



## AVIFAUNA SPECIALIST ASSESSMENTS

### Zionsheuvel Solar Photovoltaic Facility

### De Aar, Northern Cape Province

April 2023

CLIENT



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Declaration	<p>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.</p>

## Executive Summary

The Biodiversity Company was appointed to undertake an Avifauna Assessment for the proposed Zionsheuveld Solar Photovoltaic (PV) facility. The project (Zionsheuveld Solar) is part of a cluster known as the Crossroads Green Energy Cluster. The Cluster entails the development of up to Twenty-one (21) solar energy facilities in three phases. Fieldwork for the facilities was undertaken simultaneously and data collected for the whole project area is presented in order to ensure the cumulative impact can be considered and to allow for the possible movement and home ranges of the species.

Based on desktop information 234 avifauna species are expected to occur in the area, of which eleven are regarded as species of conservation concern (SCC) either regionally or/and internationally. Of the eleven SCCs expected, five species were confirmed during the two field assessments. An additional four SCC were also recorded that was not listed as expected based on SABAP 2 data. During the first field assessment 124 bird species were recorded, while during the second survey 109 species were recorded. The SCCs recorded were: Kori Bustard (*Ardeotis kori*) (NT Regional, NT International); Verreaux's Eagle (*Aquila verreauxii*) (VU, LC); Blue Crane (*Grus paradisea*) (NT, VU); Secretarybird (*Sagittarius serpentarius*) (EN, EN); Tawny Eagle (*Aquila rapax*) (EN, VU); Black Harrier (*Circus maurus*) (EN, EN), Blue Korhaan (*Eupodotis caerulescens*) (LC, NT), Karoo Korhaan (*Eupodotis vigorsii*) (NT, LC) and Lanner Falcon (*Falco biarmicus*) (VU; NT).

During the nest surveys, three active Verreaux's Eagle nests were observed as well as an additional two inactive nests. Two active Secretarybird nests were also found. As per the Species Environmental Assessment Guidelines (2020) a core area of 1 km (core buffer) surrounding the nests must be treated as a no-go area, an additional area of 5.2 km (seasonal buffer) was also placed around the nest as per the Birdlife Verreaux's Eagle and Wind Farms Guidelines (2021). This 5.2 km area is based on the average home range of the Verreaux's Eagle during the breeding season, and as such this area must be avoided during the breeding season of the species which stretches from April to July to avoid disturbing the species. As per the guidelines, buffers were also placed around the inactive nests. For the Secretarybird nests a 4 km buffer were placed around the nests, 2 km must be treated as no go (core buffer), while the other 2 km must be low impact development (low impact buffer) (pers comms Birdlife, 2022). Secretarybirds breeds year around therefore low impact development is required and a breeding season limitation will not suffice. The main impacts identified in the assessment were disruption of the nests, habitat loss, collisions and electrocutions. These impacts ratings ranged from Very-High- Medium pre mitigation and High- Low post mitigation.

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## 1 Introduction

### 1.1 Project Description

Zionsheuvel Solar Energy (Pty) Ltd (a consortium consisting of Akuo Energy Afrique, Africoast Investments and Golden Sunshine Trading) propose to develop the Zionsheuvel Solar PV Facility and its associated electrical infrastructure on the Remainder of Farm Leeuwberg 79 in the Renosterberg Local Municipality in the greater Pixley ka Seme District Municipality in the Northern Cape Province. The project site is located approximately 20km north of Philipstown and 30km west of Petrusville and within the Central Transmission Corridor. The Project (Zionsheuvel Solar PV Facility) is part of a cluster known as the Crossroads Green Energy Solar Cluster. The Cluster entails the development of up to twenty-one (21) solar energy facilities.

A technically suitable project site of ~2964ha has been identified by Akuo Energy Afrique for the establishment of the PV facility. The proposed facility will have a contracted capacity of 240MW and will include the following infrastructure:

- Solar PV array comprising PV modules and mounting structures (monofacial or bifacial and a single axis tracking system);
- Inverters and transformers;
- Cabling between the project components;
- Battery Energy Storage System (BESS);
- On-site facility substation and power lines between the solar PV facility and the Eskom substation (to be confirmed and assessed through a separate process);
- Site offices, Security office, operations and control, and maintenance and storage laydown areas; and
- Access roads, internal distribution roads.

### 1.2 Background

The Biodiversity Company was appointed to undertake an Avifauna Assessment for the proposed Zionsheuvel Solar Photovoltaic (PV) facility. The project (Zionsheuvel Solar) is part of a cluster known as the Crossroads Green Energy Cluster. The Cluster entails the development of up to Twenty-one (21) solar energy facilities in three phases (Figure 1-1).

Although the fieldwork for the facilities was undertaken simultaneously, and data collected for the whole project area is presented, this report only details the assessment of the Zionsheuvel facility. 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). The National Web based Environmental Screening Tool has characterised the terrestrial theme sensitivity of the project area as “Very High”. The animal sensitivity is rated as “Medium”.

This report, after taking into consideration the findings and recommendations provided by the specialist herein, should inform and guide the Environmental Assessment Practitioner (EAP) and regulatory authorities, enabling informed decision making, as to the ecological viability of the proposed project.

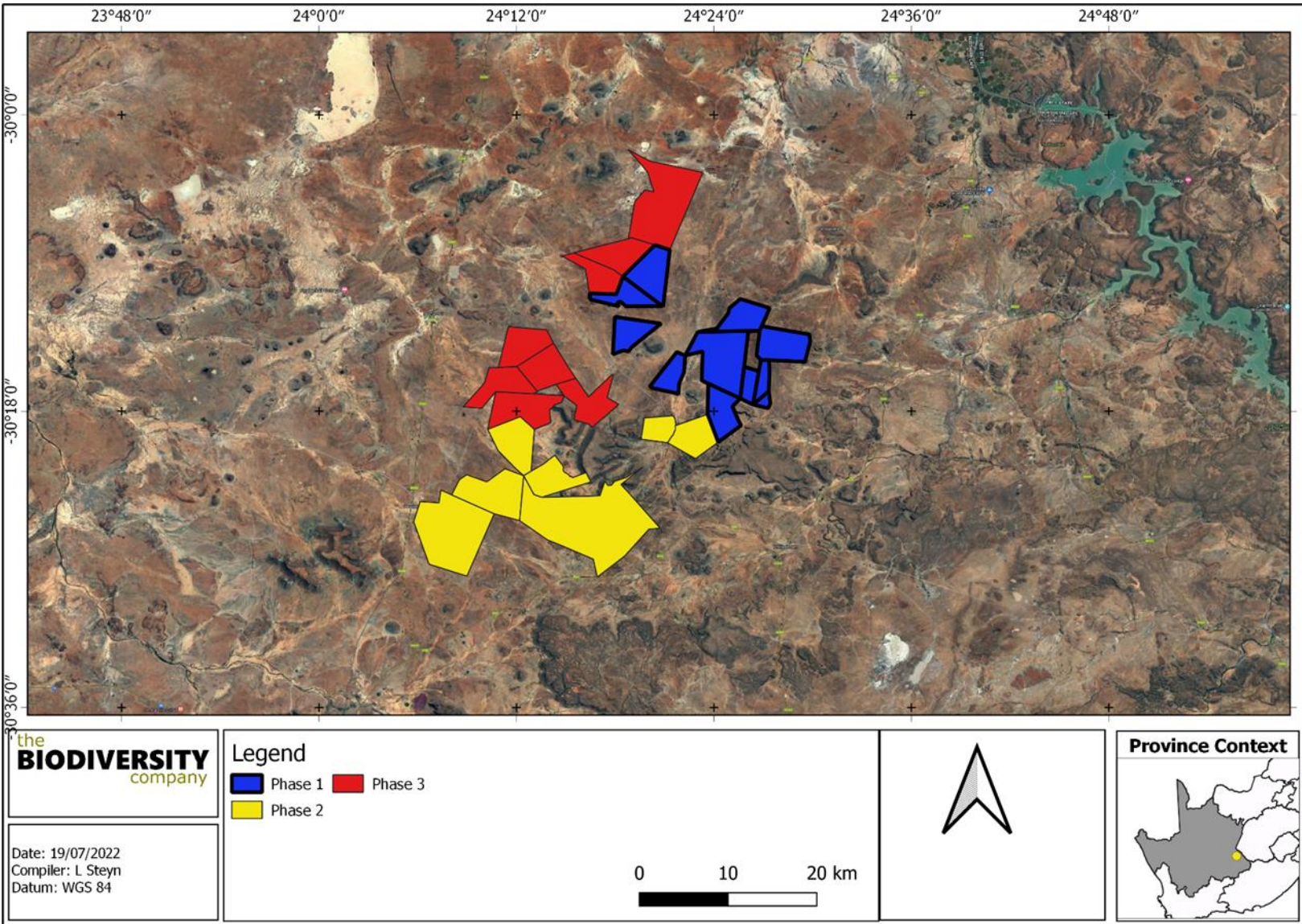
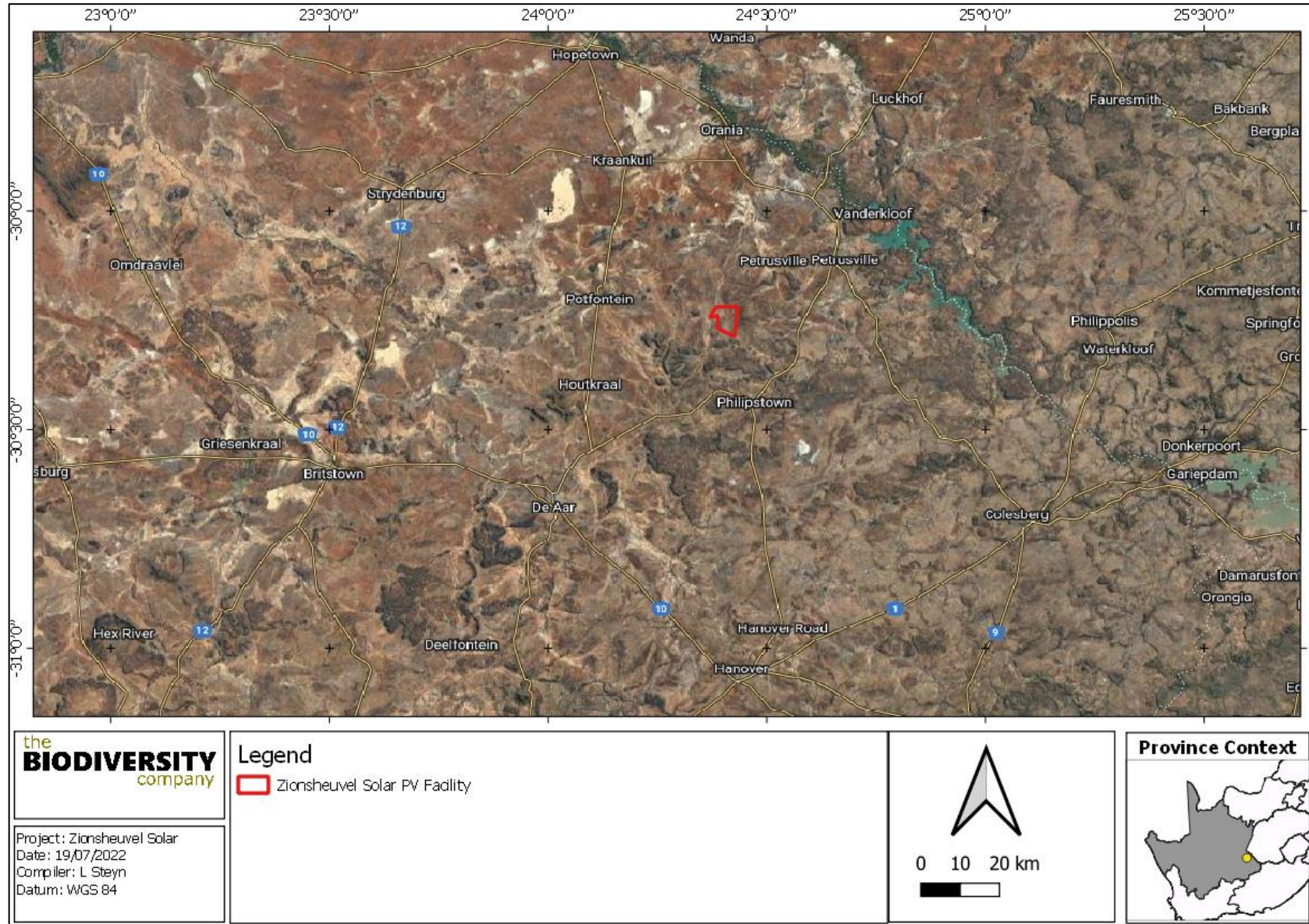


Figure 1-1 The proposed Crossroads Green Energy Solar PV Cluster projects



**Figure 1-2** Proposed location of the project area in relation to the nearby towns

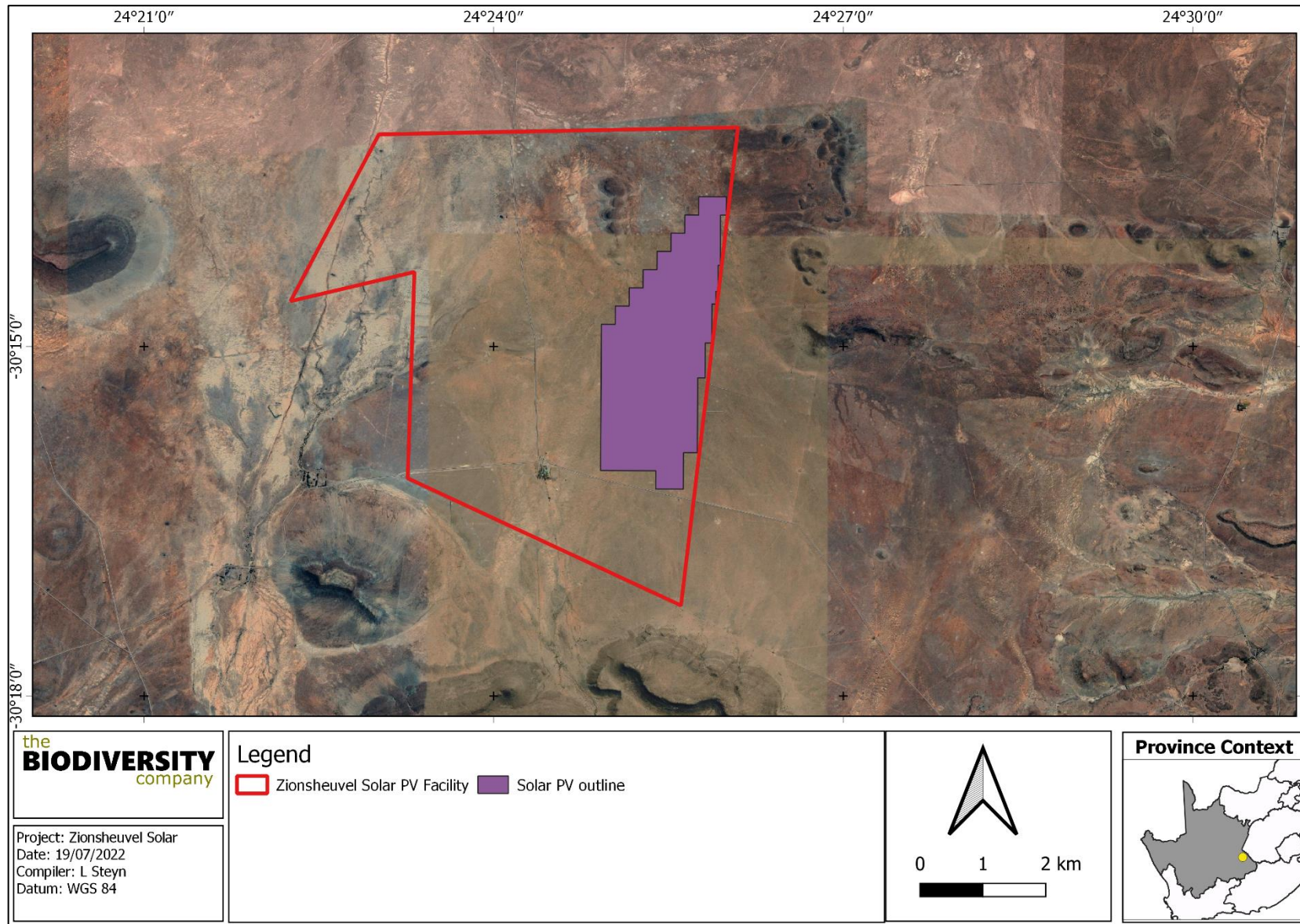


Figure 1-3 The layout of the solar plant on the property

### 1.3 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);
- Long term nest and flight monitoring was not done;
- The field work component of the project was done for the three clusters concurrently;
- Flight analyses were not performed due to time restraints; and
- Night surveys were not done due to safety risk.

## 2 Scope of Work

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

The scope of the Avifaunal Impact 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 area; and
- Impact assessment, mitigation measures to prevent or reduce the possible impacts.

## 3 Key Legislative Requirements

The legislation, policies and guidelines listed below in Table 3-1 are applicable to the current project. The list below, although extensive, may not be complete and other legislation, policies and guidelines may apply in addition to those listed below.

**Table 3-1** *A list of key legislative requirements relevant to biodiversity and conservation in the Northern Cape Provinces*

Region	Legislation / Guideline
International	Convention on Biological Diversity (CBD, 1993)
	The Convention on Wetlands (RAMSAR Convention, 1971)
	The United Nations Framework Convention on Climate Change (UNFCC, 1994)
	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)
	The National Environmental Management Act (NEMA) (Act No. 107 of 1998)
	The National Environmental Management: Protected Areas Act (Act No. 57 of 2003)
	The National Environmental Management: Biodiversity Act (Act No. 10 of 2004), Threatened or Protected Species Regulations

	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: 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 Forest Act (Act No. 84 of 1998)
	National Veld and Forest Fire Act (101 of 1998)
	National Water Act (NWA) (Act No. 36 of 1998)
	National Spatial Biodiversity Assessment (NSBA)
	World Heritage Convention Act (Act No. 49 of 1999)
	Municipal Systems Act (Act No. 32 of 2000)
	Alien and Invasive Species Regulations and, Alien and Invasive Species List 20142020, published under NEMBA
	South Africa's National Biodiversity Strategy and Action Plan (NBSAP)
	Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983) (CARA)
	Sustainable Utilisation of Agricultural Resources (Draft Legislation).
	White Paper on Biodiversity
	Northern Cape Nature Conservation act no. 9 of 2009
Provincial	Northern Cape Planning and Development Act no. 7 of 1998

## 4 Methods

### 4.1 Desktop Assessment

The desktop assessment was principally undertaken using a Geographic Information System (GIS) to access the latest available spatial datasets to develop digital cartographs and species lists. These datasets and their date of publishing are provided below.

#### 4.1.1 Ecologically Important Landscape Features

Existing ecologically relevant data layers were incorporated into a GIS to establish how the proposed project might interact with any ecologically important entities. Emphasis was placed around the following spatial datasets:

- National Biodiversity Assessment (NBA) 2018 (Skowno *et al*, 2019) - The purpose of the NBA is to assess the state of South Africa's biodiversity based on best available science, with a view to understanding trends over time and informing policy and decision-making across a range of sectors. The NBA deals with all three components of biodiversity: genes, species, and ecosystems; and assesses biodiversity and ecosystems across terrestrial, freshwater, estuarine and marine environments. The two headline indicators assessed in the NBA are:
  - *Ecosystem Threat Status* – indicator of an ecosystem's wellbeing, based on the level of change in structure, function or composition. Ecosystem types are categorised as Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT)

or Least Concern (LC), based on the proportion of the original extent of each ecosystem type that remains in good ecological condition.

- *Ecosystem Protection Level* – indicator of the extent to which ecosystems are adequately protected or under-protected. Ecosystem types are categorised as Well Protected (WP), Moderately Protected (MP), Poorly Protected (PP), or Not Protected (NP), based on the proportion of the biodiversity target for each ecosystem type that is included within one or more protected areas. NP, PP or MP ecosystem types are collectively referred to as under-protected ecosystems.
- Protected areas - South Africa Protected Areas Database (SAPAD) (DFFE, 2021) – The SAPAD Database contains spatial data pertinent to the conservation of South African biodiversity. It includes spatial and attribute information for both formally protected areas and areas that have less formal protection. SAPAD is updated on a continuous basis and forms the basis for the Register of Protected Areas, which is a legislative requirement under the National Environmental Management: Protected Areas Act, Act 57 of 2003.
- National Protected Areas Expansion Strategy (NPAES) (SANBI, 2016) – The NPAES provides spatial information on areas that are suitable for terrestrial ecosystem protection. These focus areas are large, intact and unfragmented and therefore, of high importance for biodiversity, climate resilience and freshwater protection.
- Conservation/Biodiversity Sector Plan:

The Northern Cape Department of Environment and Nature Conservation 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.
- Important Bird and Biodiversity Areas (IBAs) (BirdLife South Africa, 2015) – IBAs constitute a global network of over 13 500 sites, of which 112 sites are found in South Africa. IBAs are sites of global significance for bird conservation, identified through multi-stakeholder processes using globally standardised, quantitative and scientifically agreed criteria; and
- South African Inventory of Inland Aquatic Ecosystems (SAIIAE) (Van Deventer *et al.*, 2018) – A SAIIAE was established during the NBA of 2018. It is a collection of data layers that represent the extent of river and inland wetland ecosystem types and pressures on these systems.



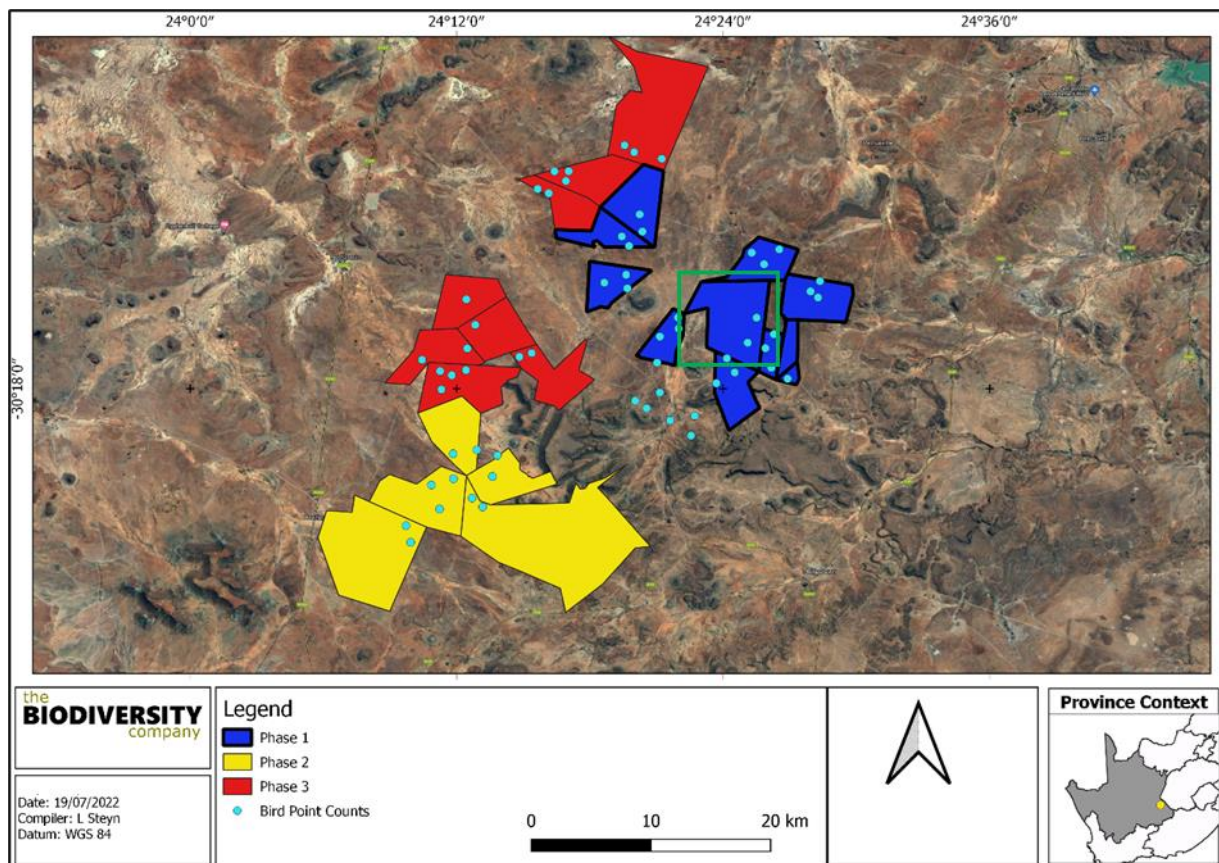
#### 4.1.2 Desktop Avifaunal Assessment

The avifaunal desktop assessment comprised of the following, compiling an expected:

- Avifauna list, generated from the SABAP2 dataset by looking at pentads 2945\_2420; 2945\_2425; 2950\_2420; 2955\_2440; 3000\_2450; 3010\_2410; 3010\_2415; 3010\_2420; 3005\_2420. The area overlapping with project area itself has not been sampled well, thus areas adjacent to the project area were included to get a representative list of expected species.

#### 4.2 Field Assessment

The first field survey was undertaken during 25 April- 6 May 2022, while the second survey was conducted from 1-10 July 2022. All properties affected by the Crossroads Green Energy Cluster were surveyed during these field surveys. Effort was made to cover all the different habitat types within the limits of time and access. Areas surrounding the project area were also surveyed, this included areas at the nearby dams and some of the nearby ridges due to the mobility of avifauna species and home range sizes of larger species (Figure 4-1). The focus of the point counts were more on the areas of development rather than the whole properties.



**Figure 4-1** Map illustrating the field survey area. The green square indicates the Zionsheuel Project 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 10 min period. The horizontal detection limit was set at 500 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 and one nocturnal search 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. In order to ascertain the differences in the structure of the species assemblage between habitats, a Bray-Curtis dissimilarity matrix was used. 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 of species abundance 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 using the Shannon Diversity Index ( $H'$ ). 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 strata matrix within which they most frequently forage (ground, water, foliage, air) and lastly by their diel activity period (nocturnal or diurnal).

#### 4.3 Site Ecological Importance (SEI)

The different habitat types within the project area were delineated and identified based on observations during the field assessment, and available satellite imagery. These habitat types will be assigned Ecological Importance (EI) categories based on their ecological integrity, conservation value, the presence of species of conservation concern and their ecosystem processes.

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) as follows.

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 Critically Endangered (CR), Endangered (EN), Vulnerable (VU) or Extremely Rare or CR species that have a global extent of occurrence (EOO) of < 10 km <sup>2</sup> . 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 <sup>2</sup> . 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 Near Threatened (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
<b>Very High</b>	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.
<b>High</b>	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.
<b>Medium</b>	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.
<b>Low</b>	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.
<b>Very Low</b>	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 Receptor Resilience (RR) criteria**

Resilience	Fulfilling Criteria
<b>Very High</b>	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: (i) remaining at a site even when a disturbance or impact is occurring, or (ii) returning to a site once the disturbance or impact has been removed.
<b>High</b>	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: (i) remaining at a site even when a disturbance or impact is occurring, or (ii) returning to a site once the disturbance or impact has been removed.
<b>Medium</b>	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: (i) remaining at a site even when a disturbance or impact is occurring, or (ii) returning to a site once the disturbance or impact has been removed.
<b>Low</b>	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: (i) remaining at a site even when a disturbance or impact is occurring, or (ii) returning to a site once the disturbance or impact has been removed.

<b>Very Low</b>	Habitat that is unable to recover from major impacts, or species that are unlikely to: (i) remain at a site even when a disturbance or impact is occurring, or (ii) return to a site once the disturbance or impact has been removed.
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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 project is provided in Table 4-6.

**Table 4-6 Guidelines for interpreting Site Ecological Importance in the context of the proposed development activities**

Site Ecological Importance	Interpretation in relation to proposed development activities
<b>Very High</b>	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.
<b>High</b>	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.
<b>Medium</b>	Minimisation and restoration mitigation – development activities of medium impact acceptable followed by appropriate restoration activities.
<b>Low</b>	Minimisation and restoration mitigation – development activities of medium to high impact acceptable followed by appropriate restoration activities.
<b>Very Low</b>	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 Results & Discussion

### 5.1 Desktop Assessment

#### 5.1.1 Ecologically Important Landscape Features

The GIS analysis pertaining to the relevance of the proposed project to ecologically important landscape features is summarised in Table 5-1.

