ENVIRONMENTAL IMPACT ASSESSMENT FOR THE PROPOSED MOGARA SOLAR PV FACILITY AND ASSOCIATED INFRASTRUCTURE, KATHU, NORTHERN CAPE:

AVIFAUNAL IMPACT STUDY

Violet-eared Waxbill *Granatina granatina*

PRODUCED FOR CAPE EAPRAC

BY

3Foxes Biodiversity Solutions

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EXECUTIVE SUMMARY

K2018091776 (SOUTH AFRICA) (Pty) Ltd. is proposing the establishment of a commercial 75 MW photovoltaic (PV) solar energy facility (SEF), called Mogara Solar, on the farm Legoko Farm No 460 Portion 2 and Portion 1, near Kathu in the Northern Cape. The development is currently in the EIA Phase and 3Foxes Biodiversity Solutions has been appointed to provide a specialist avifaunal impact 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 218 bird species have been recorded within the study area and surrounds, of which 74 species were observed during a four-day site visit (April 2018). Of these, six species are considered near-endemic to South Africa, while no endemic species are known to occur. The avifauna of the preferred Alternative 1 site for development was compared to that of the Alternative 2 site. Preliminary data suggest that the species richness and abundance appear to be higher at the Alternative 2 site compared to the preferred site. This is most likely due to the greater habitat heterogeneity at the former site, which supports a more open savannah with a somewhat higher density of *Acacia erioloba* trees.

With respect to priority avifauna species, a total of 11 species are listed as threatened, and a further five species are considered Near-Threatened. Only one red-listed species was recorded during the site visit, namely the Endangered Tawny Eagle *Aquila rapax*. Other red-listed species of concern that may occur in the study area albeit in low numbers or infrequently include the Critically Endangered White-backed Vulture *Gyps africanus, the* Endangered Martial Eagle *Polemaetus bellicosus*, the Vulnerable Secretarybird *Sagittarius serpentarius*, and Lanner Falcon *Falco biarmicus*, and the Near-Threatened Kori Bustard *Ardeotis kori*. Many of these species, and particularly the terrestrial Kori Bustard and Secretarybird, are more likely to favour the Alternative 2 site with its more open savannah and lower density of *Tarchonanthus* scrub.

The expected impacts of the proposed solar development within the study area include 1) habitat loss and fragmentation associated with the *Tarchonanthus* scrub, 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 mostly small passerines, ground-dwelling non-passerines and large raptors 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 impacts on the avifauna and ecological processes at the preferred Alternative 1 site would be markedly lower than the Alternative 2 site, due to lower habitat heterogeneity and lower species diversity and abundance at the preferred site.

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 dense *Acacia erioloba* woodland from any development, 3) fitment of bird diverters where necessary on all erected power lines associated with the development to reduce the possibility of collisions and electrocutions should these occur, and 4) ensure that perimeter fencing along the boundaries of the development are bird (especially ground-dwelling species) and wildlife friendly.

The development footprint of the Preferred Alternative 1 Mogara PV facility is restricted largely to low sensitivity avifaunal habitat within the site. The affected area is considered suitable for development and there are no avifaunal impacts associated with the Mogara PV Facility that cannot be mitigated to a low level. As such there are no fatal flaws or high post-mitigation impacts that should prevent the development from proceeding. Based on the layout provided for the assessment, the Mogara PV Facility can be supported from an avifaunal point of view. The Mogara Grid Connection with associated infrastructure is likely to generate very low impacts on avifauna after mitigation. No high impacts that cannot be avoided were observed and from an avifaunal perspective, there are no reasons to oppose the development of the grid connections and associated infrastructure.

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

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k) any mitigation measures for inclusion in the EMPr;	33-36
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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

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 Process. 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.

Eric Herrmann

Eric Herrmann is an avifaunal specialist with over 15 years of experience in biodiversity research and conservation in the Northern Cape. He completed a B.Tech Degree (cum laude) in Nature Conservation (1997) at the Cape Technikon, followed by a Masters (cum laude) in Conservation Ecology at the University of Stellenbosch (2004). He has worked as a research assistant for the Endangered Wildlife Trust (1999-2001) in the Kgalagadi Transfrontier Park, and then for the Percy FitzPatrick Institute of African Ornithology (University of Cape Town) as project manager of a field research centre near Kimberley (2003 to 2006). In 2006 he joined the provincial Department of Environment and Nature Conservation (DENC) in Kimberley as a faunal scientist until 2012. Since 2016 he has been working independently as an avifaunal specialist largely on wind and solar energy projects in the Western and 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 Avifaunal projects related to Solar and Wind energy or transmission infrastructure:

- Hyperion Solar PV Facility, Kathu. Avifaunal Specialist Scoping Report. Savannah Environmental. 2018.
- Dassieklip Wind Facility, Caledon. Avifaunal post-construction monitoring. BioTherm Energy. 2018.
- Excelsior Wind Facility, Swellendam. Avifaunal pre-construction monitoring. BioTherm Energy. 2018.
- Mamre Wind Facility, Mamre. Avifaunal pre-construction monitoring. Mulilo Renewable Project Developments. 2017.
- Soventix Solar PV Facility (De Aar). Avifaunal Specialist Scoping and EIA Reports. Ecoleges. 2017.
- Olifantshoek-Emil 132kV power line. Ecological Basic Assessment Report. Savannah Environmental. 2016.
- Klondike (Vryburg) Solar PV Facility. Ecological Specialist Report for EIA. Cape EAPrac 2016.

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: ____30 October 2018_____

1 INTRODUCTION

K2018091776 (SOUTH AFRICA) (Pty) Ltd. (the applicant) is proposing the establishment of a commercial photovoltaic (PV) solar energy facility (SEF), called Mogara Solar, on the farm Legoko Farm No 460 Portion 2 and Portion 1, situated in the District of Kuruman Rd, Northern Cape Province, within the jurisdiction area of the Gamagara Local Municipality. Mogara Solar will have a net generating capacity of 75 MWAC with an estimated maximum footprint of ± 225 ha. The applicant has appointed Cape EAPrac to undertake the required application for environmental authorisation process for the above development. The development is currently in the EIA Phase and the applicant has appointed 3Foxes Biodiversity Solutions to provide a specialist avifaunal impact study of the development site as part of the EIA process.

The purpose of the Mogara Solar Avifaunal Impact 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 (25 to 27, and 29 April 2018) as well as a desktop review of the available literature for the area was conducted in order to identify and characterise the local avifaunal community and avifaunal habitats present at the site. This information is used to derive an avifaunal sensitivity map that has been used to inform the development layouts at the site. Impacts on avifauna are assessed for the preconstruction, construction, operation, and decommissioning phases of the development. A variety of avoidance and mitigation measures associated with each identified impact are recommended to reduce the likely impact of the development, which should be included in the EMPr for the development. The full scope of study is detailed below.

1.1 SCOPE OF STUDY

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 (incl. 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 the 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 faunal 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
- Decommissioning

1.2 RELEVANT ASPECTS OF THE DEVELOPMENT

The proposed development site is located south of Kathu on Portion 2 and Portion 1 of Farm 460 situated in the District of Kuruman RD, Northern Cape Province, with an overall extent of 1916ha (Figure 1). The alternative site is located on the adjacent property Legoko 460/1. The development will require approximately 225ha of the site and will consist of the following:

» PV and/or concentrated PV with fixed, single- or double axis- tracking technology. The actual technology to be used will be decided at a later date.
» The grid connection would be to the Eskom Ferrum Substation via the proposed Sekgame Switching Station located west of the site.
» A Facility Substation located on Portion 2 of Farm 460.
» Auxiliary buildings of approximately 1ha. The functions within these buildings include (but is not limited to) ablutions, workshops, storage areas/warehousing, control room and site offices.
» Fencing height shall be below 5m, but expected to be approximately 3m.
» Access roads are expected to be 6m in width, but less than 8m in width.
» Approximately 2-5ha of laydown area will be required, but will not exceed 5ha.

