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AN AVIFAUNA SPECIALIST REPORT FOR THE PROPOSED RENEWABLE ENERGY GENERATION PROJECT ON THE FARM RHODES 269, NORTHERN CAPE PROVINCE

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AN AVIFAUNA SPECIALIST REPORT FOR THE PROPOSED RENEWABLE ENERGY GENERATION PROJECT ONTHE FARM RHODES 269, NORTHERN CAPE PROVINCE

AVIFAUNA SPECIALIST STUDY

April 2016

Conducted on behalf of:
MIKO ENERGY (PTY) LTD

Compiled by:

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REPORT DISTRIBUTION LIST

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Ms. E. Grobler	AGES Limpopo

DOCUMENT HISTORY

Date	Version	Status
April 2016	1.0	Final

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1 ASSIGNMENT

Exigo Sustainability was appointed by AGES Limpopo on behalf of MIKO ENERGY (PTY) LTD to conduct an avifauna specialist study for the proposed establishment of a solar energy generation facility to be known as the Rhodes 2 Solar Park with associated and structures on a footprint area of approximately 250 hectares. The Rhodes 2 solar park will be developed on the farm Rhodes 269 (1810.8314 ha), located in the Joe Morolong Local Municipality, John Taolo Gaetsewe District Municipality, Northern Cape Province.

The assignment is interpreted as follows: Compile a study on the avifauna potentially occurring in the project area and determine the potential impacts of the proposed Photovoltaic Power Plant, access road and associated power line on the birds as well as proposed mitigation measures. The study will be done according to guidelines and criteria set by Eskom, Birdlife South Africa (BLSA) and the by Northern Cape (NC) Department of Environmental Affairs and Nature Conservation (DENC) for avifauna studies. The study will include an impact assessment. In order to compile this, the following had to be done:

1.1 Information Sources

The following information sources were obtained:

- Bird distribution data of the Southern African Bird Atlas Project (SABAP – Harrison, Allan, Underhill, Herremans, Tree, Parker & Brown, 1997) obtained from the Avian Demography Unit of the University of Cape Town, in order to ascertain which species occur in the study area. A separate data set was obtained for each quarter degree square covering the study area, in this case only the square 2722BB (marginal overlaps were discounted).
- All relevant maps through GIS mapping, and information (previous studies and environmental databases) on the avifauna of the area concerned.
- Requirements regarding the avifauna study as requested by Eskom and the NC DENC;
- The conservation status of all bird species occurring in the aforementioned degree squares was then determined with the use of The Eskom Red Data book of birds of South Africa, Lesotho and Swaziland (Barnes, 2000).
- A classification of the vegetation types in the Savanna Biome as classified by Mucina & Rutherford (2006).
- Information on the micro-habitat level was obtained through visiting the area and obtaining a firsthand perspective.

1.2 Regulations governing this report

This report has been prepared in terms of Regulation 32 of the National Environmental Management Act (No. 107 of 1998) Regulations GN 33306 GNR 543 for environmental impact assessment. Regulation 33 states that a specialist report must contain:

1. An application or the EAP managing an application may appoint a person to carry out a specialist study or specialized process.
2. The person referred to in sub-regulation 1 must comply with the requirements of regulation 17 (General requirements for EAPs or a person compiling a specialist report or undertaking a specialized process).
3. A specialist report or a report on a specialized process prepared in terms of these regulations must contain:
    a. Details of
        i. The person who prepared the report; and Letter of Appointment
        ii. The expertise of that person to carry out the specialist study or specialized process.
    b. A declaration that the person is independent in a form as may be specified by the competent authority;
    c. An indication of the scope of, and purpose for which, the report was prepared;
    d. A description of the methodology adopted in preparing the report or carrying out the specialized process;
    e. A description of any assumptions made and any uncertainties or gaps in knowledge;
    f. A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment;
    g. Recommendations in respect of any mitigation measures that should be considered by the applicant and competent authority;
    h. A description of any consultation process that was undertaken during the course of carrying out the study;
    i. A summary and copies of any comments that were received during any consultation process;
    j. Any other information requested by the competent authority.

1.3 Terms of reference

1.3.1 Rationale of solar development

South Africa currently relies principally on fossil fuels (coal and oil) for the generation of electricity. At the present date, Eskom generates approximately 95% of the electricity used in South Africa. On the other hand, South Africa has a largely unexploited potential in renewable energy resources such as solar, wind, biomass and hydro-electricity to produce electricity as opposed to other energy types (fuel or coal).

South Africa's electricity supply still heavily relies upon coal power plants, whereas the current number of renewable energy power plants is very limited. In the last few years, the demand for electricity in South Africa has been growing at a rate of approximately 3% per annum. These factors, if coupled with the rapid advancement in community development, have determined the growing consciousness of the significance of environmental impacts, climate change and the need for sustainable development. The use of renewable energy technologies is a sustainable way in which to meet future energy requirements. The development of clean, green and renewable energy has been qualified as a priority by the Government of South Africa with a target goal for 2013 of 10,000 GWh, as planned in the Integrated Resource Plan 1 (IRP1) and with the Kyoto Protocol. Subsequently the Department of Energy of South Africa (DoE) decided to undertake a detailed process to determine South Africa's 20-year electricity plan, called Integrated Resources Plan 2010-2030 (IRP 2010).

The IRP1 (2009) and the IRP 2010 (2011) outline the Government's vision, policy and strategy in matter of the use of energy resources and the current status of energy policies in South Africa.

In particular, the IRP 2010 highlights the necessity of commissioning 1200 MW with solar PV technology by the end of 2015. In order to achieve this goal, in 2011 the DoE announced a Renewable Energy IPP (Independent Power Producers) Procurement Programme. The IPP Procurement Programme, issued on 3rd August 2011, envisages the commissioning of 3725 MW of renewable projects (1450 MW with solar photovoltaic technology) capable of beginning commercial operation before the end of 2017.

The development of PV power plants will represent a key feature in the fulfilment of the proposed target goal and the reduction of CO_2 emissions. The purpose of Rhodes 2 Solar Park is to add new capacity for the generation of renewable electrical energy to the national electricity supply in compliance with the IPP Procurement Programme and in order to meet the "sustainable growth" of the Northern Cape Province. The use of solar radiation for power generation is considered as a non-consumptive use and a renewable natural resource which does not produce greenhouse gas emissions. With specific reference to PV energy and the proposed project, it is important to consider that South Africa has one of the highest levels of solar radiation in the world.

1.3.2 Objectives

1. Determine the number of bird habitats present in the direct area of the proposed development from relevant databases and field surveys (micro-habitats);
2. Determine the potential ecological impacts and actions the development will have on the avifauna populations and provide mitigation measures to limit impacts to a minimum.

1.3.3 Scope

1. Bird habitat survey – in each vegetation type/plant community on site:
   a. After studying the aerial photograph to identify specific bird habitats where micro-habitats might occur to be surveyed and confirm location by making use of a Geographical Positioning System (GPS).
   b. List the potential bird species present and link them to the specific potential habitats that occur as identified in the habitat survey.
   c. List the bird species observed during the field survey as well as specific relevant habitat characteristics.
2. Identify the impact of the proposed development on the avifauna of the area, with specific relevance to the red data birds potentially occurring in the area.
3. Indicate species mitigation measures and management measures to be implemented to prevent any negative impacts on the avifauna of the area.
4. Identify potential problem areas in need of special treatment or management related to the avifauna in the area, e.g. bush encroachment, erosion, degraded areas, reclamation areas.
5. Make recommendations and impact rating assessments for each specific impact on the avifauna.

1.3.4 Limitations and assumptions

In order to obtain a comprehensive understanding of the dynamics of avifauna communities and the status of endemic, rare or threatened species in an area, avifauna studies should ideally be replicated over several seasons and over a number of years. However, due to project time constraints such long-term studies are not feasible;

The large study area did not allow for the finer level of assessment that can be obtained in smaller study areas. Therefore, data collection in this study relied heavily on data from representative sections, as well as general observations and a desktop analysis.

2 INTRODUCTION

South Africa has one of the world's greatest diversity of plant and animal species contained within one country, and is home to many species found nowhere else in the world. From an avifauna perspective, South Africa has 101 Global Important Bird Areas (IBAs) and an additional 21 Regional IBAs. South Africa is a large country, supporting eight biomes and 841 bird species, of which more than 700 are resident or annual visitors, 74 of which are endemic or near-endemic and 125 of which are listed in The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland.

Terrestrial resources are rapidly disappearing due to conversion of natural habitat to farmland, forestry, human settlement, and industrial development. Solar energy is renewable and more environmentally friendly than energy from non-renewable sources such as coal-fired power stations, but solar farms can still be environmentally damaging. Solar farms typically cover large areas and if incorrectly located, could displace or exclude threatened, rare, endemic, or range-restricted bird species from important habitats. Associated infrastructure can also cause disturbance and sometimes mortality. Overhead power lines and associated infrastructure such as substations are known to impact significantly on various bird species, both directly through causing mortality of birds, and indirectly through disturbance of birds and destruction of habitats. This study will identify these impacts, their location and significance, and recommend suitable mitigation measures that can be implemented to minimize these impacts. The study will also identify the preferred corridor from a bird impact perspective. An important principle of the guidelines is to encourage the thorough assessment and mitigation of the potential impacts of solar farms on birds.

This study will identify the potential impacts of the solar development on the avifauna of the study and recommend suitable mitigation measures that can be implemented to minimize these impacts. The study will also identify the preferred corridor from a bird impact perspective.

3 STUDY AREA

3.1 Location and description of activity

Rhodes 2 Solar Park will be established on the farm Rhodes 269 (1810.8314 ha), located in the Joe Morolong Local Municipality, John Taolo Gaetsewe District Municipality, Northern Cape Province (Figure 1). The proposed project is situated directly north of the town of Hotazel and 62 kilometers to the North of the town of Kathu, with the footprint planned to the east of Eskom's "Hotazel - Heuningvlei" 132 kV power line.

