AVIFAUNAL IMPACT ASSESEMENT BASED ON 12 MONTH PRE-CONSTRUCTION MONITORING TO INFORM THE BASIC ASSESSMENT:

Basic Assessment for the Proposed Development of the 325MW Kudusberg Wind Energy Facility and associated infrastructure, between Matjiesfontein and Sutherland in the Western and Northern Cape Provinces: BA REPORT

Report prepared for:

CSIR – Environmental Management Services

P O Box 320

Stellenbosch, 7599

South Africa

Report prepared by:

Bioinsight (Pty) Ltd.

Unit 306, Warwick Place

Grand National Boulevard, Milnerton 7441

South Africa

5th December 2018

SPECIALIST EXPERTISE

The Avifaunal Specialist, Miguel Mascarenhas (Pri.Sci.Nat), serves as an independent specialist and is professionally registered with the South African Council for Natural Scientific Professions (Registration: Professional in Ecological Sciences, 400168/14). His short CV detailing a portion of his recent work and publications in 2018 is presented below. A full CV can be provided upon request.

—— MIGUEL MASCARENHAS ——

Profile

Miguel Mascarenhas is a Manager and an Ecological Environmental specialist that likes challenges, innovation and be a solution designer. As a consequence, at Bioinsight, Miguel assumes the role of business developer focused on leading a highly motivated team that also loves to be challenged, whether by complex project or the development of disruptive solutions.

Experience:

16 years

648 proj.

Worked in countries:

- Portugal
- Mozambique

Projects for countries:

- South Africa
- Cape Verde
- Mexico
- Mozambique
- Poland
- Portugal

Skills

Corporate management ●●●●●

Environmental Impact ●●●●○

Ecology ●●●●○

+ Employment

CHAIRMAN OF THE BOARD | BIODINÂMICA, MOZAMBIQUE
Since 2017

SENIOR CONSULTANT | BIO3 LDA., PORTUGAL
2012 - 2016

CEO AND BUSINESS DEVELOPMENT DIRECTOR | BIO3 LDA., PORTUGAL
2011 - 2012

CEO | BIOINSIGHT (BIO3), PORTUGAL
Since 2011

CEO | BIO3 LDA., PORTUGAL
2005 - 2011

CEO | BIO3 LDA., PORTUGAL
2005 - 2013

FREELANCER | SEVERAL COMPANIES SUCH AS DHVFBO, ENERPRO, PROCESL E PGG, PORTUGAL
2003 - 2005

RESEARCHER | LABORATÓRIO DE BIOLOGIA CELULAR - INSTITUTO DE BIOLOGIA EXPERIMENTAL E TECNOLÓGICA, PORTUGAL
2002 - 2003

+ Education

MSC IN BUSINESS MANAGEMENT (EQF LEVEL 7)
INDEG Business School, Portugal
2011 - 2013

POS-GRADUATION IN GEOGRAPHIC INFORMATION SYSTEMS
Higher Institute of Agronomy, Portugal
2006 - 2006

MSC IN ENVIRONMENTAL IMPACT ASSESSMENT (EQF LEVEL 7)
Institute of Ecology Investigation of Málaga, Spain
2003 - 2004

GRADUATION IN APPLIED PLANTS BIOLOGY (EQF LEVEL 6)
Sciences Faculty of the University of Lisbon, Portugal
1995 - 2001

+ Projects

Bioinsight projects

2018	Nature Conservation	Ecological Component of the Environmental Incidence Assessmen of na Aviary in Évora, Portugal. Portugal.
2018	Tourism&Urban Areas	Ecological Component of the Environmental Incidence Assessmen of an Execution Project for the Eletrification of the section Marco de Canaveses - Régua da Linha do Douro, Portugal. Portugal.
2018	Nature Conservation	Characterization of Flora and Vegetation of a Rural Hotel in Herdade da Comporta, Portugal. Portugal.
2018	Wind Energy	Ecological Component of the Environmental Impact Assessmen of Arrimal's Wind Farm, Portugal. Portugal.
2018	Wind Energy	Annual Monitoring Study of Birds and Bats (daytime and nightime) in 2018 in the Park and in the Eletric Line of Bii Stinu Wind Farm (EDI), Oaxaca, Mexico. Mexico.
2018	Oil & Gas	Ecological Monitoring of the Construction of the Replacement Village (RV) Ecological Monitoring of a Replacement Village Project associated to the development of a Liquefied Natural Gas Project of Anadarko Moçambique Area 1 Limitada (AMA 1) in Palma. Mozambique.
2018	Mines	Ecological Component of the Environmental Impact Assessmen of an Mining Instalation enlargement in Aljustrel, Portugal. Portugal.
2018	Hidric Energy	Ecological and climate componente of a Special Program for Ribeiradio-Ermida Dam, Portugal. Portugal.
2018	Electric Sector	Ecological Component of the Environmental Impact Assessmen of a substation of an Electric Energy Transformation - Tabaqueira, Portugal. Portugal.
2018	Wind Energy	Environmental Report for legal framework apllication to APA on the Overcapacity Equipment in Archeira Wind Farm, Portugal. Portugal.

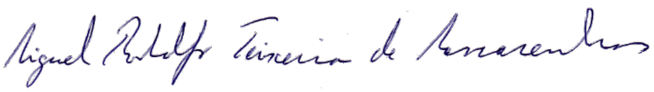
+ Publications

2018	Book Chapter | Wind energy Impacts	Santos, J., Marques, J., Neves, T., Marques, A.T., Ramalho, R., Mascarenhas, M. (2018). Environmental Impact Assessment Methods: An Overview of the Process for Wind Farm's Different Phases – From Pre-Construction to Operation. In: Mascarenhas, M., Marques, A.T., Ramalho, R., Santos, D., Bernardino, J., Fonseca, C. (Eds). Biodiversity and Wind Farms in Portugal: Current Knowledge and Insights for an Integrated Impact Assessment Process, pp. 35-86. Springer International Publishing.
2018	Book Chapter | Wind energy impacts	Rodrigues, S. , Rosa, L., Mascarenhas, M. (2018). An Overview on Methods to Assess Bird and Bat Collision Risk in Wind Farms. In: Mascarenhas, M., Marques, A.T., Ramalho, R., Santos, D., Bernardino, J., Fonseca, C. (Eds). Biodiversity and Wind Farms in Portugal, pp. 87-110. Springer International Publishing.
2018	Book Chapter | Wind energy impacts	Marques, J., Rodrigues, S., Ferreira, R., Mascarenhas, M. (2018). Wind Industry in Portugal and Its Impacts on Wildlife: Special Focus on Spatial and Temporal Distribution on Bird and Bat Fatalities. In: Mascarenhas, M., Marques, A.T., Ramalho, R., Santos, D., Bernardino, J., Fonseca, C. (Eds). Biodiversity and Wind Farms in Portugal, pp. 1-22. Springer International Publishing.
2018	Book Chapter | Wind energy Impacts	Paula, J., Augusto, M., Neves, T., Bispo, R., Cardoso, P., Mascarenhas, M. (2018). Comparing Field Methods Used to Determine Bird and Bat Fatalities. In: Mascarenhas, M., Marques, A.T., Ramalho, R., Santos, D., Bernardino, J., Fonseca, C. (Eds). Biodiversity and Wind Farms in Portugal. Springer International Publishing.
2018	Book chapter | Wind energy impacts	Coelho, H., Mesquita, S., Mascarenhas, M. (2018). How to Design an Adaptive Management Approach? In: Biodiversity and Wind Farms in Portugal - Current knowledge and insights for an integrated impact assessment process. Editors: Mascarenhas, M., Marques, A.T., Ramalho, R., Santos, D., Bernardino, J., Fonseca, C. (Eds.). Chapter 8 - Pages 205-224. Springer Book.
2017	Oral Presentation | Statistics & Ecology	Cláudio, N., Rodrigues, S., Mascarenhas, M., Mouriño, H., Marques, T.A. (2017). Classificação automática de sons de morcegos [Automatic identification of bat sounds]. Congresso da Sociedade Portuguesa de Estatística. 18 to 21 de October 2017. Lisbon, Portugal.[in Portuguese]
2017	Oral presentation | Wind energy impacts	Coelho, H., McLean, N., Mascarenhas, M., Pendlebury, C. (2017). Experiences gained from delivery of offshore wind energy in the UK that could inform the environmental assessment of Portuguese projects. 4th Conference on Wind energy and Wildlife impacts (CWW). 6 to 8 September 2017. Estoril, Portugal.
2017	Poster | Wind energy Environ. Assessment	Mascarenhas, M., Coelho, H., Sá da Costa, A. (2017). Wind farms aren't the same concept to all of us? So what are they? 4th Conference on Wind energy and Wildlife impacts (CWW). 6 to 8 september 2017. Estoril, Portugal.
2017	Poster | Wind energy Environ. Assessment	Tidhar, D., Mascarenhas, M., Coelho, H., McLean, N. (2017). How to reduce uncertainty using a question based approach for universal wind energy assessment. 4th Conference on Wind energy and Wildlife impacts (CWW). 6 to 8 september 2017. Estoril, Portugal.
2017	Poster | Wind energy impacts	Mesquita, S., Coelho, H., Mascarenhas, M. (2017). Adding value to wind farm projects by integrating ecosystem services in the environmental impact assessment process. 4th Conference on Wind energy and Wildlife impacts (CWW). 6 to 8 september 2017. Estoril, Portugal.

SPECIALIST DECLARATION

I, **Miguel Rodolfo Teixeira de Mascarenhas**, as the appointed independent specialist, in terms of the 2014 EIA Regulations, hereby declare that I:

- I act as the independent specialist in this application;
- I perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I have no vested interest in the proposed activity proceeding;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- I have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;
- I have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;
- all the particulars furnished by me in this specialist input/study are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the specialist: 

Name of Specialist: Miguel Rodolfo Teixeira de Mascarenhas

Date: 5th December 2018

EXECUTIVE SUMMARY

Kudusberg Wind Energy Facility (WEF) is a proposed 325 MW wind farm development planned at approximately 50 km southwest of Sutherland, on the border between the Western and Northern Cape Provinces. Bioinsight (Pty) Ltd. (hereafter referred to as 'Bioinsight') was appointed to undertake and finalise the 12-month bird pre-construction monitoring programme in accordance with the best practice pre-construction monitoring guidelines (Jenkins *et al*., 2015). Bioinsight was also appointed to undertake the bird specialist study for the Basic Assessment for the proposed Kudusberg WEF.

The study area is characterised by accentuated mountainous areas with vegetation adapted to the semi-arid conditions and harsh rocky conditions. Currently, the area where Kudusberg WEF is proposed shows no signs of intense disturbance. The area is logistically very difficult for human access and therefore remains in almost pristine natural conditions, apart from the general impacts on the veld caused by the three-year period of drought and grazing.

During the 12 months of pre-construction bird monitoring at the site, several methodologies were implemented to study the local bird communities and inform the assessment of potential risks from the construction and operation of the proposed project. The following techniques were applied at the proposed WEF area and its immediate surroundings: a desktop and bibliographic review, walked and vehicle based transects, vantage point monitoring, incidental observations and waterbody and breeding evidence surveys.

Site visits confirmed the occurrence of relatively high abundances of *Accipitrid* and *Falcon* species. The results have shown that both groups have a constant presence at the site throughout the year and spend a high proportion of their time and/or number of contacts at rotor height in comparison with the other groups of species. It is also noteworthy that their activity was especially associated with the hillside and escarpment areas, where most of the potential collision risk movements (flight at potential rotor height depending on the turbine specifications) were observed. A total of eight species confirmed on site may be of special concern for having an unfavourable conservation status in South Africa: Black Harrier *Circus maurus*, Ludwig's Bustard *Neotis ludwigii*, Martial Eagle *Polemaetus bellicosus* – Endangered; Black Stork *Ciconia nigra*, Verreauxs' Eagle *Aquila verreauxii* – Vulnerable; Karoo Korhaan *Eupodotis vigorsii*, Maccoa Duck *Oxyura maccoa*, Greater Flamingo *Phoenicopterus roseus* – Near Threatened.

Sensitive areas identified at the proposed site considered the relevant aspects collected through the bird monitoring programme, including: relevant activity of sensitive species and associated potential for collision recorded in areas of hillsides and escarpments; particular association of passerine species and other relevant sensitive species to riverine thickets and water features; association of red-listed species with their potential breeding/roosting locations. This allowed for establishment of avoidance areas (areas with very high sensitivity for birds).

The main direct impacts identified to potentially occur are: increased habitat loss, increased fatalities due to collision with various project infrastructures, and increased disturbance/displacement effects. The overall significance of these impacts expected to occur during the construction, operation, and decommissioning phases, is expected to be <u>low</u> before mitigation, and <u>very low</u> after mitigation.

Cumulative impacts were assessed by adding expected impacts from the Kudusberg WEF to existing and proposed wind energy developments with similar impacts, within a 50 km radius. It is however important to note that the quantification or even evaluation of cumulative impacts is uncertain as there is not a generalised knowledge of large-scale movements or connection

between bird populations within the region. The overall significance of cumulative impacts expected to occur is estimated to be moderate before mitigation, and low after mitigation.

No-go Alternative:

Should the Kudusberg Wind Farm not be constructed, then all impacts (whether it be negative or positive) identified within the impact analysis will not take place. As a result, it is expected that the present environmental characteristics relevant for the bird community on site will remain unchanged, relative to that which is being observed at present, under current land-use practices.

Kudusberg WEF **is considered to be located in an area of moderate bird sensitivity with some habitat features of very high sensitivity in terms of the bird community** present. Impacts may be magnified due to cumulative impacts caused by other wind energy developments proposed in the area. Nonetheless, it is considered that although impacts cannot be totally eliminated, they can be minimised to the maximum extent possible, mostly through the **avoidance of very high sensitivity areas (i.e. no-go areas)**, and with the implementation of mitigation measures for areas of **moderate sensitivity**.

It is also recommended that a construction and operational phase bird monitoring programme is implemented in line with the best practice monitoring guidelines to confirm and determine the extent of the impacts predicted as well as to validate the success of the mitigation strategies proposed. It is of the opinion of the specialist, that from a bird perspective, the proposed Kudusberg WEF can be authorised, provided the recommendations and mitigation measures outlined in this report are adhered to.

LIST OF ABBREVIATIONS

BA	Basic Assessment
BACI	Before-After Control-Impact Analysis
CITES	The Convention on International Trade in Endangered Species of Wild Fauna and Flora
CO	Control
DEA	Department of Environmental Affairs
ECO	Environmental Control Officer
EMPr	Environmental Management Programme
GIS	Geographic Information System
IBA	Important Bird Area
IUCN	Internal Union for Conservation of Nature (Global conservation status)
PVSEF	Photo Voltaic Solar Energy Facility
SA	South Africa
WEF	Wind Energy Facility

GLOSSARY

Definitions	
Cut-in wind speed	The lowest wind speed at hub height at which the wind turbine starts to produce power.
Endemic species	Species that are restricted to southern Africa.
Fatal Flaw	A major defect or deficiency in a project proposal that should result in an Environmental Authorisation being refused.
Red data species	A list of international (IUCN) as well as southern African threatened species.
Sensitive species	Species that aggregate a set of characteristics (higher risk of collision with wind turbines, specific habitat or ecological requirements, etc) and that are prone to be most affected by the project development.

COMPLIANCE WITH THE APPENDIX 6 OF THE 2014 EIA REGULATIONS

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	Addressed in the Specialist Report
1. (1) A specialist report prepared in terms of these Regulations must contain- a) details of- i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	Yes Pages 1-2
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Yes Page 3
c) an indication of the scope of, and the purpose for which, the report was prepared;	Yes Section 1.1.1
(cA) an indication of the quality and age of base data used for the specialist report;	Yes Section 1.1.5
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Yes Section 1.6
d) the date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Yes Section 1.1.3
e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Yes Section 1.1.3
f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Yes Section 1.2 and 1.3
g) an identification of any areas to be avoided, including buffers;	Yes Section 1.3
h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Yes Section 1.3
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Yes Section 1.1.4
j) a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment or activities;	Yes Section 1.6
k) any mitigation measures for inclusion in the EMPr;	Yes Section 1.8
l) any conditions for inclusion in the environmental authorisation;	Yes Section 1.9
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Yes Section 1.8
n) a reasoned opinion- i. as to whether the proposed activity, activities or portions thereof should be authorised; (iA) regarding the acceptability of the proposed activity or activities; and ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Yes Section 1.9
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	N/A
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	
q) any other information requested by the competent authority.	N/A
2) Where a government notice *gazetted* by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	N/A

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FIGURES

1 AVIFAUNAL IMPACT ASSESSMENT

IMPORTANT NOTE:
THE AVIFAUNAL SPECIALIST STUDY HAS BEEN REVISED FOLLOWING COMMENTS RECEIVED FROM MS SAMANTHA RALSTON-PATON OF BIRDLIFE SOUTH AFRICA IN HER LETTER DATED 23 NOVEMBER 2018. THE LETTER IS INCLUDED IN APPENDIX E.6 AND RESPONSES TO THE COMMENTS FROM BIRDLIFE HAVE BEEN INCLUDED IN THE COMMENTS AND RESPONSES TRAIL WHICH HAS BEEN INCLUDED IN ASPPENDIX E.7. THE TEXT OR SECTIONS WHICH HAVE BEEN ADDED TO THIS REPORT FOLLOWING THE COMMENTS FROM BIRDLIFE ARE UNDERLINED, IN ITALICS AND IN BOLD. IN ADDITION, THE 12-MONTH PRE-CONSTRUCTION AVIFAUNAL MONITORING PROGRAMME HAS BEEN INCLUDED IN APPENDIX D OF THIS FINAL BA REPORT.

1.1 INTRODUCTION AND METHODOLOGY

1.1.1 Scope and Objectives

The main objective of the pre-construction bird monitoring programme was to characterise the bird community present in the area and provide baseline information to assess bird habitat use in a pre-impact scenario, and to further inform the evaluation of the potential impacts caused by the proposed Kudusberg Wind Energy Facility (WEF) (such as bird collision mortality, displacement due to disturbance, barrier effects and habitat loss (Drewitt & Langston, 2006) and to consider and propose suitable mitigation measures. The specific objectives of the Bird Impact Assessment are to:

a) Establish the pre-impact baseline reference and characterisation of the bird communities occurring within the development area;
b) Identify the bird species or groups more susceptible to potential impacts (displacement and/or collision) during the construction and operation phase of the wind energy facility;
c) Identify the project elements more likely to produce impacts on the avifauna and/or habitats during and after construction;
d) Evaluate potential changes in the way sensitive species, and the general bird community, will use the wind energy facility site during the construction and operational phases;
e) Assess and map the collision risk for sensitive species. Outline sensitive areas and/or No-Go areas if necessary;
f) Propose measures to avoid or, if unavoidable, mitigate, compensate and monitor, identified potential impacts; and
h) Present the information in a logical manner to inform the authorities and key stakeholders.

In order to achieve the objectives of the pre-construction bird monitoring programme, an experimental protocol was established, covering the WEF site, its immediate surroundings and a Control (CO) area. This pre-construction bird monitoring programme was based on extensive experience in bird and wind farm monitoring and was designed in order to comply with the key requirements of the “Best- Practice Guidelines for assessing and monitoring the impact of wind-energy facilities on birds in southern Africa” (Jenkins *et al*., 2015). This programme entails the implementation of standardised study methods before, during and after construction, in the area of the proposed WEF, its immediate surroundings and a CO area Before-After Control-Impact (BACI) Analysis as proposed by national and international references (such as SNH 2009; Atienza *et al*. 2011; Strickland *et al*. 2011; Jenkins *et al*. 2012; USFWS 2012).

Although the general bird community was surveyed, the experimental protocol was specially directed to a set of 25 species considered sensitive to wind energy development impacts (hereafter simply referred to as sensitive species), 11 of which are Accipitrids, Falcons and similar, 8 are Large Terrestrial Birds and 6 are Passerine and other small terrestrial birds (Table 1). These species were selected considering those identified as target species throughout the monitoring campaign (Bioinsight, 2018); species considered as priority for inclusion in studies considering wind farms (Retief *et al*., 2012) and lastly species considered prone to impacts caused by WEFs.

Table 1 - Sensitive bird species considered central to the avian impact assessment process for the proposed Kudusberg WEF. Global RLCS (WW) (Red List Conservation Status) (IUCN 2016) and South Africa RLCS (SA) (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. Likely Impacts: C – Collision; D – Disturbance and/or Displacement; H – Habitat destruction.

Group	Common Name	Scientific Name	Red List Conservation Status (South Africa)	Conservation Status (IUCN	Convention Migratory Species	Endemic to South Africa	Population Trend	Priority species	Likely Impacts
"Ciconids"	Hamerkop	*Scopus umbretta*	-	LC	-	-	Stable	X	D
"Ciconids"	Black Stork	*Ciconia nigra*	VU	LC	II	-	Unknown	X	C, D
"Ciconids"	African Sacred Ibis	*Threskiornis aethiopicus*	-	LC	II (subsp. aethiopicus)	-	Decreasing	X	D
"Waterbirds"	Greater Flamingo	*Phoenicopterus roseus*	NT	LC	II	-	Increasing	X	C; D
"Waterbirds"	Cape Shoveler	*Anas smithii*	-	LC	II	-	Increasing	-	D
"Waterbirds"	Maccoa Duck	*Oxyura maccoa*	NT	NT	II	-	Decreasing	-	D
"Nocturnal Raptors"	Spotted Eagle-Owl	*Bubo africanus*	-	LC	-	-	Stable	X	D, H
"Accipitrids"	Verreauxs' Eagle	*Aquila verreauxii*	VU	LC	II	-	Stable	X	C, D, H
"Accipitrids"	Booted Eagle	*Hieraaetus pennatus*	-	LC	II	-	Decreasing	X	C, D, H
"Accipitrids"	Martial Eagle	*Polemaetus bellicosus*	EN	VU	II	-	Decreasing	X	C; D; H
"Accipitrids"	Black-chested Snake Eagle	*Circaetus pectoralis*	-	LC	II	-	Unknown	X	C; D; H
"Accipitrids"	Jackal Buzzard	*Buteo rufofuscus*	-	LC	II	(*)	Stable	X	C, D, H
"Accipitrids"	Pale Chanting Goshawk	*Melierax canorus*	-	LC	II	-	Stable	X	C, D, H
"Accipitrids"	Black Harrier	*Circus maurus*	EN	VU	II	(*)	Stable	X	C, D, H
"Accipitrids"	African Harrier-Hawk	*Polyboroides typus*	-	LC	II	-	Stable	X	C, D, H
"Falcons"	Rock Kestrel	*Falco rupicolus*	-	NA	II	-	NA	-	C, D, H
"Falcons"	Greater Kestrel	*Falco rupicoloides*	-	LC	II	-	Stable	X	C, D, H
"Bustards"	Ludwig's Bustard	*Neotis ludwigii*	EN	EN	-	-	Decreasing	X	D, H
"Bustards"	Karoo Korhaan	*Eupodotis vigorsii*	NT	LC	-	-	Increasing	X	D, H
"Phasianids"	Grey-winged Francolin	*Scleroptila africana*	-	LC	-	SLS	Stable	X	D, H
"Phasianids"	African Snipe	*Gallinago nigripennis*	-	LC	II	-	Unknown	-	D
"Passerines"	Common Swift	*Apus apus*	-	LC	-	-	Decreasing	-	C; H
"Passerines"	Cape Clapper Lark	*Mirafra apiata*	-	LC	-	(*)	Decreasing	-	C, D, H
"Passerines"	Karoo Lark	*Calendulauda albescens*	-	LC	-	(*)	Decreasing	-	C; D; H
"Passerines"	Large-billed Lark	*Galerida magnirostris*	-	LC	-	(*)	Increasing	-	C, D, H

1.1.2 Terms of Reference

The Bird Impact Assessment to inform this Basic Assessment was conducted according to the specialist Terms of Reference:

- A key task for the specialists is to review the existing sensitivity mapping from the SEA for the project area and provide an updated sensitivity map for the Kudusberg WEF project site;
- Adhere to the requirements of specialist studies in terms of Appendix 6 of the NEMA EIA Regulations (2014), as amended;
- Assess the potential impacts of the proposed Kudusberg WEF project and its associated infrastructure by assessing the impacts during the construction, operational and decommissioning phases;
- Assess Cumulative impacts from other Wind and Solar PV projects located within a 50 km radius from the Kudusberg WEF that already have received Environmental Authorisation (EA), are preferred bidders and/or may still be identified as having received a positive Environmental Authorisation at the start of this BA process;
- Propose mitigation measures to address possible negative effects and to enhance positive impacts to increase the benefits derived from the project.
- Use the Impact Assessment Methodology as provided by the CSIR;
- Assess the project alternatives and the no-go alternative; and
- Provide a recommendation as to whether the project must receive Environmental Authorisation of not and identify any aspects which are conditional to the findings of the assessment which are to be included as conditions of the Environmental Authorisation.

Specific ToR:

- Describe the affected environment from an avifaunal perspective, including consideration of the surrounding habitats and avifaunal features (e.g. Ramsar sites, Critical Bird Areas, wetlands, migration routes, feeding, roosting & nesting areas, etc);
- Describe and map bird habitats on the site, based on on-site monitoring, desk-top review, collation of available information, studies in the local area, previous experience, and the Wind and Solar SEA (CSIR, 2015);
- Map the sensitivity of the site in terms of avifaunal features such as habitat use, roosting, feeding and nesting/breeding; and
- Identify and assess the potential impacts of the proposed project on avifauna, including impacts that may be seasonal or diurnal, or linked to specific species and their feeding, roosting or nesting habitats and habits. Provide sufficient mitigation measures to include in the Environmental Management Programme.
- Conduct a review of national and international specialised literature and experiences regarding birds and wind farms;
- Conduct a field investigation to determine the bird community present in the study area (as undertaken during the 12-month bird monitoring campaign). Although the general bird community is considered, this study will have special focus on the species considered to be more sensitive to wind energy development related impacts;

- Identify and map sensitive and "no-go" areas within and around the proposed Wind Energy Facility site;
- Identify any gaps in knowledge as well as any areas that would constitute "acceptable and defendable loss";
- Provide a statement regarding the potential significance of the identified issues based on the evaluation of the issues/impacts and a reasoned opinion as to whether the proposed project should be authorised; and
- Propose a suitable monitoring programme for the evaluation of the impacts expected during the construction and operational phase of the development, if considered necessary.

1.1.3 Approach and Methodology

The proposed methodology assumes as a baseline the requirements outlined by the most recent version of the Best-Practice Guidelines for assessing and monitoring the impact of wind-energy facilities on birds in southern Africa (Jenkins *et al*., 2015). Complementarily, the methodology is also based on current international best practice (Table 2).

Prior to the initiation of field surveys, a desktop survey was conducted to compile the best information possible, in order to provide a better evaluation of all conditions present within the study area. Therefore, data sources (as detailed in Table 2) were consulted in order to assess the species likely to occur within the study area. The following steps were taken:

- Based on a desktop study and considering all literature references available (Table 2), a list of all bird species considered to potentially occur within, or in close proximity to the site was compiled.
- Abundance of all species listed from the aforementioned process was assessed at a national level in terms of endemism, population trend, habitat preferences and conservation status.
- The sensitivity of these species towards 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 referred document were also considered sensitive because of their abundance, flight characteristics, ecological role, population trend and conservation status.
- A short list of sensitive species for this study species, to which the assessment and monitoring programme should pay special attention to, was compiled and supplemented with sensitive species identified in the previous steps.
- A desktop study, based on all the available information such as topographic South Africa maps, Google Earth imagery, and Geographical Information System (GIS) software was conducted for a preliminary evaluation of the area.
- Micro habitats and vegetation units were characterised using Google Earth imagery and refined during the field visits conducted to the site through the monitoring programme.

The pre-construction bird monitoring programme included the following components:

- Vantage points – to allow for the detection of large bird species present in the study area, the estimation of their abundance, seasonality and the characterisation of their flights, and to gain a general idea of their use of the habitats. This data is important in achieving Objectives a) to e) in Section 1.1.1).
- Walked linear transects – designed to survey passerines and other small to medium sized birds. Using this technique, densities and composition of these groups of birds are estimated for the different habitats, seasons and sampling sites. This data is important in achieving Objectives a) to e).
- Vehicle based transects – implemented to detect other large bird species less prone to flight (such as Bustards) and allows covering greater areas in the WEF surroundings. This technique was used to complement nest and roost surveys and for defining the distribution of sensitive species. This data is important in achieving Objectives a) to e).
- Waterbodies monitoring – used for characterising the use of these features by Waterbirds and contribute to Objectives a) to e).
- Inventory, search, inspection and monitoring of breeding evidences. This data is important in achieving Objectives a) to e).

The implementation of an operational monitoring programme should include the undertaking of bird carcass searches around the turbines and determination of the searcher efficiency and carcass persistency (by scavengers or decomposition) which will provide data to quantify bird fatalities associated with the WEF and determine the species affected as per the recommendations of the best practice guidelines.

By referring to the baseline scenario established (regarding the scope of the present report) and implementing a BACI analysis, it will be possible to validate the potential impacts identified and to determine if other impacts are occurring, and adequately adjust any mitigation measures proposed at this stage (or propose new and more appropriate ones if necessary).

All the above methodologies will enable the accomplishment of Objective (f).

The monitoring effort and methodological approach was defined and implemented.

While the main emphasis of the pre-construction monitoring programme was focussed on the sensitive species identified (Table 1), a systematic approach was implemented in order to determine the general composition of the bird community within the study area, as well as to evaluate the potential negative effects that the operational phase of the Kudusberg WEF has on this group. The surveys conducted involved several methodologies and procedures.

Vantage points monitoring

Vantage point surveys were conducted by two technicians accordingly to the most recent recommendation from the best practice guidelines at the time (Jenkins et al. 2015). In some cases, observers would split vantage points due to time or logistical reasons, but only if conditions were deemed suitable for it. Each location was surveyed for a minimum of 12 hours of observation per season (winter, spring, summer and autumn) divided through the early morning, midday and late afternoon times of day.

As mentioned, in terms of Vantage Points, the protocols established by Jenkins et al. (2015) were used. Vantage Points were not conducted according to the new Verreaux's

Eagle Guidelines (Birdlife South Africa, 2017), as these only came into effect after the pre-construction monitoring campaign had already concluded (conclusion in October 2016). However, the recommendations for mitigation strategies have been considered for this report, wherever pertinent.

Vantage points were used to detect sensitive species, focused on Raptors and other large birds. Therefore, a systematic approach to detect and characterise the species of this group, many of them endangered or sensitive species, was implemented. This methodology included a standard way of collecting data (e.g. flying patterns and characteristics), which allows for the comparison between different areas and sampling periods (SNH 2009; Atienza *et al*. 2011; Strickland *et al*. 2011; Jenkins *et al*. 2012).

This methodology allows the collection of accurate records based on the movements of Raptors and large birds through the study area. The main objectives for this methodology was to record the behaviour, estimate activity indexes and, if possible, determine the number of breeding pairs (if any) that frequently utilise the study area.

The following parameters were evaluated:

- Activity Index – determined by considering the number of contacts per observation hour. In this case every bird is considered a contact, thus a flock of five birds would be considered five contacts.
- Activity at Rotor Swept Area – determined by considering the number of contacts per observation hour spent in the space considered between the lower turbine blade tip and the upper blade tip.
- Time use at Rotor Swept Area – this parameter was determined by considering the amount of time spent at rotor height in relation to the total time spent flying through the area.
- Risk Analysis – The probability of collision of any bird species in the study area was determined by analysing the collision prone behaviours at a wide range of Rotor swept area ranging between 50 and 230 m.

All the data collected during the fieldwork (vantage points and complementary records recorded during observer's movements throughout the study area) were inserted into a geographical information system in order to map the areas used by sensitive species and to perform a spatial analysis of the results. This allowed the estimation of several indexes and parameters, calculated by analysing the distribution of the flight records throughout the area.

In order to assess variations in the spatial utilisation of the different bird species, the analysis was conducted for different groups based on particular characteristics relevant to their biology, ecology and behaviour. This classification is not just ecological, but rather practical and aiming to focus on the specific impacts likely to occur as a result of the installation of the WEF, depending on the characteristics of the birds affected. Thus, the species were divided into groups (Table 1):

- *Accipitrids* - fairly large raptors, usually presenting a large wingspan and making use of thermal uplifts or hillside currents when soaring or gliding;
- *Falcons* - usually smaller raptors that make use of fast flight. Many of them display specific hunting behaviours such as hovering while looking for small prey. Some species tend to roost and hunt in large numbers,
- *Crows* - corvid species are classified within this group. They are usually common, widespread, opportunistic species. Although they often tend to fly at rotor height, they have not been found to be particularly affected by wind energy facilities. Sometimes they

appear in large numbers and their populations are often unbalanced by the extra available resources found in human-influenced habitats.

- *Waterbirds* - mainly ducks, cormorants, geese and other waterbody-associated species (usually swimmers or divers) appear in this group.
- *Ciconids* - Ibis, Egrets and Herons mainly. While also being closely associated to water, these species are not swimmers or divers and are, in fact, often found away from actual waterbodies but in relatively muddy areas.
- *Bustards* – large to medium sized terrestrial birds, usually associated with agriculture areas where they tend to gather and forage. Includes bustards and korhaans, several of these species being endemic or near endemic to southern Africa. Most have the ability to make short commuting flights, while other species, can even migrate.

<u>Linear walking transects</u>

To characterise the passerine and small bird communities occurring in the study area, walked transects were used – as recommended by the best practice guidelines at the time (Jenkins *et al*., 2015). This is a technique used to produce estimates of densities/actual numbers of bird species - making it a very thorough and sufficient means of measurement for the application.

The following parameters were estimated for each species and transect, both in the wind energy facility as well as in the control area:

- Relative density, expressed as the number of birds per hectare, per study area (WEF and Control). This variable takes into account the probability of detection of the different groups of species into consideration.
- Occurrence of sensitive species in the vicinity of the proposed facility and its immediate surroundings.

The analysis of all collected data parameters allows for the detection of spatial and temporal variations being placed on the bird community occurring at the study area, as well as for important and/or special areas for sensitive species. Density estimation was conducted using Distance© 6.2 Release 1 (Thomas *et al*., 2010). Density estimation was applied to the general community using Conventional Distance Sampling analysis (Buckland *et al*. 1993, 2001) per season and per major biotope. A second analysis was conducted focusing on the groups of species with a higher frequency of detection (n ≥ 40).

<u>Vehicle based transects</u>

As a complementary method, seven vehicle-based transects were conducted – three in the WEF- and four in its immediate surroundings – measuring approximately between 5 and 9 km each (Appendix I - Figure 6).

The purpose of the survey was to provide a measure of abundance and richness for those species observed (large terrestrial birds and raptors). At the same time, this information complements that obtained from the vantage point surveys and aids in the detection of species less prone to flying, such as bustards. It also helps in detecting roosting and nesting sites as it covers extensive areas in a short period of time.

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. The following parameters were recorded: species and number of individual's present, perpendicular distance from the road, bird activity at the moment of observation and any additional notes that were considered relevant. If the contacts were seen flying, it was noted. The distance from the observer to the point where the bird was first detected was then recorded.

The following parameters were recorded, and all records were taken note of on a standard field sheet especially designed for this methodological approach:

- bird species, gender and age (whenever possible);
- number of individuals;
- perpendicular distance from the road;
- bird activity observed and type of observation (acoustic/visual).

Whenever relevant, additional information was collected in order to contribute to the detailed characterisation of areas usage by the species.

<u>Breeding Evidences</u>

Surveys were conducted in the area in order to detect breeding evidences and/or roosting locations of sensitive species. These surveys took place in every season. The habitats located within the impact zone are likely to support key species, such as cliffs, power lines, stands of large trees, marshes and drainage lines (Malan, 2009) which were surveyed by the combination of different inspection techniques according to the specifics of each site.

The location and status of the nests were determined by active searches and direct observations, by making use of a handheld GPS (Garmin® ETREX 10 and ETREX 20), a pair of binoculars and a spotting scope. After a nest was located, the observer spent time observing it. The following parameters were registered: type of nest (e.g. cliff, tree, pylon, building, rock cavity), vertical position at the supporting structure of the nest, orientation (north, south, etc.), status (e.g. good condition, bad condition, collapsed) and, whenever possible, construction phase (e.g. inactive, building, fixing, green branches). When an active nest was found, the following parameters were registered: reproduction phase (e.g. construction, incubation and chicks), presence of parents in the nest, number of eggs, number of descendants/flying offspring. Whenever relevant, additional information was registered according to observations found in the field.

<u>Waterbody monitoring</u>

Several waterbodies were identified within the proposed wind energy facility site and the surrounding area. Therefore, these were mapped on a GIS by using 1:50 000 topographic maps and aerial photos and later surveyed in order to determine their level of utilisation by Waterbirds (Figure 6).

The water bodies found to be most relevant (due to their size and ability to hold water in the rainy season) were visited by two expert observers at least twice during the pre-construction monitoring campaign. The observers were aided by a pair of binoculars and a spotting scope. Whenever a relevant water body was found to be present, the approach followed the established methodology for the Coordinated Waterbird Counts (Taylor *et al*., 1999). The observations were made simultaneously by two observers, from a fixed point, for a minimum of 30 min. The species present were then recorded at the beginning of the observation. For the remaining period, the observer recorded the main movements around the water body. The following parameters were registered: species and number of birds present, gender and age (adult, juvenile/chicks) (whenever possible), direction of arrival/departure from the water body and any additional notes that may have been important.

Incidental Observations

All contacts of sensitive 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*., 2015) and the previous stages of the monitoring programme.

Control Area

A Control area was considered for this project, located approximately 2 km north of the proposed WEF site (Figure 6). This area was selected due to its extreme similarities to the study site, in terms of vegetation and topography. Both sites are equally comprised of Central Mountain Shale Renoserveld and Koedoesberge-Moordenaars Karoo vegetation (Mucina & Rutherford, 2006). Additionally, both sites also exhibit mountainous regions with shallow valleys. As such, very similar bird micro-habitats are expected to occur in both areas. Data gathered at this similar area will allow a comparison of the results obtained with a reference, non-affected area, in order to distinguish between impacts produced by the project and background effects produced by natural processes (SNH 2009; Atienza *et al*. 2011; Strickland *et al*. 2011; USFWS 2012; Jenkins *et al*. 2015).

Sampling Period

The surveys of the bird community monitoring programme were conducted between January and October 2016. The field surveys were conducted so that the area was surveyed throughout all seasons of the year, in compliance with the requirements of the Best Practice Guidelines (Jenkins *et al*., 2015). Therefore, the monitoring programme included a total of 8 visits to the site where all methodologies were implemented in each season: walked transects and vantage points, as well as other methodologies, spread over the pre-construction monitoring year.

The timing of site visits was conducted as follows:

- Summer
  - 12th to 22nd January 2016
  - 3rd to 13th February 2016
- Autumn
  - 1st to 11th April 2016
  - 17th to 27th May 2016
- Winter
  - 21st to 28th June 2016
  - 15th to 26th August 2016
- Spring
  - 6th to 15th September 2016
  - 26th September to 5th October 2016

1.1.4 Assumptions and Limitations

The following assumptions and limitations apply:

- The pre-construction bird monitoring is based on both primary (data collection) and secondary data sources, such as those indicated in section 1.1.5.
- 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. Species were considered as being possibly present within the study area if they occurred in any of the pentads, QDGS or wetland sites considered for analysis. Coordinate Avifauna Roadcounts data and Coordinated Waterbird Counts data was also requested for consideration in this study. ***A final bird list to inform sensitivity has subsequently been produced and tabulated in the final monitoring report (Bioinsight 2018). Similarly, data from all nearby projects was difficult to attain for the purposes of this report. However, reports from 11 of these surrounding projects were obtained and considered where considered relevant (such as priority species nesting sites and cumulative impacts etc.).***
- As vantage points had good visibility conditions, it was assumed that not only flying birds but also individuals on the ground should be detected. However, large terrestrial birds which do not fly often or spend long periods on the ground, would be more difficult to detect on hilly or wooded areas. This fact directly implies that activity indexes for these species can be underestimated. To deal with this issue a vehicle based transect was set up in the development area. This allowed moving through the area and having different perspectives over topographic features - therefore increasing the chance of detecting these types of birds, though activity indexes obtained through these two different methods cannot be directly compared.
- Vantage point surveys are only conducted during daylight. Therefore, any bird movement occurring at night is not recorded.
- At this stage, no inter-annual variations are taken into consideration as only one year of data has been collected. Nevertheless, the basis for comparisons with subsequent years has been established.
- The recommendations on the current version of the applied guidelines were followed to the maximum extent possible and exceeded whenever feasible. The methodologies implemented were adjusted to the specificities of the area. Compliance and any deviations from the guidelines are presented in this report.
- Mitigation measures pertaining to any avifaunal component that are inherent to the project design, include the complete avoidance of any areas that are considered to have a very high sensitivity (i.e. no-go areas).
- Cumulative impacts are assessed by adding expected impacts from this proposed development to existing and proposed developments with similar impacts, within a 50km radius. The existing and proposed developments that were taken into consideration for cumulative impacts are listed in Appendix 2.

1.1.5 Source of Information

A desktop survey was conducted to compile the best information possible, in order to provide a better evaluation of all conditions present within the study area. Therefore, the available data sources (Table 2) were consulted to assess which species could occur in the different habitat occurring at the Kudusberg WEF study area. The following steps were taken:

- Based on a desktop review and considering all literature references available, a list of all bird species with potential to occur within or in close proximity to the site was compiled.
- Literature references and local farmers were consulted concerning any available information regarding presence of known nests/roosts in the vicinity of the proposed site. Literature review was conducted regarding wind developments in South Africa or similar environments.
- All listed species were assessed at a national level in terms of endemism, population trend, habitat preferences and conservation status.
- All listed species were classified in terms of probability of occurrence within the site, considering several criteria evaluated in conjunction with one another, such as historical confirmation of species in the area, presence of known nests/roosts and presence of suitable habitats, etc.
- The vulnerability of these species to potential impacts caused by wind energy developments (in terms of potential collision risks with wind turbines) was evaluated according to the most recent “South African Good Practice Guidelines for Surveying Birds on Wind Farms” (Jenkins *et al*., 2015).
- A short list of sensitive species was identified to which the assessment and monitoring programme paid special attention to. Sensitive species were identified by means of a specific structured decision process based each species’ conservation status, vulnerability to collision and ecological characteristics such as migratory behaviour.
- A desktop study, based on 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. A reconnaissance field visit was conducted in February 2016 to achieve an initial understanding of characteristics of the site.
- It was 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). At a micro level, it was also important to define presence of specific features that could shape the local occurrence and bird distribution within the site. Bird abundance and movements are largely related to certain vegetation features such as tree-lined avenues, hedges and other relevant features which could potentially be used as corridors or feeding/roosting grounds. It was therefore essential to also characterise the study area in these terms. Google™ Earth imagery and most importantly, the field work, which was used to identify the available micro-habitats on site.

Table 2 includes (although not limited to) the list of data sources and reports consulted and taken into consideration, for the compilation of this report, in varying levels of detail. Other references were consulted for particular issues (these are detailed in section 1.10).

Table 2 - Data sources consulted for the evaluation of the bird community present in the study area. The international references and guidelines used to support the methodological approach and result 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 level
	Coordinated Waterbird Counts	http://cwac.adu.org.za/	Local level
	Gunstfontein wind energy facility – Bird pre-construction monitoring and Specialist Impact Assessment. Pre-construction phase. Final Monitoring Report 2013/2014	(Bioinsight, 2015)	Local level
	Birds of Southern Africa	(Hockey, Dean, & Ryan, 2005)	National level
	BirdLife South Africa Checklist of Birds in South Africa 2016	(BLSA, 2016)	National level
	The 2015 Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland	(Taylor, Peacock, & Wanless, 2015)	National level
	Renewable Energy Application Mapping. Third Quarter 2016	(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*., 2015)	National level Methodological approach
	Vearreaux's Eagle and Wind Farms Guidelines for impact assessment, monitoring and mitigation	***(Birdlife South Africa, 2017)***	***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
	Guidelines for impact assessment of wind farms on birds and bats	(Atienza, Martin Fierro, Infante, Valls, & Dominguez, 2011)	International level Methodological approach and analysis
	Windfarm impacts on birds guidance	www.snh.gov.uk/	International level Methodological approach and analysis

The key source of data is that collected onsite during the 12-month pre-construction monitoring programme.

1.2 DESCRIPTION OF PROJECT ASPECTS RELEVANT TO AVIFAUNAL IMPACTS

The project aspects relevant to avifauna include:

Presence of Wind Turbines

The presence of wind turbines, in general, can result in certain avifaunal impacts such as fatalities due to collision, as well as disturbance / displacement effects. It is very important that turbines are sited correctly, to avoid and/or minimise these potential impacts. Careful planning and avoidance measures is therefore crucial to achieve this.

