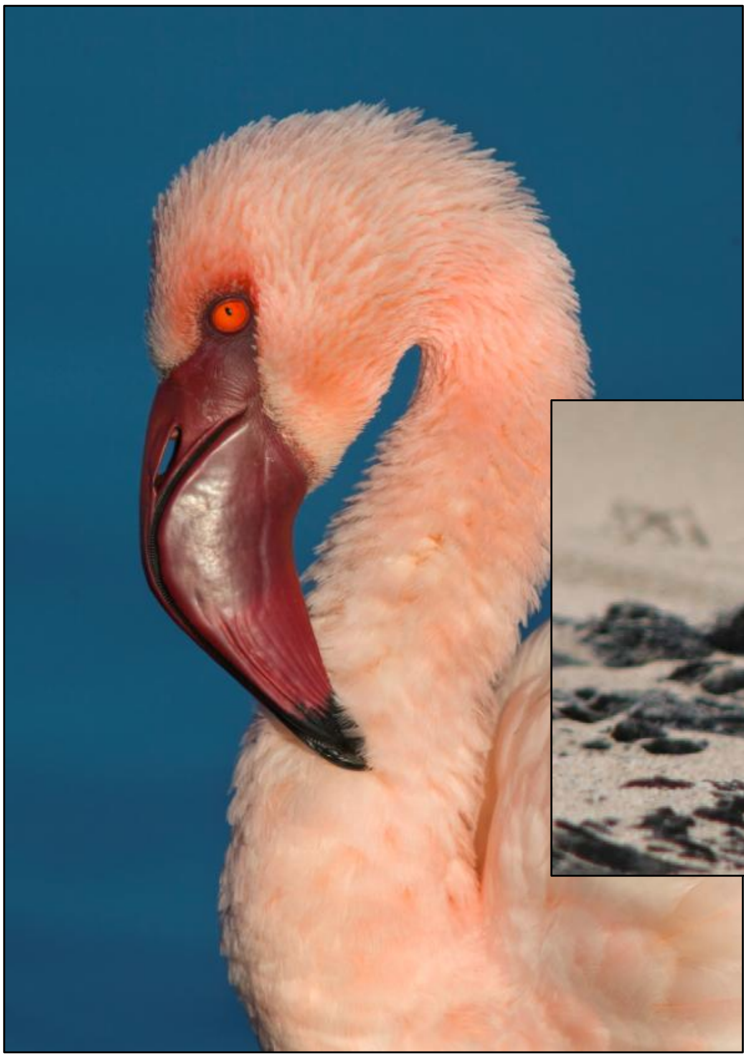
KLEINZEE 300MW WIND FARM

Avian impact assessment

- Scoping Phase -



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EXECUTIVE SUMMARY

This study contains a review of the relevant literature on wind energy impacts on avifauna, and identifies potential impacts of the proposed Kleinzee Wind Energy Facility on the avifauna of the area. The possible impacts are: habitat alteration by the facility itself and any associated power lines or substation/s and other associated infrastructure, disturbance by construction and maintenance activities and possible displacement or disturbance of sensitive species, collision with blades of the wind turbines and with the associated power line network, and electrocution of avifauna by the required power line infrastructure.

The impact zone of the large (300 MW) wind energy facility proposed for the area near Kleinsee within the Namaqualand vegetation zone is reviewed. The area is likely to support over 160 bird species, including 14 threatened (red-listed) species, 4 endemic species, of which 6 are red-listed endemics. The avian groups of greatest conservation significance likely to be impacted by the turbines include the flocking waterbirds such as cormorants and flamingos, two species of collision-prone bustards, and a suite of resident raptor species. Impacts may occur in terms of both collision and disturbance from the facility itself. A rich vein of endemic passerines may also be affected by disturbance impacts.

These issues can be investigated in more detail during the EIA phase. In particular the significance of bird collisions with the turbines will be assessed in order to determine whether the risk warrants mitigation. The degree and significance of this impact will depend largely on the relative abundance and movements of key species, and the distribution of their preferred microhabitats in relation to the turbines. The Impact Assessment phase will generate more detailed assessments of all impacts. Recommended mitigation where necessary must be implemented to address the actual impacts of the wind energy facility after construction.

1. CONSULTANT'S DECLARATION OF INDEPENDENCE

I, Dr. Rob Simmons am an independent consultant to Savannah Environmental (Pty) Ltd and to Eskom Holdings SOC Limited. I have no business, financial, personal or other interest in the activity, application or appeal in respect of which I was 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.

2. BACKGROUND AND QUALIFICATIONS OF SPECIALIST CONSULTANT

Dr Rob Simmons is a private consultant approached to undertake the specialist avifaunal assessment for the Wind Farms proposed near Kleinzee. I am an experienced ornithologist, with over 25 years experience in avian research and impact assessment work. I have undertaken eighteen avian impact assessments throughout Namibia and South Africa, and I undertake research on threatened species at the FitzPatrick Institute, UCT. In the Western and Northern Cape I specialize in raptors (particularly Black Harriers), shorebirds (particularly flamingos) and seabirds (particularly Damara Terns). I am a Research Associate of the University of Cape Town and of the Institute of Zoology, London.

3. INTRODUCTION

Savannah Environmental has been commissioned to determine the impacts of a proposed Eskom Generation 300MW wind energy facility near Kleinzee on the Northern Cape coast They have appointed Dr Rob Simmons to conduct the specialist avifaunal assessment. This report is set at the Scoping stage to review the bird species present from bird atlas records, to determine which are most at risk from collision, avoidance and electrocution with the various turbines, power lines and substations and other infrastructure proposed for this project. In addition it gives an overview of the habitats and areas that may pose the greatest risk, such that turbine placement can be re-evaluated.

4. TERMS OF REFERENCE

The terms of reference for the Scoping study were not explicitly outlined but I here:

- Describe the existing avifaunal and mammalian environment at the appropriate scale (local and regional)
- Determine the importance and conservation value of the existing avian communities.
- Determine and assess the potential avian impacts associated with the proposed development.
- Ensure that the assessment meets the requirements as outlined in the Recommended Terms of Reference for the consideration of Biodiversity in Environmental Assessment and Decision Making (Botanical Society of SA Conservation Unit, December 2004) and DEA Guidelines for involving Biodiversity Specialists in the EIA processes.
- Suggest additional studies at the Impact Assessment phase

5. STUDY METHODOLOGY

5.1. Approach

This desktop scoping study included the following steps:

- A review of available published and unpublished literature pertaining to bird interactions with wind energy facilities that 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 wind energy facilities and electrical infrastructure associated with them.
- An inclusive list of the avifauna likely to occur within the impact zone of the proposed wind energy facility was compiled using a combination of the existing distributional data from published atlases and my previous experience of the avifauna of the general area.
- A short-list of priority bird species (defined in terms of conservation status and endemicity) which may be impacted by the proposed wind energy facility was extracted from the bird list. These species were considered as adequate surrogates for the local avifauna generally, and mitigation of impacts on these species was considered likely to accommodate any less important bird species that may be affected.

- A summary of more likely and significant impacts of the wind energy facility on the local avifauna was drawn up, and a brief methodology was devised for the EIA phase for confirming these impacts and developing an effective mitigation strategy.