Figure 1. Satellite image of the Mogara study site, illustrating the two Legoko 460 property boundaries in black and the preferred Alternative 1 in the north and the Alternative 2 in the south, as well as the power line route to the proposed Sekgame Switching Station.

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 cell (QDGC) that covers the study area is 2723CC (9 cards, 90 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 2745_2305 (1 card, 24 species) and 2740_2305 (7 cards, 108 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.
- A previous avifaunal assessment at the site has also been conducted as part of the AEP Legoko PV development (DEA 14/12/16/3/3/2/819). This included a site visit and avifaunal field assessment during December 2015 (Zoghby & Todd, 2016).

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 four days was made to the study area in early autumn following a wet summer (25 to 27, and 29 April 2018) to determine the *in situ* local avifauna and avian habitats present on site. Linear transects measuring 1km in length were walked through the preferred Alternative 1 site and adjacent areas (n = 10), mostly in a zig-zag formation to ensure adequate coverage under the time constraints. Another six transects were walked through the Alternative 2 site. 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, or attracted to focal points such as watering holes (e.g. sandgrouse 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 mapping the avifaunal habitats as observed on the site and the observed or potential presence of avifaunal species of conservation concern associated with each habitat or part of the site as well as any observed nesting sites, feeding areas, wetlands or other features of significance. The avifaunal sensitivity of the different units identified in the mapping procedure was rated according to the following scale:

Sensitivity	Description
Low	Areas of natural or transformed habitat which are considered low sensitivity where there is likely to be a negligible impact on avifaunal biodiversity. Most types of development can proceed within these areas with little avifaunal impact.
Medium	Areas of natural or previously transformed land where the impacts on avifauna or avifaunal habitats are likely to be largely local in nature. These areas usually comprise the bulk of avifaunal habitats within an area. Development within these areas can proceed with relatively little avifaunal impact provided that appropriate mitigation measures are taken.
High	Usually areas of natural habitat where a high impact on avifauna is anticipated due to the high avifaunal diversity, sensitivity or presence of important avifaunal habitats or nesting sites. 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/No-Go	Critical and unique avifaunal habitats that serve as habitat, nesting sites or forging area for rare/endangered species or otherwise of significant local or regional avifaunal value. These areas are essentially no-go areas from a developmental perspective and should be avoided as much as possible.

2.4 SAMPLING LIMITATIONS AND ASSUMPTIONS

The current study consisted of a single detailed field assessment as well as a desktop study, which serves to significantly reduce the limitations and assumptions required for the study. In addition, the site has been previously assessed as part of the AEP Legoko PV development (DEA 14/12/16/3/3/2/819) during December 2015 (Zoghby & Todd, 2016), which provided additional avifaunal seasonal (summer) data. 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 (Visser, 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), while there are presently only eight SABAP 2 atlas cards recorded for the two relevant pentads combined. No more reliable and/or more recent formal data on bird species distribution in the study area are available.
- Limited time in the field and seasonal spread means that important components of the local avifauna (i.e. 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 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.
- During walking transects many birds were heard but not seen, which made it difficult to estimate the number of individuals present per detection. However, considering that the same observer was responsible for recording all detections, it is assumed that sampling error would be distributed evenly across all samples.

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). Although the preferred and alternative sites differed to some extent with respect to the structural composition of the vegetation, four main avian microhabitats could be identified which formed the basis of the avian sensitivity map. These vegetation units include:

- ***Tarchonanthus shrubland*****:** This habitat unit is fairly homogenous and covers the majority of the preferred Alternative 1 site on Legoko 460/2 (Figure 2). This habitat consists of a dense shrubland about 2m tall, dominated by *Tarchonanthus camphoratus* with other tall shrubs and trees of the genera *Ziziphus*, *Acacia, Searsia*, *Diospyros* and *Grewia*. The grass layer is dominated by genera such as *Aristida*, *Cymbopogon, Cynodon, Enneapogon, Eragrostis and the species Schmidtia pappophoroides.*

- ***Kathu bushveld:*** This habitat is predominant on the Alternative 2 site located on the property Legoko 460/1, immediately south of the preferred alternative on Legoko 460/2 (Figure 3). This habitat consists of mixed *Acacia erioloba* thornveld which broadly corresponds to the Kathu Bushveld vegetation type, as described by Mucina and Rutherford (2006). The habitat in this area is considered to be in a better condition than the veld on Legoko 460/2. The vegetation represents a more open savannah, although there are still some areas present where *Tarchonanthus camphoratus* is dominant. Plant species are similar as those found at Legoko 460/2, although dominance within the grass layer is skewed towards more palatable species, such as *Schmidtia pappophoroides.* This habitat is considered to have a *Medium* sensitivity because the scattered large trees provide structural and compositional variation.

- ***Acacia erioloba woodland:*** This unit is associated with deeper soils and is restricted to the south western corner of Legoko 460/2. This habitat is associated with well-wooded linear depressions that pass beyond the boundaries of the proposed development area. This habitat is considered to have a *High* sensitivity because the area supports a higher biomass of large protected trees (*Acacia erioloba)* which are also important for birds, specifically for roosting and nesting.

- ***Pans*****:** There are several small pans (<=1ha) in the wider area which hold water only after exceptional rains, but are nevertheless important habitat for certain bird

species such as coursers, while also providing focal points for widespread species that occupy neighbouring habitats (Figure 4). These pans are therefore considered to have a *Very High* sensitivity and should be buffered from any development and disturbance by at least 100m. However, none of these pans lie within or near the preferred development footprint of the Mogara site, and as such are not considered to represent an avifaunal microhabitat that would be affected by the current development but are highlighted as an important feature of the broader study area.

It should however be noted, that the study area, and especially the preferred Alternative 1 site, has already been subject to varying degrees of disturbance and degradation caused by past and present land-use practises. The site is currently used for livestock grazing and evidence of high stocking rates and grazing pressure is apparent. There is also a network of minor farm roads throughout.

Figure 2. Dense *Tarchonanthus camphoratus*-dominated veld within the preferred Alternative 1 site, where plant diversity is generally low.

Figure 3. Open *Acacia erioloba* bushveld near to the north eastern boundary of Alternative 2, showing the low bush density compared with the majority of the Alternative 1 area.

Figure 4. One of the small pans present in the broader study, with the pan pictured above being the largest pan within the broader area and occurs just south of the Alternative 2 footprint area. There are no pans within or in close proximity to the preferred alternative.

3.2 AVIFAUNAL COMMUNITY COMPOSITION

An approximate total of 218 bird species are known to occur in the study area and surrounds (Annexure 1), of which 74 species were recorded during the site visit. Eleven species are listed as threatened, and a further five species are considered Near-Threatened, while six species are near-endemic to South Africa (Taylor *et al*., 2015). Only two biome-restricted species occur, the Kalahari Scrub-robin *Cercotrichas paena* and Burchell's Sandgrouse *Pterocles burchelli* (Marnewick *et al*., 2015).

The bird assemblages recorded within the preferred Alternative 1 site and the Alternative 2 site are typical of the Kalahari bioregion. Of the 38 species that were recorded during walking transects, nearly 70% (26 species) occurred in both sites, indicating that the two sites supported fairly similar species assemblages. Although the total number of species recorded at each site was similar (31 versus 32), more species were detected along walking transects within the alternative site (Table 1) despite fewer transects being completed (10 vs. 6). This suggests that the Alternative 2 site, which supports more habitat heterogeneity, may support more species as well as greater bird abundance.

Table 1. Comparison of the total number of individual birds and species recorded along walking transects in the preferred Alternative 1 site (n = 10) and the Alternative 2 site (n = 6) during the site visit (late April 2018). Standard deviation values are provided.

