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ENVIRONMENTAL IMPACT ASSESSMENT FOR THE  
PROPOSED KLONDIKE SOLAR PV DEVELOPMENT, VRYBURG,  
NORTH WEST PROVINCE:  
**AVIFAUNAL SPECIALIST SCOPING STUDY**

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Produced for Cape EAPrac on behalf of AMDA Developments by:



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## EXECUTIVE SUMMARY

AMDA is proposing the establishment of three 75 MW commercial photovoltaic (PV) solar energy facilities on the Remainder of Farm Klondike 670 near Vryburg in the North West Province. Cape EAPrac have been appointed as independent environmental assessment practitioners to conduct the required EIA process and have appointed Simon Todd Consulting to provide an avifaunal scoping study of the study area. The development will consist of the AMDA Delta, AMDA Echo and AMDA Foxtrot facilities, with a net generating capacity of 75 MW each and would consist of solar panels covering an area of 250 hectares each, an on-site substation, auxiliary buildings, access and internal roads and a 132kV power line linking the facility to the national grid. As part of the required EIA process, this avifaunal specialist scoping study describes and details the avian ecological features of the proposed site and provides an assessment of the avian ecological sensitivity of the site and provides a preliminary assessment of the likely impacts associated with the development.

Up to 218 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 36 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 only major feature of high significance for avifauna at the site is a pan, which has been excluded from the development footprint.

The study area and more specifically the proposed development areas 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 in the broader impact zone of the development – Secretarybird and Abdim's Stork – and one species within the study area – European Roller - the area is not considered critical for their conservation and the extent of habitat loss for these species would be considered low.

The development will pose several impacts to avifauna, including: a **low** displacement impact caused by disturbance and habitat destruction associated with construction and maintenance activities of the proposed facilities and 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 proposed Klondike developments and their associated power infrastructure is likely to have a **medium-low** impact on priority species and general avifauna occurring in the study area and broader impact zone of the development. The current layout for assessment in the scoping phase has been informed by an ecological screening exercise at the site, aimed at reducing the negative impacts of the development

and is a key measure that has been successful in reducing the likely avifaunal impacts of the development of the three facilities at the site.

The various identified impacts will be assessed in detail in the EIA phase, based on the final layout of the three developments in relation to the various avifaunal features and habitats present at the site. Mitigation and avoidance measures that should be implemented to reduce the impact of the development will be investigated in the EIA, based on the final layout of the development and other relevant technical features of the facilities.

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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 Cape EAPrac for this project.
- Do not have any personal, business or financial interest in the project except 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.

March 2016

## **1. INTRODUCTION**

### **1.1. BACKGROUND**

AMDA Developments (Pty) Ltd, a renewable energy developer, is proposing the establishment of three 75 MW commercial photovoltaic (PV) solar energy facilities on the Remainder of Farm Klondike 670 near Vryburg in the North West Province. The developments will be known as the AMDA Delta, AMDA Echo and AMDA Foxtrot Power Plants, each with their own associated special purpose vehicle to bring the projects to financial close.

The National Environmental Management Act (NEMA) (Act 107 of 1998) requires that an Environmental Impact Assessments (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 minimize 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, AMDA Developments (Pty) Ltd has appointed Cape EAPrac as independent environmental assessment practitioners. As part of the specialist studies required for the EIA, Cape EAPrac has enlisted Simon Todd Consulting to provide an avifaunal scoping study of the developable area.

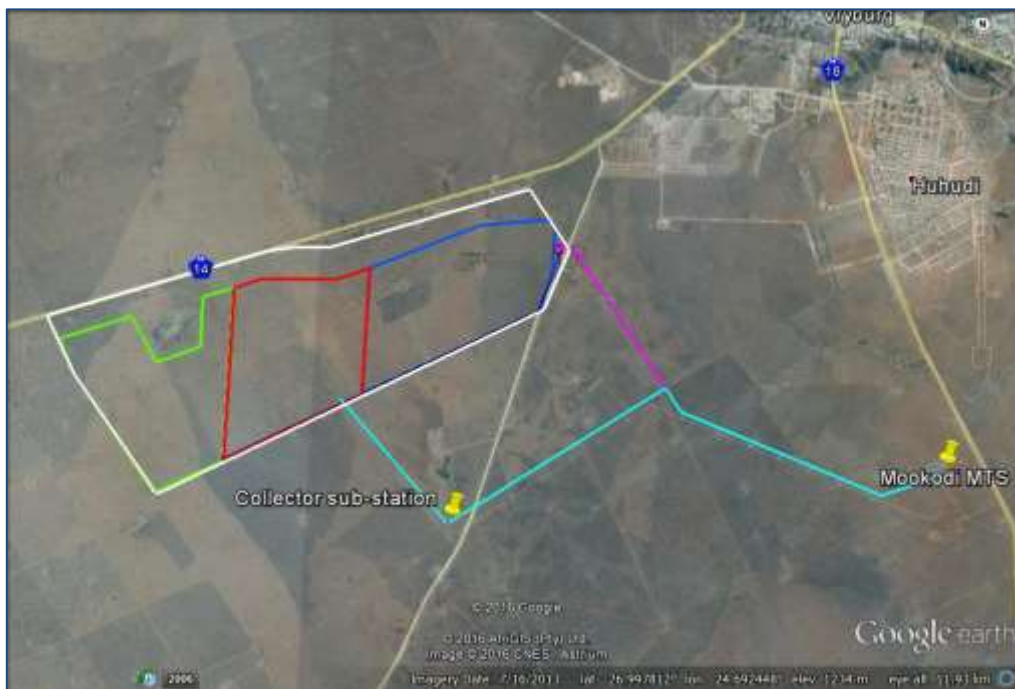
The purpose of the avifaunal specialist scoping study is to describe and detail the avian ecological features of the proposed site, provide an assessment of the avian ecological sensitivity of the site, identify and provide a preliminary assessment of the likely impacts associated with the development. Although each of the three projects would require their own authorisation and hence EIA report, a single scoping report which covers all three reports is provided here for the Scoping phase because the sites are adjacent to one another and in terms of avifauna, there is little to differentiate the three facilities in terms of avifaunal impacts and avifaunal impacts are considered in light of the development as a whole.

