Prepared for:

Vredenburg Windfarm (Pty) Ltd.

Proposed Boulders Wind Farm

Avifaunal Specialist Scoping Report

Scoping Report

October 2017

LOOKING DEEP INTO NATURE

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EXECUTIVE SUMMARY

This scoping report aims to provide a preliminary evaluation of the potential impacts between birds and the proposed Boulders Wind Farm (Boulders WF), in the Western Cape Province of South Africa. The proposed site is located in an area dominated by cereal croplands, mostly wheat fields and pasture areas interspersed with patches of natural vegetation. Several drainage lines and small dams can be found scattered across the study site. A total of up to 252 bird species can be potentially present within the proposed Boulders WF area and the surrounding areas, according to the bibliographic data sources consulted and the field visits conducted. Out of the total 252 species with potential occurrence, 21 species are considered to be of special conservation concern including 11 "Endangered", 10 "Vulnerable" and 12 "Near-threatened" (Taylor, Peacock & Wanless 2015).

From the list of potentially occurring species, 48 species were selected as sensitive (i.e. focal) species for the EIA process due to their conservation status, regional endemicity and sensitivity to wind energy facility development impacts.

Visits to the site confirmed the occurrence of 32 sensitive species, including the following species of conservation concern: Cape Cormorant *Phalacrocorax capensis*, Martial Eagle *Polemaetus bellicosus*, Black Harrier *Circus maurus*, Ludwig's Bustard *Neotis ludwigii* – Endangered –, Great White Pelican *Pelecanus onocrotalus*, Verreauxs' Eagle *Aquila verreauxii*, Secretarybird *Sagittarius serpentarius*, Lanner Falcon *Falco biarmicus*, Southern Black Korhaan *Afrotis afra*, Caspian Tern *Sterna caspia* – Vulnerable –, Greater Flamingo *Phoenicopterus roseus*, Lesser Flamingo *Phoeniconaias minor* and Blue Crane *Anthropoides paradiseus* – Near Threatened (Taylor, 2014). One nest of Secretarybird was found within the proposed implementation area of this project.

The proposed Boulders Wind Farm may cause potential negative impacts on the local bird community through: (i) disturbance of birds and habitat destruction during construction and maintenance of the facility and associated infrastructure; (ii) displacement and/or exclusion of birds from the area; and (iii) collision of birds with turbine blades during operation. The analysis of the sensitivity of the development area has determined that there are some areas of probable **medium** sensitivity for bird communities, following the principle of the precautionary approach, though it is relevant to further analyse the data collected during the pre-construction monitoring phase especially regarding the sensitive species movements.

It is recommended that the sensitive areas identified at this stage for the bird community should be excluded from the development, as far as possible. It is relevant to mention that this scoping assessment is based on a desktop based study informed by limited site visits and the preliminary analysis of some of the data collected during a one-year pre-construction bird monitoring programme. The data collected is not yet fully analysed and will be further looked into during the EIA phase in order to confirm and validate the impacts identified and the sensitive areas. The pre-construction bird monitoring programme methodology implemented covered all the relevant seasons for the avifauna community on the site, as recommended by the *Best practice guidelines* (Jenkins *et al.* 2012, 2015). During- and post- construction monitoring will be very important to improve the understanding of the real impact caused by the WF on local bird populations.

TECHNICAL TEAM

The technical team responsible for the avian impact desktop study is presented in the table below.

Technician	Qualifications	Role on project
João Paula	BSc in Biology	Data Analysis Report Compilation
Ricardo Branca	BSc in Biology MSc in Management and Conservation of Natural Resources	Report Compilation
Craig Campbell	BSc in Conservation Ecology	Project Manager Field observer
Miguel Mascarenhas	Graduation in Applied Biology to Plant Resources MSc on Environmental Impact Assessment Postgraduate studies on Geographic Information Systems	Technical coordination
Nuno Salgueiro	Graduation in Applied Biology to Plant Resources Postgraduate on Environmental Sciences and Technologies	Technical coordination
Sílvia Mesquita	Graduation in Applied Biology to Terrestrial animal resources Postgraduate Specialization in Nature Tourism	Technical coordination
Helena Coelho	Graduation in Biology MSc in Marine and Coastal Sciences PhD in Biology	Technical coordination

Report compiled in October 2017.

CITATION

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SPECIALIST DECLARATION

Professional registration

The Natural Scientific Professions Act of 2003 aims to "Provide for the establishment of the South African Council of Natural Scientific Professions (SACNASP) and for the registration of professional, candidate and certified natural scientists; and to provide for matters connected therewith."

"Only a registered person may practice in a consulting capacity" – Natural Scientific Professions Act of 2003 (20(1)-page 14)

Investigator:	Miguel Mascarenhas (Pri.Sci.Nat)
Qualification:	MSc on Environmental Impact Assessment – Univ. of Málaga (Spain)
	Postgraduate on Business Management – INDEG Business School (Portugal)
	Postgraduate on Geographic Information Systems – Univ. of Lisboa (Portugal)
BSc on Applied Biology to Plant Resources – Univ. of Lisboa (Portugal)	
Affiliation:	South African Council for Natural Scientific Professions
Registration number:	400168/14
Fields of Expertise:	Ecological Science
Registration:	Professional Member

Declaration of Independence

The specialist investigator declares that:

- We act as independent specialists for this project.
- We consider ourselves bound by the rules and ethics of the South African Council for Natural Scientific Professions.
- We do not have any personal or financial interest in the project except for financial compensation for specialist investigations completed in a professional capacity as specified by the Environmental Impact Assessment Regulations, 2006.
- We will not be affected by the outcome of the environmental process, of which this report forms part of.
- We do not have any influence over the decisions made by the governing authorities.
- We do not object to or endorse the proposed developments, but aim to present facts and our best scientific and professional opinion with regard to the impacts of the development.
- We undertake to disclose any information, to relevant authorities, that has or may have the potential to influence its decision or the objectivity of any report, plan, or document required in terms of the Environmental Impact Assessment Regulations, 2006.
- Should we consider ourselves to be in conflict with any of the above declarations, we shall formally submit a Notice of Withdrawal to all relevant parties and formally register as an Interested and Affected Party.

Professional experience

Miguel Mascarenhas has been involved in environmental impact assessment and ecological monitoring for more than 10 years. He has experience with bat interactions with renewable projects, namely energy infrastructure for more than 6 years. During this period, he has been involved in impact assessments and ecological monitoring for over 100 projects, at least 50 of which involved onshore wind energy generation in South Africa. A full Curriculum Vitae can be supplied on request.

Terms and Liabilities

- This report is based on a full pre-construction monitoring year, using the available information and data related to the site to be affected.
- The Precautionary Principle has been applied throughout this investigation.
- Additional information may become known or available during a later stage of the process for which no allowance could have been made at the time of this report.
- The specialist investigator reserves the right to amend this report, recommendations and conclusions at any stage, should additional information become available.
- Information, recommendations and conclusions in this report cannot be applied to any other area without proper investigation.

- This report, in its entirety or any portion thereof, may not be altered in any manner or purpose without the specific and written consent from the specialist investigator as specified above.
- Acceptance of this report, in any physical or digital form, serves to confirm acknowledgment of these terms and liabilities.

Signed on the 23th October 2017 by Miguel Rodolfo Teixeira de Mascarenhas in his capacity as specialist investigator.

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1. INTRODUCTION

This document presents the Avifauna Impact Scoping Assessment for the Boulders Wind Farm (hereafter referred as Boulders WF) proposed by Vredenburg Wind Farm (Pty) Ltd. It forms part of the Scoping and Environmental Impact Assessment that is being undertaken for the proposed Boulders WF by Vredenburg Wind Farm (Pty) Ltd.

The study area where the Boulders Wind Farm Project is proposed was subjected to a 12-month bird monitoring campaign, between June 2014 and May 2015. At the time, the project was designated as Vredenburg Wind Energy Facility development by Vredenburg Windfarm (Pty) Ltd. However, the Environmental Impact Assessment (EIA) application was not completed and the EIA process was restarted in 2017, following the most recent regulations (NEMA 2014), under the designation of Boulders Wind Farm Project.

It is the developer's intention to use all data collected between June 2014 and May 2015 from bird pre-construction monitoring programme, to inform the specialist impact assessment reports for the current Boulders Wind Farm Scoping & Environmental Impact Assessment procedure. It is also important to note that the study area has not significantly changed. The specialist conducted a reconnaissance site visit in October 2017 and it was confirmed that the general characteristics of the study area have not changed since the initial bird pre-construction monitoring campaign. This assessment took into account the area's land-use and habitats or suitability for bird communities. At present, the new project specifications have not been provided.

As the monitoring programme started in June 2014, the applicable best practice guidelines were the 2012 version (Jenkins et al. 2012). Nonetheless, according to the most recent version of the guidelines (Jenkins et al. 2015), Section 2.2.2 (Timing of study):

> *If there is a significant gap (i.e. more than three years) between the completion of the initial pre-construction monitoring and impact assessment, and the anticipated commencement of construction, it may be advisable to repeat the pre-construction monitoring (or parts thereof) to assess whether there have been any changes in species abundance, movements and/or habitat use in the interim.*

Considering that the bird monitoring programme ended in May 2015, this study is still valid, according to the Best Practice Guidelines. As mentioned, the bird monitoring programme was undertaken in full compliance with the 2012 version of the Best Practice Guidelines and it is considered to also comply with all requirements of the most recent version of the Guidelines (Jenkins et al. 2015).

Considering all of the above, we can conclude that the original bird pre-construction monitoring studies conducted at Vredenburg WEF are still valid and accurately represent the bird community trends expected to occur at the Boulders Wind Farm Project. The EIA application can therefore commence without the implementation of additional field monitoring.

1.1. Summary of the EIA process

This Avifaunal Scoping Report has the main objectives of:

- Identifying potential sensitive environments and receptors that may be impacted on by the proposed facility and the types of impacts that are most likely to occur;

- Determining the nature and extent of potential impacts during the construction and operation phases;
- Identifying No-Go areas, where applicable;
- Summarising the potential impacts that will be considered further in the EIA Phase through specialist assessment.

This Avifaunal Scoping study is a short term study based solely on the information available at the time this report was compiled. The study includes four main stages:

(i) literature review of bird and WF interactions as well as bird species and habitats likely to occur within the study area;

(ii) site visit for the validation of the bird species (particularly species of conservation concern) and habitats present;

(iii) identification of potential issues considering the bird community present at the site;

(iv) preliminary impact assessment and proposal of mitigation measures, when necessary.

1.2. Proposed Wind Farm and study area

The proposed Boulders Wind Farm (WF) is located approximately 1 km south of Britannia Bay and 7 km north of the town of Vredenburg in the West Coast Peninsula in the Western Cape Province. The project considers a contracted capacity up to 140MW.

Important Bird Areas

The closest Important Bird Areas (IBA) to the project, Lower Berg River Wetlands, is located approximately 8 km east which, given the proximity, may influence the bird community present in the site or commuting within the area. A second IBA is located approximately 30 km south, coincident with the West Coast National Park, and this one is not expected to have great influence on the bird community present at the proposed site (Figure 1).

The Lower Berg River Wetlands are situated at the Berg River mouth at Laaiplek (BirdLife South Africa, 2014a). Approximately 250 bird species have been recorded using the area, 120 of which are waterbirds. This important estuary presents important habitats such as mudflats and floodplain pans. The area supports colonies of African Black Oystercatcher (*Haematopus moquini*), Common Tern (*Sterna hirundo*), Sandwich tern (*Sterna sandvicensis*), Swift Tern (*Sterna bergii*), Greater Flamingo (*Phonicopterus roseus*), Lesser Flamingo (*Phoeniconaias minor*), Chesnut-banded Plover (*Charadrius pallidus*), Hartlaub's Gull (*Larus hartlaubii*) and Great White Pellican (*Pelecanus onocrotalus)* among others. The Tern roosting site is a Coordinated Waterbird Counts (CWAC) registered site (Berg River 17), being monitored regularly. On average approximately 1100 individuals of Sandwich Tern, 200 Swift Terns and 100 Common Terns are detected at

this site[1]. One other CWAC site (Berg River 16) is known to serve as a major night roost for various waterbirds, including very large number of Cape Cormorant (up to 15000 birds)[1]. Raptors, such as the African Marsh Harrier (*Circus ranivorus*) or African Fish Eagle (*Haliaeetus vocifer*) breed in the area as well.

West Coast National Park and Saldanha Bay Island includes the Langebaan Lagoon, the coastal zone holding Postberg Nature Reserve and several islands (BirdLife South Africa 2014b). The park supports important communities of waterbirds and is considered to be the most important wetland for waders in South Africa. Species such as: Grey Plover (*Pluvialis squatarola*), Curlew Sandpiper (*Calidris ferruginea*), Sanderling (*Calidris alba*), Red Knot (*Calidris canutus*), Ruddy Turnstone (*Arenaria interpres*), Chestnut-banded Plover (*Charadrius pallidus*), White-fronted Plover (*Charadrius marginatus*) and Kittlitz's Plover (*Charadrius pecularius*) are important components of such communities.

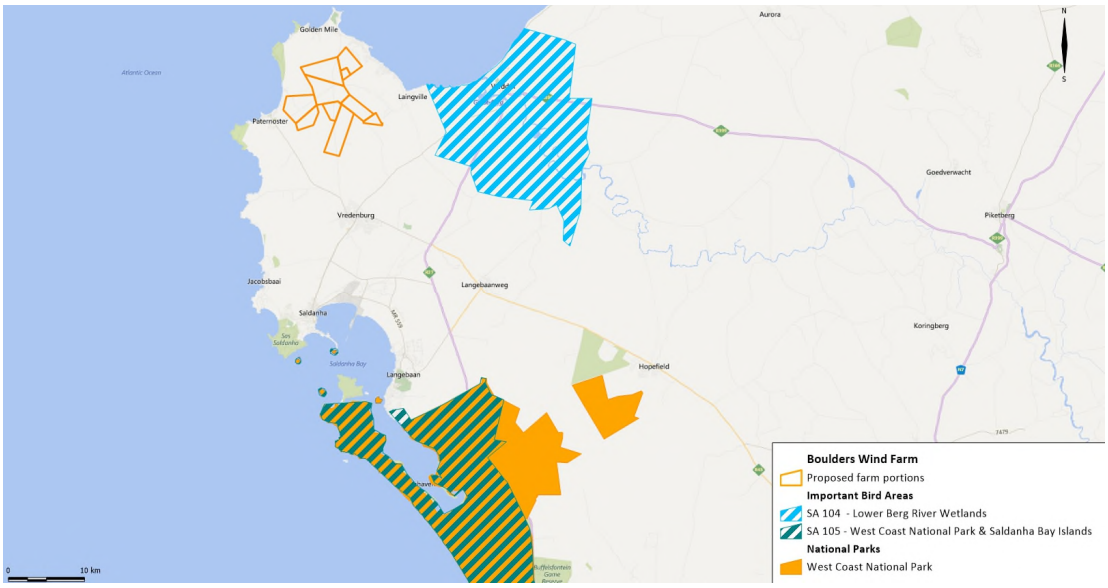

Figure 1 – Important Bird Areas and Conservancy Areas surrounding Boulders Wind Farm (background source: Virtual Earth WMS).

Other Renewable Energy Projects

There are several wind energy facility projects currently undergoing Environmental Authorisation processes and already approved in the West Coast Peninsula, including the 30 MW St Helena WF (Approved), the Nooitgedacht WF and Solar Facility (Approved), the West Coast One WF (approved and operational), and the Isivunguvungu WF (Approved). However of these 4 facilities only two are considered to be viable due the technical constriants on the other facilities (refer to Figure 2 below). Other wind energy facilities are being

[1] CWAC data were obtained from the Animal Demography Unit, University of Cape Town (28-07-2015).

constructed within a 150km radius from the site under study (CSIR 2014). Predicted cumulative impacts resulting from the proximity of such developments will be assessed further in this report.

