ANKERLIG POWER LINE ALTERNATIVE

Avian Basic Assessment

Prepared by:

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EXECUTIVE SUMMARY

This study contains a brief review of literature on bird-power line impacts, and identifies potential impacts associated with a new 132 kV power routing from Atlantis Power station (Ankerlig) to Koeberg Nuclear Power plant, Western Cape. The possible impacts are: (i) minimal aerial-habitat alteration by the power lines themselves (due to existing lines along most of the planned route), (ii) disturbance by construction and maintenance activities, (iii) possible displacement or disturbance of sensitive species, and most critical, (iv) direct collision of birds with the power line network. Electrocution of avifauna is a lesser problem for all but the largest species on the power line infrastructure.

The impact zone of the power line route lies within the Hopefield Sand Fynbos vegetation zones. Up-to-date bird atlas data from the region indicates that habitat around the 7 km new routing supports up to 171 bird species, including 14 threatened (red-listed) species, and 18 collision-prone species ranked in the top 105 species.

The avian groups of greatest conservation significance likely to be impacted by the power lines include the flocking waterbirds near the main wetland hotspots near the Atlantis water treatment works where collision-prone White Pelicans *Pelecanus onocrotalus,* Fish Eagles *Haliaetus vocifer* and African Marsh Harriers *Circus ranivorus* were found at the wetland. Resident raptors such as Black Harriers *Circus maurus*, and African Marsh Harrier are rare collision-prone species within the Koeberg Nature Reserve at the southern end of the line.
Semi-quantitative assessments of the significance of the impacts to birds found before mitigation a medium score (56) suggesting mitigations are necessary, and after mitigation this could drop to medium-low score of 33.

Of the three alternative lines around the Ankerlig substation are concerned, the best option from an avian perspective is one that stays closest to the substation itself (option 2 [black] or 3 [pink]). Because option 1 [green] runs through a conservation area where endemic fynbos birds and Endangered Black Harriers *Circus maurus* are known to occur this is the least preferred option.

To mitigate the possible problems raised we recommend that: (i) Option 2 is followed from Ankerlig itself (ii) all power lines – *present and future* – particularly near the Atlantis wetland, and in the Koeberg Nature Reserve, are marked with diurnal and nocturnal bird diverters to reduce collision risk and (ii) monitoring of bird sensitive areas takes place for the areas highlighted as “sensitive” as well as the other existing lines in the area.

1. CONSULTANT'S DECLARATION OF INDEPENDENCE

Dr Rob Simmons and Marlei Martins are independent consultant (of Birds- Unlimited Environmental Consulting) hired by Savannah Environmental. We have no business, financial, personal or other interest in the activity, application or appeal in respect of which we were appointed other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise the objectivity of this specialist performing such work.

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R.E. Simmons, Marlei Martins, March 2015

2. BACKGROUND AND QUALIFICATIONS OF SPECIALIST CONSULTANT

Dr Rob Simmons was approached to undertake the specialist avifaunal assessment for the new 132 kV power line routes from Atlantis Power Station (Ankerlig) to Koeberg, in the Western Cape. He is an experienced ornithologist, with 30 years' experience and 100 papers on avian research and impact assessment work. More than twenty avian impact assessments have been undertaken throughout Namibia and South Africa. He independently undertakes research on threatened species (raptors, flamingos, waders and terns) at the FitzPatrick Institute, UCT (see www.fitzpatrick.uct.ac.za/docs/robert.html). Marlei Martins has 20 years' experience in animal rehabilitation and 4 years' experience in environmental impact assessment work as both a specialist and an assistant. She has worked in the Western Cape, Eastern Cape and Northern Cape and has experience in the Succulent Karoo, Nama Karoo and Fynbos biomes.

INTRODUCTION

Savannah Environmental have been commissioned by Eskom to determine the impacts of a two newly proposed power line that runs from Atlantis (Ankerlig) to the Koeberg power station (~7 km), in the Western Cape. They have appointed Dr Rob Simmons and Marlei Martins to conduct the specialist avifaunal assessment. This report is a Basic Assessment that reviews the bird species present from bird atlas records, and reports on those species most at risk from collision, avoidance and electrocution of the power lines and substations. In addition a brief (1d) site visit allowed us to record numbers of birds along sensitive sections of the proposed power line, particularly those associated with wetlands and possible flyways. We were also asked to investigate the possible impacts and suggest ways to mitigate them wherever feasible. This allows us to reduce impacts to the avian community to a minimum.

3. TERMS OF REFERENCE

The terms of reference for the Basic Assessment as provided by Savannah Environmental are as follows :

- To provide a basic avifaunal assessment of the power line options from the Atlantis substation to Koeberg
- Suggest mitigation measures to reduce all avian impacts to a minimum
- Review new alternatives suggested in November 2014
- To recommend a preferred route of three suggested for the power line alternatives around the Ankerlig Power station

4. STUDY METHODOLOGY

5.1. Approach

This Basic Assessment study includes the following steps:

- A review of available published and unpublished literature pertaining to bird interactions with power lines; this summarises the issues involved and the current level of knowledge in this field. Various data sources were examined including details of the avifauna of the area and previous studies of bird interactions with electrical infrastructures associated with them.

- A list of the avifauna likely to occur along the length of the power lines was compiled using a combination of the most recent (2007-2013) distributional data from bird atlas data and a 1-day visit to critical sections of the proposed line.
- A semi-quantified assessment of the significance of the impacts to birds

Table 1. A compilation of the bird atlas cards that the new line option crosses from Atlantis to Koeberg. A pentad refers to 5 x 5' square area that the Southern African bird atlas covers.

Locality and bird atlas cards		
Pentad	**Cards**	**Area**
3335_1825	24	Atlantis
3340-1825	51	Koeberg
Total 2 pentads; 75 cards		

- A short-list of priority bird species (defined in terms of conservation status and collision-prone ranking) which may be impacted by the power lines was extracted from the bird list. These species are considered the most important and their likelihood of occurrence (reporting rate) is given.

- The power line option to be put in context of the BAWESG (Birds and Wind Energy Specialist Group) sensitivity map of the western Cape taken from (http://www.birdlife.org.za/conservation/birds-and-wind-energy/windmap/325-windmap documentation)

5.2 Assessment of Impacts

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

» The **nature** - a description of what causes the effect, what will be affected and how it will be affected.
» The **extent (E)**, - 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 (D)**, - an indication of the expected length of impact:

* ∗ 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 (M)**, 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 (P)** *of occurrence*, is the likelihood of the impact actually occurring. Probability will be estimated on a scale of 1–5, where 1 is very unlikely (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 **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 (S)**, is a synthesis of the quantified characteristics above and can be assessed as low, medium or high; and is calculated as follows:

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).

