

Kareekloof PVSEF

Avifauna Pre-Construction Monitoring

Scoping Report

10 August 2023

for

Cape EAPrac

Dale Holder

dale@cape-eaprac.co.za

prepared by

Enviro-Insight CC

Luke Verburgt (*Pr. Sci. Nat.*)

A.E. van Wyk (*Cand. Sci. Nat.*)



luke@enviro-insight.co.za

Author contributions

Author	Qualification	SACNASP	Role in project
Luke Verburgt	MSc Zoology	<i>Pr. Sci. Nat. – 400506/11</i>	Project management, GIS, reporting
AE Van Wyk	Hons Zoology	<i>Cand. Sci. Nat. – 125266</i>	Field technician, data management

Disclaimer by specialists

We,

	
Luke Verburgt	AE Van Wyk
<i>Pr. Sci. Nat.</i>	<i>Cand. Sci. Nat.</i>

declare, that the work presented in this report is our own and has not been influenced in any way by the developer or the Environmental Assessment Practitioner (EAP). At no point has the developer asked us as specialists to manipulate the results in order to make it more favourable for the proposed development. We consider ourselves bound to the rules and ethics of the South African Council for Natural Scientific Professions (SACNASP) and the EIA Regulations (2014, as amended). We have the necessary qualifications and expertise (*Pr. Sci. Nat. Zoological Science*) for developing this specialist report.

EXECUTIVE SUMMARY

To be provided in the final EIA report

TABLE OF CONTENTS

1	Introduction.....	6
1.1	Project Description.....	6
1.2	Legal Context & Study Guidance.....	6
1.3	Screening Tool Report.....	7
2	Methods.....	8
2.1	GIS	8
2.2	Desktop and Literature Survey	8
2.3	Solar Energy Facilities (SEF) Survey Requirements	9
2.4	Walking & Driving Transects.....	10
2.5	Species of Conservation Concern	11
2.6	Impact Assessment	11
2.6.1	Definitions of terminology	11
2.6.2	Scoring System for Impact Assessment Ratings.....	13
2.7	Assumptions & Limitations.....	13
3	Results.....	14
3.1	Kareekloof PVSEF	14
3.1.1	Regional Context.....	14
3.1.2	Habitat Description	15
3.1.3	Survey Coverage.....	19
3.1.4	Expected & Observed Avifauna.....	19
3.1.5	Species of Conservation Concern (SCC)	20
3.1.6	Existing Impacts	23
3.1.7	Site Ecological Importance (SEI).....	23
3.1.8	Anticipated Impact Description and Assessment	23
3.2	Anticipated Cumulative Impacts	29
3.3	Opportunities and Constraints	31
4	Conclusions and Professional Opinion	32

5	References	33
6	Appendix.....	34
6.1	Expected & Observed Avifauna Species	34
6.2	SACNASP registration of specialists	37

LIST OF FIGURES

Figure 1-1.	Location of the proposed Kareekloof PVSEF to be developed.....	6
Figure 1-2.	Animal Theme Sensitivities of the Kareekloof PVSEF project area indicated by the National Screening Tool.....	7
Figure 2-1.	The proposed Kareekloof PVSEF project area in relation to the SABAP2 pentads.....	9
Figure 3-1.	The Kareekloof PVSEF in relation to the regional vegetation types (SANBI 2018).	14
Figure 3-2.	The Kareekloof PVSEF in relation to the nearest protected areas and IBAs.....	15
Figure 3-3.	The major habitats of the Kareekloof PVSEF.	16
Figure 3-4.	Major habitat of the Kareekloof PVSEF: Grassland on soft sandy soils.....	17
Figure 3-5.	Major habitat of the Kareekloof PVSEF: Scrubland.	17
Figure 3-6.	Major habitat of the Kareekloof PVSEF: Rocky ridges & steep slopes.	18
Figure 3-7.	Major habitat of the Kareekloof PVSEF: Drainage, wetlands & dams.....	18
Figure 3-8.	Avifauna survey coverage of the Kareekloof PVSEF during the summer survey.	19
Figure 3-9.	A Secretarybird observed on the Kareekloof PVSEF project area during the winter survey.....	21
Figure 3-10.	A Verreaux's Eagle observed on the Kareekloof PVSEF project area during the winter survey.....	22
Figure 3-11.	Location of known regional renewable energy projects (Quarter 1, 2023) in relation to the Kareekloof PVSEF. ..	31
Figure 3-12.	Avifauna opportunities and constraints (No-Go areas) map for the proposed Kareekloof PVSEF.	32

LIST OF TABLES

Table 1:	Expected and observed avifauna species of conservation concern for the Kareekloof PVSEF project area.....	20
Table 2:	Cumulative impact from renewable energy developments in the region.	30
Table 3:	Observed avifauna species for the nine focal SABAP2 pentads of the Kareekloof PVSEF [see Figure 2-1]. Species of conservation concern are highlighted at the top of the table.	34

1 INTRODUCTION

1.1 PROJECT DESCRIPTION

The proposed Kareekloof Photovoltaic Solar Energy Facility (PVSEF) and associated infrastructure which includes the BESS, covers an area of ~3720 ha, has a proposed generation capacity of up to 800 MW, is located ~14 km southeast of Potfontein in the Northern Cape Province (Figure 1-1) and is not situated within a Renewable Energy Development Zone (REDZ). Enviro-Insight was commissioned to perform the required pre-construction avifauna studies as part of the Environmental Authorisation (EA) application process. This document is the Scoping Report for the avifauna pre-construction monitoring component of the Environmental Impact Assessment (EIA) required as part of the process to obtain environmental authorisation (EA) for the proposed development.

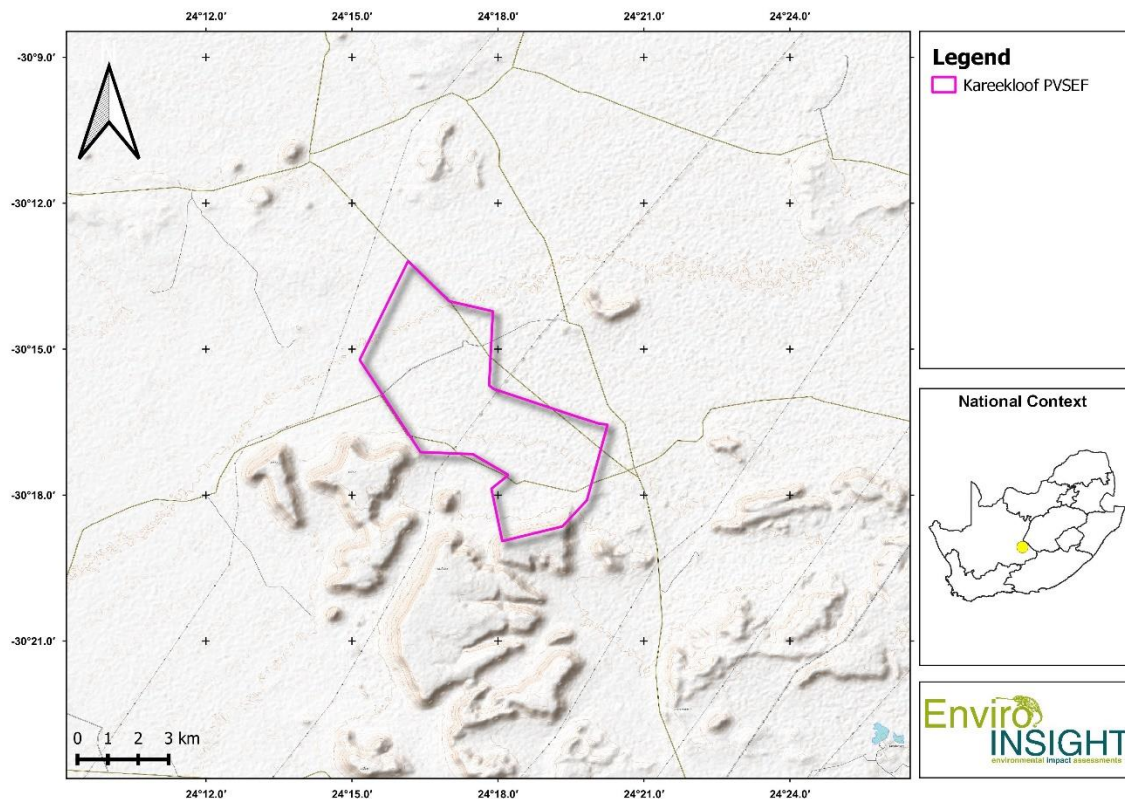


Figure 1-1. Location of the proposed Kareekloof PVSEF to be developed.

1.2 LEGAL CONTEXT & STUDY GUIDANCE

- This report addresses the avifauna species of the Sensitive Animal Species Theme of the Scoping Phase of the Environmental Impact Assessment report (EIAR) required for the environmental authorisation process for a proposed development.

- The minimum report content requirements for environmental impacts on terrestrial animal and plant species in terms of sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998 (Act No. 107 of 1998)¹ are applicable;
- Guidance for the implementation of the above-mentioned protocol is followed according to SANBI (2020), hereafter referred to as “the animal species protocol guidelines”; and
- Guidance for avifauna studies in relation to developments of solar facilities is followed according to the “*Best-Practice Guidelines for assessing and monitoring the impact of solar energy facilities on birds in southern Africa*” (Jenkins *et al.*, 2017).

1.3 SCREENING TOOL REPORT

The Screening Tool Report (STR) produced by the National Environmental Screening Tool² (generated on 10 August 2023) indicated a **Medium** Animal Theme Sensitivity for the Kareekloof PVSEF project area, due to the potential presence (medium sensitivity) of two avifauna species of conservation concern (SCC), namely the Endangered Tawny Eagle (*Aquila rapax*) and the Endangered Ludwig’s Bustard (*Neotis ludwigii*) (Figure 1-2).

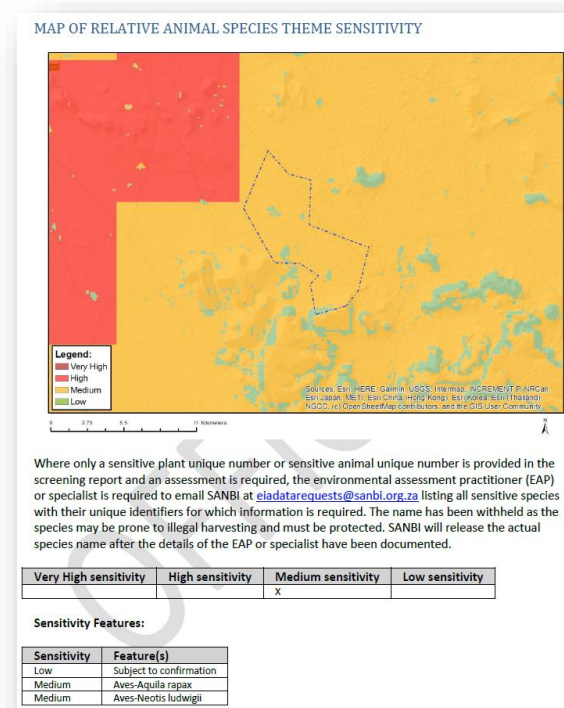


Figure 1-2. Animal Theme Sensitivities of the Kareekloof PVSEF project area indicated by the National Screening Tool.

