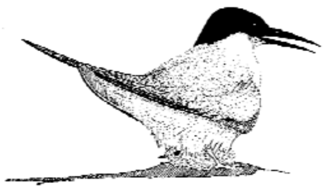
PROJECT BLUE WIND ENERGY FACILITY NORTH OF KLEINSEE

Scoping Report - Birds

Prepared by:



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EXECUTIVE SUMMARY

This study reviews recent literature on wind energy impacts on avifauna, and in particular identifies potential impacts of the proposed Project Blue Wind Energy Facility on the avifauna of this coastal area of the Northern Cape. The potential impacts are deemed to be: (i) habitat alteration by the facility itself and associated power lines or substation/s and other associated infrastructure, (ii) disturbance by construction and maintenance activities, (iii) possible displacement or disturbance of sensitive species, and (iv) direct collision with blades of the wind turbines or the associated power line network. Electrocution of avifauna can be a problem for the larger species on the power line infrastructure.

The wind energy facility is proposed in 3 phases indicated on five different areas. I reviewed the impact zone of the wind energy facility proposed for the undulating areas inside and outside the mining areas north of the town of Kleinsee within the Namaqualand vegetation zone. The region is likely to support at least 168 bird species, including 15 threatened (red-listed) species, and 44 endemic species. The avian groups of greatest conservation significance likely to be impacted by the turbines include the flocking waterbirds such as red-listed cormorants and flamingos, a large group of (15) raptor species and collision-prone bustards, that were found in the study area despite their low occurrence in bird atlas records. Greater Kestrels breed on pylon poles along the roads and threatened Black Harriers occur at low frequency in the area and breed in the nearby Buffels River. Impacts may occur in terms of both collision and disturbance from the facility itself. A brief survey revealed a rich vein of endemic passerines (26% of the total number of species) which could be affected by disturbance impacts.

A recommended full EIA study should include in-field studies of the five areas for sensitive bird species that occur and breed there. Early mitigation measures that can pre-empt many possible issues of displacement or impact of birds with future turbines include: (i) all power lines – present and future – are marked with bird flappers to reduce possible collisions with large migrating birds (ii) turbine blades are marked with UV paint that increases the probability that birds flying through the area will see and avoid them, (iii) where possible turbine strings are orientated north-south not east-west and (iv) pristine areas farther east that hold Ludwig's Bustards (areas 2 and 3) have fewer turbines than other areas to the west to reduce the likelihood of impact. Each will reduce the possibility that birds will collide with the turbines or be attracted to them.

The degree and significance of the impact will depend largely on the relative abundance and movements of collision-prone species, through the wind farm. A Scoping study such as this can only give an idea of the species likely to occur and not which ones use the proposed site. A full EIA and a 12-month pre-construction monitoring phase is recommended as it will generate more detailed assessments of all potential impacts, provide passage rates of critical species and better inform recommended mitigation where necessary.

1. CONSULTANT'S DECLARATION OF INDEPENDENCE

Dr Rob Simmons is an independent consultant to Savannah Environmental (Pty) Ltd. 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 of the proposed Project Blue Wind Energy Facility proposed, north-east of the mining town of Kleinsee. I am an experienced ornithologist, with over 25 years' experience in avian research and impact assessment work. I have undertaken twenty 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, and a member of the Birds and Wind Energy Specialist Group (BAWESG).

3. INTRODUCTION

Savannah Environmental has been commissioned to determine the potential impacts of a proposed 150 MW wind energy facility (in 3 phases) near the mining town of Kleinzee on the Northern Cape coast. Dr Rob Simmons was appointed to conduct the specialist avifaunal assessment. This report is an initial Scoping exercise set to review the bird species present from bird atlas records, and aided by a short site visit in August 2011, to determine which avian species are most at risk from collision, avoidance and electrocution with the turbines, a power line and substation/s and other infrastructure proposed for this project. I have also attempted to quantify the possible impacts and suggest early solutions to mitigate them wherever feasible. In addition I give 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 as follows:

- Describe the existing avifaunal 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.
- Detail a full EIA study that will elucidate the issues raised and quantify the mitigation measures necessary to reduce impacts on the avian community

5. STUDY METHODOLOGY

5.1. Approach

This Scoping study included the following steps:

- A review of available published and unpublished literature on bird interactions with wind energy facilities (WEFs) that summarises the issues involved and the current level of knowledge. Data sources were examined including atlas records on the avifauna of the area and previous studies of bird interactions with wind energy facilities and electrical infrastructure associated with them.

- An annotated 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 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 cover less sensitive bird species that may be affected.
- A short site visit was undertaken in August to determine which species actually occurred in the wind farm and where they occurred. The five WEF sites chosen precluded in-depth studies of any one, and they could not be assessed in relation to proposed turbine placement because this information was not available at the time of the field trip.
- A summary of more likely and significant impacts of the wind energy facility on the local avifauna was drawn up.

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. Recent 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 this pentad I compiled a list of the avifauna likely to occur within the broader impact zone of the proposed wind farm. I combined these data, with my own 2 day visit to the area (with one assistant) in August 2011 and previous experience/knowledge of the local avifauna, undertaken on trips made through this area over the last 10 years.
- 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 life-histories (Hockey *et al.* 2005).