Turbine machine specifications

In terms of turbine specifications, the most relevant aspect to consider is the machine size, in terms of rotor diameter and lower tip height. The turbines proposed for the Kudusberg project have a hub height of up to 140 m, with a rotor diameter of up to 180 m, making it a relatively large machine. Larger machines with bigger rotor diameters are generally considered better for avifauna, as they would restrict the project to have fewer wind turbines – due to their increased generating capacity. As a result of a larger machine, the lower tip height is also higher than that of smaller machines. This is considered relatively safer for smaller passerine species, as well as some medium-large terrestrial birds that are not known to frequently use the higher air spaces – subsequently reducing the risk of collision with turbine blades.

Wind measurement masts

The presence of four wind measurement masts may pose a risk to several avifauna species, due to the presence of guyed wires that are used to anchor the masts in place. These guyed wires are known to cause bird fatalities due to the collision of birds with these wires. Several measures can, however, be used to minimise the risk of collision. These mitigation measures have been included in the EMPr.

Underground 33kV cabling and Overhead 33kV Power Lines

The use of underground cabling is preferred to overhead power lines. However, it is important to note that underground cabling may also result in habitat destruction. Regardless, this impact is only considered to be short-term and is likely to only occur during the installation process. More relevant to the Kudusberg Project is the proposed use of a 33kV overhead power line that will be used to group turbines to crossing valleys and ridges outside of the road footprints, in order to reach the 33/132kV onsite substation. This overhead line may potentially serve as a source for bird collision fatalities, if not managed correctly.

Other associated Infrastructure

Other sources of disturbance and habitat destruction can be the presence of other associated infrastructures, such as electrical transformers, access roads, a substation, temporary construction camp, fencing around the batching plant and construction camp, and temporary infrastructure to obtain water from available sources. These infrastructures are however not expected to have a significant impact on the avifaunal community due to some of the structures only being temporary, and also due to the fact that the area required for construction only represents a small percentage of the total area available with the same habitat characteristics.

1.3 DESCRIPTION OF THE AFFECTED ENVIRONMENT

At a macro level, there are no nature conservancy areas, to our present knowledge, within a 30 km radius of the proposed development area. The proposed Kudusberg WEF site is located approximately 55 km south-east of the Tankwa Karoo National Park, 90 km north-east from Swartberg Mountains Important Bird Area (IBA) (SA106), 49 km east of the Cedarberg – Koue Bokkeveld Complex IBA (SA101) and 56 km north from Anysberg Nature Reserve Important Bird Area (SA108) (Figure 1). Considering that these areas are located at a considerable distance from the proposed WEF area it is not expected that the species using them are affected in any way by the implementation of this project. Nonetheless the analysis of the bird species present in these areas, which are of similar nature to the Kudusberg WEF proposed area, may provide an indication on the suite of species likely to be present in the study area.

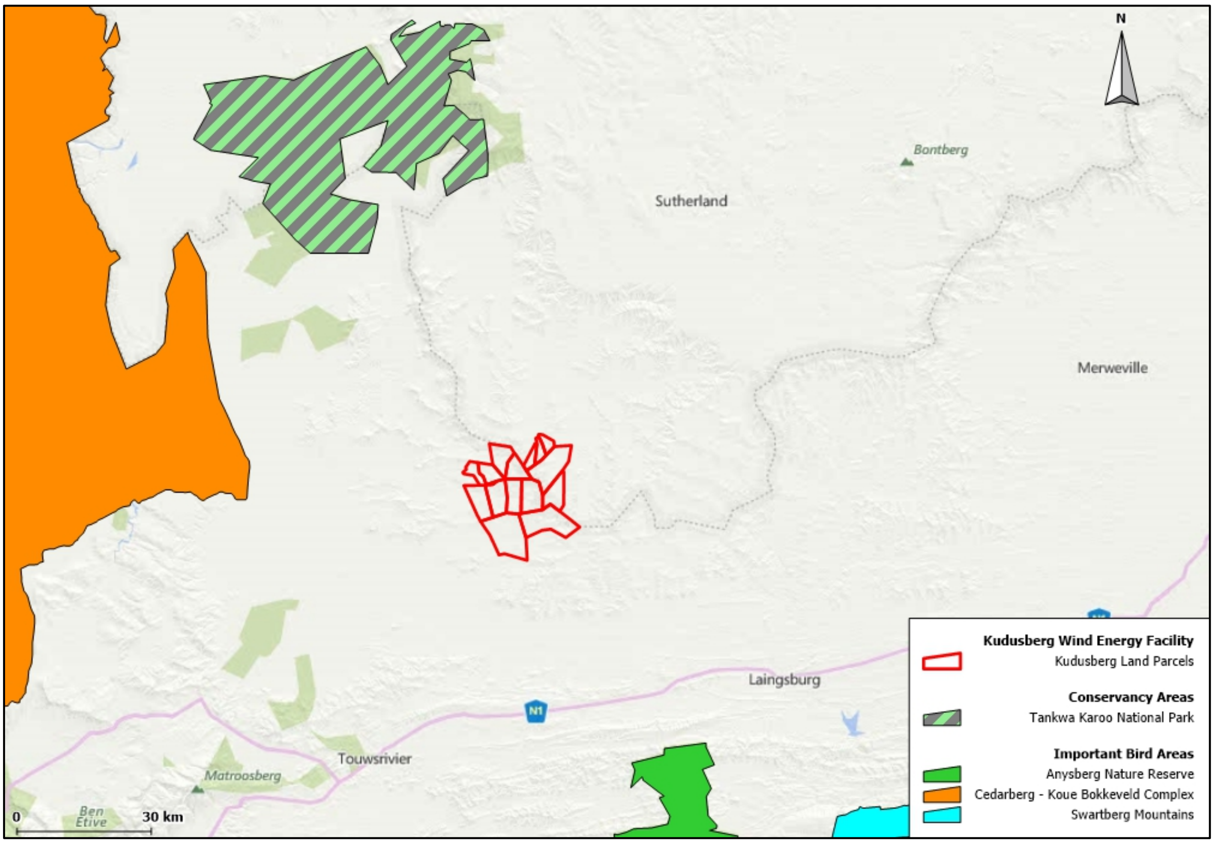

Figure 1 - Location of the Kudusberg WEF in relation to the surrounding conservancy areas (background image source: Google Earth Street Map)

At the WEF site level, the site falls within the Succulent Karoo and the Fynbos biome, with the occurrence of two main vegetation types (Mucina & Rutherford, 2006) (Figure 2):

- Central Mountain Shale Renosterveld (Fynbos biome): associated with areas of slopes and broad ridges where the vegetation is predominantly tall shrubland and renosterveld composed by non-succulent karoo shrubs and a rich flora in rockier areas.
- Koedoesberge-Moordenaars Karoo (Succulent Karoo biome): this type of vegetation is found in slightly undulating to hilly landscape and is characterised by low succulent scrub with interspersed taller shrubs. Rain may occur through the year though it is more likely during winter season – two rainfall peaks during the year: one in March and the other in May – August.

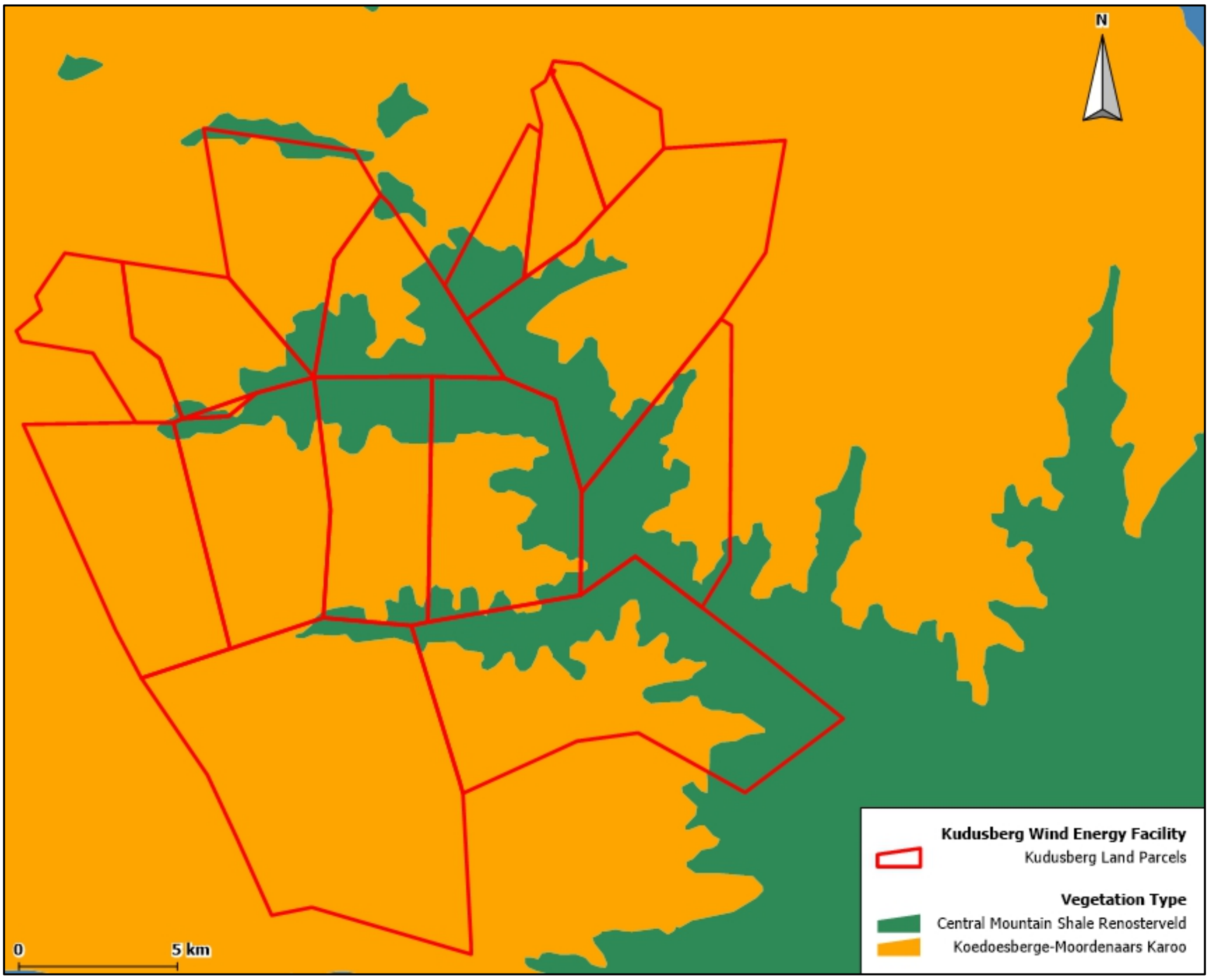

Figure 2 - Vegetation units present within the Kudusberg WEF and surrounding area according to Mucina & Rutherford (2006) updated to version 2012.

The site is characterised by accentuated mountainous areas with very difficult human access and therefore it is in almost pristine natural conditions. Vegetation is adapted to the semi-arid conditions and harsh rocky conditions. Currently the area where Kudusberg WEF is proposed shows no signs of intense disturbance other than that caused by natural impacts on the veld due to a three-year period of drought and grazing. Signs of human disturbance are characterised by the presence of a few farm houses.

Both the Fynbos biome and the Succulent Karoo biome are characteristic of higher altitudes and are present both in the bottom and top of the mountains. There are several species which are dependent on this type of habitat such as: Verreauxs' Eagle *Aquila verreauxii*, Grey-backed Cisticola *Cisticola subruficapilla*, Karoo Prinia *Prinia maculosa* and Grey-winged Francolin *Scleroptila Africana*. Apart from the bird species that are naturally associated with the Fynbos and the Succulent Karoo biome, other species with more widespread distributions and less specific habitat requirements may also occur. These species are likely to be attracted by factors such as land-use, topography and the presence of drainage lines and water features in the surroundings of the site. Within the proposed Kudusberg WEF site, however, the habitat is mostly reserved as low natural vegetation within a mountainous area, with some mostly dry water features. Regardless, species still make use of these habitats occurring on site (Figure 3). For example, a Western Barn Owl *Tyto alba* roost was found in a rock-face crevice on site, as well as a few other smaller nests that were found. However, these other nests were not identified as being in use any more, as they were collapsed and in very poor condition.

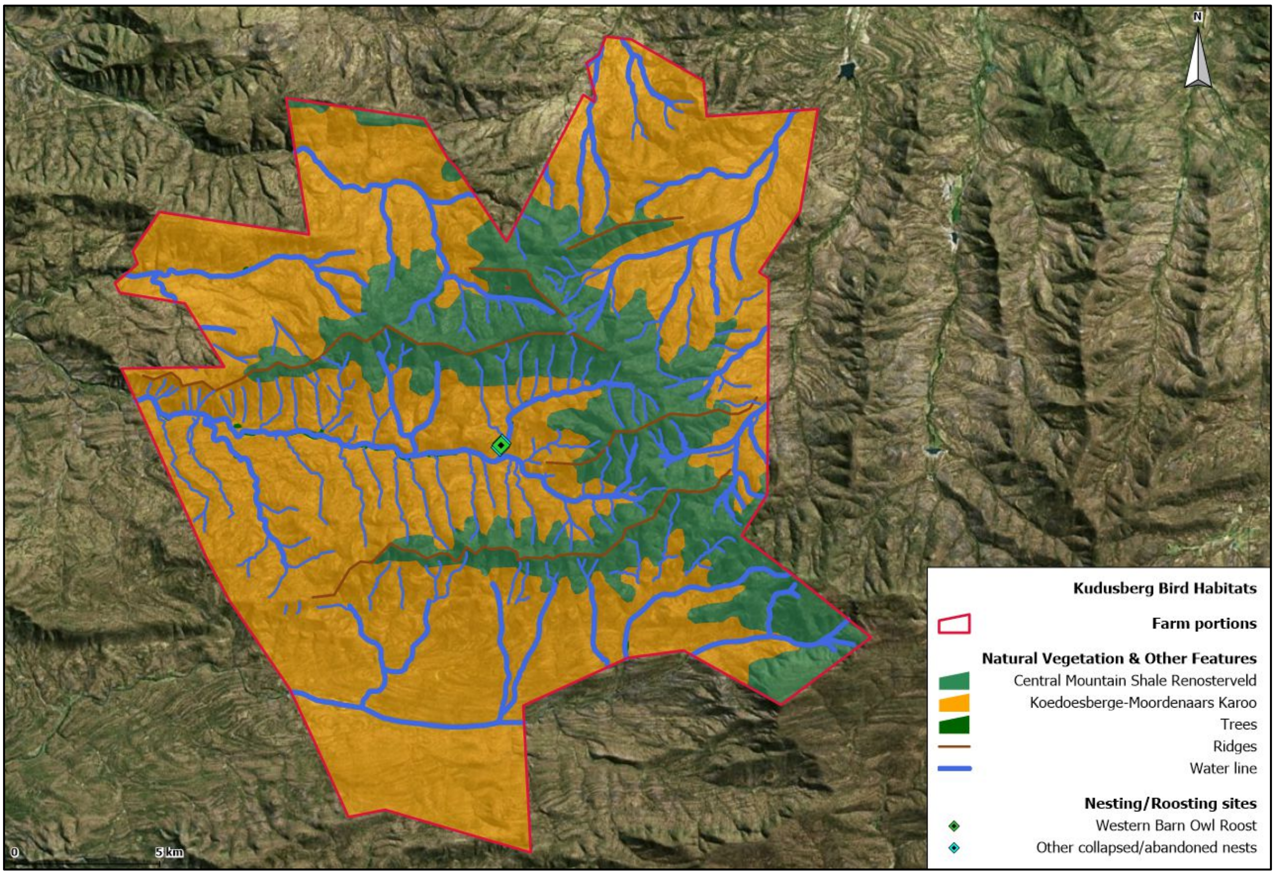

Figure 3 - Bird habitats occurring within the proposed Kudusberg WEF

Rocky hillsides characterise a large portion of the site due to the site being relatively mountainous. These areas may also be important for certain species that use these areas for nesting or thermalling, such as: Rock Martin *Hirundo fuligula*, Rock Kestrel and Verreauxs' Eagle, among others. For this reason, the site has been generally classified as one with <u>moderate</u> sensitivity, with some areas considered to be <u>very highly sensitive</u> (i.e. no-go areas that should be avoided from wind turbine installation) (Figure 4).

- Moderate sensitivity (Acceptable for turbine placement, but with mitigation measures)
    - *Hillside and Ridges*: This type of biotope is frequently used by Accipitrids and Falcons, for soaring and hunting flights, in which a lot of potential collision risk movements (flight at rotor height) are observed.
    - *Natural vegetation*: Within the proposed Kudsberg WEF site the area is mostly comprised of natural vegetation. Avifaunal community, especially raptors usually will forage in natural veld, as well as the passerine community use this biotope for nesting and foraging.
- Very High Sensitivity (No-Go areas)
    - *Riverine thickets*: This type of biotope showed a high importance for passerine species as well as for Raptors and soaring birds. Considering the scarceness and sensitivity of this vegetation type to land modifications, a 200m protection buffer is considered around the margins of the waterlines with this type of vegetation. No turbine placement or substation placement is allowed to occur within these buffered zones. ***Although it is advised for Overhead Powerlines to avoid these buffered areas as much as possible, they are allowed to be built within these buffered regions, as long as they run parallel with any bird flightpaths, as opposed to a more perpendicular orientation that could increase the risk of collision. This should be further assessed by the specialist for approval once the powerline layout becomes available – the powerline will be subject to a separate basic assessment, during which the impacts of the powerline must be assessed in detail.*** Existing roads should be used/upgraded as far as possible, within these areas.
    - *Water bodies*: As these supply important sources of water, nesting and resting locations for many bird species (not only waterbirds), a 200m protection buffer is considered around any potential margins of water present within the study area.
    - *Sensitive Flight Paths*: ***as activity index thresholds are not fully understood and enforced in South Africa, nor presented in the most recent version of the bird monitoring guidelines (Jenkins et al., 2015), it was determined that the best approach would be to follow the activity trends of familiar projects (from sites exhibiting similar characteristics). It was observed from a relatively nearby operational wind farm that high risk flights of priority species (where important fatalities were also noted) were generally orientated in areas where >1 contacts/hour were observed. As such, a grid analysis was conducted to determine the use of geographical space by certain bird species. It was subsequently decided that only sensitive species with >0.25 contacts per hour (precautionary approach) were to be considered in each 500x500m no-go square***. A 200m buffer was then applied around each square to account for potential sensitive flight paths occurring on the inner border of each square.

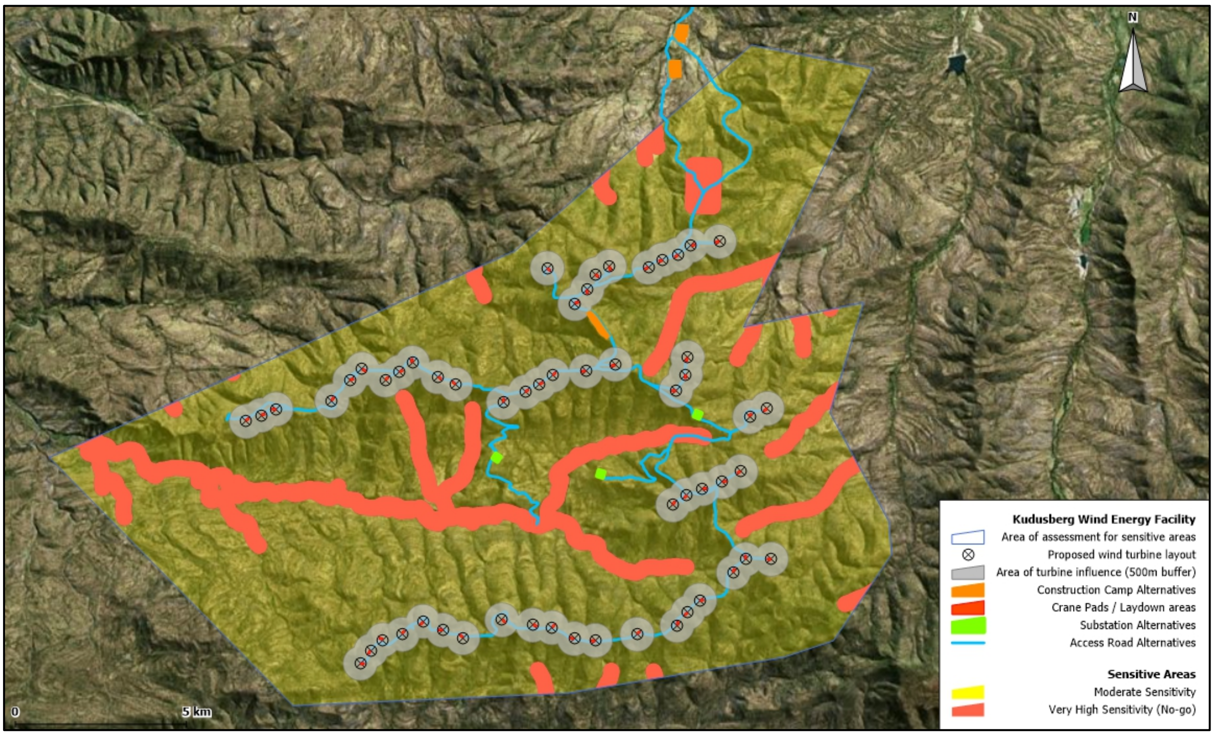

Figure 4 - Sensitive areas identified for birds during the pre-construction monitoring campaign at Kudusberg WEF, overlaid with the proposed development features.

The aforementioned sensitivity classification has also been noted as being relatively representative of the broader region due to the information obtained from nearby proposed renewable energy developments. Williams (2014) explains that the proposed Karreebosch WEF is comprised of vegetation (particularly on ridges, where turbines are to be sited) that lacks resources to attract birds (Williams, 2014). Williams (2016) also specifies that the Brandvalley WEF has hilltops that are depauperate (in terms of bird numbers and diversity), and that only two areas showed a potential for collision risks (Williams, 2016). For the Rietkloof WEF, Williams (2016) states that the hilltops are depauperate for bird numbers and diversity, and that it is the general consensus that the available habitats cannot support more than a low number of species that have been identified to be at collision risk (Williams, 2016). Jenkins (2011) describes the Sutherland Renewable Energy Facility as one to have minimal negative impacts on key rare, red-listed and/or endemic species. However, species such as Verreaux's Eagle and Martial Eagle would likely experience important negative impacts. Regardless, it is also noted that these effects may be reduced to an acceptable and sustainable level if proposed mitigation measures are adhered to (Jenkins, 2011). Bioinsight (2016) mentions that the Gunsfontein Wind Energy Facility is a site that generally has a medium sensitivity, with some areas of high sensitivity (Bioinsight, 2016). The Endangered Wildlife Trust (2012) identified that the Hidden Valley WEF is a site that is generally considered to be moderately sensitive in terms of avifauna, based on the occurrence of a number of listed species in the study area, as well as for the availability of various micro-habitats (Endangered Wildlife Trust, 2012). The Roggeveld Wind Farm is also described as one to have bird-depauperate habitats and low numbers of birds with minimal probably impact on the local avifauna. Williams (2013) describes it as a project that is unlikely to have critical cumulative impacts due to the similarity of the regional ecology and terrain, as well as the lack of regular migratory movements across the region (Williams, 2013). For the Maralla East & West, and Esizayo WEF projects, van Rooyen (2016; 2016; 2016) mentions that the greatest cause for concern is a 70km radius around the Komsberg

substation for large raptor species – particularly in terms of cumulative impacts. However, with mitigation measures, the impact should be less severe at a national level, due to the large distribution ranges of the species. Nonetheless, it is mentioned that the situation should be carefully monitored and that mitigation measures are to be strictly adhered to (van Rooyen, 2016; 2016; 2016). Simmons & Martins (2018) noted that the proposed Witberg WEF would likely show main concerns for the Verreaux's Eagle species present on site. However, after a proposed layout change, it was determined that the likely number of estimated fatalities would decrease to about 0.72 eagles per year, and that if suitable mitigation measures were implemented, then the project would be deemed acceptable for development (Simmons & Martins, 2018). These reports were also broadly used in the assessment of potential cumulative impacts.

Based on the sources above, priority species nests from outside of the proposed Kudusberg WEF were also mapped relative to the proposed development envelope. As one can see from Figure 5, the nearest known priority species nest is that belonging to a Verreaux's Eagle (5.3 km east of the nearest turbine). A Martial Eagle nest can be observed 36 km north-east from the nearest turbine, while a Secretarybird nest can be seen 46.4 km north-east of the nearest turbine. As per the most recent Verreaux's Eagle guidelines for impact assessments, monitoring and mitigation (Birdlife South Africa, 2017), no construction is allowed to take place within 1 km of a known nest during it's breeding season. Similarly, all active nests (including alternate nests) are to receive a 3 km buffer where no construction is allowed to take place. As the nearest known nest occurs 5.3 km east of the nearest turbine, it is noted that this distance is considered acceptable in terms of reducing the likely negative impact on the breeding pair.

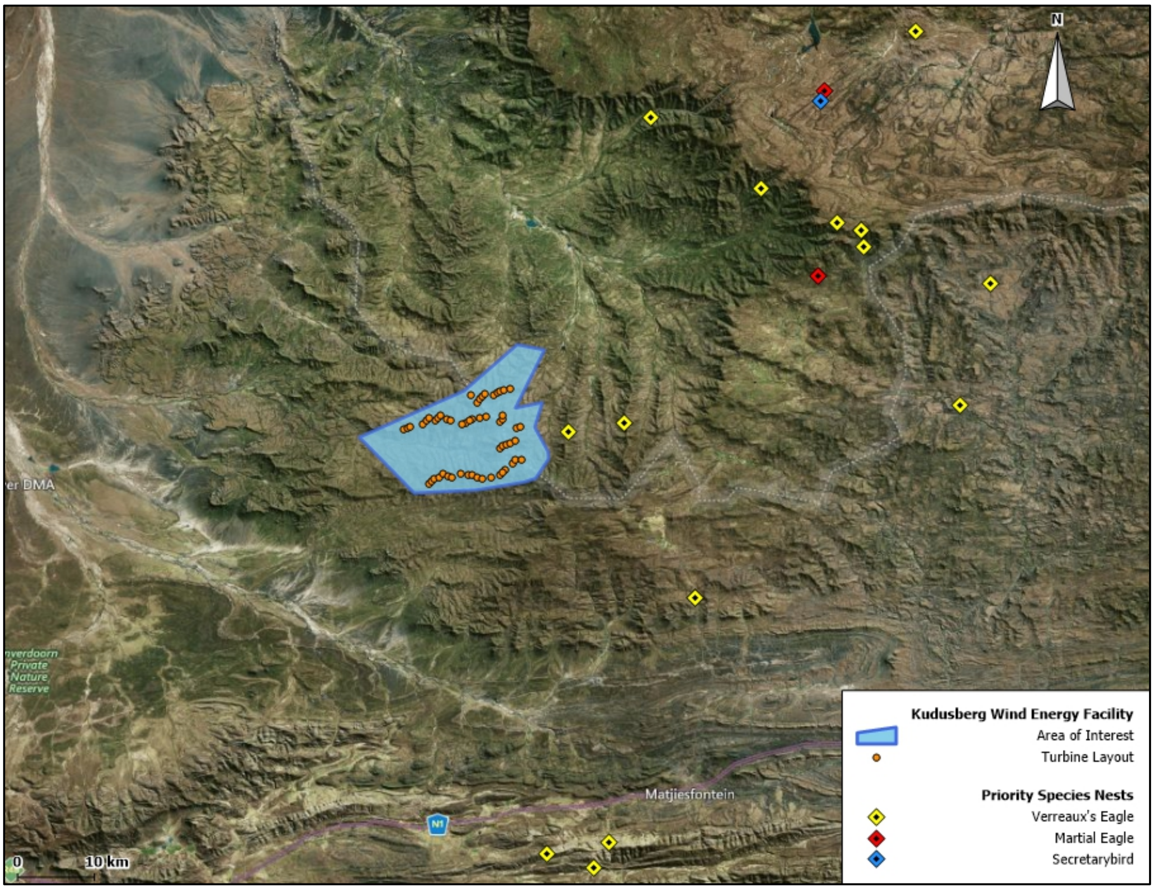

Figure 5 - Priority species nests relative to Kudusberg WEF (based on information from surrounding projects).

1.4 APPLICABLE LEGISLATION AND PERMIT REQUIREMENTS

It is considered best practise for bird monitoring to be undertaken on wind energy facility sites, in order to fulfil the requirements outlined by the "Best- Practice Guidelines for assessing and monitoring the impact of wind-energy facilities on birds in southern Africa" (Jenkins *et al*., 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) (NEMBA) provides for listing threatened or protected ecosystems, in one of four categories: critically endangered (CR), endangered (EN), vulnerable (VU) or protected.

NEMBA 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.

Northern Cape Nature Conservation Act, 2009 (Act No 9 of 2009)

At a Provincial level, birds are protected by Northern Cape Department of Environment and Nature Conservation (DENC) under the National Environmental Management: Biodiversity Act (see above).

In addition, provincially protected and specially protected species are listed in the Northern Cape Nature Conservation Act, 2009 (Act No 9 of 2009).

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, thus 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 of 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 in good quality 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 IDENTIFICATION OF KEY ISSUES

1.5.1 Key Issues Identified

The potential avifaunal issues identified include:

- Habitat Destruction.
- Disturbance and/or Displacement effects.
- Fatalities due to collision with the projects' infrastructures.

To date, no consultation process has been undertaken for this project. However, CSIR will provide all stakeholders with the opportunity to comment on the Draft Basic Assessment Report which will be released for a 30-day commenting period.

1.5.2 Identification of Potential Impacts

Considering the species with potential occurrence at the Kudusberg WEF, the main potential impacts identified during the BA assessment are:

1.5.3 Construction Phase

- Direct Impacts
  - Habitat Loss
  - Disturbance Effects
- Indirect Impacts
  - Displacement to other areas which may or may not have the ability to support the influx of species

1.5.4 Operational Phase

- Direct Impacts
  - Fatalities due to collision with the wind turbines and other project infrastructure
  - Disturbance Effects
- Indirect Impacts
  - Displacement to other areas which may or may not have the ability to support the influx of species
  - Population decline over time

1.5.5 Decommissioning Phase

- Direct Impacts
  - Disturbance Effects
- Indirect Impacts
  - Displacement to other areas which may or may not have the ability to support the influx of species

1.5.6 Cumulative impacts

- Increased Habitat Loss
- Increased fatalities due to collision with wind turbines and other project infrastructure
- Increased disturbance/displacement effects

1.6 ASSESSMENT OF IMPACTS AND IDENTIFICATION OF MANAGEMENT ACTIONS

1.6.1 Main Results of the Field Study

From a total of 131 species potentially occurring in the area (Bioinsight, 2018), 67 bird species were detected within the study area (WEF and surrounding area) across all the survey methodologies implemented through the pre-construction monitoring, including eight species that were not identified to occur at the site during the monitoring campaign. Seventeen of the species identified are considered priority species for the monitoring campaign (Table 1).

Out of the total species identified to potentially occur on site, 6 are of special concern for having an unfavourable conservation status in South Africa: Black Harrier *Circus maurus*, Ludwig's Bustard *Neotis ludwigii*, Martial Eagle *Polemaetus bellicosus* – Endangered; Verreauxs' Eagle *Aquila verreauxii*, Black Stork *Ciconia nigra* – Vulnerable; Greater Flamingo *Phoenicopterus roseus* – Near Threatened (Taylor *et al*., 2015).

Of these six species, 5 were observed within the wind farm boundaries. The Verreaux's Eagle was detected in the summer, winter and spring seasons, with some individuals gliding and perching throughout the area – mostly at the higher altitudes. Black Harrier was observed in the winter and spring seasons. Three of these records were at rotor height and were displaying risky flight behaviours. One Ludwig's Bustard was observed using the area during spring and was observed below the rotor swept zone. Martial Eagle was not observed within the WEF but was picked up inside of the control site on a few occasions. About half of these incidental observations occurred at rotor swept height. Lastly, the Black Stork was seen during winter and spring in the control site. All recorded flights were at rotor height.

A map showing the flight paths of all sensitive species (irrespective of conservation status) is shown in figure 6 below.

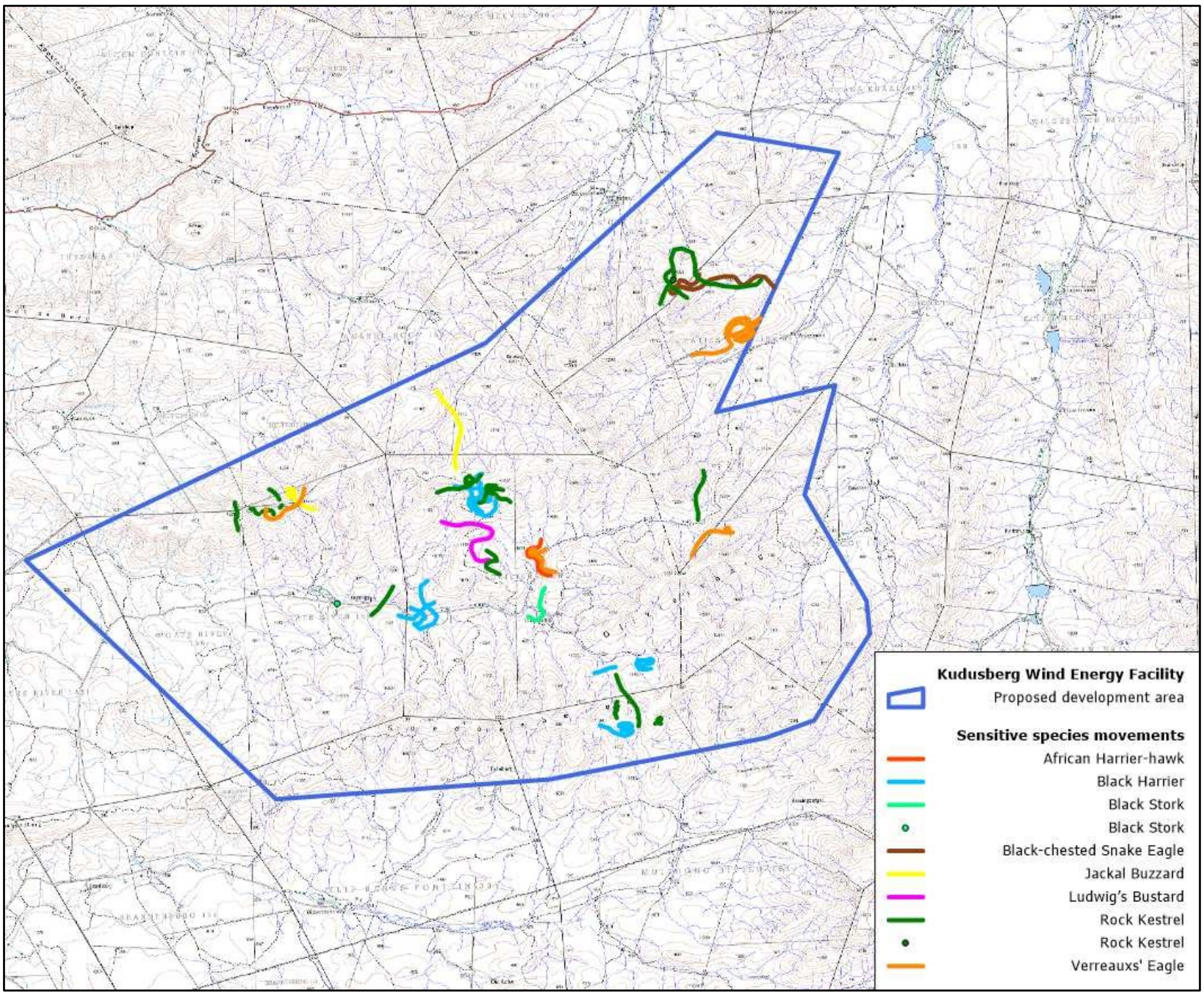

Figure 6 - Observed movements of sensitive species during the pre-construction bird monitoring programme at Kudusberg WEF.

Eleven species detected during field work are considered to be endemic or near endemic to South Africa including sensitive species such as Jackal Buzzard, Karoo Lark, Black Harrier, Large-billed Lark and Cape Clapper Lark.

The bird community in the study area (67 total bird species) is mostly comprised of passerine and small bird species (43% of the total species), followed by bird species associated with waterbodies (28% of the total bird species), Accipitrids (10% of species) and Ciconids (10% of species). Representing a smaller proportion, 7% of the species found in the study area were Bustards, Falcon or Crow species. From the aforementioned groups, the Raptors (Accipitrids), Falcons, Waterbirds and "Ciconids" are considered most likely to suffer impacts caused by wind farms (Retief *et al.*, 2012). Passerines might also be sensitive to impacts and collide with wind turbines, especially those which are known to migrate (AWWI, 2015).

A large portion of the species confirmed in the area were observed in both the proposed wind energy facility site and the surrounding area (33 species – 49% of the total species observed). These species may not be severely impacted by the presence of the wind energy facility as they already use the surrounding area, making it possible for them to therefore have an ability to potentially shift their utilisation area slightly. This includes most of the priority species present at the site (12 out of 17 species), of which 7 are Accipitrids and Falcons species, considered to have a higher vulnerability to collision, especially if using the area of development only (AWWI, 2015).

Nineteen of the remaining species were observed using only the WEF site, with most of them being from the Waterbird, Ciconid and Passerine groups. Of these 19 species, only three are considered sensitive to impacts caused by wind energy facilities.

A similar number of species were detected using only the Control area, with similar group characteristics. Such species are considered to be less likely negatively impacted by the Kudusberg WEF as they do not regularly use the area where the WEF will be constructed. They may however be somewhat affected by the disturbance caused by the temporary construction activities which can have repercussions to the broader study area.

1.6.2 Habitat Loss (Construction Phase)

- Nature: Destruction of natural vegetated areas due to platforms construction, workstation and substation construction, internal access roads construction, and turbines, underground cabling and overhead power lines installation – **negative impacts**.
- Significance of impact without mitigation measures: Relating to habitat loss, it is expected to be of **low** significance as the WEF footprint is not very large.
- Proposed mitigation measures: The minimisation of this impact is mainly achieved in the project design phase through the avoidance of new infrastructure siting (especially wind turbines) in very high (no-go) areas. Additionally, in affected areas, activities of clearance and removal of vegetation should be kept to a minimum. The use of existing access roads should be used to the maximum extent possible. If large portions of very high sensitive areas are affected during the construction phase, then measures should be taken to restore vegetation as soon as possible after construction has completed. The area of intervention should be identified and delimitated prior to the beginning of the work.
- Significance of impact with mitigation measures: In spite of the mitigation measures, impacts cannot be completely prevented from occurring. However, the magnitude and significance of these effects can be minimised to a high degree, with mitigation measures in place. As such, habitat loss is considered to have an impact of very low significance **following mitigation**.

1.6.3 Disturbance Effects (Construction Phase)

- Nature: Disturbance of the bird community due to the increase of people and vehicles in the area – **negative impacts**.
- Significance of impact without mitigation measures: The disturbance due to people and vehicle presence is considered an impact of **low** significance due to the temporary nature and very restricted area of the impact – being that of a local extent.
- Proposed mitigation measures: In order to minimise this impact, certain measures can be taken, such as to avoid or minimise the presence of people and vehicles in the very high (no-go) areas as much as possible. Noise levels should be kept to a minimum as far as possible.
- Significance of impact with mitigation measures: In spite of the mitigation measures, impacts cannot be completely prevented from occurring. However, the magnitude and significance of these effects can be minimised to a high degree, with mitigation measures in place. As such, disturbance effects are considered to have an impact of **very low significance following mitigation.**

1.6.4 Displacement (Construction Phase)

- Nature: Displacement of the bird community due to the increase of disturbances in the area – **negative impacts**.

- Significance of impact without mitigation measures: The displacement of species is considered an impact of **low** significance due to the temporary nature and very restricted area of the impact – being that of a local extent.
- Proposed mitigation measures: In order to minimise this impact, certain measures can be taken, such as to avoid or minimise the presence of people and vehicles in the very high (no-go) areas as much as possible. Noise levels should be kept to a minimum as far as possible.
- Significance of impact with mitigation measures: Despite the mitigation measures, impacts cannot be completely prevented from occurring. However, the magnitude and significance of these effects can be minimised to a high degree, with mitigation measures in place. As such, displacement is considered to have an impact of **very low significance following mitigation**.

1.6.5 Fatalities due to collision (Operational Phase)

- Nature: Fatality of individuals due to collision with turbine blades or associated infrastructure – **negative impacts**.
- Significance of impact without mitigation measures: Considering the potential risk of fatality of birds in the study area, due to the presence of collision-prone species, this impact is considered to have a **moderate** level of significance, with a high probability of occurrence.
- Proposed mitigation measures: The minimisation of fatalities is mainly achieved through planning during the layout definition phase. For example: ***Avoidance of turbine installation in very high sensitive areas for birds, and avoidance of overhead powerlines being built to run perpendicularly to known bird flight paths / migratory routes. These powerlines are however allowed to be built within sensitive buffered locations, as long as they only run parallel to bird flight paths. This is to be further assessed for approval by the avifaunal specialist once the powerline layout becomes available.*** Powerlines should be fitted with bird flight diverters, to allow them to be more visible to bird species. ***All above-ground powerline infrastructure must be signed off as "bird-friendly" by the avifaunal specialist prior to construction.*** Considering the bird movements observed, it is recommended that the turbine minimum height of the rotor swept area is not lower than 40m. Also, a monitoring plan is recommended during the construction and operational phase to improve the understanding of the real impact caused by the WEF on local bird populations, as well as to validate the success of the mitigation measures proposed.
- Significance of impact with mitigation measures: If mitigation measures are successfully implemented, then it is expected that the impact can be lowered to a degree that will have a **low significance with mitigation**.

1.6.6 Disturbance Effects (Operational Phase)

- Nature: Disturbance of bird community due to noise and movement generated by turbines, as well as an increase of people and vehicles in the area during maintenance activities – **negative impacts**.

- Significance of impact without mitigation measures: The disturbance due to operational turbines and people / vehicles in the area is considered to be an impact of **low** significance. Generally, the people/vehicles on site (for maintenance activities) are not expected to cause a significant increased effect with regards to disturbance, as the area already has some movement through the site by local landowners and visitors to a local guesthouse. However, the more relevant disturbance effect would be that which is derived from the newly sited wind turbines. These are structures that the local bird community will not be familiar with, and as such, it is suspected that the significance of the impact would rather be low (instead of very low).

- Proposed mitigation measures: In order to minimise this impact, certain measures can be taken. Lower levels of noise disturbance is recommended whenever possible.
- Significance of impact with mitigation measures: In spite of the mitigation measures, impacts cannot be completely prevented from occurring. However, the magnitude and significance of these effects can be minimised to a high degree, with mitigation measures in place. As such, disturbance effects are considered to have an impact of **very low** significance.

1.6.7 Displacement (Operational Phase)

- Nature: Displacement of the bird community due to the increase of disturbances in the area – **negative impacts**.
- Significance of impact without mitigation measures: The displacement of species due to the disturbance of operating turbines and maintenance activities is considered an impact of **low** significance due to the small footprint of the project, and due to the disturbance likely not being of a significant aggressive nature.
- Proposed mitigation measures: In order to minimise this impact, certain measures can be taken. Lower levels of noise disturbance are recommended whenever possible.
- Significance of impact with mitigation measures: In spite of the mitigation measures, impacts cannot be completely prevented from occurring. However, the magnitude and significance of these effects can be minimised to a high degree, with mitigation measures in place. As such, displacement effects are considered to have a **very low** significance, **when mitigation is implemented.**

1.6.8 Population Decline (Operational Phase)

- Nature: Population decline of the bird community due to long-term increasing fatality events – **negative impacts**.
- Significance of impact without mitigation measures: Long-term population decline due to fatality events is considered an impact of **low** significance, as the collision risk of species is not anticipated to be significantly high. This is mostly due to activity levels and risk flights (recorded on site during the monitoring campaign) being quite low.
- Proposed mitigation measures: To minimise this impact, careful planning should be made in the layout definition phase, where all very high sensitive areas are avoided from wind turbine placement. Caution should also be taken not to disrupt or destroy important bird habitats during the construction phase, particularly in very high sensitive areas. Additionally, it is recommended that a construction and operational phase monitoring programme is conducted to validate the effectiveness of the proposed mitigation measures, and if need be, propose new measures – should the need arise.
- Significance of impact with mitigation measures: Although impacts cannot be completely avoided, the implementation of the aforementioned mitigation measures may reduce the magnitude and significance of these impacts. As such, population decline is considered to have an impact of very low significance, with the implementation of mitigation measures.

1.6.9 Disturbance Effects (Decommissioning Phase)

- Nature: Disturbance of the bird community due to the increase of people and vehicles in the area, while dismantling wind turbines and associated infrastructures – **negative impacts**.
- Significance of impact without mitigation measures: The disturbance due to people and vehicle presence is considered an impact of **low** significance due to the temporary nature and very restricted area of the impact – being that of a local extent.
- Proposed mitigation measures: In order to minimise this impact, certain measures can be taken. Lower levels of noise disturbance are recommended whenever possible.
- Significance of impact with mitigation measures: In spite of the mitigation measures, impacts cannot be completely prevented from occurring. However, the magnitude and significance of these effects can be minimised to a high degree, with mitigation measures in place. As such, disturbance effects are considered to have an impact of **v**ery low significance following mitigation.