The solar project is called RHODES 2 SOLAR PARK, and it envisages the establishment of a Photovoltaic (PV) Power Plant having a maximum generating capacity up to 120 MW. The PV power plant will have a footprint (fenced area) up to 250 ha, within the total study area 1810 ha in extent.

Thes new access road will start from a local upgraded farm road diverted of the regional road R31, which runs parallel to the eastern boundary of Rhodes.

The chosen site is suitable for the installation of a photovoltaic (PV) power plant. It is appropriate morphologically (flat terrain) and regarding the favourable radiation conditions. The available radiation allows a high rate of electric energy production, as a combination of latitude-longitude and climatic conditions.

The aerial image of the site is indicated in figure 2, while the layout plan of the proposed development is indicated in figure 3.

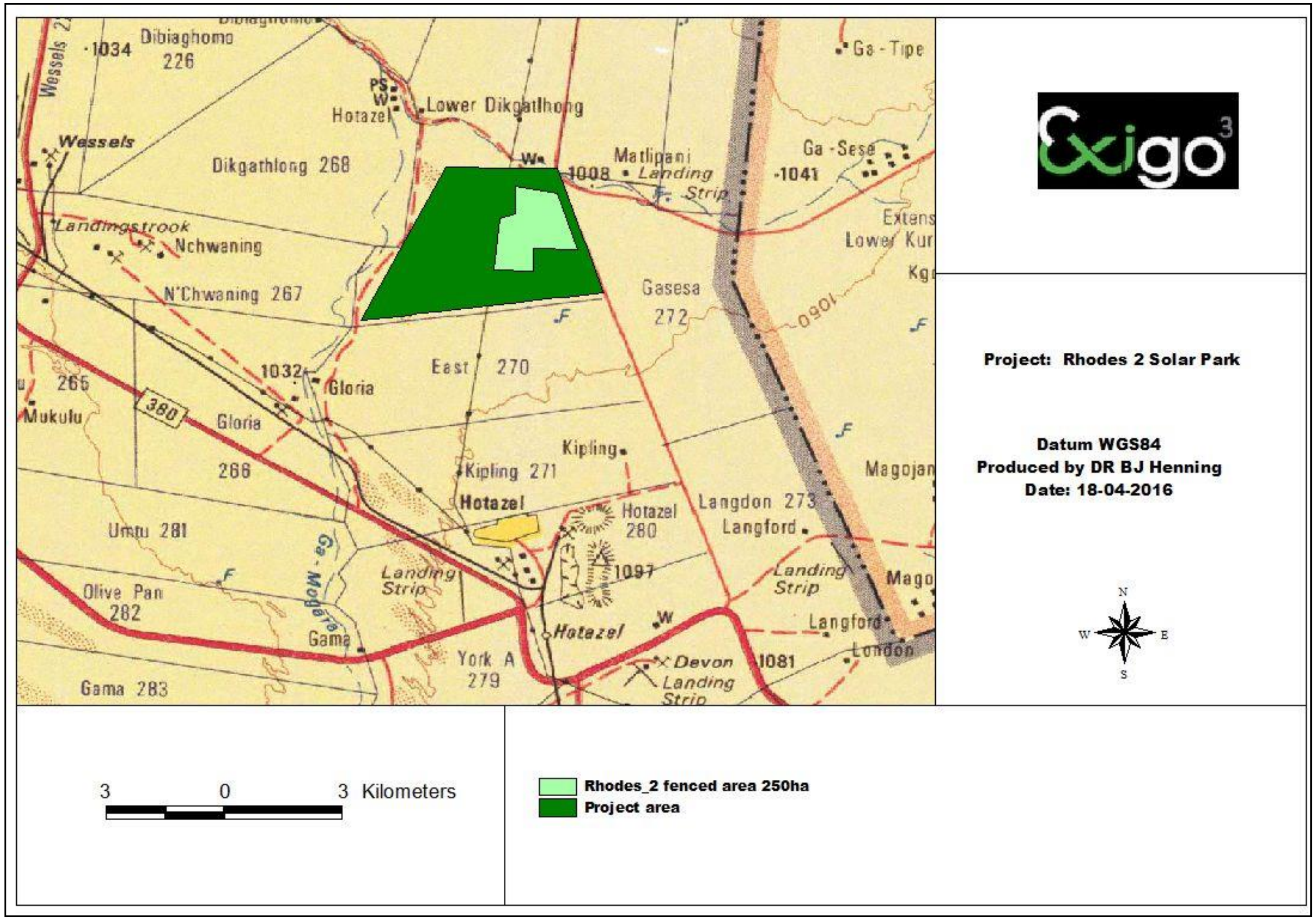


Figure 1. Regional Location Map

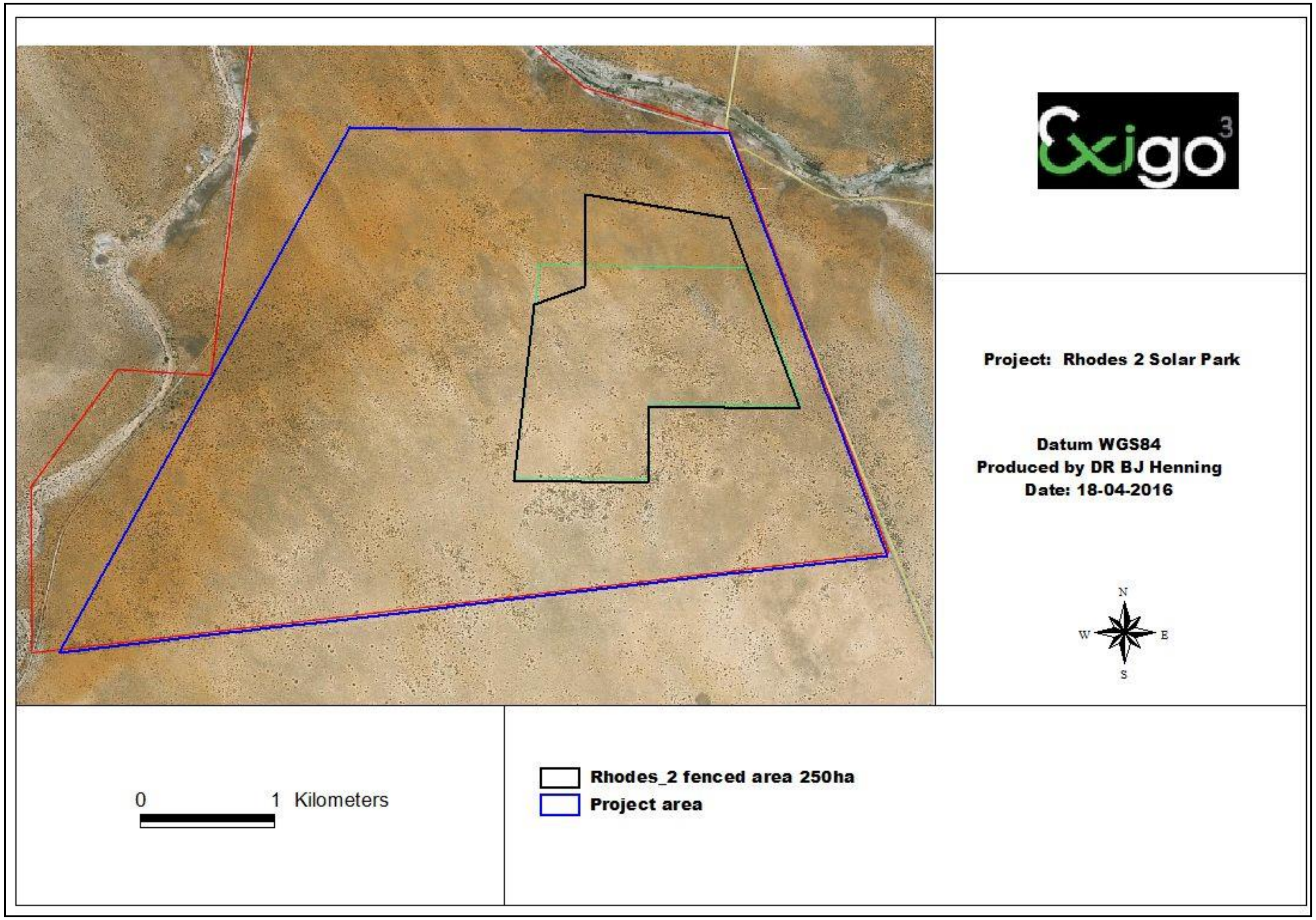


Figure 2. Satelite image showing the project area and proposed access road and focus area (Google Pro, 2010)