- EIA reports and subsequent monitoring of the potential impacts on birds at other WEFs in South Africa were also assessed (van Rooyen 2001, Jenkins 2001, 2003, Küyler 2004, Jenkins 2008, 2009, Simmons et al. in press).

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 healthy set of 110 atlas cards has been submitted to the SABAP2 system for Kleinsee itself (4 km south of area 5) and this forms the basis for this study.

There are only three small wind energy facilities functioning in South Africa (totaling 8 turbines), therefore data on the environmental effects of wind energy facilities here is limited (Simmons et al. 2011). However numerous studies have emerged from such facilities internationally. General principles can be gleaned from them, but care is required when adapting international knowledge and experience to uniquely South African birds and conditions.

6. BACKGROUND

6.1 Interactions between wind farms 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 facilities are rare or highly threatened species, and thus 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, mainly at two pilot facilities at Klipheuwel and Darling in the Western Cape (van Rooyen 2001, Jenkins 2001, 2003), and a single turbine in the Port Elizabeth area. 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) despite recommendations to do as such. 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 5-10 birds 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 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 when the turbines 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 Project Blue 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 affect 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 turbines area (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 this infrastructure is placed along ridges, because 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 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 CAA regulations disallow marking of turbine blades this can avoided by using UV paint that is visible to birds but not to pilots.

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. These activities have an impact on birds breeding, foraging and roosting in or close 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).

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. This applies to turbine placements too. Where this cannot be avoided the use of static or dynamic marking devices to the make the lines, (particular the earthwires), more conspicuous are needed. While various marking devices have been used globally (for both lines and turbines), 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 an 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. 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 information available on the size and capacity of the wind energy facility proposed for Project Blue Wind Energy Facility is that approximately 75 turbines will be sited across all of the five areas allocated for the project as illustrated in Figure 1. The towers supporting the turbines are proposed to be 120 m at hub height with a blade length of about 60m. The facility will generate up to 150 MW of power and link to the present grid system via the Gromis Substation (green east-west route shown in Figure 1).

The existing network of gravel tracks within the development site will need to be upgraded, and additional internal access roads will connect the turbine array. In addition, a weather mast is likely to be erected on site. One new power line will link Area 2 with Area 3, and all links between the turbines will be laid underground and will follow the internal access roads where possible.

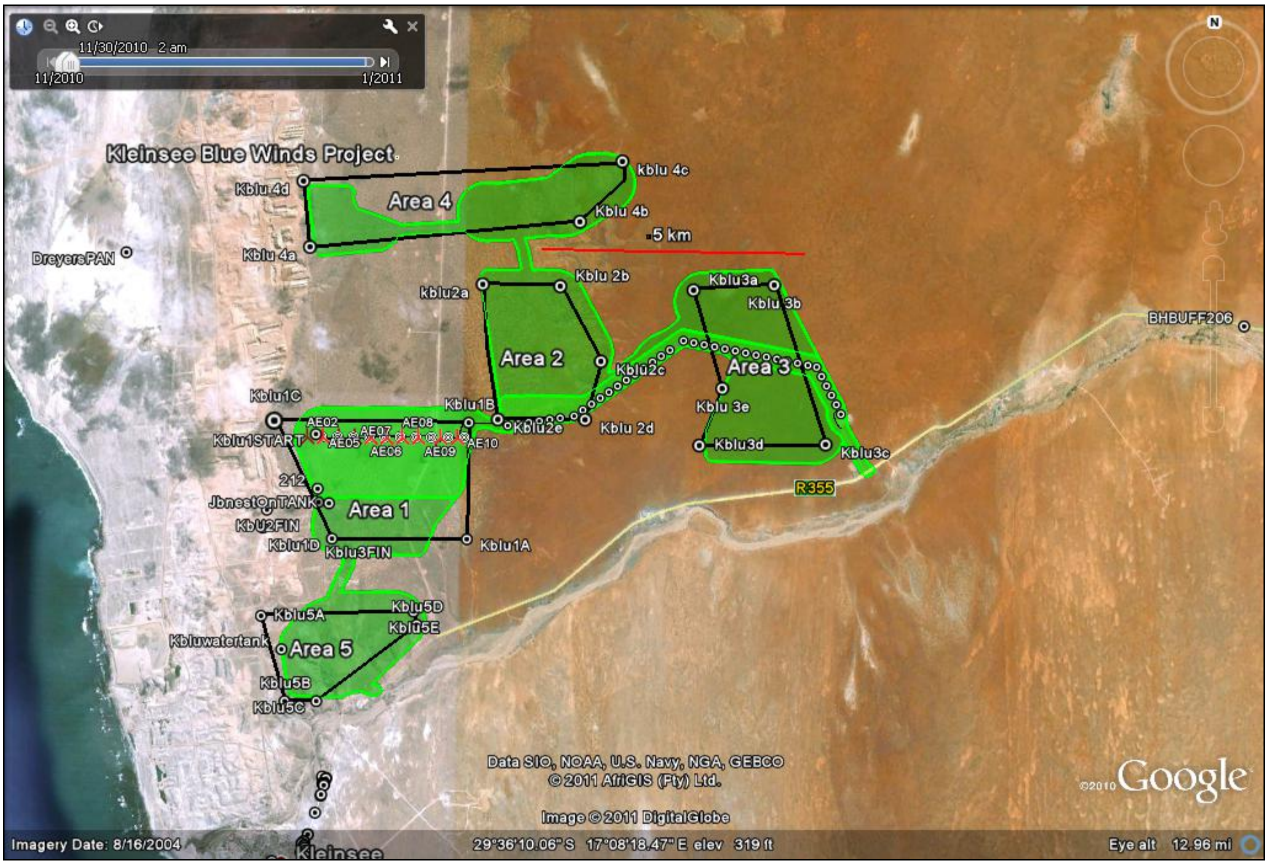

Figure 1: The five proposed areas of the Project Kleinzee Blue Wind Energy Facility as laid out by WWK Development in September 2011.