¹ GOVERNMENT GAZETTE, No. 43855, 30 OCTOBER 2020. Available from: http://www.gpwonline.co.za/Gazettes/Gazettes/43855_30-10_NationalGovernment.pdf

² <https://screening.environment.gov.za/screeningtool/>

2 METHODS

2.1 GIS

Existing data layers were incorporated into a Geographic Information System (GIS) to establish how the study area interacts with important terrestrial entities. Emphasis was placed on the following spatial datasets:

- Vegetation Map of South Africa, Lesotho and Swaziland (SANBI, 2018);
- Important Bird and Protected Areas (Marnewick *et al.*, 2015); and
- South African Protected Areas Database (SAPAD).

The existing national landcover classification was used to assist with the identification of habitat types of importance for avifauna during the initial surveys. Furthermore, a drainage and aquatic habitat map was obtained from the aquatic specialist. These were pre-emptively buffered by 100 m to include the more prominent marginal vegetation. Finally, a digital elevation model (DEM) was obtained for the area and a slope analysis was performed to delineate sensitive rocky habitats. Slopes of $> 7^\circ$ were considered steep enough in this region to constitute potentially sensitive rocky habitats and these were buffered by 30 m. All mapping was performed using open-source GIS software (QGIS³ and SAGA⁴).

2.2 DESKTOP AND LITERATURE SURVEY

A desktop study and literature review was undertaken to evaluate all bird species which could potentially occur in the vicinity of the Kareekloof PVSEF project area (see Figure 2-1), predominantly using data from the second South African Bird Atlas Project (SABAP 2⁵; [SABAP2, 2020]) but cross-referencing with Hockey *et al.* (2005) and Sinclair & Ryan (2010). SABAP 2 data are collected as records per pentad (i.e., 5' X 5' or roughly 9 x 9 km). A list of species potentially occurring within and adjacent to the Kareekloof PVSEF project area was therefore developed from SABAP 2 data for the nine (9) pentads overlapping with the Kareekloof PVSEF project area (3010_2410, 3010_2415, 3010_2420, 3015_2410, 3015_2415, 3015_2420, 3020_2410, 3020_2415, 3020_2420; Figure 2-1). The expected species list is therefore based on an area much larger than the Kareekloof PVSEF project area. This approach was adopted to ensure that all species potentially occurring within the Kareekloof PVSEF project area, whether resident, nomadic, or migratory, were included.

Species were considered as sensitive to the proposed development based on their abundance, flight characteristics, ecological role, population trend and conservation status.

The following main literature sources were consulted for the study:

- Information relating to avifauna species of conservation concern (SCC) was obtained from Taylor *et al.* (2015) and the IUCN Red List of threatened species (IUCN 2023);

³ <http://qgis.osgeo.org/en/site/>

⁴ <https://saga-gis.sourceforge.io/>

⁵ <http://sabap2.birdmap.africa/>

- del Hoyo *et al.* (1992) and Hockey *et al.* (2005) were consulted for general information on the life history attributes of relevant bird species;
- Distributional data was sourced from the Southern Africa Bird Atlas Project (SABAP 2 2023), Hockey *et al.* (2005), del Hoyo *et al.* (1992) and Sinclair & Ryan (2010);
- iNaturalist⁶ records within ~15 km of the Kareekloof PVSEF were also consulted (no records of Tawny Eagle and Ludwig's bustard found);
- Nomenclature and taxonomy followed the IOC World Bird Names unless otherwise specified (see www.worldbirdnames.org; Gill & Donsker 2012).

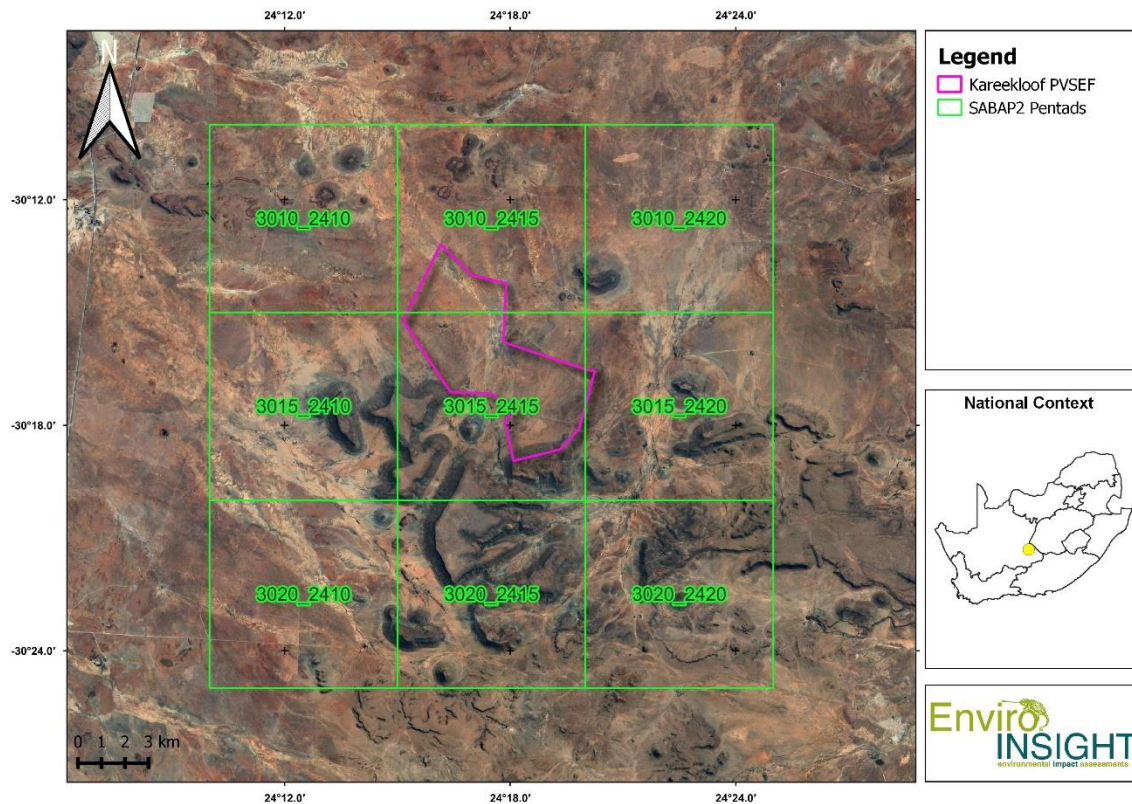


Figure 2-1. The proposed Kareekloof PVSEF project area in relation to the SABAP2 pentads.

2.3 SOLAR ENERGY FACILITIES (SEF) SURVEY REQUIREMENTS

The Birds and Solar Energy Guidelines (Jenkins *et al.* 2017) provide clear requirements for Avifauna Impact Assessments of SEFs. SEFs are categorised into 3 regimes depending on the potential impact on Avifauna. The regime determines the level and intensity of surveys to be completed by the avifauna specialist.

⁶ <https://www.inaturalist.org/home>

The proposed Kareekloof PVSEF is regarded to be a **Regime 2** facility, because the facility has a potentially large footprint (>150 ha) and it is of Medium avifauna sensitivity (Figure 1-2).

A Regime 2 facility has the following requirements (Jenkins et al. 2017):

1. Preliminary Assessment
 - a. Literature review, habitats and desktop – *provided in this report*;
2. Structured and detailed data collection
 - a. Baseline data collection over 6-12 months, across as many seasons as possible –*only a single season survey performed thus far. A Spring season fieldwork is planned*;
 - b. Small bird abundance estimates – *to be provided in EIA report*;
 - c. Transect and vantage point abundances for large birds and raptors – *to be provided in EIA report*;
 - d. Flight behaviour of priority species – *to be provided in EIA report*;
 - e. Wetland bird counts and movements between wetlands using the CWAC initiative (Taylor et al. 1999) – *not possible for this site*;
 - f. Existing power line collision mortalities – *none observed*.
3. Impact Assessment (informed by 2)
 - a. Map key habitats and flyways to be avoided – *preliminary understanding provided in this report*;
 - b. Inform SEF layout – *provided in this report*;
 - c. Assess impacts and mitigation strategies – *provided in brief in this report. Will be expanded upon in the EIA report*.

2.4 WALKING & DRIVING TRANSECTS

A single site visits was conducted as follows:

- Winter: 31 July - 4 August 2023

Sampling was performed by means of combined walking and driving transects in and around the Kareekloof PVSEF project area. Driving was done at very low speeds, with frequent stoppages to observe birds and record data. Short walking transects were conducted from the vehicle wherever habitat allowed and bird productivity was high. The entire Kareekloof PVSEF project area and all the different habitats were surveyed in this manner. Although waterbodies were present on the Kareekloof PVSEF project area, none were appropriate for waterbirds counts (CWAC) as far fewer than 500 individual birds were present at a time. Suitable nesting structures and habitats were evaluated carefully for any possible nests of sensitive/priority bird species and recorded for mapping purposes.

A second survey will be undertaken in Spring to comply with the requirements of a Regime 2 (Jenkins *et al.*, 2017).

2.5 SPECIES OF CONSERVATION CONCERN

The Red List of threatened species generated by the IUCN (<http://www.iucnredlist.org/>) provided the global conservation status of avifauna. However, Taylor *et al.* (2015) produced a regional conservation status assessment following the IUCN criteria which takes precedent for this assessment, but only in cases where the current global status is not of a higher risk. The first three categories i.e. Critically Endangered, Endangered and Vulnerable, are collectively referred to as 'threatened' species.

The extinction risk status categories defined by the IUCN, which are considered here to represent species of conservation concern (SCC), are defined as follows:

- **Critically Endangered (CR)** - Critically Endangered refers to species facing immediate threat of extinction in the wild.
- **Endangered (EN)** - Endangered species are those facing a very high risk of extinction in the wild within the foreseeable future.
- **Vulnerable (VU)** - Vulnerable species are those facing a high risk of extinction in the wild in the medium-term.
- **Near Threatened (NT)** - any indigenous species which does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.

2.6 IMPACT ASSESSMENT

The following impact assessment methodology will be followed for the EIA phase of the project. SANBI (2020) cautions that assessing impacts by assigning numerical rankings that are then mathematically combined is not the preferred manner to evaluate impacts, and may frequently lead to erroneous evaluations. Care must therefore be taken when interpreting such evaluations. The Mitigation Hierarchy Guideline for South Africa which offers appropriate guidance to determine impact significance is still in development and therefore cannot be implemented here. As such, the "traditional" method of evaluating impacts is followed in lieu of an accepted published alternative.