5.2 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 quarter-degree square (SABAP 1) and the "pentads" of 5' x 5' from (SABAP 2: 2940_1700). From these squares, a list of the avifauna likely to occur within the broader impact zone of the proposed wind monitoring masts was compiled. This data, with previous experience/knowledge of the local avifauna, undertaken on trips made through this area over the last 10 years was combined.
- Conservation status and endemicity of all species considered likely to occur in the area was determined from the national Red-list for birds (Barnes 2000), and the most recent and comprehensive summary of southern African bird biology (Hockey *et al.* 2005).
- EIA reports and subsequent monitoring reports on the potential impacts on birds of other wind energy facilities in South Africa were also assessed (van Rooyen 2001, Jenkins 2001, 2003, Küyler 2004, Jenkins 2008, 2009).

5.3 Limitations & assumptions

Inaccuracies in the above sources of information could limit this study. The SABAP1 data for this area is almost 19 years old (Harrison *et al.* 1997), and this area is relatively remote and seldom visited. However, a relatively healthy set of atlas cards has been submitted by Dr Sutherland (private resident of Kleinsee) in the SABAP2 scheme and this forms a solid basis for this desk-top study.

There are only two, small wind energy facilities functioning in South Africa (totaling 8 turbines), therefore data on the environmental effects of wind energy facilities in South Africa is limited. However, numerous studies are emerging from such facilities internationally. While general principles can be gleaned from them, care is required when adapting international knowledge and experience to uniquely South African birds and conditions.

6. BACKGROUND

6.1 Interactions between wind energy facilities and birds

Recent literature reviews (www.nrel.gov, Kingsley & Whittam 2005, Drewitt & Langston 2006, Kuvlevsky *et al.* 2007, Stewart *et al.* 2007, Drewitt & Langston 2008) are essential summaries and sources of information in the field of wind energy facilities. The number of longer-term analyses of the effects of wind energy facilities on birds is increasing, but scientific research in this field is still in its infancy (Madders & Whitfield 2006, Stewart *et al.* 2007). Available information originates from short-term studies from the United States, and more recently longer-term ones from western Europe, where wind power generation is well established.

Concern about the impacts of wind facilities on birds first arose in the 1980s when numerous raptor mortalities were detected in California (Altamont Pass - USA) and at Tarifa (Spain). Mortalities at these sites focused attention on the impact of wind energy facilities on birds, and subsequently much monitoring has been done at a wide variety of wind energy facility sites. More recently, there has been additional concern about the degree to which birds avoid or are excluded from the areas occupied by wind energy facilities – either because of the action of the turbine blades or because of the noise they generate - and hence suffer a loss of habitat (Larsen & Guillemette 2007, Stewart *et al.* 2007, Devereaux *et al.* 2008. Pearce-Higgins *et al.* 2009). With a few important exceptions, most studies suggest very low numbers of bird fatalities at wind energy facilities numbering tens to hundreds of birds per year (Kingsley & Whittam 2005). The observed mortality caused by wind energy facilities is also very low compared to other existing sources of anthropogenic avian mortality on a per structure basis (Crockford 1992, Colson & associates 1995, Gill *et al.* 1996, and Erickson *et al.* 2001). Problems arise when the birds impacted by the wind energy facility are rare or highly threatened species, or species of concern.

6.1.1. Collisions with turbines

Collision rates

As more monitoring has been conducted, bird mortality rates at wind energy facilities have ultimately been compared in terms of a common unit: mortalities/turbine/year, or mortalities MW^{-1} $year^{-1}$ (Smallwood & Thelander 2008). Wherever possible, measured collision rates should allow for (i) the proportion of actual casualties which are detected by observers (searcher efficiency), and (ii) the rate at which carcasses are removed by scavengers (scavenger removal rate – important in an African landscape). Although collision rates may appear relatively low in many instances, cumulative effects over time, especially when applied to large, long lived, slow reproducing and/or threatened species (many of which are collision-prone), may be of considerable conservation significance.

The National Wind Co-ordinating Committee (2004) estimated that 2.3 birds are killed/turbine/year in the US outside California – correcting for searcher efficiency and scavenger rates. However, this index ranges from as low as 0.63 in Oregon to as high as 10 in Tennessee (NWCC 2004) illustrating the wide variance in mortality rates between sites. Curry & Kerlinger (2000) found that only 13% of the >5000 turbines at Altamont Pass, California were responsible for all Golden Eagle *Aquila chrysaetos* and Red-tailed Hawk *Buteo jamaicensis* collisions. However, the most recent total casualty estimates for Altamont run to >1000 raptors, and nearly 3000 birds, killed in turbine collisions annually (Smallwood & Thelander 2008). This large figure includes >60 Golden Eagles, and at a mean rate of about 2-4 mortalities MW^{-1} $year^{-1}$.

At the Tarifa and Navarre wind energy facility sites on the Straits of Gibraltar, southern Spain, about 0.04-0.08 birds are killed/turbine/year (Janss 2000a, de Lucas *et al.* 2008), with relatively high collision rates for threatened raptors such as Griffon Vulture *Gyps fulvus*, of particular concern. At the same sites, collisions have also been found to be non-randomly distributed between turbines, with >50% of the vulture casualties recorded at Tarifa being killed by only 15% of the turbine array at the facility (Acha 1997). Collision rates from other European sites are equally variable, with certain locations sporadically problematic (Everaert 2003). Migration highways and other areas where birds funnel through a bottleneck are areas which should be avoided.

To date, only eight wind turbines have been constructed in South Africa, seven at two pilot facilities at Klipheuwel and Darling in the Western Cape (van Rooyen 2001, Jenkins 2001, 2003), and one at Coega. An avian mortality monitoring program was established at the Klipheuwel facility once the turbines were operational, involving regular site visits to monitor bird traffic through the area, and to detect bird mortalities (Küyler 2004). This study found that (i) 9-57% of birds observed within 500m of the turbines per survey period were flying at blade height, and (ii) 0-32% of birds sighted were flying either between the turbines or within the arc of the rotors of the outermost turbines. Five bird carcasses were found on the three-turbine site during the 8-month monitoring period, of which two, a Horus Swift *Apus horus* and a Large-billed Lark *Galerida magnirostris*, were thought to have been killed by collision with turbine blades, indicating a net collision rate for birds of about 1.00 mortality/turbine/year. Only short-term studies have been undertaken at the Darling site (Simmons et al. in press). Endemic species such as Black Harrier, and Jackal Buzzard and also Martial Eagles and Great White Pelican were observed, and the rate of passage was 13birds h^{-1}.

Causes of collision

Multiple factors influence the number of birds killed at wind energy facilities. These can be classified into three broad groupings: avian variables, location variables, and facility-related variables. Although only one study has so far shown a direct relationship between the abundance of birds in an area and the number of collisions (Everaert 2003), it would seem logical to assume that the more birds there are flying through an array of turbines, the higher the chances of a collision occurring. The identity of the species present in the area is also very important as some birds are more vulnerable to collision with turbines than others, and feature disproportionately frequently in collision surveys (Drewitt & Langston 2006, 2008, de Lucas *et al.* 2008). Species-specific variation in behaviour, such as foraging, commuting or courting, also affects 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.

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 when the turbines (at hub heights of 40-80m) are functioning at their maximum speed, birds are likely to be flying at their lowest, exponentially increasing collision risk (Drewitt & Langston 2006, 2008).