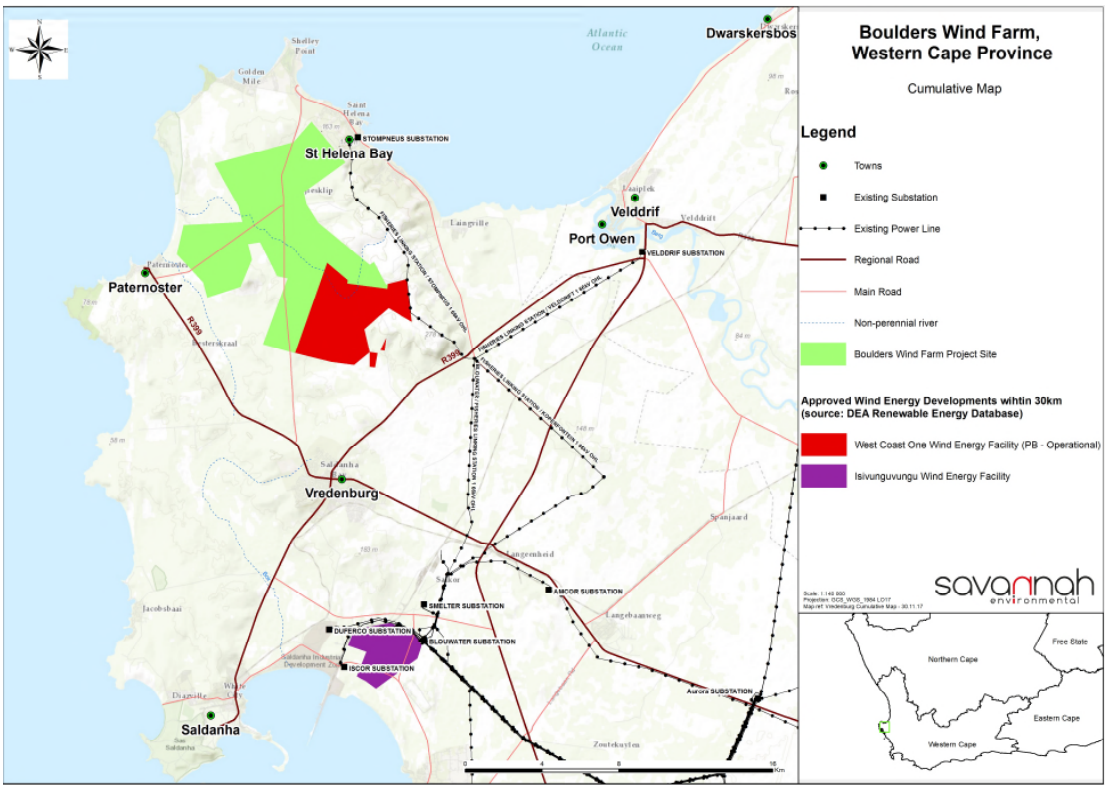

Figure 2 – Renewable Energy Projects, including wind energy and solar energy facilities, proposed and/or approved in the surroundings of the proposed Boulders WF (provided by Savannah Environmental).

1.3. Terms of reference and scope of work

This assessment was conducted according to the following specialist terms of reference, in accordance to the Environmental Impact Assessment Regulations (December 2014):

- Conduct a review of national and international specialised literature and experiences regarding birds and wind farms;
- Conduct a bibliographic review to determine the avifauna community present in the study area, describe the affected environment, identify species of special concern and assess potential negative impacts caused by the WF;
- Map sensitive areas in and around the proposed WF site;
- Provide recommendations for relevant mitigation measures which will allow the reduction of negative impacts and the maximisation of the benefits associated with any identified positive impacts;

- This avifaunal impact assessment report has integrated the results of the information readily available from the site visits conducted for the pre-construction bird monitoring programme for the proposed WF, in addition to the available bibliographic information available. This pre-construction monitoring programme was undertaken according to the recommendations of the "BirdLife South Africa/Endangered Wildlife Trust best practice guidelines for avian monitoring and impact mitigation at proposed wind energy development sites in southern Africa" (Jenkins *et al.* 2012) covering a full year period. The bird monitoring programme was undertaken in full compliance with the 2012 version of the Best Practice Guidelines, and it is considered to also comply with all requirements of the most recent version of the Guidelines *Best- Practice Guidelines for Assessing and Monitoring the Impact of Wind-Energy Facilities on Birds in Southern Africa* (Jenkins *et al.* 2015). The methodology implemented is detailed in Appendix II.
- Propose an adequate monitoring programme for the evaluation of the impacts expected during the operation phase of the WF as well as during its construction phase, if considered necessary.

1.4. Legal Framework

The Boulders WF is subject to the requirements of the National Environmental Management Act 104 of 1998. The EIA Regulations of December 2014 requires that an EIA process must be undertaken for the development of the proposed project. As part of the EIA process, specialist input has been sought from Bioinsight regarding an assessment of the potential impacts of the WF on birds. In line with the principles of NEMA, impacts on the environment (and is this case birds specifically) must be determined, assessed and recommendations provided on how to avoid (as far as possible), then mitigate and manage potential negative impacts on bird species caused by human-made infrastructures (e.g. wind turbines and associated infrastructures). In this context, the bird assessment considered the bird species which occur on the site and an assessment of potential impacts on birds, avoidance of impacts on birds (if possible), and where avoidance of impacts of the WF on birds is not possible, mitigation measures have been proposed.

It is considered best practice for bird monitoring to be undertaken on WF sites, striving for the reconciliation of wind energy and birds, aiming to evaluate and minimise any potential impacts. This can be achieved by fulfilling the requirements outlined by the *Best practice guidelines* (Jenkins *et al.* 2012, 2015).

There are no permit requirements dealing specifically with birds in South Africa. However, legislation which applies to birds includes the following:

National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004)

Sections 2, 56 and 97 are of specific reference. Section 97 considers the Threatened or Protected Species Regulations: The Act calls for the management and conservation of all biological diversity within South Africa.

The National Environmental Management: Biodiversity Act (Act 10 of 2004) (NEM:BA) provides for listing threatened or protected ecosystems, in one of four categories: critically endangered (CR), endangered (EN), vulnerable (VU) or protected.

NEM:BA also deals with endangered, threatened and otherwise controlled species, under the ToPS Regulations (Threatened or Protected Species Regulations). The Act provides for listing of species as threatened or protected, under one of the following categories:

- Critically Endangered: any indigenous species facing an extremely high risk of extinction in the wild in the immediate future.

- Endangered: any indigenous species facing a high risk of extinction in the wild in the near future, although it is not a critically endangered species.
- Vulnerable: any indigenous species facing an extremely high risk of extinction in the wild in the medium-term future; although it is not a critically endangered species or an endangered species.
- Protected species: any species which is of such high conservation value or national importance that it requires national protection. Species listed in this category include, among others, species listed in terms of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

A ToPS permit is required for any activities involving the removal or destruction of any ToPS-listed species.

Western Cape Nature Conservation Laws Amendment Act of 2000

Although the primary purpose of this Act is to provide for the amendment of various laws on nature conservation in order to transfer the administration of the provisions of those laws to the Western Cape Nature Conservation Board, it also deals with a number of other issues. Under this Act, lists of provincially protected and endangered fauna and flora are provided. A permit is required for any activities which involve endangered or protected flora and fauna.

IUCN Red List of Threatened Species

The International Union for the Conservation of Nature (IUCN) Red List of Threatened Species ranks plants and animals according to threat levels and risk of extinction, therefore providing an indication of biodiversity loss. This has become a key tool used by scientists and conservationists to determine which species are most urgently in need of conservation attention. In South Africa, a number of birds are listed on the IUCN Red List.

Convention on Biological Diversity

This Convention aims to protect and maintain biological diversity, the sustainable use of its components, and the fair and equitable sharing of benefits from the use of genetic resources. The Convention intends to enforce the concept of sustainable use of resources among decision-makers and that these are not infinite. It also offers decision-makers guidance based on the precautionary principle. South Africa is a Party to this convention since 1993.

Convention on the Conservation of Migratory Species of Wild Animals (CMS)

CMS is a treaty of the United Nations Environment Programme (UNEP), which provides a global platform for the conservation and sustainable use of migratory animals and their habitats. South Africa is a Party State since 1991. CMS includes the States through which migratory animals pass (Range States), and establishes the legal foundation for internationally coordinated conservation measures throughout a migratory range. Besides establishing obligations for each State joining the Convention, CMS promotes concerted action among the Range States of many of these species.

The CMS has two Appendices: Appendix I pertains to migratory species threatened with extinction and Appendix II that regards migratory species that need or would significantly benefit from international co-operation. CMS Parties strive towards strictly protecting these animals, conserving or restoring the places where they live, mitigating obstacles to migration and controlling other factors that might endanger them.

African-Eurasian Waterbird Agreement (AEWA)

The Agreement on the Conservation of African-Eurasian Migratory Waterbirds was established under the CMS and administered by the UNEP. It is an intergovernmental treaty focused on the conservation of migratory waterbirds and their habitats across their occurrence range. South Africa is a contracting party since 2002. The Agreement requires that the habitat of the species covered by the AEWA are suitable for breeding, and therefore it is essential for the signatory countries to have concerted efforts in the conservation and management of these migratory populations.

1.5. Report Structure

This report content was organised in the following chapters:

- Section 1: Introduction – description of aims and scope of the study and technical team;
- Section 2: Study Methodology – description of methodology and impact assessment;
- Section 3: Description of the affected environment – presentation of the bird community within the study area and sensitivity mapping for the proposed site;
- Section 4: Impact assessment of the proposed facility – preliminary assessment of impacts in the proposed site and proposal of minimisation and/or mitigation measure for the proposed site;
- Section 5: Impact Statement – conclusion regarding the main impacts caused by the proposed site;
- Section 6: References;
- Section 7: Appendices.

2. STUDY METHODOLOGY

2.1. Approach and data sources

As a baseline for this impact assessment a desktop study was conducted to compile the most recent and accurate information available, in order to provide a better evaluation of all conditions present within the study area. Therefore, data sources (as detailed in Table 1) were consulted in order to assess the species likely to occur within the Boulders WF area. The following steps were taken:

- Based on a desktop review and considering all literature references available (Table 1), a list of all bird species considered to potentially occur within, or in close proximity to the site was compiled.
- Literature references and bird specialists were consulted concerning any available information regarding possible migration routes, patterns of bird activity throughout the study area, presence of known breeding and roosting, or other types of information that could be relevant for the contextualisation of the importance of the study area for birds occurring in South Africa, particularly, in the Western Cape.
- All species listed from the aforementioned process were assessed at a national level in terms of endemism, population trend, habitat preferences and conservation status.
- The vulnerability of these species in terms of the potential impacts from wind energy developments was evaluated using the Avian Wind Sensitivity Map (Retief *et al.* 2012). Other species not listed in the aforementioned document were also considered sensitive because of their abundance, flight characteristics, ecological role, population trend and conservation status.
- A short list of sensitive species, to which the assessment and monitoring programme should pay special attention to, was compiled based on the sensitive species identified in the previous steps.
- A desktop study, of all the available information such as topographical maps of South Africa, Google™ Earth imagery, and Geographical Information System software was conducted for a preliminary evaluation of the area. This information was validated through the field visits conducted during the pre-construction bird monitoring.
- It is important to characterise the study area in terms of the vegetation and habitat present on site. The method used for vegetation classification is that developed by Mucina & Rutherford (2006). Even more important than the biomes are the vegetation units, which are shaped by various local factors. Bird density, abundance and movement are all determined largely by available vegetation. It is therefore essential to characterise the study area in these terms. Google Earth imagery and more importantly, field work, was used to identify the available micro-habitats on site.

Table 1 – Data sources consulted for the evaluation of the avifauna present in the study area. The international references and guidelines used to support the methodological approach and results analysis are presented.

Type	Title	Bibliographic Reference	Detail of information
Data sources	South African Bird Atlas Project 2 (SABAP2)	http://sabap2.adu.org.za/	Local
	South African Bird Atlas Project 1 (SABAP1)	(Harrison *et al.* 1997)	Local
	Avian Wind Farm Sensitivity Map for South Africa	(Retief *et al.* 2012)	Pentad (5 x 5 minutes)
	Coordinated Avifauna Roadcounts (CAR)	http://car.adu.org.za/	Local

Type	Title	Bibliographic Reference	Detail of information
	Coordinated Waterbird Counts	http://cwac.adu.org.za/	Local
	IPD Wind Energy Facility, Western Cape – Avifaunal Impact Assessment Scoping Phase	(Smallie 2014)	Local
	Nooitgedacht Renewable Energy Facility – Bird Impact Assessment	(Avisense Consulting 2010)	Local
	Proposed 140MW Vredenburg Windfarm (Pty) Ltd - Final Scoping report for Comment	(Venturi & Michalowska 2014)	Local
	The 2014 Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland 2014	(Taylor, 2014)	National level
	Renewable Energy Application Mapping – Report version I	(DEA 2016)	National level
	Global List of Threatened Species	(IUCN 2016)	Global level
Guidelines and other international references	BirdLife South Africa/Endangered Wildlife Trust best practice guidelines for avian monitoring and impact mitigation at proposed wind energy development sites in southern Africa	(Jenkins *et al.* 2012)	National level Methodological approach
	Best- Practice Guidelines for Assessing and Monitoring the Impact of Wind-Energy Facilities on Birds in Southern Africa	(Jenkins *et al.* 2015)	National level Methodological approach
	Wind energy development and Natura 2000	(European Commision 2010)	International level Methodological approach and analysis
	Good Practice Wind Project	www.project-gpwind.eu/	International level Methodological approach and analysis
	Comprehensive Guide to Studying Wind Energy/Wildlife Interaction	(Strickland *et al.* 2011)	International level Methodological approach and analysis
	U.S. Fish and Wildlife Service Land-Based Wind Energy Guidelines	(USFWS 2012)	International level Methodological approach and analysis
	Directrices para la evaluación del impacto de los parques eólicos en aves y murciélagos	(Atienza *et al.* 2011)	International level Methodological approach and analysis
	Windfarm impacts on birds guidance	www.snh.gov.uk/	International level Methodological approach and analysis

Definition of the different types of surrogate species

An evaluation of the potential impacts of the development was made in order to select the species that could be affected by it – i.e. **sensitive species**. These were identified by implementing a structured decision process (refer to Figure 3) in which several factors related to the species' physiology and biology are considered, such as its; taxonomic order (Jordan & Smallie 2010), threatened status (Barnes 2000; IUCN 2016) ecological role e.g. raptors are considered to be key elements of the ecosystems and particularly vulnerable to collision with

wind turbines (Strickland *et al.* 2011), abundance (Hockey, Dean & Ryan 2005) and population trend (IUCN 2016). The sensitive species list also included priority species (Retief *et al.* 2012) updated in 2014[2].

The use of the analysis of sensitive species, will add valuable information on particular assessments, whether it would be cumulative effects, turbine micro sitting or post-construction Before-After Control-Impact.

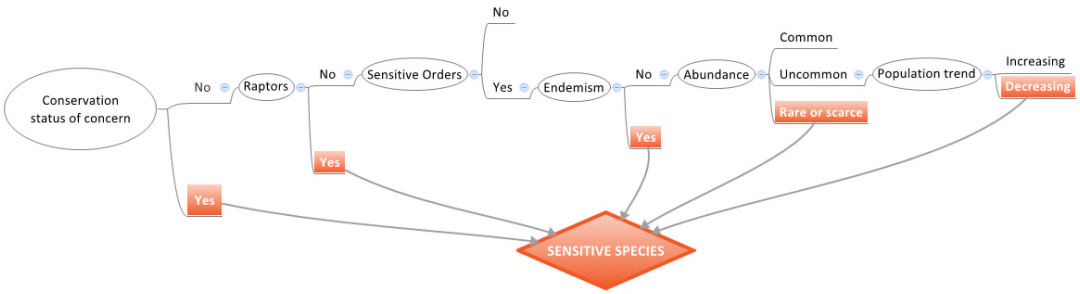

Figure 3 - Decision process scheme used to define sensitive species. A species is sensitive when following its characteristics through the scheme it ends in a red square. On the other hand, if it does not end up in a red square it would not be considered sensitive for the Boulders WF area.

2.2. Field visits

This Scoping report has taken into consideration the information collected during the bird pre-construction monitoring programme undertaken at the Boulders WF by Bioinsight between June 2014 and May 2015.At this stage, data collected from the field was used to validate the desktop analysis conducted and to inform the scoping impact assessment phase of the project. All the methodologies conducted for this assessment were in compliance with the "Best practice guidelines for avian monitoring and impact mitigation at proposed wind energy development sites in Southern Africa" (Jenkins *et al.* 2012) and the "Best- Practice Guidelines for Assessing and Monitoring the Impact of Wind-Energy Facilities on Birds in Southern Africa" (Jenkins *et al.* 2015) (refer to Appendix II for further information on the methodologies implemented). The following methodologies were conducted within the proposed wind energy facility farm portions and its immediate surroundings (Figure 4):

- Vantage points monitoring, to define the utilisation of the area by raptors and other large birds;
- Linear walking transects, to determine factors related to passerine and small bird communities on the wind energy facility site and the control area;

[2] **Priority species -** Species listed in the Avian Wind Farm Sensitivity Map for South Africa (Retief *et al.* 2012). This list of species is considered a priority as it sets the basis for a common evaluation scheme in South Africa and therefore it is believed that any species contained in these documents should be identified as a priority for conservation. The criteria used by Retief et al., 2012 were: species conservation concern - IUCN (2013) and *The Eskom Red Data Book of Birds of South Africa*, Lesotho and Swaziland (Barnes 2000) -, species endemism and species that might be sensitive to wind farms based on a bibliographic review and comparing to the groups affected in other parts of the world.