### **1.2. RELEVANT ASPECTS OF THE DEVELOPMENT**

- The proposed developable area of the three developments (Delta, Echo and Foxtrot) that make up the Klondike SEF is located on Remainder of Farm Klondike 670 and has a total extent of 1 143 ha.
- Each development is planned and designed with a net generating capacity of 75 MW.



- The proposed developable area required to meet the proposed capacity will cover an area of 250 ha for each development.
- Grid connection will be via a 132kV power line from the on-site substation south east to the Eskom Mookodi MTS substation. Two grid connection options exist:
  - Grid Connection 1: runs south east from the eastern side of the development, with the on-site substation being located on Delta. Length of line  $\pm$  5.9 km.
  - Grid Connection 2: runs south east from the centre of the development to a collector substation, with the on-site substation being located on Echo. Length of line  $\pm$  8.7 km.
- Infrastructure associated with the SEF is likely to include:
  - PV and/or concentrated 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 Klondike SEF illustrating the property boundaries (white), preferred site layouts (Delta = Blue, Echo = Red and Foxtrot = Green) and grid connection to the Eskom Mookodi substation (Grid Con 1 = Purple and Grid Con 2 = Light blue).

### 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 Conservation 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 specialist scoping 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 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 within the avifaunal specialist scoping study in terms of the following criteria:
  - The **nature**, which includes a description of what causes the effect, what will be affected and how it will be affected.
  - The **extent**, wherein it is indicated whether the impact will be local (limited to the immediate area or site of development), regional, national or international.
- A statement regarding the potential significance of the identified issues based on the evaluation of the issues/impacts.
- Identification of potentially significant impacts to be assessed within the EIA phase and the details of the methodology to be adopted in assessing these impacts. This should be detailed enough to be included within the Plan of Study for the EIA and

include a description of the proposed method of assessing the potential environmental impacts associated with the development.

## 1.5. STUDY METHODOLOGY

### 1.5.1. Approach

The avifaunal specialist scoping 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 (26-28 February 2016) to determine the *in situ* local avifauna and avian habitats present on 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.
- A final statement on the overall significance of the potential impacts of the development on the avifauna of the area will be written up.

### 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) 2624DC (51 cards) and 2724BA (9 cards) as well as the Southern African Bird Atlas Project 2 (SABAP 2; <http://sabap2.adu.org.za/index.php>) pentads 2655\_2435 (2 cards), 2655\_2440 (41 cards), 2700\_2435 (1 card) and 2700\_2440 (4 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 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 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.

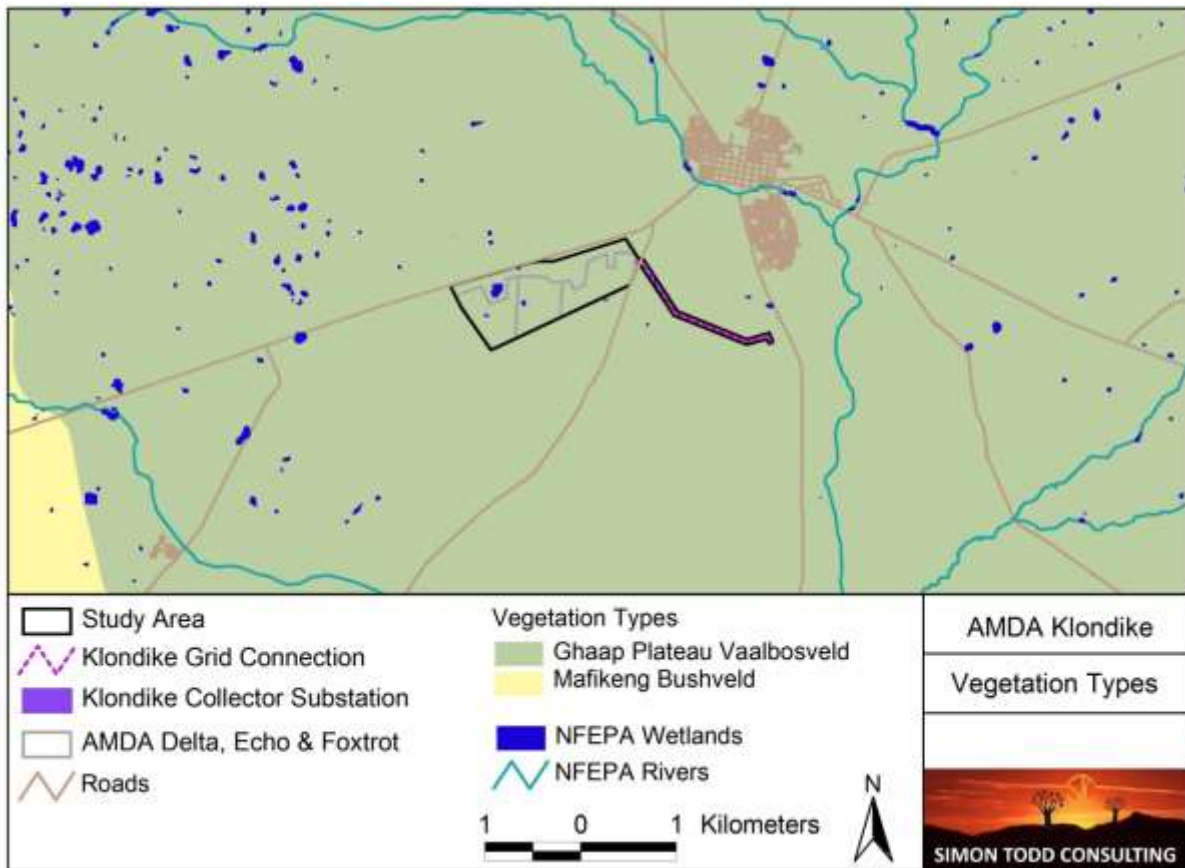
The site visit as well as personal experience of the avifauna of the area and of similar species in different parts of South Africa, through the specialist's experience working across the country, goes some way to remedying any knowledge deficiencies.

