ENVIRONMENTAL IMPACT ASSESSMENT FOR PROPOSED DEVELOPMENT OF ALLEPAD PV FOUR SOLAR PV FACILITY AND ASSOCIATED INFRASTRUCTURE ON A SITE NEAR UPINGTON, IN THE NORTHERN CAPE PROVINCE.:

AVIFAUNAL SPECIALIST SCOPING REPORT

savannah environmental

PRODUCED FOR SAVANNAH ENVIRONMENTAL

BY

3Foxes Biodiversity Solutions

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EXECUTIVE SUMMARY

ILEnergy Development is proposing the establishment of the 100MW Allepad PV Four commercial photovoltaic solar energy facilities on a portion of the Remaining Extent of Erf 5315, located approximately 11km north-west of Upington, in the Northern Cape Province. Savannah Environmental has been appointed to undertake the required application for environmental authorisation process for the above development. The development is currently in the Scoping Phase and 3Foxes Biodiversity Solutions has been appointed to provide a specialist avifaunal scoping study of the development site as part of the EIA process.

A full field assessment as well as a desktop review of the available avifaunal information for the area was conducted in order to identify and characterise the avifaunal features of the site. An approximate total of 145 bird species have been recorded within the study area and surrounds, of which 54 species were observed on site during a three-day field survey in July 2018. Only five of these are listed as near-endemic and a further ten species as biome-restricted. There are no known Important Bird Areas (IBAs) within the vicinity of the study site, while there are also no known large terrestrial bird populations or wetlands of significant avifaunal importance.

Nine species recorded in the broader area are red-listed, of which six species are listed as threatened, and three considered Near-Threatened. Two Near-Threatened species were recorded during the site visit, namely Karoo Korhaan (several pairs) and Kori Bustard *Ardeotis kori* (one pair). All six of the threatened species that may occur in the study area, albeit in low numbers or infrequently, and include White-backed Vulture *Gyps africanus* (Critically Endangered), Ludwig's Bustard *Neotis ludwigii* (Endangered), Martial Eagle *Polemaetus bellicosus* (Endangered), Tawny Eagle *Aquila rapax* (Endangered), Secretarybird *Sagittarius serpentarius* (Vulnerable), and Lanner Falcon *Falco biarmicus* (Vulnerable). No sensitive breeding or roosting sites of any red-listed species were observed at the site during the field survey.

The expected impacts of the proposed solar development within the study area include 1) habitat loss and fragmentation associated with sandy plains habitat of the Gordonia Duneveld vegetation type, 2) disturbance caused during the construction and maintenance phases, and 3) direct mortality of avifauna colliding with solar panels and associated power line structures, as well as electrocutions with power line infrastructure. The species that will be the most negatively impacted by the proposed development include primarily small passerines, ground-dwelling non-passerines and large raptors and terrestrial birds that occasionally use the area for foraging. The impacts on the avifauna would normally be expected to be of medium importance, but due to the low frequency of occurrence of priority species, the impacts are likely to be low and no high post-mitigation impacts are expected.

The primary mitigation measures required to reduce the potential impacts on priority species include 1) restrict habitat destruction and disturbance to within the footprint of the proposed development, 2) exclusion of the Kalahari Karroid Shrubland from any development as this area supports resident Karoo Korhaans, 3) exclusion of the linear dunes fields within the north-west portion of the study area, 4) fitment of bird diverters where necessary on all erected power lines associated with the development to reduce the possibility of collisions and electrocutions, 4) ensure that perimeter fencing along the boundaries of the development are bird (especially ground-dwelling species) and wildlife friendly.

Cumulative impacts associated with the development area may be of concern due to increasing number of solar facility developments proposed for the broader Upington area. Considering that the vegetation and avifauna that occur on the property are rather typical of the Kalahari bioregion, the overall cumulative avifaunal impact of the development is considered likely to be low, provided that the remaining areas of the property remain undeveloped and that suitable ecological corridors are identified and maintained. This is to ensure that ecological connectivity between areas of higher conservation value is maintained.

Considering that the study area supports a typical bioregional avifaunal assemblage, and that there are no known breeding or roosting sites of red-listed priority species, there are no impacts associated with the development that are considered to be of high significance and which cannot be mitigated to a low level. Therefore, based on the results of this assessment, there are no reasons to indicate that the development should not proceed to the EIA phase. A proposed plan of study for the EIA phase is provided.

CONTENTS

COMPLIANCE WITH APPENDIX 6 OF THE 2014 EIA REGULATIONS, AS AMENDED

Requirements of Appendix 6 – GN R326 2014 EIA Regulations, 7 April 2017	**Addressed in the Specialist Report**
1. (1) A specialist report prepared in terms of these Regulations must contain- a) details of- i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	7-8
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	9
c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 1
(cA) an indication of the quality and age of base data used for the specialist report;	Section 2.1
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 3
d) the date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 2.2
e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 2
f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 3
g) an identification of any areas to be avoided, including buffers;	Section 3
h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 3
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 2.4
j) a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	Section 4
k) any mitigation measures for inclusion in the EMPr;	
l) any conditions for inclusion in the environmental authorisation;	
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	
n) a reasoned opinion- i. whether the proposed activity, activities or portions thereof should be authorised; (iA) regarding the acceptability of the proposed activity or activities and ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	See Main Report
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	See Main Report
q) any other information requested by the competent authority.	
2) Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	N/A

SHORT CV/SUMMARY OF EXPERTISE

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Ecological Solutions for People & the Environment

Simon Todd

Simon Todd is Director and principal scientist at 3Foxes Biodiversity Solutions and has over 20 years of experience in biodiversity measurement, management and assessment. He has provided specialist ecological input on more than 200 different developments distributed widely across the country. This includes input on the Wind and Solar SEA (REDZ) as well as the Eskom Grid Infrastructure (EGI) SEA and Karoo Shale Gas SEA. He is on the National Vegetation Map Committee as representative of the Nama and Succulent Karoo Biomes. Simon Todd is a recognised ecological expert and is a past chairman and current deputy chair of the Arid-Zone Ecology Forum. He is registered with the South African Council for Natural Scientific Professions (No. 400425/11).

Skills & Primary Competencies

- Research & description of ecological patterns & processes in Nama Karoo, Succulent Karoo, Thicket, Arid Grassland, Fynbos and Savannah Ecosystems.
- Ecological Impacts of land use on biodiversity
- Vegetation surveys & degradation assessment & mapping
- Long-term vegetation monitoring
- Faunal surveys & assessment.
- GIS & remote sensing

Tertiary Education:

- 1992-1994 – BSc (Botany & Zoology), University of Cape Town
- 1995 – BSc Hons, Cum Laude (Zoology) University of Natal
- 1996-1997- MSc, Cum Laude (Conservation Biology) University of Cape Town

Employment History

- 2009 – Present – Sole Proprietor of Simon Todd Consulting, providing specialist ecological services for development and research.
- 2007 Present – Senior Scientist (Associate) – Plant Conservation Unit, Department of Botany, University of Cape Town.

- 2004-2007 – Senior Scientist (Contract) – Plant Conservation Unit, Department of Botany, University of Cape Town
- 2000-2004 – Specialist Scientist (Contract) - South African National Biodiversity Institute
- 1997 – 1999 – Research Scientist (Contract) – South African National Biodiversity Institute

A selection of recent work is as follows:

Strategic Environmental Assessments

Co-Author. Chapter 7 - Biodiversity & Ecosystems - Shale Gas SEA. CSIR 2016.

Co-Author. Chapter 1 Scenarios and Activities – Shale Gas SEA. CSIR 2016.

Co-Author – Ecological Chapter – Wind and Solar SEA. CSIR 2014.

Co-Author – Ecological Chapter – Eskom Grid Infrastructure SEA. CSIR 2015.

Contributor – Ecological & Conservation components to SKA SEA. CSIR 2017.

Recent Specialist Ecological Studies in the Vicinity of the Current Site

- Kathu Solar PV Facility. Fauna and Flora EIA Process. Cape EAPrac 2015.
- Mogobe Solar PV Facility. Fauna and Flora EIA Process. Cape EAPrac 2015.
- Legoko Solar PV Facility. Fauna and Flora EIA Process. Cape EAPrac 2015.
- RE Capital 10 Solar Power Plant, Postmasburg. Fauna and Flora EIA Proces. Cape EAPrac 2015.
- Walk-through study of Kumba Iron Ore expansion area at Dingleton, Northern Cape. MSA Group. 2017.
- Adams PV Project – EIA process and follow-up vegetation survey. Aurora Power Solutions. 2016.
- Mamatwane Compilation Yard. Fauna and Flora EIA process. ERM. 2013.
- Olifantshoek-Emil 132kV power line, Olifantshoek. Fauna and Flora BA process. Savannah Environmental 2017.
- Gaetsewe Solar PV Facility, Kathu. Fauna and Flora EIA Process. Cape EAPrac 2018.
- Mogara Solar PV Facility, Kathu. Fauna and Flora EIA Process. Cape EAPrac 2018.
- Kathu Hyperion Solar PV Facility, Kathu. Fauna and Flora EIA Process. Cape EAPrac 2018.

Eric Herrmann

Eric Herrmann is an independent consultant with over 15 years of experience in avifaunal and mammalian research and conservation in the Northern Cape.

Tertiary Education:

- 1994 - 1997 – National Diploma: Nature Conservation (cum laude), Cape Technikon
- 1998 - 1999 – B.Tech Degree: Nature Conservation (cum laude), Cape Technikon
- 2000 - 2004 – MFor: Conservation Ecology (cum Laude), University of Stellenbosch

Employment History

- 2016 - Present – Independent contractor, avifaunal specialist for renewable energy projects.
- 2006 - 2012 – Senior Conservation Scientist, Department of Environment and Nature Conservation, Kimberley.
- 2003 - 2006 – Research Assistant and Field Projects Manager, Percy Fitzpatrick Institute of African Ornithology, Cape Town
- 2001 - 2002 – Field Researcher, Deciduous Fruit Producers Trust, Stellenbosch.
- 1999 - 2001 – Research Assistant, Endangered Wildlife Trust, Johannesburg.

