ENVIRONMENTAL IMPACT ASSESSMENT FOR THE PROPOSED WOODHOUSE SOLAR 1 PV FACILITY, VRYBURG, NORTH WEST PROVINCE:

AVIFAUNAL IMPACT STUDY

Produced for Savannah Environmental by:

April 2016

EXECUTIVE SUMMARY

Simon Todd Consulting was enlisted by Genesis Woodhouse Solar 1 (Pty) Ltd to undertake an avifaunal impact study for the proposed Woodhouse Solar 1 PV Facility near Vryburg in the North West Province. The facility will have a net generating capacity of 100 MW and will consist of solar panels covering an area of less than 300 hectares, an on-site substation, auxiliary buildings, access and internal roads and a 132kV power line linking the facility to the national grid.

Up to 177 bird species are known to occur within the study area and broader impact zone of the development, including 17 red-listed or threatened species, 12 endemic species and 28 near-endemic species. The birds of greatest potential relevance and importance in terms of the possible impacts of the solar energy facility and its associated power infrastructure are likely to be local populations of endemic passerines, shy ground-nesting species, resident or visiting large terrestrial birds, resident or passing raptors and transient waterbirds.

The proposed Woodhouse Solar 1 PV Facility and its associated power infrastructure has been assessed as having a medium-low impact (after mitigation) to priority species and general avifauna occurring in thethe proposed site layout for the development study area and broader impact zone of the development. The development will pose several impacts to avifauna, including: a medium displacement impact caused by disturbance and habitat destruction associated with construction and maintenance activities of the proposed PV facility and its associated power infrastructure; a low impact of electrocutions of birds on power infrastructure, with the implementation of mitigation measures; and a medium impact of avian collisions with power line infrastructure and solar panels. The development is however likely to have little, if any significant long-term impact on the avifauna of the wider area, especially after mitigation, and as such, is considered to have acceptable levels of impact overall.

The location of the study area and more specifically the proposed site layout are not considered unique habitats in the landscape and are already subject to varying degrees of transformation and degradation. Although two threatened and/or priority species were recorded within the broader study area – White-backed Vulture and Greater Flamingo respectively – these are widespread species, the area is not considered critical for their conservation and the extent of habitat loss for these species would be considered low.

In terms of the direct impacts of the development in isolation, the proposed site layout option is considered optimal for the development due to the homogenous nature of the vegetation, the level of degradation already present and the lower bird species diversity and abundance recorded in this area.

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DECLARATION OF INDEPENDENCE

I, **Blair Zoghby**, in my capacity as a specialist consultant, hereby declare that I:

- Act/acted as an independent specialist to Savannah Environmental for this project.
- Do not have any personal, business or financial interest in the project expect for financial remuneration for specialist investigations completed in a professional capacity as specified by the Environmental Impact Assessment Regulations, 2014.
- Will not be affected by the outcome of the environmental process, of which this report forms part of.
- Do not have any influence over the decisions made by the governing authorities.
- Do not object to or endorse the proposed developments, but aim to present facts and my best scientific and professional opinion with regard to the impacts of the development.
- Undertake to disclose to the relevant authorities any information that has or may have the potential to influence its decision or the objectivity of any report, plan or document required in terms of the Environmental Impact Assessment Regulations, 2014.

PROFESSIONAL EXPERIENCE

Simon Todd Consulting has extensive experience in the assessment of renewable energy developments, having provided ecological assessments for more than 100 different renewable energy developments. This includes a variety of facilities in the immediate vicinity of the current site as well as in the broader North Cape region. Simon Todd is a recognised arid-areas ecological expert and is a past chairman of the Arid-Zone Ecology Forum and has 18 years' experience working throughout the country. Simon Todd is registered with the South African Council for Natural Scientific Professions (No. 400425/11).

Blair Zoghby has been involved in ornithological conservation and research for eight years and holds an MSc degree in Zoology/Conservation Biology obtained through the Percy FitzPatrick Institute of African Ornithology, University of Cape Town, South Africa. He has undertaken numerous avian impact assessments across the country and as such, has experience working with a wide variety of bird species and bird habitats.

INDEMNITY

- This report is based on survey and assessment techniques which are limited by time and budgetary constraints relevant to the type and level of investigation undertaken.
- This report is based on a desktop investigation using available information and data related to the site to be affected, *in situ* fieldwork, surveys and assessments and the specialists best scientific and professional knowledge.
- The Precautionary Principle has been applied throughout this investigation.
- The findings, results, observations, conclusions and recommendations given in this report are based on the specialist's best scientific and professional knowledge as well as available information at the time of study.
- Additional information may become known or available during a later stage of the process for which no allowance could have been made at the time of this report.
- The specialist reserves the right to modify this report, recommendations and conclusions at any stage should additional information become available.
- Information, recommendations and conclusions in this report cannot be applied to any other area without proper investigation.
- This report, in its entirety or any portion thereof, may not be altered in any manner or form or for any purpose without the specific and written consent of the specialist as specified above.
- Acceptance of this report, in any physical or digital form, serves to confirm acknowledgement of these terms and liabilities.

Blair Zoghby

Simon Todd Pr.Sci.Nat 400425/11.

April 2016

1. INTRODUCTION

1.1. BACKGROUND

Genesis Woodhouse Solar 1 (Pty) Ltd, an Independent Power Producer (IPP), is proposing the establishment of a 100 MW commercial photovoltaic (PV) solar energy facility (SEF) on the Remaining Extent of Farm Woodhouse 729 near Vryburg in the North West Province. The development will be known as the Woodhouse Solar 1 PV Facility.The National Environmental Management Act (NEMA) (Act 107 of 1998) requires that an Environmental Impact Assessment (EIA) be conducted for any development which could have a significant effect on the environment, with the objective to identify, predict and evaluate the actual and potential impacts of these activities on ecological systems; identify alternatives; and provide recommendations for mitigation to minimise the negative impacts. The results of the EIA are then lodged with the National Department of Environmental Affairs (DEA) for further examination before an outcome of authorisation for the development is given.

In order to meet these requirements and manage the EIA process, Genesis Woodhouse Solar 1 (Pty) Ltd has appointed Savannah Environmental as independent environmental assessment practitioners. As part of the specialist studies required for the EIA, Savannah Environmental has enlisted Simon Todd Consulting to provide an avifaunal impact study of the developable area.

The purpose of the avifaunal impact study is to describe and detail the avian ecological features of the proposed site, provide an assessment of the avian ecological sensitivity of the site, identify and assess the significance of the likely impacts associated with the development and provide measures to avoid, minimize and mitigate project related impacts to avifauna.

1.2. RELEVANT ASPECTS OF THE DEVELOPMENT

- The proposed developable area of the Woodhouse Solar 1 PV Facility is located on the Remaining Extent of Farm Woodhouse 729 and has a total extent of 2 264 ha.
- The development is planned and designed with a net generating capacity of 100 MW.
- The proposed developable area required to meet the proposed capacity will cover an area of less than 300 ha.
- Grid connection will be via a new 132kV power line between the on-site substation and the Eskom grid connection point. Four alternatives are being considered for the grid connection:
    - Alternative 1: A direct connection to the authorised Eskom Bophirima Substation to be constructed within the northern portion of the affected property (i.e. the Remaining Extent of the farm Woodhouse 729);
    - Alternative 2: A direct connection to the existing Woodhouse 88/22kV Substation located north of the boundary of the affected property;
    - Alternative 3: A turn-in turn-out connection to the existing Delareyville Munic / Vryburg 1 88kV Feeder located along the northern boundary of the affected property; and
    - Alternative 4: A turn-in turn-out connection to the authorised 132kV Eskom Bophirima–Mookodi power line to be constructed by Eskom.
- Infrastructure associated with the SEF is likely to include:
    - PV panels, with fixed, single or double axis tracking technology;
    - Auxiliary buildings for control, equipment and maintenance;
    - Cabling between the above-mentioned infrastructures;
    - Internal access roads; and
    - Fencing surrounding the facility.

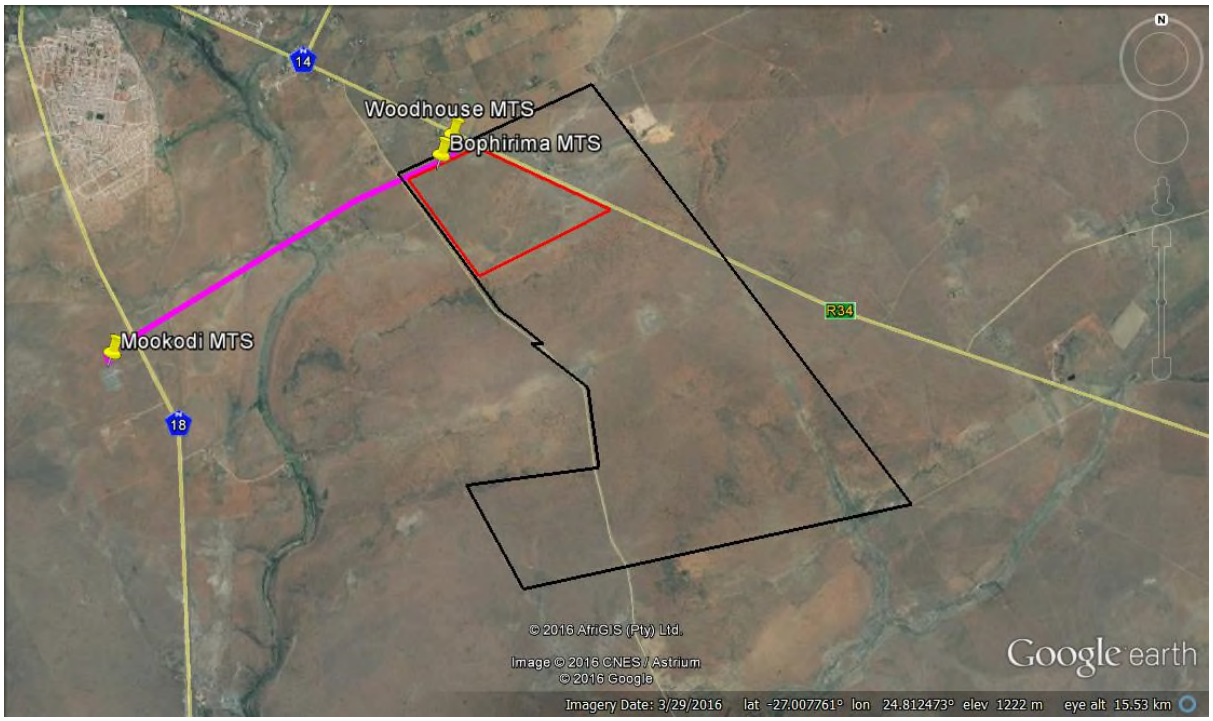

Figure 1: Satellite image of the Woodhouse Solar 1 PV Facility illustrating the property boundaries (black), proposed site layout (red) and relevant substations, with the proposed power line to the Mookodi substation (purple).

