AVIFAUNAL IMPACT ASSESMENT 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

26th October 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.

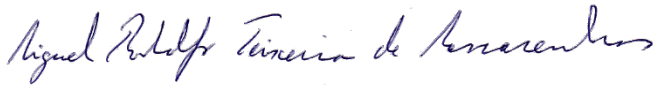
+ Publications

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: 26th October 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 low before mitigation, and very low 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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1 AVIFAUNAL BASIC ASSESSMENT

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 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.

Linear walking transects

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 ($n \geq 40$).

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 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.

Breeding Evidences

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.

Waterbody monitoring

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.

- 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
	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.

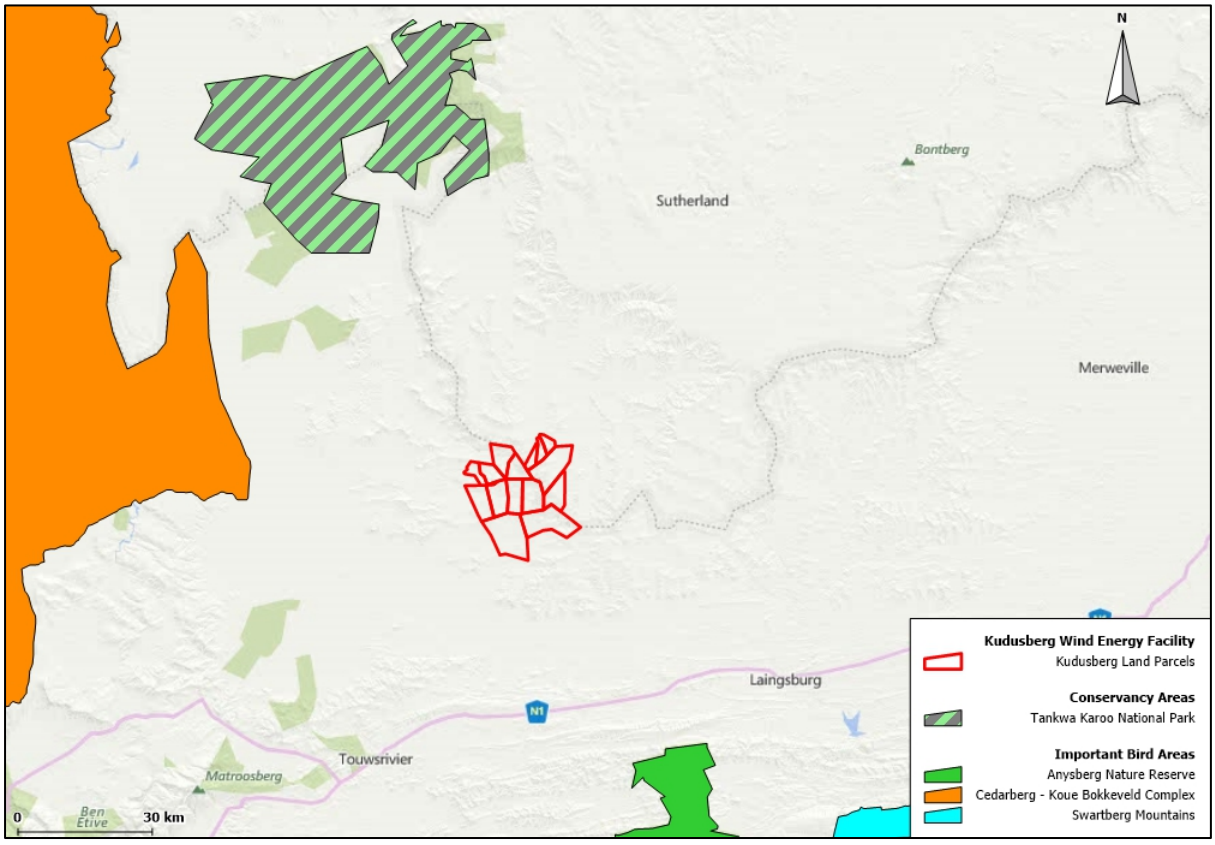

Figure 1 - Location of the Kudusberg WEF in relation to the surrounding conservancy areas (background image source: Google Earth Street Map)

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.

