GAROB - KRONOS 132KV POWER LINE

BASIC ASSESSMENT

AVIFAUNAL IMPACT STUDY

31 January 2013

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EXECUTIVE SUMMARY

Juwi Renewable Energies (Pty) Ltd is applying to construct a new 132kV overhead power line from the proposed Garob Wind Energy Facility to the existing Eskom Kronos Substation (a distance of approximately 14 kilometres).

The site is characterised by flat shrubland or karoo type ~~veld~~vegetation. Towards Kronos it is relatively cluttered with developments such as mine slimes dams, gravel roads, existing overhead power lines and electrical substations. Up to approximately 97 bird species could occur on the site (based on Harrison *et al*, 1997), including 3 Red Data species: 1 Vulnerable; and 2 Near-threatened. This data probably under represents the situation on the ground though due to the remoteness of the site and consequent poor coverage by counters during the project. This report has suggested various bird species that are likely to be important for this project, some of which may not have been recorded by Harrison *et al* but are in this authors' opinion likely to occur on site. Of the priority bird species for this project, the Ludwig's Bustard *Neotis ludwigii* probably poses the most concern. This is a species which has proven extremely vulnerable to collision with overhead power lines, and has been recorded in the area. Although the site is possibly not prime habitat for the species and may not attract them frequently or in high numbers, temporary influxes of small groups of birds could occur in response to rainfall and during these periods collision with the proposed power line are a strong likelihood. Various large raptors occur in the area, such as Verreaux's Eagle *Aquila verreauxii*, but as described in this report impacts on these species through electrocution is relatively straightforward to mitigate.

The impacts of the proposed power line are adjudged to be of low significance overall. Destruction of habitat is likely to be fairly minimal, and the habitat is already reasonably disturbed. Disturbance of birds is unlikely to be significant on this site due to the low abundance of sensitive species and the already disturbed nature of parts of the site. Electrocution of birds can easily be managed for by using a bird friendly pylon structure. Collision of birds is a possibility, and should be mitigated for on certain sections of the line. An avifaunal walk through is recommended as part of the site specific Environmental Management Plan in order to identify final sections of line requiring collision mitigation, as well as identifying any other sensitive avifaunal features such as breeding raptors and other sensitive species.

Only one possible route for this power line has been provided for assessment. This route is the result of examination of all available options to connect to the grid, considering that several other proposed renewable energy projects are positioned in the broader area. Despite this lack of alternative routes for assessment, the proposed route is acceptable from an avifaunal perspective and it is recommended that this project be allowed to proceed, subject to the implementation of the recommendations of this report.

SPECIALIST DETAILS

Specialist Investigator

The Natural Scientific Professions Act of 2003 aims to "Provide for the establishment of the South African Council of Natural Scientific Professions (SACNASP) and for the registration of professional, candidate and certified natural scientists; and to provide for matters connected therewith.""Only a registered person may practice in a consulting capacity" – Natural Scientific Professions Act of 2003 (20(1)-pg 14)

Investigator:	Jon Smallie (Pri.Sci.Nat)
Qualification:	BSc (hons) Wildlife Science
Affiliation:	South African Council for Natural Scientific Professions
Registration number:	400020/06
Fields of Expertise:	Ecological Science
Registration:	Professional Member

Declaration of Independence

All specialist investigators specified above declare that:

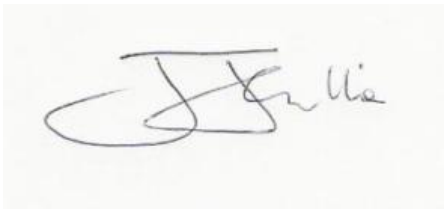
» We act as independent specialists for this project.
» We consider ourselves bound by the rules and ethics of the South African Council for Natural Scientific Professions.
» We do not have any personal or financial interest in the project except for financial compensation for specialist investigations completed in a professional capacity as specified by the Environmental Impact Assessment Regulations, 2006.
» We will not be affected by the outcome of the environmental process, of which this report forms part of.
» We do not have any influence over the decisions made by the governing authorities.
» We do not object to or endorse the proposed developments, but aim to present facts and our best scientific and professional opinion with regard to the impacts of the development.
» We 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, 2006.

Terms and Liabilities

» This report is based on a short term investigation using the available information and data related to the site to be affected. No long term investigation or monitoring was conducted.

» The Precautionary Principle has been applied throughout this investigation.
» 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 investigator withholds the right to amend 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 investigator as specified above.
» Acceptance of this report, in any physical or digital form, serves to confirm acknowledgment of these terms and liabilities.

Signed on the 31 January 2013 by Jon Smallie in his capacity as avifaunal specialist.