1.3. RELEVANT LEGISLATION AND GUIDELINES

The following legislation is applicable to the proposed development:

1.3.1. The Convention on Biological Diversity

The Convention on Biological Diversity (CBD) is an international convention (to which South Africa is a signatory) and represents a commitment to sustainable development. The Convention has three main objectives: the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of the benefits from the use of genetic resources (http://cbd.int/convention/guide/). Although the convention does not include specific recommendations or guidelines pertaining to birds and energy infrastructure interactions and impacts, it does make provisions for keeping and restoring biodiversity.

1.3.2. The Convention on the Conservation of Migratory Species of Wild Animals

The Convention on the Conservation of Migratory Species of Wild Animals (also known as CMS or the Bonn Convention) is an intergovernmental treaty and is the most appropriate instrument to deal with the conservation of terrestrial, aquatic and avian migratory species. The convention includes policy and guidelines with regards to the impact associated with man-made infrastructure. CMS requires that parties (South Africa is a signatory) take

measures to avoid migratory species from becoming endangered (Art II, par. 1 and 2) and to make every effort to prevent the adverse effects of activities and obstacles that seriously impede or prevent the migration of migratory species i.e. power lines (Art 111, par. 4b and 4c).

1.3.3. The Agreement on the Convention of African-Eurasian Migratory Water Birds

The Agreement on the Conservation of African-Eurasian Migratory Water birds (AEWA) is an intergovernmental treaty dedicated to the conservation of migratory waterbirds and their habitat across Africa, Europe, the Middle East Central Asia, Greenland and the Canadian Archipelago. The AEWA covers 255 species of birds ecologically dependent on wetlands for at least part of their annual cycle and is a legally binding agreement by all contracting parties (South Africa included) to guarantee the conservation of migratory waterbirds within their national boundaries through species and habitat protection and the management of human activities.

1.3.4. The National Environmental Management: Biodiversity Act

The National Environmental Management: Biodiversity Act (No. 10 of 2004, NEMBA) regulations on Threatened and Protected Species (TOPS) provides for the consolidation of biodiversity legislation through establishing national norms and standards for the management of biodiversity across all sectors and by different management authorities. The national Act and several sets of provincial conservation legislation provide for among other things, the management and conservation of South Africa's biodiversity; protection of species and ecosystems that necessitate national protection and the sustainable use of indigenous biological resources.

1.3.5. Guidelines to minimise the impacts on birds of Solar Facilities and Associated Infrastructure in South Africa

The "Guidelines to minimise the impact on birds of Solar Facilities and Associated Infrastructure in South Africa" (Smit, 2012) is perhaps the most important (although not legally binding) document from an avifaunal impact perspective currently applicable to solar development in South Africa. The guidelines are published by BirdLife South Africa (BLSA) and detail the recommended procedure for conducting an avifaunal specialist study as well as list all of the potential impacts of interactions between birds and solar facilities and associated infrastructure. We are aware of changes to the BirdLife South Africa best-practise guidelines recently published at the Birds and Renewable Energy Forum in Johannesburg (2015) and although the revised requirements are still a work in progress and have not yet been ratified, they will inform this assessment where applicable.

1.4. TERMS OF REFERENCE

The specific terms of reference for this Avifaunal Impact Study include the following:

- A description of the environment of the study area in terms of the avian habitats present.
- A consolidated list of bird species and priority bird species (priority species will include nationally and/or globally threatened, rare, endemic or range-restricted bird species) likely to occur within the study area and broader impact zone of the development, with information on the relative value (in terms of breeding, nesting, roosting and foraging) of the site for these birds.
- A description of the likely seasonal variation in the presence/absence of priority species and observations of their movements throughout the study area;
- A delineation of areas that are potentially highly sensitive, no-go areas that may need to be avoided by the development.
- A description and evaluation of the environmental issues and potential impacts (including direct, indirect and cumulative impacts) that the proposed development may have on the bird species present. Direct, indirect and cumulative impacts of the identified issues will be evaluated for various stages of the development and according to predefined criteria.
- A statement regarding the potential significance of the identified issues based on the evaluation of the issues/impacts.
- A comparative evaluation of feasible site alternatives and nomination of a preferred site alternative for the development.
- A description of any mitigation measures that may be required to manage impacts related to the monitoring and assessment of the site.

1.5. STUDY METHODOLOGY

1.5.1. Approach

The Avifaunal Impact Study included the following steps:

- A review of all available published and unpublished literature pertaining to bird interactions with SEFs and their associated power infrastructure, summarising the issues involved and the current level of knowledge in the field. Various information sources including data on the local avifauna of the area and previous studies of bird interactions with SEFs and their associated power infrastructure were examined.
- A site visit of 3 days to the study area (11-13 April 2016) to determine the *in situ* local avifauna and avian habitats present on site. Walked linear transects, vehicle transects and vantage point surveys were conducted in various habitats across the site 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.
- The compilation of a consolidated and annotated list of the avifauna likely to occur within the study area and the broader impact zone of the development based on a combination of existing distributional data, species seen during the site visit and previous experience of the avifauna of the area.
- The compilation of 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. 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.
- An avian site sensitivity map was generated by integrating avian microhabitats present on site and avifaunal information collected during the site visit. The avian sensitivity of the different units identified in the mapping procedure were 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 avifauna. 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. These areas usually comprise the bulk of habitats within an area. Development within these areas can proceed with relatively little ecological and avian impacts 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, sensitivity or important ecological role of the area. 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, threatened, endemic or range-restricted species and/or perform critical ecological roles. These areas are essentially no-go areas from a development 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.

- The construction of a matrix of potential impacts of the development on the local avifauna will be drawn up and the significance of these impacts will be assessed in terms of the available suite of mitigation options available.

1.5.2. Data sources used

The following data sources and reports were used in varying degrees of detail for this study:

- The Southern African Bird Atlas Project 1 (SABAP 1; Harrison *et al*., 1997) quarter degree squares (QDC) 2624DD (14 cards) and 2724BB (6 cards) as well as the Southern African Bird Atlas Project 2 (SABAP 2; http://sabap2.adu.org.za/index.php) pentads 2655_2445 (1 card) and 2700_2445 (2 cards) were consulted to determine the bird species likely to occur within the study area and the broader impact zone of the development.
- The conservation status, endemism and biology of all species considered likely to occur within the study area was then 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.

1.5.3. Limitations and assumptions

The specialist made the assumption that the sources of information used in the compilation of this report are reliable. 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 vetted information regarding the avifaunal impacts of 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 complete absence of any local, empirical data describing the known impacts of existing SEFs on birds (Jenkins, 2011).
- Limited time in the field and no 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 development area does not contain many large trees, so it is highly unlikely that there are any significant nesting sites of larger species present within the affected area that would not have been observed.

The site visit as well as personal experience of the avifauna of the area and of similar species in different parts of South Africa, through the specialist's experience working across the country, goes some way to remedying any knowledge deficiencies.

2. DESCRIPTION OF THE AFFECTED ENVIRONMENT

2.1. BROAD-SCALE VEGETATION PATTERNS

According to the national vegetation map (Mucina & Rutherford, 2006), the site falls entirely within the Ghaap Plateau Vaalbosveld vegetation type. This vegetation type is comprised of flat plateau with a well-developed shrub layer and an open tree layer. It is classified as *Least Threatened*, with very little of the area of this vegetation type having been transformed. There is however none of this vegetation type conserved in statutory conservation areas.

2.2. AVIAN MICROHABITATS

While broad-scale vegetation patterns influence the distribution and abundance of bird species holistically, it is the fine-scale vegetation patterns and various avian microhabitats in an area that determine local avifauna populations.

A number of different avian microhabitats were identified at the site and these formed the basis of the avian site sensitivity map. These units include:

- *Cultivated/modified land:* This habitat unit makes up a large majority of the proposed site layout. Although this habitat unit is considered disturbed due to human modification, it represents a significant feeding area for many bird species. The land preparation process opens up the soil and makes insects, seeds, bulbs and other food sources readily accessible to birds.
- *Vaalbos shrubland:* This habitat unit represents the majority of the vegetation in the study area (Ghaap Plateau Vaalbosveld) and is largely made up of extensive plains of low shrubs *Tarchonanthus camphoratus* (an encroaching species in overgrazed or disturbed veld – which is evident in the study area). This habitat unit does not support the highest diversity and abundance of bird species.
- *Bushveld:* This habitat unit is found patchily throughout the study area and is characterised by a mix of larger trees, shrubs and interspersed open plains. The higher biomass and structural and compositional variation in the vegetation supports a high diversity and abundance of bird species, with large trees potentially providing

roosting and nesting for many bird species (no important roosting or nesting sites were however recorded in the study area).

- *Ephemeral pan:* There are two ephemeral pans (which will only hold water after heavy rains) within the study area. This habitat unit is important for numerous species, as it is a reliable source of surface water in the area and because the vegetation within and surrounding the areas supports numerous wetland bird species.
- *Drainage line:* A tributary of the Losase river runs through the south east corner of the study area and although it may seldom contain surface water, it is important for ecosystem functioning. The slightly deeper soils support a marginally higher biomass including woody species and provide a structural and compositional variation in the vegetation to the surrounding shrublands

It should however be noted, that the study area has already been subject to varying degrees of disturbance and degradation caused by past and present land-use practises. Evidence of high stocking rates and grazing pressure is apparent. There is also a network of minor farm roads throughout and within the study area, and specifically the proposed developable area, which borders the R34 regional road.

Figure 2: Cultivated/modified land (left) and Vaalbos shrubland (right).

Figure 3: Patches of Bushveld (left) and Ephemeral pan (right).

Figure 4: Drainage line supporting larger trees.

2.3. AVIFAUNA

Up to 177 bird species are known to occur within the study area and broader impact zone of the development (Appendix 1), including 17 red-listed or threatened species (Table 1), 12 endemic species and 28 near-endemic species. Of these, 35 species were recorded during the site visit, most notable of which, despite being recorded outside of the study area (but included due to their transient nature which could bring them into contact with the development), being the sightings of White-backed Vulture *Gyps africanus* and Greater Flamingo *Phoenicopterus roseus*.