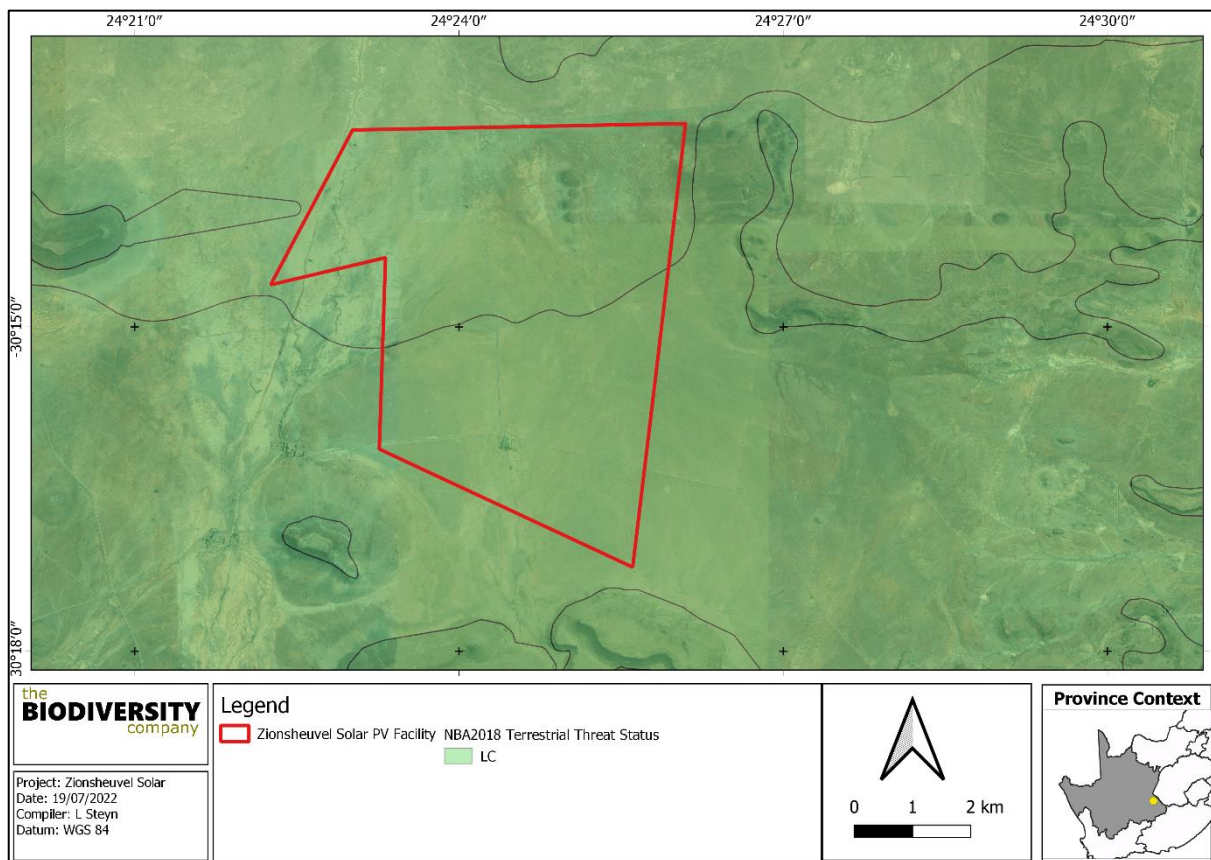
**Table 5-1 Summary of relevance of the proposed project to ecologically important landscape features**

Desktop Information Considered	Relevant/Irrelevant	Section
Ecosystem Threat Status	Irrelevant – Overlaps with a Least Concern ecosystem	5.1.1.1
Ecosystem Protection Level	Relevant – Overlaps with a Not Protected and Poorly Protected Ecosystem	5.1.1.2

Renewable Energy Development Zones	Irrelevant - The project area is ~129 km for the closest REDZ	-
Powerline Corridor	Relevant- The project area falls within the Central Corridor	5.1.1.7
Critical Biodiversity Area	Relevant – The project area overlaps with ESA classified area	5.1.1.3
Important Bird and Biodiversity Areas	Relevant – The project area is within the Platberg-Karoo Conservancy IBA	5.1.1.4
South African Inventory of Inland Aquatic Ecosystems	Relevant - The project area overlaps with an unclassified wetland and an EN river	5.1.1.5
National Freshwater Priority Area	Relevant– the project area overlaps with unclassified wetlands and an unclassified river	5.1.1.6
Coordinated Waterbird Count	Relevant – Three CWAC sites is in the surrounding area; Bosduiwekop, De Aar sewage works and Nooitgedaght	5.1.1.9
Coordinated Avifaunal Road Count	Relevant – The project area is close to two CAR routes.	5.1.1.8

**5.1.1.1 Ecosystem Threat Status**

The Ecosystem Threat Status is an indicator of an ecosystem’s wellbeing, based on the level of change in structure, function or composition. Ecosystem types are categorised as Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT) or Least Concern (LC), based on the proportion of the original extent of each ecosystem type that remains in good ecological condition. According to the spatial dataset the proposed project overlaps with a LC ecosystem (Figure 5-1).

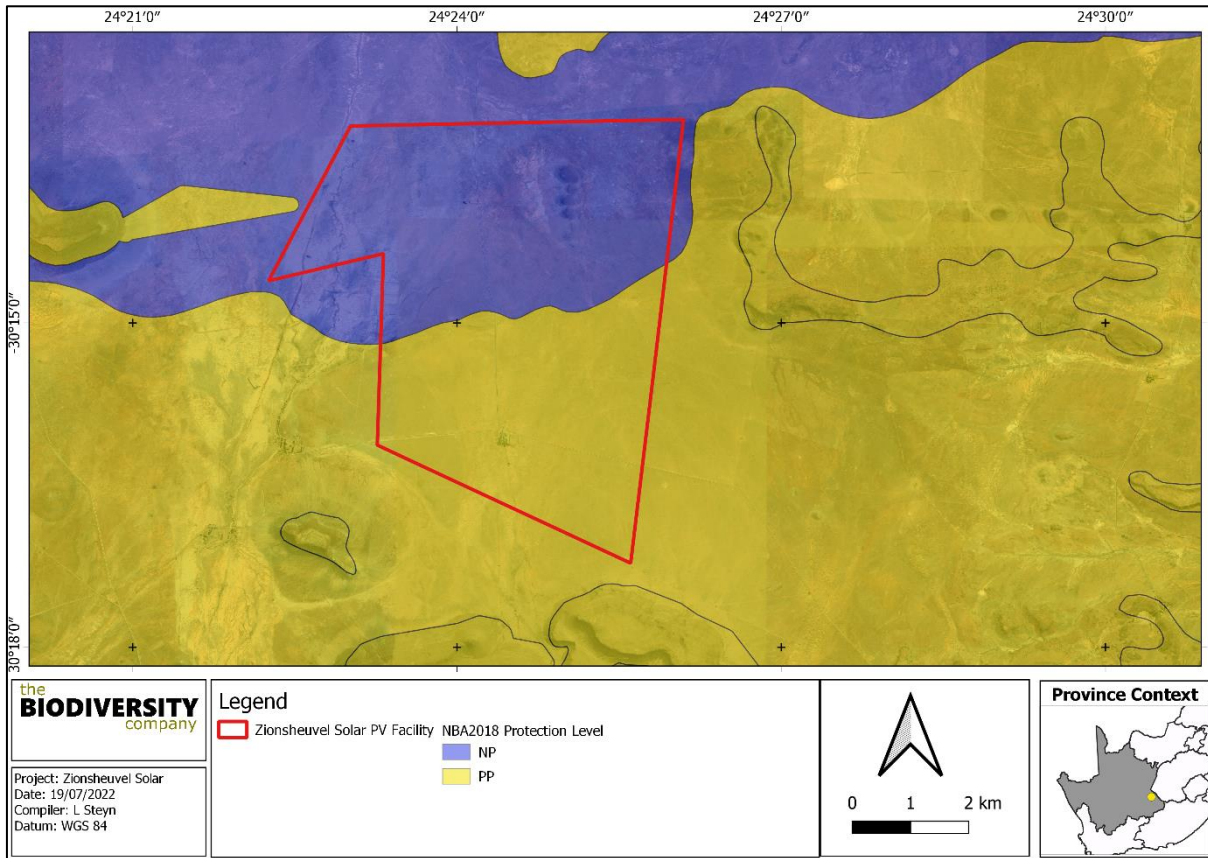


**Figure 5-1** Map illustrating the ecosystem threat status associated with the project area.

**5.1.1.2 Ecosystem Protection Level**

This is an indicator of the extent to which ecosystems are adequately protected or under-protected. Ecosystem types are categorised as Well Protected (WP), Moderately Protected (MP), Poorly Protected (PP), or Not Protected (NP), based on the proportion of the biodiversity target for each ecosystem type that is included within one or more protected areas. NP, PP or MP ecosystem types are collectively

referred to as under-protected ecosystems. The proposed project overlaps with a NP and PP ecosystem (Figure 5-2).

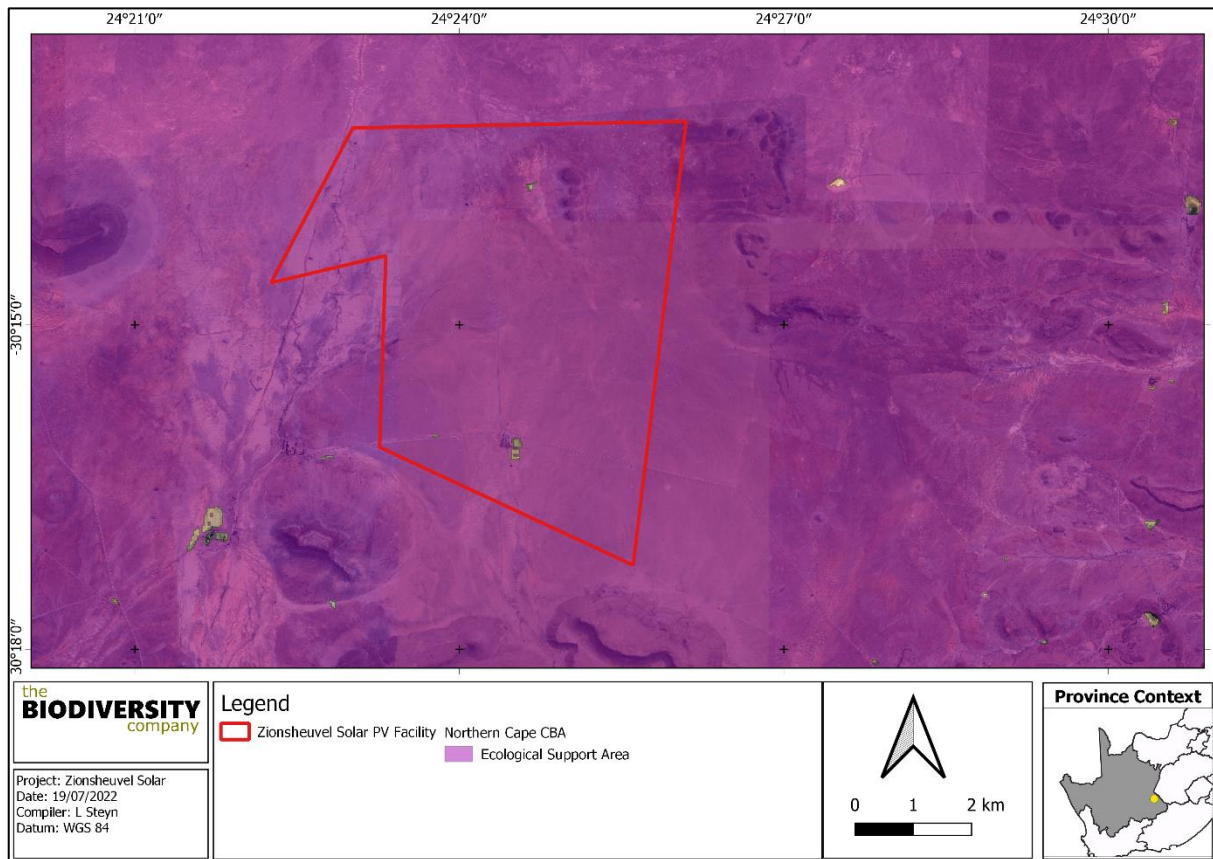


**Figure 5-2** Map illustrating the ecosystem protection level associated with the project area

**5.1.1.3 Critical Biodiversity Areas and Ecological Support Areas**

The Northern Cape Department of Environment and Nature Conservation 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.

Figure 5-3 shows the project area superimposed on the Terrestrial CBA maps. The project area overlaps with ESA classified area. Development of this nature (ie: Solar PV facilities and associated infrastructure) may occur in an ESA area provided all mitigation measures are adhered to. It must be noted, however, when taken into consideration in conjunction with the other Solar PV facilities planned for all three phases of the overall proposed development, that the cumulative fragmentation of the ESA is very high. The associated cumulative fragmentation impacts are expected to be high for the overall development. This project should ideally not be considered in isolation but rather as a part of the full proposed development when considering impacts.



**Figure 5-3** Map illustrating the locations of CBAs in the project area

### 5.1.1.4 Important Bird and Biodiversity Areas

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).

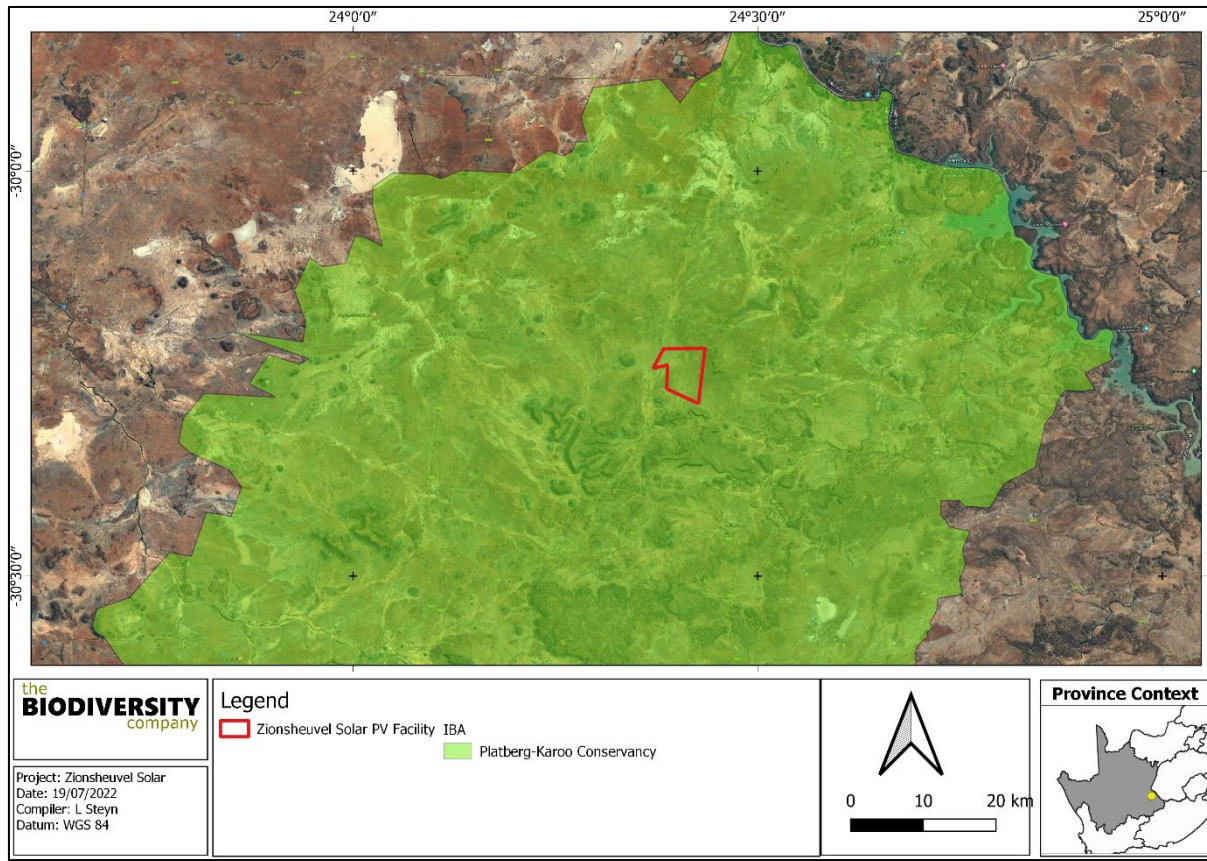
According to Birdlife International (2017), the selection of IBAs is achieved through the application of quantitative ornithological criteria, grounded in up-to-date knowledge of the sizes and trends of bird populations. The criteria ensure that the sites selected as IBAs have true significance for the 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 5-4 shows the project area is within the Platberg-Karoo Conservancy IBA.

Platberg–Karoo Conservancy IBA can be found in the districts of De Aar, Philipstown and Hanover. This IBA falls across two biomes, the Nama Karroo and the Grassland Biome, which contributes to its diversity of species. In total 289 bird species have been recorded here. Threats in this IBA include overgrazing, erosion and encroachment by Karroo shrubs, all of which result in the loss of habitat and a decrease in available food for large terrestrial birds.

Large terrestrial birds and raptors found here include: Blue Crane *Anthropoides paradiseus*, Ludwig's Bustard *Neotis ludwigii*, Kori Bustard *Ardeotis kori*, Blue Korhaan *Eupodotis caerulescens*, Black Stork *Ciconia nigra*, Secretarybird *Sagittarius serpentarius*, Martial Eagle *Polemaetus bellicosus*, Verreaux's Eagle *Aquila verreauxii* and Tawny Eagle *A. rapax*.

Biome-restricted species found here include Karoo Lark *Calendulauda albescens*, Karoo Long-billed Lark *Certhilauda subcoronata*, Karoo Chat *Cercomela schlegelii*, Tractrac Chat *C. tractrac*, Sickle-winged Chat *C. sinuata*, Namaqua Warbler *Phragmacia substriata*, Layard's Tit-Babbler *Sylvia layardi*, Pale-

winged Starling *Onychognathus nabouroup* and Black-headed Canary *Serinus alario*. Two congregatory species found here are the Lesser Kestrel and the Amur Falcon (Birdlife, 2015).

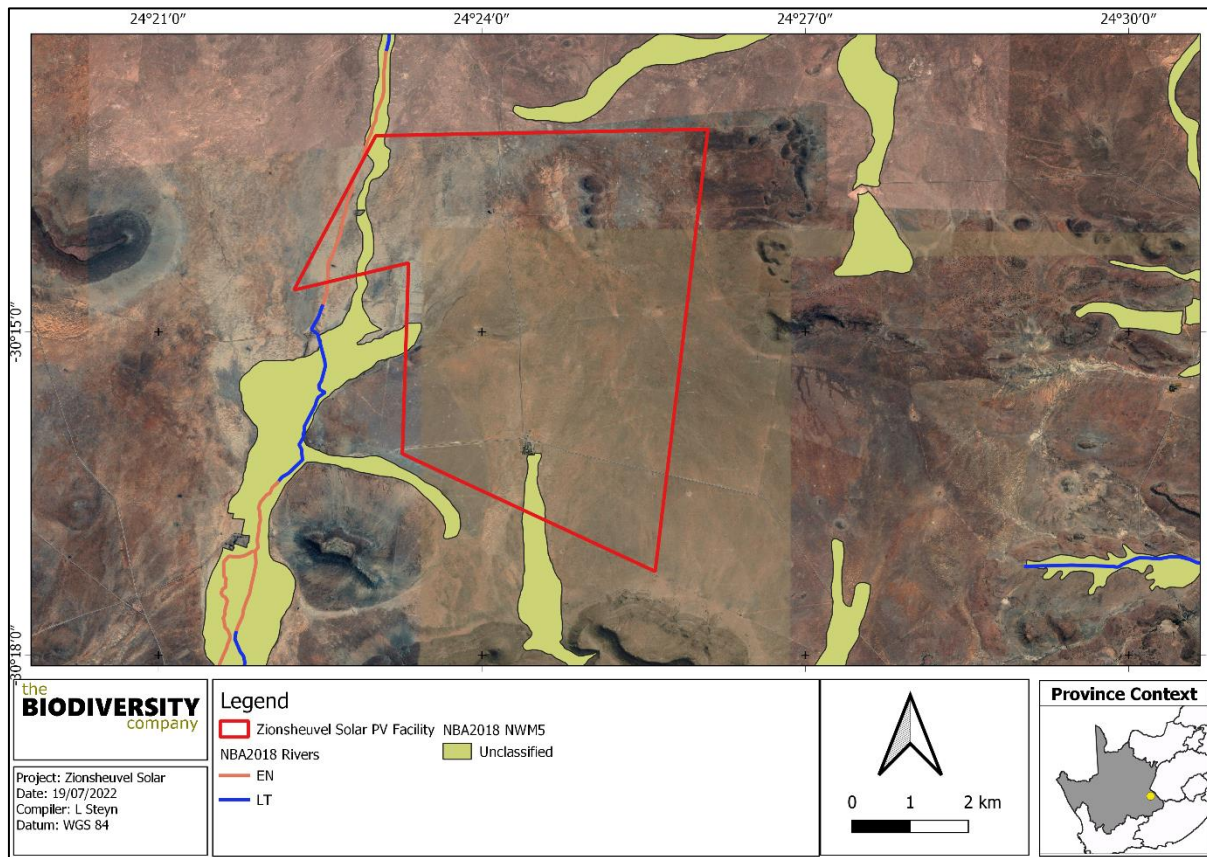


**Figure 5-4** The project area in relation to the Platberg Karoo Conservancy IBA

### 5.1.1.5 Hydrological Setting

The South African Inventory of Inland Aquatic Ecosystems (SAIIAE) was released with the NBA 2018. Ecosystem threat status (ETS) of river and wetland ecosystem types are based on the extent to which each river ecosystem type had been altered from its natural condition. Ecosystem types are categorised as CR, EN, VU or LT, with CR, EN and VU ecosystem types collectively referred to as ‘threatened’ (Van Deventer *et al.*, 2019; Skowno *et al.*, 2019). The project area overlaps with an unclassified wetland and an EN river (Figure 5-5).



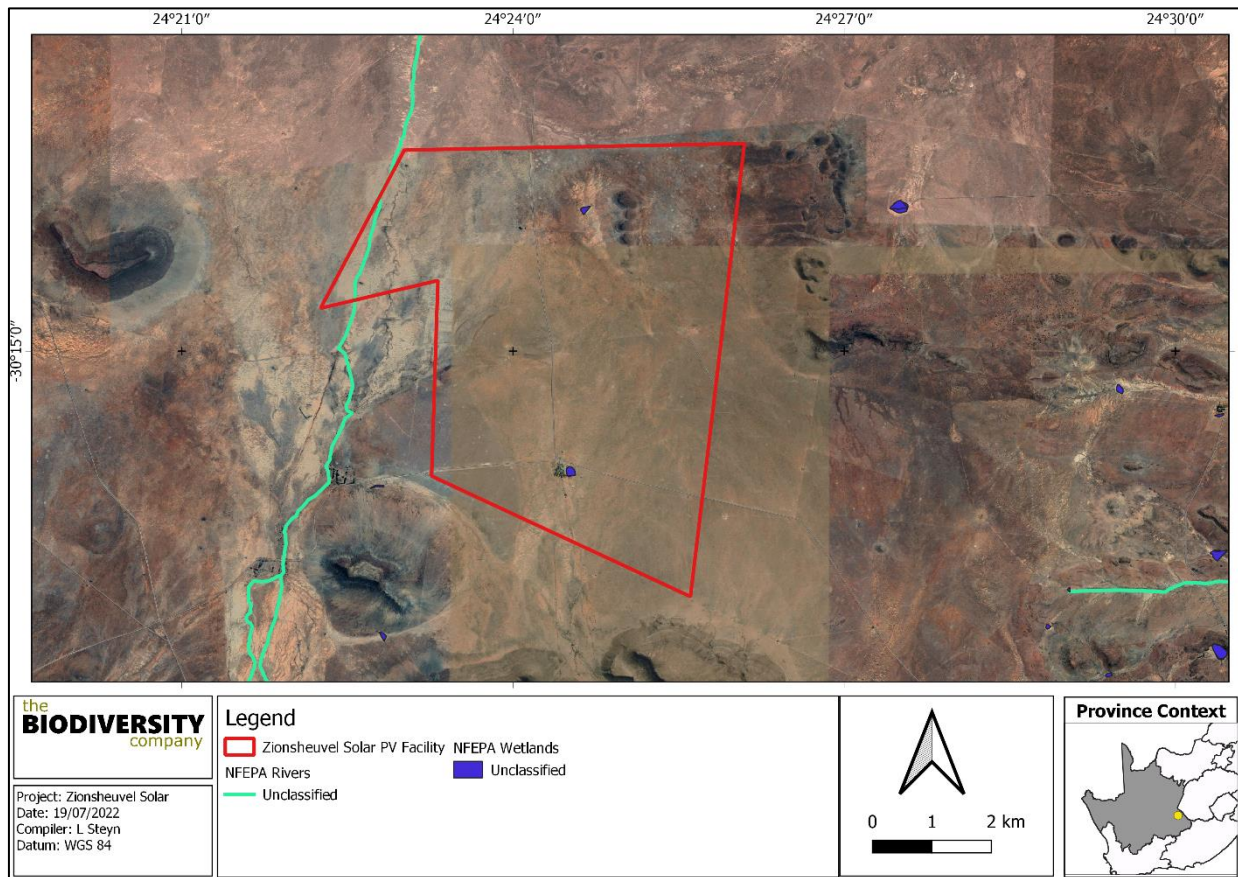


**Figure 5-5** Map illustrating ecosystem threat status of rivers and wetland ecosystems in the project area

### 5.1.1.6 National Freshwater Ecosystem Priority Area Status

In an attempt to better conserve aquatic ecosystems, South Africa has categorised its river systems according to set ecological criteria (i.e., ecosystem representation, water yield, connectivity, unique features, and threatened taxa) to identify Freshwater Ecosystem Priority Areas (FEPAs) (Driver *et al.*, 2011). The FEPAs are intended to be conservation support tools and envisioned to guide the effective implementation of measures to achieve the National Environment Management Biodiversity Act's (NEM:BA) biodiversity goals (Nel *et al.*, 2011).

Figure 5-6 shows the project area overlaps with unclassified wetlands and an unclassified river.



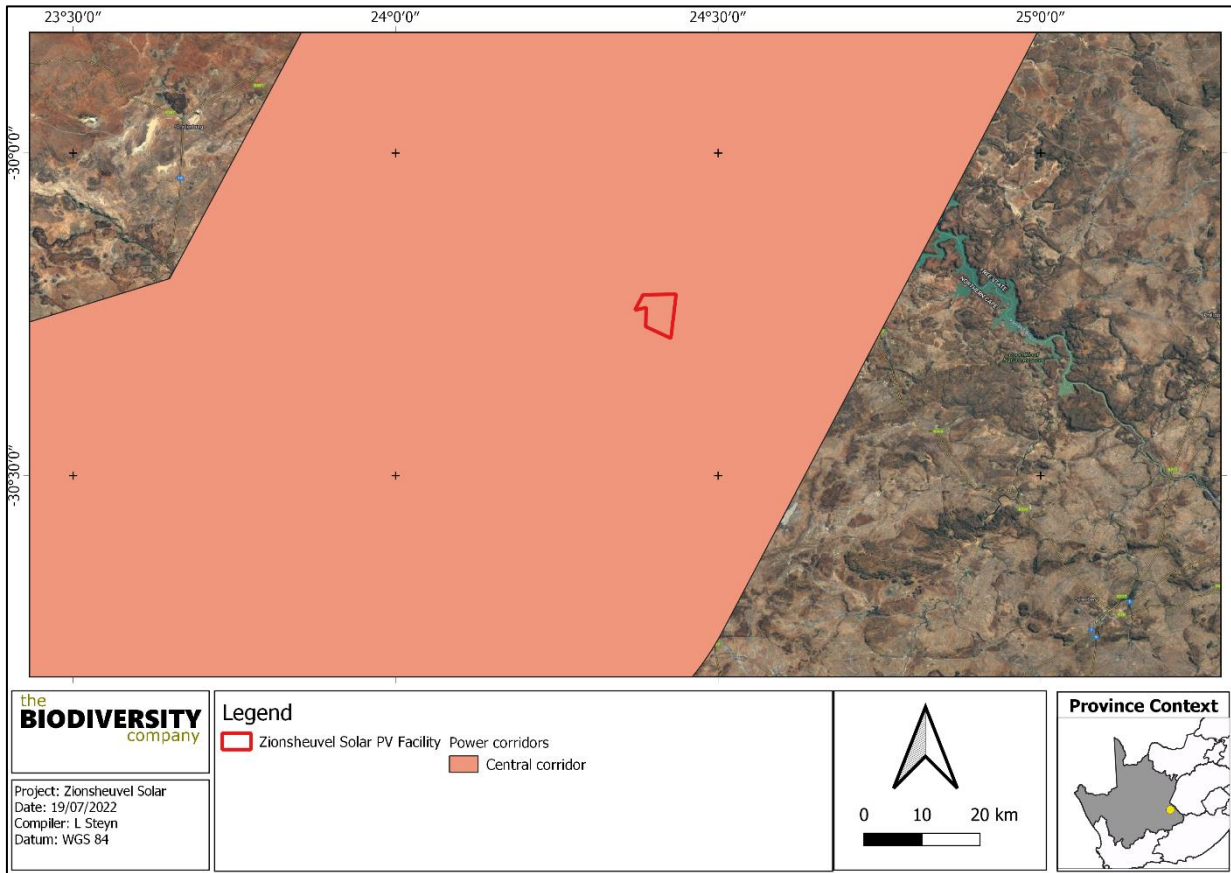
**Figure 5-6** The project area in relation to the National Freshwater Ecosystem Priority Areas.

**5.1.1.7 Strategic Transmission Corridors (EGI)**

On the 16 February 2018 Minister Edna Molewa published Government Notice No. 113 in Government Gazette No. 41445 which identified 5 strategic transmission corridors important for the planning of electricity transmission and distribution infrastructure as well as procedure to be followed when applying for environmental authorisation for electricity transmission and distribution expansion when occurring in these corridors.

On 29 April 2021, Minister Barbara Dallas Creecy published Government Notice No. 383 in Government Gazette No. 44504, which expanded the eastern and western transmission corridors and gave notice of the applicability of the application procedures identified in Government Notice No. 113, to these expanded corridors. More information on this can be obtained from <https://egis.environment.gov.za/egi>.