Assessment of impacts is summarised in table format.

4.2 Data sources used

The following data sources and reports were used in the compilation of this report:

- Information on the biology (Hockey et al 2005), distribution (Harrison et al. 1997) and conservation status (Barnes 2000) of southern African birds was consulted. Up to date data were extracted from the Southern African Bird Atlas Projects (SABAP), which were obtained from the Animal Demography Unit website (http://sabap2.adu.org.za/index.php) for the relevant "pentads" of 5' x 5' from (SABAP 2: Table 1 above). From these data we compiled a list of the avifauna known to occur within the impact zone of the proposed power lines. These data were combined, with our own 1 day visit to the area on 6 March 2014.
- Conservation status and collision-prone ranking of all species considered likely to occur in the area was determined from the South African Red-list for birds and its updates (Barnes 2000, M Taylor in litt), and the ranking of collision-prone birds drawn from the BAWESG tabulation.
- Data on breeding Black Harriers *Circus maurus* (R.E. Simmons unpubl. data)
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4.3 Limitations & assumptions

Inaccuracies in the above sources of information can limit this study. The SABAP1 data for this area is over 20 years old (Harrison *et al.* 1997), so we have used only the new SABAP 2 data set. This has a higher spatial resolution specific to the power lines and is up to date (2007 to 2014). A 1-day site visit is insufficient to cover all areas, so we sub-sampled at sensitive spots along the line. These 3-4 hour sampling bouts may miss certain areas of importance or rarer birds that a longer visit, in a different season, with longer sampling intervals would cover better.

6. BACKGROUND REVIEW

6.1 Interactions between power lines and birds

Causes of collision

The identity of the species present in the area is also very important as some birds are more vulnerable to collision with power lines than others, and feature disproportionately in collision surveys (Drewitt & Langston 2006, 2008, de Lucas *et al.* 2008). Species-specific variation in behaviour, such as foraging, commuting or courting, also affect susceptibility to collision (Barrios & Rodríguez 2004, Smallwood *et al.* 2009). There may also be seasonal and temporal differences in behaviour, for example breeding males displaying may be particularly at risk (Simmons 2011).

Landscape features often channel birds towards a certain area, and in the case of raptors, influence their flight and foraging behaviour. Ridges and steep slopes are important factors in determining the extent to which an area is used by gliding and soaring birds (Barrios & Rodríguez 2004). High densities of prey will attract raptors, increasing the time spent hunting, and as a result reducing the time spent being vigilant. Poor weather affects visibility. Birds fly lower during strong headwinds (Hanowski & Hawrot 2000, Richardson 2000), so they are more susceptible to power lines - even small reticulation lines (K de Goode, Eskom, pers comm).
Indeed more large-bodied birds such as bustards are killed on smaller reticulation lines than larger transmission lines because there are about 58 000 km of such line in South Africa. This amounts to an estimated 47 000 bustards per year for Ludwig's Bustards *Neotis ludwigii (*Shaw 2013).

Collision prone birds

Collision prone birds are generally either (i) large species or those with high ratios of body weight to wing surface area, and low maneuverability (e.g. cranes, bustards, vultures, gamebirds, waterfowl, falcons), (ii) species which fly at high speeds (gamebirds, pigeons and sandgrouse, swifts, falcons), (iii) species which are distracted in flight - predators or species with aerial displays (many raptors, aerial insectivores, some open country passerines), (iv) species which habitually fly in low light conditions (owls, dikkops), and (v) species with narrow fields of forward binocular vision (blue crane, bustard) (Drewitt & Langston 2006, 2008, Jenkins *et al.* 2010). These traits confer high levels of *susceptibility*, which may be compounded by high levels of *exposure* to man-made obstacles such as overhead power lines and wind turbines area (Jenkins *et al.* 2010). Exposure is greatest in (i) highly aerial species, (ii) species that make regular or long distance movements (e.g. migrants, any species with widely separated resources: food, water, roost and nest sites), (iii) species that fly in flocks (increasing the chances of incurring multiple fatalities in single collision incidents). Soaring species may be particularly prone to colliding with power lines where these are placed along ridges - vultures, storks, cranes, and most raptors (Erickson et al. 2001, Kerlinger & Dowdell 2003, Drewitt & Langston 2006, 2008, Jenkins *et al.* 2010).

Analysis of the susceptibility to power line collisions for some species (e.g. bustards and cranes) has been undertaken by Martin and Shaw (2010) and Shaw et al. (2010). From lab experiments they determined that species such as bustards and cranes have **"blind spots**" in their forward vision and simply do not see obstacles in front of them. This is due more to the placement of the eyes in the skull than poor vision by the birds. To see forward the birds have to turn their heads from side to side. This is why these species head the collision-victim tables of the EWT power-line monitoring. Collisions of bustards are so common that it is difficult to know how the southern African populations of Ludwig's Bustards are maintained (Shaw 2013).

Mitigating collision risk

Laboratory-based studies of visual acuity in raptors have determined that (i) visual acuity in kestrels appears superior when objects are viewed at a distance, suggesting that the birds may view nearby objects with one visual field and objects further away with another.

Marking overhead lines with bird diverters is one way of reducing impacts for those species that see such devices. However, not all collision-prone species do so, and avoiding areas where these birds occur, congregate or breed is the best form of mitigation. Night-time fliers (e.g. flamingos) are particularly susceptible and newly developed LED lights powered with tiny solar panels are currently being field-tested (C. Hoogstadt, EWT, pers. comm.).

6.1.1 Habitat loss – destruction, disturbance and displacement

The construction and maintenance of substations, power lines, servitudes and roadways causes both temporary and permanent habitat destruction and disturbance. New overhead power lines also pose a collision - and possibly an electrocution - threat to certain species (Van Rooyen 2004a, Lehman *et al.* 2007, Jenkins *et al.* 2010). This may be of lasting significance in cases where power lines and pylons coincide with critical areas or migration corridors for restricted range, endemic and/or threatened species. Similarly, construction, and to a lesser extent ongoing maintenance activities, are likely to cause some disturbance of birds in the general surrounds, and especially of shy or ground-nesting species resident in the area. Mitigation of such effects requires that best-practice principles be rigorously applied - sites are selected to avoid the destruction of key habitats, and construction and final footprints, as well as sources of disturbance of key species, must be kept to a minimum.

On the other hand pylons erected in a tree-less landscape can have positive effects for some raptorial species and vultures that have adapted to using the structures for perching-hunting and/or breeding. Red-listed Martial Eagles *Polemaetus bellicosus*, for example, now use extensive areas of the Karoo where they did not occur before, nesting on the top stanchions of the pylons (Machange et al. 2005). All precautions should, though, be taken to ensure that perching raptors are not electrocuted.

