



BAT IMPACT ASSESSMENT BASED ON 12 MONTH PRE-CONSTRUCTION MONITORING TO INFORM THE BASIC ASSESSMENT REPORT:

**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

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26th October 2018

SPECIALIST EXPERTISE

The Bat 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

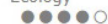
Corporate management



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

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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 Assessment of an Aviary in Évora, Portugal. Portugal.
2018	Tourism&Urban Areas	Ecological Component of the Environmental Incidence Assessment of an Execution Project for the Electrification 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 Assessment of Arrimal's Wind Farm, Portugal. Portugal.
2018	Wind Energy	Annual Monitoring Study of Birds and Bats (daytime and nighttime) in 2018 in the Park and in the Electric 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 Assessment of an Mining Installation enlargement in Aljustrel, Portugal. Portugal.
2018	Hidric Energy	Ecological and climate components of a Special Program for Ribeiradio-Ermida Dam, Portugal. Portugal.
2018	Electric Sector	Ecological Component of the Environmental Impact Assessment of a substation of an Electric Energy Transformation - Tabaqueira, Portugal. Portugal.
2018	Wind Energy	Environmental Report for legal framework application 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., Mourão, 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

The Kudusberg Wind Farm (hereafter referred to as “Kudusberg Wind Energy Facility” or “Kudusberg WEF”) is a proposed 325 MW wind farm development by Kudusberg Wind Farm (Pty) Ltd. The project is located on the border between the Western and Northern Cape, south of the R356 and west of the R354, at approximately 50km southwest of Sutherland. Bioinsight (Pty) Ltd. was appointed to conduct the bat pre-construction monitoring programme and compile the final bat pre-construction monitoring report in accordance with the best practice pre-construction monitoring guidelines.

The site is characterised by accentuated mountainous areas with very difficult human access and therefore in almost pristine natural conditions. Vegetation is adapted to the semi-arid conditions and harsh rocky conditions. Currently the area where Kudusberg WEF is proposed shows no signs of intense disturbance apart from the severe impacts on the veld caused by the three-year period of drought. Signs of human disturbance are characterised by the presence of a few farm dwellings and extensive sheep farming, mostly during the winter season.

Various techniques were implemented to study the local bat community and inform the assessment of potential risks from the construction and operation of the proposed project. The following techniques were applied at the proposed area for the wind energy development and its immediate surroundings: a desktop and bibliographic review, active acoustic detection surveys by means of vehicle-based transects, passive surveys by means of installation of five automatic acoustic detectors (rotor height and ground level in various habitats) and roost searches/inspection and monitoring.

The main results of the bat community pre-construction monitoring programme of the Kudusberg WEF are presented in the final bat pre-construction monitoring report¹ resulting from the analysis of the surveys conducted between December 2015 and December 2016. These methodologies resulted in confirming the occurrence of four bat species and the identification of them. The confirmed species are the Egyptian free-tailed bat (*Tadarida aegyptiaca*), the Cape serotine (*Neoromicia capensis*), the Natal long-fingered bat (*Miniopterus natalensis*) and the Egyptian slit-faced bat (*Nycteris thebaica*). These are all “Near Threatened”, or “Least Concern” species, according to the South African Red List (Friedmann & Daly, 2004b) and are considered sensitive species to the WEF development since three of them are considered to have medium to high risk of collision with wind turbines.

Results of the pre-construction bat monitoring indicate that the bat activity at the proposed Kudusberg WEF area is in general low considering the bat guidelines (Sowler *et al.*, 2016).

According to pre-construction phase results, Kudusberg WEF is classified as having low sensitivity, but with some areas in particular with high and very high sensitivity due to the presence of specific features and habitat that may have an increased bat activity. These include the presence of potential roosts, as well as water lines which are important for bats, since they are likely to act as commuting routes, providing food resources likely to be associated to a higher bat activity.

It is recommended that the very high (no-go) areas identified for the bat community should be excluded from turbine placement and the areas considered as high sensitivity avoided as much as possible.

The potential occurrence of the following impacts on the general bat community was identified: direct mortality caused by collisions and barotrauma; Displacement effects by habitat alteration; Disturbance due to noise, machinery movements and maintenance operations.

¹ BioInsight, 2018. 2015/2016 Final bat pre-construction monitoring report for the proposed Kudusberg wind farm.

The overall significance of impacts expected to occur during the construction, operation, and decommissioning phases, is expected to be low before mitigation, and very low after mitigation.

Impacts may also be magnified due to cumulative impacts caused by other wind energy developments proposed in the area.

Cumulative impacts were assessed by adding expected impacts from the Kudusberg WEF to existing and proposed 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 bat populations within the region. The main direct cumulative 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 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 bat community on site will remain unchanged, relative to that which is being observed at present, under current land-use practices.

Consequently, no fatal flaws were identified for the project, only very high (no-go) areas were identified which should be excluded from development due to the high sensitivity of the environmental features located within these areas.

From the perspective of the impact on bats, the proposed Kudusberg WEF may be authorised subject to the implementation of the recommendations proposed.

It is also recommended that a construction and operational phase bat 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.

LIST OF ABBREVIATIONS

BA	Basic Assessment
CITES	The Convention on International Trade in Endangered Species of Wild Fauna and Flora
DEA	Department of Environmental Affairs
ECO	Environmental Control Officer
EMPr	Environmental Management Programme
GIS	Geographical Information System
IUCN	International Union for Conservation of Nature (Global conservation status)
PVSEF	Photovoltaic Solar Energy Facility
SA	South Africa
WEF	Wind Energy Facility

GLOSSARY

Definitions	
<i>Acoustic bat survey</i>	Bat sampling conducted through recording and analysing echolocation calls.
<i>Active detection</i>	A method of recording echolocation calls whereby the researcher actively orients the bat detector to follow bats as long as possible in real time; this method generally results in higher quality pulses and longer call sequences than passive recording.
<i>Bat activity index</i>	A way of normalising data by dividing the number of bat calls by time.
<i>Bat detector</i>	Electronic device that converts the ultrasonic echolocation calls of bats into an audible or readable signal.
<i>Bat pass</i>	For the purpose of this study, a bat pass was considered as a sequence of more than 1 echolocation calls where the duration of each pulse is equal or greater than 2ms.
<i>Barotrauma</i>	Tissue damage to the lungs caused by rapid or excessive changes in pressure.
<i>Biotope</i>	A region that has a characteristic set of environmental conditions and consequently a particular type of fauna and flora (biota).
<i>Call sequence</i>	A series of bat echolocation call pulses.
<i>Conspecific</i>	An organism of the same species as another.
<i>Cut-in wind speed</i>	The lowest wind speed at hub height at which the wind turbine starts to produce power.
<i>Echolocation</i>	The ability of bats and some other animals to orient themselves and locate obstacles and their prey using echoes from sound emitted, typically from the mouth or nostrils.
<i>Endemic species</i>	Species that are restricted to southern Africa.
<i>Fatal Flaw</i>	A major defect or deficiency in a project proposal that should result in an Environmental Authorisation being refused.
<i>Frequency</i>	The “pitch” of a sound (high or low), determined by the number of wavelengths per second, measured in Hertz (1 Hz=1cycle per second).
<i>Insectivorous</i>	Species that feed exclusively from insects.
<i>Passive detection</i>	A method of recording echolocation calls whereby the researcher is absent and a bat acoustic detector is placed at fixed position and left operational for long periods of time (usually over 1-month period); this method provides great amounts of data and allows to understand bat activity at a certain location over a full night for long periods of time, covering various environmental characteristics (good weather, bad weather, etc).
<i>Red data species</i>	A list of international (IUCN) as well as southern African threatened species.
<i>Sensitive species</i>	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- <ul style="list-style-type: none"> 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, duration 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 1.3
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- <ul style="list-style-type: none"> 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	N/A
q) any other information requested by the competent authority.	N/A
2) Where a government notice <i>gazetted</i> 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 BAT IMPACT ASSESSMENT REPORT

1.1 INTRODUCTION AND METHODOLOGY

As a basis to the impact assessment, this report refers to the findings of the bat pre-construction monitoring surveys conducted at the proposed Kudusberg Wind Energy Facility (hereafter referred as Kudusberg WEF), between December 2015 and December 2016. The project is being developed by Kudusberg Wind Farm (Pty) Ltd. and is located in the border between the Western and Northern Cape, south of the R356 and west of the R354, at approximately 50 km southwest of Sutherland.

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

Bioinsight (Pty) Ltd. was appointed to produce the Bat Specialist Impact Assessment report for the Kudusberg WEF to inform the Basic Assessment process currently undertaken by the CSIR.

The final results of the pre-construction monitoring phase of the project have contributed to the characterisation of the bat community present in the location defined for development and its immediate surroundings; as well as informed the prediction of potential impacts in future phases of the project and defined sensitive areas in terms of bat communities and adjustments to the project layout and measures required to avoid or mitigate identified impacts.

1.1.1 *Scope and Objectives*

The main objective of this report is to use the baseline information collected over 12-months to assess bat habitat use in a pre-impact scenario and evaluate the potential impact of the Kudusberg WEF on bats (such as bat direct mortality caused by collisions and barotrauma, displacement due to disturbance, barrier effects and habitat loss) (Drewitt & Langston, 2006) and consider suitable mitigation measures. The pre-construction bat monitoring programme data, which characterised the bat community present in the area was used as a basis for this report. The specific objectives in the Impact Assessment are to:

- a) Inform the authorities and key stakeholders of the proposed project;
- b) Inform the authorities and key stakeholders regarding the alternatives that have been considered;
- c) Assist authorities in the decision-making;
- d) Outline the baseline receiving environment;
- e) Identify potential impacts on the environment from the proposed activity, and their significance, as well as describe mitigation measures to minimise such impacts;
- f) Compile mitigation measures to be included in the proposed Environmental Management Programme (EMPr) to mitigate the expected impacts.

To achieve the objectives of the Impact Assessment Report, the results of the pre-construction bat monitoring programme, as well of the Final Scoping report of the proposed Kudusberg WEF (Bioinsight, 2016) were considered. By referring to the baseline scenario established (on the scope of the present report) it will be possible to ground-truth the potential impacts identified, to determine if other impacts are occurring and adequately adjust any mitigation measures proposed at this stage (or propose new and more appropriate ones if necessary).

1.1.2 Terms of Reference

The following 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 or 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 a bat perspective, including consideration of the surrounding habitats and bat habitat/foraging features (e.g. caves, ridges, crevices, migration routes, feeding, roosting & nesting areas, etc.);
- Describe and map bat 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);
- Compile a detailed list of bat species present on site, including SCC;
- Map the sensitivity of the site in terms of bat features such as habitat use, roosting, feeding and nesting/breeding.
- Identify and assess the potential impacts of the proposed project on bats, 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 (EMPr).
 - Conduct a review of national and international specialised literature and experiences regarding bats and wind farms;
 - Conduct a field investigation to determine the bat community present in the study area, describe the affected environment and identify species of special concern for the proposed wind farm (12-month pre-construction monitoring). Although the general community is considered, this study has special focus on the species considered to be more sensitive to wind energy development related impacts;

1.1.3 Approach and Methodology

Surveys undertaken during the pre-construction bat monitoring programme included the use of several field techniques, adjusted to the specific characteristics of the study area. The pre-construction bat monitoring programme, implemented across a 12-month period, from December 2015 to December 2016, included the following:

- Active acoustic bat surveys, by means of vehicle-based transects and point-based monitoring with an ultrasound automatic bat detector;
- Passive acoustic surveys at ground level and rotor height with ultrasound automatic bat detectors; and
- Roost searches and inspections - any structure thought to be used as a roosting location by bats was inspected, following the “South African Best Practice Guidelines for Surveying Bats in Wind Farm Developments” that were available at the time that the pre-construction monitoring programme initiated (Sowler & Stoffberg, 2014).