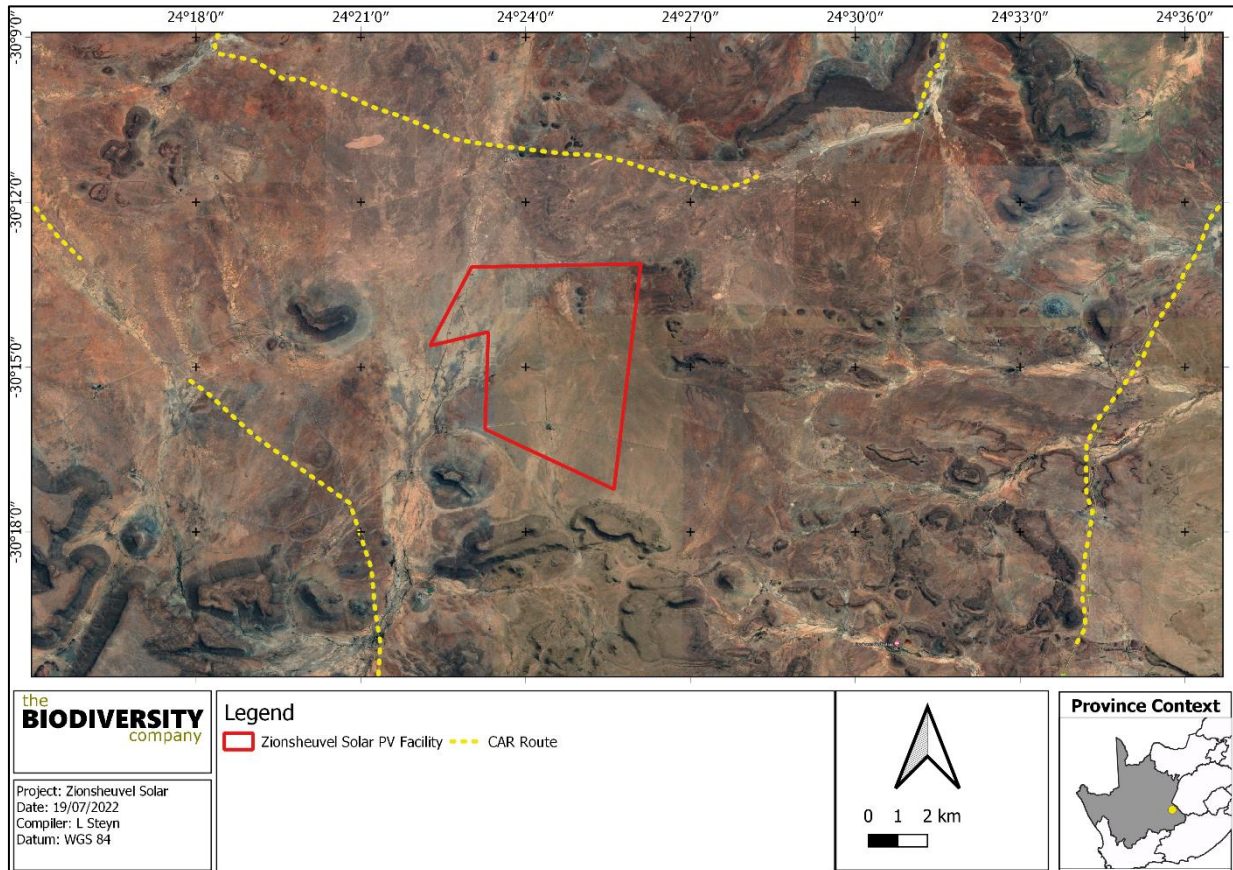
Figure 5-7 shows the project area falls within the central corridor.



**Figure 5-7 The project area in relation to the closest EGI corridor**

**5.1.1.8 Coordinated Avifaunal Roadcount (CAR)**

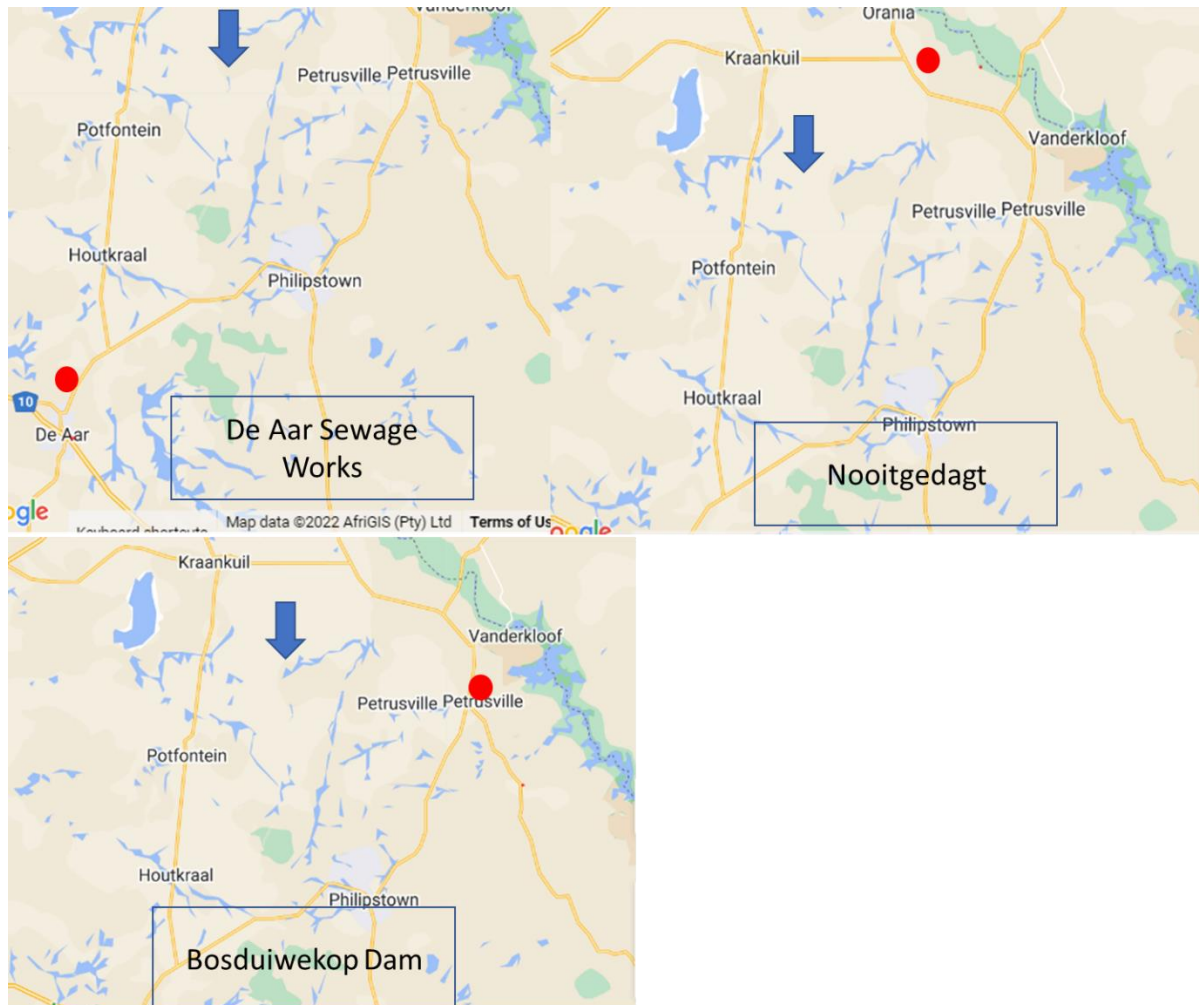
The ADU/Cape bird club pioneered avifaunal roadcount of larger birds in 1993 in South Africa. Originally it was started to monitor the Blue Crane *Anthropoides paradiseus* and Denham's/Stanley's Bustard *Neotis denhami*. Today it has been expanded to the monitoring of 36 species of large terrestrial 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 5-8 shows that the project area is close to two CAR routes.



**Figure 5-8**    *The project area in relation to the CAR routes*

**5.1.1.9 Coordinated Waterbird Counts (CWAC)**

The Animal demographic unit launched the Coordinated Waterbird Counts (CWAC) project in 1992 as part South Africa’s commitment to International waterbird conservation. Regular mid-summer and mid-winter censuses are done to determine the various features of water birds including population size, how waterbirds utilise water sources and determining the health of wetlands. For a full description of CWAC please refer to <http://cwac.birdmap.africa/about.php>. Three CWAC sites are in the surrounding area; Bosduiwepok, De Aar sewage works and Nooitgedacht (Figure 5-9 and Table 5-2).



**Figure 5-9** The project area in relation to the closest CWAC site, red dot the CWAC site, blue arrow estimate location of the project area

**Table 5-2** Observed species in the CWAC sites and their average reporting rate

Common name	Taxonomic name	De Aar Sewage	Nooitgedagt	Bosduiwekop
Sandpiper, Common	<i>Actitis hypoleucos</i>	1.00	2.00	5.00
Goose, Egyptian	<i>Alopochen aegyptiaca</i>	2.00	333.73	63.35
Teal, Cape	<i>Anas capensis</i>	15.33	6.00	8.00
Teal, Red-billed	<i>Anas erythrorhyncha</i>		14.54	6.11
Duck, African Black	<i>Anas sparsa</i>			2.50
Duck, Yellow-billed	<i>Anas undulata</i>	7.67	27.50	104.53
Darter, African	<i>Anhinga rufa</i>		3.00	
Heron, Grey	<i>Ardea cinerea</i>	1.71	2.00	1.86
Heron, Goliath	<i>Ardea goliath</i>		1.00	
Heron, Black-headed	<i>Ardea melanocephala</i>	1.50		1.00
Ibis, Hadada	<i>Bostrychia hagedash</i>	11.00	6.75	2.00
Egret, Western Cattle	<i>Bubulcus ibis</i>		6.00	
Thick-knee, Water	<i>Burhinus vermiculatus</i>			2.00

Common name	Taxonomic name	De Aar Sewage	Nooitgedaght	Bosduiwepkop
Sandpiper, Curlew	<i>Calidris ferruginea</i>		123.33	4.50
Stint, Little	<i>Calidris minuta</i>	8.50	78.20	164.86
Ruff	<i>Calidris pugnax</i>	10.00	78.43	40.20
Plover, Common Ringed	<i>Charadrius hiaticula</i>		3.00	3.00
Plover, Chestnut-banded	<i>Charadrius pallidus</i>			14.00
Plover, Kittlitz's	<i>Charadrius pecuarius</i>		30.38	15.67
Plover, Three-banded	<i>Charadrius tricollaris</i>	3.17	7.75	6.17
Tern, Whiskered	<i>Chlidonias hybrida</i>			8.00
Tern, White-winged	<i>Chlidonias leucopterus</i>			9.50
Duck, White-faced Whistling	<i>Dendrocygna viduata</i>		7.63	
Egret, Little	<i>Egretta garzetta</i>		1.00	
Coot, Red-knobbed	<i>Fulica cristata</i>	4.67	127.38	388.89
Snipe, African	<i>Gallinago nigripennis</i>		1.00	3.00
Moorhen, Common	<i>Gallinula chloropus</i>		3.09	
Eagle, African Fish	<i>Haliaeetus vocifer</i>		1.00	1.20
Stilt, Black-winged	<i>Himantopus himantopus</i>	9.60	17.14	10.40
Tern, Caspian	<i>Hydroprogne caspia</i>			1.00
Cormorant, Reed	<i>Microcarbo africanus</i>	3.00	9.64	3.75
Wagtail, African Pied	<i>Motacilla aguimp</i>			1.00
Wagtail, Cape	<i>Motacilla capensis</i>	4.00	5.11	19.08
Stork, Yellow-billed	<i>Mycteria ibis</i>		3.00	1.00
Pochard, Southern	<i>Netta erythrophthalma</i>		3.50	8.00
Duck, Maccoa	<i>Oxyura maccoa</i>			1.00
Cormorant, White-breasted	<i>Phalacrocorax lucidus</i>		1.00	3.75
Flamingo, Greater	<i>Phoenicopterus roseus</i>	4.00	17.60	24.00
Spoonbill, African	<i>Platalea alba</i>		3.25	2.75
Goose, Spur-winged	<i>Plectropterus gambensis</i>	4.75	42.33	88.00
Ibis, Glossy	<i>Plegadis falcinellus</i>		15.00	3.00
Grebe, Great Crested	<i>Podiceps cristatus</i>			10.00
Swamphen, African	<i>Porphyrio madagascariensis</i>		1.00	
Avocet, Pied	<i>Recurvirostra avosetta</i>		20.20	7.67
Martin, Brown-throated	<i>Riparia paludicola</i>	1.00	1.00	1.00
Duck, Knob-billed	<i>Sarkidiornis melanotos</i>		1.50	
Hamerkop	<i>Scopus umbretta</i>			1.20
Teal, Blue-billed	<i>Spatula hottentota</i>		1.50	
Shoveler, Cape	<i>Spatula smithii</i>		15.85	14.50
Grebe, Little	<i>Tachybaptus ruficollis</i>	9.00	38.00	68.63
Shelduck, South African	<i>Tadorna cana</i>	2.25	71.00	28.11

Common name	Taxonomic name	De Aar Sewage	Nooitgedaght	Bosduiwepok
Duck, White-backed	<i>Thalassornis leuconotus</i>		1.33	28.00
Ibis, African Sacred	<i>Threskiornis aethiopicus</i>	6.00	1.00	2.13
Sandpiper, Wood	<i>Tringa glareola</i>	4.00	7.00	
Greenshank, Common	<i>Tringa nebularia</i>	1.00	3.83	32.00
Sandpiper, Marsh	<i>Tringa stagnatilis</i>	3.00	9.00	3.00
Lapwing, Blacksmith	<i>Vanellus armatus</i>	11.36	10.80	12.41

### 5.1.2 Expected Avifauna

The SABAP2 Data lists 234 avifauna species that could be expected to occur within the area (Appendix B). Eleven (11) of these expected species are regarded as SCC (Table 5-3).

**Table 5-3** *Threatened avifauna species that are expected to occur within the project area. CR = Critically Endangered, EN = Endangered, LC = Least Concern, NT = Near Threatened and VU = Vulnerable*

Species	Common Name	Conservation Status		Likelihood of occurrence
		Regional (SANBI, 2016)	IUCN (2021)	
<i>Anthus crenatus</i>	Pipit, African Rock	NT	NT	High
<i>Aquila verreauxii</i>	Eagle, Verreaux's	VU	LC	Confirmed
<i>Ciconia abdimii</i>	Stork, Abdim's	NT	LC	High
<i>Cursorius rufus</i>	Cursorer, Burchell's	VU	LC	Moderate
<i>Eupodotis vigorsii</i>	Korhaan, Karoo	NT	LC	Confirmed
<i>Falco biarmicus</i>	Falcon, Lanner	VU	LC	Confirmed
<i>Anthropoides paradisea</i>	Crane, Blue	NT	VU	Confirmed
<i>Neotis ludwigii</i>	Bustard, Ludwig's	EN	EN	High
<i>Phoeniconaias minor</i>	Flamingo, Lesser	NT	NT	High
<i>Phoenicopterus roseus</i>	Flamingo, Greater	NT	LC	High
<i>Sagittarius serpentarius</i>	Secretarybird	VU	EN	Confirmed

*Anthus crenatus* (African Rock Pipit) is endemic to South Africa and Lesotho (IUCN, 2017). They are classed as NT 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. Suitable habitat can be found in the project areas, therefore the species has a high likelihood of occurring.

*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). Numerous breeding pairs were observed throughout the project area.

*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 existence of wet areas creates the potential for this species to occur in the area therefore likelihood of occurrence was rated as high.

*Cursorius rufus* (Burchell's Courser) is categorised as VU on a regional scale. It inhabits open short-sward grasslands, dry savannas, fallow fields, overgrazed or burnt grasslands and pastures, bare or sparsely

vegetated sandy or gravelly deserts, stony areas dotted with small shrubs and salt pans (IUCN, 2017). The species is threatened in the south of its range by habitat degradation as a result of poor grazing practices and agricultural intensification. The likelihood of occurrence in the project area is rated as moderate.

*Eupodotis vigorsii* (Karoo Korhaan) is listed as NT on a regional scale and as LC on a global scale. This korhaan lives in a range of arid habitats associated with the karoo and other arid scrubland habitats found in eastern South Africa and Namibia. It is also found in slightly denser scrubland, preferring habitat with cover ranging from 10 to 50 cm off the ground. This species was confirmed in the project area.

*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. This species was confirmed in the project area.

*Anthropoides paradiseus* (Blue Crane) is listed as NT on a regional scale and as VU on a global scale. This species has declined, largely owing to direct poisoning, power-line collisions and loss of its grassland breeding habitat owing to afforestation, mining, agriculture and development (IUCN, 2017). This species breeds in natural grass- and sedge-dominated habitats, preferring secluded grasslands at high elevations where the vegetation is thick and short. Numerous birds were observed throughout the project area, a farmer also indicated the birds breed near one on the dams (see section 6.1).

*Neotis ludwigii* (Ludwig's Bustard) is listed as EN both locally and internationally. This species is found in the desert, grassland and shrubland specifically in rocky areas such as mountains and cliffs. The main reason for the decline in the numbers are ascribed to the collisions with power lines. Based on the highly suitable habitat, this species were given a high likelihood of occurring.

*Phoeniconaias minor* (Lesser Flamingo) is listed as NT on a global and regional scale whereas *Phoenicopterus roseus* (Greater Flamingo) is listed as NT on a regional scale only. Both species have similar habitat requirements and the species breed on large undisturbed alkaline and saline lakes, salt pans or coastal lagoons, usually far out from the shore after seasonal rains have provided the flooding necessary to isolate remote breeding sites from terrestrial predators and the soft muddy material for nest building (IUCN, 2017). Some suitable water sources can be found in the project area where both species might occur, and these species have a high likelihood of occurrence.

*Sagittarius serpentarius* (Secretarybird) occurs in sub-Saharan Africa and inhabits grasslands, open plains, and lightly wooded savanna. It is also found in agricultural areas and sub-desert (IUCN, 2017). Two breeding pairs were observed in the project area.

## 6 Field Assessment

### 6.1 First Assessment

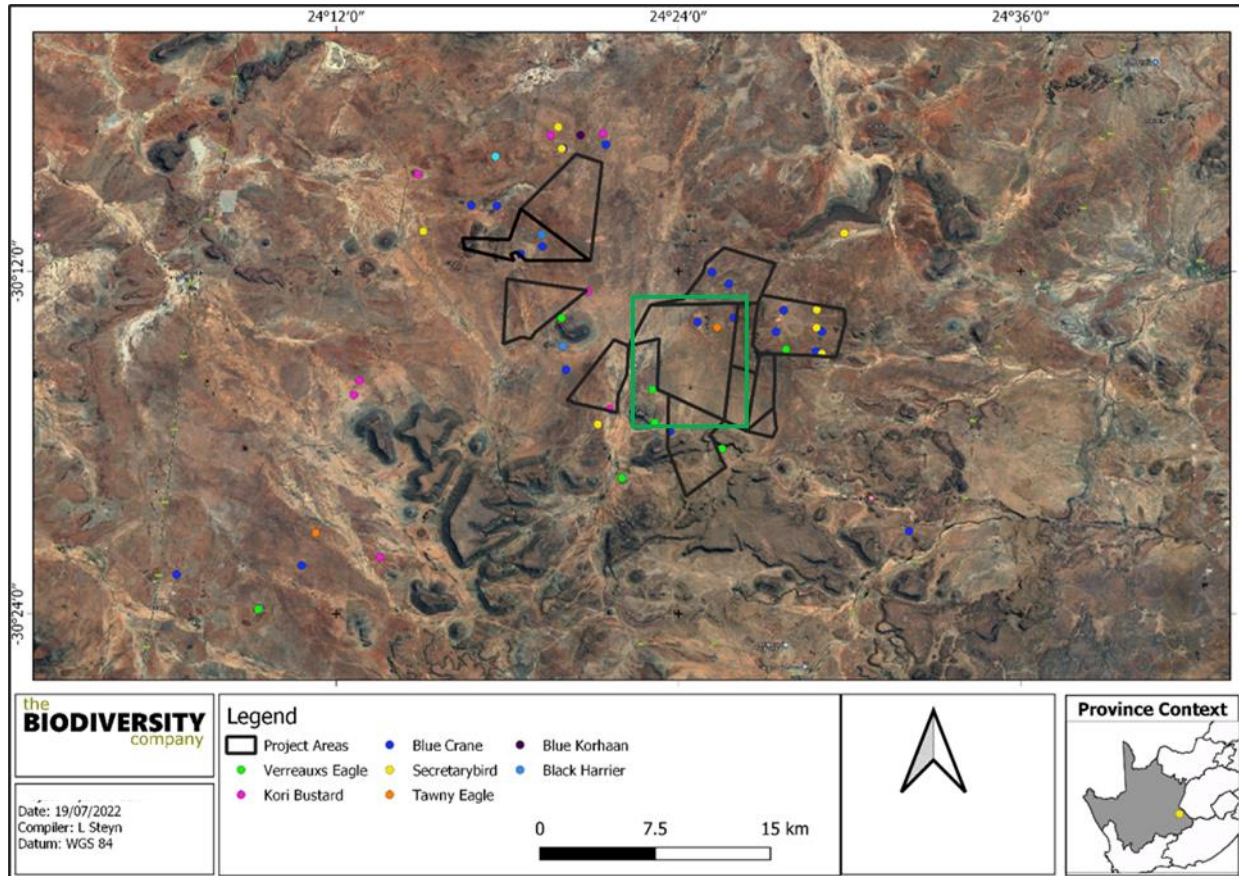
One hundred and twenty-four (124) bird species were recorded across all properties in the first survey. The full list of species recorded, their threat status, guild and location observed is shown in Appendix C. A list of the species incidentally recorded moving between point count locations are provided in Appendix D. Seven of the species recorded were SCCs on a national or international scale. The species were some observe on a single sighting, while others were observed on numerous occasions throughout the project area (Figure 6-1, Figure 6-2 and Table 6-1).

**Table 6-1** Species of conservation concern observed during the first field survey. EN = Endangered, LC = Least Concern, NT = Near Threatened and VU = Vulnerable

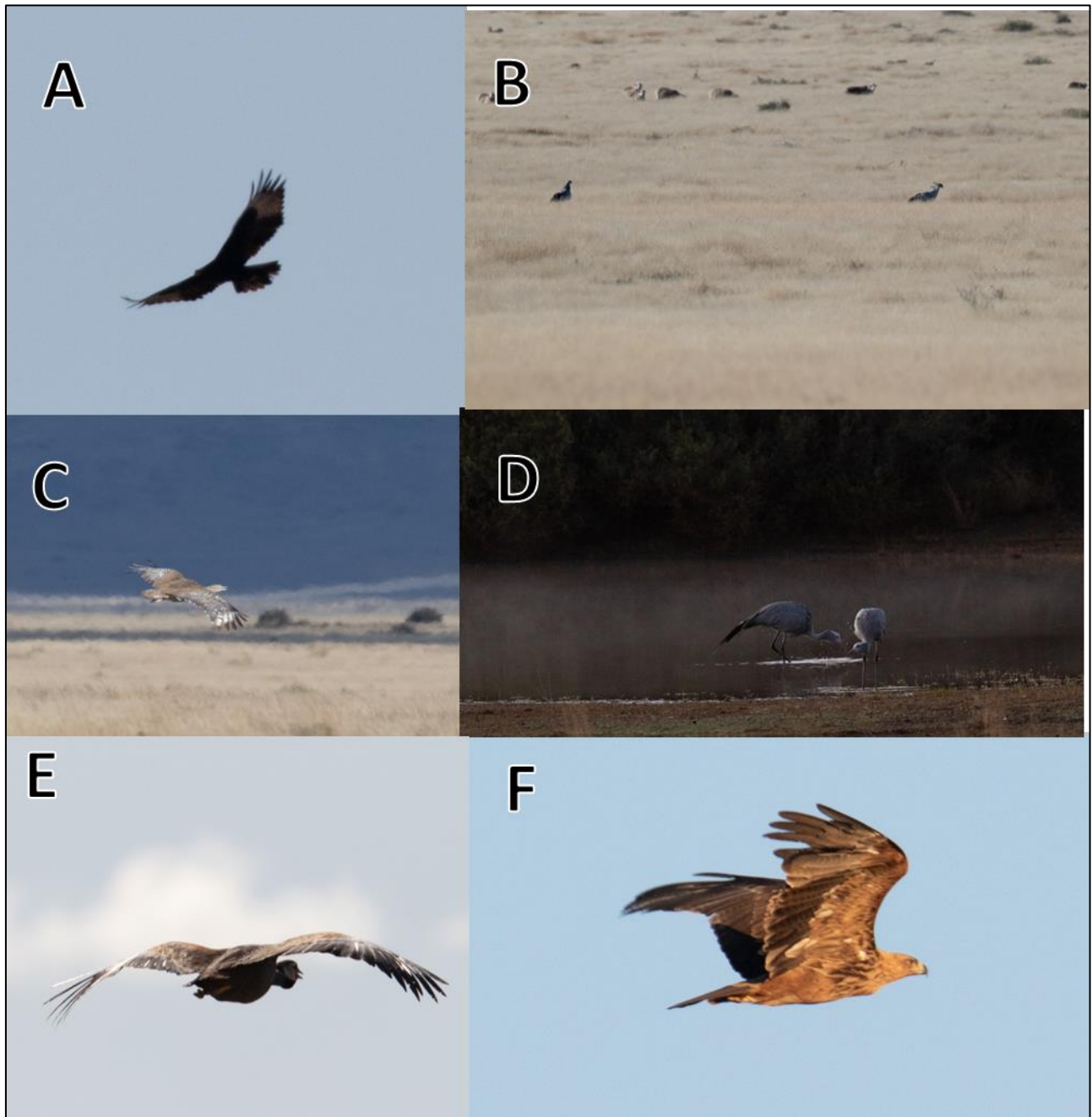
Common Name	Species	Conservation Status		Total Birds	Total Sightings
		Regional (SANBI, 2016)	IUCN (2021)		
Kori Bustard	<i>Ardeotis kori</i>	NT	NT	15	8



Verreaux's Eagle	<i>Aquila verreauxii</i>	VU	LC	11	7
Blue Crane	<i>Grus paradisea</i>	NT	VU	81	20
Secretarybird	<i>Sagittarius serpentarius</i>	VU	EN	10	8
Tawny Eagle	<i>Aquila rapax</i>	EN	VU	4	2
Black Harrier	<i>Circus maurus</i>	EN	EN	1	1
Blue Korhaan	<i>Eupodotis caerulea</i>	LC	NT	2	1



**Figure 6-1** The location of the recordings of the species of conservation concern. The green square indicates the Zionsheuvel Project area.



**Figure 6-2** Photographs of some of the SCCs recorded, A) Verreauxs Eagle, B) Secretarybird, C) Kori Bustard, D) Blue Crane, E) Blue Korhaan, and F) Tawny Eagle

### Blue Crane

*Grus paradiseus* (Blue Crane) are endemic to Southern Africa occurring mainly in the southern and eastern Mpumalanga Highveld through the Free State, KwaZulu-Natal and the Eastern Cape. Blue cranes are omnivorous with their diet consisting of plant material such as small bulbs, seeds and roots, and animals such as insects (especially grasshoppers), small reptiles, frogs, fish, crustaceans and small mammals (SANBI, 2015). This species has declined, largely owing to direct poisoning, power-line collisions and loss of its grassland breeding habitat owing to afforestation, mining, agriculture and development (IUCN, 2017). This species breeds in natural grass- and sedge-dominated habitats, preferring secluded grasslands at high elevations where the vegetation is thick and short. The risk of powerline collisions is enhanced by their habit to fly in a v-shape formation sometimes at a rate of 60-70km, this increases the likelihood of multiple bird strikes at once.

**Secretarybird**

*Sagittarius serpentarius* (Secretarybird) is listed as EN on a global scale (BirdLife International, 2020). The species has a wide distribution across sub-Saharan Africa, but surveyed densities suggest that the total population size does not exceed a five-figure number. Ad-hoc records, localised surveys and anecdotal observations indicate apparent declines in many parts of the species' range, especially in South Africa where reporting rates decreased by at least 60% of quarter degree grid cells used in Southern African Bird Atlas Projects. Threats include excessive burning of grasslands that may suppress populations of prey species, whilst the intensive grazing of livestock is also probably degrading otherwise suitable habitat. Disturbance by humans is likely to negatively affect breeding. The species is captured and traded; however, it is unknown how many deaths occur in captivity and transit. Direct hunting and nest-raiding for other uses and indiscriminate poisoning at waterholes are also further threats. A proposed conservation action is that landowners of suitable properties should join biodiversity stewardship initiatives and to manage their properties in a sustainable way for the species' populations.

**Blue Korhaan**

*Eupodotis caerulescens* (Blue Korhaan) is endemic to South Africa and Lesotho and occurs in grassveld usually over 1 500 m above sea level, preferring open, fairly short grassland and a mixture of grassland and karoo dwarf-shrubland within 1 km of water, with termite mounds and few or no trees (BirdLife International, 2017). The total global population is estimated to number between 12 000-15 000 individuals, equivalent to 8 000-10 000 mature individuals, with a decreasing population trend. The main threat is intensive agriculture, especially within the east of its range.

**Black Harrier**

*Circus maurus* (Black Harrier) is endemic to southern Africa, where its core range is in the Western Cape, but also occurs in the Eastern Cape, the Northern Cape and Free State (where it is irruptive in both areas), Lesotho and Namibia (BirdLife International, 2021b). The species occupies coastal and montane fynbos, highland grasslands, Karoo subdesert scrub, open plains with low shrubs and croplands. It often breeds close to coastal and upland marshes with tall shrubs or reeds, occurring in dry steppe and grassland areas further north in the non-breeding season. Local fluctuations in breeding numbers may be related to population cycles in its prey base, such as mice whose numbers fluctuate with rainfall, especially in the more arid regions. The total population is estimated at < 1 000 individuals in South Africa, Lesotho and Eswatini (Taylor et al, 2015) with only around 10 mature individuals outside this region. The population is thought to have undergone a major decline of 85% in the past 100 years (17% in 20 years) due to habitat loss (BirdLife International, 2021b). Habitat is primarily lost to agriculture, and this is compounded by the uncontrolled burning of fynbos and grassland, which renders these habitats unsuitable for breeding for about five years. Additional threats include low hatching rates due to pesticide use and overgrazing.