Larger wind energy facilities, with more turbines, are almost by definition more likely to incur significant numbers of bird casualties (Kingsley & Whittam 2005), and turbine size may be proportional to collision risk, with taller turbines associated with higher mortality rates in some instances (e.g. de Lucas *et al.* 2009, although see Howell 1995, Erickson *et al.* 1999, Barclay *et al.* 2007). However, with newer technology, fewer, larger turbines are needed to generate the same amount of power, which may result in fewer collisions per Megawatt of power produced (Erickson *et al.* 1999). Certain turbine tower structures, and particularly the old-fashioned lattice designs, present many potential perches for birds, increasing the likelihood of collisions occurring as birds land at or leave these perch or roost sites. This problem has largely been solved with more modern, tubular tower designs (Drewitt & Langston 2006, 2008) (as proposed for the Kleinzee Wind Energy Facility).

Illumination of turbines and other infrastructure often increases collision risk (Winkelman 1995, Erickson *et al.* 2001), either because birds moving long distances at night navigate using stars, and mistake lights for stars (Kemper 1964), or because lights attract insects, which in turn attract birds. Changing constant lighting to intermittent lighting has been shown to reduce nocturnal collision rates (Richardson 2000, APLIC 1994, Jaroslow 1979, Weir 1976) and changing flood-lighting from white to red (or green) can effect an 80% reduction in mortality rates (Weir 1976).

Spacing between turbines at a wind facility can also affect the number of collisions. Some authors have suggested that paths need to be left between turbines so that birds can move through these paths. Alternatively, where certain turbines are known to kill more birds they can be temporarily be taken out of service (e.g. during migration or breeding). For optimal wind generation, relatively large spaces are required between turbines in order to avoid wake and turbulence effects.

Collision prone birds

Collision prone birds are generally either (i) large species and/or species with high ratios of body weight to wing surface area, and low maneuverability (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, and (v) species with narrow fields of forward binocular vision (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 turbine areas (Jenkins *et al.* 2010). Exposure is greatest in (i) highly aerial species, (ii) species that make regular and/or long distance movements (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 wind turbines or power lines where these infrastructure are placed along ridges, the turbines exploit the same updrafts favoured by such birds - vultures, storks, cranes, and most raptors (Erickson et al. 2001, Kerlinger & Dowdell 2003, Drewitt & Langston 2006, 2008, Jenkins *et al.* 2010).

Mitigating collision risk

One direct way to reduce the risk of birds colliding with turbine blades is to render the blades more conspicuous and hence easier to avoid. Blade conspicuity is compromised by a phenomenon known as 'motion smear' or retinal blur, in which rapidly moving objects become less visible the closer they are to the eye (McIsaac 2001, Hodos 2002). The retinal image can only be processed up to a certain speed, after which the image cannot be perceived. This effect is magnified in low light conditions, so that even slow blade rotation can be difficult for birds to see.

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, (ii) moderate motion of the visual stimulus significantly influences acuity, and kestrels may be unable to resolve all portions of an object such as a rotating turbine blade because of motion smear, especially under low contrast or dim lighting conditions, (iii) this deficiency can be addressed by patterning the blade surface in a way which maximizes the time between successive stimulations of the same retinal region, and (v) the easiest, cheapest and most visible blade pattern for this purpose, effective across the widest variety of backgrounds, is a single black blade in an array of white blades (McIsaac 2001, Hodos 2002). Hence blade marking or reflective paint may be an important means to reduce collision rates by making the rotating turbine blades as conspicuous as possible under the least favourable visual conditions, particularly at facilities where raptors are known or considered to be the most likely collision casualties. While it is contra to CAA regulations to mark turbine blades in South Africa, their marking with UV paint that is highly visible to birds, but invisible to the human eye. Thus blade marking with UV may benefit blade visibility and not violate South African regulations.

Marking turbine rotors in this way, does not guarantee reduced collision frequency, especially during strong winds (when rotor speeds increase and birds tend to fly low and with less control) and when visibility is poor (at night or in thick mist). All other collision mitigation options operate indirectly, by reducing the frequency with which collision prone species are exposed to collision risk. This is achieved mainly by: (i) siting farms and individual turbines away from areas of high density or groupings and regular commuting or slope-soaring regions; (ii) using low risk turbine designs and configurations, which discourage birds from perching on turbine towers or blades, and allow sufficient space for commuting birds to fly safely through the turbine strings; and (iii) carefully monitoring collision incidence, and being prepared to shut-down problem turbines at particular times or under particular conditions (e.g. increased migration activity).

6.1.2 Habitat loss – destruction, disturbance and displacement

Although the final footprint of most wind energy facilities is likely to be relatively small, the construction phase of development inevitably incurs quite extensive temporary damage or permanent destruction of habitat, which may be of lasting significance in cases where wind energy facility sites coincide with critical areas 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 and/or ground-nesting species resident in the area. Mitigation of such effects requires that generic 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 an absolute minimum.

Some studies have shown significant decreases in the numbers of certain birds in areas where wind energy facilities are operational as a direct result of avoidance of the noise or movement of the turbines (e.g. Larsen & Guillemette 2007), while others have shown decreases which may be attributed to a combination of collision casualties and avoidance or exclusion from the impact zone of the facility in question (Stewart *et al.* 2007). Such displacement effects are probably more relevant in situations where wind energy facilities are built in natural habitat (Pearce-Higgins *et al.* 2009, Madders & Whitfield 2006) than in more modified environments such as farmland (Devereaux *et al.* 2008).

6.1.3 Impacts of associated infrastructure

Infrastructure commonly associated with wind energy facilities can be detrimental to birds. 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).

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, substations and associated roadways. Also, power line servitudes have to be cleared of excess vegetation at regular intervals in order to allow access to the line for maintenance. These activities may have an impact on birds breeding, foraging and roosting in or in close proximity to the servitude, because they can have the effect of altering bird community structure along the length of a power line (e.g. King & Byers 2002).

Collision with power lines
Power lines and wind turbines 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 (bird flappers) to make the lines, particular the earthwires more conspicuous are needed. While various marking devices have been used globally, many remain untested in terms of reducing collisions, and those that have been are only partially effective (Drewitt & Langston 2008, Jenkins *et al.* 2010).

Electrocution on power lines
Avian electrocutions occur when a bird perches or attempts to perch on electrical structure and causes a short circuit by physically bridging the air 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. Given that Eskom are planning a 400 kV line for this project this is likely to be lower risk. 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, and comprehensive insulation of such areas (van Rooyen 2004b, Lehman *et al.* 2007).

6.2. Description of the proposed wind energy facility

The wind energy facility proposed for the Kleinzee site will generate 300 MW with up to 200 wind turbines, distributed within an area of about 9 300 ha, and will link directly using a 400kV overhead power line to the existing Gromis Substation located approximately 60km from the site (Fig. 1). The existing site access network of gravel tracks within the development site will need to be upgraded, and an additional system of minor service roadways will presumably connect the turbine array. In addition, wind masts may be erected on site.