1. INTRODUCTION

1.1 Background

Juwi Renewable Energies (Pty) Ltd is applying to construct a new 132kV (kilovolt) overhead power line from the proposed Garob Wind Energy Facility to the existing Eskom Kronos Substation (a distance of approximately 14 kilometres).

Savannah Environmental (Pty) Ltd has been appointed to undertake the necessary Basic Assessment investigation for the planned infrastructure. Jon Smallie (WildSkies Ecological Services) was subsequently appointed as the avifaunal specialist.

Up to approximately 97 bird species could occur on the site (based on Harrison *et al*, 1997), including 3 Red Data species: 1 Vulnerable; and 2 Near-threatened. In addition to these a number of other species are considered likely to occur in the area by this author. Of the priority species for this project, the Ludwig's Bustard is of most concern as described in this report.

In general terms, the impacts that could be associated with a project of this nature include: collision of birds with the overhead cables; electrocution of birds whilst perched on the tower structures or on hardware in the substations; destruction of habitat; disturbance of birds; and nesting on tower structures.

1.2 Terms of reference

The following terms of reference were received from Savannah for this project:

A basic assessment study of the identified alternatives for all components of the project must be undertaken. The Basic Assessment Report must include:

- a description of the environment that may be affected by the activity and the manner in which the environment may be affected by the proposed project
- a description and evaluation of environmental issues and potential impacts (including direct, indirect and cumulative impacts) that have been identified
- a statement regarding the potential significance of the identified issues based on the evaluation of the issues/impacts
- an indication of the methodology used in determining the significance of potential environmental impacts
- an assessment of the significance of direct, indirect and cumulative impacts in terms of the following criteria:

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

» a description and comparative assessment of all alternatives

» recommendations regarding practical mitigation measures for potentially significant impacts, *for inclusion in the Environmental Management Programme (EMPr)*

» an indication of the extent to which the issue could be addressed by the adoption of mitigation measures

» a description of any assumptions, uncertainties and gaps in knowledge

» an environmental impact statement which contains:

- a summary of the key findings of the environmental impact assessment;
- an assessment of the positive and negative implications of the proposed activity (one alternative only in EIA phase);
- a comparative assessment of the positive and negative implications of identified alternatives

1.3 Description of proposed activities

The following are the proposed project activities (see Figure 1):

» Construction of a new 132kV overhead power line totalling approximately 14 kilometres in length

» The proposed tower structure has not been finalised. It is therefore recommended that a bird friendly structure be used, which provides at least 2 000 millimetres of clearance between phases and between phase and earth.

