation and restoration mitigation – development activities of medium impact acceptable followed by appropriate restoration activities.
Low	Minimisation and restoration mitigation – development activities of medium to high impact acceptable followed by appropriate restoration activities.
Very Low	Minimisation mitigation – development activities of medium to high impact acceptable and restoration activities may not be required.

The SEI evaluated for each taxon can be combined into a single multi-taxon evaluation of SEI for the assessment area. Either a combination of the maximum SEI for each receptor should be applied, or the SEI may be evaluated only once per receptor but for all necessary taxa simultaneously. For the latter, justification of the SEI for each receptor is based on the criteria that conforms to the highest CI and FI, and the lowest RR across all taxa.

5 Receiving Environment

5.1 Desktop Spatial Assessment

The following features describes the general area and habitat, this assessment is based on spatial data that are provided by various sources such as the provincial environmental authority and SANBI. The desktop analysis and their relevance to this project are listed in Table 5-1.

Table 5-1 Desktop spatial features examined.

Desktop Information Considered	Relevant/Not relevant	Section
Conservation Plan	The PV site overlaps with areas classified as Other Natural Area (ONA)	5.1.1

Protected Areas (SAPAD & SACAD)	Red Sands PV3 site is approximately 10,5 km form the Glen Lyon Nature Reserve	-
Important Bird and Biodiversity Areas	Red Sands PV3 site is approximately 165 km from the Augrabies National Park Important Bird Area (IBA).	5.1.2
Coordinated Avifaunal Road (CAR) count	The project site is 214 km away from the closest CAR route.	5.1.3
Vegetation Type	The project site overlaps with the Olifantshoek Plains Thornveld and the Gordonia Duneveld.	5.1.5
Renewable Energy Development Zones REDZ Phase 2	The project site overlaps with the Upington Solar phase 1 REDZ zone.	5.1.7
Coordinated Waterbird Count (CWAC)	The project site is approximately 116 km from the closest CWAC site	-

5.1.1 Northern Cape Biodiversity Spatial Plan

The Northern Cape Department of Environment and Nature Conservation (2017) has developed the Northern Cape CBA Map which identifies biodiversity priority areas for the province, called Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs). These biodiversity priority areas, together with protected areas, are important for the persistence of a viable representative sample of all ecosystem types and species as well as the long-term ecological functioning of the landscape as a whole.

The identification of Critical Biodiversity Areas for the Northern Cape was undertaken using a Systematic Conservation Planning approach. Available data on biodiversity features (incorporating both pattern and process, and covering terrestrial and inland aquatic realms), their condition, current Protected Areas and Conservation Areas, and opportunities and constraints for effective conservation were collated.

The Northern Cape Critical Biodiversity Area (CBA) Map updates, revises and replaces all older systematic biodiversity plans and associated products for the province. These include the:

- Namakwa District Biodiversity Sector Plan;
- Cape Fine-Scale Plan (only the extent of the areas in the Northern Cape i.e. Bokkeveld and Nieuwoudtville); and
- Richtersveld Municipality Biodiversity Assessment.

The project site is located in an area classified as Other Natural Area (*Figure* 5-1).

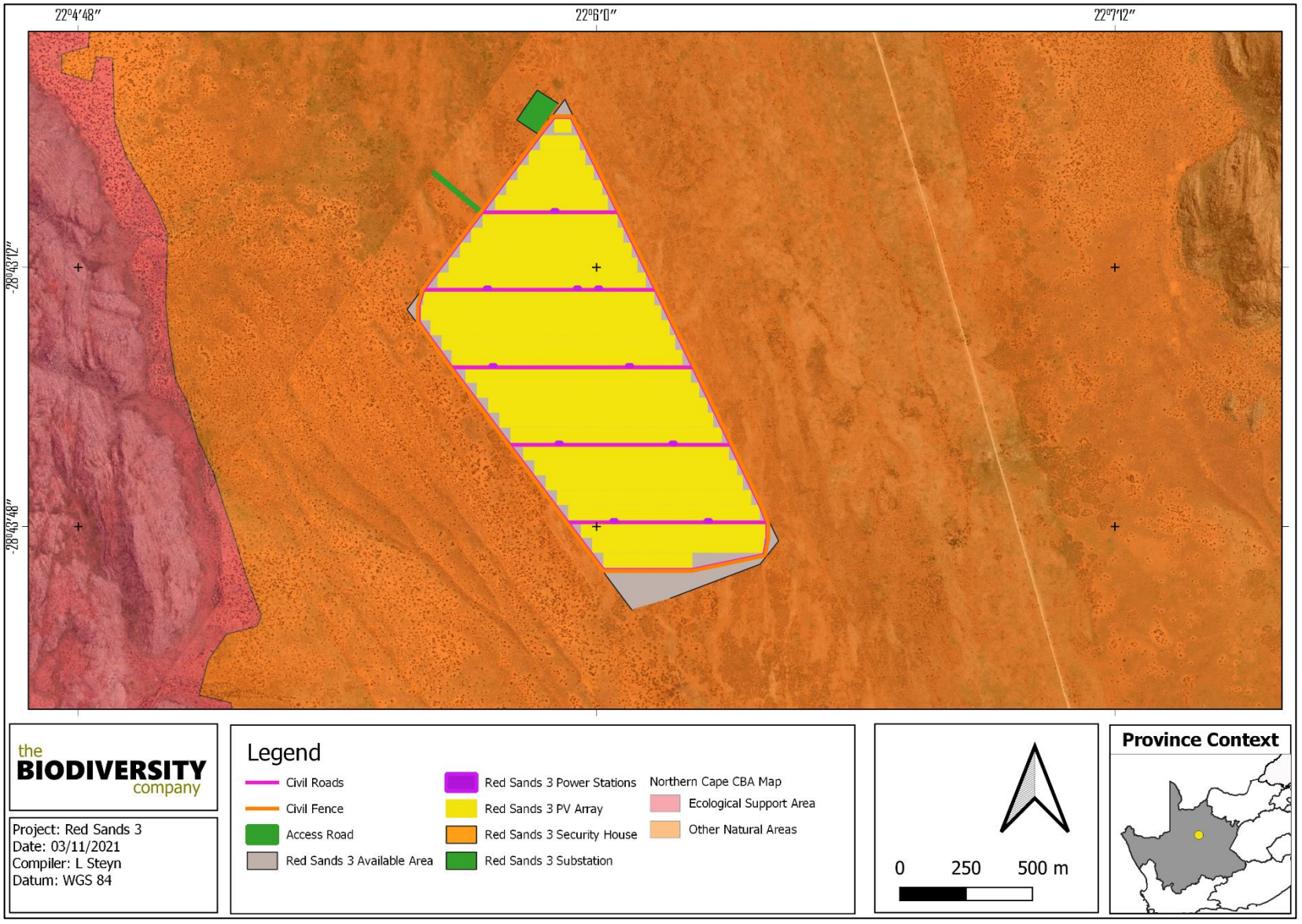

Figure 5-1 The project site superimposed on the Northern Cape Biodiversity Spatial Plan (NCBCP, 2017)

5.1.2 Important Bird and Biodiversity Area

Important Bird & Biodiversity Areas (IBAs) are the sites of international significance for the conservation of the world's birds and other conservation significant species as identified by BirdLife International. These sites are also all Key Biodiversity Areas; sites that contribute significantly to the global persistence of biodiversity (Birdlife, 2017).

According to Birdlife International (2017), the selection of IBAs is achieved through the application of quantitative ornithological criteria, grounded in up-to-date knowledge of the sizes and trends of bird populations. The criteria ensure that the sites selected as IBAs have true significance for the international conservation of bird populations and provide a common currency that all IBAs adhere to, thus creating consistency among, and enabling comparability between, sites at national, continental and global levels.

Figure 5-2 shows that the Red Sands PV3 site is approximately 165 km from the Augrabies National Park IBA.

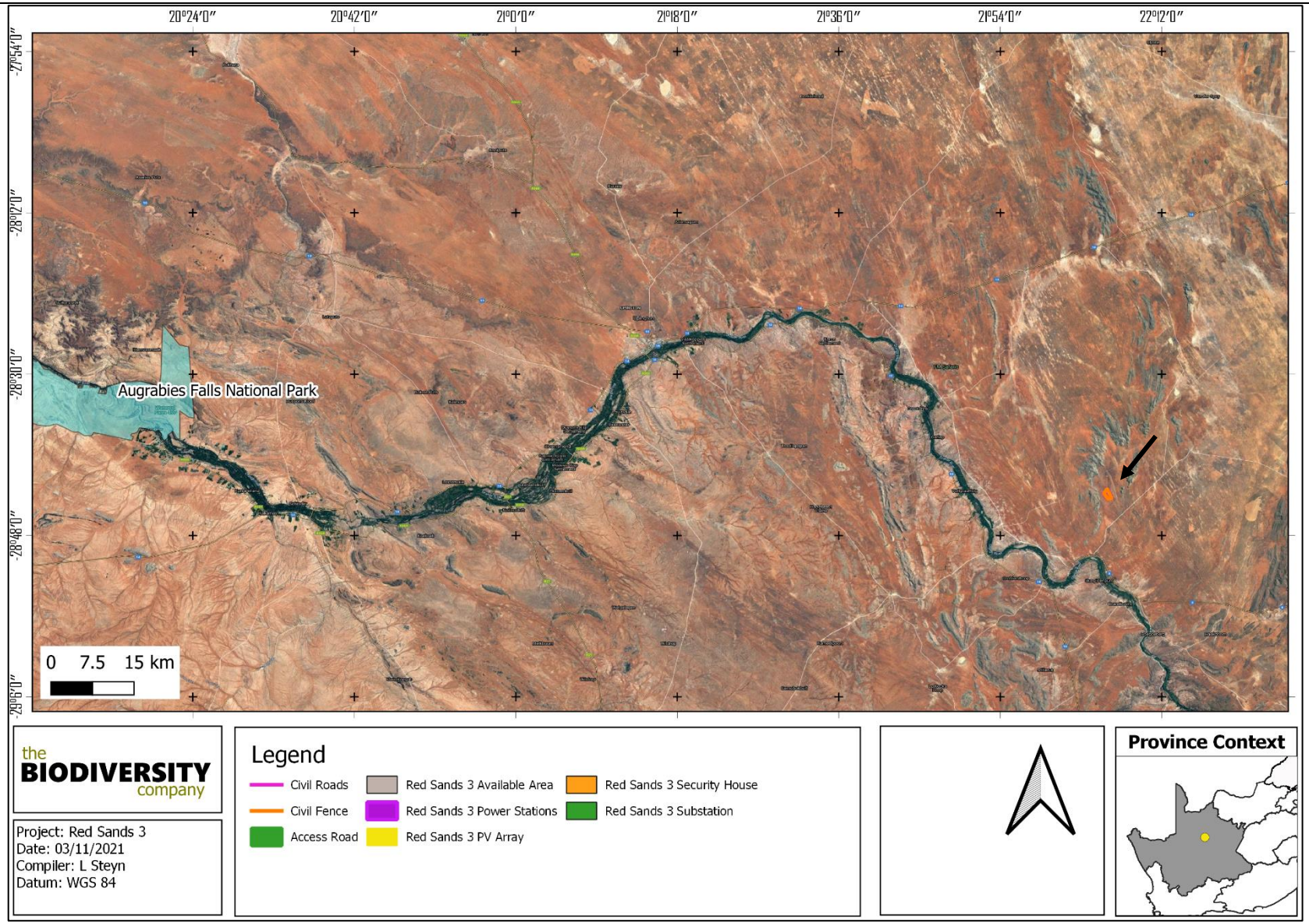

Figure 5-2 The important bird and biodiversity areas in relation to the project site (IBA, 2015)

5.1.3 Coordinated Avifaunal Roadcount (CAR)

The ADU/Cape bird club pioneered avifaunal roadcount of larger birds in 1993 in South Africa. Originally it was started to monitor the Blue Crane *Anthropoides paradiseus* and Denham's/Stanley's Bustard *Neotis denhami*. Today it has been expanded to the monitoring of 36 species of large terrestrial birds (cranes, bustards, korhaans, storks, Secretarybird and Southern Bald Ibis) along 350 fixed routes covering over 19 000 km. Twice a year, in midsummer (the last Saturday in January) and midwinter (the last Saturday in July), roadcounts are carried out using this standardised method. These counts are important for the conservation of these larger species that are under threat due to loss of habitat through changes in land use, increases in crop agriculture and human population densities, poisoning as well as man-made structures like power lines. With the prospect of wind and solar farms to increase the use of renewable energy sources monitoring of these species is most important (CAR, 2020). Figure 5-3 shows that the project site is 214 km away from the closest CAR route.

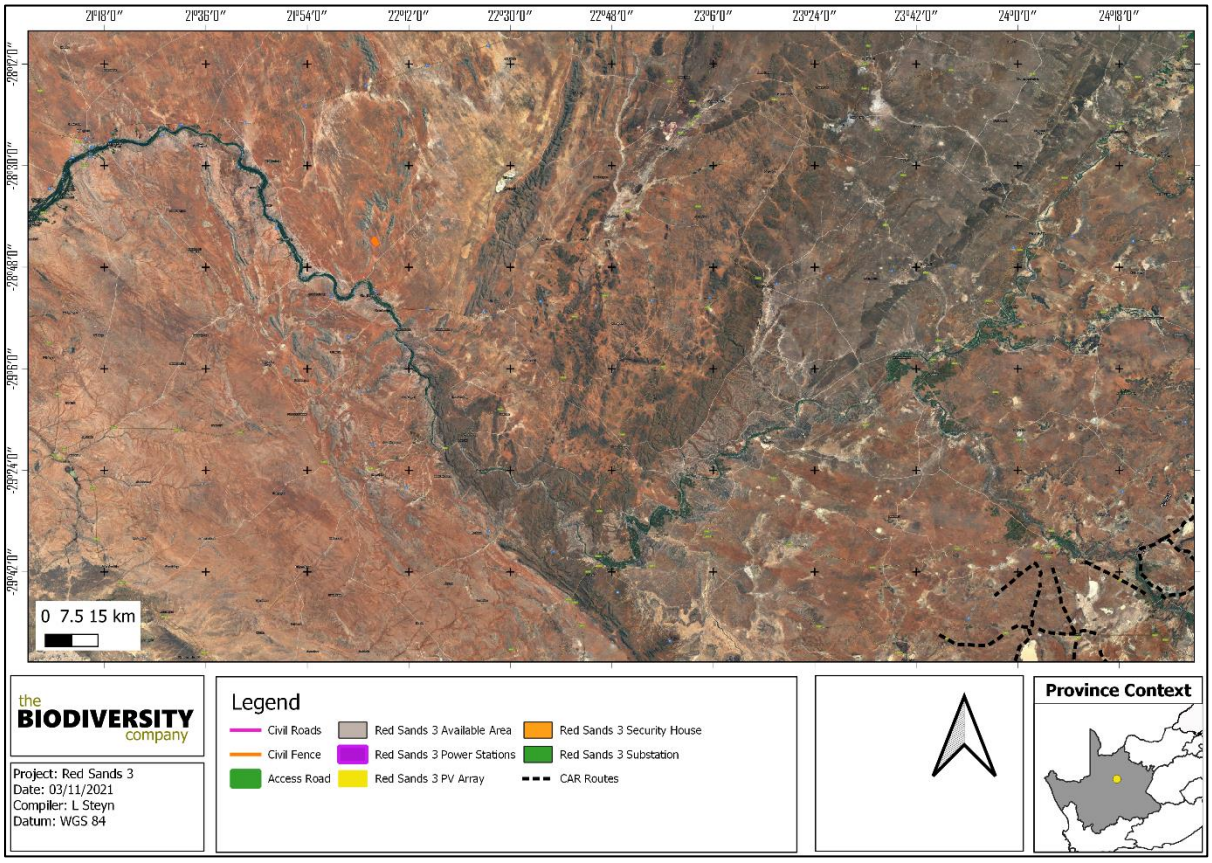

Figure 5-3 The project site in relation to the Coordinated Avifaunal Roadcount route

5.1.4 Vegetation Types

The project site overlaps with the Olifantshoek Plains Thornveld and the Gordonia Duneveld. The Olifantshoek Plains Thornveld mainly consist of mid-height shrublands and grasslands, while the Gordonia Duneveld consist of open shrubland with ridges of grassland dominated by *Stipagrostis amabilis* on the dune crests and *Acacia haematoxylon* on the dune slopes (Figure 5-4).

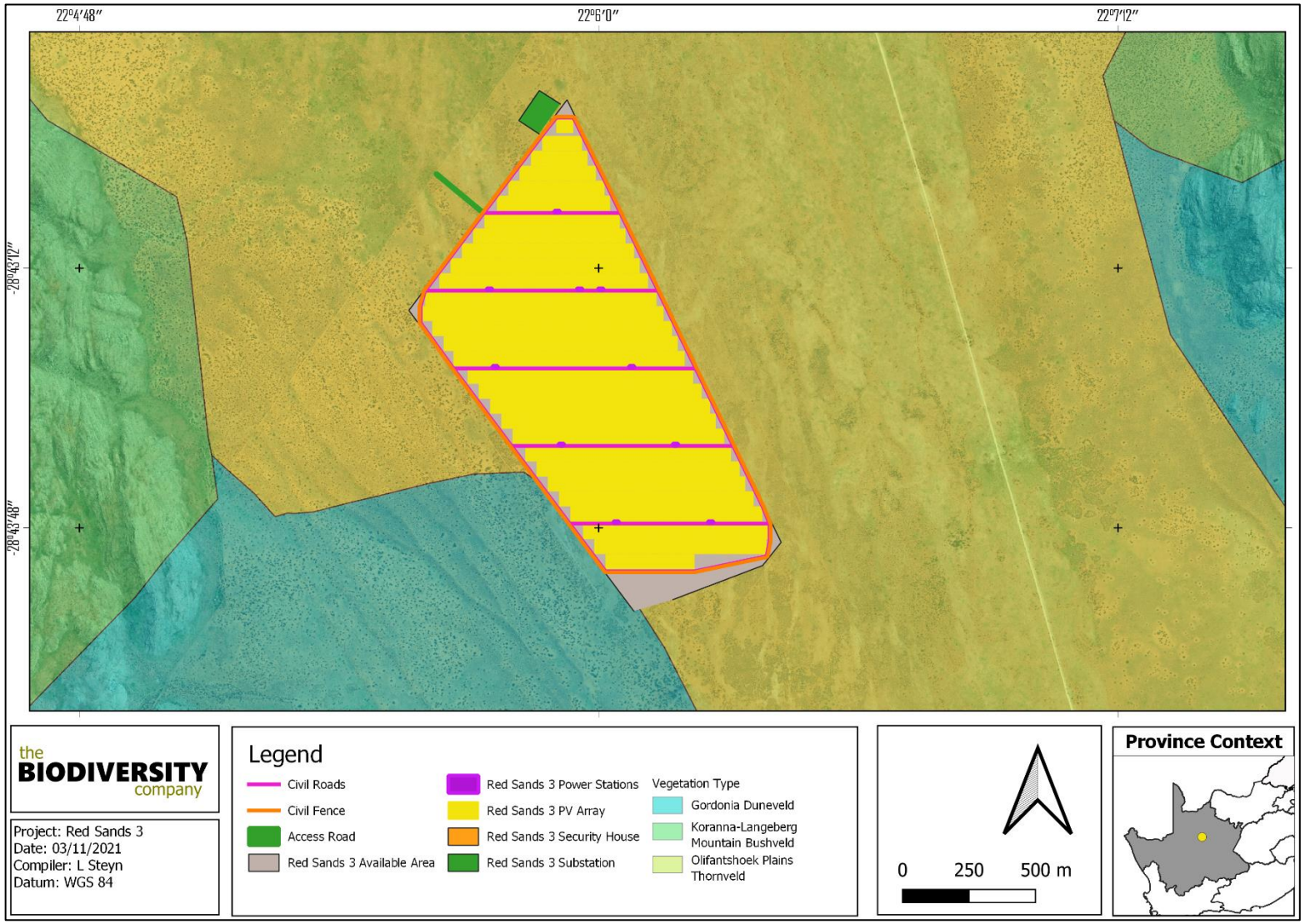

Figure 5-4 The project site showing the vegetation type based on the Vegetation Map of South Africa, Lesotho & Swaziland (BGIS, 2018)

5.1.5 Aquatic Habitat

The project site overlaps or are not in close proximity to a number of water sources (Figure 5-5). The main water source close to the project site is the Orange River.