Habitat destruction during construction and maintenance of power lines and substations

Some habitat destruction and alteration inevitably takes place during the construction of power lines, the on-site substation (switching yard) and associated roadways. Also, power line servitudes have to be cleared of excess vegetation at regular intervals to allow access to the line for maintenance, and to prevent vegetation from intruding into the gaps between the ground and the conductors. These activities have an impact on birds breeding, foraging and roosting in or in close proximity to the servitude, and retention of cleared servitudes can have the effect of altering bird community structure along the length of any given power line (e.g. King & Byers 2002).

Another negative influence can be the introduction of Pied Crows to an otherwise crow-free environment, that allows these cosmopolitan predators into an area where they may reduce the survival and success of the small bird community around them (Madden 2013) and potentially reduce success of raptorial species breeding nearby (Simmons & Barnard 2011).

Collision with power lines

Power lines and wind turbines in principle pose equal collision risks to birds, affecting the same suite of collision prone species (Bevanger 1994, 1995, 1998, Janss 2000b, Anderson 2001, van Rooyen 2004a, Drewitt & Langston 2008, Jenkins *et al.* 2010). Mitigation of this risk involves the careful selection of low impact alignments for new power lines relative to bird movements and avoidance of concentrations of high risk species. Where this cannot be avoided, the use of static or dynamic marking devices to make the lines, (in particular the narrow earth wires at the top of the cable network), more conspicuous are needed (photo 1). While various marking devices have been used globally, many remain untested in terms of reducing collisions. Those that have been are only partially effective (Drewitt & Langston 2008, Jenkins *et al.* 2010). These devices are currently being field-tested in the Karoo with some success on reducing bird mortalities of Blue Cranes *Anthropoides paradiseus*.

Photo 1 Bird diverter on the earthwire

Electrocution on power lines

Avian electrocutions occur when a bird attempts to perch on an electrical structure and causes a short circuit by bridging the gap between live components and/or live and earthed components (van Rooyen 2004b, Lehman *et al.* 2007). Electrocution risk is strongly influenced by the voltage and design of the power lines erected – increasing where air gaps are relatively small on low voltage lines. They mainly affect larger, perching species, such as vultures, eagles and storks, capable of spanning the spaces between "live" components. This can be mitigated by the use of bird-safe structures (with critical air gaps >2 m), the physical exclusion of birds from high risk areas of live infrastructure (with spikes and other bird-unfriendly structures), and comprehensive insulation of such areas (van Rooyen 2004b, Lehman *et al.* 2007).

6.2. Description of the proposed alternative power lines

The route for the new power line is shown in Figure 1 (a). Alternatives suggested in November 2014 are shown in Figure 1 (b).

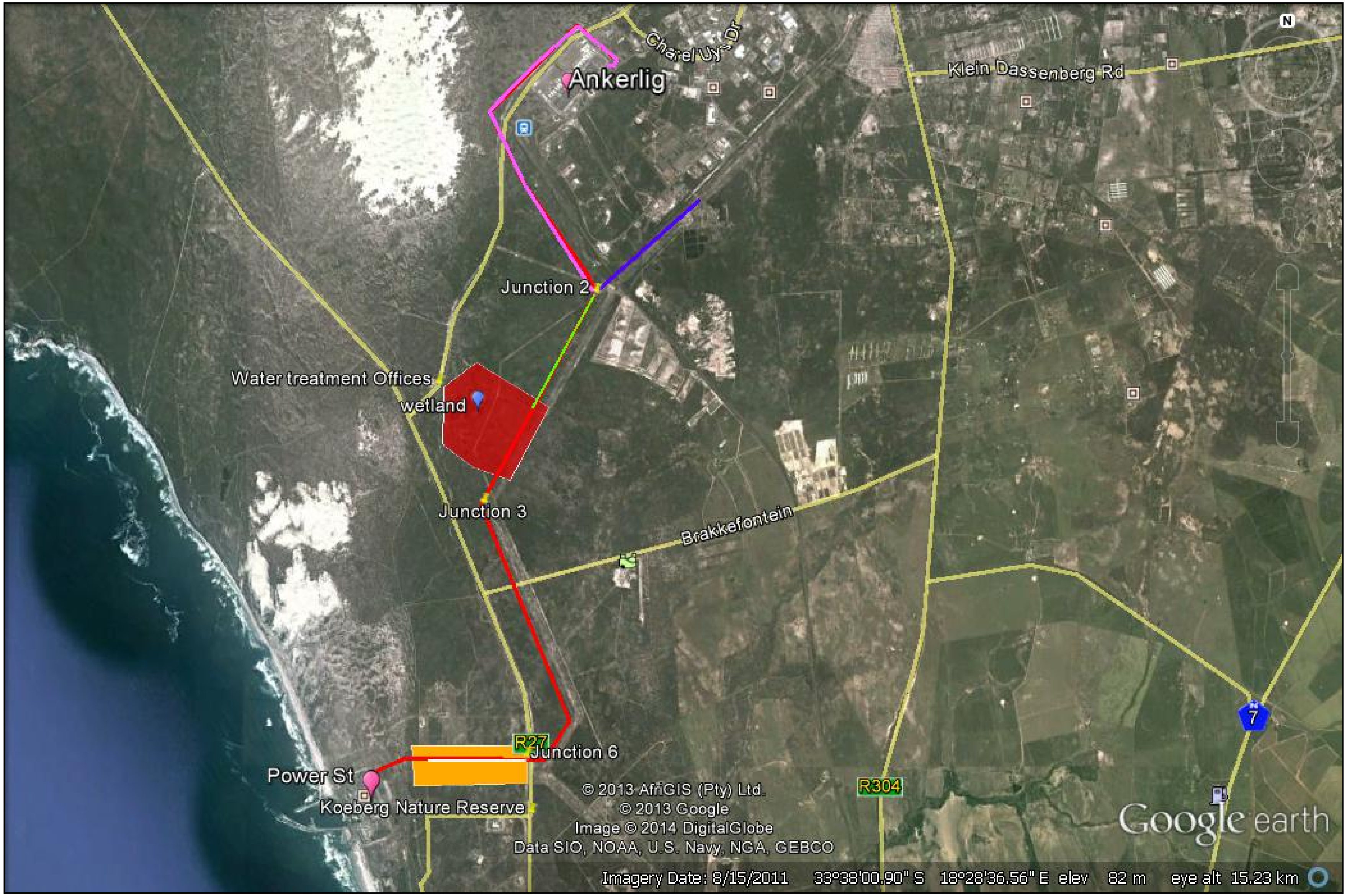

Figure 1a: The proposed power line from the Atlantis substation to Koeberg. The proposed line is 7 km long, and environmentally sensitive points are highlighted (wetland in red and Koeberg Nature Reserve in orange).