7. DESCRIPTION OF THE AFFECTED ENVIRONMENT

7.1 Vegetation of the study area

The vegetation of this coastal region is described as part of the Namaqualand Coastal Duneveld – and is 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^{o}C. Coastal fog is common adding substantially to high soil moisture levels. There is high plant species diversity and the habitat differs radically from inside and outside the mining area. Inside it has been heavily impacted by the mining operations of De Beers, including large mine tailings surrounded by large areas devoid of vegetation. Outside as the land rises, vegetation is intact and light sheep farming appears to be the main land use at present. None of the areas are formerly conserved as they lie midway between the Richtersveld in the north and Namaqua National Park coastal section to the south.

7.2 Avian microhabitats

Bird habitats vary across the 5 proposed areas: habitats ***east*** of the Kleinzee mining fence comprise intact low succulent karoo bush used mainly by small endemic bird species **(area 2 and area 3 and eastern half of area 4)**. The ephemeral Buffels River runs through some of the area and supports low Sarcocornia vegetation. Farther upstream (c. 8 km from the west boundary of area 3) this is used by breeding pairs of the threatened Black Harrier. Other microhabitats are provided by the few farm dams that are scattered across the landscape (attracting wetland species), and the power poles (providing Pied and Cape Crows and Greater Kestrels with nesting opportunities).

West of the de Beers Kleinzee mining fence the habitat is drastically altered **(Area 5 and most of area 1, and western portion of area 4)**, with little to no vegetation suitable for birds in the mining area. Where open-cast mining has created deep pits (> 20 m deep) wetland birds (e.g. Coots and Blacksmith Lapwings) occur where the pits are water-filled. Cliff-nesting habitat is also provided for species such as Rock Kestrels and Familiar Chats. A large storage tank on the hill within Area 1 has attracted nesting Jackal Buzzards and Rock Kestrels (Figure 2).

7.3 Bird Species and habitats found in the Kleinsee Blue Winds area

I used 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. This bird species list is based on 110 cards submitted from 2007 to 2011. This also allows a "reporting rate" to be generated which is a guide to how likely the species is to occur in the area. It thus allows us to determine, for example, the likelihood of occurrence of sensitive species such as the red-listed species flamingos, bustards and birds of prey. I also drove and walked briefly in each area with my assistant on 19 – 20 August 2011 and some transects in area 1 are shown in Figure 2.