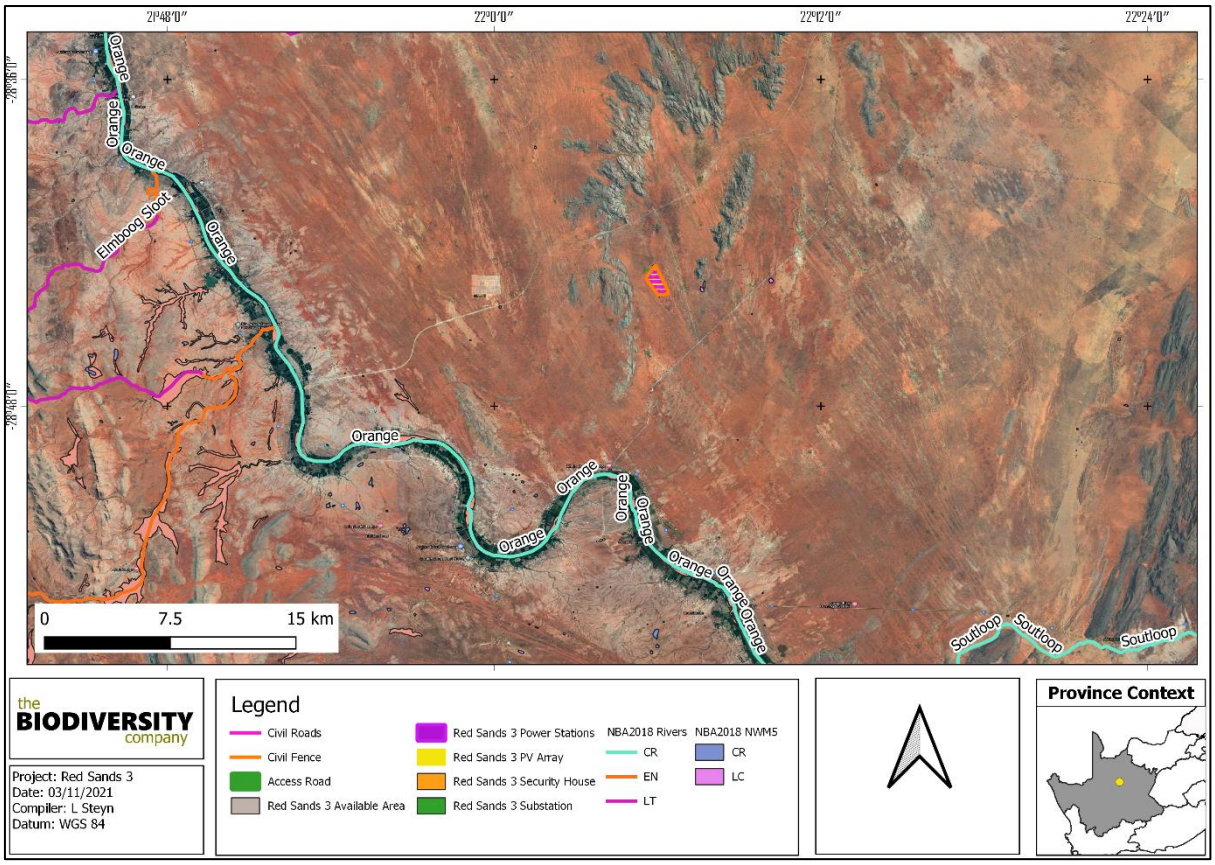

Figure 5-5 The project site in relation to the water resources

5.1.6 Renewable Energy Development Zones (REDZ)

In 2018 the Government Notice No. 114 in Government Gazette No. 41445 was published where 8 renewable energy development zones important for the development of large scale wind and solar photovoltaic facilities were identified. In 2021 an additional 3 sites were included. The REDZs were identified through the undertaking of 2 Strategic Environmental Assessments. More detailed information can be obtained from https://egis.environment.gov.za/redz. The project site overlaps with the Upington Solar phase 1 REDZ zone.

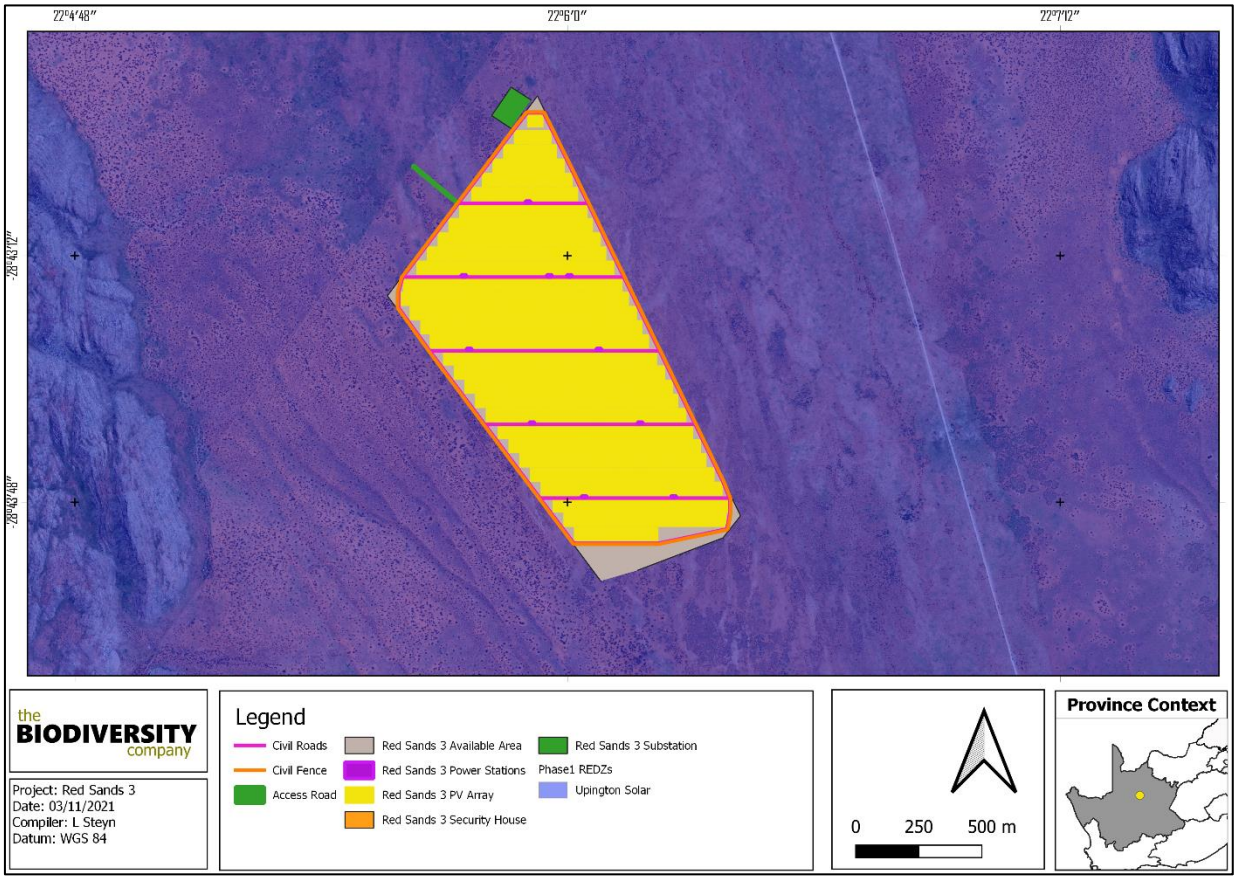

Figure 5-6 The Renewable Energy Development Zone and Database associated with the project site

5.2 South African Bird Atlas Project 2

Based on the South African Bird Atlas Project, Version 2 (SABAP2) database, 164 bird species have the potential to occur in the vicinity of the project site. The full list of potential bird species is provided in Appendix B, the list was compiled from all the pentads along the project site (2840_2200, 2840_2205, 2840_2210, 2845_2200, 2845_ 2200, 2845_2205, 2850_2155). Of the potential bird species, six (6) species are listed as SCC either on a regional or global scale (Table 5-2).

Table 5-2 List of bird SCCs that are expected to occur in close vicinity to the project site and their reporting rates (SABAP2).

Species	Common Name	Conservation Status		Pentad						Likelihood of occurrence
		Regional (SANBI, 2016)	IUCN (2021)	2840_2200	2840_2205	2840_2210	2845_2200	2845_2205	2850_2155	
Anthus crenatus	Pipit, African Rock	NT	LC	50.0	100.0		25.0	50.0		Moderate
Aquila verreauxii	Eagle, Verreaux's	VU	LC	50.0	16.7		25.0	50.0		High
Ardeotis kori	Bustard, Kori	NT	NT		33.3			12.5		High
Ciconia abdimii	Stork, Abdim's	NT	LC						7.1	Moderate
Eupodotis vigorsii	Korhaan, Karoo	NT	LC						7.1	High
Falco biarmicus	Falcon, Lanner	VU	LC		33.3				7.1	High

Anthus crenatus (African Rock Pipit) is endemic to South Africa and Lesotho (IUCN, 2017). They are classed as near threatened after undergoing a decline in habitat of 34% in the last 10 years (IUCN, 2017). The species is associated with rocky habitats that has abundant shrub and grassy areas. Some areas of suitable rocky habitat can be found adjacent to the project site therefore the likelihood of occurrence is rated as moderate.

Aquila verreauxii (Verreaux's Eagle) is listed as VU on a regional scale and LC on a global scale. This species is locally persecuted in southern Africa where it coincides with livestock farms, but because the species does not take carrion, is little threatened by poisoned carcasses. Where hyraxes are hunted for food and skins, eagle populations have declined (IUCN, 2017). Based on the expected habitat, the close proximity of the mountain range and the availability of prey items, the likelihood of occurrence of this species at the project site is rated as high.

Ardeotis kori (Kori Bustard) is listed as NT both on a regional and global scale. It occurs in flat, arid, mostly open country such as grassland, karoo, bushveld, thornveld, scrubland and savanna but also including modified habitats such as wheat fields and firebreaks. Collisions with high voltage power lines are a major threat to this species in the Karoo of South Africa (IUCN, 2007). The habitat at the project site is highly suitable for this species, therefore the likelihood of occurrence is rated as high.

Ciconia abdimii (Abdim's Stork) is listed as NT on a local scale and the species is known to be found in open grassland and savanna woodland often near water but also in semi-arid areas, gathering beside pools and water-holes. They tend to roost in trees or cliffs (IUCN, 2017). The nearby Orange river increases the likelihood of occurrence and it is therefore rated as moderate.

Eupodotis vigorsii (Karoo Korhaan) is listed as NT on a regional scale. This species prefers dwarf arid shrubland of the Nama Karoo and succulent Karoo, especially with stony ground, while in the Western Cape it also occurs in cultivated land. The habitat is highly suitable for the species.

Falco biarmicus (Lanner Falcon) is native to South Africa and inhabits a wide variety of habitats, from lowland deserts to forested mountains (IUCN, 2017). They may occur in groups up to 20 individuals but have also been observed solitary. Their diet is mainly composed of small birds such as pigeons and francolins. The likelihood of incidental records of this species in the project site is rated as high due to the natural veld condition and the presence of many bird species on which Lanner Falcons may predate.

5.3 Renewable Energy Projects in the nearby area

A number of existing and planned applications for PV, CSP and CPV solar developments are found around the project site (Figure 5-7). The data used to determine the number of applications in the nearby area were obtained from SA Renewable Energy EIA Application Database (REEA) (https://egis.environment.gov.za/) and were accurate as per 31 August 2021. The cumulative impact of all these projects on avifauna would be high, especially in such an arid area where a large number of highly endemic species are found.

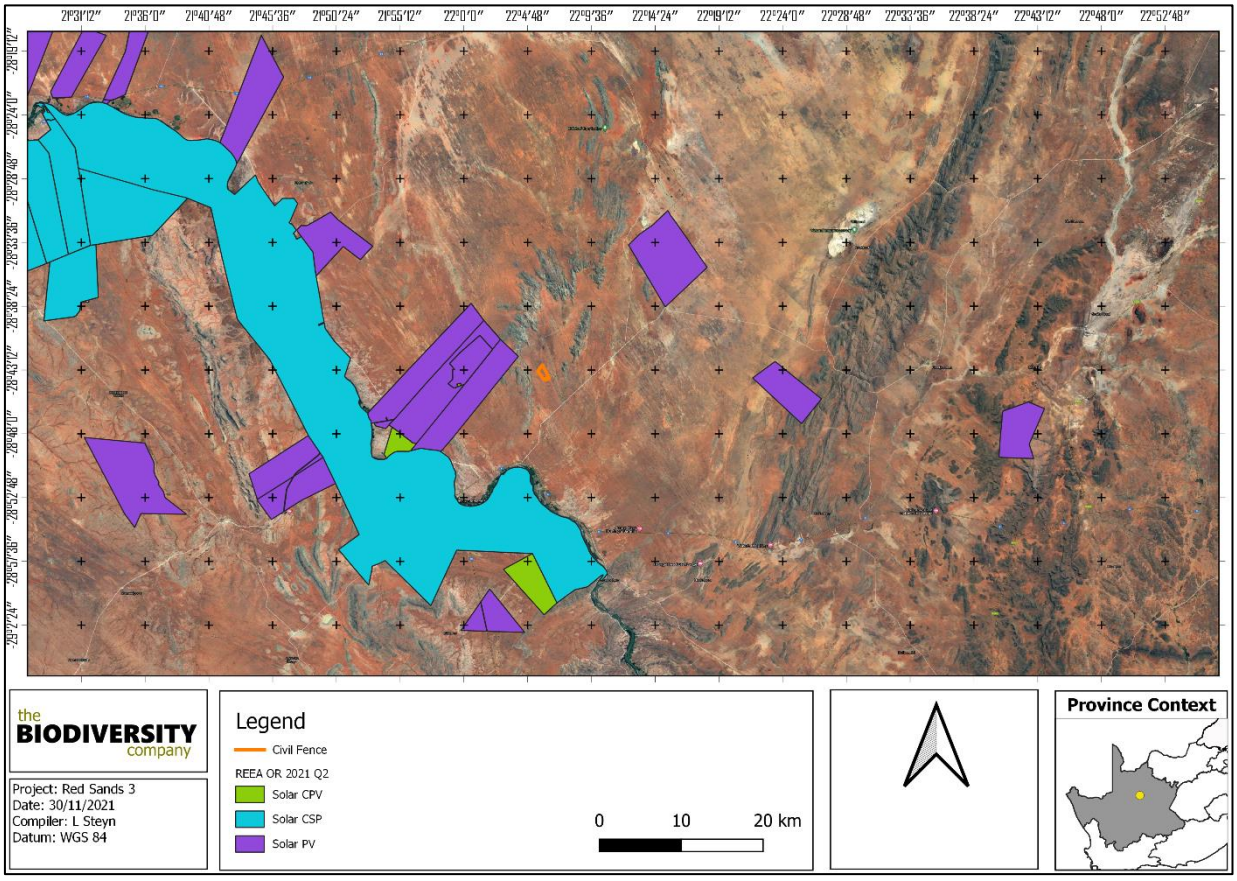

Figure 5-7 The renewable energy applications found in the area

5.4 Review of Nearby Assessments

An Environmental Impact Assessment (EIA) was conducted for a 75 MW concentrating solar thermal power plant (Bokpoort) and associated infrastructure in the Siyanda district (Bohlweki, 2011). The main impacts identified in this report for avifauna were the collisions with the panels, loss of habitat, loss of nests (especially those of the sociable weaver), collisions with associated powerlines and electrocutions. The avifauna assessment for this EIA was conducted by Chris van Rooyen consulting (2010). No species of conservation concern were said to be found during the assessment.

A basic assessment for the proposed development of eight 200MW Photovoltaic (PV) Plants on the remaining extent of farm Bokpoort 390, Groblershoop, Northern Cape (Royal Haskoning DHV, 2020) was also conducted in the nearby area. The avifauna assessment for this development was conducted by Arcus Consulting Services (2019), they confirmed the locations of three Verreauxs Eagle nests and one Martial Eagle nests. These nests were given a 3 km buffer each and were declared no-go areas. The impacts listed in this report were similar to the ones listed above.