Recent Specialist Ecological Studies in the Vicinity of the Current Site

- Olifantshoek-Emil 132kV power line, Olifantshoek. Fauna and Flora BA process. Savannah Environmental 2017.
- Gaetsewe Solar PV Facility, Kathu. Avifaunal Scoping Report. Cape EAPrac 2018.
- Mogara Solar PV Facility, Kathu. Avifaunal Scoping Report. Cape EAPrac 2018.
- Kathu Hyperion Solar PV Facility, Kathu. Fauna and Flora EIA Process. Cape EAPrac 2018.

SPECIALIST DECLARATION

I, ..Simon Todd....., as the appointed independent specialist, in terms of the 2014 EIA Regulations, hereby declare that I:

- I act as the independent specialist in this application;
- I 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;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act;
- 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 have no vested interest in the proposed activity proceeding;
- 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;
- I have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;
- I have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;
- all the particulars furnished by me in this specialist input/study are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the specialist: 

Name of Specialist: ____Simon Todd_____

Date: ____14 September 2018_____

1 INTRODUCTION

ILEnergy Development is proposing the establishment of the 100MW Allepad PV Four commercial photovoltaic solar energy facilities on a portion of the Remaining Extent of Erf 5315, located approximately 11km north-west of Upington, in the Dawid Kruiper Local Municipality, of the ZF Mgcawu District, in the Northern Cape Province. Savannah Environmental has been appointed to undertake the required application for environmental authorisation process for the above development. The development is currently in the Scoping Phase and 3Foxes Biodiversity Solutions has been appointed to provide a specialist avifaunal scoping study of the development site as part of the EIA process.

The purpose of the Allepad PV Four Avifaunal Scoping Report is to 1) describe the avian ecological features of the proposed PV project site, 2) to provide a preliminary assessment of the avian ecological sensitivity of the site, and 3) identify and assess the significance of the likely impacts on the avifauna associated with the development of the site as a solar PV facility, and 4) to provide measures to avoid, minimize and mitigate project related impacts to the avifauna. A site visit (13 to 16 August 2018) as well as a desktop review of the available literature for the area was conducted in order to identify and characterise the local avifauna at the site.

This information is used to derive a draft avifaunal sensitivity map that presents the ecological constraints and opportunities for development at the site. The information and sensitivity map presented here provides an avifaunal baseline that should be used in the planning phase of the development to ensure that the potential negative avifaunal impacts associated with the development can be minimised. Furthermore, the study defines the terms of reference for the EIA phase of the project and outlines a plan of study for the EIA which will follow the Scoping Study. The full scope of study is detailed below.

1.1 Scope of Study

The assessment is conducted according to the 2014 EIA Regulations (Government Notice Regulation 982) in terms of the National Environmental Management Act (Act 107 of 1998) as amended (NEMA), as well as best-practice guidelines and principles for avifaunal assessment within solar energy facilities as outlined by Birdlife South Africa.

The scope of the study includes the following activities

- a description of the avifauna that may be affected by the activity and the manner in which the avifauna may be affected by the proposed project
- a description and evaluation of environmental issues and potential impacts on the avifauna (including using direct, indirect and cumulative impacts) that have been identified

- a statement regarding the potential significance of the identified issues based on the evaluation of the issues/impacts
- an indication of the methodology used in determining the significance of potential impacts on the avifauna
- an assessment of the significance of direct indirect and cumulative impacts in terms of the following criteria:
    - the nature of the impact, which shall include a description of what causes the effect, what will be affected, and how it will be affected
    - the extent of the impact, indicating whether the impact will be local (limited to the immediate area or site of development), regional, national or international
    - the duration of the impact, indicating whether the lifetime of the impact will be of a short-term duration (0-5 years), medium-term (5-15 years), long-term (> 15 years, where the impact will cease after the operational life of the activity), or permanent
    - the probability of the impact, describing the likelihood of the impact actually occurring, indicated as improbable (low likelihood) probable (distinct possibility), highly probable (most likely), or definite (Impact will occur regardless of any preventable measures)
    - the severity/beneficial scale indicating whether the impact will be very severe/beneficial (a permanent change which cannot be mitigated/permanent and significant benefit with no real alternative to achieving this benefit), severe/beneficial (long-term impact that could be mitigated/long-term benefit), moderately severe/beneficial (medium- to long-term impact that could be mitigated/ medium- to long-term benefit), slight, or have no effect
    - the significance which shall be determined through a synthesis of the characteristics described above and can be assessed as low medium or high
    - the status which will be described as either positive, negative or neutral
    - the degree to which the impact can be reversed
    - the degree to which the impact may cause irreplaceable loss of resources
    - the degree to which the impact can be mitigated

- a description and comparative assessment of all alternatives
- recommendations regarding practical mitigation measures for potentially significant impacts, for inclusion in the Environmental Management Programme (EMPr)
- an indication of the extent to which the issue could be addressed by the adoption of mitigation measures
- a description of any assumptions uncertainties and gaps in knowledge
- an environmental impact statement which contains:
    - a summary of the key findings of the environmental impact assessment;
    - an assessment of positive and negative implications of the proposed activity;
    - a comparative assessment of the positive and negative implications of identified

alternatives.

General Considerations:

- Disclose any gaps in information or assumptions made.
- Identify recommendations for mitigation measures to minimise impacts.
- Outline additional management guidelines.
- Provide monitoring requirements, mitigation measures and recommendations in a table format as input into the Environmental Management Plan (EMP) for avifaunal related issues.

A description of the potential impacts of the development and recommended mitigation measures are to be provided, which will be separated into the following project phases:

- Preconstruction
- Construction
- Operational Phase

1.2 RELEVANT ASPECTS OF THE DEVELOPMENT

The development project is proposed on a portion of the Remaining Extent of Erf 5315, located approximately 11km north-west of Upington (Figure 1). The area under investigation is approximately 3 889ha in extent and comprises a single agricultural property. The project site can be accessed directly via the N10 national road which borders the southern boundary of the site. Photovoltaic (PV) technology is proposed for the generation of electricity. The solar energy facility will have a contracted capacity of up to 100MW, and will make use of either fixed-tilt, single-axis tracking, or double axis tracking PV technology. The solar energy facility will comprise the following key infrastructure components:

- Arrays of PV panels with a generation capacity of up to 100MW.
- Mounting structures to support the PV panels.
- Combiner boxes, on-site inverters (to convert the power from Direct Current (DC) to Alternating Current (AC)), and power transformers.
- An on-site substation up to 1ha in extent to facilitate the connection between the solar energy facility and the Eskom electricity grid.
- A new 132kV power line approximately 5km in length, between the on-site substation and Eskom grid connection point.
- Cabling between the project's components (to be laid underground where practical).
- Meteorological measurement station.
- Energy storage area of up to 2ha in extent.
- Access road and internal access road network.

- On-site buildings and structures, including a control building and office, ablutions and guard house.
- Perimeter security fencing, access gates and lighting.
- Temporary construction equipment camp up to 1ha in extent, including temporary site offices, parking and chemical ablution facilities.
- Temporary laydown area up to 1ha in extent, for the storage of materials during the construction.

In terms of the grid connection, the following is proposed:

- The project will connect to the upgraded 132kV double circuit line which runs approximately 5km east of the project site, between the new Upington MTS (currently under construction approximately 15km south of the project site) and the Gordonia Distribution substation (located in Upington town).
- The grid connection will make use of a "loop in-and-loop out" configuration.
- The shortest route is along the N10 in a 300m wide corridor.

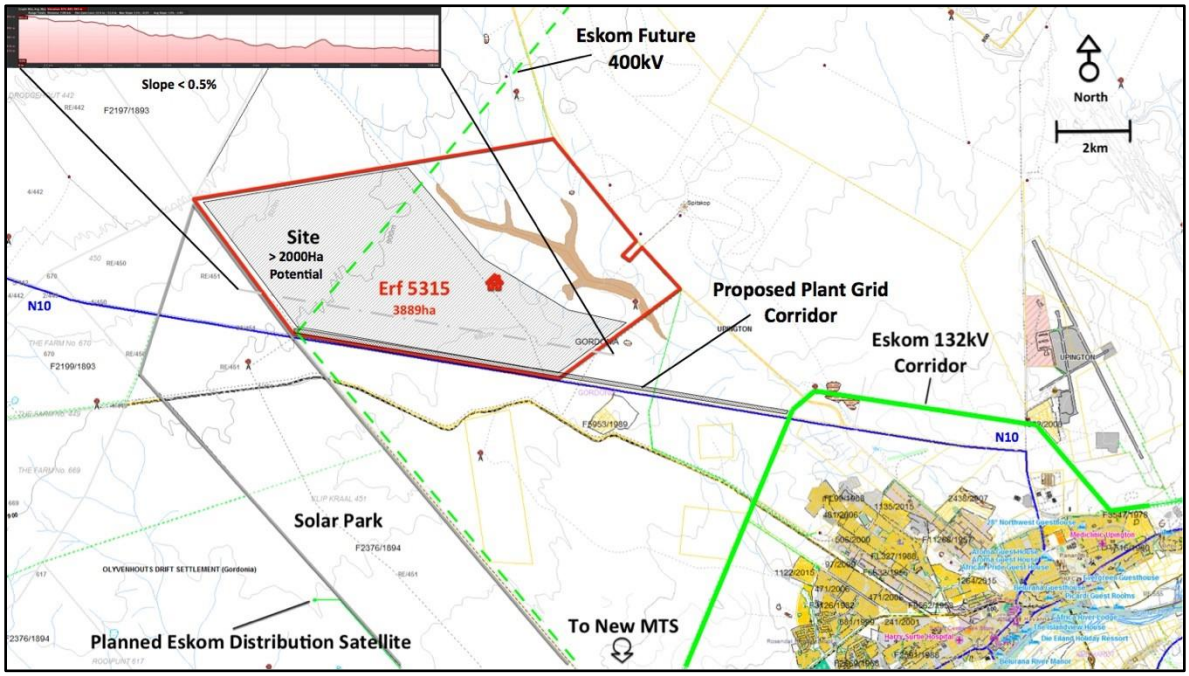

Figure 1. Locality map of the Allepad PV Four study site, illustrating the property boundary in red and the proposed power line route to the Eskom substation at Upington.