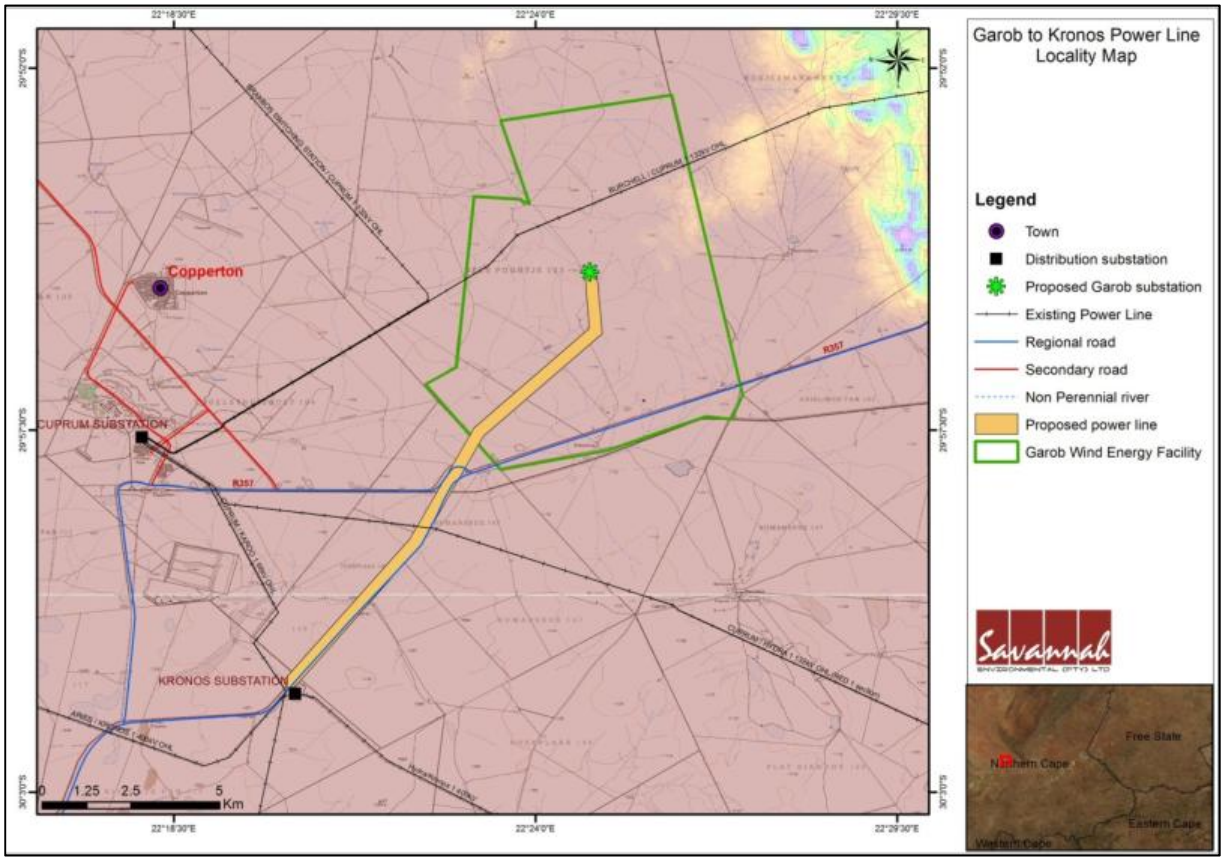


Figure 1. The layout of the proposed Garob Kronos 132kV power line.

2. METHODS

2.1. Methodology

In predicting the impacts of a proposed power line on birds, a combination of science, field experience and common sense is required. More specifically the methodology used to predict impacts in the current study was as follows:

» The various data sets listed below and the micro habitats within the study area were examined to determine the likelihood of these relevant species occurring on or near the site.
» The potential impacts of the proposed facility on these species were described and evaluated.
» Sensitive areas within the proposed site, where the above impacts are likely to occur, were identified using various GIS (Geographic Information System) layers and Google Earth.
» Recommendations were made for the management and mitigation of impacts.

2.2 Sources of information

The study made use of the following data sources:

» 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. Two quarter degree squares are relevant, 2922CD and 3022AB. The more recent SABAP2 data was consulted online (- http://sabap2.adu.org.za/v1/gap_analysis.php). The two relevant pentads had been recorded as follows: 2955_2220 – 4 cards, 67 species; 3000_2220 – 2 cards, 36 species.
» 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 study area was obtained from Mucina and Rutherford (2006).
» Information on the micro-habitat level was obtained through visiting the area and obtaining a first hand perspective.
» Electronic 1:50 000 maps were obtained from the Surveyor General.
» The EIA phase avifaunal specialist study for the Garob Wind Energy Facility, and the two available progress reports for pre-construction bird monitoring at the Garob Wind Energy Facility were used as reference material.

2.3 Limitations & assumptions

This study made the assumption that the above sources of information are reliable. The following factors may potentially detract from the accuracy of the predicted results:

» The SABAP1 data covers the period 1986-1997. Bird distribution patterns fluctuate continuously according to availability of food and nesting substrate. (For a full discussion of potential inaccuracies in ASAB data, see Harrison, Allan, Underhill, Herremans, Tree, Parker & Brown, 1997). Unfortunately the SABAP 2 data is of limited value for areas as remote as the current study area. This data was however used to check if any additional priority species should be considered at this site.
» Predictions in this study are based on experience of these and similar species in different parts of South Africa, through the authors experience since 1999. Bird behaviour cannot be reduced to formulas that will hold true under all circumstances. This is particularly true in arid environments such as this where the distribution of many key bird species is so closely linked to rainfall, which is extremely variable geographically. So an area which recorded low abundance of a particular species during atlasing periods could attract higher abundance of these birds in the future (and once this power line is built), resulting in greater risk of impacts occurring.

3. DESCRIPTION OF THE RECEIVING ENVIRONMENT

3.1 Study area vegetation classification

The study area is extremely uniform in terms of vegetation classification, being classed as entirely "Bushmanland Basin Shrubland" by Mucina and Rutherford (2006). Vegetation structure is far more important in determining bird distribution and abundance than vegetation species composition. For the purposes of determining which bird species will occur on site and their abundance, it is adequate to note that Bushmanland Basin Shrubland is a low vegetation type, interspersed with *Prosopis* sp. in places.

3.2 Bird micro habitats

The above vegetation description partially describes the habitat available and hence the species likely to occur in the study area. However, more detail is required in order to understand exactly where within the study area certain species will occur and how suitable these areas are for the relevant species. The habitats available to birds at a small spatial scale are known as micro habitats. These micro habitats are formed by a combination of factors such as vegetation, land use, anthropogenic factors, topography and others. These micro habitats will be critically important in

siting the proposed development and ascertaining where mitigation is required. The following micro habitats were observed from the site visit:

Acacia woodland (sparse):

This is evident only in the larger drainage lines and may in fact be evidence of disturbance of some form. In any event, the woody component of this micro habitat does provide different habitat to the remainder of the study area, and is worth mentioning. It is likely to most important to the smaller bird species in the area, which may be able to reside in this area as a result of the presence of this woody vegetation in the drainage lines, whereas they would otherwise not find suitable habitat in this arid area. Luckily these areas can typically be spanned by the proposed power line so as to avoid any impact on this vegetation.