6 Field Assessment

6.1 Avifauna Species

Eighty-seven (87) bird species were recorded in the summer survey. The full list of species recorded, their threat status, guild and location observed is shown in Appendix B. Three of the

species recorded were SCCs on a national or international scale. Thirteen individuals of the Cape Vulture were found 3.5 km north of the project site, while a further 30 were found 17 km from the site. Upon communication with a local farmer, he indicated that there has been an influx of vultures in the area, he also mentioned that the area has been in a drought for 5 years. It can thus be speculated that the high number of livestock carcasses has led to them moving into the area. The nests of these vultures were said to be on the Kalahari Oryx reserve (this could not be determined or confirmed during the assessments). Two Verreaux's Eagles were recoded souring 4.5 km from the property, their possible nest location were recorded in the winter screening assessment. Unfortunately, access could not be obtained during the summer assessment. A 3 km buffer were however placed around the nests to ensure this sensitive species nest is not disturbed. Four Kori Bustards were recorded close to the project site, one of which was found in the footprint itself. No nest were found of this species, which could be because of the drought, in which this species is known to have reduced breeding rate. These sedentary birds are threatened by collisions with powerlines and habitat degradation. Kori Bustards were the second most commonly recovered bird after Ludwig's Bustard during a mortality survey conducted in the Karoo, with 720 (95% CI 190-1,260) estimated to be killed annually on transmission lines in the Nama Karoo alone (Shaw, 2013).

A number of species recorded are protected under the NC Conservation Act of 2009, however three species are being highlighted here, the Pygmy Falcon (due to the nest found on the way to the project site) as well as the Northern Black Korhaan and the Red Crested Korhaan (due to their small territories). A Pygmy Falcon nest were found along the main road to the project site, 5.5 km from the project footprint. Upon consultation with Dr Robert Thomson (Pygmy Falcon Specialist) a 500m buffer was recommended for the nest, as this is the core home range as per unpublished data. The nest of these falcons were highlighted as large vehicles can disturb them, it is also imperative that should the width of the transport vehicles be broader than the current access road that the poles this nest is found on not be disturbed. The Northern Black Korhaan and the Red Crested Korhaan males are said to be highly territorial, with the territories only being 200-300m^2. Only a few of the locations of the korhaans recorded are shown on the map below, but this does highlight the importance of project site as habitat for these species.

A long term monitoring study must be done to monitor the nest locations, and the overall impact of solar development on these species. Table 6-1 lists the species as well as their threatened status, Figure 6-1 shows the locations where the species were observed and Figure 6-2 is photographs of the recorded species.

Table 6-1 Species of conservation concern observed during the survey (VU, Vulnerable; NT, Near Threatened; EN, Endangered; LC, Least Concerned)

Common Name	Species	Conservation Status	
		Regional (SANBI, 2016)	IUCN (2017)
Afrotis afraoides	Korhaan, Northern Black	Unlisted	LC
Ardeotis kori	Bustard, Kori	NT	NT
Aquila verreauxii	Eagle, Verreaux's	VU	LC
Gyps coprotheres	Vulture, Cape	EN	EN
Lophotis ruficrista	Korhaan, Red-crested	Unlisted	LC
Polihierax semitorquatus	Falcon, Pygmy	Unlisted	LC

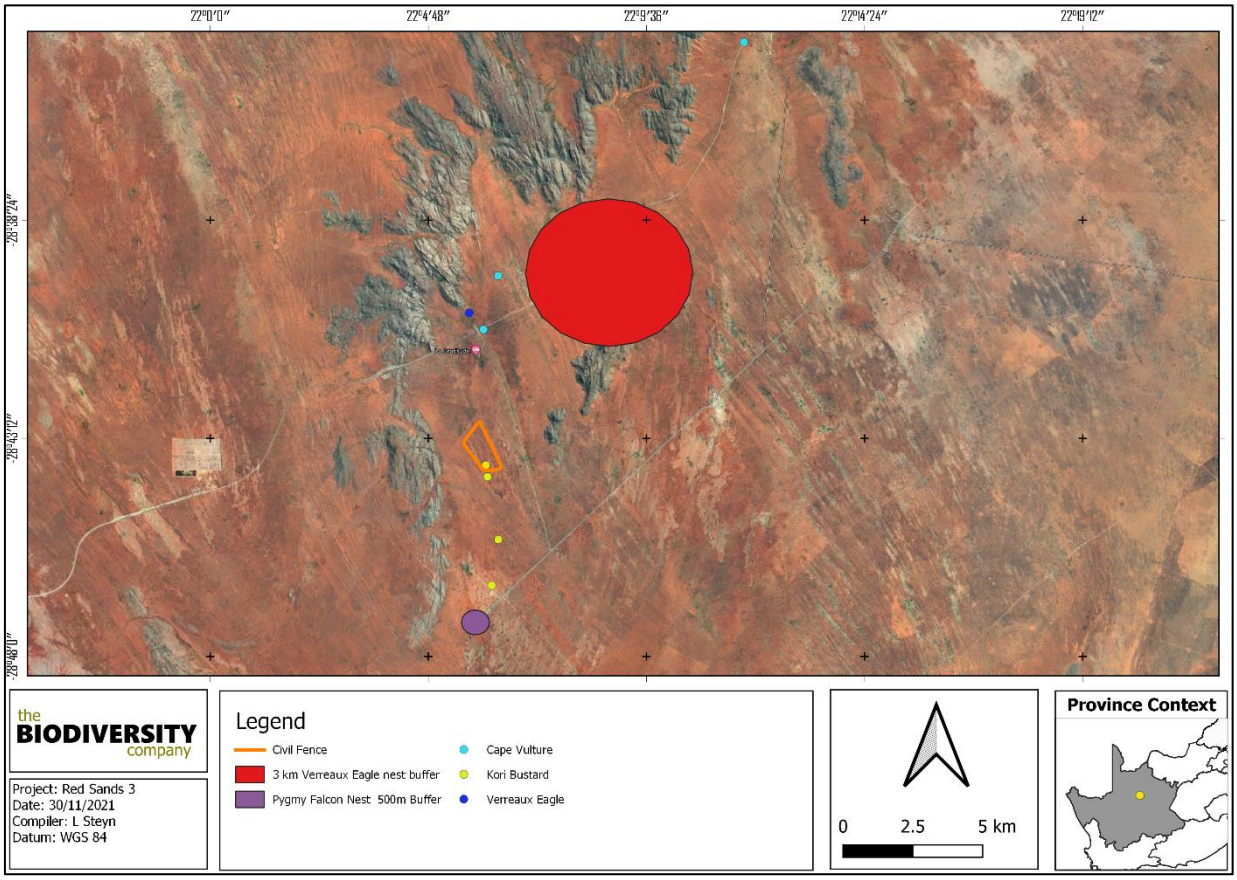

Figure 6-1 The location of the nest sites and recording of the species of conservation concern

Figure 6-2 Photographs of the recorded species, A) Kori Bustard, B) Cape Vultures, C) Verreaux's Eagles and D) Pygmy Falcon

6.1.1.1 Dominant species

Table 6-2 provide lists of the dominant species for the winter survey together with the frequency with which each species appeared in the point count samples. The data shows the Sociable Weavers, Southern Masked Weavers, Namaqua Sandgrouse, Pied Crows and White-browed Sparrow Weavers were the most abundant species during the survey. Due to the high number of Cape Vultures recorded, they were the sixth most abundant species found, their frequency was low as they were only recorded on a few occasions. Figure 6-3 shows some of the birds that were recorded during the survey.

Table 6-2 Dominant avifaunal species within the project site during the winter survey as defined as those species whose relative abundances cumulatively account for more than 76% of the overall abundance shown alongside the frequency with which a species was detected among point counts

Scientific Name	Common Name	Conservation Status		Guild code	Relative abundance	Frequency
		Regional (SANBI, 2016)	IUCN (2017)			
Philetairus socius	Weaver, Sociable	Unlisted	LC	GGD	0,302	27,778
Ploceus velatus	Masked-weaver, Southern	Unlisted	LC	GGD	0,095	22,222
Pterocles namaqua	Sandgrouse, Namaqua	Unlisted	LC	GGD	0,054	33,333
Corvus albus	Crow, Pied	Unlisted	LC	OMD	0,045	16,667
Plocepasser mahali	Sparrow-weaver, White-browed	Unlisted	LC	OMD	0,045	16,667
Gyps coprotheres	Vulture, Cape	EN	EN	CGD	0,034	5,556
Estrilda astrild	Waxbill, Common	Unlisted	LC	GGD	0,019	16,667
Prinia flavicans	Prinia, Black-chested	Unlisted	LC	IGD	0,019	27,778
Prinia maculosa	Prinia, Karoo	Unlisted	LC	IGD	0,019	27,778
Riparia paludicola	Martin, Brown-throated	Unlisted	LC	IAD	0,019	11,111
Myrmecocichla formicivora	Chat, Anteating	Unlisted	LC	IGD	0,015	22,222
Numida meleagris	Guineafowl, Helmeted	Unlisted	LC	OMD	0,015	11,111
Batis pririt	Batis, Pririt	Unlisted	LC	IGD	0,013	16,667
Lamprotornis nitens	Starling, Cape Glossy	Unlisted	LC	IGD	0,013	11,111
Eremomela icteropygialis	Eremomela, Yellow-bellied	Unlisted	LC	IGD	0,011	16,667
Euplectes orix	Bishop, Southern Red	Unlisted	LC	GGD	0,011	5,556
Passer domesticus	Sparrow, House	Unlisted	LC	GGD	0,011	5,556
Quelea	Quelea, Red-billed	Unlisted	LC	GGD	0,011	5,556
Sporopipes squamifrons	Finch, Scaly-feathered	Unlisted	LC	GGD	0,011	5,556

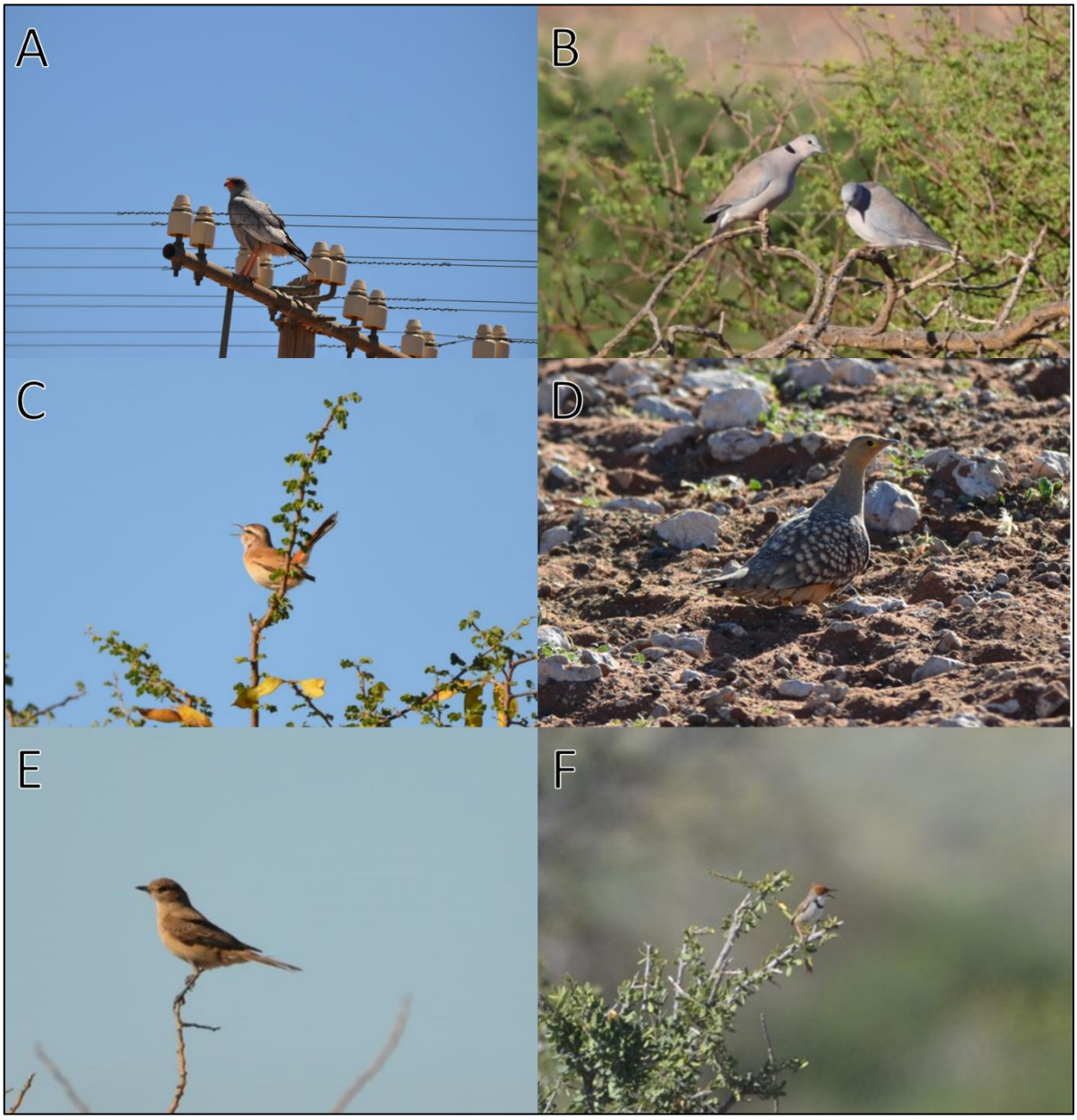

Figure 6-3 Some of the birds recorded in the project site: A) Pale-chanting Goshawk, B) Cape turtle Dove, C) Kalahari Scrub-robin, D) Namaqua Sandgrouse, E) Sickle-winged Chat and F) Rufous-eared warbler

6.1.1.2 Trophic Guilds

Trophic guilds are defined as a group of species that exploit the same class of environmental resources in a similar way (González-Salazar *et al,* 2014). The guild classification used in this assessment is as per González-Salazar *et al* (2014); they divided avifauna into 13 major groups based on their diet, habitat, and main area of activity. The analysis of the major avifaunal guilds reveals that the species composition during the survey was dominated by insectivorous birds that feed on the ground during the day (IGD) (30%) (Figure 6-4). Granivores that feed on the ground (GGD) made up the second highest group (17%), closely followed by omnivorous species (OMD) (13%). The feeding groups illustrate the area has a healthy balance of species, it is however very likely that the drought in the area has influenced the dominant feeding groups as very few grass species were present.

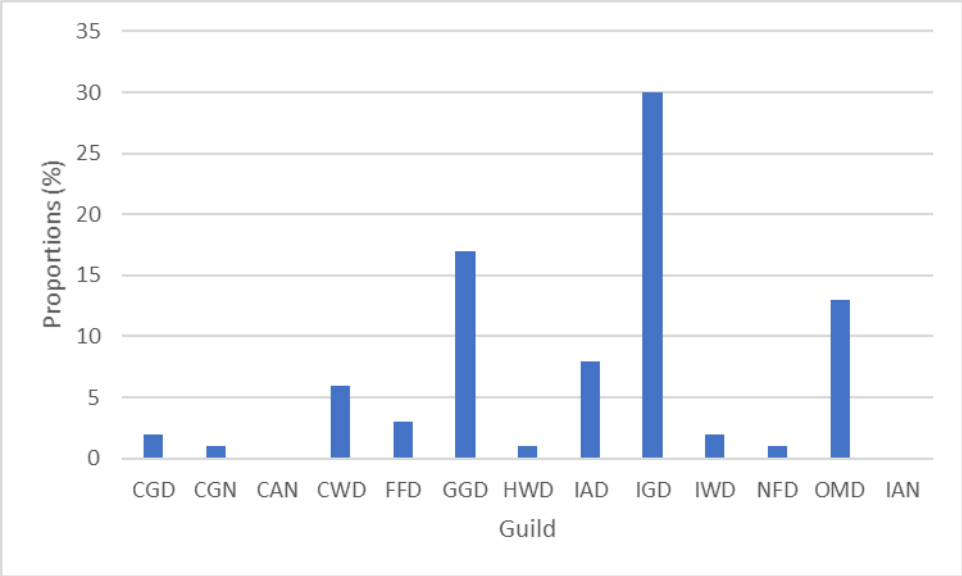

Figure 6-4 Avifaunal trophic guilds. CGD, carnivore ground diurnal; CGN, carnivore ground nocturnal, CAN, carnivore air nocturnal, CWD, carnivore water diurnal; FFD, frugivore foliage diurnal; GCD, granivore ground diurnal; HWD, herbivore water diurnal; IAD, insectivore air diurnal; IGD, insectivore ground diurnal; IWD, insectivore water diurnal; NFD, nectivore foliage diurnal; OMD, omnivore multiple diurnal; IAN, Insectivore air nocturnal.

6.1.2 Risk Species

A number of species were found that would be regarded as high risk species (Table 6-3 and Figure 6-5). Risk species are species that would be sensitive to habitat loss, that are regarded as collision prone species and species that would have a high electrocution risk. Species recorded along the Orange river were included as they could very likely be influenced should they be moving between water sources. Even though the panels does not pose an extensive collision risk for larger birds, powerlines associated with the infrastructure, guidelines (anchor lines) and connection lines does pose a risk. The fence could also pose a collision risk for various species as described in section 8.2.

Table 6-3 At risk species found in the survey.