2 METHODOLOGY

2.1 DATA SOURCING AND REVIEW

Data sources from the literature consulted and used where necessary in the study include the following:

- The Southern African Bird Atlas Project 1 (SABAP 1; Harrison *et al*., 1997), which obtained bird distribution data between 1987 and 1992, was consulted to determine the bird species likely to occur within the study area. The relevant quarter-degree grid cells (QDGC) that covers the study area is 2821AC (35 cards, 144 species). More recent bird distribution data were also obtained from the second bird atlas project, which has been on-going since its inception in 2007 (SABAP 2; http://sabap2.adu.org.za/). SABAP2 employs a finer resolution using the pentad scale (5' latitude x 5' longitude), with the relevant pentad codes for the study area being 2820_2105 (52 cards, 131 species) and 2820_2100 (6 cards, 43 species). These were consulted to determine the bird species likely to occur within the study area and the broader impact zone of the development.
- The Important Bird Areas of South Africa (IBA; Marnewick *et al*., 2015) was consulted to determine the location of the nearest IBAs to the study area.
- The data from the Coordinated Avifaunal Roadcounts (CAR; Young *et al*., 2003) were consulted to determine the location of the nearest CAR routes to the study area.
- The data from the Coordinated Waterbird Counts (CWAC; Taylor *et al*., 1999) were consulted to determine the location of the nearest CWAC sites to the study area.
- The conservation status, endemism and biology of all species considered likely to occur within the study area were determined from Hockey *et al.* (2005) and Taylor *et al.* (2015).
- The South African National Vegetation Map (Mucina & Rutherford, 2006) was consulted in order to determine the vegetation types and their conservation status that occur within the study area.

The literature review revealed that there are no Important Bird Areas (IBAs), Coordinated Avifaunal Roadcounts (CAR) routes, or Coordinated Waterbird Counts (CWAC) wetlands in the vicinity of the study area.

2.2 SITE VISIT & FIELD METHODOLOGY

A site visit of three days was made to the study area in mid-winter (15 to 17 July 2018) to determine the *in situ* local avifauna and avian habitats present on site. A total of 35 line transects, measuring 1km in length, were walked throughout the study area to ensure adequate coverage under the time constraints. All birds detected by sight or sound during

these transect walks were recorded, as well as the number of birds per detection. These walked transects served to:

- Quantify aspects of the local avifauna (such as species diversity and abundance);
- Identify important avian features present on site (such as nesting and roosting sites);
- Confirm the presence, abundance, habitat preference and movements of priority species;
- Identify important flyways across the site; and
- Delineate any obvious, highly sensitive, no-go areas to be avoided by the development.

Prior to analysing the transect data, all records of birds that were only seen flying over the study site (e.g. sandgrouse), or large flocking species attracted to focal points such as watering holes (e.g. bishop and quelea), were excluded from the database.

A list was compiled of all the avifaunal species likely to occur within the study area and the broader impact zone of the development, based on a combination of existing distributional data (SABAP 1 and SABAP 2) and species seen during the site visit. A short-list of priority bird species (including nationally and/or globally threatened, rare, endemic or range-restricted bird species) which could be affected by the proposed development was also compiled. These species will subsequently be considered as adequate surrogates for the local avifauna in general, and mitigation of impacts on these species will be considered likely to accommodate any less important bird populations that may also potentially be affected.

2.3 SENSITIVITY MAPPING & ASSESSMENT

An avifaunal sensitivity map of the site was produced by integrating the available ecological and biodiversity information available in the literature and various spatial databases with mapping based on the satellite imagery of the site as well as personal knowledge of the site. This includes delineating different habitat units identified on the satellite imagery and assigning likely sensitivity values to the units based on their ecological properties, conservation value and the potential presence of avifaunal species of conservation concern. The ecological sensitivity of the different units identified in the mapping procedure was rated according to the following scale:

- **Low** – Areas of natural or transformed habitat with a low sensitivity where there is likely to be a negligible impact on ecological processes and avifaunal biodiversity. Most types of development can proceed within these areas with little ecological impact.
- **Medium**- Areas of natural or previously transformed land where the impacts are likely to be largely local and the risk of secondary impact such as erosion low. These areas usually comprise the bulk of habitats within an area. Development within these areas can proceed with relatively little ecological impact provided that appropriate mitigation measures are taken.

- **High** – Areas of natural or transformed land where a high impact is anticipated due to the high biodiversity value, sensitivity or important ecological role of the area. These areas may contain or be important habitat for avifaunal species or provide important ecological services such as water flow regulation or forage provision. Development within these areas is undesirable and should only proceed with caution as it may not be possible to mitigate all impacts appropriately.
- **Very High** – Critical and unique habitats that serve as habitat for rare/endangered species or perform critical ecological roles. These areas are essentially no-go areas from a developmental perspective and should be avoided as much as possible.

In some situations, areas were also classified between the above categories, such as Medium-High, where it was deemed that an area did not fit well into a certain category but rather fell most appropriately between two sensitivity categories. However, it is important to note that there are no sensitivities that are identified as "Medium to High" or similar ranged categories because this adds uncertainty to the mapping as it is not clear if an area falls at the bottom or top of such a range.

2.4 SAMPLING LIMITATIONS AND ASSUMPTIONS

The current study consisted of a relatively detailed field assessment as well as a desktop study, which serves to significantly reduce the limitations and assumptions required for the study. However, it must be noted that there are limiting factors and these could detract from the accuracy of the predicted results:

- There is a scarcity of published, scientifically assessed information regarding the avifaunal impacts at existing SEFs. Recent studies at SEFs (all using different solar technologies) in southern California have revealed that a wide range of bird species are susceptible to morbidity and mortality at SEFs, regardless of the type of technology employed. It must however be noted, that facility related factors could influence impacts and mortality rates and as such, each SEF must be assessed individually, taking all variables into account.
- Assessment of the impacts associated with bird-SEF interactions is problematic due to: (i) limitations on the quality of information available describing the composition, abundance and movements of the local avifauna, and (ii) the lack of local, empirical data describing the known impacts of existing SEFs on birds (Jenkins, 2011). A more recent study (Venter, 2016), however, provides some preliminary data within the South African context.
- The SABAP 1 data for the relevant quarter degree squares covering the proposed development area are now >21 years old (Harrison *et al*., 1997). However, with nearly 60 cards being submitted for the two relevant pentads that cover the study area during SABAP 2, relatively reliable data exist with respect to species reporting rates. In an attempt to ensure a conservative approach with regards to the species included on the

final avifaunal list (Annexure 1), the species list derived from the literature was obtained from an area somewhat larger than the study site, and thus likely includes a much wider array of species than what actually occurs at the site. Aquatic species that were included on the original SABAP1 list for the area, but are largely restricted to permanent water bodies such as the nearby Orange River, were excluded from the final list compiled.

- Limited time in the field and seasonal spread means that important components of the local avifauna (i.e.Important nest sites or localised areas of key habitats for rare or threatened species) could have been missed. However, the extent of the development area is not that large with the result that it has been well-covered and as it contains few large trees, it is highly unlikely that there are any significant nesting sites of larger species present within the affected area that would not have been detected.

3 DESCRIPTION OF THE AFFECTED ENVIRONMENT- BASELINE

3.1 AVIFAUNAL MICROHABITATS

Broad-scale vegetation patterns influence the distribution and abundance of bird species holistically, while vegetation structure, rather than plant species composition, has a greater influence on local avifauna populations and species assemblages (Harrison *et al*., 1997). The study area lies within two vegetation types, the Gordonia Duneveld roughly within the western half of the study area, and the Kalahari Karroid Shrubland to the east. These vegetation types are both classified as Least Threatened, and are predominantly (99%) untransformed. At the study site the Gordonia duneveld occurs on red soils of varying depth, characterised by linear dunes to the north-west, and sandy plains to the south and south-east. This habitat supports primarily the protected trees *Acacia haematoxylon* and *Boscia albitrunca*, while the grass layer is dominated by *Stipagrostis* species and *Centropodia glauca,* amongst others (Figures 3 & 4). The sandy plains of this vegetation type are dominated by *Rhigozum trichotomum* shrubs and grasses, and also support numerous patches of *Parkinsonia africana* trees (Figure 5 & 6). The Kalahari Karroid Shrubland occurs mainly within the eastern half of the study area on mostly gravel plains and very shallow red soils. The dwarf shrubs that characterise this habitat include the following genera, *Monechma*, *Salsola*, *Hermannia* and *Zygophyllum*, amongst others, with the grass layer dominated by *Stipagrostis* species (Figure 7).

Figure 2. Linear dune crest of the Gordonia Duneveld, within the western half of the study area, with a *Boscia foetida* tree in the foreground.

Figure 4. Linear dune crest of the Gordonia Duneveld, within the western half of the study area, with *Acacia haematoxylon* trees.

Figure 5. Sandy plains of the Gordonia Duneveld along the southern boundary of the study area, showing stands of *Rhigozum trichotomum* shrubs.

Figure 6. Sandy plains of the Gordonia Duneveld dominated by a mix of shrubs and grasses.

3.2 General Avifauna

An approximate total of 145 bird species are known to occur in the study area and surrounds (Annexure 1), of which 54 species were recorded on site during the field survey. Six of these species are listed as threatened, and three are considered Near-Threatened. Only five species are considered true near-endemics to South Africa (Taylor *et al*., 2015), while ten are considered biome-restricted species (Marnewick *et al*., 2015).