The birds of greatest potential relevance and importance in terms of the possible impacts of the SEF and its associated power infrastructure are likely to be local populations of threatened or endemic passerines (Ant-eating Chat *Myrmecocichla formicivora* and Cape Longclaw *Macronyx capensis*), shy ground-nesting species (Burchell's Courser *Cursorius rufus* and Double-banded Courser *Rhinoptilus africanus*), resident or visiting large terrestrial birds (Secretarybird *Sagittarius serpentarius*, Abdim's Stork *Ciconia abdimii*, Black Stork *Ciconia nigra* and Blue Crane *Anthropoides paradieus*), resident or passing raptors (Martial Eagle *Polemaetus bellicosus,* Tawny Eagle *Aquila rapax,* Lanner Falcon *Falco biarmicus* and

Red-footed Falcon *Falco vespertinus* and White-back Vulture) and transient waterbirds (Greater Flamingo*,* Lesser Flamingo *Phoenicopterus minor,* South African Shelduck *Tadorna cana* and Yellow-billed Stork *Mycteria ibis*).

At the time of the site visit (11-13 April 2016) bird species diversity and abundance was relatively low across the entire study area. The *Bushveld* habitat unit supported the highest species diversity and abundance due to the structural variation provided by the composition of trees, shrubs and grass patches. This habitat unit was also associated with a low ridge line which bisects the study area and provides niche habitats for certain species. The *Cultivated/modified land* habitat unit within which the proposed development is due to be sited had a low bird species diversity and abundance, but has the potential to support priority species such as Secretarybird, Abdim's Stork and Black Stork.

On the basis of the observations recorded during the field visit, and in combination with already documented information on the avifauna of the study area, 17 priority species are considered central in this avifaunal impact study (Table 1). These are mostly threatened species which are known to occur, or could occur, in relatively high numbers in the study area and the broader impact zone of the development and which are likely to be, or could be, negatively affected by the SEF. Two species, White-backed Vulture and Greater Flamingo were recorded within the broader impact zone of the development.

Overall, the avifauna of the study area and the broader impact zone of the SEF is not considered unique and is typical of what occurs across large areas of the Savannah Biome, which therefore suggests that the sensitivity of the site, from an avian perspective, will not be of any great significance.

Table 1: Priority species list considered central to the avifaunal impact study for the proposed Woodhouse Solar 1 PV Facility, selected on the basis of conservation status (Taylor *et al.*, 2015).

Common name	Scientific name	Conservation status	Regional endemism	Estimated importance of local population	Preferred habitat	Likelihood of occurring in study area	Susceptible to
Bustard, Kori	*Ardeotis kori*	Near-threatened	-	Low	Dry open savanna woodland, dwarf shrubland and occasionally grassland	Low	Collision
Courser, Burchell's	*Cursorius rufus*	Vulnerable	Near-endemic	Moderate	Sparsely vegetated arid regions	Moderate	Habitat loss/disturbance
Crane, Blue	*Anthropoides paradieus*	Near-threatened	Endemic	Low	Grasslands, but also in wetlands, cultivated pastures and croplands	Moderate	Collision
Duck, Maccoa	*Oxyura maccoa*	Near-threatened	-	Moderate	Inland water bodies with emergent vegetation; flyover	Low	Habitat loss/disturbance
Eagle, Martial	*Polemaetus bellicosus*	Endangered	-	Low	Open savanna and woodland on plains, also semi-arid shrublands	Moderate	Collision; electrocution
Eagle, Tawny	*Aquila rapax*	Endangered	-	Moderate	Open savanna woodland	Moderate	Habitat loss/disturbance; electrocution
Falcon, Lanner	*Falco biarmicus*	Vulnerable	-	Low	Open grassland or woodland near cliff or electricity pylons	Low	Habitat loss/disturbance; collisions
Falcon, Red-footed	*Falco vespertinus*	Near-threatened	-	High	Open semi-arid and arid savannas	High	Habitat loss / disturbance
Flamingo, Greater	*Phoenicopterus ruber*	Near-threatened	-	Moderate	Saline or brackish water bodies; flyover		Collisions
Flamingo, Lesser	*Phoenicopterus minor*	Near-threatened	-	Moderate	Eutrophic shallow wetlands, saltpans; flyover	Moderate	Collisions
Roller, European	*Coracias garrulus*	Near-threatened	-	Low	Open woodlands	Moderate	Habitat loss / disturbance
Secretarybird	*Sagittarius serpentarius*	Vulnerable	-	Moderate	Open grassland with scattered trees and shrubs	High	Habitat loss/disturbance; collisions
Stork, Abdim's	*Ciconia abdimii*	Near-threatened	-	Moderate	Grassland, savanna woodland and cultivated lands	Moderate	Habitat loss/disturbance; collisions
Stork, Black	*Ciconia nigra*	Vulnerable	-	Moderate	Mountainous regions	Moderate	Collision; electrocution
Stork, Yellow-billed	*Mycteria ibis*	Endangered	-	Low	Inland freshwater bodies, occasionally in estuaries	Moderate	Habitat loss/disturbance
Vulture, Cape	*Gyps coprotheres*	Endangered	Near-endemic	Low	Mountainous regions, but range widely in surrounding areas	Low	Habitat loss/disturbance; collisions; electrocutions
Vulture, White-backed	*Gyps africanus*	Critically Endangered	-	Low	Savanna woodland and bushveld	Low	Habitat loss/disturbance; collisions; electrocutions

2.4. AVIAN SITE SENSITIVITY MAP

The avian site sensitivity map (Figure 5) was generated by integrating avian microhabitats present on site and avifaunal information collected during the site visit. It is important to delineate sensitive avian microhabitats within the study area in order to ensure that the development does not have a long term negative impact on these habitats. Important avian microhabitats in the developable area play an integral role within the landscape, providing nesting, foraging and reproductive benefits to the local avifauna.

The majority of the site falls within *Low* sensitivity areas associated with the *Vaalbos shrubland* habitat unit. The vegetation in this habitat unit is homogenous, lacking structural and compositional variation, and did not support a high diversity and abundance of bird species. Similarly so, the *Cultivated/modified land* habitat unit was also classified as *Medium-Low* sensitivity.

Patches of *Bushveld* throughout the study area were assessed as being of *Medium* sensitivity. These areas are to the east of the R34. These areas supported a relatively high diversity and abundance of bird species, due to the structural and compositional variation in the vegetation, but were also subject to varying degrees of degradation throughout. The elevated ridgeline to the south of the development area was also assessed as being of *Medium* sensitivity, and a 100m buffer has been applied to this feature from the base of the foothill.

The *Ephemeral pan* and *Drainage line* habitat unit to the south of the development area was assessed as being of *Very High* sensitivity. These habitat units provide a source of surface water in the area and support a number of large trees – which could potentially be important for roosting and nesting.

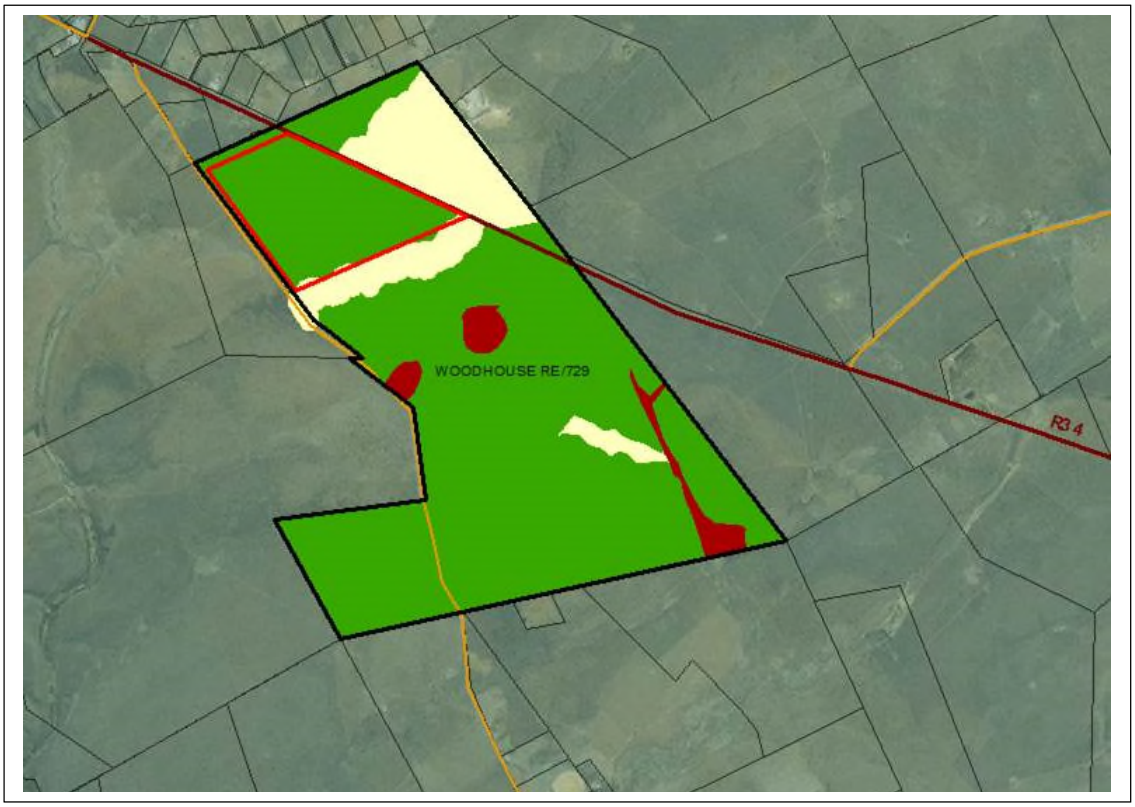

Figure 5: Avian site sensitivity map of the Woodhouse Solar 1 PV Facility illustrating the property boundaries (black) and preferred site layout (red). Avifaunal sensitivity: Green = *Medium*-Low, Yellow = *Medium* and Red = *Very High*.

3. ASSESSMENT OF IMPACTS

3.1. GENERAL DESCRIPTION OF BIRD INTERACTIONS WITH SOLAR ENERGY FACILITIES AND THEIR ASSOCIATED POWER INFRASTRUCTURE

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.