1.6.10 Displacement (Decommissioning Phase)

- Nature: Displacement of the bird community due to the increase of disturbances in the area, while dismantling wind turbines and associated infrastructure – **negative impacts**.
- Significance of impact without mitigation measures: The displacement of species is considered an impact of **low** significance due to the temporary nature of the impact, as well as the very restricted area where disturbances will take place. Additionally, after the disturbances have taken place and the project has been decommissioned, the available habitat may increase which could attract species to the area again – ultimately leading to a positive impact.
- Proposed mitigation measures: In order to minimise this impact, certain measures can be taken. Lower levels of noise disturbance are recommended whenever possible.
- Significance of impact with mitigation measures: With mitigation, displacement is not expected to occur at any significant level. As such, the impact is considered to have a **very low significance with mitigation**.

1.6.11 Cumulative Impacts

- Nature: The effects of the Kudusberg WEF, considering other projects, will produce impacts that are likely to impact on the bird communities, on a broader scale – **negative impacts**. Although wind energy facilities' footprints are not that intense, the construction of roads and building platforms can affect relatively large portions of natural vegetation. Also, it is important to consider that other renewable energy facilities which therefore leads to increased destruction of habitats. Such facilities have also been planned and approved in the proximities of the Kudusberg WEF (Figure 5).
- Significance of impact without mitigation measures:
  - Cumulative impacts relating to habitat loss are expected to be of **moderate** significance, as the footprint of the Kudusberg WEF is relatively small. However, when added to other facilities, the footprint may seem relatively larger.

  - Cumulative impacts relating to disturbance effects are expected to be of **moderate** significance, as an increase in human presence and turbine operation across all facilities may disrupt the general pristine environment and habitats of several bird species in the broader region.
  - Cumulative impacts relating to displacement effects are expected to be of **moderate** significance, as the areas required to sustain a higher population size (originating from surrounding renewable energy facilities) may not be able to support it.
  - Cumulative impacts relating to fatalities due to collision are expected to be of **moderate** significance, as wind energy facilities nearby or adjacent to one another are known to increase the likelihood of collision, due to the establishment of a relatively increased risk area.
  - Cumulative impacts relating to population decline are expected to be of **moderate** significance, due to the potential for several facilities to disrupt each of their populations over time, either through direct fatalities, or through disturbance/displacement effects. If this takes place at each facility, then the general population across all facilities may become under threat – ultimately leading to potential local extinctions.

- Proposed mitigation measures: Avoid infrastructure siting, especially turbines, in very high sensitive areas (i.e. no-go areas). Keep all noise disturbance to a minimum, especially near areas that have been defined as being sensitive. The use of existing access routes must be used as far as possible during construction. Considering the likelihood of displaying passerines in the Karoo area, it is recommended that the turbine minimum rotor swept height is not lower than 40m. A monitoring plan is recommended during the construction and operational phase to improve the understanding of the real impact caused by the WEF on local bird populations, as well as to validate the success of the mitigation measures proposed.
- Significance of impact with mitigation measures: Mitigation measures are designed to lower the magnitude and significance of impacts. Assuming mitigation measures at the Kudusberg WEF (and preferably at all facilities) are correctly implemented, it is expected that the cumulative impacts on the general bird community will have a low significance following mitigation.

It is however important to note that the quantification or even evaluation of cumulative impacts is uncertain as there is not a generalised knowledge of large-scale movements or connection between bird populations within the region. If present, cumulative impacts will be reflected by a very rapid decline of bird populations, i.e. above that which is expected from a single wind energy facility operation. Further monitoring and meta-analysis of the results of the monitoring programmes of all operational phase WEF's and PVSEF's will help validate and determine these type of impacts.

No-go Alternative:

Should the Kudusberg Wind Farm not be constructed, then all impacts (whether it be negative or positive) identified within the impact analysis will not take place. As a result, it is expected that the present environmental characteristics relevant for the bird community on site will remain unchanged, relative to that which is being observed at present, under current land-use practices.

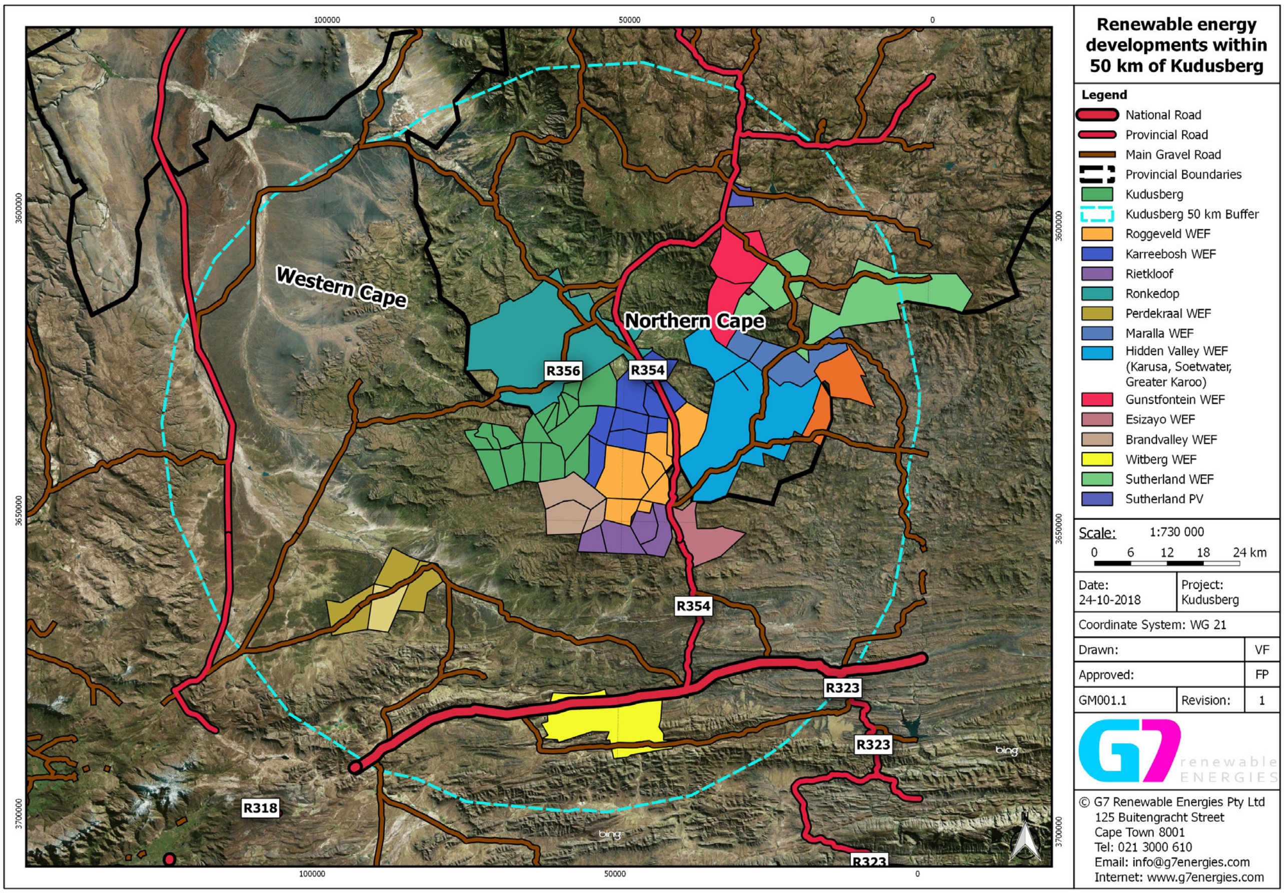

Figure 7 - Onshore Renewable Energy projects currently proposed or approved in the surrounding area of the Kudusberg Wind Energy Facility (according to the REEA most recent available dataset – 2018 2nd Quarter).

1.7 IMPACT ASSESSMENT SUMMARY

The assessment of impacts and recommendations of mitigation measures, as discussed above, are collated in Tables 3 to 6 below.

Table 3 - Impact assessment summary table for the Construction Phase

Impact pathway	Nature of potential impact/risk	Status[1]	Extent[2]	Duration[3]	Conse-quence	Probability	Reversibility of impact	Irreplaceability of receiving environment/ resource	Significance of impact/risk = consequence x probability (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Potential mitigation measures	Significance of residual risk/ impact (after mitigation)	Ranking of impact/ risk	Confidence level
AVIFAUNA															
CONSTRUCTION PHASE															
Direct Impacts															
Habitat loss	Destruction of important habitat areas (natural vegetation & water features etc.) due to the construction of wind turbines and associated infrastructures	Negative	Local	Long-term	Moderate	Very likely	Moderate	Moderate	Low	No	Yes	Avoidance of new infrastructure siting (especially wind turbines) in very high areas. Clearance and removal of vegetation should be kept to a minimum. Vegetation restoration should take place after construction, if significant sensitive areas are affected	Very low	5	High
Disturbance effects	Disturbance of the bird community due to the increase of people and vehicles in the area	Negative	Local	Medium-term	Moderate	Very likely	High	Replaceable	Low	No	Yes	Avoid/minimise the presence of people and vehicles in very high sensitive areas as much as possible. Low levels of noise disturbance are recommended wherever possible. An avifaunal monitoring campaign is recommended for	Very low	5	High

[1] Status: Positive (+) ; Negative (-)
[2] Site; Local (<10 km); Regional (<100); National; International
[3] Very short-term (instantaneous); Short-term (<1yr); Medium-term (1-10 years); Long-term (project duration); Permanent (beyond project decommissioning)

Impact pathway	Nature of potential impact/risk	Status[1]	Extent[2]	Duration[3]	Conse-quence	Probability	Reversibility of impact	Irreplaceability of receiving environment/ resource	Significance of impact/risk = consequence x probability (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Potential mitigation measures	Significance of residual risk/ impact (after mitigation)	Ranking of impact/ risk	Confidence level
												at least one year during the construction phase			
Indirect Impacts															
Displacement effects	Displacement of bird community due to increased disturbances in the area	Negative	Local	Medium-term	Moderate	Unlikely	Moderate	Low	Low	No	Yes	Avoid/minimise the presence of people and vehicles in very high sensitive areas as much as possible. Low levels of noise disturbance are recommended wherever possible	Very low	5	High

Table 4 - Impact assessment summary table for the Operational Phase

Impact pathway	Nature of potential impact/risk	Status	Extent	Duration	Conse-quence	Probability	Reversibility of impact	Irreplaceability of receiving environment/ resource	Significance of impact/risk = consequence x probability (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Potential mitigation measures	Significance of residual risk/ impact (after mitigation)	Ranking of impact/ risk	Confidence level
AVIFAUNA															
OPERATIONAL PHASE															
Direct Impacts															
Fatalities due to collision	Fatalities due to collision with wind turbine blades or associated infrastructures	Negative	Local	Long-term	Substantial	Likely	Non-reversible	High irreplaceability	Moderate	No	Yes	Avoid turbine placement in no-go areas. ***Overhead powerlines must be fitted with bird flight diverters and may not run perpendicularly to any known bird flight paths. All above-ground powerline infrastructure must be signed off as "bird-friendly" by the avifaunal specialist, prior to construction.*** Lower blade tip should not be lower than 40m. A monitoring programme (including carcass searches and bias/scavenger trials) is recommended for a minimum of two years during the	Low	4	High

Impact pathway	Nature of potential impact/risk	Status	Extent	Duration	Conse-quence	Probability	Reversibility of impact	Irreplaceability of receiving environment/ resource	Significance of impact/risk = consequence x probability (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Potential mitigation measures	Significance of residual risk/ impact (after mitigation)	Ranking of impact/ risk	Confidence level
												operational phase			
Disturbance effects	Disturbance of bird community due to noise and movement generated by turbines and people/vehicles operating in the area	Negative	Local	Long-term	Moderate	Very likely	High	Replaceable	Low	No	Yes	Lower the noise levels as far as possible.	Very low	5	High
Indirect Impacts															
Displacement effects	Displacement of bird species due to increased disturbances	Negative	Local	Long-term	Moderate	Unlikely	Moderate	Low	Low	No	Yes	Lower the noise levels as far as possible.	Very low	5	High
Population decline	Population decline due to long-term increasing fatality events	Negative	Local	Long-term	Severe	Very unlikely	Low	High irreplaceability	Low	No	Yes	Avoid turbine placement in very high sensitive areas. Bird habitats should not be severely destroyed, particularly in sensitive areas.	Very low	5	High

Table 5 - Impact assessment summary table for the Decommissioning Phase

Impact pathway	Nature of potential impact/risk	Status[4]	Extent[5]	Duration[6]	Conse-quence	Probability	Reversibility of impact	Irreplaceability of receiving environment/ resource	Significance of impact/risk = consequence x probability (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Potential mitigation measures	Significance of residual risk/ impact (after mitigation)	Ranking of impact/ risk	Confidence level
AVIFAUNA															
DECOMMISSIONING PHASE															
Direct Impacts															
Disturbance effects	Disturbance of bird community due to the increase of people and vehicles in the area, when dismantling wind turbines and associated infrastructures	Negative	Local	Short-term	Moderate	Very likely	High	Replaceable	Low	No	Yes	Lower the noise levels as far as possible.	Very low	5	High
Indirect Impacts															
Displacement effects	Displacement of bird community due to the increase in disturbances in the area, while dismantling wind turbines and associated infrastructures	Negative	Local	Medium-term	Moderate	Unlikely	Moderate	Low	Low	No	Yes	Lower the noise levels as far as possible.	Very low	5	High

[4] Status: Positive (+) ; Negative (-)
[5] Site; Local (<10 km); Regional (<100); National; International
[6] Very short-term (instantaneous); Short-term (<1yr); Medium-term (1-10 years); Long-term (project duration); Permanent (beyond project decommissioning)

Table 6 - Cumulative impact assessment summary table

Impact pathway	Nature of potential impact/risk	Status	Extent	Duration	Conse-quence	Probability	Reversibility of impact	Irreplaceability of receiving environment/ resource	Significance of impact/risk = consequence x probability (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Potential mitigation measures	Significance of residual risk/ impact (after mitigation)	Ranking of impact/ risk	Confidence level
AVIFAUNA															
CUMULATIVE IMPACTS															
Habitat loss	Destruction of important habitat areas (natural vegetation & water features etc.) at multiple renewable energy facilities	Negative	Regional	Long-term	Substantial	Unlikely	Moderate	Moderate	Moderate	No	Yes	Avoid placement of infrastructures (especially wind turbines) in very high sensitive areas. Use existing roads as far as possible. If large portions of sensitive areas are affected, then vegetation restoration should take place.	Low	4	Medium
Disturbance effects	Disturbance of bird community due to the increase of wind turbine infrastructures, people and vehicles at multiple renewable energy facilities	Negative	Regional	Long-term	Substantial	Likely	High	Replaceable	Moderate	No	Yes	Lower the noise levels as far as possible.	Low	4	Medium
Displacement effects	Displacement of bird communities due to the increase in disturbances at multiple renewable energy facilities	Negative	Regional	Long-term	Substantial	Unlikely	Moderate	Low	Moderate	No	Yes	Lower the noise levels as far as possible.	Low	4	Medium
Fatalities due to collision	Fatalities as a result of increased collisions with wind	Negative	Regional	Long-term	Substantial	Likely	Non-reversible	High irreplaceability	Moderate	No	Yes	Avoid placement of infrastructures (especially wind	Low	4	Medium

Impact pathway	Nature of potential impact/risk	Status	Extent	Duration	Conse-quence	Probability	Reversibility of impact	Irreplaceability of receiving environment/ resource	Significance of impact/risk = consequence x probability (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Potential mitigation measures	Significance of residual risk/ impact (after mitigation)	Ranking of impact/ risk	Confidence level
	turbine blades at multiple renewable energy facilities											turbines) in very high sensitive areas. Lower blade tip of turbines should not be lower than 40m.			
Population decline	Decline in the broader population of avifauna due to long-term fatality events at multiple renewable energy facilities	Negative	Regional	Permanent	Substantial	Unlikely	Low	High irreplaceability	Moderate	No	Yes	Avoid turbine placement in very high sensitive areas. Bird habitats should not be severely destroyed, particularly in sensitive areas.	Low	4	Medium

1.8 INPUT INTO THE ENVIRONMENTAL MANAGEMENT PROGRAMME

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
A. DESIGN PHASE					
A.1. AVIFAUNA IMPACTS					
Potential impacts on avifauna (as a result of the proposed Kudusberg WEF and associated infrastructures) in future project phases, such as loss of habitat, fatality due to collision, disturbance, displacement and population decline.	Avoid or minimise the impacts on the avifauna present on site.	▪ Ensure that the design of the WEF takes the sensitivity mapping of the avifauna specialist into account to avoid and/or reduce the impacts on Species and habitats of Conservation Concern. ▪ Regarding the above, minimise the footprint of the construction to an acceptable level, as defined by the avifaunal specialist. ▪ Use existing road networks as far as possible.	▪ Ensure that the design of the WEF takes the sensitivity mapping of the avifauna specialist into account to avoid and reduce impacts of avifauna species and important features.	▪ During design cycle and before construction commences.	▪ Holder of the EA.

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
B. CONSTRUCTION PHASE					
B.1 AVIFAUNA IMPACTS					
Habitat loss	Reduce the extent of habitat destruction caused by the clearings for the working areas, to only the extent required.	▪ An ECO should be appointed to oversee that the EMP is being adhered to. ▪ ECO Training & Education of bird and energy related impacts. ▪ Clearance and removal of natural vegetation should be kept to a minimum. ▪ Provide sufficient drainage along access roads to prevent erosion and pollution of adjacent watercourses or wetlands. No chemical spills or any other material dumps should be allowed within the WEF implementation area, with special focus on areas nearby riparian vegetation or drainage lines. ▪ No off-road driving.	▪ Monitor the efficiency of the EMP and revise, if necessary. Also monitor whether proposed measures are being adhered to or not. ▪ The ECO should be trained to identify priority bird species, as well as their breeding habits/locations. ▪ The ECO should monitor the removal of natural vegetation. If significant portions of natural vegetation are removed in very high sensitive areas, then an appropriate rehabilitation specialist should be consulted for further actions. ▪ The ECO should monitor	▪ EMP efficiency monitoring during the construction phase. ▪ Training of ECO to be conducted shortly before construction commences. ▪ Natural vegetation removal monitoring during the construction phase. ▪ Erosion and pollution monitoring during the construction phase. ▪ Monitoring of potential off-road driving to occur during	▪ Holder of the EA to appoint ECO. ▪ Avifaunal specialist to conduct training of ECO, if ECO is not educated and trained already. ▪ ECO. ▪ ECO. ▪ ECO.

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
			and prevent any erosion and pollution (chemical spills etc.) within the WEF boundaries, particularly when associated with water features such as drainage lines, riparian vegetation and water bodies / wetlands. ▪ Driving should, at all times, remain on existing or newly constructed roads. This should be strictly monitored so that habitat destruction does not occur.	construction phase.	
Disturbance effects	Avoid disturbance of bird community due to the increase of people and vehicles in the area.	▪ Implement construction phase avifaunal monitoring. ▪ An ECO should be appointed to oversee that the EMP is being adhered to. ▪ ECO Training & Education of bird and energy related impacts. ▪ Minimise on-site disturbances.	▪ Appoint an avifaunal specialist to undertake a construction phase monitoring programme (minimum 1-year) to assess the disturbances occurring on site, as well as the success of the mitigation measures. To be conducted in accordance with the relevant Best Practice	▪ Appointment of specialist shortly before construction commences. ▪ Appointment of ECO shortly before construction commences. ▪ Training of ECO shortly before	▪ Holder of the EA to appoint avifaunal specialist. ▪ Holder of the EA to appoint avifaunal specialist. ▪ Avifaunal specialist to provide training

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
			Guidelines. ▪ Monitor the efficiency of the EMP and revise, if necessary. Also monitor whether proposed measures are being adhered to or not. ▪ The ECO should be trained to identify priority bird species, as well as their breeding habits/locations. ▪ Reduce noise levels as far as possible.	construction commences. ▪ Minimise disturbances throughout the construction phase.	to ECO, if not trained and educated already. ▪ Construction staff to adhere. ECO to oversee.
Displacement effects	Minimise displacement effects of the bird community due to on-site disturbances.	▪ Minimise on-site disturbances.	▪ Reduce noise levels as far as possible.	▪ During the construction phase.	▪ Construction staff to adhere. ECO to oversee.
Fatalities due to collision	Prevent mortality of sensitive bird species due to collision with wind turbines and associated infrastructures.	▪ Fit bird flight diverters to overhead powerlines and weather mast guyed wires. The spacing of devices should be not more than 5-10 m apart. ▪ ***<u>Powerlines should cross very high sensitive areas as little as possible, but should mainly aim to not be orientated perpendicularly to known bird flight paths.</u>***	▪ Attach bird flight diverters to overhead powerlines and weather mast guyed wires, to increase the visibility of these structures to low flying birds. ▪ ***<u>Powerlines should never</u>***	▪ During the construction phase. ▪ During the construction phase. ▪ During the construction	▪ Holder of the EA to ensure this is installed. Construction staff to implement. ECO to oversee. ▪ Holder of the EA to organise.

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
		▪ Lowest tip of turbines blades should not be lower than 40m. ▪ ***All overhead powerlines must be signed off as "bird-friendly" by an avifaunal specialist prior to construction.***	***run perpendicularly to known flight paths. They should only be orientated parallel to these flight paths – to avoid an increased risk of collision.*** ▪ To prevent collisions of small passerine species and low-flying birds, the lowest blade tip should not be lower than 40m. ▪ ***To ascertain that the overhead powerlines are relatively safe for the bird community, they should be signed off as being "bird-friendly" by the avifaunal specialist, prior to construction.***	phase.	Construction staff to implement. ECO to oversee. ▪ Holder of the EA to organise. Construction staff to implement. ECO to oversee.

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
C. OPERATIONAL PHASE					
C.1 AVIFAUNA IMPACTS					
Fatalities due to collision	Prevent mortality of sensitive bird species due to collision with wind turbines and associated infrastructures.	▪ Implement an operational phase avifaunal monitoring programme, in full compliance with the relevant Best Practice Guidelines, considering the following aspects: ○ During the first two years of the projects' operational phase: ▪ Monitoring campaign mirroring as a minimum, that conducted by Bioinsight during the pre-construction phase. ▪ Carcass searches, searcher efficiency trials and scavenger removal trials. ○ In the fifth year of the operational phase, and every five years thereafter (for the entire lifespan of the project): ▪ Carcass searches, searcher efficiency trials and scavenger removal trials. ▪ Necessity for a monitoring campaign (or parts thereof) to be reviewed after	▪ Implement an avifaunal monitoring programme in line with the most recent version of the Best Practice Guidelines that will be available at the time. ▪ Further operational mitigation measures to be researched during the operational monitoring campaign as an adaptive management approach. If significant levels of fatalities are observed in the opinion of the avifauna specialist, then these measures should be implemented. Such measures could include (***<u>but not limited to</u>***) shut-down	▪ During the first two years of the projects' operational phase. Then in the fifth year, and every five years thereafter. ▪ During the operational phase of the project.	▪ Avifaunal specialist. ▪ Avifaunal specialist for monitoring. Holder of the EA for implementation.

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
		completion of the second operational monitoring year, and then again after the fifth year, and every five years thereafter. ▪ Further operational mitigation measures to be researched during the operational monitoring campaign.	on demand technology, habitat management, or bird deterrence systems. ***Regardless, according to IFC (2012) and BBOP (2012), if mitigation strategies are required, then all stakeholders (including, but not limited to: Birdlife South Africa, DEA, developer, landowners etc.) are to be consulted accordingly, in order to make decisions on thresholds and the types of mitigation measures. Additionally, as soon as these issues are identified, the mitigation strategies should be written into the EMPr for the developer to comply with, irrespective of***		

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
			cost.		
Disturbance effects	Avoid disturbance of bird community due to the increase of people and vehicles in the area.	▪ Minimise general on-site disturbances. ▪ No off-road driving. ▪ Implement speed limits.	▪ Reduce noise levels as far as possible. ▪ Driving should, at all times, remain on existing roads. ▪ Speed limits should be implemented for driving, and should not exceed 40km/h.	▪ Minimise disturbances throughout the operational phase. ▪ No off-road driving throughout the operational phase. ▪ Speed limits to be implemented throughout the operational phase.	▪ All on-site personnel. ▪ All on-site personnel. ▪ All on-site personnel, and monitored by the facility manager.
Displacement effects	Minimise displacement effects of the bird community due to on-site disturbances.	▪ Minimise on-site disturbances.	▪ Reduce noise levels as far as possible.	▪ During the operational phase.	▪ Operational staff to adhere. Facility Manger to oversee.
Population Decline	Reduce the risk of population decline within the area.	▪ Implement an operational monitoring programme with carcass searches, searcher efficiency trials and scavenger removal trials, to gain a better understanding of real impacts occurring on the avifaunal community. ▪ Further operational mitigation measures to be researched during the operational monitoring	▪ Conduct a monitoring campaign (with carcass searches, searcher efficiency trials and scavenger removal trials) during the first two years of the projects' operational	▪ During the first two years of the projects' operational phase. Then in the fifth year, and every five years thereafter.	▪ Avifaunal Specialist. ▪ Avifaunal specialist for monitoring. Holder of the EA for

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
		campaign.	phase. Then again in the fifth year, and every five years thereafter. It is only necessary to conduct the relevant carcass searches and trials after the completion of the second operational year. Further monitoring can, however, be recommended during later stages – if deemed relevant by the avifaunal specialist. ▪ Further operational mitigation measures to be researched during the operational monitoring campaign as an adaptive management approach. If significant levels of fatalities are observed in the opinion of the avifauna specialist, then these measures should be	▪ During the operational phase.	implementation.

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
			implemented. Such measures could include shut-down on demand technology, habitat management, or bird deterrence systems.		

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
D. DECOMMISSIONING PHASE					
D.1 AVIFAUNA IMPACTS					
Disturbance effects	Avoid disturbance of bird community due to the increase of people and vehicles in the area.	▪ Minimise on-site disturbances.	▪ Minimise the presence of people and vehicles in very high sensitive areas, and reduce noise levels as far as possible.	▪ Minimise disturbances throughout the decommissioning phase.	▪ All on-site personnel.
Displacement effects	Minimise displacement effects of the bird community due to on-site disturbances.	▪ Minimise on-site disturbances.	▪ Minimise the presence of people and vehicles in very high sensitive areas, and reduce noise levels as far as possible.	▪ Minimise disturbances throughout the decommissioning phase.	▪ All on-site personnel.

1.9 CONCLUSION AND RECOMMENDATIONS

This report details the findings of the 12-month bird pre-construction monitoring programme conducted at the proposed Kudusberg WEF site, and how such findings inform the requirements needed for the construction and implementation of the proposed development. The pre-construction bird monitoring programme methodology implemented covered all four seasons for the bird community on the site, as recommended by the *Best practice guidelines for avian monitoring and impact mitigation at proposed wind energy development sites in southern Africa* (Jenkins *et al*., 2015), therefore providing a solid baseline for the establishment of the future assessments.

Site visits confirmed the occurrence of a relatively high abundance of Accipitrid and Falcon species. The results have shown that both groups have a constant presence at the site throughout the year and spend a high proportion of their time and/or number of contacts at rotor height in comparison with the other groups of species. It is also important to note that their activity was largely associated with the hillside and escarpment areas, where most of the potential collision risk movements (flight at potential rotor height depending on the turbine specifications) were observed. A total of eight species confirmed on site may be of special concern for having an unfavourable conservation status in South Africa: Black Harrier *Circus maurus*, Ludwig's Bustard *Neotis ludwigii*, Martial Eagle *Polemaetus bellicosus* – Endangered; Black Stork *Ciconia nigra*, Verreauxs' Eagle *Aquila verreauxii* – Vulnerable; Karoo Korhaan *Eupodotis vigorsii*, Maccoa Duck *Oxyura maccoa*, Greater Flamingo *Phoenicopterus roseus* – Near Threatened (Taylor *et al*., 2015).

Sensitive areas identified at the proposed site considered the relevant aspects collected through the bird monitoring programme, including: relevant activity of sensitive species and associated potential for collision recorded in areas of hillsides and escarpments; particular association of passerine species and other relevant sensitive species to riverine thickets and water features; association of red-listed species with their potential breeding/roosting locations. This allowed for establishing avoidance areas (areas with very high sensitivity for birds).

Kudusberg WEF **is considered to be located in an area of medium sensitivity with some habitat features of very high sensitivity in terms of the bird community** present. It is considered that the impacts can be minimised to the maximum extent possible, mostly through the **avoidance of very high sensitive areas, and through mitigation measures within areas of moderate sensitivity**.

<u>**Presently, the potential impacts to birds is not anticipated to be of a high significance, provided that the aforementioned avoidance/mitigation measures are followed. As such, no fatal flaws were identified for this project, and the project may be authorised from a birds perspective, subject to the proposed mitigation measures listed below are being implemented.**</u>

The following recommendations are proposed to reduce/mitigate the potential negative impacts that the Kudusberg WEF may have on the local bird community:

<u>Project Design Phase</u>

- Ensure that the design of the WEF takes the sensitivity mapping of the avifauna specialist into account to avoid and/or reduce the impacts on Species and habitats of Conservation Concern.
- Plan to minimise the footprint of the construction to an acceptable level, as defined by the avifaunal specialist.

- Plan to use existing road networks, as far as possible.

Construction Phase

- Appoint an avifaunal specialist to conduct construction phase monitoring at the facility (and in a surrounding control area), for a minimum period of 1 year – to improve the understanding of the real impact caused by the WEF on local bird populations, as well as validate the success of mitigation strategies proposed.
- Appoint an ECO to oversee that the EMPr is being adhered to, and to be aware of bird sensitive species occurring in the area (including potential nests) – so that he/she can report any significant findings to the avifaunal specialist.
- Clearance and removal of natural vegetation should be kept to a minimum.
- Provide sufficient drainage along access roads to prevent erosion and pollution of adjacent watercourses or wetlands.
- No chemical spills or any other material dumps should be allowed within the WEF implementation area, with special focus on areas that are situated nearby riparian vegetation or drainage lines.
- No off-road driving is allowed, apart from when new roads are being constructed.
- Reduce noise levels as far as possible.
- Fit bird flight diverters to overhead powerlines and weather mast guyed wires to increase the visibility of these structures to low flying birds.
- ***Powerlines should try and avoid being sited in very highly sensitive areas, whenever possible. However, it will be more important that the orientation of the powerlines do not intercept any known bird flight paths / migratory routes at a perpendicular angle. Instead, to reduce the risk of collision, the orientation should rather be parallel to these flight paths. This should be further assessed for approval by the avifaunal specialist as soon as the powerline layout becomes available (to be subject of a separate basic assessment report).***
- ***All above-ground powerlines must be signed off as being “bird-friendly” by an avifaunal specialist, prior to construction.***
- To prevent collisions of small passerine species and low-flying birds, the lowest blade tip should not be lower than 40m.

Operational Phase

Implement an operational phase avifaunal monitoring programme, in full compliance with the most recent/relevant Best Practice Guidelines that will be available at the time, to improve the understanding of the real impact caused by the WEF on local bird populations, as well as to validate the success of mitigation strategies proposed. This should include a programme that mirrors (as a minimum) the pre-construction monitoring programme, but should also include carcass searches, searcher efficiency trials and scavenger removal trials. This programme should run for the first two years of the projects’ operational phase. Thereafter, only the carcass searches, searcher efficiency trials and scavenger removal trials should be conducted during the projects’ fifth operational year, and every five years thereafter (for the entire duration of the projects' life-span). The inclusion of a monitoring programme (similar to that of the pre-construction phase) can however be recommended by the relevant avifaunal specialist, should the requirement be identified at the end of the second operational monitoring year.

Further operational mitigation measures are to be researched during the operational monitoring campaign as an adaptive management approach. If significant levels of fatalities are observed in the opinion of the avifauna specialist, then these measures should be implemented. Such measures could include (but not limited to) the use of shut-down on demand technology, habitat management, or bird deterrence systems. ***All potential thresholds and mitigation strategies should always be consulted with all stakeholders including (but not limited to) Birdlife South Africa, Department of Environmental Affairs, Developer, and Landowners etc. These stakeholders should come up with appropriate strategies that are to be written into the EMPr immediately and strictly followed by the project developer, irrespective of the costs involved.***

Reduce noise levels as far as possible.

Driving should, at all times, remain on existing roads.

A speed limit of 40km/h should always be adhered to within the facility.

Decommissioning Phase

Minimise the presence of people and vehicles (e.g. decommissioning staff) in very high sensitive areas, and reduce noise levels as far as possible.

Alternative/Updated Layouts

Regarding the available layout options that were provided for consideration in this Basic Assessment Report, it can be confirmed that all updated layouts, as well as the preferred options and all of their alternatives were thoroughly analysed to further inform the broader environmental authorisation process. The alternatives considered included:

- Access Roads: two alternatives to connect the public MN004469 road to the new wind farm road network between the turbines on the ridges. One of these roads is the western route (alternative 1) of approximately 4.6 km in length. The other is an eastern route (alternative 2) and is approximately 5.7 km in length.
- Construction Camps: three alternatives (including batching plants), of which one is located between turbines 43 and 47 (alternative 1), while another is located adjacent to the east of the MN4469 public road (south of construction camp 3) (alternative 2), and another also being located adjacent to the east of the MN4469 public road (but north of construction camp 2) (alternative 3).
- Substations: three alternatives (33/132kV), of which alternative 1 is located south of turbine 38 and north of turbine 39. Alternative 2 is located south of turbine 42 and north of turbine 33. Alternative 3 is located southeast of turbine 44.

After analysing all the above alternatives, it was found that all proposed layout options are deemed acceptable for development. It is subsequently our professional opinion that the project may proceed accordingly. It is however also important to note that this conclusion was drawn up with the information made available at the time of report compilation. Should any new layout alterations be proposed (differing from that which was previously analysed) in the interim, then it will be necessary for these changes to be re-assessed by the specialist prior to submission.

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APPENDICES

Appendix I - Figures

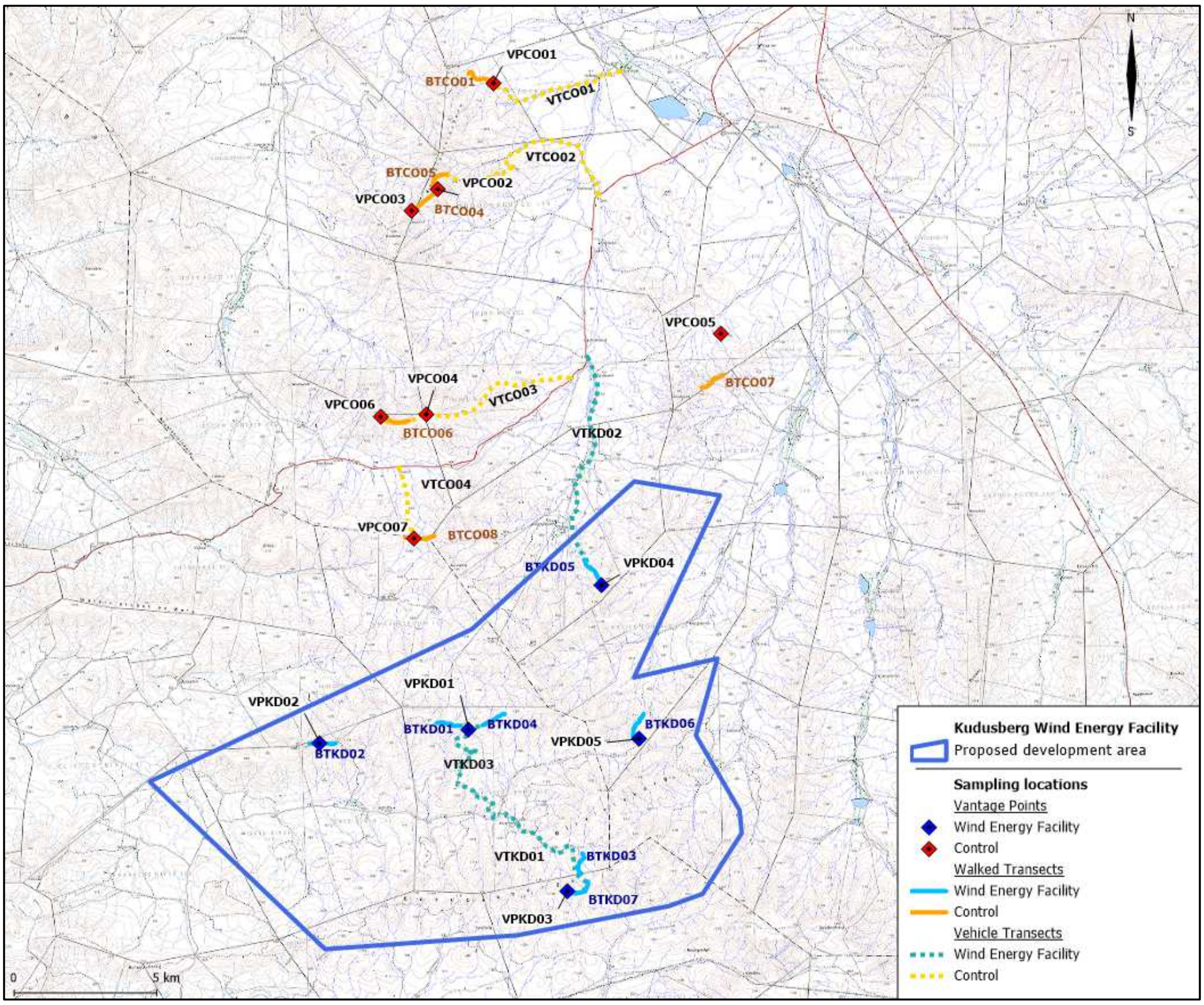

Figure 8 - Sampling locations at Kudusberg WEF during the pre-construction bird monitoring programme.

Appendix II

DEA REFERENCE NUMBER	EIA PROCESS	APPLICANT	PROJECT TITLE	EAP	TECHNOLOGY	MEGAWATT	STATUS
WIND PROJECTS							
14/12/16/3/3/2/967	Scoping and EIA	Biotherm Energy (Pty) Ltd	Proposed 140 MW Esizayo Wind Energy Facility and its associated infrastructure near Laingsburg within the Laingsburg Local Municipality in the Western Cape	WSP/Parsons Brinckerhoff	Wind	140 MW	Approved
East -14/12/16/3/3/2/962 West- 14/12/16/3/3/2/693	Scoping and EIA	Biotherm Energy (Pty) Ltd	East: Proposed 140 MW Maralla West Wind Energy Facility on the remainder of the farm Welgemoed 268, the remainder of the farm Schalkwykskraal 204 and the remainder of the farm Drie Roode Heuvels 180 north of the town of Laingsburg within the Laingsburg and Karoo Hoodland Local Municipalities in the Western and Northern Cape Provinces	WSP/Parsons Brinckerhoff	Wind	140 MW	Approved

DEA REFERENCE NUMBER	EIA PROCESS	APPLICANT	PROJECT TITLE	EAP	TECHNOLOGY	MEGAWATT	STATUS
			West: Proposed 140 MW Maralla West Wind Energy Facility on the remainder of the Farm Drie Roode Heuvels 180, the remainder of the farm Annex Drie Roode Heuvels 181, portion 1 of the farm Wolven Hoek 182 and portion 2 of the farm Wolven Hoek 182 north of the town of Laingsburg within the Karoo Hoodland Local Municipality in the Northern Cape Province				
12/12/20/1966/AM5	Amendment	Witberg Wind Power (Pty) Ltd	Proposed establishment of the Witberg Wind Energy Facility, Laingsburg Local Municipality, Western Cape Province	Environmental Resource Management (Pty) Ltd / Savannah Environmental Consultants (Pty) Ltd	Wind	140 MW	Approved
12/12/20/1783/2/AM1	Scoping and EIA	South Africa Mainstream Renewable Power Perdekraal West (Pty) Ltd	Proposed development of a Renewable Energy Facility (Wind) at the Perdekraal Site 2, Western Cape Province	Environmental Resource Management (Pty) Ltd	Wind	110 MW	Under construction
12/12/20/1783/1	Scoping and EIA	South Africa Mainstream Renewable Power Perdekraal East (Pty) Ltd	Proposed development of a Renewable Energy Facility (Wind) at the Perdekraal Site 2, Western Cape Province	Savannah Environmental Consultants (Pty) Ltd	Wind	150 MW	Approved
14/12/16/3/3/2/899	Scoping and EIA	Rietkloof Wind Farm (Pty) Ltd	Proposed Rietkloof Wind Energy (36 MW) Facility within the Laingsburg	EOH Coastal & Environmental Services	Wind	36 MW	Approved

DEA REFERENCE NUMBER	EIA PROCESS	APPLICANT	PROJECT TITLE	EAP	TECHNOLOGY	MEGAWATT	STATUS
			Local Municipality in the Western Cape Province				
TBC	BA		Proposed Rietkloof Wind Energy Facility, Western Cape, South Africa	WSP	Wind	140 MW	In progress
14/12/16/3/3/2/826	Scoping and EIA	Gunstfontein Wind Farm (Pty) Ltd	Proposed 200 MW Gunstfontein Wind Energy Facility on the Remainder of Farm Gunstfontein 131 south of the town of Sutherland within the Karoo Hooglands Local Municipality in the Northern Cape Province, south of Sutherland.	Savannah Environmental Consultants (Pty) Ltd	Wind	200 W	Approved
12/12/20/1782/AM2	Scoping and EIA	Mainstream Power Sutherland	Proposed development of 140 MW Sutherland Wind Energy Facility, Sutherland, Northern and Western Cape Provinces	CSIR	Wind	140 MW	Approved
Karusa - 12/12/20/2370/1 Soetwater -12/12/20/2370/2	Scoping and EIA	African Clean Energy Developments Renewables Hidden Valley (Pty) Ltd	Proposed Hidden Valley Wind Energy Facility on a site south of Sutherland, Northern Cape Provinces (Karusa & Soetwater)	Savannah Environmental Consultants (Pty) Ltd	Wind	140 MW each	Preferred bidders. Construction to commence in 2019
12/12/20/2370/3	Scoping and EIA	African Clean Energy Developments Renewables Hidden Valley (Pty) Ltd	Proposed Hidden Valley Wind Energy Facility on a site south of Sutherland, Northern Cape Provinces (Greater Karoo))	Savannah Environmental Consultants (Pty) Ltd	Wind	140 MW	Approved
West -14/12/16/3/3/2/856 East - 14/12/16/3/3/2/857	Scoping and EIA	Komsberg Wind Farm (Pty) Ltd	Proposed 275 MW Komsberg West Wind Energy Facility near Sutherland within the Northern and Western Cape Provinces	Savannah Environmental Consultants (Pty) Ltd	Wind	140 MW each	Approved

DEA REFERENCE NUMBER	EIA PROCESS	APPLICANT	PROJECT TITLE	EAP	TECHNOLOGY	MEGAWATT	STATUS
			Proposed 275 MW Komsberg East Wind Energy Facility near Sutherland within the Northern and Western Cape Provinces				
12/12/20/1988/1/AM1	Amendment	Roggeveld Wind Power (Pty) Ltd	Proposed Construction of the 140 MW Roggeveld Wind Farm within the Karoo Hoogland Local Municipality and the Laingsburg Local Municipality in the Western and Northern Cape Provinces	Savannah Environmental Consultants (Pty) Ltd	Wind	140 MW	Preferred bidders. Construction to commence in 2019.
14/12/16/3/3/2/807/AM1	Scoping and EIA Amendment	Karreebosch Wind Farm (Pty) Ltd	Proposed Karreebosch Wind Farm (Roggeveld Phase 2) and its associated infrastructure within the Karoo Hoogland and Laingsburg Local Municipalities in the Northern and Western Cape Provinces	Savannah Environmental Consultants (Pty) Ltd	Wind	140 MW	Approved
14/12/16/3/3/2/900	Scoping and EIA	Brandvalley Wind Farm (Pty) Ltd	Proposed 147 MW Brandvalley Wind Energy Facility North of the Town of Matjiesfontein within the Karoo Hoogland, Witzenberg and Laingsburg Local Municipalities in the Northern and Western Cape Provinces	EOH Coastal & Environmental Services	Wind	140 MW	Approved
TBA	Scoping and EIA	Rondekop Wind Farm (Pty) Ltd	Proposed establishment of the Rondekop WEF, south-west of Sutherland	SiVEST SA (Pty) Ltd	Wind	325 MW	In process

DEA REFERENCE NUMBER	EIA PROCESS	APPLICANT	PROJECT TITLE	EAP	TECHNOLOGY	MEGAWATT	STATUS
			in the Northern Cape				
West 14/12/16/3/3/2/856 East 14/12/16/3/3/2/857	Scoping and EIA	Komsberg Wind Farms (Pty) Ltd	Komsberg East and West WEF	Arcus Consulting Services (pty) Ltd	Wind	140 MW each	
TBC	BA	ENERTRAG SA (Pty) Ltd	Proposed Development of the Tooverberg Wind Energy Facility and the associated grid connection near Touws River, Wester Cape Province)	SiVEST SA (Pty) Ltd	Wind	140 MW	In process
SOLAR PROJECTS							
12/12/20/2235	BA	Inca Sutherland Solar (Pty) Ltd	Proposed Photovoltaic (PV) Solar Energy Facility on A Site South Of Sutherland, Within The Karoo Hoogland Municipality Of The Namakwa District Municipality, Northern Cape Province	CSIR	Solar	10 MW	Approved

Bird Pre-construction Monitoring Report

bioinsight
SOUTH AFRICA

Prepared for:

Kudusberg Wind Farm (Pty) Ltd

Kudusberg Wind Energy Facility

Bird Pre-construction Monitoring

Pre-construction phase (2015/2016)

Final bird pre-construction monitoring report

July 2018

LOOKING DEEP INTO NATURE

www.bioinsight.co.za

Executive summary

Kudusberg Wind Energy Facility (WEF) is a proposed 140MW wind farm development planned at approximately 50km southwest of Sutherland, on the border between the Western and Northern Cape Provinces. Bioinsight (Pty) Ltd was appointed to undertake and finalise the bird pre-construction monitoring programme in accordance with the best practice pre-construction monitoring guidelines.