2.6.1 Definitions of terminology

ITEM	DEFINITION
EXTENT	
Local	Extending only as far as the boundaries of the activity, limited to the site and its immediate surroundings
Regional	Impact on the broader region
National	Will have an impact on a national scale or across international borders
DURATION	
Short-term	0-5 years
Medium- Term	5-15 years
Long-Term	>15 years, where the impact will cease after the operational life of the activity

Permanent	Where mitigation, either by natural process or human intervention, will not occur in such a way or in such a time span that the impact can be considered transient.
MAGNITUDE OR INTENSITY	
Low	Where the receiving natural, cultural or social function/environment is negligibly affected or where the impact is so low that remedial action is not required.
Medium	Where the affected environment is altered, but not severely and the impact can be mitigated successfully and natural, cultural or social functions and processes can continue, albeit in a modified way.
High	Where natural, cultural or social functions or processes are substantially altered to a very large degree. If a negative impact then this could lead to unacceptable consequences for the cultural and/or social functions and/or irreplaceable loss of biodiversity to the extent that natural, cultural or social functions could temporarily or permanently cease.
PROBABILITY	
Improbable	Where the possibility of the impact materialising is very low, either because of design or historic experience
Probable	Where there is a distinct possibility that the impact will occur
Highly Probable	Where it is most likely that the impact will occur
Definite	Where the impact will undoubtedly occur, regardless of any prevention measures
SIGNIFICANCE	
Low	Where a potential impact will have a negligible effect on natural, cultural or social environments and the effect on the decision is negligible. This will not require special design considerations for the project
Medium	Where it would have, or there would be a moderate risk to natural, cultural or social environments and should influence the decision. The project will require modification or mitigation measures to be included in the design
High	Where it would have, or there would be a high risk of, a large effect on natural, cultural or social environments. These impacts should have a major influence on decision making.
Very High	Where it would have, or there would be a high risk of, an irreversible negative impact on biodiversity and irreplaceable loss of natural capital that could result in the project being environmentally unacceptable, even with mitigation. Alternatively, it could lead to a major positive effect. Impacts of this nature must be a central factor in decision making.
STATUS OF IMPACT	
Whether the impact is positive (a benefit), negative (a cost) or neutral (status quo maintained)	
DEGREE OF CONFIDENCE IN PREDICTIONS	
The degree of confidence in the predictions is based on the availability of information and specialist knowledge (e.g. low, medium or high)	
MITIGATION	

Mechanisms used to control, minimise and or eliminate negative impacts on the environment and to enhance project benefits
Mitigation measures should be considered in terms of the following hierarchy: (1) avoidance, (2) minimisation, (3) restoration and (4) off-sets.

2.6.2 Scoring System for Impact Assessment Ratings

To comparatively rank the impacts, each impact has been assigned a score using the scoring system outlined in the Table below. This scoring system allows for a comparative, accountable assessment of the indicative cumulative positive or negative impacts of each aspect assessed.

IMPACT PARAMETER	SCORE	
Extent (A)	Rating	
Local	1	
Regional	2	
National	3	
Duration (B)	Rating	
Short term	1	
Medium Term	2	
Long Term	3	
Permanent	4	
Probability (C)	Rating	
Improbable	1	
Probable	2	
Highly Probable	3	
Definite	4	
IMPACT PARAMETER	NEGATIVE IMPACT SCORE	POSITIVE IMPACT SCORE
Magnitude/Intensity (D)	Rating	Rating
Low	-1	1
Medium	-2	2
High	-3	3
SIGNIFICANCE RATING (F)	Rating	Rating
Low	0 to - 40	0 to 40
Medium	- 41 to - 80	41 to 80
High	- 81 to - 120	81 to 120
Very High	> - 120	> 120

2.7 ASSUMPTIONS & LIMITATIONS

- It is assumed that all third-party information acquired is correct (e.g. GIS data and scope of work);

3 RESULTS

3.1 KAREEKLOOF PVSEF

3.1.1 Regional Context

The Kareekloof PVSEF project area spans three regional vegetation types all of which are considered to be of Least Concern (Figure 3-1; SANBI 2018), and all of which contain mostly natural habitats, with some low intensity impacts from sheep farming. The Kareekloof PVSEF project area is not within a REDZ but is situated entirely within the Central Power Corridor. The nearest protected area is the Rolfontein Provincial Nature Reserve situated ~ 40 km away towards the northeast and the Kareekloof PVSEF project area is situated entirely within the “Platberg-Karoo Conservancy” Important Bird Area (IBA) (Figure 3-2).

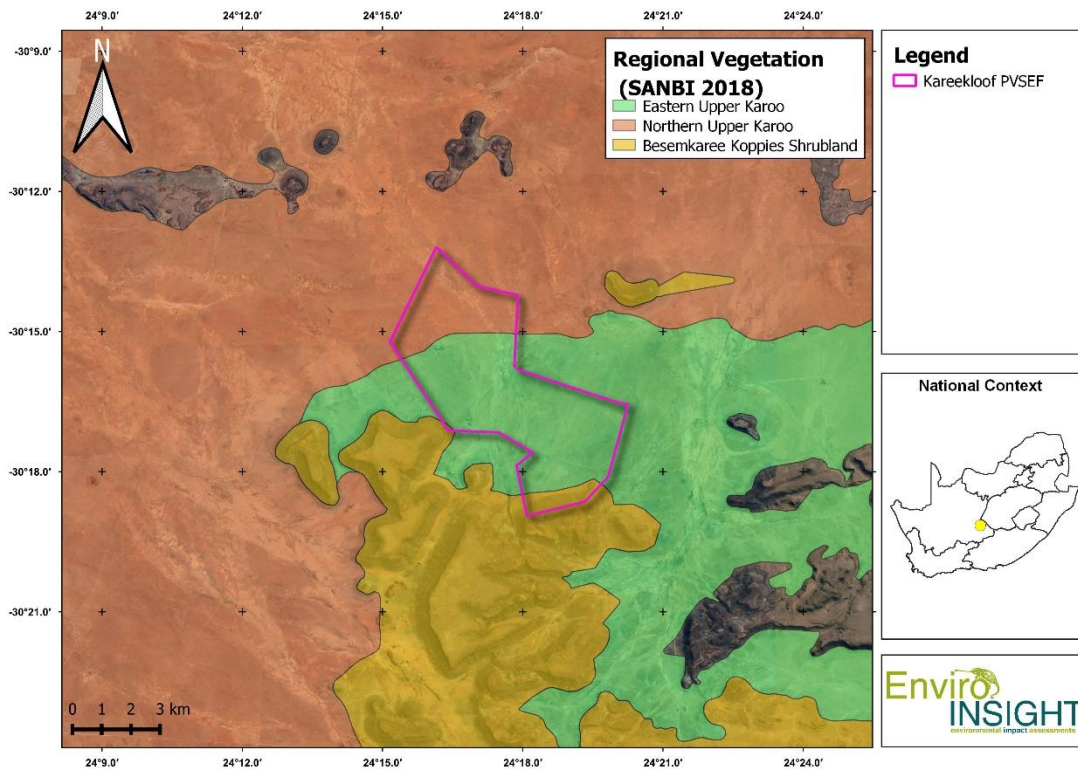


Figure 3-1. The Kareekloof PVSEF in relation to the regional vegetation types (SANBI 2018).

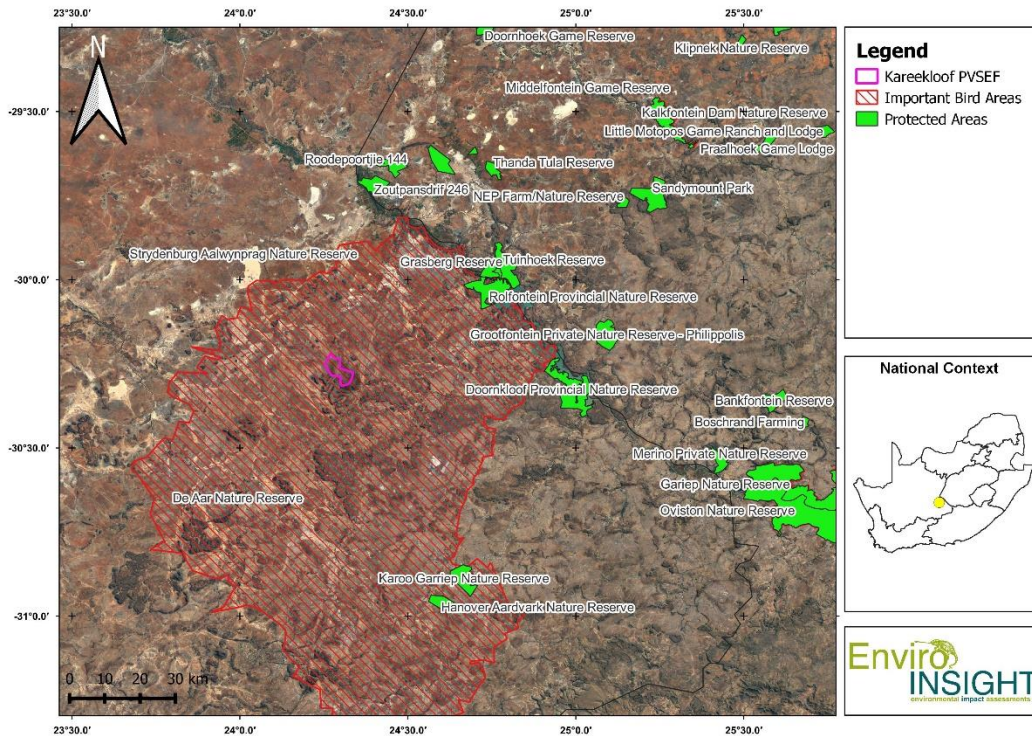


Figure 3-2. The Kareekloof PVSEF in relation to the nearest protected areas and IBAs.

3.1.2 Habitat Description

The Kareekloof PVSEF project area is predominantly located on relatively flat land, with elevated rocky ridges characterising the southern areas outside of the proposed PVSEF (Figure 3-1). These flat areas of Northern and Eastern Upper Karoo vegetation types are characterised by two major habitat types namely Nama Karoo Low Shrubland and Natural Grassland according to the National Landcover Classification (NLC 2018⁷) (Figure 3-3). In addition, aquatic habitats are represented by a prominent drainage area bisecting the PVSEF with several scattered artificial dams (Figure 3-3).