## 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 (Figure 2). 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.





**Figure 2.** Extract of the national vegetation map for the study area, showing the site within the Ghaap Plateau Vaalbosveld vegetation type.

## 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:

- *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).

- *Cultivated/modified land*: This habitat unit occurs intermittently throughout the study area and 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.
- *Ephemeral pan*: There is one ephemeral pan (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 surrounding the pan supports larger trees (i.e. structural and compositional variation and potential roosting and nesting sites).

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.



**Figure 3:** Vaalbos shrubland (left) is considered relatively low sensitivity due to low avifaunal diversity and use of these areas, while the Cultivated/modified land (right), has been impacted but remains relatively important for avifauna for foraging and where larger trees are present, this also provide structural diversity.





**Figure 4:** Patches of Bushveld, dominated by *Grewia flava* and *Tarchonanthus camphoratus*, left and areas with a higher density of trees, right, especially *Searsia lancea* and *Acacia tortillis*.

### 2.3. AVIFAUNA

Up to 218 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 36 near-endemic species. Of these, 53 species were recorded during the site visit, most notable of which being the sightings of Secretarybird *Sagittarius serpentarius* and Abdim's Stork *Ciconia abdimii* just outside of the study area and European Roller *Coracias garrulus* within the study area.

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, Abdim's Stork, Black Stork *Ciconia nigra* and Blue Crane *Anthropoides paradiseus*), resident or passing raptors (Martial Eagle *Polemaetus bellicosus*, Tawny Eagle *Aquila rapax*, Lanner Falcon *Falco biarmicus* and Red-footed Falcon *Falco vespertinus*) and transient waterbirds (Greater Flamingo *Phoenicopterus ruber*, Lesser Flamingo *Phoenicopterus minor* and Yellow-billed Stork *Mycteria ibis*).

At the time of the site visit (26-28 February 2016) bird species diversity and abundance was high in both the *Bushveld* and *Cultivated/modified land* habitat units. Similarly so, outside of the study area, within the broader impact zone of the development, *Cultivated/modified land* supported large aggregations of Abdim's Stork. This species forages on irrigated lands, pastures and recently ploughed fields and is also attracted to areas following insect emergences.

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, Secretarybird and Abdim's Stork were recorded within the broader impact zone of the development, while one species, European Roller, was recorded within the study area.

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, is moderate and negative impacts would be of local significance only.

**Table 1:** Priority species list considered central to the avifaunal impact study for the proposed Klondike SEF, 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	<i>Ardeotis kori</i>	Near-threatened	-	Low	Dry open savanna woodland, dwarf shrubland and occasionally grassland	Low	Collision
Cursorer, Burchell's	<i>Cursorius rufus</i>	Vulnerable	Near-endemic	Moderate	Sparsely vegetated arid regions	Moderate	Habitat loss/disturbance
Crane, Blue	<i>Anthropoides paradiseus</i>	Near-threatened	Endemic	Low	Grasslands, but also in wetlands, cultivated pastures and croplands	Moderate	Collision
Duck, Maccoa	<i>Oxyura maccoa</i>	Near-threatened	-	Moderate	Inland water bodies with emergent vegetation; flyover	Low	Habitat loss/disturbance
Eagle, Martial	<i>Polemaetus bellicosus</i>	Endangered	-	Low	Open savanna and woodland on plains, also semi-arid shrublands	Moderate	Collision; electrocution
Eagle, Tawny	<i>Aquila rapax</i>	Endangered	-	Moderate	Open savanna woodland	Moderate	Habitat loss/disturbance; electrocution
Falcon, Lanner	<i>Falco biarmicus</i>	Vulnerable	-	Low	Open grassland or woodland near cliff or electricity pylons	Low	Habitat loss/disturbance; collisions
Falcon, Red-footed	<i>Falco vespertinus</i>	Near-threatened	-	High	Open semi-arid and arid savannas	High	Habitat loss / disturbance
Flamingo, Greater	<i>Phoenicopterus ruber</i>	Near-threatened	-	Moderate	Saline or brackish water bodies; flyover		Collisions
Flamingo, Lesser	<i>Phoenicopterus minor</i>	Near-threatened	-	Moderate	Eutrophic shallow wetlands, salt pans; flyover	Moderate	Collisions
Roller, European	<i>Coracias garrulus</i>	Near-threatened	-	Low	Open woodlands	Moderate	Habitat loss / disturbance
Secretarybird	<i>Sagittarius serpentarius</i>	Vulnerable	-	Moderate	Open grassland with scattered trees and shrubs	High	Habitat loss/disturbance; collisions
Stork, Abdim's	<i>Ciconia abdimii</i>	Near-threatened	-	Moderate	Grassland, savanna woodland and cultivated lands	Moderate	Habitat loss/disturbance; collisions
Stork, Black	<i>Ciconia nigra</i>	Vulnerable	-	Moderate	Mountainous regions	Moderate	Collision; electrocution
Stork, Yellow-billed	<i>Mycteria ibis</i>	Endangered	-	Low	Inland freshwater bodies, occasionally in estuaries	Moderate	Habitat loss/disturbance
Vulture, Cape	<i>Gyps coprotheres</i>	Endangered	Near-endemic	Low	Mountainous regions, but range widely in surrounding areas	Low	Habitat loss/disturbance; collisions; electrocutions
Vulture, White-backed	<i>Gyps africanus</i>	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 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 *Medium-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 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 degree of degradation throughout.

One section, the *Ephemeral pan*, was assessed as being of *Very High* sensitivity. This habitat unit provides the only source of surface water in the area and supports a number of large trees surrounding the pan – which could potentially be important for roosting and nesting.