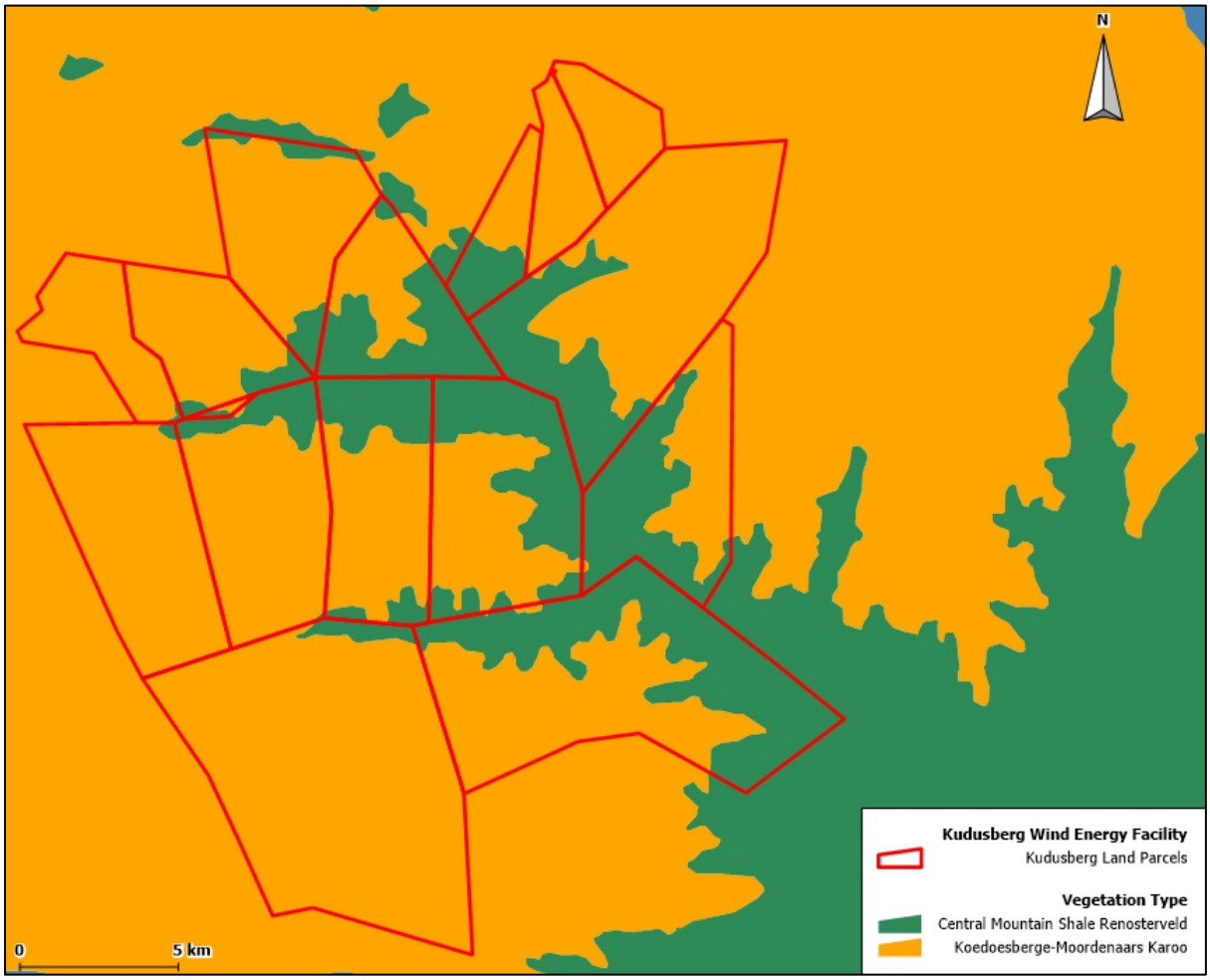

Figure 2 - Vegetation units present within the Kudusberg WEF and surrounding area according to Mucina & Rutherford (2006) updated to version 2012.

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.