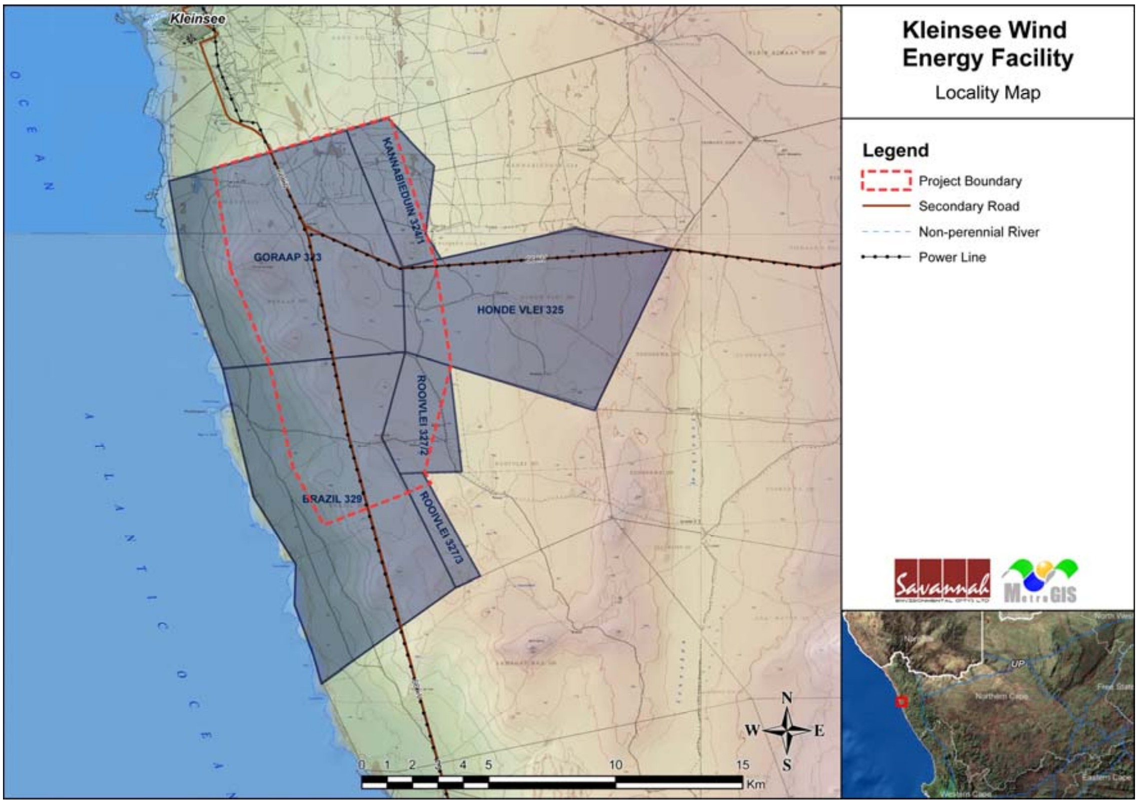

Figure 1: Proposed site of the Kleinzee 300 MW Wind Energy Facility as proposed by Eskom

7. DESCRIPTION OF THE AFFECTED ENVIRONMENT

7.1 Vegetation of the study area

The vegetation is described as part of the Namaqualand Coastal Duneveld – a part of the Succulent Karoo Biome (Mucina and Rutherford 2006, p 265). This is a hyper arid area with a mean annual rainfall of just 114 mm but relatively cool temperatures averaging just 17.3°C. Coastal fog is common, adding substantially to high soil moisture levels. There is high plant species diversity but the habitat is heavily impacted by the diamond mining operations. None of the area is formerly conserved but recent additions and expansion to the Namaqua National Park around the Spoeg Rivier mouth recently changed that.

A very rare (but Least Threatened) vegetation type found within the area is the Namaqualand Salt Pan (vegetation unit AZi 2, Mucina and Rutherford 2006, p 643), of which Dreyer's Pan is one example just south of the proposed wind farm boundary. These are – or were – important avian habitats given that the Endangered Damara Tern *Sterna balaenarum* once bred here (Environmental Management report of de Beers, undated).

7.2 Avian microhabitats

Bird habitats at Kleinzee comprise coastal marine rocky shore habitat backed by natural and man-made salt pans and gravel plains. The environment has been largely man-altered with large slimes dams (mine tailing dams) as part of the current landscape. Rehabilitation of the tailing dams have been ongoing for the past 5 years to re-introduce plants into this sensitive areas (P Carrick pers comm.). These are likely to be the least used of the habitats given the lack of seeds (for local passerines) or roost sites.

7.3 Bird Species and habitats found in the Kleinzee area

The most up-to-date information available from the SABAP2 bird atlas scheme of the Avian Demography Unit downloaded from http://sabap2.adu.org.za/map_interactive.php was used in this avian scoping report. This allows for an accurate bird species list mainly from the observations of Dr S Sutherland, based on 110 cards submitted from 2007 to 2011 as well as a reporting rate to be generated to determine how likely the occurrence of any species is. It thus allows us to determine, for example, the likelihood of occurrence of red-listed species such as the flamingos, oystercatchers and terns.

There are three main microhabitats for birds in the area (i) coastal beaches, rocky shores and islands for marine and coastal bird species (ii) salt pans for terns and flamingos and (iii) succulent shrub habitat for larks and other endemic avifauna.

7.4 Species of Special Concern (SSC) likely to occur in the study area

The total number of birds recorded in the study area is a healthy 166 species (SABAP2 scheme). Among the species recorded, 14 are threatened or red-listed in South Africa (Barnes 2000). Several of these are collision-prone species: 10 are highly collision prone (based on their low maneuverability and their known collision rate) and 4 are moderately collision prone (refer to Table 1). Among these are pelicans, cormorants, and the bustards. The low occurrence of the bustards makes it unlikely that they will be at risk. However, the flamingos (33% to 44% probability for the two species occurring) and pelican (34% probability) are the most likely to suffer impacts from inappropriately placed turbines.

It must be noted that there are no data from South Africa on the susceptibility of particular bird species to turbine collisions per se, only to power lines. I have extrapolated from the power line vulnerability to turbine collisions based on work by Martin and Shaw (2010) who indicate that species such as bustards and cranes have blind spots in their forward vision and simply do not see obstacles in front of them. The collision proneness (refer to Table 1) is also based on reports from various wind farms in California and Norway where species such as eagles and other large raptors are killed or displaced on a regular basis by turbines similar to the ones proposed.

Among these red-listed species are six endemic or near-endemic species - three cormorants, the African Black Oystercatcher, the Cape Gannet and Damara Tern (refer to Table 1). The three cormorants are highly susceptible to collisions, and two are moderately susceptible.

Among the 166 species, no less than 43 (26%) are endemic or near-endemic species. Of these endemics five species are considered highly collision-prone – the three cormorants, the shelduck and the korhaan.

Thus in summary, among the important species (threatened red-listed or endemic) the highly collision prone species are the flamingos (2), cormorants (3) , pelican (1), bustards (2), korhaan (1), raptors (2) and one duck; i.e. twelve species in total. These species will require special mitigation. There are other raptor species that are not red-listed (refer to Appendix 2 in bold) including African Fish Eagle, Black-chested Snake Eagle and Southern Pale Chanting Goshawk, which may also be vulnerable to collision.