**Figure 5:** Avian site sensitivity map of the Klondike SEF illustrating the property boundaries (white) and preferred site layouts (Delta = Blue, Echo = Red and Foxtrot = Green). 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, and 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. 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). Electrocutation 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.

#### *Habitat destruction and disturbance associated with the construction and maintenance of power lines, substations and service roads*

During the construction phase and maintenance of power lines, substations and service roads, some habitat destruction and alteration inevitably takes place. These activities have an impact on birds breeding, foraging and roosting in close proximity to the servitude through the modification of habitats and disturbance, particularly during breeding activities.

### 3.2. PROJECT SPECIFIC ASSESSMENT OF IMPACTS

Specific impacts of the proposed Klondike SEF 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 and Lanner Falcon – 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 KLONDIKE SOLAR ENERGY FACILITY

#### *Habitat loss due to construction and maintenance activities*

**Nature:** All construction and maintenance activities would result in a loss of vegetation and habitat affecting endemic passerines, large terrestrial species and raptors through site clearance for solar panels and power infrastructure, the construction of internal roads and the establishment of auxiliary buildings.

**Extent:** The total extent of the development is relatively low and would result in a concentrated local impact on avifauna up to a few hundred hectares. Within this area, the impact is likely to be relatively high, but if appropriate areas within the site are used, then it is not likely that the developments would have an impact on avifauna beyond the local on-site scale.

**Potential significance:** Habitat loss is likely to have a **low** impact due to the relatively small spatial extent of the proposed development.

*Disturbance during construction and maintenance activities*

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

**Extent:** The extent of this impact would largely be restricted to the local on-site scale, but may also impact bird species within a nearby radius of the development area.

**Potential Significance:** Disturbance and displacement during the construction phase is likely to be **medium** as a result of vegetation clearing, noise and human presence. However, during the operational phase, impacts are likely to be of **low** significance given the low activity levels which will occur at this time.

*Collisions with power line infrastructure and solar panels*

**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 bustards, storks, korhaans and certain raptors. Similarly so, but less of a threat, avifauna can be disorientated by the reflected light and confuse solar arrays for large bodies of water and attempt to land on them and injure/kill themselves in the process.

**Extent:** The extent of this impact would be local-regional, as transient birds may be affected as well.

**Potential Significance:** Collisions with power lines are likely to have a **medium** impact, as even with mitigation, it is envisaged that mortalities will still occur.

*Avian electrocutions on power infrastructure*

**Nature:** 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). 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.

**Extent:** The extent of this impact would be local-regional, as transient birds may be affected as well.



**Potential Significance:** Avian electrocutions are likely to have a **low** impact, as mitigation measures are usually effective in greatly reducing this impact.

### 3.4. ASSESSMENT OF SITE SENSITIVITY

There are not different site or layout options being considered for each development, but the chosen development areas were identified based on a screening process aimed at minimising the impact of each development within the context of the site and the constraints on the available space. The following is a description of the site layout options in terms of their avian sensitivity.

#### **AMDA Delta layout**

The Delta site layout falls half within a *Medium* sensitivity area and half within a *Medium-Low* sensitivity area. Bird species diversity and abundance was relatively high within this area due to the varying habitat units within the site layout (*Bushveld*, *Cultivated/modified land* and *Vaalbos shrubland*). Development in this site layout is therefore expected to have a medium impact on avifauna.

#### **AMDA Echo layout**

The majority of the Echo site layout falls within *Medium-Low* sensitivity areas, associated with the *Cultivated/modified land* and *Vaalbos shrubland* habitat units. A small portion of the site falls within the *Bushveld* habitat unit which is considered to have a *Medium* sensitivity. Development in this site layout is expected to have a medium-low impact on avifauna as bird diversity and abundance was not that high in this section of the study area.

#### **AMDA Foxtrot layout**

The Foxtrot site layout falls entirely within a *Medium-Low* sensitivity area associated with the *Vaalbos shrubland* habitat unit. The lack of structural and compositional variation in the vegetation in this habitat unit meant that the diversity and abundance of bird species recorded in this section of the study area was low. Development in this site layout is therefore expected to have a low impact on avifauna.

## 4. CONCLUSION

The study area and more specifically the proposed development area 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 in the broader impact zone of the development – Secretarybird and Abdim's Stork – and one species within the study area – European Roller – the area is not considered

critical for their conservation and the extent of habitat loss for these species would be considered low.

The proposed Klondike facilities and their associated power infrastructure has been assessed as having a **medium-low** impact on priority species and general avifauna occurring in the study area and broader impact zone of the development. Factors resulting in the relatively low impact include the proximity of the site to Vryburg as well as the low structural diversity of the Vaalbosveld which occupies a significant proportion of the site. There were no breeding sites of large raptors or other species of concern observed within the study area and it is not considered to be locally or regionally of above average significance value for avifauna.

The development will pose several impacts to avifauna, including: a **low** displacement impact caused by disturbance and habitat destruction associated with construction and maintenance activities of the proposed SEF 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. These impacts will be assessed in detail in the EIA phase, based on the final layout of the three developments in relation to the various avifaunal features and habitats present at the site. Mitigation and avoidance measures that should be implemented to reduce the impact of the development will be investigated in the EIA, based on the final layout of the development and other technical features of the facilities.