Sampling period

The bat community monitoring programme started in December 2015 at the Kudusberg proposed WEF development area. The area was surveyed for a total of 12 months, covering all seasons (Table 1) in order to comply with the requirements of the “South African Good Practice Guidelines for Surveying Bats in Wind Farm Developments” (Sowler *et al.*, 2016).

Passive detection was conducted continually during a 12-month period and active detection surveys were conducted twice per season, starting in January 2016, covering all seasons.

For passive monitoring, five automated detection recorded continuously in order to achieve a total of 100% and a minimum of 75% of the total nights of the year, as recommended on the guidelines (Sowler *et al.*, 2016).

The detectors coverage during the year is presented in Table 2. Three passive detectors were installed in the first reconnaissance survey and have been running since the 17th December 2015 (PQKDA01-10m, PQKDA01-90m, PQKDA02-10m, PQKDA02-90m, PQKDA03-10m and PQKDA03-90m) and the other two (PQKDA04-10m, PQKDA04-90m, PQKDA05-10m, PQKDA05-90m) were installed on 4th February 2016. Overall, 77,13% of the nights were surveyed by automated detection, which therefore meet the requirements of the bat guidelines as indicated above.

Table 1 - Schedule of bat monitoring fieldwork at the Kudusberg proposed WEF site (* - not undertaken).

Year	Season	Survey	Bat Monitoring method	
			Active ultrasound detection & Roost search and monitor	Passive ultrasound detection
2015	Summer	December	*	Continuous
2016		January	13 rd to 22 nd January	Continuous
		February	3 rd to 13 rd February	Continuous
	Autumn	March	*	Continuous
April		1 st to 11 st April	Continuous	
May		17 th to 27 th May	Continuous	

Year	Season	Survey	Bat Monitoring method	
			Active ultrasound detection & Roost search and monitor	Passive ultrasound detection
	Winter	June	21 st to 28 th June	Continuous
		July	*	Continuous
		August	15 th to 26 th August	Continuous
	Autumn	September	6 th to 15 th September	Continuous
		October	26 th September to 5 th October	Continuous
		November	*	Continuous

Table 2 - Percentage of the total nights covered by automated bat detection per detector. *- Incomplete month

Detector	Dec 2015*	Jan 2016	Feb 2016	Mar 2016	Apr 2016	May 2016	June 2016	July 2016	Aug 2016	Sep 2016	Oct 2016	Nov 2016	Dec 2016*	Average
PQKDA01	48%	100%	100%	100%	100%	100%	27%	16%	100%	100%	100%	57%	10%	79,83%
PQKDA02	45%	100%	100%	100%	37%	45%	100%	100%	100%	100%	100%	57%	39%	85,25%
PQKDA03	42%	100%	100%	100%	100%	100%	100%	100%	100%	100%	81%	0%	48%	89,25%
PQKDA04	0%	0%	90%	13%	67%	45%	87%	68%	100%	100%	100%	57%	13%	61,66%
PQKDA05	0%	0%	90%	23%	73%	100%	100%	100%	100%	100%	100%	40%	10%	69,66%
														77,13%

Evaluated Parameters

To characterise the bat community present in the study area, the following parameters were evaluated for the Kudusberg WEF site:

- Species Richness;
- Activity Index;
- Location and use of roosts within and around the site; and
- Type of utilisation of the study area by bats.

Data collection techniques and methods

Bats are usually divided into two main groups: echolocating and non-echolocating bats, the former usually use highly evolved ultrasound echolocation to navigate, forage and communicate (Schnitzler & Kalko, 2001) and the latter uses vision for orientation, to navigate and search for food sources (Monadjem *et al.*, 2010). Non-echolocating bats are commonly known as fruit bats (feeds mainly on fruits); whereas echolocating bats are known as insectivorous bats (insects are their main food source). The different flight and echolocation inter-specific characteristics are directly related to differences in species' foraging habitats (Schnitzler & Kalko, 2001).

Tracking the conservation status of bat populations through the abundance and distribution of echolocation calls has the potential to offer a more efficient alternative to trapping or visual sampling methods for bat survey and monitoring programmes (Walters *et al.*, 2012). The detection, recording and analysis of ultrasounds is very useful in the detection and identification of different bat species, since these mammals are nocturnal and, in the majority of species, emit ultrasound calls to guide them, and to detect prey, as well as to communicate. Details pertaining to the collection techniques are provided below.

Active detection

The active detection of ultrasounds was conducted with a portable ultrasound detector (Wildlife Acoustics® EM3+ automatic ultrasound detector with an attached GPS) along vehicle-based transects (Figure 1). The active detection surveys were conducted twice per season for a full year, and the established transects were intended to be representatives of the biotopes present at the study area. Therefore, four transects were established crossing all the main biotopes present within the development area and extending to the surrounding area. Characterization points were established for each transect, at approximately every 2 kms, where environmental variables were collected during each active survey.

Sampling commenced at evening civil twilight (hereafter referred to as sunset) and continued for a minimum of 1.5 hours and a maximum 4 hours after sunset - ensuring that bat species that emerge early in the evening can be included in the surveys (according to Sowler & Stoffberg, 2014). At each survey the order by which the sampling points established along transects was conducted was altered so that each transect would not be conducted at the same time of the night. Each characterisation point was characterised in terms of lunar phase, cloudiness, temperature, precipitation and wind speed and direction at the time it was conducted. The manual surveys were not performed in adverse weather conditions (rain, very strong wind, fog, thunderstorms).

After conducting transect sampling surveys, the recorded data was analysed in order to determine spatial use by bat community, as well as to acoustically confirm the presence of bat species that may occur in the area.

Passive detection

Passive detection for this monitoring programme was conducted by making use of automatic ultrasound detectors (Wildlife Acoustics® SM2BAT+) with automatic triggering (starting an ultrasound recording when a bat echolocation is detected). The equipment was scheduled to automatically record calls every night starting 30 min before sunset and ending 30 min after morning civil twilight (hereafter referred to as sunrise).

Five different locations and five detectors were used: all the detectors were placed on meteorological masts (PQKDA01, PQKDA02, PQKDA03, PQKDA04 and PQKDA05) (Figure 1). These locations cover the different combinations of vegetation types and topography and were determined following the recommendations included in the 4th Edition of the "South African Good Practice Guidelines for Surveying Bats in Wind Farm Developments" (Sowler *et al.*, 2016). The detectors had a microphone installed at 90m and at 10 m (ground level). Bat activity was measured continuously, aiming to cover a minimum of 75% of at least 365 nights (12-month period) (and aiming to cover 100% during the bat migration months – April, May and September). The placement of microphones at two different heights on the met mast will allow for comparisons of bat activity and diversity, both at approximate rotor height and ground level.

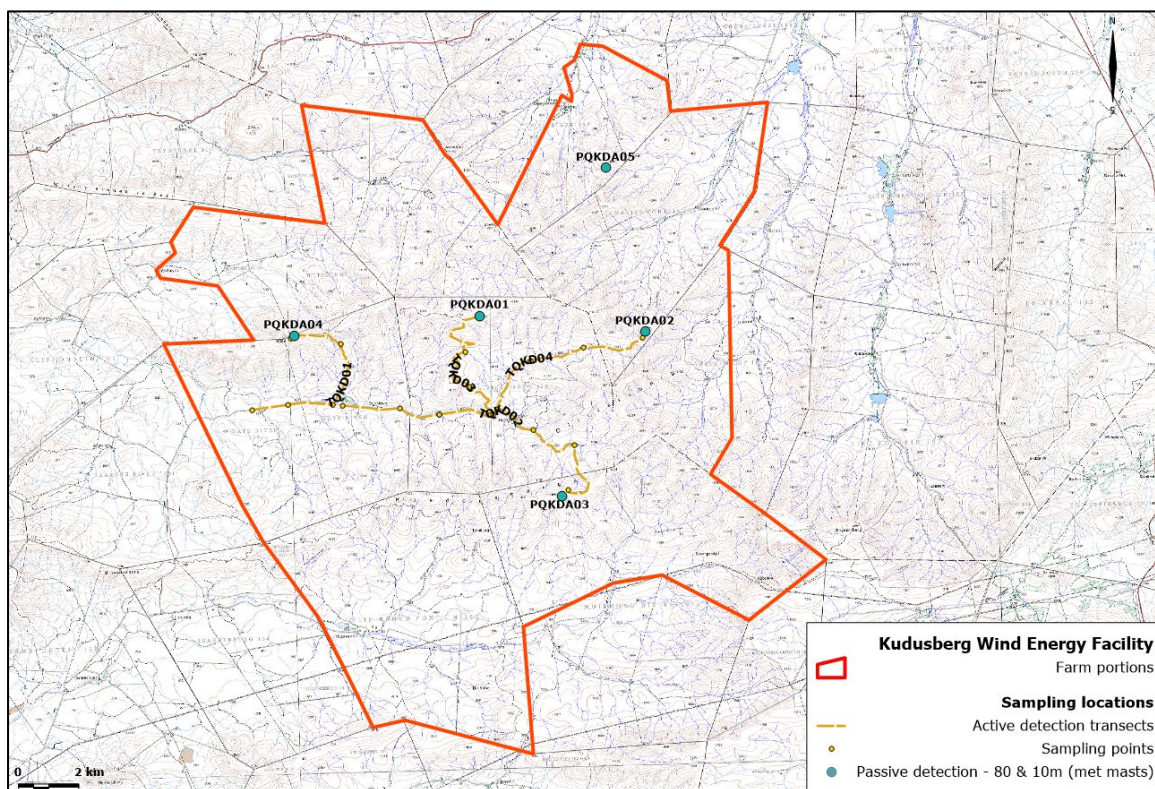


Figure 1 - Bat sampling locations at Kudusberg WEF site.

Non-echolocating bats

The South African fruit bats feed on the fruits, flowers and nectar of a wide range of indigenous trees as well on domestic or commercial fruit trees (Monadjem *et al.*, 2010). To determine the occurrence of fruit-eating bat species on the study area, searches were directed to potential roosting sites suitable to these species during daytime.

Roost searches, inspection and monitoring

All structures considered to have potential for bat species roosting (e.g. caves, mines, abandoned buildings, bridges, etc.) were identified in the study area and its surroundings by means of a GIS based desktop study and during the fieldwork visits to the area. The potential roosting locations identified were then inspected in the subsequent surveys in order to record evidence of bats presence and occupation (such as live bats roosting, bat droppings accumulation, bat corpses or insect remains). During the fieldwork, the location of each prospected roost was recorded with a handheld GPS (Garmin® ETREX 10 or ETREX 20), and photographs were taken for documentation (Figure 3).

When a roost was considered to have potential to be occupied by bats (determined either by means of interviews to the local inhabitants or direct observation of traces of bat occupation), an active survey was conducted outside of the potential roost during sunset (to determine number of bats leaving the roost) using the same equipment described above (Wildlife Acoustics® EM3+ automatic ultrasound detector). Additionally, static Wildlife Acoustics® SM2+ automatic ultrasound detector was left overnight inside the roost (when possible) in order to confirm bat usage and determine roosting activity, such as, time of usage/time of arrival/time of exit). Determining time of arrival also aids to determine when is the best time to inspect roosts in order to determine the species and number of individuals inhabiting the roost.