The bird assemblage recorded within the study site is fairly typical of the Kalahari bioregion, with elements of the Nama-Karoo. Of the 54 species recorded on site, 48 species were detected during line transects. An average of 12.1 species were recorded per transect, with an average of 30.9 individual birds. Small passerines species made up two-thirds (31 species, 63%) of the species detected, compared to non-passerines (18 species, 37%). The five near-endemic species reported for the broader study area occur with low SABAP2 reporting rates (in parentheses), and are therefore not considered common in the area, and include, Karoo Thrush *Turdus smithi* (12%), Black-eared Sparrowlark *Eremopterix australis* (4%), Fiscal Flycatcher *Sigelus silens* (2%), Black-headed Canary *Serinus alario* (2%), and Jackal Buzzard (0%). None of these species were detected during the field survey, and can generally be considered uncommon in the area. Only three of the 10 biome-restricted species were recorded, which also have the highest SABAP2 reporting rates, namely, Karoo Korhaan *Eupodotis vigorsii* (73%), Sociable Weaver *Philetairus socius* (56%) and Kalahari Scrub Robin *Cercotrichas paena* (42%). Other biome-restricted species with appreciable reporting rates include Stark's Lark *Spizocorys starki* (29%), Ludwig's Bustard (15%), and Karoo Thrush (12%), none of which were seen during the field survey.

The most abundant species with the highest detection rates along the line transects were Fawn-coloured Lark *Calendulauda africanoides* (3.7 birds/km) and Namaqua Dove *Oena capensis* (3.5 birds/km) (Table 1). Other regularly encountered species, but with markedly lower encounter rates, included Scaly-feathered Finch *Sporopipes squamifrons* (2.3 birds/km), Spike-heeled Lark *Chersomanes albofasciata* (2.3 birds/km), and Northern Black Korhaan *Afrotis afraoides* (1.5 birds/km). Grey-backed Sparrowlark *Eremopterix verticalis* and Pink-billed Lark *Spizocorys conirostris* also occurred with reasonable frequency (0.5 to 1.0 bird/km), considering their irregularity as nomadic species.

Table 1. Summary of line transects (n = 35) walked throughout the Allepad solar site during the field survey (13 to 16 August 2018), with respect to the number of detections per species, the total number of birds detected per species, and the number of birds seen per kilometer, as a measure of relative abundance. Large flocking species such as Red-billed Quelea, Southern Red Bishop and Southern Masked Weaver were excluded due to the uncertainty in identifying the species in large distant flocks.

Species	No. of detections	No. of birds	Birds/km
Fawn-coloured Lark	121	130	3.71
Namaqua Dove	77	123	3.51
Sociable Weaver	12	112	3.20
Scaly-feathered Finch	39	82	2.34
Spike-heeled Lark	42	82	2.34
Northern Black Korhaan	45	51	1.46
Rufous-eared Warbler	28	44	1.26
Lark-like Bunting	27	38	1.09
Black-chested Prinia	28	36	1.03
Yellow Canary	20	34	0.97
Grey-backed Sparrow-lark	14	31	0.89
Kalahari Scrub Robin	28	30	0.86
Ant-eating Chat	19	28	0.80
Cape Turtle Dove	19	23	0.66
Southern Fiscal	22	23	0.66
Bokmakierie	20	22	0.63
Pink-billed Lark	9	20	0.57
Karoo Korhaan	6	12	0.34
Red-crested Korhaan	12	12	0.34
Chat Flycatcher	8	11	0.31
White-backed Mousebird	5	10	0.29
Yellow-bellied Eremomela	7	10	0.29

Some species showed rather clear preferences for parts of the study area. Karoo Korhaan were found exclusively on the gravel plains in the eastern side of the study area, as were Sabota Lark (*Calendulauda sabota*). Red-crested Korhaan *Lophotis ruficrista* were only recorded within the sandy plains habitat in the west, particularly where there were *Parkinsonia* trees. Pink-billed Lark were also only recorded on the sandy plains.

3.3 RED-LISTED SPECIES

Red-listed species are considered fundamental to this study, because of their susceptibility to the various threats posed by solar facilities and associated infrastructures. Only six species that have been recorded in the area are threatened, while a further three are listed as Near-Threatened (Table 2). The most important of these with respect to its red-listed status is the Critically Endangered White-backed Vulture *Gyps africanus*, which has been recorded in the area during SABAP2, albeit only twice (4% reporting rate). The species is thus probably only

an occasional visitor to the area, with no breeding or roosting sites nearby, perhaps primarily due to the absence of suitably large *Acacia erioloba* trees.

Only two listed species were recorded during the field survey, including a number of pairs of Karoo Korhaan (Near-Threatened) and a pair of Kori Bustard (Near-Threatened). The Karoo Korhaan were all recorded within the gravel plains habitat in the east of the study area, which represents the species' more preferred Karoo-like habitat type. The Kori Bustard were recorded within the sandy plains habitat adjoining the linear dunes in the north of the study area, which represents more typical Kalahari habitat. Although not recorded during the field survey, the highly nomadic Ludwig's Bustard has a fairly high reporting rate (15%), and it is predicted that this species would occupy the gravel plains in favourable years.

All other red-listed species have rather low SABAP2 reporting rates (<5%) for the area, and include Martial Eagle *Polemaetus bellicosus* (Endangered), Tawny Eagle (Endangered), Lanner Falcon *Falco biarmicus* (Vulnerable), Secretarybird *Sagittarius serpentarius* (Vulnerable) and Abdim's Stork *Ciconia abdimii* (Near-Threatened). The local populations of these species are, however, mostly of low to moderate importance, as these species appear to be only occasional visitors based on their low reporting rates. The study site and surrounds most likely serve as only part of the foraging range of occasional individuals passing through.

With respect to these red-listed species, the gravel plains habitat in the eastern portion of the study area, and the dunes habitat within the north, appear to be important for resident and visiting species. The presence of several individuals of Karoo Korhaan on the gravel plains clearly illustrate the importance of this habitat for the species.

Table 3. Red-listed species recorded in the study area during SABAP1 (1987-1991), SABAP2 (2007 on-going) and the site visit (15 to 17 July 2018), ranked according to their red-list status. All species besides Abdim's Stork have been recorded during the SABAP2 period. Only two species were observed during the site visit (marked in bold), with the most of the other species having low reporting rates (<5%).

English name	Taxonomic name	Red-list status	Estimated importance of local population	Preferred habitat	Probability of occurrence	Threats
Vulture, White-backed	*Gyps africanus*	Critically Endangered	Low	Savanna	High	Habitat loss/Disturbance Collisions/Electrocution
Bustard, Ludwig's	*Neotis ludwigii*	Endangered	Moderate	Shrubland plains	High	Habitat loss/Disturbance Collisions
Eagle, Martial	*Polemaetus bellicosus*	Endangered	Moderate	Savanna & shrublands	High	Habitat loss/Disturbance Collisions/Electrocution
Eagle, Tawny	*Aquila rapax*	Endangered	Low	Savanna & Karoo plains	Low	Habitat loss/Disturbance Collisions/Electrocution
Falcon, Lanner	*Falco biarmicus*	Vulnerable	Moderate	Widespread	High	Habitat loss/Disturbance Collisions/Electrocution
Secretarybird	*Sagittarius serpentarius*	Vulnerable	Low	Open savanna & grassland	Moderate	Habitat loss/Disturbance Collisions
Bustard, Kori	***Ardeotis kori***	**Near-Threatened**	**Moderate**	**Open savanna**	**Recorded**	**Habitat loss/Disturbance Collisions**
Korhaan, Karoo	***Eupodotis vigorsii***	**Near-Threatened**	**Moderate**	**Shrubland plains**	**Recorded**	**Habitat loss/Disturbance Collisions**
Stork, Abdim's	*Ciconia abdimii*	Near-threatened	Low	Grassland & savanna	Low	Collisions

During the walking transects regular scans were made to detect any large flying birds to establish the presence of flight paths across the study site. Besides the predominantly terrestrial Karoo Korhaan and Kori Bustard, no other red-list species were seen using the site or flying routine flight paths. This may be due to the apparent absence of communal roosting and breeding sites, and hence birds may be traversing the site on an ad hoc basis. Besides the absence of communal nest sites, no individual nests were located during the field survey. However, it may be possible that species such as Secretarybird may use solitary *Boscia* or other tree species for nesting, which may have been missed during the survey.

In essence, much of the avifauna within the study area appears fairly similar to that found across the Kalahari bioregion of the Northern Cape. The apparent lack of red-listed species in the area could be attributed to their naturally low densities and large ranges (eagles and Secretarybird), the absence of suitable habitat (Abdim's Stork) and nesting/roosting trees (White-backed Vulture). However, certain species may use the study on occasion as part of their large ranges, such as Martial Eagle, Kori Bustard, Tawny Eagle and Secretarybird. However, since the study area appears not to directly support large and healthy populations of red-listed species, the sensitivity of the study area in general can be considered to be of medium significance with respect to avifauna.

3.4 AVIAN SENSITIVITY ASSESSMENT

Important avian microhabitats in the study area play an integral role within the landscape, providing nesting, foraging and reproductive benefits to the local avifauna. In order to ensure that the development does not have a long term negative impact on the local avifauna, it is important to delineate these avian microhabitats within the study area. To this end an avian sensitivity map (Figure 10) was generated by integrating avian microhabitats present on the site and avifaunal information collected during the site visit.

The study area supports three main avifaunal microhabitats, which are referred to as the gravel plains, sandy plains, and dunes habitat. These three habitats have different sensitivities, due to the subtle differences in the avifaunal assemblages that they support, especially with respect to red-listed species. The gravel plains are considered to be of High Sensitivity, due firstly to the habitat diversity of the area and the fact that it support several pairs of the Near-Threatened Karoo Korhaan, which are presumably resident in the area. The dune habitat is well represented within the bioregion, but due to the deeper soils, supports a number of protected tree species, such as the *Acacia erioloba, A.haematoxylon* and *Boscia albitrunca, B.foetida subsp. foetida.* These tree species, in turn, provide important nesting and roosting sites for birds, including large raptors. This habitat is therefore considered to be of Medium Sensitivity due to its importance to a wide variety of avifaunal species. The sandy plains habitat represents the most widely distributed habitat in the region, and occurs

primarily on shallower soils that do not support an extensive tree layer, besides scattered *Parkinsonia africana*. This habitat is therefore regarded to be of Low-Medium sensitivity.