Preferred Alternative 1 site			Alternative 2 site		
2	**Total birds**	**Species**	**Transect**	**Total birds**	**Species**
1	19	11	1	61	16
2	49	12	2	28	13
3	35	12	3	105	22
4	27	11	4	39	11
5	27	9	5	35	14
6	38	13	6	39	14
7	17	6			
8	41	13			
9	30	11			
10	55	13			
Average	**33.8**	**11.1**	**Average**	**51.2**	**15.0**
Std deviation	**12.3**	**2.2**	**Std deviation**	**28.6**	**3.8**

The most abundant species at both sites included Scaly-feathered Finch *Sporopipes squamifrons*, Black-chested Prinia *Prinia flavicans*, Chestnut-vented Warbler *Sylvia subcaeruleum*, and Kalahari Scrub-robin, with similar relative abundances (Table 2). For

other species that were less common there were marked differences in their respective abundance rates between the two sites. However, more species showed higher relative abundance in the Alternative 2 site, further suggesting that this site supports higher avifaunal abundance.

Table 2. The most commonly detected bird species during transects walks within the preferred Alternative 1 and Alternative 2 site, with the number of birds seen per kilometre as a measure of relative abundance. Species that were seen only once in a large flock are indicated by an asterix (*).

Preferred Alternative 1 site		Alternative 2 site	
Species	**Birds/km**	**Species**	**Birds/km**
Scaly-feathered Finch	7.2	Scaly-feathered Finch	7.0
Black-chested Prinia	4.5	Black-chested Prinia	6.8
Chestnut-vented Warbler	3.8	Chestnut-vented Warbler	6.7
Kalahari Scrub Robin	3.3	African Red-eyed Bulbul	3.8
Yellow Canary	3.1	Kalahari Scrub Robin	3.7
Cape Turtle Dove	2.2	White-backed Mousebird	3.3
Cape Penduline Tit	1.3	Namaqua Dove	2.8
Namaqua Dove	1.1	African Grey Hornbill*	2.2
Red-faced Mousebird	1.0	Fawn-coloured Lark	2.0
Golden-breasted Bunting	0.6	Cape Turtle Dove	1.5
African Red-eyed Bulbul	0.5	Crimson-breasted Shrike	1.5
Southern Red Bishop	0.5	Southern Fiscal	1.0
Yellow-bellied Eremomela	0.5	Golden-breasted Bunting	0.8
Black-throated Canary	0.4	Tinkling Cisticola	0.8
Red-crested Korhaan	0.4	Yellow Canary	0.8
Shaft-tailed Whydah	0.4	Brown-crowned Tchagra	0.7

Red-listed species are considered fundamental to this study, because of their susceptibility to the various threats posed by solar facilities and associated infrastructures. A total of 11 species that have been recorded in the area are threatened, and a further five species are considered Near-Threatened (Table 3). The study by Zoghby and Todd (2016) reported a very similar list of threatened avifaunal species for the broader area. Only one Red-listed species was recorded during the current site visit, namely the Endangered Tawny Eagle *Aquila rapax*, seen soaring overhead across the study site. However, other red-listed species of concern that may have a high probability of occurring in the study area include Martial Eagle *Polemaetus bellicosus* (Endangered), Secretarybird *Sagittarius serpentarius* (Vulnerable), Lanner Falcon *Falco biarmicus* (Vulnerable), and Kori Bustard *Ardeotis kori* (Near-Threatened). The local populations of these species are mostly of moderate importance, as the study site and surrounds most likely serve as only part of the foraging

range of occasional individuals passing through. Species with a moderate probability of occurring in the study area include the White-backed Vulture *Gyps africanus* (Critically Endangered), the Lapped-faced Vulture *Torgos tracheliotos* (Endangered), Verreaux's Eagle *Aquila verreauxii* (Vulnerable), Burchell's Courser *Cursorius rufus* (Vulnerable) and European Roller *Coracias garrulous* (Near-Threatened). These species appear not to be resident in the study area based on bird atlas data (SABAP2) and have also not been recently sighted in the general area. However, the probability of these species occurring in the study area on occasion cannot be excluded. Other red-listed species which may occur with negligible frequency and therefore are of less concern include the Endangered Bateleur *Terathopius ecaudatus*, Black Harrier *Circus maurus* and Ludwig's Bustard *Neotis ludwigii*, and Black Stork *Ciconia nigra,* and the Near-threatened Abdim's Stork *Ciconia abdimii* and Maccoa Duck *Oxyura maccoa*. The habitats of the study area are not entirely suitable for these species, barring the Bateleur, which has been exterminated from large parts of the northern parts of the Northern Cape mainly due to poisoning (Taylor *et al.*, 2015). The absence of water bodies at the study site would exclude Black Stork and Maccoa Duck.

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. Aside from a single Tawny Eagle seen soaring over the area at a height of approximately 100m, only Gabar Goshawk and Greater Kestrel were seen flying within the study area on a few occasions. A pair of kestrels was regularly seen perching and hunting in the vicinity of the 400kV power line that traverses the north boundary of the Legoko 460/2 site. This power line was also observed from the study area early mornings and late afternoons on three consecutive days to determine whether it is used by large raptors and vultures as a night-time roost. No red-listed species or any other large birds where seen using the pylon structures for roosting during the period of the site visit, although this does not exclude the possibility that birds may use these structures at other times of the year. No nest or communal nesting sites of red-listed species were found in the study area during the site visit. These observations seem to suggest that red-listed or large communal species are not currently using the study area or parts thereof for roosting or nesting.

In essence, much of the avifauna within the study area appears 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, vultures and Secretarybird), the absence of suitable habitat (Black Stork and Maccoa Duck), and their having been largely exterminated from the region (Bateleur). However, certain species may use the study area on occasion as part of their large ranges, such as Kori Bustard and Secretarybird, also reported by Zoghby & Todd (2016). Since the study area appears not to 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.

Table 3. Red-listed species recorded in the study area during SABAP1 (1987-1991), SABAP2 (2007 on-going) and the site visit (25 to 27, and 29 April 2018). Only one species was observed during the site visit (marked in bold). Species are ranked according to their red-list status.

English name	Taxonomic name	Red-list status	Regional endemism	Estimated importance of local population	Preferred habitat	Probability of occurrence	Threats
Vulture, White-backed	*Gyps africanus*	Critically Endangered	-	Moderate	Savanna	Moderate	Habitat loss/Disturbance Collisions/Electrocution
Vulture, Lapped-faced	*Torgos tracheliotos*	Endangered	-	Moderate	Savanna and desert	Moderate	Habitat loss/Disturbance Collisions/Electrocution
Bateleur	*Terathopius ecaudatus*	Endangered	-	Low	Savanna	Low	Habitat loss/Disturbance Collisions/Electrocution
Bustard, Ludwig's	*Neotis ludwigii*	Endangered	Near-endemic	Low	Semi-arid shrublands	Low	Habitat loss/Disturbance Collisions
Eagle, Martial	*Polemaetus bellicosus*	Endangered	-	Moderate	Savanna & shrublands	High	Habitat loss/Disturbance Collisions/Electrocution
Eagle, Tawny	***Aquila rapax***	**Endangered**	**-**	**Moderate**	**Savanna & Karoo plains**	**High**	**Habitat loss/Disturbance Collisions/Electrocution**
Harrier, Black	*Circus maurus*	Endangered	-	Low	Fynbos, Karoo & grassland	Low	Habitat loss/Disturbance/Collisions
Courser, Burchell's	*Cursorius rufus*	Vulnerable	Near-endemic	Low	Shrubland plains	Moderate	Habitat loss/Disturbance
Eagle, Verreaux's	*Aquila verreauxii*	Vulnerable	-	Low	Mountainous and rocky areas	Moderate	Habitat loss/Disturbance Collisions/Electrocution
Falcon, Lanner	*Falco biarmicus*	Vulnerable	-	Low	Widespread	High	Habitat loss/Disturbance Collisions/Electrocution
Secretarybird	*Sagittarius serpentarius*	Vulnerable	-	Moderate	Open savanna & grassland	High	Habitat loss/Disturbance Collisions
Stork, Black	*Ciconia nigra*	Vulnerable	-	Low	Water bodies	Low	Collisions
Bustard, Kori	*Ardeotis kori*	Near-threatened	-	Moderate	Open savanna	High	Habitat loss/Disturbance Collisions
Duck, Maccoa	*Oxyura maccoa*	Near-Threatened	-	Low	Water bodies	Low	Habitat loss/Disturbance
Roller, European	*Coracias garrulus*	Near-Threatened	-	Moderate	Open savanna	Moderate	Habitat loss/Disturbance
Stork, Abdim's	*Ciconia abdimii*	Near-threatened	-	Low	Grassland & savanna	Moderate	Collisions