Data analysis and criteria

Ultra-sounds analysis

Automatic acoustic monitoring produces a large amount of data recorded by the SM2BAT+ as *.WAV format, automatic identification is needed to process data and determine bat activity analysis. In order to eliminate all non-bat ultrasounds detections and process data to determine bat activity, AnalookW4.1d© Software was used to identify and filter out non-biological noise such as rain, wind, birds and insect sounds. In this first step, files were converted to *.ZC format using Kaleidoscope© 2.1.0 and then a filter for bat pulses was applied with AnalookW©.

To determine bat activity, it was necessary to define a “bat pass”. For this study, a bat pass was considered as a sequence of more than 1 echolocation call where the duration of each pulse is ≥ 2 ms (Weller & Baldwin 2012). Single call fragments do not apply, and therefore only complete pulses were considered for the analysis. Where there is a gap between pulses of >500 ms in one file, this then represents a new bat pass (Sowler & Stoffberg, 2014).

Considering the characteristics of a bat pass and the characteristics of echolocation pulses (e.g. characteristic frequency, slope, pulse duration, initial and final frequencies, bandwidth, interval between pulses) a set of filters were produced for the species/group of species identification. The reference values used were the ones presented in several published and unpublished sources of South Africa (Gauteng & Northern Regions Bat Interest Group; Taylor *et al.*, 2005; Hauge, 2010; Monadjem *et al.*, 2010; Kopsinis *et al.*, 2010; ACR, 2013; Pierce, 2012). This acoustic echolocation parameters reference table was reviewed and adjusted in order to use the most accurate reference parameters as possible, considering the limitations of the current knowledge on South African bats echolocation. The filters were cross-validated by selecting a proportion of recordings in each survey and analysing them manually by a specialized technician. The analysis of the recorded calls was performed using *Audacity© 2.0.0 – Cross-Platform Digital Audio Editor*, from Dominic Mazzoni. The results of the manual identification analysis were used to cross validate the results from the automatic identification with AnalookW and the filters were adjusted to the best extent possible.

As bats have extremely flexible call structures which may depend on various factors including habitat structure, foraging strategy, age, gender, morphology, and the presence of other conspecifics (Thomas, Bell & Fenton, 1987; Obrist, 1995; Murray, Britzke & Robbins, 2001), call convergence has led to overlap in frequencies and call shapes, making it difficult to distinguish between some calls (Preatoni *et al.*, 2005). For that reason, and to optimize the identification process, the filters produced in AnalookW aimed to identify groups of species, which shared similar acoustic characteristics, instead of individual species. These groups were assembled based on the list of species considered as potential for the area, collision risk and characteristics of their echolocation calls, i.e., species with the same collision risk and echolocation parameters were grouped together. Whenever species with different conservation status and relevant ecological behaviour (such as migration) were present, attempts to separate them in different groups were made. If the filter cross-validation results were not satisfactory (over 80% capacity to correctly detect bat passes of the species), the filter would not be used for activity analysis purposes. These filters will, however, be used to aid in species confirmation at the site. Recordings selected by these filters were subject to manual identification by specialists.

Spatial-temporal analysis

The results obtained from the surveys undertaken between December 2015 and December 2016 were analysed according to the number of bat passes at each sampling point and allowed the determination of the following parameters for active and passive detection:

- Average number of bat passes per hour (e.g. activity index) (data from passive detection);
- Average number of bat passes per sampling location (e.g. activity index) (data from active detection); and
- Frequency of occurrence of each species/group of species identified (number of contacts of a species or group of species / total number of records identified).

Notice however that the activity index does not provide an absolute number of individuals, indicating solely a relative index of abundance (Hayes, 2000). An analysis of the activity index for each hour of the recording period was also performed in order to evaluate the variation of activity through time, indicating periods of higher bat activity.

These parameters were also analysed in terms of environmental factors, such as temperature, wind speed and biotope. The same parameters were analysed in terms of space, according to the point locations (WEF site and control area).

1.1.4 Assumptions and Limitations

- The pre-construction bat monitoring is based on both primary (data collection) and secondary data sources, such as those indicated in section 1.1.5.
- In South Africa, data on migratory paths of bats is still largely unknown, this limiting the ability to determine if the wind farm might have impact on migratory species.
- Any inaccuracies or lack of information in the bibliographic sources consulted could limit this study. In particular, 8 years have passed since the leading literature that is available for bat distribution in South Africa has been updated (Monadjem *et al.*, 2010).
- Bat detectors were installed and used according to the manufacturer's indications. However, data gaps still occurred due to technical limitations of the detector and/or unavoidable malfunctions. Nevertheless, a sampling effort of more than 75% of the year was obtained as per the requirements of the 4th Edition of the "South African Good Practice Guidelines for Surveying Bats in Wind Farm Developments" (Sowler *et al.*, 2016).
- 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 very high sensitivity areas (no-go areas) identified for the bat community are to be excluded from development (excluding the use/upgrading of existing roads).
- The quantification or even evaluation of cumulative impacts is uncertain as there is not a generalised knowledge of the large-scale movements or connection between bat populations within the greater area. If present, cumulative impacts will be reflected on a very rapid decline of bat populations far from the impacts expected from a single wind energy facility operation. As such, further monitoring during the operational phase will be beneficial in helping to determine the presence of this type of impact.
- Cumulative impacts are assessed by adding expected impacts from this proposed development to existing and proposed developments with similar impacts in a 50 km radius. The existing and proposed developments that were taken into consideration for cumulative impacts are listed in Appendix 1.

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 3) 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 (Table 3), a list of all bat 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 roosts in the vicinities of the proposed site. Literature review was conducted as well 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 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 Bats in Wind Farm Developments”, the 4th Edition” (Sowler *et al.*, 2016).
- A short list of sensitive species was identified to which the assessment and monitoring programme should pay 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 its characteristics.
- It is important to characterise the study area in terms of the vegetation and habitat present on site. The method used for vegetation classification is that developed by Mucina & Rutherford (2006). At a micro level, more important than the biomes, is the presence of specific structures which shaped the local occurrence and bat distribution within the site. Bat abundance and movement are related to vegetation features such as tree-lined avenues, hedges and other relevant features which could potentially be used as roosts (open water bodies, cliff faces, buildings with accessible roofs or attics etc.). It is therefore essential to characterise the study area in these terms. Google™ Earth imagery and most importantly, field work, was used to identify the available micro-habitats on site.

Table 3 includes, but is 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 3 - Main data sources consulted for the evaluation of bat species present in the study area (international references and guidelines used to support the methodological approach and resulting analysis are also presented).

Type	Name	Reference	Detail of information
Data sources	Bats of Southern and Central Africa	(Monadjem <i>et al.</i> , 2010)	National level
	African Chiroptera Report 2013	(ACR, 2013)	National level
	Caves and Caving in the Cape	http://www.darklife.co.za/Caves/	Regional level
	Endangered Wildlife Trust	www.ewt.org.za	Regional level
	Bat fatality at a wind energy facility in the Western cape, South Africa	(Aronson, Thomas & Jordaan 2013; Doty & Martin, 2013)	Regional level
	The Vegetation of South Africa, Lesotho and Swaziland	(Mucina & Rutherford, 2006)	National level
	Global List of Threatened Species	(IUCN, 2018)	International level
	Renewable Energy Application Mapping – Report version I	(CSIR, 2013)	National level
	Strategic Environmental Assessment for wind and solar photovoltaic energy in South Africa	(CSIR, 2015)	National level
	Renewable Energy Application Mapping. Third Quarter 2016	(DEA, 2016)	National level
Guidelines and Other international references	Wind energy development and Natura 2000	(European Commission, 2011)	International level Methodological approach and analysis
	Directrices para la evaluación del impacto de los parques eólicos en aves y murciélagos	(Atienza <i>et al.</i> , 2011)	International level Methodological approach and analysis
	Comprehensive Guide to Studying Wind Energy/Wildlife Interaction	(Strickland <i>et al.</i> , 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
	South African Good Practice Guidelines for Surveying Bats in Wind Farm Developments	(Sowler & Stoffberg, 2012)	Methodological approach
	South African Good Practice Guidelines for Surveying Bats in Wind Farm Developments – 3rd Edition	(Sowler & Stoffberg, 2014)	South African Good Practice Guidelines for Surveying Bats in Wind Farm Developments – 3rd Edition
	South African Good Practice Guidelines for Surveying Bats in Wind Farm Developments (4 th Edition)	(Sowler <i>et al.</i> , 2016)	Methodological approach
	Bat surveys: Good practice guidelines, 2nd edition	(Hundt, 2012)	Methodological approach
	Guidelines for consideration of bats in wind farm projects	(Rodrigues <i>et al.</i> , 2008)	International level Methodological approach and analysis
	Good Practice Wind Project	www.project-gpwind.eu/	International level Methodological approach and analysis

1.2 DESCRIPTION OF PROJECT ASPECTS RELEVANT TO BAT IMPACTS

The project aspects relevant to bats include:

Presence of Wind Turbines

The presence of wind turbines, in general, can result in certain bat impacts such as fatalities due to collision, and/or barotrauma 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 are 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 bats, 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 total affected airspace would be less, and the lower tip height is also higher than that of smaller machines. This is considered relatively safer for the clutter & clutter-edge foragers species (due to a higher 'lowest rotor swept height') – subsequently reducing the risk of collision with turbine blades.

However, in terms of migratory species, it is not uncommon for bat activity to be higher at increased heights during the autumn and spring migration months (namely March, April and October). It is therefore possible that higher mortality rates may be associated with the use of larger machines during migratory periods (Barclays *et al.*, 2007; Kunz *et al.*, 2007). However, studies also suggest that nocturnal migrants have the tendency to fly at heights ranging from <100 m to 1 km in height.

Wind measurement masts

The presence of wind measurement masts usually poses no risk to bat species. Four monitoring masts have been erected on the project site.

Underground 33kV cabling and Overhead 33kV Power Lines

The use of underground cabling is preferred over 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, to reach the 33/132kV onsite substation. According to the bat guidelines (Sowler *et al.*, 2016), no powerline infrastructure should be constructed within 2km of any large known confirmed roosts and 500m from smaller confirmed roosts. There are no large confirmed roosts within the Kudusberg wind farm project site. As discussed in section 1.3, there are four confirmed buildings that serve as roosts and therefore no turbines, 33kV or 132kV powerlines may be placed within 500 m thereof.

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 bat 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 known features considered to have relevant importance for bats in the broader area of the proposed Kudusberg WEF development area. As referred to in Figure 2, the closest known roost is located at approximately 100 km from the site (Montagu Guano Cave). Additionally, there are no nature conservancy areas, to our present knowledge, within a 30km radius of the proposed development area. The proposed Kudusberg WEF site is located approximately 55km south-east of the Tankwa Karoo National Park (Figure 2). Considering that this area is located at a considerable distance from the proposed WEF area it is not expected that the species using the National Park will be affected in any way by the implementation of this project. Nonetheless the analysis of the bat species present in the area, which are of similar nature to the Kudusberg WEF proposed area, may provide an indication of the suite of species likely to be present in the study area.