Scientific Name	Common Name	Conservation Status		Risk posed by		
		Regional (SANBI, 2016)	IUCN (2017)	Collision	Electrocution	Disturbance / habitat loss
Afrotis afraoides	Korhaan, Northern Black	Unlisted	LC	x		x
Ardeotis kori	Bustard, Kori	NT	NT	x		x
Alopochen aegyptiaca	Goose, Egyptian	LC	LC	x	x	
Anas sparsa	Duck, African Black	Unlisted	LC	x		
Anhinga rufa	Darter, African	Unlisted	LC	x		
Aquila verreauxii	Eagle, Verreaux's	VU	LC	x	x	x
Ardea cinerea	Heron, Grey	Unlisted	LC	x	x	
Ardea goliath	Heron, Goliath	Unlisted	LC	x	x	

Bostrychia hagedash	Ibis, Hadeda	Unlisted	LC	x	x	
Corvus albus	Crow, Pied	Unlisted	LC		x	
Gyps coprotheres	Vulture, Cape	EN	EN	x	x	x
Haliaeetus vocifer	Fish-eagle, African	Unlisted	LC	x	x	
Lophotis ruficrista	Korhaan, Red-crested	Unlisted	LC	x		x
Numida meleagris	Guineafowl, Helmeted	Unlisted	LC	x	x	
Phalacrocorax africanus	Cormorant, Reed	Unlisted	LC	x		
Phalacrocorax lucidus	Cormorant, White-breasted	Unlisted	LC	x		
Polihierax semitorquatus	Falcon, Pygmy	Unlisted	LC			x
Scopus umbretta	Hamerkop	Unlisted	LC	x		

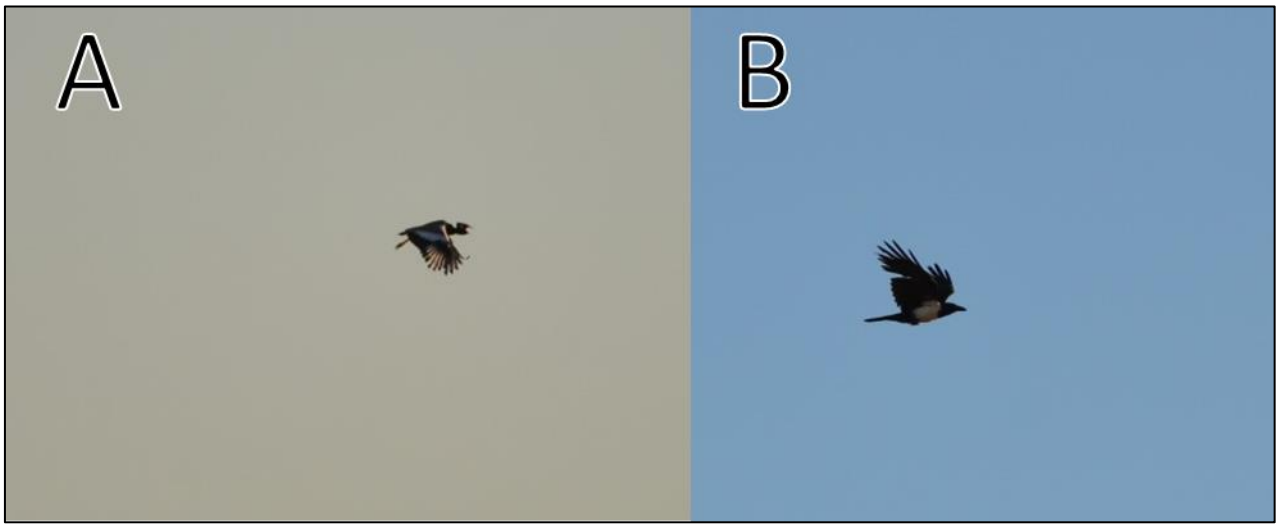

Figure 6-5 Two of the high collision risk species recorded on site: A) Northern Black Korhaan and B) Pied Crow

6.1.3 Nest and Flight Analysis

In the project site two large Sociable Weaver nests as well as two Camel Thorns with numerous White-browed Sparrow weavers' nests were found. One Cape Penduline-Tit nest were recorded on the eastern side of the project site (Figure 6-7). With regards to flight paths, a main pattern were observed for the Namaqua Sandgrouse, during every morning survey they were observed flying from the east to the southwestern side of the project site. It is assumed that they are going to the Orange river for water. The Figure 6-6 only shows the direction of two groups, this pattern were however observed for a number of Namaqua Sandgrouse groups.

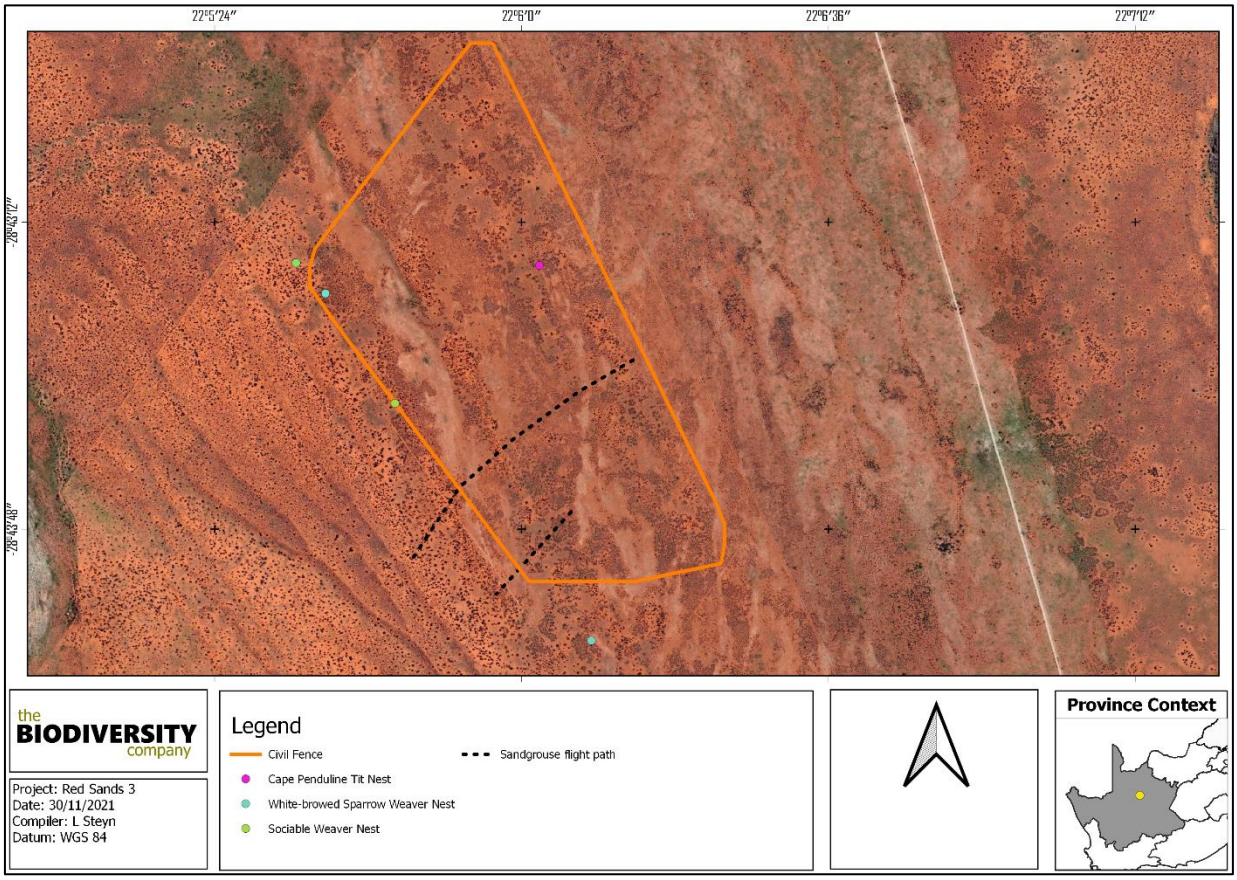

Figure 6-6 The nest locations and flight directions observed.

Figure 6-7 Nests observed on site: A) White-browed Sparrow Weaver nest, B) Cape Penduline Tit Nest, and C) Sociable Weaver Nest

6.1.4 Fine-Scale Habitat Use

Fine-scale habitats within the landscape are important in supporting a diverse avifauna community as they provide differing nesting, foraging and reproductive opportunities. The assessment area overlapped with one homogenous habitat type (Plains Thornveld), however two more habitats were assessed the Orange river and the Ridges (Figure 6-9). These habitats were based on the species compositions in the various areas. The areas of interests outside of the direct footprint were included as these areas could also support species that could be influenced by the development. The habitat on site is delineated, while the locations alone of areas assessed in the other two types are shown in Figure 6-8.

The Plains Thornveld were dominated by dense stands of *Rhigozum trichotomum* and *Senegalia mellifera* subsp. *detinens.* The overall state of the area was regarded as degraded, with the ground cover being sparce and few grass species recorded. The habitat did however still support a good level of insect life, especially in the form of Formicidae species. Even with these challenges a number of both granivorous and insectivorous species such as Sociable weaver, Pririt Batis, Chestnut-vented Tit-babbler, Roufous-Eared warbler, Sickle-winged Chat and Anteating Chat were recorded.

The Orange River acts as a major water source and habitat for a large number of bird species in this arid landscape. Seventeen species were recorded here that were found exclusively in

this habitat type. These include species such as Reed Cormorant, African Darter, Fish Eagle, Hamerkop, Cape Wagtail and African Black Ducks.

Ridges are high lying areas characterised by a rocky landscape with very little sand or clay present in the substrate. Plant species encountered here were mostly grasses. No trees were encountered due to this limited substrate. Species found here included: Verreaux's Eagle, Rock Martin, Short-toed Rock Thrush and Cape Buntings.

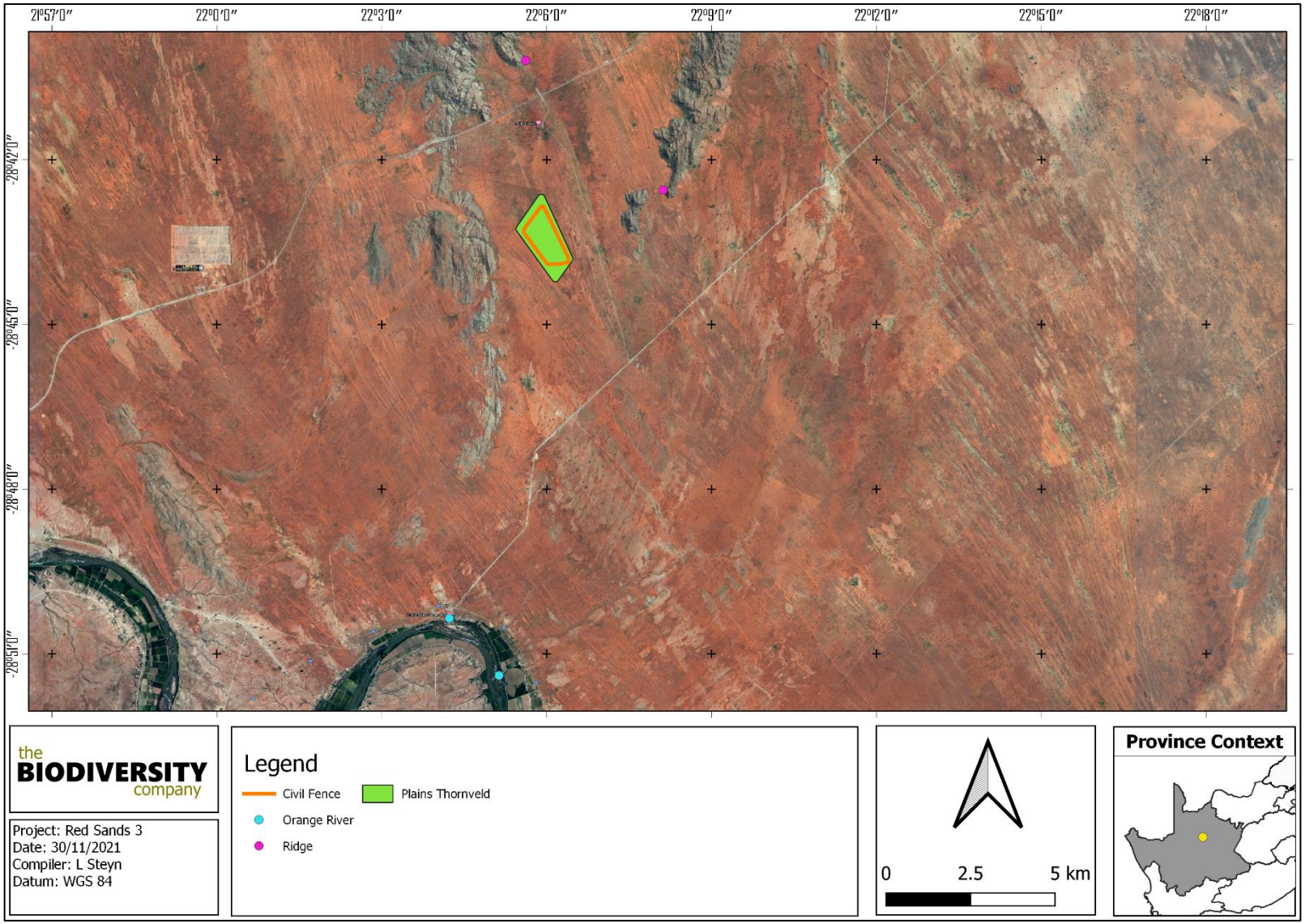

Figure 6-8 The avifauna habitats found in the project site.

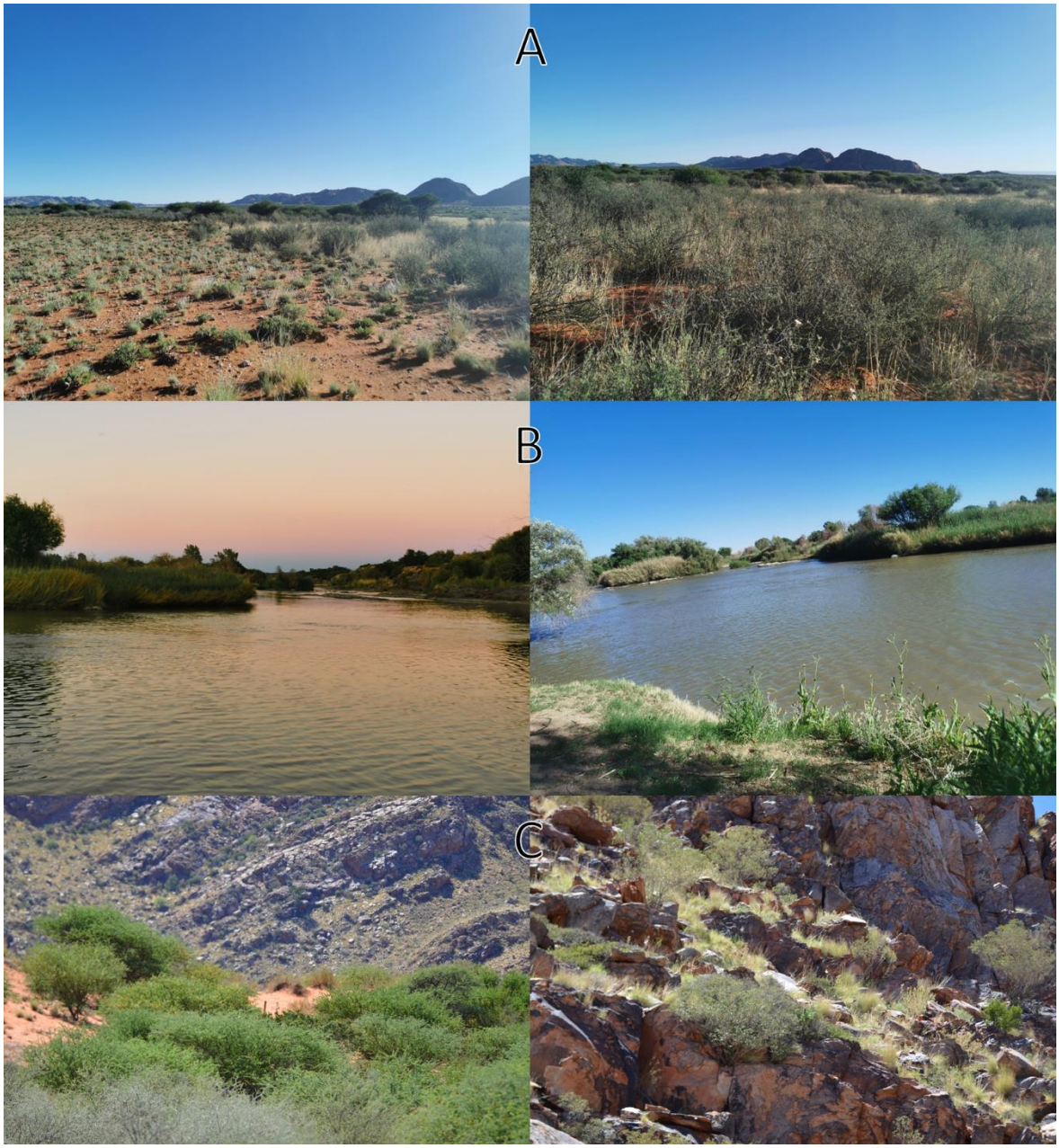

Figure 6-9 A) Photographs illustrating examples of the Plains Thornveld habitat type delineated within the assessment area, B) Orange River points that were assessed, and C) ridge points that were assessed

7 Site Sensitivity

The Department of Environment, Forestry and Fisheries (DEFF) National Screening Tool classifies a section of the project site as sensitive from an avifaunal perspective (Figure 7-1). Consequently, by application of the protocol and associated guidelines, this project warrants an avifaunal assessment. The national environmental screening tool is a web-based application hosted by the Department of Environmental Affairs that allows developers to screen their prospective site for environmental sensitives. Importantly, this tool now serves as the first step in the environmental authorisation process as laid out in the gazetted assessment protocols for each environmental theme. Guidance towards achieving these protocols for terrestrial biodiversity is provided in the Species Environmental Assessment Guideline

(SANBI, 2020) which, in turn, relies on the results of the screening tool to inform the level of assessment required. The screening tool provides an avifaunal sensitivity theme. However, this layer is applicable to wind energy developments and for all other projects, the user must evaluate the animal species sensitivity's theme for any avifaunal triggers. The avian species sensitivity theme shows that the project site has a moderate sensitivity, this is as Ludwig's Bustard has a moderate change of occurrence (Figure 7-1).