The study area is characterised by accentuated mountainous areas with vegetation adapted to the semi-arid conditions and harsh rocky conditions. Currently, the area where Kudusberg WEF is proposed shows no signs of intense disturbance (e.g. farm houses). The area is very difficult human access and therefore in almost pristine natural conditions apart from the severe impacts on the veld caused by the three year period of drought and grazing.

During the 12 months of pre-construction bird monitoring at the site, several methodologies were implemented to study the local bird communities, and inform the assessment of potential risks from the construction and operation of the proposed project. The following techniques were applied at the proposed WEF area and its immediate surroundings: a desktop and bibliographic review, walked and vehicle based transects, vantage point monitoring, incidental observations and waterbody and breeding evidence surveys.

Site visits confirmed the occurrence of a high abundance of *Accipitrids* and *Falcon* species. The results have shown that both groups have a constant presence at the site through the year and spend a high proportion of their time and/or number of contacts at rotor height in comparison with the other groups of species. It is also of note that their activity was especially associated with the hillside and escarpment areas, where most of the potential collision risk movements (flight at potential rotor height depending on the turbine specifications) were observed. A total of eight species confirmed on site may be of special concern for having an unfavourable conservation status in South Africa: Black Harrier *Circus maurus*, Ludwig's Bustard *Neotis ludwigii*, Martial Eagle *Polemaetus bellicosus* – Endangered; Black Stork *Ciconia nigra*, Verreauxs' Eagle *Aquila verreauxii* – Vulnerable; Karoo Korhaan *Eupodotis vigorsii*, Maccoa Duck *Oxyura maccoa*, Greater Flamingo *Phoenicopterus roseus* – Near Threatened (Taylor, Peacock & Wanless 2015).

Sensitive areas identified at the proposed site considered the relevant aspects collected through the bird monitoring programme, including: relevant activity of sensitive species and associated potential for collision recorded in areas of hillsides and escarpments; particular association of passerine species and other relevant sensitive species to riverine thickets and water features.

Kudusberg WEF **is considered to be located in an area of medium sensitivity with some habitat features of high sensitivity in terms of the bird community** present. Impacts may be magnified due to cumulative impacts caused by other wind energy developments proposed in the area. Nonetheless, it is considered that though impacts cannot be totally eliminated, they can be minimised to the maximum extent possible, mostly through the **avoidance of no-go areas defined**. To the **medium sensitivity areas**, mitigation and compensation measures must be applied.

It is also recommended that a construction and operational phase bird monitoring programme be implemented in line with the best practice monitoring guideline to confirm and determine the extent of the impacts predicted as well as validate the success of mitigation strategy proposed.

Technical Team

The technical team responsible for the pre-construction monitoring surveys and reporting is presented in following table.

Technician	Qualifications	Role on project
Margarida Augusto	MSc in Conservation Biology BSc in Terrestrial Environmental Biology	Data Analysis Report compilation
Joana Marques	MSc in Ecology and Environmental Management BSc in Terrestrial Environmental Biology	Data analysis Report compilation
Craig Campbell	BSc in Conservation Ecology	Technician 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
Silvia Mesquita	Graduation in Applied Biology to Terrestrial animal resources Postgraduate Specialisation in Nature Tourism	Technical coordination
Helena Coelho	Graduation in Biology MSc in Marine and Coastal Sciences PhD in Biology	Technical coordination

Report compiled in July 2018.

Citation

Recommended citation when using this report as a reference: Bioinsight (2018). *Kudusberg Wind Energy Facility – Bird Pre-Construction Monitoring* 2015/2016.

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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)

Specialist 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

Bioinsight (Pty) Ltd and 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 to the relevant authorities any information that has or may have the potential to influence its decision or the objectivity of any report, plan, or document required in terms of the Environmental Impact Assessment Regulations, 2006.

* 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.

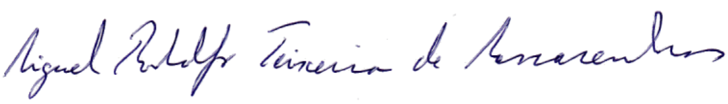
Professional experience

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 investigation 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 form or for any purpose without the specific and written consent of the specialist investigator as specified above.
* Acceptance of this report, in any physical or digital form, serves to confirm acknowledgment of these terms and liabilities.

Signed on the 15th of May 2018 by Miguel Rodolfo Teixeira de Mascarenhas in his capacity as specialist investigator.



PREFACE: BIRDS AND WIND TURBINES

Wind power has grown exponentially in the last decade and it is one of the main alternative energy sources to fossil fuels (Gsänger & Pitteloud 2013). Its development in South Africa is relatively new – having installed only 10MW by the end of 2012 (Gsänger & Pitteloud 2013). South Africa, the largest CO_2 emission country of the African continent, is also considered to represent one of the fastest growing wind energy industry markets (Mukasa *et al.* 2013).

This energy source is however not free from environmental impacts. The installation of wind energy facilities around the world has revealed some issues regarding wildlife conservation, specially related to bird and bat communities. Since 1992, when the first episodes of avian fatalities related to wind turbines were published (Orloff & Flannery 1992), social concern has arisen, and many articles and reports have been issued to date. Several recent reviews on this topic are available and this introductory chapter provides a summary of these (Drewitt & Langston 2006; Arnett *et al.* 2007; NRC 2007; Strickland *et al.* 2011) in an attempt to outline the possible impacts of wind energy facilities on bird communities. Until today the potential for significant impacts remains a concern as many wildlife populations overlapping with wind energy development experience declines potentially caused by habitat loss, disease, non-native invasive species and increased mortality (AWWI 2015).

Mortality caused by collision with wind turbines

Direct mortality can be caused by collision with the rotating blades of the wind turbines. Although most of the attention has been directed to *Raptors* and other large-sized birds, most of the fatalities recorded at wind farms are of passerines and other small species (<31cm length) (AWWI 2015). The reason for considering *Raptors* and large birds to be more sensitive to this impact is because of their relatively low numbers (i.e. proportion of fatalities and abundance), important role in ecosystems, and their low densities and reproduction rates. Therefore, the loss of a few individuals can have significant implications at the local and regional level, and the combined effects of several projects can be detrimental at a broader scale. This is especially true for endangered, rare or scarce species.

Bearing this in mind, it is important to note that the majority of the wind energy facilities operating internationally report low levels of bird fatalities from collision with wind turbine blades, ranging from three to five birds per MW per year (adjusted for detection biases) (AWWI 2015). Additionally, the results from the first round of wind farms in the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) in South Africa indicate that the levels of bird fatalities from collision with turbine blades, range from approximately one to six birds per MW per year (Ralston-Paton et al., 2017), being in line with the findings that have been reported internationally.In fact, for passerines it is considered a relatively minor source of mortality compared to other human structures or activities such as transport infrastructures (e.g. roads and highways), buildings, mining activities, windows and communication towers (Calvert *et al.* 2013; Loss, Will & Marra 2013; AWWI 2015). However, the cumulative effects and the development of new installations in places where there was no previous human presence are important factors to take into consideration.

Although most of the international projects do not result in high fatality rates, some of them have reported important episodes (e.g. Altamont Pass, California (Orloff & Flannery 1992; Smallwood & Thelander 2004); Tarifa, Spain (Barrios 1995; Barrios & Rodríguez 2004); Navarra, Spain (Lekuona & Ursúa 2007) and some uncertainty about the real numbers of wind turbine bird fatalities remains (e.g. due to lack of standardisation of the studies).

It is considered that collision probability is related to particular characteristics of the species present in the area (e.g. large species with low flight manoeuvrability and/or with particular flight behaviours are more prone to collisions), to the presence of certain environmental features (e.g. ridges, forests or wetlands that could attract different species), and to the characteristics of the infrastructure (e.g. lighting, shape and material of the wind turbines and rotor size) and wind turbine layout (De Lucas *et al.* 2008; Ferrer *et al.* 2012).

Habitat related impacts

Direct habitat loss due to the installation of turbines is generally not considered a critical issue, as the amount of habitat directly transformed by the development of wind energy facilities is not usually high. Nevertheless, the construction of roads and other infrastructure associated with wind developments in sensitive habitats could lead to displacement of species with narrow ecological niches.

Some species may suffer from displacement due to disturbance produced by human activity in the area. This is highly dependent on different species and on the characteristics and availability of the habitats at each location. Habituation to these changes cannot be assumed as some studies undertaken internationally concluded that bird abundance declines with time after the impact occurs, at least if the impact persists (Hotker, Thomsen & Jeromin 2006; De Lucas, Janss & Ferrer 2008).

Wind energy facilities located directly within migration or local commuting routes can produce barrier effects, causing avoidance of the area and therefore the utilisation of alternative routes. If this alternative route consumes more energy, linkages between areas of biological importance for birds, such as feeding, roosting or nesting can be affected, and result in significant reductions in use of the area and/or species fitness (Winkelman 1992; Christensen *et al.* 2004).

Cumulative effects

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) and more recently as "additional changes caused by a proposed development in conjunction with other similar developments or as the combined effect of a set of developments, taken together" (SNH 2012). This assumes the knowledge of other projects or actions whose effects could be added to the ones resulting from the project being assessed. The effect of cumulative impacts will be assessed and documented in the avifauna environmental impact assessment report, which terms of reference will be determined by the appointed environmental assessment practitioner. However, it is proposed that the analysis should focus on (Masden *et al.* 2010; SNH 2012):

- 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;
- The impact sensitive species more relevant and/or susceptible to the expected impacts.

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

The cumulative effects of large wind farm installations may be considerable if bird movements are consequently displaced. This may lead to the disruption of ecological links between feeding, breeding and roosting areas.

The need to evaluate these effects, outlined above, is more relevant in South Africa since the South African experience of wind energy generation has been extremely limited to date and wind energy developments are currently under expansion. Until the end of 2013, only eight wind turbines had been constructed and operated in South Africa, namely, three at a demonstration facility at Klipheuwel in the Western Cape, four at a site near Darling, and one at Coega near Port Elizabeth. During that time period only one peer-reviewed 12-month study assessing birds and bird fatalities has been completed in South Africa and the results published, reporting bat and bird fatalities produced by wind energy facilities (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*. In this study no information regarding habitat related issues were determined. In 2014 several other wind turbines started operating, and fatality results obtained from these wind farms indicated an average of 4.11 bird fatalities per turbine per year (adjusted for bias trials) (Raston-Paton et al., 2017), being in line with results obtained internationally (AWWI 2015). Recent fatality reports indicated direct impacts in species of conservation concern: three Verreauxs' Eagle *Aquila verreauxii* fatalities in the same wind energy facility, in the Eastern Cape. Evidence of what caused those impacts is still limited (Smallie 2015). Also a recent short note has given notice of three Blue Crane *Anthropoides paradiseus* fatalities caused by collision with wind turbines (Smallie 2016). The potential impacts of wind turbines on South African bird communities are still largely unknown. Therefore, data collection and further investigation are needed and pre- and post-construction monitoring should be implemented to fill these gaps and promote the sustainability of wind energy developments in South Africa.

The Best practice guidelines for avian monitoring and impact mitigation at proposed wind energy development sites in Southern Africa (Jenkins *et al.* 2015) were developed BirdLife South Africa and the Endangered Wildlife Trust (EWT). These guidelines provide technical guidance for consultants to carry out impact assessments and monitoring programmes for proposed wind energy facilities, in order to ensure that pre-construction monitoring surveys produce the required level of detail for authorities reviewing environmental authorisation applications. The minimum standards of best practice specific considerations relating to the pre-construction monitoring of proposed wind energy facility sites in relation to birds are outlined in this document.

In conclusion, the selection of the correct location of these facilities at various levels, from the location of the project to the micro sitting of the turbines, and the application of the correct mitigation measures are considered critical issues in reducing the impacts and reconciling development of the wind energy industry and biodiversity conservation.

INDEX

1. INTRODUCTION

This report details the findings of the bird pre-construction monitoring surveys conducted at the proposed Kudusberg Wind Energy Facility (hereafter referred to as Kudusberg WEF), between January 2016 and October 2016.

In order to assess the potential impact of the project, a complete monitoring programme was developed including one year of surveys prior to the wind farm construction to establish a baseline scenario for the future project phases (construction and operation).

1.1. Scope of work and Objectives

The main objective of the pre-construction bird monitoring programme was to characterise the bird community present in the area and provide baseline information to assess bird habitat use in a pre-impact scenario, and inform evaluation of the potential impact produced by the Kudusberg WEF (such as bird collision mortality, displacement due to disturbance, barrier effects and habitat loss (Drewitt & Langston 2006)). The specific objectives outlined for this pre-construction bird monitoring programme are:

a) Establish the pre-impact baseline reference and characterisation of the bird communities occurring within the development area;

b) Identify the bird species or groups more susceptible to potential impacts (displacement and/or collision) during the construction and operation phase of the wind energy facility;

c) Identify the project elements more likely to produce impacts on the avifauna and/or habitats during and after construction;

d) Evaluate potential changes in the way sensitive species, and the general bird community, will use the wind energy facility site during the construction and operation phases;

e) Assess and map the collision risk for sensitive species. Outline sensitive areas and/or No-Go areas if necessary;

f) Propose measures to avoid or, if unavoidable, mitigate, compensate and monitor, identified potential impacts.

In order to achieve the objectives of the pre-construction bird monitoring programme an experimental protocol was established, covering the Wind Energy Facility site (WEF), its immediate surroundings and a Control (CO) area. This pre-construction bird monitoring programme was based on extensive experience in bird and wind farm monitoring and was designed in order to comply with the key requirements of the "*Best-Practice Guidelines for assessing and monitoring the impact of wind-energy facilities on birds in southern Africa*" (Jenkins *et al.* 2015) and the recommendations of the Avifaunal Specialist Impact Scoping Report for the current EIA application (Bioinsight 2016a). This programme entails the implementation of standardised study methods before, during and after construction, in the area of the WEF, its immediate surroundings and a CO area (BACI, Before-After Control-Impact analysis) as proposed by national and international references (such as SNH 2009; Atienza *et al.* 2011; Strickland *et al.* 2011; Jenkins *et al.* 2012; USFWS 2012).

Although the general bird community was surveyed, the experimental protocol was specially directed to a set of **25 species considered sensitive** to wind energy development impacts (hereafter simply referred to as sensitive species), 11 of which are *Accipitrids, Falcons and similar*, 8 are *Large Terrestrial Birds* and 6 are *Passerine and other small terrestrial birds* (Table 1). These species were selected considering those identified in the Avifaunal Impact Assessment Scoping Report as target species (Bioinsight 2016a); species considered as priority for inclusion in studies considering wind farms (Retief *et al.* 2012) and lastly species considered prone to impacts caused by wind energy facilities (see section 2.1.1 for the definition of the types of surrogate species).

The pre-construction bird monitoring programme includes the following components:

- Vantage point – to allow for the detection of large bird species present in the study area, the estimation of their abundance, seasonality and the characterisation of their flights, and to gain a general idea of their use of the habitats. This data is important in achieving Objectives a) to e).
- Walked linear transects – designed to survey passerines and other small to medium sized birds. Using this technique, densities and composition of these groups of birds are estimated for the different habitats, seasons and sampling sites. This data is important in achieving Objectives a) to e).
- Vehicle based transects – implemented in order to detect other large bird species less prone to flight (such as *Bustards*), and allows covering greater areas in the wind energy facility surroundings. This technique was used to complement nest and roost surveys and for defining the distribution of sensitive species. This data is important in achieving Objectives a) to e).
- Waterbodies monitoring – used for characterizing the use of these features by *Waterbirds*, and contribute to Objectives a) to e).
- Inventory, search, inspection and monitoring of breeding evidence – during pre-construction and operation phases. This data is important in achieving Objectives a) to e).

The implementation of the continuation of a similar monitoring programme during the operations phase of the development should include the implementation of bird carcass searches around the turbines and determination of the searcher efficiency and carcass persistency (by scavengers or decomposition) which will provide data to quantify bird fatalities associated with the wind energy facility and determine the species affected as per the recommendations of the best practice guideline (stage 3 and 4 monitoring).

By referring to the baseline scenario established (on the scope of the present report) and implementing a BACI analysis it will be possible to validate the potential impacts identified, to determine if other impacts are occurring and adequately adjust any mitigation measures proposed at this stage (or propose new and more appropriate ones if necessary).

All the above methodologies will enable the accomplishment of Objective f).

Table 1 - Sensitive bird species considered central to the avian impact assessment process for the Kudusberg WEF. Global RLCS (WW) (Red List Conservation Status) (IUCN 2016) **and South Africa RLCS (SA)** (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. Likely Impacts: C – Collision; D – Disturbance and/or Displacement; H – Habitat destruction.**

Group	Common Name	Scientific Name	RLCS SA	RLCS WW	Convention Migratory Species (Appendix)	Endemic to South Africa	Population Trend	Priority species	Likely Impacts
"Ciconids"	Hamerkop	*Scopus umbretta*	-	LC	-	-	Stable	X	D
"Ciconids"	Black Stork	*Ciconia nigra*	VU	LC	II	-	Unknown	X	C, D
"Ciconids"	African Sacred Ibis	*Threskiornis aethiopicus*	-	LC	II (subsp. aethiopicus)	-	Decreasing	X	D
"Waterbirds"	Greater Flamingo	*Phoenicopterus roseus*	NT	LC	II	-	Increasing	X	C; D

Group	Common Name	Scientific Name	RLCS SA	RLCS WW	Convention Migratory Species (Appendix)	Endemic to South Africa	Population Trend	Priority species	Likely Impacts
"Waterbirds"	Cape Shoveler	*Anas smithii*	-	LC	II	-	Increasing	-	D
"Waterbirds"	Maccoa Duck	*Oxyura maccoa*	NT	NT	II	-	Decreasing	-	D
"Nocturnal Raptors"	Spotted Eagle-Owl	*Bubo africanus*	-	LC	-	-	Stable	X	D, H
"Accipitrids"	Verreauxs' Eagle	*Aquila verreauxii*	VU	LC	II	-	Stable	X	C, D, H
"Accipitrids"	Booted Eagle	*Hieraaetus pennatus*	-	LC	II	-	Decreasing	X	C, D, H
"Accipitrids"	Martial Eagle	*Polemaetus bellicosus*	EN	VU	II	-	Decreasing	X	C; D; H
"Accipitrids"	Black-chested Snake Eagle	*Circaetus pectoralis*	-	LC	II	-	Unknown	X	C; D; H
"Accipitrids"	Jackal Buzzard	*Buteo rufofuscus*	-	LC	II	(*)	Stable	X	C, D, H
"Accipitrids"	Pale Chanting Goshawk	*Melierax canorus*	-	LC	II	-	Stable	X	C, D, H
"Accipitrids"	Black Harrier	*Circus maurus*	EN	VU	II	(*)	Stable	X	C, D, H
"Accipitrids"	African Harrier-Hawk	*Polyboroides typus*	-	LC	II	-	Stable	X	C, D, H
"Falcons"	Rock Kestrel	*Falco rupicolus*	-	NA	II	-	NA	-	C, D, H
"Falcons"	Greater Kestrel	*Falco rupicoloides*	-	LC	II	-	Stable	X	C, D, H
"Bustards"	Ludwig's Bustard	*Neotis ludwigii*	EN	EN	-	-	Decreasing	X	D, H
"Bustards"	Karoo Korhaan	*Eupodotis vigorsii*	NT	LC	-	-	Increasing	X	D, H
"Phasianids"	Grey-winged Francolin	*Scleroptila africana*	-	LC	-	SLS	Stable	X	D, H
"Phasianids"	African Snipe	*Gallinago nigripennis*	-	LC	II	-	Unknown	-	D
"Passerines"	Common Swift	*Apus apus*	-	LC	-	-	Decreasing	-	C; H
"Passerines"	Cape Clapper Lark	*Mirafra apiata*	-	LC	-	(*)	Decreasing	-	C, D, H
"Passerines"	Karoo Lark	*Calendulauda albescens*	-	LC	-	(*)	Decreasing	-	C; D; H
"Passerines"	Large-billed Lark	*Galerida magnirostris*	-	LC	-	(*)	Increasing	-	C, D, H

1.2. Terms of reference

The final avifauna monitoring assessment was conducted according to the specialist terms of reference:

- Conduct a review of national and international specialised literature and experiences regarding birds and wind farms;
- Conduct a field investigation to determine the bird community present in the study area. Although the general bird community is considered, this study will have special focus on the species considered to be more sensitive to wind energy development related impacts;
- Describe the environment that may be affected by the activity and the manner in which the environment may be affected by the proposed project;
- Describe and evaluate the environmental issues and potential impacts (including direct, indirect, cumulative impacts and residual risks) identified of the proposed project and identified alternatives in terms of the nature, the causes of the effect, what will be affected and how it will be affected;
- Compare feasible alternatives, and nominate a preferred layout alternative;

- Identify any aspects which are conditional to the findings of the assessment which are to be included as conditions of the Environmental Authorisation;
- Identify and map sensitive and "no-go" areas within and around the proposed Wind Energy Facility site;
- Identify any gaps in knowledge as well as any areas that would constitute "acceptable and defendable loss";
- Provide a statement regarding the potential significance of the identified issues based on the evaluation of the issues/impacts and a reasoned opinion as to whether the proposed project should be authorised;
- Provide recommendations regarding any mitigation measures and management to be included in the Environmental Management Programme to be submitted with the Final Environmental Impact Assessment Report;
- Propose a suitable monitoring programme for the evaluation of the impacts expected during the operational phase of the development, if considered necessary.

1.3. Legal framework

It is considered best practise for bird monitoring to be undertaken on wind energy facility sites, in order to fulfil the requirements outlined by the "Best- Practice Guidelines for assessing and monitoring the impact of wind-energy facilities on birds in southern Africa" (Jenkins *et al.* 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) (NEMBA) provides for listing threatened or protected ecosystems, in one of four categories: critically endangered (CR), endangered (EN), vulnerable (VU) or protected.

NEMBA 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.

Northern Cape Nature Conservation Act, 2009 (Act No 9 of 2009)

At a Provincial level, birds are protected by Northern Cape Department of Environment and Nature Conservation (DENC) under the National Environmental Management: Biodiversity Act (see above). In addition, provincially protected and specially protected species are listed in the Northern Cape Nature Conservation Act, 2009 (Act No 9 of 2009).

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, thus 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 of 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 in good quality for breeding, and therefore it is essential for the signatory countries to have concerted efforts in the conservation and management of these migratory populations.

1.4. Proposed wind energy facility and study area

Kudusberg WEF is being proposed by G7 Renewable Energies (Pty) Ltd for the installation of wind turbine generators. The project is located in the border between the Western and Northern Cape, south of the R356 and west of the R354, at approximately 50km southwest of Sutherland (Figure 1). The WEF includes the proposed implementation of 98 wind turbines, however no information regarding additional project infrastructures (e.g. turbine specifications, road access, power lines, substation location) has been provided at this stage. The development comprises an area of approximately 11000 hectares in extent and is expected to be able to produce at least 140 MW.

Figure 1 – Location of the proposed Kudusberg Wind Energy Facility (source: Google Earth).

Vegetation types

The site falls within the Succulent Karoo and the Fynbos biome, with the occurrence of two main vegetation types (Mucina & Rutherford 2006) (Figure 2):

- **Central Mountain Shale Renosterveld** (Fynbos biome): associated with areas of slopes and broad ridges where the vegetation is predominantly tall shrubland and renosterveld composed by non-succulent karoo shrubs and a rich flora in rockier areas.
- **Koedoesberge-Moordenaars Karoo** (Succulent Karoo biome): this type of vegetation is found in slightly undulating to hilly landscape and is characterised by low succulent scrub with interspersed taller shrubs. Rain may occur through the year though it is more likely during winter season – two rainfall peaks during the year: one in March and the other in May – August.

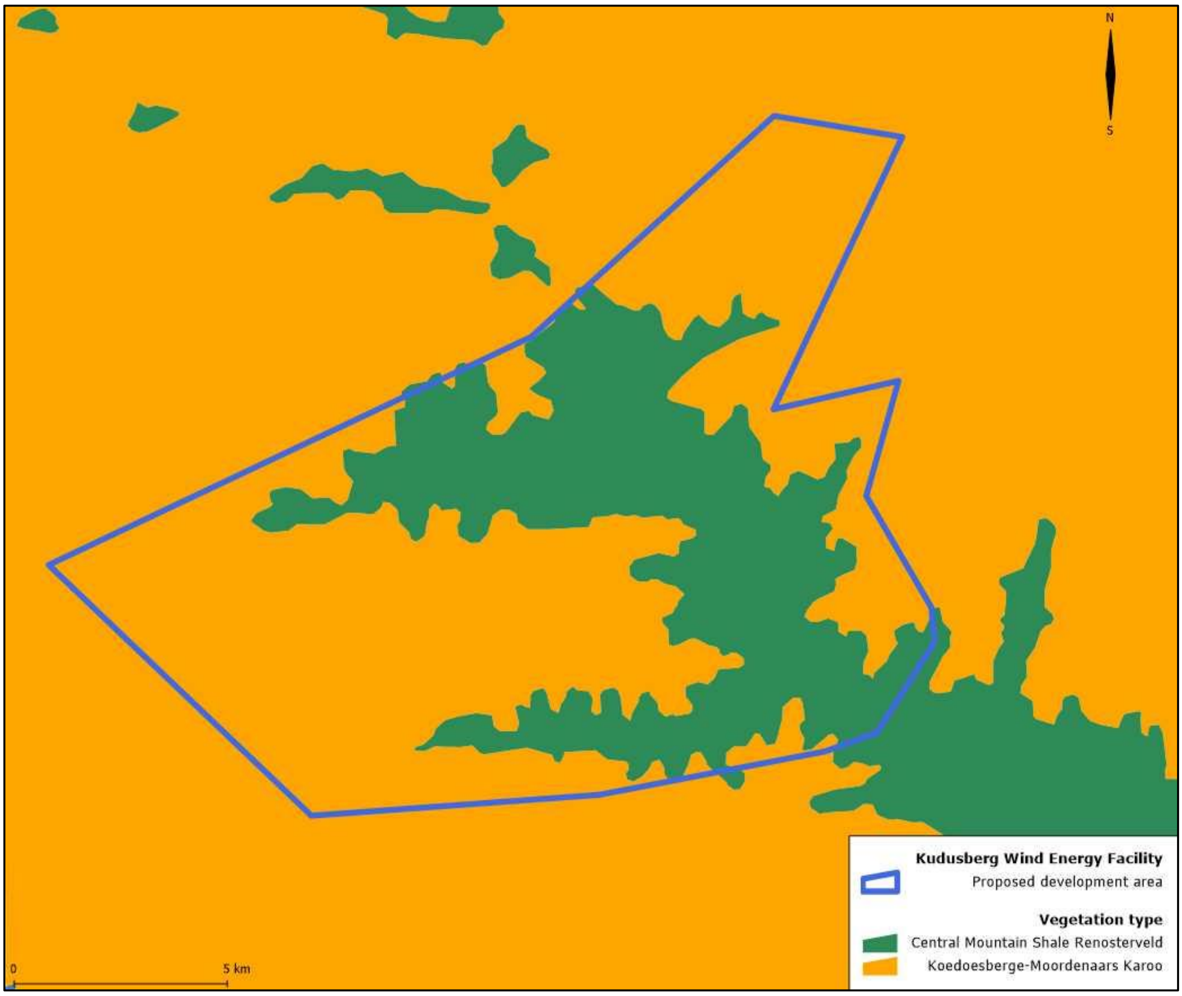


Figure 2 – Vegetation units present within the Kudusberg WEF and surrounding area according to Mucina & Rutherford (2006) updated to version 2012.

As mentioned the site is characterised by accentuated mountainous areas with very difficult human access and therefore in almost pristine natural conditions. Vegetation is adapted to the semi-arid conditions and harsh rocky conditions. Currently the area where Kudusberg WEF is proposed shows no signs of intense disturbance (Photograph 3) other than apart from the severe natural impacts on the veld caused by the three year period of drought and grazing. Signs of human disturbance are characterised by the presence of a few farm houses.

Bird micro-habitats

The proposed Kudusberg WEF site and surrounding area is characterised by accentuated mountainous areas which is located between two vegetation types and major biotopes: the Fynbos biome and the Succulent Karoo biome. Both are characteristic of higher altitudes and are present both in the bottom and top of the mountains. The area is mostly comprised of natural vegetation. Nonetheless there are several species which are dependent on this type of habitat such as per example: Verreauxs' Eagle *Aquila verreauxii*, Grey-backed Cisticola *Cisticola subruficapilla*, Karoo Prinia *Prinia maculosa* and Grey-winged Francolin *Scleroptila Africana*.

Apart from the bird species that are naturally associated with the Fynbos and the Succulent Karoo biome, other species with more widespread distribution areas and less specific habitat requirements may also occur. These species are likely to be attracted by factors such as land-use, topography and the presence of drainage lines and wetlands in the surroundings of the site. Within the proposed Kudusberg WEF site the area is mostly reserved as natural vegetation. Potential avifaunal micro habitats identified at the site are described below.

Water bodies

During the field visit and through analysis of the aerial imagery it was found that the site is lacking in water features of large dimensions and with well-developed surrounding vegetation, adequate to accommodate large bird species such as Cormorants, Grebes, Herons or Ibises. Nonetheless a small pond was found in the surroundings of the study area (Photograph 1) (32°46'57.99"S | 20°17'22.73"E). A site with these characteristics may be an attraction feature for bird species such as the Red-knobbed coot *Fulica cristata*, Three-banded Plover *Charadrius tricollaris*, among others.

Photograph 1 – Water body found in the surrounding area of the Kudusberg WEF site with water during the reconnaissance visit conducted in February 2016.

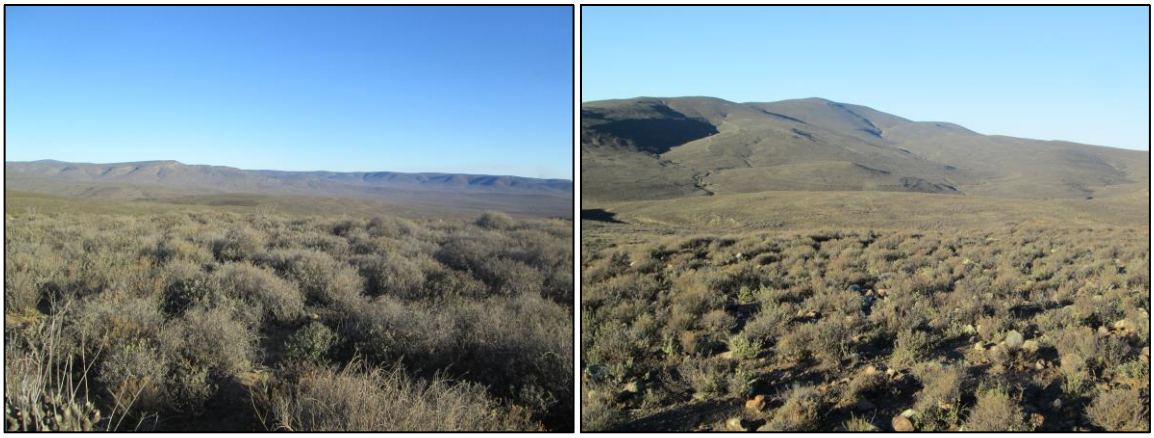
Rocky outcrops

A large portion of the site is dominated by rocky hillsides mostly from the natural degradation of the rock by the elements (wind, rain) (Photograph 2). Rock crevices in the mountain side may also be important for cliff-nesting species such as Rock Martin *Hirundo fuligula*, Rock Kestrel and Verreauxs' Eagle, among others.

Photograph 2 – Boulder accumulations found within Kudusberg WEF proposed farm portions.

Natural vegetation

The proposed development area is occupied mainly by natural vegetation. Though composed by two vegetation units it has a homogenous and similar structure from the top of mountains to the bottom valleys, revealed by the constant presence of small scrubby vegetation (Photograph 3). Although the raptors listed as sensitive species do not necessarily roost or nest at the WEF site, they will forage in natural veld. Therefore, several sensitive species have potential to be present in the study area due to this type of vegetation including Booted Eagle *Hieraaetus pennatus*, Jackal Buzzard *Buteo rufofuscus* Black Harrier *Circus maurus*, Karoo Lark *Calendulauda albescens* and Large-billed Lark *Galerida magnirostris*.



Photograph 3 – Examples of areas of natural vegetation within the Kudsberg WEF proposed wind farm portions.

Buildings

Being the site mostly composed by areas of natural vegetation, the presence of man-made infrastructures is very little. In this first visit to the site two houses was found and documented below (Photograph 4) (**Left**: 32°53'34.34"S | 20°18'9.51"E; **Right**: 32°53'19.36"S | 20°16'8.21"E). These locations as well as others with similar characteristics that were undetected during this survey may be important for several bird species which use them for roosting and/or nesting, such as Spotted Eagle-Owl *Bubo africanus*, House Sparrow *Passer domesticus*.

Photograph 4 – Man-made infrastructures with suitable characteristics for roosting or nesting of several bird species.

Trees

Other micro-habitats present within and in the area immediately adjacent to the proposed site, which are important for a number of bird species, are stands of trees. In the study area such trees are usually associated with streams and water bodies with well-developed vegetation (Photograph 5).

These locations provide perching and roosting and/or nesting locations for raptor species as well as refugee for smaller passerine species (e.g. African Harrier-Hawk *Polyboroides typus*, Pied Crow *Corvus albus,* among others).

Photograph 5 – Scattered trees found in the middle of shrubland areas.

Conservancy areas

There are no nature conservancy areas, to our present knowledge, within a 30km radius of the proposed development area. The proposed Kudusberg WEF site is located approximately 55km south-east of the Tankwa Karoo National Park, 90km north-east from Swartberg Mountains Important Bird Area (IBA) (SA106), 49 km east of the Cedarberg – Koue Bokkeveld Complex IBA (SA101) and 56km north from Anysberg Nature Reserve Important Bird Area (SA108) (Figure 3). **Considering that these areas are located at a considerable distance from the proposed WEF area it is not expected that the species using them are affected in any way by the implementation of this project. Nonetheless the analysis of the bird species presents in these areas, which are of similar nature to the Kudusberg WEF proposed area, may provide indication on the suite of species likely to be present in the study area.**

The Tankwa Karoo National Park is home to several Karoo endemic bird species. Among the species known to occur on the site there are the Burchell's Courser *Cursorius rufus*, the Double-banded Courser *Rhinoptilus africanus*, and the Karoo Long-billed Lark *Certhilauda subcoronata*. Additionally, species known to be sensitive to man-made infrastructures such as the Verreauxs' Eagle *Aquila verreauxii* and the Kori Bustard *Ardeotis kori* are widespread in the area (SANParks 2015).

The Swartberg Mountains IBA (SA106) is characterised by montane fynbos at higher altitudes and karroid and renosterveld shrubland on the lower slopes. The following are considered the IBA trigger species for this area: Globally threatened species - Martial Eagle and Black Harrier. Regionally threatened species - Verreauxs' Eagle, Lanner Falcon, Cape Rockjumper, Hottentot Buttonquail and African Rock Pipit. Common restricted-range and biome-restricted species - Cape Spurfowl and Cape Bulbul. Locally common restricted - range and biome-restricted species are Cape Sugarbird, Orange-breasted Sunbird, Cape Siskin, Karoo Korhaan, Karoo Chat, Layard's Tit-babbler, Black-headed Canary, Pale-winged Starling and Namaqua Warbler. Uncommon biome-restricted species - Victorin's Warbler, Cape Rockjumper, Protea Seedeater, Karoo Lark, Karoo Long-billed Lark, Sickle-winged Chat and Karoo Eremomela (BirdLife South Africa 2015a).

The Cedarberg – Koue Bokkeveld Complex IBA (SA101) stretches from the Groot Winterhoek Wilderness Area, with its eastern boundary running north along the Ceres–Op-die-Berg road and then turning east to Katbakkies to join the road running north from Karooport to Calvinia. The variation in edaphic factors, leads to a diverse flora, with mesic mountain fynbos grading into xeric succulent Karoo. The IBA trigger species for the Platberg Karoo Conservancy IBA are: Globally threatened species - Martial Eagle, Black Harrier and Ludwig's Bustard. Regionally threatened species - Verreauxs' Eagle, Lanner Falcon, Black Stork, Cape Rockjumper and Hottentot Buttonquail. Common Biome- and range-restricted species - Cape Spurfowl, Cape Bulbul, Cape Sugarbird, Orange-breasted Sunbird, Karoo Chat and Layard's Tit-babbler. Locally common Biome- and range-restricted species - Karoo Lark and Namaqua Warbler. Uncommon biome- and range-restricted species include Ludwig's Bustard, Karoo Long-billed Lark, Tractrac Chat, Sickle-winged Chat, Karoo Eremomela, Namaqua Warbler, Pale-winged Starling, Cinnamon-breasted Warbler, Black-headed Canary, Swee Waxbill *Coccopygia melanotis*, Cape Rockjumper, Protea Seedeater, Cape Siskin, Victorin's Warbler and Hottentot Buttonquail (BirdLife South Africa 2015b).

The Anysberg Nature Reserve (SA108) supports many Fynbos and Namib-Karoo biome-restricted species as well as many other arid-zone associated species. A total of 212 bird species have been recorded in the area so far, including the Ludwig's Bustard *Neotis ludwigii*, Karoo Korhaan *Eupodotis vigorsii*, Karoo Lark *Calendulauda albescens*, Karoo Chat *Cercomela schlegelii*, Karoo Eremomela *Eremomela gregalis*, Rufous-eared Warbler *Malcorus pectoralis*, Martial Eagle *Polemaetus bellicosus* and Black Harrier *Circus maurus*. Blue Crane *Anthropoides paradiseus* is also an occasional occurrence. The cliffs at this IBA are also known breeding locations for bird species such as Black Stork *Ciconia nigra*, Peregrine Falcon *Falco peregrinus*, Cape Eagle Owl *Bubo capensis*, Booted Eagle *Hieraaetus pennatus* and Verreauxs' Eagle. The IBA trigger species for the Anysberg Nature Reserve IBA are: Globally threatened species - Blue Crane, Ludwig's Bustard, Southern Black Korhaan *Afrotis afra*, Martial Eagle and Black Harrier. Regionally threatened species - Verreauxs' Eagle, Black Stork, Lanner Falcon *Falco biarmicus* and Cape Rockjumper. Common Range- and biome-restricted species - Cape Spurfowl, Cape Bulbul and Karoo Chat. Locally common range- or biome-restricted species - Karoo Korhaan, Karoo Lark, Layard's Tit-babbler, Karoo Eremomela and Namaqua Warbler. Uncommon range- or biome-restricted species - Ludwig's Bustard, Sickle-winged Chat *Cercomela sinuata*, Cape Rockjumper, Victorin's Warbler, Cape Sugarbird, Cape Siskin, Protea Seedeater *Crithagra leucoptera*, Orange-breasted Sunbird, Pale-winged Starling and Black-headed Canary (BirdLife South Africa 2015c).

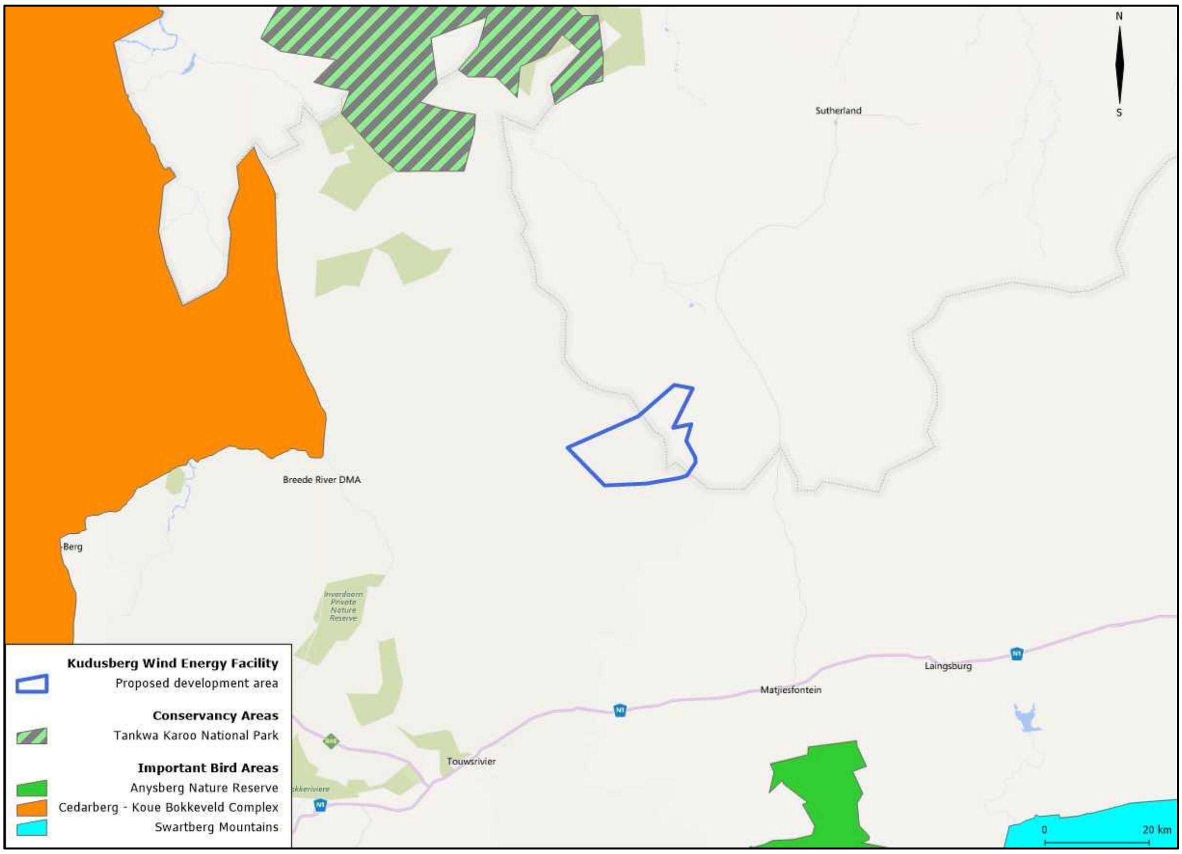


Figure 3 – Location of the Kudusberg WEF in relation to the surrounding conservancy areas (background image source: Google Earth Street Map)

Cumulative impacts

The main known activities or projects, relevant for the cumulative impacts analysis, known in the broader area of the proposed Kudusberg WEF are mostly the presence of power lines, roads and other proposed wind energy facilities. With present knowledge this is not considered likely therefore no additional cumulative impacts are foreseen due to the presence of additional power lines in the surrounding area of the site.

The presence of additional wind energy facilities has the potential to exacerbate the impacts for the general bird species in the area.

Potential cumulative impacts may materialise if the bird species using the Kudusberg WEF also use the broader surrounding area, in that case, they will be subjected to an increased reduction in available habitat availability and increased collision risk with the wind turbines and associated infrastructure. If this happens fatality occurring at each of these sites should be evaluated together as impacts are most likely being caused over the same populations.