Figure 1 (b). Three alternatives proposed in November 2014 for the routing of the lines around the power station at Ankerlig. Alternative 1 (green) is the longest (5.1 km as shown) and occurs north of the Dassenberg Rd. Alternative 2 (black) is a short modification of that on the south of the road (4.0 km) and alternative 3 (pink) is around the substation (4.3 km) but is not considered feasible by Eskom for engineering reasons.

7. DESCRIPTION OF THE AFFECTED ENVIRONMENT

7.1 Vegetation of the study area

The region occurs in the western part of the Fynbos Biome (Mucina and Rutherford 2006) and the line crosses dry Sand Plain Fynbos (Mucina & Rutherford 2006) for the majority of its route south. Near Atlantis, the line passes through alien vegetation supporting Australian *Acacias* (Port Jackson and Rooikrans). The area experiences winter rainfall with an average of 326 mm. Relatively cool temperatures average just 16.6 – 16.9^{o}C. Coastal fog is common adding to soil moisture levels (Mucina & Rutherford 2006). There is high plant species diversity particularly in the Koeberg Nature Reserve.

7.2 Avian microhabitats

Bird habitats along the line options occurred in similar sand plain Fynbos, but some areas (closer to Atlantis) were choked with alien acacias. These offer very limited bird habitat and are depauperate in birds (photo 2).

Photo 2: Alien trees dominated the areas closer to the Ankerlig power station, providing poor bird habitat.

Photo 3: Wetland "Pond 6" near the Water Treatment Plant off the Atlantis Road. These inter-connected pans hold large numbers of wetland birds and raptors such as African Marsh Harriers *Circus ranivorus* and African Fish Eagles *Haliaetus vocifer*.

Photo 4. Vegetation occurring in the Koeberg Nature Reserve is mainly coastal Fynbos and is grazed by Eland and Zebra under the existing power lines.

The most important bird habitat is the wetland near the Water Treatment works ("Pond 6") just off the main Atlantis Road (photo 3). These always contain (fresh) water and islands where wetland birds can roost. In the central sections, the line runs parallel with the R27 but also through alien vegetation – again bird-poor habitat. Some raptors are likely to use the existing lines for perching and hunting, and Steppe Buzzards *Buteo vulpinus* often hunt the road verge for mice.

In the southern sections, the proposed line runs through pristine fynbos vegetation within the Koeberg Nature reserve, constituting only 2 km of the total 7 km line. This area, however, supports indigenous bird species such as prinias, sunbirds, sugarbirds, robins and Black Harriers (which breed here: RE Simmons unpubl data). Other raptors are likely to occur here and indeed were recorded in our site visit.

Of the three alternative lines from the Ankerlig substation itself,

- Option 1 (green in Figure 1b), is the longest (5.1 km) and traverses natural vegetation in the Atlantis Conservation area, north of the road;
- Option 2 (black in Figure 1b), is the shortest (4.0 km) and is routed south of the road and close to the existing substation in its initial routing;
- Option 3 (pink), hugs the perimeter of the substation. However, because of the sharp (90^{o}) angles of the power line, Eskom state that this is technically not a feasible option.

7.3 Bird Species and habitats found along the new power line route

The most up-to-date information available from the SABAP2 bird atlas scheme was used: 75 atlas cards were available along the 7 km length of line, submitted from 2007-2014.

A total of 171 bird species were recorded in the area through which the line passes (including the coast where this line does not pass). Of these, 18 were collision prone species as ranked by the BAWESG (2011), and 13 of these were red-listed. Excluding the coastal waterbirds (cormorants, penguins and oystercatcher), that will not be impacted by this line, 9 red-listed species are likely to occur near the power line option.

7.5 Likelihood of occurrence of collision-prone and red-listed birds in the study area

Here we now compare the likelihood of occurrence of the collision-prone and red-listed species using the reporting rate from SABAP2 atlas data.

Table 2. The likelihood of occurrence of Red-listed (**in red**) followed by other collision-prone species that occur along the entire route of the new line option, drawn from SABAP2 atlas cards for 2 pentads. These are based on 75 atlas cards submitted to the SABAP2 project from 2007 to 2014. Reporting rates **in bold** denote relatively common species.

Susceptible to:

Common name (collision ranking)	Scientific name	Red-list status	Reporting Rate* %	Electrocution	Disturb
Great White Pelican (11)	*Pelecanus onocrotalus*	Near-threatened	**25.3**	-	
Greater Flamingo (19)	*Phoenicopterus ruber*	Near-threatened	5.3	-	High
Secretarybird (9)	*Sagittarius serpentarius*	Near-threatened	2.7	-	
Peregrine (24)	*Falco peregrines*	Near-threatened	9.3	-	
Lanner Falcon (30)	*Falco biarmicus*	Near-threatened	1.3	-	
Black Harrier (6)	*Circus maurus*	Vulnerable	**21.3**	-	Moderate
Africa Marsh Harrier (15)	*Circus ranivorus*	Vulnerable	**10.7**	Moderate	High
Blue Crane (7)	*Anthropoides paradiseus*	Vulnerable	**24.0**	-	Moderate
Caspian Tern (60)	*Sterna caspia*	Near-threatened	2.7	-	High
Black-shouldered Kite (96)	*Elanus caeruleus*	-	**49.3**		
Booted Eagle (56)	*Aquila pennatus*	-	4.0		
African Fish Eagle (23)	*Haliaetus vocifer*	-	**12.0**		
Jackal Buzzard (44)	*Buteo rufofuscus*	-	**21.3**	Moderate	Moderate
Steppe Buzzard (65)	*Buteo vulpinus*	-	**28.0**		
Black Sparrowhawk (102)	*Accipiter melanoleucus*	-	1.3		
Grey-winged Francolin (76)	*Scleroptila africanus*	-	4.0		
TOTALS:	**Of 9 Red data species: 4 species relatively common**				
Of 7 (other) collision-prone species: 4 species relatively common					
All red data and collision-prone species: 8 species relatively common					

*Reporting rate is a measure of the likelihood of occurrence,

** Collision rank derived from the BAWSESG guidelines. Smaller numbers denote more collision-prone.

The likelihood of occurrence of red-listed species in the new line option is shown in Table 2. Of the nine red-listed species, 4 species had a reporting rate above 10%, suggesting they are relatively common in the study area (pelican, Black Harrier, Marsh Harrier, and Blue Crane). If we include the other 7 collision-prone species (Table 2) we see that four further species occurred above 10% - thus also relatively commonly (kite, Fish eagle, Jackal Buzzard, and Steppe Buzzard).