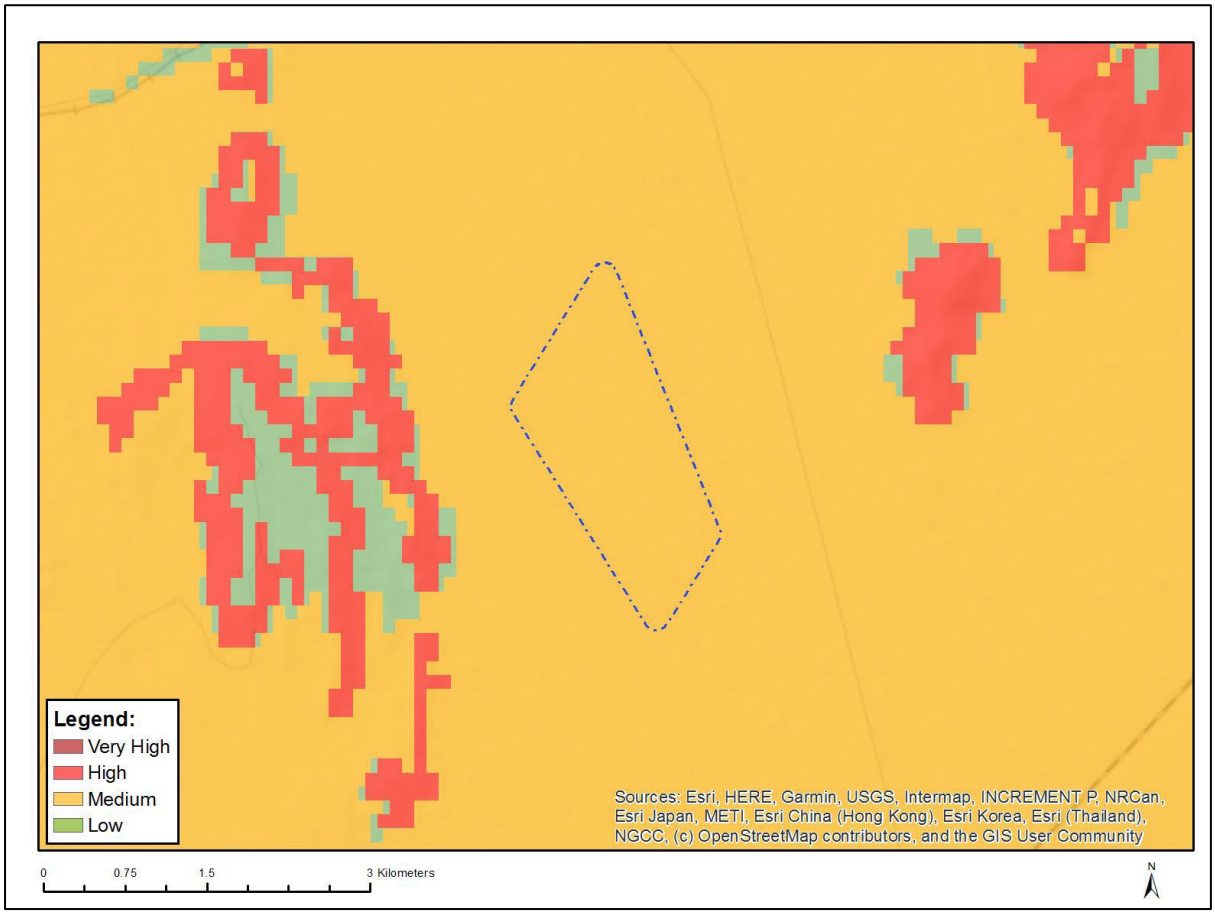

Figure 7-1 Map depicting relative avian species theme sensitivity of the project (National Environmental Screening Tool, 2021)

The three (3) habitat types were subjected to the SEI methods as described in section 4.3 and allocated a sensitivity category (Table 7-1). The SEI of the Orange River and the Ridges were added to provide a holistic view. The location and extent of these habitats are illustrated in Figure 6-8. The sensitivities of the habitat types delineated are illustrated in Figure 7-2.

Table 7-1 Summary of habitat types delineated within the field assessment area of the project.

Habitat	Conservation Importance	Functional Integrity	Biodiversity Importance	Receptor Resilience	Site Ecological Importance
Plains Thornveld	High	High	High	Moderate	High
Orange River	Very High	Very High	Very High	Low	Very High
Ridges	Very High	High	Very High	Very Low	Very High

Interpretation of the SEI in the context of the proposed development activities is provided in Table 7-2. The species composition and number of SCCs found in this area is high this along with the low resilience to development led to a High SEI rating for the Plains Thornveld.

Table 7-2 Guidelines for interpreting Site Ecological Importance in the context of the proposed development activities

Site Ecological Importance (SEI)	Interpretation in relation to proposed development activities
High	Avoidance mitigation wherever possible. Minimisation mitigation – changes to project infrastructure design to limit the amount of habitat impacted, limited development activities of low impact acceptable. Offset mitigation may be required for high impact activities.
Very High	Avoidance mitigation – no destructive development activities should be considered. Offset mitigation not acceptable/not possible (i.e., last remaining populations of species, last remaining good condition patches of ecosystems/unique species assemblages). Destructive impacts for species/ecosystems where persistence target remains.

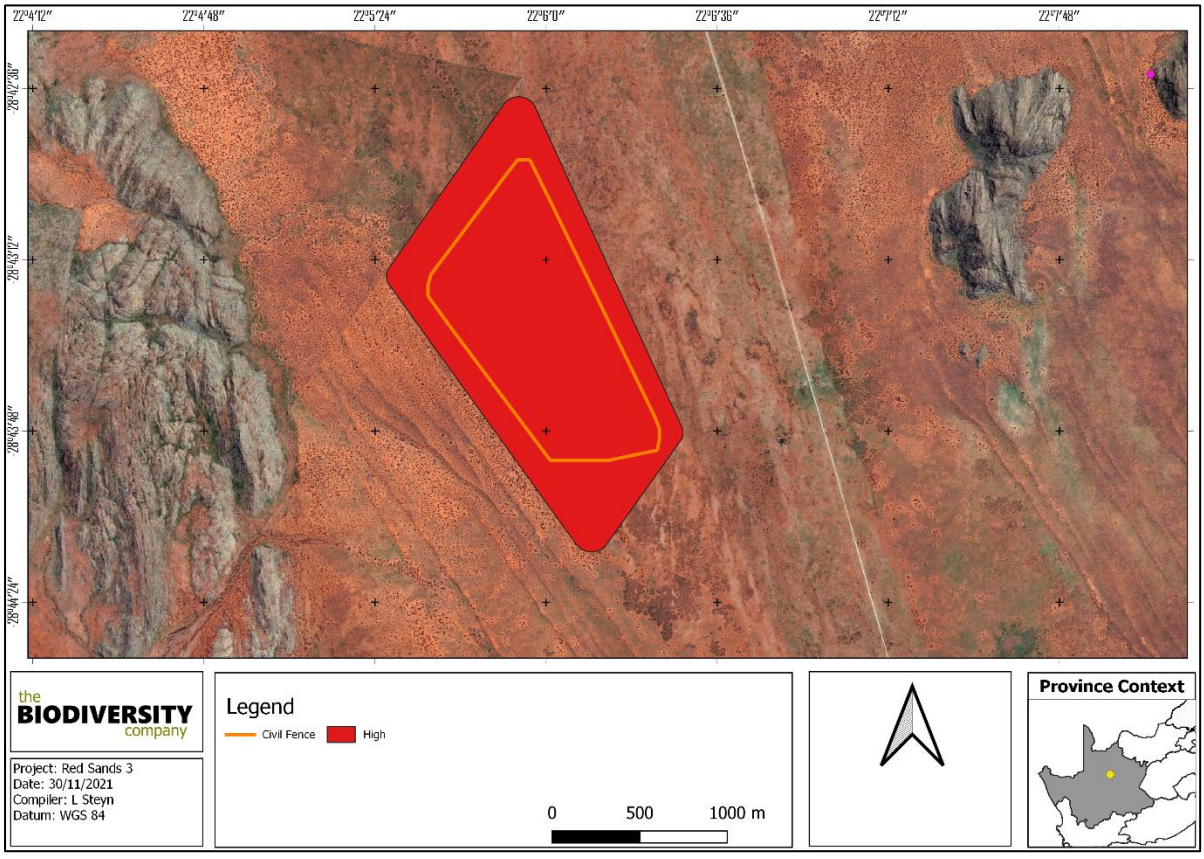

Figure 7-2 Site Ecological Importance of the project site

8 Impact Assessment

Potential impacts were evaluated against the data captured during the fieldwork and from a desktop perspective to identify relevance to the project site, specifically the proposed development footprint area.

The assessment of the significance of direct, indirect and cumulative impacts was undertaken using the method as developed by Savannah Environmental (Pty) Ltd.

Bennun *et al* (2021) describes three broad types of impacts associated with solar energy development:

- Direct impacts – Impacts that result from project activities or operational decisions that can be predicted based on planned activities and knowledge of local biodiversity, such as habitat loss under the project footprint, habitat frag- mentation as a result of project infrastructure and species disturbance or mortality as a result of project operations.
- Indirect impacts – Impacts induced by, or 'by-products' of, project activities within a project's area of influence.
- Cumulative impacts – Impacts that result from the successive, incremental and/or combined effects of existing, planned and/or reasonably anticipated future human activities in combination with project development impacts.

The assessment of impact significance was undertaken in consideration of the following:

- Extent of impact;
- Duration of impact;
- Magnitude of impact;
- Probability of impact; and
- Reversibility.

The assessment of impact significance considers pre-mitigation as well as implemented post-mitigation scenarios. Three phases were considered for the impact assessment:

- Construction Phase;
- Operational Phase; and
- Closure/Rehabilitation Phase.

8.1 Current Impacts

The current impacts observed during the survey are listed below. Photographic evidence of a selection of these impacts is shown in Figure 8-1.

- Multiple high voltage powerlines;
- Grazing and trampling of natural vegetation by livestock;
- Farm roads and main roads (and associated traffic and wildlife road mortalities);
- Fences; and
- Existing Solar Energy Facilities in the surrounding landscape.

Figure 8-1 Some of the identified impacts within the project site; A) Existing substation with associated powerlines, B) High voltage powerlines, C & E) Fencing, D) Livestock and E) Roads and Cell phone towers

8.2 Avifauna Impact Assessment

This section describes the potential impacts on avifauna associated with the construction and operational phases of the proposed development and is only relevant to the PV site and associated infrastructure and does not consider the powerline grid system. During the construction phase vegetation clearing and brush cutting of vegetation for the associated infrastructure will lead to direct habitat loss. Vegetation clearing will create a disturbance and will therefore potentially lead to the displacement of avifaunal species. The operation of

construction machinery on site will generate noise and cause dust pollution. Should non-environmentally friendly dust suppressants be used, chemical pollution can take place. Increased human presence can lead to poaching and the increase in vehicle traffic will potentially lead to roadkill.

The principle impacts of the operational phase are electrocution, collisions, fencing, chemical pollution due to chemical for the cleaning of the PV panels and habitat loss. Solar panels have been implicated as a potential risk for bird collisions. Collisions are thought to arise when birds (particularly waterbirds) mistake the panels for waterbodies, known as the “lake effect” (Lovich & Ennen, 2011), or when migrating or dispersing birds become disorientated by the polarised light reflected by the panels. This “lake-effect” hypothesis has not been substantiated or refuted to date (Visser *et al.,* 2019). It can however be said that the combination of powerlines, fencing and large infrastructure will influence avifauna species. Visser *et al.* (2019) performed a study at a utility-scale photovoltaic solar energy facility in the Northern Cape and found that most of the species affected by the facility were passerine species. Larger species were said to be more influenced by the facilities when they were found foraging close by and were disturbed by predators which resulted in collisions.

Large passerines are particularly susceptible to electrocution because owing to their relatively large bodies, they are able to touch conductors and ground/earth wires or earthed devices simultaneously. The chances of electrocution are increased when feathers are wet, during periods of high humidity or during defecation. Prevailing wind direction also influences the rate of electrocution casualties.

Fencing of the PV site can influence birds in six ways (Birdlife SA, 2015);

1. Snagging: Occurs when a body part is impaled on one or more barbs or razor points of a fence.
2. Snaring: When a birds foot/leg becomes trapped between two overlapping wires.
3. Impact injuries: birds flying into a fence, the impact may kill or injure the bird
4. Snarling: When birds try and push through a mesh or wire stands, ultimately becoming trapped (uncommon).
5. Electrocution: Electrified fence can kill or severely injure birds.
6. Barrier effect: Fences may limit flightless birds (e.g. Moulting waterfowl) from resources.

Chemical pollution from PV cleaning, if not environmentally friendly will result in either long term or short-term poisoning. Should this chemical run into the water sources it would also impact the whole bird population and not just species found in and around the PV footprint.

PV sites require the overall removal of vegetation, this is a measure that is implemented to restrict the risk of fire (Birdlife, 2017). The removal of vegetation results in the loss of habitat for a number of species in this case it would be displacing grassland, tree dwellers from the alien clumps and waterfowl.

8.2.1 Alternatives considered

No alternative was provided.

8.2.2 Loss of Irreplaceable Resources

Portions of the habitat and home range of the Kori Bustard, Cape Vulture and the Verreauxs Eagle will be lost. The nests and territories of the NC protected Pygmy Falcon, Northern Black Korhaan and Red-crested Korhaan will be disturbed or lost.

8.3 Assessment of Impact Significance

The assessment of impact significance considers pre-mitigation as well as implemented of post-mitigation scenarios. Although different species and groups will react differently to the development, the risk assessment was undertaken bearing in mind the potential impacts to the priority species listed in this report. More mitigations can be seen in section 9.

8.3.1 Construction Phase

The construction of the associated infrastructure and the PV site has been assessed collectively as their impacts overlap.

The following potential impacts were considered (Table 8-1 till Table 8-4):

- Destruction, fragmentation and degradation of habitats;
- Displacement of avifaunal community (Including several SCC) due to disturbance such as noise, light, dust, vibration;
- Collection of eggs and poaching;
- Roadkill.

Table 8-1 Construction activities impacts on the avifauna

Nature:		
Destruction, fragmentation and degradation of habitats;		
	Without mitigation	**With mitigation**
Extent	Medium (3)	Medium (3)
Duration	Long term (4)	Long term (4)
Magnitude	High (8)	High (8)
Probability	Highly probable (4)	Highly probable (4)
Significance	**Medium**	**Medium**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	No	
Mitigation:		
• **The loss of habitat in the project footprint cannot be mitigated. This will result in the loss of territory, feeding area, nesting sites and prey availability for numerous species.** The habitat outside the footprint can be protected by implementing the following compensatory measures: • Construction activity to only be within the project footprint and the area is to be well demarcated.		

- Areas where vegetation has been cleared must be re-vegetated within local indigenous plant species.
- The affected area must be monitored for invasive plant encroachment and erosion and must be controlled.
- The use of laydown areas within the development footprint must be used, to avoid habitat loss and disturbance to adjoining areas.
    - All areas to be developed must be walked through prior to any activity to ensure no nests or avifauna species are found in the area.
    - Should any Species of Conservation Concern not move out of the area or their nest be found in the area a suitably qualified specialist must be consulted to advise on the correct actions to be taken.

Residual Impacts:

The loss of habitat is a residual impact that is unavoidable. The disturbance may also cause some erosion and invasive alien plant encroachment. Movement corridors will be disrupted in the area., the species will however move into adjacent areas. Based on the total area lost the residual impact is acceptable.

Table 8-2 Construction activities impacts on the avifauna

Nature:		
Displacement of avifaunal community (Including several SCC) due to disturbance such as noise, light, dust, vibration		
	Without mitigation	**With mitigation**
Extent	High (4)	Moderate (3)
Duration	Long term (4)	Short term (2)
Magnitude	High (8)	Moderate (6)
Probability	Highly probable (4)	Probable (3)
Significance	**High**	**Medium**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes, but only to a limited extent. The mitigation of noise pollution during construction is difficult to mitigate against	

Mitigation:

- Minimize disturbance impact by abbreviating construction time
- Schedule the activities to avoid breeding and movement time.
- Ensure lights are kept to a minimum, lights must be red or green and not white to reduce confusion for nocturnal migrant.
- Dust management need to be done in the areas where the vegetation will be removed, this includes wetting of the soil.

Residual Impacts:

Displacement of endemic and SCC avifauna species.

Table 8-3 Construction activities impacts on the avifauna

Nature:		
Collection of eggs and poaching		
	Without mitigation	With mitigation
Extent	High (4)	Low (2)
Duration	Permanent (5)	Short term (2)
Magnitude	Moderate (6)	Low (4)

Probability	Highly probable (4)	Improbable (2)
Significance	**Medium**	**Low**
Status (positive or negative)	Negative	Negative
Reversibility	Low	High
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	

Mitigation:

- All personnel should undergo environmental induction with regards to avifauna and in particular awareness about not harming, collecting or hunting terrestrial species (e.g. bustards, korhaans, francolin), and owls, which are often persecuted out of superstition.
- Signs must be put up stating that should any person be found poaching any species they will be fined.

Residual Impacts:

There is a possibility that the eggs to be poached could be that of an SCC with decreasing numbers

Table 8-4 Construction activities impacts on the avifauna

Nature:

Roadkill

	Without mitigation	With mitigation
Extent	Moderate (3)	Low (2)
Duration	Short term (2)	Short term (2)
Magnitude	Moderate (6)	Minor (2)
Probability	Highly probable (4)	Improbable (2)
Significance	**Medium**	**Low**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	

Mitigation:

- All construction vehicles should adhere to clearly defined and demarcated roads. No off-road driving to be allowed outside of the construction area.
- All vehicles (construction or other) accessing the site should adhere to a low speed limit on site (40 km/h max) to avoid collisions with susceptible avifauna, such as nocturnal and crepuscular species (e.g. nightjars and owls) which sometimes forage or rest on roads, especially at night.

Residual Impacts:

Roadkills could still occur

8.3.2 Operational Phase

The operational phase of the impact of daily activities is anticipated to lead to collisions and electrocutions. Moving vehicles don't only cause sensory disturbances to avifauna, affecting

their life cycles and movement, but will lead to direct mortalities due to collisions. The area surrounding the direct footprint will be maintained to prevent uncontrolled events such as fire, this practice will however result in the disturbance and displacement of breeding and non-breeding species.

The following potential impacts were considered (Table 8-5 to Table 8-8):

- Collisions with PV panels, associated powerlines and connection lines and fences;
- Electrocution with solar plant connections;
- Roadkill during maintenance procedures; and
- Habitat degradation and displacement of resident, visiting and breeding species (as well as SCCs).