Table 1 Red-listed (**in red**) and endemic species (**in green**) in the Kleinzee area drawn from SABAP2 atlas cards for pentad 2940_1700. These are based on 108 cards submitted by Dr S Sutherland from 2007 to May 2011

				Susceptibility to		
Common name	**Scientific name**	**Red-list and Reporting Rate**	**Regional endemic?**	**Collision**	**Electrocution**	**Disturbance**
Great White Pelican	*Pelicanus onocrotalus*	Near Threatened 34%		High	-	Moderate
Cape Gannet	*Morus capensis*	Vulnerable 1%	Endemic	Moderate	-	High
African Black Oystercatcher	*Hameatopus moquini*	Near Threatened 94%	Endemic	-	-	High
Kori Bustard	*Ardeotis kori*	Near Threatened 1%		High	-	Moderate
Ludwig's Bustard	*Neotis ludwigi*	Vulnerable 8%		High	-	Moderate
Damara Tern *	*Sterna balaenarum*	Endangered 0%	Endemic	Moderate		High
Martial Eagle	*Polemaetus bellicosus*	Vulnerable 3%	-	Moderate	High	Moderate
Secretarybird	*Sagittarius serpentarius*	Near-threatened 1%	-	High	-	Moderate
Lanner Falcon	*Falco biarmicus*	Near-threatened 8%	-	High	Moderate	-
Cape Cormorant	*Phalacrocorax capensis*	Near-Threatened 71%	Endemic	High	-	Moderate
Bank Cormorant	*Phalacrocorax neglectus*	Endangered 6%	Endemic	High	-	High
Crowned Cormorant	*Phalacrocorax cornotus*	Near-Threatened 93%	Endemic	High	-	High
Greater Flamingo	*Phoenicopterus ruber*	Near-threatened 44%	-	High	-	-
Lesser Flamingo	*Phoenicopterus minor*	Near-threatened 33%	-	High	-	-
White-backed Mousebird	*Colius colius*	18%	Endemic	-	-	Moderate
Cape Shoveler	*Anas smithii*	100%	Endemic	Moderate	-	-
South African Shelduck	*Tadorna cana*	100%	Endemic	High	-	-
Southern Black Korhaan	*Afrotis afra*	7%	Endemic	High	-	Moderate
Namaqua Sandgrouse	*Pterocles namaqua*	4%	-	Moderate	-	-
Southern Pale Chanting Goshawk	*Melierax canorus*	32%	Near-endemic	Moderate	Moderate	Moderate
Jackal Buzzard	*Buteo rufofuscus*	6%	Endemic	-	Moderate	Moderate
Bokmakierie	*Telophorus zeylonus*	87%	Near-endemic	-	-	Moderate
Cape Penduline-Tit	*Anthoscopus minutus*	9%	Near-endemic	-	-	Moderate
Grey Tit	*Parus afer*	12%	Endemic	-	-	Moderate
Cape Bulbul	*Pycnonotus capensis*	22%	Endemic	-	-	Moderate
Red-eyed Bulbul	*Pycnonotus nigricans*	4%	Near-endemic			
Orange River White-eye	*Zosterops pallidus*	44%	Endemic	-	-	-
Grey-backed Cisticola	*Cisticola subruficapilla*	19%	Near-endemic	-	-	Moderate
Namaqua Warbler	*Phragmacia substriata*	3%	Endemic	-	-	-
Rufous-eared Warbler	*Malcorus pectoralis*	1%	Endemic	-	-	-
Karoo Prinia	*Prinia maculosa*	71%	Endemic	-	-	Moderate
Karoo Lark	*Calendulauda albescens*	3%	Endemic	-	-	Moderate
Cape Long-billed Lark	*Certhilauda curvirostris*	75%	Endemic			-
Stark's Lark	*Spizocorys starki*	1%	Endemic			-

				Susceptibility to		
Common name	**Scientific name**	**Red-list and Reporting Rate**	**Regional endemic?**	**Collision**	**Electrocution**	**Disturbance**
Grey-backed Sparrowlark	*Eremopterix verticalis*	4%	Near-endemic	-	-	Moderate
Karoo Thrush	*Turdus smithi*	52%	Endemic			-
Fairy Flycatcher	*Stenostira scita*	1%	Endemic	-	-	Moderate
Karoo Scrub-Robin	*Cercotrichas coryphoeus*	75%	Endemic	-	-	Moderate
Tractrac Chat	*Cercomela tractrac*	42%	Endemic			Moderate
Mountain Wheatear	*Oenanthe monticola*	1%	Near-endemic	-	-	Moderate
Ant-eating Chat	*Myrmecocichla formicovera*	19%	Near Endemic			-
Pale-winged Starling	*Onychognathus nabourup*	3%	Near – Endemic	-	-	Moderate
Pied Starling	*Spreo bicolor*	82%	Endemic	-	-	Moderate
Southern Double-collared Sunbird	*Cinnyris chalybeus*	90%	Endemic	-	-	Moderate
Dusky Sunbird	*Cinnyris fuscus*	1%	Near-Endemic	-	-	-
Cape Weaver	*Ploceus capensis*	76%	Endemic	-	-	Moderate
Cape Sparrow	*Passer melanurus*	99%	Near-endemic	-	-	Moderate
Yellow Canary	*Crithagra flaviventris*	23%	Near-endemic	-	-	Moderate
White-throated Canary	*Crithagra albogularis*	42%	Near-endemic	-	-	Moderate
Lark-like Bunting	*Emberiza impetuani*	1%	Near-endemic	-	-	Moderate
Cape Bunting	*Emberiza capensis*	18%	Near-endemic	-	-	Moderate

*this species was unaccountably not recorded in the SABAP2 data set but is well known from this area from previous reports

7.5 Migration and/or preferential flight corridors for avifauna in general in the area and in particular for red-listed or endemic species of concern

Flight corridors are likely to occur along the entire coast as wading birds (plovers, sandpipers, godwits etc) and the red-listed flamingos, pelicans and oystercatchers use the beaches and areas parallel to the beaches as flyways. For more long-distance flights, these areas are also used by flamingos at night to commute to breeding areas or communal roosting feeding areas such as the Orange River mouth. Species such as the cormorants, oystercatchers and flamingos are generally found within 1 km of the coast and these will be high risk zones. However, flamingos and pelicans may also both travel inland to dams and flooded pans and could well be found frequently farther than 1 km from the coast. The actual flight paths will require investigation in the EIA phase. It is further important to recognise that even if flamingos are not found in large numbers in the proposed wind farm area, they will pass through on their nocturnal migrations and are assumed to follow coastal corridors. Thus a row of turbines orientated east-west near the coast has the potential to become problematic and should be avoided in preference for north-south orientation.

Flight corridors are also likely for birds visiting flooded or dry pans inland. These will be important for flamingos which will commute inland and particularly the Damara Terns – should they still breed here.
Damara Terns nesting on the pans typically fly into the wind to reach the sea (Rob E. Simmons pers obs) and prevailing winds are from the south or south-east. Therefore, bird-sensitive corridors for this species will be orientated southeast

– northwest. While the Buffels River is about 15 km south of the proposed wind farm site it is an important habitat for flamingos and other wetland species (avocets, plovers). They occur at the mouth of the Buffels River but may also fly inland to search for foraging areas and are likely to follow the river.
Further up river are the breeding sites of Black Harriers (RES unpubl data) and this collision-prone red-listed species may well forage down into the mining concession. It is not listed in the SABAP data for Kleinzee but it has been noted by the author that it nests only 20 km inland – well within its foraging range.

The least sensitive bird areas will be the mine dumps themselves where very few species are likely to occur given the lack of seeds and the lack of sheltered roosting sites. Only a site visit can reveal the true extent of the use of these areas, and especially the pans, coastline and river mouth.