**Verreaux Eagle**

*Aquila verreauxii* (Verreaux's Eagle) is found in mountainous and rocky cliff habitat. They are usually found in pairs that remain close for up to 95 % of the day. This monogamous pair are solitary nesters with two nests in their territories, a main and an alternative nest. The nest is a stick structure, up to 1.8m in diameter. They mainly breed on steep inaccessible cliffs, but artificial structures and in some instances large trees are also used. Breeding occurs from April to November (Del Hoyo, 1994). Their diet consist of Hyrax (60%), Vervet Monkeys, Chacma Baboons and smaller mammal species. The 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 (Ferguson- Lees and Christie, 2001).

**Kori Bustard**

*Ardeotis kori* (Kori Bustard) is listed as NT on a regional and global scale (BirdLife International, 2016a). This species has a large but disjunct range in sub-Saharan Africa, occurring from Ethiopia and Somalia south to Tanzania, and from southern Angola and Zimbabwe south to South Africa. The species occupies 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. The diet includes a wide range of plants and animals including insects, reptiles, small rodents, birds, carrion, seeds, berries and roots. It is largely sedentary but does undertake local movements. The global population size has not been quantified, but the population in South Africa has been estimated at 2 000-5 000 birds individuals (BirdLife International, 2016c). A major threat is collision with overhead powerlines but the causes of population declines and range losses in many parts of the distribution are unknown. These have been hypothesised to include persecution, rangeland degradation and bush encroachment.

### Tawny Eagle

*Aquila rapax rapax* (Tawny Eagle) is listed as VU on a global scale (BirdLife International, 2021a) and EN on a regional scale (Taylor et al, 2015). This is a widespread raptor occurring over large areas of Sub-Saharan Africa, with isolated populations in North Africa, the Middle East and South Asia, albeit the African population is now becoming increasingly dependent on protected areas (BirdLife International, 2021a). The species occupies dry open from sea level to 3000 m and will occupy both woodland and wooded savannah. *Aquila rapax rapax* predated on mammals, birds, reptiles, insects, and occasionally fish and amphibians. It will also regularly consume carrion and pirate other raptors' prey. The African population is estimated at 73 860 pairs with a severely declining population at a rate of decline as > 60% over the past 50 years within South Africa, Lesotho and eSwatini. The main threats are secondary poisoning, direct persecution and collisions with powerlines (BirdLife International, 2021a).

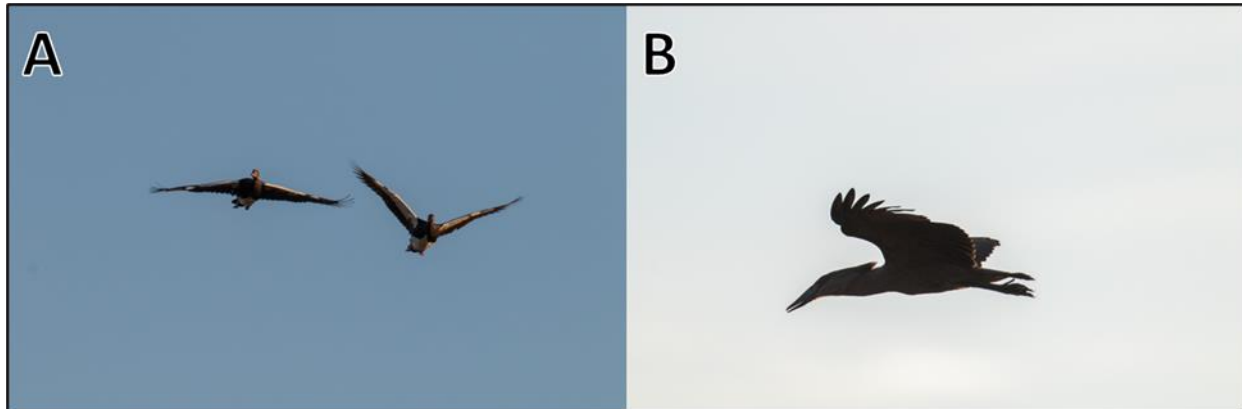
#### 6.1.1 Dominant Species

Table 6-2 provide lists of the dominant species for the first survey together with the frequency with which each species appeared in the point count samples. The data shows that Pied Crow, Red-billed Quelea, Spiked-heel Lark and Pink-billed Lark were the most abundant species recorded during the survey. Figure 6-3 shows some of the bird species that were recorded during the survey.

**Table 6-2** *Dominant avifaunal species within the cluster area during the first survey as defined as those species whose relative abundances cumulatively account for more than 86% of the overall abundance shown alongside the frequency with which a species was detected among point counts.*

Common Name	Scientific Name	Relative abundance	Frequency
Pied Crow	<i>Corvus albus</i>	0,106	52,632
Red-billed Quelea	<i>Quelea quelea</i>	0,106	8,772
Spike-heeled Lark	<i>Chersomanes albofasciata</i>	0,104	54,386
Pink-billed Lark	<i>Spizocorys conirostris</i>	0,082	10,526
Ant-eating Chat	<i>Myrmecocichla formicivora</i>	0,066	50,877
Rufous-eared Warbler	<i>Malcorus pectoralis</i>	0,056	49,123
Wattled Starling	<i>Creatophora cinerea</i>	0,049	3,509
Blue Crane	<i>Grus paradisea</i>	0,045	10,526
Desert Cisticola	<i>Cisticola aridulus</i>	0,032	29,825
Black-chested Prinia	<i>Prinia flavicans</i>	0,030	31,579
Eastern Clapper Lark	<i>Mirafrasi fasciolata</i>	0,030	15,789
Large-billed Lark	<i>Galerida magnirostris</i>	0,025	24,561
Northern Black Korhaan	<i>Afrotis afraoides</i>	0,024	28,070

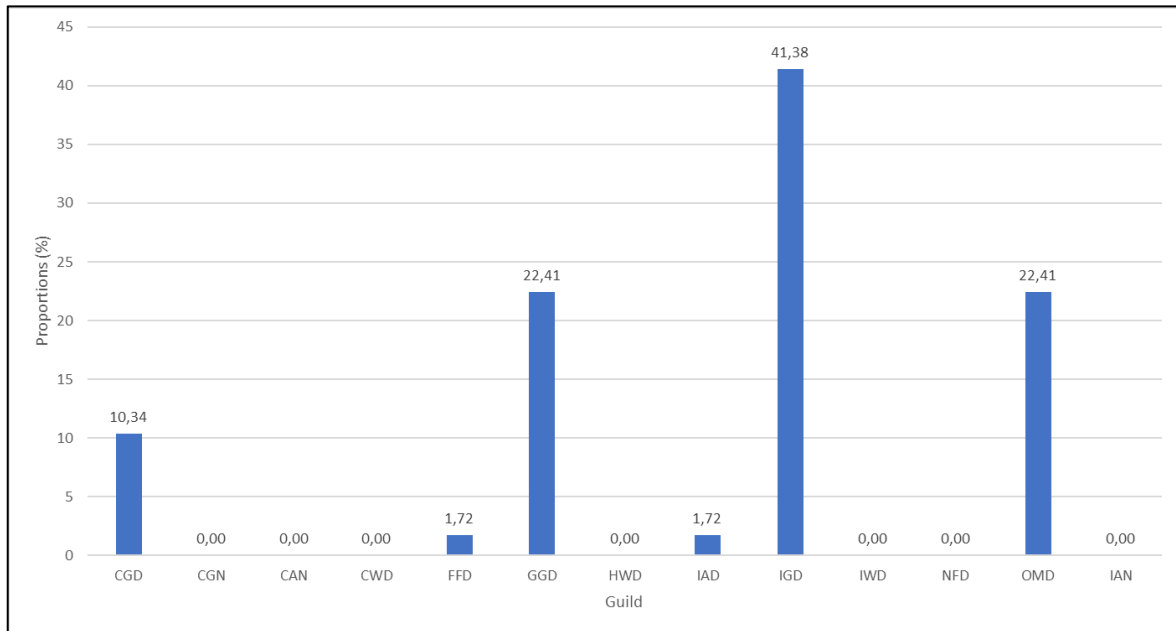
Speckled Pigeon	<i>Columba guinea</i>	0,021	3,509
Bokmakierie	<i>Telophorus zeylonus</i>	0,015	10,526
African Pipit	<i>Anthus cinnamomeus</i>	0,014	15,789
Yellow Canary	<i>Crithagra flaviventris</i>	0,013	5,263
Kori Bustard	<i>Ardeotis kori</i>	0,011	7,018
Verreaux's Eagle	<i>Aquila verreauxii</i>	0,008	7,018
Helmeted Guineafowl	<i>Numida meleagris</i>	0,008	3,509
Spur-winged Goose	<i>Plectropterus gambensis</i>	0,008	1,754



**Figure 6-3** Some of the birds recorded in the project area: A) Spur-winged Goose, B) Hamerkop

### 6.1.2 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, i.e., Invertivore Ground Diurnal (IGD) (41%) (Figure 6-4). Omnivore Multiple Diurnal (OMD), and Granivore Ground Diurnal (GGD) made up the second highest groups (22%, respectively). As illustrated in Figure 6-4, the cluster area was dominated by a few feeding groups.



**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; GGD, 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.

**6.1.3 Risk Species**

A number of species were found during the survey that would be regarded as ‘high risk’ species (Table 6-3 and Figure 6-5 to Figure 6-9). Priority species are susceptible to impacts from energy developments (Ralston Paton *et al.* 2017). These species are typically susceptible to collisions. This list (Ralston Paton *et al.* 2017) was developed initially for use with Wind Energy Facilities; however, the collision, electrocution and habitat loss risks are considered appropriate for renewable energy developments and so are utilised here. Also utilised here is the Eskom and EWT poster: Birds and Powerlines (Eskom and EWT, Date unknown) poster, which identifies birds most prone to collision and electrocution from powerlines. Some birds are not included in these lists, but are considered by the TBC avifauna specialists as risk species for collisions, electrocutions and habitat loss as a result of Solar PV infrastructure. All of species are referred to collectively in this report as “Risk Species”. The fence could also pose a collision risk for various species as described in section 8.2.

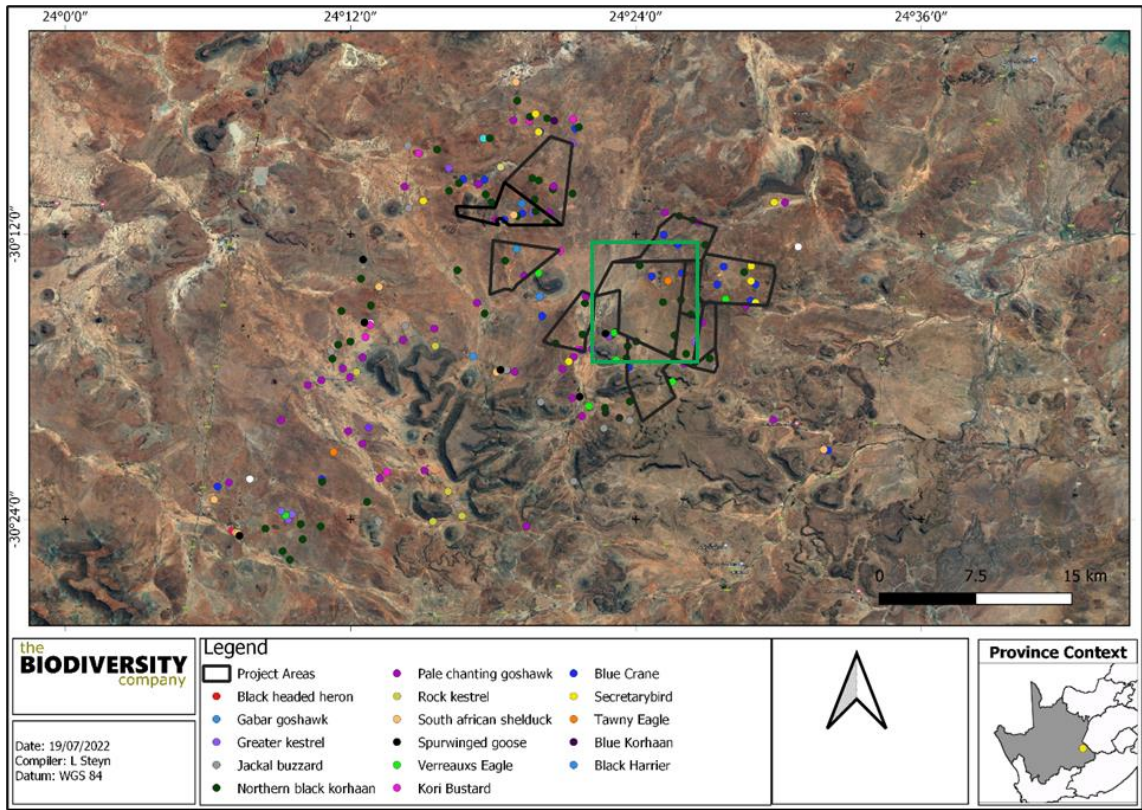
**Table 6-3** At risk species found in the survey.

Common Name	Scientific Name	Collision	Electrocution	Habitat Loss
African Darter	<i>Anhinga rufa</i>	x		
African Fish Eagle	<i>Haliaeetus vocifer</i>	x	x	
African Harrier-Hawk	<i>Polyboroides typus</i>	x	x	
Black Harrier	<i>Circus maurus</i>	x	x	x
Black-chested Snake Eagle	<i>Circaetus pectoralis</i>		x	
Black-headed Heron	<i>Ardea melanocephala</i>	x	x	
Blue Crane	<i>Grus paradisea</i>	x		x
Blue Korhaan	<i>Eupodotis caerulescens</i>	x	x	x

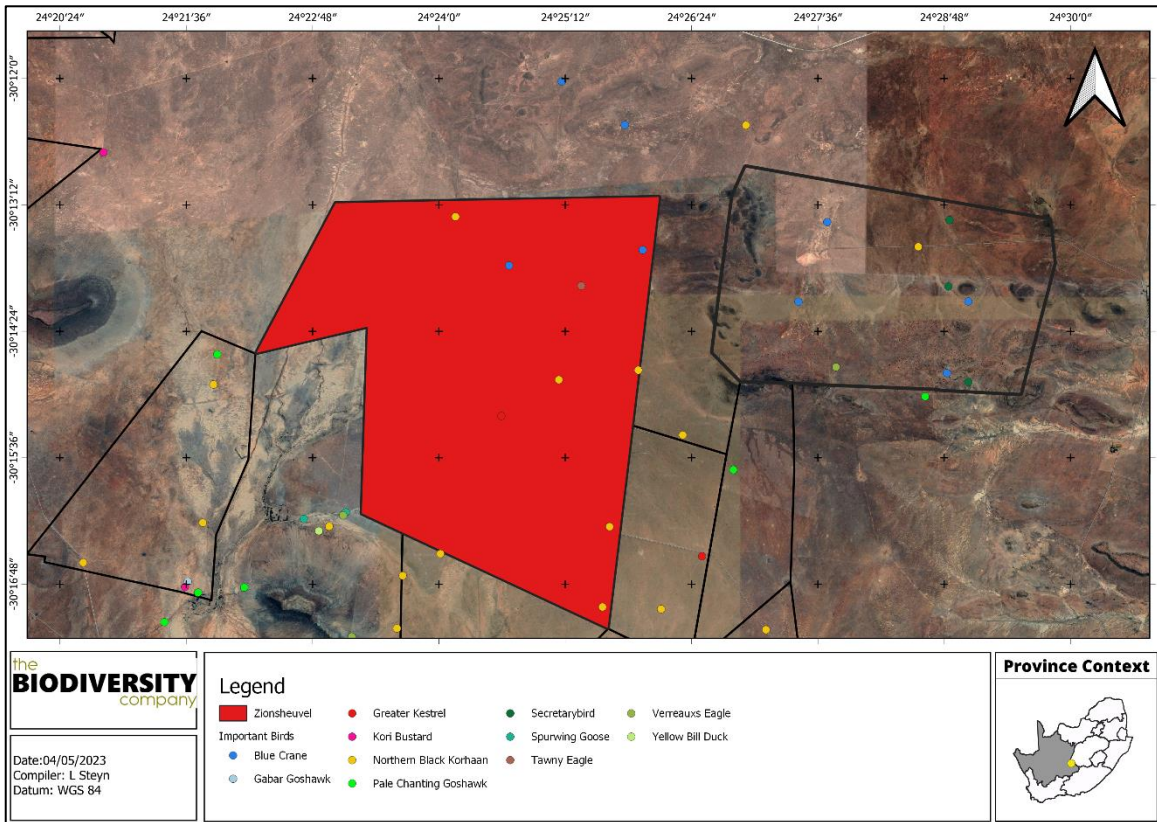
Common Name	Scientific Name	Collision	Electrocution	Habitat Loss
Egyptian Goose	<i>Alopochen aegyptiaca</i>	x	x	
Gabar Goshawk	<i>Micronisus gabar</i>		x	
Greater Kestrel	<i>Falco rupicoloides</i>		x	
Grey Heron	<i>Ardea cinerea</i>	x	x	
Hadeda (Hadada) Ibis	<i>Bostrychia hagedash</i>	x	x	
Hamerkop	<i>Scopus umbretta</i>	x		
Helmeted Guineafowl	<i>Numida meleagris</i>		x	
Jackal Buzzard	<i>Buteo rufofuscus</i>	x	x	
Kori Bustard	<i>Ardeotis kori</i>	x	x	x
Lanner Falcon	<i>Falco biarmicus</i>			x
Northern Black Korhaan	<i>Afrotis afraoides</i>	x	x	x
Pale Chanting Goshawk	<i>Melierax canorus</i>	x	x	
Pied Crow	<i>Corvus albus</i>		x	
Rock Kestrel	<i>Falco rupicolus</i>		x	
Secretarybird	<i>Sagittarius serpentarius</i>	x		x
South African Shelduck	<i>Tadorna cana</i>	x	x	
Spotted Eagle-Owl	<i>Bubo africanus</i>		x	
Spur-winged Goose	<i>Plectropterus gambensis</i>	x	x	
Tawny Eagle	<i>Aquila rapax</i>	x	x	x
Verreaux's Eagle	<i>Aquila verreauxii</i>	x	x	x
Western Barn Owl	<i>Tyto alba</i>		x	
Western Cattle Egret	<i>Bubulcus ibis</i>		x	
White-breasted Cormorant	<i>Phalacrocorax lucidus</i>	x	x	
White-faced Whistling Duck	<i>Dendrocygna viduata</i>	x	x	
White-necked Raven	<i>Corvus albicollis</i>		x	
Yellow-billed Duck	<i>Anas undulata</i>	x	x	



**Figure 6-5** Some of the high collision risk species recorded on site: A) Northern Black Korhaan, B) White-breasted Cormorant and Spoonbill



**Figure 6-6** Location of some of the risk species observed in and around the project area. The green square indicates the Zionsheuvel Project Area.



**Figure 6-7** The risk species in close proximity to the project area



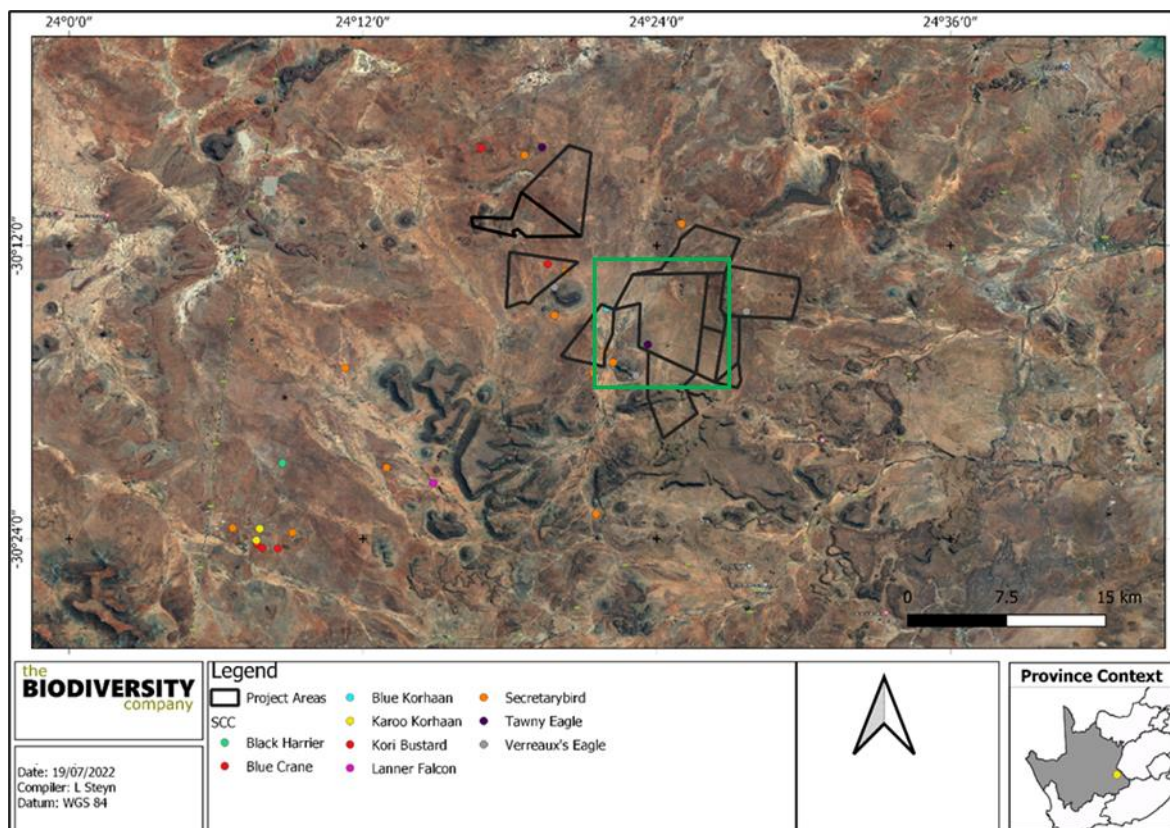
## 6.2 Second Assessment

One hundred and two (102) bird species were recorded during the second survey across all areas surveyed. The full list of species recorded, their threat status, guild and location observed is provided in Appendix E, incidental records are listed in Appendix F. Nine of the species recorded were SCC on a national or international scale. They were found in varying degrees of frequency.

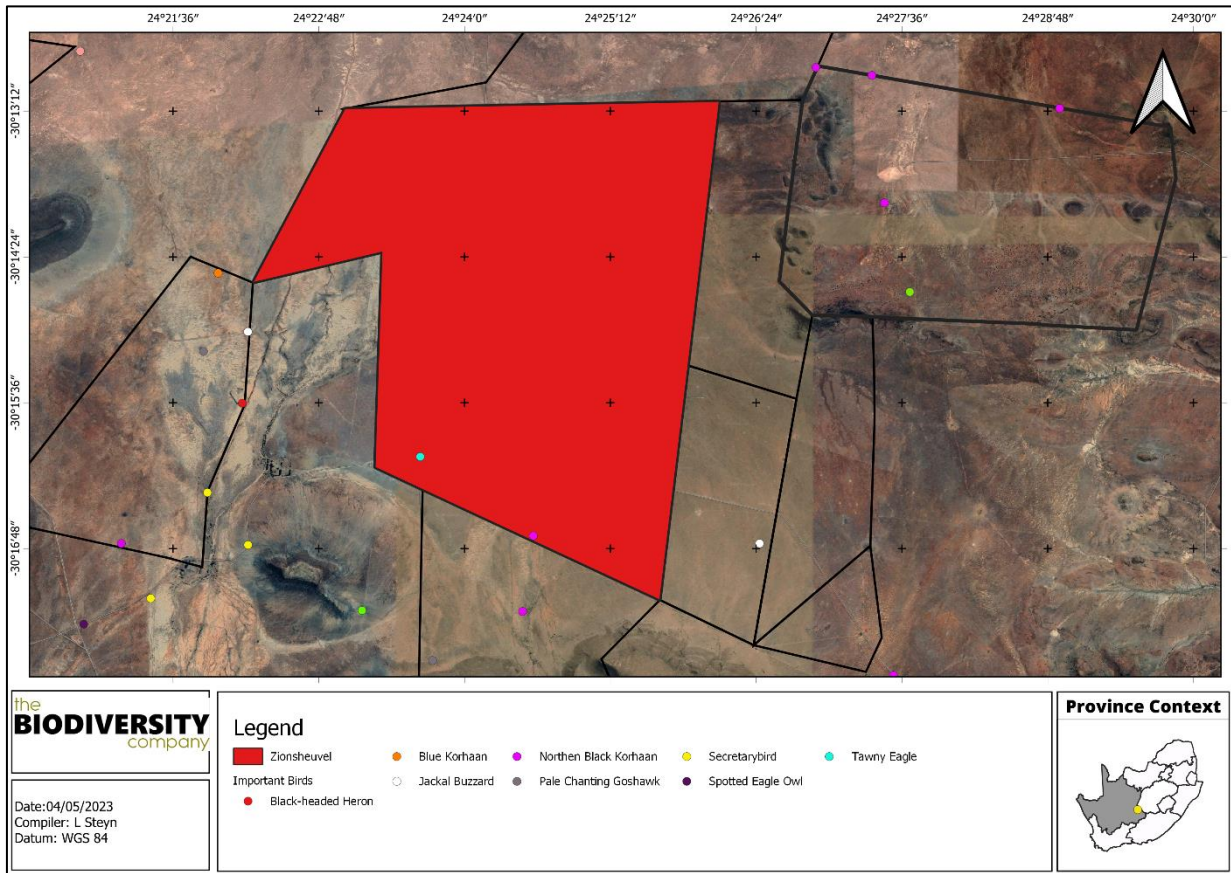
Table 6-4 lists the species as well as their threatened status, Figure 6-8 shows the locations where the species were observed and Figure 6-10 provides photographs of these recorded SCC.

**Table 6-4** Species of conservation concern observed during the survey (EN = Endangered; VU= Vulnerable, LC = Least Concerned, NT = Near Threatened)

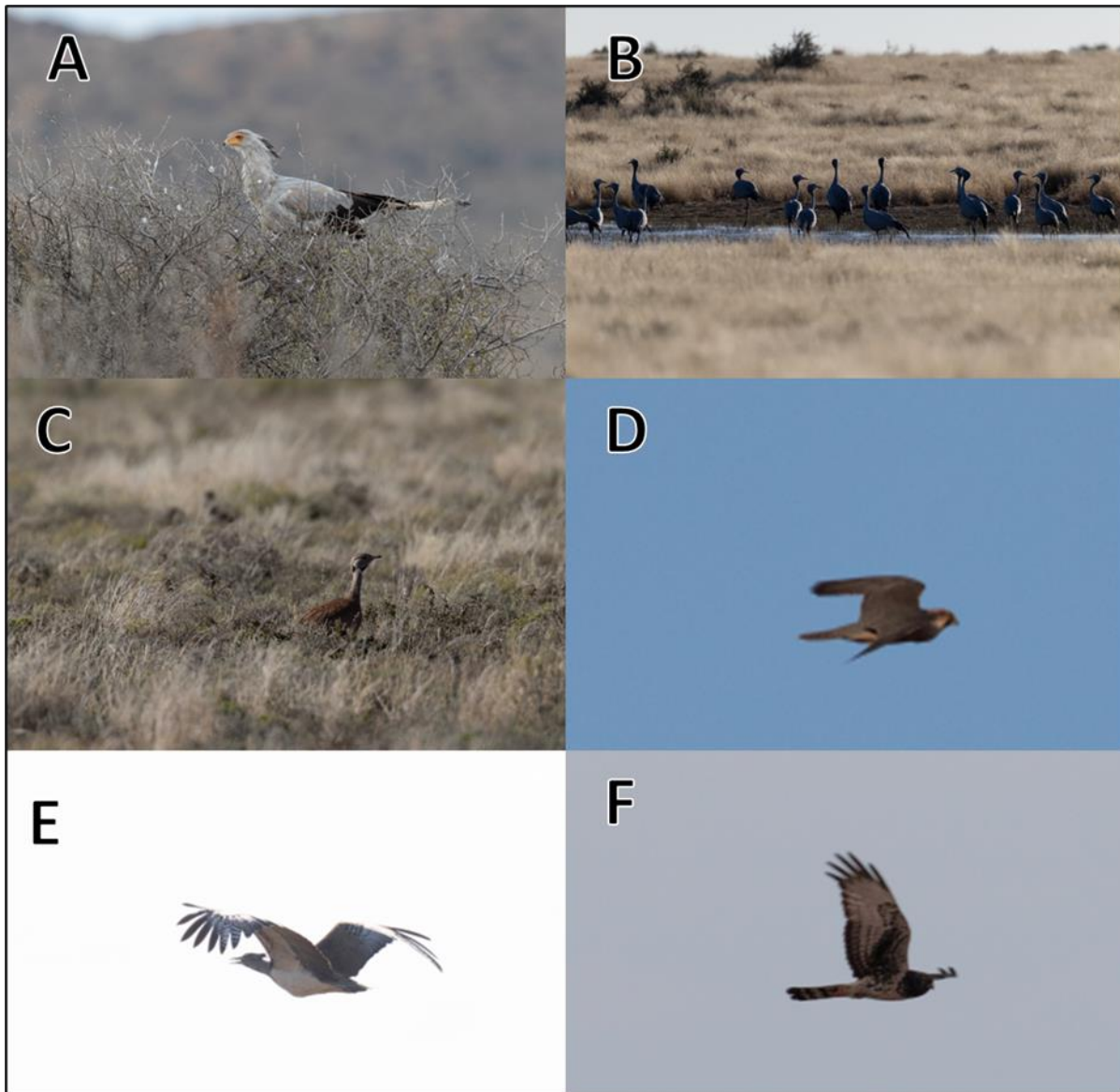
Common Name	Scientific Name	Conservation Status		Total Birds	Total Sightings
		Regional	Global		
Tawny Eagle	<i>Aquila rapax</i>	EN	VU	3	2
Verreaux's Eagle	<i>Aquila verreauxii</i>	VU	LC	5	3
Kori Bustard	<i>Ardeotis kori</i>	NT	NT	1	1
Black Harrier	<i>Circus maurus</i>	EN	EN	1	1
Blue Korhaan	<i>Eupodotis caerulescens</i>	LC	NT	2	1
Karoo Korhaan	<i>Eupodotis vigorsii</i>	NT	LC	3	2
Lanner Falcon	<i>Falco biarmicus</i>	VU	NT	1	1
Blue Crane	<i>Grus paradisea</i>	NT	VU	69	4
Secretarybird	<i>Sagittarius serpentarius</i>	VU	EN	18	12



**Figure 6-8** The location of the recordings of the species of conservation concern in the 2<sup>nd</sup> survey. The green square indicates the Zionsheuel Project Area.