3.3 CURRENT BASELINE & CUMULATIVE IMPACT

There are several existing PV projects in the Kathu area including the already built Kalahari Solar, Kathu Solar and Sishen Solar Farms (Figure 6). These cover an area of 950ha and are considered to form part of the existing baseline for the area and represent existing impact to the area. The 950ha footprint of these is however small in comparison with the iron and manganese mines in the area, which with an existing footprint of at least 12 000ha are currently the major driver of habitat loss and transformation in the area. There are several authorised developments in close vicinity to the Mogara site, including the Legoko PV plant on the same property as the current development, the Kathu Solar PV facility immediately east of the site and the Mogobe Solar Energy facility on the same property as the alternative site for the current development. This raises the potential for cumulative impact in the area. The specific contribution of the current development is 225ha, but it is important to note the degraded nature of the site and the comparatively low value of this area compared to vegetation in better condition elsewhere in the area. Provided that areas such as the Alternative 2 site are not subjected to future developments, the proposed development is expected to have a minimal cumulative impact on the local avifauna.

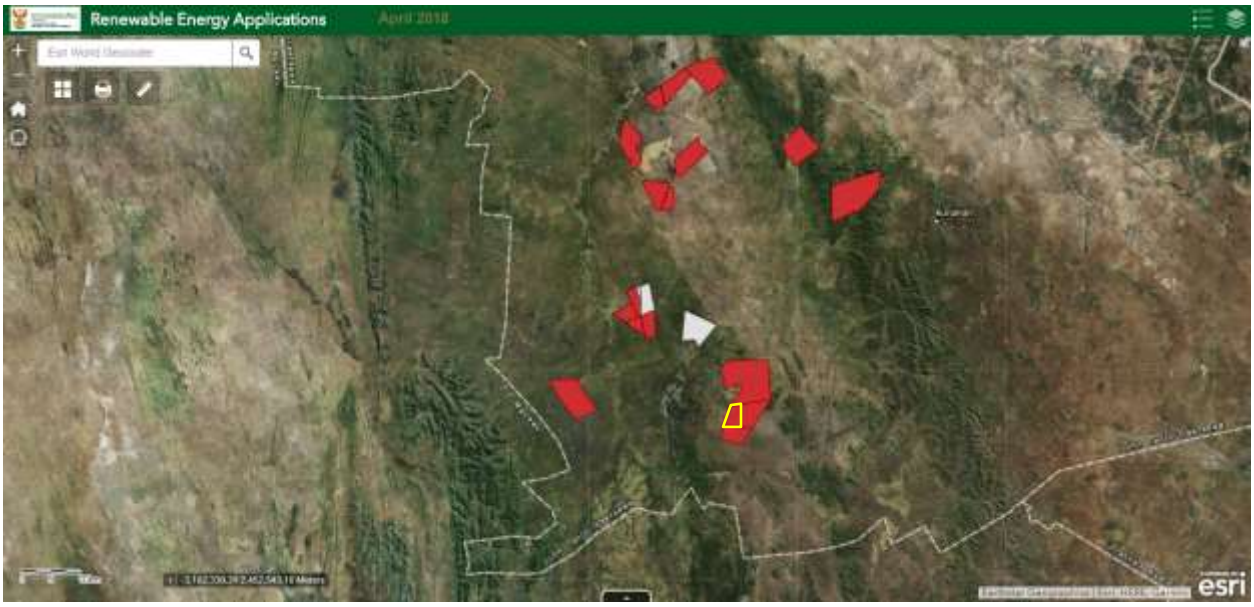

Figure 6. Map of DEA registered renewable energy applications as of July 2018. The site is already highlighted as a renewable energy development site due to the existing Legoko Solar project.

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 7) was generated by integrating avian microhabitats present on the site and avifaunal information collected during the site visit.

The Alternative 1 development area is considered to be Low sensitivity *Tarchonanthus* scrub. It is likely that development of the solar energy development in this area would generate low impacts on the avifauna. The Alternative 2 site is considered to be Medium sensitivity and represents habitat with a much higher ecological condition than the preferred alternative, and density of large tree species, as well as higher avifaunal species richness and abundance. The current study supports the notion that the development of the preferred alternative will have a lower environmental impact than the Alternative 2 site, which is considered to be significantly less suitable for the development of a solar energy facility.

With the development of the preferred alternative, the project would result in some habitat loss for avifauna of local significance, but without negatively impacting red-listed species which appear to occur sparsely within the study area and immediate surroundings.