3.1.1. Impacts of solar energy facilities

Habitat loss

Although the degree of this impact is dependent on the location and scale of the development, this is potentially the most significant impact associated with the construction

and operation (maintenance) of SEFs. Extensive areas of vegetation (habitat) are cleared to accommodate the considerable amount of infrastructure required at these facilities, reducing the amount of habitat available to birds for foraging, roosting and breeding (Smallie, 2013). Given the considerable space requirements of commercially viable facilities (> 200 ha), this effect could be significant in some instances, particularly given the possibility that the initial footprint of successful facilities may be expanded over time, allowing for the possible cumulative effects of multiple facilities in one area. This impact is likely to affect smaller bird species (i.e. larks and pipits) with small home ranges, as entire territories could be removed during construction activities.

Disturbance and displacement

Construction of SEFs requires a significant amount of machinery and labour to be present on site for a period of time (~12-18 months). For shy, sensitive species or ground-nesting birds resident in the area, construction activities are likely to cause a temporary disturbance or even result in displacement from the site entirely. In addition, species commuting around the site may become disorientated by the reflected light and consequently fly longer distances to avoid the area, potentially resulting in displacement and energy implications (Smallie, 2013). Similarly, but to a lesser extent, ongoing maintenance activities at the operational facility are likely to cause some degree of disturbance to birds in the general vicinity.

Mortality

Bird mortality has been shown to occur due to direct collisions with solar panels. Species affected include waterbirds, small raptors, doves, sparrows and warblers (Kagan et al., 2014). The reflective surfaces of PV panels may confuse approaching birds and in some cases act as an attractant, being mistaken for large water bodies, resulting in injuries and/or mortalities when birds attempt to land on the installations.

Human conflict

Certain bird species may seek to benefit from the installations, using the erected structures as prominent perches, sheltered roost sites or even nesting sites, and possibly foraging around the infrastructure in response to changes in the distribution of preferred foods (i.e. plants growing under the panelling and other animals attracted to the facility). This may result in the fouling of critical components in the solar array, bringing local bird populations into conflict with facility operators.

3.1.2. Impacts of associated power infrastructure

Collisions with power infrastructure

Power lines pose a significant collision risk to birds, affecting a particular suite of collision prone species. These are mostly heavy-bodied birds such as bustards, cranes, storks, large eagles and various species of waterbirds that have limited manoeuvrability in flight, which

makes it difficult for them to take the necessary evasive action to avoid colliding with power lines (Anderson, 2001; van Rooyen 2004a; Jenkins *et al.,* 2010).

Electrocutions on power line and power infrastructure
Avian electrocutions occur when a bird perches or attempts to perch on an electrical structure and causes an electrical short circuit by physically bridging the gap between live components and/or live and earthed components (van Rooyen, 2004b; Lehman *et al.,* 2007). Electrocution risk is strongly influenced by the power line voltage and the design of the pole structure and mainly affects larger, perching species such as vultures, eagles and storks that are capable of spanning the spaces between energised components.

3.2. PROJECT SPECIFIC ASSESSMENT OF IMPACTS

Specific impacts of the proposed Woodhouse Solar 1 PV Facility are most likely to be manifested in the following ways:

- Disturbance and displacement of local endemic passerines – Ant-eating Chat and Cape Longclaw – and shy ground-nesting species – Burchell's Courser and Double-banded Courser – from nesting and/or foraging areas by construction and/or operation and/or decommissioning of the SEF.
- Disturbance and displacement of resident or visiting large terrestrial species – Secretarybird, Abdim's Stork, Black Stork and Blue Crane – from nesting and/or foraging areas by construction and/or operation and/or decommissioning of the SEF, and/or mortality of these species in collisions with new power lines whilst flying *en route* to distant resource areas.
- Disturbance and displacement of resident or visiting raptors – Martial Eagle, Tawny Eagle, Lanner Falcon and White-backed Vulture – from foraging areas by construction and/or operation and/or decommissioning of the SEF, and/or mortality of these species in collisions with new power lines or by electrocutions when perched on power infrastructure.
- Injury or mortality of transient waterbirds – Greater Flamingo, Lesser Flamingo and Yellow-billed Stork – using possible flight paths in and out of resource areas in the broader impact zone of the SEF in collisions with solar panels and/or new power lines.

Generally, however, the anticipated impacts on avifauna of the proposed development are not considered to be of any great significance if mitigation measures are applied. There will be some habitat loss for endemic passerines, some species – endemic passerines, large terrestrial species and raptors – may be displaced from a broader area either temporarily by construction and maintenance activities, or more permanently by the disruptive, reflective properties of the solar panels and ongoing activities at the operational development, and some species (large terrestrials, raptors and transient waterbirds) may be killed in

interactions (collisions and electrocutions) with the new power lines and power infrastructure, but numbers affected are likely to be low.

3.3. SIGNIFICANCE OF IDENTIFIED IMPACTS OF THE WOODHOUSE SOLAR 1 PV FACILITY

3.3.1. Assessment methodology

Direct, indirect and cumulative impacts of the impacts identified above will be assessed according to the following standard methodology:

- The **nature** which shall include a description of what causes the effect, what will be affected and how it will be affected.
- The **extent** wherein it will be indicated whether the impact will be local (limited to the immediate area or site of development) or regional, and a value between 1 and 5 will be assigned as appropriate (with 1 being low and 5 being high).
- The **duration** wherein it will be indicated whether:
    - The lifetime of the impact will be of very short duration (0 - 1 years) – assigned a score of 1;
    - The lifetime of the impact will be of short duration (2 - 5 years) – assigned a score of 2;
    - Medium-term (5 - 15 years) – assigned a score of 3;
    - Long-term (> 15 years) – assigned a score of 4; or
    - Permanent – assigned a score of 5.
- The **magnitude** quantified on a scale from 0 - 10 where 0 is small and will have no effect on the environment, 2 is minor and will result in an impact on processes, 4 is low and will cause a slight impact on processes, 6 is moderate and will result in processes continuing but in a modified way, 8 is high (processes are altered to the extent that they temporarily cease) and 10 is very high and results in complete destruction of patterns and permanent cessation of processes.
- The **probability** of occurrence, which shall describe the likelihood of the impact actually occurring. Probability will be estimated on a scale of 1 - 5 where 1 is very improbable (probably will not happen), 2 is improbable (some possibility, but of low likelihood), 3 is probable (distinct possibility), 4 is highly probable (most likely) and 5 is definite (impact will occur regardless of any prevention measures).
- The **significance** which shall be determined through a syntheses of the characteristics described above and can be assessed as low, medium or high; and
- The **status**, which is described as 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.

The **significance** is calculated by combining the criteria in the following formula:

S = (E + D + M) x P

S = Significance weighting

E = Extent

D = Duration

M = Magnitude

P = Probability

The **significance weightings** for each potential impact are as follows:

- < 30 points: Low (i.e. where this impact would not have a direct influence on the decision to develop in the area);
- 30 – 60 points: Medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated); and
- > 60 points: High (i.e. where the impact must have an influence on the decision process to develop in the area).

3.3.2. Woodhouse Solar 1 PV Facility - construction phase impacts

Habitat loss due to construction

Nature
All construction activities would result in a loss of vegetation and habitat affecting endemic passerines, large terrestrial species and raptors through site clearance for solar panels, the construction of internal roads and the establishment of auxiliary buildings. The habitat is however already degraded to varying degrees across the developable area and the habitat is not unique within the landscape.
All priority species could potentially be affected by this impact.

	Without mitigation	**With mitigation**
Extent	Low (1)	Low (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Highly probably (4)	Highly probable (4)
Significance	**Medium (44)**	**Medium (36)**
Status	Negative	
Reversibility	Low (habitat will be lost during construction)	
Irreplaceable loss of resources	Yes	
Can impacts be mitigated?	Partially, due to the space requirements, some land and avian microhabitats will be impacted.	

Mitigation

- All construction activities must be carried out according to the generally accepted

environmental best practise and the temporal and spatial footprint of the development should be kept to a minimum.

- Care must be taken in the vicinity of sensitive microhabitats such as *Ephemeral pans* and *Drainage lines.*
- Existing roads must be used as much as possible for access during construction.
- The boundaries of the development area are to be clearly demarcated and it must be ensured that all activities remain within the demarcated footprint.
- Provide adequate briefing for site personnel.
- Any bird nests that are found during the construction phase must be reported to the Environmental Control Officer (ECO).
- The above measures must be covered in a site specific EMPr and controlled by an ECO.

Cumulative impacts

Moderate. The development borders the proposed Woodhouse Solar 2 PV Facility which will also contribute to the loss of natural habitat within the area. However, as the wider landscape is already somewhat degraded due to agricultural practises in the area and the proximity to the town of Vryburg, the contribution would be small and the overall significance low.

Residual impacts

Moderate. The vegetation within the development area can be rehabilitated after the life time of the facility if proposed mitigation measures are put in place.

Disturbance during construction

Nature

All construction activities would result in a disturbance impact affecting endemic passerines, large terrestrial species and raptors through the noise and movement of construction equipment and personnel.

The proposed developable area has already been subjected to disturbance through agricultural practises and is in close proximity to the town of Vryburg and as such the local avifauna has already experienced a degree of disturbance. As a result, the disturbance of birds by the proposed PV facility is anticipated to be of moderate significance as birds will move away from the area temporarily.

It must however be noted, that species are particularly sensitive to disturbance during the breeding season and this must be borne in mind during the construction phase.

All priority species could potentially be affected by this impact.

	Without mitigation	**With mitigation**
Extent	Low (2)	Low (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Low (4)	Minor (2)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (32)**	**Low (15)**
Status (positive or negative)	Negative	
Reversibility	Low (species will be disturbed)	
Irreplaceable loss of resources?	Yes	
Can impacted be mitigated?	Partially	

Mitigation

- Strict control must be maintained over all activities during construction, in line with an approved construction EMPr.
- During construction, if any priority species identified in this report are observed to be roosting and/or nesting and breeding in the vicinity, the ECO must be notified.
- The construction camps and laydown areas and site offices etc. must be as close to the site as possible.
- Contractors and working staff should stay within the development area and movement outside these areas especially into sensitive avian microhabitats must be restricted.
- Driving must take place on existing roads and a speed limit of 50 km/h must be implemented on all internal roads.