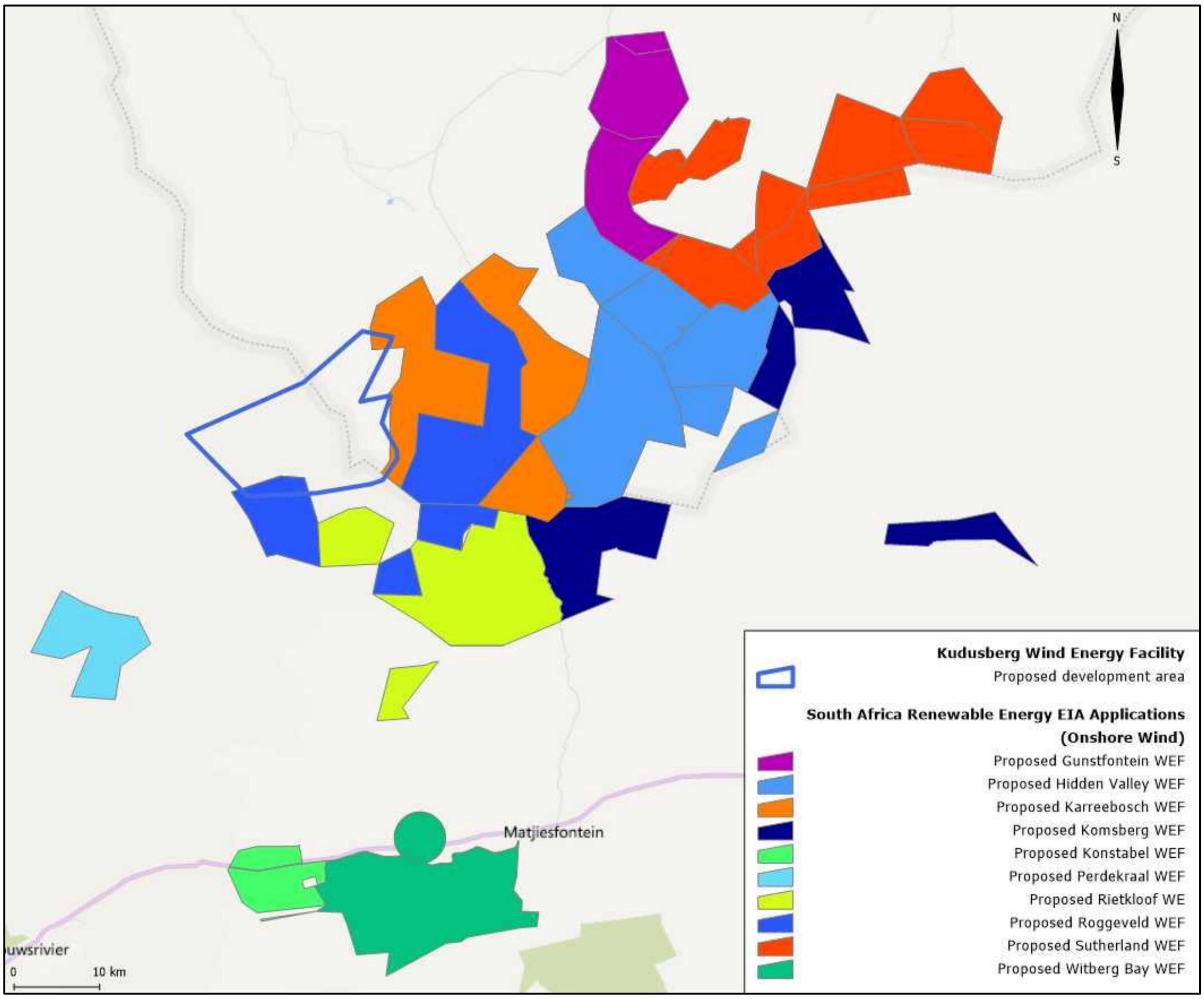


Figure 4 – Onshore Wind Renewable Energy projects currently proposed or approved the surrounding area of the Kudusberg Wind Energy Facility (according to the REEA most recent available dataset – 2017 4th Quarter).

1.5. Summary of the Avian Scoping Assessment

An Avifaunal Scoping Assessment was conducted in 2016, for the area of the proposed Kudusberg WEF (Bioinsight 2016a). The Avifaunal Scoping Report identified the bird community with potential presence in the area, including up to 131 bird species of which 8 are considered of conservation concern including Black Stork *Ciconia nigra* and Verreauxs' Eagle *Aquila verreauxii* considered Vulnerable, Martial Eagle *Polemaetus bellicosus*, Black Harrier *Circus maurus* and Ludwig's Bustard *Neotis ludwigii* considered Endangered and Greater Flamingo *Phoenicopterus roseus*, Maccoa Duck *Oxyura maccoa*, Karoo Korhaan *Eupodotis vigorsii* classified as Near Threatened (Taylor 2014). This study also outlined a list of 25 sensitive species, which should be considered as the focus of the pre-construction bird monitoring (refer to section 1.1 - Table 1).

The impacts identified by this preliminary study are described as follows:

- **Habitat destruction and bird disturbance** – caused by construction and decommissioning phase (specifically the disturbance impacts). As the proposed WEF is located within natural vegetation it is expected that these biotopes will be negatively affected by the construction phase, leading to the loss of a portion of hunting and feeding grounds, which could be detrimental small passerines, accipitrids, falcons and bustards. Nonetheless the areas required for the construction and implementation of the turbines platforms represent only a small percentage of the total available area with these characteristics. Thus these impacts were considered as having a low significance.
- **Bird Fatality** – caused by collision with turbine blades and/or with overhead power lines. This impact is considered particularly relevant for the species observed actively using the site, including Verreauxs' Eagle, Rock Kestrel and African Harrier-Hawk (Figure 5). Hence this impact was considered as a medium significance impact.

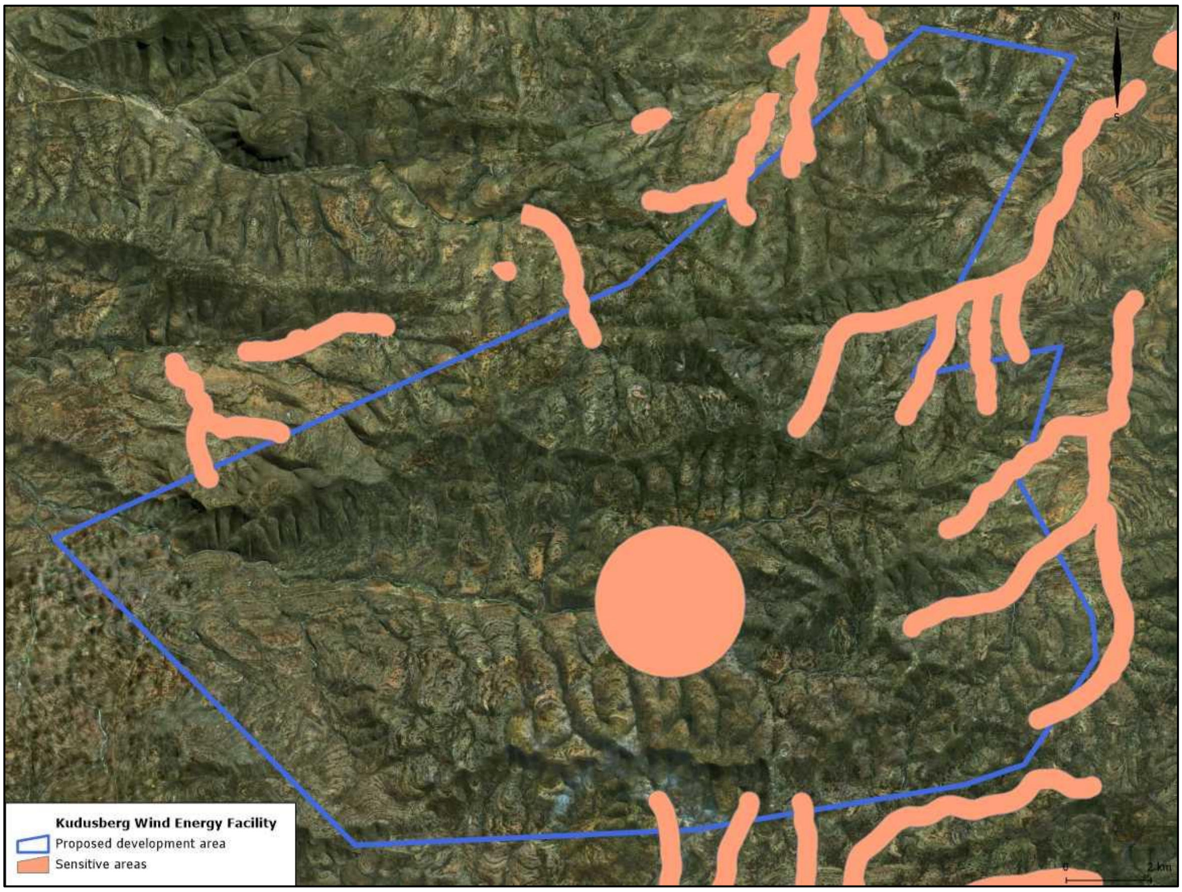


Figure 5 – Preliminary sensitivity mapping of the proposed Kudusberg WEF considered in the Avifaunal Scoping Study (Bioinsight 2016a).

2. Monitoring programme description

The proposed methodology assumes as a baseline the requirements outlined by the most recent version of the *Best-Practice Guidelines for assessing and monitoring the impact of wind-energy facilities on birds in southern Africa* (Jenkins *et al.* 2015). Complementarily, the methodology is also based on current international good practice (Table 2).

2.1. Desktop preparatory work

Prior to the initiation of field surveys, a desktop survey was conducted to compile the best information possible, in order to provide a better evaluation of all conditions present within the study area. Therefore, data sources (as detailed in Table 2) were consulted in order to assess the species likely to occur within the study area. The following steps were taken:

- Based on a desktop study and considering all literature references available (Table 2), a list of all bird species considered to potentially occur within, or in close proximity to the site was compiled.
- Abundance of all species listed from the aforementioned process was assessed at a national level in terms of endemism, population trend, habitat preferences and conservation status.
- The sensitivity of these species towards 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 referred document were also considered sensitive because of their abundance, flight characteristics, ecological role, population trend and conservation status (refer to Section 2.1.1 for selection criteria).
- A short list of sensitive species for this study species, to which the assessment and monitoring programme should pay special attention to, was compiled based on the Avifaunal Scoping Report (Bioinsight 2016b), and supplemented with sensitive species identified in the previous steps.
- A desktop study, based on all the available information such as topographic South Africa maps, Google Earth imagery, and Geographical Information System software was conducted for a preliminary evaluation of the area.
- Micro habitats and vegetation units were characterised using Google Earth imagery and refined during the field visits conducted to the site through the monitoring programme.

The monitoring effort and methodological approach was defined and implemented.

The following data sources and reports (as per Table 2 below) were consulted and taken into consideration for the compilation of this report, in varying levels of detail. Many other references were consulted for particular issues (these are detailed in section 6).

Table 2 – Data sources consulted for the evaluation of the bird community present in the study area. The international references and guidelines used to support the methodological approach and result 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)

Type	Title	Bibliographic Reference	Detail of information
	Coordinated Avifauna Roadcounts (CAR)	http://car.adu.org.za/	Local level
	Coordinated Waterbird Counts	http://cwac.adu.org.za/	Local level
	Kudusberg Wind Energy Facility – Scoping Avifaunal Impact Scoping Desktop Study	(Bioinsight 2016a)	Local level
	Gunstfontein wind energy facility – Bird pre-construction monitoring and Specialist Impact Assessment. Pre-construction phase. Final Monitoring Report 2013/2014	(Bioinsight 2015)	Local level
	Birds of Southern Africa	(Hockey, Dean & Ryan 2005)	National level
	BirdLife South Africa Checklist of Birds in South Africa 2016	(BLSA 2016)	National level
	The 2015 Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland	(Taylor, Peacock & Wanless 2015)	National level
	Renewable Energy Application Mapping. Third Quarter 2016	(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.* 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

2.1.1. Definition of the different types of surrogate species

A two-step approach was used to define abundance, distribution and flying patterns within the study area in order to evaluate the potential effects of development on the local bird community. Initially, the records of all bird species were included in the analysis to give an idea of their general use of the area and to define the composition of the community. In a second step, only species considered to be particularly sensitive to the impacts of wind energy facilities were considered in order to investigate particularities of species often scarcer and less frequently recorded.

These species were identified by implementing a structured decision process (refer to Figure 6) in which several factors related to the species' physiology and biology are considered, taxonomic order (Jordan & Smallie 2010), threatened status (Taylor, Peacock & Wanless 2015; 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), endemism, abundance (Hockey, Dean & Ryan 2005) and population trend (IUCN 2016). The sensitive species list also included priority species (Retief *et al.* 2012) and target species (Bioinsight 2016b)[1]. The sensitive species list identified for the proposed Kudusberg WEF is presented in Table 1 (refer to section 1.1).

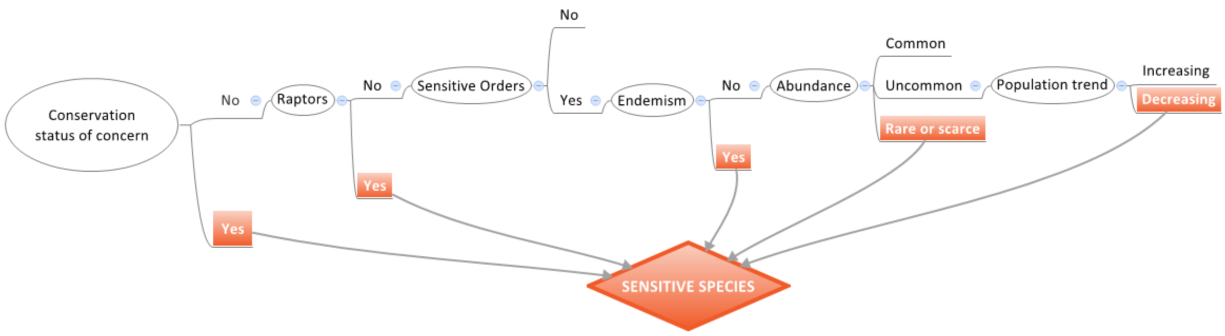


Figure 6 - Decision process scheme used to define sensitive species. A species is sensitive when following its characteristics through the scheme it ends in a red square. On the other hand, if it does not end up in a red square it would not be considered sensitive for the Kudusberg WEF area.

The analysis of sensitive species, as a complement to the in-depth analysis of the results gathered for the general community, will provide valuable information on particular assessments, whether it would be cumulative effects, turbine micro sitting or post-construction Before-After Control-Impact. It also separates common, abundant events or species, from those scarcer or rare, allowing for its detection.

2.2. Field surveys

While the main emphasis of the pre-construction monitoring programme was focussed on the sensitive species identified (Table 1), a systematic approach was implemented in order to determine the general composition of the bird community within the study area, as well as to evaluate the potential negative effects

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[1] **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 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 (2016) and *The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland* (Taylor, Peacock & Wanless 2015) - 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.

Target species - This is a shortlist of species defined by the Avian Specialist that conducted the previous stages of the EIA. This is stated in the *Best Practice Guidelines* (Jenkins *et al.* 2015). Based in their experience as well as project specifics, the specialist draws up a list of species to which special concern should be placed. In-detailed data for all species, particularly those under special concern, should be recorded in the field.

that the operational phase of the Kudusberg WEF has on this group. The surveys conducted involved the following methodologies (Appendix I - Figure 28):

- Vantage points monitoring, to define the utilisation of the area by *Accipitrids, Falcons* 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;
- 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;
- Waterbody monitoring, to evaluate the species present and their relevant movements at and between the main waterbodies.

All contacts of sensitive 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.* 2015) and the previous stages of the Impact Assessment (scoping).

A Control area was considered for this project, being located approximately 2km north of the proposed WEF site (Figure 28). This area was selected due to it's extreme similarities to the study site, in terms of vegetation and topography. Both sites are equally comprised of Central Mountain Shale Renoserveld and Koedoesberge-Moordenaars Karoo vegetation (Mucina & Rutherford 2006). Additionally, both sites also exhibit mountaineous regions with shallow valleys. As such, very similar bird micro-habitats are expected to occur in both areas. Data gathered at this similar area will allow to compare the results obtained with a reference, non-affected area, in order to distinguish between impacts produced by the project and background effects produced by natural processes (SNH 2009; Atienza *et al.* 2011; Strickland *et al.* 2011; USFWS 2012; Jenkins *et al.* 2015).

2.2.1. Sampling Period

The surveys of the bird community monitoring programme were conducted between January and October 2016. The field surveys were conducted so that the area was surveyed through all seasons of the year, in compliance with the requirements of the Best Practice Guidelines (Jenkins *et al.* 2015). Therefore, the monitoring programme included a total of 8 visits to the site where all methodologies were implemented in each season: walked transects and vantage points, as well as other methodologies, spread over the pre-construction monitoring year.

Table 3 – Schedule of bird monitoring fieldwork at the Kudusberg WEF site and Control area. VP – Vantage points; WT – Walked transects; VT – Vehicle transects; NE – Nest searches, inspection and monitoring; WB – Waterbody inspection and monitoring; Inc – Incidental observations.

Year	Month	Season	Methods
2016	12th to 22nd January	Summer	WT; VP; VT; NE; WB; Inc
	3rd to 13th February		WT; VP; VT; NE; WB; Inc
	1st to 11th April	Autumn	WT; VP; VT; NE; WB; Inc

Year	Month	Season	Methods
	17th to 27th May		WT; VP; VT; NE; WB; Inc
	21st to 28th June	Winter	WT; VP; VT; WB; Inc
	15th to 26th August		WT; VP; VT; NE; WB; Inc
	6th to 15th September	Spring	WT; VP; VT; NE; WB; Inc
	26th September to 5th October		WT; VP; VT; NE; WB; Inc

2.2.2. Weather conditions

Wind speed recorded by the observers during field surveys at Kudusberg WEF was constantly high, with a yearly average ranging from 3.1 to 4.3 m/s (depending on the season). Temperatures were lower during the winter season – averaging 15ºC, while higher temperatures were generally experienced during summer season, being recorded an average of 28ºC (Table 4). However, temperatures were mild throughout the year, with a variation of 13ºC between average lower and higher temperatures. Precipitation was more frequent in the winter season though small events were observed in all surveys (Table 4).

Table 4 – Prevailing meteorological conditions during surveys conducted. Avg Wind Speed – Average wind speed at ground level; Prevailing Cloudiness: 0-no clouds to 4-completely covered; Prevailing Precipitation: 0- no rain, * - periods of precipitation occurred; Avg Temp – Average temperature.

Year	Season	Avg Wind Speed (m/s)	Prevailing Wind Direction	Prevailing Cloudiness	Prevailing Precipitation	Avg Temp (°C)
2016	Summer	4.3	SE	1	0*	28
	Autumn	3.2	W	1	0*	18
	Winter	3.1	E	1	0*	15
	Spring	4.3	W	1	0*	16.2

2.2.3. Passerine and small bird communities – walked transects

To characterise the passerine and small bird communities occurring in the study area were used the walked transects methodology, as recommended in the best practice guidelines at the time (Jenkins *et al.* 2015). This is a technique used to produce estimates of densities/actual numbers of bird species - making it a very thorough and sufficient means of measurement for the application.

The following parameters were estimated for each species and transect, both in the wind energy facility as well as in the control area:

- Relative density, expressed as the number of birds per hectare, per study area (WEF and Control). This variable takes into account the probability of detection of the different groups of species into consideration.

- Occurrence of sensitive species in the vicinity of the proposed facility and its immediate surroundings.

Data collection techniques and methods

The passerine and small bird communities were characterised by conducting 13 linear transects of approximately 1000 m each, in total length – 7 located within the proposed Kudusberg WEF area and 6 at a similar Control area. Linear transects were established by the previous service provider, after the completion of a desktop study and a preliminary inspection of the area by an expert bird specialist. These transects were validated by Bioinsight and are representative of the biotopes present within the study area (Appendix I – Figure 28).

Data analysis and criteria

The analysis of all collected data parameters allows for the detection of spatial and temporal variations being placed on the bird community occurring at the study area, as well as for important and/or special areas for sensitive species. Density estimation was conducted using Distance© 6.2 Release 1 (Thomas *et al.* 2010). Density estimation was applied to the general community using Conventional Distance Sampling analysis (Buckland *et al.* 1993, 2001) per season and per major biotope. A second analysis was conducted focusing on the groups of species with a higher frequency of detection ($n \geq 40$).

2.2.4. *Raptors* and large birds – vantage points

Vantage points were used to detect sensitive species, focused on *Raptors* and other large birds. Therefore, a systematic approach to detect and characterise the species of this group, many of them endangered or sensitive species, was implemented. This methodology included a standard way of collecting data (e.g. flying patterns and characteristics), which allows for the comparison between different areas and sampling periods (SNH 2009; Atienza *et al.* 2011; Strickland *et al.* 2011; Jenkins *et al.* 2012).

This methodology allows the collection of accurate records based on the movements of *Raptors* and large birds through the study area. The main objectives for this methodology is to record the behaviour, estimate activity indexes and, if possible, determine the number of breeding pairs (if any) that frequently utilise the study area.

The following parameters were evaluated:

- Activity Index – determined by considering the number of contacts per observation hour. In this case every bird is considered a contact, thus a flock of five birds would be considered five contacts.
- Activity at Rotor Swept Area – determined by considering the number of contacts per observation hour spent in the space considered between the lower turbine blade tip and the upper blade tip.
- Time use at Rotor Swept Area – this parameter was determined by considering the amount of time spent at rotor height in relation to the total time spent flying through the area.
- Risk Analysis – The probability of collision of any bird species in the study area was determined by analysing the collision prone behaviours at a wide range of Rotor swept area ranging between 70 and 190m.

Data collection techniques and methods

Twelve vantage points were monitored throughout the monitoring programme, including five located at the Wind Energy Facility and seven at the Control area. These sampling points were located at strategic locations within the Kudusberg WEF site and Control area and set up to allow the visual coverage of the wind energy facility and its immediate surroundings. Since the area is very homogeneous with natural vegetation, drainage lines, and ridges all the vantage points cover all types of habitats (Appendix I – Figure 28).

Vantage point surveys were conducted accordingly to the most recent recommendation from the best practice guidelines at the time (Jenkins *et al.* 2015). Each location was surveyed for a minimum of 12 hours of observation per season divided through the early morning, midday and late afternoon times of day.

All the *Raptors* and large terrestrial bird species observed during this period were recorded and their flight paths registered. For each observation the number of individuals and, whenever possible, the gender and age was recorded. Behavioural patterns observed were also recorded. This included but were not restricted to:

- Type of flight – passage flight, soaring, display, territorial, etc.;
- Flight height[2] in relation to wind turbine height;
- Time – duration of the observation, and;
- Environmental conditions (air temperature, wind speed and direction, occurrence of precipitation, cloud cover and visibility).

Whenever pertinent, additional information was collected in order to contribute to the detailed characterisation of the usage of the area by each species.

During all the observers' movements within and around the study area (through slow driving or walking), all the contacts with *Raptors* and large birds (particularly those regarding pathway flights, flights at rotor swept height, hunting and display behaviours or those suggestive of important feeding, nesting or roosting sites) were recorded with the same detail as described above and were noted as "extra" or incidental observations (Jenkins *et al.* 2015). This methodology complemented the results from the vantage points and subsequently contributed to increasing the information regarding the distribution of the species over the relatively large study area.

Data analysis and criteria

All the data collected during the fieldwork (vantage points and complementary records recorded during observer's movements throughout the study area) were inserted into a geographical information system in

[2] Estimating the height of birds while flying can be challenging, especially during pre-construction phase when there's no physical height reference (e.g. such as power lines or wind turbines). This is overcome by the field observers by specific training in height estimation and extensive field work experience, aided by rangefinders in the field to constantly calibrate the observers distance bearings. The field measurements are, however, estimates to best reflect the reality so the data can be used to drawn fairly robust conclusions. The values for the lowest and highest tips of rotor swept area are obtained from the turbine characteristics and rounded to the nearest ten, always applying a precautionary approach and considering the largest swept area. Since the turbine specification has not yet been confirmed, the range between 70 and 190m was considered.

order to map the areas used by sensitive species and to perform a spatial analysis of the results. This allowed the estimation of several indexes and parameters, calculated by analysing the distribution of the flight records throughout the area.

In order to assess variations in the spatial utilisation of the different bird species, the analysis was conducted for different groups based on particular characteristics relevant to their biology, ecology and behaviour. This classification is not just ecological[3], but rather practical and aiming to focus on the specific impacts likely to occur as a result of the installation of the wind energy facility, depending on the characteristics of the birds affected. Thus, the species were divided into (Table 1):

- *Accipitrids* - fairly large raptors, usually presenting a large wingspan and making use of thermal uplifts or hillside currents when soaring or gliding;
- *Falcons* - usually smaller raptors that make use of fast flight. Many of them display specific hunting behaviours such as hovering while looking for small prey. Some species tend to roost and hunt in large numbers,
- *Crows* - corvid species are classified within this group. They are usually common, widespread, opportunistic species. Although they often tend to fly at rotor height, they have not been found to be particularly affected by wind energy facilities. Sometimes they appear in large numbers and their populations are often unbalanced by the extra available resources found in human-influenced habitats.
- *Waterbirds* - mainly ducks, cormorants, geese and other waterbody-associated species (usually swimmers or divers) appear in this group.
- *"Ciconids"* - Ibis, Egrets and Herons mainly. While also being closely associated to water, these species are not swimmers or divers and are, in fact, often found away from actual waterbodies but in relatively muddy areas.
- *Bustards* – large to medium sized terrestrial birds, usually associated with agriculture areas where they tend to gather and forage. Includes bustards and korhaans, several of these species being endemic or near endemic to southern Africa. Most have the ability to make short commuting flights, while other species, can even migrate.

2.2.5. Vehicle-Based Transects

As a complementary method, seven vehicle-based transects were conducted – three in the WEF and four in its immediate surroundings – measuring approximately between 5 and 9km each (Appendix I - Figure 28).

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[3] This classification is important as some common, generalised events may obscure other similar events that are more important and/or scarce. For example, while the apparition of a few kestrels hovering at a particular area is a quite a common sighting in the field, the sighting of a Martial Eagle occurs seldom. These events were meant to be clearly differentiated as to help define the possible impacts. Therefore, the classification is not just ecological but also practical. It aims to help represent important facts in order to assess particularities of the impacts that may be a result of the development.

The purpose of the survey was to provide a measure of abundance and richness for those species observed (large terrestrial birds and raptors). At the same time, this information complements that obtained from the vantage point surveys and aids in the detection of species less prone to flying, such as bustards. It also helps in detecting roosting and nesting sites as it covers extensive areas in a short period of time.

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. The following parameters were recorded: species and number of individual's present, perpendicular distance from the road, bird activity at the moment of observation and any additional notes that were considered relevant. If the contacts were seen flying, it was noted. The distance from the observer to the point where the bird was first detected was then recorded.

The following parameters were recorded and all records were taken note of on a standard field sheet especially designed for this methodological approach:

- bird species, gender and age (whenever possible);
- number of individuals;
- perpendicular distance from the road;
- bird activity observed and type of observation (acoustic/visual).

Whenever relevant, additional information was collected in order to contribute to the detailed characterisation of areas usage by the species.

2.2.6. Breeding Evidences

A possible Verreaux's Eagle breeding location was identified within the proposed Wind Energy Facility in the visits conducted during the Scoping stage (Bioinsight 2016a). However, over the course of the monitoring programme, this nest was confirmed to be collapsed Hamerkop nest, rather than a Vereaux's Eagle nest.

Surveys were conducted in the area in order to detect breeding evidences and/or roosting locations of sensitive species. These surveys took place in every season. The habitats located within the impact zone are likely to support key species, such as cliffs, power lines, stands of large trees, marshes and drainage lines (Malan 2009) which were surveyed by the combination of different inspection techniques according to the specifics of each site.

The location and status of the nests was determined by active searches and direct observations, by making use of a handheld GPS (Garmin® ETREX 10 and ETREX 20), a pair of binoculars and a spotting scope. After a nest was located, the observer spent time observing it.. The following parameters were registered: type of nest (e.g. cliff, tree, pylon, building, rock cavity), vertical position at the supporting structure of the nest, orientation (north, south, etc.), status (e.g. good condition, bad condition, collapsed) and, whenever possible, construction phase (e.g. inactive, building, fixing, green branches). When an active nest was found, the following parameters were registered: reproduction phase (e.g. construction, incubation and chicks), presence of parents in the nest, number of eggs, number of descendants/flying offspring. Whenever relevant, additional information was registered according to observations found in the field.

2.2.7. Waterbody monitoring

Several waterbodies were identified within the proposed wind energy facility site or the surrounding. Therefore, these were mapped on a Geographical Information System by using 1:50 000 topographic maps and aerial photos and later surveyed in order to determine their level of utilisation by *Waterbirds* (Figure 28).

The water bodies found to be most relevant (due to their size and ability to hold water in the rainy season) were visited by two expert observers at least twice during the pre-construction monitoring campaign. The observers were aided by a pair of binoculars and a spotting scope. Whenever a relevant water body was found to be present, the methodological approach followed the established for the Coordinated Waterbird Counts (Taylor *et al.* 1999). The observations were made simultaneously by two observers, from a fixed point, for a minimum of 30 min. The species present were then recorded at the beginning of the observation. For the remaining period, the observer recorded the main movements around the water body. The following parameters were registered: species and number of birds present, gender and age (adult, juvenile/chicks) (whenever possible), direction of arrival/departure from the water body and any additional notes that may have been important.

2.3. Assumptions & Limitations

- The pre-construction bird monitoring is based on 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. Species were considered as being possibly present within the study area if they occurred in any of the pentads, QDGS or wetland sites considered for analysis. Coordinate Avifauna Roadcounts data and Coordinated Waterbird Counts data was also requested for consideration in this study.
- As vantage points had good visibility conditions, it was assumed that not only flying birds but also individuals on the ground should be detected. However, large terrestrial birds which do not fly often or spend long periods on the ground, would be more difficult to detect on hilly or wooded areas. This fact directly implies that activity indexes for these species can be underestimated. To deal with this issue a vehicle based transect was set up in the development area. This allowed moving through the area and having different perspectives over topographic features - therefore increasing the chance of detecting these type of birds, though activity indexes obtained through these two different methods cannot be directly compared.
- Vantage point surveys are only conducted during daylight. Therefore, any bird movement occurring at night is not recorded.
- At this stage, no inter-annual variations are taken into consideration as only one year of data has been collected. Nevertheless, the basis for comparisons with subsequent years has been established.
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- The recommendations on the current version of the applied guidelines were followed to the maximum extent possible and exceeded whenever feasible. The methodologies implemented were adjusted to the specificities of the area. Compliance and any deviations from the guidelines are presented in this report.

3. Results and discussion

The results presented in this report consider the information recorded during the pre-construction bird monitoring programme for the Kudusberg WEF undertaken across all four seasons. Therefore, they constitute a baseline reference for the bird communities in a pre-construction scenario. The discussion is based on the analysis of data collected and specialised bibliographic information available.

3.1. General results

From a total of 131 species potentially occurring in the area (Bioinsight 2016a), a total of 67 bird species were detected within the study area (WEF and surrounding area) across all the survey methodologies implemented through the pre-construction monitoring, including eight species that were not identified as occurring at the site in the Scoping phase (Appendix II). Seventeen of the species identified are considered to be sensitive to impacts caused by wind energy facilities (Table 1).

Out of the total species identified, 6 are of special concern for having an unfavourable conservation status in South Africa (Appendix II): Black Harrier *Circus maurus*, Ludwig's Bustard *Neotis ludwigii*, Martial Eagle *Polemaetus bellicosus* – Endangered; Verreauxs' Eagle *Aquila verreauxii*, Black Stork *Ciconia nigra* – Vulnerable; Greater Flaming *Phoenicopterus roseus* – Near Threatened (Taylor, Peacock & Wanless 2015). A description of these species occurrence in the study area is given in Appendix IV.

Eleven species detected during field work are considered to be endemic or near endemic to South Africa including sensitive species such as Jackal Buzzard, Karoo Lark, Black Harrier, Large-billed Lark and Cape Clapper Lark (Appendix II).

The bird community at the study area (67 total bird species) was mostly composed by passerine and small bird species (43% of the total species), followed by bird species associated with waterbodies (28% of the total bird species), *Accipitrids* (10% of species) and *Ciconids* (10% of species). Representing a smaller proportion, 7% of the species found in the study area were *Bustards, Falcon* or *Crow* species (Table 5). From the aforementioned groups the *Raptors (Accipitrids), Falcons, Waterbirds* and "*Ciconids*" are considered most likely to suffer impacts caused by wind farms (Retief *et al.* 2012). Passerines might also be sensitive to impacts and collide with wind turbines, especially those which conduct migrations (AWWI 2015).

A large portion of the species confirmed in the area were observed at both the proposed wind energy facility site and the surrounding area (33 species – 49% of the total species observed). These species may not be severely impacted by the wind energy facility presence as they already use the surrounding area, being therefore possibly able to shift their utilisation area slightly. These include most of the priority species present at the site (12 out of 17 species), of which 7 are *Accipitrids* and *Falcons* species, considered to have a higher vulnerability to collision, especially if using the development site only (AWWI 2015).

Nineteen of the remaining species were observed using only the WEF site, being these mostly *Waterbirds*, *Ciconids* and *Passerines and small bird species* – from these only three species are considered sensitive to impacts caused by wind energy facilities (Table 5).

A similar number of species were detected using only the Control area, with similar group characteristics. Such species are considered to be less likely to be negatively impacted by the Kudusberg WEF as they do not regularly use the area where the WEF will be constructed. They may however be somewhat affected by the disturbance caused by the temporary construction activities which can have repercussions to the broader study area. Additionally, it is of note that they may also use the WEF area, though they have not been observed doing so.

Table 5 – Number of species observed at the Kudusberg WEF and Control (CO) area, considering their sensitivity to impacts caused by wind energy facilities (refer to Table 1).

Group of species	WEF only		CO only		WEF & CO	
	Total Non-sensitive	Sensitive	Total Non-sensitive	Sensitive	Total Non-sensitive	Sensitive
"Ciconids"	3	1	4	2	7	3
Bustards	1	1	0	0	1	1
Crows	1	0	0	0	3	0
Falcons	0	0	0	0	1	1
Passerines and other small birds	11	1	5	0	29	4
Raptors (*Accipitrids*)	1	0	0	0	7	6
Waterbirds	2	0	6	1	19	3
Total	**19**	**3**	**15**	**3**	**67**	**18**

3.2. Passerine and small bird communities

Amongst the diverse community of passerine species and similar small bird species four sensitive species were observed using the WEF site and surrounding area: Cape Clapper Lark *Mirafra apiata*, Grey-winged Francolin *Scleroptila africana*, Karoo Lark *Calendulauda albescens*, Larged-billed Lark *Galerida magnirostris*, (Table 6). From the aforementioned species none have a conservation status of concern (Taylor, Peacock & Wanless 2015; IUCN 2016). Due to their ecological characteristics these species are regarded as sensitive to habitat related impacts, such as disturbance and displacement. A particular notice is given to larks as they usually perform aerial displays during the breeding season, which extends from about August to November in the area (Hockey *et al*. 2005). These aerial displays can extend to very high altitudes, potentially entering the collision risk area (i.e. the rotor swept area), and leading to fatalities of some individuals due to collision with rotating turbine blades. Though larks were present at the WEF site, they were not abundant nor frequently observed. Swifts and swallows are also considered to be potentially susceptible to collisions with wind turbines due to their migration pattern (Strickland *et al.* 2011; AWWI 2015).

Passerine community observed at the WEF site and Control area presented similar compositions and abundances. This indicates that the Control area chosen is an adequate representative of the WEF site and additionally is regarded as alternative habitat for some of the species present, being this the case for two of the sensitive species detected: Large-billed Lark and Karoo Lark.

Species from this group were particularly abundant in winter and spring with both a medium relative abundance and estimated density (Table 6; Figure 7). The same trend was observed regarding species richness, with a higher number of species detected both at the WEF and Control areas in winter and spring seasons. This increase of activity during spring season is most likely due to a higher conspicuousness of most resident passerine species which are more vocal for breeding purposes. Additionally, in situations where wind speed is in favour of the observers it will increase detectability of most passerine species. Nonetheless, it is of note that higher abundance and densities were observed of non-sensitive species. With the exception of the Large-billed Lark which was particularly abundant in the winter season at the WEF and in spring and summer in CO (average of 1.43, 1,33 and 1.14 contacts/transect, respectively), all other passerine sensitive species presented an average abundance lower than 0.8 contacts/transect.

Considering the most abundant groups of passerine bird species, a specific analysis of their density was conducted and is presented in Figure 8. Cisticolas, represented by Grey-backed Cisticola, Karoo Prinia, among others were particularly abundant in the study area in the winter season. Buntings (Cape Bunting) especially occurred in winter and spring seasons. Flycatchers, on the other hand were almost equally detected in all seasons. Larks, were mostly detected during winter and spring seasons. Lastly, Shrikes abundance were similar in all seasons.

Table 6 – Main results for passerines of the walked transects conducted at the Kudusberg WEF and Control area.

Season	Avg. number of contacts/transect	Avg. number of species/transect	Sensitive species	Non- Sensitive Abundant species
Summer				
WEF	5.4	6.3	Large-billed Lark; Grey-winged Francolin	Karoo Scrub Robin
Control	10.7	9.7	Large-billed Lark	Bokmakierie; Karoo Scrub Robin
Autumn				
WEF	8.4	7.9	Large-billed Lark; Karoo Lark	Bokmakierie; Cape Bunting
Control	16.8	14.5	Large-billed Lark; Karoo Lark	Bokmakierie; Grey-backed Cisticola
Winter				
WEF	32.3	20.4	Cape Clapper Lark; Large-billed Lark	Bokmakierie; Cape Bunting; Cape Sparrow; Grey-backed Cisticola; Mountain Wheatear
Control	17	14.3	Rock Kestrel; Large-billed Lark	Bokmakierie; Cape Bunting; Grey-backed Cisticola; Southern Double-collared Sunbird
Spring				
WEF	17.6	13.4	Rock Kestrel; Black Harrier; Large-billed Lark	Cape Bunting; Grey-backed Cisticola; Karoo Scrub Robin
Control	18.6	16.9	Large-billed Lark; Karoo Lark	Cape Bunting; Grey-backed Cisticola

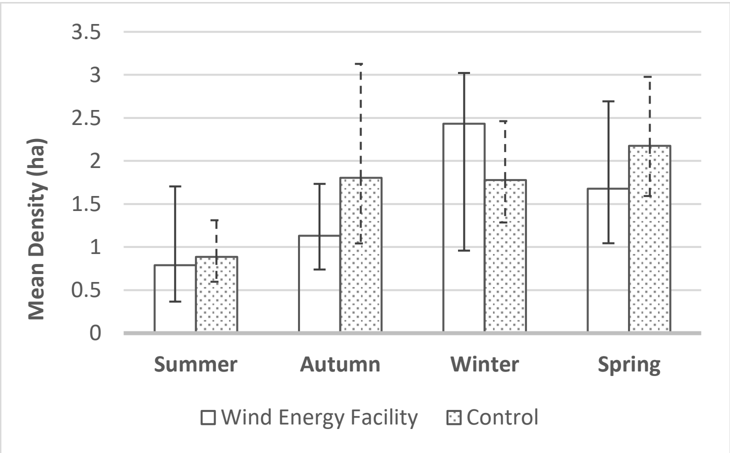

Figure 7 - Estimated densities of the general small bird community per season detected at Kudusberg WEF and Control area during pre-construction monitoring programme.

A summary of the observations of sensitive passerine and small bird species is given below. These include Large-billed Lark, Karoo Lark, Cape Clapper Lark and Grey-winged Francolin.

Large-billed Lark (*Galerida magnirostris*), a near endemic species to South Africa, is known to display during the breeding season in circling flights, 15 to 50 m high (Hockey, Dean & Ryan 2005). This would be the passerine species considered to be the most sensitive species to collision with turbine blades as it is the only one known to enter a rotor swept area bellow 50/60m. It selects semi-arid environments and also cereal crops and degraded rangelands (Hockey, Dean & Ryan 2005). In the study area it was observed at BTKD01, 03, 04, 05, 06, 07 (WEF) and BTCO01, 02, 04, 05, 06, 07, 08 (CO), during all seasons, indicating a very widespread distribution in the area.

Karoo Lark (*Calendulauda albescens*), a near endemic species to South Africa, displays flying 15-25 m high (Hockey, Dean & Ryan 2005). Occurs in open, sandy shrub, avoiding generally agricultural areas, although it is tolerant to old fallows and areas recolonized by shrubs (Hockey, Dean & Ryan 2005). Karoo Lark was observed during autumn and spring, at the walked transects both in WEF (BTKD05) and control (BTCO01 and BTCO08).

Cape Clapper Lark (*Mirafra apiata*) is a near endemic species to South Africa. Displays rising steeply in the air (Hockey, Dean & Ryan 2005). Occurs in dense shrubland but also tolerates cereal crops if they are densely covered and about natural vegetation (Hockey, Dean & Ryan 2005). Only one individual of this species was detected once during the winter season, at the walked transect BTKD01. The lack of observations in the remaining surveys or even at the Control area suggest that the species may not use the proposed WEF site frequently and that the identification made may be of a vagrant individual instead of a resident species.

Grey-winged Francolin (*Scleroptila africana*), is endemic to South Africa and Lesotho. This species is considered sensitive to impacts caused by wind farms due to habitat loss and potential displacement effects, and it is not known to fly at rotor swept area (Hockey, Dean & Ryan 2005). This species was seldom detected at walked transect BTKD06 (WEF) during summer, and from Vantage Point VPKD02 (WEF) during winter,and VPCO05 and 06 (CO) during autumn. Though widespread its distribution in the area appears to be sparse, most likely due to the detection difficulties related to this species camouflage plumage.

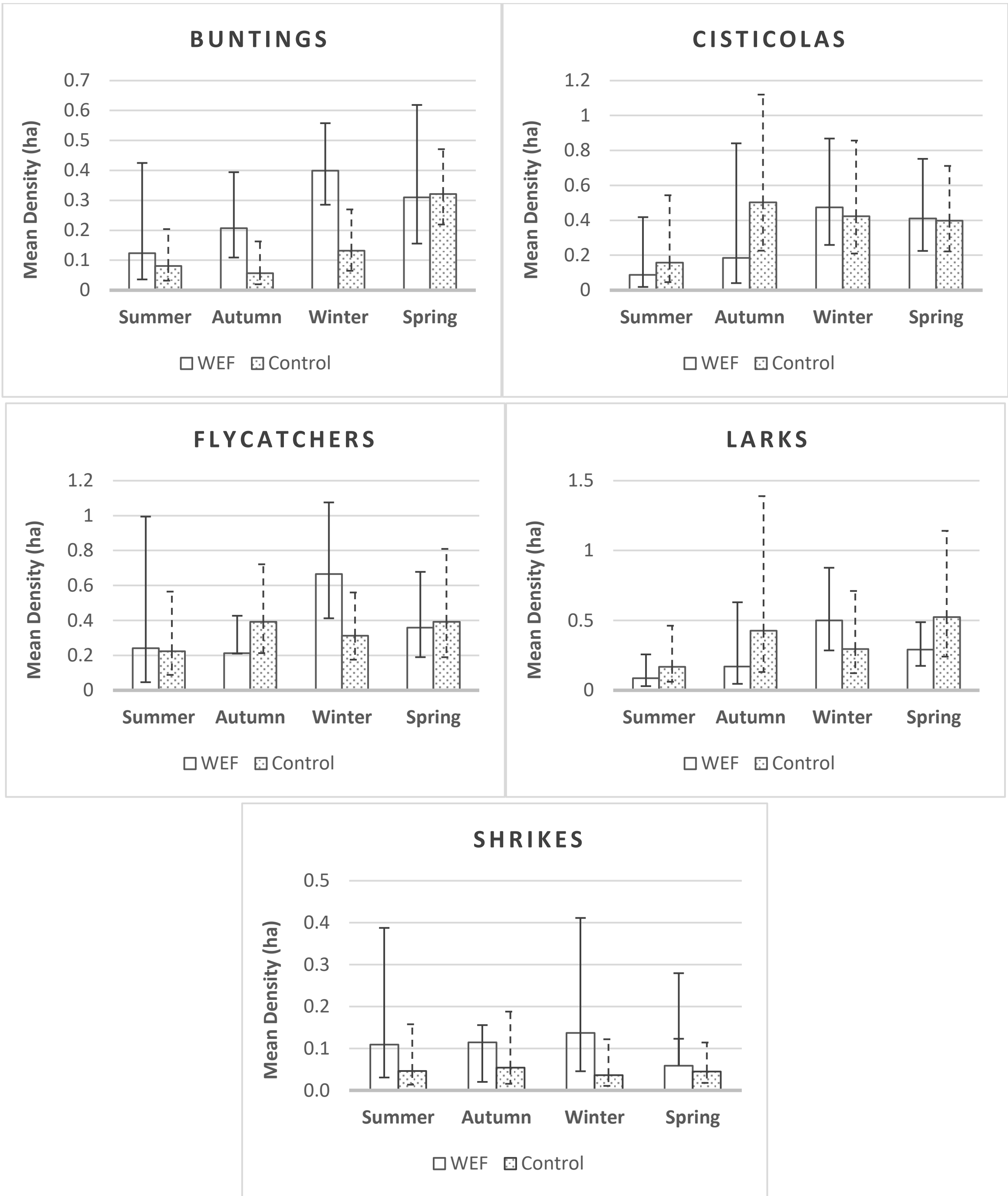

Figure 8 – Estimated densities of the most frequent passerine groups of species per season detected at Kudusberg WEF site and Control area during pre-construction monitoring programme.

3.3. Raptors and large birds

General community

A total of 17 species of *Raptors, Falcons* and other large birds were observed in the study area and its surroundings (including seven Raptors, three "Ciconids", three species of Corvid, two Waterbirds, one Bustard and one Falcon species), through all methodologies implemented.