Shrubland:

This is the dominant micro habitat in the area, and has been described above. Species likely to make use of this are shown in Table 1, and include most importantly the Ludwig's Bustard, korhaans and various raptors.

Drainage line/'wetland':

A small depression exists in the south of the study area, just south of the slimes dam. A second drainage line exists on the Garob Wind Energy Facility site itself, just south-west of the proposed substation site. This area contains slightly different vegetation, and probably contains standing water after rainfall events. As such, in this arid environment, it is likely to be an important area for certain bird species. Since the area is lower than the surrounds it also may represent a flight path for birds.

Figure 2. Example of arid shrubland in study area.

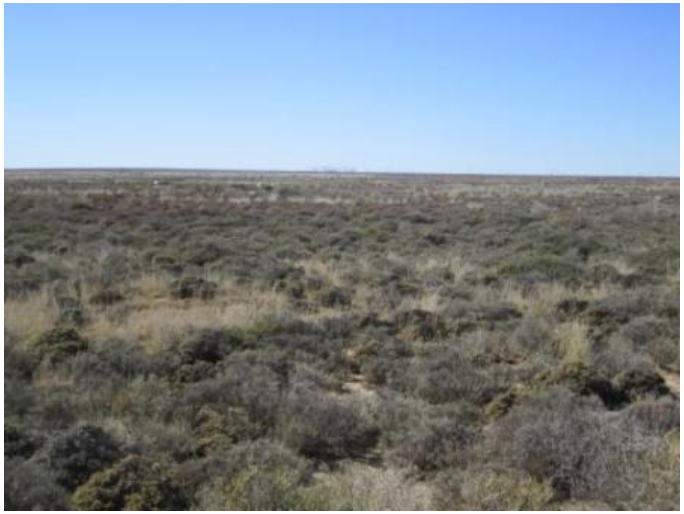


Figure 3. Example of arid shrubland in study area.

Figure 4. Example of low shrubland in the study area

Figure 5. A drainage line/wetland/depression in the study area.

Table 1 below shows the micro habitats that each Red Data bird species typically frequents in the study area. It must be stressed that birds can and will, by virtue of their mobility, utilise almost any areas in a landscape from time to time. However, the analysis below represents each species' most preferred or normal habitats. These locations are where most of the birds of that species will spend most of their time – so logically that is where impacts on those species will be most significant. Table 1 makes use of the authors' extensive experience gained through personal observations of the relevant bird species.

3.3 Relevant bird populations

Table 1 lists the Red Data bird species recorded by the SABAP1 (Harrison *et al*, 1997) in the two quarter degree squares covering the study area, i.e. 2922CD and 3022AB. The total number of all species recorded and the number of cards (counts) submitted per square is also shown. A total of up to approximately 97 species could occur in the area, based on what has been recorded by Harrison *et al* (1997). Report rates are essentially percentages of the number of times a species was recorded in the square, divided by the number of times that square was counted. It is important to note that this data provides an indication of which species *could* occur on the proposed site. The species in Table 1 were recorded in the entire quarter degree square in each case, and may not actually have been recorded on the proposed site for this study. In total 3 Red Data species were recorded across the two squares, comprising 1 Vulnerable and 2 Near-threatened species. The number of cards can be used as an indicator of our confidence in that particular report rate. If lots of cards have been submitted our confidence in the data is higher, and vice versa. In this study, both squares have been very poorly covered by counting (8 cards each). For this reason the atlas data is not taken as the final indicator of which bird species could occur on site. Field work in the area for various other projects has been conducted previously by this author and this experience has been used to add species that could occur here.

Using this data in combination with the assessment of the micro habitats available to birds in the area – an effective assessment of potential impacts of the proposed developments has been made as described below.

TABLE 1 – Abundances of Red Data bird species in the study area (Harrison *et al*, 1997) & their preferred microhabitats.