Rhodes 2 Avifauna Study

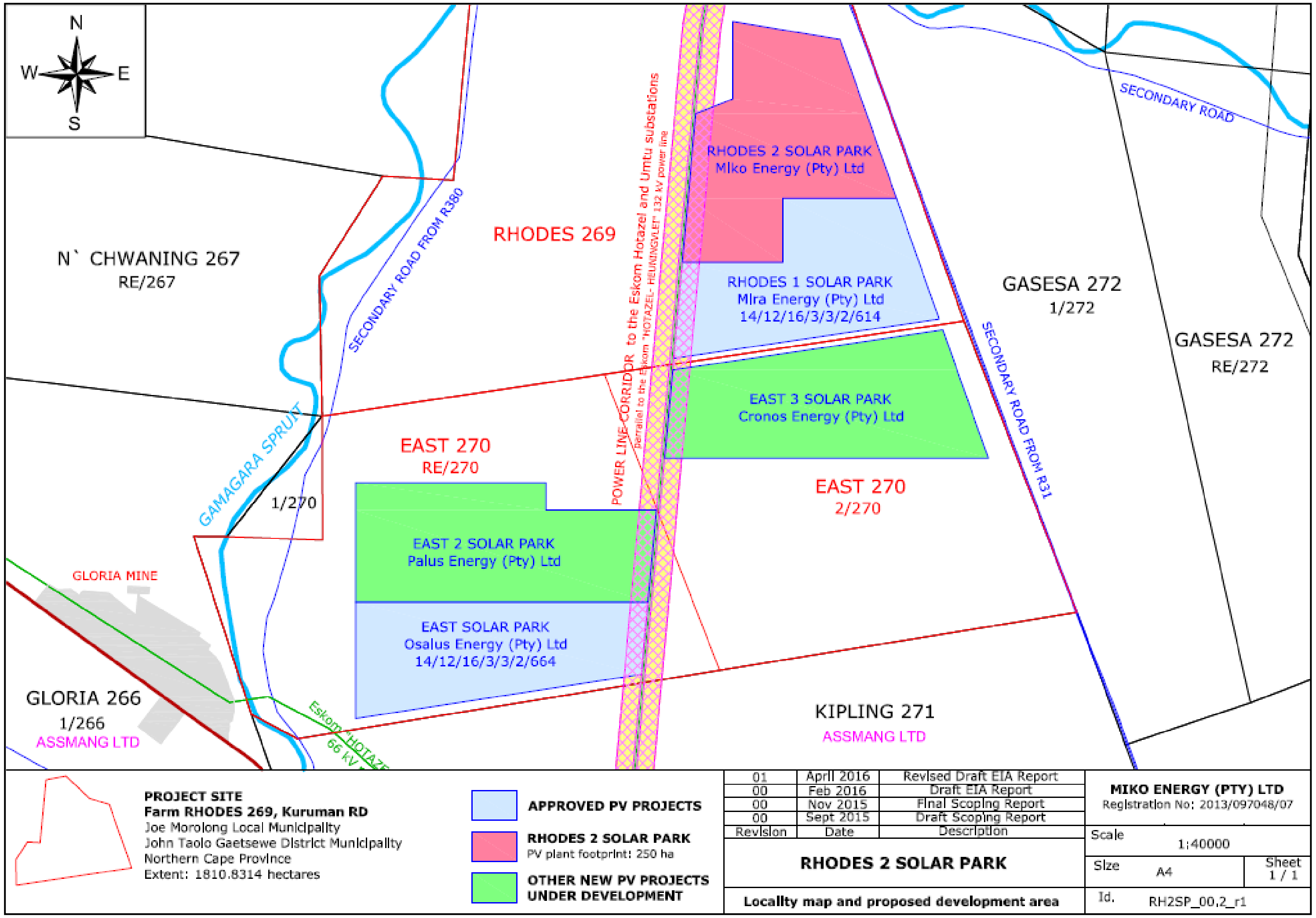


Figure 3. Layout plan for the proposed Rhodes 2 Solar Park in relation to other planned solar park and power lines in the larger area

4 METHODS

4.1 AVIFAUNA SURVEY

The avifauna survey was conducted as follows:

- A site survey was done to identify potential habitats after identifying the broad vegetation types and micro-habitats. Avifauna observed on site or any specific indication of species was noted as confirmed in the species lists.
- A scoping survey was then conducted by comparing the habitat types identified with the preferred habitats of species occurring in the area.
- The data obtained from the surveys was then used to identify the most suitable footprint area after an impact assessment was conducted.

4.1.1 Data recorded included:

A list of all species of avifauna and their status as observed on the site or that could potentially occur on the site. Notes were made of any specific sensitive or specialized habitats that occur on the site.

4.1.2 Red data species lists

A species list of the red data species of the avifauna was obtained from the Atlas of the Southern African Birds - digital data on quarter degree grid data (Avian Demography Unit, University of Cape Town)

4.2 Data processing

A comparison of the habitats (vegetation units) occurring on the property was made to the preferred habitats of the avifauna species. In addition to species observed on the site, lists of the potential bird species were compiled, an impact assessment was conducted for the specific power line corridors and mitigating measures recommended to minimize the potential negative impacts of the proposed development on the avifauna.

4.3 IMPACT RATING ASSESSMENT MATRIX

An impact can be defined as any change in the physical-chemical, biological, cultural and/or socio-economic environmental system that can be attributed to human activities related to alternatives under study for meeting a project need.

The significance of the impacts will be determined through a synthesis of the criteria below (Plomp, 2004):

Probability: This describes the likelihood of the impact actually occurring:

- Improbable: The possibility of the impact occurring is very low, due to the circumstances, design or experience.
- Probable: There is a probability that the impact will occur to the extent that provision must be made therefore.
- Highly Probable: It is most likely that the impact will occur at some stage of the development.
- Definite: The impact will take place regardless of any prevention plans, and there can only be relied on mitigatory actions or contingency plans to contain the effect.

Duration: The lifetime of the impact

- Short term: The impact will either disappear with mitigation or will be mitigated through natural processes in a time span shorter than any of the phases.
- Medium term: The impact will last up to the end of the phases, where after it will be negated.
- Long term: The impact will last for the entire operational phase of the project but will be mitigated by direct human action or by natural processes thereafter.
- Permanent: Impact that will be non-transitory. Mitigation either by man or natural processes will not occur in such a way or in such a time span that the impact can be considered transient.

Scale: The physical and spatial size of the impact

- Local: The impacted area extends only as far as the activity, e.g. footprint.
- Site: Impact could affect whole, or measurable portion of development site.
- Regional: Impact could affect the area including the neighbouring residential areas.

Magnitude/ Severity: Does the impact destroy the environment, or alter its function.

- Low: Impact alters affected environment in such a way that natural processes are not affected.
- Medium: The affected environment is altered, but functions and processes continue in a modified way.
- High: Function or process of the affected environment is disturbed to the extent where it temporarily or permanently ceases.

Significance: This is an indication of the importance of the impact in terms of both physical extent and

time scale, and therefore indicates the level of mitigation required.

- Negligible: The impact is non-existent or unsubstantial and is of no or little importance to any stakeholder and can be ignored.
- Low: The impact is limited in extent, has low to medium intensity; whatever its probability of occurrence is, the impact will not have a material effect on the decision and is likely to require management intervention with increased costs.
- Moderate: The impact is of importance to one or more stakeholders, and its intensity will be medium or high; therefore, the impact may materially affect the decision, and management intervention will be required.
- High: The impact could render development options controversial or the project unacceptable if it cannot be reduced to acceptable levels; and/or the cost of management intervention will be a significant factor in mitigation.

The following weights will be assigned to each attribute (Table 1):

Table 1. Impact ratings and weights attributed for each rating

Aspect	Description	Weight
Probability	Improbable	1
	Probable	2
	Highly Probable	4
	Definite	5
Duration	Short term	1
	Medium term	3
	Long term	4
	Permanent	5
Scale	Local	1
	Site	2
	Regional	3
Magnitude/Severity	Low	2

Aspect	Description	Weight
	Medium	6
	High	8
Significance	**Sum(Duration, Scale, Magnitude) x Probability**	
	Negligible	<20
	Low	<40
	Moderate	<60
	High	>60

Significance of each activity will be rated without mitigation measures and with mitigation measures.

5 RESULTS

5.1 Vegetation Types of the study area

The development site lies in the Savanna biome which is the largest biome in Southern Africa. It is characterized by a grassy ground layer and a distinct upper layer of woody plants (trees and shrubs). Environmental factors delimiting the biome are complex and include altitude, rainfall, geology and soil types, with rainfall being the major delimiting factor. Fire and grazing keep the grassy layer dominant. The most recent classification of the area by Mucina & Rutherford (2006) shows the site forms part of the Kathu Bushveld and Gordonia Dunveld vegetation types. The vegetation and landscape characteristics of the Kathu Bushveld include a medium-tall tree layer with dense stands of *Acacia erioloba* in places, but mostly an open woodland with *Boscia albitrunca* as prominent tree species, while the shrub layer is dominated by *Acacia mellifera, Lycium hirsitum* and *Diospyros lycioides*. This vegetation type in its pristine state is characterized by plains with layer of scattered, low to medium high deciduous microphyllous trees and shrubs with a few broadleaved tree species, and an almost continuous herbaceous layer dominated by grasses. This vegetation type has a Least Threatened conservation status, with 1% transformed and none statutorily conserved. Landscape features of Gordonia Duneveld vegetation type are mostly parallel dunes (3-8m in height) with open shrubland woody structure and ridges of grassland dominated by *Stipagrostis amabilis* on dune crests and *Acacia hamematoxylon* on the dunes slopes. The conservation status of the Gordonia Duneveld is Least Threatened with very little transformation and 14% statutorily conserved in the Kgalagadi Transfrontier Park (Mucina & Rutherford, 2006).

5.2 Bird microhabitats of the study area

The Kalahari is essentially a dry subset of the woodland biome generally. It comprises the extensive central depression of Southern Africa, characterized by its deep Kalahari sands and low rainfall. In the north, where rainfall averages 400 500 mm, the vegetation mostly comprises dense shrubland or woodland dominated by semi deciduous to deciduous acacia, *Terminalia* and *Combretum* trees, and *Acacia, Grewia* and *Catophractes alexandri* shrubs. The avifauna of the Kalahari is characteristic and essentially comprises a subset of the birds of drier woodlands generally. Many species widespread in moister woodlands avoid the Kalahari, e.g. Greenspotted Dove and Blue Waxbill, with perhaps the absence of surface water in most of the Kalahari providing the major constraint. This is not matched by the presence of any species truly endemic to the Kalahari, as all Kalahari woodland birds also extend into many of the other woodland types, where patches of acacia dominated woodland occur. Nevertheless, the Fawncoloured Lark and Kalahari Robin are two examples of species with their ranges and abundances obviously centred on the Kalahari vegetation type. Within the Kalahari, many species also show clear differences between the southern and northern Kalahari. For example, the Namaqua Sandgrouse and Sociable Weaver are widespread and common in the south but are uncommon in the north, and the reverse applies to the Lilacbreasted Roller, Forktailed Drongo and Marico Flycatcher. Another interesting feature is the large difference in abundance of several species in the central Kalahari across the South Africa Botswana border, e.g. Laughing Dove, Whitebacked Mousebird, Fiscal Flycatcher and Cape Sparrow. It seems likely that the increase in surface water points, presence of farm homesteads and irrigated farming is responsible for the greater abundance of these species in South Africa.