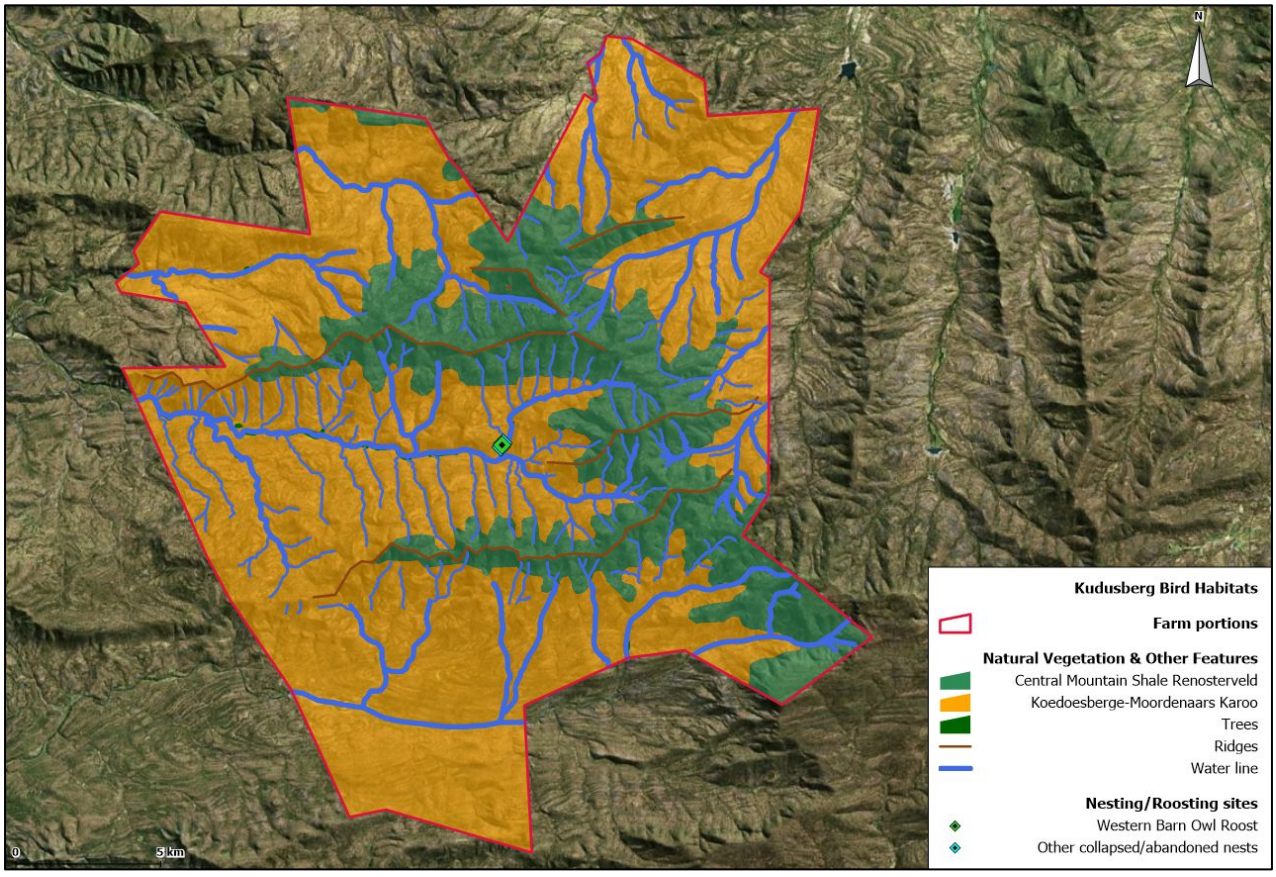

Figure 3 - Bird habitats occurring within the proposed Kudusberg WEF

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 moderate sensitivity, with some areas considered to be very highly sensitive (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. 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 Flight Paths*: 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.