**Figure 6-9** The risk species in close proximity to the project area



**Figure 6-10** Photographs of some of the recorded species, A) Secretarybird, B) Blue Crane, C) Karoo Korhaan, D) Lanner Falcon, E) Kori Bustard, and F) Black Harrier

During the second survey similar SCCs were recorded with the exception of the Karoo Korhaan and Lanner Falcon.

#### **Karoo Korhaan**

*Eupodotis vigorsii* (Karoo Korhaan) is found in dwarf arid shrubland of the Nama Karoo and Succulent Karoo. They are resident and sedentary species which means their movement is restricted to their home range and they do not migrate locally. Their diets consist mainly of invertebrates, reptiles and plant matter, on which they feed while walking along. The pairs are monogamous and often breed in family groups. Helpers can assist in defending the territory or feeding of the young. They nest on the ground with the main egg-laying season being between June and February. Main threats include habitat degradation due to agricultural practices and ecosystem stresses due to climate change (IUCN, 2022).

#### **Lanner Falcon**

*Falco biarmicus* (Lanner Falcon) is native to South Africa and inhabits a wide variety of habitats, from lowland deserts to forested mountains (IUCN, 2017). Global population estimates is more than 30000 breeding pairs, in South Africa it is estimated to be 1400 pairs. They may occur in groups up to 20

individuals, but have also been observed solitary. They are partial and facultative migrants, that breeds from May to early September. Nests are mostly found on cliff ledges, and they may alternate between more than one nest. Their diet is mainly composed of small birds such as pigeons and francolins. Anecdotal evidence suggest these species are susceptible to agrochemicals, another threat to their population is the clearing of grassland habitats (Roberts *et al.*, 2023).

### 6.2.1 Dominant Species

Table 6-5 lists the dominant species for the second survey together with the frequency with which each species appeared in the point count samples. The data shows the Helmeted Guineafowl, Pink-billed Lark, Spike-heeled Lark, Ant-eating Chat and Pied Crow were the most abundant species during the survey. Figure 6-11 shows some of the birds that were recorded during the survey.

**Table 6-5** *Dominant avifaunal species within the project site during the winter survey as defined as those species whose relative abundances cumulatively account for more than 88% of the overall abundance shown alongside the frequency with which a species was detected among point counts.*

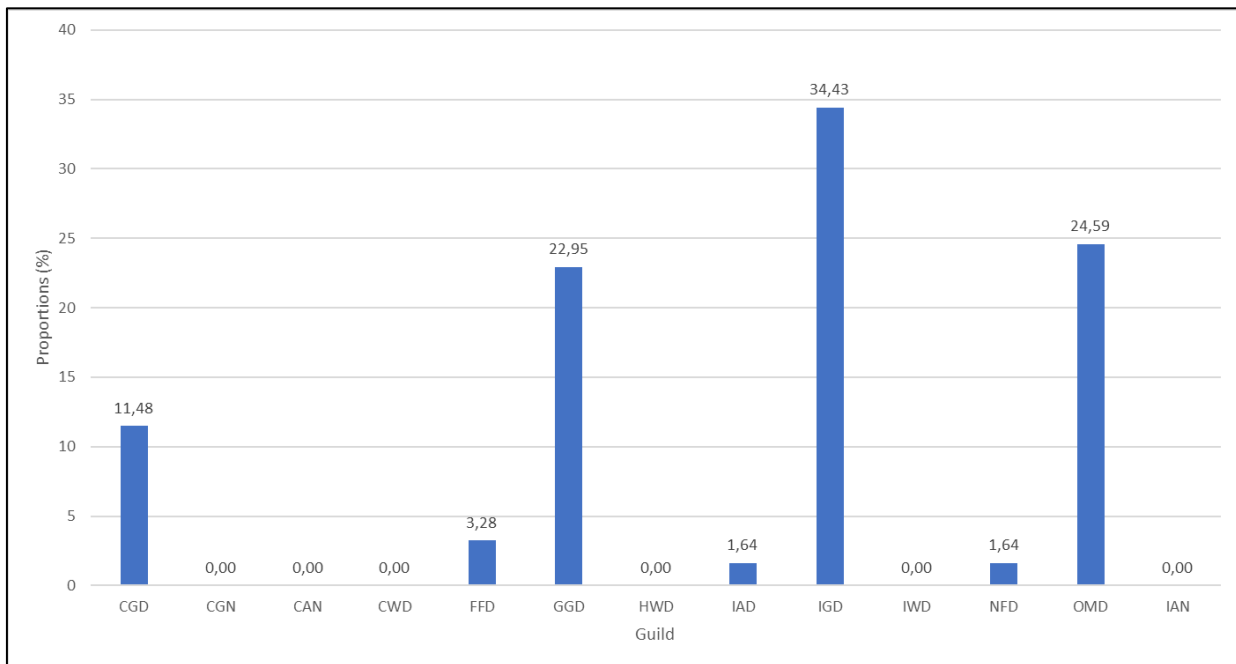
Common Name	Scientific Name	Relative abundance	Frequency (%)
Helmeted Guineafowl	<i>Numida meleagris</i>	0,120	6,667
Pink-billed Lark	<i>Spizocorys conirostris</i>	0,097	18,333
Spike-heeled Lark	<i>Chersomanes albofasciata</i>	0,089	61,667
Ant-eating Chat	<i>Myrmecocichla formicivora</i>	0,072	48,333
Pied Crow	<i>Corvus albus</i>	0,068	50,000
Desert Cisticola	<i>Cisticola aridulus</i>	0,058	61,667
African Quail-finch	<i>Ortygospiza atricollis</i>	0,053	6,667
Red-billed Quelea	<i>Quelea quelea</i>	0,049	5,000
Rufous-eared Warbler	<i>Malcorus pectoralis</i>	0,049	51,667
Eastern Clapper Lark	<i>Mirafra fasciolata</i>	0,047	35,000
Large-billed Lark	<i>Galerida magirostris</i>	0,033	33,333
Black-chested Prinia	<i>Prinia flavicans</i>	0,025	30,000
Northern Black Korhaan	<i>Afrotis afraoides</i>	0,024	21,667
Yellow Canary	<i>Crithagra flaviventris</i>	0,018	6,667
Sickle-winged Chat	<i>Emarginata sinuata</i>	0,013	13,333
African Pipit	<i>Anthus cinnamomeus</i>	0,011	15,000
Cape Sparrow	<i>Passer melanurus</i>	0,009	3,333
Common Quail	<i>Coturnix coturnix</i>	0,009	6,667
Verreaux's Eagle	<i>Aquila verreauxii</i>	0,009	6,667
Bokmakierie	<i>Telophorus zeylonus</i>	0,008	8,333
Pale Chanting Goshawk	<i>Melierax canorus</i>	0,008	8,333
Wattled Starling	<i>Creatophora cinerea</i>	0,008	1,667



**Figure 6-11** Some of the birds recorded in the project area: A) Rufous -Eared Warbler and B) Orange-river Francolin

### 6.2.2 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) (31%) (Figure 6-4 and Figure 6-12). Omnivorous species (OMD) (25 %) made up the second highest groups, followed by the granivores (GGD) (23 %). A higher number of carnivores were observed in the second survey compared to the first survey.



**Figure 6-12** Avifaunal trophic guilds. CGD, carnivore ground diurnal; CGN, carnivore ground nocturnal, CAN, carnivore air nocturnal, CWD, carnivore water diurnal; FFD, frugivore foliage diurnal; GGD, 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.

### 6.2.3 Risk Species

A number of species were found that would be regarded as ‘high risk’ species (Table 6-6 and Figure 6-13). High 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.

**Table 6-6 At risk species found in the 2<sup>nd</sup> survey.**

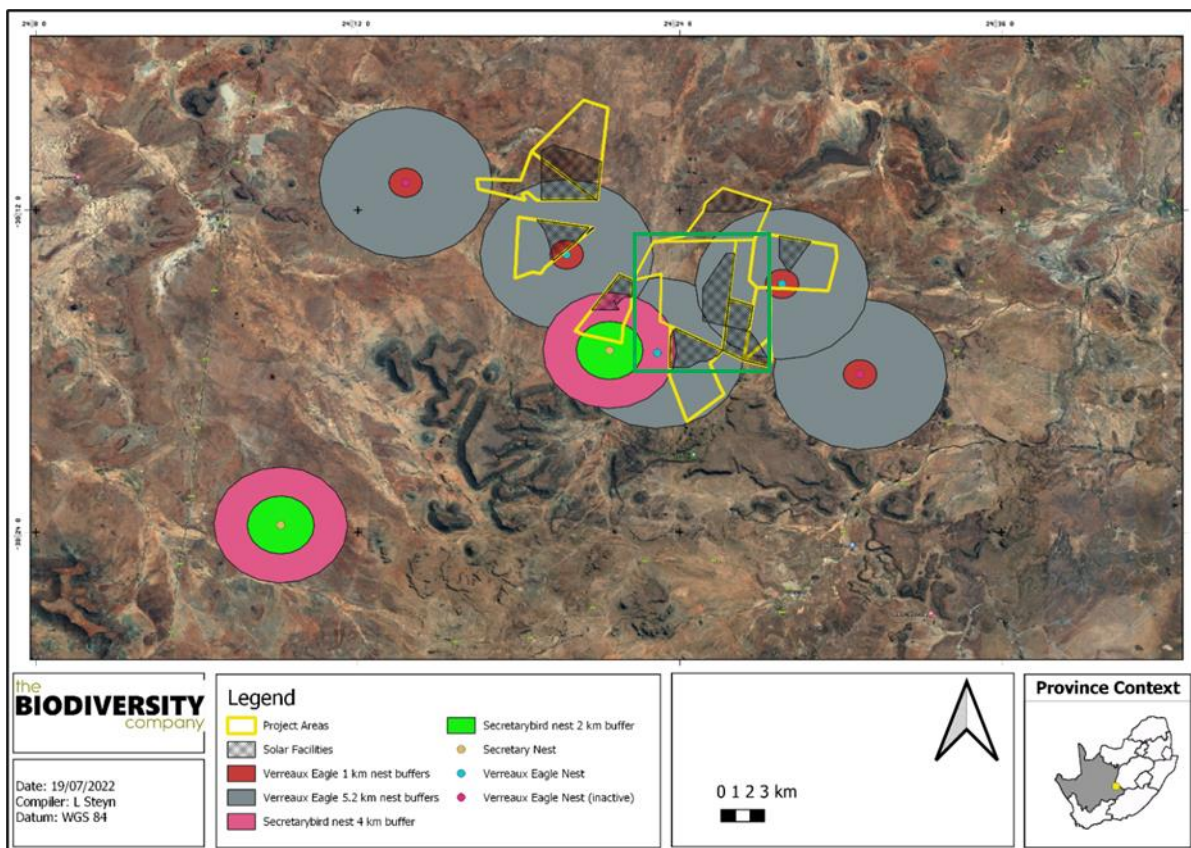
Common Name	Scientific Name	Collision	Electrocution	Habitat Loss
African Harrier-Hawk	<i>Polyboroides typus</i>	x	x	
African Sacred Ibis	<i>Threskiornis aethiopicus</i>	x	x	
Black Harrier	<i>Circus maurus</i>	x	x	x
Black-headed Heron	<i>Ardea melanocephala</i>	x	x	
Blue Crane	<i>Grus paradisea</i>	x		x
Blue Korhaan	<i>Eupodotis caerulescens</i>	x	x	x
Cape Eagle-Owl	<i>Bubo capensis</i>		x	
Egyptian Goose	<i>Alopochen aegyptiaca</i>	x	x	
Greater Kestrel	<i>Falco rupicoloides</i>		x	
Hadeda (Hadada) Ibis	<i>Bostrychia hagedash</i>	x	x	
Helmeted Guineafowl	<i>Numida meleagris</i>		x	
Jackal Buzzard	<i>Buteo rufofuscus</i>	x	x	
Karoo Korhaan	<i>Eupodotis vigorsii</i>	x	x	x
Kori Bustard	<i>Ardeotis kori</i>	x	x	x
Lanner Falcon	<i>Falco biarmicus</i>			x
Northern Black Korhaan	<i>Afrotis afraoides</i>	x	x	x
Pied Crow	<i>Corvus albus</i>		x	
Reed Cormorant	<i>Microcarbo africanus</i>	x	x	
Rock Kestrel	<i>Falco rupicolus</i>		x	
Secretarybird	<i>Sagittarius serpentarius</i>	x		x
South African Shelduck	<i>Tadorna cana</i>	x	x	
Spotted Eagle-Owl	<i>Bubo africanus</i>		x	
Tawny Eagle	<i>Aquila rapax</i>	x	x	x
Verreaux's Eagle	<i>Aquila verreauxii</i>	x	x	x
White-necked Raven	<i>Corvus albicollis</i>		x	



**Figure 6-13 Some of the high collision risk species recorded on site: A) Helmeted Guineafowl and B) Secretarybird**

### 6.3 Nest Analysis

Observing and monitoring nesting sites are important in ascertaining habitat sensitivity and evaluating the impact risk significance of any proposed development. During the field survey recording nesting sites within the larger cluster area were undertaken for certain species. Three active Verreaux's Eagle nests were observed and an additional two inactive nests were also noted. Two active Secretarybird nests were also found. As per the Species Environmental Assessment Guidelines (2020) a core area of 1 km (core buffer) surrounding the nests must be treated as a no-go area, an additional area of 5.2 km (seasonal buffer) was also placed around the nest as per the Birdlife Verreaux's Eagle and Wind Farms Guidelines (2021). This 5.2 km area is based on the average home range of the Verreaux Eagle during the breeding season, and as such this area must be avoided during the breeding season of the species which stretches from April to July to avoid disturbing the species. As per the guidelines buffers were also placed around the inactive nests. For the Secretarybird nests a 4 km buffer were placed around the nests, 2 km must be treated as no go (core buffer), while the other 2 km must be low impact development (low impact buffer) (pers comms Birdlife, 2022). Secretarybirds breeds year around therefore low impact development is required and a breeding season limitation will not suffice. Figure 6-14 further shows the nest locations.



**Figure 6-14** Nests of the SCC in the project area and surrounds and their associated buffers. The green square indicates the Zionsheuvel project area.

## 7 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 three habitat types namely, Grassland Karoo, Shrubland Karoo and Water Resources (Dams, drainage lines and river). 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. Habitat types delineated within the direct project footprint and adjacent survey areas are illustrated Figure 7-5. The Water resources were only delineated to the extend it was surveyed in the avifauna assessment and does not represent the true extend of the

features. The habitats were only delineated for the areas of interest surrounding the PV plants and not the properties as a whole. Numerous ridges and mountains were surveyed around the project area, as all of them fall outside the project areas they were excluded from the habitat delineations.

Karoo grassland habitat was made up of mainly grass species with some herbs and forbs spread throughout. The grasses in this habitat type formed dense carpets of grass (Figure 7-1). Majority of the habitats where the PV plants are proposed to be placed consisted of grasslands. The grasses found here are mainly found in areas covered by a sandy soils (SANBI, 2022). Drivers in these grasslands consist mainly of livestock grazing. The grasslands Avifauna species found here included African Pipit, Northern Black Korhaan, Large-billed Lark, Desert Cisticola, Common Quail and African Stonechat.



**Figure 7-1**      **Example of the Karoo grassland habitat type**

Karoo Shrubland, made up a small section of the delineated habitats. This habitat was dominated by dwarf shrublands, found in lime-rich soil (Figure 7-2). Most of the shrubs are deciduous in response to the rainfall (500-2000mm) (SANBI, 2022). Avifauna species found here includes Rufous-eared Warbler, Karoo Scrub-robin, Yellow Canary, Fairy Flycatcher, Kori Bustard and Sickle-winged Chat.



**Figure 7-2**      **Example of the Karoo Shrubland habitat found in the PAOI**



The water resources identified on site consisted of drainage lines, dams and a river (Figure 7-3). These water sources provide crucial habitat and water for the avifauna species found in the area. As per communication with a farmer the one dam also provide breeding habitat for Blue Crane (Figure 7-4), this could not be confirmed during the assessments. Other species found here include: African Fish Eagle, African Spoonbill, Cape Shoveler, Red-billed Teal, South African Shelduck and Spurwing Goose.



**Figure 7-3**      *Examples of the water resources found in the PAOI and surrounds*



**Figure 7-4**      *Use of the water features by the Blue Crane*

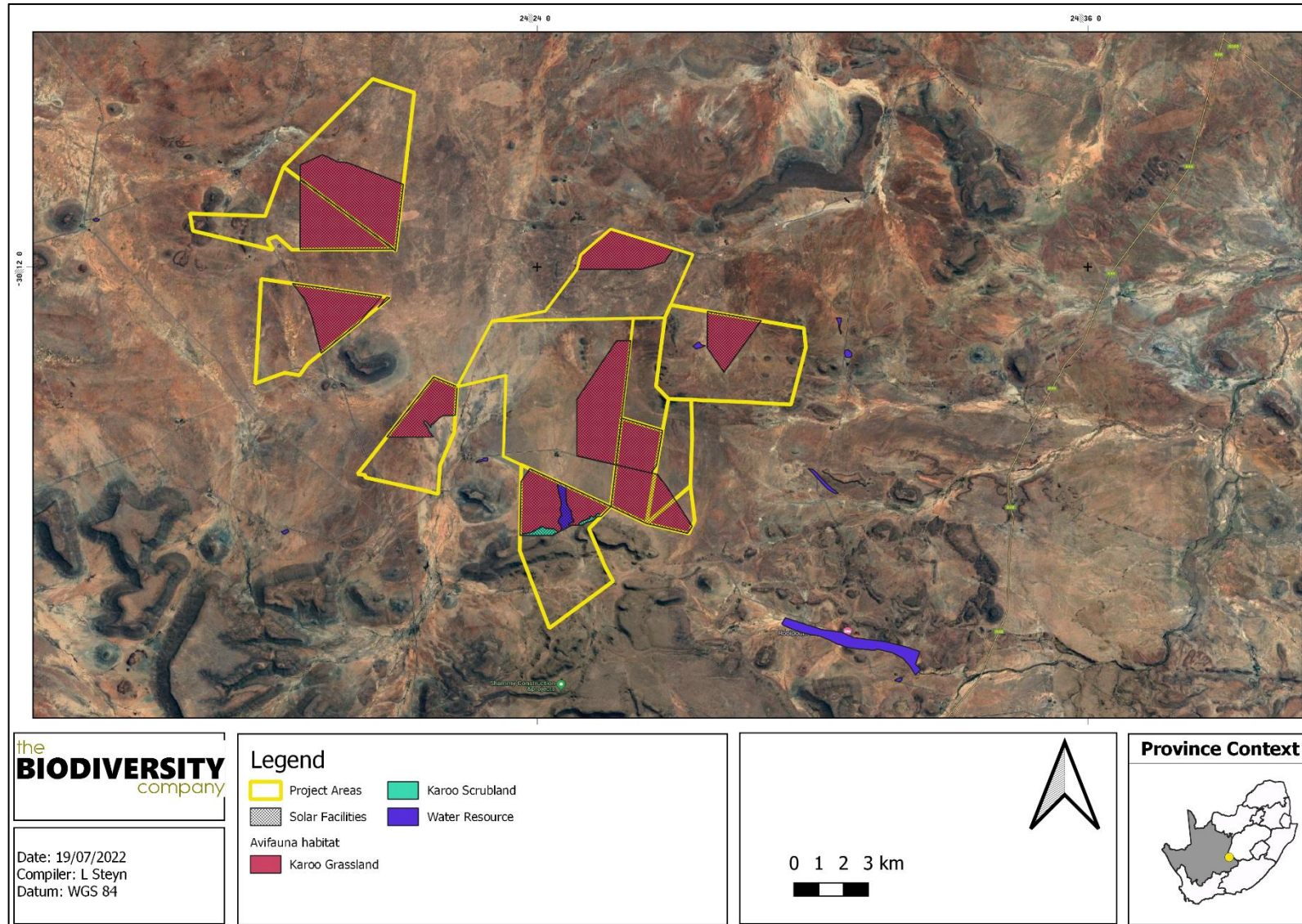


Figure 7-5 The avifauna habitats found in the cluster area.

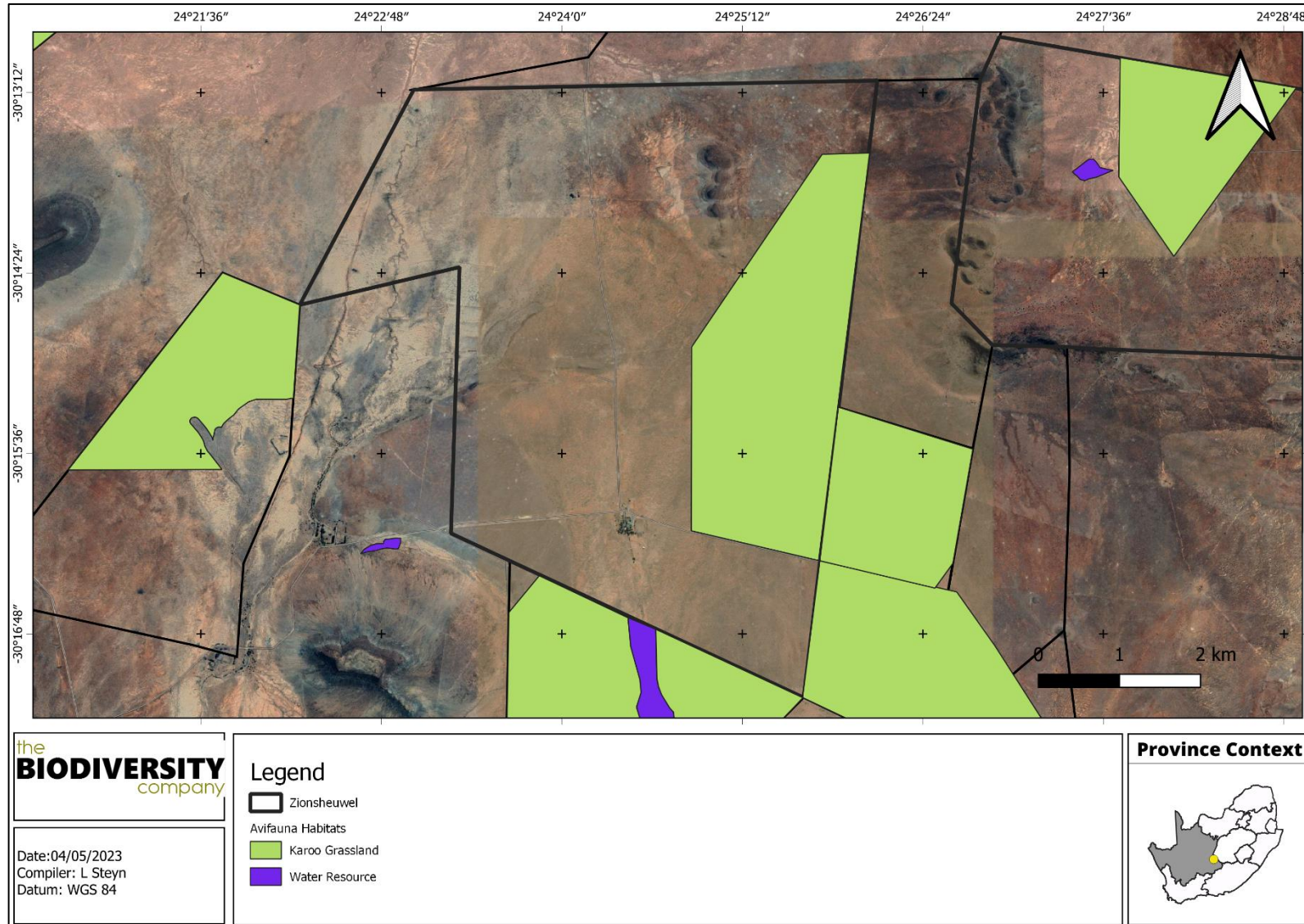
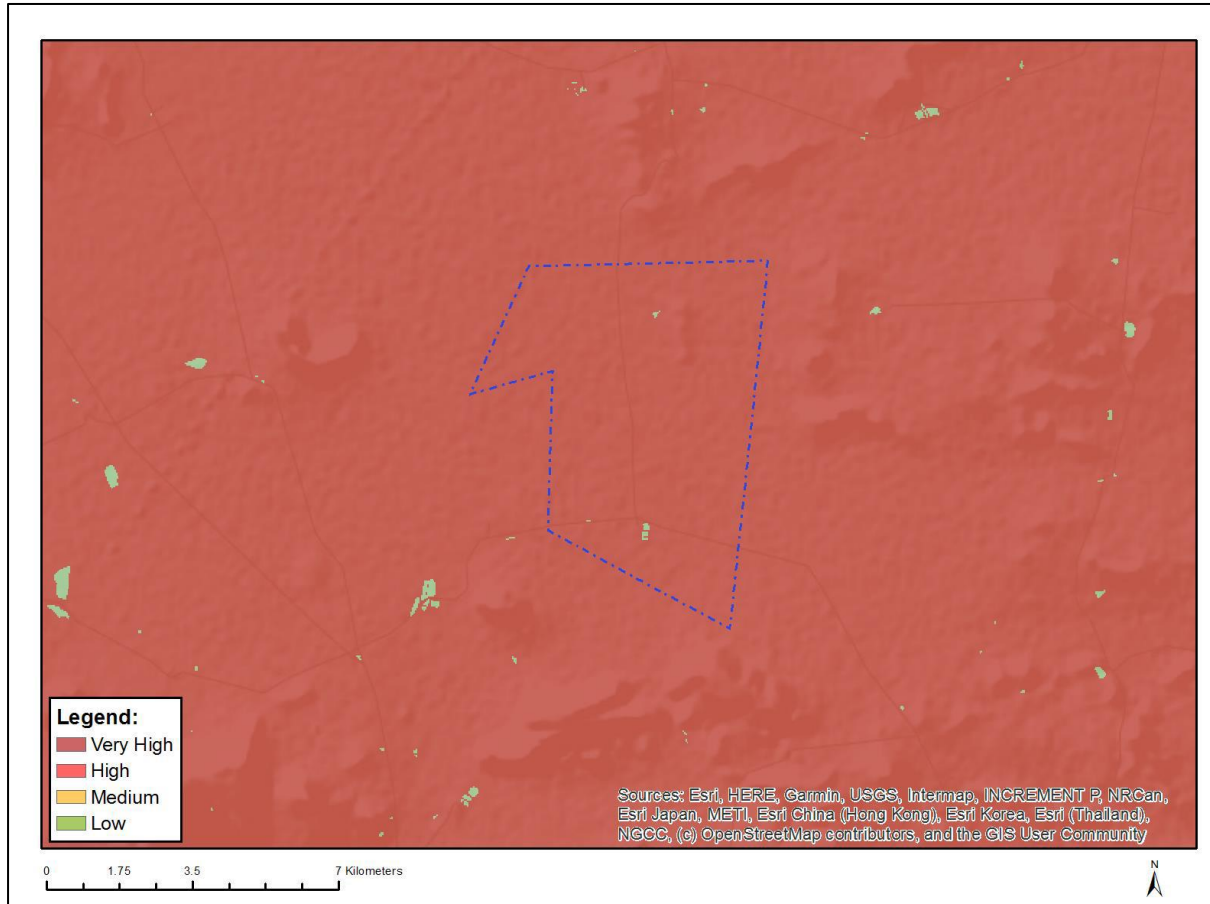


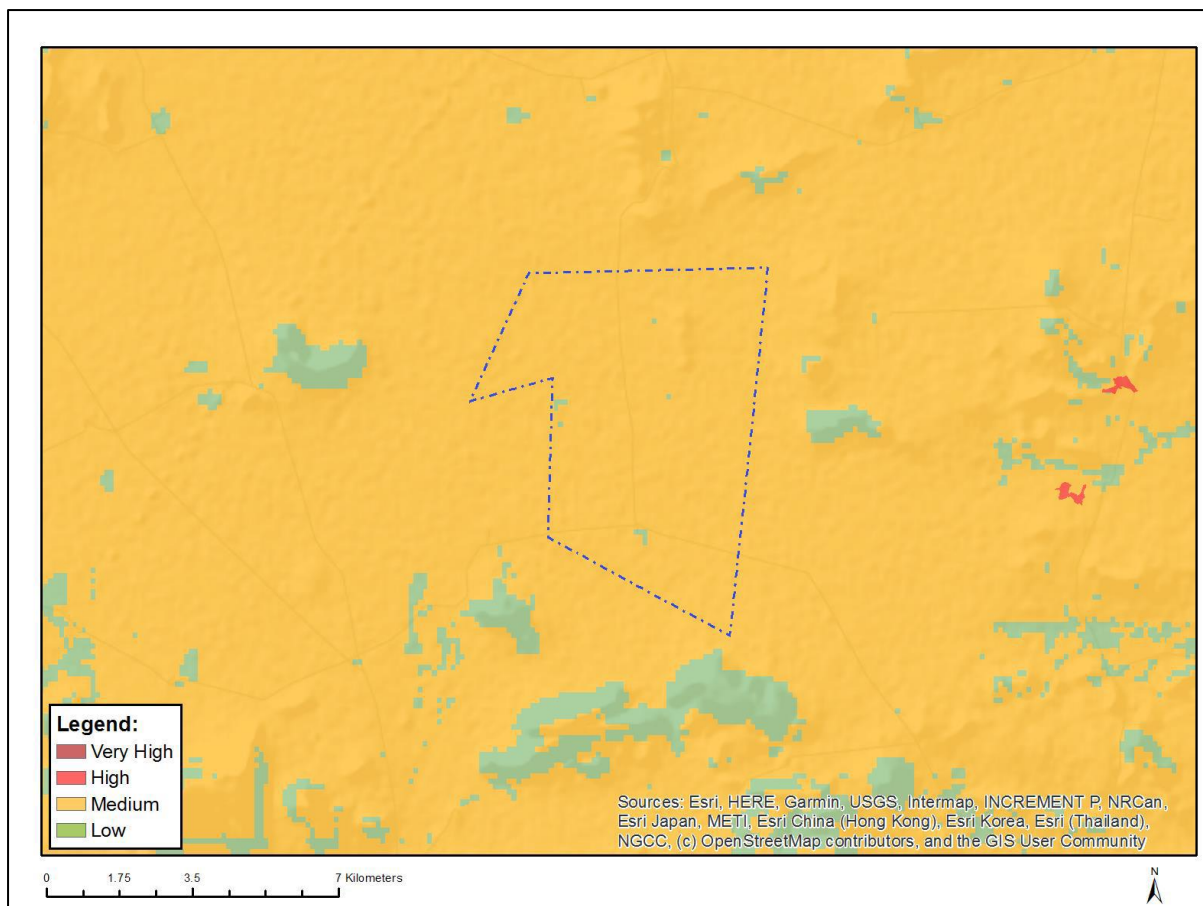
Figure 7-6 The avifauna habitats found in the project area

## 8 Site Sensitivity

The biodiversity theme sensitivity, as indicated in the screening report, was derived to be Very High, (Figure 8-1) while the fauna sensitivity was rated as 'Medium' (Figure 8-2). The very high terrestrial sensitivity was due to the and ESA1 status of the project area. The Medium fauna sensitivity is based on the likely occurrence of both Tawny Eagles and Ludwig's Bustards in the area. The terrestrial sensitivity from an avifauna perspective is confirmed, the animal sensitivity is disputed, it should be rated as high based on the high number of avifauna SCCs present.