Activity calculated through standardised metrics (i.e. vantage points) in the proposed WEF and surrounding area was very variable considering the groups with occurrence in the study area (Figure 9). While *Accipitrids*, *Falcons* and *Waterbirds* were observed throughout the whole year (or most of the year), *Crows* were detected only in spring seasons. *Phasianids* were observed only in autumn and winter through vantage points and in WEF walked transect during summer.

Accipitrids were mostly active in the summer season (approx. 0.059 contacts/hour), showing a decrease in autumn, spring and winter (approx. 0.029, 0.028 and 0.022 contacts/hour, respectively). *Falcons* on the other hand have shown a more irregular activity pattern, with general peak of activity in the summer season (approx. 0.078 contacts/hour) and much lower activity levels in the autumn and spring (around 0.008 and 0.021 contacts/hour). *Falcons* were also quite active in winter, when a general activity of 0.044 contacts/hour was recorded. Also, *Waterbirds* showed an irregular activity pattern recording higher activity in autumn and spring (approx. 0.039 and 0.033 contacts/hour) while and no activity was registered in the summer season.

In general, bird activity detected, as well as the gliding and hunting movements of species observed during vantage point hours were concentrated in the escarpment and hillside areas, followed by areas of natural vegetation with sparse coverage (Figure 15; Figure 16; Figure 17). These areas also coincide with the locations where contacts at RSH were more abundant (Figure 24), and generally where the highest amount of time was also spent at RSH (Figure 18).

While vantage points allowed to determine in a more consistent way the spatial utilisation of the area by a general list of species, vehicle-based transects were also useful in detecting general abundance of potentially less aerial species, such as Black Stork, among other sensitive species. Figures of the contacts recorded through vehicle-based transects are shown in Table 7. Activity recorded through this method was higher in the spring season, also due to a higher number of species observed, while the activity in the Control site was relatively constant throughout the year, apart from a slight peak during winter (summer, autumn and spring: 0.04 contacts/km; winter: 0.16 contacts/km). In the WEF area, the average number of detection was more irregular, with no detections recorded in the summer and autumn, followed by a peak in the winter and spring seasons. Amongst the sensitive species detected through this method, besides the aforementioned Black Stork, are included Martial Eagle, Rock Kestrel, Jackal Buzzard, Pale Chanting Goshawk, Black Harrier. Also, a Black Harrier was observed trough the walked transects methodology (BTKD03).

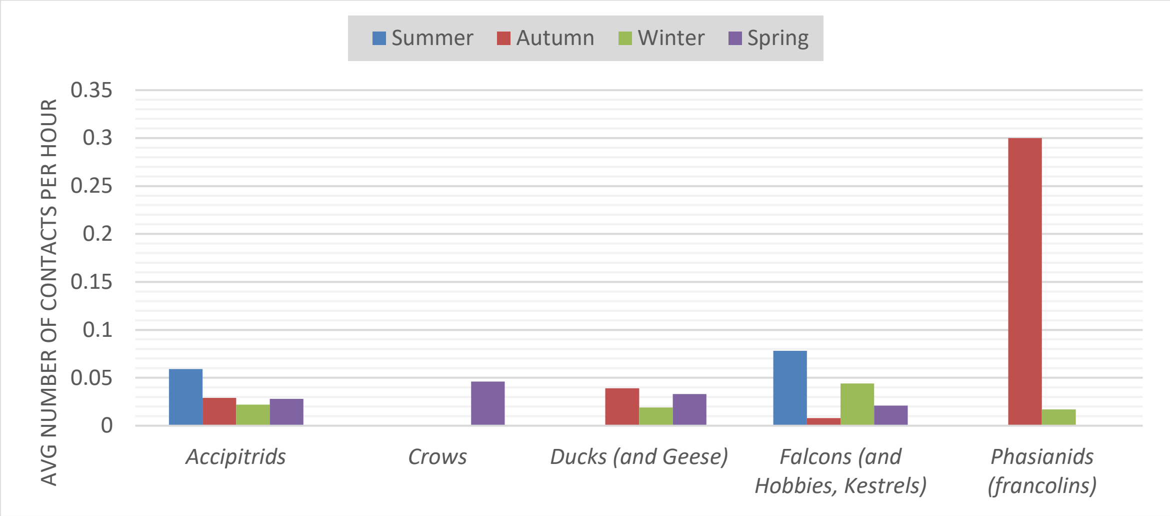

Figure 9 - Average number of contacts per hour for the general bird community obtained through the vantage points conducted during the bird pre-construction monitoring programme.

Table 7 – Main results of the vehicle based transects conducted at the Kudusberg WEF and Control area.

Season	Avg. number of contacts/km	Avg. number of species/transect	Sensitive species
Summer			
WEF	0	0	-
Control	0.04	0.25	Martial Eagle
Autumn			
WEF	0	0	-
Control	0.04	0.25	Martial Eagle
Winter			
WEF	0.05	0.33	Rock Kestrel
Control	0.16	0.5	Jackal Buzzard; Pale Chanting Goshawk
Spring			
WEF	0.14	0.75	Black Harrier; Black Stork; Rock Kestrel
Control	0.04	0.25	Pale Chanting Goshawk

Accipitrids and *Falcons*

Compared with other groups of species, *Raptors* and *Falcons* represent a larger number of species of concern and a diverse community. These two different groups might differ in habits and behaviour: *Falcons*, small fast flyers and Accipitrids, larger, soaring *Raptors*, however they are common in their higher vulnerability to collision with wind turbines and higher susceptibility to population decrease due to longer lifespan and lower reproductive rate when compared with passerine species for example (AWWI 2015). From these two groups, a total of 8 species were detected in the study area and surroundings and were all are considered sensitive to impacts caused by wind energy facilities: African Harrier-Hawk, Black Harrier, Black-chested Snake Eagle, Jackal Buzzard, Martial Eagle, Pale Chanting Goshawk, Rock Kestrel and Verreauxs' Eagle. Three of these species are of conservation status of concern: Verreauxs' Eagle (*Vulnerable*), Black Harrier and Martial Eagle (*Endangered*) (Taylor, Peacock & Wanless 2015). A description of the movements and general occurrence of these species is supplied in Appendix IV.

As mentioned in relation to Figure 9, *Accipitrids* and *Falcons* are included in the species with the most frequent and abundant occurrence in the study area. Analysing the spatial utilisation of these groups in relation to the biotope distribution it was evident that most contacts for both groups were in hillside areas (Figure 10). This is not unusual as soaring birds who tend to use slope areas to gain lift and soar through the area. Additionally, *Falcons* more frequently used areas of open natural vegetation, without tree coverage, while *Accipitrids* showed a different pattern, preferring areas of natural vegetation with sparse trees. Riverine vegetation and drainage lines was also actively used both by *Falcons* and *Accipitrids*.

In terms of the time spent at rotor swept height, *Falcon* and *Accipitrid* species spend a large portion of their time at rotor swept height (RSH), except during autumn (for both the WEF and CO areas).

- *Accipitrid*: average of 29% in spring, 84% in summer, 31% in winter of the total time observed at the study area and
- *Falcon*: average of 91% in spring, 48% in summer, 52% in winter of the total time observed at the study area (Figure 22).

To this elevated percentage some species had a higher contribution than others, including the Rock Kestrel, the Verreauxs' Eagle and the Martial Eagle which spent most of the recorded time flying at RSH.

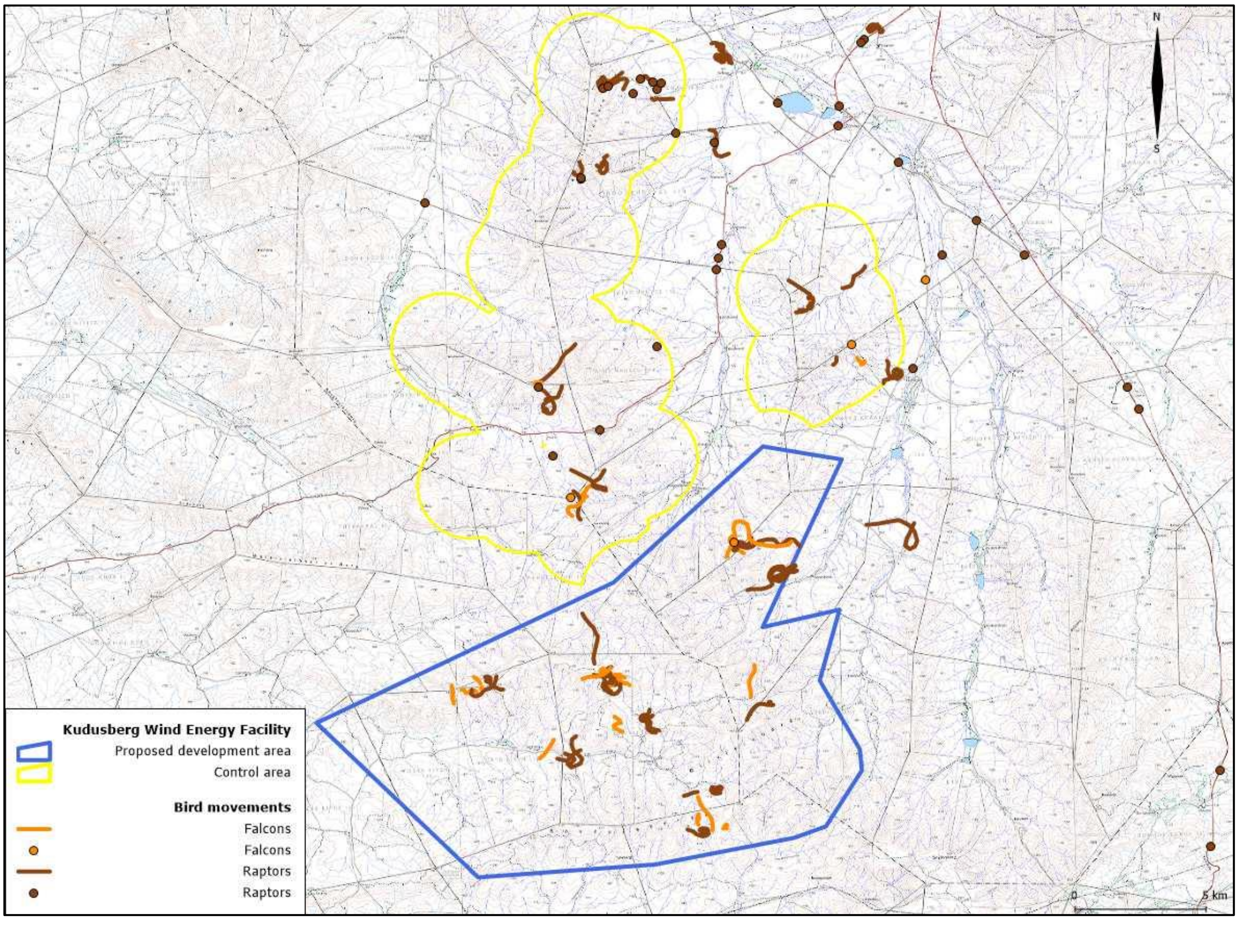

Figure 10 – Distribution of *Accipitrid* and *Falcon* movements collected through the bird monitoring programme at the proposed Kudusberg WEF.

Bustards and Cranes

Bustards were represented by the presence of Ludwig's Bustard in the study area only, while no Crane species was observed in the study area (refer to Appendix IV for more details on the observations of this species). Both species groups are considered sensitive to impacts caused by wind energy facilities. Ludwig's Bustard was only detected in spring through vantage points, thus no standardised calculations could be made regarding its activity in the area (Figure 11). However, no flights at RSH were observed hence the potential collision probability for this species is expected to be low.

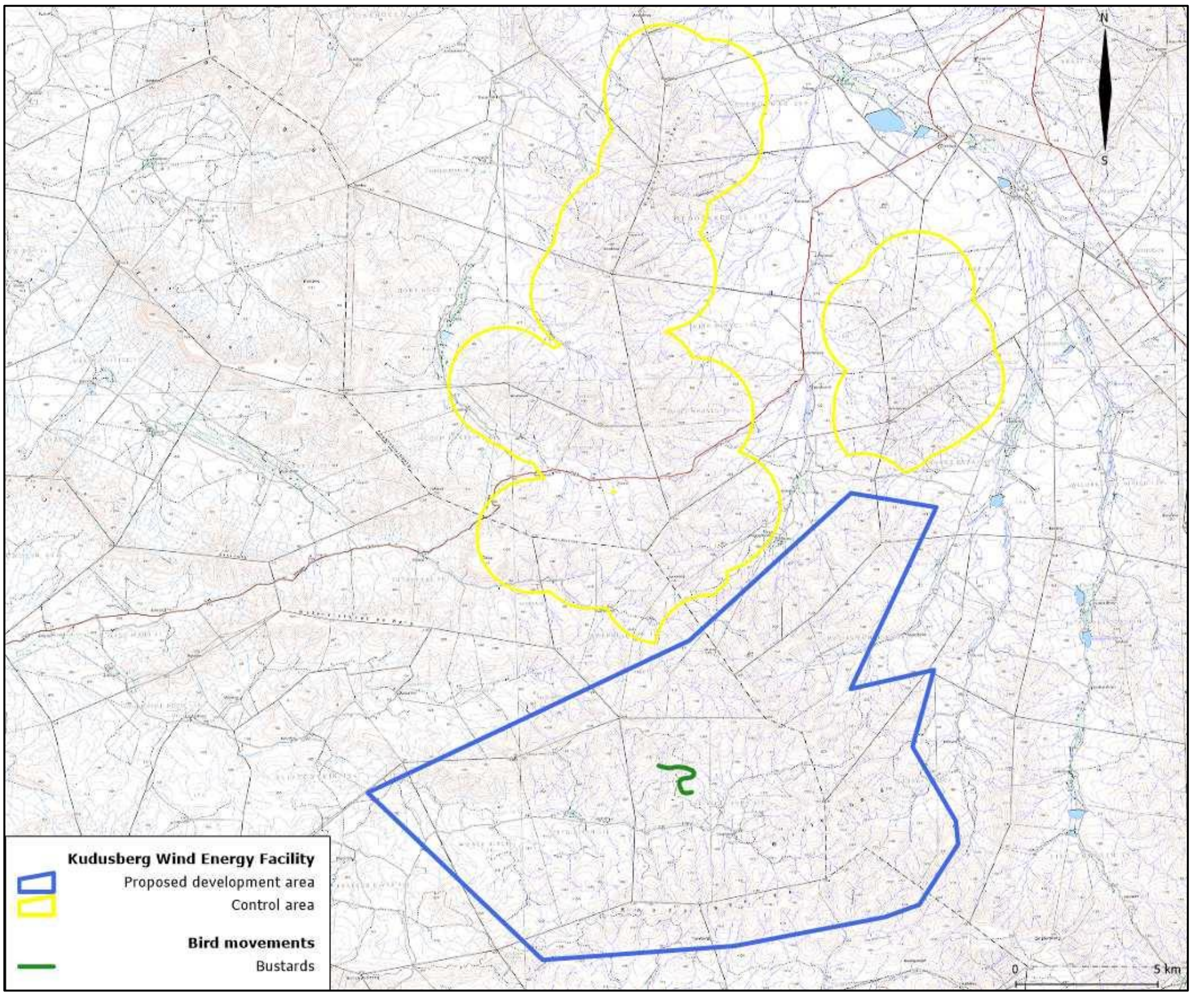

Figure 11 – Distribution of *Bustards* (Ludwig's Bustard) movements collected through the bird monitoring programme at the proposed Kudusberg WEF.

"Ciconids"

"*Ciconids*" was not particularly abundant at the study area, however, the occurrence of at least three sensitive species was confirmed: Black Stork (during winter), as well as the Hamerkop and African Spoonbill (during spring). The observations of this group were made through non-directed methodologies both in WEf and Control area, but in spite of this, a single very brief flight was observed at RSH, of one Black Stork in the Control area. The remaining observations of this group occurred in WEF were of three individuals of African Spoonbill foraging on the ground, and one Hamerkop gliding below the RSH (Figure 12).

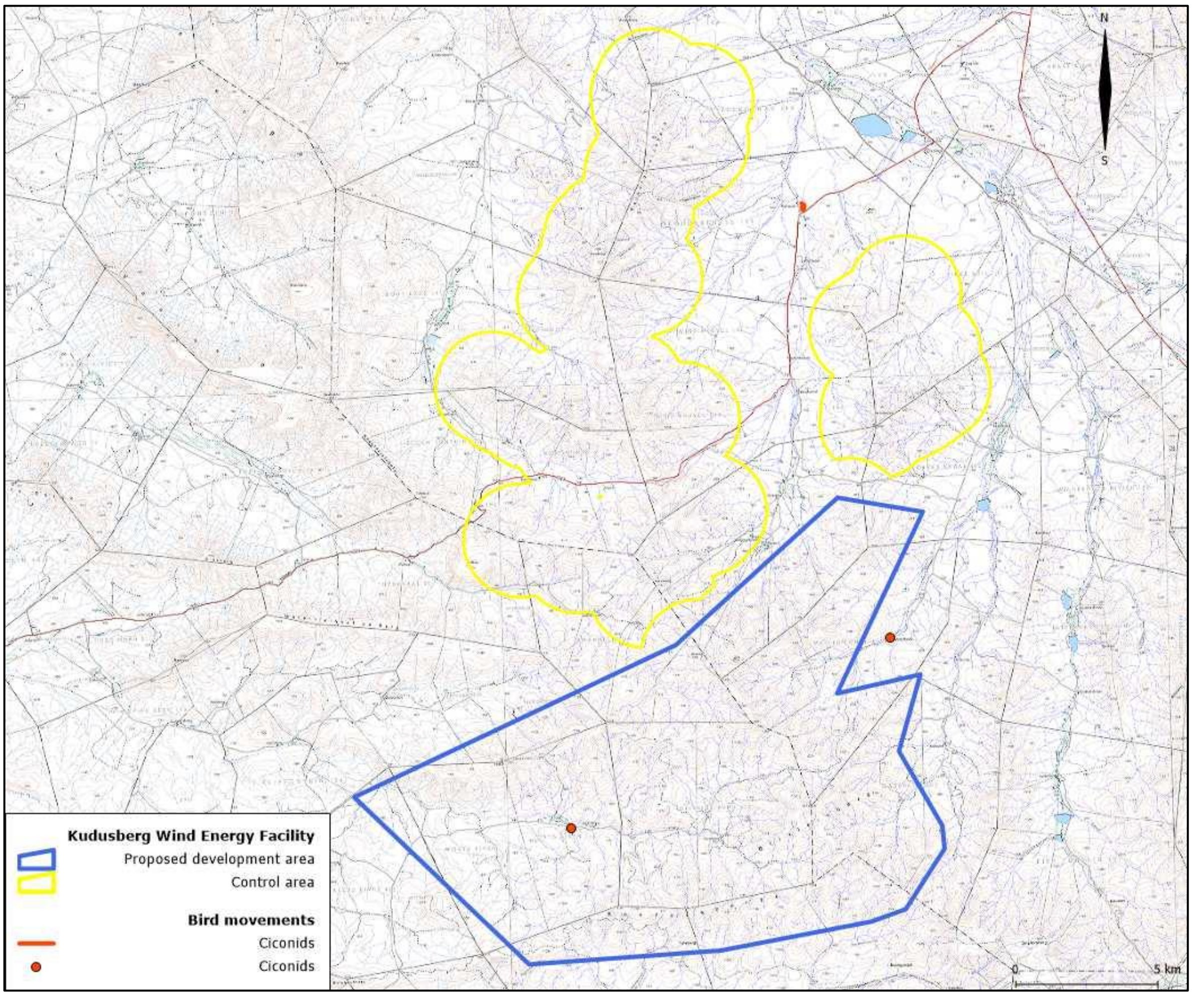

Figure 12 – Distribution of *"Ciconids"* movements collected through the bird monitoring programme at the proposed Kudusberg WEF.

Crows

Three Corvid species were abundantly and frequently detected in the study area: Cape Crow, Pied Crow and White-necked Raven. None of these species has a conservation status of concern nor is considered sensitive to impacts caused by wind energy facilities. However, it is of note that 22% of the flights documented through vantage points methodology for Pied Crow were recorded at RSH (Figure 13; Figure 22). In spite of absence of fatality records of Corvid species at wind energy facilities this is a risk that could contribute to a higher collision probability for this species during the operational phase of the project.

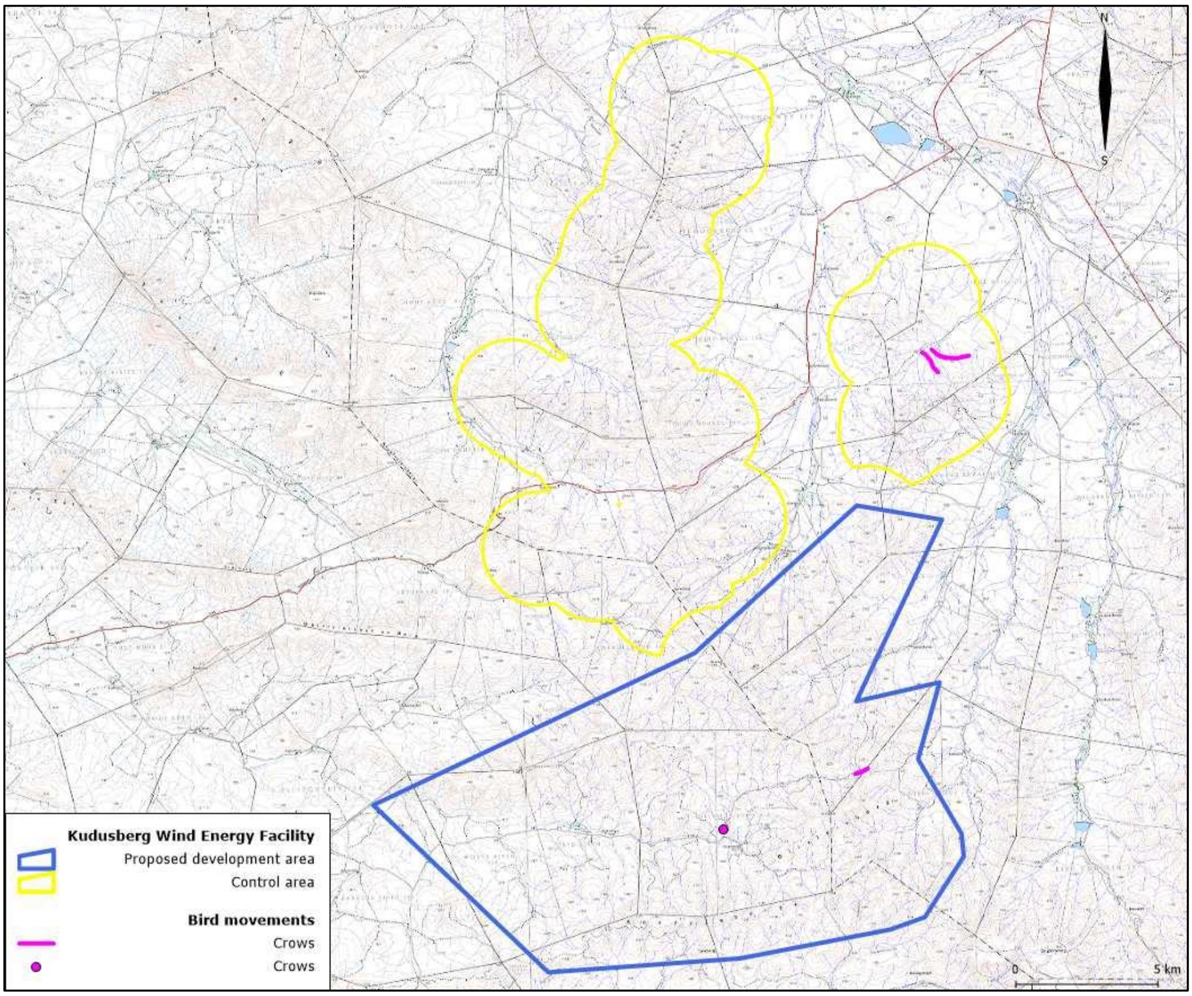

Figure 13 – Distribution of the *Crows* movements collected through the bird monitoring programme at the proposed Kudusberg WEF.

Waterbirds

Waterbird species recorded at the study area included Egyptian Goose, and South African Shelduck. None of these species presents a conservation status of concern or is considered sensitive to impacts caused by wind energy facilities. It is of note the high utilisation of the RSH by both species, during autumn and winter while commuting through the area (Figure 14; Figure 22). Movements observed occurred especially in Control area and in the northern section of the WEF (Figure 14).

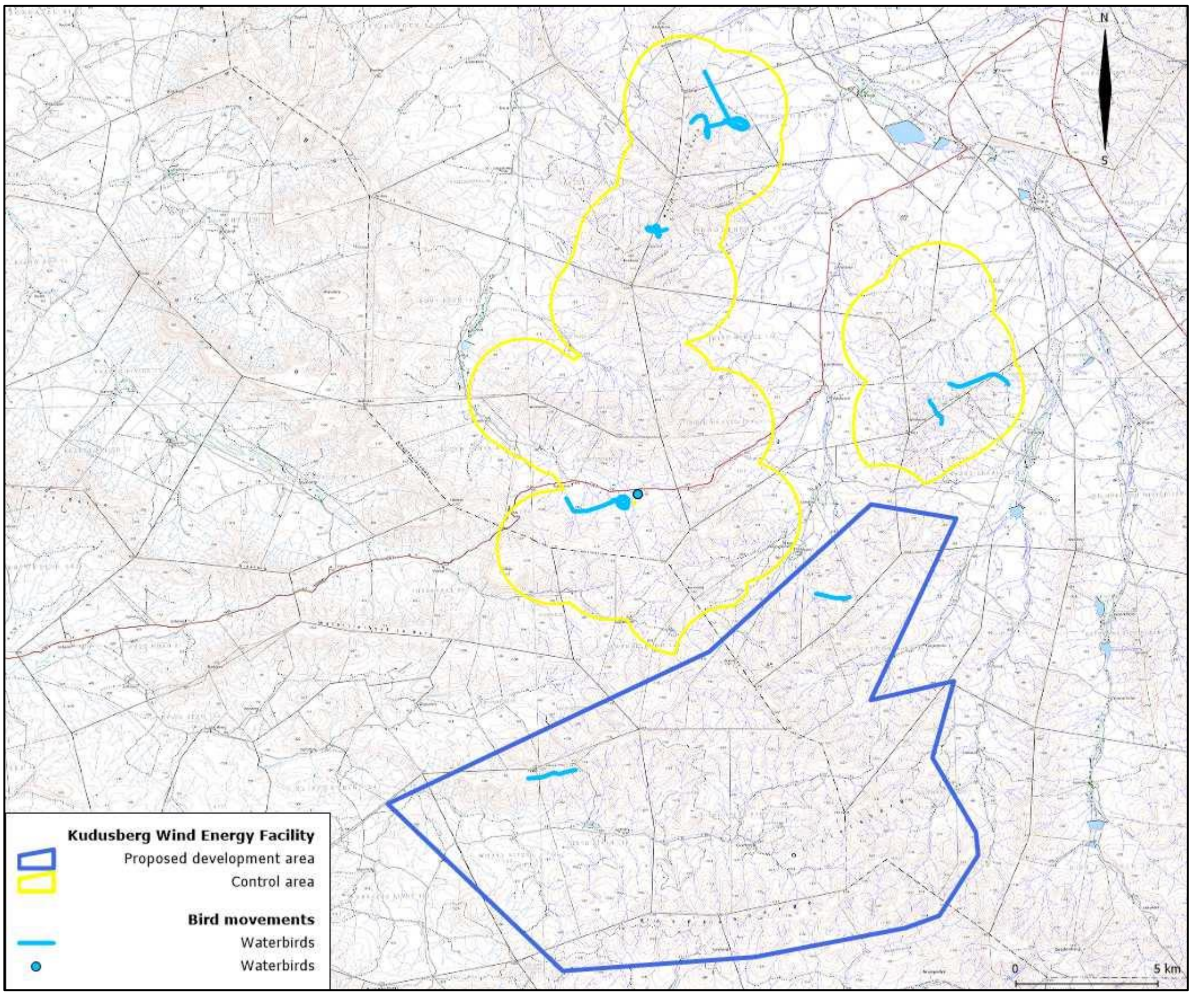

Figure 14 – Distribution of the *Waterbirds* movements collected through the bird monitoring programme at the proposed Kudusberg WEF.

General considerations

In terms of community composition and general utilisation of the proposed site some aspects are highlighted as of special concern:

- A constant and higher activity of *Accipitrids* and *Falcons* has been observed throughout the year. Both groups of species also spent a high proportion of their time flying at rotor swept height (between 70m and 190m). This is regarded as the dominant group of sensitive species at the site, due both to their conservation status and high likelihood to collide with rotating wind turbines (collision risk analysis is presented in section 3.6);
- Remaining groups have demonstrated a sparser occurrence and lower activity levels at the site. Nonetheless some species, such as South African Shelduck, Egyptian Goose and Pied Crow conducted flights at rotor swept height, indicating a certain degree of collision probability. This will be evaluated in section 3.6;
- General activity was particularly associated with the hillsides which compose a big portion of the proposed WEF site. These areas were particularly important for *Accipitrids* and *Falcons* since most of the flights observed concentrated around these features. Riverine vegetation and drainage lines was also actively used both by *Falcons* and *Accipitrids*.

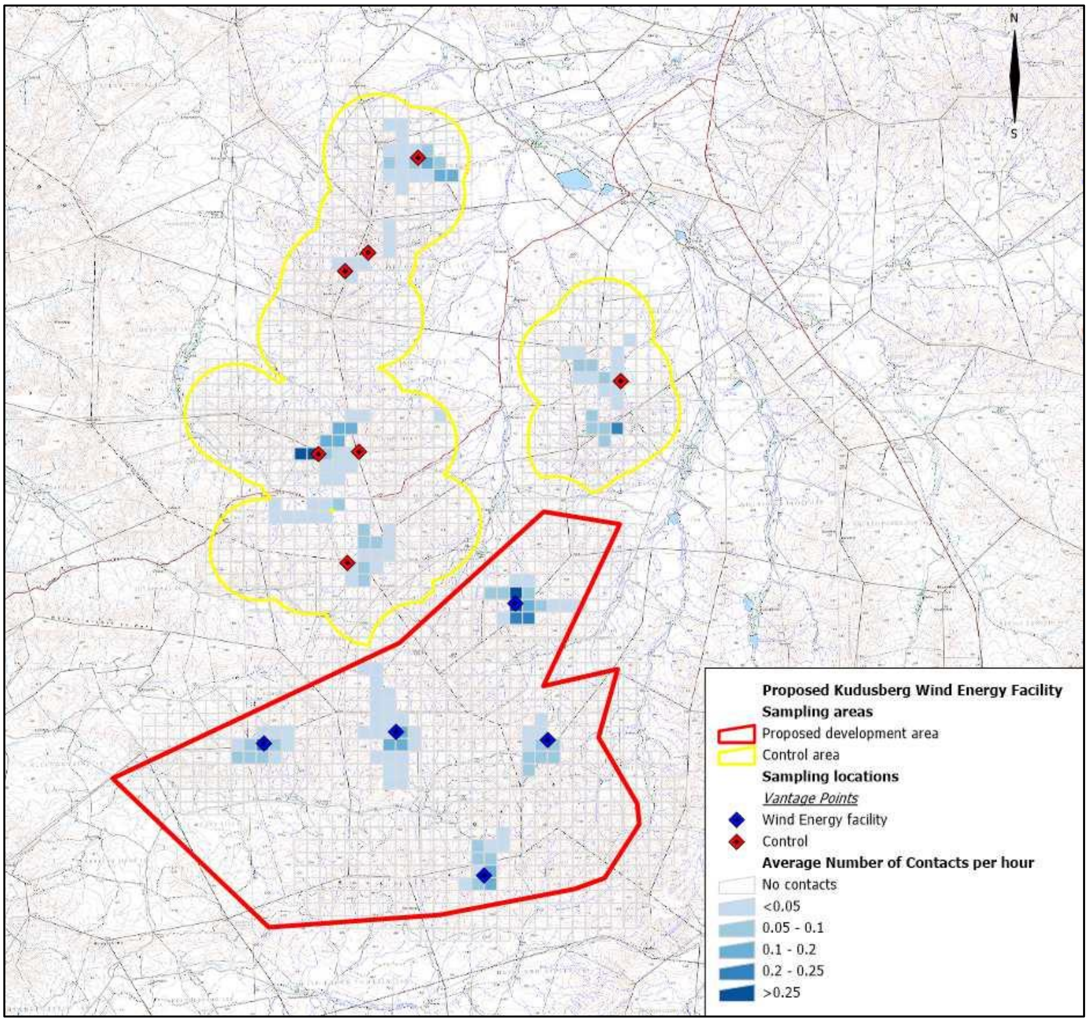

Figure 15 – Average activity recorded through vantage points for all bird species during the 12-month pre-construction bird monitoring programme.

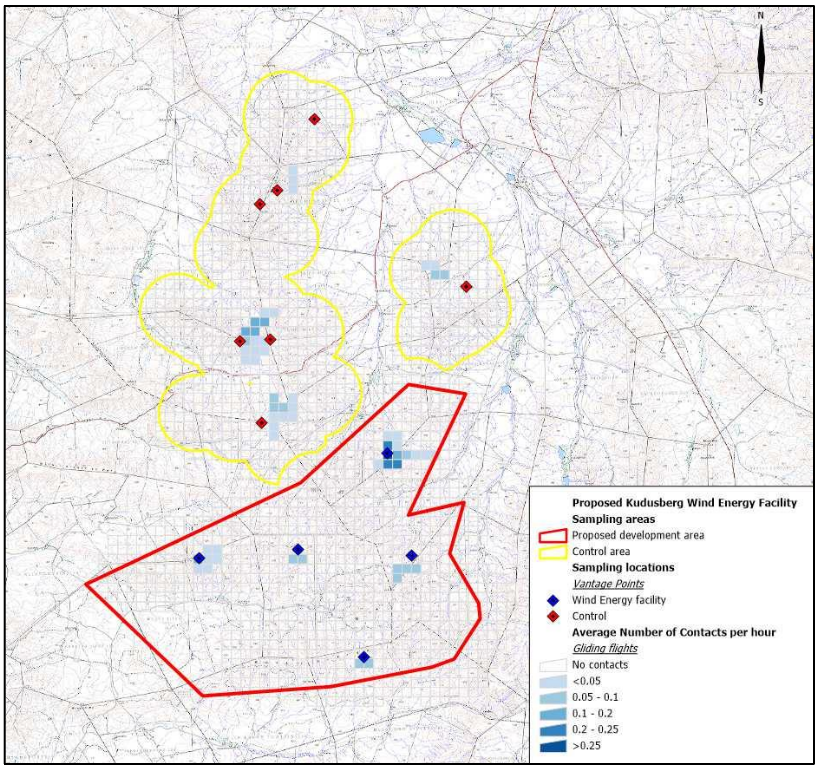

Figure 16 – Average activity of <u>Gliding flights</u> recorded through vantage points for all bird species during the 12-month pre-construction bird monitoring programme.

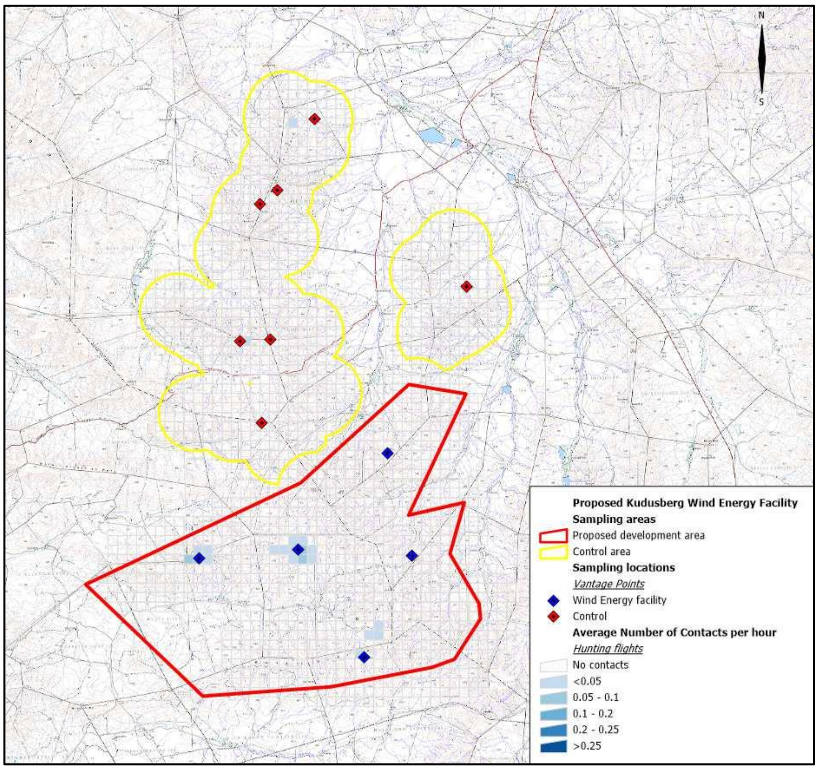

Figure 17 – Average activity of <u>Hunting flights</u> recorded through vantage points for all bird species during the 12-month pre-construction bird monitoring programme.

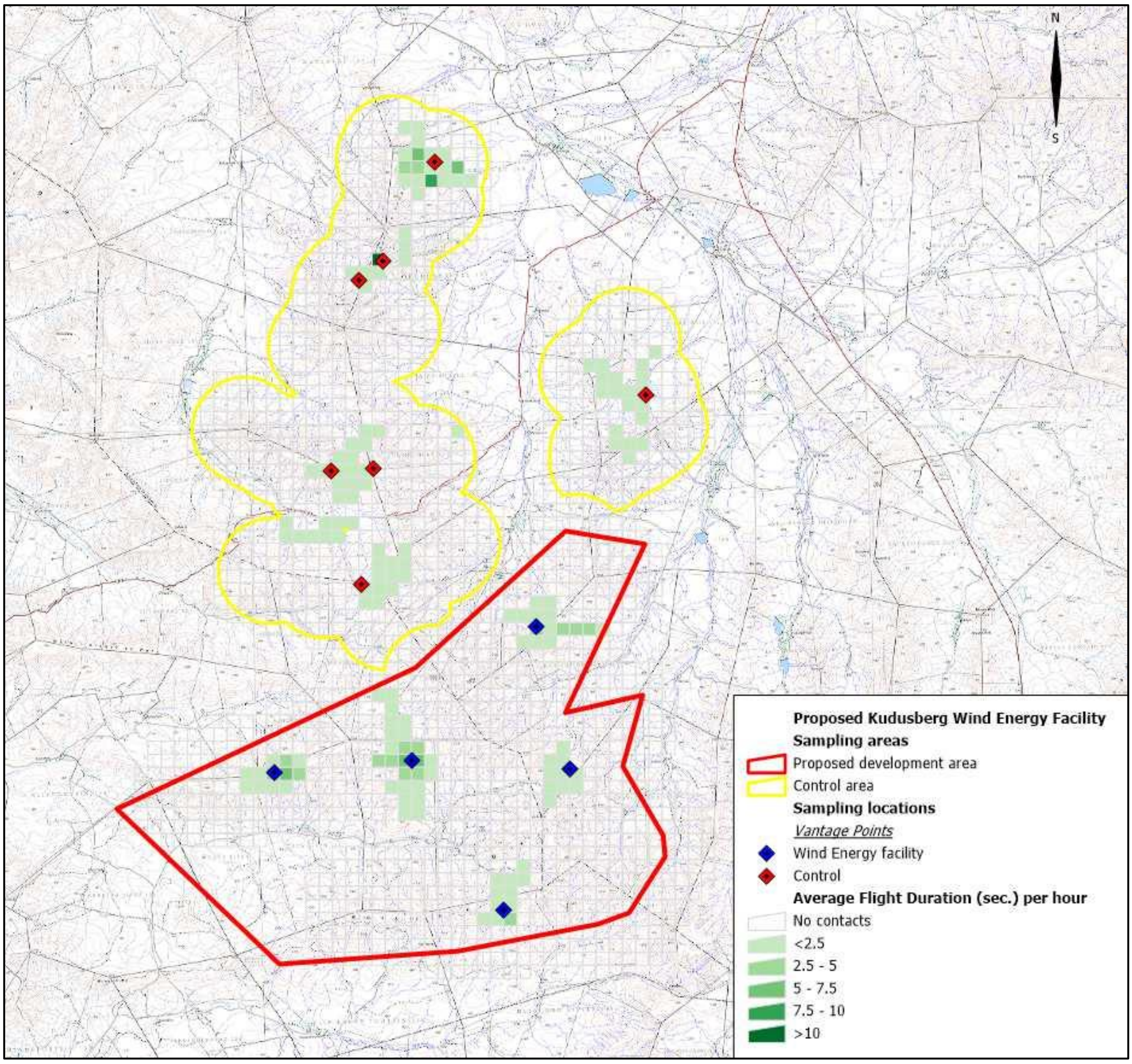

Figure 18 – Distribution of the average time spent recorded through vantage points during the 12-month pre-construction bird monitoring programme.

3.4. Focal sites survey

Waterbodies

As a complement to the previous methodologies, the WEF study site was also searched in order to identify, map and monitor important waterbodies (Figure 21). Ten features of interest to waterbirds and other species were identified, three outside the study area but close to the WEF site and an additional seven in the Control area and immediate surroundings, and visited at least once during the pre-construction monitoring programme.

Most waterbodies visited were considered not important for the sensitive bird community. The waterbodies identified with a higher relevance for the bird community (considering the total data collected) were the WBCO02 and WBKD03 (Figure 19). WBCO02 is located in the north of the Control area and the usage of this site was recorded year round, with the occurrence of sensitive species such as: Greater Flamingo, African Sacred Ibis and Cape Shoveler (Figure 20). Additionally, the WBKD03 was the location observed with a second highest abundance, especially due to the large numbers of Red-knobbed coot observed in spring. Bird presence was higher especially through winter and spring season, being observed the Cape Shoveler, a sensitive species using the site.

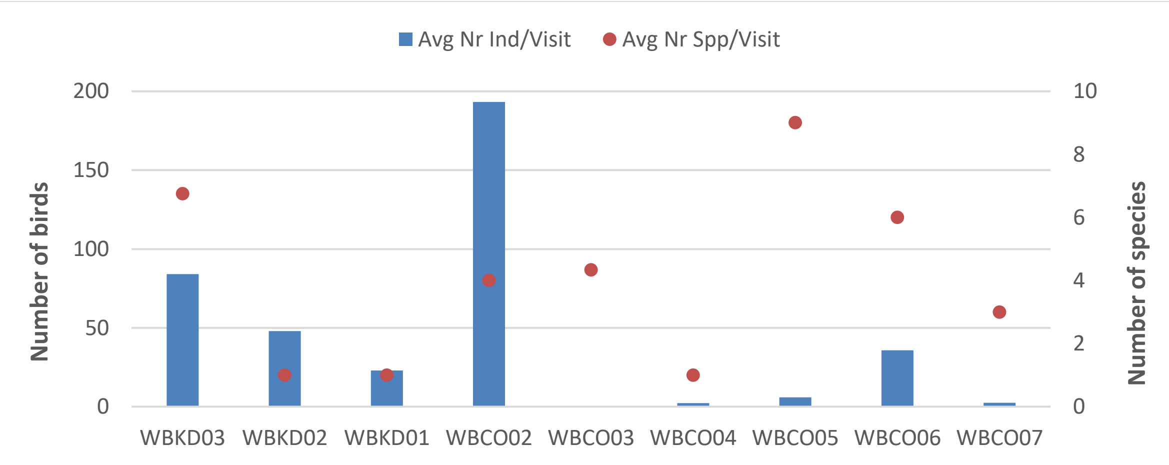

Figure 19 - Average number of birds and the average number of species recorded by visit to each of the waterbodies all located outside of the WEF study area.