- Vehicle based transects, to complement the vantage point, nest and roost survey and aid in the definition of the distribution of some species not prone to flying, such as bustards and, to a lesser extent, cranes.
- Priority species nest survey, to locate and monitor active nesting sites of sensitive species within the study area and immediate surroundings;
- Water body monitoring, to evaluate the species present and their relevant movements at and between the main water bodies.

All contacts of target species during the driving and/or walking transects of the observers in the study area were recorded as incidental observations and were used as complementary data to characterise the bird community and its utilisation of the site, as recommended by the Best Practice Guidelines (Jenkins *et al.* 2012, 2015) and the previous stages of the Impact Assessment.

2.2.1. Sampling Period

The bird pre-construction monitoring programme spanned from between June 2014 and May 2015. The field surveys were accommodated so the area was surveyed for a total period span of 12 months. This complies with the requirements of the Best Practice Guidelines that were in place when the monitoring programme was designed and initiated (Jenkins *et al.* 2012, 2015). Therefore, the monitoring programme included a total of 10 visits to the site, covering the area through a 12-month period that sampled the four seasons of the year. Also, a short site visit was conducted on the 9th of October 2017, to see if any significant changes have occurred to the general area in terms of land-use and habitats or suitability for bird communities, since the last pre-construction monitoring campaign.

2.2.2. Linear Walking Transects

Six linear transects were conducted within the Wind Farm site, and three additional transects were conducted in a similar Control area, each with approximately 1000m in length (Figure 4). These covered all micro-habitats or biotopes[3] relevant for the local bird community present on site. These transects were conducted once during the reconnaissance visit.

Each linear transect was conducted by expert bird observers who slowly walked recording all bird contacts, both seen and heard. These contacts were recorded on both the left and right side of the progression line, with no distance limit between the observer and the birds (Buckland *et al.* 1993; Bibby *et al.* 2000).

[3] Biotope is an area of uniform environmental conditions providing a living place for a specific assemblage of plants and animals. Biotope is almost synonymous with the term Habitat , but while the subject of a habitat is a species or a population, the subject of a biotope is a biocenosis.

2.2.3. Vantage Points

Four suitable vantage points were implemented at strategic locations in the Wind Farm and in such a way as to allow for efficient visualisation of the proposed area for the wind farm and its immediate surroundings (Figure 4). Observations from each vantage point were conducted for at least twelve hours per season each covering a 360º area. For each observation the number of individuals and, whenever possible, the gender and age was recorded. Behavioural patterns observed were also recorded, including (*i*) type of flight - passage flight, soaring, display, territorial; (*ii*) flight height - below rotor height, rotor height, above the rotor height; and (*iii*) environmental variables (air temperature, wind speed and direction, occurrence of precipitation, cloud cover and visibility).

2.2.4. Vehicle-Based transects

As a complementary method, two vehicle-based transects of approximately 16km and 18km respectively were conducted in the WF and its immediate surroundings (Figure 4).

Each transect was conducted by two expert observers; one driving slowly and the other recording all of the contacts being seen or heard. During each linear transect, the total number of birds observed was counted and recorded.

2.2.5. Breeding and roosting evidences

The methodology implemented followed the general guidelines presented in the Best Practice Guidelines for Bird Monitoring (Jenkins *et al.* 2012, 2015). The area of the WF and its immediate surroundings was investigated for nesting and/or roosting locations of priority species. All the nesting and/or roosting locations identified during inspection was registered with a handheld GPS, after which the data was imported into an appropriate Geographical Information System.

2.2.6. Water body monitoring

The main water bodies within the study area and its immediate surroundings were identified, mapped and surveyed in order to determine their level of utilisation by water birds (Figure 4). The methodological approach followed the prescribed protocol of the Coordinated Water bird Counts (Taylor *et al.* 1999).

2.2.7. Bird micro-habitats mapping

The mapping of vegetation and other relevant features was performed by means of Google Earth Imagery and Geographic Information System software. These features were subsequently validated on site by field observers, while travelling by car across the extent of the WF area.

2.3. Impact Evaluation

A preliminary identification and characterisation of the potential impacts caused by the implementation of the Boulders WF will be conducted based on extensive experience in environmental impacts assessment, supplemented by specific knowledge and investigation of the area. The impacts identified will provide a baseline for the evaluation to be conducted in the EIA.

2.4. Assumptions and limitations

- The avifaunal assessment of such a study area will be dependent on the accuracy of both primary (data collection) and secondary data sources, such as those indicated in section 2.1.
- Any inaccuracies or lack of information in the bibliographic sources consulted could limit this study. In particular, the SABAP1 data is now fairly old (Harrison *et al.* 1997). To surpass this possible problem in the data used, the more recent and updated SABAP2 was consulted. However, the number of lists submitted for this area in the SABAP 2 is not yet adequate for the single use of this more recent data source. Therefore, both South African Bird Atlases (Project 1 and 2) were consulted in a complementary way.

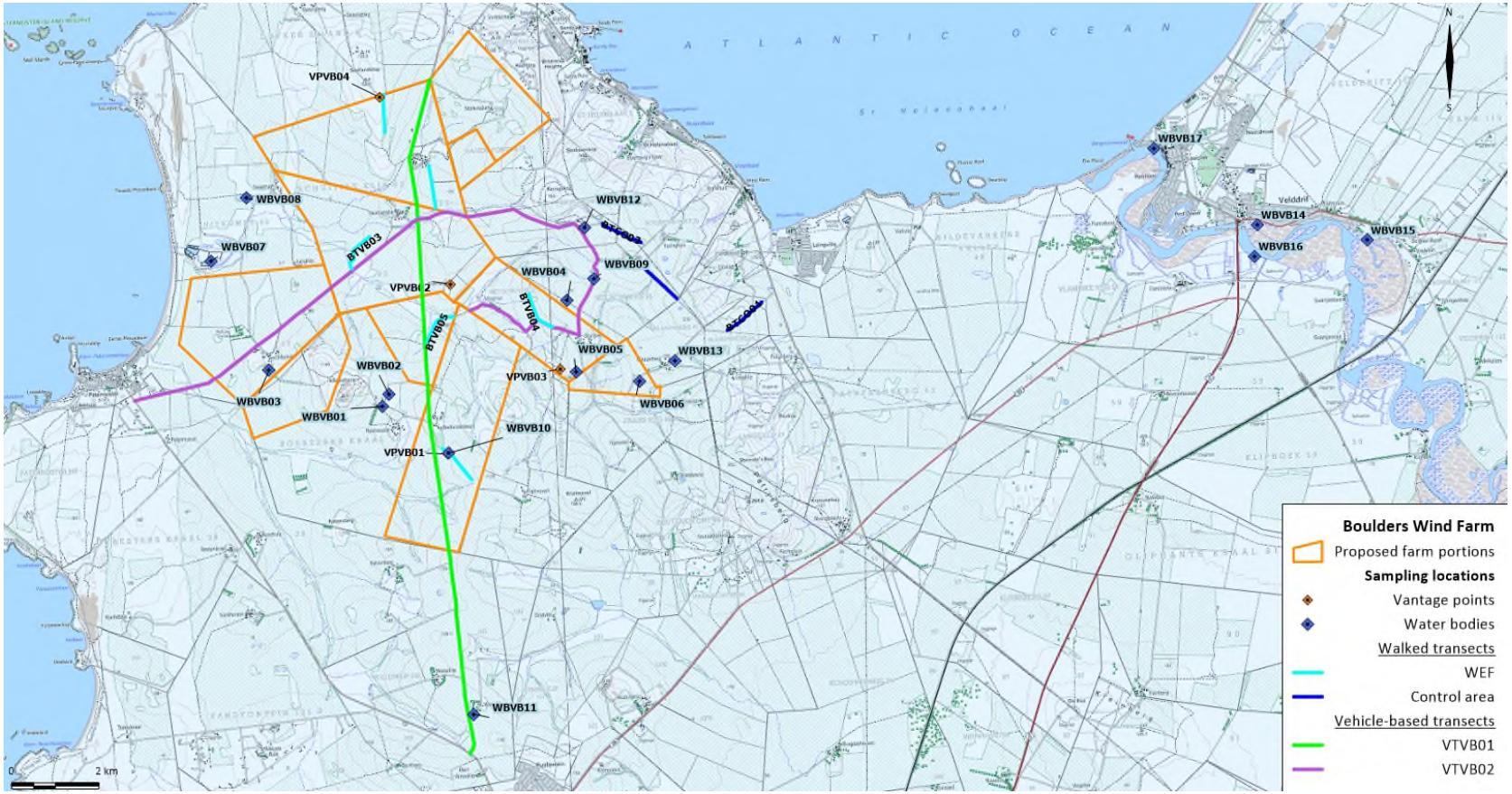

Figure 4 - Sampling locations at Boulders WF for the pre-construction bird monitoring programme.

3. DESCRIPTION OF THE AFFECTED ENVIRONMENT

3.1. Bird micro-habitats

The site falls within the Fynbos biome, with just two types of vegetation occurring (Mucina & Rutherford 2006), Saldanha Granite Strandveld and Langebaan Dune Strandveld. The first is present in the eastern and southern farm portions, while the second only occurs in the north-western section of the site. Saldanha Granite Strandveld is characterised by low to medium height shrubland and some succulent elements, with interspersed rounded granite forms. Langebaaan Dune Strandveld on the other hand is the remnants of an old coastal dune system which supports evergreen shrubland (up to 2m tall) (Mucina & Rutherford 2006).

In addition to its potential vegetation, the area proposed for the development is highly transformed for agriculture and pasture purposes and the natural vegetation can only be found in some strips of land and close to drainage lines.

The study area is relatively flat with some undulation – from about 4m a.s.l. to 194m a.s.l. – reaching the highest points in the south western section of the study area. There are several small temporary water courses and drainage lines crossing the study area, as well as temporary pans and farm dams. Additionally, the area is surrounded by the coastline from west, north and east directions. The only major water course in the area is found approximately 12 km east of the site: the Berg River and Lower Berg River Estuary.

Therefore, the study area may be defined in the main types of habitats available for birds (Figure 5; Photograph 1):

- **Pasture**

Pasture areas may be attractive to some bird species since food and water supplements given to cattle and sheep may also attract large number of birds, such as Egyptian and Spur-winged Goose and also Blue Cranes, storks, egrets or herons. On the other hand, cattle presence can possibly attract insects and small rodents which provide food sources for raptors and falcons which can hunt over these areas.

- **Cereal cropland**

Highly seasonal, these transformed habitats, dominated by wheat in the study area, may attract seed eaters such as Blue Cranes and also foraging raptors. Croplands in the area were in various stages, meaning that through the area at the same time some sections were ploughed, others were harvested and others presented grown cereal. These different stages attracted different bird species to the area depending on their biotope preferences.

- **Drainage lines**

The site contains some small farm dams and pans which, depending on their intrinsic characteristics, can be important for some bird species. Additionally, several drainage lines of considerable dimension, likely to carry water at least during the winter season, cross the site in its central and southern sections. Natural dams with shallow sloping sides and well-developed surrounding vegetation are suitable for a wider range of species.

- **Farm Buildings**

Considering the site transformation for agriculture and pasture purposes, some installations are present for human use. These include houses and smaller storage buildings. These locations may be important for several bird species which use them for roosting and/or nesting, such as Western Barn Owl *Tyto alba*, Barn Swallow *Hirundo rustica*.

- **Natural vegetation**

The natural vegetation present within the proposed WF is dominated by fynbos vegetation, which is considered as a relatively low bird diversity biotope compared with other vegetation types. The low coverage provided by fynbos vegetation, with its small shrubs and scrubs, is not very attractive for most bird species, especially passerines. It is however relevant for some endemic bird species such as the Cape Long-billed Lark, the Southern Black Korhaan, or the Black Harrier.

- **Coastline and oceanic waters**

The proximity to the coastline in west, north and west, increases the likelihood that the proposed site is used by maritime species instead of just terrestrial species. These species can fly at considerable altitudes while crossing the area from the ocean to roosting places (as the ones known in the Berg River Estuary). Species with these characteristics include species such as the Kelp Gull *Larus dominicanus*, Caspian Tern *Sterna caspia*, among others.

- **Roads**

Raptors and other aerial species can frequently be found associated with this type of infrastructure, possibly due to the perching locations available near roads (due to the electric or telephone lines running alongside) or due to prey availability (road kills). Some bird species may even use roads as landscape marks to travel through the area.

- **Water bodies**

The site contains several small farm dams which, depending on its characteristics, may be important for some bird species. These features may condition the general composition of the communities of large birds, which are likely to use them as stepping stones during their movements or as feeding or roosting areas, depending on water levels, availability of food, etc. These points may as well attract predatory birds trying to feed on the waterbirds. Considering the proximity of the coastline and the known large roosts at the Berg River Mouth it is very likely that at least some birds use the area to commute, therefore using these locations preferably for this purpose.

- **Trees**

Other micro-habitats present within and in the area immediately adjacent to the proposed site, which are important for a number of priority raptor and falcon species, are stands of trees. In the study area such trees are usually associated with homesteads. These locations provide perching and roosting and/or nesting locations for raptor species as well as refuge for smaller passerine species (e.g. Secretarybird, African Sacred Ibis *Threskiornis aethiopicus*, Sickle-winged Chat *Cercomela sinuata*, Cloud Cisticola *Cisticola textrix*, among others).

Photograph 1 – General landscape features of the Boulders WF site, from left to right and top to bottom: waterline, buildings and associated tree lines, wheat cropland and boulders.

It is of note that during the site visit in October 2017 it was possible to verify that the land-use and bird habitats stil the same as those that are characterized in the beginning of the monitoring programme.

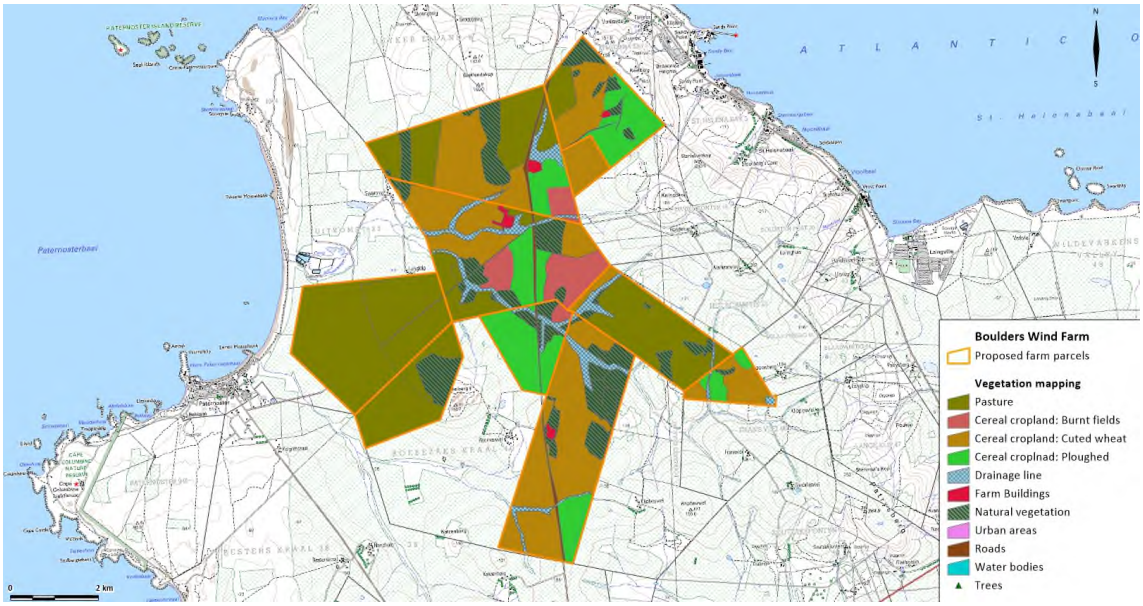

Figure 5 – Characterisation of the study area according to the biotopes present.

3.2. Avifauna community within the development site

3.2.1. Potential bird community

Considering all data sources referred previously (refer to section 2.1) approximately 252 bird species are considered likely to be present within the Boulders WF site and/or its surrounding area (refer to Appendix I - Table 5). The bird community present may include up to 21 species of special conservation concern (refer to Appendix I - Table 5). From the species considered to be potentially present at the study area 6 are regarded as endemic to South Africa, 17 are near endemic to South Africa and 2 are breeding endemic to South Africa, Lesotho and Swaziland (refer to Appendix I - Table 5).

A short list of species, considered to present a higher sensitivity to the impacts caused by wind energy facility developments, such as collision with the operational turbine blades, collision and electrocution on the associated infrastructure as well as loss of habitat and displacement is presented in Table 2. It includes 48 bird species, 19 of which are raptors, 13 waterbirds, 6 small passerines, 5 falcons, 2 bustards, 2 ciconids and 1 crane. This list will be helpful in the next stages of the impact assessment procedure by focusing the impact evaluation on such species, considered as indicators, rather than on the extended full species list with species less prone to negative impacts. This list should also be updated if necessary depending on the results of the bird pre-construction monitoring programme.