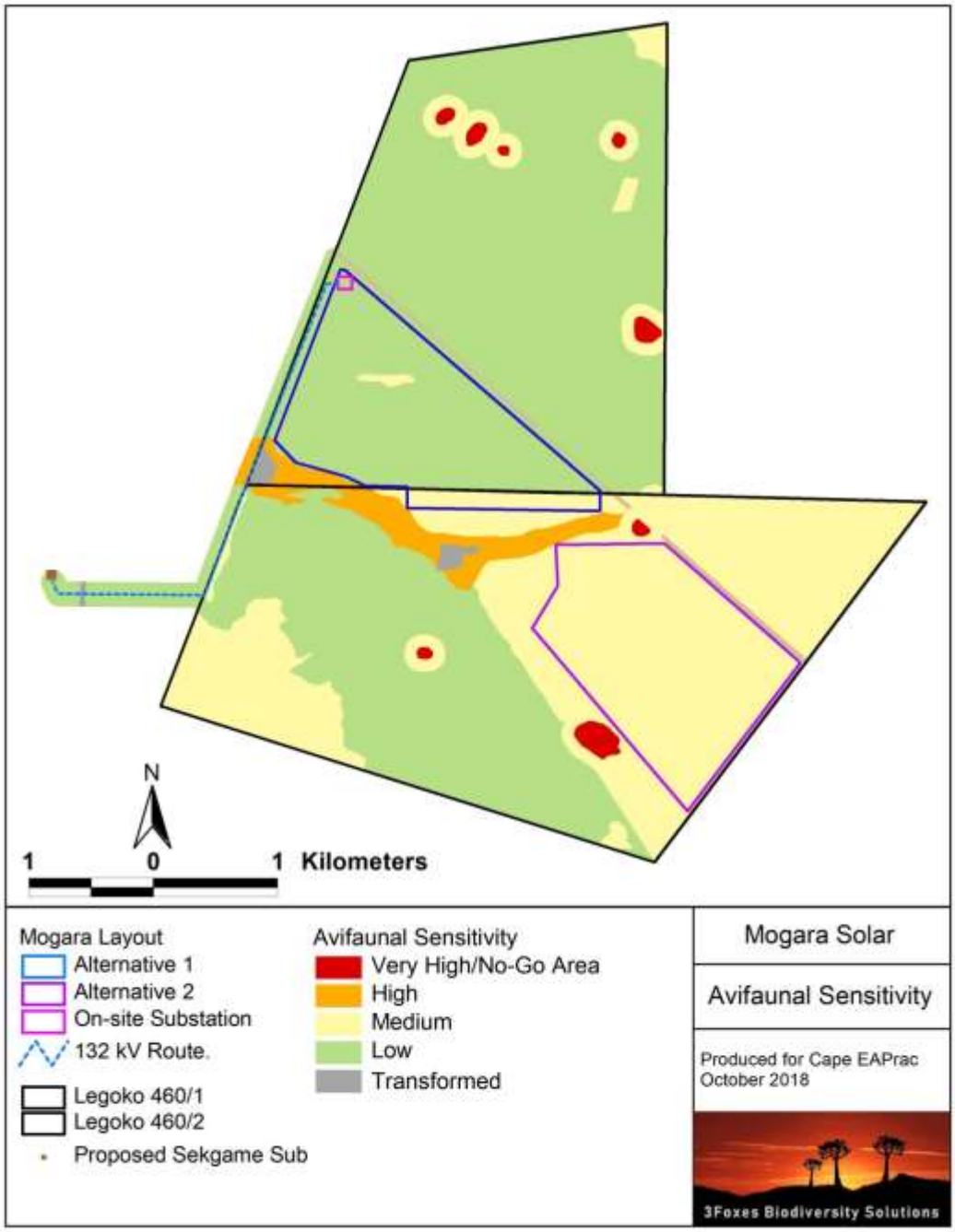

Figure 7. Avifaunal sensitivity map for the Mogara Solar project, showing the two alternatives and the grid connection.

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 proposed Mogara Solar development will cover an area of up to approximately 225ha, located primarily within the *Tarchonanthus* shrubland habitat on the Legoko Farm No 460/2 and 460/1. This habitat is somewhat degraded due to historical management practices, with few features of concern present across most of the site. Of 16 red-listed species that are known to occur in the areas, only one was seen during the site visit, while only six near-endemic species and two biome-restricted species occur. While the development may have an insignificant impact on these species, it will nevertheless impact on 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 Mogara Solar energy facility 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:

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 Gabar Goshawk *Micronisus gabar*, Pale Chanting Goshawk *Melierax canorus*, Greater Kestrel *Falco rupicoloides*, and the ground-dwelling Namaqua Sandgrouse *Pterocles namaqua* and Burchell's Sandgrouse *Pterocles burchelli*, Orange River Francolin *Scleroptila gutturalis,* and Red-crested Korhaan *Lophotis ruficrista*. 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. Orange River Francolin 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 Tawny Eagle, Martial eagle, Verreaux's Eagle, Secretarybird, and Kori Bustard. 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).

4.2 IDENTIFICATION OF IMPACTS TO BE ASSESSED

In this section each of the potential impacts identified above are 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.

Direct avifaunal impacts

Increased levels of noise, pollution, disturbance and human presence during construction will be detrimental to the avifauna. Sensitive and shy avifauna would move away from the area during the construction phase as a result of the noise and human activities present. Some impact on the avifauna is highly likely to occur during construction and operation of the facility, and this impact will therefore be assessed for the construction phase and operational phase.

Reduced ability to meet conservation obligations & targets

The loss of unprotected vegetation types on a cumulative basis from the broad area may impact the country's ability to meet its conservation targets. Although the receiving vegetation type in the study area is classified as Least Threatened and is still more than 98% intact, it is a relatively restricted vegetation type for an arid area and is therefore vulnerable to cumulative impact. This impact is therefore assessed in light of the current development as well as any other developments in the surrounding area which would also contribute to cumulative impacts.

Impact on broad-scale ecological processes

Transformation of intact habitat on a cumulative basis would contribute to the fragmentation of the landscape and would potentially disrupt the connectivity of the landscape for resident avifauna. Although most avifaunal species in the area are common throughout the Kalahari region, scarcer species with large foraging ranges (such as the bustards, Secretarybird, eagles and vultures) may be negatively impacted by cumulative developments in the broader are. Due to the presence of a number of other renewable energy and mining developments in the area, this is a potential cumulative impact of the development that is assessed.

5 ASSESSMENT OF IMPACTS

The various identified impacts are assessed below for the different phases of the development.

5.1 MOGARA SOLAR PV DEVELOPMENT

The following is an assessment of the Mogara SEF, for the planning, construction and operational phase of the development.

5.1.1 Planning & Construction Phase

Nature of impact	**Direct Avifaunal Impacts During Construction – habitat loss and disturbance**							
Alternative	**Spatial Extent**	**Duration**	**Intensity**	**Probability**	**Reversibility**	**Significance and Status**		**Confidence level**
						Without Mitigation	**With Mitigation**	
Alternative 1	Local	Short- Term	Medium	High	High	Medium Negative	Medium-Low Negative	High
Alternative 2	Local	Short- Term	Medium	High	High	Medium Negative	Medium-Low Negative	High

Mitigation/Management Actions

- Avoid the high sensitive portions of the layout as indicated in the sensitivity map, such as the dense *Acacia erioloba* woodland and any raptor nests that may be discovered prior to or during construction. The destruction of habitat during construction should also be strictly contained within the development footprint.
- The use of lay-down areas within the footprint of the development should be used where feasible, to avoid habitat loss and disturbance to adjoining areas.
- All building waste produced during the construction phase should be removed from the development site and be disposed of at a designated waste management facility. Similarly, all liquid wastes should be contained in appropriately sealed vessels/ponds within the footprint of the development, and be disposed of at a designated waste management facility after use. Any liquid and chemical spills should be dealt with accordingly to avoid contamination of the environment.
- Preconstruction environmental induction for all construction staff on site to ensure that basic environmental principles are adhered to, and awareness about not harming or hunting ground-dwelling species (e.g. bustards, korhaans, thick-knees and coursers), and owls, which are often persecuted out of superstition. This induction should also include awareness as to no littering, appropriate handling of pollution and chemical spills, avoiding fire hazards, minimizing wildlife interactions, remaining within demarcated construction areas etc.
- All construction vehicles should adhere to a low speed limit to avoid collisions with susceptible species such as nocturnal and crepuscular species (e.g. nightjars, thick-knees and owls) which sometimes forage or rest along roads.
- Sensitive microhabitats should be avoided, such as nesting sites during the breeding season of large terrestrial birds (generally summer; Hockey *et al.*, 2005).
- Any avifauna threatened by the construction activities should be removed to safety by the ECO or appropriately qualified environmental officer.
- If holes or trenches need to be dug, these should not be left open for extended periods of time as ground-dwelling avifauna or their flightless young may fall in and become trapped in them. Holes should only be dug when they are required and should be used and filled shortly thereafter.
- No construction activity should occur near to active raptor nests should these be discovered prior to or during the construction phase. If there are active nests near construction areas, these should be reported to ECO and should be monitored until the birds have finished nesting and the fledglings left the nest.

5.1.2 Operational Phase Impacts

Nature of Impact	**Avifaunal Impacts due to operational activities – disturbance and collisions with PV panels**							
Alternative	**Spatial Extent**	**Duration**	**Intensity**	**Probability**	**Reversibility**	**Significance and Status**		Confidence level
						Without Mitigation	**With Mitigation**	
Alternative 1	Local	Long-term	Medium-Low	Moderate	High	Medium-Low Negative	Low-Negative	High
Alternative 2	Local	Long-term	Medium-Low	Moderate	High	Medium-Low Negative	Low-Negative	High