It is likely that development of the solar energy facility on the lower sensitivity parts of the site, such as the sandy plains habitat, would generate the low impacts on the avifauna, provided suitable mitigation measures are employed during construction and operation of the proposed facility. While the development would result in some habitat loss for avifauna of local significance, it will not necessarily impact negatively on red-listed avifaunal species, which appear to occur sparsely within the broader study area and primarily in adjacent habitats.

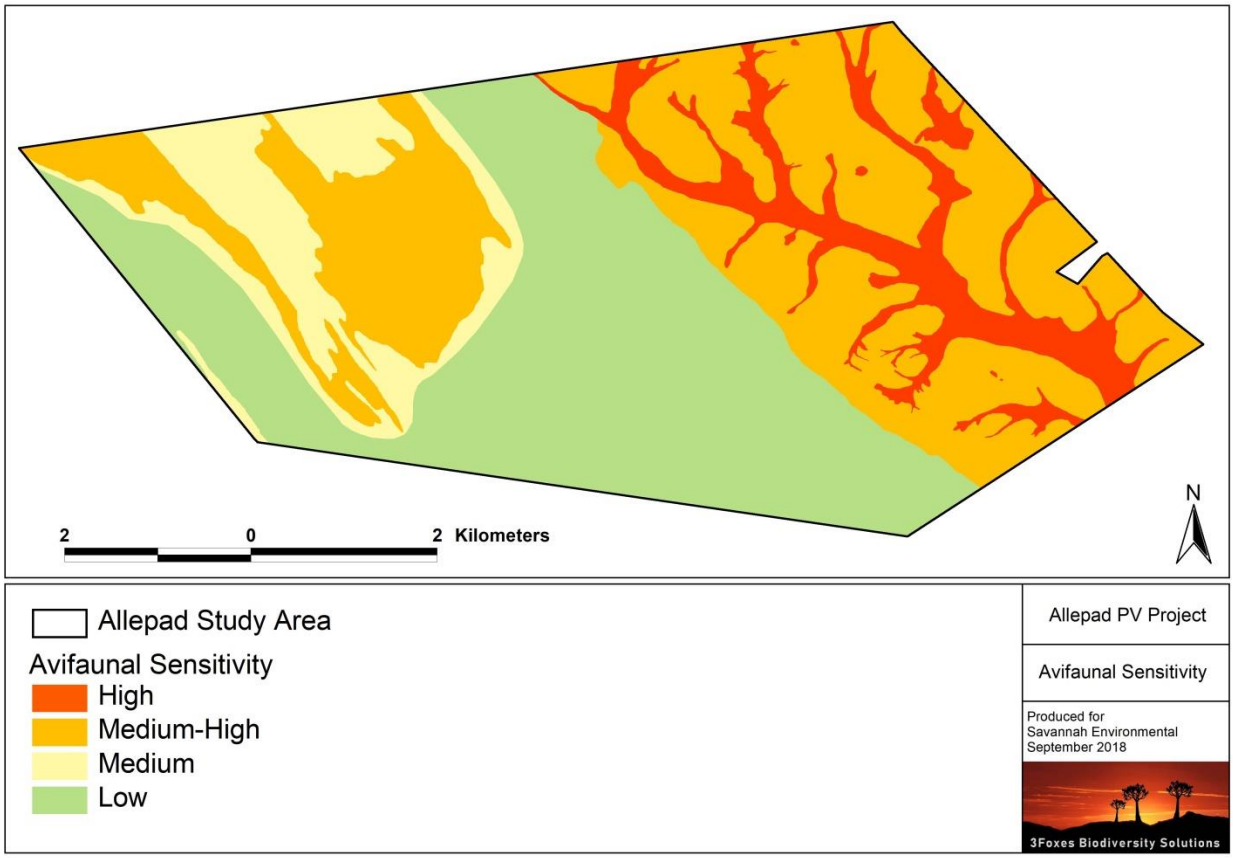

Figure 10. Avifaunal sensitivity map for the Allepad Solar project, showing the High Sensitivity gravel plains in the east of the study area, and the Medium and Medium High Sensitivity dunes habitat in the west. The remaining central and southern areas constitute the sandy plains habitat with a Low Sensitivity.

4 IDENTIFICATION & NATURE OF IMPACTS

In this section, the potential impacts and associated risk factors that may be generated by the development are identified. In order to ensure that the impacts identified are broadly

applicable and inclusive, all the likely or potential impacts that may be associated with the development are listed. The relevance and applicability of each potential impact to the current situation are then examined in more detail in the next section.

According to a position statement by Birdlife South Africa, the main concerns with PV facilities are the following:

- Displacement or the exclusion of nationally and/or globally threatened, rare, endemic, or range-restricted bird species from important habitats.
- Loss of habitat and disturbance of resident bird species caused by construction, operation and maintenance activities.
- Collision with the solar panels, which may be mistaken for water bodies.
- Collision and electrocution caused when perching on or flying into associated power line infrastructure.
- Habitat destruction and disturbance/exclusion of avifauna through construction (short-term) and maintenance (long-term) of new power line infrastructure.
- Habitat destruction and disturbance of birds caused by the construction and maintenance of new roads and other infrastructure.

The habitat on the site represents typical vegetation of the broader area, with no features of concern present across most of the habitat. Of the nine red-listed species that are known to occur in the broader area, only two were seen during the site visit, while most of the five near-endemic species and ten biome-restricted species are uncommon at the study site. While the development may have an insignificant impact on these species, it will nevertheless impact on other common local bird assemblages primarily through direct habitat loss and displacement. Species are expected to be impacted to varying degrees based on their life-history strategies, abundance and general susceptibility to the threats posed by PV facilities. While habitat loss can be quantified by extent of the development footprint, there are other impacts such as direct mortalities caused by collisions with solar panels, which are still poorly understood.

Data on estimates of birds killed at solar facilities as a direct result of collisions with associated infrastructure are limited, especially in South Africa. A recent study at a large solar facility in the Northern Cape (Visser, 2016) provides the first estimates of the potential impact on birds within the region, with direct mortalities amounting to 4.5 birds/MW/year. This short term study also concluded, however, that there was no significant association with collision-related mortality at that study site, and that further studies were required. Most injuries that were recorded were related to species such as francolin colliding with the underside of PV panels, and korhaans becoming entrapped along the perimeter fencing, between the mesh and electrical strands (Visser, 2016). A PV solar facility in the United States is reported to result in the deaths of 0.5 birds/MW/year as a direct result of the collisions with infrastructure (Walston *et al*., 2016).

4.1 IDENTIFICATION OF POTENTIAL IMPACTS AND DAMAGING ACTIVITIES

In this section each of the potential impacts on avifauna associated with the development is explored in more detail with reference to the features and characteristics of the site and the likelihood that each impact would occur given the characteristics of the site and the extent and nature of the development. While renewable energy sources, such as solar energy, are important to the future development of power generation and hold great potential to alleviate the dependence on fossil fuels, they are not without their environmental risks and negative impacts. Poorly sited or designed SEFs can have negative impacts on not only vulnerable species and habitats, but also on entire ecosystem functioning. These impacts are extremely variable, differing from site to site, and are dependent on numerous contributing factors which include the design and specifications of the development, the importance and sensitivity of avian microhabitats present on site and the diversity and abundance of the local avifauna.

Potential avifaunal impacts resulting from the development of the Allepad SEF would stem from a variety of different activities and risk factors associated with the preconstruction, construction and operational phases of the project including the following:

Preconstruction Phase

- Human presence and uncontrolled access to the site may result in negative impacts on the avifauna through poaching and uncontrolled collection of fauna and flora for traditional medicine or other purpose.
- Site clearing and exploration activities for site establishment may have a negative impact on biodiversity if this is not conducted in a sensitive manner.

Construction Phase

- Vegetation clearing for the reflector field, access roads, site fencing and associated infrastructure will impact the local avifauna directly through habitat loss. Vegetation clearing will therefore lead potentially to the loss of avifaunal species, habitats and ecosystems as birds are displaced from their habitat.
- Presence and operation of construction machinery on site. This will create a physical impact as well as generate noise, pollution and other forms of disturbance at the site.
- Increased human presence can lead to poaching, illegal fauna collecting and other forms of disturbance such as fire.

Operational Phase

- The operation of the facility will generate noise and disturbance which may deter some avifauna from the area, especially red-listed avifaunal species which are less tolerant of disturbances.

- Mortality among the local avifauna may result due to direct collisions with solar panels (Kagan *et al*., 2014) or entrapment along the fenced boundaries of the facility (Visser, 2016).
- The areas inside the facility will require management and if this is not done appropriately, it could impact adjacent intact areas through impacts such as erosion, alien plant invasion and contamination from pollutants, herbicides or pesticides.
- The associated overhead power lines will pose a risk to avifauna susceptible to collisions and electrocution with power line infrastructure (Jenkins *et al*., 2010).

Cumulative Impacts

- The loss of unprotected vegetation types on a cumulative basis from the broader area may impact the country's ability to meet its conservation targets.
- Transformation of intact habitat would contribute to the fragmentation of the landscape and would potentially disrupt the connectivity of the landscape for fauna and flora and impair their ability to respond to environmental fluctuations. This is particularly a concern with regards to species and ecosystems with limited geographical distributions (Rudman *et al.*, 2017).