Table 2 - Sensitive bird species considered central to the avian impact assessment process for the Boulders WF. Global RLCS (Red List Conservation Status) (IUCN 2016) **and South Africa RLCS** (Taylor, Peacock & Wanless 2015)**: EN – Endangered; VU – Vulnerable; NT – Near threatened; LC – Least Concern; NA – Not Assessed; Endemism in South Africa** (BLSA 2016)**: * – endemic; (*) – near-endemic; SLS – endemic to South Africa, Lesotho and Swaziland.**

Group	Common Name	Scientific Name	Global RLCS	South Africa RLCS	CMS Appendix	Endemic South Africa
Waterbirds	Sooty Shearwater	*Puffinus griseus*	NT	NT		
Waterbirds	Great White Pelican	*Pelecanus onocrotalus*	LC	VU	I	
Waterbirds	Cape Gannet	*Morus capensis*	VU	VU		
Waterbirds	Cape Cormorant	*Phalacrocorax capensis*	EN	EN		
Waterbirds	Bank Cormorant	*Phalacrocorax neglectus*	EN	EN		
Waterbirds	Greater Flamingo	*Phoenicopterus roseus*	LC	NT	II	
Waterbirds	Lesser Flamingo	*Phoeniconaias minor*	NT	NT	II	
Waterbirds	Maccoa Duck	*Oxyura maccoa*[+]	NT	NT	II	
Waterbirds	Greater Painted-snipe	*Rostratula benghalensi*	LC	VU		
Waterbirds	African Black Oystercatcher	*Haematopus moquini*	NT	LC		
Waterbirds	Chestnut-banded Plover	*Charadrius pallidus*	NT	NT	II	
Waterbirds	Eurasian Curlew	*Numenius arquata*	NT	NT	II	
Waterbirds	Caspian Tern	*Sterna caspia*	LC	CU	II	
Ciconids	White Stork	*Ciconia ciconia*[+]	LC		II	
Ciconids	African Sacred Ibis	*Threskiornis aethiopicus*	LC		II (subsp. *aethiopicus*)	
Raptors	Secretarybird	*Sagittarius serpentariu*	VU	VU		
Raptors	Cape Vulture	*Gyps coprotheres*	VU	EN	II	
Raptors	Yellow-billed Kite	*Milvus aegyptius*	NA		II	
Raptors	Black-shouldered Kite	*Elanus caeruleus*	LC		II	
Raptors	Verreauxs' Eagle	*Aquila verreauxii*	LC	VU	II	
Raptors	Booted Eagle	*Hieraaetus pennatus*	LC		II	
Raptors	Martial Eagle	*Polemaetus bellicosus*	VU	EN	II	
Raptors	African Fish Eagle	*Haliaeetus vocifer*	LC		II	
Raptors	Common (Steppe) Buzzard	*Buteo buteo*	LC		II	
Raptors	Jackal Buzzard	*Buteo rufofuscus*[+]	LC		II	(*)
Raptors	African Goshawk	*Accipiter tachiro*	LC		II	
Raptors	Pale Chanting Goshawk	*Melierax canorus*	LC		II	
Raptors	African Marsh Harrier	*Circus ranivorus*	LC	EN	II	
Raptors	Black Harrier	*Circus maurus*	VU	EN	II	(*)
Raptors	Western Osprey	*Pandion haliaetus*	LC		II	
Raptors	Western Barn Owl	*Tyto alba*	LC			
Raptors	Marsh Owl	*Asio capensis*	LC			
Raptors	Cape Eagle-Owl	*Bubo capensis*	LC			
Raptors	Spotted Eagle-Owl	*Bubo africanus*	LC			
Falcons	Peregrine Falcon	*Falco peregrinus*	LC		II	
Falcons	Lanner Falcon	*Falco biarmicus*	LC	VU	II	
Falcons	Rock Kestrel	*Falco rupicolus*	NA		II	
Falcons	Greater Kestrel	*Falco rupicoloides*	LC		II	
Falcons	Lesser Kestrel	*Falco naumanni*	LC		I, II	

Cranes	Blue Crane	*Anthropoides paradiseus*	VU	NT		
Bustards	Ludwig's Bustard	*Neotis ludwigii*	EN	EN		
Bustards	Southern Black Korhaan	*Afrotis afra*	VU	VU		*
Passerines	Grey-winged Francolin	*Scleroptila africana*	LC			SLS
Passerines	Cape Clapper Lark	*Mirafra apiata*	LC			(*)
Passerines	Cape Long-billed Lark	*Certhilauda curvirostris*	LC			*
Passerines	Karoo Lark	*Calendulauda albescens*	LC			(*)
Passerines	Large-billed Lark	*Galerida magnirostris*	LC			(*)
Passerines	African Pipit	*Anthus cinnamomeus*	NA			

Raptor and falcon species

Among the sensitive raptor and falcon species potentially present at the study area six species stand out: Cape Vulture, Martial Eagle, African Marsh Harrier and Black Harrier, classified as *Endangered* species in South Africa, and also the Secretarybird, Verreauxs' Eagle and Lanner Falcon, considered as *Vulnerable* in South Africa (Taylor, Peacock & Wanless 2015). Impacts affecting this group will likely be mostly during the operation of the wind energy facility, resulting in fatalities caused by collision with rotating turbine blades.

Waterbird species

The most relevant occurrences of this group in the area would be the potential presence of Cape Cormorant and Bank Cormorant, classified as *Endangered* species in South Africa, and Great White Pelican, Cape Gannet and Greater Painted-Snipe considered as *Vulnerable* in South Africa (Taylor, Peacock & Wanless 2015). If species of this group make regular movements through the area at the rotor swept area it is likely that they will be affected by impacts resulting from collision with wind turbines.

Bustard species

Ludwig's Bustard, classified as *Endangered* species in South Africa, and Southern Black Korhaan, considered as *Vulnerable* in South Africa (Taylor, Peacock & Wanless 2015), are the sensitive species of bustard that can potencially be present at the study area. Both species are considered as sensitive to impacts (Retief *et al.* 2012) due to their collisions with overhead power lines. Additionally, both species could be affected by habitat destruction.

Crane species

Blue Crane is a species of conservation concern in South Africa: *Near Threatned*. There is a probability of some individuals' collision with wind turbines during the operation phase.

Ciconid species

None of the sensitive ciconid species potenctially present at the study area is of conservation concern.

Passerines and small bird species

The community of sensitive passerines and small birds potentially present on site is quite varied and include one species endemic to South Africa: Cape-Long-Billed Lark; and several species regarded as near-endemic to South Africa. There are no species of conservation concern included in this group. There may be consequences for species of this group resulting from the installation of the WF such as loss of habitat and disturbance and/or displacement effects. Aerial displays of Larks and Chats are also likely to increase the probability of some individuals' collision with wind turbines.

3.2.2. Confirmed bird community

A total of 119 bird species were confirmed in the study area (WF and control site) across all the survey methodologies implemented from the beginning of the pre-construction monitoring, 32 of which are considered to be potentially sensitive to impacts from wind energy facilities (refer to Appendix I - Table 5). Out of these species 13 are of especial concern for having an unfavourable conservation status (refer to Appendix I - Table 5): Cape Cormorant *Phalacrocorax capensis*, Martial Eagle *Polemaetus bellicosus*, Black Harrier *Circus maurus*, Ludwig's Bustard *Neotis ludwigii* – Endangered –, Great White Pelican *Pelecanus onocrotalus*, Verreauxs' Eagle *Aquila verreauxii*, Secretarybird *Sagittarius serpentarius*, Lanner Falcon *Falco biarmicus*, Southern Black Korhaan *Afrotis afra*, Caspian Tern *Sterna caspia* – Vulnerable –, Greater Flamingo *Phoenicopterus roseus*, Lesser Flamingo *Phoeniconaias minor* and Blue Crane *Anthropoides paradiseus* – Near Threatened (Taylor, 2014).

Most of the species with an unfavourable conservation status were detected both on the WF site and the surrounding area, with the exception of the Great White Pelican, Caspian Tern, Martial Eagle, Verreauxs' Eagle and Ludwig's Bustard detected exclusively outside the area of influence of the proposed WF.

A total of 24 species of raptors and large terrestrial birds were observed in the study area and its surroundings, 14 of which are considered sensitive species (refer to Appendix I - Table 5). Figure 6 and Figure 7 shows sensitive bird species general movements within in the study area and surroundings. Blue Crane *Anthropoides paradiseus*, Yellow-billed Kite *Milvus aegyptius,* African Sacred Ibis *Threskiornis aethiopicus* and Jackal Buzzard *Buteo rufofuscus* were the most common large sensitive species recorded on site from the beginning of the monitoring, and especially during summer season.

Fourteen species detected during the field work are considered to be endemic or near endemic to South Africa (refer to Appendix I - Table 5). Out of these the Jackal Buzzard *Buteo rufofuscus*, Black Harrier, Southern Black Korhaan, Cape Clapper Lark *Mirafra apiata*, Cape Long-billed Lark *Certhilauda curvirostris*, Karoo Lark *Calendulauda albescens* and Large-billed Lark *Galerida magnirostris* are especially important for being considered sensitive species.

An active Secretarybird nest was found within the proposed Boulders WF area. This nest was monitored in the site visit in October 2017 and still appears to be in good condition (and highly likely to be in use). No Secretarybirds were however observed around it during the short site visit.

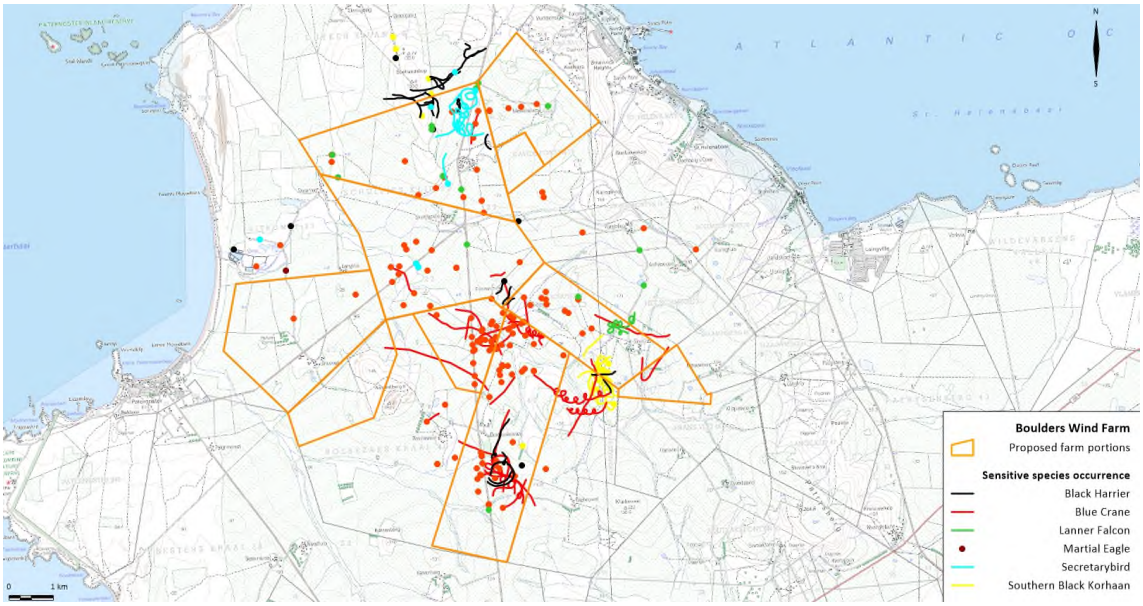

Figure 6 – Sensitive Bird Species general movements recorded during the bird pre-construction monitoring programme conducted at the Boulders Wind Farm collected through all methodologies implemented.

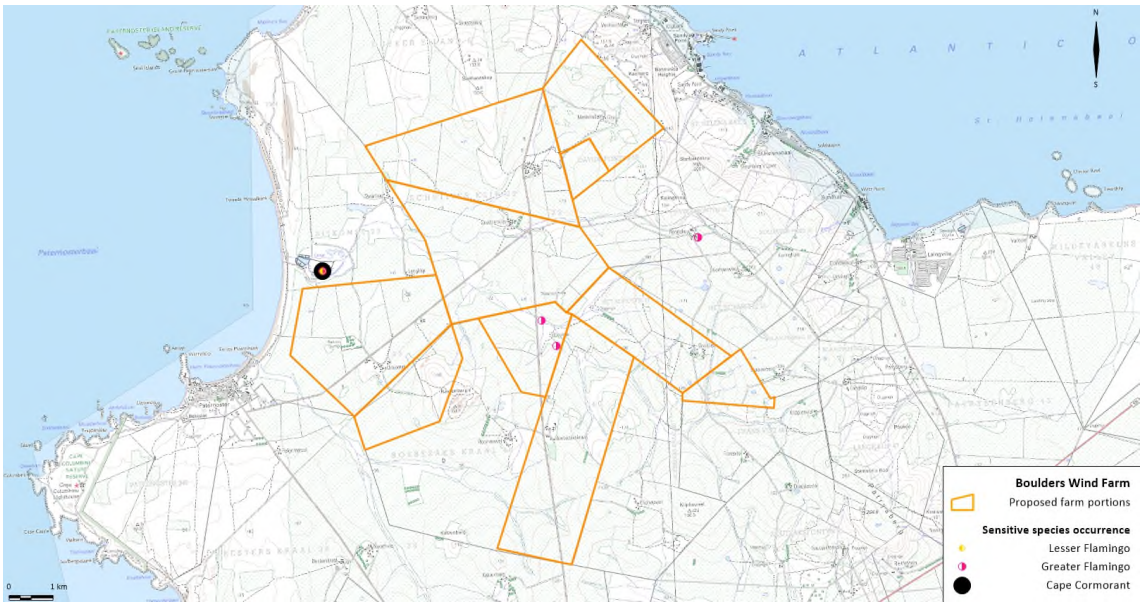

Figure 7 – Sensitive Bird Species recorded during the bird pre-construction monitoring programme conducted at the Boulders Wind Farm collected through all methodologies implemented.

3.3. Sensitivity mapping for the development site

In this section a brief preliminary analysis of the proposed Boulders WF bird sensitivity is presented based on bibliographic resources (Large scale sensitivity) and the results of the reconnaissance visit and identification of main bird microhabitats (Small scale sensitivity). This analysis will be refined in the EIA phase.

3.3.1. Large scale sensitivity

Figure 8 below displays the location of Boulders WF in relation to the Avian Wind Farm Sensitivity Map compiled for South Africa. The darker grid cells represent higher sensitivity values while lighter coloured grid cells refer to less sensitivity. Regarding the proposed Boulders WF site it is observed that the site is within low sensitivity grid cells (Retief *et al.* 2012).

In the following section an analysis of the sensitivity of the area at a finer scale is presented.

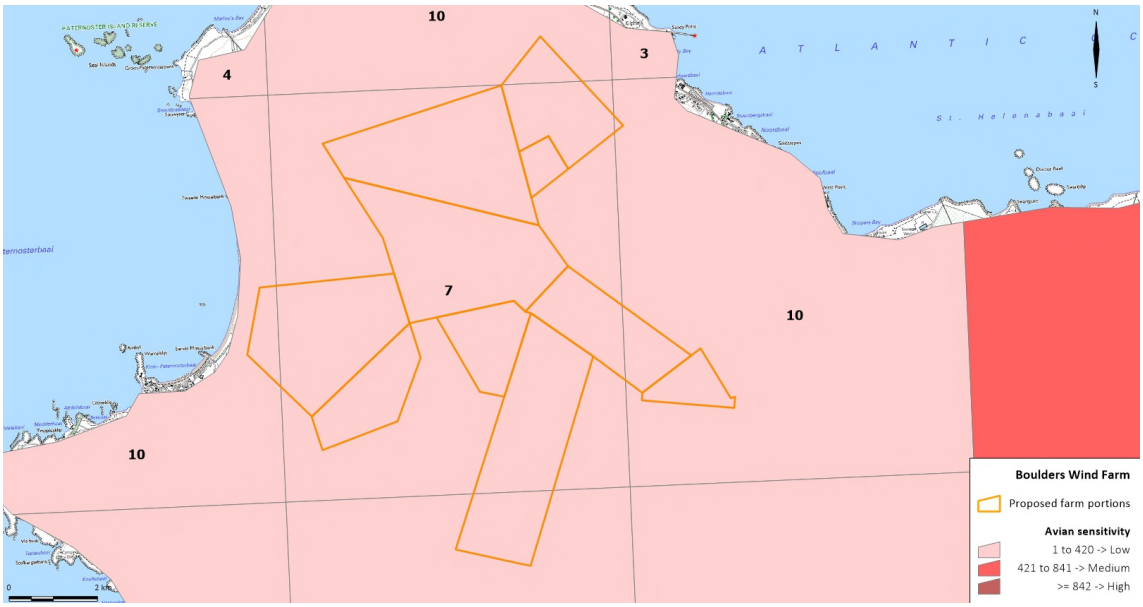

Figure 8 – Location of the proposed Boulders WF in relation to the Avian Wind Farm Sensitivity Map for South Africa (Retief et al. 2012).