5.2.1 Microphyllous Woodland and dune habitat

Woodland habitat, in its undisturbed state, is suitable for a wide range of birds – in fact the woodland species are the most species rich community. Relevant to this study is the fact that many priority bird species such as raptor species utilize woodland extensively. The main woodland component occurring in the area is microphyllous woodland.

This vegetation unit is the most common and dominant natural vegetation entity occurring on the proposed development site and is characterized by a microphyllous woodland component dominated by trees and shrubs such as grey camel thorn, camel thorn, blackthorn, shepherds tree and velvet raisin. The grass species composition varies from being dense on the dune crests, to patchier on the dune slopes and low-lying plains. The Kalahari thornveld holds typical Kalahari basin birds, such as Kalahari Scrub Robin *Erythropygia paena*, Crimson-breasted Shrike *Laniarius atrococcineus*, Burchell's Starling *Lamprotornis australis*, Shaft-tailed Whydah *Vidua regia*, Monotonous Lark *Osalusfra passerina*, Southern Pied Babbler *Turdoides bicolor*, Barred Wren-warbler *Calamonastes fasciolata*, Marico

Flycatcher *Bradornis mariquensis* and the Sociable Weaver *Philetairus socius*, which constructs huge communal nests in the larger trees.

Wherever seeding grasses sprout, Red-headed Finch *Amadina erythrocephala*, Black-faced Waxbill *Estrilda erythronotos* and Violet-eared Waxbill *Uraeginthus granatinus* are found. Stark's Lark *Spizocorys starki* and Black-eared Sparrow-lark *Eremopterix australis* are nomadic species that sporadically occur in the area when conditions are favourable.

Southern Africa, although primarily a semi arid region, has a wide diversity of wetland types. These comprise estuaries and lagoons, lakes, pans, and marshy wetlands (variously known as vleis, sponges and flood-plains). Pans are endorheic, i.e. water flows in from catchments but with no outflow from the pan basins themselves, and they typically only hold water ephemerally. The major 'pan-veld' of Southern Africa lies on the interior central plateau and is represented on the study area. Vleis, marshes, sponges and floodplains are characterized by slow flowing water and are covered with emergent wetland vegetation.

The bird habitats represented in the area are presented in Figure 4 below:

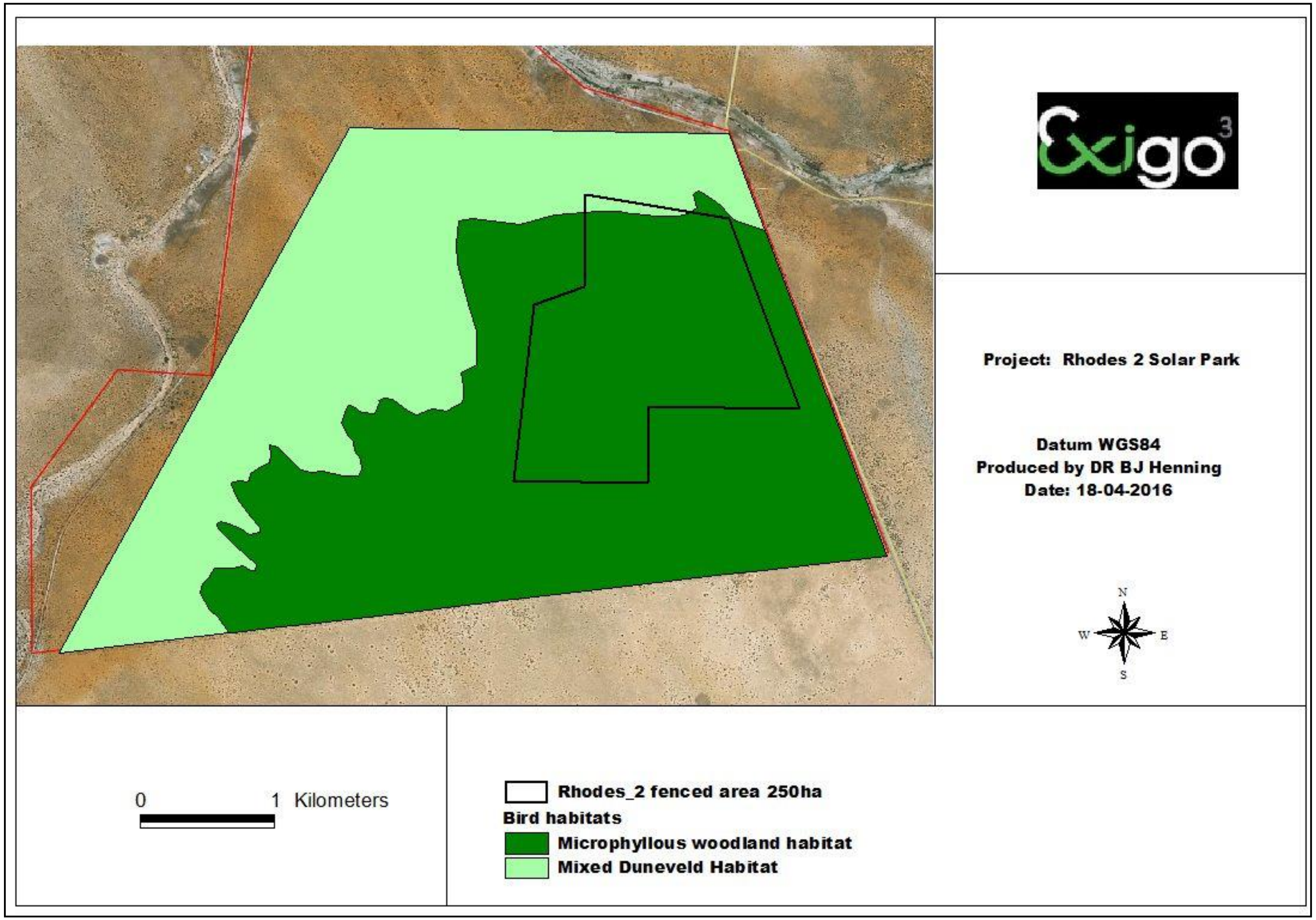


Figure 4. Avifauna habitat map for the proposed solar plant & associated infrastructure

5.3 Relevant bird species

A healthy environment is inhabited by animals that vary from micro-organisms to the birds and mammals. The species composition and diversity are often parameters taken into consideration when determining the state of the environment. A comprehensive survey of all avifauna is a time consuming task that will take a long time and several specialists to conduct. The alternative approach to such a study is to do a desktop study from existing databases and conduct a site visit to verify the habitat requirements and condition of the habitat.

As discussed in the previous section the area represents a homogenous vegetation structure and height class. A detailed species list for the avifauna is included in Appendix A for the study area. According to the existing databases and field survey the following number of birds species included in the IUCN red data lists can potentially be found in the proposed development site for the PV plant (Table 2).

Table 2. Red data list of potential avifauna for the study area

English Name	Conservation status	Priority Species (Birdlife SA)	Probability of occurrence in area	Probability of impact on species
Bateleur	Vulnerable	X	Medium-High	Medium
Black Harrier	Near threatened	X	Low	Medium
Black Stork	Near threatened	X	Low	High
Blackwinged Pratincole	Near threatened	X	Medium	Low
Blue Crane	Vulnerable	X	Low	High
Cape Vulture	Vulnerable	X	Medium	High
Chestnutbanded Plover	Near threatened	X	Low	Low
Greater Flamingo	Near threatened	X	Low	High
Kori Bustard	Vulnerable	X	High	High
Lanner Falcon	Near threatened	X	High	Medium
Lappetfaced Vulture	Vulnerable	X	Medium	High
Lesser Flamingo	Near threatened	X	Low	High
Lesser Kestrel	Vulnerable	X	Medium	Medium
Ludwig's Bustard	Vulnerable	X	High	High
Marabou Stork	Near threatened	X	Medium	High
Peregrine Falcon	Near threatened	X	Medium	Medium-low
Secretarybird	Near threatened	X	High	High
Tawny Eagle	Vulnerable	X	Medium	Medium
Whitebacked Vulture	Vulnerable	X	Medium	High

The following general observations and recommendations regarding the red data avifauna of the area can be made:

- Examination of the data reveals that the report rates for most Red Data species according to the Bird Atlas Project of Southern Africa are probable or possible, with the exception of the birds associated with open water habitats (e.g. harrier species, storks) being unlikely. It must be noted that many "non-Red Data" bird species also occur in the study area and will also be impacted on by the proposed development. Although this impact assessment focuses on Red Data species, the impact on non-red Data species is also assessed;
- If one considers the habitat descriptions of the red data species, some of them are limited in range or threatened as a direct result of habitat loss in the southern African sub-region, although other species with large home ranges (e.g. martial eagle) are not directly threatened by habitat loss. The impact of development on the red data species would therefore be less than predicted;
- The removal of vegetation should only occur if necessary considering the height of the vegetation layer that will occur beneath the solar panels. Slashing of the herbaceous layer and shrubs is recommended rather than total clearing of the site. The anticipated impact will be on small sections in relation to the total available surrounding habitat for avifauna. The habitats of the fauna will not be significantly fragmented since the area below the panels will still be available for fauna to move through. Development also won't influence the natural feeding and movement patterns of the existing fauna in the area. Peripheral impacts on the larger area should however still be avoided;
- The actual construction of the solar plant will not have a direct significant impact on the above mentioned red data fauna since the herbaceous layer will regrow beneath the solar panels while adequate natural habitat/vegetation would be available on the peripheral Savanna habitats outside the study area. Furthermore, the sensitive habitats of the riparian woodland represented outside the project area will be preserved as avifauna habitat. The woodland areas will be cleared although considering this habitat type to be well presented in the area, the impact will be lower than anticipated. The probability that the solar plant will indirectly impact on certain of the larger red data bird species (e.g. storks, vultures etc.) through collisions and / or electrocutions is high though;
- The protection of different habitat types in the area will be important to ensure the survival of the different birds due to each species' individual needs and requirements.