⁷ https://www.dffe.gov.za/projectsprogrammes/egis_landcover_datasets

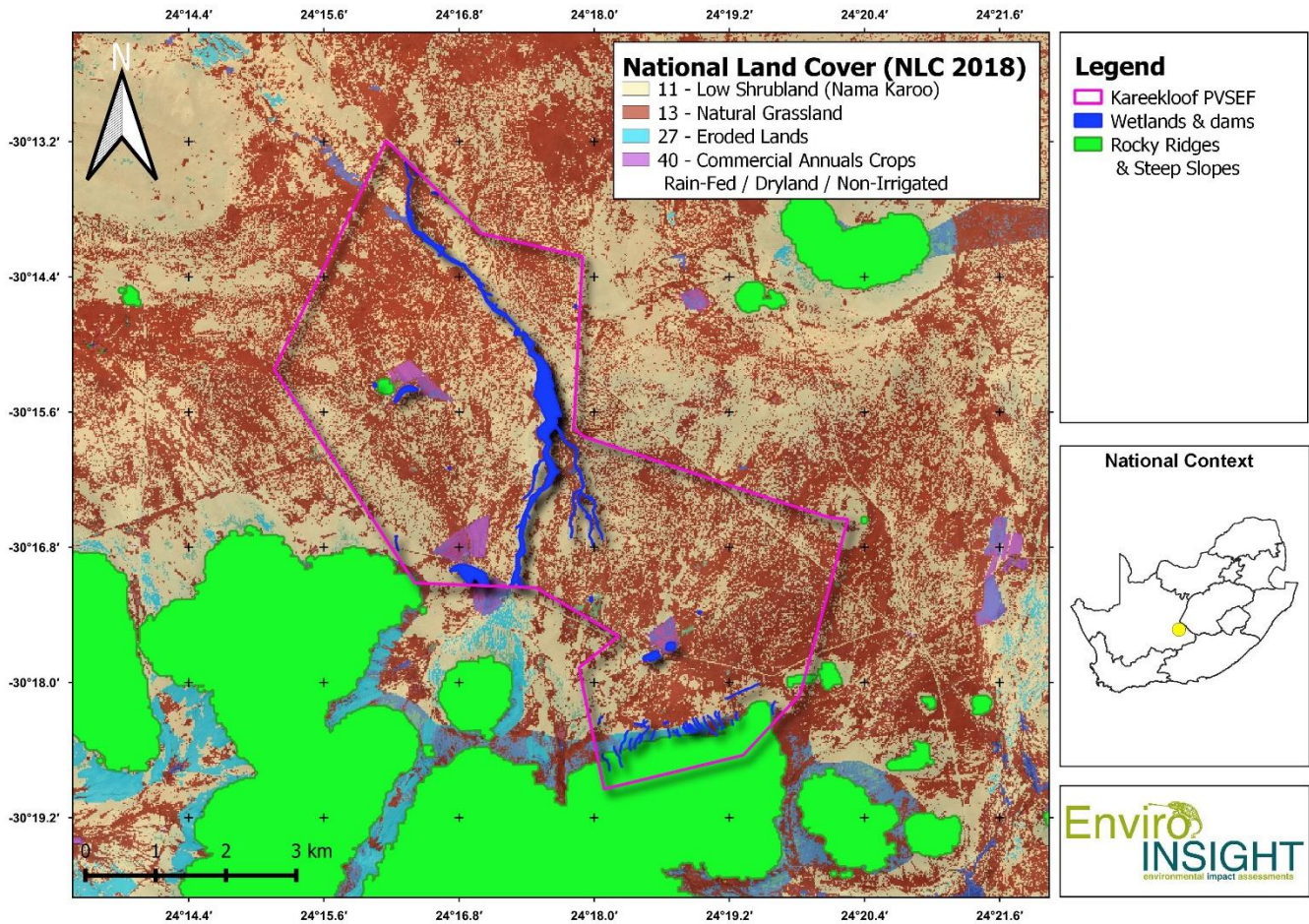


Figure 3-3. The major habitats of the Kareekloof PVSEF.

There are four specific avifauna habitats within the Kareekloof PVSEF project area, mostly consistent with the national landcover data (Figure 3-3). These habitats are each briefly described below and partially fulfil the requirements of a Site Sensitivity Verification (SSV). The Site Ecological Importance evaluation which will be conducted for the EIA reporting will fulfil the remaining requirements for the SSV.

3.1.2.1 Grassland

This is the dominant habitat and is mostly present on softer, sandier soils. It is characterised by a dense grass sward with no or only few shrubs present (Figure 3-4). It extends up onto the foot-slopes of the rocky ridges. Given the very expansive occurrence of this habitat and its ability to support only few avifauna species of conservation (SCC) at low densities, it is not considered to be highly sensitive from an avifauna perspective.



Figure 3-4. Major habitat of the Kareekloof PVSEF: Grassland on soft sandy soils.

3.1.2.2 Scrubland

This habitat is present as patches amongst the grassland, typically characterised by the absence or near-absence of grasses and the presence of large, woody shrubs (Figure 3-5). However, it often forms a habitat mosaic with the grassland, particularly on the ecotone of the two habitats. Similar to the grassland habitat, scrubland has a very expansive occurrence in the region and does not support SCC at high densities and is therefore not considered to be highly sensitive from an avifauna perspective.



Figure 3-5. Major habitat of the Kareekloof PVSEF: Scrubland.

3.1.2.3 Rocky Ridges & Steep Slopes

This structurally defined habitat (Figure 3-6) is limited in the region and has the potential to support lekking sites for the Endangered Ludwig's Bustard and was confirmed to have a nesting pair of Vulnerable Verreaux's Eagles too. Due to the importance of lekking habitat for breeding success of Ludwig's Bustard, the presence of nesting Verreaux's Eagles, and the fact

that such habitat is limited in the landscape, it is considered to be sensitive from the avifauna perspective and has therefore been buffered from development by 30 m.



Figure 3-6. Major habitat of the Kareekloof PVSEF: Rocky ridges & steep slopes.

3.1.2.4 Drainage, wetlands & dams

This is a collection of aquatic habitats predominantly characterised by the ephemeral drainage lines and their marginal vegetation, but also the man-made impoundments (dams) in these drainage lines which retain surface water for longer (Figure 3-7). These habitats are very limited in this arid region and due to the periodic presence of water provide excellent foraging habitats for avifauna, particularly in the dry months. The dense marginal vegetation is also often suitable for breeding purposes. Since certain avifauna SCC may rely on these habitats for foraging purposes, and since the limited presence of surface water in the region may enhance the likelihood of waterbirds landing on the reflective surface of solar panels if placed nearby to these water sources, this habitat is considered to be sensitive from the avifauna perspective and has therefore been buffered from development by 100 m.



Figure 3-7. Major habitat of the Kareekloof PVSEF: Drainage, wetlands & dams.

3.1.3 Survey Coverage

The flat, open landscape without any obstructions and the large-bodied target avifauna SCC meant that observations were possible for up to 1 km on either side of the road/transect with the aid of binoculars and spotting scopes. The survey coverage of the Kareekloof PVSEF project area was comprehensive and sufficient (Figure 3-8).

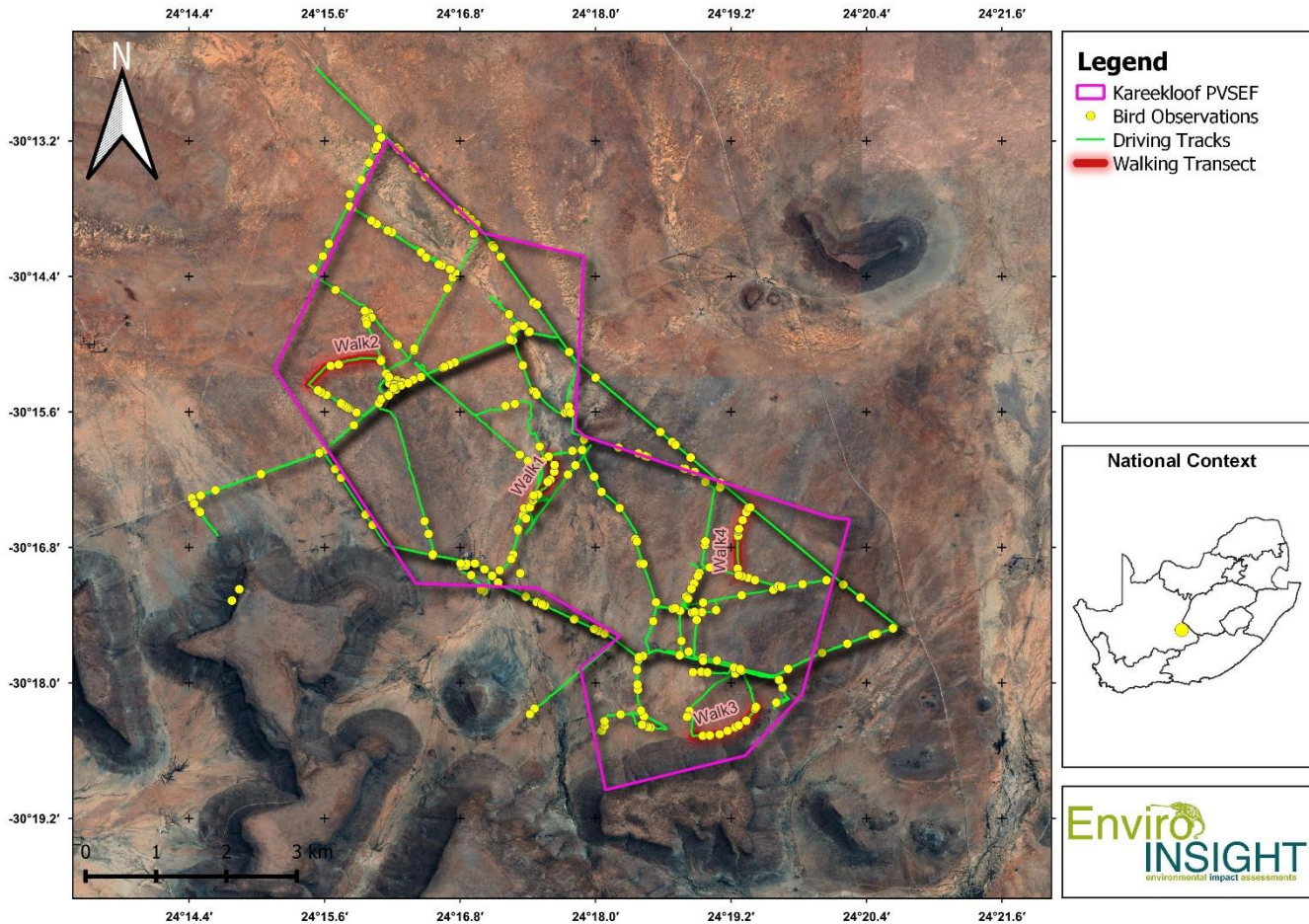


Figure 3-8. Avifauna survey coverage of the Kareekloof PVSEF during the summer survey.