7.6 Actual numbers of collision-prone red data species

While the reporting rates (Table 2) indicate the likelihood of occurrence, it does not reveal numbers of birds. So we undertook a 1-day site visit and sampled at the two sensitive areas: (i) the open-water dams near the Atlantis Water treatment works and (ii) the 2 km length that falls within the Koeberg Nature Reserve. We spent 4.25 hours at the wetland and 3.5 hours in the Koeberg Nature Reserve and walked a 1 km transect to record the smaller species.

At the water treatment wetland "pond 6" we counted 136 birds of 23 species in 4 h 15 mins: these comprised wetland birds and raptors including two red-listed species: White Pelican *Pelecanus onocrotalus* and African Marsh Harrier.

The new alternatives for the lines around the substation at Ankerlig (Figure 1b) make no difference to the number of birds at risk.

However, because option 1 traverses the City of Cape Town conservation area, where natural vegetation (coastal and sand plain fynbos) occurs, this is the least preferred option from an avian point of view. Also conservation personnel at the conservation centre (K McKie pers obs) indicates that Black Harriers often cross the road here and would pass under the lines. Since we believe a Black Harrier pair may breed in the reserve (R.E. Simmons unpubl data), these birds may well display in this area and expose themselves to risk by impacting the lines.

Option 2 does not traverse the conservation area and therefore is less likely to cause impacts or displacement of birds in the area. Option 3 is apparently not feasible for technical reasons, and is not evaluated for avian impacts.

Table 3. Wetland and raptorial birds recorded in wetland near the Water Treatment work, 6 March 2014.

SPECIES	Pond 1	Pond 2	Pond 3
Little Grebe	2	7	
White Pelican	**6**		
White-b Cormorant	6	11	
Reed Cormorant	1	1	
African Darter	3	2	
Purple Heron	1		
Black-headed Heron	2		
Grey Heron	1		
Black-crowned Night Heron	9		
Great White Egret	5		1
Glossy Ibis	1	1	
African Spoonbill		2	
Egyptian Goose		9	2
Sacred Ibis		2	
Yellow-billed Duck	3	4	
Red-billed Teal		2	
Duck spp		32	
Blacksmith Plover	5		
Black-winged Stilt	2		
Hartlaub's Gull	3	4	
African Marsh Harrier	**1**		
African Fish Eagle	**2**		
African Goshawk	1		

Black shouldered Kite		**1**	**1**
TOTALS:	**45**	**87**	**4**
Species: 23 Red-listed spp: 2		**Birds: 136**	

Numbers of smaller bird species recorded in the 1 km transect in Koeberg Nature Reserve were typical of Fynbos habitat – 59 birds of 12 species were recorded including sunbirds, crows, bulbuls and prinias (Table 4). Two of these species were collision-prone species: Jackal Buzzards *Buteo rufofuscus* (2 adults and a juvenile), mobbed by a Black-shouldered Kite *Elanus caeruleus*. While not present in summer, Black Harriers forage through this area in the late winter through to December (RE Simmons pers obs) but generally occur at low level, foraging 1-5 m above the vegetation.

Table 4. Small Fynbos birds recorded in a 1 km transect under the proposed power line in the Koeberg NR

Species	No	Perpendic distance to observer (m)	Date	Habitat
Fiscal shrike	1	60	6/3/2014	Fynbos-type, wild dagga, sandy
Jackal Buzzard	1	0	6/3/2014	Fynbos-type, wild dagga, sandy
Karoo Prinia	1	30	6/3/2014	Fynbos-type, wild dagga, sandy
Cape spurfowl	1	10	6/3/2014	Fynbos-type, wild dagga, sandy
Cape bulbul	2	5	6/3/2014	Fynbos-type, wild dagga, sandy
Jackal Buzzard	1	100	6/3/2014	Fynbos-type, wild dagga, sandy
Kelp gull	1	75	6/3/2014	Fynbos-type, wild dagga, sandy
Pied crow	2	60	6/3/2014	Fynbos-type, wild dagga, sandy
Southern double-collared sunbird	1	55	6/3/2014	Fynbos-type, wild dagga, sandy
Jackal Buzzard (juv)	1	75	6/3/2014	Fynbos-type, wild dagga, sandy
Malachite sunbird	2	10	6/3/2014	Fynbos-type, wild dagga, sandy
Grey-backed Cisticola	1	20	6/3/2014	Fynbos-type, wild dagga, sandy
Karoo Prinia	1	60	6/3/2014	Fynbos-type, wild dagga, sandy
Fiscal shrike	1	5	6/3/2014	Fynbos-type, wild dagga, sandy
Pied starling	2	100	6/3/2014	Fynbos-type, wild dagga, sandy
Common starling	40	75	6/3/2014	Fynbos-type, wild dagga, sandy
12 species	**59**	**birds**		**Collision-prone species = 1** **Red-data species in this transect= 0**

If we include the BAWESG sensitivity map in the assessment (Figure 4) we see that the line passes through 2 medium risk squares.

Figure 2: Numbers and locations of all wetland species recorded on the pans Water Treatment works (see photo 3). The area held 136 birds in March 2014, of which 2 were red-listed (pelican and marsh harrier) and a total 11 collision-prone. This is a **high risk area** and requires mitigation occurring within 540 m of the proposed line (red line).