Table 8-5 Operational activities impacts on the avifauna

Nature:		
Collisions with PV panels, associated powerlines and connection lines and fences		
	Without mitigation	With mitigation
Extent	High (4)	High (4)
Duration	Long term (4)	Long term (4)
Magnitude	High (8)	Moderate (6)
Probability	Highly probable (4)	Probable (3)
Significance	**High**	**Medium**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	

Mitigation:

- The design of the proposed solar plant must be of a type or similar structure as endorsed by the Eskom-Endangered Wildlife Trust (EWT) Strategic Partnership on Birds and Energy, considering the mitigation guidelines recommended by Birdlife South Africa.
- Infrastructure should be consolidated where possible in order to minimise the amount of ground and air space used. This would involve using existing/approved pylons and associated infrastructure for different lines.
- If any powerlines/connection lines are to be placed above ground, they must be marked with industry standard bird flight diverters.
- Fencing mitigations:
    - Top 2 strands must be smooth wire
    - Routinely retention loose wires
    - Minimum 30cm between wires
    - Place markers on fences

Residual Impacts:

Some collisions of SCCs might still occur regardless of mitigations

Table 8-6 Operational activities impacts on the avifauna

Nature:		
Electrocution with solar plant connections		
	Without mitigation	With mitigation
Extent	High (4)	High (4)
Duration	Long term (4)	Long term (4)
Magnitude	High (8)	Moderate (6)
Probability	Highly probable (4)	Improbable (2)
Significance	**High**	**Low**
Status (positive or negative)	Negative	Negative
Reversibility	Low	High
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	
Mitigation:		
• The design of the proposed solar plant must be of a type or similar structure as endorsed by the Eskom-EWT Strategic Partnership on Birds and Energy, considering the mitigation guidelines recommended by Birdlife South Africa. • Infrastructure should be consolidated where possible/practical in order to minimise the amount of ground and air space used. This would involve using the existing/approved pylons and associated infrastructure for different lines. • Ensure that monitoring is sufficiently frequent to detect electrocutions reliably and that any areas where electrocutions occurred are repaired as soon as possible. • During the first year of operation quarterly reports, summarizing interim findings should be complied and submitted to BirdLife South Africa. If the findings indicate that electrocutions have not occurred or are minimal with no red-listed species, an annual report can be submitted.		
Residual Impacts:		
Electrocutions might still occur regardless of mitigations		

Table 8-7 Operational activities impacts on the avifauna

Nature:		
Roadkill during maintenance procedures		
	Without mitigation	With mitigation
Extent	Moderate (3)	Moderate (3)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Improbable (2)
Significance	**Medium**	**Low**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	

Mitigation:

- All personnel should undergo environmental induction with regards to avifauna and their behaviour on roads.
- All vehicles should adhere to clearly defined and demarcated roads. No off-road driving to be allowed.
- All vehicles accessing the site should adhere to a low speed limit on site (40 km/h max) to avoid collisions with susceptible avifauna, such as nocturnal and crepuscular species (e.g. nightjars and owls) which sometimes forage or rest on roads, especially at night.

Residual Impacts:

Road collisions can still occur regardless of mitigations

Table 8-8 Operational activities impacts on the avifauna

Nature:

Habitat degradation and displacement of resident, visiting and breeding species (as well as SCCs).

	Without mitigation	With mitigation
Extent	High (4)	Moderate (3)
Duration	Long term (4)	Short term (2)
Magnitude	High (8)	Moderate (6)
Probability	Highly probable (4)	Probable (3)
Significance	**High**	**Medium**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	No, the footprint has already been disturbed. The area surrounding the development can be mitigated to some extent	

Mitigation:

- Minimising habitat destruction caused by the maintenance by demarcating the footprint so that it does not increase yearly.
- All areas where maintenance must be for example grass cutting walked through prior to any activity to ensure no nests or fauna species are found in the area. Should any Species of Conservation Concern not move out of the area or their nest be found in the area a suitably qualified specialist must be consulted to advise on the correct actions to be taken.

Residual Impacts:

Migratory routes of avifauna species could change, and the species composition could also change regardless of mitigations

8.3.3 Decommissioning Phase

This phase is when the scaling down of activities ahead of temporary or permanent closure is initiated. During this phase, the operational phase impacts will persist until of the activity reduces and the rehabilitation measures are implemented.

The following potential impacts were considered (Table 8-9 to Table 8-10):

- Continued fragmentation and degradation of habitats;

- Displacement of faunal community (including SCC) due disturbance (road collisions, noise, dust, vibration).

Table 8-9 Decommissioning activities impacts on the avifauna

Nature:		
Continued fragmentation and degradation of habitats		
	Without mitigation	With mitigation
Extent	Moderate (3)	Low (2)
Duration	Long term (4)	Very short term (1)
Magnitude	High (8)	Minor (2)
Probability	Highly probable (4)	Very improbable (1)
Significance	**Medium**	**Low**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	
Mitigation:		
• Implementation of a rehabilitation plan. • Implementation of an alien invasive management plan and monitoring on an annual basis for 3 years post construction. • There should be follow-up rehabilitation and revegetation of any remaining bare areas with indigenous flora.		
Residual Impacts:		
No significant residual risks are expected, although IAP encroachment and erosion might still occur but would have a negligible impact if effectively managed.		

Table 8-10 Decommissioning activities impacts on the avifauna

Nature:		
Displacement of faunal community (including SCC) due disturbance (road collisions, noise, dust, vibration).		
	Without mitigation	**With mitigation**
Extent	High (4)	Moderate (3)
Duration	Long term (4)	Moderate term (3)
Magnitude	High (8)	Moderate (6)
Probability	Highly probable (4)	Probable (3)
Significance	**High**	**Medium**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	
Mitigation:		
• Minimize disturbance impact by abbreviating construction time		

- Schedule the activities to avoid breeding and movement times report
- Dust management need to be done in the areas where the vegetation will be removed, this includes wetting of the soil. This area must be rehabilitated as soon as possible.
- All construction vehicles should adhere to clearly defined and demarcated roads. No off-road driving to be allowed outside of the decommissioning area.
- All vehicles (construction or other) accessing the site should adhere to a low speed limit on site (40 km/h max) to avoid collisions with susceptible avifauna, such as nocturnal and crepuscular species (e.g. nightjars and owls) which sometimes forage or rest on roads, especially at night.

Residual Impacts:

If this is mitigated and monitored correctly no residual impacts should be present

8.4 Cumulative Impacts

The impacts of projects are often assessed by comparing the post-project situation to a pre-existing baseline. Where projects can be considered in isolation this provides a good method of assessing a project's impact. However, in areas where baselines have already been affected, or where future development will continue to add to the impacts in an area or region, it is appropriate to consider the cumulative effects of development. This is similar to the concept of shifting baselines, which describes how the environmental baseline at a point in time may represent a significant change from the original state of the system. This section describes the potential impacts of the project that are cumulative for terrestrial fauna and flora.

Localised cumulative impacts include the cumulative effects from operations that are close enough to potentially cause additive effects on the environment or sensitive receivers (such as the nearby existing solar facility and the existing powerlines). These include dust deposition, noise and vibration, disruption of corridors or habitat, , groundwater drawdown, groundwater and surface water quality, and transport.

Long-term cumulative impacts due to the large number of development close by (Section 5.3) can lead to the loss of endemic and threatened species, loss of habitat and vegetation types and even degradation of well conserved areas. A number of solar plants and powerlines can already be found in the project site, this combination of obstacles increases the risk of bird collisions and habitat loss as well as territorial disputes (species forced out of the one area to just again be forced out) (Table 8-11). In the light of all above, the expected cumulative impact is expected to be highly detrimental.

Table 8-11 Cumulative impact of the solar facility

Nature:		
Loss of habitat and increase in bird collisions		
	Overall impact of the proposed development considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	**Moderate (3)**	**Very high (5)**
Duration	**Long term (4)**	**Permanent (5)**
Magnitude	**High (8)**	**Very high (10)**
Probability	**Highly probable (4)**	**Definite (5)**

Significance	**Medium**	**High**
Status (positive or negative)	**Negative**	**Negative**
Reversibility	**Low**	**None**
Irreplaceable loss of resources?	**Yes**	**Yes**
Can impacts be mitigated?	**No**	
Mitigation:		
The overall combined habitat loss is extensive and cannot be replaced. Even though collisions can be mitigated to some extent for individual lines/solar plants their combined densities will increase the rate of collisions.		
Residual Impacts:		
Loss of habitat for endemic and SCC. Loss of SCCs due to collisions.		

9 Specialist Management Plan

The aim of the management outcomes is to present the mitigations in such a way that they can be incorporated into the Environmental Management Programme (EMPr), allowing for more successful implementation and auditing of the mitigations and monitoring guidelines.

Table 9-1 presents the recommended mitigation measures and the respective timeframes, targets, and performance indicators for the avifaunal study.

Table 9-1 Summary of management outcomes pertaining to impacts to avifauna and their habitats

Impact Management Actions	Implementation		Monitoring	
	Phase	Responsible Party	Aspect	Frequency
Management outcome: Habitats				
Areas outside of the direct project footprint, should under no circumstances be fragmented or disturbed further. Clearing of vegetation should be minimized and avoided where possible.	Life of operation	Project manager, Environmental Officer	Areas of indigenous vegetation	Ongoing
The development footprint must be used for storage and the contractors' camps as well. This may not be outside the direct project site to ensure the disturbance area is as small as possible.	Construction	Project manager, Environmental Officer	Project footprint	During Stage
Where possible, existing access routes and walking paths must be made use of.	Construction/Operational Phase	Environmental Officer & Design Engineer	Roads and paths used	Ongoing
Areas that are denuded during construction need to be re-vegetated with indigenous vegetation to prevent erosion during flood and wind events. This will also reduce the likelihood of encroachment by alien invasive plant species.	Closure Phase/Rehabilitation phase	Environmental Officer & Contractor	Assess the state of rehabilitation and encroachment of alien vegetation	Quarterly for up to two years after the closure
Any woody material removed can be shredded and used in conjunction with the topsoil to augment soil moisture and prevent further erosion.	Closure Phase/ Post Closure Phase	Environmental Officer & Contractor	Road edges and project site footprint	During Phase

Rehabilitation of the disturbed areas existing in the project site must be made a priority. Topsoil must also be utilised, and any disturbed area must be re-vegetated with plant and grass species which are endemic to this vegetation type.	Operational/Closure Phase	Environmental Officer & Contractor	Road edges and footprint	During Phase
Erosion control and alien invasive management plan must be compiled.	Life of operation	Environmental Officer & Contractor	Erosion and alien invasive species	Ongoing
Environmentally friendly dust suppressants need to be utilised	Operational phase	Environmental Officer & Contractor	Water pollution	During Phase
A fire management plan needs to be compiled and implemented to restrict the impact fire might have on the surrounding areas.	Life of operation	Environmental Officer & Contractor	Fire Management	During Phase

Management outcome: Avifauna

Impact Management Actions	Implementation		Monitoring	
	Phase	Responsible Party	Aspect	Frequency
The areas to be developed must be specifically demarcated to prevent movement of staff or any individual into the surrounding environments. Signs must be put up to enforce this.	Construction/Operational Phase	Project manager, Environmental Officer	Infringement into these areas	Ongoing
The nest buffers must be treated as No-go areas	Life of operation	Environmental Officer, Project Manager	Evidence of disturbance of the SCCs	Ongoing
All personnel should undergo environmental induction with regards to avifauna and in particular awareness about not harming, collecting, or hunting terrestrial species (e.g., guineafowl and francolin), and owls, which are often persecuted out of superstition. Signs must be put up to enforce this.	Life of operation	Environmental Officer	Evidence of trapping etc	Ongoing
The duration of the construction should be kept to a minimum to avoid disturbing avifauna.	Construction/Operational Phase	Project manager, Environmental Officer & Design Engineer	Construction/Closure Phase	During Phase
Outside lighting should be designed and limited to minimize impacts on fauna. All outside lighting should be directed away from highly sensitive areas. Fluorescent and mercury vapor lighting should be avoided and sodium vapor (red/green) lights should be used wherever possible.	Construction/Operational Phase	Project manager, Environmental Officer & Design Engineer	Light pollution and period of light.	During Phase
All construction and maintenance motor vehicle operators should undergo an environmental induction that includes instruction on the need to comply with speed limit (40km/h), to respect all forms of wildlife. Speed limits must still be enforced to ensure that road killings and erosion is limited.	Life of operation	Health and Safety Officer	Compliance to the training.	Ongoing
Schedule or limit (where feasible) activities and operations during least sensitive periods, to avoid migration, nesting and breeding seasons (June – August)	Construction/Operational Phase	Project manager, Environmental Officer & Design Engineer	Activities should take place during the day in winter.	During Phase

All project activities must be undertaken with appropriate noise mitigation measures to avoid disturbance to avifauna population in the region	Construction/Operational Phase	Project manager, Environmental Officer	Noise	During Phase
All areas to be developed must be walked through prior to any activity to ensure no nests or avifauna species are found in the area. Should any Species of Conservation Concern be found and not move out of the area, or their nest be found in the area a suitably qualified specialist must be consulted to advise on the correct actions to be taken.	Planning, Construction and Decommissioning	Project manager, Environmental Officer	Presence of Nests and faunal species	During Phase
The design of the proposed PV must be of a type or similar structure as endorsed by the Eskom-EWT Strategic Partnership on Birds and Energy, considering the mitigation guidelines recommended by Birdlife South Africa (Jenkins *et al.,* 2015).	Planning and construction	Environmental Officer & Contractor, Engineer	Presence of electrocuted birds or bird strikes	During Phase
Infrastructure should be consolidated where possible in order to minimise the amount of ground and air space used.	Planning and construction	Environmental Officer & Contractor, Engineer	Presence of bird collisions	During phase
All the parts of the infrastructure must be nest proofed and anti-perch devices placed on areas that can lead to electrocution	Planning and construction	Environmental Officer & Contractor, Engineer	Presence of electrocuted birds	During phase
Use environmentally friendly cleaning and dust suppressant products	Construction and operation	Environmental Officer & Contractor, Engineer	Presence of chemicals in and around the project site	During phase
Fencing mitigations: • Top 2 strands must be smooth wire • Routinely retention loose wires • Minimum 30cm between wires • Place markers on fences	Planning, construction, and operation	Environmental Officer & Contractor, Engineer	Presence of birds stuck /dead in fences Monitor fences for slack wires	During phase
As far as possible power cables within the project site should be thoroughly insulated and preferably buried.	Planning and construction	Environmental Officer & Contractor, Engineer	Exposed cables	During phase
Any exposed parts must be covered (insulated) to reduce electrocution risk	Planning and construction	Environmental Officer & Contractor, Engineer	Presence of electrocuted birds	During phase
White strips should be placed along the edges of the panels, to reduce similarity to water and deter birds and insects (Horvath *et al,* 2010). Consider the use of bird deterrent devices to limit collision risk.	Planning and construction	Environmental Officer & Contractor, Engineer	Presence of dead birds in the project site	During phase

10 Monitoring

Should the development be authorised, nest and SCC monitoring must be done to determine the effect of the development on these species, this would also allow for more available data for future projects.

The locations of the nests to be monitored is provided in section 6. Monitoring must be done prior to the construction phase, at time of construction and for 3 consecutive years after construction. Vantage and nest monitoring standard methods as per the species protocols must be followed.

11 Recommendations

The following recommendations are proposed for the project:

- As very little is known about the impacts of solar facilities on birds in South Africa, a construction monitoring regime is recommended for the proposed project site to document any impacts and this data must be used for improving mitigation measures to reduce the impact on biological resources, particularly avifauna; and
- A follow-up assessment on avian biodiversity and species abundance within the project site and surrounding areas must be conducted within one year after the facility has been in operation and should be repeated every 3-5 years.

12 Conclusion

The project site from an avifauna perspective is regarded as very highly sensitive. The following SCCs were recorded:

- Four Kori Bustards (NT) were found in and around the project site, these species are sedentary, and the project site would be part of their core territories;
- Breeding pair of Verreaux's Eagle (VU) recorded 4.5 km form the site and have a nest nearby. A 3 km Buffer was placed around the nest;
- Thirteen Cape Vultures (EN) were found 3.5km for the site, while an additional 30 vultures were recorded 17km from the site;
- Two korhaan species (Red-Crested and Northern Black, NC Conservation Act of 2009) having territories in the project site; and
- A Pygmy Falcon Nest was found 3km from the site along the main access route (NC Conservation Act of 2009), a 500m buffer was placed around the nest.

The development will result in the loss of habitat for these SCCs, it will also lead to sensory disturbance, collision and electrocution risks. Even though the latter three impacts can be mitigated to some extent, the loss of habitat cannot be mitigated. These species could move into surrounding areas however based on the number of applications and current solar plant developments in the area the cumulative impact is also regarded as being high.

The SEI was determined to 'High' based on the presence of SCCs and their known nesting locations.

12.1 Impact Statement

The main expected impact of the proposed Red Sands 2 Solar PV Cluster will be the loss of habitat, loss of nesting sites and emigration of avifauna. Based on the outcomes of the SEI determination, the project possesses a 'High' SEI. This denotes that avoidance mitigation wherever possible must be implemented. This includes changes to project infrastructure design to limit the amount of habitat impacted. In order to appreciate the extent of 'avoidance' achieved for the project, the three proposed PV facilities have been jointly considered, the following is noteworthy:

- The footprint areas for the three facilities amounts to 403 ha, with a total area of 164 ha being avoided within the respective project areas combined;
- The total extent of the entire Kheis farm area comprising five portions measures 21,464 ha, thus approximately 2% of the farm area will be developed; and
- The extent of the two farm portions (PV 1 and PV 2 are located on 2/386, and PV 3 is located on 19/387) with 'High' SEI habitat directly affected by the project area measures 8,668 ha; thus approximately 5% of the two farm portions will be developed.

The project area has been designated as a REDZ (Renewable Energy Development Zone) and taking into consideration the extent of 'avoidance' achieved for the project, it is the opinion of the specialist that the authorisation of the proposed project may be favourably considered. It is recommended that should any future developments be proposed for the remaining extent of the 'High' and 'Very High' areas within the Kheis farm area, that compensation strategies be required for these authorisations.