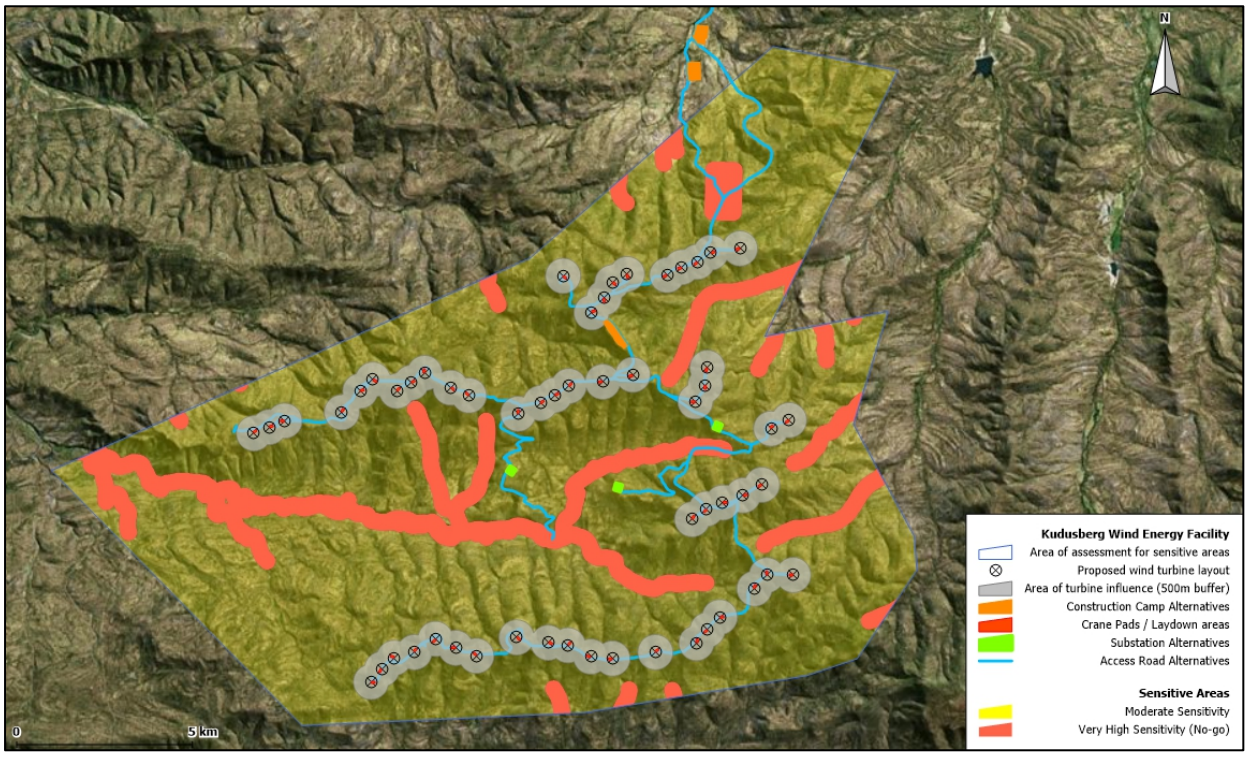

Figure 4 - Sensitive areas identified for birds during the pre-construction monitoring campaign at Kudusberg WEF, overlaid with the proposed development features.

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, 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 Flaming *Phoenicopterus roseus* – Near Threatened (Taylor *et al*., 2015).

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 in parallel with sensitive linear features. These powerlines are however allowed to be built within sensitive locations, as long as they only cross these areas perpendicularly. Powerlines should be fitted with bird flight diverters, to allow them to be more visible to bird species. 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.