3.3.2. Small scale sensitivity

Considering the bird micro-habitats identified in section 3.1 and the observations through the pre-construction bird monitoring programme, sensitive areas were selected within the proposed Boulders WF (Figure 9). This analysis is informed by the preliminary results of the pre-construction monitoring site visit results.

In general, the site may be divided into two major areas regarding its sensitivity: 1) no-go areas which must be avoided from the proposed WF development in order to reduce impacts on sensitive bird species to a minimum; 2) sensitive areas requiring management actions with the project's implementation process.

Therefore, the following features are considered for the definition of sensitive areas (Figure 9):

1) **No-go Areas**

- Drainage lines and areas with natural vegetation used by raptors and other sensitive species (such as Blue Crane) and are associated to a high probability of collision consistently throughout the year. Furthermore, natural vegetation represents an important habitat for sensitive, endangered species, such as the Black Harrier;
- A 200m buffer around water bodies, as these features may attract birds under certain conditions and are the only places were certain sensitive species such as Greater and Lesser Flamingos were observed;
- 500m around the Secretarybird nest identified during the pre-construction monitoring period;

2) **Cereal Cropland and Pasture areas**

- Cereal cropland and Pasture areas were observed to be used moderately by Blue Cranes, and ocassionaly by Black Harrier, Lanner Falcon, Secretarybird and Southern Black Koohran. Blue Cranes and Southern Black Koorhan are not considered to have a high likelihood to collide with wind turbines and negative impacts are expected to be of low significance. On the other hand, raptors are considerd to have high likelihhod to collide with wind turbines, but due to the low use of the area observed negative impacts are also expected to be of low significance. However, the risk of fatalities due to collision cannot be completely rulled out, especially considering that a large number of Blue Cranes have been confirmed using the cropland and pasture areas (associated with particular phases of the cropland, such as ploughing and harvesting). For these(is) reason(s) it is considered that the use of the areas are compatible with wind turbine sitting although management measures are recommended to be implemented in order to further reduce risk of negative impacts. Upon consideration of the results of the pre-construction monitoring programme in finner detail it will be possible to propose adjusted management measures for the cereal cropland and pasture areas.

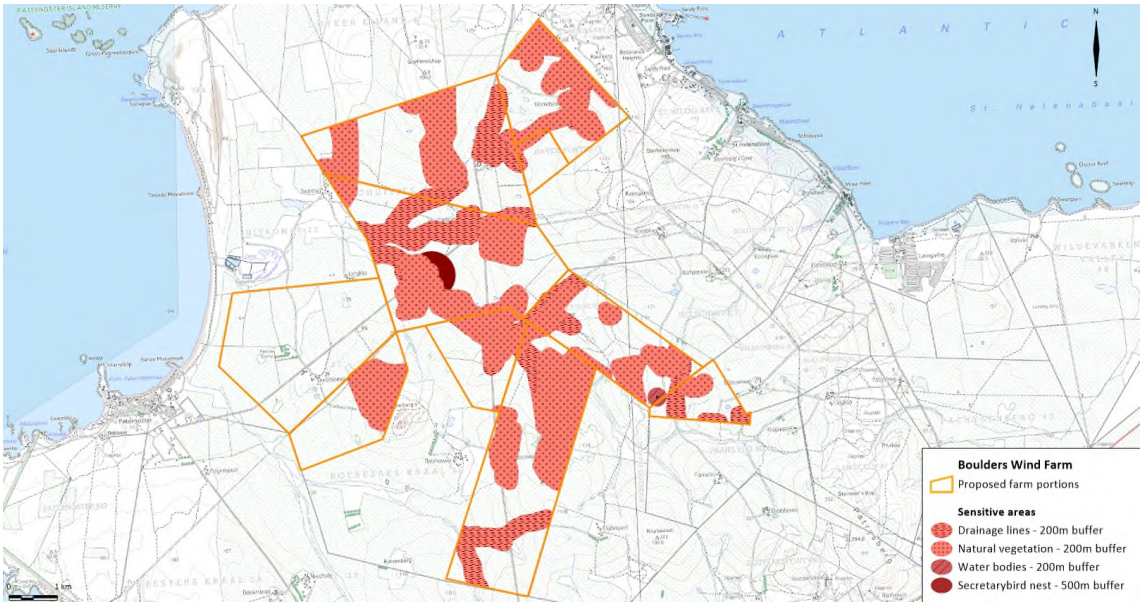

Figure 9 – Preliminary sensitivity mapping of the proposed Boulders WF illustrating the no-go areas to be considered (background image: Virtual Earth Satellite Imagery).

4. IMPACT ASSESSMENT OF THE PROPOSED BOULDERS WEF

4.1. Interactions between Wind Energy Facilities and Birds

Wind energy generation in South Africa has rapidly expanded over the last years. More recently the wind energy facilities up until now under evaluation, or under construction have started their operation phases and the first results of the impacts caused are starting to become available through grey literature, and/or through oral presentations. Moreover, to date only a 1-year preliminary study, assessing birds and bird fatalities at south African wind farms, has been completed and published (Doty & Martin 2013). This study was undertaken at a pilot turbine installed in the Coega Industrial Development Zone, Port Elizabeth, Eastern Cape. Only one bird fatality was reported, i.e. a Little Swift (Apus affinis). More recent studies, resulting from operation phase monitoring programmes disclose a different reality, with a higher number of fatalities and species diversity. However, it is of note that the data available does not provide standardised data by a wind turbine and/or MW produced, therefore comparisons are limited. Nonetheless the potential non-fatal impacts of wind turbines on South African bird communities are still largely unknown (e.g. displacement and/or disturbance effects). Therefore, data collection and further investigation is needed and pre-construction as well as operation phase monitoring should be implemented to fill these gaps and promote the sustainability of wind energy developments in South Africa.

4.1.1. Collision with turbines

A number of factors influence the number of birds killed at wind energy facilities, including bird related variables and site related variables.

4.1.1.1. Bird related variables

Whilst all birds face some inherent risk of impact by wind turbines, there are definitely certain groups that are more at risk due to their flight behaviour or habitat preferences (Jordan & Smallie 2010). Jordan & Smallie (2010) summarised knowledge from the European Union, United Kingdom, United States, Canada and Australia to identify the following taxonomic groups as being affected most by wind energy facilities: Podicipediformes, Pelicaniformes, Ciconiiformes, Anseriformes, Falconiformes, Charadriformes, Strigiformes, Caprimulgiformes, Gruiformes, Galliformes, Psittaciformes, Passeriformes. In determining which species are likely to be at risk at wind energy facilities in South Africa, the above groups form a useful starting point. Large birds with low manoeuvrability in flight are usually more prone to collide with wind turbines, but raptors and falcons, species that fly at rotor height and exhibit hunting behaviour are also very susceptible to collide with man-made structures (De Lucas, Janss & Ferrer 2008).

Considering the bird community present at the proposed Boulders WF, the groups most susceptible to collision with wind turbines are raptors. Other groups of species such as bustards are known to collide with power lines. However, the potential of Bustards in terms of collision with wind turbines remains unknown, as no evidences of collision between these groups of birds and wind turbines are known to date either nationally or internationally.

4.1.1.2. Site related variables

Landscape features can channel or funnel birds towards a certain area and in the case of raptors, influence their flight and foraging behaviour. Elevation, ridges and slopes are all important factors in determining the extent to which an area is used by birds in flight (Barrios & Rodríguez 2004; De Lucas, Janss & Ferrer 2008; Smallwood & Thelander 2008). High levels of prey will attract raptors, increasing the time spent hunting, and as a result reducing the time spent being observant of their surroundings. In addition, poor weather affects visibility meaning that during conditions of very thick fog, the collision risk is higher than normal. Very strong winds may also contribute to a higher collision risk, since birds fly lower during headwinds, meaning that when the turbines are functioning at their maximum speed, birds are likely to be flying at their lowest, exponentially increasing collision risk.

The proposed Boulders WF is located in an area with a high abundance of water sources (water bodies, oceanic waters and drainage lines), pastures and cereal croplands, coataline, fynbos vegetation and micro-habitats of trees. These features can provide shelter, food and nesting conditions to the species potentially present at the study area. Secretary bird, for exemple, nests in the Boulders WF area. These conditions could lead to risk flights near the wind turbines that could result in colisions.

4.1.2. Habitat loss – destruction, disturbance and displacement

In spite of the limited destructive footprint of most wind energy facilities, some damage to the environment (more or less temporary) is always caused during the construction phase. This damage may be more or less significant dependant on whether it is coincident with sensitive/important areas for restricted range, endemic and/or threatened species. Therefore construction, and to a lesser extent on-going maintenance activities, are likely to cause some disturbance to birds in the general surrounds, and especially of shy and/or ground-nesting species resident in the area.

Mitigation of such effects requires that best-practice principles are rigorously applied - sites are selected to avoid the destruction of key habitats, and sources of disturbance of priority 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 the noise or movement of the turbines (Larsen & Guillemette 2007; Farfán *et al.* 2009), 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 project (Stewart, Pullin & Coles 2007). Such displacement effects are probably more relevant in situations where wind energy facilities are built in natural habitat (Madders & Whitfield 2006; Pearce-Higgins *et al.* 2009) than in more modified environments such as farmland (Devereaux, Denny & Whittingham 2008).

The Boulders WF area has human presence and human activities and so it is expected that the bird community are familiar with some disturbance. The contruction of Boulders WF is expected to cause low perturbations in the local bird community.

4.1.3. Cumulative impacts

Cumulative impacts of a development project may be defined as “impacts resulting from incremental actions from the project, by addition with other past, present or future impacts resulting from other actions/project reasonable predictable” (Walker & Johnston 1999). This assumes the knowledge of other projects or actions whose effects could be cumulative to the ones resulting from the project being assessed. Since it is not

reasonably viable to consider in the analysis all the existing or proposed projects for a certain region the analysis should focus on (Masden *et al.* 2010):

- The projects known for the area and its surroundings and for which there's information readily available;
- The projects mentioned above and that could be relevant in terms of the expected impacts, in relation to the project under assessment;
- Similar to the overall impact assessment analysis, on the sensitive species more relevant and/or susceptible to the expected impacts.

Even where fatality rates may appear low there should be adequate attention given to the situation. The cumulative effects of several facilities on the same species could be considerable, particularly if these are sited in the same region and impact on the same regional population of the species. In addition, most long lived slow reproducing Red List species may not be able to sustain any additional mortality factors over and above existing factors.

The main known activities or projects, relevant for the cumulative impacts analysis, known in the broader area of the Boulders WF, is the presence of additional wind energy facilities.

Other projects have already been proposed or are already approved in the adjacent farm portions to the Boulders proposed project (Figure 2): St Helena WEF (Approved), the Nooitgedacht WEF and Solar Facility (Approved), the West Coast One WEF (Operational), and the Isivunguvungu WEF (approved and under construction).

Potential cumulative impacts may materialise if the bird species using the Boulders WF also use the above referred sites and in that case, they will suffer an increased reduction in available habitat and increased collision risk with the wind turbines and associated infrastructure. For migratory species and/or species with wide home ranges those impacts can translate into consequences at population level, being these particularly relevant for long-lived low rate preproduction species, generally also with a conservation status of concern. This is particularly relevant for some sensitive species, which have a conservation status of concern and may further reduce their populations.

4.2. Impact Assessment

Construction phase

During the construction phase several activities will occur which might result in negative impacts on the local bird community, viz: the wind turbines platform construction and erection of the turbines, as well as operations related to the construction of associated infrastructures.

The main impacts that are expected to result from the construction phase are likely to be habitat destruction from opening clearings for the working areas, construction of roads and landscape modifications and disturbance of birds due to the increase of people and vehicles in the area, high levels of noise and machinery movements (Table 3).

The study area is mostly occupied by pastures and cereal crops. Therefore, it is expected that these biotopes will be negatively affected by the construction phase. Turbine placement will probably lead to the loss of a portion of hunting, feeding and nesting grounds (e.g. secretarybird). If the sensitivity map is respected during the layout definition phase these impacts are expected to be of low significance.

In order not to decrease the impact significance, it is recommended that the infrastructures placement is studied from an ecological point of view, in order to avoid its placement in areas sensitive for birds (refer to section

3.3.2). Additionally, existing accesses should be used as far as possible. The results of the pre-construction monitoring programme must inform further mitigation measures (if necessary) during this phase of the project.

Table 3 – Potential impacts associated with the construction (and decommissioning) phase of the Boulders Wind Farm.

Impacts: Habitat destruction and Disturbance and/or displacement impacts. Areas affected will include the location of the wind turbines, roads, substation and all infrastructures associated to the wind energy facility construction. **Desktop Sensitivity Analysis of the site:** Sensitive areas to be affected may include the surroundings of drainage lines and water bodies, natural vegetation, the Secretarybird nest and, in a lower level of sensitivity, the cereal croplands and pasture areas. A large portion of the project site is transformed and considered to be low sensitivity with little risk of natural habitat loss. Disturbance of the intact habitat areas should however be avoided as much as possible.			
Issue	**Nature of Impact**	**Extent of Impact**	**No-Go Areas**
Habitat destruction and Disturbance and/or displacement impacts	Negative though possibly only relevant for species highly dependent of the natural vegetation present and range-restricted species.	Local	Surroundings of drainage lines and water bodies, natural vegetation and the Secretarybird nest.
Description of expected significance of impact Duration: Short; Probabilirty: Highly probable; Reversibility: Can be reversed; Siginificance: The impact is expected to be of low significance, if the no-go areas are avoided in the layout definition phase.			
Gaps in knowledge and recommendations for further study Within this scoping study the specific analysis of the bird activity through the area was not assessed, i.e. in further steps of the EIA process, it will be important to analyse the occurrence of especially important areas for range-restricted species, likely to be negatively affected by this type of impact. This will be assessed in the final bird specialist report.			

Operation phase

It is during operation phase that the most significant negative potential impacts on bird communities may occur. The most negative and significant impacts which will likely (unless mitigated against) be caused by the proposed Boulders WF are mostly related to bird fatality due to collision with turbine blades (Table 4), considered to be of a medium significance at this stage. The collision risk is not the same for all species and it varies according to the species' habits and ecology. Certain bird habits, such as migration, high flight or nocturnal flight, hunting or foraging in mid-air, contribute to species susceptibility to collision (Retief *et al.* 2012). Of the 252 bird species with possible occurrence in the study area, 21 are species with a conservation status of concern (Taylor, Peacock & Wanless 2015), which may possibly collide with wind turbines. Additionally, other species without conservation status of concern will also likely be affected by impacts during the operation phase of the project, by possibly colliding with stationary or rotating turbine blades (Table 2). Among these species several are raptor species which were found in the study area. Also one nest of Secretaribird was found within the study area, which is a good indicator that the species use the area and that disturbances caused by the WF operation may reflect in its reproductive success. In addition it is important to note the existing records of bustard species

fatalities at overhead power lines elsewhere in South Africa (Shaw *et al.* 2010b; a; Jenkins *et al.* 2011; Shaw 2013). Though the collision likelihood of these species with wind turbines has not yet been determined, this should be investigated in the next phase of the EIA process.

In addition to the fatality risk it must also be considered that the presence of the turbines itself, as well as human and vehicles movements through the area (associated with maintenance movements) has the potential to negatively affect the bird community, especially during sensitive seasons (i.e. breeding season), an impact considered at this stage to be of low significance.

Table 4 – Potential impacts associated with the operation phase of the Boulders Wind Farm.

Impacts: Collision (and fatality) with turbine blades. Disturbance due to maintenance activities. **Desktop Sensitivity Analysis of the Site:** Sensitive areas to be affected may include the surroundings of drainage lines and water bodies, natural vegetation the Secretarybird nest and, at a lower level of sensitivity, the cereal croplands and pasture areas.			
Issue	**Nature of Impact**	**Extent of Impact**	**No-Go Areas**
Collision (and fatality) with turbine blades	Negative, especially for species with a conservation status of concern	Possibly Regional (for species with large scale movements)	Surroundings of drainage lines and water bodies, natural vegetation and the Secretarybird nest.
Disturbance due to maintenance activities	Negative, especially for breeding species	Local	Secretarybird nest
Description of expected significance of impact Duration: Permanent; Probabilirty: Probable; Reversibility: Can cause irreplaceable loss of resources, but also can be managed or mitigated; Siginificance: The impact is expected to be of medium significance, at this stage.			
Gaps in knowledge and recommendations for further study Within this scoping study the specific analysis of the bird activity through the area was not assessed, i.e. in further steps of the EIA process, it will be important to analyse the occurrence of flights at the rotor swept area, their location both in the horizontal and vertical plane, time spent at rotor height and which species presented flights with a probable collision risk. It will be very important to determine areas of collision risk in order to overlay them with the preliminary sensitivity mapping, allowing it to be confirmed and/or refined. No-Go areas identified are recommended to be excluded from the sitting of wind turbine generators.			