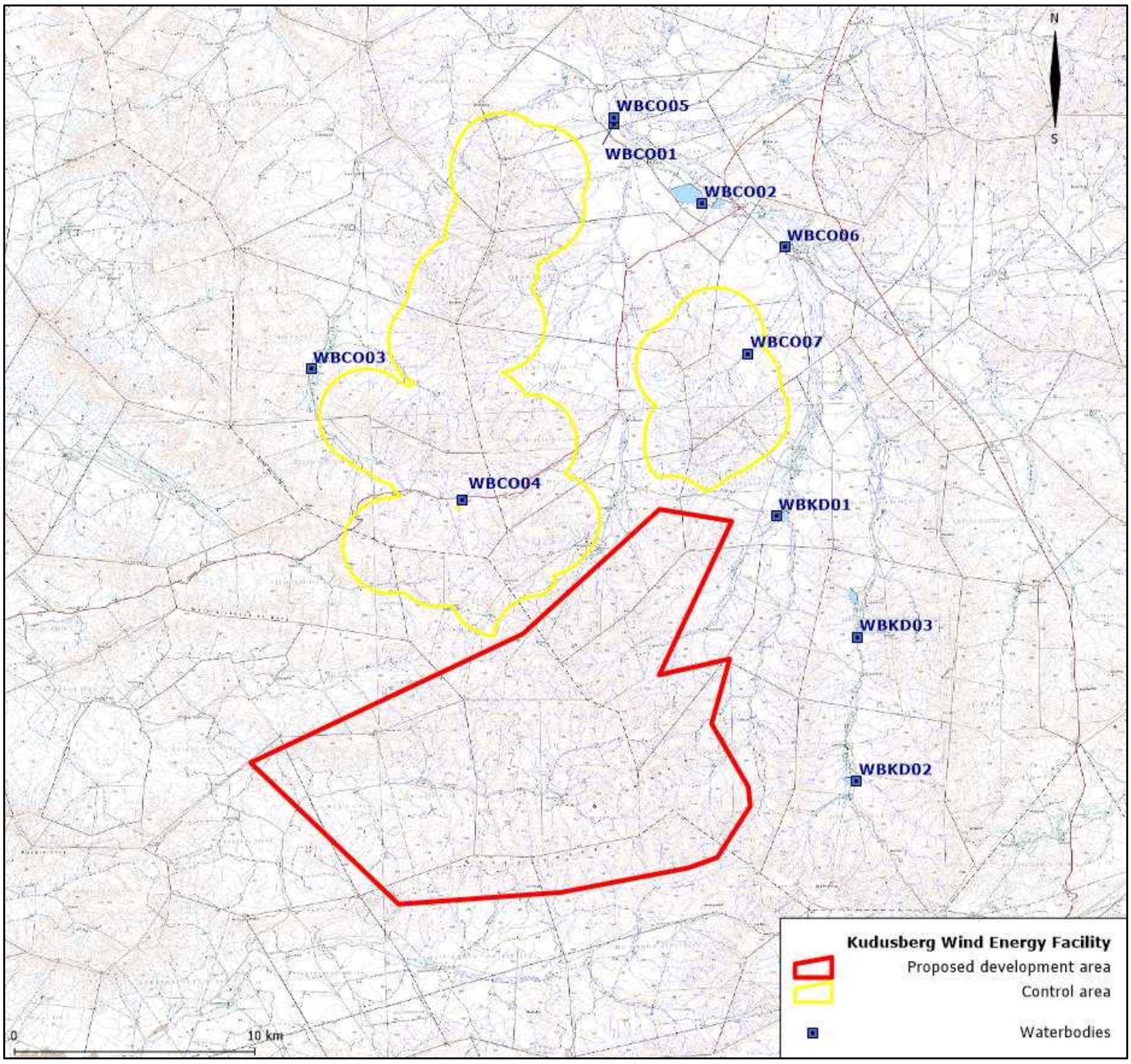

Figure 20 – Distribution of the water features identified and monitored through the bird monitoring programme.

Breeding evidence

Five potential breeding locations were identified during the bird pre-construction monitoring programme, as shown in Figure 21. However, none of the nests detected have signs of occupation. The NECO01 was not visited during the winter survey, however has been visited in autumn season and no evidence of breeding location was found. Instead it is now suspected that this may have been a temporary feeding location for a Verreaux's Eagle, as a Klipspringer/Steenbok leg was found close to NECO01.

During the monitoring programme, nest "NEKD01" showed no signs of occupation. The local landowner stated that this was a Verreaux's Eagle nest. However, further observations throughout the monitoring campaign revealed that this nest was too exposed to belong to a Verreaux's Eagle. After consultation with other specialists, it was confirmed that this nest is a collapsed Hamerkop nest.

The NEKD02 and NEKD03 also show no signs of occupation. The NEKD04 is a Western Barn Owl roost located in a cliff with the presence of one adult. However, no breeding evidences were confirmed.

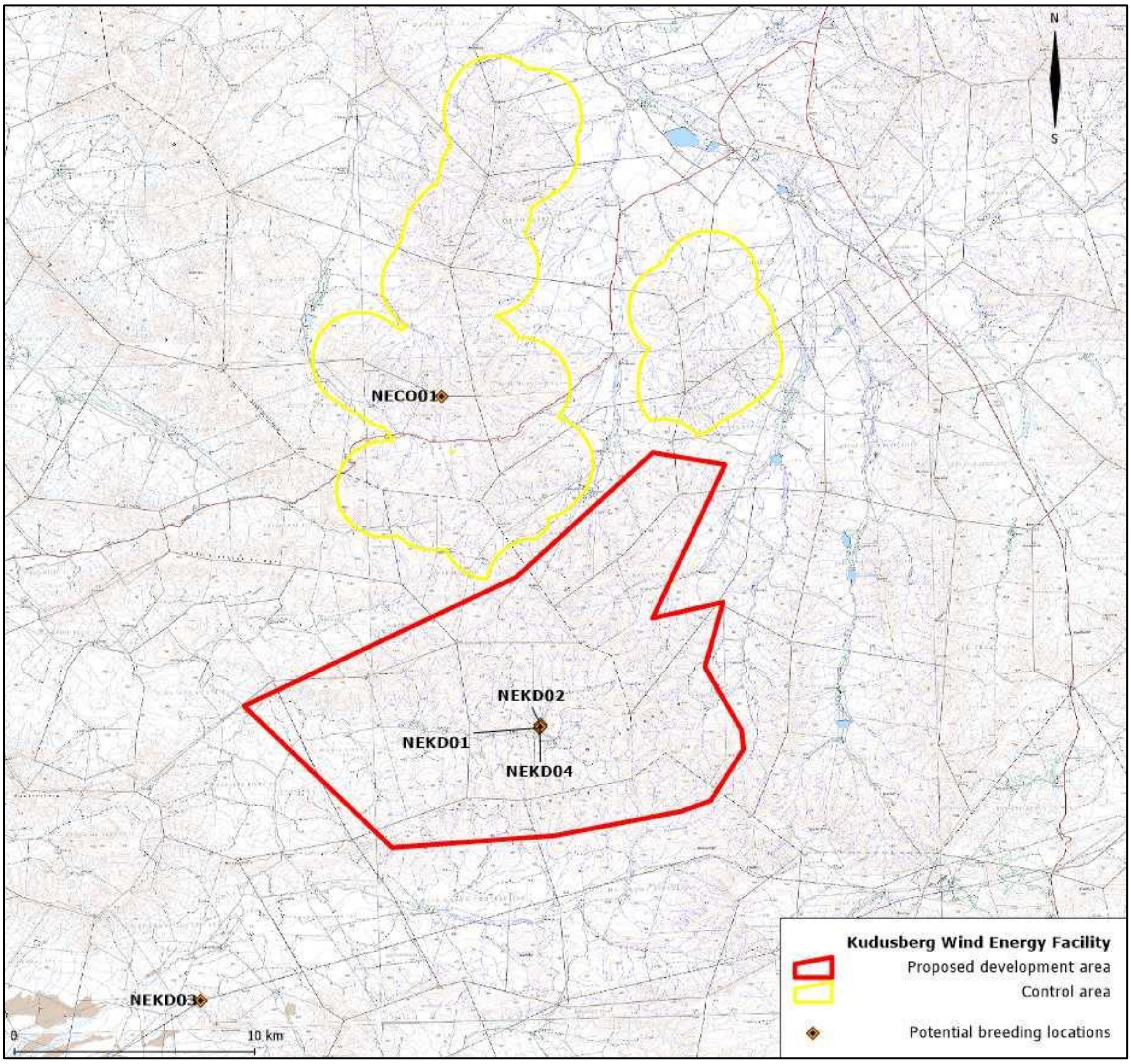

Figure 21 – Potential breeding locations visited during the pre-construction bird monitoring programme at the Kudusberg WEF and surrounding area.

3.5. Risk analysis

Risk analysis usually is conducted by taking into consideration the movements observed in the area which could lead to future collisions with wind turbines, both considering proposed turbine placement and technical specifications (such as rotor height). Since there's no information to the turbines placement, a preliminary analysis presented below provides an indication of the location where sensitive species flies at rotor height, taking into consideration one year of observations (Figure 22, Figure 23, Figure 24, Figure 25).

The analysis of the height of flight risk of each species in relation to the underlying biotope revealed that most of the risk movements of sensitive species occurred in hillside/escarpment, ridges, and/or areas of natural vegetation.

In all seasons, there was always observations of some species that fly at rotor height and some exhibit hunting behaviours are also very susceptible to collide with man-made structures, especially *Accipitrids* and *Falcons* (Figure 22, Figure 24).

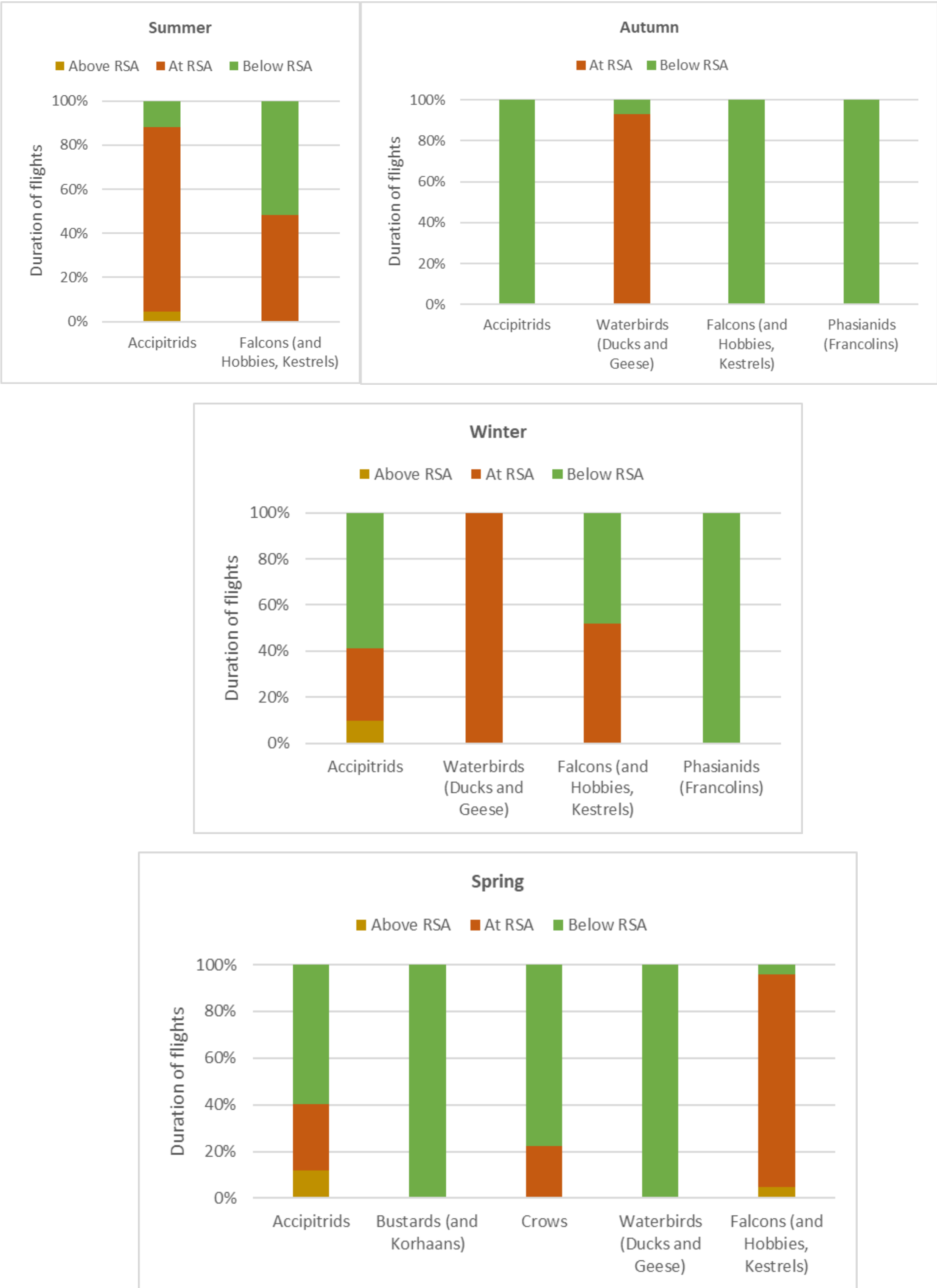

Figure 22 – Duration of flights in relation to RSH per season.

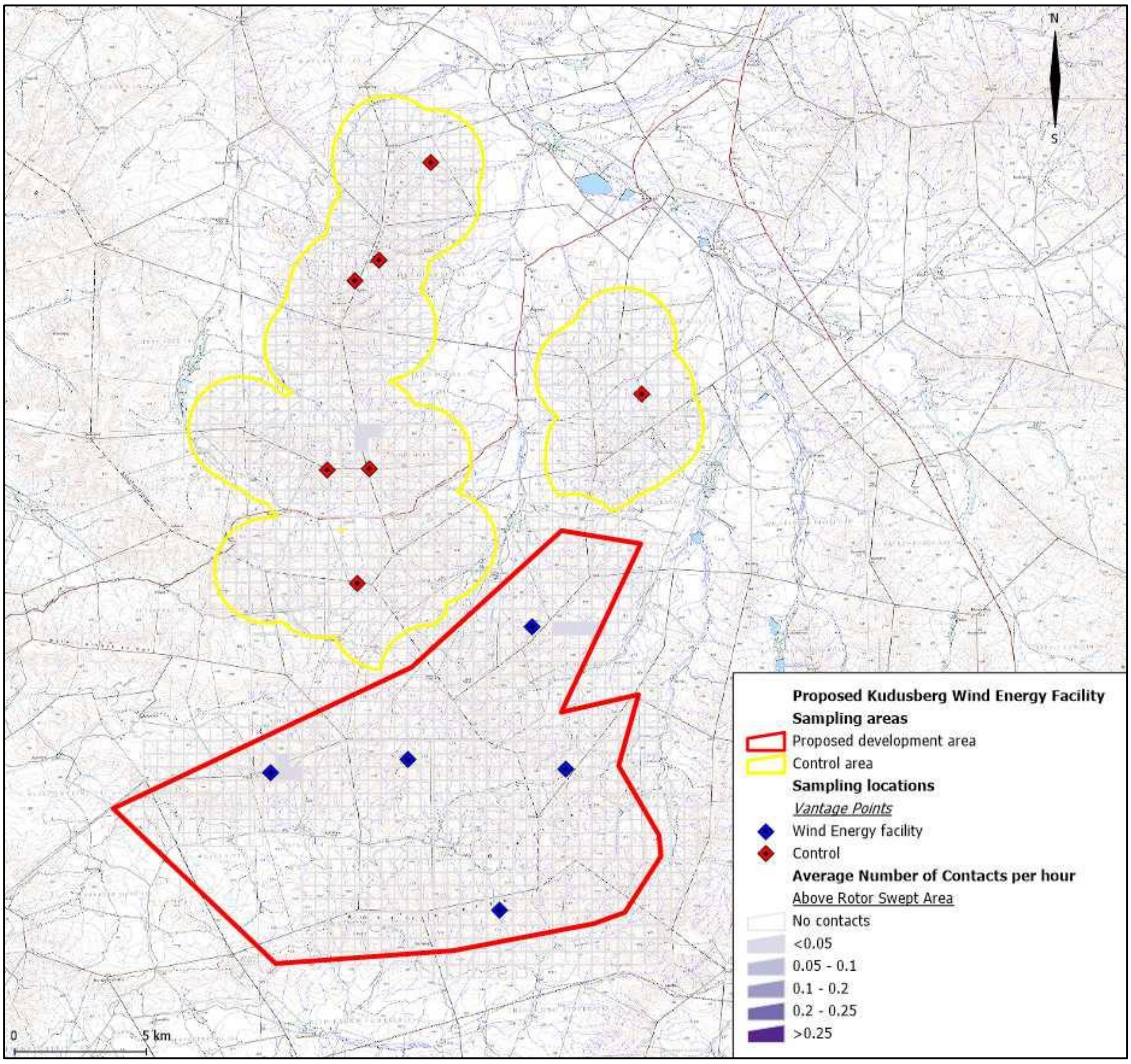

Figure 23 - Average activity recorded above RSA through vantage points during the 12-month pre-construction bird monitoring programme.

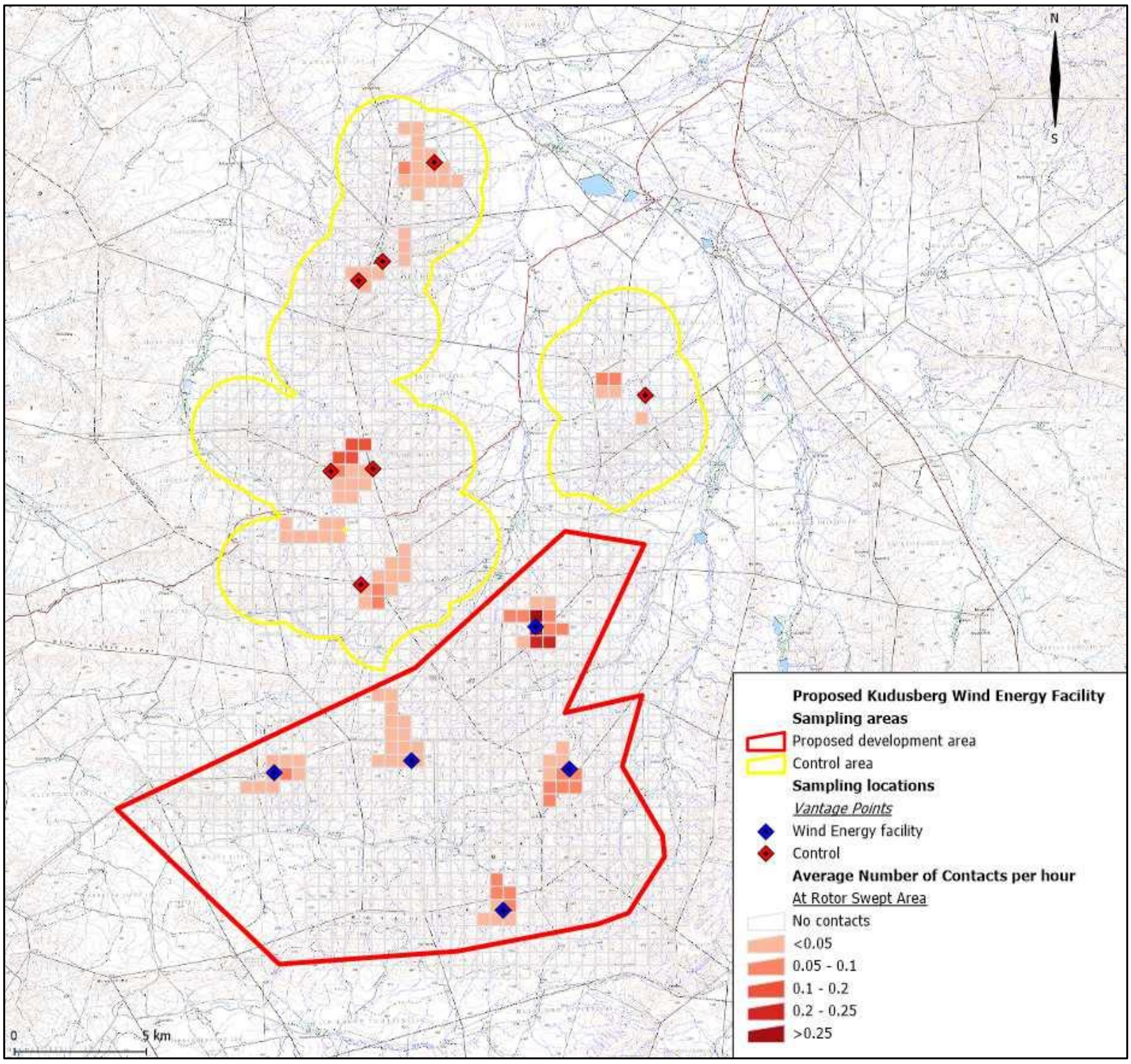

Figure 24 - Average activity recorded at RSA through vantage points during the 12-month pre-construction bird monitoring programme.

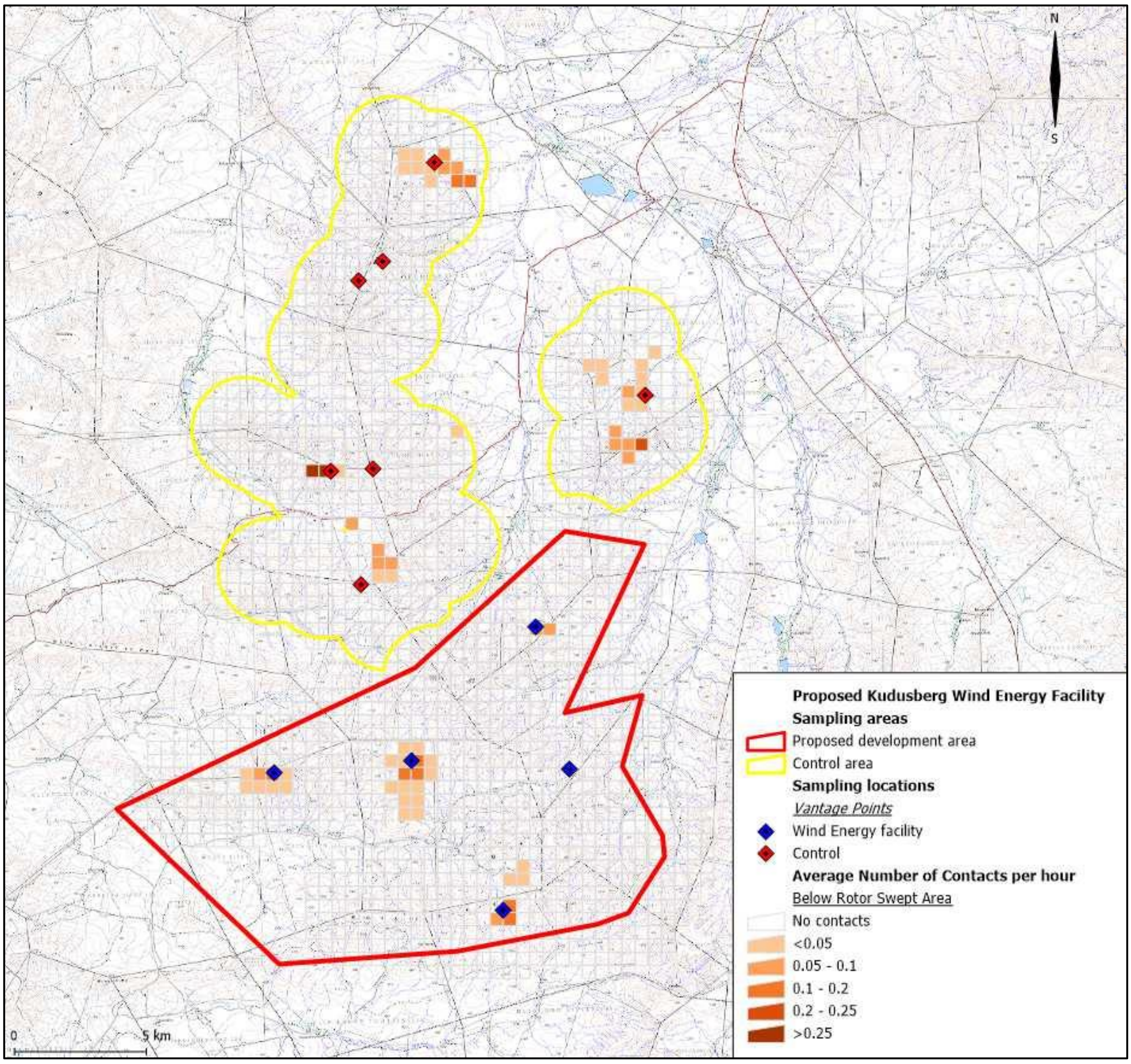

Figure 25 - Average activity recorded below RSA through vantage points during the 12-month pre-construction bird monitoring programme.

3.6. Sensitive areas analysis

Considering the bird community present within the site, some precautions must be followed in order to minimise the potential negative impacts caused by implementation of the Kudusberg WEF on the bird community. The presence of sensitive species, as well as the observation of risk behaviours of bird species with known collision with wind turbines, led to the classification of the general area as a medium sensitivity location. In order to safeguard the risk movements identified and thus avoid fatalities caused by the operation of wind turbines, as well as disturbance and/or displacement of sensitive species, the areas presented in Figure 26 were identified to be avoided and/or mitigated from activities associated with wind development:

- Medium sensitivity (Acceptable for turbine placement, but with mitigation measures)
  - *Hillside and Ridges:* This type of biotope is frequently used by Accipitrids and Falcons, for soaring and hunting flights, in which a lot of potential collision risk movements (flight at rotor height) are observed.

- *Natural vegetation:* Within the proposed Kudsberg WEF site the area is mostly comprised of natural vegetation. Avifaunal community, especially raptors usually will forage in natural veld, as well as the passerine community use this biotope for nesting and foraging.

- High Sensitivity (No-Go):
  - *Riverine thickets*: This type of biotope showed a high importance for passerine species as well as for Raptors and soaring birds. Considering the scarceness and sensitivity of this vegetation type to land modifications, a 200m protection buffer is considered around the margins of the waterlines with this type of vegetation. No turbine placement or substation placement is allowed to occur within these buffered zones. Overhead Powerlines are allowed to be built within these buffered areas, as long as they only cross these areas perpendicularly and don't run in parallel with them. Existing roads should be used/upgraded as far as possible, within these areas.
  - *Water bodies*: As these supply important sources of water, nesting and resting locations for many bird species (not only waterbirds), a 200m protection buffer is considered around any potential margins of water present within the study area.
  - *Sensitive routes:* a grid analysis was conducted to determine the use of geographical space by certain bird species. Only sensitive species with >0.25 contacts per hour were considered in each 500x500m no-go square. A 200m buffer was then applied around each square to account for potential sensitive flight paths occurring on the inner border of each square.

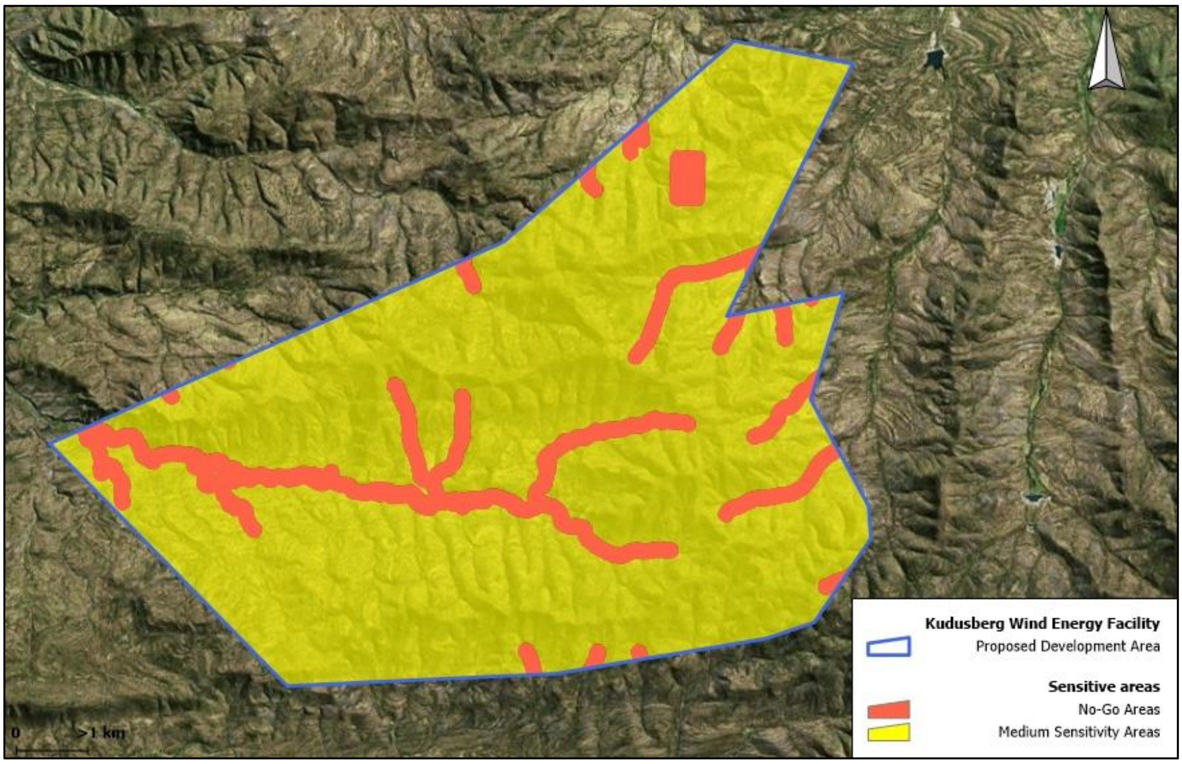

Figure 26 - Sensitive areas for birds identified for the Kudusberg WEF during the pre-construction monitoring programme.

4. Conclusions

This report details the findings of the bird pre-construction monitoring surveys conducted at the proposed Kudusberg WEF. The pre-construction bird monitoring programme methodology implemented covered all the relevant seasons for the bird community on the site, as recommended by the *Best practice guidelines for avian monitoring and impact mitigation at proposed wind energy development sites in southern Africa* (Jenkins *et al.* 2015) providing therefore a solid baseline for the establishment of the future assessments (refer to section 2 for details on the methodology implemented, its assumptions and limitations).

The pre-construction bird monitoring programme analysed the study area in order to identify the relevant features for the bird community, as well as the deliniation of the sensitive areas to propose areas for avoidance (no-go areas).

Kudusberg WEF **is considered to be located in an area of medium sensitivity with some habitat features of high sensitivity in terms of the bird community** present. It is considered that the impacts can be minimised to the maximum extent possible, mostly through the **avoidance of no-go areas defined, and mitigation measures within areas of medium sensitivity**.

Presently, it is not expected for impacts to be significant, provided that the aforementioned avoidance/mitigation measures are followed. As such, no fatal flaws were identified for this project at this stage. However, this statement is solely based on a monitoring campaign alone, and should be reviewed in the final specialist impact assessment report.

A bird monitoring programme implemented during construction and operational phase will be very important to improve the understanding of the real impact caused by the WEF on local bird populations, as well as validate the success of mitigation strategy proposed.

5. ACKNOWLEDGEMENTS

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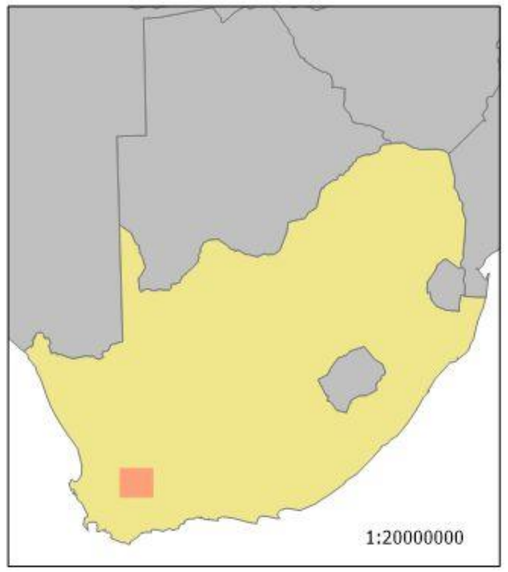
7. APPENDICES

7.1. Appendix I – Figures

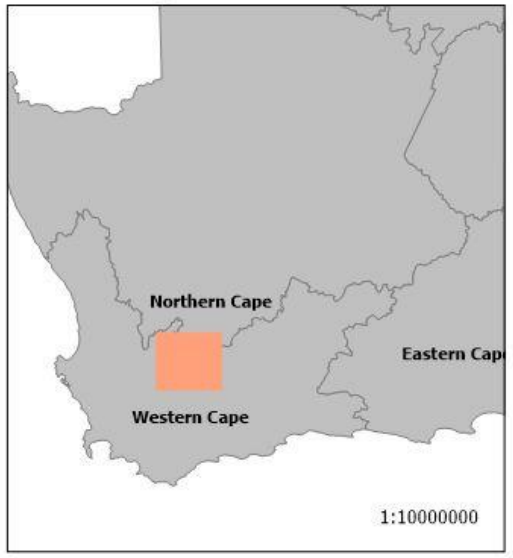
National Framework



Location on maps

3219DB	3220CA	3220CB	3220DA
3319DD	3320CC	3320CD	3320DC
3319BB	3320AA	3320AB	3320BA

Regional Framework



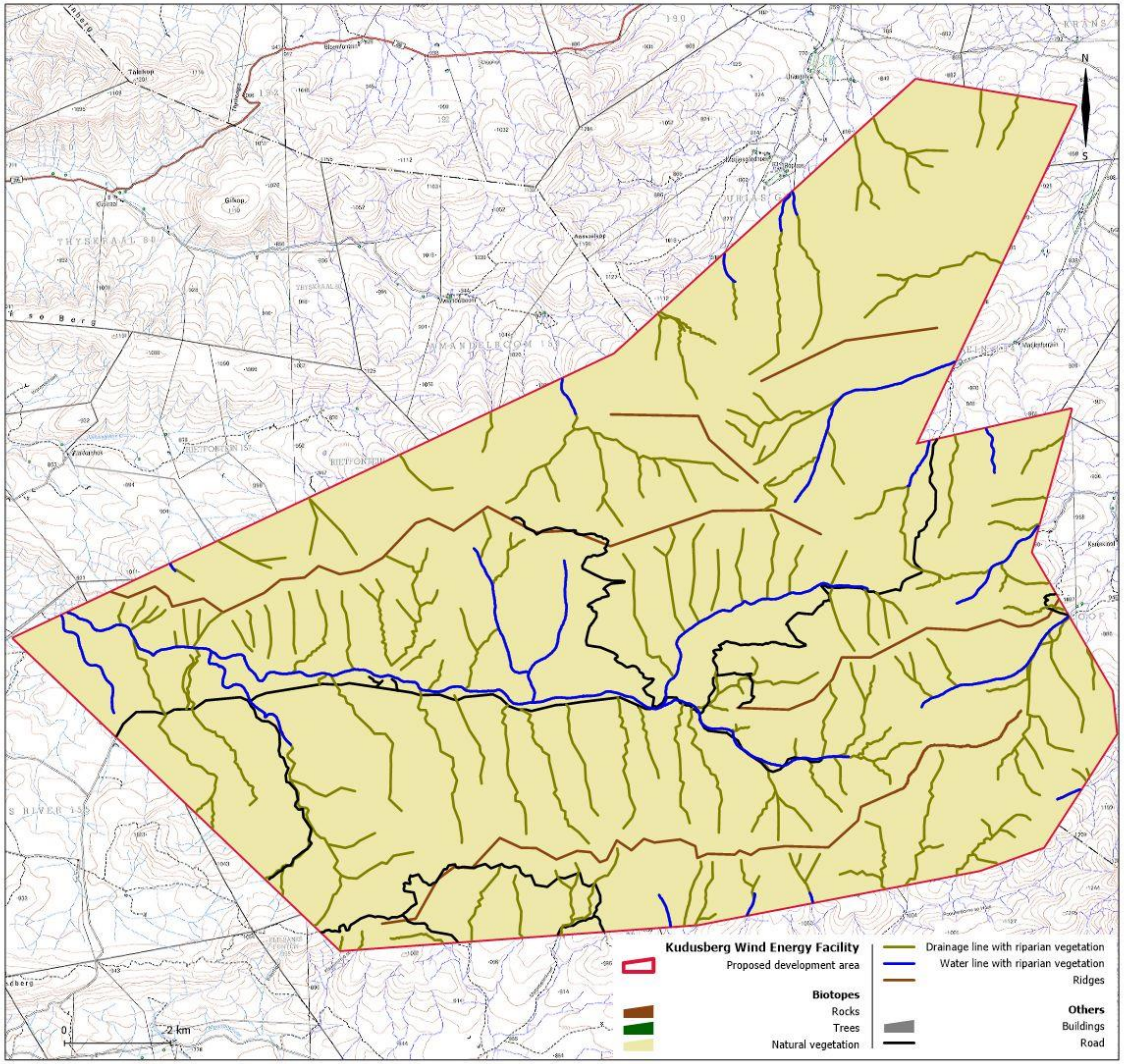


Figure 27 - Location of the proposed Kudusberg Wind Energy Facility.

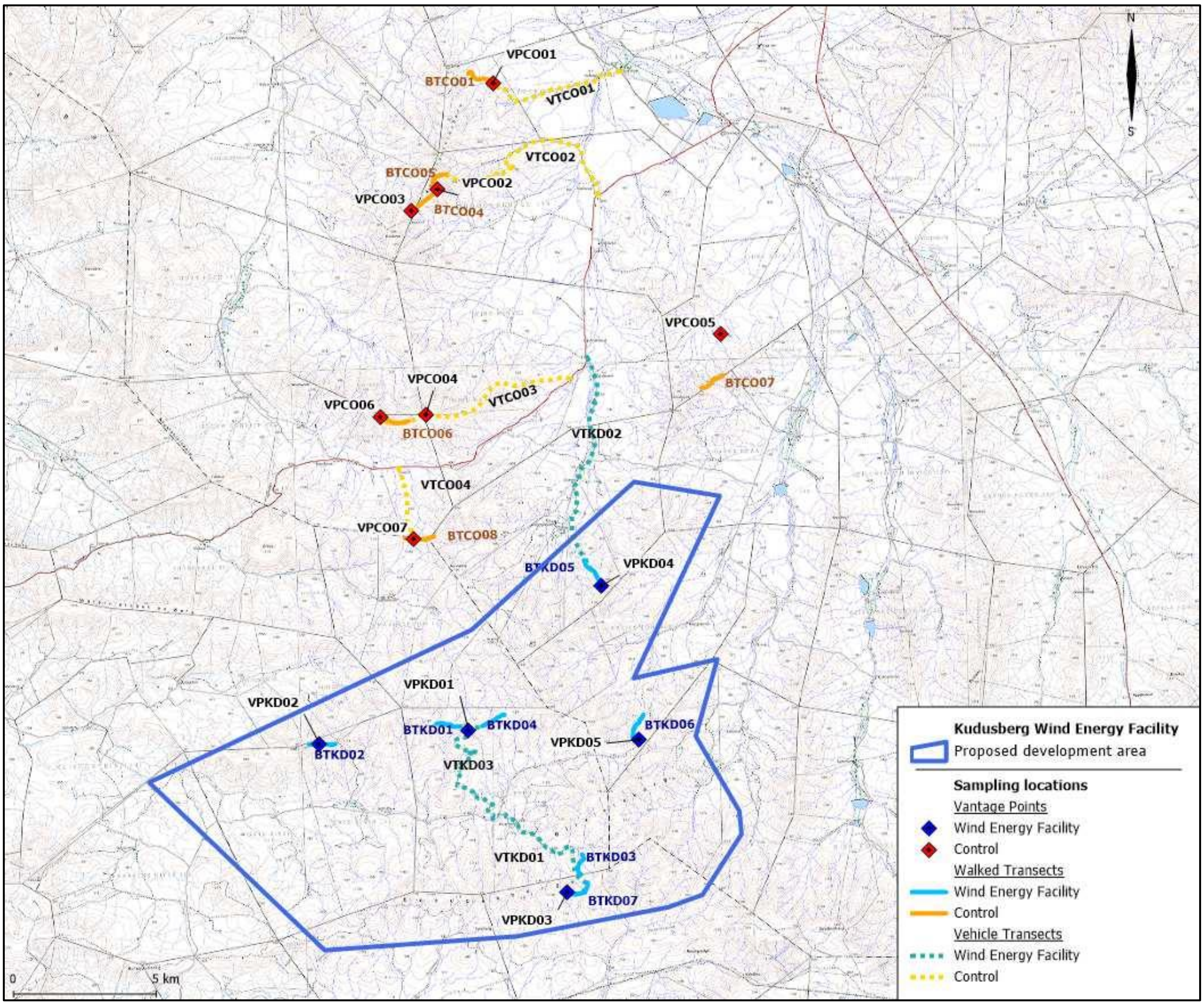


Figure 28 - Sampling locations at Kudusberg for the pre-construction bird monitoring programme.

Sampling Locations:

Vantage Points: VPKD01 (32°51'54.88"S | 20°18'45.74"E), **VPKD02** (32°52'5.87"S | 20°15'24.70"E), **VPKD03** (32°55'3.08"S | 20°20'52.82"E), **VPKD04** (32°49'14.44"S | 20°21'50.58"E), **VPKD05** (32°52'11.11"S | 20°22'35.50"E), **VPCO01** (32°39'38.36"S | 20°19'41.82"E), **VPCO02** (32°41'37.94"S | 20°18'23.34"E), **VPCO03** (32°42'1.46"S | 20°17'47.37"E), **VPCO04** (32°45'54.07"S | 20°18'0.09"E), **VPCO05** (32°44'31.68"S | 20°24'40.24"E), **VPCO06** (32°45'54.96"S| 20°16'58.57"E), **VPCO07** (32°48'16.01"S | 20°17'38.69"E).

Walked Transects (Central Points): BTKD01 (32°51'48.02"S | 20°18'19.85"E), **BTKD02** (32°52'6.15"S | 20°15'28.76"E), **BTKD03** (32°54'31.21"S | 20°21'10.24"E), **BTKD04** (32°51'44.58"S | 20°19'20.09"E), **BTKD05** (32°48'55.98"S | 20°21'37.23"E), **BTKD06** (32°51'53.83"S | 20°22'31.77"E), **BTKD07** (32°55'4.36"S | 20°21'13.31"E), **BTCO01** (32°39'33.89"S | 20°19'23.52"E), **BTCO04** (32°41'50.60"S | 20°18'5.33"E), **BTCO05** (32°41'26.55"S | 20°18'19.15"E), **BTCO06** (32°46'2.65"S | 20°17'17.91"E), **BTCO07** (32°45'24.28"S | 20°24'26.95"E), **BTCO08** (32°48'15.60"S | 20°17'46.87"E).