3.1.4 Expected & Observed Avifauna

A total of 109 bird species have been recorded by the South African Bird Atlas Project (SABAP2) on the nine focal pentads relevant to the Kareekloof PVSEF project area (Table 3), all of which are expected to occur on the project area. Eight species of conservation concern (SCC; threatened and near-threatened) have been observed within at least one of the nine focal pentads for the Kareekloof PVSEF project area (Table 1), two of which were observed during the winter survey (August 2023). It is interesting to note that the Tawny Eagle, predicted by the Screening Tool (Figure 1-2), has not been recorded in the SABAP2 dataset for the nine focal pentads for the Kareekloof PVSEF project area (Table 1).

Table 1: Expected and observed avifauna species of conservation concern for the Kareekloof PVSEF project area.

Common Name	Scientific Name	Global Status (IUCN)	Regional Status (Taylor et al. 2015)	Individuals Observed Winter (Aug '23)
Ludwig's Bustard	<i>Neotis ludwigii</i>	EN	EN	
Martial Eagle	<i>Polemaetus bellicosus</i>	EN	EN	
Secretarybird	<i>Sagittarius serpentarius</i>	EN	VU	1
African Rock Pipit	<i>Anthus crenatus</i>	LC	NT	
Verreaux's Eagle	<i>Aquila verreauxii</i>	LC	VU	5
Lanner Falcon	<i>Falco biarmicus</i>	LC	VU	
Blue Korhaan	<i>Eupodotis caerulescens</i>	NT	LC	
Blue Crane	<i>Grus paradisea</i>	VU	NT	

The total number of bird species observed within and around the Kareekloof PVSEF project area during the winter survey (31 July - 4 August 2023) was 69, comprising a total of 907 individuals. Of these, two species are considered to be of conservation concern, namely the Verreaux's Eagle and Secretarybird. In general, the observed avian species richness is relatively low but expected for this region and abundances were moderate to high due to a productive summer season.

3.1.5 Species of Conservation Concern (SCC)

Brief descriptions of each of the expected and observed threatened (CR, EN, VU) SCC (Table 1) are provided below in context with the proposed development.

3.1.5.1 Endangered species

- Ludwig's Bustard (*Neotis ludwigii*) is widely but patchily distributed across the arid interior of South Africa, extending into western Namibia (Shaw 2015). This species is particularly prone to fatalities caused by collisions with electricity transmission lines and is also susceptible to disturbance, as well as hunting and poisoning (Shaw 2015). This species was not recorded during the survey but is considered likely to be present periodically. Lekking sites for this species are typically elevated areas compared to the surrounding landscape and therefore all such areas, indicated by the delineated "Rocky Ridges & Steep Slopes" have been pre-emptively buffered from development.
- The Martial Eagle (*Polemaetus bellicosus*) is infrequently recorded for the nine focal pentads. No observations of this species have been recorded for the region on iNaturalist. This species forages extremely widely and could occasionally fly over the study area but will not breed there "naturally" owing to the absence of suitable natural breeding habitat. However, it regularly breeds on large electricity pylons. It was not observed during the fieldwork surveys and is considered unlikely to be affected by the proposed development (excluding the associated overhead powerlines).

- The Tawny Eagle (*Aquila rapax*) is one of the most threatened eagles in South Africa with a high sensitivity to land transformation. They are known to have been electrocuted by overhead power lines (Taylor *et al.* 2015). They forage extremely widely and require tall structures (trees or electricity pylons) for breeding. This species is expected to sporadically forage over the Kareekloof PVSEF project area.
- Secretarybird (*Sagittarius serpentarius*) is listed as Endangered globally and Vulnerable regionally (Taylor *et al.*, 2015; BirdLife International 2020). Secretarybirds favour open habitats for terrestrial foraging and seek out flat-top trees for nesting. This species has an extremely wide distribution across Africa but occurs at very low densities. It is prone to collision with powerlines and fences (from being flushed), while habitat loss and alteration are also major regional threats. Only a single individual was observed during the survey (Figure 3-9), and this species is expected to be an infrequent visitor to the Kareekloof PVSEF project area.



Figure 3-9. A Secretarybird observed on the Kareekloof PVSEF project area during the winter survey.

3.1.5.2 Vulnerable species

- Lanner Falcon (*Falco biarmicus*) occurs widely across South Africa in nearly all open habitat types. Major threats include habitat loss and collisions with powerlines. No individuals were recorded within the project area during the surveys. This species is adept at using man-made structures such as transmission pylons as perches, sites to hunt from, and nesting sites. It is considered to be an infrequent visitor to the Kareekloof PVSEF project area.

- Verreaux's Eagle (*Aquila verreauxii*) is quite widely distributed in South Africa, showing a preference for rocky ridges and mountains on which it breeds and hunts for Dassies and Rock Rabbits. The main threats facing this species in South Africa are direct persecution, drowning in farm dams, and collisions with and electrocutions on electricity transmission lines. Collisions with wind turbines is a growing threat. This species is breeding on the cliffs just outside the Kareekloof PVSEF project area and was regularly observed during the survey (Figure 3-10).
- Blue Crane (*Grus paradisea*) was recently downgraded from regionally Vulnerable to Near-Threatened (Taylor et al., 2015), but is still considered as globally Vulnerable (IUCN, 2023). The species was not observed in the Kareekloof PVSEF project area and no suitable breeding habitat was observed. The species prefers open areas, and it is considered as a foraging visitor in the region.



Figure 3-10. A Verreaux's Eagle observed on the Kareekloof PVSEF project area during the winter survey.

3.1.5.3 Summary

Loss of foraging habitat and potential collisions and electrocutions with powerlines associated with the PVSEF represents the major threats from the proposed development to the avifauna SCC discussed above. No loss of breeding habitat is expected from the proposed development.

3.1.6 Existing Impacts

Very low levels of existing impacts to avifauna were observed in the Kareekloof PVSEF project area during the surveys. Land use is almost exclusively low intensity livestock farming. Nevertheless, some potential impacts to avifauna observed on site include:

- Livestock grazing – reduces plant diversity and abundance and therefore habitat viability for foraging avifauna. However the low intensity of this practice is unlikely to have significantly altered the avifauna assemblage within the region. Death of livestock will attract scavenging species (e.g. Tawny Eagle) and could bring such species into direct contact with the project infrastructure (specifically powerlines) leading to fatalities.
- Built infrastructure – Some small farm structures, predominantly drinking facilities for livestock, are present which modify the habitat. Usually this is through the presence of a few alien trees which act as an attractant for avifauna and the trampling of vegetation by livestock which removes foraging habitat for birds.
- Alien and invasive species – Very few alien tree species are present, usually in association with the built infrastructure.

3.1.7 Site Ecological Importance (SEI)

As described in the species protocol guidelines (SANBI 2020), Site Ecological Importance (SEI) is a “standardised metric for identifying site-based ecological importance for species, in relation to a proposed project with a specific footprint and suite of anticipated activities”. SEI allows for rapid spatial inspection and evaluation of impacts of a proposed development within the context of on-site habitats and SCC, and also facilitates integration of inputs from different specialist studies. SEI depends on the careful spatial delineation of habitat types and an understanding of their utilisation by species of conservation concern.

SEI will be evaluated for each of the avifauna habitats in the Kareekloof PVSEF project area for the final EIA report, after all fieldwork has been completed, which will also complete the requirements of a SSV.

3.1.8 Anticipated Impact Description and Assessment

The main anticipated environmental impacts on avifauna from the proposed Kareekloof PVSEF are:

- the removal or alteration of large expanses of habitat specifically utilised by avifauna species of conservation concern;
- collisions with solar panels from the effects of polarized light and/or the “lake effect”⁸;
- collisions/electrocutions with auxiliary infrastructure, specifically electrical transmission lines and security fences (vehicle induced flushing);

⁸ There is no research to unambiguously support or refute this hypothesized effect. However, ample evidence exists to suggest that it is likely to be an impact at PVSEFs (e.g. based on identified collision deaths of water-associated birds from an American review study by Kosciuch et al. 2020). Monitoring of bird carcasses at PVSEFs is in its infancy in South Africa and as such, there is no certainty of the causal mechanism behind waterbird deaths at these facilities. Consequently, the precautionary approach must be taken until ample evidence refutes the “lake effect” hypothesis and BLSA updates the Birds & Solar Guidelines to exclude it.

- disturbance due to noise such as, machinery movements and maintenance operations during the construction and operational phase of the proposed PVSEF;
- attraction of certain bird species due to the development of PVSEF with associated infrastructure such as perches, nest and shade opportunities; and
- chemicals used to keep the PV panels clean from dust (suppressants) may cause poisoning and or exacerbate habitat loss.

Each of the potential impacts is carefully described below along with proposed mitigation measures to limit these impacts.

Ratings to determine significance will be provided in the EIA report after the final layout design has been provided.

3.1.8.1 Habitat Loss

IMPACT NATURE	Direct loss of avifaunal habitat		STATUS	NEGATIVE
Impact Description	Clearing of natural vegetation for the construction and establishment of the solar PV and associated infrastructure will result in the loss, degradation and fragmentation of foraging and breeding habitat for avifauna. Optimal foraging habitat in and around drainage areas have been excluded from the development area by a buffer of 100 m. Loss of breeding and/or mating display habitat for SCC or the loss of habitat for important bird congregations may also occur. It is possible that a lekking site of Ludwig's Bustard may be present on the elevated areas from which to be visible from great distances and these have been excluded from the development area by a buffer of 30 m. The Kareekloof PVSEF project area does not support any globally, nationally or regionally important congregations of waterfowl and / or migratory species.			
Impact Source(s)	Site clearing and preparation.			
Receptor(s)	Ludwig's Bustard, Blue Korhaan, Blue Crane and Secretarybird.			
PARAMETER	WITHOUT MITIGATION	SCORE	WITH MITIGATION	SCORE
EXTENT (A)	Preferred Alternative:		Preferred Alternative:	
DURATION (B)	Preferred Alternative:		Preferred Alternative:	
PROBABILITY (C)	Preferred Alternative:		Preferred Alternative:	
INTENSITY OR MAGNITUDE (D)	Preferred Alternative:		Preferred Alternative:	
SIGNIFICANCE RATING (F) = A*B*D*C	Preferred Alternative:		Preferred Alternative:	
CUMULATIVE IMPACTS	If the PVSEF and WEF facilities in the region take the necessary precautions to buffer the sensitive habitats for the receptor species and to prevent collisions of the receptor species with turbines and/or overhead powerlines (such as high rotor sweep heights, bird flight diverters on powerlines etc.), the receptor species should persist within the region at ecologically viable			

	population densities, limiting the potential for cumulative impacts to occur. The buffered sensitive habitats in the proposed Kareekloof PVSEF project area is expected to provide ample remaining habitat for the receptor species to persist. Therefore, the cumulative impacts to the receptor species are unlikely to be significant.
CONFIDENCE	High
MITIGATION MEASURES	<ul style="list-style-type: none"> • Limit the areas cleared for construction purposes (e.g. laydown areas). • Do not implement a bare earth policy for construction of solar panels, rather mow the vegetation. • Use the finalized SEI spatial layers (to be developed) to appropriately position all surface infrastructure so as to minimise loss of high sensitivity avifaunal habitat. • Demarcate such areas on the ground during construction and sign post them as "Environmentally sensitive areas - keep out!". • Ensure that all non-solar panel infrastructure occurs in Low SEI portions of the project area. • Rehabilitate all areas disturbed immediately after construction. • Prioritise existing roads for access routes. • Develop and implement an Alien and Invasive Plant Control Plan.