**Figure 8-1** *Terrestrial Biodiversity Theme Sensitivity, National Web based Environmental Screening Tool*

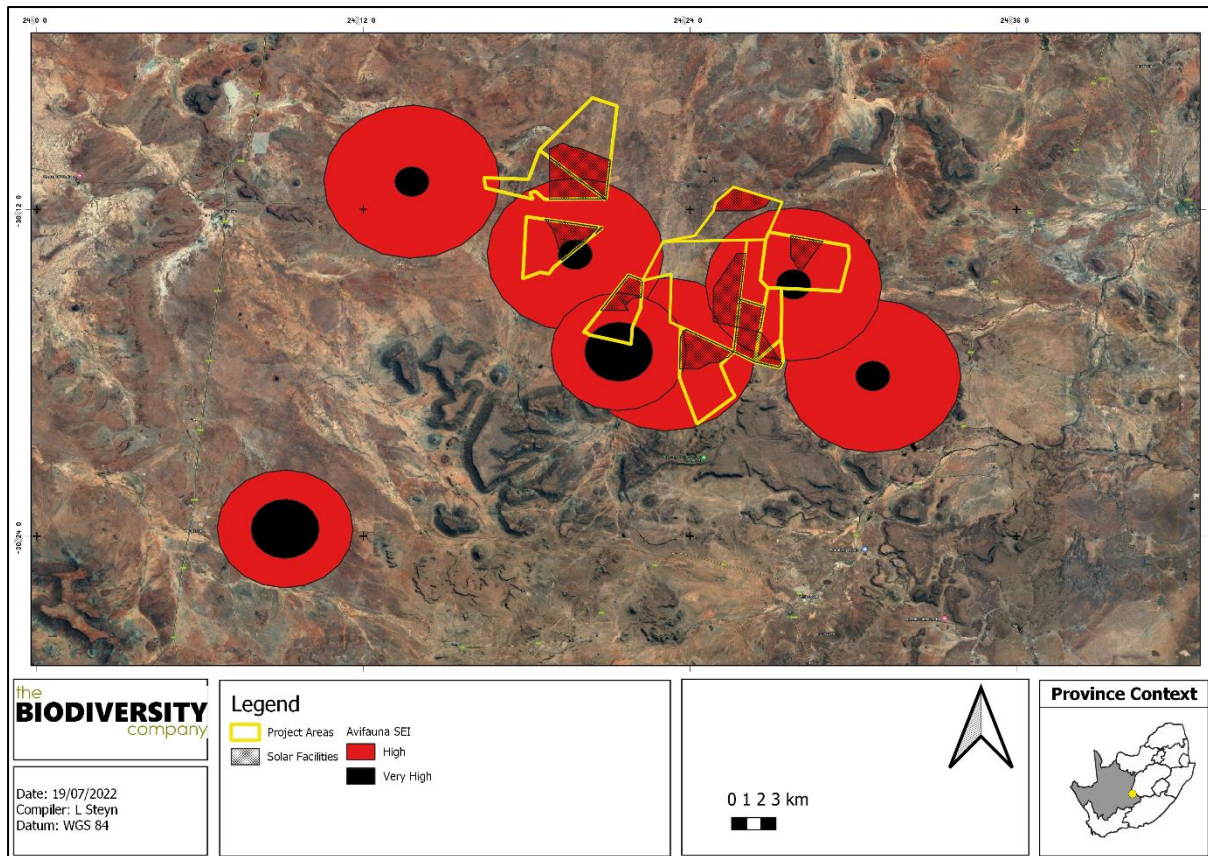


**Figure 8-2 Fauna Theme Sensitivity, National Web based Environmental Screening Tool**

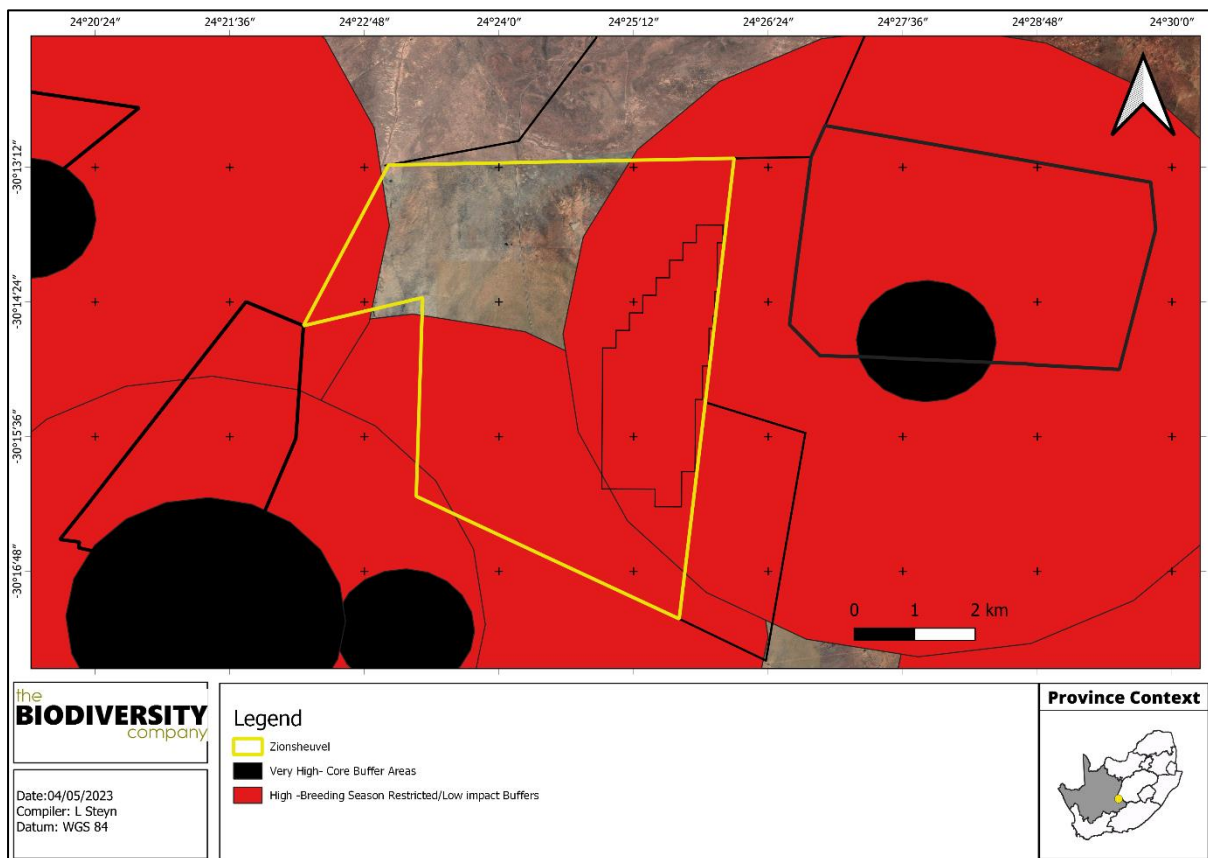
Sensitivities were compiled for the avifauna study based on the field results and desktop information. Based on the criteria provided in Section 4.3 of this report, all habitats within the assessment area of the proposed project were allocated a sensitivity category (Table 8-1). The sensitivities of the habitat types delineated are illustrated in Figure 8-3, the sensitivities specific to the Zionsheuel site is shown in Figure 8-4.. The Water resources and Nest buffers were given a very high sensitivity based on the low receptor resilience these areas and species will have to change. The Karoo scrubland and Karoo Grasslands all support a large number of SCCs (9 species), the biodiversity importance of these areas are thus high.

**Table 8-1 SEI Summary of habitat types delineated within field assessment area of project area**

Habitat	Conservation Importance	Functional Integrity	Biodiversity Importance	Receptor Resilience	Site Ecological Importance
Karoo grassland	High	High	High	Medium	High
Karoo scrubland	High	High	High	Medium	High
Water resources	High	High	High	Low	Very High
Nest buffers (Core)	High	High	High	Low	Very High
Nest Buffers (Outside)	High	High	High	Medium	High



**Figure 8-3 Avifauna sensitivities**



**Figure 8-4 Zionsheuvel Project area in relation to the buffer areas**

Interpretation of the SEI in the context of the proposed project is provided in Table 8-2.

**Table 8-2 Guidelines for interpreting Site Ecological Importance in the context of the proposed development activities**

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.

## 9 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 fragmentation 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:

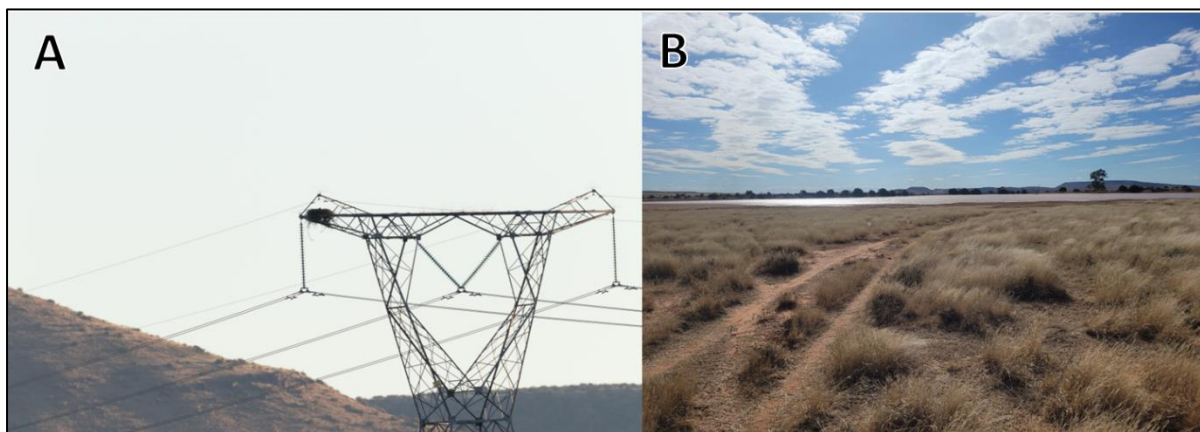
- Construction Phase;
- Operational Phase; and

- Closure/Rehabilitation Phase.

### 9.1 Current Impacts

The current impacts observed during the survey are listed below. Photographic evidence of a selection of these impacts is shown in Figure 9-1.

- Multiple high voltage powerlines;
- Grazing and trampling of natural vegetation by livestock;
- Farm roads and main roads (and associated traffic and wildlife road mortalities);
- Some alien vegetation species; and
- Fences.



**Figure 9-1** Some of the identified impacts within the project site; A) Powerlines and B) Farm roads.

### 9.2 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 principal 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.

### **9.2.1 Alternatives considered**

No alternative was provided.

### **9.2.2 Loss of Irreplaceable Resources**

- Loss of habitat and possible reduction in breeding success of SCCs;
- Loss of ESA; and
- Loss of IBA habitat.

### **9.3 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. The impact assessment is based on the development outside of the core nest buffer and does not consider development within the nest buffers as these areas are seen as a No-Go area. More mitigations can be seen in section 10.

#### **9.3.1 Construction Phase**

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

The following potential impacts were considered (Table 9-1 till Table 9-4):

- 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; and
- Loss and disruption of SCC nests.

**Table 9-1 Construction activities impacts on the avifauna**

<i>Nature:</i>		
Destruction, fragmentation and degradation of habitats;		
	Without mitigation	With mitigation
<b>Extent</b>	Regional (4)	Local (3)
<b>Duration</b>	Permanent (5)	Long term (4)
<b>Magnitude</b>	High (8)	High (8)
<b>Probability</b>	Definite (5)	Highly probable (4)
<b>Significance</b>	<b>High (85)</b>	<b>Medium (60)</b>
<b>Status (positive or negative)</b>	Negative	Negative
<b>Reversibility</b>	Low	High
<b>Irreplaceable loss of resources?</b>	Yes	Yes
<b>Can impacts be mitigated?</b>	To some extent, habitat will still be lost	

**Mitigation:**

- The loss of habitat in the project footprint cannot be negated but can be restricted to some extent. The loss of habitat 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 mitigations:
- 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.
- Nest Core Buffers must be regarded as no-go buffers and the seasonal buffers must be avoided from April- July.

**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.

**Table 9-2 Construction activities impacts on the avifauna**

**Nature:**

<b>Displacement of avifaunal community (Including several SCC) due to disturbance such as noise, light, dust, vibration</b>		
	<b>Without mitigation</b>	<b>With mitigation</b>
<b>Extent</b>	Regional (4)	Footprint and Surrounds (2)
<b>Duration</b>	Long term (4)	Short term (2)
<b>Magnitude</b>	High (8)	Minor (2)
<b>Probability</b>	Highly probable (4)	Improbable (2)
<b>Significance</b>	<b>High (64)</b>	<b>Low (12)</b>
<b>Status (positive or negative)</b>	Negative	Negative
<b>Reversibility</b>	Low	Low
<b>Irreplaceable loss of resources?</b>	Yes	Yes
<b>Can impacts be mitigated?</b>	Yes, but only to a limited extent. The mitigation of noise pollution during construction is difficult to mitigate against	
<b>Mitigation:</b>		
<ul style="list-style-type: none"> <li>Minimize disturbance impact by abbreviating construction time. Schedule the activities to avoid breeding and movement time.</li> <li>Ensure lights are kept to a minimum, lights must be red or green and not white to reduce confusion for nocturnal migrants. Lights should be placed so that they face downward onto working areas and not straight or upward to reduce the sky glow effect.</li> <li>Dust management need to be done in the areas where the vegetation will be removed, this includes wetting of the soil.</li> </ul>		
<b>Residual Impacts:</b>		
Displacement of endemic and SCC avifauna species.		

**Table 9-3 Construction activities impacts on the avifauna**

<b>Nature:</b>		
<b>Collection of eggs and poaching</b>		
	<b>Without mitigation</b>	<b>With mitigation</b>
<b>Extent</b>	Regional (4)	Footprint and surrounding areas (2)
<b>Duration</b>	Short term (2)	Short term (2)
<b>Magnitude</b>	Moderate (6)	Low (4)
<b>Probability</b>	Highly probable (4)	Improbable (2)
<b>Significance</b>	<b>Medium (48)</b>	<b>Low (16)</b>
<b>Status (positive or negative)</b>	Negative	Negative
<b>Reversibility</b>	Low	High
<b>Irreplaceable loss of resources?</b>	Yes	No
<b>Can impacts be mitigated?</b>	Yes	
<b>Mitigation:</b>		

- 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 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 9-4 Construction activities impacts on the avifauna**

<b>Nature:</b>		
<b>Roadkill</b>		
	Without mitigation	With mitigation
<b>Extent</b>	Local (3)	Footprint and Surrounding areas (2)
<b>Duration</b>	Short term (2)	Short term (2)
<b>Magnitude</b>	Moderate (6)	Minor (2)
<b>Probability</b>	Highly probable (4)	Improbable (2)
<b>Significance</b>	<b>Medium (44)</b>	<b>Low (12)</b>
<b>Status (positive or negative)</b>	Negative	Negative
<b>Reversibility</b>	Low	Low
<b>Irreplaceable loss of resources?</b>	Yes	No
<b>Can impacts be mitigated?</b>	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

**Table 9-5 Construction activities impacts on the avifauna**

<b>Nature:</b>		
<b>Loss and disruption of SCC nests</b>		
	Without mitigation	With mitigation
<b>Extent</b>	Very high (5)	Very low (1)
<b>Duration</b>	Permanent (5)	Very short term (1)
<b>Magnitude</b>	Very high (10)	None (0)
<b>Probability</b>	Highly probable (4)	Very improbable (1)
<b>Significance</b>	<b>High (80)</b>	<b>Low (2)</b>

<b>Status (positive or negative)</b>	Negative	Negative
<b>Reversibility</b>	Low	Low
<b>Irreplaceable loss of resources?</b>	Yes	No
<b>Can impacts be mitigated?</b>	Yes, but only if the nest buffers are treated as no go areas	
<b>Mitigation:</b>		
<ul style="list-style-type: none"> <li>If the nest buffers are not adhered to then this impact cannot be mitigated. The core area of 1 km surrounding nests must be treated as No-Go area, the additional areas must be avoided from April to July to avoid disturbing the species.</li> </ul>		
<b>Residual Impacts:</b>		
Nests can still be disturbed		

### 9.3.2 Operational Phase

The operational phase of the impact of daily activities is anticipated to lead to collisions and electrocutions. Moving vehicles do not 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 9-6 to Table 9-9):

- Collisions with PV panels, BESS, 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 9-6 Operational activities impacts on the avifauna**

<b>Nature:</b>		
<b>Collisions with PV panels, BESS, associated connection lines and fences</b>		
	Without mitigation	With mitigation
<b>Extent</b>	Regional (4)	Moderate (3)
<b>Duration</b>	Permanent (5)	Long term (4)
<b>Magnitude</b>	Very high (10)	Moderate (6)
<b>Probability</b>	Highly probable (4)	Probable (3)
<b>Significance</b>	<b>High (76)</b>	<b>Medium (39)</b>
<b>Status (positive or negative)</b>	Negative	Negative
<b>Reversibility</b>	Low	Low
<b>Irreplaceable loss of resources?</b>	Yes	No
<b>Can impacts be mitigated?</b>	Yes	
<b>Mitigation:</b>		
<ul style="list-style-type: none"> <li>Infrastructure should be consolidated where possible in order to minimise the amount of ground and air space used.</li> </ul>		

- White strips must be placed on the edge of the solar panels to reduce reflection and prevent collisions.
- If any connection lines are to be placed above ground, they must be marked with industry standard bird flight diverters.
- During the first year of operation quarterly reports, summarizing interim findings should be compiled 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.
- 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 9-7 Operational activities impacts on the avifauna**

**Nature:**

**Electrocution with solar plant connections**

	Without mitigation	With mitigation
<b>Extent</b>	Regional (4)	Footprint and Surrounding areas (2)
<b>Duration</b>	Long term (4)	Long term (4)
<b>Magnitude</b>	High (8)	Moderate (6)
<b>Probability</b>	Highly probable (4)	Improbable (2)
<b>Significance</b>	<b>High (64)</b>	<b>Low (24)</b>
<b>Status (positive or negative)</b>	Negative	Negative
<b>Reversibility</b>	Low	High
<b>Irreplaceable loss of resources?</b>	Yes	No
<b>Can impacts be mitigated?</b>	Yes	

**Mitigation:**

- Infrastructure should be consolidated where possible/practical in order to minimise the amount of ground and air space used.
- 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 compiled 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 9-8 Operational activities impacts on the avifauna**

**Nature:**

<b>Roadkill during maintenance procedures</b>		
	Without mitigation	With mitigation
<b>Extent</b>	Footprint & surrounding areas (2)	Footprint & surrounding areas (2)
<b>Duration</b>	Long term (4)	Long term (4)
<b>Magnitude</b>	Moderate (6)	Low (4)
<b>Probability</b>	Probable (3)	Improbable (2)
<b>Significance</b>	<b>Medium (36)</b>	<b>Low (20)</b>
<b>Status (positive or negative)</b>	Negative	Negative
<b>Reversibility</b>	Low	Low
<b>Irreplaceable loss of resources?</b>	Yes	No
<b>Can impacts be mitigated?</b>	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 9-9 Operational activities impacts on the avifauna**

<b>Nature:</b>		
<b>Habitat degradation and displacement of resident, visiting and breeding species (as well as SCCs) in areas affected by maintenance.</b>		
	Without mitigation	With mitigation
<b>Extent</b>	Regional (4)	Local (3)
<b>Duration</b>	Long term (4)	Short term (2)
<b>Magnitude</b>	High (8)	Moderate (6)
<b>Probability</b>	Highly probable (4)	Probable (3)
<b>Significance</b>	<b>High (64)</b>	<b>Medium (33)</b>
<b>Status (positive or negative)</b>	Negative	Negative
<b>Reversibility</b>	Low	Low
<b>Irreplaceable loss of resources?</b>	Yes	No
<b>Can impacts be mitigated?</b>	<b>No, the footprint has already been disturbed. The area surrounding the development can be mitigated to some extent</b>	

**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.

### 9.3.3 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 9-10 to Table 9-11):

- Continued fragmentation and degradation of habitats;
- Displacement of faunal community (including SCC) due disturbance (road collisions, noise, dust, vibration).

**Table 9-10 Decommissioning activities impacts on the avifauna**

<b>Nature:</b>		
<b>Continued fragmentation and degradation of habitats</b>		
	Without mitigation	With mitigation
<b>Extent</b>	Local (3)	Footprint and surrounding areas (2)
<b>Duration</b>	Short term (2)	Very short term (1)
<b>Magnitude</b>	High (8)	Minor (2)
<b>Probability</b>	Highly probable (4)	Very improbable (1)
<b>Significance</b>	<b>Medium (52)</b>	<b>Low (5)</b>
<b>Status (positive or negative)</b>	Negative	Negative
<b>Reversibility</b>	Low	Low
<b>Irreplaceable loss of resources?</b>	Yes	No
<b>Can impacts be mitigated?</b>	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 9-11 Decommissioning activities impacts on the avifauna**

<b>Nature:</b>		
<b>Displacement of faunal community (including SCC) due disturbance (road collisions, noise, dust, vibration).</b>		
	Without mitigation	With mitigation



<b>Extent</b>	Regional (4)	Local (3)
<b>Duration</b>	Short term (2)	Short term (2)
<b>Magnitude</b>	High (8)	Moderate (6)
<b>Probability</b>	Highly probable (4)	Improbable (2)
<b>Significance</b>	<b>Medium (56)</b>	<b>Low (22)</b>
<b>Status (positive or negative)</b>	Negative	Negative
<b>Reversibility</b>	Low	Low
<b>Irreplaceable loss of resources?</b>	Yes	No
<b>Can impacts be mitigated?</b>	Yes	

**Mitigation:**

- Minimize disturbance impact by abbreviating decommissioning 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 vehicles should adhere to clearly defined and demarcated roads. No off-road driving to be allowed outside of the decommissioning area.
- 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:**

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

## 9.4 Cumulative Impacts

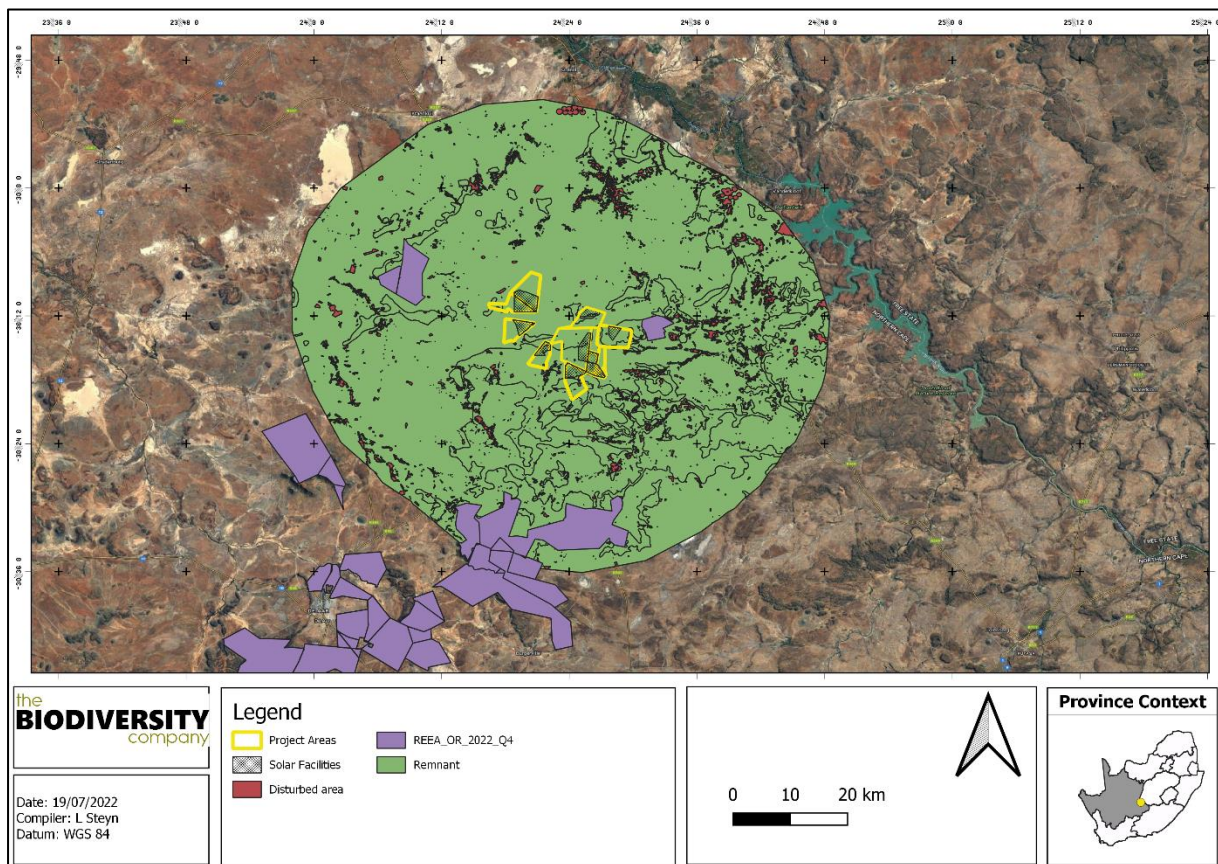
Cumulative impacts are assessed within the context of the extent of the proposed cluster project area, other developments and activities in the area (existing and proposed) and general habitat loss and disturbance resulting from any other anthropogenic activities in the area. The impacts of projects 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 or disturbance activities. This is similar to the concept of shifting baselines, which describes how the environmental baseline at a specific point in time may actually represent a significant change from the original state of the system. This section describes the potential cumulative impacts of the project on the local and regional avifauna community.

Localised cumulative impacts include those from operations that are close enough to potentially cause additive effects on the local environment or any sensitive receivers (such as nearby large road networks, other solar PV facilities, and power infrastructure). Relevant activities and impacts include dust deposition, noise and vibration, loss of corridors or habitat, disruption of waterways, groundwater drawdown, groundwater and surface water depletion, and transport activities. Long-term cumulative impacts associated with the site development activities can lead to the loss of endemic and threatened species, including natural habitat and vegetation types, and these impacts can even lead to the degradation of conserved areas such as the adjacent game parks and reserves.

A total area of 30 km surrounding the PAOI were used to assess the total habitat loss in the area and subsequently the cumulative impact. To determine the intact remnant habitat the NBA (2018) remnant spatial data was utilised. The future renewable energy projects were also considered by utilising the REEA Q4 (2022) spatial dataset. In order to remove any duplication, only the areas that overlap with the remanence areas were considered. The total cumulative loss was found to be 16.8% (Table 9-12), a visual representation of this is shown in Figure 9-2. Table 9-13 rates the cumulative impact as Low.