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## 6. APPENDIX

**Appendix 1:** Consolidated species list of the proposed Klondike SEF, 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	Susceptibility to		
				Collision	Electrocution	Disturbance / habitat loss
Avocet, Pied	<i>Recurvirostra avosetta</i>	-	-	-	-	-
Babbler, Southern Pied	<i>Turdoides bicolor</i>	-	Endemic	-	-	Moderate
<b>Barbet, Acacia Pied</b>	<b><i>Tricholaema leucomela</i></b>	-	<b>Near-endemic</b>	-	-	<b>Moderate</b>
<b>Barbet, Black-collared</b>	<b><i>Lybius torquatus</i></b>	-	-	-	-	<b>Moderate</b>
<b>Barbet, Crested</b>	<b><i>Trachyphonus vaillantii</i></b>	-	-	-	-	<b>Moderate</b>
Batis, Pirit	<i>Batis pririt</i>	-	Near-endemic	-	-	Moderate
<b>Bee-eater, European</b>	<b><i>Merops apiaster</i></b>	-	-	-	-	-
Bee-eater, Little	<i>Merops pusillus</i>	-	-	-	-	Moderate
Bee-eater, Swallow-tailed	<i>Merops hirundineus</i>	-	-	-	-	-
Bishop, Southern Red	<i>Euplectes orix</i>	-	-	-	-	-
Bishop, Yellow-crowned	<i>Euplectes afer</i>	-	-	-	-	Moderate
Bokmakierie	<i>Telophorus zeylonus</i>	-	Near-endemic	-	-	Moderate
<b>Brubru</b>	<b><i>Nilaus afer</i></b>	-	-	-	-	<b>Moderate</b>
Bulbul, African Red-eyed	<i>Pycnonotus capensis</i>	-	Near-endemic	-	-	Moderate
Bunting, Cinnamon-breasted	<i>Emberiza tahapisi</i>	-	-	-	-	Moderate
<b>Bunting, Golden-breasted</b>	<b><i>Emberiza flaviventris</i></b>	-	-	-	-	<b>Moderate</b>
Bunting, Lark-like	<i>Emberiza impetuani</i>	-	Near-endemic	-	-	Moderate
Bustard, Kori	<i>Ardeotis kori</i>	Near-threatened	-	High	-	Moderate
Buzzard, Common	<i>Buteo buteo</i>	-	-	Moderate	Moderate	-
Canary, Black-throated	<i>Crithagra atrogularis</i>	-	-	-	-	Moderate

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Canary, Yellow	<i>Crithagra flaviventris</i>	-	Near-endemic	-	-	Moderate
<b>Chat, Ant-eating</b>	<b><i>Myrmecocichla formicivora</i></b>	-	<b>Endemic</b>	-	-	<b>Moderate</b>
Chat, Familiar	<i>Cercomela familiaris</i>	-	-	-	-	-
Cisticola, Desert	<i>Cisticola aridulus</i>	-	-	-	-	Moderate
Cisticola, Levaillant's	<i>Cisticola tinniens</i>	-	-	-	-	-
<b>Cisticola, Rattling</b>	<b><i>Cisticola chiniana</i></b>	-	-	-	-	-
<b>Cisticola, Zitting</b>	<b><i>Cisticola juncidis</i></b>	-	-	-	-	<b>Moderate</b>
Cliff-Swallow, South African	<i>Petrochelidon spilodera</i>	-	Endemic	-	-	Moderate
Coot, Red-knobbed	<i>Fulica cristata</i>	-	-	-	-	-
<b>Cormorant, Reed</b>	<b><i>Microcarbo africanus</i></b>	-	-	<b>Moderate</b>	-	-
Cormorant, White-breasted	<i>Phalacrocorax lucidus</i>	-	-	Moderate	-	-
Coucal, Burchell's	<i>Centropus burchellii</i>	-	Near-endemic	-	-	Moderate
Cursorer, Burchell's	<i>Cursorius rufus</i>	Vulnerable	Near-endemic	-	-	Moderate
Cursorer, Double-banded	<i>Rhinoptilus africanus</i>	-	-	-	-	Moderate
Crake, Black	<i>Amaurornis flavirostra</i>	-	-	-	-	-
Crane, Blue	<i>Anthropoides paradiseus</i>	Near-threatened	Endemic	High	-	-
<b>Crombec, Long-billed</b>	<b><i>Sylvietta rufescens</i></b>	-	-	-	-	<b>Moderate</b>
Crow, Pied	<i>Corvus ablus</i>	-	-	Moderate	Moderate	-
<b>Cuckoo, Diederick</b>	<b><i>Chrysococcyx caprius</i></b>	-	-	-	-	<b>Moderate</b>
Cuckoo, Jacobin	<i>Clamator jacobinus</i>	-	-	-	-	Moderate
<b>Cuckoo, Klaas's</b>	<b><i>Chrysococcyx klaas</i></b>	-	-	-	-	<b>Moderate</b>
Curlew, Eurasian	<i>Numenius arquata</i>	-	-	-	-	-
Darter, African	<i>Anhinga rufa</i>	-	-	Moderate	-	-
<b>Dove, Cape Turtle</b>	<b><i>Streptopelia capicola</i></b>	-	-	-	-	-
<b>Dove, Laughing</b>	<b><i>Spilopelia senegalensis</i></b>	-	-	-	-	-
<b>Dove, Namaqua</b>	<b><i>Oena capensis</i></b>	-	-	-	-	<b>Moderate</b>
Dove, Red-eyed	<i>Streptopelia semitorquata</i>	-	-	-	-	Moderate
Dove, Rock	<i>Columba livia</i>	-	-	-	-	-
<b>Drongo, Fork-tailed</b>	<b><i>Dicrurus adsimilis</i></b>	-	-	-	-	-
Duck, African Black	<i>Anas sparsa</i>	-	-	Moderate	-	-