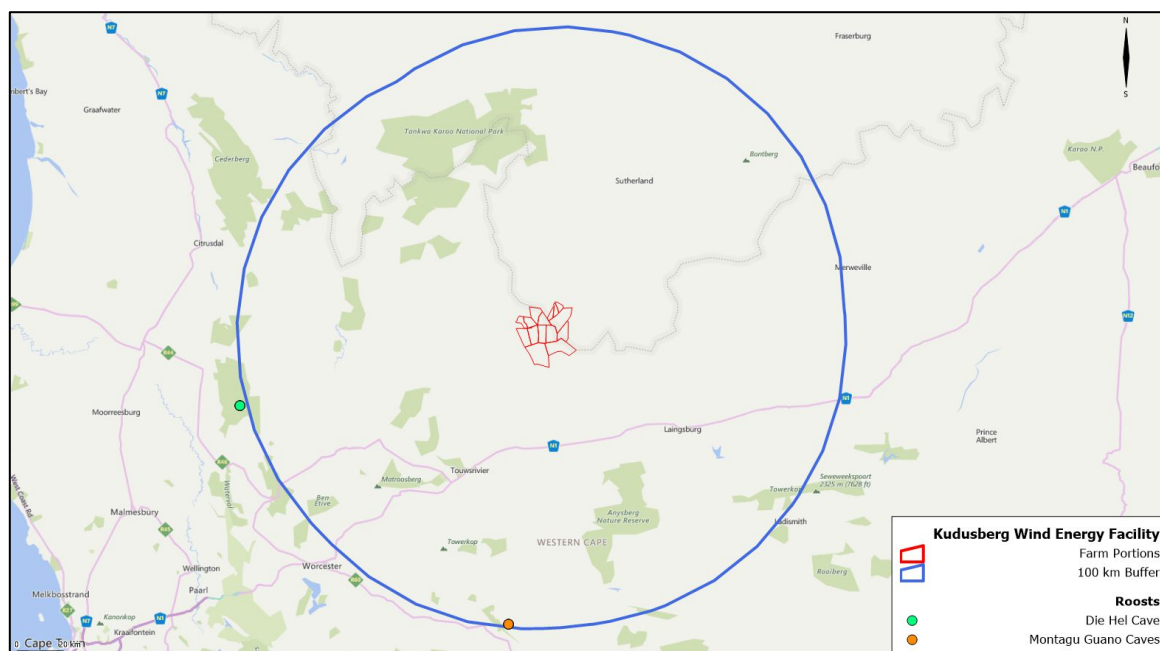


Figure 2 - Confirmed roosts located in the vicinity of the proposed WEF site (background image source: Virtual Earth Street Image).

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 updated to version 2012) (Figure 3):

- 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 the winter season – two rainfall peaks during the year: one in March and the other in May – August.

Vegetation structure is a key determining factor in bat distribution. The proposed Kudusberg WEF site is characterised by accentuated mountainous areas which is located between two vegetation types and major biotopes: the Fynbos biome and the Succulent Karoo biome (Figure 3). Both are characteristic of higher altitudes and are present both in the bottom and top of the mountains. Within the proposed Kudusberg WEF site the area is mostly comprised of natural vegetation that is adapted to the hot and seasonal climate. This type of habitat is generally associated with the presence of several bat species that occur in these arid and semi-arid habitats. Such species include the Egyptian slit-faced bat (*Nycteris thebaica*), the Lesueur's wing gland bat (*Cistugo lesueuri*), the Cape horseshoe bat (*Rhinolophus capensis*), or the Egyptian free-tailed bat (*Tadarida aegyptiaca*). Other species may be present in the area, not due to the vegetation structure but due to the terrain features, which include mountains, cliffs and ridges. The Long-tailed serotine (*Eptesicus hottentotus*), the Natal long-fingered bat (*Miniopterus natalensis*) and the Temminck's myotis (*Myotis tricolor*) are examples of species which can be present in these areas due to their preference for roosting in caves and cracks in rocks (Monadjem *et al.*, 2010).

The study area is not abundant in water sources at present, and therefore it is expected that the few water features present will have a high attraction factor for bats, especially during the wet season. Their importance is not restricted only to water availability but also to insect abundance due to the associated vegetation present.

The proposed development area is occupied mainly by natural vegetation. The vegetation provides a very sparse coverage of the soil and does not provide much refuge to any bat species. It is however a good hunting ground for open-air foragers such as the Egyptian free-tailed bat. Natural shrubby vegetation is present both at the top of the mountain ridges and in the slope and flatter plain areas.

Vegetation taller than shrubs is very scarce in the study area and is generally associated with watercourse lines. These locations may have two different utilisations by the different bat species potentially present in the area: they may be used as roosts by tree-dwelling or be used as feeding roosts during the night by other bat species, such as the Geoffroy's horseshoe bat, which then roost during the day at separate locations (usually caves or mines).

At a WEF site level, activity in the area is considered to be low at ground and rotor level. The general area of the site is being used by sensitive species, with a medium to high risk of collision with wind turbines (e.g. Natal long-fingered bat, Cape serotine and the Egyptian free-tailed bat). The mountains and ridges present throughout the site supply many rock crevices suitable for bat roosts, however the roosts identified within the proposed WEF area are all buildings identified to have potential to be used as roosts. It has been confirmed that the four roosts located within the proposed Kudusberg WEF area have bat occupation (Figure 3).

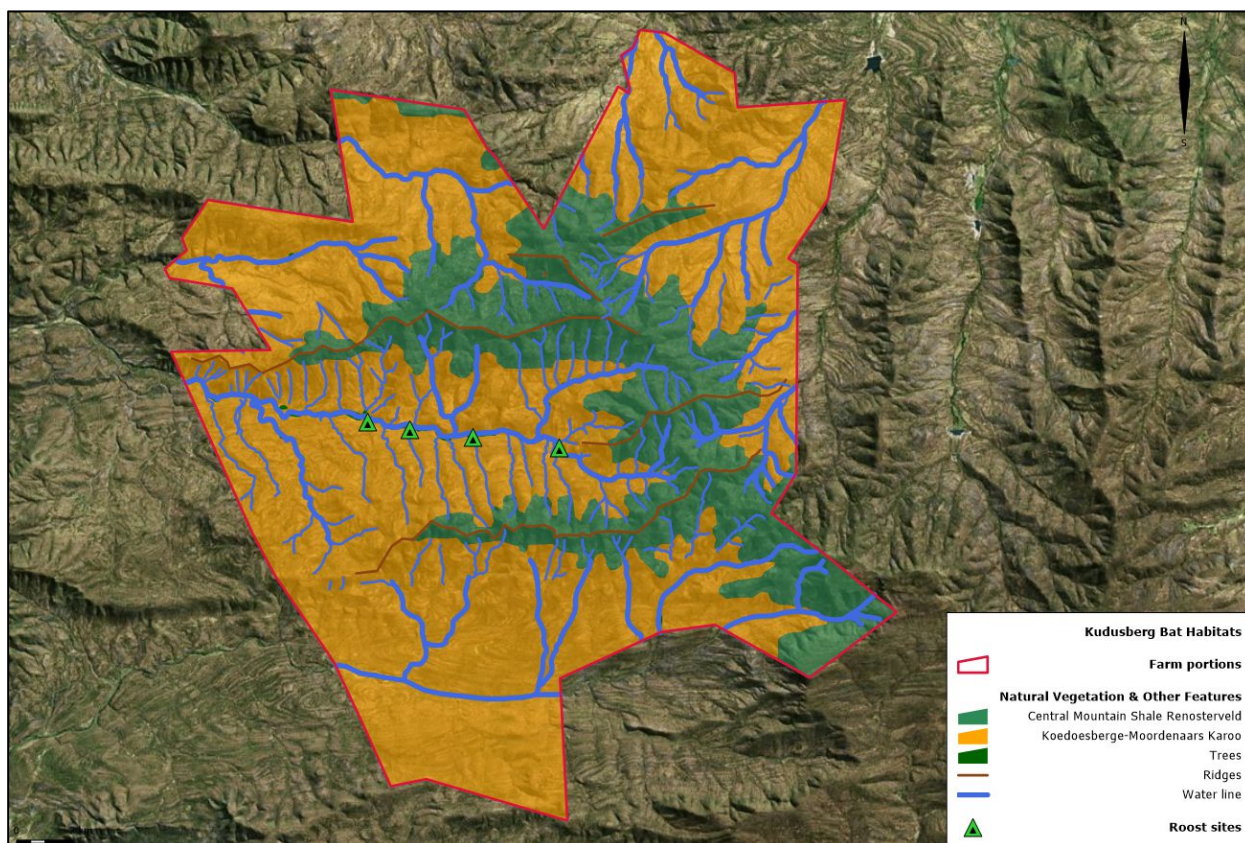


Figure 3 - Bat habitats occurring within the Kudusberg WEF. *watercourses mapped using open source data and not confirmed through a hydrology assessment.

The general area of the proposed WEF is classified as having a low bat sensitivity due to the very low bat activity observed during the 12-month monitoring. However, considering the presence of medium-high and high collision risk species, some precautionary measures are needed.

Therefore, very high (no-go) areas and other sensitive areas for bats are outlined in Figure 4 and follow the recommendation from the South African Bat Assessment Advisory Panel (SABAAP; in Sowler *et al.*, 2016). The very high sensitivity areas (no-go areas) should exclude all new WEF-associated structures (wind turbines, roads, powerlines, substation infrastructures or other associated structures).

Considering the Best practice recommendations, the sensitivity areas were delineated according to the buffer areas indicated in the “Bat Sensitivity Buffer Zone Recommendations” of the South African Bat Assessment Advisory Panel (SABAAP) (SABAAP, 2013) and the fourth edition of the South African Good Practice Guidelines for Surveying Bats at Wind Energy Facility Developments - Pre-construction:

- High sensitivity - 200m around all potentially bat important features:
 - *Along water lines and associated riverine vegetation.* Such features are important for bats, since they are likely to act as commuting routes, providing food resources, likely to be associated with higher bat activity, and likely to favour the occurrence of dispersion routes, besides local commuting routes. A 200m buffer was considered around those features. It is recommended that should new infrastructures (including roads and electrical infrastructures) cross these features (including buffers), then they should not be routed to run parallel with them, but rather cross them perpendicularly, as far as possible. Additionally, this avoidance recommendation will not include the use of existing roads, as long as they are not upgraded in such a manner that will re-route them (to be more parallel with the feature) within those

buffered areas. However, no wind turbines or substations may be permanently placed within any of these buffered areas.

- Very High sensitivity (No-Go):
 - *Confirmed Roosts*. There are four confirmed roosts within the proposed Kudusberg WEF. During ultrasound monitoring and inspection of the roosts, it was confirmed that bats are using the identified buildings as roosts. While the number of individuals using the roosts remain relatively uncertain, we estimate that there are at least about 1-50 individuals, resulting in a 500m buffer, considering the known occurrence species with medium-high and high risk of collision with wind turbines. As such, no wind turbines, electrical infrastructure, substations or new roads may be permanently placed within the buffered areas. However, the use of existing roads may be used, as long as they are not upgraded in such a manner that will cause them to be re-routed and subsequently run more perpendicular to the roosts (and their buffered areas).