Project specific impacts on particular groups of avifauna are as follows:

Habitat loss and disturbance of small passerines

For the smaller passerine species the most important impacts will involve displacement from the area encompassed by the development footprint as a result of habitat destruction. The loss of habitat will be permanent while disturbance may be continuous during the operational phase of the solar facility. Other impacts such as disturbances caused by reflective panels and grid connecting power lines are not likely to have any appreciable impact on these small species. The impacts in general can be expected to be minimal as these smaller species are far less susceptible to the associated impacts than larger species.

Habitat loss, disturbance and collision risk of medium terrestrial birds and raptors

Small to medium-sized non-passerines that may be impacted to some extent due to habitat loss and displacement include resident raptors such as Pale Chanting Goshawk *Melierax canorus*, and the ground-dwelling Namaqua Sandgrouse *Pterocles namaqua*, Northern Black Korhaan, and Red-crested Korhaan. These species may also be susceptible to collisions with associated infrastructure such as the PV panels and power lines, but this is not expected to have a major impact on most of these species. Northern Black Korhaan and Red-crested Korhaan, may, however, be at more risk based on the recent research (Visser, 2016).

Habitat loss, disturbance and collision risk of large terrestrial birds and raptors

The group of primary concern is the medium to large non-passerines, which include the large terrestrial birds and diurnal raptors. Many of these are also red-listed, such as White-backed Vulture, Martial eagle, Secretarybird and Tawny Eagle. Besides the loss of habitat that these species will experience, disturbances during construction and maintenance of the facility is also expected to have a negative impact. In addition, most of these species are also highly susceptible to collisions with power lines owing to reduced ability to see the power lines and reduced manoeuvrability in flight to avoid collisions (Martin & Shaw, 2010; Jenkins *et al.*, 2010). All large terrestrial birds, including the red-listed species, are killed in substantial numbers by existing and newly erected power lines in the country (Jenkins *et al.*, 2010; Jenkin *et al*., 2011; Shaw, 2013). An additional threat faced by the large raptors is electrocution when perched or attempting to perch on power line structures (Lehman *et al*., 2007).

5 SCOPING PHASE ASSESSMENT OF IMPACTS

The various identified impacts are assessed below for the different phases of the development. It is important to note that this is a scoping-phase assessment and subject to change based on any changes to the layout or project description that might occur before the EIA Phase.

5.1 ALLEPAD PV FOUR DEVELOPMENT

The following is a Scoping Phase Assessment of the Allepad PV Four plant, for the planning, construction and operational phase of the development.

5.1.1 Planning & Construction Phase

Impact Direct Avifaunal Impacts During Construction – habitat loss and disturbance			
Sensitivity Analysis			
Issue	**Nature of Impact**	**Extent of Impact**	**No-Go Areas**
Loss of intact habitat due to transformation for the PV plant as well as disturbance of local avifauna due to construction activities.	Vegetation clearing will potentially lead to the loss of avifaunal species, habitats and ecosystems as birds are displaced from their habitat	Local	The Gravel Plains habitat in the east of the site should be avoided, due to the habitat diversity of this area as well as the confirmed presence of avifauna species of concern in this area. Development within the larger contiguous dune field in the west of the site should also be limited as far as possible.
Description of expected significance of impact: Since habitat loss and disturbance are an unavoidable outcome of the development, this impact cannot be fully mitigated and the impacts on the local avifauna after mitigation are likely to be Medium Low Negative, but could also potentially be Medium Negative depending on the final position of the development footprint and the extent of habitat loss within the Medium and Medium High sensitivity areas.			

Gaps in Knowledge and recommendations for further study:

- The use and presence of larger raptors and other similar species of conservation concern at the site should be better quantified with a summer-season survey. This information should be used to inform the sensitivity mapping at the site as well as the final layout of the development footprint.
- The fence around the facility should be designed with potential impacts on avifauna in mind. This includes the location and positioning of the electrified strands in relation to the fence as it has been shown that avifauna may become trapped in the gap between these two components of the fence.

5.1.2 Operational Phase Impacts

Impact Avifaunal Impacts During Operation –disturbance and collisions with PV panels, security fences and other site infrastructure.			
Sensitivity Analysis			
Issue	**Nature of Impact**	**Extent of Impact**	**No-Go Areas**
Disturbance due to general operational activities and mortality of avifauna from collisions with plant infrastructure	Mortality among the local avifauna may result due to direct collisions with solar panels or entrapment along the fenced boundaries of the facility. The operation of the facility will also generate noise and disturbance which may deter some avifauna from the area, especially red-listed avifaunal species which are less tolerant of disturbances.	Local	The Gravel Plains habitat in the east of the site should be avoided, due to the presence and significance of this area for avifauna species of concern.
Description of expected significance of impact:			

Specific areas that will require mitigation include design of night-lighting and ensuring that the fence around the facility is constructed according to a bird-friendly design as well as management of bird interactions will the infrastructure of the facility. With mitigation, the operational phase impact on avifauna can be reduced to a low significance.
Gaps in Knowledge and recommendations for further study: • The presence and distribution of species with are considered potentially more vulnerable to impact at PV facilities, such as Northern Black Korhaan and Red-crested Korhaan should be better quantified with a follow-up summer season survey.

5.2 ALLEPAD PV FOUR GRID CONNECTION

The following is an assessment of the Grid Connection for the Allepad Four PV Plant, for the planning and construction and operational phases of the development.

5.2.1 Planning & Construction Phase

Impact Direct Avifaunal Impacts During Construction – habitat loss and disturbance			
Sensitivity Analysis			
Issue	**Nature of Impact**	**Extent of Impact**	**No-Go Areas**
The construction of the power line will result in some habitat loss and disturbance of local avifauna	Disturbance and construction phase activities will result in habitat loss and displacement of avifauna from the vicinity of the development footprint	Local	Impact near to important habitats such as stands of large trees that may be breeding sites for large raptors should be minimised.
Description of expected significance of impact: The footprint of the power line would be relatively low and the construction phase disturbance would be transient. As a result, the impact of the power line construction on avifauna can be mitigated to a low significance.			

Gaps in Knowledge and recommendations for further study: • The features along the proposed route have not been characterised and important avifaunal features such as drainage lines and stands of large trees that may be breeding sites for large raptors should be investigated and mapped in the field. • Areas where the power line should be fitted with bird flight diverters to reduce collision risk should be identified.

5.2.2 Operational Phase

Impact Operational phase power line electrocution and collision risk of large terrestrial birds and raptors			
Sensitivity Analysis			
Issue	**Nature of Impact**	**Extent of Impact**	**No-Go Areas**
Many larger bird species are vulnerable to collision with or electrocution from power line infrastructure.	Many red-listed know to occur in the area such as White-backed Vulture, Martial eagle, Secretarybird and Tawny Eagle, are susceptible to collisions with power lines owing to reduced ability to see the power lines and reduced manoeuvrability in flight to avoid collisions. All large terrestrial birds, including the red-listed species, are killed in substantial numbers by existing and newly erected power lines in the country. An additional threat faced by the large raptors is electrocution when perched or attempting to perch on power line structures.	Local	Impact near to important habitats such as stands of large trees that may be breeding sites for large raptors should be minimised

Description of expected significance of impact: With mitigation such as fitting bird flappers to the line along identified stretches of the line, it is likely that the impact of the power line on avifauna during operation can be reduced to a low significance.
Gaps in Knowledge and recommendations for further study • The power line should be monitored for collisions post-construction to evaluate the impact of the power line on species of conservation concern and also to identify if there are any additional areas where further mitigation actions may be required.

5.3 CUMULATIVE IMPACTS

The following are the cumulative impacts that are assessed as being a likely consequence of the development of the Allepad PV Four Facility. These are assessed in context of the extent of the current site, other developments in the area as well as general habitat loss and transformation resulting from mining and other activities in the area.

Cumulative Impact 1. Impact on avifaunal habitats, migration routes and nesting areas due to cumulative loss and fragmentation of habitat

Impact Impact on avifaunal habitats, migration routes and nesting areas due to cumulative loss and fragmentation of habitat			
Sensitivity Analysis			
Issue	**Nature of Impact**	**Extent of Impact**	**No-Go Areas**
Cumulative development pressure in the greater Upington area may lead to significant cumulative impact on restricted avifaunal habitats, nesting	There is a large amount of existing or planned solar development in the wider Upington area. This is likely to generate cumulative impact on avifauna through habitat loss, fragmentation and loss of breeding sites.	Regional	Sensitive and restricted habitats as well as any identified breeding sites of species of conservation concern

sites and movement pathways			

Description of expected significance of impact:

The cumulative impact associated with the development is to some degree dependent on the extent and distribution of the final development footprint in relation to the different avifaunal habitats on the site. A single phase is not likely to generate very high cumulative impact but several phases would generate increasing impact. Under the current proposal of up to four PV plants at the site, the overall cumulative impact of the development would be of moderate significance, but this could potentially be reduced to a low significance if impact to areas of high avifaunal value are avoided. This is however also contingent on the results of the summer survey and there is currently a large degree of uncertainty in this aspect of the assessment.

Gaps in Knowledge and recommendations for further study

- The presence and distribution of species with are considered potentially more vulnerable to impact at PV facilities, such as Northern Black Korhaan and Red-crested Korhaan should be better quantified with a follow-up summer season survey. This information would be used to inform the site sensitivity mapping as well as inform the final assessment of impacts on avifauna.

6 CONCLUSION & RECOMMENDATIONS

Although the Allepad PV Four development is in the Scoping Phase, the current study is based on a detailed field assessment of the proposed development area. Consequently, the scoping impact assessment and sensitivity map presented herein are based on detailed on-site information and as such have a relatively high degree of confidence. However, this information is based on a single season of assessment and it is strongly recommended that a follow-up summer season assessment is conducted in order to confirm and further validate and refine the results of the current study and field assessment.

The study area lies within the Kalahari bioregion and supports a fairly typical avifaunal assemblage expected for the area. Although six threatened and three Near-Threatened species are known to occur within the broader study area, most of these are not common in the area and probably occur in low numbers. Further, the vegetation of the sandy plains habitat within the southern parts of the study area supports few species or features of concern, such as nesting of roosting sites of red-listed species. Impacts on avifauna with the development of this particular habitat will likely to be medium-low and no high post-mitigation impacts are likely. The gravel plains habitat which characterises the north-eastern part of the site is considered to be high sensitivity and unsuitable for development from an avifaunal perspective.