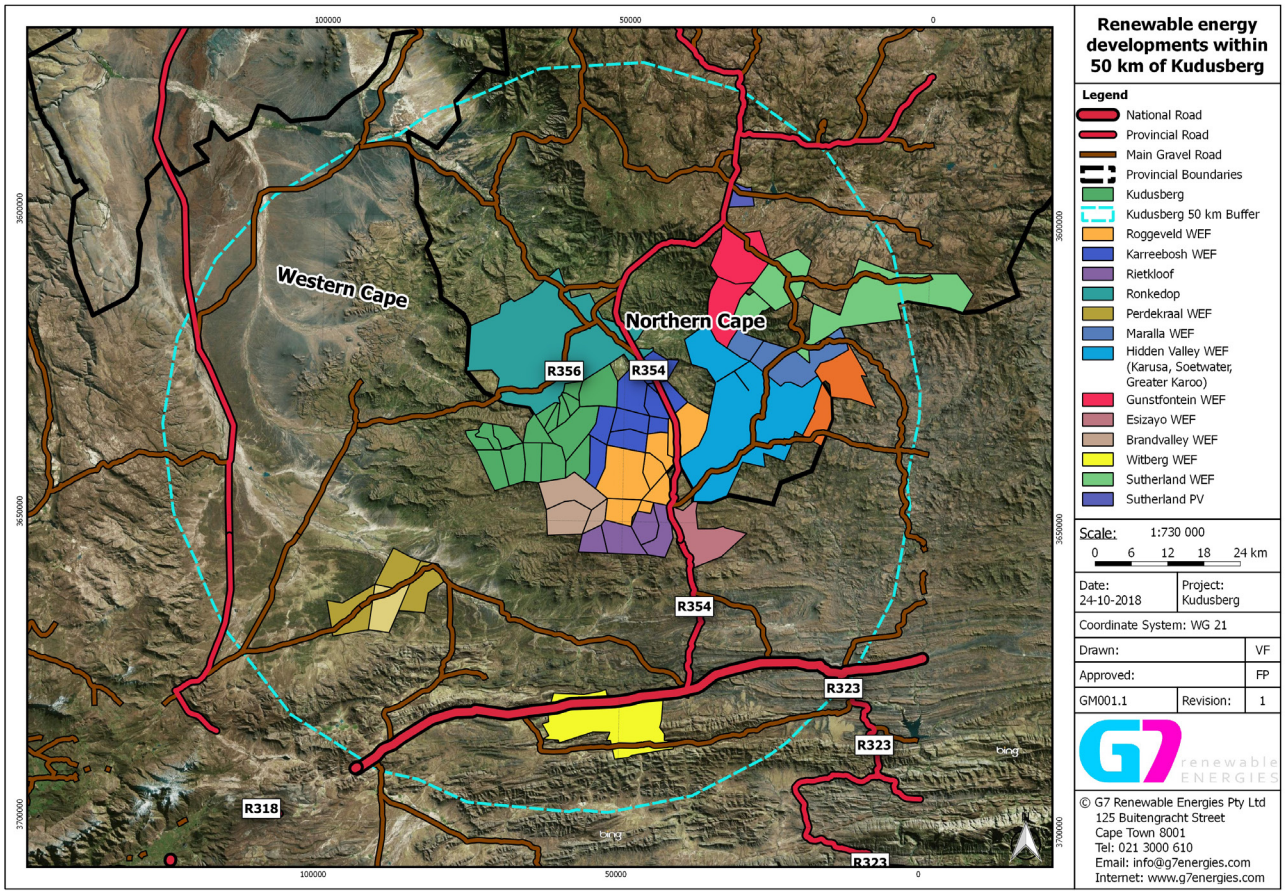

Figure 5 - Onshore Renewable Energy projects currently proposed or approved in the surrounding area of the Kudusberg Wind Energy Facility (according to the REEA most recent available dataset – 2018 2nd Quarter).

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 in parallel with very high sensitive features (within the no-go buffers). 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 operational phase	Low	4	High
Disturbance effects	Disturbance of bird community due to noise and movement generated by turbines and	Negative	Local	Long-term	Moderate	Very likely	High	Replaceable	Low	No	Yes	Lower the noise levels as far as possible.	Very low	5	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
	people/vehicles operating in the area														
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. ▪ Powerlines should only cross very high sensitive areas at a perpendicular angle. ▪ Lowest tip of turbines blades should not be lower than 40m.	▪ Attach bird flight diverters to overhead powerlines and weather mast guyed wires, to increase the visibility of these structures to low flying birds. ▪ Powerlines should never	▪ 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***
			run in parallel, within a very high sensitive (buffered) area. They should only cross the area at a perpendicular angle – to avoid 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.	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: o 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. o 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 shut-down on demand technology,	▪ 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.	habitat management, or bird deterrence systems.		
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	Reduce the risk of population decline	▪ Implement an operational monitoring programme with carcass searches, searcher	▪ Conduct a monitoring campaign (with carcass	▪ During the first two years of the	▪ Avifaunal

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
Decline	within the area.	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 campaign.	searches, searcher efficiency trials and scavenger removal trials) during the first two years of the projects' operational 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	projects' operational phase. Then in the fifth year, and every five years thereafter. ▪ During the operational phase.	Specialist. ▪ Avifaunal specialist for monitoring. Holder of the EA for implementation.

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
			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 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**.

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.