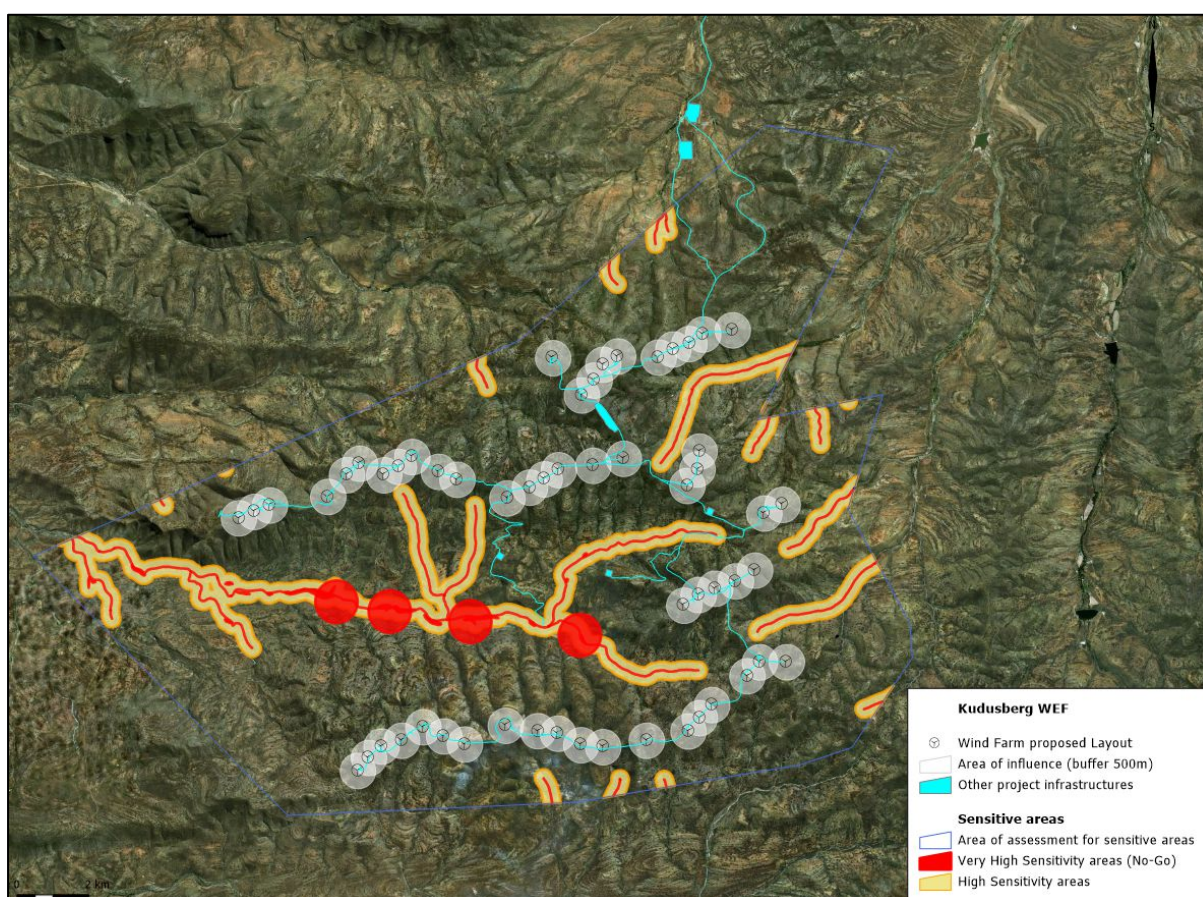


Figure 4 - Sensitive areas for bats within the Kudusberg WEF.

Approximately 67 bat species may occur within South Africa (Monadjem *et al.*, 2010). Bat distribution areas are, however, strongly influenced by geographic and climatic variables, with only a few species occurring throughout the entire South African territory. Therefore, not all of these 67 bat species are likely to occur within Kudusberg WEF study area. Considering several criteria, it was possible to determine that at least four species had confirmed occurrence in the area and fifteen have the potential to occur in the immediate vicinity of the site (Table 2). From all these fifteen species, nine of them are considered to be sensitive to the project development.

The confirmed species on site are the Egyptian free-tailed bat (*Tadarida aegyptiaca*), the Cape serotine (*Neoromicia capensis*), the Natal long-fingered bat (*Miniopterus natalensis*) and the

Egyptian slit-faced bat (*Nycteris thebaica*). These are all “Near Threatened” or “Least Concern” species, according to the South African Red List (Friedmann & Daly, 2004b)

One species with confirmed occurrence is perceived as having a potential high risk of collision with wind turbines (according to Sowler *et al.*, 2016) due to their behaviour, i.e. Egyptian free-tailed bat (*Tadarida aegyptiaca*). Two other species with confirmed presence in the area raise concerns regarding their probability of fatalities, as they have a medium-high risk of collision with wind turbines: Cape serotine (*Neoromicia capensis*) and Natal long-fingered bat (*Miniopterus natalensis*). Additionally, *Miniopterus natalensis* is a migrant species that can use air space at rotor level during migration periods being prone to collision during these events.

According to pre-construction monitoring results, the bat activity at the proposed Kudusberg WEF area is **generally low** considering the bat guidelines (Sowler *et al.*, 2016). Although the Kudusberg WEF is considered to be classified as having **low bat sensitivity**, it is noteworthy that some areas in particular, have high and very high sensitivity due to the presence of specific features and habitat that may have an increased bat activity. These include the presence of potential roosts, as well as watercourse lines which are important for bats, since they are likely to act as commuting routes, providing food resources, and are therefore likely to be associated with higher bat activity.

1.4 APPLICABLE LEGISLATION AND PERMIT REQUIREMENTS

The Kudusberg WEF is subject to the requirements of the National Environmental Management Act (Act 104 of 1998). The EIA Regulations of December 2014 (as amended) require that an EIA process must be undertaken for the development of the proposed project with strict timeframes. Considering that Kudusberg WEF is located within the Komsberg renewable energy development zone, a Basic Assessment process instead of an EIA can be undertaken.

In line with the principles of NEMA, impacts on the environment (and in this case, bats specifically) must be determined and assessed, and recommendations made on how to avoid, as far as possible, mitigate and manage negative impacts on bat species caused by human-made infrastructures (e.g. wind turbines and associated infrastructures). In this context, the bat assessment considers all bat species that may occur within the site, provides an assessment of potential impacts as well as recommend mitigation measures for the avoidance of impacts (if possible).

It is considered best practice for bat monitoring to be undertaken on WEF sites, thereby striving for the reconciliation of wind energy facilities and bats, with the aim of evaluating and minimising any potential impacts. This can be achieved by fulfilling the requirements outlined by the most recent version of the “South African Good Practice Guidelines for Surveying Bats in Wind Farm Developments” (Sowler *et al.*, 2016).

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

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

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

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

NEMBA also deals with endangered, threatened and otherwise controlled species, under the Threatened or Protected Species (ToPS) 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 that is of such high conservation value or national importance that national protection is required. 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 any ToPS-listed species. Several bat species are listed as critically endangered, endangered, vulnerable and protected in terms of Regulations published under this Act.

Nature and Environmental Conservation Ordinance No. 19 of 1974; Schedule 5:

Although the primary purpose of this Act is to provide for the amendment of various laws on nature conservation, it also deals with a number of other issues. This Act lists protected wild animals, including all bats except Fruit Bats of the family PTEROPODIDAE. A permit is required for any activities which involve endangered or protected flora and fauna.

IUCN Red List of Threatened Species

The International Union for the Conservation of Nature (IUCN) Red List of Threatened Species ranks plants and animals according to threat levels and risk of extinction, 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 bats are listed on the IUCN Red List.

Convention on Biological Diversity

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

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

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

State joining the Convention, CMS promotes concerted action among the Range States of many of these species.

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

1.5 IDENTIFICATION OF KEY ISSUES

1.5.1 Key Issues Identified

The potential bat issues identified include:

- 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;
- Disturbance and/or Displacement effects of bat community due to noise and movement generated by turbines operation, an increase of people and vehicles in the area and destruction of roosts location; and
- Fatality of individuals due to collision with turbine blades or barotrauma caused by operating turbines.

To date, no consultation process has been undertaken for this project. However, CSIR will provide all stakeholders with the opportunity to comment on the proposed project.

1.5.2 Identification of Potential Impacts

Considering the species that could potentially occur at the proposed Kudusberg WEF site, 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 wind turbines or barotrauma.
 - 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 various projects' infrastructures and/or barotrauma
- Increased disturbance/displacement effects

1.6 ASSESSMENT OF IMPACTS AND IDENTIFICATION OF MANAGEMENT ACTIONS

1.6.1 Results of the Field Study

From the 67 bat species that may occur within South Africa (Monadjem *et al.*, 2010), according to several criteria, only 15 bat species are likely to occur within the Kudusberg WEF study area. From all these 15 species, at least four species had confirmed occurrence in the area. From all these fifteen species, nine of them are considered to be sensitive to the project development. (Table 4).

Table 4 - List of species with possible occurrence at Kudusberg WEF (IUCN, 2018) and South Africa Red List (Friedmann & Daly, 2004b): VU – Vulnerable; NT – Near Threatened; LC – Least Concerned; NE – Not Evaluated; Collision risk according to Sowler *et al.*, 2016; Probability of occurrence: High; Low; Mod – Moderate

Species name	Common name	IUCN	SA Red List	Collision risk	Sensitive species	Probability of occurrence	Presence confirmed during campaign
<i>Nycteris thebaica</i>	Egyptian slit-faced bat	LC	LC	Low	X	Low	Yes
<i>Miniopterus fraterculus</i>	Lesser long-fingered bat	LC	NT	Med-High	X	Low	No
<i>Miniopterus natalensis</i>	Natal long-fingered bat	LC	NT	Med-High	X	High	Yes
<i>Cistugo lesueuri</i>	Lesueur's wing-gland bat	LC	NT	Low	-	Mod	No
<i>Cistugo seabrae</i>	Angolan wing-gland bat	LC	VU	Low	X	Mod	No
<i>Eptesicus hottentotus</i>	Long-tailed serotine	LC	LC	Med	-	Low	No
<i>Laephotis namibensis</i>	Namibian long-eared bat	LC	NE	Low	-	Mod	No
<i>Myotis tricolor</i>	Temminck's myotis	LC	NT	Med-High	X	Low	No
<i>Neoromicia capensis</i>	Cape serotine	LC	LC	Med-High	X	High	Yes
<i>Scotophilus leucogaster</i>	White-bellied house bat	LC	LC	Med-High	X	Low	No
<i>Rhinolophus capensis</i>	Cape horseshoe bat	LC	NT	Low	-	Low	No
<i>Rhinolophus clivosus</i>	Geoffroy's horseshoe bat	LC	NT	Low	-	Mod	No
<i>Rhinolophus darlingi</i>	Darling's horseshoe bat	LC	NT	Low	-	Low	No
<i>Sauromys petrophilus</i>	Robert's flat-headed bat	LC	LC	High	X	Low	No
<i>Tadarida aegyptiaca</i>	Egyptian free-tailed bat	LC	LC	High	X	High	Yes

1.6.2 *Habitat Loss (Construction Phase)*

- Nature: Destruction of natural vegetated areas due to the construction of crane platforms, workstation, substation, internal access roads, and turbines, underground cabling and overhead power lines installation – **negative impacts**.
- Significance of impact without mitigation measures: Relating to habitat loss is expected to be of **moderate** significance as the affected WEF footprint is not very big.
- Proposed mitigation measures: The minimisation of this impact is mainly achieved, in layout planning phase, through the avoidance of infrastructure siting (wind turbines, powerlines, sub-station infrastructures or other associated buildings) in very high (no-go) areas and wind turbines in areas of higher bat sensitivity (refer to map in section 1.3). Any roads crossing watercourses must do so perpendicularly and not be routed parallel to it, unless agreed with the aquatic specialist. Additionally, in affected areas, clearance and removal of vegetation should be kept to a minimum as far as possible. The beneficiation of existing accesses can be conducted with the removal of natural vegetation strictly reduced to the extent necessary.
- 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, the habitat loss is considered to have an impact of **low** significance, when mitigation is implemented.