Cumulative impacts

Moderate. The development borders the proposed Woodhouse Solar 2 PV Facility which will also contribute to the disturbance of avifauna within the area. However, as the wider landscape is already somewhat disturbed due to agricultural practises in the area and the proximity to the town of Vryburg, the contribution would be small and the overall significance low.

Residual risks

Moderate. Some disturbance during the construction phase is inevitable. It is likely that some species will be disturbed and potentially displaced by the development.

3.3.3. Woodhouse Solar 1 PV Facility - operational phase impacts

Disturbance during operation

Nature

All maintenance and operational activities would result in a disturbance impact affecting endemic passerines, large terrestrial species and raptors through the noise and movement of maintenance equipment and personnel.

All priority species could potentially be affected by this impact.

	Without mitigation	**With mitigation**
Extent	Low (2)	Low (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Minor (2)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (40)**	**Low (24)**
Status (positive or negative)	Negative	
Reversibility	Low	
Irreplaceable loss of resources?	No	
Can impacted be mitigated?	Partially	

Mitigation

- If birds are nesting on the infrastructure of the facility and cannot be tolerated due to operational risks of fire, electrical short, soiling of panels or other problems, 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 already with eggs and chicks should be allowed to fledge their chicks before nests are removed.
- If there are any persistent problems with avifauna, then an avifaunal specialist should be consulted for advice on further mitigation.
- Contractors and working staff should stay within the development area and movement outside these areas especially into sensitive avian microhabitats must be restricted.
- Driving must take place on existing roads and a speed limit of 50 km/h must be implemented on all access roads.

Cumulative impacts

Moderate. The development borders the proposed Woodhouse Solar 2 PV Facility which will also contribute to the disturbance of avifauna within the area.

Residual risks

Moderate. Some disturbance during the operational phase is inevitable. It is likely that some species will be disturbed and potentially displaced by the development.

Collisions with solar panels

Nature

The PV facility is comprised of reflective panelling occupying a large area. Avifauna can be disorientated by the reflected light and consequently be displaced from an area more extensive than just the development footprint.

Waterbirds have been known to mistake the reflective surface for an expanse of water and attempt to land on the panels, resulting in injuries and even death.

Large terrestrial species, raptors and waterbirds could potentially be affected by this impact.

	Without mitigation	**With mitigation**
Extent	Low (2)	Low (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Minor (2)
Probability	Improbable (2)	Improbable (2)
Significance	**Low (20)**	**Low (16)**
Status (positive or negative)	Negative	
Reversibility	Low (birds may be injured or killed)	
Irreplaceable loss of resources?	No	
Can impacted be mitigated?	No	

Mitigation

- Monitor all avifaunal incidents or mortalities observed within the facility (recorded and documented with photographs to ensure correct identification).
- If there are any persistent problems with avifauna, then an avifaunal specialist should be consulted for advice.

Cumulative impacts

Moderate. The development borders the proposed Woodhouse Solar 2 PV Facility which will also contribute to the area being covered by solar panels thus increasing the probability of collisions.

Residual risks

None. Once the solar panels are decommissioned the injuries and mortalities will cease.

3.3.4. Woodhouse Solar 1 PV Facility grid connection - construction phase impacts

In order for the facility to evacuate the generated electricity into the Eskom national grid four grid connection options are being considered which includes the following:

- Alternative 1: a direct connection to the authorised Eskom Bophirima Substation to be constructed within the northern portion of the affected property;
- Alternative 2: a direct connection to the existing Woodhouse 88/22kV Substation located north of the boundary of the affected property;
- Alternative 3: a turn-in turn-out connection to the existing Delareyville Munic / Vryburg 1 88kV Feeder located along the northern boundary of the affected property; and
- Alternative 4: a turn-in turn-out connection to the authorised 132kV Eskom Bophirima–Mookodi power line to be constructed by Eskom[1].

Four alternative power line routes are being considered to connect the facility via a 132kV power line to the national grid (see Figure 6 below).

[1] In the event that Eskom is unable to complete the construction of the proposed 132kV Eskom Bopirima-Mookodi Overhead Line Genesis Eco-Energy Developments would consider undertaking the construction of the authorised power line within the authorised corridor (DEA Ref.: 12/12/20/1929) to connect the PV Facility via the completed 132kV power line to the existing Mookodi 400/132KV Substation located to the west of the project site.

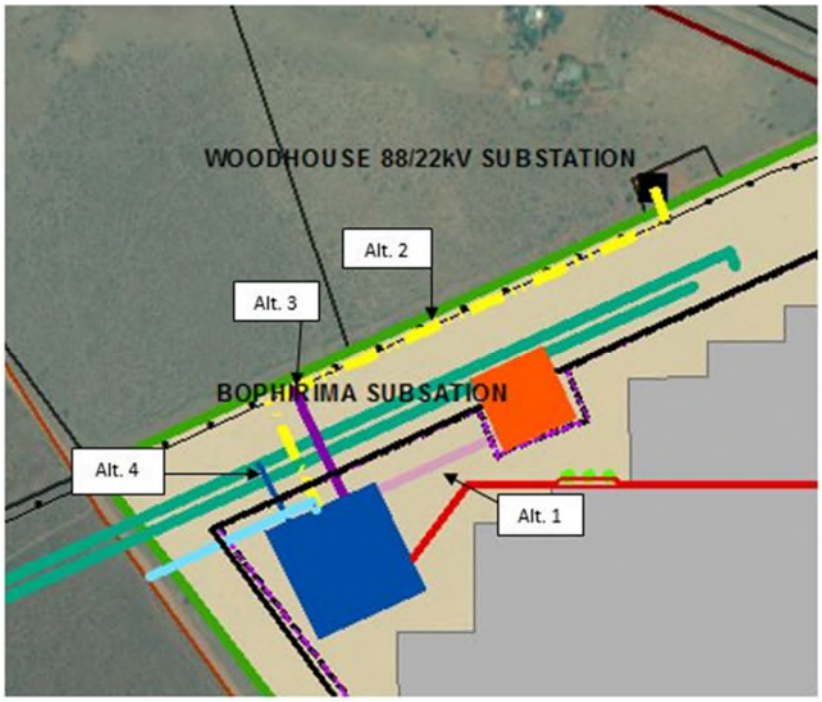

Figure 6. An illustration of the alternative power line routes showing where the power line will be connected at the on-site substation and where it connects to the grid connection alternative.

Habitat loss due to power line construction

Nature

All construction activities would result in a loss of vegetation and habitat affecting endemic passerines, large terrestrial species and raptors, through site clearance for substations and power line infrastructure and servitudes which have to be cleared of excess vegetation at regular intervals in order to allow access to power lines for maintenance and to prevent vegetation from intruding into the legally prescribed clearance gap, minimising the risk of fire.

The habitat is however already degraded to varying degrees across the developable area and the habitat is not unique within the landscape. All power line alternatives are less than 1km in length, and the associated impact is low as the area is currently degraded and has existing impacts (other power lines and roads and bare soils from overgrazing).

All priority species could potentially be affected by this impact.

	Without mitigation				**With mitigation**			
	Alt. 1	**Alt. 2**	**Alt. 3**	**Alt. 4**	**Alt. 1**	**Alt. 2**	**Alt. 3**	**Alt. 4**
Extent	Low (1)	Low (1)	Low (1)	Low (1)	Low (1)	Low (1)	Low (1)	Low (1)
Duration	Long-term (4)	Long-term (4)	Long-term (4)	Long-term (4)	Long-term (4)	Long-term (4)	Long-term (4)	Long-term (4)
Magnitude	Minor (2)	Minor (2)	Minor (2)	Minor (2)	Minor (1)	Minor (1)	Minor (1)	Minor (1)
Probability	Probable (3)	Probable (3)	Probable (3)	Probable (3)	Probable (3)	Probable (3)	Probable (3)	Probable (3)
Significance	**Low (21)**	**Low (21)**	**Low (21)**	**Low (21)**	**Low (18)**	**Low (18)**	**Low (18)**	**Low (18)**

Status (positive or negative)	Negative
Reversibility	Low (habitat will be lost during construction)
Irreplaceable loss of resources?	Yes
Can impacts be mitigated?	Yes

Mitigation

- All construction activities must be carried out according to the generally accepted environmental best practise and the temporal and spatial footprint of the development should be kept to a minimum.
- Existing roads must be used as much as possible for access during construction.
- The boundaries of the development area are to be clearly demarcated and it must be ensured that all activities remain within the demarcated footprint.
- Provide adequate briefing for site personnel.
- Any bird nests that are found during the construction phase must be reported to the Environmental Control Officer (ECO).
- The above measures must be covered in a site specific EMPr and controlled by an ECO.

Cumulative impacts

Moderate. The development borders the proposed Woodhouse Solar 2 PV Facility which will also contribute to the loss of natural habitat within the area. However, as the wider landscape is already somewhat degraded due to agricultural practises in the area and the proximity to the town of Vryburg, the contribution would be small and the overall significance low.

Residual risks

Moderate. The vegetation within the development area can be rehabilitated after the life time of the facility if proposed mitigation measures are put in place.

Avifaunal disturbance due to grid connection construction activities

Nature

All construction activities would result in a disturbance impact affecting endemic passerines, large terrestrial species and raptors through the noise and movement of construction equipment and personnel. The relatively small scale of the proposed developable area has already been subjected to disturbance through agricultural practises and is in close proximity to the town of Vryburg and as such the local avifauna has already experienced a degree of disturbance. As a result, the disturbance of birds by the associated power infrastructure is anticipated to be of low significance as birds will move away from the area temporarily. The power line is also short (<1km) and in close proximity to existing infrastructure.

It must however be noted, that species are particularly sensitive to disturbance during the breeding

season and this must be borne in mind during both the construction and operational phases.
All priority species could potentially be affected by this impact.