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

Project Design Phase

- 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 never run in parallel, within a very high sensitive (buffered) area. They should only cross the area at a perpendicular angle – to avoid 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.

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.

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.

1.10 REFERENCES

Atienza, J., Martin Fierro, I., Infante, O., Valls, J., & Dominguez, J. (2011). *Directrices Para La Evaluacion Del Impacto de Los Parques Eolicos En Aves Y Murcienlagos (Version 3.0).* Madrid.

AWWI. (2015). *Wind Turbine Interactions with Wildlife and Their Habitats: A Summary of Research Results and Priority Questions. (Updated May 2015).* Washington, DC.

Bioinsight. (2015). *Gunstfontein Wind Energy Facility - Bird Pre-Construction Monitoring and Specialist Impact Assessment. Pre-Construction Phase. Final Monitoring Report 2013/2014.*

Bioinsight. (2018). *Kudusberg Wind Energy Facility - Bird Pre-Construction Monitoring 2015/2016.*

BLSA. (2016). *BirdLife South Africa Checklist of Birds in South Africa.* Excel Version 2.1.

Buckland, S., Anderson, D., Burnham, K., & Laake, J. (1993). *Distance Sampling. Estimating Abundance of Biological Populations.* London: Chapman and Hall.

Buckland, S., Anderson, D., Burnham, K., Laake, J., Borchers, D., & Thomas, L. (2001). *Introduction to Distance Sampling.* Oxford: Oxford University Press.

DEA. (2016). *Renewable Energy EIA Applications Map. First Quarter 2016.*

Drewitt, A., & Langston, R. (2006). Assessing the impacts of wind farms on birds. *Ibis*, 29-42.

European Commision. (2010). *Wind Energy Developments and Natura 2000.*

Harrison, J., Allan, D., Underhill, L., Herremans, M., Tree, A., Parker, V., & Brown, C. (1997). *The Atlas of Southern African Birds.* Johannesburg: BirdLife South Africa.

Hockey, P., Dean, W., & Ryan, P. (2005). *Roberts - Birds of Southern Africa.* Cape Town: The Trustees of the John Voelcker Bird Book Fund.

IUCN. (2016). *The IUCN Red List of Threatened Species. Version 2015-4.* http://www.iucnredlist.org.

Jenkins, A., Van Rooyen, C., Smallie, J., Anderson, M., Smit, H., Harrison, J., & Diamond, M. (2012). *BirdLife South Africa / Endangered Wildlife Trust Best Pract Guidelines for Avian Monitoring and Impact Mitigation at Proposed Wind Energy Development Sites in Southern Africa.*

Jenkins, A., Van Rooyen, C., Smallie, J., Anderson, M., Smit, H., Harrison, J., & Diamond, M. (2015). *Best-Practice Guidelines for Assessing and Monioring the Impact of Wind-Energy Facilities on Birds in Southern Africa.*

Malan, G. (2009). *Raptor Survey and Monitoring - a Field Guide for African Birds of Prey.* Pretoria: Briza Publications.

Mucina, L., & Rutherford, M. (2006). *The Vegetation of South Africa, Lesotho and Swaziland.* Pretoria: South African National Biodiversity Institute.

Retief, E., Diamond, M., Anderson, M., Smit, H., Jenkins, A., Brooks, M., & Simmons, R. (2012). *Avian Wind Farm Sensitivity Map for South Africa. Criteria and Procedures Used.*

SNH. (2009). *Guidance on Methods for Monitoring Bird Populations at Onshore Wind Farms.*

Strickland, M., Arnett, E., Erickson, W., Johnson, G., Johnson, D., Morrison, M., . . . Warren-Hicks, W. (2011). *Comprehensive Guide to Studying Wind Energy/Wildlife Interactions.* Washington D.C., USA.

Taylor, M., Peacock, F., & Wanless, R. (2015). *The 2015 Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland.* Johannesburg: BirdLife South Africa.

Taylor, P., Navarro, R., Wren-Sargent, M., Harrison, J., & Kieswetter, S. (1999). *TOTAL CWAC Report: Coordinated Waterbird Counts in South Africa, 1992-97.* Cape Town.

Thomas, L., Buckland, S., Rexstad, E., Laake, J., Strindberg, S., Hedley, S., . . . Burnham, K. (2010). Distance software: design and analysis of distance sampling surveys for estimating population size. *The Journal of applied ecology: 47*, 5-14.