1.6.3 *Disturbance Effects (Construction Phase)*

- Nature: Disturbance of bat community due to the increase of people and vehicles in the area, and destruction of roost locations – **negative impacts**.
- Significance of impact without mitigation measures: The disturbance due to people and vehicle presence and driving is considered an impact of **low** significance due to the temporary nature and very restricted area of impact, having therefore a local extent.
- Proposed mitigation measures: In order to minimise this impact certain measures can be taken, such as lower the levels of noise whenever possible around very high and high sensitivity areas for bats (refer to map in section 1.3); avoid construction works during the night and avoid the destruction or disturbance of identified roosting sites. Movement of machinery, vehicles and persons should be restricted to the existing or new roads and avoid the existing natural areas.
- 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 very low degree, with mitigation measures in place. As such, the disturbance of bat community is considered to have an impact of **very low** significance, when mitigation is implemented.

1.6.4 *Displacement Effects (Construction Phase)*

- Nature: Displacement of the bat community due to the increase of disturbances in the area and destruction of roost locations – **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, having therefore a local extent.
- Proposed mitigation measures: In order to minimise this impact certain measures can be taken, such as lower the levels of noise whenever possible around very high and high sensitivity areas for bats (refer to map in section 1.3); avoid construction works during the night and avoid the destruction or disturbance of identified roosting sites. Movement of machinery, vehicles and persons should be restricted to the existing and new roads and avoid the existing natural areas.
- 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, the displacement is considered to have an impact of **very low** significance, when mitigation is implemented.

1.6.5 Fatality Events (Operational Phase)

- Nature: Fatality of individuals due to collision with turbine blades or barotrauma caused by turbines operation – **negative impacts**.
- Significance of impact without mitigation measures: Considering the potential risk of fatality of bats at the study area, species of high, medium-high and medium collision risk can suffer fatality events in the wind energy facility. Bat fatality is considered a **moderate** significance impact, although there is high probability of occurrence of the impact.
- Proposed mitigation measures: The minimisation of fatalities caused by wind turbines can be mainly achieved through planning during the layout definition phase, by the avoidance of turbines installation in very high sensitive areas for bats (no-go areas) (refer to map in section 1.3).

Additionally, it is recommended that no tall vegetation should be allowed within the 200 m buffer around the wind turbines to reduce the suitability of the areas for bat foragers. A construction and operational phase bat monitoring program should be implemented to determine the actual impacts of the wind energy facility on the bat community, as well as the implementation of mitigation measures, such as the utilisation of red lights in the turbines, instead of white, to minimise insect attraction and bat foraging behaviors near the turbines. Also, a monitoring plan is recommended during operation phase and, if high levels of mortality are observed during operational phase, management actions should be put into action to mitigate fatality.

- 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, 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.

1.6.6 Disturbance Effects (Operational Phase)

- Nature: Disturbance of bat community due to noise and movement generated by turbines operation and increase of people and vehicles in the area associated with maintenance activities – **negative impacts**.
- Significance of impact without mitigation measures: Disturbance of the bat community 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.
- Proposed mitigation measures: 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 very low degree, with mitigation measures in place. As such, the disturbance of bat community is considered to have an impact of **very low** significance, when mitigation is implemented.

1.6.7 Displacement Effects (Operational Phase)

- Nature: Displacement of the bat 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: Lower levels of noise disturbance are recommended whenever 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 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 bat 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 optimized placement of the 56 turbines, low activity levels and flights at ground and rotor level (recorded on site during the monitoring campaign) being quite low.
- Proposed mitigation measures: Caution should also be taken not to disrupt or destroy important bat habitats and roosts during the operational phase, particularly in very high (no-go) 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 bat community due to noise and movement generated by dismantling of turbines and associated infrastructure, as well as the dismantling of power lines – **negative impacts**.
- Significance of impact without mitigation measures: Disturbance of the bat community 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, having therefore a local extent.
- Proposed mitigation measures: To minimise this impact certain measures can be taken, such as lower the levels of noise whenever possible around very high and high sensitivity areas for bats (refer to map in section 1.3); avoid dismantling works during the night and avoid the disturbance of identified roosting sites. Movement of machinery, vehicles and persons should be restricted to the existing roads and avoid the existing natural areas.
- 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, the disturbance of bat community is considered to have an impact of **very low** significance, when mitigation is implemented.

1.6.10 Displacement Effects (Decommissioning Phase)

- Nature: Displacement of the bat 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, such as lower the levels of noise whenever possible around very high and high sensitivity areas for bats (refer to map in section 1.3); avoid dismantling works during the night and avoid the disturbance of identified roosting sites. Movement of machinery, vehicles and persons should be restricted to the existing roads and avoid the existing natural areas.
- 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.

1.6.11 Cumulative Impacts

- Nature: The effects of the Kudusberg WEF considering other projects, will produce impacts that are likely to accumulate on the bat communities – **negative impacts**. Although wind energy facilities' footprint is not intense, the construction of roads and building platforms can affect significant portions of natural vegetation. Also, it is important to consider that besides the wind energy facility, other renewable energy facilities, are also being planned and approved in the proximities of the Kudusberg WEF (Figure 5).
- Significance of impact without mitigation measures:
 - o 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.
 - o 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 bat species in the broader region.
 - o 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. Bats with a higher sensitivity to human presence will flee from these sites and seek refuge elsewhere, hence losing available habitat.
 - o Cumulative impacts relating to fatalities due to collision and/or barotrauma 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 and/or barotrauma, due to the establishment of a relatively increased risk area.
 - o 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 (no-go) areas. Keep all noise disturbance to a minimum, especially near areas that have been defined as being sensitive. Lower levels of noise disturbance are recommended whenever possible. The use of existing access routes must be used as far as possible during construction. 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 bat populations, as well as to validate the success of the mitigation measures proposed.
- Significance of impact with mitigation measures: The mitigation measures are recommended to lower the magnitude and significance of the impacts. This way, with mitigation measures, the cumulative impacts on the bat community is considered to have an impact of **low** significance.

It is however important to note that the quantification or even evaluation of cumulative impacts is uncertain as there is not a generalized knowledge of the large-scale movements or connection

between bat populations within the region. If present, cumulative impacts will be reflected by a very rapid decline of bat populations, i.e. above that 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 types of impacts.

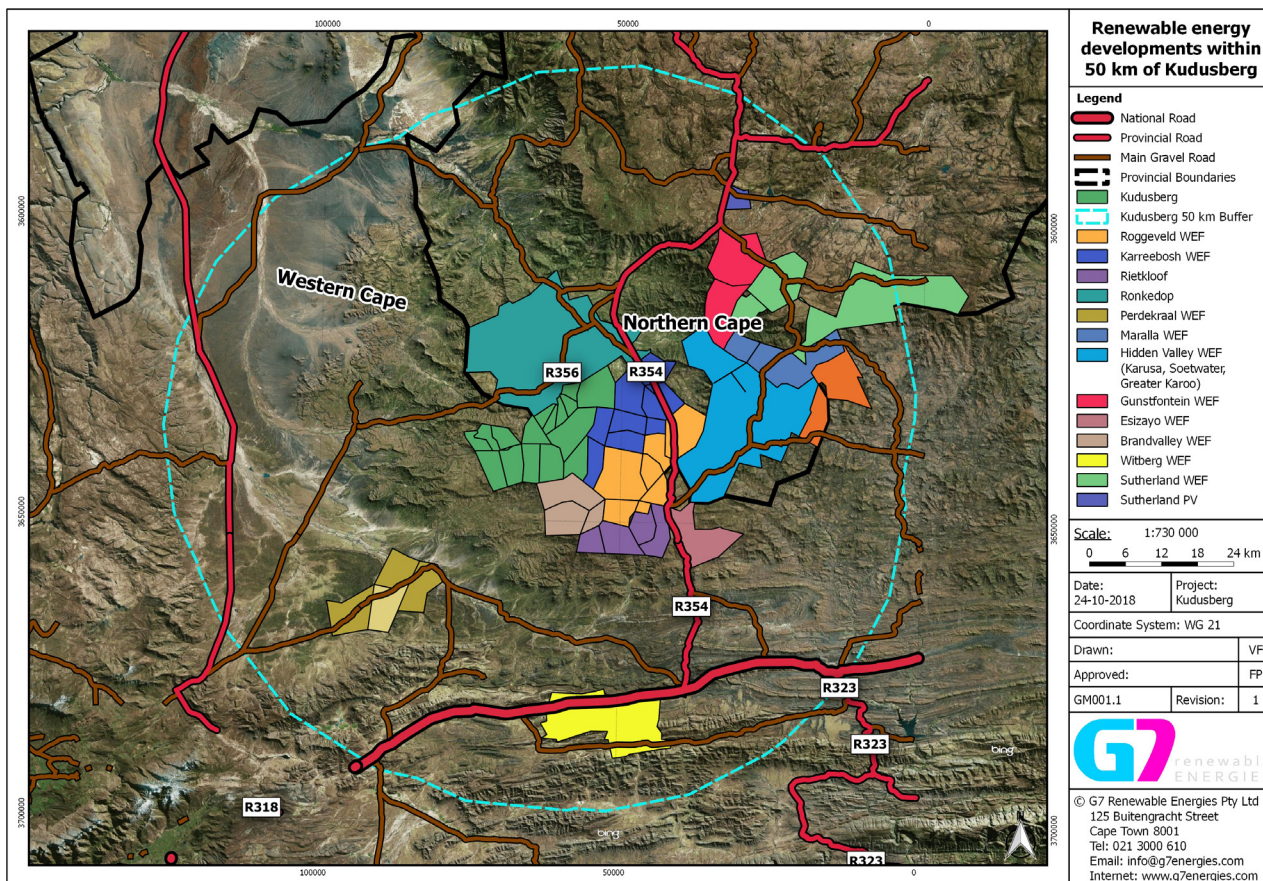


Figure 5 - Other Renewable Energy projects currently proposed or approved in the surrounding area of the Kudusberg WEF (according to the REEA most recent available dataset – 2018 2nd Quarter).

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 bat community on site will remain unchanged, relative to that which is being observed at present, under current land-use practices.

1.7 IMPACT ASSESSMENT SUMMARY

The assessment of impacts and recommendation of mitigation measures as discussed above and collated in Table 5 to Table 8 below.