Species	**Conservation status**	**Report rate 2922CD (%)**	**Report rate 3022AB (%)**	**Preferred micro habitat in this study area**	**Likelihood of occurrence in this study area**	**Importance of this study area for the species**
Cards		8	8			
Total species		97	77			
Breeding species		5	4			
Ludwig's Bustard *Neotis ludwigi*	V	25	25	Natural veld	Probable – particularly temporary influxes of small groups of birds on a seasonal, and rainfall related basis	Low to medium. This species is severely under pressure in South Africa so all habitat is important, but due to the uniformity of this area, and that to this authors knowledge this area is not regularly home to concentrations of the species, the importance is slightly lower.
Greater Flamingo *Phoenicopterus roseus*	NT	-	13	Unlikely to occur	Unlikely – there are no large open water sources in the area that could attract this species	Low
Sclater's Lark *Spizocorys sclateri*	NT	13	13	Natural veld	Possible	Low

V = Vulnerable; NT = Near-threatened

For the purpose of this study, the priority species are probably Ludwig's Bustard *Neotis ludwigi* and Sclaters Lark *Spizocorys sclateri*, although the likelihood of either occurring in any abundance on site is low. Other large terrestrial species that are likely to occur in the area include Secretarybird (Near-threatened – Barnes, 2000), and non-threatened species such as Northern Black Korhaan and Karoo Korhaan. Various large raptors such as Verreaux's Eagle *Aquila verreauxii* could also occur in the area. Greater Kestrel and Southern Pale Chanting Goshawk are medium size raptors that are frequently recorded in the area. It must be noted that many "non Red Data" bird species also occur in the study area and could be impacted on by the power line. Although this impact assessment focuses on Red Data species, the impact on non Red Data species is also assessed, albeit in less detail. Furthermore, much of the mitigation recommended for Red Data species will also protect non Red Data species in the study area.

The more recent SABAP2 data was consulted online (http://sabap2.adu.org.za/v1/gap_analysis.php). The two relevant pentads had been recorded as follows: 2955_2220 – 4 cards, 67 species; 3000_2220 – 2 cards, 36 species. These data confirmed the presence of species such as Northern Black Korhaan, Karoo Korhaan, Southern Pale Chanting Goshawk, Greater Kestrel, Spotted Eagle Owl, and perhaps most importantly Secretarybird (not recorded by SABAP1 – Near-threatened – Barnes 2000). The Ludwig's Bustard and Greater Flamingo were not recorded in either of these pentads.

4. DESCRIPTION & ASSESSMENT OF IMPACTS

4.1 General description of impacts of power lines and substations on birds

Because of its' size and prominence, electrical infrastructure constitutes an important interface between wildlife and man. Negative interactions between wildlife and electricity structures take many forms, but two common problems in southern Africa are electrocution of birds (and other animals) and birds colliding with power lines. (Ledger & Annegarn 1981; Ledger 1983; Ledger 1984; Hobbs & Ledger 1986a; Hobbs & Ledger 1986b; Ledger, Hobbs & Smith, 1992; Verdoorn 1996; Kruger & Van Rooyen 1998; Van Rooyen 1998; Kruger 1999; Van Rooyen 1999; Van Rooyen 2000). Other problems are electrical faults caused by bird excreta when roosting or breeding on electricity infrastructure, (Van Rooyen & Taylor 1999) and disturbance and habitat destruction during construction and maintenance activities.

Electrocutions

Electrocution of birds on overhead lines is an important cause of unnatural mortality of raptors and storks. It has attracted plenty of attention in Europe, USA and South Africa (APLIC 1994; van Rooyen & Ledger 1999). 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).

Electrocution is possible on 132kV lines such as those proposed, depending on the exact pole structure used. Since ~~Eskom have not yet committed to a~~the exact tower structure has not been determined yet, this impact cannot be fully assessed. As discussed below in this report, the author has therefore taken the approach of stipulating a minimum phase – phase and phase – earth clearance (of 2000mm) for whichever structure is used, in order to mitigate for electrocution.

Collisions

Collisions with overhead power lines are one of the single biggest ~~single~~ threats ~~posed by overhead power lines~~ to birds in southern Africa (van Rooyen 2004). Most heavily impacted upon are bustards, storks, cranes and various species of waterbirds. 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).

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 result 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.

The Ludwig's Bustard is classified as Vulnerable in southern Africa (Barnes, 2000) but was recently upgraded on the IUCN Red List, from Least concern to Endangered (i.e. skipping Near-threatened and Vulnerable), on the basis primarily of its mortality due to power lines (IUCN, 2012). This near endemic has an estimated population in SA of between 56 and 81 000 birds (Hockey *et al* 2005). This estimate is however relatively old and is currently being updated by Jessica Shaw (Phd, in press). A final count is not yet available. This is a Karoo and succulent Karoo species, with a suspected east-west migration seasonally, with winter spent in the winter rainfall parts of the Karoo. It is a highly nomadic species with extremely unpredictable movement in response (presumably) to rainfall. The Ludwig's Bustard tops the list of species killed on transmission lines with 100 birds killed in the period August 1996 to June 2006. Jenkins, Shaw, Smallie, Gibbons, Visagie & Ryan (2011) estimated collision rates at an average of 0.63 fatal collisions per kilometre of transmission line per year, with relatively little regional variation. This estimate was obtained through sampling 6 sections of transmission line (totalling 289 kilometres), several of which are situated quite close to the current study area. Jenkins