13 References

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14 Appendices

14.1 Appendix A: Avifaunal species expected in the area.

Species	Common Name	Conservation Status		Pentad					
		Regional (SANBI, 2016)	IUCN (2021)	2840_2200	2840_2205	2840_2210	2845_2200	2845_2205	2850_2155
Acridotheres tristis	Myna, Common	Unlisted	LC				25.0		
Acrocephalus baeticatus	Reed-warbler, African	Unlisted	Unlisted						14.3
Acrocephalus gracilirostris	Swamp-warbler, Lesser	Unlisted	LC						14.3
Actitis hypoleucos	Sandpiper, Common	Unlisted	LC						0.0
Afrotis afraoides	Korhaan, Northern Black	Unlisted	LC	50.0	16.7	50.0	25.0	25.0	
Alopochen aegyptiaca	Goose, Egyptian	LC	LC		16.7			50.0	57.1
Amadina erythrocephala	Finch, Red-headed	Unlisted	LC	50.0	83.3	50.0		37.5	14.3
Anas sparsa	Duck, African Black	Unlisted	LC						7.1
Anas undulata	Duck, Yellow-billed	Unlisted	LC						7.1
Anhinga rufa	Darter, African	Unlisted	LC						78.6
Anthoscopus minutus	Penduline-tit, Cape	Unlisted	LC		16.7	50.0	25.0	50.0	
Anthus cinnamomeus	Pipit, African	Unlisted	LC		16.7				28.6
Anthus crenatus	Pipit, African Rock	NT	LC	50.0	100.0		25.0	50.0	
Anthus nicholsoni	Nicholson's pipit	Unlisted	Unlisted		16.7			12.5	
Apus affinis	Swift, Little	Unlisted	LC	50.0	33.3			12.5	71.4
Apus	Swift, Common	Unlisted	LC		33.3		25.0	25.0	
Apus bradfieldi	Swift, Bradfield's	Unlisted	LC		33.3				
Apus caffer	Swift, White-rumped	Unlisted	LC	0.0	50.0	50.0	25.0	50.0	35.7
Aquila verreauxii	Eagle, Verreaux's	VU	LC	50.0	16.7		25.0	50.0	
Ardea cinerea	Heron, Grey	Unlisted	LC						21.4
Ardea goliath	Heron, Goliath	Unlisted	LC						57.1
Ardea melanocephala	Heron, Black-headed	Unlisted	LC						21.4
Ardeotis kori	Bustard, Kori	NT	NT		33.3			12.5	
Batis pririt	Batis, Pririt	Unlisted	LC	50.0	100.0	100.0	100.0	62.5	21.4
Bostrychia hagedash	Ibis, Hadeda	Unlisted	LC				50.0	25.0	71.4
Brunhilda erythronotos	Waxbill, Black-faced	Unlisted	LC		0.0			37.5	7.1
Bubo africanus	Eagle-owl, Spotted	Unlisted	LC		16.7		25.0	25.0	
Bubulcus ibis	Egret, Cattle	Unlisted	LC		16.7		25.0		35.7
Burhinus capensis	Thick-knee, Spotted	Unlisted	LC		16.7			25.0	21.4
Calendulauda africanoides	Lark, Fawn-coloured	Unlisted	LC	100.0	100.0	100.0	100.0	87.5	21.4
Calendulauda sabota	Lark, Sabota	Unlisted	LC	100.0				25.0	35.7

Campethera abingoni	Woodpecker, Golden-tailed	Unlisted	LC						21.4
Caprimulgus pectoralis	Nightjar, Fiery-necked	Unlisted	LC		16.7			12.5	
Caprimulgus rufigena	Nightjar, Rufous-cheeked	Unlisted	LC		16.7			37.5	
Cecropis cucullata	Swallow, Greater Striped	Unlisted	LC	0.0	66.7	50.0			71.4
Cercotrichas coryphoeus	Scrub-robin, Karoo	Unlisted	LC	0.0	16.7		25.0	25.0	21.4
Cercotrichas paena	Scrub-robin, Kalahari	Unlisted	LC	100.0	100.0	100.0	75.0	100.0	35.7
Certhilauda subcoronata	Lark, Karoo Long-billed	Unlisted	LC	50.0	16.7				21.4
Charadrius tricollaris	Plover, Three-banded	Unlisted	LC						7.1
Chersomanes albofasciata	Lark, Spike-heeled	Unlisted	LC	100.0	66.7		50.0	12.5	7.1
Chrysococcyx caprius	Cuckoo, Diderick	Unlisted	LC		33.3		25.0	12.5	28.6
Ciconia abdimii	Stork, Abdim's	NT	LC						7.1
Cinnyris fuscus	Sunbird, Dusky	Unlisted	LC	100.0	83.3	0.0	100.0	75.0	50.0
Cisticola aridulus	Cisticola, Desert	Unlisted	LC	50.0					7.1
Cisticola fulvicapilla	Neddicky, Neddicky	Unlisted	LC	25.0				12.5	
Cisticola juncidis	Cisticola, Zitting	Unlisted	LC						21.4
Cisticola subruficapilla	Cisticola, Grey-backed	Unlisted	LC	50.0	100.0	50.0	50.0	50.0	7.1
Cisticola tinniens	Cisticola, Levaillant's	Unlisted	LC						28.6
Clamator jacobinus	Cuckoo, Jacobin	Unlisted	LC		33.3		25.0	12.5	14.3
Colius colius	Mousebird, White-backed	Unlisted	LC	100.0	33.3	50.0	50.0	50.0	78.6
Columba guinea	Pigeon, Speckled	Unlisted	LC	50.0	66.7	50.0			85.7
Corvus albus	Crow, Pied	Unlisted	LC	0.0	50.0		50.0	62.5	14.3
Cossypha caffra	Robin-chat, Cape	Unlisted	LC						85.7
Coturnix coturnix	Quail, Common	Unlisted	LC	50.0				12.5	
Creatophora cinerea	Starling, Wattled	Unlisted	LC	0.0				12.5	50.0
Crithagra albogularis	White-throated Canary	LC	LC	50.0	33.3	25.0			14.3
Crithagra atrogularis	Canary, Black-throated	Unlisted	LC		16.7				35.7
Crithagra flaviventris	Canary, Yellow	Unlisted	LC	50.0	50.0	50.0	75.0	50.0	71.4
Curruca layardi	Warbler, Layards	Unlisted	LC	50.0	100.0	50.0	50.0	25.0	7.1
Curruca subcoerulea	Tit-babbler, Chestnut-vented	Unlisted	Unlisted	100.0	83.3	50.0	75.0	87.5	28.6
Cypsiurus parvus	Palm-swift, African	Unlisted	LC						14.3
Dendropicos fuscescens	Woodpecker, Cardinal	Unlisted	LC						7.1
Dicrurus adsimilis	Drongo, Fork-tailed	Unlisted	LC					12.5	
Elanus caeruleus	Kite, Black-shouldered	Unlisted	LC						28.6
Emberiza capensis	Bunting, Cape	Unlisted	LC	50.0					

Emberiza capensis	Bunting, Cape	Unlisted	LC		100.0		25.0	25.0	0.0
Emberiza impetuani	Bunting, Lark-like	Unlisted	LC	100.0	66.7	50.0	50.0	12.5	14.3
Emberiza tahapisi	Bunting, Cinnamon-breasted	Unlisted	LC		16.7			12.5	
Eremomela icteropygialis	Eremomela, Yellow-bellied	Unlisted	LC	100.0	50.0	50.0	75.0	25.0	14.3
Eremopterix verticalis	Sparrowlark, Grey-backed	Unlisted	LC	50.0				12.5	
Estrilda astrild	Waxbill, Common	Unlisted	LC				25.0		28.6
Euplectes orix	Bishop, Southern Red	Unlisted	LC					25.0	57.1
Eupodotis vigorsii	Korhaan, Karoo	NT	LC						7.1
Falco biarmicus	Falcon, Lanner	VU	LC		33.3				7.1
Falco rupicoloides	Kestrel, Greater	Unlisted	LC			0.0		12.5	
Falco rupicolus	Kestrel, Rock	Unlisted	LC	50.0	66.7	50.0	25.0	12.5	0.0
Gallinula chloropus	Moorhen, Common	Unlisted	LC						7.1
Glaucidium perlatum	Owlet, Pearl-spotted	Unlisted	LC						14.3
Granatina granatina	Waxbill, Violet-eared	Unlisted	LC					12.5	
Halcyon albiventris	Kingfisher, Brown-hooded	Unlisted	LC						7.1
Haliaeetus vocifer	Fish-eagle, African	Unlisted	LC						64.3
Hieraaetus pennatus	Eagle, Booted	Unlisted	LC						0.0
Himantopus himantopus	Stilt, Black-winged	Unlisted	LC						0.0
Hirundo albigularis	Swallow, White-throated	Unlisted	LC						50.0
Hirundo dimidiata	Swallow, Pearl-breasted	Unlisted	LC						7.1
Hirundo rustica	Swallow, Barn	Unlisted	LC	0.0	83.3	100.0	50.0	62.5	28.6
Indicator minor	Honeyguide, Lesser	Unlisted	LC					12.5	
Lamprotornis nitens	Starling, Cape Glossy	Unlisted	LC	0.0	16.7			12.5	78.6
Laniarius atrococcineus	Shrike, Crimson-breasted	Unlisted	LC		16.7		25.0	25.0	7.1
Lanius collaris	Fiscal, Common (Southern)	Unlisted	LC	100.0	83.3	100.0	50.0	75.0	35.7
Lanius collurio	Shrike, Red-backed	Unlisted	LC	0.0	33.3		25.0	12.5	7.1
Lanius minor	Shrike, Lesser Grey	Unlisted	LC	0.0			25.0	25.0	
Lophotis ruficrista	Korhaan, Red-crested	Unlisted	LC	50.0	50.0		50.0	50.0	
Malcorus pectoralis	Warbler, Rufous-eared	Unlisted	LC	50.0	33.3	100.0	25.0	62.5	21.4
Megaceryle maxima	Kingfisher, Giant	Unlisted	Unlisted						21.4
Melaenornis infuscatus	Flycatcher, Chat	Unlisted	LC	0.0	33.3	100.0	25.0	62.5	7.1
Melaenornis mariquensis	Flycatcher, Marico	Unlisted	LC	0.0					0.0
Melaenornis mariquensis	Flycatcher, Marico	Unlisted	LC					12.5	78.6
Melaniparus cinerascens	Tit, Ashy	Unlisted	LC	100.0	100.0		25.0	50.0	14.3

Melierax canorus	Goshawk, Southern Pale Chanting	Unlisted	LC	66.7		50.0	25.0	75.0	21.4
Merops apiaster	Bee-eater, European	Unlisted	LC	16.7				25.0	
Merops bullockoides	Bee-eater, White-fronted	Unlisted	LC						28.6
Merops hirundineus	Bee-eater, Swallow-tailed	Unlisted	LC	0.0	16.7	50.0	25.0	25.0	21.4
Microcarbo africanus	Cormorant, Reed	Unlisted	LC						42.9
Mirafra fasciolata	Lark, Eastern Clapper	Unlisted	LC	50.0	50.0		50.0	25.0	
Monticola brevipes	Rock-thrush, Short-toed	Unlisted	LC	50.0	33.3			12.5	
Motacilla aguimp	Wagtail, African Pied	Unlisted	LC						21.4
Motacilla capensis	Wagtail, Cape	Unlisted	LC	0.0					78.6
Myrmecocichla formicivora	Chat, Anteating	Unlisted	LC	50.0	50.0	100.0	25.0	62.5	7.1
Myrmecocichla monticola	Wheatear, Mountain	Unlisted	LC	50.0	100.0	100.0	50.0	50.0	
Nilaus afer	Brubru	Unlisted	LC	50.0	33.3			25.0	21.4
Numida meleagris	Guineafowl, Helmeted	Unlisted	LC		16.7			12.5	21.4
Oena capensis	Dove, Namaqua	Unlisted	LC	100.0	83.3	50.0	50.0	62.5	64.3
Oenanthe familiaris	Chat, Familiar	Unlisted	LC	0.0	50.0				35.7
Oenanthe pileata	Wheatear, Capped	Unlisted	LC	0.0	33.3			50.0	
Onychognathus nabouroup	Starling, Pale-winged	Unlisted	LC	100.0	83.3		50.0	62.5	
Passer diffusus	Sparrow, Southern Grey-headed	Unlisted	LC		16.7				14.3
Passer domesticus	Sparrow, House	Unlisted	LC		50.0			12.5	85.7
Passer melanurus	Sparrow, Cape	Unlisted	LC	50.0	66.7	50.0	25.0	37.5	92.9
Phalacrocorax lucidus	Cormorant, White-breasted	Unlisted	LC						57.1
Philetairus socius	Weaver, Sociable	Unlisted	LC	50.0	100.0	100.0	50.0	100.0	78.6
Phragmacia substriata	Warbler, Namaqua	Unlisted	Unlisted						28.6
Plectropterus gambensis	Goose, Spur-winged	Unlisted	LC					12.5	
Plectropterus gambensis	Goose, Spur-winged	Unlisted	LC						7.1
Plocepasser mahali	Sparrow-weaver, White-browed	Unlisted	LC	100.0	100.0	0.0	25.0	50.0	85.7
Ploceus velatus	Masked-weaver, Southern	Unlisted	LC	50.0	33.3	50.0	50.0	25.0	92.9
Polihierax semitorquatus	Falcon, Pygmy	Unlisted	LC	50.0	66.7	100.0	50.0	75.0	0.0
Polyboroides typus	Harrier-Hawk, African	Unlisted	LC						7.1
Prinia flavicans	Prinia, Black-chested	Unlisted	LC	100.0	83.3	100.0	75.0	100.0	78.6
Pterocles namaqua	Sandgrouse, Namaqua	Unlisted	LC	100.0	50.0	50.0	50.0	87.5	28.6
Ptyonoprogne fuligula	Martin, Rock	LC	LC	50.0	100.0	50.0	75.0	62.5	85.7
Pycnonotus nigricans	Bulbul, African Red-eyed	Unlisted	LC	100.0	83.3		25.0	37.5	92.9
Quelea quelea	Quelea, Red-billed	Unlisted	LC		16.7			12.5	42.9

Rhinopomastus cyanomelas	Scimitarbill, Common	Unlisted	LC	50.0	66.7		25.0	62.5	
Riparia paludicola	Martin, Brown-throated	Unlisted	LC				25.0		50.0
Scopus umbretta	Hamerkop	Unlisted	LC						35.7
Spilopelia senegalensis	Dove, Laughing	Unlisted	LC	100.0	83.3	50.0	50.0	37.5	100.0
Sporopipes squamifrons	Finch, Scaly-feathered	Unlisted	LC	100.0	66.7	50.0	25.0	75.0	28.6
Streptopelia capicola	Turtle-dove, Cape	Unlisted	LC	100.0	66.7		75.0	100.0	50.0
Streptopelia semitorquata	Dove, Red-eyed	Unlisted	LC						78.6
Struthio camelus	Ostrich, Common	Unlisted	LC						7.1
Sylvietta rufescens	Crombec, Long-billed	Unlisted	LC	100.0	100.0	50.0	75.0	75.0	14.3
Tachybaptus ruficollis	Grebe, Little	Unlisted	LC						7.1
Tachymarptis melba	Swift, Alpine	Unlisted	LC	0.0					
Tadorna cana	Shelduck, South African	Unlisted	LC	0.0					14.3
Tchagra australis	Tchagra, Brown-crowned	Unlisted	LC		66.7		75.0	50.0	
Telophorus zeylonus	Bokmakierie, Bokmakierie	Unlisted	LC	100.0	100.0	50.0	75.0	87.5	57.1
Threskiornis aethiopicus	Ibis, African Sacred	Unlisted	LC						42.9
Tockus leucomelas	Hornbill, Southern Yellow-billed	Unlisted	LC						7.1
Trachyphonus vaillantii	Barbet, Crested	Unlisted	LC						85.7
Tricholaema leucomelas	Barbet, Acacia Pied	Unlisted	LC	50.0	83.3	0.0	75.0	50.0	78.6
Turdus smithi	Thrush, Karoo	Unlisted	LC						64.3
Turnix sylvaticus	Buttonquail, Kurrichane	Unlisted	LC	50.0	16.7			12.5	
Tyto alba	Owl, Barn	Unlisted	LC	50.0					7.1
Upupa africana	Hoopoe, African	Unlisted	LC	50.0	16.7				42.9
Urocolius indicus	Mousebird, Red-faced	Unlisted	LC	100.0	33.3	50.0	50.0	12.5	42.9
Vanellus armatus	Lapwing, Blacksmith	Unlisted	LC		16.7				50.0
Vanellus coronatus	Lapwing, Crowned	Unlisted	LC		66.7				7.1
Vidua macroura	Whydah, Pin-tailed	Unlisted	LC						7.1
Vidua regia	Whydah, Shaft-tailed	Unlisted	LC	0.0					
Zapornia flavirostra	Crake, Black	Unlisted	LC						7.1
Zosterops pallidus	White-eye, Orange River	Unlisted	LC	25.0					92.9

14.2 Appendix B: Avifauna species recorded in the survey

Scientific Name	Common Name	Conservation Status		Guild code	Relative abundance	Frequency
		Regional (SANBI, 2016)	IUCN (2017)			
Afrotis afraoides	Korhaan, Northern Black	Unlisted	LC	IGD	0,006	16,667
Alopochen aegyptiaca	Goose, Egyptian	LC	LC	HWD	0,006	11,111
Anas sparsa	Duck, African Black	Unlisted	LC	IWD	0,004	11,111
Anhinga rufa	Darter, African	Unlisted	LC	CWD	0,002	5,556
Anthoscopus minutus	Penduline-tit, Cape	Unlisted	LC	IGD	0,004	11,111
Apus affinis	Swift, Little	Unlisted	LC	IAD	0,002	5,556
Apus caffer	Swift, White-rumped	Unlisted	LC	IAD	0,009	16,667
Aquila verreauxii	Eagle, Verreaux's	VU	LC	CGD	0,005	5,556
Ardea cinerea	Heron, Grey	Unlisted	LC	CWD	0,002	5,556
Ardea goliath	Heron, Goliath	Unlisted	LC	CWD	0,002	5,556
Ardeotis kori	Bustard, Kori	NT	NT	OMD	0,002	5,556
Batis pririt	Batis, Pririt	Unlisted	LC	IGD	0,013	16,667
Bostrychia hagedash	Ibis, Hadeda	Unlisted	LC	OMD	0,009	11,111
Bradornis infuscatus	Flycatcher, Chat	Unlisted	LC	IGD	0,002	5,556
Burhinus capensis	Thick-knee, Spotted	Unlisted	LC	OMD	0,002	5,556
Calendulauda africanoides	Lark, Fawn-coloured	Unlisted	LC	GGD	0,004	11,111
Calendulauda sabota	Lark, Sabota	Unlisted	LC	OMD	0,006	16,667
Cercomela familiaris	Chat, Familiar	Unlisted	LC	IGD	0,004	5,556
Cercomela sinuata	Chat, Sickle-winged	Unlisted	LC	IGD	0,002	5,556
Cercotrichas coryphoeus	Scrub-robin, Karoo	Unlisted	LC	IGD	0,002	5,556
Cercotrichas paena	Scrub-robin, Kalahari	Unlisted	LC	IGD	0,006	16,667
Certhilauda subcoronata	Lark, Karoo Long-billed	Unlisted	LC	IGD	0,004	11,111
Charadrius pecuarius	Plover, Kittlitz's	Unlisted	LC	IWD	0,002	5,556
Chersomanes albofasciata	Lark, Spike-heeled	Unlisted	LC	IGD	0,006	11,111
Cinnyris fuscus	Sunbird, Dusky	Unlisted	LC	NFD	0,006	11,111
Cisticola aridulus	Cisticola, Desert	Unlisted	LC	IGD	0,006	16,667
Cisticola juncidis	Cisticola, Zitting	Unlisted	LC	IGD	0,002	5,556
Colius colius	Mousebird, White-backed	Unlisted	LC	FFD	0,006	5,556
Columba guinea	Pigeon, Speckled	Unlisted	LC	FFD	0,004	5,556
Corvus albus	Crow, Pied	Unlisted	LC	OMD	0,045	16,667
Cossypha caffra	Robin-chat, Cape	Unlisted	LC	OMD	0,002	5,556
Crithagra flaviventris	Canary, Yellow	Unlisted	LC	GGD	0,004	11,111
Curruca subcoerulea	Tit-babbler, Chestnut-vented	Unlisted	Unlisted	IGD	0,004	11,111
Dendropicos fuscescens	Woodpecker, Cardinal	Unlisted	LC	IGD	0,002	5,556