	Without mitigation				With mitigation			
	Alt. 1	**Alt. 2**	**Alt. 3**	**Alt. 4**	**Alt. 1**	**Alt. 2**	**Alt.3**	**Alt. 4**
Extent	Low (1)	Low (1)	Low (1)	Low (1)	Low (1)	Low (1)	Low (1)	Low (1)
Duration	Short-term (2)	Short-term (2)	Short-term (2)	Short-term (2)	Short-term (2)	Short-term (2)	Short-term (2)	Short-term (2)
Magnitude	Low (4)	Low (4)	Low (4)	Low (4)	Minor (2)	Minor (2)	Minor (2)	Minor (2)
Probability	Highly Probable (4)	Highly Probable (4)	Highly Probable (4)	Highly Probable (4)	Probable (3)	Probable (3)	Probable (3)	Probable (3)
Significance	**Low (28)**	**Low (28)**	**Low (28)**	**Low (28)**	**Low (15)**	**Low (15)**	**Low (15)**	**Low (15)**
Status (positive or negative)	Negative							
Reversibility	Low (species will be disturbed)							
Irreplaceable loss of resources?	Yes							
Can impacts be mitigated?	Partially							

Mitigation

- Strict control must be maintained over all activities during construction, in line with an approved construction EMPr.
- During construction, if any priority species identified in this report are observed to be roosting and/or nesting and breeding in the vicinity, the ECO must be notified.
- The construction camps and laydown areas and site offices etc. must be as close to the site as possible.
- Contractors and working staff should stay within the development area and movement outside these areas especially into sensitive avian microhabitats must be restricted.
- Driving must take place on existing roads and a speed limit of 50 km/h must be implemented on all internal roads.

Cumulative impacts

Moderate. The development borders the proposed Woodhouse Solar 2 PV Facility which will also contribute to the disturbance of avifauna within the area. However, as the wider landscape is already somewhat disturbed due to agricultural practises in the area and the proximity to the town of Vryburg, the contribution would be small and the overall significance low.

Residual risks

Moderate. Some disturbance during the construction phase is inevitable. It is likely that some species will be disturbed and potentially be displaced by the development.

3.3.5. Woodhouse Solar 1 PV Facility grid connection - operational phase impacts

Disturbance along power line

Nature

All maintenance and operational activities would result in a disturbance impact affecting endemic passerines, large terrestrial species and raptors through the noise and movement of maintenance equipment and personnel.

All priority species could potentially be affected by this impact.

	Without mitigation				With mitigation			
	Alt. 1	**Alt. 2**	**Alt. 3**	**Alt. 4**	**Alt. 1**	**Alt. 2**	**Alt. 3**	**Alt. 4**
Extent	Low (1)	Low (1)	Low (1)	Low (1)	Low (1)	Low (1)	Low (1)	Low (1)
Duration	Short-term (2)	Short-term (2)	Short-term (2)	Short-term (2)	Short-term (2)	Short-term (2)	Short-term (2)	Short-term (2)
Magnitude	Minor (2)	Minor (2)	Minor (2)	Minor (2)	Minor (2)	Minor (2)	Minor (2)	Minor (2)
Probability	Highly Probable (4)	Highly Probable (4)	Highly Probable (4)	Highly Probable (4)	Probable (3)	Probable (3)	Probable (3)	Probable (3)
Significance	**Low (20)**	**Low (20)**	**Low (20)**	**Low (20)**	**Low (15)**	**Low (15)**	**Low (15)**	**Low (15)**
Status (positive or negative)	Negative							
Reversibility	Low (species will be disturbed)							
Irreplaceable loss of resources?	Yes							
Can impacts be mitigated?	Partially							

Mitigation

- If birds are nesting on the infrastructure of the facility and cannot be tolerated due to operational risks of fire, electrical short, soiling or panels or other problems, 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 already with eggs and chicks should be allowed to fledge their chicks before nests are removed.
- If there are any persistent problems with avifauna, then an avifaunal specialist should be consulted for advice on further mitigation.
- Contractors and working staff should stay within the development area and movement outside these areas especially into sensitive avian microhabitats must be restricted.
- Driving must take place on existing roads and a speed limit of 50 km/h must be

implemented on all access roads.
Cumulative impacts Moderate. The development borders the proposed Woodhouse Solar 2 PV Facility which will also contribute to the disturbance of avifauna within the area. However, as the wider landscape is already somewhat disturbed due to agricultural practises in the area and the proximity to the town of Vryburg, the contribution would be small and the overall significance low.
Residual risks Moderate. Some disturbance during the operational phase is inevitable. It is likely that some species will be disturbed and potentially displaced by the development.

Avian electrocutions on power infrastructure

Nature

Electrocutions of birds on associated power infrastructure results in injuries or death and could potentially affect large, perching species in the area such as raptors and storks. Avian electrocutions occur when a bird perches or attempts to perch on an electrical structure and causes an electrical short circuit by physically bridging the gap between live components and/or live and earthed components (van Rooyen, 2004b; Lehman *et al.,* 2007).

Of the priority species, Martial Eagle and White-backed Vulture could potentially be affected by this impact.

	Without mitigation				**With mitigation**			
	Alt. 1	**Alt. 2**	**Alt. 3**	**Alt. 4**	**Alt. 1**	**Alt. 2**	**Alt. 3**	**Alt. 4**
Extent	Low (2)	Low (2)	Low (2)	Low (2)	Low (2)	Low (2)	Low (2)	Low (2)
Duration	Long-term (4)	Long-term (4)	Long-term (4)	Long-term (4)	Long-term (4)	Long-term (4)	Long-term (4)	Long-term (4)
Magnitude	Minor (2)	Minor (2)	Minor (2)	Minor (2)	Minor (2)	Minor (2)	Minor (2)	Minor (2)
Probability	Highly Probable (4)	Highly Probable (4)	Highly Probable (4)	Highly Probable (4)	Probable (3)	Probable (3)	Probable (3)	Probable (3)
Significance	**Medium (32)**	**Medium (32)**	**Medium (32)**	**Medium (32)**	**Low (24)**	**Low (24)**	**Low (24)**	**Low (24)**
Status (positive or negative)	Negative							
Reversibility	Low (birds will be injured or killed)							
Irreplaceable loss of resources?	Yes							
Can impacts be mitigated?	Yes							
Mitigation								

- A "Bird Friendly" structure, with a bird perch (as per standard Eskom guidelines) should be used for the power infrastructure.
- All relevant perching surfaces should be fitted with bird guards and perch guards as deterrents (Hunting, 2002).
- Installation of artificial bird space perches and nesting platforms, at a safe distance from energised components (Goudie, 2006; Prinsen *et al*., 2012).

Cumulative impacts
Moderate. The development borders the proposed Woodhouse Solar 2 PV Facility which will also contribute to the length of power infrastructure in the area and therefore the subsequent risk.

Residual risks
Moderate. The power line infrastructure will be within the area over a long period of time, if not permanently. However, if the power line infrastructure is removed the impacts associated (avian injuries and mortalities) will cease.

Avian collisions with power lines

Nature
Collisions are the single biggest threat posed by power lines in South Africa (van Rooyen, 2004). Avian species most susceptible and impacted upon are large, heavy-bodied birds such as bustards, storks, korhaans and certain raptors.
All priority species could potentially be affected by this impact, but specifically, Secretarybird, Blue Crane, Martial Eagle, White-backed Vulture and Greater and Lesser Flamingo.

	Without mitigation				**With mitigation**			
	Alt. 1	**Alt. 2**	**Alt. 3**	**Alt. 4**	**Alt. 1**	**Alt. 2**	**Alt. 3**	**Alt. 4**
Extent	Low (2)	Low (2)	Low (2)	Low (2)	Low (2)	Low (2)	Low (2)	Low (2)
Duration	Long-term (4)	Long-term (4)	Long-term (4)	Long-term (4)	Long-term (4)	Long-term (4)	Long-term (4)	Long-term (4)
Magnitude	Minor (2)	Minor (2)	Minor (2)	Minor (2)	Minor (2)	Minor (2)	Minor (2)	Minor (2)
Probability	Highly Probable (4)	Highly Probable (4)	Highly Probable (4)	Highly Probable (4)	Probable (3)	Probable (3)	Probable (3)	Probable (3)
Significance	**Medium (32)**	**Medium (32)**	**Medium (32)**	**Medium (32)**	**Low (24)**	**Low (24)**	**Low (24)**	**Low (24)**
Status (positive or negative)	Negative							
Reversibility	Low (birds will be injured or killed)							
Irreplaceable loss of resources?	Yes							
Can impacts be mitigated?	Yes							

Mitigation • High sensitivity sections of the power line should be marked with Bird Flight Diverters (BFDs), on the earth wire of the line, 5 metres apart, alternating black and white to increase the visibility of the power line and reduce the likelihood of collisions. • The power line route should be scanned at least twice a month for the first year after construction to identify and locations of high impact. All mortalities along the power line route should be recorded and if there are any sites where repeated mortalities have occurred, an avifaunal specialist should be consulted for advice on additional mitigation measures to be implemented.
Cumulative impacts Moderate. The development borders the proposed Woodhouse Solar 2 PV Facility which will also contribute to the length of power infrastructure in the area and therefore the subsequent risk.
Residual risks Moderate. The power line infrastructure will be within the area over a long period of time, if not permanently. However, if the power line infrastructure is removed the impacts associated (avian injuries and mortalities) will cease.

The power line alternative routes have been considered (within the construction and operation phase of the PV facility) from an avifaunal perspective to identify the impact of each power line route on the avifauna of the area.

3.4. SIGNIFICANCE OF CUMULATIVE IMPACTS OF THE WOODHOUSE SOLAR 1 PV FACILITY

Nature
Cumulative impact on avifauna in the area as a result of habitat loss and increased risk associated with power line infrastructure

	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Low (2)	Medium (3)
Duration	Long-term (4)	Long-term (4)
Magnitude	Minor (2)	Moderate (6)
Probability	Probable (3)	Highly Probable (4)
Significance	**Low (24)**	**Medium (52)**
Status (positive/negative)	Negative	Negative
Reversibility	High	Low
Irreplaceable loss of resources?	Yes (birds may be displaced, injured or killed)	
Can impacts be mitigated?	Partially	
Confidence in findings	High	

Mitigation
Follow the recommended mitigation measures for each of the aforementioned impacts listed in section 3.3.

3.5. COMPARISON OF SITE ALTERNATIVES AND GRID CONNECTION OPTIONS

One of the main objectives of the avifaunal impact study is to provide input on the feasibility of the preferred development site identified for the proposed Woodhouse Solar 1 PV Facility, from an avifaunal perspective. The following is a description of the site layout options in terms of their avian sensitivity.

Proposed site layout

The proposed site layout for the Woodhouse Solar 1 PV Facility falls entirely within a *Medium-Low* sensitivity area associated with the *Cultivated/modified land* and *Vaalbos shrubland* habitat units. Bird species diversity and abundance was relatively low in these habitats, especially in comparison to other habitats of the developable area (specifically the *Bushveld* habitat unit), and as such, in terms of the potential impacts to avifauna, the proposed site layout is located within an area that is considered to have acceptable levels of impact.