Mitigation/Management Actions

- If the site must be lit at night for security purposes, this should be done with downward-directed low-UV type lights (such as most LEDs), which do not attract insects. The use of lighting at night should be kept to a minimum, so as not to unnecessarily attract invertebrates to the solar facility and possibly their avian predators, and to minimise disturbance to birds flying over the facility at night.
- It has been suggested by Visser (2016) that collision mortality could be reduced at solar facilities by using 28 cm-spaced contrasting bands or 10 cm spatial gaps between solar panels. This enables birds, particularly waterbirds, to differentiate the expansive layout of panels as a solid structure, reducing the likelihood that they may try to land and collide with the panels. This recommendation is, however, not considered necessary since the area appears not to support regular flight paths for waterbirds or other groups of birds.
- All incidents of collision with panels should be recorded as meticulously as possible, including data related to the species involved, the exact location of collisions within the facility, and suspected cause of death. Post-construction monitoring with the aid of video surveillance should be considered, as this will contribute towards understanding bird interactions with solar panels.
- If birds are nesting on the infrastructure of the facility and cannot be tolerated due to operational risks of fire, electrical shorts, soiling of panels or other concerns, birds should be prevented from accessing nesting sites by using mesh or other manner of excluding them. Birds should not be shot, poisoned or harmed as this is not an effective control method and has negative ecological consequences. Birds that already have eggs or nestlings should be allowed to fledge their young before nests are removed.
- If there are any persistent problems with avifauna, then an avifaunal specialist should be consulted for advice on further mitigation.
- Any movements by vehicle and personnel should be limited to within the footprint of power lines and other associated infrastructure, especially during routine maintenance procedures. Utmost care should be taken to not disturb nests that may be constructed on power line structures.
- All food waste and litter at the site should be placed in bins with lids and removed from the site on a regular basis.
- All vehicles accessing the site should adhere to a low speed limit (30km/h max) to avoid collisions with susceptible species such nocturnal and crepuscular species (e.g. nightjars, thick-knees and owls) which sometimes forage or rest on roads at night.

5.1.3 Decommissioning Phase Impacts

Nature of Impact	**Avifaunal Impacts due to decommissioning activities – disturbance and habitat loss**							
Alternative	**Spatial Extent**	**Duration**	**Intensity**	**Probability**	**Reversibility**	**Significance and Status**		Confidence level
						Without Mitigation	**With Mitigation**	
Alternative 1	Local	Short-term	Medium-Low	Moderate	High	Medium-Low Negative	Low-Negative	High
Alternative 2	Local	Short-term	Medium-Low	Moderate	High	Medium-Low Negative	Low-Negative	High

Mitigation/Management Actions

- All above-ground infrastructure should be removed from the site. Below-ground infrastructure such as cabling can be left in place if it does not pose a risk, as removal of such cables may generate additional disturbance and impact, however, this should be in accordance with the facility's decommissioning and recycling plan, and as per the agreements with the land owners concerned.
- All vehicles accessing the site should adhere to a low speed limit (30km/h max) to avoid collisions with susceptible species such nocturnal and crepuscular species (e.g. nightjars, thick-knees and owls) which sometimes forage or rest on roads at night.
- Rehabilitation and revegetation of the site in accordance with a site-specific revegetation and rehabilitation plan, with follow-up monitoring to ensure compliance and adequate achievement of revegetation targets.

5.2 MOGARA SOLAR GRID CONNECTION

The following is an assessment of the Grid Connection for the Mogara Solar Facility, for the planning and construction and operational phases of the development.

5.2.1 Planning & Construction Phase

Impact Nature	**Direct Avifaunal Impacts During Construction**							
Alternative	**Spatial Extent**	**Duration**	**Intensity**	**Probability**	**Reversibility**	**Significance and Status**		**Confidence level**
						Without Mitigation	**With Mitigation**	
Alternative 1	Local	Short- Term	Medium-Low	High	High	Medium-Low Negative	Low Negative	High

Mitigation/Management Actions

- All personnel should undergo environmental induction with regards to avifauna and in particular awareness about not harming, collecting or hunting ground-dwelling species (e.g. bustards, korhaans, thick-knees and coursers), and owls, which are often persecuted out of superstition.
- Any avifauna threatened by the construction activities should be removed to safety by the ECO or appropriately qualified environmental officer.
- All vehicles (construction or other) accessing the site should adhere to a low speed limit (30km/h max) to avoid collisions with susceptible species such as nocturnal and crepuscular species (e.g. nightjars, thick-knees and owls) which sometimes forage or rest on roads, especially at night.
- If holes or trenches need to be dug, these should not be left open for extended periods of time as ground-dwelling avifauna or their flightless young may fall in and become trapped in them. Holes should only be dug when they are required and should be used and filled shortly thereafter.
- The design and layout of any proposed power lines must be endorsed by members of the Eskom-EWT Strategic Partnership, taking into account the mitigation guidelines recommended by Birdlife South Africa (Smit, 2012; Jenkins *et al*., 2017).
- The route that the power line will follow should be the shortest distance possible across an area where collisions are expected to be minimal, or follow existing power lines, and be marked with bird diverters to make the lines as visible as possible to collision-susceptible species. Recommended bird diverters such as brightly coloured 'aviation' balls, thickened wire spirals, or flapping devices that increase the visibility of the lines should be fitted were considered necessary.
- Regular monitoring of power lines should be undertaken to detect bird carcasses, to enable the identification of any areas of high impact to be marked with bird diverters.
- Only power lines structures that are considered safe for birds should be erected to avoid the electrocutions of birds (particularly large raptors) perching or attempting to perch. Where necessary, deterrent devices such as bird guards should be mounted on relevant parts of the pylons to further reduce the possibility of electrocutions.

5.3 CUMULATIVE IMPACTS

The following are the cumulative impacts that are assessed as being a likely consequence of the development of the Mogara Solar PV 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

Nature of Impact	**Broad-scale avifaunal impacts due to cumulative loss and fragmentation of habitat**							
Alternative	**Spatial Extent**	**Duration**	**Intensity**	**Probability**	**Reversibility**	**Significance and Status**		**Confidence level**
						Without Mitigation	**With Mitigation**	
Alternative 1	Regional	Long-Term	Medium	Moderate	Low	Medium-Low Negative	Low Negative	Moderate-High
Alternative 2	Regional	Long-Term	Medium	Moderate	Low	Medium-Low Negative	Medium Low Negative	Moderate-High

Mitigation/Management Actions

- Minimise the development footprint as far as possible.
- The facility should be fenced off in a manner which allows small fauna to pass through the facility, but that does not result in ground-dwelling avifauna (e.g. bustards, korhaan, francolin, thick-knees) being trapped and electrocuted along the boundary fences (Visser, 2016). In practical terms this means that the facility should be fenced-off to include only the developed areas and should include as little undeveloped ground or natural veld as possible. In addition, there should not be electrified ground-strands present within 30cm of the ground and the electrified strands should be located on the inside of the fence and not the outside. Furthermore, the fence should be a single layer fence and not a double fence with a large gap between. Images of suitable fencing types from existing PV facilities are available on request.

6 CONCLUSION & RECOMMENDATIONS

The study area lies within the Kalahari bioregion and supports the typical avifaunal assemblage expected for the area. Although 11 threatened and five Near-Threatened species are known to occur within the area, most of these are not common in the area and probably occur in low numbers. Further, the vegetation of the preferred Alternative 1 consists of homogenous and degraded *Tachonanthus camphoratus* scrub. Impacts on avifauna with the development on this site are likely to be low and no high post-mitigation impacts are likely. The Alternative 2 option occurs within better condition rangeland with greater structural diversity and associated higher avifaunal species richness and abundance. This is the less preferred alternative from an avifaunal perspective and would likely generate significantly higher impacts on the avifauna than the preferred alternative.

The expected impacts of the proposed solar development area will include the following, 1) habitat loss and fragmentation associated with the *Tarchonanthus* scrub habitat, 2) disturbance and displacement 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, and 4) a cumulative habitat loss at a broader scale from renewable energy developments in the wider 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, francolin and 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 strictly to within the footprint of the development. 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 diversions (e.g. bird flappers) should be located along the power line route. Identified sensitive habitats, such as the dense *Acacia erioloba* woodland, should be excluded from the development footprint; this has already been taken into account with the preferred layout.

Cumulative impacts in the area are a concern due firstly to the mining activity that characterises the area and secondly due to the proliferation of solar energy development in the Kathu area. The current development would contribute approximately 225ha of habitat loss within an area considered to be of relatively low avifaunal significance and which does not lie within a likely avifaunal movement corridor or along an important ecological gradient that would be regularly or seasonally used by avifauna. As such, the overall cumulative impact of the development on avifauna is considered likely to be low.