Decommissioning phase

During the decommissioning phase it is expected that the dismantling of wind turbines, associated infrastructure, and power lines, can lead to disturbance of bird community, in all ways similar to that resulting from the construction phase (Table 3).

The dismantling of the project will eventually contribute to the removal of all the implemented structures which would be a cause for negative impacts on the bird community and this may, therefore, be considered a positive impact.

5. IMPACT STATEMENT

As aforementioned, it is the developer's intention to use all data collected during the Vredenburg WEF bird pre-construction monitoring programme, to inform the specialist impact assessment reports for the current Boulders Wind Farm Scoping & Environmental Impact Assessment procedure. It is also important to note that the study area has not significantly changed.

Considering that the bird monitoring programme ended in May 2015, this study is still valid, according to the Best Practice Guidelines. As mentioned, the bird monitoring programme was undertaken in full compliance with the 2012 version of the Best Practice Guidelines and it is considered to also comply with all requirements of the most recent version of the Guidelines (Jenkins *et al.* 2015).

Considering all of the above, we can conclude that the original bird pre-construction monitoring studies conducted at Vredenburg WEF are still valid and accurately represent the bird community trends expected to occur at the Boulders Wind Farm Project.

This study intends to provide a preliminary avifaunal impact assessment to determine the main impacts likely to affect the bird community present within the proposed Boulders WF. The results of the data collected served to determine that the general area proposed for the Boulders Wind Farm may be considered of low to medium sensitivity in terms of the avifauna coumunities. There are, however, areas within the proposed development area considered to have a likely higher sensitivity for the bird communities and are proposed to be excluded from development: 200m surrounding areas of natural vegetation, 200m surrounding water features and 500m surrounding sensitive species breeding sites. The majority of the proposed development area falls within cereal cropland and pastures, areas already transformed and under constant human pressure and transformation. These areas are considered to be of low sensitivity and preffered for wind turbine sitting, however management measures may have to be implemented to further minimise collision. It is relevant to further analyse the data collected during the pre-construction monitoring phase and consider the results to inform a finer and more detailed impact assessment of the proposed wind development, especially regarding the sensitive species movements.

Impacts identified for the construction, operation and decommissioning phases of the project are expected to be habitat destruction, disturbance and/or displacement and collision with wind turbines. Therefore, a pre-construction bird monitoring programme was implemented in order to inform the EIA and validate the predicted impacts and significance as well as proposed appropriate mitigation measures. The methodological approach implemented for the assessment of pre-construction monitoring is presented in Appendix II.

It is recommended that the sensitive areas already identified for the bird community should be excluded from development, as far as possible. At this stage, if this measure is implemented, the project is not considered to cause irreplaceable loss of biodiversity and should proceed to the next environmental impact stage, where the impacts identified at this preliminary phase must be confirmed and the proposed mitigation measures adjusted to the site's specificities. Additionally, should existing road networks need to be upgraded during the construction phase, and certain portions of these roads fall within high sensitivity and/or no go areas, then upgrading may proceed on condition that avifaunal specialist input is provided (where necessary). At this stage, with the information available and to our best knowledge, there are no fatal flaws identified for the project apart from the higher sensitivity areas, identified in section 3.3.2, which should be excluded from the development footprint.

It is relevant to mention that this environmental assessment is based on a desktop based study, informed by site visits and the data collected during a pre-construction bird monitoring programme. The data collected was only preliminarily analysed and should be further looked into in order to confirm and validate the impacts identified and the sensitive areas. The pre-construction bird monitoring programme methodology implemented covered all the relevant seasons for the avifauna community on the site, as recommended by the *Best practice guidelines* (Jenkins *et al.* 2012, 2015) providing therefore a solid baseline for the establishment of further assessments (refer to Appendix II for details on the methodology implemented). During- and post- construction monitoring will be very important to improve the understanding of the real impact caused by the WF on local bird populations.

Considering the findings of this Scoping report, a Final bird pre-construction monitoring report (in the EIA phase) is required to further inform in the decision-making process. The plan of study for the bird impact assessment are as follow:

- Characterize the avifauna community and its utilization of the development site, through a 12-months monitoring (conducted between 2014 and 2015);
- Assessment of the site in terms of bird habitat features (conducted between 2014 and 2015, and in October 2017);
- Establish the baseline scenario during the pre-construction phase - providing the information required to identify potential changes in the bird community occurring within the study area, as well as the eventual exclusion/displacement effect (avoidance of the wind facility area post-construction);
- Provide the baseline scenario of the developments' pre-construction phase to the EIA avifauna specialist, for the construction of the final report;
- Evaluate the potential changes that may arise in relation to how the target-species and overall bird community utilize the site;
- Document patterns of bird activity and movements within the site and its immediate surroundings, as well as to establish a pre-impact baseline scenario of bird utilization in the study area;
- Estimate predicted collision risks for target-species;
- Identify sensitive areas;
- Propose mitigation measures.

6. REFERENCES

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7. APPENDICES

7.1. Appendix I - List of bird species potentially present and confirmed at Boulders WF

Table 5 – List of confirmed and potentially occurring bird species at the Boulders WF site and surrounding area. Phenology (IUCN 2016)**: R – Resident; BM – Breeding migrant; NBM – Non breeding migrant. RLCS - IUCN Red List of Threatened Species Conservation Status** (IUCN 2016) **and SA RLCS - South Africa Red List Conservation Status** (Taylor, Peacock & Wanless 2015)**: VU – Vulnerable, NT – Nearly Threatened, LC - Least concern; NE – Not Evaluated; Population Trend** (IUCN 2016)**. CMS – Convention of Migratory Species. Endemism (BLSA, 2014): * – Endemic. (*) – Nearly Endemic. SLS - endemic to South Africa, Lesotho and Swaziland.**

Order	Full Name	Scientific Name	Phenology	RLCS	SA RLCS	CMS	Population Trend	Abundance	Endemic SA	Sensitive	Confirmed
STRUTHIONIFORMES	Common Ostrich	*Struthio camelus*	R	LC	-		Decreasing	Unknown	-	-	-
SPHENISCIFORMES	African Penguin	*Spheniscus demersus*	R	EN	EN	II	Decreasing	Locally common	-	X	-
PODICIPEDIFORMES	Great Crested Grebe	*Podiceps cristatus*	R	LC	-		Unknown	Locally common	-	-	X
	Black-necked Grebe	*Podiceps nigricollis*	R	LC	-		Unknown	Uncommon to locally common	-	-	X
	Little Grebe	*Tachybaptus ruficollis*	R	LC	-		Decreasing	Common to locally abundant	-	-	X
PROCELLARIIFORMES	Black-browed Albatross	*Thalassarche melanophrys*	-	NT	EN	II	Decreasing	-	-	X	-
	Southern Giant Petrel	*Macronectes giganteus*	NBM	LC	NT	II	Increasing	Fairly common	-	X	-
	Great-winged Petrel	*Pterodroma macroptera*	NBM	LC	NT		Decreasing	Common	-	X	-
	Soft-plumaged Petrel	*Pterodroma mollis*	NBM	LC	NT		Stable	Common	-	X	-
	Blue Petrel	*Halobaena caerulea*	Rare or vagrant	LC	NT		Stable	Rare	-	X	-
	White-chinned Petrel	*Procellaria aequinoctialis*	NBM	VU	VU	II	Decreasing	Common	-	X	-
	Sooty Shearwater	*Puffinus griseus*	NBM	NT	NT		Decreasing	Abundant	-	X	-
	Wilson's Storm Petrel	*Oceanites oceanicus*	NBM	LC	-		Stable	Locally abundant	-	-	-

PELECANIFORMES	Great White Pelican	*Pelecanus onocrotalus*	R	LC	VU	I	Unknown	Locally fairly common	-	X	X
SULIFORMES	Cape Gannet	*Morus capensis*	R	VU	VU		-	Locally abundant	-	X	-
	White-breasted Cormorant	*Phalacrocorax lucidus*	R	LC	-		Increasing	Common	-	-	X
	Cape Cormorant	*Phalacrocorax capensis*	R	EN	EN		Decreasing	Common to locally abundant	-	X	X
	Bank Cormorant	*Phalacrocorax neglectus*	R	EN	EN		Decreasing	Scarce to locally common	-	X	-
SULIFORMES	Reed Cormorant	*Phalacrocorax africanus*	R	LC	-		Decreasing	Common	-	-	X
	Crowned Cormorant	*Phalacrocorax coronatus*	R	NT	NT		Stable	Uncommon to rare	-	X	-
	African Darter	*Anhinga rufa*	R	LC	-		Decreasing	Fairly common	-	-	X
PELECANIFORMES	Grey Heron	*Ardea cinerea*	R	LC	-		Unknown	Locally common	-	-	X
	Black-headed Heron	*Ardea melanocephala*	R	LC	-		Increasing	Common	-	-	X
	Purple Heron	*Ardea purpurea*	R	LC	-	II	Decreasing	Uncommon to locally common	-	X	X
	Great Egret	*Egretta alba*	R	LC	-		Unknown	Generally uncommon	-	X	-
	Little Egret	*Egretta garzetta*	R	LC	-		Increasing	Fairly common	-	-	X
	Yellow-billed Egret	*Egretta intermedia*	R	LC	-		Decreasing	Uncommon to locally common	-	X	-
	Western Cattle Egret	*Bubulcus ibis*	R	LC	-		Increasing	Very common	-	-	X
	Black-crowned Night Heron	*Nycticorax nycticorax*	R	LC	-		Decreasing	Common	-	-	-
	Little Bittern	*Ixobrychus minutus*	R	LC	-	II (subs. minutus)	Decreasing	Generally uncommon	-	X	-
	Hamerkop	*Scopus umbretta*	R	LC	-		Stable	Locally common	-	X	-
	African Sacred Ibis	*Threskiornis aethiopicus*	R	LC	-	II (subsp. aethiopicus)	Decreasing	Common	-	X	X
	Glossy Ibis	*Plegadis falcinellus*	R	LC	-	II	Decreasing	Locally common	-	-	-
	Hadeda Ibis	*Bostrychia hagedash*	R	LC	-		Increasing	Common	-	-	X

	African Spoonbill	*Platalea alba*	R	LC	-	II	Stable	Locally common	-	-	X
CICONIIFORMES	White Stork	*Ciconia ciconia*	NBM	LC	-	II	Increasing	Common to abundant	-	X	-
PHOENICOPTERIFORMES	Greater Flamingo	*Phoenicopterus roseus*	R	LC	NT	II	Increasing	Locally abundant	-	X	X
	Lesser Flamingo	*Phoeniconaias minor*	R	NT	NT	II	Decreasing	Locally abundant	-	X	X
ANSERIFORMES	White-faced Whistling Duck	*Dendrocygna viduata*	R	LC	-	II	Increasing	Common	-	-	-
	Egyptian Goose	*Alopochen aegyptiaca*	R	LC	-	II	Decreasing	Common to abundant	-	-	X
	South African Shelduck	*Tadorna cana*	R	LC	-	II	Increasing	Common	-	-	X
	Yellow-billed Duck	*Anas undulata*	R	LC	-	II	Stable	Common	-	-	X
	African Black Duck	*Anas sparsa*	R	LC	-	II	Decreasing	Fairly common	-	-	-
ANSERIFORMES	Cape Teal	*Anas capensis*	R	LC	-	II	Increasing	Uncommon to locally abundant	-	-	X
	Red-billed Teal	*Anas erythrorhyncha*	R	LC	-	II	Decreasing	Very common	-	-	-
	Cape Shoveler	*Anas smithii*	R	LC	-	II	Increasing	Rare to locally abundant	-	X	X
	Southern Pochard	*Netta erythrophthalma*	R	LC	-	II	Decreasing	Common	-	-	-
	Mallard	*Anas platyrhynchos*	R	LC	-	II	Decreasing	Locally fairly common	-	-	-
	Spur-winged Goose	*Plectropterus gambensis*	R	LC	-	II	Increasing	Locally common to very common	-	-	X
	Maccoa Duck	*Oxyura maccoa*	R	NT	NT	II	Decreasing	Common	-	X	-
ACCIPITRIFORMES	Secretarybird	*Sagittarius serpentarius*	R	VU	VU		Decreasing	Locally fairly common	-	X	X
	Cape Vulture	*Gyps coprotheres*	R	VU	EN	II	Decreasing	Locally common	-	X	-
	Yellow-billed Kite	*Milvus aegyptius*	BM	NE	-	II	NA	Common	-	X	X
	Black-shouldered Kite	*Elanus caeruleus*	R	LC	-	II	Stable	Common	-	X	X
	Verreauxs' Eagle	*Aquila verreauxii*	R	LC	VU	II	Stable	Locally fairly common	-	X	X

	Booted Eagle	*Hieraaetus pennatus*	R	LC	-	II	Decreasing	Locally fairly common	-	X	X
	Martial Eagle	*Polemaetus bellicosus*	R	VU	EN	II	Decreasing	Uncommon	-	X	X
	African Fish Eagle	*Haliaeetus vocifer*	R	LC	-	II	Stable	Locally common	-	X	-
	Common (Steppe) Buzzard	*Buteo buteo*	0	LC	-	II	Increasing	0	-	X	X
	Jackal Buzzard	*Buteo rufofuscus*	R	LC	-	II	Stable	Fairly common	(*)	X	X
	African Goshawk	*Accipiter tachiro*	R	LC	-	II	Decreasing	Scarce to locally common	-	X	X
	Pale Chanting Goshawk	*Melierax canorus*	R	LC	-	II	Stable	Rare to locally common	-	X	X
	African Marsh Harrier	*Circus ranivorus*	R	LC	EN	II	Decreasing	Locally common	-	X	-
	Black Harrier	*Circus maurus*	R	VU	EN	II	Stable	Uncommon	(*)	X	X
	Western Osprey	*Pandion haliaetus*	NBM	LC	-	II	Increasing	Generally uncommon	-	X	-
FALCONIFORMES	Peregrine Falcon	*Falco peregrinus*	R	LC	-	II	Stable	Uncommon	-	X	X
	Lanner Falcon	*Falco biarmicus*	R	LC	VU	II	Increasing	Fairly common	-	X	X
	Rock Kestrel	*Falco rupicolus*	R	NE	-	II	NA	Common to uncommon	-	X	X
	Greater Kestrel	*Falco rupicoloides*	R	LC	-	II	Stable	Fairly common	-	X	-
FALCONIFORMES	Lesser Kestrel	*Falco naumanni*	NBM	LC	-	I, II	Stable	Locally common	-	X	-
GALLIFORMES	Grey-winged Francolin	*Scleroptila africana*	R	LC	-		Stable	Common	SLS	X	X
	Cape Spurfowl	*Pternistis capensis*	R	NE	-		NA	Common to locally abundant	(*)	-	X
	Common Quail	*Coturnix coturnix*	BM	LC	-	II (subsp. coturnix)	Decreasing	Very common	-	-	X
	Helmeted Guineafowl	*Numida meleagris*	R	LC	-		Stable	Locally common to abundant	-	-	X
GRUIFORMES	Blue Crane	*Anthropoides paradiseus*	R	VU	NT		Stable	Locally common	-	X	X
	African Rail	*Rallus caerulescens*	R	LC	-		Unknown	Uncommon to locally common	-	-	-

	Black Crake	*Amaurornis flavirostra*	R	LC	-		Unknown	Common	-	-	-
	African (Purple) Swamphen	*Porphyrio madagascariensis*	R	NE	-		NR	Locally common	-	-	-
	Common Moorhen	*Gallinula chloropus*	R	LC	-		Unknown	Locally common	-	-	-
	Red-knobbed coot	*Fulica cristata*	R	LC	-		Decreasing	Common	-	-	-
OTIDIFORMES	Ludwig's Bustard	*Neotis ludwigii*	R	EN	EN		Decreasing	Sparse to locally common	-	X	X
	Southern Black Korhaan	*Afrotis afra*	R	VU	VU		Decreasing	Uncommon to common	*	X	X
CHARADRIIFORMES	Greater Painted-snipe	*Rostratula benghalensis*	R	LC	VU		Decreasing	Rare to locally fairly common	-	X	-
	African Black Oystercatcher	*Haematopus moquini*	R	NT	LC		Increasing	Locally common	-	-	X
	Common Ringed Plover	*Charadrius hiaticula*	NBM	LC	-	II	Decreasing	Locally common	-	-	-
	White-fronted Plover	*Charadrius marginatus*	R	LC	-	II	Decreasing	Common	-	-	X
	Chestnut-banded Plover	*Charadrius pallidus*	R	NT	NT	II	Stable	Locally common	-	X	-
	Kittlitz's Plover	*Charadrius pecuarius*	R	LC	-	II	Unknown	Locally common	-	-	X
	Three-banded Plover	*Charadrius tricollaris*	R	LC	-	II	Unknown	Common	-	-	X
	Lesser Sand Plover	*Charadrius mongolus*	NBM	LC	-	II	Unknown	locally common	-	-	-
	Greater Sand Plover	*Charadrius leschenaultii*	NBM	LC	-	II	Unknown	Uncommon	-	X	-
	Grey Plover	*Pluvialis squatarola*	NBM	LC	-	II	Decreasing	Common	-	-	X
	Crowned Lapwing	*Vanellus coronatus*	R	LC	-	II	Increasing	Common	-	-	X
	Blacksmith Lapwing	*Vanellus armatus*	R	LC	-	II	Increasing	Common	-	-	X
	Ruddy Turnstone	*Arenaria interpres*	NBM	LC	-	II	Decreasing	Common	-	-	-
CHARADRIIFORMES	Terek Sandpiper	*Xenus cinereus*	-	LC	-	II	Stable	-	-	-	-
	Common Sandpiper	*Actitis hypoleucos*	NBM	LC	-	II	Decreasing	Common	-	-	-