Power line alternative 1

The grid connection option to the proposed Bophirima substation (to be constructed on-site) would have the least potential impact to avifauna due its minimal spatial extent and the fact that the on-site substation and new power lines would fall within/span *Low* sensitivity areas. This grid connection option is considered to have acceptable levels of impact.

Power line alternative 2

The grid connection option to the existing Woodhouse substation - located on the northern boundary of the site (less 1 km away) - is considered to have acceptable levels of impact due to its minimal spatial extent and the fact that the new power line would fall within/span *Low* sensitivity areas associated with the *Cultivated/modified land* and *Vaalbos shrubland* habitat units.

Power line alternative 3

The grid connection option to the existing Delareyville Munic / Vryburg 1 88kV Feeder located along the northern boundary of the affected property is considered to have acceptable levels of impact due to its minimal spatial extent and the fact that the new power line would fall within/span *Low* sensitivity areas associated with the *Cultivated/modified* land and *Vaalbos shrubland* habitat units.

Power line alternative 4

The grid connection option to the authorised 132kV Eskom Bophirima–Mookodi power line to be constructed by Eskom is considered to have acceptable levels of impact due to its minimal spatial extent and the fact that the new power line would fall within/span *Low* sensitivity areas associated with the *Cultivated/modified* land and *Vaalbos shrubland* habitat units.

The following table provides a comparative assessment of the four proposed power line alternatives.

Aspect	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Avifauna	Acceptable – • No major impact expected • Located within a low sensitive area	Acceptable – • No major impact expected • Located within a low sensitive area	Acceptable – • No major impact expected • Located within a low sensitive area	Acceptable – • No major impact expected • Located within a low sensitive area

After the comparative assessment and consideration of the power line alternatives it is considered that all the proposed power line routes are acceptable and appropriate from an avifaunal perspective and can all be considered as feasible options (with the implementation of appropriate mitigation measures).

4. CONCLUSION

The proposed Woodhouse Solar 1 PV Facility and its associated power infrastructure has been assessed as having a **low** impact (after mitigation) to priority species and general avifauna occurring in the proposed site layout for the development and broader impact zone of the development. The development will pose several impacts to avifauna, including: a **medium** displacement impact caused by disturbance and habitat destruction associated with construction and maintenance activities of the proposed PV facility and its associated power infrastructure; a **low** impact of electrocutions of birds on power infrastructure, with the implementation of mitigation measures; and a **medium** impact of avian collisions with power line infrastructure and solar panels. **The development is likely to have little, if any significant long-term impact on the avifauna of the wider area, especially after mitigation, and as such, is considered to have acceptable levels of impact overall.**

The location of the study area and more specifically the proposed site layout are not considered unique habitats in the landscape and are already subject to varying degrees of transformation and degradation. Although two threatened and/or priority species were recorded within the broader study area – White-backed Vulture and Greater Flamingo respectively – these are widespread species, the area is not considered critical for their conservation and the extent of habitat loss for these species would be considered **low**.

In terms of the direct impacts of the development in isolation, the proposed site layout option is considered optimal for the development due to the homogenous nature of the vegetation, the level of degradation already present and the lower bird species diversity and abundance recorded in this area.

All of the power line alternatives proposed for the development is considered feasible and appropriate due to the fact that it is considered to have a low overall impact to avifauna due to its small spatial extent and the fact that the on-site substation and the power line route alternatives fall within/span *Low* sensitivity areas associated with the *Cultivated/modified land* and *Vaalbos shrubland* habitat units.

Implementation of the required mitigation measures should reduce the construction and operational phase impacts to acceptable levels. A post construction avifauna monitoring programme be initiated at the site, if required, and include a wet and dry season survey.

Every effort should be made to monitor impacts throughout, to learn as much as possible about the effects of SEFs on South African avifauna, and to implement any further mitigation measures as required.

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6. APPENDIX

Appendix 1: Consolidated species list of the proposed Woodhouse Solar 1 PV Facility, including SABAP 1, SABAP 2 and field visit data. Species highlighted in bold are those that were recorded during the field visit.

Common name	Scientific name	Conservation status	Regional endemism	Suscepitibility to		
				Collision	Electrocution	Disturbance / habitat loss
Avocet, Pied	*Recurvirostra avosetta*	-	-	-	-	-
Barbet, Acacia Pied	***Tricholaema leucomela***	**-**	**Near-endemic**	**-**	**-**	**Moderate**
Barbet, Crested	*Trachyphonus vaillantii*	-	-	-	-	Moderate
Batis, Pririt	*Batis pririt*	-	Near-endemic	-	-	Moderate
Bee-eater, European	***Merops apiaster***	**-**	**-**	**-**	**-**	**-**
Bee-eater, Little	*Merops pusillus*	-	-	-	-	Moderate
Bee-eater, Little	*Merops pusillus*	-	-	-	-	Moderate
Bee-eater, Swallow-tailed	*Merops hirundineus*	-	-	-	-	-
Bishop, Southern Red	*Euplectes orix*	-	-	-	-	-
Bishop, Yellow-crowned	*Euplectes afer*	-	-	-	-	Moderate
Bokmakierie	*Telophorus zeylonus*	-	Near-endemic	-	-	Moderate
Bulbul, African Red-eyed	*Pycnonotus capensis*	-	Near-endemic	-	-	Moderate
Bunting, Cinnamon-breasted	*Emberiza tahapisi*	-	-	-	-	Moderate
Bunting, Golden-breasted	***Emberiza flaviventris***	**-**	**-**	**-**	**-**	**Moderate**
Bustard, Kori	*Ardeotis kori*	Near-threatened	-	High	-	Moderate
Buzzard, Common	*Buteo buteo*	-	-	Moderate	Moderate	-
Canary, Black-throated	*Crithagra atrogularis*	-	-	-	-	Moderate
Canary, Yellow	***Crithagra flaviventris***	**-**	**Near-endemic**	**-**	**-**	**Moderate**
Chat, Ant-eating	***Myrmecocichla formicivora***	**-**	**Endemic**	**-**	**-**	**Moderate**
Chat, Familiar	*Cercomela familiaris*	-	-	-	-	-

Cisticola, Desert	*Cisticola aridulus*	-	-	-	-	Moderate
Cisticola, Levaillant's	*Cisticola tinniens*	-	-	-	-	-
Cisticola, Rattling	*Cisticola chiniana*	-	-	-	-	-
Cisticola, Zitting	***Cisticola juncidis***	**-**	**-**	**-**	**-**	**Moderate**
Cliff-Swallow, South African	*Petrochelidon spilodera*	-	Endemic	-	-	Moderate
Coot, Red-knobbed	*Fulica cristata*	-	-	-	-	-
Cormorant, Reed	*Microcarbo africanus*	-	-	Moderate	-	-
Cormorant, White-breasted	*Phalacrocorax lucidus*	-	-	Moderate	-	-
Courser, Burchell's	*Cursorius rufus*	Vulnerable	Near-endemic	-	-	Moderate
Courser, Temminck's	***Cursorius temminckii***	**-**	**-**	**-**	**-**	**Moderate**
Crane, Blue	*Anthropoides paradieus*	Near-threatened	Endemic	High	-	-
Crombec, Long-billed	*Sylvietta rufescens*	-	-	-	-	Moderate
Crow, Pied	***Corvus ablus***	**-**	**-**	**Moderate**	**Moderate**	**-**
Cuckoo, Diederick	*Chrysococcyx caprius*	-	-	-	-	Moderate
Cuckoo, Jacobin	*Clamator jacobinus*	-	-	-	-	Moderate
Darter, African	*Anhinga rufa*	-	-	Moderate	-	-
Dove, Cape Turtle	*Streptopelia capicola*	-	-	-	-	-
Dove, Laughing	***Spilopelia senegalensis***	**-**	**-**	**-**	**-**	**-**
Dove, Namaqua	***Oena capensis***	**-**	**-**	**-**	**-**	**Moderate**
Dove, Red-eyed	*Streptopelia semitorquata*	-	-	-	-	Moderate
Dove, Rock	*Columba livia*	-	-	-	-	-
Drongo, Fork-tailed	*Dicrurus adsimilis*	-	-	-	-	-
Duck, Maccoa	*Oxyura maccoa*	Near-threatened	-	Moderate	-	-
Duck, White-faced	*Dendrocygna viduata*	-	-	Moderate	-	-
Duck, Yellow-billed	*Anas undulata*	-	-	Moderate	-	-
Eagle, African Fish	*Haliaeetus vocifer*	-	-	Moderate	Moderate	-
Eagle, Martial	*Polemaetus bellicosus*	Endangered	-	High	High	Moderate
Eagle, Tawny	*Aquila rapax*	Endangered	-	High	Moderate	Moderate
Eagle-Owl, Spotted	*Bubo africanus*	-	-	-	High	Moderate

Egret, Great	*Ardea alba*	-	-	Moderate	-	-
Egret, Little	*Egretta garzetta*	-	-	-	-	-
Egret, Western Cattle	***Bubulcus ibis***	**-**	**-**	**-**	**-**	**-**
Egret, Yellow-billed	*Egretta intermedia*	-	-	Moderate	-	-
Falcon, Amur	*Falco amurensis*	-	-	-	-	Moderate
Falcon, Lanner	*Falco biarmicus*	Vulnerable	-	High	Moderate	-
Falcon, Red-footed	*Falco vespertinus*	Near-threatened	-	-	-	Moderate
Finch, Red-headed	*Amadina erythrocephala*	-	Near-endemic	-	-	Moderate
Finch, Scaly-feathered	***Sporopipes squamifrons***	**-**	**Near-endemic**	**-**	**-**	**Moderate**
Firefinch, Red-billed	*Lagonosticta senegala*	-	-	-	-	Moderate
Fiscal, Common	*Lanius collaris*	-	-	-	-	-
Flamingo, Greater	***Phoenicopterus ruber***	**Near-threatened**	**-**	**High**	**-**	**-**
Flamingo, Lesser	*Phoenicopterus minor*	Near-threatened	-	High	-	-
Flycatcher, Fairy	*Stenostira scita*	-	Endemic	-	-	Moderate
Flycatcher, Fairy	*Stenostira scita*	-	Endemic	-	-	Moderate
Flycatcher, Fiscal	***Sigelus silens***	**-**	**Endemic**	**-**	**-**	**Moderate**
Flycatcher, Marico	*Bradornis mariquensis*	-	Near-endemic	-	-	Moderate
Francolin, Orange River	*Scleroptila levaillantoides*	-	Near-endemic	-	-	Moderate
Goose, Egyptian	*Alopochen aegyptiaca*	-	-	High	High	-
Goose, Spur-winged	*Plectropterus gambensis*	-	-	Moderate	-	-
Goshawk, Southern Pale Chanting	*Melierax canorus*	-	Near-endemic	-	Moderate	Moderate
Grebe, Little	*Tachybaptus ruficollis*	-	-	-	-	-
Guineafowl, Helmeted	***Numida meleagris***	**-**	**-**	**Moderate**	**-**	**-**
Hamerkop	*Scopus umbretta*	-	-	Moderate	Moderate	-
Heron, Black-headed	*Ardea melanocephala*	-	-	Moderate	Moderate	-
Heron, Green-backed	*Butorides striata*	-	-	-	-	-
Heron, Grey	*Ardea cinerea*	-	-	High	High	-
Hoopoe, African	*Upupa africana*	-	-	-	-	-

