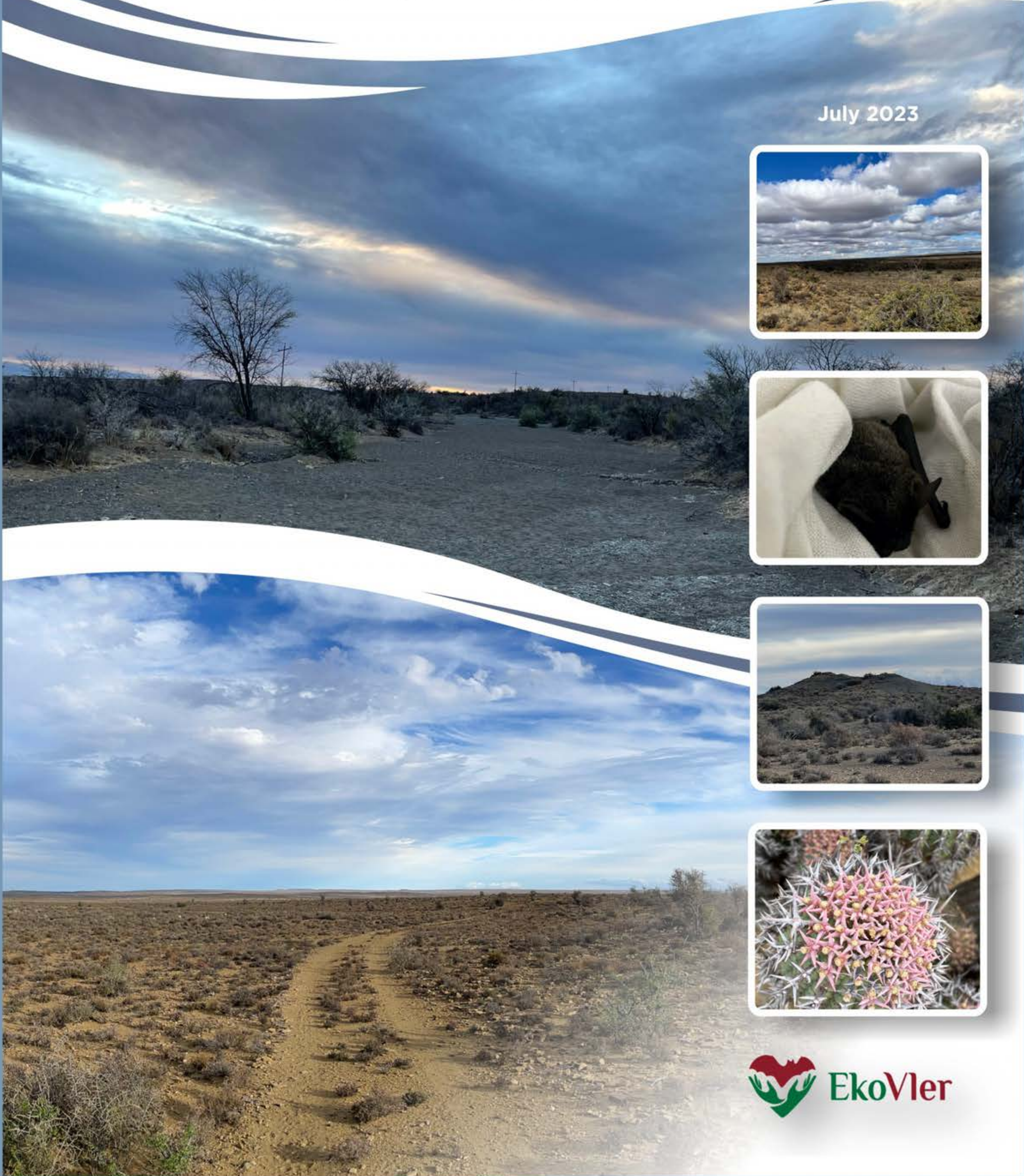
Bat Monitoring Report for the Proposed Construction of the Kraaltjies 240 MW Wind Energy Facility within the Beaufort West Local Municipality, Western Cape Province, South Africa

July 2023



SiVEST SA (PTY) LTD

BAT MONITORING REPORT FOR THE PROPOSED CONSTRUCTION OF THE KRAALTJIES 240 MW WIND ENERGY FACILITY WITHIN THE BEAUFORT WEST LOCAL MUNICIPALITY, WESTERN CAPE PROVINCE, SOUTH AFRICA