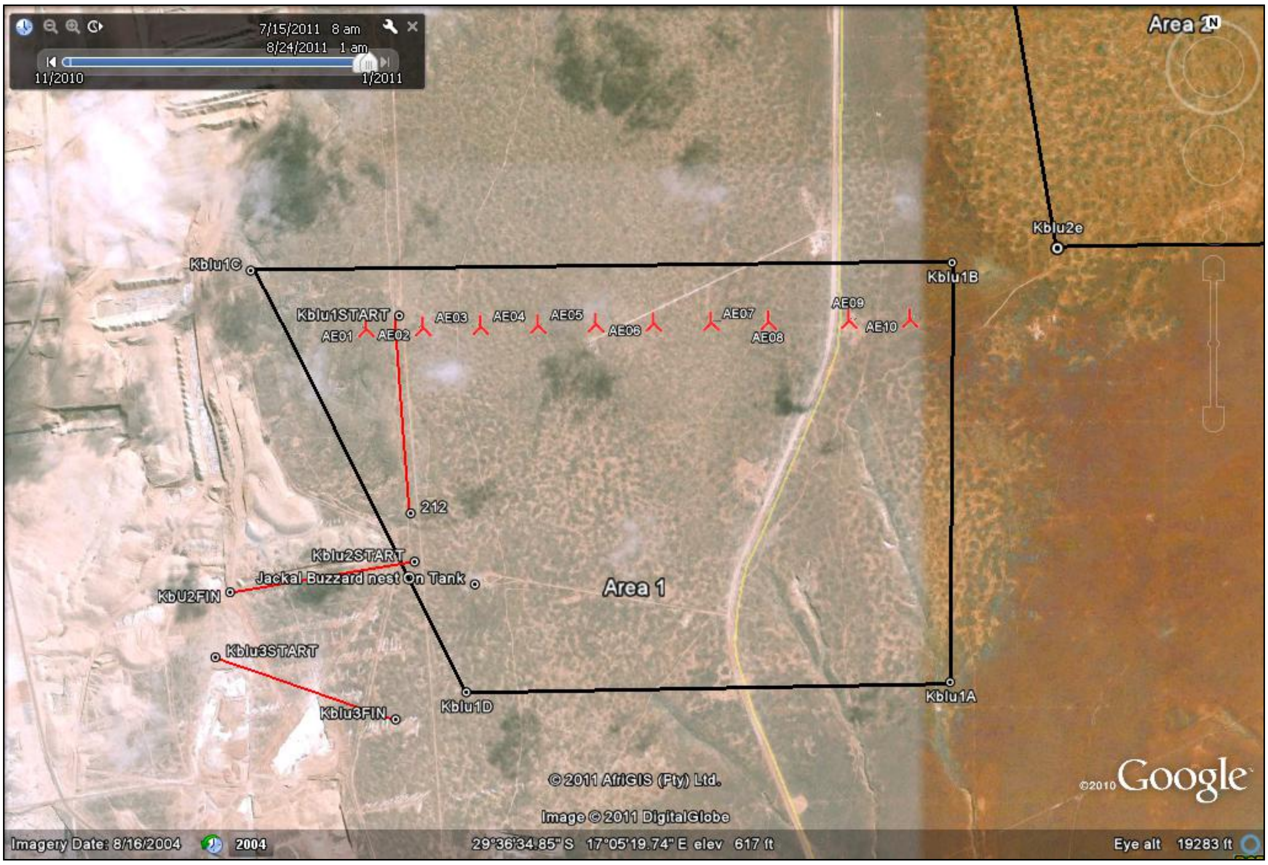

Figure 2: The main Area (1) of the proposed wind farm (and phase 1) of the Project Blue Wind Energy Facility, showing the boundary (black) and our bird surveys therein from 19-20 August 2011. Important species included a Jackal Buzzard active nest on the storage tank located at the lower left of the site.

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

The total number of birds recorded around the study area is a healthy 168 species. Among the species recorded are 15 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 manoeuvrability and known collision rate) and 4 are moderately collision prone and one (the oystercatcher) is not seen to be threatened by turbines (Table 1). Among these are pelicans, flamingos (2), cormorants (3), bustards (2) and raptors (4). While atlas data suggests a low occurrence of the bustards, our observations revealed at least two groups (including one breeding) of Ludwig's Bustards resident within the boundary of the proposed Wind Energy Facility. The flamingos (33% to 44% probability of the two species occurring) and pelican (34% probability) are the most likely to suffer from inappropriately placed turbines. This assumes that they will fly through the area, but their migration routes flight paths are more likely to remain coastal. This can only be checked at later, during the EIA phase. The red-listed collision-prone raptors occur at low frequency but are likely to forage over the wind farm area.

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 but based on work by Martin and Shaw (2010) 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 (see 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 the 168 species, no less than 44 (26%) are endemic or near-endemic species. Of these *endemics*, four species are considered highly collision-prone (the bustard and Secretarybird mentioned above, and the South African Shelduck and the Korhaan). The endemic Damara Tern and Oystercatcher (Table 1) are unlikely to fly through this area and will remain over pans or gravel plains.

Thus in summary, among the important species (threatened red-listed or endemic) the collision prone (high or moderate) species are the gannet (1), flamingos (2), cormorant (3) , bustards (2), korhaan (1), raptors (4) and one duck species; 14 species in total. These species will require special mitigation. There are other raptor species that are not red-listed (Appendix 1) including, Greater Kestrel (common), and Southern Pale Chanting Goshawk (rare), that are collision-prone.

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 110 cards submitted by Dr Sandy Sutherland from 2007 to May 2011, and my own records from 19-20 Aug 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	*Hameatopus moquini*	Near Threatened	Endemic	-	-	High

				Susceptibility to		
Common name	**Scientific name**	**Red-list and Reporting Rate**	**Regional endemic?**	**Collision**	**Electrocution**	**Disturbance**
Oystercatcher		94%				
Kori Bustard	*Ardeotis kori*	Near Threatened 1%		High	-	Moderate
Ludwig's Bustard	*Neotis ludwigi*	Vulnerable 8%	Endemic	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	-
Black Harrier	*Circus maurus*	Vulnerable occurs	Endemic	Moderate	-	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	-	High
Lesser Flamingo	*Phoenicopterus minor*	Near-threatened 33%	-	High	-	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	-	-	-

				Susceptibility to		
Common name	**Scientific name**	**Red-list and Reporting Rate**	**Regional endemic?**	**Collision**	**Electrocution**	**Disturbance**
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			-
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
Black-eared Sparrowlark	*Eremopterix australis*	2 flocks of 8 birds	Near-Endemic	-	-	-
Cape Bunting	*Emberiza capensis*	18%	Near-endemic	-	-	Moderate

7.5 Migration or preferential flight corridors for avifauna in the area particularly 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 flamingo, use the beaches and areas parallel to them 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 and flamingos are generally found within 1 km of the coast and these will be high risk zones. Given that the closest boundary of the wind farm is 1.9 km from the coast the proposed turbines is not expected to impact these coastal species. However, flamingos 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 and pre-construction monitoring phases. 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 turbine string orientated east-west near the coast has the potential to become problematic and should be avoided in preference for north-south orientation.