Hornbill, African Grey	*Tockus nasutus*	-	-	-	-	-
Ibis, African Sacred	*Threskiornis aethiopicus*	-	-	Moderate	-	-
Ibis, Glossy	*Plegadis falcinellus*	-	-	Moderate	-	-
Ibis, Hadeda	*Bostrychia hagedash*	-	-	Moderate	Moderate	-
Kestrel, Greater	*Falco rupicoloides*	-	-	-	Moderate	Moderate
Kestrel, Lesser	*Falco naumanni*	-	-	High	-	Moderate
Kingfisher, Brown-hooded	*Halycon albiventris*	-	-	-	-	Moderate
Kingfisher, Pied	*Ceryle rudis*	-	-	-	-	-
Kite, Black-shouldered	***Elanus caeruleus***	**-**	**-**	**-**	**-**	**Moderate**
Korhaan, Northern Black	***Afrotis afraoides***	**-**	**Endemic**	**High**	**-**	**Moderate**
Korhaan, Red-crested	*Lophotis ruficrista*	-	Near-endemic	Moderate		Moderate
Lapwing, Blacksmith	*Vanellus armatus*	-	-	-	-	-
Lapwing, Crowned	*Vanellus coronatus*	-	-	-	-	-
Lark, Eastern Clapper	*Mirafra fasciolata*	-	Near-endemic	-	-	Moderate
Lark, Fawn-coloured	*Calendulauda semitorquata*	-	Near-endemic	-	-	Moderate
Lark, Rufous-naped	***Mirafra africana***	**-**	**-**	**-**	**-**	**Moderate**
Lark, Sabota	***Calendulauda sabota***	**-**	**Near-endemic**	**-**	**-**	**Moderate**
Lark, Spike-heeled	*Chersomanes albofasciata*	-	Near-endemic	-	-	High
Longclaw, Cape	***Macronyx capensis***	**-**	**Endemic**	**-**	**-**	**Moderate**
Martin, Brown-throated	*Riparia paludicola*	-	-	-	-	Moderate
Masked-Weaver, Southern	*Ploceus velatus*	-	-	-	-	Moderate
Moorhen, Common	*Gallinula chloropus*	-	-	-	-	-
Mousebird, Red-faced	*Urocolius indicus*	-	-	-	-	Moderate
Mousebird, White-backed	***Colius colius***	**-**	**Endemic**	**-**	**-**	**Moderate**
Neddicky	*Cisticola fulvicapilla*	-	-	-	-	Moderate
Night-Heron, Black-crowned	*Nycticorax nycticorax*	-	-	-	-	-
Ostrich, Common	*Struthio camelus*	-	-	-	-	-
Owl, Marsh	*Asio capensis*	-	-	Moderate	-	Moderate

Pigeon, Speckled	*Columba guinea*	-	-	-	-	-
Pipit, African	***Anthus cinnamomeus***	**-**	**-**	**-**	**-**	**Moderate**
Plover, Kittlitz's	*Charadrius pecuarius*	-	-	-	-	-
Plover, Three-banded	*Charadrius tricollaris*	-	-	-	-	-
Pochard, Southern	*Netta erythrophthalma*	-	-	Moderate	-	-
Prinia, Black-chested	*Prinia flavicans*	-	Near-endemic	-	-	Moderate
Pytilia, Green-winged	*Pytilia melba*	-	-	-	-	Moderate
Quailfinch, African	*Ortygospiza fuscocrissa*	-	-	-	-	Moderate
Quelea, Red-billed	***Quelea quelea***	**-**	**-**	**-**	**-**	**-**
Robin-chat, Cape	*Cossypha caffra*	-	-	-	-	-
Roller, European	*Coracias garrulus*	Near-threatened	-	-	-	Moderate
Roller, Lilac-breasted	*Coracias caudatus*	-	-	-	-	-
Ruff	*Philomachus pugnax*	-	-	-	-	-
Sandgrouse, Namaqua	***Pterocles namaqua***	**-**	**Near-endemic**	**-**	**-**	**Moderate**
Sandpiper, Common	*Actitis hypoleucos*	-	-	-	-	-
Sandpiper, Curlew	*Calidris ferruginea*	-	-	-	-	-
Sandpiper, Marsh	*Tringa stagnatilis*	-	-	-	-	-
Sandpiper, Wood	*Tringa glareola*	-	-	-	-	-
Scimitarbill, Common	*Rhinopomastus cyanomelas*	-	-	-	-	Moderate
Scrub-Robin, Kalahari	***Erythropygia paena***	**-**	**Near-endemic**	**-**	**-**	**Moderate**
Secretarybird	*Sagittarius serpentarius*	Vulnerable	-	High	-	Moderate
Shelduck, South African	*Tadorna cana*	-	Endemic	Moderate	-	-
Shoveler, Cape	*Anas smithii*	-	Near-endemic	Moderate	-	-
Shrike, Crimson-breasted	***Laniarius atrococcineus***	**-**	**Near-endemic**	**-**	**-**	**Moderate**
Shrike, Lesser Grey	***Lanius minor***	**-**	**-**	**-**	**-**	**-**
Shrike, Red-backed	*Lanius collurio*	-	-	-	-	-
Snake-Eagle, Black-chested	***Circaetus pectoralis***	**-**	**-**	**Moderate**	**-**	**-**
Snake-Eagle, Brown	***Circaetus cinereus***	**-**	**-**	**-**	**Moderate**	**Moderate**

Sparrow, Cape	***Passer melanurus***	**-**	**Near-endemic**	**-**	**-**	**-**
Sparrow, House	*Passer domesticus*	-	-	-	-	-
Sparrow, Southern Grey-headed	*Passer diffusus*	-	-	-	-	-
Sparrowlark, Chestnut-backed	*Eremopterix leucotis*	-	-	-	-	Moderate
Sparrow-Weaver, White-browed	***Plocepasser mahali***	**-**	**-**	**-**	**-**	**Moderate**
Spoonbill, African	*Platalea alba*	-	-	Moderate	-	-
Spurfowl, Swainson's	*Pternistis swainsonii*	-	-	Moderate	-	-
Starling, Cape Glossy	*Lamprotornis nitens*	-	-	-	-	-
Stilt, Black-winged	*Himantopus himantopus*	-	-	-	-	-
Stint, Little	*Calidris minuta*	-	-	-	-	-
Stork, Abdim's	*Ciconia abdimii*	Near-threatened	-	-	Moderate	Moderate
Stork, Black	*Ciconia nigra*	Vulnerable	-	High	Moderate	-
Stork, Yellow-billed	*Mycteria ibis*	Endangered	-	Moderate	-	Moderate
Sunbird, Dusky	*Cinnyris fuscus*	-	Near-endemic	-	-	Moderate
Swallow, Barn	*Hirundo rustica*	-	-	-	-	Moderate
Swallow, Greater-striped	*Cecropis cucullata*	-	-	-	-	Moderate
Swallow, Red-breasted	*Cecropis semirufa*	-	-	-	-	-
Swallow, White-throated	*Hirundo albigularis*	-	-	-	-	Moderate
Swift, African Black	*Apus barbatus*	-	-	-	-	-
Swift, Little	***Apus affinis***	**-**	**-**	**-**	**-**	**-**
Swift, White-rumped	*Apus caffer*	-	-	-	-	-
Tchagra, Brown-crowned	*Tchagra australis*	-	-	-	-	Moderate
Teal, Cape	*Anas capensis*	-	-	Moderate	-	-
Teal, Red-billed	*Anas erythrorhyncha*	-	-	Moderate	-	-
Tern, Whiskered	*Chlidonias hybrida*	-	-	-	-	-
Tern, White-winged	*Chlidonias leucopterus*	-	-	-	-	-
Thrush, Karoo	*Turdus smithii*	-	Endemic	-	-	Moderate
Tit, Cape Penduline-	*Anthoscopus minutus*	-	Near-endemic	-	-	Moderate

Tit-Babbler, Chestnut-vented	***Sylvia subcaerulea***	**-**	**Near-endemic**	**-**	**-**	**Moderate**
Vulture, Cape	*Gyps coprotheres*	Endangered	Near-endemic	High	High	-
Vulture, White-backed	***Gyps africanus***	**Critically Endangered**	**-**	**High**	**High**	**-**
Wagtail, Cape	*Motacilla capensis*	-	-	-	-	-
Warbler, Lesser Swamp	*Acrocephalus gracilirostris*	-	-	-	-	-
Waxbill, Black-faced	*Estrilda erythronotos*	-	-	-	-	Moderate
Waxbill, Common	*Estrilda astrild*	-	-	-	-	Moderate
Waxbill, Violet-eared	*Uraeginthus granatinus*	-	-	-	-	Moderate
Weaver, Sociable	*Philetairus socius*	-	Endemic	-	-	Moderate
Wheatear, Capped	*Oenanthe pileata*	-	-	-	-	Moderate
Whydah, Long-tailed Paradise	***Vidua paradisaea***	**-**	**-**	**-**	**-**	**Moderate**
Whydah, Pin-tailed	*Vidua macroura*	-	-	-	-	Moderate
Whydah, Shaft-tailed	*Euplectes progne*	-	Near-endemic	-	-	Moderate
Widowbird, Long-tailed	*Euplectes progne*	-	-	-	-	Moderate
Woodpecker, Golden-tailed	*Campethera abingoni*	-	-	-	-	Moderate
Wren-Warbler, Barred	*Calamonastes fasciolatus*	-	Near-endemic	-	-	Moderate