Impact Statement

The development footprint of the Preferred Alternative 1 Mogara PV facility is restricted largely to low sensitivity avifaunal habitat within the site. The affected area is considered suitable for development and there are no avifaunal impacts associated with the Mogara PV Facility that cannot be mitigated to a low level. As such there are no fatal flaws or high post-mitigation impacts that should prevent the development from proceeding. Based on the layout provided for the assessment, the Mogara PV Facility can be supported from an avifaunal point of view. The Mogara Grid Connection with associated infrastructure is likely to generate very low impacts on avifauna after mitigation. No high impacts that cannot be avoided were observed and from avifaunal perspective, there are no reasons to oppose the development of the grid connections and associated infrastructure.

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8 ANNEX 1. LIST OF AVIFAUNA

A consolidated avifaunal list for the Mogara 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. 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 (25 to 27, and 29 April 2018).

Common name	Taxonomic name	Red-list status	Regional endemism	Reporting rate (%)
Avocet, Pied	*Recurvirostra avosetta*			0
Babbler, Southern Pied	*Turdoides bicolor*			44.4
Barbet, Acacia Pied	***Tricholaema leucomelas***			**66.7**
Bateleur	*Terathopius ecaudatus*	Endangered		0
Batis, Pririt	***Batis pririt***			**44.4**
Bee-eater, European	*Merops apiaster*			11.1
Bee-eater, Swallow-tailed	*Merops hirundineus*			11.1
Bishop, Southern Red	***Euplectes orix***			**11.1**
Bishop, Yellow-crowned	*Euplectes afer*			0
Bittern, Little	*Ixobrychus minutus*			0
Bokmakierie	*Telophorus zeylonus*			0
Brubru	***Nilaus afer***			**22.2**
Buffalo-weaver, Red-billed	*Bubalornis niger*			0
Bulbul, African Red-eyed	***Pycnonotus nigricans***			**100**
Bunting, Cape	*Emberiza capensis*			0
Bunting, Cinnamon-breasted	***Emberiza tahapisi***			**11.1**
Bunting, Golden-breasted	***Emberiza flaviventris***			**66.7**
Bunting, Lark-like	***Emberiza impetuani***			**11.1**
Bustard, Kori	*Ardeotis kori*	Near-threatened		0
Bustard, Ludwig's	*Neotis ludwigii*	Endangered		0
Buttonquail, Kurrichane	*Turnix sylvaticus*			0
Buzzard, Common	*Buteo vulpinus*			0
Canary, Black-headed	*Serinus alario*		Near-endemic	0
Canary, Black-throated	***Crithagra atrogularis***			**22.2**
Canary, Yellow	***Crithagra flaviventris***			**88.9**
Chat, Anteating	***Myrmecocichla formicivora***			**66.7**
Chat, Familiar	***Cercomela familiaris***			**33.3**
Cisticola, Desert	*Cisticola aridulus*			11.1
Cisticola, Levaillant's	*Cisticola tinniens*			0
Cisticola, Tinkling	***Cisticola rufilatus***			**11.1**
Cisticola, Zitting	*Cisticola juncidis*			0

Coot, Red-knobbed	*Fulica cristata*			0
Cormorant, Reed	*Phalacrocorax africanus*			0
Cormorant, White-breasted	*Phalacrocorax carbo*			0
Courser, Burchell's	*Cursorius rufus*	Vulnerable		0
Courser, Double-banded	*Rhinoptilus africanus*			0
Courser, Temminck's	***Cursorius temminckii***			**11.1**
Crombec, Long-billed	***Sylvietta rufescens***			**44.4**
Crow, Cape	*Corvus capensis*			0
Crow, Pied	***Corvus albus***			**22.2**
Cuckoo, African	*Cuculus gularis*			0
Cuckoo, Black	*Cuculus clamosus*			22.2
Cuckoo, Diderick	*Chrysococcyx caprius*			22.2
Cuckoo, Great Spotted	*Clamator glandarius*			0
Cuckoo, Jacobin	***Clamator jacobinus***			**22.2**
Darter, African	*Anhinga rufa*			0
Dove, Laughing	***Streptopelia senegalensis***			**100**
Dove, Namaqua	***Oena capensis***			**55.6**
Dove, Red-eyed	***Streptopelia semitorquata***			**11.1**
Drongo, Fork-tailed	***Dicrurus adsimilis***			**100**
Duck, Knob-billed	*Sarkidiornis melanotos*			0
Duck, Maccoa	*Oxyura maccoa*	Near-threatened		0
Duck, White-faced	*Dendrocygna viduata*			0
Duck, Yellow-billed	*Anas undulata*			0
Eagle, Martial	*Polemaetus bellicosus*	Endangered		0
Eagle, Tawny	***Aquila rapax***	**Endangered**		**11.1**
Eagle, Verreaux's	*Aquila verreauxii*	Vulnerable		0
Eagle-owl, Spotted	*Bubo africanus*			0
Eagle-owl, Verreaux's	*Bubo lacteus*			0
Egret, Cattle	*Bubulcus ibis*			44.4
Egret, Little	*Egretta garzetta*			0
Eremomela, Yellow-bellied	***Eremomela icteropygialis***			**44.4**
Falcon, Lanner	*Falco biarmicus*	Vulnerable		0
Falcon, Peregrine	*Falco peregrinus*			0
Finch, Red-headed	***Amadina erythrocephala***			**22.2**
Finch, Scaly-feathered	***Sporopipes squamifrons***			**100**
Firefinch, Red-billed	*Lagonosticta senegala*			0
Fiscal, Southern	***Lanius collaris***			**44.4**
Flycatcher, Chat	***Melaenornis infuscatus***			**22.2**
Flycatcher, Fairy	***Stenostira scita***		**Near-endemic**	**22.2**
Flycatcher, Fiscal	***Melaenornis silens***		**Near-endemic**	**77.8**

Flycatcher, Marico	***Bradornis mariquensis***			**77.8**
Flycatcher, Spotted	*Muscicapa striata*			22.2
Francolin, Orange River	***Scleroptila gutturalis***			**22.2**
Goose, Egyptian	*Alopochen aegyptiacus*			44.4
Goose, Spur-winged	*Plectropterus gambensis*			0
Goshawk, Gabar	***Melierax gabar***			**22.2**
Goshawk, Pale Chanting	***Melierax canorus***			**44.4**
Grebe, Little	*Tachybaptus ruficollis*			0
Greenshank, Common	*Tringa nebularia*			0
Guineafowl, Helmeted	***Numida meleagris***			**33.3**
Hamerkop	*Scopus umbretta*			0
Harrier, Black	*Circus maurus*	Endangered	Near-endemic	0
Heron, Black-headed	*Ardea melanocephala*			0
Heron, Grey	*Ardea cinerea*			11.1
Honeyguide, Greater	*Indicator indicator*			0
Hoopoe, African	***Upupa africana***			**77.8**
Hornbill, African Grey	***Tockus nasutus***			**44.4**
Hornbill, Southern Yellow-billed	*Tockus leucomelas*			44.4
Ibis, African Sacred	*Threskiornis aethiopicus*			0
Ibis, Glossy	*Plegadis falcinellus*			0
Ibis, Hadeda	***Bostrychia hagedash***			**33.3**
Kestrel, Greater	***Falco rupicoloides***			**11.1**
Kestrel, Lesser	*Falco naumanni*			0
Kestrel, Rock	*Falco rupicolus*			0
Kingfisher, Pied	*Ceryle rudis*			0
Kite, Black	*Milvus migrans*			0
Kite, Black-shouldered	*Elanus caeruleus*			0
Kite, Yellow-billed	*Milvus aegyptius*			0
Korhaan, Northern Black	*Afrotis afraoides*			0
Korhaan, Red-crested	***Lophotis ruficrista***			**55.6**
Lapwing, Blacksmith	***Vanellus armatus***			**66.7**
Lapwing, Crowned	***Vanellus coronatus***			**66.7**
Lark, Eastern Clapper	*Mirafra fasciolata*			33.3
Lark, Fawn-coloured	***Calendulauda africanoides***			**55.6**
Lark, Red-capped	*Calandrella cinerea*			22.2
Lark, Sabota	*Calendulauda sabota*			22.2
Lark, Spike-heeled	*Chersomanes albofasciata*			33.3
Martin, Banded	***Riparia cincta***			**11.1**
Martin, Brown-throated	*Riparia paludicola*			0
Martin, Rock	***Hirundo fuligula***			**44.4**