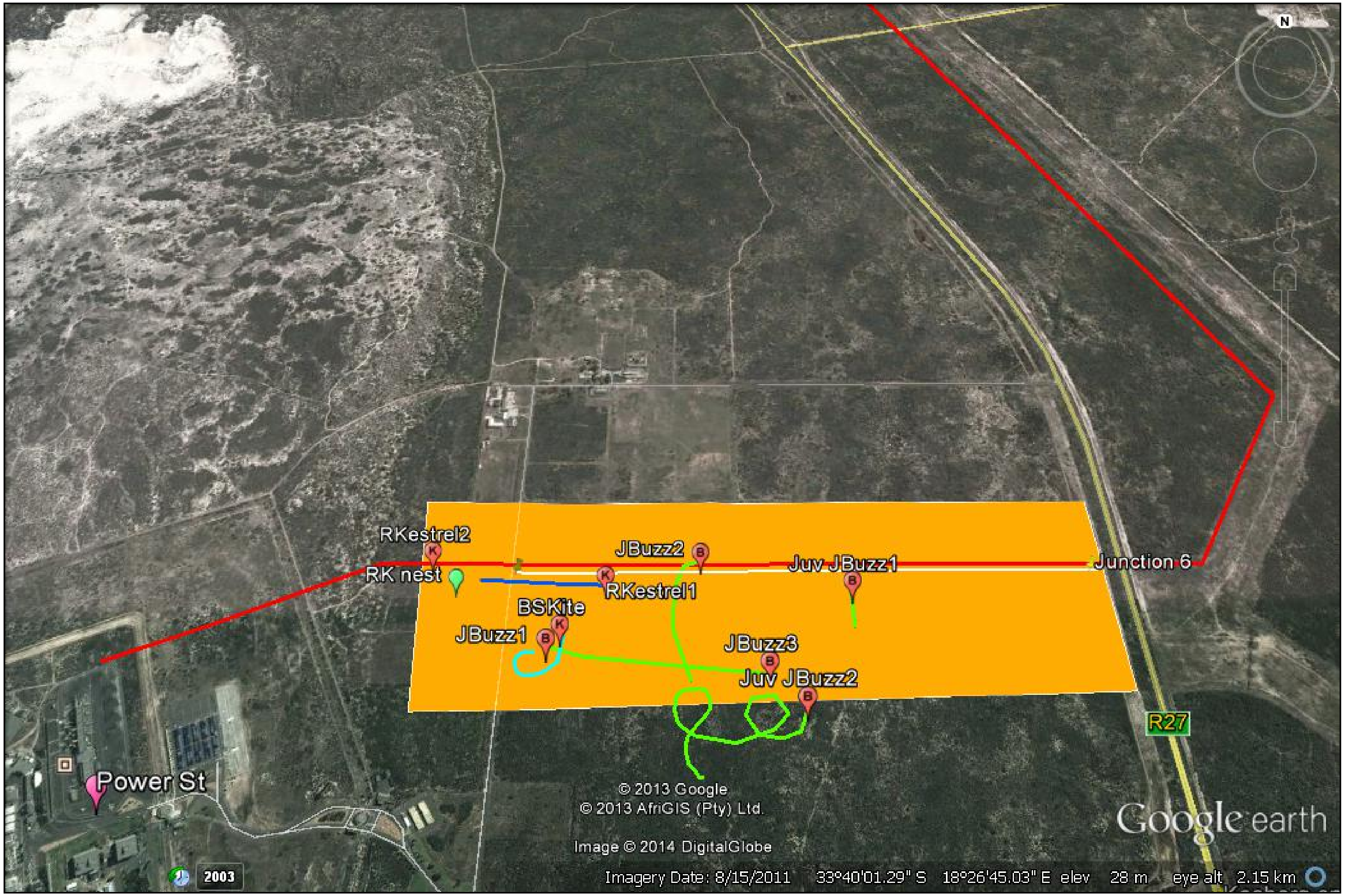

Figure 3 In the southern section of the line options near the Koeberg power station. Jackal Buzzards, Rock Kestrels (breeding) and Black shouldered Kites (BSKite) were all recorded with some flight paths (shown). More importantly, previous research has shown that the fynbos here is the main summer foraging area of Black Harriers which breed in the reserve. This is a **medium risk area.**

7.7 Line options in relation to national bird sensitivity areas

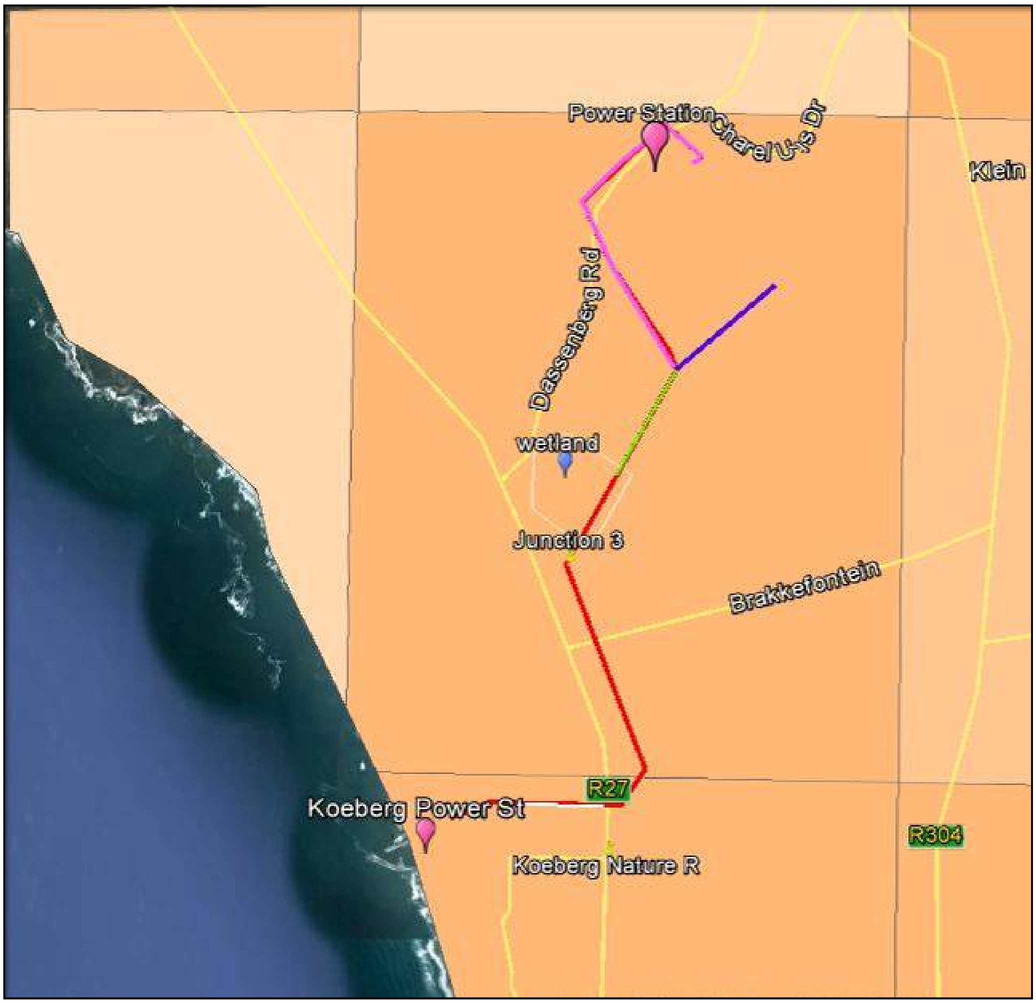

Figure 4: The main **line option** relative to the national bird sensitivity map (BAWESG 2011). The darker shaded areas (representing pentads of 9 x 7 km), indicate medium risk areas.