8. PROVISIONAL ASSESSMENT OF IMPACTS

Of the 14 conservation priority, red-listed species, 10 of the 14 are considered to have a high probability of collision – and the 3 of the 14 are considered to be at moderate risk of colliding with the blades of the turbines. (The remaining species – the oystercatcher – is unknown). Two species are perceived to have a moderate to high risk of electrocution on bird-unfriendly power infrastructure (Martial Eagle and Lanner Falcon), and 5 high risk (two cormorants, Cape Gannet, Damara Tern and African Black Oystercatcher). Eight species (moderate) are considered to be at risk of being disturbed and losing habitat during the construction of the wind energy facility. All these species may be disturbed in the longer term by operational activities around the facility such as power line and turbine maintenance, (refer to Table 1).

It is not possible at the desktop study or scoping stage to determine the relative significance of these various potential impacts, mainly because too little information is available on the relative size of *local* populations of the priority species (refer to Table 1). This can be investigated in more detail during the EIA phase and a site visit. It is however predicted that the two species of cormorants, the two species of flamingos and the Great White Pelican with reporting rates over 30% (refer to Table 1 and Appendix 1) will be the most collision-prone impacted species, and the Damara Tern will be the most likely to be displaced.

9. CONCLUSIONS AND PLAN OF STUDY FOR EIA PHASE

The scoping phase has identified the following species that require further assessment of the local population: both species of flamingos, the cormorants, two species of bustard, the Damara Tern and Cape Gannet, the Great White Pelican and the various species of raptor (at fairly low numbers or occurrence).

The likelihood of collision and electrocution of the species highlighted here will be investigated in more detail during the full EIA phase. In particular, bird collisions in relation to the proposed sites of the turbines will be assessed to determine whether the risk warrants mitigation such as no-go areas for turbines, patterning of turbine blades, or periodic shutting down of the certain rotors (as discussed above). This will be assessed mainly in terms of (i) the actual or estimated abundance of priority bird species in the area, and (ii) the distribution of relevant microhabitats and food resources, and the way in which microhabitats influence groupings and especially movement of priority birds through the impact zone of the proposed wind energy facility.

The EIA phase will include:

(i) sample surveys of large terrestrial species, raptors and other collision-prone species within the study area to determine the relative importance of local populations of priority taxa,

(ii) estimates of the extent and direction of movements of these species through the impact zone of the wind energy facility, in relation to nesting or roosting sites (e.g. cliff-lines, wetland pans, existing power lines) and foraging areas (high productivity coastlines and inland wetlands).

(iii) identification of the least sensitive/lowest risk areas to locate wind turbines within the broader study area, in terms of (i) and (ii) above.

The results will include a more detailed assessment of all impacts, recommended mitigation where necessary (particularly with reference to the siting of turbines). It can also detail a long-term programme for monitoring actual impacts from pre- to post-construction phases of the development, and improving our understanding of the long-term effects of wind energy developments on South African avifauna.

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Appendix 1. List of bird species recorded within the Kleinsee pentad 2940_1700 in the period 2007 to 2011, SABAP2 atlas period. Data provided by the Avian Demography University of Cape Town and based on 110 atlas cards.

	Ref No	English Name	*Scientific Name*	Rarity regions	Full protocol		Ad hoc Protocol		Incidental
					Sightings	Reporting rate	Sightings	Reporting rate	Reports
1	90	South African Shelduck	*Tadorna cana*	NP	110	100.0%			
2	212	Red-knobbed Coot	*Fulica cristata*		110	100.0%			
3	287	Kelp Gull	*Larus dominicanus*		110	100.0%			
4	84	Hadeda Ibis	*Bostrychia hagedash*		110	100.0%			
5	686	Cape Wagtail	*Motacilla capensis*		110	100.0%			
6	94	Cape Shoveler	*Anas smithii*		110	100.0%			
7	311	Speckled Pigeon	*Columba guinea*		109	99.1%			
8	522	Pied Crow	*Corvus albus*		109	99.1%			1
9	89	Egyptian Goose	*Alopochen aegyptiacus*		109	99.1%			
10	733	Common Starling	*Sturnus vulgaris*		109	99.1%			
11	786	Cape Sparrow	*Passer melanurus*		109	99.1%			
12	808	Southern Red Bishop	*Euplectes orix*		108	98.2%			
13	6	Little Grebe	*Tachybaptus ruficollis*		108	98.2%			
14	317	Laughing Dove	*Streptopelia senegalensis*		107	97.3%			
15	314	Red-eyed Dove	*Streptopelia semitorquata*		106	96.4%			1
16	576	African Stonechat	*Saxicola torquatus*		106	96.4%			
17	81	African Sacred Ibis	*Threskiornis aethiopicus*		106	96.4%			
18	97	Red-billed Teal	*Anas erythrorhyncha*		105	95.5%			
19	289	Hartlaub's Gull	*Larus hartlaubii*	KZ	105	95.5%			
20	245	Blacksmith Lapwing	*Vanellus armatus*		105	95.5%			
21	47	White-breasted Cormorant	*Phalacrocorax carbo*		104	94.5%			
22	54	Grey Heron	*Ardea cinerea*		104	94.5%			
23	231	African Black Oystercatcher	*Haematopus moquini*	KZ	104	94.5%			
24	59	Little Egret	*Egretta garzetta*		103	93.6%			
25	509	Brown-throated Martin	*Riparia paludicola*		103	93.6%			
26	51	Crowned Cormorant	*Phalacrocorax coronatus*		102	92.7%			
27	96	Yellow-billed Duck	*Anas undulata*		100	90.9%			

	Ref No	English Name	*Scientific Name*	Rarity regions	Full protocol		Ad hoc Protocol		Incidental
28	**275**	Spotted Thick-knee (Gewone Dikkop)	*Burhinus capensis*		100	90.9%			
29	**235**	White-fronted Plover (Vaalstrandkiewiet)	*Charadrius marginatus*	GP,MP	99	90.0%			
30	**760**	Southern Double-collared Sunbird (Klein-rooibandsuikerbekkie)	*Cinnyris chalybeus*	FS	99	90.0%			
31	**803**	Southern Masked-Weaver (Swartkeelgeelvink)	*Ploceus velatus*		97	88.2%			
32	**506**	Rock Martin (Kransswael)	*Hirundo fuligula*		97	88.2%			
33	**394**	Pied Kingfisher (Bontvisvanger)	*Ceryle rudis*		96	87.3%			
34	**722**	Bokmakierie Bokmakierie (Bokmakierie)	*Telophorus zeylonus*		95	86.4%			
35	**746**	Pied Starling (Witgatspreeu)	*Spreo bicolor*	NP	91	82.7%			
36	**55**	Black-headed Heron (Swartkopreier)	*Ardea melanocephala*		91	82.7%			
37	**210**	Common Moorhen (Grootwaterhoender)	*Gallinula chloropus*		90	81.8%			
38	**604**	Lesser Swamp-Warbler (Kaapse Rietsanger)	*Acrocephalus gracilirostris*		86	78.2%			
39	**298**	Swift Tern (Geelbeksterretjie)	*Sterna bergii*		85	77.3%			
40	**799**	Cape Weaver (Kaapse Wewer)	*Ploceus capensis*		84	76.4%			
41	**583**	Karoo Scrub-Robin (Slangverklikker)	*Cercotrichas coryphoeus*	NW	83	75.5%			
42	**5**	Black-necked Grebe (Swartnekdobbertjie)	*Podiceps nigricollis*	KZ	83	75.5%			
43	**98**	Cape Teal (Teeleend)	*Anas capensis*		82	74.5%			
44	**843**	Common Waxbill (Rooibeksysie)	*Estrilda astrild*		81	73.6%			
45	**4125**	Cape Long-billed Lark (Weskuslangbeklewerik)	*Certhilauda curvirostris*		81	73.6%			