et al extrapolated collision rates across the range of the species to suggest that 4 000 – 11 900 birds are killed annually on high-voltage transmission lines. In her Phd thesis, Jessica Shaw (in press.) will provide an updated assessment of the same power lines and additional ones. Based on this species susceptibility to collision with overhead lines, no effort should be spared in managing and mitigating this risk for the proposed power line.

Collision of certain bird species, including Ludwig's Bustard, could occur on the proposed power line, particularly in the area shown in Figure 1 and should be prevented as far as possible. This report has identified sections of line requiring mitigation for this impact, but these will be refined and finalised during the site specific Environmental Management Plan (EMP).

Habitat destruction

During the construction phase and maintenance of power lines and substations, some habitat destruction and alteration inevitably takes place. This happens with the construction of access roads, the clearing of servitudes and the levelling of substation yards. Servitudes have to be cleared of excess vegetation at regular intervals in order to allow access to the line for maintenance, to prevent vegetation from intruding into the legally prescribed clearance gap between the ground and the conductors and to minimize the risk of fire under the line 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.

Habitat destruction will undoubtedly occur, however the general nature of the study area (already relatively disturbed, and extremely uniform throughout wider area) means that this is not likely to impact significantly on the avifauna of the area. This has been assessed in more detail below.

Disturbance

Similarly, the above mentioned construction and maintenance activities impact on bird through disturbance, particularly during breeding activities.

Certain bird species could also choose to nest on the pylons of the proposed power line. In this arid and largely tree less landscape any form of available nesting substrate will probably be utilised by medium sized raptors, crows and the Sociable Weaver (a nest of which is pictured on the title page of this report). Since the proposed power line is likely to be built on a monopole structure, which is not the most conducive structure for nesting, and this interaction is not strictly speaking an impact of the proposed development, this has not been formally assessed below.

4.2 Description of impacts of this proposed project

The anticipated impacts of the proposed project have been assessed formally below according to the criteria provided by Savannah. The four possible impacts are: destruction of habitat, disturbance of birds, electrocution and collision.

Nature: Destruction of natural bird habitat on and near site – impact on sensitive and threatened species and habitat specialists		
	Without mitigation	**With mitigation**
Extent	Low (1)	Low (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Minor (2)	Minor (2)
Probability	Highly Probable (4)	Highly Probable (4)
Significance	**32 (Medium)**	**32 (Medium)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes – bird habitat	Yes
Can impacts be mitigated?	Yes – but only partially, some habitat removal is inevitable	
Mitigation: The primary mitigation measure is to ensure that any sensitive habitats along the alignment are spanned by the line, i.e. ensuring that no pylons or poles are erected in these sensitive areas. The sensitive areas have so far been identified to be the drainage lines, shown in the figure below. These areas should also be avoided as far as possible by vehicles and heavy machinery. In addition care should be taken to minimise any unnecessary impact on the vegetation in these areas through activities such as storing materials, turning vehicles, labour camps and others.		
Cumulative impacts: The cumulative impacts of the construction of new electrical and energy infrastructure in this Copperton area could be quite significant. This author is aware of at least two other wind energy facilities and several solar facilities proposed. All of these facilities, plus their grid connection power line, will remove a significant amount of natural vegetation from the land surface in this wider area. A full cumulative impact assessment is beyond the scope of this current study, and the competitive nature of the bidding process makes it unlikely that developers will provide information on all projects. It is however recommended that the Department of Environmental Affairs take note of the number of applications for this area and intervene by commissioning a full cumulative impact assessment if deemed necessary.		
Residual Impacts: The residual impacts of the proposed power line would be primarily through habitat alteration. In these arid areas it can take a very long time for vegetation to recover. It is therefore likely that the residual impacts would be relatively high.		