On my 2-day site visit I recorded three species of raptor foraging and soaring through the five areas (Figure 2). These included two kestrels (Rock and Greater) and the larger Jackal Buzzard. Raptors such as this are likely to use the updrafts along the hilltops from the prevailing south-west wind to commute, or hover-hunt. Further (7.8 km) up the Buffels River is the breeding site of a Black Harrier (RES unpubl data) so their recorded presence in the bird atlas data is not unexpected. Thus ideally if turbines are to avoid impacting raptors such as these, the turbines should be positioned away from the tops of the ridges (where they gain most lift) and ideally on the east side of the ridge top where orographic lift is less strong.

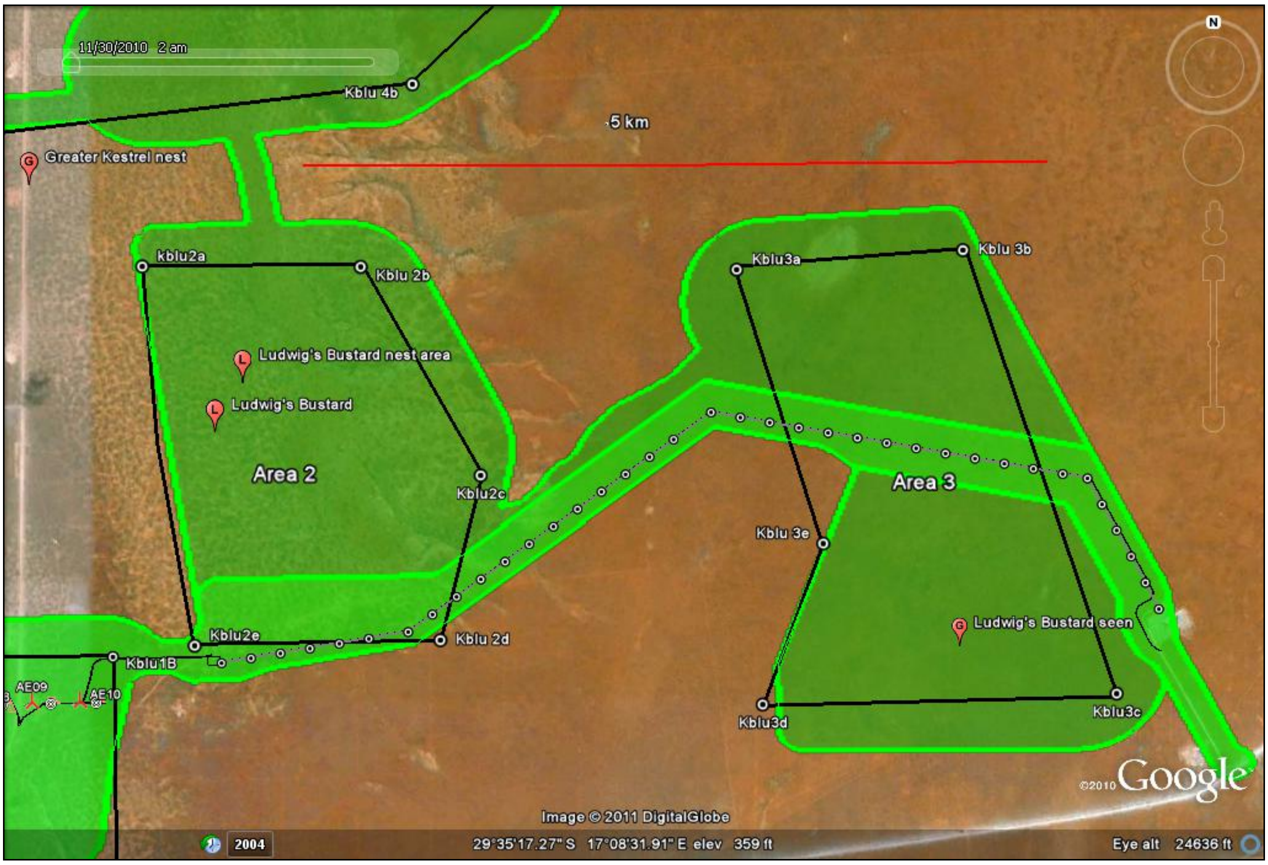

Figure 3: Sightings of highly collision-prone Ludwig's Bustards in Areas 2 and 3 in August 2011. Note that this species was breeding in Area 2 (i.e. the area proposed for Phase 1 and part of Phase 3 of the development).

8. PROVISIONAL ASSESSMENT OF IMPACTS

A suite of (3-4) raptors, two flamingos, one duck and a bustard and korhaan were identified as at risk to collisions with turbines given their presence in the area and their vulnerability to collision. The probability that they will be affected by the proposed wind energy facility is insufficiently known at present – it is dependent on their use of the area and the numbers present. However my preliminary assessment from 2 days work found that Ludwig's Bustard were breeding in Area 2 (phase 2 and 3) and present in Area 3 (phase 3). These birds will most likely be impacted by a wind farm and mitigation will be required. There may well be more collision-prone species uncovered with further work in the EIA phase of the process.

A preliminary list of possible mitigations at the start of this project would include: turbines not being placed on the hill tops (because raptors hover there), and all turbines should be painted with ultra-violet paint that is highly visible to birds (but not to humans). Further monitoring will give better data on the use of different parts of the wind farm by these and other birds. Overhead power lines from the wind farm and the potential impact on birds can be reduced by adding bird flappers to all new (and preferably all existing) lines. Where possible power lines should be buried underground.