USFWS. (2012). *U.S. Fish and Wildlife Service Land-Based Wind Energy Guidelines.* Arlington.

APPENDICES

Appendix I - Figures

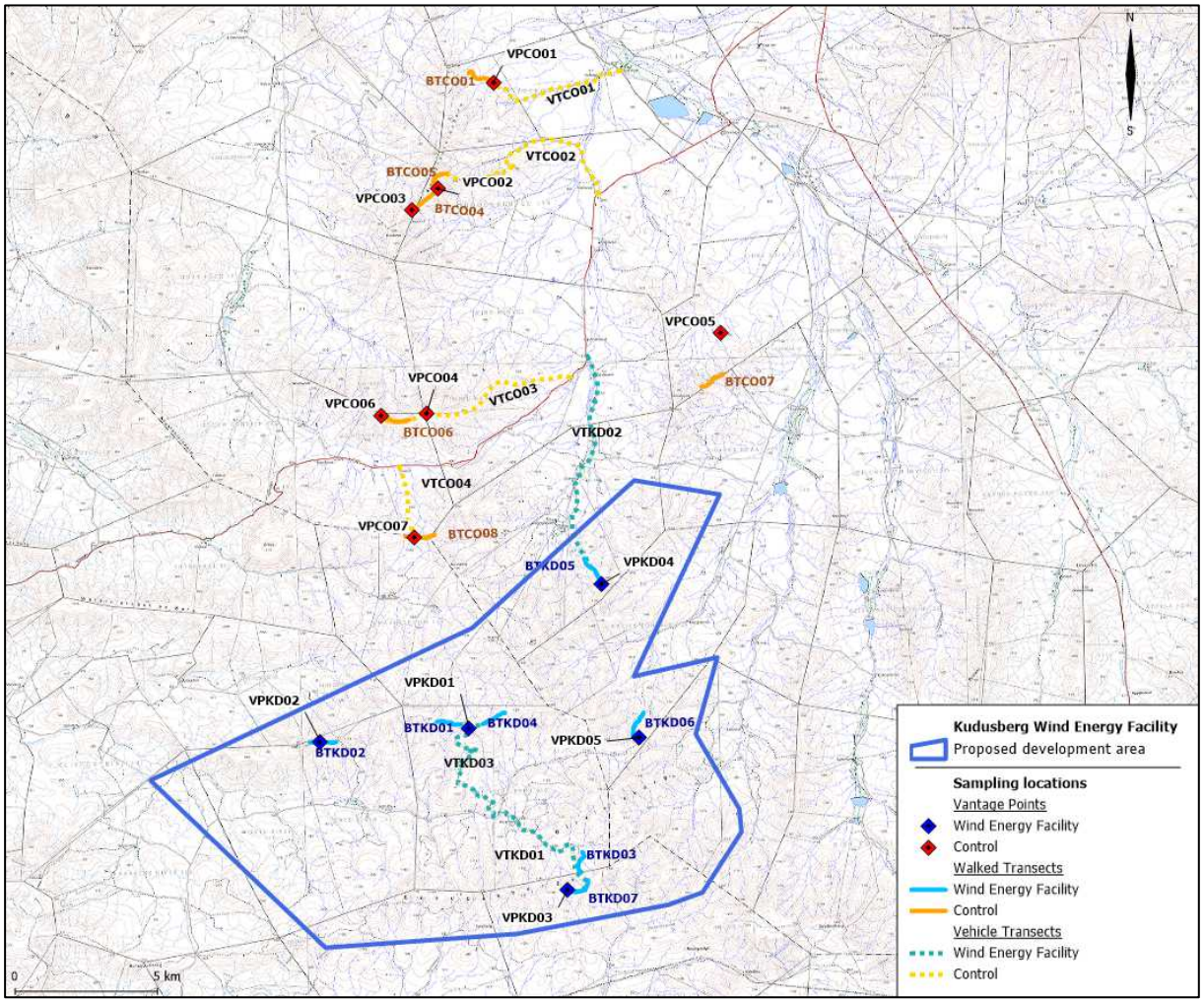

Figure 6 - Sampling locations at Kudusberg WEF during the pre-construction bird monitoring programme.

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