The expected impacts of the proposed solar development area will include the following, 1) habitat loss and fragmentation associated with the sandy plains of the Gordonia Duneveld vegetation type, 2) disturbance and displacement caused during the construction and maintenance phases, and 3) possible direct mortality of avifauna colliding with solar panels and associated power line structures, as well as electrocutions with power line infrastructure, and 4) a cumulative habitat loss at a broader scale from renewable energy developments in the broader area. Habitat loss and disturbance during the construction phase of the development will impact mostly small passerine species and medium-sized non-passerines, with consequences restricted to the local area only. Impacts related to collisions with PV panels and associated infrastructure (such as fencing) will impact mostly medium-sized non-passerines (e.g. korhaans, thick-knees and possibly sandgrouse). Red-listed species will be impacted by the loss of foraging habitat and disturbances, and potentially by collisions and electrocutions with power line infrastructure. However, given the extensive national ranges of these species, the impact of the development on habitat loss for these species would be minimal and a long-term impact unlikely.

Several mitigation measures can be implemented during the construction and maintenance phase of the proposed development to reduce the impacts on the avifauna. During the construction phase, mitigation measures may assist in reducing displacement and disturbance by restricting habitat loss and disturbance to within the footprint of the development within

the lower sensitivity habitat types and especially the open sandy plains. Impacts associated with the power line, such as collisions and electrocutions, should be mitigated where necessary through regular monitoring to determine high risk areas where bird diverters (e.g. bird flappers) should be located along the power line route. Identified sensitive habitats, such as the gravel plains of the Kalahari Karroid Shrubland in the north east of the site should be excluded from the development footprint. With the implementation of the mitigation measures, the impact of the development can be reduced to an acceptable level and as such there are no fatal flaws associated with the development that should prevent it from proceeding. This will however be confirmed through the detailed EIA Phase studies to be undertaken and in particular a follow-up summer season survey.

Cumulative impacts in the area are a concern due to the proliferation of solar energy development in the Upington area. In terms of habitat loss, the affected Gordonia Duneveld vegetation type is still approximately 90% intact, while it has an extensive range within the bioregion. The transformation and loss of 250 ha of this habitat is not considered highly significant. In terms of potential losses to landscape connectivity, the site is not considered to lie within an area that is considered a likely avifaunal movement corridor or along an important ecological gradient. As such, the overall cumulative impact of the development is considered likely to be low, but further investigation in this regard during the EIA phase is recommended.

Although a specific development footprint has not yet been identified within the site for the Allepad PV Four site, this should as far as possible be restricted to the sandy plains habitat of the Gordonia Duneveld vegetation type and while some loss of dune areas may be acceptable, this would quickly increase cumulative impacts associated with the development and should be restricted to less than 10% of this habitat. There are no known impacts associated with the development that are considered to be of high significance and which cannot be mitigated to a low level. Therefore, based on the results of this assessment, there are no reasons to indicate that the development should not move into the EIA phase. A proposed plan of study for the EIA phase is detailed below.

7 PLAN OF STUDY FOR THE EIA PHASE

The current study is based on three-day site visit during which intense avifaunal surveys were undertaken, it is recommended that this is followed-up be a summer season survey to further confirm and refine the results of the current field assessment. Apart from the additional field assessment, the major tasks remaining prior to the EIA phase revolve around assessing the final layout, assessing the cumulative impacts associated with the development in more detail, and making the appropriate recommendations with regards to the most appropriate mitigation and avoidance measures to be included in the EMPr for the development.

Based on the results of the current study and the features of the site, the following activities and outputs are planned to inform the EIA phase of the development:

- Conduct a summer-season avifaunal survey within the development footprint to confirm the preliminary findings from the winter-season survey. Include the results of the summer-season survey into the EIA Phase report and assess the implications of these results for the impact assessment and the recommended mitigation and avoidance measures.

- Provide a more detailed assessment of cumulative impacts associated with the development of the site. Including an assessment of the extent of habitat lost to solar energy development in the area to date and the likely future potential loss from the current as well as other proposed developments in the area. The potential for there to be disruption of broad-scale ecological processes in the area will be examined by evaluating the extent of habitat loss to date and the distribution of this impact in relation to the gradients, corridors and associated processes operating in the area.

- Evaluate, based on the site attributes and final layout of the development, what the most applicable mitigation measures to reduce the impact of the development on the site would be and if there are any areas where specific precautions or mitigation measures should be implemented. Particular attention will be paid to potential impacts on seemingly unimportant landscape features such as the dense stands of *Parkinsonia africana*, which may serve unknown benefits to avifaunal.

- Assess the impacts identified above in light of the site-specific findings and the final layout for assessment in the EIA Phase to be provided by the developer.

- Address any comments received on the scoping study from I&APs and commenting authorities and ensure that that study complies with best practice and the requirements of the 2014 EIA regulations as amended.

8 REFERENCES

Harrison, J.A., Allan, D.G., Underhill, L.G., Herremans, M., Tree, A.J., Parker, V. & Brown, C.J. (eds). 1997. The atlas of southern African birds. Vol. 1 & 2. BirdLife South Africa, Johannesburg.

Hockey, P.A.R., Dean, W.R.J. & Ryan, P.G. (eds). 2005. Roberts Birds of Southern Africa, 7th edition. The Trustees of the John Voelcker Bird Book Fund, Cape Town.

Jenkins, A.R., Ralston-Paton, S. & Smit-Robinson, H.A. 2016. Birds and solar energy best practice guidelines. Birdlife South Africa, Johannesburg.

Jenkins, A.R., Shaw, J.M., Smallie, J.J., Gibbons, B., Visagie, R. & Ryan, P.G. 2011. Estimating the impacts of power line collisions on Ludwig's Bustards Neotis ludwigii. Bird Conservation International 21: 303–310.

Jenkins, A.R., Smallie, J.J. & Diamond, M. 2010. Avian collisions with power lines: a global review of causes and mitigation with a South African perspective. Bird Conservation International 20: 263-278.

Kagan, R.A., Verner, T.C., Trail, P.W. & Espinoza, E.O. 2014. Avian mortality at solar energy facilities in southern California: a preliminary analysis. Unpublished report National Fish & Wildlife Forensics Laboratory, USA.

Lehman, R.N., Kennedy, P.L. & Savidge, J.A. 2007. The state of the art in raptor electrocution research: A global review. Biological Conservation 136: 159-174.

Marnewick, M.D., Retief, E.F., Theron, N.T., Wright, D.R. & Anderson, T.A. 2015. Important Bird and Biodiversity Areas of South Africa. Birdlife South Africa, Johannesburg.

Martin, G.R. & Shaw, J.M. 2010. Bird collisions with power lines: Failing to see the way ahead? Biological Conservation 143: 2695-2702.

Mucina L. & Rutherford M.C. (eds) 2006. *The Vegetation of South Africa, Lesotho and Swaziland*. Strelitzia 19. South African National Biodiversity Institute, Pretoria.

Nel, J.L., Murray, K.M., Maherry, A.M., Petersen, C.P., Roux, D.J., Driver, A., Hill, L., Van Deventer, H., Funke, N., Swartz, E.R., Smith-Adao, L.B., Mbona, N., Downsborough, L. and Nienaber, S. (2011). Technical Report for the National Freshwater Ecosystem Priority Areas project. WRC Report No. K5/1801.

Oosthuysen, E. & Holness, S. 2016. Northern Cape Critical Biodiversity Areas (CBA) Map. Northern Cape Department of Environment and Nature Conservation & Nelson Mandela Metropolitan University. Available at SANBI BGIS http://bgis.sanbi.org/.

Rudman, J., Gauché, P., Esler, K.J. 2017. Direct environmental impacts of solar power in two arid biomes: An initial investigation. South African Journal of Science 113(11/12), Art. #2017-0113, 13 pages. http://dx.doi.org/10.17159/sajs.2017/20170113

Shaw, J.M. 2013. Power line collisions in the Karoo: conserving Ludwig's Bustard. Unpublished PhD thesis, University of Cape Town, Cape Town.

Smit, H.A. 2012. Guidelines to minimise the impacts on birds of solar facilities and associated infrastructure in South Africa. Birdlife South Africa, Johannesburg.

Southern African Bird Atlas Project 2 (SABAP2). http://sabap2.adu.org.za Accessed July 2018.

Taylor, M.R., Peacock, F. & Wanless, R.W. (eds) 2015. The 2015 Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland. Birdlife South Africa, Johannesburg.

Taylor, P.B., Navarro, R.A., Wren-Sargent, M., Harrison, J.A. & Kieswetter, S.L. (eds) 1999. TOTAL CWAC Report: Coordinated Waterbird Counts in South Africa, 1992-1997. Avian Demography Unit, University of Cape Town, Cape Town.

Visser, E. 2016. The impact of South Africa's largest photovoltaic solar energy facility on birds in the Northern Cape, South Africa. Unpublished MSc thesis, University of Cape Town, Cape Town.

Walston, L.J, Rollins, K.E, LaGory, K.E., Smith, K.P. & Meyers, S.A. 2016. A preliminary assessment of avian mortality at utility-scale solar energy facilities in the United States. Renewable Energy 92: 405-414.

Young, D.J., Harrison, J.A., Navarro, R.A., Anderson, M.A. & Colahan, B.D. 2003. Big birds on farms: Mazda CAR report 1993-2001. Avian Demography Unit, Cape Town.

9 ANNEX 1. LIST OF AVIFAUNA

A consolidated avifaunal list for the Allepad study area and surrounds, including records from SABAP1, SABAP2 and the site visit, and includes red-list status (Taylor *et al.*, 2015), regional endemism (Taylor *et al.*, 2015), and SABAP2 reporting rates (based on 52 cards). Species with a zero reporting rate were only recorded during SABAP1 and not SABAP2. Species highlighted in bold text were recorded during the site visit (15 to 17 July 2018).