The new alternatives 1-3 around the Ankerlig power station do not influence the bird sensitivity map as they fall within this same square.

8. SUMMARY OF IMPACTS and MITIGATION

From the summary of all data sets (Table 8.1), we see that the proposed lines intersect habitat with 18 collision-prone species, 9 red-listed species, of which are relatively common in the study area. The number of areas where mitigation is required is one in the open wetlands (high risk area) and a second in a medium risk area in the Koeberg Nature Reserve.

Table 8.1. Summary of all data sets: atlas data (red-listed, collision-prone), likelihood of occurrence, actual numbers of birds in sensitive areas and number of sensitive areas (wetland and Koeberg NR) along the proposed line.

Category	**Number**
Atlas data: Collision prone species	**18**
Atlas data: **Red-listed** species	**9**
Relatively common (>10% reporting rate) Red-listed species	**4 of 9**
Number of high and medium risk crossings	**1 High risk** **1 Medium risk**
Highly sensitive bird pentads (from Fig 4)	**0**

Table 8.2. Quantified assessment of the risks associated with the power lines through the different areas. The two areas of concern (high-risk and medium-risk) marked red and orange in Figures 2 and 3 respectively above, are treated together in the table below.

Nature: *Power lines generally have a negative influence on birds in the landscape and often kill large unmanouverable species such as bustards, cranes, and vultures through direct impact or (less often) electrocution. They also provide nesting sites for Pied Crows in tree-less environments and these species often interact negatively with small passerines and larger raptors.*
Power lines can have a positive influence where they provide nesting sites for large threatened raptors (Martials and Vultures) in otherwise open habitats. This is a much rarer occurrence.

	Without mitigation	**With mitigation**
Extent	Local (2)	Low (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Moderate-High (7)	Medium-Low (5)
Probability	Probable (4)	Probable (3)
Significance	**Medium (56)**	**Medium-Low (33)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes, there two main methods of mitigating impacts of power lines (i) Moving the line farther from the potential source of conflict (ii) Affixing bird diverters (bird flappers) which alert birds to a danger ahead of them. Both **are strongly recommended** to be employed in the	

	placement of the line from Ankerlig to Koeberg
Mitigation: For the **High Risk area (Figure 2),** the best mitigation is to move the line to the **south of the exisiting line** and thus further from the source of the large numbers of birds (132 birds of 23 species in our survey). This means the line would be at least 700 m from the wetlands which are the focus of the birds in the area. The second, less effective option is to affix bird diverters (diurnal and nocturnal) to the lines in this area. For the **medium risk areas (Figure 3)** in the Koeberg Nature reserve, the line could not be moved and bird diverters are the best way to reduce bird impacts. Black Harriers breed in this reserve (to the north-west of the power station (R.E. Simmons unpubl), and they forage under these lines. Sometimes they perform aerial displays which bring them close these lines. Bird diverters would help reduce impacts by this Endangered species. To prevent crows breeding on the lines all pylon platforms should be fixed with "spikes" similar to those presently in use along these lines.	
Cumulative impacts: Thousands of kilometers of Eskom power lines occur throughout South Africa and large numbers of birds impact these lines each year. For example, 40% of the Ludwig's Bustard population are estimated to be killed by these lines every year (Shaw et al. 2012, Shaw 2013). An estimated 1 bird/km of line/year is killed so it is logical that the more lines there are the more deaths will occur. Every new line that is erected therefore must have mitigation measures (position, diverters, size, length and design for safety as possible). Without mitigation, some species (such as the bustards) are in danger of suffering such large population losses that their populations will decline in certain areas where power lines occur in highest densities.	
Residual Impacts: After mitigation there may still exist impacts to birds. For example, by moving the line away from the settling ponds at Atlantis there is no guarantee that birds will not still impact the line. The ideal way to avoid further impacts is for longer-term studies in the areas around the ponds at Atlantis and the line through the Koeberg NR to determine flight paths of collision-prone species. Many wetlands are approached from certain directions depending on the wind direction and openness of the surrounding vegetation (wetland birds have high wing-loading i.e. they are heavy fliers) and land and take off into the wind.	

By **summarizing** all these different risk assessments (Table 4) we see that the proposed line option has

- 9 red-listed species that occur along the proposed path;
- 4 of 9 red-listed species are relatively common (two harriers, pelican and Blue Crane) and collision-prone Black Harriers forage through the Koeberg section.
- The wetland area near the Water Treatment works is a **High risk area**, because of the large number of wetland birds (136) and species (23) recorded there.
- The Koeberg Nature Reserve is a **medium risk area** because of the collision-prone raptors there – Black Harriers, Jackal Buzzards, and Black-shouldered Kites. That 7

existing lines occur there already and three species (the buzzard, the kite and Rock Kestrels) use the pylons on which to perch and breed, means that these species are unlikely to be adversely affected. However, it is noted that **no bird deflectors** were present in either area, adding to the danger of the area for birds.

- The semi-quantitative summary (Table 8.2) indicates that the significance of the impacts is likely **medium (score 56)** before mitigation for the entire line and **low-medium (score 33)** after mitigation.
- We favour the routing power line alternative 2, (black) around the substation at Ankerlig because it does not cross natural vegetation within the conservation area, and is less likely to impact or displace birds.

Mitigation

Where the proposed line passes within 540 m of the wetland in the north (categorized as high risk because of the number of wetland birds) all lines should be **marked with bird diverters**.
Ideally the lines would be **constructed on the south-east side** of the present line – taking it further way (approximately 760 m) from the wetland and the birds there. This will help reduce bird impacts with this line.
Within the Koeberg NR, the line must also be marked with nocturnal and diurnal bird diverters, as it goes up.

There are many power lines that already cross highly sensitive areas (i.e. those close to the wetlands mentioned above) and **these should <u>all</u> be marked with bird diverters** to reduce possible collisions by pelicans, Black Harriers, marsh harriers and fish eagles that regularly use the wetland**.**

Construction work timing - should avoid the breeding season of the most sensitive species, particularly the raptorial species such as the African Marsh Harriers and Black Harriers. These species start to breed in July and end by December (Simmons 2005a, b). **Thus work is best carried out from January to May.**

Electrocutions can be avoided using the present devices (spikes) found on the pylons in Koeberg NR that prevent large birds from perching on the pylons. These are recommended for all pylons to be erected.

9. CONCLUSIONS AND PLAN OF STUDY FOR ENVIRONMENTAL MANAGEMENT PROGRAMME

The Basic Assessment study has identified that the proposed line option has one high risk (Water Treatment wetland) and one medium risk area (Koeberg NR) for birds.