**Table 9-12 The cumulative impacts considered for avifauna**

Total Area of 30 km <sup>2</sup>	Intact Remnant Habitat	REEA area that does not overlap with disturbed areas	Total Disturbed/Transformed habitat	Percentage area lost
494454.44 Ha	460532.1 Ha	49369 Ha	83291.31 Ha	16.8%



**Figure 9-2 Map illustrating the additional renewable energy developments within the landscape overlaid onto the remnant vegetation types**

**Table 9-13 Cumulative impact of the solar facility**

**Nature:** : Cumulative habitat loss within the region

The development of the proposed infrastructure will contribute to cumulative habitat loss within ESAs and result in the loss of habitat for SCCs

	Project in isolation	Project with adjacent PV projects with associated infrastructure
<b>Extent</b>	Moderate (3)	High (4)
<b>Duration</b>	Permanent (5)	Permanent (5)
<b>Magnitude</b>	Moderate (6)	High (8)

<b>Probability</b>	Probable (3)	Probable (3)
<b>Significance</b>	<b>Medium (42)</b>	<b>Medium (51)</b>
<b>Status (positive or negative)</b>	Negative	Negative
<b>Reversibility</b>	None	None
<b>Irreplaceable loss of resources?</b>	Yes	Yes
<b>Can impacts be mitigated?</b>	No	

**Mitigation:**

Even though collisions can be mitigated to some extent for individual solar plants their combined densities will increase the rate of collisions. Monitoring of the implementation of mitigation measures needs to be done to ensure the cumulative impact does not become high.

**Residual Impacts:**

Loss of habitat for endemic and SCC. Loss of SCC due to collisions.

## 10 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 10-1 to Table 10-4 presents the recommended mitigation measures and the respective timeframes, targets, and performance indicators for the avifaunal study.

**Table 10-1 Mitigation measures including requirements for timeframes, roles and responsibilities for this report**

<b>OBJECTIVE: Minimise the habitat degradation of avifauna habitats</b>		
<b>Project component/s</b>	Impacts of the PV facility and roads on the avifauna habitat	
<b>Potential Impact</b>	Destruction, fragmentation and degradation of habitats	
<b>Activity/risk source</b>	Without mitigations: High (76) With mitigations: Medium (39)	
<b>Mitigation: Target/Objective</b>	Avoidance / minimisation of the disturbance and degradation of intact vegetation	
<b>Mitigation: Action/control</b>	<b>Responsibility</b>	<b>Timeframe</b>
<ul style="list-style-type: none"> <li>The loss of habitat in the project footprint cannot be negated but can be restricted to some extent. The loss of habitat will result in the loss of territory, feeding area, nesting sites and prey availability for numerous species.</li> <li>The habitat outside the footprint can be protected by implementing the following mitigations:</li> <li>Construction activity to only be within the project footprint and the area is to be well demarcated.</li> <li>Areas where vegetation has been cleared must be re-vegetated within local indigenous plant species.</li> <li>The affected area must be monitored for invasive plant encroachment and erosion and must be controlled.</li> <li>The use of laydown areas within the development footprint must be used, to avoid habitat loss and disturbance to adjoining areas.</li> <li>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.</li> <li>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.</li> <li>Rehabilitation of the disturbed areas existing in the project area must be made a priority. Topsoil must also be utilised,</li> </ul>	Project Manager, Environmental Officer	Construction and Operational Phase

<p>and any disturbed area must be re-vegetated with plant and grass species which are endemic to this vegetation type.</p> <ul style="list-style-type: none"> <li>• Erosion control and alien invasive management plan must be compiled.</li> <li>• A fire management plan needs to be compiled and implemented to restrict the impact fire might have on the surrounding areas.</li> <li>• Nest buffers core areas must be treated as no go areas.</li> </ul>		
<p><b>Performance Indicator</b></p>		<ul style="list-style-type: none"> <li>• Project footprint</li> <li>• Roads and path used.</li> <li>• Assess the state of rehabilitation and encroachment of alien vegetation.</li> <li>• Road edges and project site footprint</li> <li>• Erosion and alien invasive species</li> </ul>
<p><b>Monitoring</b></p>		<ul style="list-style-type: none"> <li>• Areas of indigenous vegetation</li> <li>• Nest buffers</li> </ul>

**Table 10-2 Mitigation measures including requirements for timeframes, roles and responsibilities for this report**

<p><b>OBJECTIVE: Minimise the displacement of avifaunal community (Including confirmed and possible SCC)</b></p>		
<p><b>Project component/s</b></p>	<p>Impacts of the PV facility and roads on the displacement of avifaunal community</p>	
<p><b>Potential Impact</b></p>	<p>Displacement of avifauna and disruption of breeding success of SCC</p>	
<p><b>Activity/risk source</b></p>	<p>Without mitigations: High (64) With mitigations: Low (12)</p>	
<p><b>Mitigation: Target/Objective</b></p>	<p>Avoidance / minimisation noise, light, vibration and dust disturbance Collection of eggs and poaching Avoid Roadkill</p>	
<p><b>Mitigation: Action/control</b></p>	<p><b>Responsibility</b></p>	<p><b>Timeframe</b></p>
<ul style="list-style-type: none"> <li>• Minimize disturbance impact by abbreviating construction time. Schedule the activities to avoid breeding and movement time.</li> <li>• Ensure lights are kept to a minimum, lights must be red or green and not white to reduce confusion for nocturnal migrants. Lights should be placed so that they face</li> </ul>	<p>Project Manager, Environmental Officer, Avifauna specialist</p>	<p>Duration of project</p>

<p>downward onto working areas and not straight or upward to reduce the sky glow effect.</p> <ul style="list-style-type: none"> <li>• Dust management need to be done in the areas where the vegetation will be removed, this includes wetting of the soil.</li> <li>• Environmentally friendly dust suppressants need to be utilised.</li> <li>• The BESS must be enclosed, and the outside surface must be non-reflective to ensure fire is not a risk and that bird collisions does not take place.</li> <li>• 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.</li> <li>• Signs must be put up stating that should any person be found poaching any species they will be fined.</li> <li>• All construction vehicles should adhere to clearly defined and demarcated roads. No off-road driving to be allowed outside of the construction area.</li> <li>• 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.</li> </ul>		
<p><b>Performance Indicator</b></p>		<ul style="list-style-type: none"> <li>• Signs must be put up.</li> <li>• Remove any trapping devices and report illegal poaching to authorities.</li> <li>• Implement speed limit to avoid roadkill and dust.</li> <li>• Bird species identification training</li> </ul>
<p><b>Monitoring</b></p>		<ul style="list-style-type: none"> <li>• Continuously monitor noise, light, vibration and dust disturbance.</li> <li>• Monitor Avifauna communities around the proposed footprint.</li> </ul>

**Table 10-3 Mitigation measures including requirements for timeframes, roles and responsibilities for this report**

OBJECTIVE: Minimise collisions with the proposed project infrastructure		
Project component/s	PV panels, associated power lines and connection lines and fences	
Potential Impact	Mortality and severe injuries	
Activity/risk source	Without mitigations: High (80) With mitigations: Medium (39)	
Mitigation: Target/Objective	Avoidance / minimisation of collision with the proposed project infrastructure.	
Mitigation: Action/control	Responsibility	Timeframe
<ul style="list-style-type: none"> <li>Infrastructure should be consolidated where possible in order to minimise the amount of ground and air space used.</li> <li>White strips must be placed on the edge of the solar panels to reduce reflection and prevent collisions.</li> <li>If any connection lines are to be placed above ground, they must be marked with industry standard bird flight diverters.</li> <li>Fencing mitigations:                             <ul style="list-style-type: none"> <li>Top 2 strands must be smooth wire</li> <li>Routinely retention loose wires</li> <li>Minimum 30cm between wires</li> <li>Place markers on fences</li> </ul> </li> </ul>	Project Manager, Environmental Officer, Avifauna specialist	Duration of project
Performance Indicator	<ul style="list-style-type: none"> <li>Number of collision mitigation installed.</li> <li>Annual walk transects to determine any fatalities.</li> <li>Fence maintenance done regularly</li> </ul>	
Monitoring	<ul style="list-style-type: none"> <li>Annual monitoring.</li> </ul>	

**Table 10-4 Mitigation measures including requirements for timeframes, roles and responsibilities for this report**

OBJECTIVE: Minimise electrocution risk		
Project component/s	Connection lines, infrastructure and fences	
Potential Impact	Mortality and severe injuries	
Activity/risk source	Without mitigations: High (64) With mitigations: Low (24)	
Mitigation: Target/Objective	Avoidance / minimisation the number of electrocution with the proposed project infrastructure.	
Mitigation: Action/control	Responsibility	Timeframe

<ul style="list-style-type: none"> <li>• Infrastructure should be consolidated where possible/practical in order to minimise the amount of ground and air space used.</li> <li>• All the parts of the infrastructure must be nest proofed and anti-perch devices placed on areas that can lead to electrocution.</li> <li>• As far as possible power cables within the project area should be thoroughly insulated and preferably buried.</li> </ul>	<p>Project Manager, Environmental Officer, Avifauna specialist</p>	<p>Duration of the project</p>
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**Performance Indicator**

- Number of bird guards and insulation installed.
- Annual walk transects to determine any fatalities.

<p><b>Monitoring</b></p>	<ul style="list-style-type: none"> <li>• Annual monitoring.</li> <li>• An Avifauna Monitoring Management Plan must be implemented with follow-ups of at least two visits per year for four years. However, thereafter annual checks need to be conducted on the condition of the mitigations and needs to be replaced if damaged. The monitoring will be conducted over a period of four years, which will include two annual walk transects along the proposed fence line and around the infrastructure to look at the effectiveness of these mitigations. The location, identity and number of all electrocution and/or collision casualties found must be recorded.</li> <li>• During the first year of operation quarterly reports, summarizing interim findings should be compiled 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.</li> </ul>
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**11 Monitoring**

A follow-up assessment on avian biodiversity and species abundance within the assessment area and surrounding areas must be conducted within one year after the facility has been in operation and should be repeated every 3-5 years. Information obtained from the monitoring must be provided to BirdLife Renewable Energy Programme on [energy@birdlife.org.za](mailto:energy@birdlife.org.za). The data must be presented as described in Jenkins *et al.*, 2017. Nest monitoring must be done for 4 years as suggested by Birdlife South Africa (Birdlife, 2021) and the details along with the land owner details must be provided to Birdlife South Africa. On completion of each annual period the data can be reviewed to determine the necessity to continue monitoring. Table 11-1 lists monitoring guidelines to be followed.



**Table 11-1 Monitoring guidelines**

Avian group	Survey Type	Survey objective	Timing
Raptor and larger ground birds	Drive transect & Incidental	To evaluate the population size To determine the abundance of the species and their use of habitat types To determine the effect of the PV on these species	Timing must overlap with birds breeding season as well as for migratory visitors
Passerines	Point Counts	Point count gives you a good representation of the species diversity and distribution throughout the various habitats. Also allows for an understanding of the impact of the PV on the various habitats.	Summer survey must be performed.
All species, but more specifically Secretarybird and Verreauxs Eagle	Nest monitoring	To ensure the breeding patterns and attempts are not interrupted or discontinued nest monitoring will be done from a distance with binoculars.	During the breeding season

## 12 Conclusion

During the first field assessment 124 bird species were recorded within the larger cluster area of which seven are SCCs on a national or international scale. Kori Bustard (*Ardeotis kori*) (NT Regional, NT International); Verreaux's Eagle (*Aquila verreauxii*) (VU, LC); Blue Crane (*Grus paradisea*) (NT, VU); Secretarybird (*Sagittarius serpentarius*) (EN, EN); Tawny Eagle (*Aquila rapax*) (EN, VU); Black Harrier (*Circus maurus*) (EN, EN) and Blue Korhaan (*Eupodotis caerulescens*) (LC, NT). During the second survey 109 species were recorded, the same group of SCCs were again observed with the addition of the Karoo Korhaan (*Eupodotis vigorsii*) (NT, LC) and Lanner Falcon (*Falco biarmicus*) (VU; NT).

Three active Verreauxs Eagle nests were observed and an additional two inactive nests were also noted. Two active Secretarybird nests were also found. As per the Species Environmental Assessment Guidelines (2020) a core area of 1 km surrounding the nests must be treated as a no-go area, an additional area of 5.2 km was also placed around the nest as per the Birdlife Verreaux's Eagle and Wind Farms Guidelines (2021). This 5.2 km area is based on the average home range of the Verreaux Eagle during the breeding season, and as such this area must be avoided during the breeding season of the species which stretches from April to July to avoid disturbing the species. As per the guidelines buffers were also placed around the inactive nests. For the Secretarybird nests a 4 km buffer were placed around the nests, 2 km must be treated as no go, while the other 2 km must be low impact development (pers comms Birdlife, 2022).

Apart from the disruption of the nests, habitat loss, collisions and electrocutions are regarded as the main impacts. Should the mitigations, monitoring and avoidance guidelines be followed the impacts can be reduced to a Moderate-Low level.

### 12.1 Impact Statement

- The development within the area of the nest core buffers is regarded as a fatal flaw<sup>1</sup> and no development is to be allowed in these areas.
- In the seasonal/low impact buffer areas construction is permitted, however must be considered with caution based on the high number of species of conservation concern and 'risk' species present. It is recommended that should development take place in the seasonal/low impact buffers that the rest of the property remain undeveloped.

<sup>1</sup> **Fatal flaw** – in the context of EIA, is a problem, issue or conflict (real or perceived) that could result in the application for a proposed development being rejected or modified by the competent authority. When related to biodiversity, a fatal flaw is usually due to an anticipated impact that would result in irreplaceable and / or irreversible loss of biodiversity (Species Protocols, 2020).

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## 14 Appendix Items

### 14.1 Appendix A: Specialist Declaration of Independence

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

Biodiversity Specialist

The Biodiversity Company

April 2023

## 14.2 Appendix B: Expected species

Species	Common Name	Conservation Status	
		Regional (SANBI, 2016)	IUCN (2021)
<i>Acridotheres tristis</i>	Myna, Common	Unlisted	LC
<i>Acrocephalus arundinaceus</i>	Reed-warbler, Great	Unlisted	LC
<i>Acrocephalus baeticatus</i>	Reed-warbler, African	Unlisted	Unlisted
<i>Acrocephalus gracillirostris</i>	Swamp-warbler, Lesser	Unlisted	LC
<i>Acrocephalus schoenobaenus</i>	Warbler, Sedge	Unlisted	LC
<i>Actitis hypoleucos</i>	Sandpiper, Common	Unlisted	LC
<i>Afrotis afraoides</i>	Korhaan, Northern Black	Unlisted	LC
<i>Alopochen aegyptiaca</i>	Goose, Egyptian	Unlisted	LC
<i>Amadina erythrocephala</i>	Finch, Red-headed	Unlisted	LC
<i>Anas capensis</i>	Teal, Cape	Unlisted	LC
<i>Anas erythrorhyncha</i>	Teal, Red-billed	Unlisted	LC
<i>Anas sparsa</i>	Duck, African Black	Unlisted	LC
<i>Anas undulata</i>	Duck, Yellow-billed	Unlisted	LC
<i>Anhinga rufa</i>	Darter, African	Unlisted	LC
<i>Anthoscopus minutus</i>	Penduline-tit, Cape	Unlisted	LC
<i>Anthus cinnamomeus</i>	Pipit, African	Unlisted	LC
<i>Anthus crenatus</i>	Pipit, African Rock	NT	NT
<i>Anthus leucophrys</i>	Pipit, Plain-backed	Unlisted	LC
<i>Anthus nicholsoni</i>	Nicholson's pipit	Unlisted	LC
<i>Anthus nicholsoni</i>	Nicholson's pipit	Unlisted	LC
<i>Apus affinis</i>	Swift, Little	Unlisted	LC
<i>Apus apus</i>	Swift, Common	Unlisted	LC
<i>Apus barbatus</i>	Swift, African Black	Unlisted	LC
<i>Apus bradfieldi</i>	Swift, Bradfield's	Unlisted	LC
<i>Apus caffer</i>	Swift, White-rumped	Unlisted	LC
<i>Apus horus</i>	Swift, Horus	Unlisted	LC
<i>Aquila verreauxii</i>	Eagle, Verreaux's	VU	LC
<i>Ardea alba</i>	Egret, Great	Unlisted	LC
<i>Ardea cinerea</i>	Heron, Grey	Unlisted	LC
<i>Ardea goliath</i>	Heron, Goliath	Unlisted	LC
<i>Ardea intermedia</i>	Egret, Yellow-billed (Intermediate)	Unlisted	LC
<i>Ardea melanocephala</i>	Heron, Black-headed	Unlisted	LC
<i>Ardea purpurea</i>	Heron, Purple	Unlisted	LC
<i>Batis pririt</i>	Batis, Pririt	Unlisted	LC
<i>Bostrychia hagedash</i>	Ibis, Hageda	Unlisted	LC
<i>Bradypterus baboecala</i>	Rush-warbler, Little	Unlisted	LC

<i>Brunhilda erythronotos</i>	Waxbill, Black Cheeked	Unlisted	LC
<i>Bubo africanus</i>	Eagle-owl, Spotted	Unlisted	LC
<i>Bubulcus ibis</i>	Egret, Cattle	Unlisted	LC
<i>Burhinus capensis</i>	Thick-knee, Spotted	Unlisted	LC
<i>Buteo buteo</i>	Buzzard, Common (Steppe)	Unlisted	LC
<i>Buteo rufofuscus</i>	Buzzard, Jackal	Unlisted	LC
<i>Calandrella cinerea</i>	Lark, Red-capped	Unlisted	LC
<i>Calendulauda africanoides</i>	Lark, Fawn-coloured	Unlisted	LC
<i>Calendulauda sabota</i>	Lark, Sabota	Unlisted	LC
<i>Calidris pugnax</i>	Ruff	Unlisted	LC
<i>Campethera abingoni</i>	Woodpecker, Golden-tailed	Unlisted	LC
<i>Caprimulgus pectoralis</i>	Nightjar, Fiery-necked	Unlisted	LC
<i>Caprimulgus rufigena</i>	Nightjar, Rufous-cheeked	Unlisted	LC
<i>Cecropis cucullata</i>	Swallow, Greater Striped	Unlisted	LC
<i>Cecropis semirufa</i>	Swallow, Red-breasted	Unlisted	LC
<i>Centropus burchellii</i>	Coucal, Burchell's	Unlisted	Unlisted
<i>Cercotrichas coryphoeus</i>	Scrub-robin, Karoo	Unlisted	LC
<i>Cercotrichas paena</i>	Scrub-robin, Kalahari	Unlisted	LC
<i>Certhilauda semitorquata</i>	Lark, Eastern Long-billed	Unlisted	LC
<i>Certhilauda subcoronata</i>	Lark, Karoo Long-billed	Unlisted	LC
<i>Ceryle rudis</i>	Kingfisher, Pied	Unlisted	LC
<i>Charadrius hiaticula</i>	Plover, Common Ringed	Unlisted	LC
<i>Charadrius pecuarius</i>	Plover, Kittlitz's	Unlisted	LC
<i>Charadrius tricollaris</i>	Plover, Three-banded	Unlisted	LC
<i>Chersomanes albofasciata</i>	Lark, Spike-heeled	Unlisted	LC
<i>Chlidonias hybrida</i>	Tern, Whiskered	Unlisted	LC
<i>Chrysococcyx caprius</i>	Cuckoo, Diderick	Unlisted	LC
<i>Chrysococcyx klaas</i>	Cuckoo, Klaas's	Unlisted	LC
<i>Ciconia abdimii</i>	Stork, Abdim's	NT	LC
<i>Ciconia ciconia</i>	Stork, White	Unlisted	LC
<i>Cinnyris fuscus</i>	Sunbird, Dusky	Unlisted	LC
<i>Cisticola aridulus</i>	Cisticola, Desert	Unlisted	LC
<i>Cisticola fulvicapilla</i>	Neddicky, Neddicky	Unlisted	LC
<i>Cisticola juncidis</i>	Cisticola, Zitting	Unlisted	LC
<i>Cisticola subruficapilla</i>	Cisticola, Grey-backed	Unlisted	LC
<i>Cisticola textrix</i>	Cisticola, Cloud	Unlisted	LC
<i>Cisticola tinniens</i>	Cisticola, Levallant's	Unlisted	LC
<i>Colius colius</i>	Mousebird, White-backed	Unlisted	LC
<i>Colius striatus</i>	Mousebird, Speckled	Unlisted	LC

<i>Columba guinea</i>	Pigeon, Speckled	Unlisted	LC
<i>Columba livia</i>	Dove, Rock	Unlisted	LC
<i>Corvus albicollis</i>	Raven, White-necked	Unlisted	LC
<i>Corvus albus</i>	Crow, Pied	Unlisted	LC
<i>Corythornis cristatus</i>	Kingfisher, Malachite	Unlisted	Unlisted
<i>Cossypha caffra</i>	Robin-chat, Cape	Unlisted	LC
<i>Creatophora cinerea</i>	Starling, Wattled	Unlisted	LC
<i>Crithagra albogularis</i>	White-throated Canary	LC	LC
<i>Crithagra atrogularis</i>	Canary, Black-throated	Unlisted	LC
<i>Crithagra flaviventris</i>	Canary, Yellow	Unlisted	LC
<i>Curruca layardi</i>	Tit-Babbler, Layard's	Unlisted	LC
<i>Curruca subcoerulea</i>	Tit-babbler, Chestnut-vented	Unlisted	Unlisted
<i>Cursorius rufus</i>	Cursorer, Burchell's	VU	LC
<i>Cypsiurus parvus</i>	Palm-swift, African	Unlisted	LC
<i>Delichon urbicum</i>	House-martin, Common	Unlisted	LC
<i>Dendrocygna viduata</i>	Duck, White-faced Whistling	Unlisted	LC
<i>Dendropicops fuscescens</i>	Woodpecker, Cardinal	Unlisted	LC
<i>Dicrurus adsimilis</i>	Drongo, Fork-tailed	Unlisted	LC
<i>Egretta garzetta</i>	Egret, Little	Unlisted	LC
<i>Elanus caeruleus</i>	Kite, Black-shouldered	Unlisted	LC
<i>Emarginata schlegelii</i>	Chat, Karoo	Unlisted	LC
<i>Emarginata sinuata</i>	Chat, Sickle-winged	Unlisted	LC
<i>Emberiza capensis</i>	Bunting, Cape	Unlisted	LC
<i>Emberiza impetuani</i>	Bunting, Lark-like	Unlisted	LC
<i>Emberiza tahapisi</i>	Bunting, Cinnamon-breasted	Unlisted	LC
<i>Eremomela icteropygialis</i>	Eremomela, Yellow-bellied	Unlisted	LC
<i>Eremopterix verticalis</i>	Sparrowlark, Grey-backed	Unlisted	LC
<i>Estrilda astrild</i>	Waxbill, Common	Unlisted	LC
<i>Euplectes afer</i>	Bishop, Yellow-crowned	Unlisted	LC
<i>Euplectes orix</i>	Bishop, Southern Red	Unlisted	LC
<i>Eupodotis vigorsii</i>	Korhaan, Karoo	NT	LC
<i>Falco biarmicus</i>	Falcon, Lanner	VU	LC
<i>Falco naumanni</i>	Kestrel, Lesser	Unlisted	LC
<i>Falco peregrinus</i>	Falcon, Peregrine	Unlisted	LC
<i>Falco rupicoloides</i>	Kestrel, Greater	Unlisted	LC
<i>Falco rupicolus</i>	Kestrel, Rock	Unlisted	LC
<i>Fulica cristata</i>	Coot, Red-knobbed	Unlisted	LC
<i>Galerida magnirostris</i>	Lark, Large-billed	Unlisted	LC
<i>Gallinula chloropus</i>	Moorhen, Common	Unlisted	LC

<i>Granatina granatina</i>	Waxbill, Violet-eared	Unlisted	LC
<i>Grus paradisea</i>	Crane, Blue	NT	VU
<i>Halcyon albibentris</i>	Kingfisher, Brown-hooded	Unlisted	LC
<i>Haliaeetus vocifer</i>	Fish-eagle, African	Unlisted	LC
<i>Hieraaetus pennatus</i>	Eagle, Booted	Unlisted	LC
<i>Himantopus himantopus</i>	Stilt, Black-winged	Unlisted	LC
<i>Hirundo albigularis</i>	Swallow, White-throated	Unlisted	LC
<i>Hirundo dimidiata</i>	Swallow, Pearl-breasted	Unlisted	LC
<i>Hirundo rustica</i>	Swallow, Barn	Unlisted	LC
<i>Indicator indicator</i>	Honeyguide, Greater	Unlisted	LC
<i>Indicator minor</i>	Honeyguide, Lesser	Unlisted	LC
<i>Lagonosticta senegala</i>	Firefinch, Red-billed	Unlisted	LC
<i>Lamprotornis bicolor</i>	Starling, Pied	Unlisted	LC
<i>Lamprotornis nitens</i>	Starling, Cape Glossy	Unlisted	LC
<i>Lanius collaris</i>	Fiscal, Common (Southern)	Unlisted	LC
<i>Lanius collurio</i>	Shrike, Red-backed	Unlisted	LC
<i>Lanius minor</i>	Shrike, Lesser Grey	Unlisted	LC
<i>Lophoceros nasutus</i>	Hornbill, African Grey	Unlisted	LC
<i>Malcorus pectoralis</i>	Warbler, Rufous-eared	Unlisted	LC
<i>Megaceryle maxima</i>	Kingfisher, Giant	Unlisted	Unlisted
<i>Melaenornis infuscatus</i>	Flycatcher, Chat	Unlisted	LC
<i>Melaenornis silens</i>	Flycatcher, Fiscal	Unlisted	LC
<i>Melaniparus afer</i>	Tit, Grey	Unlisted	Unlisted
<i>Melaniparus cinerascens</i>	Tit, Ashy	Unlisted	LC
<i>Melierax canorus</i>	Goshawk, Southern Pale Chanting	Unlisted	LC
<i>Merops apiaster</i>	Bee-eater, European	Unlisted	LC
<i>Merops bullockoides</i>	Bee-eater, White-fronted	Unlisted	LC
<i>Merops hirundineus</i>	Bee-eater, Swallow-tailed	Unlisted	LC
<i>Microcarbo africanus</i>	Cormorant, Reed	Unlisted	LC
<i>Micronisus gabar</i>	Goshawk, Gabar	Unlisted	LC
<i>Mirafra fasciolata</i>	Lark, Eastern Clapper	Unlisted	LC
<i>Monticola brevipes</i>	Rock-thrush, Short-toed	Unlisted	LC
<i>Motacilla aguimp</i>	Wagtail, African Pied	Unlisted	LC
<i>Motacilla capensis</i>	Wagtail, Cape	Unlisted	LC
<i>Muscicapa striata</i>	Flycatcher, Spotted	Unlisted	LC
<i>Myrmecocichla formicivora</i>	Chat, Anteating	Unlisted	LC
<i>Myrmecocichla monticola</i>	Wheatear, Mountain	Unlisted	LC
<i>Neotis ludwigii</i>	Bustard, Ludwig's	EN	EN
<i>Nilaus afer</i>	Brubru	Unlisted	LC

<i>Numida meleagris</i>	Guineafowl, Helmeted	Unlisted	LC
<i>Nycticorax nycticorax</i>	Night-Heron, Black-crowned	Unlisted	LC
<i>Oena capensis</i>	Dove, Namaqua	Unlisted	LC
<i>Oenanthe familiaris</i>	Chat, Familiar	Unlisted	LC
<i>Oenanthe pileata</i>	Wheatear, Capped	Unlisted	LC
<i>Onychognathus morio</i>	Starling, Red-winged	Unlisted	LC
<i>Onychognathus nabouroup</i>	Starling, Pale-winged	Unlisted	LC
<i>Ortygospiza atricollis</i>	Quailfinch, African	Unlisted	LC
<i>Pandion haliaetus</i>	Osprey, Osprey	Unlisted	LC
<i>Passer diffusus</i>	Sparrow, Southern Grey-headed	Unlisted	LC
<i>Passer domesticus</i>	Sparrow, House	Unlisted	LC
<i>Passer melanurus</i>	Sparrow, Cape	Unlisted	LC
<i>Pavo cristatus</i>	Peacock, Common	Unlisted	LC
<i>Petrochelidon spilodera</i>	Cliff-swallow, South African	Unlisted	LC
<i>Phalacrocorax lucidus</i>	Cormorant, White-breasted	Unlisted	LC
<i>Phoeniconaias minor</i>	Flamingo, Lesser	NT	NT
<i>Phoenicopterus roseus</i>	Flamingo, Greater	NT	LC
<i>Phoeniculus purpureus</i>	Wood-hoopoe, Green	Unlisted	LC
<i>Phragmacia substriata</i>	Warbler, Namaqua	Unlisted	Unlisted
<i>Phylloscopus trochilus</i>	Warbler, Willow	Unlisted	LC
<i>Platalea alba</i>	Spoonbill, African	Unlisted	LC
<i>Plectropterus gambensis</i>	Goose, Spur-winged	Unlisted	LC
<i>Plegadis falcinellus</i>	Ibis, Glossy	Unlisted	LC
<i>Plocepasser mahali</i>	Sparrow-weaver, White-browed	Unlisted	LC
<i>Ploceus velatus</i>	Masked-weaver, Southern	Unlisted	LC
<i>Podiceps cristatus</i>	Grebe, Great Crested	Unlisted	LC
<i>Polyboroides typus</i>	Harrier-Hawk, African	Unlisted	LC
<i>Prinia flavicans</i>	Prinia, Black-chested	Unlisted	LC
<i>Prinia maculosa</i>	Prinia, Karoo	Unlisted	LC
<i>Pternistis swainsonii</i>	Spurfowl, Swainson's	Unlisted	LC
<i>Pterocles namaqua</i>	Sandgrouse, Namaqua	Unlisted	LC
<i>Ptyonoprogne fuligula</i>	Martin, Rock	Unlisted	Unlisted
<i>Pycnonotus nigricans</i>	Bulbul, African Red-eyed	Unlisted	LC
<i>Quelea quelea</i>	Quelea, Red-billed	Unlisted	LC
<i>Rallus caerulescens</i>	Rail, African	Unlisted	LC
<i>Recurvirostra avosetta</i>	Avocet, Pied	Unlisted	LC
<i>Rhinopomastus cyanomelas</i>	Scimitarbill, Common	Unlisted	LC
<i>Rhinoptilus africanus</i>	Courser, Double-banded	Unlisted	LC
<i>Riparia paludicola</i>	Martin, Brown-throated	Unlisted	LC