7.2. Appendix II - List of potential and occurring species at the site

Species of birds identified in the study area by all the methodologies implemented for the monitoring programme. 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; na – not evaluated; Population Trend** (IUCN 2016)**. Endemism** (BLSA 2016)**: * – Endemic. (*) – Nearly Endemic. SLS - endemic to South Africa, Lesotho and Swaziland; BSLS – breeding endemic to South Africa, Lesotho and Swaziland. WEF – the species was detected within the proposed WEF area; CO – the species was detected in the surrounding area. Scoping phase** (Bioinsight 2016a)**.**

Order	Common Name	Scientific Name	Phenology	RLCS	SA RLCS	CMS	Population Trend	Abundance	Endemic SA	Sensitive sp.	Scoping phase	WEF	CO
PODICIPEDIFORMES	Great Crested Grebe	*Podiceps cristatus*	R	LC	-	-	Unknown	Locally common	-	-	X	-	-
PODICIPEDIFORMES	Black-necked Grebe	*Podiceps nigricollis*	R	LC	-	-	Unknown	Uncommon to locally common	-	-	X	X	X
PODICIPEDIFORMES	Little Grebe	*Tachybaptus ruficollis*	R	LC	-	-	Decreasing	Common to locally abundant	-	-	X	X	-
SULIFORMES	White-breasted Cormorant	*Phalacrocorax lucidus*	R	LC	-	-	Increasing	Common	-	-	X	-	-
SULIFORMES	Reed Cormorant	*Phalacrocorax africanus*	R	NA	-	-	Decreasing	Common	-	-	X	-	-
PELECANIFORMES	Grey Heron	*Ardea cinerea*	R	LC	-	-	Unknown	Locally common	-	-	X	-	X
PELECANIFORMES	Black-headed Heron	*Ardea melanocephala*	R	LC	-	-	Increasing	Common	-	-	X	-	-
PELECANIFORMES	Western Cattle Egret	*Bubulcus ibis*	R	LC	-	-	Increasing	Very common	-	-	X	-	-
PELECANIFORMES	Black-crowned Night Heron	*Nycticorax nycticorax*	R	LC	-	-	Decreasing	Common	-	-	-	-	X
PELECANIFORMES	Hamerkop	*Scopus umbretta*	R	LC	-	-	Stable	Locally common	-	X	X	X	-
CICONIIFORMES	Black Stork	*Ciconia nigra*	-	LC	VU	II	Unknown	Uncommon	-	X	X	-	X
PELECANIFORMES	African Sacred Ibis	*Threskiornis aethiopicus*	R	LC	-	II (subsp. aethiopicus)	Decreasing	Common	-	X	X	-	X
PELECANIFORMES	Glossy Ibis	*Plegadis falcinellus*	R	LC	-	II	Decreasing	Locally common	-	-	X	-	-
PELECANIFORMES	Hadeda Ibis	*Bostrychia hagedash*	R	LC	-	-	Increasing	Common	-	-	X	X	-
PELECANIFORMES	African Spoonbill	*Platalea alba*	R	LC	-	II	Stable	Locally common	-	-	X	X	-
PHOENICOPTERIFORMES	Greater Flamingo	*Phoenicopterus roseus*	R	LC	NT	II	Increasing	Locally abundant	-	X	X	-	X

Order	Common Name	Scientific Name	Phenology	RLCS	SA RLCS	CMS	Population Trend	Abundance	Endemic SA	Sensitive sp.	Scoping phase	WEF	CO
ANSERIFORMES	Egyptian Goose	*Alopochen aegyptiaca*	R	LC	-	II	Decreasing	Common to abundant	-	-	X	X	X
ANSERIFORMES	South African Shelduck	*Tadorna cana*	R	LC	-	II	Increasing	Common	-	-	X	X	X
ANSERIFORMES	Yellow-billed Duck	*Anas undulata*	R	LC	-	II	Stable	Common	-	-	X	X	X
ANSERIFORMES	African Black Duck	*Anas sparsa*	R	LC	-	II	Decreasing	Fairly common	-	-	X	-	-
ANSERIFORMES	Cape Teal	*Anas capensis*	R	LC	-	II	Increasing	Uncommon to locally abundant	-	-	X	-	X
ANSERIFORMES	Red-billed Teal	*Anas erythrorhyncha*	R	LC	-	II	Decreasing	Very common	-	-	X	X	X
ANSERIFORMES	Cape Shoveler	*Anas smithii*	R	LC	-	II	Increasing	Rare to locally abundant	-	X	X	X	X
ANSERIFORMES	Southern Pochard	*Netta erythrophthalma*	R	LC	-	II	Decreasing	Common	-	-	X	-	-
ANSERIFORMES	Spur-winged Goose	*Plectropterus gambensis*	R	LC	-	II	Increasing	Locally common to very common	-	-	X	-	X
ANSERIFORMES	Maccoa Duck	*Oxyura maccoa*	R	NT	NT	II	Decreasing	Common	-	X	X	-	-
ACCIPITRIFORMES	Verreauxs' Eagle	*Aquila verreauxii*	R	LC	VU	II	Stable	Locally fairly common	-	X	X	X	X
ACCIPITRIFORMES	Booted Eagle	*Hieraaetus pennatus*	R	LC	-	II	Decreasing	Locally fairly common	-	X	X	-	-
ACCIPITRIFORMES	Martial Eagle	*Polemaetus bellicosus*	R	VU	EN	II	Decreasing	Uncommon	-	X	X	X	X
ACCIPITRIFORMES	Black-chested Snake Eagle	*Circaetus pectoralis*	R	LC	-	II	Unknown	Uncommon to locally common	-	X	X	X	X
ACCIPITRIFORMES	Jackal Buzzard	*Buteo rufofuscus*	R	LC	-	II	Stable	Fairly common	(*)	X	X	X	X
ACCIPITRIFORMES	Pale Chanting Goshawk	*Melierax canorus*	R	LC	-	II	Stable	Rare to locally common	-	X	X	X	X
ACCIPITRIFORMES	Black Harrier	*Circus maurus*	R	VU	EN	II	Stable	Uncommon	(*)	X	X	X	X
ACCIPITRIFORMES	African Harrier-Hawk	*Polyboroides typus*	R	LC	-	II	Stable	Locally common	-	X	X	X	X
FALCONIFORMES	Rock Kestrel	*Falco rupicolus*	R	NA	-	II	NA	Common to uncommon	-	X	X	X	X
FALCONIFORMES	Greater Kestrel	*Falco rupicoloides*	R	LC	-	II	Stable	Fairly common	-	X	X	-	-
GALLIFORMES	Grey-winged Francolin	*Scleroptila africana*	R	LC	-		Stable	Common	SLS	X	X	X	X
GALLIFORMES	Cape Spurfowl	*Pternistis capensis*	R	LC	-		NA	Common to locally abundant	(*)	-	X	-	-
GRUIFORMES	Red-knobbed coot	*Fulica cristata*	R	LC	-		Decreasing	Common	-	-	X	X	X
OTIDIFORMES	Ludwig's Bustard	*Neotis ludwigii*	R	EN	EN		Decreasing	Sparse to locally common	-	X	X	X	-
OTIDIFORMES	Karoo Korhaan	*Eupodotis vigorsii*	R	LC	NT		Increasing	Uncommon to common	-	X	X	-	-

Order	Common Name	Scientific Name	Phenology	RLCS	SA RLCS	CMS	Population Trend	Abundance	Endemic SA	Sensitive sp.	Scoping phase	WEF	CO
CHARADRIIFORMES	Kittlitz's Plover	*Charadrius pecuarius*	R	LC	-	II	Unknown	Locally common	-	-	X	-	X
CHARADRIIFORMES	Three-banded Plover	*Charadrius tricollaris*	R	LC	-	II	Unknown	Common	-	-	X	-	X
CHARADRIIFORMES	Crowned Lapwing	*Vanellus coronatus*	R	LC	-	II	Increasing	Common	-	-	X	-	-
CHARADRIIFORMES	Blacksmith Lapwing	*Vanellus armatus*	R	LC	-	II	Increasing	Common	-	-	X	X	X
CHARADRIIFORMES	Common Sandpiper	*Actitis hypoleucos*	NBM	LC	-	II	Decreasing	Common	-	-	X	-	-
CHARADRIIFORMES	Common Greenshank	*Tringa nebularia*	0	LC	-	II	Stable	-	-	-	X	-	-
CHARADRIIFORMES	Little Stint	*Calidris minuta*	NBM	LC	-	II	Decreasing	Common	-	-	X	-	-
CHARADRIIFORMES	African Snipe	*Gallinago nigripennis*	R	LC	-	II	Unknown	Uncommon to locally common	-	X	X	-	-
CHARADRIIFORMES	Pied Avocet	*Recurvirostra avosetta*	R	LC	-	II	Unknown	Locally common	-	-	X	-	X
CHARADRIIFORMES	Black-winged Stilt	*Himantopus himantopus*	R	LC	-	II	Increasing	Common	-	-	X	X	X
CHARADRIIFORMES	White-winged Tern	*Chlidonias leucopterus*	NBM	LC	-	II	Stable	Common	-	-	X	-	-
PTEROCLIFORMES	Namaqua Sandgrouse	*Pterocles namaqua*	R	LC	-	-	Stable	Common	-	-	X	X	-
COLUMBIFORMES	Rock Dove	*Columba livia*	R	LC	-	-	Decreasing	Abundant to uncommon	-	-	X	-	-
COLUMBIFORMES	Speckled Pigeon	*Columba guinea*	R	LC	-	-	Stable	Common	-	-	X	-	X
COLUMBIFORMES	Red-eyed Dove	*Streptopelia semitorquata*	R	LC	-	-	Increasing	Fairly common to common	-	-	X	-	-
COLUMBIFORMES	Cape Turtle Dove	*Streptopelia capicola*	R	LC	-	-	Increasing	Common to fairly common	-	-	X	X	-
COLUMBIFORMES	Laughing Dove	*Streptopelia senegalensis*	R	LC	-	-	Stable	Common	-	-	X	-	-
COLUMBIFORMES	Namaqua Dove	*Oena capensis*	R	LC	-	-	Increasing	Fairly common to comon	-	-	X	-	-
STRIGIFORMES	Western Barn Owl	*Tyto alba*	R	LC	-	-	Stable	Generally common	-	-	-	X	-
STRIGIFORMES	Spotted Eagle-Owl	*Bubo africanus*	R	LC	-	-	Stable	Generally common	-	X	X	-	-
APODIFORMES	Common Swift	*Apus apus*	NBM	LC	-	-	Decreasing	Unknown	-	X	X	-	-
APODIFORMES	White-rumped Swift	*Apus caffer*	BM	LC	-	-	Increasing	Very common	-	-	X	X	-
APODIFORMES	Little Swift	*Apus affinis*	R	LC	-	-	Increasing	Common	-	-	X	-	-
APODIFORMES	Alpine Swift	*Tachymarptis melba*	BM	LC	-	-	Stable	Generally common	-	-	X	-	-
COLIIFORMES	White-backed Mousebird	*Colius colius*	R	LC	-	-	Increasing	Locally common	-	-	X	-	-

Order	Common Name	Scientific Name	Phenology	RLCS	SA RLCS	CMS	Population Trend	Abundance	Endemic SA	Sensitive sp.	Scoping phase	WEF	CO
COLIIFORMES	Red-faced Mousebird	*Urocolius indicus*	R	LC	-	-	Unknown	Locally common	-	-	X	-	-
CORACIIFORMES	European Bee-eater	*Merops apiaster*	NBM	LC	-	II	Decreasing	Common	-	-	X	-	-
BUCEROTIFORMES	African Hoopoe	*Upupa africana*	R	NA	-	-	NA	Fairly common	-	-	X	-	-
PICIFORMES	Acacia Pied Barbet	*Tricholaema leucomelas*	R	LC	-	-	Increasing	Fairly common	-	-	X	-	-
PICIFORMES	Ground Woodpecker	*Geocolaptes olivaceus*	R	LC	-	-	Stable	Locally Common	SLS	-	X	-	-
PASSERIFORMES	Cape Clapper Lark	*Mirafra apiata*	R	LC	-	-	Decreasing	Fairly common to common	(*)	X	X	X	-
PASSERIFORMES	Karoo Long-billed Lark	*Certhilauda subcoronata*	R	LC	-	-	Stable	Common	-	-	X	X	X
PASSERIFORMES	Karoo Lark	*Calendulauda albescens*	R	LC	-	-	Decreasing	Common to fairly common	(*)	X	X	X	X
PASSERIFORMES	Spike-heeled Lark	*Chersomanes albofasciata*	R	LC	-	-	Decreasing	Fairly common to common	-	-	X	X	-
PASSERIFORMES	Red-capped Lark	*Calandrella cinerea*	R	LC	-	-	Increasing	Common to locally abundant	-	-	X	-	-
PASSERIFORMES	Large-billed Lark	*Galerida magnirostris*	R	LC	-	-	Increasing	Fairly common to common	(*)	X	X	X	X
PASSERIFORMES	Barn Swallow	*Hirundo rustica*	NBM	LC	-	-	Decreasing	Common to abundant	-	-	X	-	-
PASSERIFORMES	White-throated Swallow	*Hirundo albigularis*	BM	LC	-	-	Increasing	Locally common	-	-	X	-	-
PASSERIFORMES	Greater Striped Swallow	*Cecropis cucullata*	BM	LC	-	-	Increasing	Locally common	-	-	X	-	-
PASSERIFORMES	Rock Martin	*Hirundo fuligula*	R	LC	-	-	Stable	Common	-	-	X	-	-
PASSERIFORMES	Brown-throated Martin	*Riparia paludicola*	R	LC	-	-	Decreasing	Locally common	-	-	X	-	-
PASSERIFORMES	Cape Crow	*Corvus capensis*	R	LC	-	-	Increasing	Common	-	-	-	X	-
PASSERIFORMES	Pied crow	*Corvus albus*	R	LC	-	-	Stable	Common to abundant	-	-	X	X	X
PASSERIFORMES	White-necked Raven	*Corvus albicollis*	R	LC	-	-	Decreasing	Locally common	-	-	X	X	X
PASSERIFORMES	Grey Tit	*Parus afer*	R	LC	-	-	Stable	Fairly common	(*)	-	X	-	X
PASSERIFORMES	Cape Penduline-Tit	*Anthoscopus minutus*	R	LC	-	-	Stable	Common	-	-	X	-	-
PASSERIFORMES	Cape Bulbul	*Pycnonotus capensis*	R	LC	-	-	Stable	Common to very common	*	-	X	X	-
PASSERIFORMES	Karoo Thrush	*Turdus smithi*	-	NA	-	-	NA	-	(*)	-	X	-	-
PASSERIFORMES	Northern Wheatear	*Oenanthe oenanthe*	Rare or Vagrant	LC	-	II	Decreasing	Rare	-	-	-	-	X
PASSERIFORMES	Mountain Wheatear	*Oenanthe monticola*	R	LC	-	II	Stable	Locally common	-	-	X	X	X

Order	Common Name	Scientific Name	Phenology	RLCS	SA RLCS	CMS	Population Trend	Abundance	Endemic SA	Sensitive sp.	Scoping phase	WEF	CO
PASSERIFORMES	Familiar Chat	*Cercomela familiaris*	R	LC	-	II	Stable	Common	-	-	X	X	-
PASSERIFORMES	Tractrac Chat	*Cercomela tractrac*	R	LC	-	II	Stable	Fairly common	-	-	X	-	-
PASSERIFORMES	Sickle-winged Chat	*Cercomela sinuata*	R	LC	-	II	Stable	Uncommon to locally common	(*)	-	X	-	-
PASSERIFORMES	Karoo Chat	*Cercomela schlegelii*	R	LC	-	II	Stable	Common	-	-	X	X	X
PASSERIFORMES	Ant-eating Chat	*Myrmecocichla formicivora*	R	LC	-	II	Stable	Common	-	-	X	-	-
PASSERIFORMES	Cape Robin-Chat	*Cossypha caffra*	R	LC	-	II	Stable	Common	-	-	X	-	-
PASSERIFORMES	Karoo Scrub Robin	*Erythropygia coryphoeus*	R	LC	-	II	Stable	Common	-	-	X	X	X
PASSERIFORMES	Chestnut-vented Tit-Babbler	*Sylvia subcaerulea*	R	LC	-	-	Stable	Common	-	-	X	-	-
PASSERIFORMES	Layard's Tit-Babbler	*Sylvia layardi*	R	LC	-	-	Stable	Common	(*)	-	X	-	-
PASSERIFORMES	African Reed Warbler	*Acrocephalus baeticatus*	BM	NA	-	-	NA	Fairly common	-	-	X	-	-
PASSERIFORMES	Long-billed crombec	*Sylvietta rufescens*	R	LC	-	-	Stable	Common	-	-	X	-	-
PASSERIFORMES	Yellow-bellied Eremomela	*Eremomela icteropygialis*	R	LC	-	-	Stable	Fairly common	-	-	X	-	-
PASSERIFORMES	Karoo Eremomela	*Eremomela gregalis*	R	LC	-	-	Decreasing	Fairly common	(*)	-	X	X	-
PASSERIFORMES	Cinnamon-breasted Warbler	*Euryptila subcinnamomea*	R	LC	-	-	Stable	Locally fairly common	(*)	-	X	-	-
PASSERIFORMES	Grey-backed Cisticola	*Cisticola subruficapilla*	R	LC	-	-	Decreasing	Locally common to very common	-	-	X	X	X
PASSERIFORMES	Neddicky	*Cisticola fulvicapilla*	R	LC	-	-	Stable	Locally common	-	-	-	X	-
PASSERIFORMES	Karoo Prinia	*Prinia maculosa*	R	LC	-	-	Decreasing	Common to locally very common	(*)	-	X	X	X
PASSERIFORMES	Namaqua Warbler	*Phragmacia substriata*	R	LC	-	-	Increasing	Common	(*)	-	X	-	-
PASSERIFORMES	Rufous-eared Warbler	*Malcorus pectoralis*	R	LC	-	-	Stable	Common	-	-	X	X	X
PASSERIFORMES	Fiscal Flycatcher	*Sigelus silens*	R	LC	-	II	Stable	Common	(*)	-	X	-	-
PASSERIFORMES	Pririt Batis	*Batis pririt*	R	LC	-	-	Stable	Common	-	-	X	-	-
PASSERIFORMES	Fairy Flycatcher	*Stenostira scita*	R	LC	-	-	Stable	Locally common to abundant	(*)	-	X	-	-
PASSERIFORMES	Cape Wagtail	*Motacilla capensis*	R	LC	-	-	Stable	Common	-	-	X	-	-
PASSERIFORMES	African Pipit	*Anthus cinnamomeus*	R	NA	-	-	NA	Common	-	-	X	-	-
PASSERIFORMES	Long-billed Pipit	*Anthus similis*	R	LC	-	-	Stable	Fairly common	-	-	X	-	-

Order	Common Name	Scientific Name	Phenology	RLCS	SA RLCS	CMS	Population Trend	Abundance	Endemic SA	Sensitive sp.	Scoping phase	WEF	CO
PASSERIFORMES	Southern (Common) Fiscal	*Lanius collaris*	R	LC	-	-	Increasing	Generally common	-	-	X	-	-
PASSERIFORMES	Bokmakierie	*Telophorus zeylonus*	R	LC	-	-	Stable	Common	-	-	X	X	X
PASSERIFORMES	Common Starling	*Sturnus vulgaris*	R	LC	-	-	Unknown	Common	-	-	X	-	-
PASSERIFORMES	Pied Starling	*Lamprotornis bicolor*	R	LC	-	-	Stable	Locally common to abundant	SLS	-	X	-	-
PASSERIFORMES	Pale-winged Starling	*Onychognathus nabouroup*	R	LC	-	-	Stable	Common	-	-	X	-	-
PASSERIFORMES	Malachite Sunbird	*Nectarinia famosa*	R	LC	-	-	Stable	Common to locally abundant	-	-	X	-	-
PASSERIFORMES	Marico Sunbird	*Cinnyris mariquensis*	R	LC	-	-	Stable	Locally common	-	-	-	-	X
PASSERIFORMES	Southern Double-collared Sunbird	*Cinnyris chalybeus*	R	LC	-	-	Stable	Common	(*)	-	X	X	X
PASSERIFORMES	Greater Double-collared Sunbird	*Cinnyris afer*	R	LC	-	-	Stable	Locally common	SLS	-	-	X	-
PASSERIFORMES	Dusky Sunbird	*Cinnyris fuscus*	R	LC	-	-	Stable	Locally common	-	-	X	-	-
PASSERIFORMES	Cape White-eye	*Zosterops capensis*	R	NA	-	-	Unknown	Common to very common	(*)	-	X	-	-
PASSERIFORMES	House Sparrow	*Passer domesticus*	R	LC	-	-	Decreasing	Locally common	-	-	X	-	-
PASSERIFORMES	Cape Sparrow	*Passer melanurus*	R	LC	-	-	Stable	Common to very common	-	-	X	X	-
PASSERIFORMES	Cape Weaver	*Ploceus capensis*	R	LC	-	-	Stable	Common	(*)	-	X	-	-
PASSERIFORMES	Southern Masked Weaver	*Ploceus velatus*	R	LC	-	-	Stable	Common	-	-	X	-	-
PASSERIFORMES	Common Waxbill	*Estrilda astrild*	R	LC	-	-	Stable	Common	-	-	X	-	-
PASSERIFORMES	Cape Canary	*Serinus canicollis*	R	LC	-	-	Stable	Locally common	-	-	X	-	-
PASSERIFORMES	Black-headed Canary	*Serinus alario*	R	LC	-	-	Stable	Locally common	(*)	-	X	X	-
PASSERIFORMES	Yellow Canary	*Crithagra flaviventris*	R	LC	-	-	Stable	Common	-	-	X	-	X
PASSERIFORMES	White-throated Canary	*Crithagra albogularis*	R	LC	-	-	Stable	Locally common	-	-	X	-	-
PASSERIFORMES	Cape Bunting	*Emberiza capensis*	R	LC	-	-	Stable	Fairly common to common	-	-	X	X	X
PASSERIFORMES	Lark-like Bunting	*Emberiza impetuani*	R	LC	-	-	Stable	Common to very common	-	-	X	X	X

7.3. Appendix III – Sampling locations characterisation

<table>
<tr><th>Sampling type</th><th>Area</th><th>Sampling point</th><th>Characterisation</th><th>Photo</th></tr>
<tr><td rowspan="4">Vantage Points</td><td rowspan="4">Kudusberg WEF</td><td>VPKD01</td><td>Biotope: Scrub / Slope
Vegetation: Central Mountain Shale Renosterveld
Minimum distance to water source: 1,0km
Minimum distance to known local nests: 2,8km

Weather conditions
<table>
<tr><th></th><th>Summer</th><th>Autumn</th><th>Winter</th><th>Spring</th></tr>
<tr><td>Avg. temp</td><td>23,5</td><td>16,4</td><td>17,0</td><td>10,9</td></tr>
<tr><td>Avg. wind speed</td><td>5,3</td><td>3,0</td><td>6,3</td><td>5,3</td></tr>
<tr><td>Wind Direction</td><td>E</td><td>W</td><td>E</td><td>N</td></tr>
</table></td><td></td></tr>
<tr><td>VPKD02</td><td>Biotope: Scrub / Slope
Vegetation: Central Mountain Shale Renosterveld
Minimum distance to water source: 1,7km
Minimum distance to known local nests: 6,7km

Weather conditions
<table>
<tr><th></th><th>Summer</th><th>Autumn</th><th>Winter</th><th>Spring</th></tr>
<tr><td>Avg. temp</td><td>26,6</td><td>13,9</td><td>16,7</td><td>11,7</td></tr>
<tr><td>Avg. wind speed</td><td>7,9</td><td>8,1</td><td>5,7</td><td>5,3</td></tr>
<tr><td>Wind Direction</td><td>S</td><td>S</td><td>NE</td><td>N</td></tr>
</table></td><td></td></tr>
<tr><td>VPKD03</td><td>Biotope: Scrub / Slope
Vegetation: Central Mountain Shale Renosterveld
Minimum distance to water source: 1,0km
Minimum distance to known local nests: 3,8km

Weather conditions
<table>
<tr><th></th><th>Summer</th><th>Autumn</th><th>Winter</th><th>Spring</th></tr>
<tr><td>Avg. temp</td><td>31,5</td><td>25,1</td><td>15,4</td><td>18,2</td></tr>
<tr><td>Avg. wind speed</td><td>4,0</td><td>5,0</td><td>4,1</td><td>4,4</td></tr>
<tr><td>Wind Direction</td><td>E/N/NE</td><td>N/NW</td><td>E/W</td><td>S</td></tr>
</table></td><td></td></tr>
<tr><td>VPKD04</td><td>Biotope: Scrub / Slope
Vegetation: Koedoesberge-Moordenaars Karoo
Minimum distance to water source: 1,6km
Minimum distance to known local nests: 8,5km

Weather conditions
<table>
<tr><th></th><th>Summer</th><th>Autumn</th><th>Winter</th><th>Spring</th></tr>
<tr><td>Avg. temp</td><td>33,3</td><td>23,3</td><td>11,0</td><td>21,0</td></tr>
<tr><td>Avg. wind speed</td><td>2,9</td><td>3,5</td><td>4,8</td><td>2,2</td></tr>
<tr><td>Wind Direction</td><td>W</td><td>E</td><td>NW</td><td>E</td></tr>
</table></td><td></td></tr>
</table>

Sampling type	Area	Sampling point	Characterisation	Photo
Vantage Points	Kudusberg WEF	VPKD05	See below	
Vantage Points	Control	VPCO01	See below	
Vantage Points	Control	VPCO02	See below	
Vantage Points	Control	VPCO03	See below	

VPKD05 (Vantage Points – Kudusberg WEF)

Biotope: Scrub / Slope
Vegetation: Central Mountain Shale Renosterveld
Minimum distance to water source: 1,0km
Minimum distance to known local nests: 5,4km

Weather conditions

	Summer	Autumn	Winter	Spring
Avg. temp	33,4	17,6	12,4	15,7
Avg. wind speed	3,3	9,8	5,0	7,9
Wind Direction	E/N/W	E/SE	N	S

VPCO01 (Vantage Points – Control)

Biotope: Scrub
Vegetation: Koedoesberge-Moordenaars Karoo
Minimum distance to water source: 0km
Minimum distance to known local nests: 12km

Weather conditions

	Summer	Autumn	Winter	Spring
Avg. temp	35,6	21,2	16,8	16,9
Avg. wind speed	2,4	0,2	3,5	5,8
Wind Direction	SE	W	W	SE

VPCO02 (Vantage Points – Control)

Biotope: Scrub / Slope
Vegetation: Koedoesberge-Moordenaars Karoo
Minimum distance to water source: 1,1km
Minimum distance to known local nests: 8,1km

Weather conditions

	Summer	Autumn	Winter	Spring
Avg. temp	30,9	21,0	10,4	17,1
Avg. wind speed	4,0	4,1	4,6	3,6
Wind Direction	SE/SW	NW/W	E/W	N

VPCO03 (Vantage Points – Control)

Biotope: Scrub / Slope
Vegetation: Koedoesberge-Moordenaars Karoo
Minimum distance to water source: 0,8km
Minimum distance to known local nests: 7,3km

Weather conditions

	Summer	Autumn	Winter	Spring
Avg. temp	32,8	20,9	9,8	17,1
Avg. wind speed	5,3	3,5	4,6	3,6
Wind Direction	E	NW/W	W	N

<table>
<tr><th>Sampling type</th><th>Area</th><th>Sampling point</th><th>Characterisation</th><th>Photo</th></tr>
<tr><td></td><td></td><td>VPCO04</td><td>Biotope: Scrub / Slope
Vegetation: Central Mountain Shale Renosterveld
Minimum distance to water source: 1,5km
Minimum distance to known local nests: 1,5km

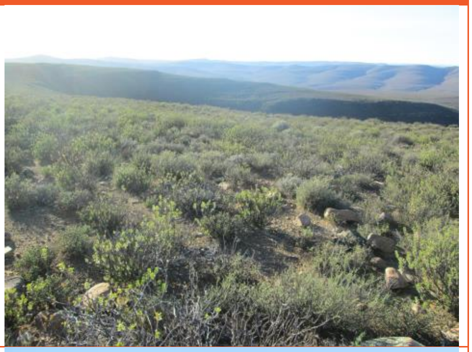
Weather conditions
<table>
<tr><th></th><th>Summer</th><th>Autumn</th><th>Winter</th><th>Spring</th></tr>
<tr><td>Avg. temp</td><td>29,7</td><td>13,9</td><td>17,6</td><td>11,4</td></tr>
<tr><td>Avg. wind speed</td><td>4,1</td><td>3,6</td><td>1,6</td><td>8,8</td></tr>
<tr><td>Wind Direction</td><td>SE</td><td>SW</td><td>N/NW</td><td>W</td></tr>
</table></td><td></td></tr>
<tr><td rowspan="3">Vantage Points</td><td rowspan="3">Control</td><td>VPCO05</td><td>Biotope: Scrub
Vegetation: Koedoesberge-Moordenaars Karoo
Minimum distance to water source: 2,4km
Minimum distance to known local nests: 12km

Weather conditions
<table>
<tr><th></th><th>Summer</th><th>Autumn</th><th>Winter</th><th>Spring</th></tr>
<tr><td>Avg. temp</td><td>32,2</td><td>19,5</td><td>15,7</td><td>16,5</td></tr>
<tr><td>Avg. wind speed</td><td>5,9</td><td>3,0</td><td>1,7</td><td>4,4</td></tr>
<tr><td>Wind Direction</td><td>SE</td><td>W</td><td>S</td><td>W</td></tr>
</table></td><td></td></tr>
<tr><td>VPCO06</td><td>Biotope: Scrub / Slope
Vegetation: Central Mountain Shale Renosterveld
Minimum distance to water source: 1,7km
Minimum distance to known local nests: 0,1km

Weather conditions
<table>
<tr><th></th><th>Summer</th><th>Autumn</th><th>Winter</th><th>Spring</th></tr>
<tr><td>Avg. temp</td><td>33,1</td><td>14,7</td><td>17,1</td><td>11,4</td></tr>
<tr><td>Avg. wind speed</td><td>3,2</td><td>4,2</td><td>1,9</td><td>5,0</td></tr>
<tr><td>Wind Direction</td><td>W</td><td>NW</td><td>N/NW</td><td>W</td></tr>
</table></td><td></td></tr>
<tr><td>VPCO07</td><td>Biotope: Scrub
Vegetation: Central Mountain Shale Renosterveld
Minimum distance to water source: 2,1km
Minimum distance to known local nests: 4,4km

Weather conditions
<table>
<tr><th></th><th>Summer</th><th>Autumn</th><th>Winter</th><th>Spring</th></tr>
<tr><td>Avg. temp</td><td>27,7</td><td>23,9</td><td>19,4</td><td>17,2</td></tr>
<tr><td>Avg. wind speed</td><td>5,4</td><td>3,2</td><td>3,1</td><td>5,6</td></tr>
<tr><td>Wind Direction</td><td>E/NE</td><td>E</td><td>NW</td><td>E</td></tr>
</table></td><td></td></tr>
</table>

<table>
<tr><th>Sampling type</th><th>Area</th><th>Sampling point</th><th>Characterisation</th><th>Photo</th></tr>
<tr><td rowspan="2">Walked Transects</td><td rowspan="2">Kudusberg WEF</td><td>BTKD01</td><td>Biotope: Scrub / Slope
Vegetation: Central Mountain Shale Renosterveld
Minimum distance to water source: 0,6km
Minimum distance to known local nests: 3km

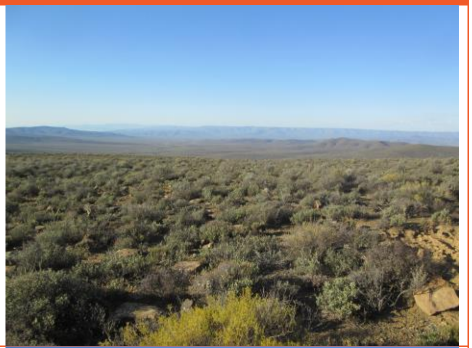
Weather conditions
<table>
<tr><th></th><th>Summer</th><th>Autumn</th><th>Winter</th><th>Spring</th></tr>
<tr><td>Avg. temp</td><td>15,0</td><td>19,9</td><td>16,2</td><td>20,0</td></tr>
<tr><td>Avg. wind speed</td><td>6,9</td><td>2,2</td><td>0,0</td><td>3,0</td></tr>
<tr><td>Wind Direction</td><td>E</td><td>W</td><td>-</td><td>W</td></tr>
</table></td><td></td></tr>
<tr><td>BTKD02</td><td>Biotope: Scrub / Slope
Vegetation: Central Mountain Shale Renosterveld
Minimum distance to water source: 1,4km
Minimum distance to known local nests: 6,2km

Weather conditions
<table>
<tr><th></th><th>Summer</th><th>Autumn</th><th>Winter</th><th>Spring</th></tr>
<tr><td>Avg. temp</td><td>25,3</td><td>10,4</td><td>16,1</td><td>17,7</td></tr>
<tr><td>Avg. wind speed</td><td>10,9</td><td>9,6</td><td>3,8</td><td>4,9</td></tr>
<tr><td>Wind Direction</td><td>S</td><td>E</td><td>-</td><td>W</td></tr>
</table></td><td></td></tr>
<tr><td rowspan="2">Walked Transects</td><td rowspan="2">Kudusberg WEF</td><td>BTKD03</td><td>Biotope: Scrub / Slope
Vegetation: Central Mountain Shale Renosterveld
Minimum distance to water source: 0,2km
Minimum distance to known local nests: 3,3km

Weather conditions
<table>
<tr><th></th><th>Summer</th><th>Autumn</th><th>Winter</th><th>Spring</th></tr>
<tr><td>Avg. temp</td><td>30,1</td><td>19,7</td><td>16,4</td><td>20,9</td></tr>
<tr><td>Avg. wind speed</td><td>3,4</td><td>2,1</td><td>3,4</td><td>4,1</td></tr>
<tr><td>Wind Direction</td><td>SE</td><td>NW</td><td>-</td><td>NE</td></tr>
</table></td><td></td></tr>
<tr><td>BTKD04</td><td>Biotope: Scrub / Slope
Vegetation: Central Mountain Shale Renosterveld
Minimum distance to water source: 1,4km
Minimum distance to known local nests: 2,9km

Weather conditions
<table>
<tr><th></th><th>Summer</th><th>Autumn</th><th>Winter</th><th>Spring</th></tr>
<tr><td>Avg. temp</td><td>26,6</td><td>13,1</td><td>16,1</td><td>17,7</td></tr>
<tr><td>Avg. wind speed</td><td>4,9</td><td>2,1</td><td>0,0</td><td>4,8</td></tr>
<tr><td>Wind Direction</td><td>E</td><td>E</td><td>-</td><td>W</td></tr>
</table></td><td></td></tr>
</table>

<table>
<tr><th>Sampling type</th><th>Area</th><th>Sampling point</th><th>Characterisation</th><th>Photo</th></tr>
<tr><td></td><td></td><td>BTKD05</td><td>Biotope: Scrub / Slope
Vegetation: Koedoesberge-Moordenaars Karoo
Minimum distance to water source: 0,5km
Minimum distance to known local nests: 8,6km

Weather conditions
<table>
<tr><th></th><th>Summer</th><th>Autumn</th><th>Winter</th><th>Spring</th></tr>
<tr><td>Avg. temp</td><td>35,5</td><td>19,7</td><td>10,5</td><td>31,2</td></tr>
<tr><td>Avg. wind speed</td><td>4,6</td><td>2,0</td><td>6,1</td><td>1,4</td></tr>
<tr><td>Wind Direction</td><td>W</td><td>E</td><td>-</td><td>SW</td></tr>
</table></td><td></td></tr>
<tr><td></td><td></td><td>BTKD06</td><td>Biotope: Scrub / Slope
Vegetation: Koedoesberge-Moordenaars Karoo
Minimum distance to water source: 0,7km
Minimum distance to known local nests: 5,2km

Weather conditions
<table>
<tr><th></th><th>Summer</th><th>Autumn</th><th>Winter</th><th>Spring</th></tr>
<tr><td>Avg. temp</td><td>35,2</td><td>10,9</td><td>11,4</td><td>14,4</td></tr>
<tr><td>Avg. wind speed</td><td>3,7</td><td>3,1</td><td>6,0</td><td>5,4</td></tr>
<tr><td>Wind Direction</td><td>SW</td><td>E</td><td>-</td><td>E</td></tr>
</table></td><td></td></tr>
<tr><td></td><td></td><td>BTKD07</td><td>Biotope: Scrub / Slope
Vegetation: Central Mountain Shale Renosterveld
Minimum distance to water source: 0,8km
Minimum distance to known local nests: 3,8km

Weather conditions
<table>
<tr><th></th><th>Summer</th><th>Autumn</th><th>Winter</th><th>Spring</th></tr>
<tr><td>Avg. temp</td><td>29,2</td><td>23,9</td><td>14,9</td><td>12,0</td></tr>
<tr><td>Avg. wind speed</td><td>4,6</td><td>4,7</td><td>1,2</td><td>5,2</td></tr>
<tr><td>Wind Direction</td><td>E</td><td>S</td><td>-</td><td>S</td></tr>
</table></td><td></td></tr>
<tr><td>Walked Transects</td><td>Control</td><td>BTCO01</td><td>Biotope: Scrub
Vegetation: Koedoesberge-Moordenaars Karoo
Minimum distance to water source: 0,09km
Minimum distance to known local nests: 12km

Weather conditions
<table>
<tr><th></th><th>Summer</th><th>Autumn</th><th>Winter</th><th>Spring</th></tr>
<tr><td>Avg. temp</td><td>26,5</td><td>16,8</td><td>21,2</td><td>20,5</td></tr>
<tr><td>Avg. wind speed</td><td>1,2</td><td>0,7</td><td>6,6</td><td>6,4</td></tr>
<tr><td>Wind Direction</td><td>SE</td><td>W</td><td>W</td><td>E</td></tr>
</table></td><td></td></tr>
</table>

Sampling type	Area	Sampling point	Characterisation	Photo

BTCO04

Biotope: Scrub / Slope
Vegetation: Koedoesberge-Moordenaars Karoo
Minimum distance to water source: 0,7km
Minimum distance to known local nests: 7,2km

Weather conditions

	Summer	Autumn	Winter	Spring
Avg. temp	26,8	22,2	10,2	21,0
Avg. wind speed	7,2	2,6	1,7	3,0
Wind Direction	SW	W	E	NW

BTCO05

Biotope: Scrub / Slope
Vegetation: Koedoesberge-Moordenaars Karoo
Minimum distance to water source: 0,9km
Minimum distance to known local nests: 8,0km

Weather conditions

	Summer	Autumn	Winter	Spring
Avg. temp	26,7	24,1	13,5	21,0
Avg. wind speed	7,3	3,2	0,9	3,0
Wind Direction	N	NW	E	NW

BTCO06

Biotope: Scrub / Slope
Vegetation: Central Mountain Shale Renosterveld
Minimum distance to water source: 1,7km
Minimum distance to known local nests: 0,1km

Weather conditions

	Summer	Autumn	Winter	Spring
Avg. temp	26,1	17,8	16,5	5,8
Avg. wind speed	2,0	4,7	1,5	2,8
Wind Direction	E	N	N	W

BTCO07

Biotope: Scrub / Slope
Vegetation: Koedoesberge-Moordenaars Karoo
Minimum distance to water source: 2,7km
Minimum distance to known local nests: 11km

Weather conditions

	Summer	Autumn	Winter	Spring
Avg. temp	25,5	10,7	14,6	12,7
Avg. wind speed	1,0	4,0	1,6	6,8
Wind Direction	SE	SE	SE	S

Sampling type	Area	Sampling point	Characterisation	Photo
Walked Transects	Control	BTCO08	Biotope: Scrub / Slope Vegetation: Central Mountain Shale Renosterveld Minimum distance to water source: 1,5km Minimum distance to known local nests: 4,3km **Weather conditions** <table><tr><th></th><th>Summer</th><th>Autumn</th><th>Winter</th><th>Spring</th></tr><tr><td>**Avg. temp**</td><td>17,9</td><td>15,3</td><td>18,7</td><td>13,0</td></tr><tr><td>**Avg. wind speed**</td><td>6,5</td><td>4,9</td><td>7,6</td><td>3,4</td></tr><tr><td>**Wind Direction**</td><td>E</td><td>E</td><td>-</td><td>N</td></tr></table>	

7.4. Appendix IV – Description of Bird Sensitive Species Observations

During the pre-construction monitoring conducted, 25 bird species considered sensitive were confirmed on the site and its surroundings. Especially important are 5 of these species for presenting an unfavourable conservation status (Taylor, Peacock & Wanless 2015). A brief description of these species is offered in this section.

Verreauxs' Eagle (*Aquila verreauxii*) (Figure 29)

Verreauxs' Eagle *Aquila verreauxii* is a resident species in South Africa, occurs mainly in mountainous habitats and rocky areas with cliffs and has a status of Least Concern globally (IUCN 2016), but at a South African level it is considered to be *Vulnerable* (Taylor, Peacock & Wanless 2015). It is considered locally as fairly common, having an estimated population of between 400-2000 pairs in the Western Cape (Hockey, Dean & Ryan 2005). Main threats for this species include prosecution by farmers, pesticides and lack of food, where hyraxes are hunted for food and skins (BirdLife International 2015a).

This species was detected in the summer, winter and spring season, consisting of some individual gliding and perching through the area, mostly at high altitude.

Black Harrier (*Circus maurus*) (Figure 29)

Black Harrier *Circus maurus* is a resident species in South Africa and endemic to Southern Africa, being that over 70% of the world population is confined within the country limits (IUCN 2016). It's considered one of the world's most range-restricted harriers (Hockey, Dean & Ryan 2005). Accordingly to the IUCN 2013 report its world population is considered stable, however it is classified as *Vulnerable* and by the Red List of Conservation for South Africa as *Endangered* (Taylor, Peacock & Wanless 2015). It is usually present in low shrubs type of habitats that it uses for hunting and breeding.

Studies on other species of Harrier, such as the Hen Harrier *Circus pygargus* in Europe, concluded that these species are not very prone to suffer from the impacts of wind energy facilities (Whitfield & Madders 2006). Thus, there are few evidences of displacement and not many records of fatalities associated with this type of project. Nevertheless, there is at least one case study of a Portuguese wind energy facility where high mortality rates of Hen Harrier have been recorded (Bio3 2009), and mitigated through habitat management.

In the study area the species was detected during the winter and spring season. Of these, 3 records were detected flying at rotor swept height, which coupled with the execution of risk behaviours such as soaring, gliding and hunting placed this species in future collision risk with wind turbines. Most of the observations were made from vantage points, indicating that the species actively uses the area.

Ludwig's Bustard (*Neotis ludwigii*) (Figure 29)

Ludwig's Bustard *Neotis ludwigii* is a species considered to have an *Endangered* status in South Africa as well as globally (Taylor, Peacock & Wanless 2015; IUCN 2016). A recent review of the status of its populations has revealed rapid declines, caused to a great extent by collision with power lines (BirdLife International 2014a).

Only one Ludwig's Bustards was observed using the area in the spring season. Of note was an observation of an isolated individual flapping below RSA.

Martial Eagle (*Polemaetus bellicosus*)

Martial Eagle *Polemaetus bellicosus* is a resident species with a widespread but discontinuous distribution. Occurs mainly in open woodland in fairly flat areas including arid savannah and forest edges. Also occurs in open scrubland with drainage lines with clutches of high trees of tall high tension pylons and is rare in mountainous areas (Hockey, Dean & Ryan 2005). Its population is considered *Endangered* in South Africa (Taylor, Peacock & Wanless 2015) with uncommon and of overall decreasing populations. Main threats for the species are: direct persecution by farmers, poisoning and electrocution and collision with power lines, as well as habitat loss (BirdLife International 2015b).

The species was observed in all seasons with the exception of the spring season. It was mostly detected through incidental observation and only in the Control area. It is of note that for all observation made, almost half of the flights were observed at rotor swept height.

Black Stork (*Ciconia nigra*) (Figure 29)

Black Stork *Ciconia nigra* is a *Vulnerable* species in South Africa (Taylor, Peacock & Wanless 2015), though its population trends are largely undetermined at a global scale. Major threats for this species have been mostly due to habitat degradation and loss of habitat since the species wintering grounds in Southern Africa have been under conversion process to other uses. It is also known to sporadically collide with power lines (BirdLife International 2015c). Black Stork is usually found in dams, pans, flood plains, estuaries, marshlands and flooded grassland, though associated with mountainous regions (Hockey, Dean & Ryan 2005).

Two individuals of Black Stork were observed in the control area, during winter and spring. The flights occurred at RSA, being considered of risk movements.

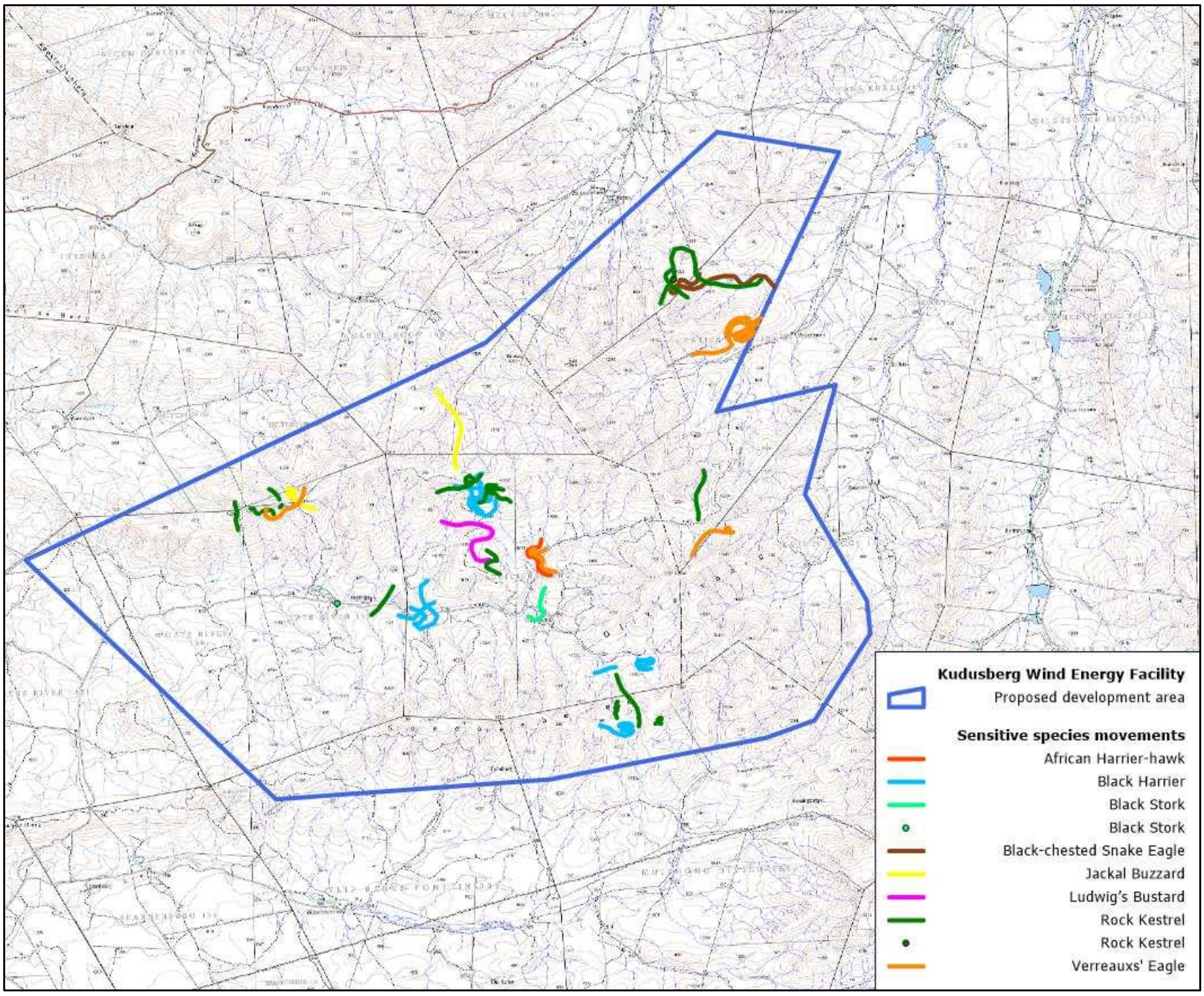


Figure 29 – Observed movements of African Harrier-hawk, Black Harrier, Black Stork, Black-chested Snake Eagle, Jackal Buzzard, Ludwing's Bustard, Rock Kestrel, Verreaux's Eagle during the pre-construction bird monitoring programme at Kudusberg WEF.

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