The study identified several areas that require further assessment and monitoring: the above wetland where large numbers of wetland species occur throughout the year. The area holds over 100 birds in summer and few of the existing lines have adequate forms of bird mitigation. Assessments in other seasons to (i) identify the use of the pans by flamingos and other collision-prone species (ii) the mortality rate and (iii) which sections are most dangerous, should also be undertaken by a trained ornithologist.

The use of the Fynbos region in the Koeberg NR where the Black Harriers forage should also be assessed for (i) breeding birds (nests are known west of here but could occur here too) and (ii) foraging birds and the hotspots of hunting.

Thus the EMPr phase should include:

(i) Regular surveys of large collision-prone species, especially pelicans, flamingos and large raptors within the study area to determine the relative importance of local populations of priority taxa;

(ii) Study of the movements of the wetland species and raptors at different times of year through the wetland and Koeberg bird-sensitive areas;

(iii) The effectiveness of bird diverters and especially any hot spots of collisions along the existing lines.

The results will allow a more detailed assessment of all impacts and the efficacy of the recommended mitigation where necessary (particularly with reference to the usefulness of the bird diverters). Ultimately it will improve our understanding of the long-term effects of power lines on birds in South Africa.

10. REFERENCES

Anderson, M.D. 2001. The effectiveness of two different marking devices to reduce large terrestrial bird collisions with overhead electricity cables in the eastern Karoo, South Africa. Draft report to Eskom Resources and Strategy Division. Johannesburg. South Africa.

Avian Powerline Interaction Committee (APLIC). 1994. Mitigating bird collisions with power lines: the state of the art in 1994. Edison Electric Institute. Washington DC.

Barnes, K.N. (ed.) 1998. The Important Bird Areas of southern Africa. BirdLife South Africa, Johannesburg.

Barnes, K.N. (ed.) 2000. The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland. BirdLife South Africa, Johannesburg.

Bevanger, K. 1994. Bird interactions with utility structures: collision and electrocution, causes and mitigating measures. *Ibis* 136: 412-425.

Bevanger, K. 1995. Estimates and population consequences of Tetraonid mortality caused by collisions with high tension power lines in Norway. *Journal of Applied Ecology* 32: 745-753.

Bevanger, K. 1998. Biological and conservation aspects of bird mortality caused by electric power lines. *Biological Conservation* 86: 67-76.

Drewitt, A.L. & Langston, R.H.W. 2008. Collision effects of wind-power generators and other obstacles on birds. *Annals of the New York Academy of Science* 1134: 233-266.

Harrison, J.A., Allan, D.G., Underhill, L.G., Herremans, M., Tree, A.J., Parker, V & Brown, C.J. (eds). 1997. The atlas of southern African birds. Vol. 1&2. BirdLife South Africa, Johannesburg.

Hockey, P.A.R., Dean, W.R.J., Ryan, P.G. (Eds) 2005. Roberts – Birds of Southern Africa, VIIth ed. The Trustees of the John Voelcker Bird Book Fund, Cape Town.

Janss, G.F.E. 2000. Avian mortality from power lines: a morphologic approach of a species-specific mortality. *Biological Conservation* 95: 353-359.

Jenkins J, Simmons RE, Curtis O, Atyeo M, Raimondo D, Jenkins AR. 2012. The value of the Black Harrier (*Circus maurus*) as a predictor of biodiversity in the plant-rich Cape Floral Kingdom, South Africa. *Bird Conservation International* 1-12. DOI: http://dx.doi.org /10.1017/S0959270911000323

Jenkins, A.R. 2008. Eskom generation wind energy facility – Western Cape: Avifaunal impact assessment. Report to Savannah Environmental PTY (Ltd).

Jenkins, A.R. 2009. Hopefield wind energy facility: avifaunal impact assessment. Report to Savannah Environmental PTY (Ltd).

Jenkins, A.R., Smallie, J.J. & Diamond, M. 2011. South African perspectives on a global search for ways to prevent avian collisions with overhead lines. *Bird Conservation International*.

King, D.I. & Byers, B.E. 2002. An evaluation of powerline rights-of-way as habitat for early-successional shrubland birds. *Wildlife Society Bulletin* 30: 868-874.

Lehman, R.N., Kennedy, P.L. & Savidge, J.A. 2007. The state of the art in raptor electrocution research: a global review. *Biological Conservation* 136: 159-174.

Machange Jenkins and Navarro. 2005. Eagles as indicators of ecosystem health: Is the distribution of Martial Eagle nests in the Karoo, South Africa, influenced by variations in land-use and range land quality. J Arid Environ 63:223-243.

Madden CF. 2013. The impact of corvids on biodiversity. Unpubl MSc thesis. FitzPatrick Institute, University of Cape Town, Rondebosh.

Mucina. L. & Rutherford, M.C. (Eds) 2006. The vegetation of South Africa, Lesotho and Swaziland. *Strelitzia* 19. South African National Biodiversity Institute, Pretoria.

Shaw, J., Jenkins, A.R. Smallie J & Ryan, P.G. 2010. Modelling collision risk for the Blue Crane *Anthropoides paradiseus*. Ibis 152: 590-599.

Shaw, J. 2013. Power line collisions in the Karoo: conserving Ludwig's Bustards. PhD thesis FitzPatrick Institute UCT.

Simmons RE. 2011. Greater Kestrel survives impact with powerlines. Ostrich 82:75-76.

Simmons RE 2005a. Black Harrier *Circus maurus. In:* In: Hockey PAR, Dean WRJ, Ryan P (eds.) *Roberts' Birds of Southern Africa***.** 7: 502-503 John Voelcker Bird Book Fund, Black Eagle Publishing Cape Town.

Simmons RE 2005b. African Marsh Harrier *Circus ranivorus.* In: Hockey PAR, Dean WRJ, Ryan P (eds.) *Roberts' Birds of Southern Africa***.** PP 501-5012. John Voelcker Bird Book Fund, Black Eagle Publishing Cape Town

Van Rooyen, C.S. 2004a. The Management of Wildlife Interactions with overhead lines. In The fundamentals and practice of Overhead Line Maintenance (132kV and above), pp217-245. Eskom Technology, Services International, Johannesburg.

Van Rooyen, C.S. 2004b. Investigations into vulture electrocutions on the Edwardsdam-Mareetsane 88kV feeder, Unpublished report, Endangered Wildlife Trust, Johannesburg.

Young, D.J., Harrison, J.A., Navarro, R.A., Anderson, M.D. & Colahan, B.D. (eds). 2003. Big birds on farms: Mazda CAR report 1993-2001. Avian Demography Unit, Cape Town.

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