	Wood Sandpiper	*Tringa glareola*	-	LC	-	II	Stable	-	-	-	-
	Common Redshank	*Tringa totanus*	-	LC	-	II	Unknown	-	-	-	-
	Marsh Sandpiper	*Tringa stagnatilis*	-	LC	-	II	Decreasing	-	-	-	X
	Common Greenshank	*Tringa nebularia*	-	LC	-	II	Stable	-	-	-	X
	Red Knot	*Calidris canutus*	NBM	LC	-	I (subs. rufa), II	Decreasing	Uncommon	-	X	-
	Curlew Sandpiper	*Calidris ferruginea*	NBM	LC	-	II	Increasing	Common	-	-	-
	Little Stint	*Calidris minuta*	NBM	LC	-	II	Decreasing	Common	-	-	X
	Red-necked Stint	*Calidris ruficollis*	Vagrant	LC	-	II	Unknown	Rare	-	X	-
	Baird's Sandpiper	*Calidris bairdii*	Vagrant	LC	-	II	Stable	Rare	-	X	-
	Sanderling	*Calidris alba*	NBM	LC	-	II	Unknown	Common	-	-	-
	Broad-billed Sandpiper	*Limicola falcinellus*	Rare or vagrant	LC	-	II	Decreasing	Rare	-	X	-
	Ruff	*Philomachus pugnax*	NBM	LC	-	II	Decreasing	Common	-	-	-
	Black-tailed Godwit	*Limosa limosa*	NBM	NT	NA	II	Decreasing	Rare	-	X	-
	Bar-tailed Godwit	*Limosa lapponica*	NBM	LC	-	II	Decreasing	Uncommon to locally common	-	X	-
	Hudsonian Godwit	*Limosa haemastica*	Rare or vagrant	LC	-	II	Decreasing	Rare	-	X	-
	Eurasian Curlew	*Numenius arquata*	NBM	NT	NT	II	Decreasing	Localised and generally uncommon	-	X	-
	Common Whimbrel	*Numenius phaeopus*	NBM	LC	-	II	Decreasing	Common	-	-	X
	Red-necked Phalarope	*Phalaropus lobatus*	Rare or vagrant	LC	-	II	Decreasing	Rare	-	X	-

	Wilson's Phalarope	*Phalaropus tricolor*	Rare or vagrant	LC	-	II	Increasing	Rare	-	X	-
	Pied Avocet	*Recurvirostra avosetta*	R	LC	-	II	Unknown	Locally common	-	-	X
	Black-winged Stilt	*Himantopus himantopus*	R	LC	-	II	Increasing	Common	-	-	X
CHARADRIIFORMES	Spotted Thick-knee	*Burhinus capensis*	R	LC	-		Stable	Fairly common to uncommon	-	-	X
	Water Thick-knee	*Burhinus vermiculatus*	R	LC	-		Unknown	Locally common	-	-	-
	Burchell's Courser	*Cursorius rufus*	R	LC	VU		Decreasing	Uncommon	-	X	-
	Parasitic Jaeger	*Stercorarius parasiticus*	NBM	LC	-		Stable	Common to locally abundant	-	-	-
	Pomarine Skua	*Stercorarius pomarinus*	NBM	LC	-		Stable	Uncommon	-	-	-
	Subantarctic Skua	*Stercorarius antarctica*	NBM	LC	EN		Stable	Fairly common	-	X	-
	Kelp Gull	*Larus dominicanus*	R	LC	-		Increasing	Common	-	-	X
	Grey-headed Gull	*Chroicocephalus cirrocephalus*	R	LC	-		Stable	Fairly common	-	-	-
	Hartlaub's Gull	*Chroicocephalus hartlaubii*	R	LC	-		Increasing	Locally common to abundant	-	-	X
	Sabine's Gull	*Xema sabini*	-	LC	-		Stable	-	-	-	-
	Caspian Tern	*Sterna caspia*	R	LC	VU	II	Increasing	Uncommon	-	X	X
	Swift Tern	*Thalasseus bergii*	-	LC	-		Stable	-	-	-	-
	Sandwich Tern	*Thalasseus sandvicensis*	-	LC	-		Stable	-	-	-	-
	Common Tern	*Sterna hirundo*	NBM	LC	-	II (subsp. hirundo)	Decreasing	Very common	-	-	-
	Arctic Tern	*Sterna paradisaea*	NBM	LC	-	II	Decreasing	Uncommon	-	X	-
	Antarctic Tern	*Sterna vittata*	NBM	LC	EN		Unknown	Locally fairly common	-	X	-
	Little Tern	*Sterna albifrons*	NBM	LC	-	II	Decreasing	Locally fairly common	-	-	-

	Black Tern	*Chlidonias niger*	NBM	LC	-	II (subsp. niger)	Decreasing	Locally common	-	-	-
	Whiskered Tern	*Chlidonias hybrida*	R	LC	-		Stable	Locally fairly common	-	-	-
	White-winged Tern	*Chlidonias leucopterus*	NBM	LC	-	II	Stable	Common	-	-	-
PTEROCLIFORMES	Namaqua Sandgrouse	*Pterocles namaqua*	R	LC	-		Stable	Common	-	-	X
COLUMBIFORMES	Rock Dove	*Columba livia*	R	LC	-		Decreasing	Abundant to uncommon	-	-	-
	Speckled Pigeon	*Columba guinea*	R	LC	-		Stable	Common	-	-	X
	Red-eyed Dove	*Streptopelia semitorquata*	R	LC	-		Increasing	Fairly common to common	-	-	X
	Cape Turtle Dove	*Streptopelia capicola*	R	LC	-		Increasing	Common to fairly common	-	-	X
COLUMBIFORMES	Laughing Dove	*Streptopelia senegalensis*	R	LC	-		Stable	Common	-	-	-
	Namaqua Dove	*Oena capensis*	R	LC	-		Increasing	Fairly common to comon	-	-	X
CUCULIFORMES	Klaas's Cuckoo	*Chrysococcyx klaas*	R	LC	-		Stable	Fairly common	-	-	-
	Diederik Cuckoo	*Chrysococcyx caprius*	BM	LC	-		Stable	Common	-	-	-
	Burchell's Coucal	*Centropus burchellii*	R	LC	-		Stable	Fairly common to uncommon	-	-	-
STRIGIFORMES	Western Barn Owl	*Tyto alba*	R	LC	-		Stable	Generally common	-	X	X
	Marsh Owl	*Asio capensis*	R	LC	-		Stable	Locally common to uncommon	-	X	-
	Cape Eagle-Owl	*Bubo capensis*	R	LC	-		Stable	Generally common	-	X	X
	Spotted Eagle-Owl	*Bubo africanus*	R	LC	-		Stable	Generally common	-	X	X
CAPRIMULGIFORMES	Fiery-necked Nightjar	*Caprimulgus pectoralis*	R	LC	-		Stable	Common	-	-	-
APODIFORMES	African Black Swift	*Apus barbatus*	R	LC	-		Stable	Locally abundant	-	-	-
	White-rumped Swift	*Apus caffer*	BM	LC	-		Increasing	Very common	-	-	-
	Little Swift	*Apus affinis*	R	LC	-		Increasing	Common	-	-	-

	Alpine Swift	*Tachymarptis melba*	BM	LC	-		Stable	Generally common	-	-	X
COLIIFORMES	Speckled Mousebird	*Colius striatus*	R	LC	-		Increasing	Common	-	-	-
	White-backed Mousebird	*Colius colius*	R	LC	-		Increasing	Locally common	-	-	X
	Red-faced Mousebird	*Urocolius indicus*	R	LC	-		Unknown	Locally common	-	-	-
CORACIIFORMES	Pied Kingfisher	*Ceryle rudis*	R	LC	-		Unknown	Locally common	-	-	X
	Giant Kingfisher	*Megaceryle maxima*	R	LC	-		Decreasing	Fairly common to uncommon	-	-	-
	Malachite Kingfisher	*Alcedo cristata*	R	LC	-		Stable	Common to locally abundant	-	-	-
	European Bee-eater	*Merops apiaster*	NBM	LC	-	II	Decreasing	Common	-	-	-
BUCEROTIFORMES	African Hoopoe	*Upupa africana*	R	NE	-		NA	Fairly common	-	-	-
PICIFORMES	Acacia Pied Barbet	*Tricholaema leucomelas*	-	LC	-		Increasing	Fairly common	-	-	X
	Greater Honeyguide	*Indicator indicator*	R	LC	-		Increasing	Uncommon	-	-	-
	Cardinal Woodpecker	*Dendropicos fuscescens*	R	LC	-		Stable	Common	-	-	-
PASSERIFORMES	Cape Clapper Lark	*Mirafra apiata*	R	LC	-		Decreasing	Fairly common to common	(*)	X	X
PASSERIFORMES	Cape Long-billed Lark	*Certhilauda curvirostris*	R	LC	-		Decreasing	Locally common	*	X	X
	Karoo Lark	*Calendulauda albescens*	R	LC	-		Decreasing	Common to fairly common	(*)	X	X
	Red-capped Lark	*Calandrella cinerea*	R	LC	-		Increasing	Common to locally abundant	-	-	X
	Large-billed Lark	*Galerida magnirostris*	R	LC	-		Increasing	Fairly common to common	(*)	X	X
	Grey-backed Sparrow-lark	*Eremopterix verticalis*	R	LC	-		Stable	Locally abundant	-	-	X
	Barn Swallow	*Hirundo rustica*	NBM	LC	-		Decreasing	Common to abundant	-	-	X
	White-throated Swallow	*Hirundo albigularis*	BM	LC	-		Increasing	Locally common	-	-	-
	Pearl-breasted Swallow	*Hirundo dimidiata*	R	LC	-		Stable	Sparse to locally common	-	-	-

	Greater Striped Swallow	*Cecropis cucullata*	BM	LC	-		Increasing	Locally common	-	-	-
	Rock Martin	*Hirundo fuligula*	R	LC	-		Stable	Common	-	-	X
	Common House Martin	*Delichon urbicum*	NBM	LC	-		Decreasing	Locally common	-	-	-
	Brown-throated Martin	*Riparia paludicola*	R	LC	-		Decreasing	Locally common	-	-	-
	Banded Martin	*Riparia cincta*	BM	LC	-		Increasing	Uncommon	-	-	X
	Cape Crow	*Corvus capensis*	R	LC	-		Increasing	Common	-	-	-
	Pied crow	*Corvus albus*	R	LC	-		Stable	Common to abundant	-	-	X
	White-necked Raven	*Corvus albicollis*	R	LC	-		Decreasing	Locally common	-	-	X
	Grey Tit	*Parus afer*	R	LC	-		Stable	Fairly common	(*)	-	X
	Cape Penduline-Tit	*Anthoscopus minutus*	R	LC	-		Stable	Common	-	-	X
	Cape Bulbul	*Pycnonotus capensis*	R	LC	-		Stable	Common to very common	*	-	-
	Olive Thrush	*Turdus olivaceus*	R	LC	-		Unknown	Generally common	-	-	-
	Mountain Wheatear	*Oenanthe monticola*	R	LC	-	II	Stable	Locally common	-	-	-
	Capped Wheatear	*Oenanthe pileata*	R	LC	-	II	Stable	Generally common	-	-	X
	Familiar Chat	*Cercomela familiaris*	R	LC	-	II	Stable	Common	-	-	X
	Sickle-winged Chat	*Cercomela sinuata*	R	LC	-	II	Stable	Uncommon to locally common	(*)	-	X
	Karoo Chat	*Cercomela schlegelii*	R	LC	-	II	Stable	Common	-	-	X
	Ant-eating Chat	*Myrmecocichla formicivora*	R	LC	-	II	Stable	Common	-	-	X
PASSERIFORMES	African StoneChat	*Saxicola torquatus*	R	LC	-	II	Stable	Common to fairly common	-	-	-
	Cape Robin-Chat	*Cossypha caffra*	R	LC	-	II	Stable	Common	-	-	X
	Karoo Scrub Robin	*Erythropygia coryphoeus*	R	LC	-	II	Stable	Common	-	-	X

	Chestnut-vented Tit-Babbler	*Sylvia subcaerulea*	R	LC	-		Stable	Common	-	-	X
	Layard's Tit-Babbler	*Sylvia layardi*	R	LC	-		Stable	Common	(*)	-	-
	African Reed Warbler	*Acrocephalus baeticatus*	BM	NE	-		NA	Fairly common	-	-	-
	Lesser Swamp Warbler	*Acrocephalus gracilirostris*	R	LC	-		Stable	Common	-	-	-
	Little Rush Warbler	*Bradypterus baboecala*	R	LC	-		Stable	Common	-	-	-
	Bar-throated Apalis	*Apalis thoracica*	R	LC	-		Stable	Common	-	-	-
	Long-billed crombec	*Sylvietta rufescens*	R	LC	-		Stable	Common	-	-	-
	Yellow-bellied Eremomela	*Eremomela icteropygialis*	R	LC	-		Stable	Fairly common	-	-	-
	Cape Grassbird	*Sphenoeacus afer*	R	LC	-		Decreasing	Locally common	(*)	-	-
	Zitting Cisticola	*Cisticola juncidis*	R	LC	-		Increasing	Common to very common	-	-	X
	Cloud Cisticola	*Cisticola textrix*	R	LC	-		Decreasing	Locally common	(*)	-	X
	Grey-backed Cisticola	*Cisticola subruficapilla*	R	LC	-		Decreasing	Locally common to very common	-	-	X
	Levaillant's Cisticola	*Cisticola tinniens*	R	LC	-		Stable	Locally common	-	-	X
	Neddicky	*Cisticola fulvicapilla*	R	LC	-		Stable	Locally common	-	-	X
	Karoo Prinia	*Prinia maculosa*	R	LC	-		Decreasing	Common to locally very common	(*)	-	X
	Rufous-eared Warbler	*Malcorus pectoralis*	R	LC	-		Stable	Common	-	-	X
	Spotted flycatcher	*Muscicapa striata*	NBM	LC	-	II	Decreasing	Common	-	-	-
	African Dusky Flycatcher	*Muscicapa adusta*	R	LC	-	II	Decreasing	Generally common	-	-	-
	Fiscal Flycatcher	*Sigelus silens*	R	LC	-	II	Stable	Common	(*)	-	-
	Cape Wagtail	*Motacilla capensis*	R	LC	-		Stable	Common	-	-	X
	African Pipit	*Anthus cinnamomeus*	R	NE	-		NA	Common	-	-	X

	Plain-backed Pipit	*Anthus leucophrys*	R	LC	-		Stable	Locally common	-	-	-
PASSERIFORMES	Cape Longclaw	*Macronyx capensis*	R	LC	-		Stable	Locally common to very common	-	-	X
	Southern (Common) Fiscal	*Lanius collaris*	R	LC	-		Increasing	Generally common	-	-	X
	Bokmakierie	*Telophorus zeylonus*	R	LC	-		Stable	Common	-	-	X
	Common Starling	*Sturnus vulgaris*	R	LC	-		Unknown	Common	-	-	X
	Pied Starling	*Lamprotornis bicolor*	R	LC	-		Stable	Locally common to abundant	SLS	-	X
	Wattled Starling	*Creatophora cinerea*	R	LC	-		Stable	Locally common	-	-	-
	Cape Glossy Starling	*Lamprotornis nitens*	R	LC	-		Stable	Locally common to very common	-	-	-
	Red-winged Starling	*Onychognathus morio*	R	LC	-		Increasing	Common	-	-	-
	Cape Sugarbird	*Promerops cafer*	R	LC	-		Stable	Locally common	*	-	-
	Malachite Sunbird	*Nectarinia famosa*	R	LC	-		Stable	Common to locally abundant	-	-	-
	Orange-breasted Sunbird	*Anthobaphes violacea*	R	LC	-		Decreasing	Common	*	-	-
	Southern Double-collared Sunbird	*Cinnyris chalybeus*	R	LC	-		Stable	Common	(*)	-	X
	Dusky Sunbird	*Cinnyris fuscus*	R	LC	-		Stable	Locally common	-	-	-
	Cape White-eye	*Zosterops capensis*	R	LC	-		Unknown	Common to very common	(*)	-	-
	House Sparrow	*Passer domesticus*	R	LC	-		Decreasing	Locally common	-	-	X
	Cape Sparrow	*Passer melanurus*	R	LC	-		Stable	Common to very common	-	-	X
	Southern Grey-headed Sparrow	*Passer diffusus*	R	LC	-		Stable	Common to fairly common	-	-	-
	Cape Weaver	*Ploceus capensis*	R	LC	-		Stable	Common	(*)	-	X
	Southern Masked Weaver	*Ploceus velatus*	R	LC	-		Stable	Common	-	-	X
	Southern Red Bishop	*Euplectes orix*	R	LC	-		Stable	Locally common to abundant	-	-	X

	Yellow Bishop	*Euplectes capensis*	R	LC	-		Stable	Fairly common	-	-	X
	Common Waxbill	*Estrilda astrild*	R	LC	-		Stable	Common	-	-	-
	Pin-tailed Whydah	*Vidua macroura*	R	LC	-		Stable	Common	-	-	-
	Cape Canary	*Serinus canicollis*	R	LC	-		Stable	Locally common	-	-	-
	Cape Siskin	*Crithagra totta*	R	LC	-		Stable	Locally common	*	-	-
PASSERIFORMES	Black-headed Canary	*Serinus alario*	R	LC	-		Stable	Locally common	(*)	-	-
	Brimstone Canary	*Crithagra sulphurata*	R	LC	-		Stable	Fairly common	-	-	-
	Yellow Canary	*Crithagra flaviventris*	R	LC	-		Stable	Common	-	-	X
	White-throated Canary	*Crithagra albogularis*	R	LC	-		Stable	Locally common	-	-	X
	Streaky-headed Seedeater	*Crithagra gularis*	R	LC	-		Stable	Fairly Common	-	-	-
	Cape Bunting	*Emberiza capensis*	R	LC	-		Stable	Fairly common to common	-	-	X
	Lark-like Bunting	*Emberiza impetuani*	R	LC	-		Stable	Common to very common	-	-	X

7.2. Appendix II - Bird monitoring programme

The following section describes the methodology proposed to be implemented at the Boulders Wind Energy Facility during the pre-construction phase for characterization of the bird community present. This methodology assumes, as a baseline, the requirements of the 2012 version of the Best Practice Guidelines, and it is considered to also comply with all requirements of the most recent version of the Guidelines (Jenkins *et al.* 2015). Additionally, the methodologies to be implemented will consider the international experience and standards for bird monitoring at wind farms.