3.1.8.2 Collision and Electrocutation

IMPACT NATURE	Direct mortality through collision and electrocutation	STATUS	NEGATIVE	
Impact Description	Mortality from collision and electrocutation is a potential impact to avifauna from solar PV farms. This risk is likely to be highest in situations where PV panels and electrical transmission infrastructure are placed closer to areas of higher habitat complexity and resource availability where bird abundances are higher (e.g. wetlands/rivers and rocky ridges). In addition, vehicle induced collisions (direct collisions with vehicles or vehicle induced flushes into fence infrastructure) can pose significant direct mortality risk, especially to large ground dwelling species. Several SCC are likely/known to occur in the region of the proposed development which have a wingspan large enough (>1.5 m) to bridge gaps between live and earthed components or between phases of powerlines. In addition, electrocutation of birds within the substations/switching areas is also possible. This impact can be reduced through appropriate planning of the infrastructure layout based on the SEI evaluation. The position of infrastructure and alignment of the electrical transmission lines have yet to be confirmed.			
Impact Source(s)	Solar PV and electrical transmission infrastructure			
Receptor(s)	All birds but particularly water birds, raptors and other large-bodied species with low power to weight ratios and in-flight manoeuvrability. Major receptors include all of the bustard species known to be present within the region.			
PARAMETER	WITHOUT MITIGATION	SCORE	WITH MITIGATION	SCORE
EXTENT (A)	Preferred Alternative:		Preferred Alternative:	
DURATION (B)	Preferred Alternative:		Preferred Alternative:	
PROBABILITY (C)	Preferred Alternative:		Preferred Alternative:	

INTENSITY OR MAGNITUDE (D)	Preferred Alternative:		Preferred Alternative:	
SIGNIFICANCE RATING (F) = A*B*D*C	Preferred Alternative:		Preferred Alternative:	
CUMULATIVE IMPACTS	Without appropriate mitigation, the cumulative impacts on the receptors most at risk (bustards) from collisions with powerlines will be marked. Even with typical mitigation such as bird flight diverters, collisions are not unavoidable and there is likely to be an appreciable cumulative impact on bustard species in the region.			
CONFIDENCE	Low (without layout depicting grid connection routes and infrastructure)			
MITIGATION MEASURES	<ul style="list-style-type: none"> • Avoid placing any infrastructure near aquatic habitats by adhering at a minimum to a 100 m buffer around these habitats. • The overhead powerline infrastructure on site and the grid connection route alternatives have not yet been provided. It is recommended that wherever possible, existing electrical transmission infrastructure is utilised or underground cabling is implemented. Where the creation of new transmission lines is necessary attempts should be made to minimise the route length to the closest existing substation and that the route be aligned with existing powerlines as far as possible. Additionally, the route should avoid or minimise wetland/riverine crossings. • Install Eskom-approved bird flight diverters (flappers or coils) on new transmission lines (particularly the earth wire). This can help to increase the visibility of transmission lines especially the thinner earth line with which most collisions tend to be associated. If the transmission lines are long or if budget is constraining then prioritise portions of the transmission lines that pass near to or cross wetlands/riverine habitats or through High and Very High SEI habitat. • Design of overhead electrical lines must take into account potential for electrocution by large species and pre-emptively avoid the likelihood of this by increasing distances between spans to avoid faecal "streamers" or large open wings creating a short. • All power cables within the project area should be fully insulated and preferably buried in demarcated corridors. • White strips or simply the exposed (lustrous) aluminium frames along the edges of the solar panels appear to help to increase visibility and deter birds and are recommended as far as practically feasible. • Installation of bird deterrent devices on and around solar panels and on transmission line poles, pylons and / or monopoles as well as security/boundary fences, will be required to limit collision risk. • The BESS (if present) must be covered in non-reflective surfaces and protected against thermal discharge and the (low) risk of veld fires as a result. • In all areas where service roads intersect with semi natural or natural habitat (which is everywhere), all fences must be set back at least (strictly) 75 metres from the edge of every service road in order to allow for vulnerable species such as bustards, storks, cranes and korhaans to obtain adequate height after being flushed by vehicle traffic. Alternatively, the fences must be placed completely adjacent to the roads with a maximum of 3 metres buffer and marked with fence flappers in order to reduce flush related collisions. 			

3.1.8.3 Disturbance

IMPACT NATURE	Sensory disturbance	STATUS	NEGATIVE
----------------------	---------------------	---------------	----------

Impact Description	Sensory disturbances to avifauna are inevitable but are unlikely to negatively impact upon nesting SCC and is mainly likely to be restricted to the construction phase. Although dust, noise and human activity during construction is unavoidable, much can be done to reduce the effect of these sensory disturbance impacts on avifauna. During operation, the residual impacts associated with sensory disturbance should be negligible.			
Impact Source(s)	Machinery, influx of people, noise, dust, light.			
Receptor(s)	All avifauna, particularly large terrestrial birds and raptors			
PARAMETER	WITHOUT MITIGATION	SCORE	WITH MITIGATION	SCORE
EXTENT (A)	Preferred Alternative:		Preferred Alternative:	
DURATION (B)	Preferred Alternative:		Preferred Alternative:	
PROBABILITY (C)	Preferred Alternative:		Preferred Alternative:	
INTENSITY OR MAGNITUDE (D)	Preferred Alternative:		Preferred Alternative:	
SIGNIFICANCE RATING (F) = A*B*D*C	Preferred Alternative:		Preferred Alternative:	
CUMULATIVE IMPACTS	Disturbances to birds from the construction of renewable energy facilities in the region is likely to be short lived and very occasional and therefore unlikely to represent a significant cumulative impact.			
CONFIDENCE	High			
MITIGATION MEASURES	<ul style="list-style-type: none"> Adopt temporal avoidance strategies. Attempt, as far as possible to conduct the majority of the high intensity earthmoving and building activities during winter (June to September) to minimize disturbance of avifauna during sensitive life stages such as lekking, courting, nesting and fledging. Minimise light pollution and fit external lighting with downward facing hoods. Demarcate natural areas beyond the surface infrastructure footprint (buffered areas) and restrict access of personnel into these areas through education and signposting. Train staff and contractors on the importance of birds and other biodiversity and the sensitive areas for these species which should be avoided. Introduce and enforce a speed limit (40 km/h) 			

3.1.8.4 Attraction to the Facility

IMPACT NATURE	Attraction of birds	STATUS	NEGATIVE
----------------------	---------------------	---------------	-----------------

Impact Description	Certain (mainly commensal species) are often attracted by the establishment of the PVSEF and associated infrastructure as it presents additional resources in the form of perches, nesting habitat, shade and often food availability (increased rodents and weedy annual plants). This artificial increase in the abundance of some species has the effect of augmentation of the natural abundance and species composition of birds but more importantly places these opportunistic species and their predators at risk of collision and electrocution.			
Impact Source(s)	PVSEF and associated infrastructure.			
Receptor(s)	Commensal and opportunistic species but also their predators			
PARAMETER	WITHOUT MITIGATION	SCORE	WITH MITIGATION	SCORE
EXTENT (A)	Preferred Alternative:		Preferred Alternative:	
DURATION (B)	Preferred Alternative:		Preferred Alternative:	
PROBABILITY (C)	Preferred Alternative:		Preferred Alternative:	
INTENSITY OR MAGNITUDE (D)	Preferred Alternative:		Preferred Alternative:	
SIGNIFICANCE RATING (F) = A*B*D*C	Preferred Alternative:		Preferred Alternative:	
CUMULATIVE IMPACTS	Expected to be low.			
CONFIDENCE	Medium			
MITIGATION MEASURES	<ul style="list-style-type: none"> Install bird deterrent devices around panels and on transmission line poles, pylons and / or monopoles to limit perching and minimise collision and electrocution risk. 			

3.1.8.5 Chemical Use

IMPACT NATURE	Ecotoxicity	STATUS	NEGATIVE
Impact Description	The surfactants, dust suppressants and other chemicals that may be used to keep the PV panels clean may cause poisoning and or exacerbate habitat loss.		
Impact Source(s)	Chemicals		
Receptor(s)	All avifauna		

PARAMETER	WITHOUT MITIGATION	SCORE	WITH MITIGATION	SCORE
EXTENT (A)	Preferred Alternative:		Preferred Alternative:	
DURATION (B)	Preferred Alternative:		Preferred Alternative:	
PROBABILITY (C)	Preferred Alternative:		Preferred Alternative:	
INTENSITY OR MAGNITUDE (D)	Preferred Alternative:		Preferred Alternative:	
SIGNIFICANCE RATING (F) = A*B*D*C	Preferred Alternative:		Preferred Alternative:	
CUMULATIVE IMPACTS	The regular use of cleaning detergents by a large number of PVSEFs in a region has the potential to adversely affect water quality of watercourses. The extent, regularity and intensity of this impact on a regional level in such an arid environment is difficult to assess and impacts of this nature from solar developments on avifauna are poorly studied. However, given the limited number of PVSEFs and the very limited occurrence of wetlands and drainage areas throughout the region as a whole, this is unlikely to be a major concern.			
CONFIDENCE	Medium			
MITIGATION MEASURES	<ul style="list-style-type: none"> • Avoid or minimise the use of chemical surfactants; • Avoid or minimise the use chemical dust suppressants on site (preferentially use natural or biodegradable options); and • Ensure that none of the cleaning water enters nearby watercourses through runoff; • Do not clean before an imminent rainstorm. 			

3.2 ANTICIPATED CUMULATIVE IMPACTS

Cumulative impacts are notoriously difficult to assess accurately. However, the evaluation of cumulative impacts from PVSEFs and to a certain degree WEFs can largely be considered as a spatial analysis, because the most obvious impact to avifauna from these developments in arid areas, when evaluated in isolation of the associated overhead powerline infrastructure, is the loss of habitat, which includes flyways (for WEFs).