Nature: Disturbance of birds on site and in surrounding area. Sensitive and threatened species are of most concern and particularly whilst breeding.		
	Without mitigation	**With mitigation**
Extent	Low (1)	Low (1)
Duration	Very short (1)	Very short (1)
Magnitude	Minor (2)	Minor (2)
Probability	Highly Probable (4)	Highly Probable (4)
Significance	**16 (low)**	**16 (low)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes – bird habitat	Yes
Can impacts be mitigated?	Yes – but only partially, some disturbance is inevitable.	
Mitigation: The primary mitigation measure is to ensure that any sensitive habitats along the alignment are spanned by the line, i.e. ensuring that no pylons or poles are erected in these sensitive areas. The sensitive areas have so far been identified to be the drainage lines, shown in the figure below. These areas should also be avoided as far as possible by vehicles and heavy machinery. In addition care should be taken to minimise any unnecessary impact on the vegetation in these areas through activities such as storing materials, turning vehicles, labour camps and others. It is possible that one or more sensitive bird species could be found breeding close to the alignment. The avifaunal walk through (recommended elsewhere in this report) will determine this if the season is appropriate. Alternatively the environmental control officer will need to survey the area when construction starts. Case specific mitigation measures and management plans will then need to be drawn up by a suitably qualified ornithologist.		
Cumulative impacts: The cumulative impacts of the construction of new electrical and energy infrastructure in this Copperton area could be quite significant. This author is aware of at least two other wind energy facilities and several solar facilities proposed. All of these facilities, plus their grid connection power line, will represent quite a significant disturbance to avifauna in the wider area. A full cumulative impact assessment is beyond the scope of this current study, and the competitive nature of the bidding process makes it unlikely that developers will provide information on all projects. It is however recommended that the Department of Environmental Affairs take note of the number of applications for this area and intervene by commissioning a full cumulative impact assessment if deemed necessary.		
Residual Impacts: since the disturbance of avifauna is a short term, temporary impact, there should be no residual impact after the power line is decommissioned.		

Nature: ***Electrocution of birds whilst perched or roosting on pylons or towers. Mostly large eagles affected.***

	Without mitigation	**With mitigation**
Extent	Low (1)	Low (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Moderate (6)	Minor (2)
Probability	Highly Probable (4)	Improbable (2)
Significance	**48 (Medium)**	**16 (low)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes – birds are killed	Yes
Can impacts be mitigated?	Yes – but only partially, some habitat removal is inevitable	

Mitigation: Eskom has guidelines and standards for the construction of bird friendly pole and pylon structures. These should be adhered to. Only a bird friendly pole structure should be used. It is recommended that a monopole structure be used with the standard Eskom Bird Perch installed on all pole tops in order to provide safe perching substrate for bird well clear of the dangerous hardware below. Large eagles occur in the area, and anecdotal reports state the (from the Garob Wind Energy Facility landowner) existance of vultures (probably White-backed Vulture) occasionally visiting the area. This means that the pole structure must be designed to accommodate these large birds.

Cumulative impacts: The cumulative impacts of the construction of new electrical and energy infrastructure in this Copperton area could be quite significant. This author is aware of at least two other wind energy facilities and several solar facilities proposed. All of these facilities, plus their grid connection power lines, will remove a significant amount of new perching substrate in this wider area, where natural perches are largely absent. This means that the cumulative electrocution risk could be quite substantial. Fortunately this impact is more easily mitigated than the others under discussion in this report, through simply ensuring that all pylon and pole tops are 100% bird friendly. A full cumulative impact assessment is beyond the scope of this current study, and the competitive nature of the bidding process makes it unlikely that developers will provide information on all projects. It is however recommended that the Department of Environmental Affairs take note of the number of applications for this area and intervene by commissioning a full cumulative impact assessment if deemed necessary.

Residual Impacts: if the power line is decommissioned the impact will cease and there will be no residual impact, except for any birds already killed.

Nature: ***Collision of birds with overhead cables, in particular the earth wires of the proposed***

power line.		
	Without mitigation	**With mitigation**
Extent	Low (1)	Low (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	High (6)	Minor (2)
Probability	Highly Probable (4)	Improbable (2)
Significance	**48 (Medium)**	**16 (low)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes – birds are killed	Yes
Can impacts be mitigated?	Yes – but only partially, line marking devices are not fully effective for some species.	
Mitigation: The high risk sections of this power line must be installed with suitable and Eskom approved anti bird collision line marking devices. The best device available at the time of construction must be used. Either Eskom or Juwi (whoever operates and maintains the line) will be responsible for ensuring that these devices are in working order, and replacing them if not. It is recommended that in order to identify the exact spans of line requiring marking, an avifaunal walk through be done as part of the site specific environmental management plan for this project. This exercise will identify the high risk sections of line, as well as considering other factors such as any breeding sensitive species on or close to site. This report has identified the high risk line generically in the figure below.		
Cumulative impacts: The cumulative impacts of the construction of new electrical and energy infrastructure in this Copperton area could be quite significant. This author is aware of at least two other wind energy facilities and several solar facilities proposed. All of these facilities, plus their grid connection power lines, will represent a significant amount of new overhead power line in this wider area. This means that the cumulative collision risk could be quite substantial. A full cumulative impact assessment is beyond the scope of this current study, and the competitive nature of the bidding process makes it unlikely that developers will provide information on all projects. It is however recommended that the Department of Environmental Affairs take note of the number of applications for this area and intervene by commissioning a full cumulative impact assessment if deemed necessary.		
Residual Impacts: Once the line is decommissioned the impact will cease. Of course birds that have collided with the line previously and been killed cannot be recovered.		