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Duck, Knob-billed	<i>Sarkidiornis melanotos</i>	-	-	Moderate	-	-
Duck, Maccoa	<i>Oxyura maccoa</i>	Near-threatened	-	Moderate	-	-
Duck, White-faced	<i>Dendrocygna viduata</i>	-	-	Moderate	-	-
Duck, Yellow-billed	<i>Anas undulata</i>	-	-	Moderate	-	-
Eagle, African Fish	<i>Haliaeetus vocifer</i>	-	-	Moderate	Moderate	-
Eagle, Martial	<i>Polemaetus bellicosus</i>	Endangered	-	High	High	Moderate
Eagle, Tawny	<i>Aquila rapax</i>	Endangered	-	High	Moderate	Moderate
Eagle-Owl, Spotted	<i>Bubo africanus</i>	-	-	-	High	Moderate
Egret, Little	<i>Egretta garzetta</i>	-	-	-	-	-
<b>Egret, Western Cattle</b>	<b><i>Bubulcus ibis</i></b>	-	-	-	-	-
<b>Eremomela, Yellow-bellied</b>	<b><i>Eremomela icteropygialis</i></b>	-	-	-	-	<b>Moderate</b>
Falcon, Lanner	<i>Falco biarmicus</i>	Vulnerable	-	High	Moderate	-
Falcon, Red-footed	<i>Falco vespertinus</i>	Near-threatened	-	-	-	Moderate
Finch, Red-headed	<i>Amadina erythrocephala</i>	-	Near-endemic	-	-	Moderate
Finch, Scaly-feathered	<i>Sporopipes squamifrons</i>	-	Near-endemic	-	-	Moderate
Firefinch, Red-billed	<i>Lagonosticta senegala</i>	-	-	-	-	Moderate
<b>Fiscal, Common</b>	<b><i>Lanius collaris</i></b>	-	-	-	-	-
Flamingo, Greater	<i>Phoenicopterus ruber</i>	Near-threatened	-	High	-	-
Flamingo, Lesser	<i>Phoenicopterus minor</i>	Near-threatened	-	High	-	-
Flycatcher, African Paradise-	<i>Terpsiphone viridis</i>	-	-	-	-	Moderate
Flycatcher, Chat	<i>Bradornis infuscatus</i>	-	Near-endemic	-	-	Moderate
Flycatcher, Fairy	<i>Stenostira scita</i>	-	Endemic	-	-	Moderate
<b>Flycatcher, Fiscal</b>	<b><i>Sigelus silens</i></b>	-	<b>Endemic</b>	-	-	<b>Moderate</b>
Flycatcher, Marico	<i>Bradornis mariquensis</i>	-	Near-endemic	-	-	Moderate
<b>Flycatcher, Spotted</b>	<b><i>Muscicapa striata</i></b>	-	-	-	-	-
Francolin, Orange River	<i>Scleroptila lewaillantoides</i>	-	Near-endemic	-	-	Moderate
<b>Goose, Egyptian</b>	<b><i>Alopochen aegyptiaca</i></b>	-	-	<b>High</b>	<b>High</b>	-
Goose, Spur-winged	<i>Plectropterus gambensis</i>	-	-	Moderate	-	-
<b>Goshawk, Southern Pale</b>	<b><i>Melierax canorus</i></b>	-	<b>Near-endemic</b>	-	<b>Moderate</b>	<b>Moderate</b>

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<b>Chanting</b>						
Grebe, Great Crested	<i>Podiceps cristatus</i>	-	-	-	-	-
Grebe, Little	<i>Tachybaptus ruficollis</i>	-	-	-	-	-
Guineafowl, Helmeted	<i>Numida meleagris</i>	-	-	Moderate	-	-
Gull, Grey-headed	<i>Chroicocephalus cirrocephalus</i>	-	-	-	-	-
Hamerkop	<i>Scopus umbretta</i>	-	-	Moderate	Moderate	-
Harrier-Hawk, African	<i>Polyboroides typus</i>	-	-	Moderate	-	-
<b>Heron, Black-headed</b>	<b><i>Ardea melanocephala</i></b>	-	-	<b>Moderate</b>	<b>Moderate</b>	-
Heron, Grey	<i>Ardea cinerea</i>	-	-	High	High	-
Heron, Purple	<i>Ardea purpurea</i>	-	-	Moderate	Moderate	-
<b>Honeyguide, Greater</b>	<b><i>Indicator indicator</i></b>	-	-	-	-	<b>Moderate</b>
Honeyguide, Lesser	<i>Indicator minor</i>	-	-	-	-	Moderate
Hoopoe, African	<i>Upupa africana</i>	-	-	-	-	-
Hornbill, African Grey	<i>Tockus nasutus</i>	-	-	-	-	-
Hornbill, Southern Yellow-billed	<i>Tockus leucomelas</i>	-	Near-endemic	-	-	Moderate
Ibis, African Sacred	<i>Threskiornis aethiopicus</i>	-	-	Moderate	-	-
Ibis, Glossy	<i>Plegadis falcinellus</i>	-	-	Moderate	-	-
<b>Ibis, Hadedra</b>	<b><i>Bostrychia hagedash</i></b>	-	-	<b>Moderate</b>	<b>Moderate</b>	-
Indigobird, Village	<i>Vidua chalybeata</i>	-	-	-	-	Moderate
Kestrel, Greater	<i>Falco rupicoloides</i>	-	-	-	Moderate	Moderate
Kestrel, Lesser	<i>Falco naumanni</i>	-	-	High	-	Moderate
Kestrel, Rock	<i>Falco rupicolus</i>	-	-	-	-	Moderate
Kingfisher, Brown-hooded	<i>Halycon albiventris</i>	-	-	-	-	Moderate
Kingfisher, Giant	<i>Megaceryle maxima</i>	-	-	-	-	-
Kingfisher, Malachite	<i>Alcedo cristata</i>	-	-	-	-	-
Kingfisher, Pied	<i>Ceryle rudis</i>	-	-	-	-	-
<b>Kite, Black-shouldered</b>	<b><i>Elanus caeruleus</i></b>	-	-	-	-	<b>Moderate</b>
Kite, Yellow-billed	<i>Milvus parasitus</i>	-	-	Moderate	-	-