<i>Riparia riparia</i>	Martin, Sand	Unlisted	LC
<i>Sagittarius serpentarius</i>	Secretarybird	VU	EN
<i>Saxicola torquatus</i>	Stonechat, African	Unlisted	LC
<i>Scleroptila afra</i>	Francolin, Grey-winged	Unlisted	LC
<i>Scleroptila gutturalis</i>	Francolin, Orange River	Unlisted	LC
<i>Scopus umbretta</i>	Hamerkop, Hamerkop	Unlisted	LC
<i>Serinus alario</i>	Canary, Black-headed	Unlisted	LC
<i>Spatula smithii</i>	Shoveler, Cape	Unlisted	LC
<i>Spilopelia senegalensis</i>	Dove, Laughing	Unlisted	LC
<i>Sporopipes squamifrons</i>	Finch, Scaly-feathered	Unlisted	LC
<i>Stenostira scita</i>	Flycatcher, Fairy	Unlisted	LC
<i>Streptopelia capicola</i>	Turtle-dove, Cape	Unlisted	LC
<i>Streptopelia semitorquata</i>	Dove, Red-eyed	Unlisted	LC
<i>Struthio camelus</i>	Ostrich, Common	Unlisted	LC
<i>Sturnus vulgaris</i>	Starling, Common	Unlisted	LC
<i>Sylvietta rufescens</i>	Crombec, Long-billed	Unlisted	LC
<i>Tachybaptus ruficollis</i>	Grebe, Little	Unlisted	LC
<i>Tachymarpis melba</i>	Swift, Alpine	Unlisted	LC
<i>Tadorna cana</i>	Shelduck, South African	Unlisted	LC
<i>Tchagra australis</i>	Tchagra, Brown-crowned	Unlisted	LC
<i>Telophorus zeylonus</i>	Bokmakierie, Bokmakierie	Unlisted	LC
<i>Terpsiphone viridis</i>	Paradise-flycatcher, African	Unlisted	LC
<i>Threskiornis aethiopicus</i>	Ibis, African Sacred	Unlisted	LC
<i>Trachyphonus vaillantii</i>	Barbet, Crested	Unlisted	LC
<i>Tricholaema leucomelas</i>	Barbet, Acacia Pied	Unlisted	LC
<i>Tringa glareola</i>	Sandpiper, Wood	Unlisted	LC
<i>Tringa nebularia</i>	Greenshank, Common	Unlisted	LC
<i>Tringa stagnatilis</i>	Sandpiper, Marsh	Unlisted	LC
<i>Turdus smithi</i>	Thrush, Karoo	Unlisted	LC
<i>Turnix sylvaticus</i>	Buttonquail, Kurrichane	Unlisted	LC
<i>Tyto alba</i>	Owl, Barn	Unlisted	LC
<i>Upupa africana</i>	Hoopoe, African	Unlisted	LC
<i>Urocolius indicus</i>	Mousebird, Red-faced	Unlisted	LC
<i>Vanellus armatus</i>	Lapwing, Blacksmith	Unlisted	LC
<i>Vanellus coronatus</i>	Lapwing, Crowned	Unlisted	LC
<i>Vidua chalybeata</i>	Indigobird, Village	Unlisted	LC
<i>Vidua macroura</i>	Whydah, Pin-tailed	Unlisted	LC
<i>Zapornia flavirostra</i>	Crake, Black	Unlisted	LC
<i>Zosterops pallidus</i>	White-eye, Orange River	Unlisted	LC

<i>Zosterops virens</i>	White-eye, Cape	Unlisted	LC
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### 14.3 Appendix C: Observed species during the point counts of the first survey

Common Name	Scientific Name	RD (Regional, Global)	Guild code	Relative abundance	Frequency (%)
Northern Black Korhaan	<i>Afrotis afraoides</i>	0	IGD	0,024	28,070
Cape Penduline-tit	<i>Anthoscopus minutus</i>	0	IGD	0,004	1,754
African Pipit	<i>Anthus cinnamomeus</i>	0	IGD	0,014	15,789
Buffy Pipit	<i>Anthus vaalensis</i>	0	IGD	0,006	1,754
Verreaux's Eagle	<i>Aquila verreauxii</i>	VU, LC	CGD	0,008	7,018
Kori Bustard	<i>Ardeotis kori</i>	NT, NT	OMD	0,011	7,018
Pirit Batis	<i>Batis pirit</i>	0	IGD	0,001	1,754
Hadedda (Hadada) Ibis	<i>Bostrychia hagedash</i>	0	OMD	0,003	1,754
Jackal Buzzard	<i>Buteo rufofuscus</i>	0	CGD	0,003	1,754
Fawn-coloured Lark	<i>Calendulauda africanoides</i>	0	GGD	0,001	1,754
Sabota Lark	<i>Calendulauda sabota</i>	0	OMD	0,001	1,754
Karoo Scrub Robin	<i>Cercotrichas coryphoeus</i>	0	IGD	0,004	5,263
Kalahari Scrub Robin	<i>Cercotrichas paena</i>	0	IGD	0,006	5,263
Karoo Long-billed Lark	<i>Certhilauda subcoronata</i>	0	IGD	0,004	3,509
Spike-heeled Lark	<i>Chersomanes albofasciata</i>	0	IGD	0,104	54,386
Desert Cisticola	<i>Cisticola aridulus</i>	0	IGD	0,032	29,825
Grey-backed Cisticola	<i>Cisticola subruficapilla</i>	0	IGD	0,004	5,263
Speckled Pigeon	<i>Columba guinea</i>	0	FFD	0,021	3,509
White-necked Raven	<i>Corvus albicollis</i>	0	OMD	0,004	5,263
Pied Crow	<i>Corvus albus</i>	0	OMD	0,106	52,632
Common Quail	<i>Coturnix coturnix</i>	0	OMD	0,007	7,018
Wattled Starling	<i>Creatophora cinerea</i>	0	OMD	0,049	3,509
White-throated Canary	<i>Crithagra albogularis</i>	0	GGD	0,003	3,509
Yellow Canary	<i>Crithagra flaviventris</i>	0	GGD	0,013	5,263
Chestnut-vented Tit-Babbler (Warbler)	<i>Curruca subcoerulea</i>	0	IGD	0,003	3,509
Black-winged Kite	<i>Elanus caeruleus</i>	0	CGD	0,001	1,754
Sickle-winged Chat	<i>Emarginata sinuata</i>	0	IGD	0,006	7,018
Cinnamon-breasted Bunting	<i>Emberiza tahapisi</i>	0	GGD	0,006	5,263
Yellow-bellied Eremomela	<i>Eremomela icteropygialis</i>	0	IGD	0,006	3,509
Greater Kestrel	<i>Falco rupicoloides</i>	0	CGD	0,006	5,263
Large-billed Lark	<i>Galerida magnirostris</i>	0	IGD	0,025	24,561
Blue Crane	<i>Grus paradisea</i>	NT, VU	OMD	0,045	10,526
Southern (Common) Fiscal	<i>Lanius collaris</i>	0	IAD	0,003	3,509

Rufous-eared Warbler	<i>Malcorus pectoralis</i>	0	IGD	0,056	49,123
Chat Flycatcher	<i>Melaenornis infuscatus</i>	0	IGD	0,001	1,754
Pale Chanting Goshawk	<i>Melierax canorus</i>	0	CGD	0,006	7,018
Eastern Clapper Lark	<i>Mirafra fasciolata</i>	0	IGD	0,030	15,789
Ant-eating Chat	<i>Myrmecocichla formicivora</i>	0	IGD	0,066	50,877
Helmeted Guineafowl	<i>Numida meleagris</i>	0	OMD	0,008	3,509
Namaqua Dove	<i>Oena capensis</i>	0	GGD	0,003	3,509
Capped Wheatear	<i>Oenanthe pileata</i>	0	IGD	0,006	3,509
Cape Sparrow	<i>Passer melanurus</i>	0	GGD	0,007	3,509
Spur-winged Goose	<i>Plectropterus gambensis</i>	0	OMD	0,008	1,754
Southern Masked Weaver	<i>Ploceus velatus</i>	0	GGD	0,003	1,754
Black-chested Prinia	<i>Prinia flavicans</i>	0	IGD	0,030	31,579
Red-billed Quelea	<i>Quelea quelea</i>	0	GGD	0,106	8,772
Double-banded Courser	<i>Rhinoptilus africanus</i>	0	IGD	0,004	3,509
Secretarybird	<i>Sagittarius serpentarius</i>	VU, EN	CGD	0,004	3,509
Grey-winged Francolin	<i>Scleroptila afra</i>	0	GGD	0,003	1,754
Laughing Dove	<i>Spilopelia senegalensis</i>	0	GGD	0,004	3,509
Pink-billed Lark	<i>Spizocorys conirostris</i>	0	GGD	0,082	10,526
Scaly-feathered Finch (Weaver)	<i>Sporopipes squamifrons</i>	0	GGD	0,004	1,754
Cape Turtle (Ring-necked) Dove	<i>Streptopelia capicola</i>	0	GGD	0,004	5,263
Long-billed crombec	<i>Sylvietta rufescens</i>	0	IGD	0,004	3,509
South African Shelduck	<i>Tadorna cana</i>	0	OMD	0,003	1,754
Bokmakierie	<i>Telophorus zeylonus</i>	0	OMD	0,015	10,526
Acacia Pied Barbet	<i>Tricholaema leucomelas</i>	0	OMD	0,001	1,754
Crowned Lapwing	<i>Vanellus coronatus</i>	0	IGD	0,006	1,754

#### 14.4 Appendix D: Incidental Observations

These are species observed moving between point counts. This list is included to provide a list of species that might not have been observed through the point count method.

Common Name	Scientific Name
Acacia Pied Barbet	<i>Tricholaema leucomelas</i>
Spike-heeled Lark	<i>Chersomanes albofasciata</i>
Secretarybird	<i>Sagittarius serpentarius</i>
Verreaux's Eagle	<i>Aquila verreauxii</i>
Blue Crane	<i>Grus paradisea</i>
Ant-eating Chat	<i>Myrmecocichla formicivora</i>
Northern Black Korhaan	<i>Afrotis afraoides</i>

Grey-backed Cisticola	<i>Cisticola subruficapilla</i>
Capped Wheatear	<i>Oenanthe pileata</i>
Pied Crow	<i>Corvus albus</i>
Wattled Starling	<i>Creatophora cinerea</i>
Bokmakierie	<i>Telophorus zeylonus</i>
Lilac-breasted Roller	<i>Coracias caudatus</i>
African Sacred Ibis	<i>Threskiomis aethiopicus</i>
Rufous-eared Warbler	<i>Malcorus pectoralis</i>
Large-billed Lark	<i>Galerida magnirostris</i>
Helmeted Guineafowl	<i>Numida meleagris</i>
Desert Cisticola	<i>Cisticola aridulus</i>
Black-winged Kite	<i>Elanus caeruleus</i>
Red-billed Quelea	<i>Quelea quelea</i>
African Pipit	<i>Anthus cinnamomeus</i>
Buffy Pipit	<i>Anthus vaalensis</i>
Kori Bustard	<i>Ardeotis kori</i>
Sabota Lark	<i>Calendulauda sabota</i>
Karoo Scrub Robin	<i>Cercotrichas coryphoeus</i>
Chat Flycatcher	<i>Melaenornis infuscatus</i>
African Pipit	<i>Anthus cinnamomeus</i>
Eastern Clapper Lark	<i>Mirafrasi fasciolata</i>
Common Quail	<i>Coturnix coturnix</i>
Greater Kestrel	<i>Falco rupicoloides</i>
Fawn-coloured Lark	<i>Calendulauda africanooides</i>
African Pipit	<i>Anthus cinnamomeus</i>
Scaly-feathered Finch (Weaver)	<i>Sporopipes squamifrons</i>
Crowned Lapwing	<i>Vanellus coronatus</i>
Cape Turtle (Ring-necked) Dove	<i>Streptopelia capicola</i>
Speckled Pigeon	<i>Columba guinea</i>
Yellow Canary	<i>Crithagra flaviventris</i>
Cape Sparrow	<i>Passer melanurus</i>
Cape Glossy (Cape) Starling	<i>Lamprotornis nitens</i>
Gabar Goshawk	<i>Micronisus gabar</i>
Spotted Eagle-Owl	<i>Bubo africanus</i>
Western Barn Owl	<i>Tyto alba</i>
Greater Striped Swallow	<i>Cecropis cucullata</i>
Grey-winged Francolin	<i>Scleroptila fra</i>
Cinnamon-breasted Bunting	<i>Emberiza tahapisi</i>
Egyptian Goose	<i>Alopochen aegyptiaca</i>

Brown-throated Martin	<i>Riparia paludicola</i>
Blacksmith Lapwing	<i>Vanellus armatus</i>
Little Grebe	<i>Tachybaptus ruficollis</i>
White-throated Canary	<i>Crithagra albogularis</i>
Sabota Lark	<i>Calendulauda sabota</i>
Sabota Lark	<i>Calendulauda sabota</i>
Red-capped Lark	<i>Calandrella cinerea</i>
Buffy Pipit	<i>Anthus vaalensis</i>
Cape Bunting	<i>Emberiza capensis</i>
Chat Flycatcher	<i>Melaenomis infuscatus</i>
Cape Penduline-tit	<i>Anthoscopus minutus</i>
Red-headed Finch	<i>Amadina erythrocephala</i>
Tawny Eagle	<i>Aquila rapax</i>
Spotted Thick-knee	<i>Burhinus capensis</i>
Red-eyed Dove	<i>Streptopelia semitorquata</i>
Lesser Grey Shrike	<i>Lanius minor</i>
Red-knobbed coot	<i>Fulica cristata</i>
Black-winged Stilt	<i>Himantopus himantopus</i>
Southern Masked Weaver	<i>Ploceus velatus</i>
Three-banded Plover	<i>Charadrius tricollaris</i>
Double-banded Courser	<i>Rhinoptilus africanus</i>
Fawn-coloured Lark	<i>Calendulauda africanoides</i>
South African Shelduck	<i>Tadorna cana</i>
Large-billed Lark	<i>Galerida magnirostris</i>
Yellow-bellied Eremomela	<i>Eremomela icteropygialis</i>
Buffy Pipit	<i>Anthus vaalensis</i>
Nicholson's Pipit	<i>Anthus nicholsoni</i>
African Harrier-Hawk	<i>Polyboroides typus</i>
Pink-billed Lark	<i>Spizocorys conirostris</i>
Blue Korhaan	<i>Eupodotis caerulescens</i>
White-faced Whistling Duck	<i>Dendrocygna viduata</i>
Black-faced Waxbill	<i>Brunhilda erythronotos</i>
African Sacred Ibis	<i>Threskiornis aethiopicus</i>
African Palm Swift	<i>Cypsiurus parvus</i>
Black-headed Heron	<i>Ardea melanocephala</i>
African Fish Eagle	<i>Haliaeetus vocifer</i>
Brown-hooded Kingfisher	<i>Halcyon albiventris</i>
African Red-eyed Bulbul	<i>Pycnonotus nigricans</i>
Buffy Pipit	<i>Anthus vaalensis</i>

White-backed Mousebird	<i>Colius colius</i>
Southern Grey-headed Sparrow	<i>Passer diffusus</i>
Rock Kestrel	<i>Falco rupicolus</i>
Namaqua Dove	<i>Oena capensis</i>
Long-billed crombec	<i>Sylvietta rufescens</i>
White-browed Sparrow-Weaver	<i>Plocepasser mahali</i>
Fiscal Flycatcher	<i>Melaenomis silens</i>
Cape Robin-chat	<i>Cossypha caffra</i>
Pied Starling	<i>Lamprotornis bicolor</i>
Red-faced Mousebird	<i>Urocolius indicus</i>
Chestnut-vented Tit-Babbler (Warbler)	<i>Curruca subcoerulea</i>
Fawn-coloured Lark	<i>Calendulauda africanoides</i>
Spur-winged Goose	<i>Plectropterus gambensis</i>
Common Ostrich	<i>Struthio camelus</i>
Little Swift	<i>Apus affinis</i>
Pirit Batis	<i>Batis pirit</i>
African Stonechat	<i>Saxicola torquatus</i>
Rock Martin	<i>Ptyonoprogne fuligula</i>
Yellow-billed Duck	<i>Anas undulata</i>
Fawn-coloured Lark	<i>Calendulauda africanoides</i>
Fairy Flycatcher	<i>Stenostira scita</i>
African Hoopoe	<i>Upupa africana</i>
Karoo Thrush	<i>Turdus smithi</i>
Black-throated Canary	<i>Crithagra atrogularis</i>
Orange River White-eye	<i>Zosterops pallidus</i>
Black-chested Snake Eagle	<i>Circaetus pectoralis</i>
Grey Heron	<i>Ardea cinerea</i>
Reed Cormorant	<i>Microcarbo africanus</i>
African Spoonbill	<i>Platalea alba</i>
Red-billed Teal	<i>Anas erythrorhyncha</i>
Kittlitz's Plover	<i>Charadrius pecuarius</i>
Cape Wagtail	<i>Motacilla capensis</i>
Lanner Falcon	<i>Falco biarmicus</i>
Cape Shoveler	<i>Spatula smithii</i>
African Darter	<i>Anhinga rufa</i>
Hamerkop	<i>Scopus umbretta</i>
Hadedda (Hadada) Ibis	<i>Bostrychia hagedash</i>
Black Harrier	<i>Circus maurus</i>
Western Cattle Egret	<i>Bubulcus ibis</i>

Pale-winged Starling	<i>Onychognathus naboroupp</i>
Green-winged Pytilia	<i>Pytilia melba</i>
Southern (Common) Fiscal	<i>Lanius collaris</i>
Dusky Sunbird	<i>Cinnyris fuscus</i>
White-breasted Cormorant	<i>Phalacrocorax lucidus</i>
Short-toed Rock Thrush	<i>Monticola brevipes</i>

#### 14.5 Appendix E: Observations during the second survey

Common Name	Scientific Name	RD (Regional, Global)	Guild code	Relative abundance	Frequency (%)
Northern Black Korhaan	<i>Afrotis afraoides</i>		IGD	0,024	21,667
African Pipit	<i>Anthus cinnamomeus</i>		IGD	0,011	15,000
Verreaux's Eagle	<i>Aquila verreauxii</i>	VU, LC	CGD	0,009	6,667
Black-headed Heron	<i>Ardea melanocephala</i>		CGD	0,001	1,667
Kori Bustard	<i>Ardeotis kori</i>	NT, NT	OMD	0,001	1,667
Hadedda (Hadada) Ibis	<i>Bostrychia hagedash</i>		OMD	0,005	6,667
Jackal Buzzard	<i>Buteo rufofuscus</i>		CGD	0,004	3,333
Karoo Scrub Robin	<i>Cercotrichas coryphoeus</i>		IGD	0,004	5,000
Kalahari Scrub Robin	<i>Cercotrichas paena</i>		IGD	0,003	3,333
Spike-heeled Lark	<i>Chersomanes albofasciata</i>		IGD	0,089	61,667
Southern Double-collared Sunbird	<i>Cinnyris chalybeus</i>		NFD	0,001	1,667
Desert Cisticola	<i>Cisticola aridulus</i>		IGD	0,058	61,667
Grey-backed Cisticola	<i>Cisticola subruficapilla</i>		IGD	0,003	1,667
Cloud Cisticola	<i>Cisticola textrix</i>		IGD	0,004	3,333
Speckled Pigeon	<i>Columba guinea</i>		FFD	0,003	1,667
Pied Crow	<i>Corvus albus</i>		OMD	0,068	50,000
Common Quail	<i>Coturnix coturnix</i>		OMD	0,009	6,667
Wattled Starling	<i>Creatophora cinerea</i>		OMD	0,008	1,667
White-throated Canary	<i>Crithagra albogularis</i>		GGD	0,006	5,000
Yellow Canary	<i>Crithagra flaviventris</i>		GGD	0,018	6,667
Chestnut-vented Tit-Babbler (Warbler)	<i>Curruca subcoerulea</i>		IGD	0,001	1,667
Sickle-winged Chat	<i>Emarginata sinuata</i>		IGD	0,013	13,333
Cape Bunting	<i>Emberiza capensis</i>		OMD	0,001	1,667
Cinnamon-breasted Bunting	<i>Emberiza tahapisi</i>		GGD	0,005	5,000
Yellow-bellied Eremomela	<i>Eremomela icteropygialis</i>		IGD	0,005	5,000
Grey-backed Sparrow-lark	<i>Eremopterix verticalis</i>		GGD	0,001	1,667
Southern Red Bishop	<i>Euplectes orix</i>		GGD	0,005	1,667
Blue Korhaan	<i>Eupodotis caerulescens</i>	LC, NT	OMD	0,003	1,667

Greater Kestrel	<i>Falco rupicoloides</i>		CGD	0,003	1,667
Rock Kestrel	<i>Falco rupicolus</i>		CGD	0,001	1,667
Large-billed Lark	<i>Galerida magnirostris</i>		IGD	0,033	33,333
Blue Crane	<i>Grus paradisea</i>	NT, VU	OMD	0,001	1,667
Pied Starling	<i>Lamprotornis bicolor</i>		IGD	0,004	1,667
Rufous-eared Warbler	<i>Malcorus pectoralis</i>		IGD	0,049	51,667
Chat Flycatcher	<i>Melaenornis infuscatus</i>		IGD	0,003	1,667
Fiscal Flycatcher	<i>Melaenornis silens</i>		OMD	0,001	1,667
Pale Chanting Goshawk	<i>Melierax canorus</i>		CGD	0,008	8,333
Eastern Clapper Lark	<i>Mirafra fasciolata</i>		IGD	0,047	35,000
Ant-eating Chat	<i>Myrmecocichla formicivora</i>		IGD	0,072	48,333
Mountain Wheatear	<i>Myrmecocichla monticola</i>		IGD	0,003	1,667
Helmeted Guineafowl	<i>Numida meleagris</i>		OMD	0,120	6,667
Namaqua Dove	<i>Oena capensis</i>		GGD	0,006	5,000
African Quail-finch	<i>Ortygospiza atricollis</i>		GGD	0,053	6,667
Southern Grey-headed Sparrow	<i>Passer diffusus</i>		GGD	0,003	1,667
Cape Sparrow	<i>Passer melanurus</i>		GGD	0,009	3,333
Black-chested Prinia	<i>Prinia flavicans</i>		IGD	0,025	30,000
Rock Martin	<i>Ptyonoprogne fuligula</i>		IAD	0,005	5,000
African red-eyed Bulbul	<i>Pycnonotus nigricans</i>		OMD	0,006	5,000
Red-billed Quelea	<i>Quelea quelea</i>		GGD	0,049	5,000
Double-banded Courser	<i>Rhinoptilus africanus</i>		IGD	0,003	1,667
Secretarybird	<i>Sagittarius serpentarius</i>	VU, EN	CGD	0,006	5,000
Grey-winged Francolin	<i>Scleroptila afra</i>		GGD	0,003	1,667
Laughing Dove	<i>Spilopelia senegalensis</i>		GGD	0,003	1,667
Pink-billed Lark	<i>Spizocorys conirostris</i>		GGD	0,097	18,333
Scaly-feathered Finch (Weaver)	<i>Sporopipes squamifrons</i>		GGD	0,006	3,333
South African Shelduck	<i>Tadorna cana</i>		OMD	0,003	1,667
Brown-crowned Tchagra	<i>Tchagra australis</i>		OMD	0,003	1,667
Bokmakierie	<i>Telophorus zeylonus</i>		OMD	0,008	8,333
Acacia Pied Barbet	<i>Tricholaema leucomelas</i>		OMD	0,004	5,000
Red-faced Mousebird	<i>Urocolius indicus</i>		FFD	0,001	1,667
Blacksmith Lapwing	<i>Vanellus armatus</i>		IGD	0,001	1,667



## 14.6 Appendix F: Incidental observations second survey

Common Name	Scientific Name
Pale Chanting Goshawk	<i>Melierax canorus</i>
Yellow Canary	<i>Crithagra flaviventris</i>
Secretarybird	<i>Sagittarius serpentarius</i>
Desert Cisticola	<i>Cisticola aridulus</i>
Rufous-eared Warbler	<i>Malcorus pectoralis</i>
Pied Crow	<i>Corvus albus</i>
African Pipit	<i>Anthus cinnamomeus</i>
Red-billed Quelea	<i>Quelea quelea</i>
White-browed Sparrow-Weaver	<i>Plocepasser mahali</i>
Blacksmith Lapwing	<i>Vanellus armatus</i>
South African Shelduck	<i>Tadorna cana</i>
Ant-eating Chat	<i>Myrmecocichla formicivora</i>
Red-billed Teal	<i>Anas erythrorhyncha</i>
Eastern Clapper Lark	<i>Mirafra fasciolata</i>
Spike-heeled Lark	<i>Chersomanes albofasciata</i>
Speckled Pigeon	<i>Columba guinea</i>
Black-chested Prinia	<i>Prinia flavicans</i>
Cape Sparrow	<i>Passer melanurus</i>
Northern Black Korhaan	<i>Afrotis afroides</i>
Cape Wagtail	<i>Motacilla capensis</i>
White-throated Canary	<i>Crithagra albogularis</i>
Karoo Korhaan	<i>Eupodotis vigorsii</i>
Pin-tailed Whydah	<i>Vidua macroura</i>
Large-billed Lark	<i>Galerida magnirostris</i>
Laughing Dove	<i>Spilopelia senegalensis</i>
Red-faced Mousebird	<i>Urocolius indicus</i>
Lanner Falcon	<i>Falco biarmicus</i>
Helmeted Guineafowl	<i>Numida meleagris</i>
Wattled Starling	<i>Creatophora cinerea</i>
Chestnut-vented Tit-Babbler (Warbler)	<i>Curruca subcoerulea</i>
Hadedda (Hadada) Ibis	<i>Bostrychia hagedash</i>
Chat Flycatcher	<i>Melaenornis infuscatus</i>
Orange River Francolin	<i>Scleroptila gutturalis</i>
Black-throated Canary	<i>Crithagra atrogularis</i>
African Pipit	<i>Anthus cinnamomeus</i>
Eastern Long-billed Lark	<i>Certhilauda semitorquata</i>
Karoo Chat	<i>Emarginata schlegelii</i>

Jackal Buzzard	<i>Buteo rufofuscus</i>
Egyptian Goose	<i>Alopochen aegyptiaca</i>
Rock Martin	<i>Ptyonoprogne fuligula</i>
Rock Kestrel	<i>Falco rupicolus</i>
Tawny Eagle	<i>Aquila rapax</i>
Red-eyed Dove	<i>Streptopelia semitorquata</i>
Reed Cormorant	<i>Microcarbo africanus</i>
Cape Glossy (Cape) Starling	<i>Lamprotornis nitens</i>
Fiscal Flycatcher	<i>Melaenornis silens</i>
Pirit Batis	<i>Batis pirit</i>
Dusky Sunbird	<i>Cinnyris fuscus</i>
Chat Flycatcher	<i>Melaenornis infuscatus</i>
Southern (Common) Fiscal	<i>Lanius collaris</i>
Chestnut-vented Tit-Babbler (Warbler)	<i>Curruca subcoerulea</i>
Short-toed Rock Thrush	<i>Monticola brevipes</i>
Sabota Lark	<i>Calendulauda sabota</i>
Black-necked Grebe	<i>Podiceps nigricollis</i>
Three-banded Plover	<i>Charadrius tricollaris</i>
Black-winged Kite	<i>Elanus caeruleus</i>
Pied Starling	<i>Lamprotornis bicolor</i>
Cloud Cisticola	<i>Cisticola textrix</i>
Red-capped Lark	<i>Calandrella cinerea</i>
Cape Turtle (Ring-necked) Dove	<i>Streptopelia capicola</i>
Kittlitz's Plover	<i>Charadrius pecuarius</i>
Cape Robin-chat	<i>Cossypha caffra</i>
White-backed Mousebird	<i>Colius colius</i>
Grey-backed Cisticola	<i>Cisticola subruficapilla</i>
Black-faced Waxbill	<i>Brunhilda erythronotos</i>
Fairy Flycatcher	<i>Stenostira scita</i>
African Red-eyed Bulbul	<i>Pycnonotus nigricans</i>
Karoo Thrush	<i>Turdus smithi</i>
Red-billed Firefinch	<i>Lagonosticta senegala</i>
African Sacred Ibis	<i>Threskiornis aethiopicus</i>
Fawn-coloured Lark	<i>Calendulauda africanoides</i>
Cape Eagle-Owl	<i>Bubo capensis</i>
White-necked Raven	<i>Corvus albicollis</i>
African Harrier-Hawk	<i>Polyboroides typus</i>
Mountain Wheatear	<i>Myrmecocichla monticola</i>
African Stonechat	<i>Saxicola torquatus</i>