	Ref No	English Name	*Scientific Name*	Rarity regions	Full protocol		Ad hoc Protocol		Incidental
46	**4139**	Karoo Prinia (Karoolangstertjie)	*Prinia maculosa*	KZ,NP,NW	80	72.7%			
47	**1**	Common Ostrich (Volstruis)	*Struthio camelus*		79	71.8%			1
48	**707**	Common Fiscal (Fiskaallaksman)	*Lanius collaris*		79	71.8%			1
49	**48**	Cape Cormorant (Trekduiker)	*Phalacrocorax capensis*		78	70.9%			
50	**238**	Three-banded Plover (Driebandstrandkiewiet)	*Charadrius tricollaris*		73	66.4%			
51	**385**	Little Swift (Kleinwindswael)	*Apus affinis*		72	65.5%			
52	**784**	House Sparrow (Huismossie)	*Passer domesticus*		72	65.5%			
53	**290**	Caspian Tern (Reusesterretjie)	*Sterna caspia*	NP,MP	70	63.6%			
54	**123**	Rock Kestrel (Kransvalk)	*Falco rupicolus*		63	57.3%			
55	**263**	Common Greenshank (Groenpootruiter)	*Tringa nebularia*		62	56.4%			
56	**270**	Black-winged Stilt (Rooipootelsie)	*Himantopus himantopus*		60	54.5%			
57	**493**	Barn Swallow (Europese Swael)	*Hirundo rustica*		60	54.5%			
58	**392**	Red-faced Mousebird (Rooiwangmuisvoel)	*Urocolius indicus*		58	52.7%			
59	**751**	Malachite Sunbird (Jangroentjie)	*Nectarinia famosa*		58	52.7%			
60	**1104**	Karoo Thrush (Geelbeklyster)	*Turdus smithi*		57	51.8%			
61	**735**	Wattled Starling (Lelspreeu)	*Creatophora cinerea*		52	47.3%			
62	**86**	Greater Flamingo (Grootflamink)	*Phoenicopterus ruber*		50	45.5%			
63	**69**	Black-crowned Night-Heron (Gewone Nagreier)	*Nycticorax nycticorax*		50	45.5%			

	Ref No	English Name	*Scientific Name*	Rarity regions	Full protocol		Ad hoc Protocol		Incidental
64	**232**	Ruddy Turnstone (Steenloper)	*Arenaria interpres*	FS,NP,GP,NW	49	44.5%			
65	**523**	Cape Crow (Swartkraai)	*Corvus capensis*		49	44.5%			
66	**1171**	Orange River White-eye (Gariepglasogie)	*Zosterops pallidus*	WC,GP,FS,NC,NW,NP,MP,KZ,EC	48	43.6%			
67	**570**	Familiar Chat (Gewone Spekvreter)	*Cercomela familiaris*		48	43.6%			
68	**269**	Pied Avocet (Bontelsie)	*Recurvirostra avosetta*		47	42.7%			
69	**571**	Tractrac Chat (Woestynspekvreter)	*Cercomela tractrac*	NW	46	41.8%			
70	**88**	Spur-winged Goose (Wildemakou)	*Plectropterus gambensis*		46	41.8%			
71	**865**	White-throated Canary (Witkeelkanarie)	*Crithagra albogularis*	KZ,NW	45	40.9%			
72	**251**	Curlew Sandpiper (Krombekstrandloper)	*Calidris ferruginea*		44	40.0%			
73	**233**	Common Ringed Plover (Ringnekstrandkiewiet)	*Charadrius hiaticula*		44	40.0%			
74	**87**	Lesser Flamingo (Kleinflamink)	*Phoenicopterus minor*		43	39.1%			
75	**404**	European Bee-eater (Europese Byvreter)	*Merops apiaster*		40	36.4%			
76	**42**	Great White Pelican (Witpelikaan)	*Pelecanus onocrotalus*	NC,FS,NP,GP,MP	39	35.5%			
77	**256**	Ruff Ruff (Kemphaan)	*Philomachus pugnax*		38	34.5%			
78	**318**	Namaqua Dove (Namakwaduifie)	*Oena capensis*		38	34.5%			
79	**237**	Kittlitz's Plover (Geelborsstrandkiewiet)	*Charadrius pecuarius*		38	34.5%			
80	**165**	**Southern Pale Chanting Goshawk** (Bleeksingvalk)	*Melierax canorus*	KZ	37	33.6%			
81	**606**	African Reed-Warbler (Kleinrietsanger)	*Acrocephalus baeticatus*		37	33.6%			

	Ref No	English Name	*Scientific Name*	Rarity regions	Full protocol		Ad hoc Protocol		Incidental
82	**291**	Common Tern (Gewone Sterretjie)	*Sterna hirundo*		36	32.7%			
83	**621**	Long-billed Crombec (Bosveldstompstert)	*Sylvietta rufescens*		35	31.8%			
84	**241**	Grey Plover (Grysstrandkiewiet)	*Pluvialis squatarola*	GP,NW	34	30.9%			
85	**296**	Sandwich Tern (Grootsterretjie)	*Sterna sandvicensis*		30	27.3%			
86	**253**	Little Stint (Kleinstrandloper)	*Calidris minuta*		30	27.3%			
87	**4142**	Southern Grey-headed Sparrow (Gryskopmossie)	*Passer diffusus*		27	24.5%			
88	**288**	Grey-headed Gull (Gryskopmeeu)	*Larus cirrocephalus*		27	24.5%			
89	**866**	Yellow Canary (Geelkanarie)	*Crithagra flaviventris*	KZ,MP	25	22.7%			
90	**50**	Reed Cormorant (Rietduiker)	*Phalacrocorax africanus*		25	22.7%			
91	**495**	White-throated Swallow (Witkeelswael)	*Hirundo albigularis*		24	21.8%			
92	**268**	Common Whimbrel (Kleinwulp)	*Numenius phaeopus*	NP,GP,NW	24	21.8%			
93	**543**	Cape Bulbul (Kaapse Tiptol)	*Pycnonotus capensis*		24	21.8%			
94	**264**	Wood Sandpiper (Bosruiter)	*Tringa glareola*		23	20.9%			
95	**52**	African Darter (Slanghalsvoel)	*Anhinga rufa*		23	20.9%			
96	**255**	Sanderling Sanderling (Drietoonstrandloper)	*Calidris alba*	NP,GP	21	19.1%			
97	**638**	Grey-backed Cisticola (Grysrugtinktinkie)	*Cisticola subruficapilla*	NW	21	19.1%			
98	**575**	Anteating Chat (Swartpiek)	*Myrmecocichla formicivora*		20	18.2%			
99	**391**	White-backed Mousebird (Witkruismuisvoel)	*Colius colius*		19	17.3%			