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<b>Korhaan, Northern Black</b>	<i>Afrotis afroides</i>	-	<b>Endemic</b>	<b>High</b>	-	<b>Moderate</b>
Korhaan, Red-crested	<i>Lophotis ruficrista</i>	-	Near-endemic	Moderate		Moderate
<b>Lapwing, Blacksmith</b>	<i>Vanellus armatus</i>	-	-	-	-	-
<b>Lapwing, Crowned</b>	<i>Vanellus coronatus</i>	-	-	-	-	-
<b>Lark, Eastern Clapper</b>	<i>Mirafra fasciolata</i>	-	<b>Near-endemic</b>	-	-	<b>Moderate</b>
Lark, Fawn-coloured	<i>Calendulauda semitorquata</i>	-	Near-endemic	-	-	Moderate
Lark, Red-capped	<i>Calandrella cinerea</i>	-	-	-	-	Moderate
<b>Lark, Rufous-naped</b>	<i>Mirafra africana</i>	-	-	-	-	<b>Moderate</b>
<b>Lark, Sabota</b>	<i>Calendulauda sabota</i>	-	<b>Near-endemic</b>	-	-	<b>Moderate</b>
Lark, Spike-heeled	<i>Chersomanes albofasciata</i>	-	Near-endemic	-	-	High
Longclaw, Cape	<i>Macronyx capensis</i>	-	Endemic	-	-	Moderate
Mannikin, Bronze	<i>Lonchura cucullata</i>	-	-	-	-	Moderate
Martin, Brown-throated	<i>Riparia paludicola</i>	-	-	-	-	Moderate
Martin, Rock	<i>Ptyonoprogne fuligula</i>	-	-	-	-	Moderate
<b>Masked-Weaver, Southern</b>	<i>Ploceus velatus</i>	-	-	-	-	<b>Moderate</b>
Moorhen, Common	<i>Gallinula chloropus</i>	-	-	-	-	-
Mousebird, Red-faced	<i>Urocolius indicus</i>	-	-	-	-	Moderate
Mousebird, White-backed	<i>Colius colius</i>	-	Endemic	-	-	Moderate
<b>Neddicky</b>	<i>Cisticola fulvicapilla</i>	-	-	-	-	<b>Moderate</b>
Night-Heron, Black-crowned	<i>Nycticorax nycticorax</i>	-	-	-	-	-
Ostrich, Common	<i>Struthio camelus</i>	-	-	-	-	-
Owl, Western Barn	<i>Tyto alba</i>	-	-	Moderate	High	-
Owlet, Pearl-spotted	<i>Glaucidium perlatum</i>	-	-	-	-	Moderate
Palm-Swift, African	<i>Cypsiurus parvus</i>	-	-	-	-	-
Pigeon, Speckled	<i>Columba guinea</i>	-	-	-	-	-
Pipit, African	<i>Anthus cinnamomeus</i>	-	-	-	-	Moderate
Pipit, Buffy	<i>Anthus vaalensis</i>	-	-	-	-	Moderate
Plover, Kittlitz's	<i>Charadrius pecuarius</i>	-	-	-	-	-
Plover, Three-banded	<i>Charadrius tricollaris</i>	-	-	-	-	-

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Pochard, Southern	<i>Netta erythrophthalma</i>	-	-	Moderate	-	-
Prinia, Black-chested	<i>Prinia flavicans</i>	-	Near-endemic	-	-	Moderate
Pytilia, Green-winged	<i>Pytilia melba</i>	-	-	-	-	Moderate
Quail, Common	<i>Coturnix coturnix</i>	-	-	-	-	-
Quailfinch, African	<i>Ortygospiza fuscocrissa</i>	-	-	-	-	Moderate
Quelea, Red-billed	<i>Quelea quelea</i>	-	-	-	-	-
Reed-Warbler, Great	<i>Acrocephalus arundinaceus</i>	-	-	-	-	-
Robin-chat, Cape	<i>Cossypha caffra</i>	-	-	-	-	-
<b>Roller, European</b>	<b><i>Coracias garrulus</i></b>	<b>Near-threatened</b>	-	-	-	<b>Moderate</b>
Roller, Lilac-breasted	<i>Coracias caudatus</i>	-	-	-	-	-
Roller, Purple	<i>Coracias naevius</i>	-	-	-	-	Moderate
Ruff	<i>Philomachus pugnax</i>	-	-	-	-	-
Sandgrouse, Burchell's	<i>Pterocles burchelli</i>	-	Near-endemic	-	-	Moderate
Sandgrouse, Namaqua	<i>Pterocles namaqua</i>	-	Near-endemic	-	-	Moderate
Sandpiper, Common	<i>Actitis hypoleucos</i>	-	-	-	-	-
Sandpiper, Curlew	<i>Calidris ferruginea</i>	-	-	-	-	-
Sandpiper, Marsh	<i>Tringa stagnatilis</i>	-	-	-	-	-
Sandpiper, Wood	<i>Tringa glareola</i>	-	-	-	-	-
<b>Scimitarbill, Common</b>	<b><i>Rhinopomastus cyanomelas</i></b>	-	-	-	-	<b>Moderate</b>
<b>Scrub-Robin, Kalahari</b>	<b><i>Erythropygia paena</i></b>	-	<b>Near-endemic</b>	-	-	<b>Moderate</b>
<b>Secretarybird</b>	<b><i>Sagittarius serpentarius</i></b>	<b>Vulnerable</b>	-	<b>High</b>	-	<b>Moderate</b>
Shelduck, South African	<i>Tadorna cana</i>	-	Endemic	Moderate	-	-
Shoveler, Cape	<i>Anas smithii</i>	-	Near-endemic	Moderate	-	-
Shrike, Crimson-breasted	<i>Laniarius atrococcineus</i>	-	Near-endemic	-	-	Moderate
<b>Shrike, Lesser Grey</b>	<b><i>Lanius minor</i></b>	-	-	-	-	-
Shrike, Red-backed	<i>Lanius collurio</i>	-	-	-	-	-
Snake-Eagle, Black-chested	<i>Circaetus pectoralis</i>	-	-	-	Moderate	Moderate
Snipe, African	<i>Gallinago nigripennis</i>	-	-	-	-	-