FINAL REPORT

TITLE:	BAT MONITORING REPORT FOR THE PROPOSED CONSTRUCTION OF THE KRAALTJIES 240 MW WIND ENERGY FACILITY WITHIN THE BEAUFORT WEST LOCAL MUNICIPALITY, WESTERN CAPE PROVINCE, SOUTH AFRICA
DFFE REFERENCE:	14/12/16/3/3/2/2264
PREPARED BY:	Stephanie Dippenaar Consulting trading as EkoVler
REPORT DATE:	May 2023
VERSION NO.:	1

BAT MONITORING REPORT FOR THE PROPOSED CONSTRUCTION OF THE KRAALTJIES 240 MW WIND ENERGY FACILITY THE BEAUFORT WEST, WESTERN CAPE PROVINCE, SOUTH AFRICA

EXECUTIVE SUMMARY

South Africa Mainstream Renewable Power Developments (Pty) Ltd (hereafter called Mainstream) proposes the construction of a 240 megawatt (MW) Wind Energy Facility (WEF) at the Kraaltjies WEF site. The project site is located within the Beaufort West Local Municipality in the Central Karoo District Municipality, Western Cape Province. The proposed WEF has an estimated 20 turbines and associated infrastructure, within a larger study area of 3 994.9 ha.

SiVEST SA (PTY) LTD (hereafter known as SiVEST) is undertaking the prerequisite environmental impact assessment application for this project. **Stephanie Dippenaar Consulting**, trading as **EkoVler,** has been appointed to assess the potential impact of the proposed development on bats in the area and to inform final design and management strategies by identifying measures that would mitigate direct, indirect, and cumulative impacts of the development and associated infrastructure. The bat specialist will also provide mitigation recommendations for inclusion in the Environmental Management Program (EMPr).

Although not situated close to any formally protected areas, various protected areas are located beyond the border of the proposed wind farm towards the south of the site, in the vicinity of the Swartberg mountains. The Henry Kruger Private Reserve, the nearest registered reserve, is situated within 60 km to the northwest as the crow flies, and the Karoo National Park is situated approximately 70 km to the north. There is a large Critical Biodiversity Area (CBA) to the south and southeast off-site of the proposed Kraaltjies WEF site, but no CBA on the actual WEF site itself. Several private game reserves occur in the vicinity of the development site.

The proposed study area falls within the Nama Karoo Biome and regionally within the Lower Karoo Bioregion, with Gamka Karoo being the single dominant vegetation type found within the study area (SANBI, 2012). The landscape is comprised of slightly undulating plains, covered with dwarf spinescent shrubland and low trees. Being located in the rain shadow of the Cape Fold Belt, the Gamka Karoo is considered one of the most arid units of the Nama Karoo Biome. Because of the low average annual rainfall, the carrying capacity in the proposed Kraaltjies area is low, resulting in large farm units.

Trees situated in the non-perennial riverbeds could provide roosting opportunities for bats that prefer roosting in vegetation or under the bark of trees. Rock formations along the hilltops and along the river valleys, as well as abandoned burrows, such as aardvark holes, provide ample roosting opportunities for bats. Where roofs are not sealed off, human dwellings could provide roosting space for some bat species; culverts and stone walls also provide roosting opportunities. Water troughs for the livestock, open dams and cement reservoirs provide permanent, open water sources for bats throughout the year. During the few rainy spells, stagnant water that usually collects in small pans and dry ditches could serve as breeding grounds for insects which could serve as food for bats. as livestock attracts flies, which could also serve as a food source for bats.

The proposed WEF is located within the distribution range of six families and approximately 12 species. Calls of five of these species have been recorded by the static recorders during the monitoring period.

Data from passive monitoring systems, transects, roost surveys and a desktop study informed this report. Four static SM4BAT systems were deployed within the project site, with two systems located near-ground and two within the sweep of the turbine blades.