Sufficient natural corridor sections should be protected around the proposed development footprints to allow avifauna to move freely between the different microhabitats in the study area. In this regard the riparian areas, floodplains and large sections of the duneveld that occurs on the proposed development area and surrounding areas will be more than sufficient as corridors.

The cumulative negative impact of the development on the fauna has the potential to be moderate. However, considering the following general mitigation and management actions taken on site during construction, the impact on avifauna populations should be low.

- Where trenches pose a risk to bird safety, they should be adequately cordoned off to prevent ground-living birds falling in and getting trapped and/or injured. This could be prevented by the constant excavating and backfilling of trenches during construction process;
- No birds may be poached during the construction of the solar plant development. Many birds are protected by law and poaching or other interference could result in a fine or jail term;
- Do not feed any birds on site;
- The occurrence of the vulture species will be influenced by the availability of carcasses and adequate roosting and nesting sites on the property. Poisons for the control of problem animals should rather be avoided since the wrong use thereof can have disastrous consequences for the vulture species as well as other birds of prey occurring in the area. The use of poisons for the control of rats, mice or other vermin should only be used after approval from an ecologist;
- The habitat and feeding grounds of the water birds would be on the peripheral areas of the rivers in the area. None of these habitats occur on site and the impact on these bird species in the study area will therefore be restricted to areas where the birds perch;
- Monitoring of the environmental aspects should be done over the longer term to ensure that impacts are limited to a minimum during the constructional and operational phases. Monitoring of specific bird species is necessary to ensure that these species would be unaffected over the longer term by the development. Information on red data species should be provided to construction workers to make them more aware of these fauna and their behaviour.

6 POTENTIAL IMPACTS OF THE PROPOSED DEVELOPMENT ON THE AVIFAUNA

The impact of the proposed solar plant developments will be adjacent to already existing power line servitudes along a linear line. The vegetation varies from being in a pristine to slightly degraded state. The following section deals with the impacts on avifauna and mitigation measures needed for the development of the Solar Parks.

6.1 Direct habitat destruction

6.1.1 Description of impact:

The construction of the Photovoltaic Power Plant, substation and power line connection will result in loss of and damage to natural bird habitats. During the construction phase and maintenance of this infrastructure, some habitat modification and alteration inevitably takes place. However re-growth of grass and dwarf shrubs under the panels will take place as the mounting systems are at least 1m above ground level. At the end of the lifetime of the solar plant, structures will be removed and natural vegetation will re-establish naturally. The lower vegetation layer underneath the solar panels and the servitudes will have to be cleared (slashed) of excess vegetation at regular intervals in order to allow access to the area for maintenance, to prevent vegetation from intruding into the legally prescribed clearance gap between the ground and the solar panels and power line conductors and to minimize the risk of fire which can result in electrical flashovers. These activities have an impact on birds breeding, foraging and roosting in or in close proximity of the servitude through modification of habitat. Rehabilitation of some of these areas would be possible but there is likely to be long-term damage in large areas. Most habitat destruction will be caused during the construction of the solar plant and power line.

6.1.2 Mitigation measures:

- The removal of vegetation should only occur on the footprint area of the development and not over the larger area. The clearing and damage of plant growth in these areas should be restricted to the footprint way leave area.
- Clearly demarcate the entire development footprint prior to initial site clearance and prevent construction personnel from leaving the demarcated area.
- Monitoring should be implemented during the construction phase of the Photovoltaic Power Plant to ensure that minimal impact is caused to the fauna of the area. The impact of power line and specific placement of the poles should be restricted to the proposed line and not over the larger area;
- Construction of the power line close to existing power lines should to a certain extent eliminate the need for new access roads and gates etc. This would reduce the level of

disturbance and habitat destruction. In addition, birds in the immediate vicinity of the existing power line would already be relatively tolerant of disturbance as a result of maintenance activities on the already established lines;

- Landscape management at the site needs to consider different objectives, including
  - Maintaining pre-existing land uses;
  - Conserving and restoring natural habitats;
  - Managing land for priority species;
  - Hunting of birdlife should be prohibited on site.
  - Facilitating post-construction monitoring. For best results, vegetation management should be carefully planned in advance, discussed with stakeholders, and recorded within the project's Environmental Management Plan.

6.2 Habitat fragmentation

6.2.1 Description of impact:

The development will have a relatively small impact on the natural movement patterns and fragmentation of avifauna habitats. Such impacts would however be temporary in the solar plant site.

6.2.2 Mitigation measures:

- Use existing facilities (e.g., access roads) to the extent possible to minimize the amount of new disturbance.
- Ensure protection of important resources by establishing protective buffers to exclude unintentional disturbance. All possible efforts must be made to ensure as little disturbance as possible to sensitive bird habitats during construction.
- During construction, sensitive habitats must be avoided by construction vehicles and equipment, wherever possible, in order to reduce potential impacts. Only necessary damage must be caused and, for example, unnecessary driving around in the veld or bulldozing natural habitat must not take place.
- Construction activities must remain within defined construction areas and the road servitudes. No construction / disturbance will occur outside these areas.

6.3 Electrocutions

6.3.1 Description of impact:

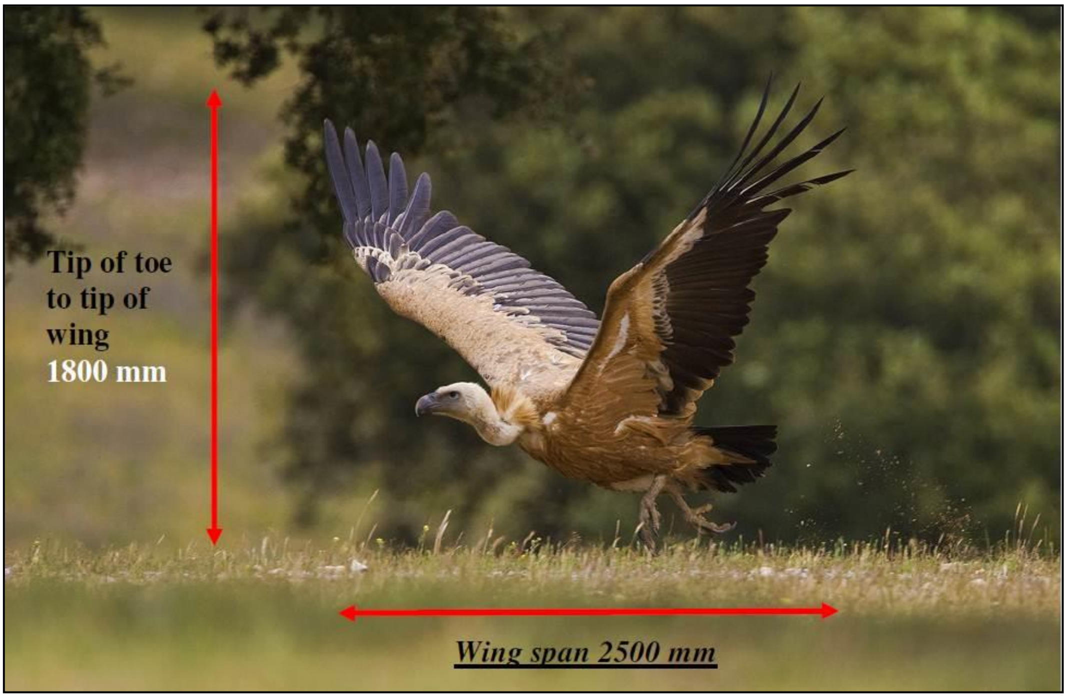
Electrocution of birds on overhead line connections associated with the Photovoltaic Power Plant is an emotional issue as well as an important cause of unnatural mortality of raptors and storks. However, in the context of overhead lines, electrocutions are not a major issue. Electrocution refers to the scenario where a bird is perched or attempts to perch on the electrical structure and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components (van Rooyen 2004). Due to the large size of the clearances on most overhead lines in the area, electrocutions are generally ruled out as even the largest birds cannot physically bridge the gap between dangerous components. In fact, transmission lines have proven to be beneficial to many birds, including species such as Martial Eagles, Tawny Eagles, African White-backed Vultures, and even occasionally Verreaux's Eagles by providing safe nesting and roosting sites in areas where suitable natural alternatives are scarce (van Rooyen 2004). Cape Vultures have also taken to roosting on power lines in certain areas in large numbers (van Rooyen 2004a), while Lappet-faced Vultures are known to use power lines as roosts, especially in areas where large trees are scarce.

Electrocution on the proposed power line is improbable given the adequate clearances and will only apply during the operational phase of the proposed development.