Masked-weaver, Southern	***Ploceus velatus***		**66.7**
Moorhen, Common	*Gallinula chloropus*		0
Mousebird, Red-faced	***Urocolius indicus***		**55.6**
Mousebird, White-backed	***Colius colius***		**88.9**
Neddicky	*Cisticola fulvicapilla*		0
Night-Heron, Black-crowned	*Nycticorax nycticorax*		0
Nightjar, European	*Caprimulgus europaeus*		0
Nightjar, Rufous-cheeked	*Caprimulgus rufigena*		0
Oriole, Eurasian Golden	*Oriolus oriolus*		0
Ostrich, Common	*Struthio camelus*		77.8
Owl, Barn	*Tyto alba*		11.1
Owlet, Pearl-spotted	*Glaucidium perlatum*		22.2
Palm-swift, African	*Cypsiurus parvus*		11.1
Penduline-tit, Cape	***Anthoscopus minutus***		**33.3**
Pigeon, Speckled	***Columba guinea***		**55.6**
Pipit, African	*Anthus cinnamomeus*		66.7
Pipit, Buffy	***Anthus vaalensis***		**11.1**
Plover, Common Ringed	*Charadrius hiaticula*		0
Plover, Kittlitz's	*Charadrius pecuarius*		0
Plover, Three-banded	*Charadrius tricollaris*		0
Pochard, Southern	*Netta erythrophthalma*		0
Prinia, Black-chested	***Prinia flavicans***		**88.9**
Pytilia, Green-winged	***Pytilia melba***		**44.4**
Quail, Common	*Coturnix coturnix*		0
Quailfinch, African	***Ortygospiza atricollis***		**44.4**
Quelea, Red-billed	***Quelea quelea***		**55.6**
Reed-warbler, African	*Acrocephalus baeticatus*		0
Robin-chat, Cape	*Cossypha caffra*		0
Rock-thrush, Short-toed	*Monticola brevipes*		0
Roller, European	*Coracias garrulus*	Near-threatened	0
Roller, Lilac-breasted	*Coracias caudatus*		11.1
Roller, Purple	*Coracias naevius*		22.2
Ruff	*Philomachus pugnax*		0
Sandgrouse, Burchell's	***Pterocles burchelli***		**11.1**
Sandgrouse, Namaqua	***Pterocles namaqua***		**66.7**
Sandpiper, Common	*Actitis hypoleucos*		0
Sandpiper, Curlew	*Calidris ferruginea*		0
Sandpiper, Marsh	*Tringa stagnatilis*		0
Sandpiper, Wood	*Tringa glareola*		0
Scimitarbill, Common	***Rhinopomastus cyanomelas***		**44.4**

Scops-owl, Southern White-faced	*Ptilopsus granti*			0
Scrub-robin, Kalahari	***Cercotrichas paena***			**88.9**
Scrub-robin, Karoo	*Cercotrichas coryphoeus*			0
Secretarybird	*Sagittarius serpentarius*	Vulnerable		0
Shelduck, South African	*Tadorna cana*			33.3
Shoveler, Cape	*Anas smithii*			0
Shrike, Crimson-breasted	***Laniarius atrococcineus***			**77.8**
Shrike, Lesser Grey	*Lanius minor*			22.2
Shrike, Red-backed	*Lanius collurio*			11.1
Snake-eagle, Brown	*Circaetus cinereus*			0
Sparrow, Cape	***Passer melanurus***			**100**
Sparrow, Great	*Passer motitensis*			0
Sparrow, House	***Passer domesticus***			**77.8**
Sparrow, Southern Grey-headed	***Passer diffusus***			**88.9**
Sparrowlark, Grey-backed	*Eremopterix verticalis*			0
Sparrow-weaver, White-browed	***Plocepasser mahali***			**88.9**
Spoonbill, African	*Platalea alba*			0
Spurfowl, Red-billed	*Pternistis adspersus*			0
Starling, Cape Glossy	***Lamprotornis nitens***			**88.9**
Starling, Pale-winged	*Onychognathus nabouroup*			0
Starling, Pied	*Lamprotornis bicolor*		Near-endemic	0
Starling, Wattled	*Creatophora cinerea*			33.3
Stilt, Black-winged	*Himantopus himantopus*			11.1
Stint, Little	*Calidris minuta*			0
Stonechat, African	*Saxicola torquatus*			0
Stork, Abdim's	*Ciconia abdimii*	Near-threatened		11.1
Stork, Black	*Ciconia nigra*	Vulnerable		0
Sunbird, Dusky	***Cinnyris fuscus***			**22.2**
Sunbird, Marico	*Cinnyris mariquensis*			22.2
Sunbird, White-bellied	*Cinnyris talatala*			0
Swallow, Barn	*Hirundo rustica*			11.1
Swallow, Greater Striped	*Cecropis cucullata*			33.3
Swallow, Red-breasted	*Cecropis semirufa*			0
Swallow, White-throated	*Hirundo albigularis*			0
Swamp-warbler, Lesser	*Acrocephalus gracilirostris*			0
Swift, Alpine	*Tachymarptis melba*			0
Swift, Bradfield's	*Apus bradfieldi*			0
Swift, Common	*Apus apus*			0
Swift, Little	*Apus affinis*			0
Swift, White-rumped	*Apus caffer*			0

Tchagra, Brown-crowned	***Tchagra australis***			**77.8**
Teal, Cape	*Anas capensis*			0
Teal, Red-billed	*Anas erythrorhyncha*			33.3
Tern, White-winged	*Chlidonias leucopterus*			0
Thick-knee, Spotted	***Burhinus capensis***			**77.8**
Thrush, Groundscraper	***Turdus litsipsirupa***			**77.8**
Thrush, Karoo	*Turdus smithi*		Near-endemic	33.3
Tit, Ashy	***Melaniparus cinerascens***			**55.6**
Turtle-dove (Ring-necked), Cape	***Streptopelia capicola***			**100**
Vulture, Lappet-faced	*Torgos tracheliotos*	Endangered		0
Vulture, White-backed	*Gyps africanus*	Critically Endangered		0
Wagtail, Cape	*Motacilla capensis*			44.4
Warbler, Chestnut-vented	***Sylvia subcaerulea***			**88.9**
Warbler, Rufous-eared	*Malcorus pectoralis*			11.1
Warbler, Willow	*Phylloscopus trochilus*			11.1
Waxbill, Black-faced	*Estrilda erythronotos*			22.2
Waxbill, Common	*Estrilda astrild*			11.1
Waxbill, Violet-eared	***Granatina granatina***			**77.8**
Weaver, Sociable	*Philetairus socius*			0
Wheatear, Capped	*Oenanthe pileata*			11.1
Wheatear, Mountain	*Myrmecocichla monticola*			0
White-eye, Orange River	*Zosterops pallidus*			0
Whydah, Pin-tailed	*Vidua macroura*			0
Whydah, Shaft-tailed	***Vidua regia***			**22.2**
Wood-hoopoe, Green	*Phoeniculus purpureus*			22.2
Woodpecker, Cardinal	*Dendropicos fuscescens*			22.2
Woodpecker, Golden-tailed	*Campethera abingoni*			22.2