63% of the calls of all the combined systems represent *Tadarida aegyptiaca*, which is the dominant species on site. *T. aegyptiaca* is a high-risk species, physiologically adapted with a narrow wingspan to fly high, in the vicinity of the turbine blades. Due to this foraging preference, the risk of collision and barotrauma at a WEF is high. Three more high-risk species have a significant presence: 13% of the activity was for the Near Threatened *Miniopterus natalensis,* 15% was for *Neoromicia capensis*, and 9% was for *Sauromys petrophilus*. The endemic *Eptesicus hottentotus* was also recorded at the site. The Molossidae family is more dominant at the high-altitude systems, with the Molossids *S. petro*philus and *T. aegyptiaca* comprising nearly 100% of all the activity recorded at height (Systems N and O).

Although the presence of *M. natalensis* was relatively low during the year, with a bit of increased activity during spring, a sudden spike of activity was recorded during May 2022 at the 10 m system Q. This might indicate the presence of migrating bats. Several potential cave structures. derelict mines and caves occur within a 100 km radius of the proposed Kraaltjies WEF, especially towards the south in the Swartberg mountain range. Calcrete deposits in these mountainous areas tend to support cave structures. Although these structures are not necessarily the size and grandeur of the Cango caves, smaller structures might house *M. natalensis*, which is a cave-dwelling bat.

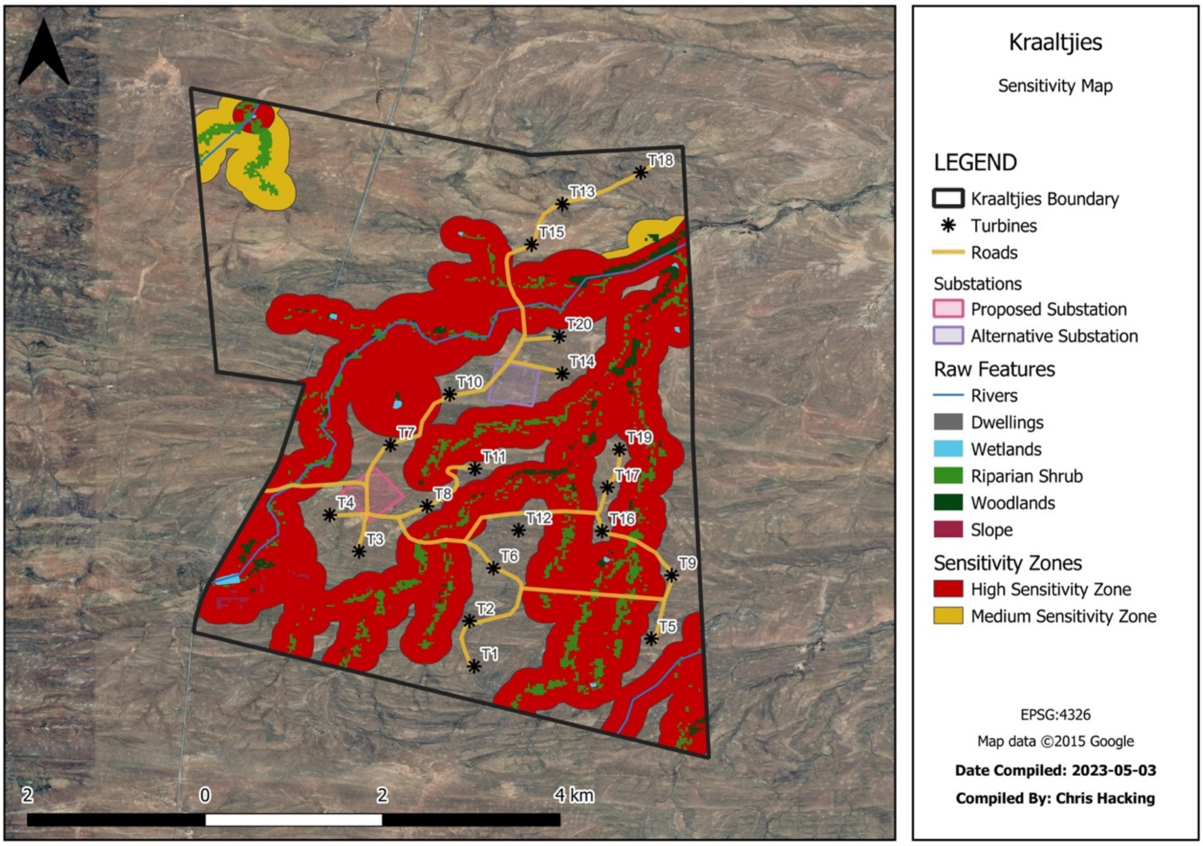
The proposed Kraaltjies WEF has a low record of bat activity during winter, between June and August, with a steady increase in activity from September (spring). The highest activity had been experienced between October and May. The peak in activity experienced during October 2022, was not portrayed in October 2021, but several peaks in activity were recorded between November 2021 and May 2022, indicating high activity during the warmer summer and autumn months. After May there is a steep decline in activity as colder temperatures set in.