Emberiza capensis	Bunting, Cape	Unlisted	LC	OMD	0,006	16,667
Eremomela icteropygialis	Eremomela, Yellow-bellied	Unlisted	LC	IGD	0,011	16,667
Eremopterix verticalis	Sparrowlark, Grey-backed	Unlisted	LC	GGD	0,006	11,111
Estrilda astrild	Waxbill, Common	Unlisted	LC	GGD	0,019	16,667
Euplectes orix	Bishop, Southern Red	Unlisted	LC	GGD	0,011	5,556
Glaucidium perlatum	Owlet, Pearl-spotted	Unlisted	LC	CGN	0,002	5,556
Granatina granatina	Waxbill, Violet-eared	Unlisted	LC	IGD	0,002	5,556
Gyps coprotheres	Vulture, Cape	EN	EN	CGD	0,034	5,556
Haliaeetus vocifer	Fish-eagle, African	Unlisted	LC	CGD	0,002	5,556
Hirundo fuligula	Martin, Rock	Unlisted	Unlisted	IAD	0,004	5,556
Lamprotornis nitens	Starling, Cape Glossy	Unlisted	LC	IGD	0,013	11,111
Lanius collaris	Fiscal, Common (Southern)	Unlisted	LC	IAD	0,004	11,111
Lanius collurio	Shrike, Red-backed	Unlisted	LC	IGD	0,002	5,556
Lophotis ruficrista	Korhaan, Red-crested	Unlisted	LC	IGD	0,006	16,667
Malcorus pectoralis	Warbler, Rufous-eared	Unlisted	LC	IGD	0,006	16,667
Melaenornis mariquensis	Flycatcher, Marico	Unlisted	LC	IAD	0,004	11,111
Melierax canorus	Goshawk, Southern Pale Chanting	Unlisted	LC	CGD	0,002	5,556
Merops apiaster	Bee-eater, European	Unlisted	LC	IAD	0,004	11,111
Merops hirundineus	Bee-eater, Swallow-tailed	Unlisted	LC	IAD	0,009	5,556
Mirafra africana	Lark, Rufous-naped	Unlisted	LC	IGD	0,002	5,556
Mirafra fasciolata	Lark, Eastern Clapper	Unlisted	LC	IGD	0,004	11,111
Motacilla capensis	Wagtail, Cape	Unlisted	LC	IGD	0,004	5,556
Myrmecocichla formicivora	Chat, Anteating	Unlisted	LC	IGD	0,015	22,222
Numida meleagris	Guineafowl, Helmeted	Unlisted	LC	OMD	0,015	11,111
Oena capensis	Dove, Namaqua	Unlisted	LC	GGD	0,009	16,667
Oenanthe pileata	Wheatear, Capped	Unlisted	LC	IGD	0,002	5,556
Passer diffusus	Sparrow, Southern Grey-headed	Unlisted	LC	GGD	0,002	5,556
Passer domesticus	Sparrow, House	Unlisted	LC	GGD	0,011	5,556
Phalacrocorax africanus	Cormorant, Reed	Unlisted	LC	CWD	0,002	5,556
Phalacrocorax lucidus	Cormorant, White-breasted	Unlisted	LC	CWD	0,006	11,111
Philetairus socius	Weaver, Sociable	Unlisted	LC	GGD	0,302	27,778
Plocepasser mahali	Sparrow-weaver, White-browed	Unlisted	LC	OMD	0,045	16,667
Ploceus velatus	Masked-weaver, Southern	Unlisted	LC	GGD	0,095	22,222
Prinia flavicans	Prinia, Black-chested	Unlisted	LC	IGD	0,019	27,778
Prinia maculosa	Prinia, Karoo	Unlisted	LC	IGD	0,019	27,778
Pterocles namaqua	Sandgrouse, Namaqua	Unlisted	LC	GGD	0,054	33,333
Pycnonotus nigricans	Bulbul, African Red-eyed	Unlisted	LC	OMD	0,002	5,556

Quelea quelea	Quelea, Red-billed	Unlisted	LC	GGD	0,011	5,556
Riparia paludicola	Martin, Brown-throated	Unlisted	LC	IAD	0,019	11,111
Scopus umbretta	Hamerkop	Unlisted	LC	CWD	0,002	5,556
Spilopelia senegalensis	Dove, Laughing	Unlisted	LC	GGD	0,009	22,222
Spizocorys conirostris	Lark, Pink-billed	Unlisted	LC	GGD	0,004	11,111
Spizocorys starki	Lark, Stark's	Unlisted	LC	GGD	0,004	11,111
Sporopipes squamifrons	Finch, Scaly-feathered	Unlisted	LC	GGD	0,011	5,556
Streptopelia capicola	Turtle-dove, Cape	Unlisted	LC	GGD	0,006	16,667
Sylvietta rufescens	Crombec, Long-billed	Unlisted	LC	IGD	0,002	5,556
Telophorus zeylonus	Bokmakierie, Bokmakierie	Unlisted	LC	OMD	0,004	11,111
Trachyphonus vaillantii	Barbet, Crested	Unlisted	LC	FFD	0,002	5,556
Turdus smithi	Thrush, Karoo	Unlisted	LC	OMD	0,002	5,556
Upupa africana	Hoopoe, African	Unlisted	LC	IGD	0,002	5,556
Vanellus coronatus	Lapwing, Crowned	Unlisted	LC	IGD	0,002	5,556
Zosterops virens	White-eye, Cape	Unlisted	LC	OMD	0,002	5,556

14.3 CV of Specialist

Lindi Steyn

PhD Biodiversity and Conservation

(*Pr Sci Nat*)

Cell: +27 72 129 3759

Email: Lindi@thebiodiversitycompany.com

Identity Number: 8805250059080

Date of birth: 25 May 1988

Profile Summary

Working experience throughout South Africa and neighbouring countries.

Specialist experience with mining, road development, engineering, renewable energy, protected areas, and biodiversity offsets.

Specialist guidance, support and facilitation for the compliance with legislative processes, for in-country requirements.

Specialist expertise include Avifauna and Terrestrial Ecology.

Areas of Interest

Mining, Oil & Gas, Renewable Energy & Bulk Services Infrastructure Development, Sustainability and Conservation.

Research publication with a conservation influence.

Birding

Key Experience

- Environmental Impact Assessment
- Terrestrial Ecological Assessments
- Rehabilitation Plans and Monitoring
- Avifaunal Conservation Surveys
- Conservation Management Plans
- Laboratory analysis
- The use of avifaunal species as indicators of pollution.

Countries worked in

South Africa

Swaziland

Zimbabwe

Lesotho

Nationality

South African

Languages

English – Proficient

Afrikaans – Proficient

Qualifications

- PhD Biodiversity and Conservation, University of Johannesburg, South Africa.
- MSc Biodiversity and Conservation, University of Johannesburg, South Africa.
- BSc Hons Biodiversity and Conservation.
- BSc Botany and Zoology.
- Certificate in Field Guiding, Damelin.
- Certificate in Ecotraining.
- Field Guiding FGASA level 1 certificate (2007).

SELECTED PROJECT EXPERIENCE

Project Name:

Client: African Grass-owl (*Tyto Capensis*) Study

Personal position / role on project: Avifauna Specialist

Location: Ventersdorp North West (2021)

Main project features: Conduct a Grass Owl screening study for the presence of Grass Owls or habitat in a 10 km area in the Ventersdorp area.

Project Name: Biodiversity baseline, impact review and offset for the proposed Lanseria waste water treatment works

Client: Zitholele

Personal position / role on project: Terrestrial Ecologist/Project Manager

Location: Lanseria Gauteng (2020)

Main project features: Compile a Biodiversity offset plan for the proposed development.

Project Name: Avifauna baseline and impact assessment for the proposed Kwamhlanga to Gemsbok Powerline.

Client: WSP

Personal position / role on project: Terrestrial Ecologist/Avifaunal specialist

Location: Kwamhlanga Mpumalanga (2020)

Main project features: To conduct a terrestrial and avifaunal environmental and impact assessment for the expected impact footprint area.

Project Name: A terrestrial specialist baseline and impact assessment for the Beitbridge Border Crossing upgrade, in the Beitbridge Town, Zimbabwe.

Client: Kongiwe.

Personal position / role on project: Avifaunal specialist

Location: Zimbabwe (Beitbridge) – October 2019

Main project features: To conduct a dry season (winter) ecological baseline and impact assessment for the proposed project. The study was required to meet national and IFC requirements, including a Critical Habitat assessment.

Project Name: The Environmental and Social Impact Assessment (ESIA) the proposed Nondvo Dam

Personal position / role on project: Terrestrial Ecologist

Location: Swaziland (2019)

Main project features: To conduct a dual season terrestrial and aquatic ecological baseline and impact assessment for the proposed dam. The study was required to meet national and IFC requirements, including a Critical Habitat assessment.

Project Name: An environmental and impact assessment for the proposed Jozini (N2) road expansion for SANRAL, KwaZulu Natal, South Africa.

Personal position / role on project: Terrestrial Ecologist.

Location: KwaZulu Natal, South Africa (2018).

Main project features: To conduct a terrestrial environmental and impact assessment for the expected impact footprint area.

Project Name: Biodiversity Assessment associated with Greylingstad Waste Water Treatment work and reticulation network, Mpumalanga, South Africa.

Personal position / role on project: Terrestrial Ecologist

Location: South Africa (2018).

Main project features: Conduct a detailed terrestrial ecology basic assessment for the expected impact footprint area.

Project Name: An Environmental and impact assessment for the proposed Kalabasfontein Coal Mining Expansion Project, Mpumalanga, South Africa.

Personal position / role on project: Terrestrial Ecologist/ Avifaunal specialist

Location: Mpumalanga, South Africa (2018)

Main project features: To conduct a terrestrial environmental and impact assessment for the expected impact footprint area.

OVERVIEW

An overview of the specialist technical expertise includes the following:

- Terrestrial Ecological Assessments.
- Faunal surveys which includes mammals, birds, amphibians and reptiles.
- Conservation Plans and Monitoring for terrestrial component.
- Avifaunal surveys.
- Biodiversity offset plans.
- Bioaccumulation assessments for birds
- Toxicity analysis of air dust samples, sediment, water and biota.

EMPLOYMENT EXPERIENCE

- **CURRENT EMPLOYMENT: The Biodiversity Company (May 2018 – Present)**
- I started working at The Biodiversity Company in mid-2018.
- The team at The Biodiversity Company have conducted stand-alone specialist studies and provided overall guidance of studies with a pragmatic approach for the management of biodiversity that takes into account all the relevant stakeholders, most importantly the environment that is potentially affected. We manage risks to the environment to reduce impacts with practical, relevant and measurable methods.
- My roles include:
  - Faunal and Floral surveys for baseline, basic or impact assessments
  - Report writing
  - GIS map work
  - Project management
  - Management Plan compilations
  - Technical assistant for fieldwork for the aquatics and wetland departments
  - Specialist inputs to the above-mentioned services.
-
- **EMPLOYMENT: University of Johannesburg (January 2012 – July 2018)**
- UJ assigned me to the role of laboratory assistant and assistant lecture.
  - Research
  - Report writing
  - Performed toxicity testing on biota, sediment, water and air dust samples.

- Completed day to day administration of the laboratory.
- Assisted with field work involving all the different specialist work which includes mammalogy, aquatics and botany.
- Lectured courses, including parasitology and Biology for teachers

- **ACADEMIC QUALIFICATIONS**

University of Johannesburg, Johannesburg, South Africa (2018): PHILOSOPHIAE DOCTOR (PhD) – Biodiversity and Conservation

Title: *The effect of DDT on the histology, reproductive success and overall health of the House Sparrow in designated areas.*

University of Johannesburg, Johannesburg, South Africa (2013): MAGISTER SCIENTIAE (MSc)- Biodiversity and Conservation

Title: Comparative determination of the numbers of four garden bird species, the House Sparrow, *Passer domesticus*, the Cape Glossy Starling, *Lamprotornis nitens*, the Cape Turtle Dove, *Streptopelia capicola* and the Laughing Dove, *Streptopelia senegalensis* in the Johannesburg and Vaalwater areas with study into possible causes of expected declines.

University of Johannesburg, Johannesburg, South Africa (2011): BACCALAUREUS SCIENTIAE CUM HONORIBUS (Hons) – Zoology

Title: The influence of agriculture on selected Mpumalanga Pans.

University of Johannesburg, Johannesburg, South Africa (2010): BACCALAUREUS SCIENTIAE IN NATURAL AND ENVIRONMENTAL SCIENCES. Majors: Zoology and Botany.

Damelin, Bramley, Johannesburg: National Certificate in Field Guiding (Lodge Management) (2007)

Damelin, Bramley, Johannesburg: Field guiding FGASA level 1 certificate (2007)

Damelin, Bramley, Johannesburg: Ecotraining- Karongwe & Selati (2007)

PUBLICATIONS

Steyn, L., Bouwman, H., Maina, J.N. (2018). Associations between DDT and egg parameters of the House Sparrow *Passer domesticus* from the Thohoyandou area of South Africa, Chemosphere.

Steyn, L., Bouwman, H., Maina, J.N. (2018). The effect of DDT and its metabolites on the structure of the shells of the eggs of the House Sparrow, *Passer domesticus*: A morphometric study. 7th International Toxicology Symposium in Africa.

Steyn, L., Bouwman, H., Maina, A.W, Hoffman, J., Maina, J.N. (2018). Bone density and asymmetry are not related to DDT in House Sparrows: insights from micro-focus X-ray computed tomography. Chemosphere.

Steyn, L., Maina, J.N. (2016). Comparison of the numbers of three species of birds in an urban- and a rural area of South Africa and possible relationship to the numbers of free (surface) macrophages in the respiratory systems. Journal of Ornithology

Willoughby, B., Steyn, L., Maina, J.N. (2015). X-ray microcomputed tomography study of the microstructure and the morphometry of the shell of the ostrich, *Struthio camerus*, egg. Anatomical record

Steyn, L., Maina, J.N. (2013). Die verwagte afname van die getalle van vier voël spesie, die Huismossie, Kleinglansspreeu, Gewone Tortelduif en die Rooiborsduifie in Gauteng en Limpopo provinsies en moontelike oorsake van die dalings. Die Suid-Afrikaanse akademie vir wetenskap en kuns afdeling biologiese wetenskappe, Pretoria.

14.4 Protocol check list

"Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Avifauna" gazetted 20 March 2020, published in Government Notice No. 320 with the relevance to this project as per the Bird and Wind- Energy Best - Practice Guideline (Birdlife SA)

Item	Pages	Comment
The assessment must be prepared by a specialist registered with the South African Council for Natural Scientific Professionals (SACNASP)	ii	
Assessments are to be done in accordance with the Bird and Wind-Energy Best -Practice Guideline.	11	Regime 2 was needed
The study area and its characteristics which must be mapped including the extent, habitat, special features including topographical and water features, quarries, drainage lines, known breeding sites, existing uses of land, existing infrastructure such as power lines and roads, and existing operational wind energy facilities within 30km of the site;	18-29 36	Section 5.1 from a desktop perspective, Section 6.1.3 field assessment
Target avifaunal species that are likely to occur on the preferred site and for which monitoring is required	26	Section 5.2
The location of monitoring points	30	Section 6.1.1
Aspects to be monitored (for example, bird abundance and flight activity, presence of target species, proportion of flying time each target species spends at turbine rotor height, preferred flight paths, risk of identified target species to collision, areas for specific monitoring if any, etc.);	30	Section 6.1.1
Monitoring methodology for the abundance or activity monitoring and for direct observation or vantage point surveys, the latest version of the BirdLife South Africa Bird and Wind -Energy Best-Practice Guideline	13	Section 4.2
The assessment, as a minimum, must include the following aspects: • **Discussion on bird abundance and movement within the site;** • **Discussion on presence of target or threatened species and their occurrence on the site at heights which could pose risks to collision;** • **Assessment of risk of identified target species to collision including the expected fatality rates of the target species based on a suitable model commonly used for risk determination, per species and for the site;** • **Identification and mapping where relevant, of any migratory or Preferential bird routes or corridors;**	30	Section 6 and 7, this will be supplemented after summer survey.

• **Where relevant, discussion on the risk of displacement** • **Where relevant, areas identified within the site as having a very high sensitivity for bird collision or displacement and in which the development should be avoided. These areas are to be mapped;**		
A plan for post construction monitoring and reporting, which must include: • **Timeframes and intervals for monitoring;** • **Any specific area for monitoring;** • **Methodology for searcher efficiency and scavenger removal;** • **Method for monitoring, i.e. transects or radial as well as extent of monitoring area;** • **Results of monitoring compared against expected fatality rates per target species as well as general species;** • **Reporting requirements, including organisations for submission of reports;** • **Years and intervals for monitoring to occur; and** • **All methods used to estimate bird numbers and movements**	58	Monitoring requirements in section 10
Contact details of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae.	71	Section 14.3
A signed statement of independence by the specialist.	I	
A statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment.	13	Section 4.2
A description of the methodology used to undertake the site verification and impact assessment and site inspection, including equipment and modelling used, where relevant.	13	Section 4
A description of the assumptions made and any uncertainties or gaps in knowledge or data as well as a statement of the timing and intensity of site inspection observations.	13	Section 3
A location of the areas not suitable for development, which are to be avoided during construction and operation (where relevant).	-	Not applicable
Additional environmental impacts expected from the proposed development.	41	Section 8
Any direct, indirect and cumulative impacts of the proposed development.	41	Section 8
The degree to which impacts and risks can be mitigated.	41	Section 8

The degree to which the impacts and risks can be reversed.	41	Section 8
The degree to which the impacts and risks can cause loss of irreplaceable resources.	41	Section 8
Proposed impact management actions and impact management outcomes proposed by the specialist for inclusion in the Environmental Management Programme (EMPr).	56	Section 9
A substantiated statement, based on the findings of the specialist assessment, regarding the acceptability, or not, of the proposed development, if it should receive approval or not;	59	Section 12.1
Any conditions to which this statement is subjected	59	Section 12.1