	Ref No	English Name	*Scientific Name*	Rarity regions	Full protocol		Ad hoc Protocol		Incidental
100	654	Spotted Flycatcher (Europese Vlieievanger)	*Muscicapa striata*	WC	19	17.3%			
101	873	Cape Bunting (Rooivlerkstreepkoppie)	*Emberiza capensis*		19	17.3%			
102	67	Little Bittern (Kleinrietreier (Woudapie))	*Ixobrychus minutus*		18	16.4%			
103	488	Red-capped Lark (Rooikoplewerik)	*Calandrella cinerea*		17	15.5%			
104	646	Levaillant's Cisticola (Vleitinktinkie)	*Cisticola tinniens*		17	15.5%			
105	99	Hottentot Teal (Gevlekte Eend)	*Anas hottentota*	WC	16	14.5%			
106	122	Greater Kestrel (Grootrooivalk)	*Falco rupicoloides*	KZ	16	14.5%			
107	316	Cape Turtle-Dove (Gewone Tortelduif)	*Streptopelia capicola*		15	13.6%			
108	525	Grey Tit (Piet-tjou-tjou-grysmees)	*Parus afer*	KZ,NW	13	11.8%			
109	258	Common Sandpiper (Gewone Ruiter)	*Actitis hypoleucos*		12	10.9%			
110	61	Cattle Egret (Veereier)	*Bubulcus ibis*		12	10.9%			
111	531	Cape Penduline-Tit (Kaapse Kapokvoel)	*Anthoscopus minutus*	MP	10	9.1%			
112	397	Malachite Kingfisher (Kuifkopvisvanger)	*Alcedo cristata*		9	8.2%			
113	218	Ludwig's Bustard (Ludwigse Pou)	*Neotis ludwigii*	NW	9	8.2%			
114	114	Lanner Falcon (Edelvalk)	*Falco biarmicus*		9	8.2%			
115	130	**Black-shouldered Kite** (Blouvalk)	*Elanus caeruleus*		9	8.2%			
116	568	Capped Wheatear (Hoeveldskaapwagter)	*Oenanthe pileata*	KZ	8	7.3%			
117	386	Alpine Swift (Witpenswindswael)	*Tachymarptis melba*		8	7.3%			

	Ref No	English Name	*Scientific Name*	Rarity regions	Full protocol		Ad hoc Protocol		Incidental
118	4134	Southern Black Korhaan (Swartvlerkkorhaan)	*Afrotis afra*		7	6.4%			
119	103	Maccoa Duck (Bloubekeend)	*Oxyura maccoa*		7	6.4%			
120	154	**Steppe Buzzard** (Bruinjakkalsvoel)	*Buteo vulpinus*		6	5.5%			
121	846	Pin-tailed Whydah (Koningrooibekkie)	*Vidua macroura*		6	5.5%			
122	152	**Jackal Buzzard** (Rooiborsjakkalsvoel)	*Buteo rufofuscus*		6	5.5%			
123	101	Fulvous Duck (Fluiteend)	*Dendrocygna bicolor*	WC	6	5.5%			
124	49	Bank Cormorant (Bankduiker)	*Phalacrocorax neglectus*	NC	6	5.5%			
125	600	Yellow-bellied Eremomela (Geelpensbossanger)	*Eremomela icteropygialis*		4	3.6%			
126	307	Namaqua Sandgrouse (Kelkiewyn)	*Pterocles namaqua*	KZ,NP,GP	4	3.6%			
127	485	Grey-backed Sparrowlark (Grysruglewerik)	*Eremopterix verticalis*	NP,GP,MP	4	3.6%			
128	544	African Red-eyed Bulbul (Rooioogtiptol)	*Pycnonotus nigricans*	KZ,	4	3.6%			
129	80	White Stork	*Ciconia ciconia*		3	2.7%			
130	805	Red-billed Quelea	*Quelea quelea*		3	2.7%			
131	498	Pearl-breasted Swallow	*Hirundo dimidiata*	KZ,MP	3	2.7%			
132	744	Pale-winged Starling	*Onychognathus nabouroup*	NW	3	2.7%			
133	653	Namaqua Warbler	*Phragmacia substriata*	NW	3	2.7%			
134	142	**Martial Eagle**	*Polemaetus bellicosus*		3	2.7%			
135	461	Karoo Lark	*Calendulauda albescens*		3	2.7%			
136	242	Crowned Lapwing	*Vanellus coronatus*		3	2.7%			
137	581	Cape Robin-Chat	*Cossypha caffra*		3	2.7%			
138	682	African Paradise-Flycatcher	*Terpsiphone viridis*	NC	3	2.7%			
139	133	**Verreaux's Eagle**	*Aquila verreauxii*		2	1.8%			
140	62	Squacco Heron	*Ardeola ralloides*	WC	2	1.8%			

	Ref No	English Name	*Scientific Name*	Rarity regions	Full protocol		Ad hoc Protocol		Incidental
141	368	**Spotted Eagle-Owl**	*Bubo africanus*		2	1.8%			
142	57	Purple Heron	*Ardea purpurea*		2	1.8%			
143	146	**Black-chested Snake-Eagle**	*Circaetus pectoralis*	FS,WC	2	1.8%			
144	85	African Spoonbill	*Platalea alba*		2	1.8%			
145	692	African Pipit	*Anthus cinnamomeus*		2	1.8%			
146	149	**African Fish-Eagle**	*Haliaeetus vocifer*		2	1.8%			
147	629	Zitting Cisticola	*Cisticola juncidis*		1	0.9%			
148	60	Yellow-billed Egret	*Egretta intermedia*		1	0.9%			
149	810	Yellow Bishop	*Euplectes capensis*	NW	1	0.9%			
150	383	White-rumped Swift	*Apus caffer*		1	0.9%			
151	257	Terek Sandpiper	*Xenus cinereus*	GP,NW	1	0.9%			
152	492	Stark's Lark	*Spizocorys starki*	FS,NW	1	0.9%			
153	102	Southern Pochard	*Netta erythrophthalma*		1	0.9%			
154	105	**Secretarybird**	*Sagittarius serpentarius*		1	0.9%			
155	619	Rufous-eared Warbler	*Malcorus pectoralis*		1	0.9%			
156	564	Mountain Wheatear	*Oenanthe monticola*		1	0.9%			
157	871	Lark-like Bunting	*Emberiza impetuani*	KZ,NP,GP,MP	1	0.9%			
158	83	Glossy Ibis	*Plegadis falcinellus*		1	0.9%			
159	678	Fairy Flycatcher	*Stenostira scita*	MP	1	0.9%			
160	894	Eurasian Oystercatcher	*Haematopus ostralegus*	NR	1	0.9%			
161	764	Dusky Sunbird	*Cinnyris fuscus*	FS	1	0.9%			
162	189	Common Quail	*Coturnix coturnix*		1	0.9%			
163	44	Cape Gannet	*Morus capensis*		1	0.9%			
164	367	Cape Eagle-Owl	*Bubo capensis*	NC,GP,MP,NW	1	0.9%			
165	266	Bar-tailed Godwit	*Limosa lapponica*	NC,FS,NP,NW	1	0.9%			
166	217	Kori Bustard	*Ardeotis kori*	WC					1
Total records: 166 species, 14 red-listed species, 43 endemics					7279		0		5