The general distribution of bat activity during each night, from sunset to sunrise, indicates a sudden increase in activity two hours after sunset, with bat activity increasing steadily until a peak at about five to six hours after sunset. This pattern of activity is normal, as bats are generally more active after sunset as they come out to forage for food and drink. Thereafter, activity declined steadily up to five to three hours before sunrise, until little activity is portrayed just before sunrise, when bats have returned to their roosts.

As indicated by the SABAA guidelines, the combined median bat activity per hour at near-ground level is 1,35, which is within the high-risk category, while the combined median bat activity per hour within the rotor sweep area is 0,39, which is in the medium-risk category. The latter is of particular importance, as this represents the overall hourly bat activity within the proposed sweep of the turbine blades, and thus in the area of expected collision risk. According to the bat threshold guidelines, fatality minimisation measures should be recommended during pre-construction and should be applied from the commencement of turbine rotation.

Data from the high system O on the Met mast were statistically analysed for correlations between weather conditions and bat activity. Optimal conditions for bat activity on the terrain include temperatures above 15 °C, wind speeds below 9 m/s, humidity levels between 40% and 90% and barometric pressure levels below 932.5 hPa.

A bat sensitivity map classified no-go, high and medium sensitivity is presented below. The client has shifted all turbine positions outside of high sensitivity as well as medium sensitivity zones so that no operating turbine components are placed in these areas. Supporting infrastructure, such as the laydown area, on-site sub-station and Battery Energy Storage System may infringe on the sensitivity areas, if necessary, but care must be taken to avoid any destruction of possible bat roosts, as per the Environmental Management Program (EMPr).



Although no curtailment is recommended at present, a curtailment schedule is presented in Section 9.3, Table 8, of the main document. This should appear in the operational bat monitoring program so that the operational bat specialist can adapt these recommendations as necessary.

Due to the spike of *M. natalensis* during autumn, curtailment of some turbines might be necessary. To refine possible mitigation and establish which turbines are affected, if any, it is proposed that several bat-detecting systems are deployed at turbine-specific locations from September 2023 up to the beginning of June 2024, for extended monitoring. Not only will this approach inform whether this spike repeats during the next season but one will also be able to target specific turbine numbers, if necessary. However, the extended monitoring need not prevent a decision on environmental authorization being made and / or issued and can be done post-authorisation. Where additional or refined mitigation is required, this must be included in an updated EMPr.

Although the combined impact during the operational phase, namely after mitigation, is predicted to be Low Negative, it should be noted that the bat activity on the project site, according to the bat threshold for Nama Karoo, is medium to high, and there is a spike of activity in autumn from a Near Threatened species. This must be confirmed during bat monitoring in the operational phase, but the developer should not rule out turbine-specific curtailment and/or installing bat deterrents when more information is available.

As indicated in the table below, the impact on bats from the proposed Kraaltjies WEF project site is predicted to be Negative Medium, with a combined rating of 36,6 before mitigation and Negative Low, with a combined rating of 23 after mitigation.

Summary of impacts (average of each section) on bats by the proposed Kraaltjies WEF according to the SiVEST impact rating		
Phase	**Impact before mitigation (negative)**	**Impact after mitigation (negative)**
Design	24 (5-23) Medium	7(5-23) Low
Construction	23 (5-23) Medium	6,6 (5-23) Low
Operation	39 (24-42) High	24,5(24-42) Medium
Decommissioning	8 (5-23) Low	6 (5-23) Low
Cumulative	43,4 (62-80) High	34,6 (24-42) Medium
Combined for the site	36,6 (24-42) Medium	23 (5-23) Low

The cumulative impacts on bat populations at the proposed Kraaltjies WEF, before mitigation, are predicted to be High Negative. This is due to the combined impact of all the proposed wind farms in the area. If all wind farms in the vicinity adhere to recommended mitigation measures, the combined cumulative impact is predicted to be reduced to Medium.