There are 4 known PVSEFs and seven known WEFs within a 30 km radius of the proposed Kareekloof PVSEF project area (REEA Q1 2023⁹) (Figure 3-11). Assuming that the total areas represented by all of these renewable energy developments

⁹ Renewable Energy EIA Application Database Quarter 1 2023 - https://egis.environment.gov.za/data_egis/data_download/current

shown in Figure 3-11 will be transformed, Table 2 shows that the maximum transformed area from renewable energy development boundaries within a 30 km radius of the proposed development cluster currently amounts to only 7.17% of the total land area. The proposed Kareekloof PVSEF itself only represents 1.01% of the 30 km radius area, indicating an insignificant proportion of transformation in the regional context that can be expected from this development alone. It is important to note that not all of these areas will be transformed by the proposed developments and mitigation recommendations made above and implemented by the existing developments will ensure that the most sensitive habitats remain undisturbed in the region.

As mentioned above, even with the best mitigation measures applied there are still cumulative negative impacts expected to bustard species, especially Ludwig's Bustard, in the region due to their propensity for collision with overhead powerlines (OHPLs) which cannot be completely mitigated with current measures such as bird flight diverters. Some cumulative impact to these species is therefore expected in the region from the renewable energy developments but it is not possible to accurately calculate the magnitude of this impact at this stage. More research is required to assess these impacts appropriately and develop mitigation solutions that are more effective than those currently available. The Endangered Wildlife Trust is currently attempting to develop new bird flight diverters to reduce Ludwig's Bustard fatalities.

The major component of cumulative impacts expected from renewable energy developments in the region is therefore from collisions with wind turbines and OHPLs, not habitat loss. Given the small additional land area that will be taken up by the proposed Kareekloof PVSEF, (Figure 3-11), it is highly unlikely to be significant in the regional context. The cumulative impact of habitat loss is therefore considered negligible.

Table 2: Cumulative impact from renewable energy developments in the region.

Elements	Area (ha)	Proportion of total area
Total area of 30 km buffer surrounding (and including) the proposed Kareekloof PVSEF.	369908.7	100.00%
Total area of known renewable energy developments within a 30 km buffer surrounding the proposed Kareekloof PVSEF.	26510.3	7.17%
Total area of known WIND energy developments within a 30 km buffer surrounding the proposed Kareekloof PVSEF.	18288.0	4.94%
Total area of known PV energy developments within a 30 km buffer surrounding the proposed Kareekloof PVSEF.	8222.3	2.22%
Total area of the proposed Kareekloof PVSEF.	3720.8	1.01%

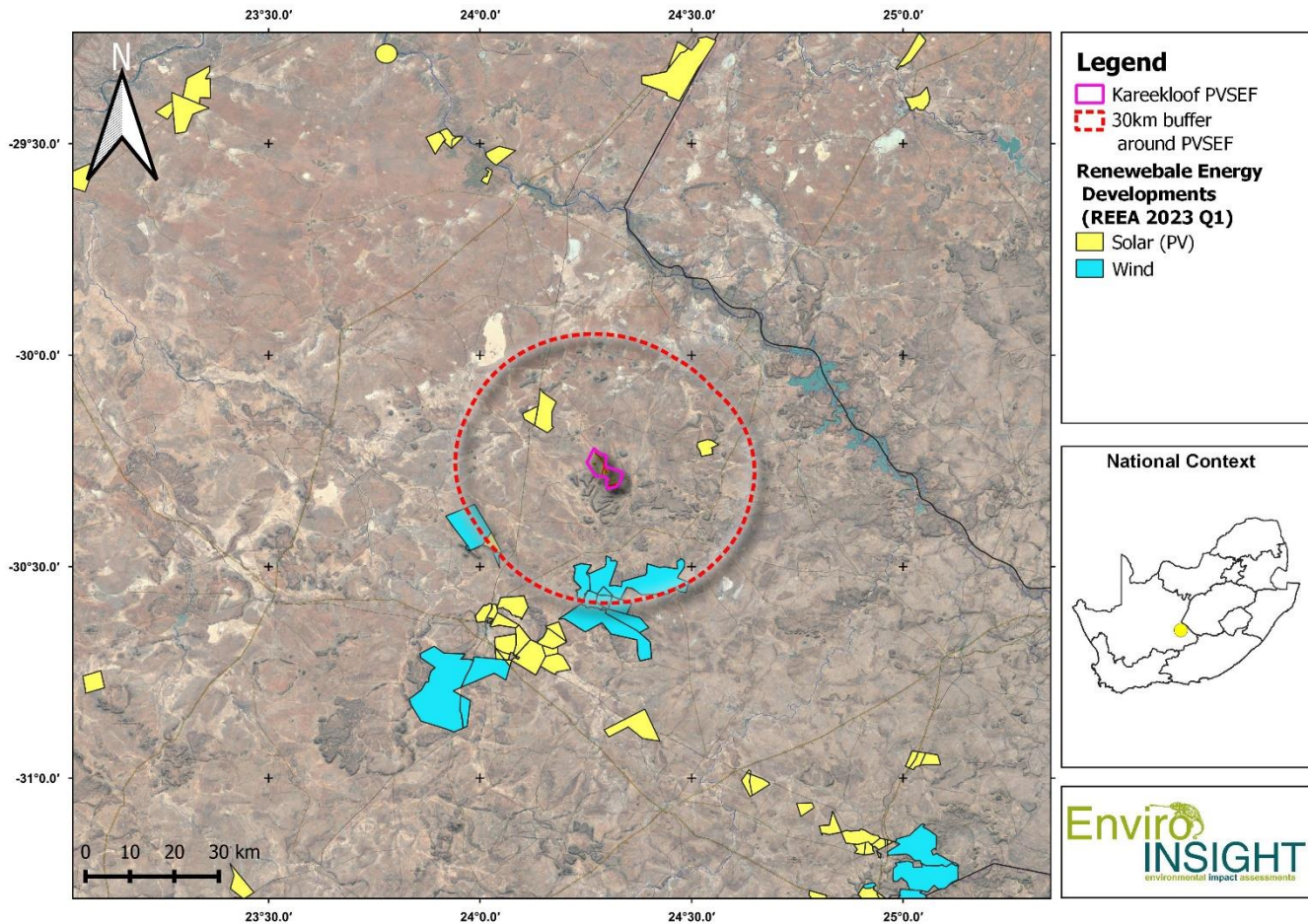


Figure 3-11. Location of known regional renewable energy projects (Quarter 1, 2023¹⁰) in relation to the Kareekloof PVSEF.

3.3 OPPORTUNITIES AND CONSTRAINTS

Following the appropriate buffering of the sensitive habitats for avifauna defined above, a No-Go delineation was developed to indicate the areas where development of infrastructure should be avoided. By implication, the areas outside of the No-Go delineation and within the boundary of the Kareekloof PVSEF project area are considered developable. The opportunities (developable) and constraints (non-developable) map for the proposed Kareekloof PVSEF project area is provide in Figure 3-12.

¹⁰ https://egis.environment.gov.za/data_egis/data_download/current

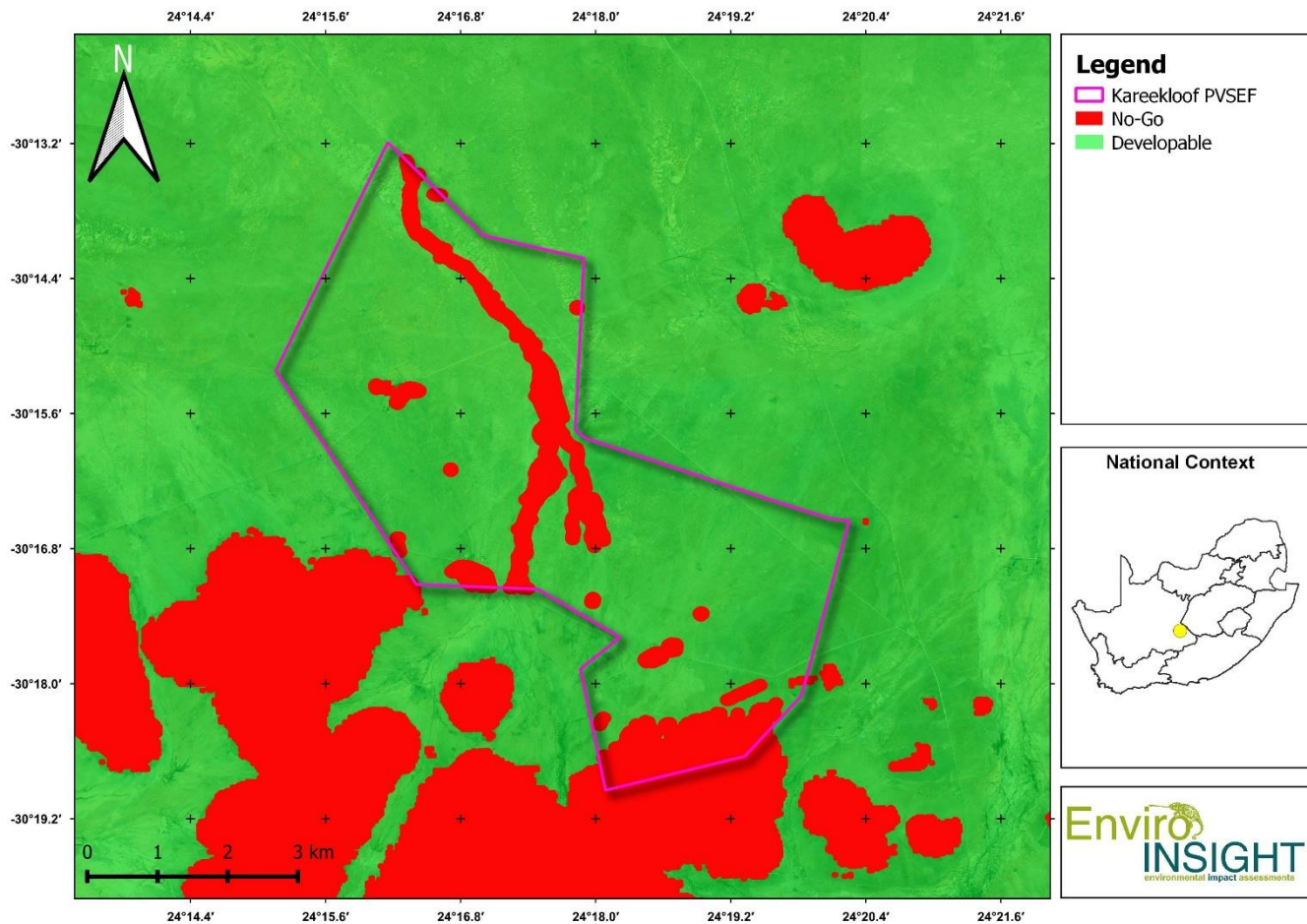


Figure 3-12. Avifauna opportunities and constraints (No-Go areas) map for the proposed Kareekloof PVSEF.