9. CONCLUSIONS AND PLAN OF STUDY FOR ENVIRONMENTAL IMPACT ASSESSMENT

This Scoping report has identified the following species that require further assessment of the local population: both Greater and Lesser Flamingo (particularly their flight paths), Ludwig's Bustard and Southern Black Korhaan, and 3-4 species of raptor (Black Harrier, Jackal Buzzard Greater Kestrel, Rock Kestrel). Their occurrence and use of the proposed wind energy facility is essential in reducing the possible threats to them. Issues related to the collision and electrocution of birds will be investigated in more detail during the full EIA phase. In particular, the significance of bird collisions with the turbines will be assessed to determine whether the risk warrants mitigation such as no-go areas for turbines, or patterning of turbine blades (according to laboratory tests done (Hodos et al) found that birds could see patterned blades better than un patterned ones). This will be assessed mainly in terms of (i) the actual abundance of priority bird species in the area, and (ii) the distribution of relevant microhabitats and food resources.

Thus the EIA phase will emphasise the outcome of the site visit, which in turn will include:

(i) sample surveys of large terrestrial species, raptors and endemic passerines within the study area to determine the relative importance of local populations of these key taxa;
(ii) estimates of the extent and direction of possible movements of these species within/through the anticipated impact zone of the wind energy facility, in relation to the distribution of available resources – e.g. nesting or roosting sites (especially existing power lines) and foraging areas; and
(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.
(iv) a field site visit of at least 1 full day per area ear-marked, or 5 days of field work.

The results will include a more detailed assessment of all impacts, recommended mitigation measures where necessary (particularly with reference to the siting of turbines) and, perhaps most importantly, a comprehensive, long-term programme for monitoring actual impacts from pre- to post-construction phases of the development. This will improve 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 Kleinzee Blue Winds pentad 2940_1700 in the period 2007 to 2011, SABAP2 atlas period. Data extracted from the Animal Demography Unit, University of Cape Town and based on 110 atlas cards. My own records from 19-20 August 2011 are added. Red-listed species are shown in red, raptors are shown in bold.

	English Name	*Scientific Name*	Sightings	Reporting rate (probability of occurrence)
1	South African Shelduck	*Tadorna cana*	110	100.0%
2	Red-knobbed Coot	*Fulica cristata*	110	100.0%
3	Kelp Gull	*Larus dominicanus*	110	100.0%
4	Hadeda Ibis	*Bostrychia hagedash*	110	100.0%
5	Cape Wagtail	*Motacilla capensis*	110	100.0%
6	Cape Shoveler	*Anas smithii*	110	100.0%
7	Speckled Pigeon	*Columba guinea*	109	99.1%
8	Pied Crow	*Corvus albus*	109	99.1%
9	Egyptian Goose	*Alopochen aegyptiacus*	109	99.1%
10	Common Starling	*Sturnus vulgaris*	109	99.1%
11	Cape Sparrow	*Passer melanurus*	109	99.1%
12	Southern Red Bishop	*Euplectes orix*	108	98.2%
13	Little Grebe	*Tachybaptus ruficollis*	108	98.2%
14	Laughing Dove	*Streptopelia senegalensis*	107	97.3%
15	Red-eyed Dove	*Streptopelia semitorquata*	106	96.4%
16	African Stonechat	*Saxicola torquatus*	106	96.4%
17	African Sacred Ibis	*Threskiornis aethiopicus*	106	96.4%

	English Name	Scientific Name	Sightings	Reporting rate (probability of occurrence)
18	Red-billed Teal	*Anas erythrorhyncha*	105	95.5%
19	Hartlaub's Gull	*Larus hartlaubii*	105	95.5%
20	Blacksmith Lapwing	*Vanellus armatus*	105	95.5%
21	White-breasted Cormorant	*Phalacrocorax carbo*	104	94.5%
22	Grey Heron	*Ardea cinerea*	104	94.5%
23	African Black Oystercatcher	*Haematopus moquini*	104	94.5%
24	Little Egret	*Egretta garzetta*	103	93.6%
25	Brown-throated Martin	*Riparia paludicola*	103	93.6%
26	Crowned Cormorant	*Phalacrocorax coronatus*	102	92.7%
27	Yellow-billed Duck	*Anas undulata*	100	90.9%
28	Spotted Thick-knee	*Burhinus capensis*	100	90.9%
29	White-fronted Plover	*Charadrius marginatus*	99	90.0%
30	Southern Double-collared Sunbird	*Cinnyris chalybeus*	99	90.0%
31	Southern Masked-Weaver	*Ploceus velatus*	97	88.2%
32	Rock Martin	*Hirundo fuligula*	97	88.2%
33	Pied Kingfisher	*Ceryle rudis*	96	87.3%
34	Bokmakierie	*Telophorus zeylonus*	95	86.4%
35	Pied Starling	*Spreo bicolor*	91	82.7%
36	Black-headed Heron	*Ardea melanocephala*	91	82.7%
37	Common Moorhen	*Gallinula chloropus*	90	81.8%
38	Lesser Swamp-Warbler	*Acrocephalus gracilirostris*	86	78.2%