6.3.2 Mitigation measures

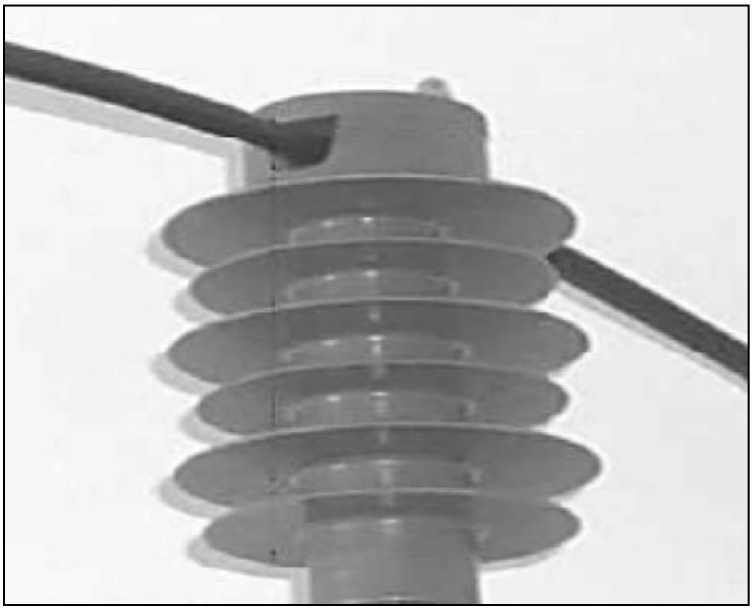
- Power line structures can present electrocution hazards to birds when less than adequate separation exist between energized conductors or between energized conductors and grounded conductors. Avian-safe facilities can be provided by one or more of the following mitigation measures as stipulated by Prinsen et al. (2011):
    - Increasing separation between abovementioned conductors to achieve adequate separation for the species involved (larger birds, raptors). To mitigate for bird electrocution, distances between electric conductors (or phases) and distances between conductors and grounded hardware should be separated over a larger distance than the wrist-to-wrist or head-to-foot distance of a bird (Photograph 1). When the power line is located within the distribution area of large raptors or species such as cranes in the study area, this distance should be increased to 1.4 m (or even 1.8 m in the case of vultures, see below). Because dry feathers provide insulation, the distance between fleshy parts, such as skin, feet or bill, is generally the critical factor to determine if a power line construction is safe for perching birds. Note, however, that wet bird feathers

provide less insulation, therefore, in wet climates safe distances between energised parts should be based on wingspan and toe-to-wing tip distances of the largest perching protected species in the area.



Photograph 1. A Cape Vulture (Gyps fulvus) indicating distances between outstretched wings and head-to-toe distances (Source: Prinsen *et al*. 2011)

- Insulation: covering energised parts and/or covering grounded parts with materials appropriate for providing incidental contact protection to birds. It is best to use suspended insulators and vertical disconnectors, if upright insulators or horizontal disconnectors are present, these should be covered. The length of insulated chains should be higher than 0.70 m. Retrofitting (polymer) insulation may be carried out on ground wires, phase conductors (Photograph 2), crossarms (Photograph 3) and jumper wires (Photograph 4), both at tap and dead end locations, especially where bare energised wires connect transformers. By insulating the wires altogether, the insulators will no longer be required, and the wires can be directly attached to the poles (Photograph 5).



Photograph 2. Example of an insulated conductor wire (black wire) (source: Podonyi, 2011)

Photograph 3. Cross-arm insulation (source: Horvath et al., 2011)

Photograph 4. A safe strain pole structure, with insulated jumper wires (black arrows) and sufficiently long insulators (broken arrow) (Photo: EWT-WEP)

Photograph 5. Completely insulated medium tension cable hanging from concrete pole without need of insulators (source: Haas, 2011)

- Applying perch managing techniques such as conspicuous objects and support roosting sites along the power line that would allow large raptors and bustards to safely roost. An “avian-safe” power pole is a configuration designed to minimise bird electrocution risk by providing sufficient separation between energised phase conductors (also-called ‘phases’) and between phases and grounded hardware to accommodate at least the wrist-to-wrist or head-to-foot distance of a bird. Cross-arms, insulators and other parts of the power lines can be constructed so that there is no space for birds to perch where they can be proximate to energised wires. This happens often by exclusion devices, or perch discouragers (Figure 5), but often these cause even more problems than benefits. Because the birds still try to perch on the constructions and the space is even more limited, birds have a higher chance to contact the energised wires. There has been considerable success achieved by providing artificial bird safe perches (Photograph 6) and nesting platforms (Photograph 7), which are placed at a safe distance from the energised parts (Bayle, 1999; Goudie, 2006).

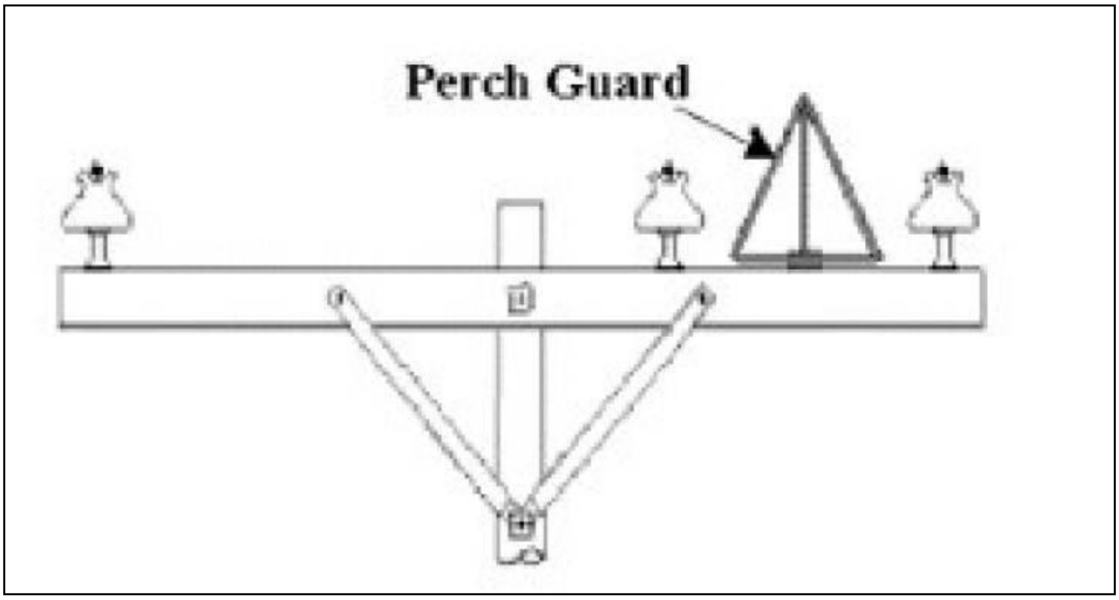


Figure 5. Distribution pole with perch guard as exclusion device (source: Hunting, 2002)

Photograph 6. A Pale Chanting Goshawk (*Melierax canorus*) perched safely on a 'Bird Perch' (Photo: EWT-WEP)

Photograph 7. Nesting Osprey on artificial platform in medium voltage transmission line (Photo; Bureau Waardenburg)

6.4 Collisions with power lines or solar panels

6.4.1 Description of impact:

Collisions are the biggest single threat posed by transmission lines to birds in southern Africa (van Rooyen 2004). Most heavily impacted upon are bustards, storks, cranes and various species of water birds. These species are mostly heavy-bodied birds with limited manoeuvrability, which makes it difficult for them to take the necessary evasive action to avoid colliding with power lines (van Rooyen 2004, Anderson 2001).

Solar installations often feature large areas of reflective panelling. Any vertical, reflective surfaces may confuse approaching birds with the result that numbers are disorientated and displaced from the area, or else killed in collisions with such surfaces. Other bird species may seek to benefit from the solar installations, using the erected structures as prominent perches, sheltered roost sites or even nesting or foraging sites. Such scenarios might be associated with fouling of critical components in the solar array, bringing local bird populations into conflict with the facility operators.

Unfortunately, many of the collision sensitive species are considered threatened in southern Africa. The Red Data species vulnerable to power line collisions are generally long living, slow reproducing species under natural conditions. Some require very specific conditions for breeding, resulting in very few successful breeding attempts, or breeding might be restricted to very small areas. These species have not evolved to cope with high adult mortality, with the results that consistent high adult mortality over an extensive period could have a serious effect on a population's ability to sustain itself in the long or even medium term. Many of the anthropogenic threats to these species are non-discriminatory as far as age is concerned (e.g. habitat destruction, disturbance and power lines) and therefore contribute to adult mortality, and it is not known what the cumulative effect of these impacts could be over the long term. This impact will only apply during the operational phase of the proposed development.

6.4.2 Mitigation measures:

- Preconstruction Monitoring needed to determine the presence of Threatened, Rare, Endemic or Range Restricted bird species;
- Should birds collide with the solar panels, efforts should be made to restrict access by birds into the relevant, hazardous areas of the facility.
- Land management practices should not attract raptors or other species vulnerable to collision. Structures should be designed to reduce the availability of perching sites.
- Ensure that sites are close to existing power lines, so that few new lines are required;

- The impact of collision of birds is partially mitigated for by placing new infrastructure close to existing lines for the following reasons:
    - The more overhead power lines and other associated infrastructure there are together, the more visible they would be to the birds in the area (Avian Power Line Interaction Committee - 1994).
    - Resident birds in an area become accustomed to a power line that crosses their flight paths, and learn to avoid it during their everyday activities. Hence adding a new connection line adjacent to existing lines would probably have less impact than putting it in a totally new area, where the resident birds are not yet accustomed to overhead power lines.
- Specialist advice should be sought in devising effective avian deterrents to minimize associated damage.
- The high risk sections of line should be marked with suitable anti-collision marking devices (Photograph 8) on the earth wire as per the Eskom guidelines. Since the assumption is that birds collide with overhead cables because they cannot see them, fitting the cables with devices in order to make them more visible to birds in flight has become the preferred mitigation option worldwide. Besides thickening, coating or colouring the often least visible thin ground wires, a wide range of potential 'line marking' devices has evolved over the years, including: spheres, swinging plates, spiral vibration dampers, strips, swan flight diverters, Firefly Bird Flight Diverters, bird flappers, aerial marker spheres, ribbons, tapes, flags, fishing floats, aviation balls and crossed bands. The design and technical aspects of using devices on the power line should consider the following:
    - Line markers should be as large as possible, and increase the visible thickness of the line by at least 20 cm, for a length of at least 10-20cm;
    - Spacing of devices should be not more than 5-10 m apart;
    - Line markers should incorporate as much contrast with relevant backgrounds as possible;
    - Colour is probably less important than contrast;
    - Movement of the device is likely to be important;
    - Markers that protrude vertically both above and below the cable are likely important;
    - Since we suspect that many collisions may occur at night, devices that are

nocturnally visible (through illumination, ultraviolet radiation and other means) would be advantageous. Although bearing in mind what is known about birds being attracted to illuminated objects.