Activity	**Impact summary**	**Significance**	**Proposed mitigation**
Alternative 1 (preferred alternative)			

Activity	Impact summary	Significance	Proposed mitigation
	Direct impacts:		
	Electrocution of birds whilst perched or roosting on pylons or towers	Medium	Use bird friendly pole structure
	Collision of birds with overhead cables	Medium	Install anti bird collision line marking devices on high risk sections of power line **Conduct avifaunal walk through to identify these high risk areas**
	Indirect impacts:		
	Destruction of natural bird habitat on and near site	Medium	Provide protection for sensitive habitats
	Disturbance of birds on site and in surrounding area	Medium	Provide protection for sensitive habitats and any breeding sensitive species close to site **Conduct avifaunal walk through to identify these areas**
	Cumulative impacts:		
	All of the above impacts will also occur at a cumulative level, although collision of birds will be of most concern.	Medium	The project specific impact mitigation is mentioned above, but a cumulative impact study for new energy infrastructure in the greater Copperton area is needed to assess and identify mitigation options for cumulative impacts.
	Direct impacts:		
	Indirect impacts:		

Activity	Impact summary	Significance	Proposed mitigation
	Cumulative impacts:		
No-go option			
	Direct impacts:	None	None
	Indirect impacts:	None	None
	Cumulative impacts:	None	None

5. EVALUATION OF ALTERNATIVES

Only one alternative route for the power line (shown in Figure 1), was provided for assessment. This alternative is the result of detailed examination of available options to connect the Garob wind energy facility to the grid. From an avifaunal perspective this route is acceptable, and it is not possible nor necessary to identify a better routing for avifauna.

6. SENSITIVITY MAPPING

The areas of higher sensitivity have been identified in Figure 6 (orange shaded areas). These are drainage lines and likely flight paths. Given the wide ranging species likely to be affected, impacts could occur almost anywhere along the alignment, but the identified areas are those where I believe the likelihood of impacts occurring to be greater. These areas will be confirmed and finalised during the avifaunal walk through recommended elsewhere in this report.

Figure 6. Avifaunal sensitivity map for the proposed Garob Kronos 132kV power line.

7. GENERIC ENVIRONMENTAL MANAGEMENT PLAN

OBJECTIVE: To restrict the impacts of the proposed power line on birds to an absolute minimum. Since the primary impact of concern for this power line is that of collision (the other impacts being easily manageable), the below section focuses on collision.

Project component/s	Overhead cables, in particular earth wire.
Potential Impact	Collision of birds with overhead cables because they either don't see them or see them too late to take evasive action whilst in flight
Activity/risk source	Stringing of cables, both conductors and earth wires
Mitigation: Target/Objective	Increase the visibility of the cables in order to reduce the number of bird collisions per year.

Mitigation: Action/control	Responsibility	Timeframe
Install suitable, effective, Eskom approved	Contractor	Line marking devices

line marking devices on the earth wire of high collision risk sections of power line. These should be installed according to Eskom standards in this regard.		should be installed immediately after string of earth wire as it will immediately pose a collision risk.

Performance Indicator	Since the primary impact of this power line is likely to be collision of birds, the number of recorded bird collisions per year is the most appropriate indicator.
Monitoring	This power line should be monitored regularly once operation in order to detect any bird collisions that may occur. It is recommended that this line be patrolled as part of the post construction bird monitoring programme for the Garob Wind Energy Facility once it is operational. This is likely to take place at least 4 times per year, and will be done by qualified independent staff.

8. IMPACT STATEMENT

The proposed power line can be built with acceptable levels of impact on avifauna should the recommendations in this report be followed. Of particular importance are: using the correct pole or pylon structure to avoid electrocution of various large bird species, and conducting an avifaunal walk down during the site specific EMP to identify sections of line requiring collision mitigation.

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APPENDIX 1. Criteria used for impact assessment (supplied by Savannah)

Direct, indirect and cumulative impacts of the issues identified through the scoping study, as well as all other issues identified in the EIA phase must be assessed in terms of the following criteria:

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

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

$S=(E+D+M)P$

S = Significance weighting

E = Extent

D = Duration

M = Magnitude

P = Probability

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

» < 30 points: Low (i.e. where this impact would not have a direct influence on the decision to develop in the area),

» 30-60 points: Medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated),

» > 60 points: High (i.e. where the impact must have an influence on the decision process to develop in the area).