	English Name	*Scientific Name*		
			Sightings	**Reporting rate (probability of occurrence)**
39	Swift Tern	*Sterna bergii*	85	77.3%
40	Cape Weaver	*Ploceus capensis*	84	76.4%
41	Karoo Scrub-Robin	*Cercotrichas coryphoeus*	83	75.5%
42	Black-necked Grebe	*Podiceps nigricollis*	83	75.5%
43	Cape Teal	*Anas capensis*	82	74.5%
44	Common Waxbill	*Estrilda astrild*	81	73.6%
45	Cape Long-billed Lark	*Certhilauda curvirostris*	81	73.6%
46	Karoo Prinia	*Prinia maculosa*	80	72.7%
47	Common Ostrich	*Struthio camelus*	79	71.8%
48	Common Fiscal	*Lanius collaris*	79	71.8%
49	Cape Cormorant	*Phalacrocorax capensis*	78	70.9%
50	Three-banded Plover	*Charadrius tricollaris*	73	66.4%
51	Little Swift	*Apus affinis*	72	65.5%
52	House Sparrow	*Passer domesticus*	72	65.5%
53	Caspian Tern	*Sterna caspia*	70	63.6%
54	**Rock Kestrel**	*Falco rupicolus*	63	57.3%
55	Common Greenshank	*Tringa nebularia*	62	56.4%
56	Black-winged Stilt	*Himantopus himantopus*	60	54.5%
57	Barn Swallow	*Hirundo rustica*	60	54.5%
58	Red-faced Mousebird	*Urocolius indicus*	58	52.7%
59	Malachite Sunbird	*Nectarinia famosa*	58	52.7%

	English Name	*Scientific Name*		
			Sightings	Reporting rate (probability of occurrence)
60	Karoo Thrush	*Turdus smithi*	57	51.8%
61	Wattled Starling	*Creatophora cinerea*	52	47.3%
62	Greater Flamingo	*Phoenicopterus ruber*	50	45.5%
63	Black-crowned Night-Heron	*Nycticorax nycticorax*	50	45.5%
64	Ruddy Turnstone	*Arenaria interpres*	49	44.5%
65	Cape Crow	*Corvus capensis*	49	44.5%
66	Orange River White-eye	*Zosterops pallidus*	48	43.6%
67	Familiar Chat	*Cercomela familiaris*	48	43.6%
68	Pied Avocet	*Recurvirostra avosetta*	47	42.7%
69	Tractrac Chat	*Cercomela tractrac*	46	41.8%
70	Spur-winged Goose	*Plectropterus gambensis*	46	41.8%
71	White-throated Canary	*Crithagra albogularis*	45	40.9%
72	Curlew Sandpiper	*Calidris ferruginea*	44	40.0%
73	Common Ringed Plover	*Charadrius hiaticula*	44	40.0%
74	Lesser Flamingo	*Phoenicopterus minor*	43	39.1%
75	European Bee-eater	*Merops apiaster*	40	36.4%
76	Great White Pelican	*Pelecanus onocrotalus*	39	35.5%
77	Ruff Ruff	*Philomachus pugnax*	38	34.5%
78	Namaqua Dove	*Oena capensis*	38	34.5%
79	Kittlitz's Plover	*Charadrius pecuarius*	38	34.5%
80	**Southern Pale Chanting Goshawk**	*Melierax canorus*	37	33.6%

	English Name	*Scientific Name*		
			Sightings	Reporting rate (probability of occurrence)
81	African Reed-Warbler	*Acrocephalus baeticatus*	37	33.6%
82	Common Tern	*Sterna hirundo*	36	32.7%
83	Long-billed Crombec	*Sylvietta rufescens*	35	31.8%
84	Grey Plover	*Pluvialis squatarola*	34	30.9%
85	Sandwich Tern	*Sterna sandvicensis*	30	27.3%
86	Little Stint	*Calidris minuta*	30	27.3%
87	Southern Grey-headed Sparrow	*Passer diffusus*	27	24.5%
88	Grey-headed Gull	*Larus cirrocephalus*	27	24.5%
89	Yellow Canary	*Crithagra flaviventris*	25	22.7%
90	Reed Cormorant	*Phalacrocorax africanus*	25	22.7%
91	White-throated Swallow	*Hirundo albigularis*	24	21.8%
92	Common Whimbrel	*Numenius phaeopus*	24	21.8%
93	Cape Bulbul	*Pycnonotus capensis*	24	21.8%
94	Wood Sandpiper	*Tringa glareola*	23	20.9%
95	African Darter	*Anhinga rufa*	23	20.9%
96	Sanderling Sanderling	*Calidris alba*	21	19.1%
97	Grey-backed Cisticola	*Cisticola subruficapilla*	21	19.1%
98	Anteating Chat	*Myrmecocichla formicivora*	20	18.2%
99	White-backed Mousebird	*Colius colius*	19	17.3%
100	Spotted Flycatcher	*Muscicapa striata*	19	17.3%
101	Cape Bunting	*Emberiza capensis*	19	17.3%