Photograph 8. High tension (150 kV) power line in the Netherlands with bird flappers (see arrows) placed at regular intervals in both ground wires as bird flight diverters, see also Box 1 (Photo: Bureau Waardenburg)

- Line design: Although different bird species fly at different heights above the ground, there is general consensus that the lower power line cables are to the ground, the better for preventing bird collision (Photograph 9). There is also consensus that less vertical separation of cables is preferred as it poses less of an ‘obstacle’ for birds to collide with. Horizontal separation of conductors is therefore preferred (Photograph 8).

Photograph 9. A 400 kV line, with all conductor wires in the same horizontal plane (Photo: EWT-WEP)

6.5 Disturbance through human activities, noise and fires

6.5.1 Description of impact:

Construction and maintenance activities impact on birds through disturbance, particularly during breeding activities. An increase in human activity on the site and surrounding areas is anticipated, especially during the construction phase of the power line. Birds will move out of the area during construction activities as a result of noise disturbance. The presence of a large number of construction workers or regular workers during the construction phase on site over a protracted period will result in a greatly increased risk of uncontrolled fires which might cause loss of bird diversity when ground-living birds are killed in the fires or their nests destroyed.

6.5.2 Mitigation measures:

- Care should always be taken to disturb the receiving environment as little as possible. Careful control of construction workers movements must be maintained at all times.
- Staff that will stay on site should be accommodated in one location of the site to ensure that the impact will be minimal on the larger area.
- Construction activities must remain within defined construction areas and the road servitudes. No construction / disturbance will occur outside these areas.
- Construction activities must be restricted to working hours Monday to Saturday, unless otherwise approved by the appropriate competent person in consultation with the affected residents.

- Educate workers regarding the occurrence of important resources in the area and the importance of protection.
- Instruct employees, contractors, and site visitors to avoid harassment and disturbance of wildlife, especially during reproductive (e.g. courtship, nesting) seasons. In addition, control pets to avoid harassment and disturbance of wildlife.
- Camp fires at construction sites must be strictly controlled to ensure that no veld fires are caused.
- Noise levels will be kept within acceptable limits by:
    - Limiting of speed of haulage vehicles/tippers;
    - Compliance with appropriate noise legislation must take place.

7 IMPACT ASSESSMENT MATRIX

Table 3 indicate the impacts described above and specific ratings of significance the impact will potentially have on the avifauna during the power line development:

Table 3. Impact assessment Matrix

Impacts	Probability	Duration	Scale	Magnitude (WOM)	Magnitude (WM)	Scoring (WOM)	Scoring (WM)
1. Direct habitat destruction	5	5	1	6	2	60 (High)	40 (Moderate)
2. Habitat fragmentation (birds)	4	5	2	6	2	52 (Moderate)	36 (Low)
3. Electrocution	1	5	1	6	2	42 (Moderate)	14 (Negligible)
4. Collisions	4	4	1	6	2	44 (Moderate)	28 (Low)
5. Disturbances through human activities, noise and fires	5	3	2	6	2	55 (Moderate)	35 (Low)

8 DISCUSSION

Considering the proposed development of the Rhodes 2 Solar Park and other associated infrastructure the following key findings was made:

- About 250 hectares of natural bird habitats will be modified through the development if one considers the vegetation types (Kathu Bushveld, Gordonia Duneveld) associated with the larger area;
- The following bird habitats were identified in the study area during the field surveys that formed part of the avifauna scoping study:
  - Microphyllous woodland;
  - Duneveld;
- The project area supports low densities of priority species such as secretary bird, kori bustard, vulture species and lanner falcons. The presence of these birds could cause collisions and increase mortality rate of these species and subsequently no additional power lines should be constructed other than the already established corridors;
- The impact associated with the proposed solar farm development include the following:
  - Habitat destruction, fragmentation and human disturbances (Indirect impacts);
  - Electrocutions and collisions (direct impacts);
- The implementation of the mitigation measures should be considered a requirement for the proposed development if approved by authorities;
- Baseline monitoring should be implemented on the avifauna during the pre-construction, construction and operational phase of the East Solar Park. This is one of the main recommended conditions of approval for solar energy facilities to monitor and reduce potential impacts on avifauna by Birdlife South Africa and Endangered Wildlife Trust;

9 CONCLUSION

The proposed development of the Rhodes 2 Solar Park and associated infrastructure would have some impact on the avian habitats of the area, and strict mitigation should be implemented to limit the impacts to a minimum if possible. Considering the layout and design of the proposed development as well as the impact assessment; the extent of the habitat that will be affected will be reduced by mitigation and design principles. Provided that the mitigation measures and recommendations in this report are adhered to, it is unlikely that the proposed development will have a long-term, significant negative impact on the local avifauna.

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11 APPENDIX A: BIRD SPECIES LIST FOR QDS

English Name	Map Status	General Status
Abdim's Stork	NBM-U	NBM-C
African Black Duck	R-C	R-U
African Cuckoo	BM-U	BM-U
African Fish Eagle	R-U	R-C
African Hoopoe	R-VC	R(n)-C
African Jacana	R-U	R-VC
African Marsh Harrier	R-U	R-C
African Marsh Warbler	BM-C	BM-C
African Pied Wagtail	R-C	R-C
African Rail	R-C	R/BM-C
African Spoonbill	R-U	R(n)-C
Alpine Swift	BM-U	BM-C
Anteating Chat	E-VC	E-C
Ashy Tit	E-C	Er-U
Baillon's Crake	R-U	R-C
Banded Martin	BM-U	BM-U
Barn Owl	R-C	R-C
Bennett's Woodpecker	R-U	R-U
Black Crake	R-C	R-C
Black Crow	R-U/VC	R-C
Black Eagle	R-C	R-U
Black Egret	R-U	R-LC/R
Black Harrier	NBM-U	E-U
Black Kite	NBM-U	NBM-LC
Black Stork	R-U	R-U/R
Black Swift	BM-U	R-C
Blackbreasted Snake Eagle	R-C	R-U
Blackcheeked Waxbill	R-C	R-LC
Blackchested Prinia	E-VC	Er-C
Blackcrowned Night Heron	R-U	R-C
Blackheaded Heron	R-VC	R-C
Blacknecked Grebe	R-U	R(n)-U
Blackshouldered Kite	R-VC	R(n)-C
Blacksmith Plover	R-A	R-VC
Blacktailed Godwit	Rare	NBM-R
Blackthroated Canary	R-VC	R-C
Blackwinged Pratincole	NBM-U	NBM-LA
Blackwinged Stilt	R-C	R-C
Blue Crane	E-U	E-U
Bluecheeked Bee-eater	NBM-U	NBM-LC

English Name	Map Status	General Status
Bokmakierie	E-VC	Er-C
Booted Eagle	NBM-U	R/NBM-C
Bradfield's Swift	E-U	Er-C
Brownhooded Kingfisher	R-C	R-C
Brownthroated Martin	R-C	R-C
Brubru	R-U	R-C
Buffy Pipit	R-U	R-U
Burchell's Coucal	R-U	R-C
Burchell's Courser	E-U	Er-U
Burchell's Sandgrouse	E-C	E-C
Cape Bunting	R-U	R-C
Cape Penduline Tit	E-C	Er-C
Cape Reed Warbler	R-C	R-C
Cape Robin	R-VC	R-C
Cape Shoveller	E-VC	Er-C
Cape Sparrow	E-A	Er-VC
Cape Teal	R-C	R-C
Cape Turtle Dove	R-A	R-VC
Cape Vulture	E-U	E-LC
Cape Wagtail	R-VC	R-C
Capped Wheatear	R-C	R/BM-C
Cardinal Woodpecker	R-U	R-C
Caspian Plover	NBM-C	NBM-U
Cattle Egret	R-A	R-C
Chat Flycatcher	E-C	Er-C
Chestnutbanded Plover	R-U	R-U
Common Moorhen	R-C	R-C
Common Quail	R-U	R/BM/NBM-C
Common Sandpiper	NBM-C	NBM-C
Common Waxbill	R-VC	R-C
Crested Barbet	R-U	R-C
Crimsonbreasted Shrike	E-VC	Er-C
Crowned Plover	R-VC	R-C
Curlew	NBM-U	NBM-U
Curlew Sandpiper	NBM-C	NBM-VC
Dabchick	R-VC	R-C
Darter	R-U/C	R-C
Desert Barred Warbler	E-U	Er-C
Desert Cisticola	R-C	R-C
Diederik Cuckoo	BM-C	BM-VC
Doublebanded Courser	R-C	R-LC