Species name	Taxonomic name	Red-list Status	Regional Endemism	Reporting Rate (%)
Barbet, Acacia Pied	***Tricholaema leucomelas***			**92**
Barbet, Crested	*Trachyphonus vaillantii*			4
Batis, Pririt	***Batis pririt***			**31**
Bee-eater, European	*Merops apiaster*			10
Bee-eater, Swallow-tailed	*Merops hirundineus*			42
Bishop, Southern Red	***Euplectes orix***			**27**
Bokmakierie	***Telophorus zeylonus***			**81**
Brubru	*Nilaus afer*			2
Bulbul, African Red-eyed	***Pycnonotus nigricans***			**83**
Bunting, Lark-like	***Emberiza impetuani***			**85**
Bustard, Kori	***Ardeotis kori***	**Near-Threatened**		**4**
Bustard, Ludwig's	*Neotis ludwigii*	Endangered		15
Buzzard, Jackal	*Buteo rufofuscus*		Near-Endemic	
Buzzard, Steppe	*Buteo vulpinus*			6
Canary, Black-headed	*Serinus alario*		Near-Endemic	2
Canary, Black-throated	***Crithagra atrogularis***			**15**
Canary, White-throated	*Crithagra albogularis*			6
Canary, Yellow	***Crithagra flaviventris***			**65**
Chat, Ant-eating	***Myrmecocichla formicivora***			**35**
Chat, Familiar	***Cercomela familiaris***			**10**
Chat, Karoo	*Cercomela schlegelii*			4
Cisticola, Desert	*Cisticola aridulus*			25
Cisticola, Grey-backed	*Cisticola subruficapilla*			
Cisticola, Zitting	*Cisticola juncidis*			2
Courser, Double-banded	*Rhinoptilus africanus*			27
Crombec, Long-billed	*Sylvietta rufescens*			4
Crow, Pied	***Corvus albus***			**65**
Cuckoo, Diderick	*Chrysococcyx caprius*			19
Cuckoo, Jacobin	*Clamator jacobinus*			10
Dove, Laughing	***Streptopelia senegalensis***			**100**
Dove, Namaqua	***Oena capensis***			**79**

Drongo, Fork-tailed	*Dicrurus adsimilis*			4
Eagle, African Fish	*Haliaeetus vocifer*			2
Eagle, Booted	*Aquila pennatus*			2
Eagle, Martial	*Polemaetus bellicosus*	Endangered		2
Eagle, Tawny	*Aquila rapax*	Endangered		0
Egret, Western Cattle	*Bubulcus ibis*			6
Eremomela, Yellow-bellied	***Eremomela icteropygialis***			**52**
Falcon, Lanner	*Falco biarmicus*	Vulnerable		6
Falcon, Pygmy	***Polihierax semitorquatus***			**8**
Finch, Red-headed	***Amadina erythrocephala***			**29**
Finch, Scaly-feathered	***Sporopipes squamifrons***			**75**
Firefinch, Red-billed	*Lagonosticta senegala*			
Fiscal, Southern	***Lanius collaris***			**100**
Flycatcher, Chat	***Bradornis infuscatus***			**71**
Flycatcher, Fiscal	*Sigelus silens*		Near-Endemic	2
Flycatcher, Marico	*Bradornis mariquensis*			4
Flycatcher, Spotted	*Muscicapa striata*			2
Goose, Egyptian	*Alopochen aegyptiacus*			35
Goshawk, Gabar	*Melierax gabar*			2
Goshawk, Pale Chanting	***Melierax canorus***			**19**
Guineafowl, Helmeted	*Numida meleagris*			10
Heron, Black-headed	*Ardea melanocephala*			2
Honeyguide, Lesser	*Indicator minor*			
Hoopoe, African	*Upupa africana*			4
Hornbill, Southern Yellow-billed	*Tockus leucomelas*			15
Ibis, Hadeda	***Bostrychia hagedash***			**54**
Kestrel, Greater	*Falco rupicoloides*			2
Kestrel, Rock	*Falco rupicolus*			13
Kingfisher, Brown-hooded	*Halcyon albiventris*			2
Kingfisher, Giant	*Megaceryle maximus*			2
Kite, Black-winged	*Elanus caeruleus*			4
Kite, Yellow-billed	*Milvus aegyptius*			2
Korhaan, Karoo	***Eupodotis vigorsii***	**Near-Threatened**		**73**
Korhaan, Northern Black	***Afrotis afraoides***			**94**
Korhaan, Red-crested	***Lophotis ruficrista***			**6**
Lapwing, Blacksmith	*Vanellus armatus*			23
Lapwing, Crowned	***Vanellus coronatus***			**88**
Lark, Black-eared Sparrow-	***Eremopterix australis***		**Near-Endemic**	**4**
Lark, Eastern Clapper	***Mirafra fasciolata***			**37**
Lark, Fawn-coloured	***Calendulauda africanoides***			**71**
Lark, Grey-backed Sparrow-	***Eremopterix verticalis***			**56**

Lark, Karoo Long-billed	*Certhilauda subcoronata*		
Lark, Pink-billed	***Spizocorys conirostris***		**13**
Lark, Red-capped	*Calandrella cinerea*		4
Lark, Sabota	***Calendulauda sabota***		**44**
Lark, Spike-heeled	***Chersomanes albofasciata***		**65**
Lark, Stark's	*Spizocorys starki*		29
Lovebird, Rosy-faced	*Agapornis roseicollis*		
Martin, Brown-throated	*Riparia paludicola*		
Martin, Rock	***Hirundo fuligula***		**73**
Mousebird, Red-faced	*Urocolius indicus*		42
Mousebird, White-backed	***Colius colius***		**88**
Nightjar, Rufous-cheeked	*Caprimulgus rufigena*		10
Oriole, Eurasian Golden	*Oriolus oriolus*		
Ostrich, Common	*Struthio camelus*		2
Owl, Spotted Eagle-	*Bubo africanus*		13
Owl, Western Barn	*Tyto alba*		35
Owlet, Pearl-spotted	*Glaucidium perlatum*		
Penduline-tit, Cape	***Anthoscopus minutus***		**10**
Pigeon, Speckled	***Columba guinea***		**62**
Pipit, African	*Anthus cinnamomeus*		8
Plover, Three-banded	*Charadrius tricollaris*		15
Prinia, Black-chested	***Prinia flavicans***		**85**
Quail, Common	*Coturnix coturnix*		6
Quelea, Red-billed	***Quelea quelea***		**37**
Robin, Kalahari Scrub	***Cercotrichas paena***		**42**
Robin, Karoo Scrub	*Cercotrichas coryphoeus*		6
Sandgrouse, Namaqua	***Pterocles namaqua***		**85**
Scimitarbill, Common	*Rhinopomastus cyanomelas*		2
Secretarybird	*Sagittarius serpentarius*	Vulnerable	2
Shelduck, South African	***Tadorna cana***		**15**
Shrike, Lesser Grey	*Lanius minor*		4
Shrike, Red-backed	*Lanius collurio*		
Snake-eagle, Black-chested	*Circaetus pectoralis*		Adhoc 4.76
Sparrow, Cape	***Passer melanurus***		**96**
Sparrow, House	*Passer domesticus*		77
Sparrow, Southern Grey-headed	*Passer diffusus*		4
Sparrow-weaver, White-browed	***Plocepasser mahali***		**98**
Starling, Cape Glossy	*Lamprotornis nitens*		2
Starling, Pale-winged	*Onychognathus nabouroup*		
Starling, Pied	*Spreo bicolor*		2
Starling, Wattled	*Creatophora cinerea*		19

Stilt, Black-winged	*Himantopus himantopus*			2
Stork, Abdim's	*Ciconia abdimii*	Near-Threatened		
Sunbird, Dusky	***Cinnyris fuscus***			**40**
Swallow, Barn	*Hirundo rustica*			44
Swallow, Greater Striped	*Cecropis cucullata*			42
Swallow, South African Cliff	*Petrochelidon spilodera*			4
Swallow, White-throated	*Hirundo albigularis*			15
Swift, African Palm	***Cypsiurus parvus***			**81**
Swift, Alpine	*Tachymarptis melba*			2
Swift, Bradfield's	*Apus bradfieldi*			4
Swift, Common	*Apus apus*			27
Swift, Little	***Apus affinis***			**56**
Swift, White-rumped	*Apus caffer*			2
Thick-knee, Spotted	***Burhinus capensis***			**46**
Thrush, Karoo	*Turdus smithi*		Near-Endemic	12
Tit, Ashy	***Parus cinerascens***			**4**
Turtle-dove, Cape	***Streptopelia capicola***			**94**
Vulture, White-backed	*Gyps africanus*	Critically Endangered		4
Wagtail, African Pied	*Motacilla aguimp*			
Wagtail, Cape	*Motacilla capensis*			12
Warbler, African Reed	*Acrocephalus baeticatus*			
Warbler, Chestnut-vented	***Sylvia subcaeruleum***			**37**
Warbler, Icterine	*Hippolais icterina*			
Warbler, Lesser Lesser	*Acrocephalus gracilirostris*			
Warbler, Rufous-eared	***Malcorus pectoralis***			**71**
Warbler, Willow	*Phylloscopus trochilus*			2
Waxbill, Common	*Estrilda astrild*			2
Weaver, Sociable	***Philetairus socius***			**56**
Weaver, Southern Masked	***Ploceus velatus***			**87**
Wheatear, Capped	*Oenanthe pileata*			25
Wheatear, Mountain	*Oenanthe monticola*			13
White-eye, Orange River	*Zosterops pallidus*			4
Whydah, Pin-tailed	*Vidua macroura*			2
Woodpecker, Cardinal	*Dendropicos fuscescens*			2
Woodpecker, Golden-tailed	*Campethera abingoni*			