Table 5 - Impact assessment summary table for the Construction Phase

Impact pathway	Nature of potential impact/risk	Status ²	Extent ³	Duration ⁴	Consequence	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
BAT IMPACTS															
CONSTRUCTION PHASE															
Direct Impacts															
Habitat Loss	Destruction of important habitat areas (natural vegetation, water features, roosts, etc.) due to the construction of wind turbines and associated infrastructures	Negative	Local	Permanent	Substantial	Very Likely	Irreversible	Moderate irreplaceability	Moderate	No	Yes	Avoidance of infrastructure siting in very high (no-go) areas; clearance and removal of vegetation should be kept to minimum extent possible; avoid destruction or disturbance of roosts; roads crossing watercourses must do so perpendicularly and not be routed parallel to it, unless agreed to by the aquatic specialist.	Low	4	High
Disturbance Effects	Disturbance of the bat community due to the increase of people and vehicles in the area, high levels of noise and machinery movements	Negative	Local	Short term	Slight	Likely	High reversibility	Replaceable	Low	No	Yes	Lower the levels of noise around highly sensitivity areas; avoid construction works during the night and destruction or disturbance of roosts; movement of machinery, a bat monitoring campaign is recommended for at least one year during the construction phase.	Very low	5	High
Indirect Impacts															
Displacement Effects	Displacement of bat community due to increased disturbances in the	Negative	Local	Medium-term	Moderate	Unlikely	Moderate reversibility	Low irreplaceability	Low	No	Yes	lower the levels of noise around highly sensitivity areas; avoid construction works during the night and	Very low	5	High

² Status: Positive (+); Negative (-)

³ Site; Local (<10 km); Regional (<100); National; International

⁴ Very short-term (instantaneous); Short-term (<1yr); Medium-term (1-10 years); Long-term (project duration); Permanent (beyond project decommissioning)

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

Impact pathway	Nature of potential impact/risk	Status ²	Extent ³	Duration ⁴	Consequence	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
	area											destruction or disturbance of roosts; movement of machinery, vehicles and persons should be restricted to the existing roads.			

Table 6 - Impact assessment summary table for the Operational Phase

Impact pathway	Nature of potential impact/risk	Status	Extent	Duration	Consequence	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
BAT IMPACTS															
OPERATIONAL PHASE															
Direct Impacts															
Fatality Events	Fatalities due to collision with turbine blades or barotrauma	Negative	Local	Permanent	Substantial	Likely	Non-reversible	High irreplaceability	Moderate	No	Yes	Avoidance of turbines installation in very high sensitive areas for bats (no-go areas); a monitoring plan is recommended during operation phase (including carcass searches and bias/scavenger trials) is recommended for a minimum of two years during the operational phase - if high levels of mortality are observed, management actions should be put into action to mitigate fatality; no tall vegetation should be allowed within the 200m buffer around the wind turbines; utilisation of red lights in the turbines, instead of white or whatever is in line with the requirements of the CAA.	Low	4	High
Disturbance Effects	Disturbance of bat community due to high levels of noise and movement generated by turbines operation and increase of people and vehicles associated with	Negative	Local	Long term	Moderate	Very likely	High reversibility	Replaceable	Low	No	Yes	Lower levels of noise disturbance are recommended whenever possible.	Very low	5	High

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

Impact pathway	Nature of potential impact/risk	Status	Extent	Duration	Consequence	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
	maintenance activities														
Indirect Impacts															
Displacement Effects	Displacement of bat community due to increased disturbances in the area	Negative	Local	Long term	Moderate	Unlikely	Moderate reversibility	Low irreplaceability	Low	No	Yes	Lower levels of noise disturbance are recommended whenever possible.	Very low	5	High
Population Decline	Population decline due to long-term increasing fatality events	Negative	Local	Long term	Severe	Very unlikely	Low reversibility	High irreplaceability	Low	No	Yes	Bat habitats (including roosts) should not be severely destroyed, particularly in sensitive areas; a construction and operational phase monitoring programme is recommended to validate the effectiveness of the proposed mitigation measures, and if need be, propose new measures.	Very low	5	High

Table 7 - Impact assessment summary table for the Decommissioning Phase

Impact pathway	Nature of potential impact/risk	Status ⁵	Extent ⁶	Duration ⁷	Consequence	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
BAT IMPACTS															
DECOMMISSIONING PHASE															
Direct Impacts															
Disturbance Effects	Disturbance of bat community due to the increase of people and vehicles in the area, high levels of noise and machinery movements when dismantling wind turbines and associated infrastructures	Negative	Local	Short term	Slight	Likely	High reversibility	Replaceable	Low	No	Yes	Lower the levels of noise around highly sensitivity areas; avoid dismantling works during the night and disturbance of roosts; movement of machinery, vehicles and persons should be restricted to the existing roads.	Very low	5	High
Indirect Impacts															
Displacement Effects	Displacement of bat community due to increased disturbances in the area	Negative	Local	Medium term	Moderate	Unlikely	Moderate reversibility	Low irreplaceability	Low	No	Yes	Lower the levels of noise around highly sensitivity areas; avoid dismantling works during the night and destruction or disturbance of roosts; movement of machinery, vehicles and persons should be restricted to the existing roads.	Very low	5	High

⁵ Status: Positive (+); Negative (-)

⁶ Site; Local (<10 km); Regional (<100); National; International

⁷ Very short-term (instantaneous); Short-term (<1yr); Medium-term (1-10 years); Long-term (project duration); Permanent (beyond project decommissioning)

Table 8 - Cumulative impact assessment summary table

Impact pathway	Nature of potential impact/risk	Status	Extent	Duration	Consequence	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
BAT IMPACTS															
CUMULATIVE IMPACTS															
Habitat Loss	Destruction of important habitat areas (natural vegetation, water features, roosts, etc.) due to the construction of wind turbines and associated infrastructures	Negative	Regional	Permanent	Substantial	Likely	Non-reversible	High irreplaceability	Moderate	No	Yes	Avoidance of infrastructure siting in very high (no-go) areas; clearance and removal of vegetation should be kept to minimum extent possible; avoid destruction or disturbance of roosts.	Low	4	Medium
Disturbance Effects	Disturbance of the bat community due to the increase of people and vehicles in the area, high levels of noise and machinery movements	Negative	Regional	Long term	Substantial	Likely	High reversibility	Replaceable	Moderate	No	Yes	Lower the levels of noise around highly sensitivity areas; avoid construction/dismantling works during the night and destruction or disturbance of roosts; movement of machinery, vehicles and persons should be restricted to the existing roads.	Low	4	Medium
Displacement Effects	Displacement of bat community due to increased disturbances in the area	Negative	Regional	Long term	Substantial	Unlikely	Moderate reversibility	Low irreplaceability	Moderate	No	Yes	Lower the levels of noise around highly sensitivity areas; avoid construction/dismantling works during the night and destruction or disturbance of roosts; movement of machinery, vehicles and persons should be restricted to the existing roads.	Low	4	Medium
Fatality Events	Fatalities due to collision with turbine blades or barotrauma	Negative	Regional	Permanent	Substantial	Likely	Non-reversible	High irreplaceability	Moderate	No	Yes	Avoidance of turbines installation in very high sensitive areas for bats (no-go areas); a	Low	4	Medium

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

Impact pathway	Nature of potential impact/risk	Status	Extent	Duration	Consequence	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
												monitoring plan is recommended during operation phase (including carcass searches and bias/scavenger trials) is recommended for a minimum of two years during the operational phase - if high levels of mortality are observed, management actions should be put into action to mitigate fatality; no tall vegetation should be allowed within the 200m buffer around the wind turbines; utilisation of red lights in the turbines, instead of white or as per the requirements of the CAA.			
Population Decline	Population decline due to long-term increasing fatality events	Negative	Regional	Permanent	Substantial	Unlikely	Low reversibility	High irreplaceability	Moderate	No	Yes	Avoid turbine placement in very high sensitive (no-go) areas; bat habitats (including roosts) should not be severely destroyed, particularly in sensitive areas.	Low	4	Medium

1.8 INPUT TO THE ENVIRONMENTAL MANAGEMENT PROGRAM

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
A. DESIGN PHASE					
A.1. BAT IMPACTS					
Potential impacts on bat (as a result of the proposed Kudusberg WEF and associated infrastructures) in future project phases, such as habitat loss, fatality, disturbance, displacement and population decline.	Avoid or minimise impacts on bat community on site.	<ul style="list-style-type: none"> ▪ Ensure that the design of the WEF takes the sensitivity mapping of the bat specialist into account to avoid and reduce impacts on bat species and bat important features. ▪ Regarding the above, minimise the footprint of the construction to an acceptable level, as defined by the bat specialist i.e. no placement of turbines in very-high sensitive areas. ▪ Use existing road networks as far as possible. 	<ul style="list-style-type: none"> ▪ Ensure the very high (no-go) areas identified for the bat community should be excluded from turbine placement and the areas considered as high sensitivity avoided as much as possible, during the planning and design phase. 	<ul style="list-style-type: none"> ▪ During design cycle and before construction commences. 	<ul style="list-style-type: none"> ▪ Holder of the EA

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
B. CONSTRUCTION PHASE					
A.1. BAT IMPACTS					
Habitat Loss	Avoid habitat destruction caused by opening clearings for the working areas, construction of roads and landscape modifications	<ul style="list-style-type: none"> ▪ An independent ECO should be appointed to oversee that the EMP is being adhered to. ▪ Training & Education of the ECO and construction staff on bat 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. 	<ul style="list-style-type: none"> ▪ 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 bat species, as well as their roosts locations. If any building, trees, or any structure with potential to provide bat roosting, needs to be demolished or removed, then a visit should be conducted, prior to the commencement of the works, by one specialist to verify the presence/absence of bats; ▪ The ECO should monitor the removal of natural vegetation. If significant portions of natural vegetation are removed 	<ul style="list-style-type: none"> ▪ 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 	<ul style="list-style-type: none"> ▪ Holder of the EA to appoint ECO. ▪ Bat specialist to conduct training of ECO, unless the ECO are already trained and educated.

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
			<p>(significantly more than what is currently proposed) in very high sensitive areas, then an appropriate rehabilitation specialist should be consulted for further actions.</p> <ul style="list-style-type: none"> ▪ The ECO should monitor 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 bat community due to the increase of people and vehicles in the area, as well as destruction of	<ul style="list-style-type: none"> ▪ Implement construction phase bat monitoring. ▪ An ECO should be appointed to oversee that the EMP is being adhered to. 	<ul style="list-style-type: none"> ▪ Appoint a bat specialist to undertake a construction phase monitoring programme (minimum 1- 	<ul style="list-style-type: none"> ▪ Appointment of bat specialist shortly before construction 	<ul style="list-style-type: none"> ▪ Holder of the EA to appoint bat specialist.

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
	roosts	<ul style="list-style-type: none"> ▪ Training & Education of the ECO and construction staff on bat and energy related impacts. ▪ Adequate training should be provided to all the construction personnel. Everybody working in the area should be aware of the sensitive areas, be alert to the possible presence of bats, especially when working close to potential and/or confirmed roosts (per example abandoned buildings). ▪ In the case that any confirmed or potential bat roost needs to be affected (e.g. utilisation conversion, demolition, recuperation) a bat specialist should confirm bat occupancy and define the necessary measures to be implemented to minimise the impact if necessary. 	<ul style="list-style-type: none"> 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 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 bat species, as well as their roosts locations. ▪ Reduce noise levels as far as possible. 	<ul style="list-style-type: none"> commences. ▪ Appointment of ECO shortly before construction commences. ▪ Training of ECO shortly before construction commences. ▪ Minimise disturbances throughout the construction phase. 	<ul style="list-style-type: none"> ▪ Bat specialist to provide training to ECO. ▪ Construction staff to adhere. ECO to oversee
Displacement Effects	Minimise displacement effects of the bat community due to on-site disturbances.	<ul style="list-style-type: none"> ▪ Minimise on-site disturbances. 	<ul style="list-style-type: none"> ▪ Reduce noise levels as far as possible. 	<ul style="list-style-type: none"> ▪ During the construction phase. 	<ul style="list-style-type: none"> ▪ Construction staff to adhere. ECO to oversee.