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Sparrow, Cape	<i>Passer melanurus</i>	-	Near-endemic	-	-	-
Sparrow, Great	<i>Passer motitensis</i>	-	Near-endemic	-	-	Moderate
<b>Sparrow, House</b>	<b><i>Passer domesticus</i></b>	-	-	-	-	-
Sparrowlark, Chestnut-backed	<i>Eremopterix leucotis</i>	-	-	-	-	Moderate
Sparrowlark, Grey-backed	<i>Eremopterix verticalis</i>	-	Near-endemic	-	-	Moderate
Sparrow-Weaver, White-browed	<i>Plocepasser mahali</i>	-	-	-	-	Moderate
Spoonbill, African	<i>Platalea alba</i>	-	-	Moderate	-	-
<b>Spurfowl, Swainson's</b>	<b><i>Pternistis swainsonii</i></b>	-	-	<b>Moderate</b>	-	-
Starling, Burchell's	<i>Lamprotornis australis</i>	-	Near-endemic	-	-	Moderate
<b>Starling, Cape Glossy</b>	<b><i>Lamprotornis nitens</i></b>	-	-	-	-	-
Starling, Wattled	<i>Creatophora cinerea</i>	-	-	-	-	-
Stilt, Black-winged	<i>Himantopus himantopus</i>	-	-	-	-	-
Stint, Little	<i>Calidris minuta</i>	-	-	-	-	-
Stonechat, African	<i>Saxicola torquatus</i>	-	-	-	-	-
<b>Stork, Abdim's</b>	<b><i>Ciconia abdimii</i></b>	<b>Near-threatened</b>	-	-	<b>Moderate</b>	<b>Moderate</b>
Stork, Black	<i>Ciconia nigra</i>	Vulnerable	-	High	Moderate	-
Stork, Yellow-billed	<i>Mycteria ibis</i>	Endangered	-	Moderate	-	Moderate
Sunbird, Dusky	<i>Cinnyris fuscus</i>	-	Near-endemic	-	-	Moderate
Sunbird, Marico	<i>Cinnyris mariquensis</i>	-	-	-	-	Moderate
Sunbird, White-bellied	<i>Cinnyris talatala</i>	-	-	-	-	Moderate
<b>Swallow, Barn</b>	<b><i>Hirundo rustica</i></b>	-	-	-	-	<b>Moderate</b>
Swallow, Greater-striped	<i>Cecropis cucullata</i>	-	-	-	-	Moderate
<b>Swallow, Red-breasted</b>	<b><i>Cecropis semirufa</i></b>	-	-	-	-	-
Swallow, White-throated	<i>Hirundo albigularis</i>	-	-	-	-	Moderate
Swamphen, African Purple	<i>Porphyrio madagascariensis</i>	-	-	-	-	-
Swamp-Warbler, Lesser	<i>Acrocephalus gracilirostris</i>	-	-	-	-	-
<b>Swift, Little</b>	<b><i>Apus affinis</i></b>	-	-	-	-	-
Swift, White-rumped	<i>Apus caffer</i>	-	-	-	-	-

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Tchagra, Brown-crowned	<i>Tchagra australis</i>	-	-	-	-	Moderate
Teal, Cape	<i>Anas capensis</i>	-	-	Moderate	-	-
Teal, Red-billed	<i>Anas erythrorhyncha</i>	-	-	Moderate	-	-
Tern, Whiskered	<i>Chlidonias hybrida</i>	-	-	-	-	-
Tern, White-winged	<i>Chlidonias leucopterus</i>	-	-	-	-	-
<b>Thick-knee, Spotted</b>	<b><i>Burhinus capensis</i></b>	-	-	<b>Moderate</b>	-	<b>Moderate</b>
Thrush, Groundscraper	<i>Psophocichla litsitsirupa</i>	-	-	-	-	Moderate
<b>Thrush, Karoo</b>	<b><i>Turdus smithii</i></b>	-	<b>Endemic</b>	-	-	<b>Moderate</b>
Thrush, Short-toed Rock	<i>Monticola brevipes</i>	-	Near-endemic	-	-	Moderate
Tit, Ashy	<i>Parus cinerascens</i>	-	-	-	-	Moderate
Tit, Cape Penduline-	<i>Anthoscopus minutus</i>	-	Near-endemic	-	-	Moderate
Tit-Babbler, Chestnut-vented	<i>Sylvia subcaerulea</i>	-	Near-endemic	-	-	Moderate
Vulture, Cape	<i>Gyps coprotheres</i>	Endangered	Near-endemic	High	High	-
Vulture, White-backed	<i>Gyps africanus</i>	Critically Endangered	-	High	High	-
Wagtail, Cape	<i>Motacilla capensis</i>	-	-	-	-	-
<b>Warbler, Willow</b>	<b><i>Phylloscopus trochilus</i></b>	-	-	-	-	<b>Moderate</b>
Waxbill, Black-faced	<i>Estrilda erythronotos</i>	-	-	-	-	Moderate
Waxbill, Common	<i>Estrilda astrild</i>	-	-	-	-	Moderate
Waxbill, Violet-eared	<i>Uraeginthus granatinus</i>	-	-	-	-	Moderate
Wheatear, Capped	<i>Oenanthe pileata</i>	-	-	-	-	Moderate
White-eye, Cape	<i>Zosterops capensis</i>	-	Endemic	-	-	Moderate
Whydah, Long-tailed Paradise	<i>Vidua paradisaea</i>	-	-	-	-	Moderate
Whydah, Pin-tailed	<i>Vidua macroura</i>	-	-	-	-	Moderate
Whydah, Shaft-tailed	<i>Euplectes progne</i>	-	Near-endemic	-	-	Moderate
Widowbird, Long-tailed	<i>Euplectes progne</i>	-	-	-	-	Moderate
<b>Woodpecker, Cardinal</b>	<b><i>Dendropicus fuscescens</i></b>	-	-	-	-	<b>Moderate</b>
<b>Woodpecker, Golden-tailed</b>	<b><i>Campethera abingoni</i></b>	-	-	-	-	<b>Moderate</b>