OBJECTIVES

The primary aims of this monitoring programme are to assess the potential impacts resulting from the construction and operation of the Boulders Wind Energy Facility on the bird community within the study area. The main objectives of this monitoring program include:

i. Characterizing the avifauna community and its utilization of the development site;

ii. Establishing the baseline scenario during the pre-construction phase - providing the information required to identify potential changes in the bird community occurring within the study area, as well as the eventual exclusion/displacement effect (avoidance of the wind facility area post-construction);

iii. Providing the baseline scenario of the developments' pre-construction phase to the EIA avifauna specialist, for the construction of the final report;

iv. Evaluating the potential changes that may arise in relation to how the target-species and overall bird community utilize the site;

v. Documenting patterns of bird activity and movements within the site and its immediate surroundings, as well as to establish a pre-impact baseline scenario of bird utilization in the study area;

vi. Estimating predicted collision risks for target-species; and

vii. Identifying sensitive areas and proposing mitigation measures.

The results of the pre-construction monitoring programme will also be used for the final turbine layout and proposed mitigation measures/strategies for the subsequent phases of the project (construction and operation).

In order to meet these objectives, the following tasks will be implemented throughout the monitoring programme:

- **Linear walking transects** to characterise the bird community (paying special attention to small terrestrial and target species) occurring within the area of the Wind Energy Facility – pre-construction (at least for one year prior to construction). All bird species seen or heard will be recorded;

- **Vantage points and Vehicle based transects** to determine and monitor the usage of the area by target species as well as those which are sensitive to the impacts derived from wind energy facilities (with special emphasis on raptors and other large birds) within and in close proximity to the Wind Energy Farm – pre-construction (covering at least four annual seasons before construction). This

aims to determine bird activity patterns and movements within the site and its immediate surroundings;

- **Radar based study** in order to detect bird movemet and identification durin the night perior and so complement the data collected with standard methodology;
- **Priority species nest search and monitoring** to identify and monitor active nesting sites of target-species within the study area and its immediate surroundings – pre-construction (continuous efforts will be directed to identify relevant water bodies throughout the year. Relevant nesting locations will be monitored at least twice a year);
- **Water body search and monitoring** to evaluate the species present, as well as their primary movements at main water bodies – pre-construction (continuous efforts will be directed to identify relevant water bodies throughout the year. Relevant water bodies will be monitored at least twice a year)
- **Incidental observations** to register all important observations located in the vicinity of the site.

All of the aforementioned methodologies will be implemented within the wind energy facility and its immediate surroundings. These methodologies will also be applied to a relatively similar control site[4].

The experimental protocol will be directed towards the sensitive bird species, identified during the scoping phase of the EIA for the Wind Energy Facility (refer to Table 2 of the Scoping Report). The species targeted by the bird monitoring programme may be adjusted at a later stage, if necessary. If so, efforts may then be directed toward species that are more likely to be at risk to the impacts derived from the wind energy facility.

MONITORING PROTOCOLS

The bird monitoring programme will be implemented throughout the pre-construction phase of the Wind Energy Facility, for the establishment of a baseline scenario (covering at least four annual seasons before construction).

The implementation of similar monitoring protocols and sampling locations during subsequent phases of the project (e.g. construction phase and at least three years after the facility becomes operational) is very important. After referring to the established baseline scenario and implementing a Before-After-Control-Impact analysis, potential identified impacts can be validated and other unidentified impacts determined. If additional impacts are found, current proposed mitigation measures can be adequately adjusted, and if

[4] A complex analysis of the vantage point data in relation to the distance from the wind turbines, will allow for the implementation of a BACI analysis in the subsequent phases of the project, without conducting vantage points in a control area during the pre-construction monitoring phase.

necessary, new and more appropriate ones may be proposed. This will allow for the baseline results to be comparable throughout the entire monitoring programme of the wind energy facility.

Regarding the bird community at the Boulders Wind Energy Facility, the project's location presents certain geographic features that must be taken into consideration during the monitoring programme.

Linear Walking Transects

A systematic approach will be implemented in order to determine the overall bird community composition (focused on the small terrestrial birds) in the affected area. Analysis of these parameters will allow for the verification of the occurrence of spatial variations of the bird community present at the study site over time, by comparing the results from the Wind Energy Facility to a similar control area. Therefore, the main objectives of this methodology are:

- To identify potential changes in the bird community within the study site and the eventual exclusion/displacement effect (avoidance of the wind facility area post-construction);
- To identify sensitive areas and propose additional mitigation / compensation measures, if needed;
- To establish a baseline scenario for the monitoring of subsequent phases of the project.

Linear walking transects, of at least 1000 m each, will be conducted. They will cover the different habitats and micro-habitats present on site and on similar biotopes[5] at a Control area (Figure 4).

Transects will be implemented in the field in order to adequately cover all the different habitats and micro-habitats present on the site. At this stage, transect locations were proposed by conducting a desktop survey. If necessary, further adjustments may be made on site.

Each linear transect will be conducted by an expert bird observer who will slowly walk recording all bird contacts, both seen and heard. These contacts will be recorded on both the left and right side of the line of progression, with no distance limit between the observer and the birds (Buckland *et al*., 1993; Bibby *et al*., 2000). Sampling will commence shortly after sunrise and continue during the early morning (the first 3 hours after sunrise), or in the last 2 hours of the evening, avoiding the warmer periods of the day when the birds may be less active/vocal and hence less conspicuous (Bibby *et al*., 2000).

Nine linear transects are proposed to be established: 6 within the Wind Energy Facility boundaries and 3 in the Control area (Figure 4).

Each linear transect will be conducted at least twice per season for a full calendar year (4 different seasons), resulting in 8 surveys during a 12-month period for each transect.

[5] Biotope is an area of uniform environmental conditions providing a living place for a specific assemblage of plants and animals. Biotope is almost synonymous with the term habitat, but while the subject of a habitat is a species or a population, the subject of a biotope is a biological community.

No more than one survey for each transect should be undertaken in the same morning/evening in order to achieve a good representation of the different environmental and meteorological conditions.

After conducting transect sampling surveys of the overall bird community, the captured data will be analysed in order to estimate the following population parameters:

- Relative Abundance/density of bird population/community;
- Average species richness of bird community.

Statistical analysis will be performed in order to test for possible differences in the bird community between seasons and sampling sites.

Vantage Points

Raptors and large bird monitoring will be implemented in order to evaluate the activity patterns of these birds in the Wind Energy Facility site and surrounding areas. By collecting this information, it will allow for the:

- Identification of potential changes in the bird community present within the wind farm and the eventual exclusion/displacement effect (avoidance of the wind facility area post-construction);
- Evaluation of potential changes that may arise in relation to how the target species and potentially sensitive overall bird community utilizes the site;
- Documentation of bird activity patterns and movements within the wind farm and its immediate surroundings, as well as the establishment of a pre-impact baseline scenario of bird utilization within the study area;
- Estimation of predicted collision risks for target and impact sensitive species;
- Identification of sensitive areas and the proposal of additional mitigation / compensation measures, if needed;
- Establishment of a baseline scenario for the monitoring of subsequent project phases.

Observations from each vantage point will be conducted for at least 12 hours per season and be performed by two experienced observer covering a 360º area. Each vantage point will be surveyed for a minimum of 3 occasions per season. All the target and impact sensitive species observed during this period will be recorded and their flight paths registered. For each observation the number of individuals and, whenever possible, the gender and age will also be recorded. Behavioral patterns observed will be recorded, including (*i*) type of flight - passage flight, soaring, display, territorial; (*ii*) flight height - below rotor height, rotor height, above the rotor height; and (*iii*) environmental variables (air temperature, wind speed and direction, occurrence of precipitation, cloud cover and visibility).

Four suitable vantage points are proposed at strategic locations in the Wind Energy Facility and in such a way as to allow for efficient visualization of the proposed area for the wind farm and its immediate surroundings (Figure 4).

Each vantage point will be surveyed at least three times per season for at least one year (4 different seasons) prior to construction (pre-construction phase), resulting in 12 surveys during a 12-month period for each vantage point.

To achieve a good representation of the different environmental and meteorological conditions along the day, each of the three surveys of each vantage point for each season, will be undertaken at different times of the day: one in the early morning (first 3-4 hour of day light), one in the evening (3-4 last hours of day light) and one at midday (time in between this periods). Furthermore, each vantage points will not be surveyed more than once in a single day.

The following parameters, derived from data collected at vantage points, will be evaluated:

- Species detected - raptors and large birds;
- Mapping of the intensity of usage of the study area by bird species;
- Mapping of the intensity of usage of the study area by flight type for the target species;
- Mapping of the Probability of Collision Risk within the study area.

Vehicle-Based Transects

The implementation of vehicle-based transects will complement the aforementioned methodologies, providing further insight so as to better evaluate the activity patterns of raptors and large birds in the Wind Energy Facility and surrounding areas. Therefore, the purpose of this survey will be to provide a measure of abundance and richness of the observed species (large birds and raptors) and aid in the detection of species less prone to flying, such as bustards or to a lesser extent, cranes.

The vehicle-based transects will be conducted by two expert observers; one driving slowly and the other recording all contacts (seen and heard). During each transect the total number of birds observed will be counted, recorded and whenever possible mapped onto available charts. The following parameters will be recorded on a standard field sheet especially designed for this methodological approach: (*i*) bird species, gender and age (whenever possible); (*ii*) number of individuals; (*iii*) perpendicular distance from the road; (*iv*) bird activity observed and type of observation (acoustic/visual). Whenever pertinent, additional information will be collected in order to contribute to the detailed characterization of the areas usage by the species.

Two vehicle-based transects will be conducted in the Wind Energy Facility and its immediate surroundings[6] (Figure 4).

Each vehicle-based transect will be surveyed at least twice per season for at least a full calendar year (4 different seasons) prior to construction (pre-construction phase), resulting in 8 surveys during a 12-month period for each transect.

The following parameters, derived from the vehicle-based transects, will be evaluated:

[6] It is acknowledged that no vehicle transects are defined outside of the boundaries considered for the wind energy facility, however this area is the area where turbines might be built, and not the actual area affected by the project. It is assumed that there will be areas not occupied by turbines, and those are referred to as immediate surroundings in this case.

- Species detected - raptors and large birds;
- Mapping of the intensity of usage of the study area by target bird species.

Radar monitoring

The implementation of vehicle-based transects will complement the aforementioned methodologies, in order to evaluate the 24h activity patterns birds in the Wind Energy Facility site and surrounding areas. By collecting this information, it will allow for the:

- Identification of potential changes in the bird community present within the wind farm and the eventual exclusion/displacement effect (avoidance of the wind facility area post-construction);
- Evaluation of potential changes that may arise in relation to how the target species and potentially sensitive overall bird community utilizes the site;
- Documentation of bird activity patterns and movements within the wind farm and its immediate surroundings, as well as the establishment of a pre-impact baseline scenario of bird utilization within the study area;
- Estimation of predicted collision risks for target and impact sensitive species;
- Identification of sensitive areas and the proposal of additional mitigation / compensation measures, if needed;
- Establishment of a baseline scenario for the monitoring of subsequent project phases.

Monitoring location should covered the proposed area for the wind farm and its immediate surroundings.

Each location will be surveyed at least one time per season for at least one year (4 different seasons) prior to construction (pre-construction phase).

The following parameters, derived from data collected at vantage points, will be evaluated:

- Species detected - raptors and large birds;
- Mapping of the intensity of usage of the study area by bird species;
- Mapping of the intensity of usage of the study area by flight type for the target species;
- Mapping of the Probability of Collision Risk within the study area.

Breeding evidence monitoring

This methodology is relevant for the evaluation of the area undergoing change, as a suitable area for species to exist without disturbance. Therefore, by monitoring the reproduction of target or sensitive species, a measure of impact can be obtained to see whether or not reproduction is possible. If not, this measure of impact could be used to see if the decline in reproduction could be as a result of the Wind Energy Facility, or other species-based intrinsic factors. The main objectives of this methodology are:

- To identify the potential changes in the bird community present within the wind farm and the eventual exclusion/displacement effect (avoidance of the wind facility area post-construction);
- To evaluate potential changes in the way target-species and the overall bird community utilizes the study site;
- To identify sensitive areas and to propose additional mitigation / compensation measures if need be.

The methodology to be implemented will follow the general guidelines presented in the Best Practice Guidelines for Bird Monitoring (Jenkins *et al.* 2012, 2015).The area of the Wind Energy Facility and its immediate surroundings will be investigated for nesting and/or roosting locations of priority species. All the nesting and/or roosting locations identified during inspection will be accurately registered with a handheld GPS, after which the data will be imported into an appropriate Geographical Information System.

Nevertheless, nest investigation and monitoring will be conducted throughout all surveys during the pre-construction phase of the project. Once detected, each known nesting location will be monitored at least twice during the year, and as many times as it needed to certify whether the reproduction took place or not and, if possible, to determine if it was successful.

The data collected from nest investigations and monitoring in the Wind Energy Facility will allow for the evaluation of the following parameters:

- Nesting locations;
- Number and species of breeding pairs;
- Productivity of breeding pairs.

Water body monitoring

The main objectives of this monitoring methodology are:

- To identify potential changes in the bird community occurring within the study site, as well as the eventual exclusion/displacement effect (avoidance of the wind facility area after construction);
- To evaluate potential changes in the way target-species and the overall bird community utilizes the study site;
- To document bird activity patterns and movements within the study area, as well as the establishment of a pre-impact baseline scenario of bird utilization within the study area;
- To identify sensitive areas and to propose additional mitigation / compensation measures if need be.

The main water bodies occurring within the study area and its immediate surroundings will be identified, mapped and surveyed in order to determine their level of utilization by water birds. The methodological approach will follow the prescribed protocol of the Coordinated Water Bird Counts (Taylor *et al.* 1999).

The main water bodies of the study area will first be identified by means of a desktop survey and then assessed when in the field. Other smaller and more temporary locations will be identified during field surveys.

Water body monitoring will be conducted throughout all surveys during the pre-construction phase of the project (at least one year prior to construction). The most relevant water bodies will be monitored at least once in each season. Smaller or otherwise less important water bodies will be visited at least twice during the pre-construction monitoring phase.

The following parameters will be assessed, based on the information collected from the monitoring of water bodies:

- Estimation of the number and densities of water bird species that use these type of areas in the Wind Energy Facility and surrounding areas;
- Bird activity patterns and movements in sensitive areas.

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info@bioinsight.co.za

www.bioinsight.co.za