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
C. OPERATION PHASE					
A.1. BAT IMPACTS					
Fatality events	Avoid fatality of individuals due to collision with turbine blades or barotrauma caused by turbines operation.	<ul style="list-style-type: none"> ▪ If turbines are to be lit at night, lighting should be kept to a minimum; ▪ Lighting of wind energy facility (for example security lights) should be kept to a minimum and should be directed downwards (with the exception of aviation security lighting); ▪ Appoint a bat specialist to develop and a post-construction monitoring programme (operation phase) to survey bat communities on the wind energy facility and the impacts resulting from the installed infrastructure, according to the Best Practice Guidelines available at that time; ▪ The results of the operational phase monitoring programme must be taken into account for the implementation of further mitigation measures, if necessary. 	<ul style="list-style-type: none"> ▪ Develop and implement a bat 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 required. If significant levels of fatalities are observed, then these measures should be implemented. Such measures could include curtailment, shut-down on demand technology, habitat management, or bat deterrence systems. 	<ul style="list-style-type: none"> ▪ During the first two years of the projects' operational phase. ▪ During the operational phase of the project. 	<ul style="list-style-type: none"> ▪ Bat specialist. ▪ Bat specialist for monitoring. Holder of the EA to implement.
Disturbance Effects	Avoid disturbance of bat community due to noise	<ul style="list-style-type: none"> ▪ Minimise general on-site disturbances. 	<ul style="list-style-type: none"> ▪ Reduce noise levels as far as possible. 	<ul style="list-style-type: none"> ▪ Minimise disturbances 	<ul style="list-style-type: none"> ▪ All on-site personnel.

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
	and movement generated by turbines operation.	<ul style="list-style-type: none"> No off-road driving. Implement speed limits. 	<ul style="list-style-type: none"> Driving should, at all times, remain on existing or new roads. Avoid maintenance activities during the night and disturbance of roosts. 	<ul style="list-style-type: none"> throughout the operational phase. No off-road driving throughout the operational phase. 	<ul style="list-style-type: none"> All on-site personnel and monitored by the facility manager.
Displacement Effects	Minimise displacement effects of the bat community due to on-site disturbances.	<ul style="list-style-type: none"> Minimise on-site disturbances. 	<ul style="list-style-type: none"> Reduce noise levels as far as possible. Avoid maintenance activities during the night and disturbance of roosts. 	<ul style="list-style-type: none"> During the operational phase. 	Operational staff to adhere. Facility Manger to oversee.
Population Decline	Reduce the risk of population decline within the area.	<ul style="list-style-type: none"> Appoint a bat specialist to develop and implement an operational monitoring programme with carcass searches, searcher efficiency trials and scavenger removal trials, to gain a better understanding of real impacts occurring on the bat community. Further operational mitigation measures to be researched during the operational monitoring campaign and implemented, if needed. 	<ul style="list-style-type: none"> Conduct a monitoring campaign (with carcass searches, searcher efficiency trials and scavenger removal trials) during the first two years of the projects' operational phase. Further monitoring can, however, be recommended during later stages – if deemed relevant by the bat specialist. Further operational 	<ul style="list-style-type: none"> During the first two years of the projects' operational phase. During the operational phase. 	<ul style="list-style-type: none"> Bat Specialist. Bat specialist for monitoring. Developer for implementation.

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
			mitigation measures to be researched during the operational monitoring campaign as an adaptive management approach. If significant levels of fatalities are observed, then these measures should be implemented. Such measures could include curtailment, shut-down on demand technology, habitat management, or bat deterrence systems.		

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
D. DECOMMISSIONING PHASE					
A.1. BAT IMPACTS					
Disturbance/ Displacement Effects	Avoid disturbance and/or displacement of bat community due to noise and movement generated by the increase of people and vehicles in the area, for the dismantling of turbines and associated infrastructure.	<ul style="list-style-type: none"> Minimise on-site disturbances. 	<ul style="list-style-type: none"> Adequate training should be provided to all the construction personnel. Everybody working in the area should be aware of the sensitive areas, be alert to the possible presence of bats, especially when working close to potential and/or confirmed roosts (per example abandoned buildings). Reduce noise levels as far as possible. 	<ul style="list-style-type: none"> Minimise disturbances throughout the decommissioning phase. 	<ul style="list-style-type: none"> All on-site personnel.

1.9 CONCLUSION AND RECOMMENDATIONS

Results of the 12-month pre-construction bat monitoring indicate that the bat activity at the proposed Kudusberg WEF area is generally **low** considering the Bat Guidelines (Sowler *et al.*, 2016).

One species with confirmed occurrence is perceived as having a potential high risk of collision with wind turbines (according to Sowler *et al.*, 2016) due to their behaviour, i.e. *Tadarida aegyptiaca*. Two other species with confirmed presence in the area raise concerns regarding their probability of fatalities, as they have a medium-high risk of collision with wind turbines: *Neoromicia capensis* and *Miniopterus natalensis*. Additionally, *Miniopterus natalensis* is a migrant species that can use air space at rotor level during migration periods being prone to collision during these events. These are all “Near Threatened” or “Least Concern” species, according to the South African Red List (Friedmann & Daly, 2004b).

According to pre-construction monitoring results, the Kudusberg WEF site is considered to be classified as having **low bat sensitivity**, but with some areas in particular with high and very high sensitivity due to the presence of specific features and habitat that may have an increased bat activity. These include the presence of potential roosts, as well as watercourse lines which are important for bats, since they are likely to act as commuting routes, providing food resources, likely to be associated with higher bat activity. For this reason, mitigation measures are proposed to mitigate potential impacts mainly during the project design phase (including the layout), as well as during the construction and operational phase.

It is recommended that the very high bat sensitivity or no-go areas identified for the bat community should be excluded from development (excluding the use/upgrading of existing roads). Additionally, the areas considered to be of high sensitivity should be avoided as much as possible, but in line with the recommendations outlined in section 1.3. Therefore, the proposed layout considered in the present report, is acceptable.

At this stage, if the proposed mitigation measures are implemented, the project is not considered to cause irreplaceable loss of bat biodiversity, therefore considering the information available and to our best knowledge, **there are no fatal flaws identified for the project apart from the very high (no-go) areas (refer to section 1.3) which should be excluded from development as is already the case with the current proposed layout.**

The following recommendations are proposed to reduce the potential collision risk and potential negative impacts from the proposed wind development on the bat community:

Project design-Layout definition phase

- Considering the analysis in the sensitive areas section (refer to section 1.3) it is recommended to avoid the overlay of the proposed turbines layout, with the areas with a very high and high level of sensitivity to bats – already implemented.

Project Construction phase

- Adequate training should be provided to all the construction personnel (ECO and construction staff) to ensure that everybody working in the area should be aware of the bat sensitive areas, be alert to the possible presence of bats, especially when working close to potential and/or confirmed roosts (per example abandoned buildings);
- Construction activities to be restricted to the demarcated construction areas;
- A pre-construction walk-through should be conducted by a bat specialist, covering the final layout to identify any roosts/activity of sensitive species, as well as any additional sensitive habitats and to propose suitable mitigation measures to avoid or minimise impacts to these species;
- Sufficient and adequate drainage should be provided 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 intervention area, with special focus on areas nearby riparian vegetation or drainage lines. All the maintenance of vehicles must be carried out in specially designated areas to prevent any type of pollution to the residual site.

Project Operational phase

Considering that bat species of high collision risk were confirmed using the area within the rotor swept area (although low activity), some recommendations are made to mitigate the risk involved for those populations. Since activity levels at rotor level are considered to be low to medium, no curtailment measures are required to be proposed at this stage.

However, if during the operation phase, high levels of mortality are identified this should be evaluated by a designated bat specialist as soon as possible. Subsequent mitigation measures, adjusted to the risk situation identified, should be then proposed and implemented.

At this stage, recommendations during operational phase are:

- If turbines are to be lit at night, lighting should be kept to a minimum;
- Lighting of wind energy facility (for example security lights) should be kept to a minimum and should be directed downwards (with the exception of aviation security lighting);
- Ensure the implementation of a post-construction monitoring programme (operation phase) to survey bat communities on the wind energy facility and the impacts resulting from the installed infrastructure, according to the prevailing Best Practice Guidelines;
- The results of the operational phase monitoring programme must be taken into account for the implementation of further mitigation measures, if necessary.

The monitoring programme should have a minimum duration of 2 years, start as soon as the wind energy facility becomes operational and be revised upon completion. It should include both the continuation of the assessment of bat communities in the site, complementing the information gathered during the pre-construction phase and allowing determination of any exclusion effects on the bat community. The operational phase monitoring programme should include carcass searches and the determination of correction factors (observer's efficiency and carcass removal) in order to accurately determine the impact of the wind turbine on bats and to determine any potential critical area and/or wind turbines. This will inform adjusted or further mitigation measures, if necessary, tailored to the site specifics. These mitigation measures must be evaluated on a case by case scenario.

A rigorous and well-planned monitoring programme is considered to be one of the most effective measures to validate the potential impacts identified and to verify the effectiveness of the mitigation measures proposed. It will provide important insights into the impacts of the wind energy facility at an early stage, thereby informing any necessary adjustments to what has previously been proposed. It will also allow for verifying if the mitigation measures are being effective or if they should be adjusted or interrupted and other more effective measures implemented. Mitigation of bat impacts on wind energy facilities should be site specific and embrace an evolutionary process throughout the development life (Hundt, 2012).

The continuation of the monitoring programme will contribute to: increased knowledge about bat communities in the Kudusberg WEF area and verification of the potential impacts identified during the pre-construction phase especially those concerning bat fatality caused by wind turbines. Although bat fatality may occur, based on pre-construction results, this is expected to affect mostly common and widespread species. However, if impacts identified in the subsequent phases of the project are more severe than expected additional mitigation measures may be evaluated, particularly if mortality occurs in levels that compromise the local population's viability. Nonetheless such measures should only be implemented if necessary and they should be carefully planned in order to find the best trade off in reduction of the collision risk and minimise the loss in revenue resulting from mitigation.

Decommissioning Phase

Vehicles to avoid very high sensitivity or no-go areas- and noise levels to be kept to a minimum 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

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APPENDICES

OTHER RENEWABLE ENERGY PROJECTS WITHIN A RADIUS OF 50 KM FROM THE PROPOSED KUDUSBERG WEF SITE

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 Local	EOH Coastal & Environmental Services	Wind	36 MW	Approved

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

DEA REFERENCE NUMBER	EIA PROCESS	APPLICANT	PROJECT TITLE	EAP	TECHNOLOGY	MEGAWATT	STATUS
			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 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 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 in the Northern Cape	SiVEST SA (Pty) Ltd	Wind	325 MW	In process
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	

DEA REFERENCE NUMBER	EIA PROCESS	APPLICANT	PROJECT TITLE	EAP	TECHNOLOGY	MEGAWATT	STATUS
TBC	BA	ENERTRAG SA (Pty) Ltd	Proposed Development of the Tooverberg Wind Energy Facility and the associated grid connection near Touws River, Western 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