4 CONCLUSIONS AND PROFESSIONAL OPINION

There are no major negative impacts to avifauna SCC expected from the proposed development, provided that the proposed mitigation measures described above are applied. The Kareekloof PVSEF and associated project activities are likely to represent a low risk to avifauna (after application of mitigation). The specialists therefore recommends that the Competent Authority should grant environmental authorisation for this proposed PVSEF development (exclusive of any transmission lines which are to be evaluated separately), on condition that:

- All mitigation measures stipulated in this EIA report above are adhered to and captured in an Environmental Management Plan (EMP);
- The EMP must include the necessity for post-construction avifauna monitoring as stipulated in Jenkins et al. (2017).

5 REFERENCES

- Del Hoyo, J., Elliott, A. AND Sargatal, J. 1992. Handbook of the birds of the world. 1992 – 2011 editions, Lynx Editions, Barcelona.
- Gill, F. & Donsker, D. (Eds). 2019. IOC World Bird List (v9.2). doi: 10.14344/IOC.ML.9.2.
- Hockey P., Dean, W., Ryan, P., Maree S. & Brickman, B. 2005. *Roberts - Birds of Southern Africa* 7th ed. Trustees of the John Voelcker Bird Book Fun/ Africa Geographic Books. 1296 p.
- Jenkins AR, Ralston-Paton S, Smit-Robinson HA. 2017. Birds & Solar Energy. Best Practice Guidelines: Guidelines for assessing and monitoring the impact of solar power generating facilities on birds in southern Africa.
- Kosciuch, K., Riser-Espinoza, D., Geringer, M. and Erickson, W. 2020. A summary of bird mortality at photovoltaic utility scale solar facilities in the Southwestern US. PloS one, 15(4), p.e0232034.
- SABAP2 (South African Bird Atlas Project). 2023. Visited February 2023. <https://sabap2.birdmap.africa/>
- SANBI. 2018. Beta Vegetation Map of South Africa, Lesotho and Swaziland (File Geodatabase) [File geodatabase] 2018. Available from the Biodiversity GIS website (<http://bgis.sanbi.org/SpatialDataset/Detail/670>).
- SANBI. 2020. Species Environmental Assessment Guideline. Guidelines for the implementation of the Terrestrial Fauna and Terrestrial Flora Species Protocols for environmental impact assessments in South Africa. South African National Biodiversity Institute, Pretoria. Version 3.1. 2022.
- Shaw, J.M. 2015. Ludwig's Bustard *Neotis ludwigii*. In: Taylor, M.R., Peacock, F. and Wanless, R.M. (eds). The 2015 Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland. BirdLife South Africa, Johannesburg, South Africa, pp. 95–96.
- Taylor MR, Peacock F, Wanless RM. (eds). 2015. *The 2015 Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland*. BirdLife South Africa, Johannesburg, South Africa.

6 APPENDIX

6.1 EXPECTED & OBSERVED AVIFAUNA SPECIES

Table 3: Observed avifauna species for the nine focal SABAP2 pentads of the Kareekloof PVSEF [see Figure 2-1]. Species of conservation concern are highlighted at the top of the table.

Common Name	Scientific Name	Global Status (IUCN)	Regional Status (Taylor et al. 2015)	Individuals Observed Winter (Aug '23)
Ludwig's Bustard	<i>Neotis ludwigii</i>	EN	EN	
Martial Eagle	<i>Polemaetus bellicosus</i>	EN	EN	
Secretarybird	<i>Sagittarius serpentarius</i>	EN	VU	1
African Rock Pipit	<i>Anthus crenatus</i>	LC	NT	
Verreaux's Eagle	<i>Aquila verreauxii</i>	LC	VU	5
Lanner Falcon	<i>Falco biarmicus</i>	LC	VU	
Blue Korhaan	<i>Eupodotis caerulescens</i>	NT	LC	
Blue Crane	<i>Grus paradisea</i>	VU	NT	
Northern Black Korhaan	<i>Afrotis afraoides</i>			10
Egyptian Goose	<i>Alopochen aegyptiaca</i>			3
Red-headed Finch	<i>Amadina erythrocephala</i>			
African Pipit	<i>Anthus cinnamomeus</i>			1
Nicholson's Pipit	<i>Anthus nicholsoni</i>			
Buffy Pipit	<i>Anthus vaalensis</i>			
Little Swift	<i>Apus affinis</i>			
Common Swift	<i>Apus apus</i>			
White-rumped Swift	<i>Apus caffer</i>			
Black-headed Heron	<i>Ardea melanocephala</i>			
Pirit Batis	<i>Batis pririt</i>			
Common Buzzard	<i>Buteo buteo</i>			
Jackal Buzzard	<i>Buteo rufofuscus</i>			5
Red-capped Lark	<i>Calandrella cinerea</i>			
Fawn-colored Lark	<i>Calendulauda africanoides</i>			
Sabota Lark	<i>Calendulauda sabota</i>			4
Greater Striped Swallow	<i>Cecropis cucullata</i>			
Red-breasted Swallow	<i>Cecropis semirufa</i>			
Karoo Scrub Robin	<i>Cercotrichas coryphoeus</i>			14
Kalahari Scrub Robin	<i>Cercotrichas paena</i>			5
Karoo Long-billed Lark	<i>Certhilauda subcoronata</i>			
Three-banded Plover	<i>Charadrius tricollaris</i>			1
Spike-heeled Lark	<i>Chersomanes albofasciata</i>			18
White Stork	<i>Ciconia ciconia</i>			
Dusky Sunbird	<i>Cinnyris fuscus</i>			5
Desert Cisticola	<i>Cisticola aridulus</i>			12
Neddicky	<i>Cisticola fulvicapilla</i>			5

Common Name	Scientific Name	Global Status (IUCN)	Regional Status (Taylor et al. 2015)	Individuals Observed Winter (Aug '23)
Grey-backed Cisticola	<i>Cisticola subruficapilla</i>			10
Cloud Cisticola	<i>Cisticola textrix</i>			
White-backed Mousebird	<i>Colius colius</i>			
Speckled Pigeon	<i>Columba guinea</i>			
White-necked Raven	<i>Corvus albicollis</i>			
Pied Crow	<i>Corvus albus</i>			74
Cape Robin-Chat	<i>Cossypha caffra</i>			1
Wattled Starling	<i>Creatophora cinerea</i>			5
White-throated Canary	<i>Crithagra albogularis</i>			14
Black-throated Canary	<i>Crithagra atrogularis</i>			
Yellow Canary	<i>Crithagra flaviventris</i>			15
Layard's Warbler	<i>Curruca layardi</i>			3
Chestnut-vented Warbler	<i>Curruca subcoerulea</i>			
African Palm Swift	<i>Cypsiurus parvus</i>			
Sickle-winged Chat	<i>Emarginata sinuata</i>			2
Cape Bunting	<i>Emberiza capensis</i>			6
Lark-like Bunting	<i>Emberiza impetuani</i>			282
Cinnamon-breasted Bunting	<i>Emberiza tahapisi</i>			
Yellow-bellied Eremomela	<i>Eremomela icteropygialis</i>			1
Grey-backed Sparrow-Lark	<i>Eremopterix verticalis</i>			107
Southern Red Bishop	<i>Euplectes orix</i>			
Cinnamon-breasted Warbler	<i>Euryptila subcinnamomea</i>			
Greater Kestrel	<i>Falco rupicoloides</i>			1
Rock Kestrel	<i>Falco rupicolus</i>			1
Large-billed Lark	<i>Galerida magirostris</i>			4
Booted Eagle	<i>Hieraaetus pennatus</i>			
Barn Swallow	<i>Hirundo rustica</i>			
Pied Starling	<i>Lamprotornis bicolor</i>			6
Cape Starling	<i>Lamprotornis nitens</i>			
Southern Fiscal	<i>Lanius collaris</i>			11
Red-backed Shrike	<i>Lanius collurio</i>			
Lesser Grey Shrike	<i>Lanius minor</i>			
Rufous-eared Warbler	<i>Malcorus pectoralis</i>			28
Chat Flycatcher	<i>Melaenornis infuscatus</i>			11
Fiscal Flycatcher	<i>Melaenornis silens</i>			3
Pale Chanting Goshawk	<i>Melierax canorus</i>			15
Gabar Goshawk	<i>Micronisus gabar</i>			
Eastern Clapper Lark	<i>Mirafra fasciolata</i>			3
Short-toed Rock Thrush	<i>Monticola brevipes</i>			1
Cape Wagtail	<i>Motacilla capensis</i>			4
Spotted Flycatcher	<i>Muscicapa striata</i>			

Common Name	Scientific Name	Global Status (IUCN)	Regional Status (Taylor et al. 2015)	Individuals Observed Winter (Aug '23)
Ant-eating Chat	<i>Myrmecocichla formicivora</i>			42
Mountain Wheatear	<i>Myrmecocichla monticola</i>			2
Helmeted Guineafowl	<i>Numida meleagris</i>			24
Namaqua Dove	<i>Oena capensis</i>			
Familiar Chat	<i>Oenanthe familiaris</i>			3
Capped Wheatear	<i>Oenanthe pileata</i>			
Pale-winged Starling	<i>Onychognathus nabouroup</i>			
Cape Sparrow	<i>Passer melanurus</i>			16
South African Cliff Swallow	<i>Petrochelidon spilodera</i>			
Willow Warbler	<i>Phylloscopus trochilus</i>			
White-browed Sparrow-Weaver	<i>Plocepasser mahali</i>			11
Southern Masked Weaver	<i>Ploceus velatus</i>			
Black-chested Prinia	<i>Prinia flavicans</i>			4
Rock Martin	<i>Ptyonoprogne fuligula</i>			3
African Red-eyed Bulbul	<i>Pycnonotus nigricans</i>			7
Red-billed Quelea	<i>Quelea quelea</i>			10
Grey-winged Francolin	<i>Scleroptila afra</i>			
Laughing Dove	<i>Spilopelia senegalensis</i>			
Pink-billed Lark	<i>Spizocorys conirostris</i>			
Scaly-feathered Weaver	<i>Sporopipes squamifrons</i>			8
Fairy Flycatcher	<i>Stenostira scita</i>			
Cape Turtle Dove	<i>Streptopelia capicola</i>			6
Common Ostrich	<i>Struthio camelus</i>			
Long-billed Crombec	<i>Sylvietta rufescens</i>			
Alpine Swift	<i>Tachymarptis melba</i>			
Bokmakierie	<i>Telophorus zeylonus</i>			6
Crested Barbet	<i>Trachyphonus vaillantii</i>			
Acacia Pied Barbet	<i>Tricholaema leucomelas</i>			10
Karoo Thrush	<i>Turdus smithi</i>			1
Red-faced Mousebird	<i>Urocolius indicus</i>			20
Blacksmith Lapwing	<i>Vanellus armatus</i>			
Crowned Lapwing	<i>Vanellus coronatus</i>			
Cape White-eye	<i>Zosterops virens</i>			

6.2 SACNASP REGISTRATION OF SPECIALISTS