English Name	Map Status	General Status
Dusky Sunbird	E-VC	Er-C
Eastern Clapper Lark	E-C	Er-C
Egyptian Goose	R-VC	R-A
Ethiopian Snipe	R-U	R-LC
Eurasian Bee-eater	NBM-VC	NBM/BM-C
Eurasian Golden Oriole	NBM-U	NBM-U
Eurasian Marsh Harrier	NBM-U	NBM-R
Eurasian Nightjar	NBM-U	R-U
Eurasian Roller	NBM-U	NBM-C
Eurasian Swallow	NBM-VC	NBM-A
Eurasian Swift	NBM-U	NBM-C
Fairy Flycatcher	NBM-C	E-C
Familiar Chat	R-VC	R-C
Fantailed Cisticola	R-C	R-VC
Fawncoloured Lark	R-VC	R-C
Feral Pigeon	R-C	R-A
Fiscal Flycatcher	E-VC	E-C
Fiscal Shrike	R-A	R-C
Forktailed Drongo	R-VC	R-C
Fulvous Duck	R-U	R-C
Gabar Goshawk	R-U	R-C
Garden Warbler	NBM-U	NBM-C
Giant Eagle Owl	R-U	R-U
Giant Kingfisher	R-U	R-U
Glossy Ibis	R-C	R-U
Glossy Starling	E-VC	Er-C
Golden Bishop	R-U/C	R(n)-LC
Goldenbreasted Bunting	R-U/VC	R-U
Goldentailed Woodpecker	R-U	R-C
Goliath Heron	R-C	R-U
Grassveld Pipit	R-VC	R-C
Great Crested Grebe	R-U	R(n)-U
Great Reed Warbler	NBM-U	NBM-C
Great Sparrow	R-C	R-U
Great Spotted Cuckoo	BM-U	NBM-U
Great White Egret	R-U/C	R-C
Greater Flamingo	R-C	R(n)-LA
Greater Honeyguide	R-U	R-U
Greater Kestrel	R-C	R-C
Greater Striped Swallow	BM-VC	BM-C
Greenshank	NBM-C	NBM-C

English Name	Map Status	General Status
Grey Heron	R-C	R-C
Grey Hornbill	R-C	R-C
Greybacked Finchlark	E-C	Er-VC
Greyheaded Gull	R-C	R-VC
Groundscraper Thrush	R-VC	R-C
Gymnogene	R-U	R-C
Hadeda Ibis	R-C/VC	R-A
Hamerkop	R-VC	R-C
Helmeted Guineafowl	R-VC	R-VC
Horus Swift	BM-U	BM-LC
Hottentot Teal	R-C	R-C
House Martin	NBM-U	NBM-LC
House Sparrow	R-VC	R-VC
Icterine Warbler	NBM-U	NBM-C
Jackal Buzzard	E-U	E-C
Jacobin Cuckoo	BM-C	BM-C
Kalahari Robin	E-VC	Er-C
Karoo Robin	E-VC	E-C
Karoo Thrush	E-VC	E-C
Kittlitz's Plover	R-C	R-C
Knobbilled Duck	R-U	R-LC
Kori Bustard	R-VC	R-R
Kurrichane Buttonquail	R-U	R(n)-U/LC
Lanner Falcon	R-C	R-C
Lappetfaced Vulture	R-U/C	R-U
Larklike Bunting	E-VC	Er-VC
Laughing Dove	R-A	R-VC
Lesser Flamingo	R-C	R(n)-LA
Lesser Grey Shrike	NBM-C	NBM-C
Lesser Honeyguide	R-U	R-LC
Lesser Kestrel	NBM-C	NBM-VC
Levaillant's Cisticola	R-U	R-C
Lilacbreasted Roller	R-VC	R/LM-C
Little Bittern	R-U	R/NBM-U
Little Egret	R-C	R-C
Little Stint	NBM-C	NBM-C
Little Swift	R-VC	R/BM-VC
Longbilled Crombec	R-VC	R-C
Longtailed Widow	R-VC	R(n)-C
Maccoa Duck	R-VC	R-U
Malachite Kingfisher	R-U	R-C

English Name	Map Status	General Status
Marabou Stork	R-U	R-R/LC
Marico Flycatcher	E-C	Er-C
Marsh Owl	R-U	R-C
Marsh Sandpiper	NBM-C	NBM-C
Martial Eagle	R-C	R-U
Masked Weaver	R-VC	R-C
Melba Finch	R-U	R-C
Monotonous Lark	E-U	Er-C
Montagu's Harrier	NBM-U	NBM-R
Mountain Chat	E-VC	Er-C
Namaqua Dove	R-VC	R-VC
Namaqua Sandgrouse	E-VC	Er-C
Neddicky	R-C	R-C
Old World Painted Snipe	R-U	R-U
Orange River Francolin	R-U	R-C
Orange River White-eye	E-VC	E-VC
Orangethroated Longclaw	E-VC	E-C
Ostrich	R-C	R-C
Pale Chanting Goshawk	E-VC	Er-C
Palewinged Starling	E-VC	Er-C
Palm Swift	R-U	R-C
Paradise Whydah	R-U	R-C
Pearlbreasted Swallow	NBM-U	R/BM-C
Pearlspotted Owl	R-C	R-C
Peregrine Falcon	R-U	R/NBM-R
Pied Avocet	R-C	R-LC
Pied Barbet	E-VC	Er-C
Pied Crow	R-A	R-A
Pied Kingfisher	R-C	R-C
Pied Starling	E-C	E-C
Pinkbilled Lark	E-C	Er-C
Pintailed Whydah	R-VC	R(n)-C
Pririt Batis	E-VC	Er-C
Purple Gallinule	R-U	R-C
Purple Heron	R-U	R-U
Purple Roller	R-C	R-U
Pygmy Falcon	R-U	R-C
Quail Finch	R-U/C	R-C
Red Bishop	R-VC	R-C
Redbacked Shrike	NBM-VC	NBM-C
Redbilled Firefinch	R-U	R-C

English Name	Map Status	General Status
Redbilled Quelea	R-VC	R(n)-LA
Redbilled Teal	R-C	R-C
Redbilled Woodhoopoe	R-U	R-C
Redbreasted Swallow	BM-C	BM-C
Redcapped Lark	R-C	R(n)-C
Redchested Cuckoo	BM-U	BM-C
Redcrested Korhaan	E-VC	Es-C
Redeyed Bulbul	E-A	Er-VC
Redeyed Dove	R-VC	R-C
Redfaced Mousebird	R-VC	R-C
Redheaded Finch	E-VC	Er-VC
Redknobbed Coot	R-VC	R-A
Reed Cormorant	R-VC	R-C
Ringed Plover	NBM-U	NBM-C
Rock Bunting	R-U	R(n)-LC
Rock Kestrel	R-U/VC	R-C
Rock Martin	R-VC	R-C
Rock Pigeon	R-VC	R-C
Ruddy Turnstone	NBM-U	NBM-C
Ruff	NBM-U/C	NBM-C
Rufouscheeked Nightjar	BM-C	BM-C
Rufouseared Warbler	E-U	E-C
Rufousnaped Lark	R-U	R-C
Sabota Lark	E-VC	Er-C
Sacred Ibis	R-VC	R-C
Sand Martin	NBM-U	NBM-C
Sanderling	NBM-U	NBM-C
Scalyfeathered Finch	E-VC	Er-C
Scimitarbilled Woodhoopoe	R-VC	R-C
Secretarybird	R-C	R-U
Shafttailed Whydah	E-U	Er-C
Shorttoed Rockthrush	E-U/C	Er-U
Sociable Weaver	E-U	E-C
South African Cliff Swallow	BM-C	Ebm-LC
South African Shelduck	E-VC	E-C
Southern Greyheaded Sparrow	E-VC	Er-C
Southern Pochard	R-C	R-C
Southern Yellowbilled Hornbill	E-VC	Er-C
Spikeheeled Lark	E-VC	Er-C
Spotted Dikkop	R-C	R-C
Spotted Eagle Owl	R-C	R-C

English Name	Map Status	General Status
Spotted Flycatcher	NBM-C	NBM-C
Spurwinged Goose	R-C	R-VC
Squacco Heron	NBM-U	R/NBM-U
Steelblue Widowfinch	R-U	R(n)-C
Steppe Buzzard	NBM-C	NBM-C
Stonechat	R-U	R-VC
Swainson's Francolin	E-VC	Er-C
Swallowtailed Bee-eater	R-U/VC	R-LC
Tawny Eagle	R-U	R-LC
Temminck's Courser	R-U	R-U
Threebanded Plover	R-VC	R-C
Threestreaked Tchagra	R-U	R-C
Tinkling Cisticola	R-U	R-U
Titbabbler	E-VC	Er-C
Violeteared Waxbill	E-U	Er-LC
Wattled Starling	R-VC	R(n)-LA
Whimbrel	NBM-U	NBM-C
Whiskered Tern	BM-C	R(n)-LC
White Stork	NBM-C	NBM-C
Whitebacked Duck	R-U	R-U
Whitebacked Mousebird	E-VC	E-C
Whitebacked Vulture	R-U	R-C
Whitebellied Sunbird	R-U	R-C
Whitebreasted Cormorant	R-VC	R-C
Whitebrowed Sparrowweaver	R-VC	R-VC
Whitefaced Duck	R-VC	R-C
Whitefaced Owl	R-U	R-C
Whitefronted Bee-eater	R-U	R-C
Whiterumped Swift	BM-C	BM-VC
Whitethroat	NBM-U	NBM-U
Whitethroated Canary	E-U	Er-C
Whitethroated Swallow	BM-C	BM-C
Whitewinged Korhaan	E-VC	E-VC
Whitewinged Tern	NBM-C	NBM-A
Willow Warbler	NBM-C	NBM-VC
Wood Sandpiper	NBM-C	NBM-C
Yellow Canary	E-VC	Er-C
Yellowbellied Eremomela	R-C	R-U
Yellowbilled Duck	R-VC	R-A
Yellowbilled Egret	R-C	R-U
Yellowbilled Kite	BM-U	BM-C

English Name	Map Status	General Status
Yellowbilled Stork	NBM-U	NBM/R-LC

R=RESIDENT; E=ENDEMIC; BM=BREEDING MIGRANT; NBM=NON-BREEDING MIGRANT; V=VAGRANT; A=ABUNDANT; VC=VERY COMMON; C=COMMON; U=UNCOMMON; R=RARE

12 PHOTOGRAPHIC GUIDE

Photograph 10. Microphyllous woodland habitat

Photograph 11. Duneveld Habitat