	English Name	Scientific Name	Sightings	Reporting rate (probability of occurrence)
102	Little Bittern	*Ixobrychus minutus*	18	16.4%
103	Red-capped Lark	*Calandrella cinerea*	17	15.5%
104	Levaillant's Cisticola	*Cisticola tinniens*	17	15.5%
105	Hottentot Teal	*Anas hottentota*	16	14.5%
106	**Greater Kestrel**	*Falco rupicoloides*	16	14.5%
107	Cape Turtle-Dove	*Streptopelia capicola*	15	13.6%
108	Grey Tit	*Parus afer*	13	11.8%
109	Common Sandpiper	*Actitis hypoleucos*	12	10.9%
110	Cattle Egret	*Bubulcus ibis*	12	10.9%
111	Cape Penduline-Tit	*Anthoscopus minutus*	10	9.1%
112	Malachite Kingfisher	*Alcedo cristata*	9	8.2%
113	Ludwig's Bustard	*Neotis ludwigii*	9	8.2%
114	**Lanner Falcon**	*Falco biarmicus*	9	8.2%
115	**Black-shouldered Kite**	*Elanus caeruleus*	9	8.2%
116	Capped Wheatear	*Oenanthe pileata*	8	7.3%
117	Alpine SwifT	*Tachymarptis melba*	8	7.3%
118	Southern Black Korhaan	*Afrotis afra*	7	6.4%
119	Maccoa Duck	*Oxyura maccoa*	7	6.4%
120	**Steppe Buzzard**	*Buteo vulpinus*	6	5.5%
121	Pin-tailed WhydaH	*Vidua macroura*	6	5.5%
122	**Jackal Buzzard**	*Buteo rufofuscus*	6	5.5%

	English Name	Scientific Name	Sightings	Reporting rate (probability of occurrence)
123	Fulvous Duck	*Dendrocygna bicolor*	6	5.5%
124	Bank Cormorant	*Phalacrocorax neglectus*	6	5.5%
125	Yellow-bellied Eremomela	*Eremomela icteropygialis*	4	3.6%
126	Namaqua Sandgrouse	*Pterocles namaqua*	4	3.6%
127	Grey-backed Sparrowlark	*Eremopterix verticalis*	4	3.6%
128	African Red-eyed Bulbul	*Pycnonotus nigricans*	4	3.6%
129	White Stork	*Ciconia ciconia*	3	2.7%
130	Red-billed Quelea	*Quelea quelea*	3	2.7%
131	Pearl-breasted Swallow	*Hirundo dimidiata*	3	2.7%
132	Pale-winged Starling	*Onychognathus nabouroup*	3	2.7%
133	Namaqua Warbler	*Phragmacia substriata*	3	2.7%
134	**Martial Eagle**	*Polemaetus bellicosus*	3	2.7%
135	Karoo Lark	*Calendulauda albescens*	3	2.7%
136	Crowned Lapwing	*Vanellus coronatus*	3	2.7%
137	Cape Robin-Chat	*Cossypha caffra*	3	2.7%
138	African Paradise-Flycatcher	*Terpsiphone viridis*	3	2.7%
139	**Verreaux's Eagle**	*Aquila verreauxii*	2	1.8%
140	Squacco Heron	*Ardeola ralloides*	2	1.8%
141	**Spotted Eagle-Owl**	*Bubo africanus*	2	1.8%
142	Purple Heron	*Ardea purpurea*	2	1.8%
143	**Black-chested Snake-Eagle**	*Circaetus pectoralis*	2	1.8%

	English Name	Scientific Name		
			Sightings	Reporting rate (probability of occurrence)
144	African Spoonbill	*Platalea alba*	2	1.8%
145	African Pipit	*Anthus cinnamomeus*	2	1.8%
146	**African Fish-Eagle**	*Haliaeetus vocifer*	2	1.8%
147	Zitting Cisticola	*Cisticola juncidis*	1	0.9%
148	Yellow-billed Egret	*Egretta intermedia*	1	0.9%
149	Yellow Bishop	*Euplectes capensis*	1	0.9%
150	White-rumped Swift	*Apus caffer*	1	0.9%
151	Terek Sandpiper	*Xenus cinereus*	1	0.9%
152	Stark's Lark	*Spizocorys starki*	1	0.9%
153	Southern Pochard	*Netta erythrophthalma*	1	0.9%
154	**Secretarybird**	*Sagittarius serpentarius*	1	0.9%
155	Rufous-eared Warbler	*Malcorus pectoralis*	1	0.9%
156	Mountain Wheatear	*Oenanthe monticola*	1	0.9%
157	Lark-like Bunting	*Emberiza impetuani*	1	0.9%
158	Glossy Ibis	*Plegadis falcinellus*	1	0.9%
159	Fairy Flycatcher	*Stenostira scita*	1	0.9%
160	Eurasian Oystercatcher	*Haematopus ostralegus*	1	0.9%
161	Dusky Sunbird	*Cinnyris fuscus*	1	0.9%
162	Common Quail	*Coturnix coturnix*	1	0.9%
163	Cape Gannet	*Morus capensis*	1	0.9%
164	**Cape Eagle-Owl**	*Bubo capensis*	1	0.9%

	English Name	Scientific Name		
			Sightings	Reporting rate (probability of occurrence)
165	Bar-tailed Godwit	*Limosa lapponica*	1	0.9%
166	Kori Bustard	*Ardeotis kori*		
167	**Black Harrier**	*Circus maurus*		1 Seen during 2 days monitoring 17-18 August
168	Black-eared Sparrowlark	*Eremopterix uastralis*		2 flocks seen comprising about 8 birds 17-18 August
Totals: 168 species, 15 species of raptor,				