It is recommended that the following mitigation measures be included in the Environmental Authorisation (EA):

- The final layout must be informed by the sensitivity map provided in Section 7.3 of the main report.
- A bat specialist must be appointed before the Commercial Operation Date (COD). A mitigation scheme, as per Section 9 in the main report, must form part of the operational management plan, and be applied.
- Extended, intensive bat monitoring, as described in Section 9.10 to establish whether species-specific and turbine-specific mitigation is necessary for the red data *M. natalensis.* This can be undertaken post-authorisation and any additional or refined mitigation measures must be included in an updated EMPr, where recommended.
- Turbines must be feathered below cut-in speed, and although they need not be at a complete standstill, there should be minimum movement so that bats are not at risk when turbines are not generating power.
- Mitigation measures must be applied as outlined in the impact tables, Section 10, of the main report and the EMPr.
- Where high fatality, above the fatality threshold of the relevant guidelines, be experienced during operation, curtailment, as indicated in Section 9 of the main report, must be adapted, or bat deterrents must be installed, as guided by the operational bat specialist.
- All newly built structures that have bat conducive features must be rehabilitated to discourage bat presence. This includes roofs of new buildings, open quarries and borrow pits. A regular investigation should establish if new roofs are still sealed.
- A minimum of two year's operational bat monitoring must be conducted after the commencement of operations at the WEF, as per the guidance of the latest operational South African Bat Assessment Association (SABAA) guidelines.

The Site Sensitivity Verification Report indicates that the area proposed for the Kraaltjies WEF has areas of high bat sensitivity. Some of the drainage lines, with relatively larger trees and denser bushes, are particularly conducive to bat activity, as confirmed in the Site Sensitivity Verification Report; however, areas between these high-sensitivity zones, portrayed lower activity. This is confirmed by the 12-month bat monitoring study.

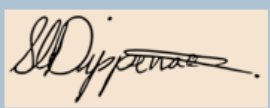
It should be noted that one year pre-construction bat monitoring is required by legislation in South Africa. However, the semi-desert Nama Karoo environment is subject to erratic weather conditions, which vary from year to year. As confirmed by operational wind farms, bat fatalities could fluctuate significantly, depending on weather conditions. These changes cannot be accounted for in a year of bat monitoring.

When data from the bat monitoring exercise it taken into consideration, the overall potential negative impact of the proposed Kraaltjies WEF on bats, combined for all the development phases, is predicted to be **Medium Negative without mitigation**, and **Low Negative with mitigation**.

Based on the findings of the one-year pre-construction monitoring undertaken at the proposed Kraaltjies 240 MW WEF project, the bat specialist is of the opinion that no fatal flaws exist which would prevent the construction and operation of the WEF. Environmental Authorization may thus be granted, subject to the implementation of the recommendations made in this report.

BAT SPECIALIST:	Stephanie C Dippenaar (MEM) Stephanie Dippenaar Consulting trading as EkoVler Professional member SAIEES sdippenaar@snowisp.com Mobile: +27 (0)82 200 5244
STATIC DETECTORS:	Inus Grobler (PhD Eng)
STATISTICAL ANALYSES:	Inus Grobler jnr. (BComm Actuarial Science)
REPORT WRITING SUPPORT:	Diane Erasmus (MSc) Franky Nightingale (BA Hon) Madeleine de Wet (BSc Hon)
FIELD WORK:	Jacob Claassen (DEAT and FAGASA registered)
PREPARED FOR:	South Africa Mainstream Renewable Power Developments (Pty) Ltd Att: Shaun Taylor 4th-floor Mariendahl House, Newlands on Main Corner Main & Campground Roads, Claremont, 7800, South Africa Shaun.Taylor@mainstreamrp.com +27 (0)60 537 8355

In terms of the National Environmental Management Act of 1998 (as amended), I, Stephanie C Dippenaar, owner of Stephanie Dippenaar Consulting, operating as a sole proprietor, do hereby declare that I have no conflicts of interest related to the work of this report, namely the Bat Impact Assessment Report, at the Kraaltjies 240 MW Wind Energy Facility, in the Northern Cape. I have no personal or financial connections to the relevant property owners, developers, planners, financiers, or consultants of the development.



Stephanie C. Dippenaar

NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 (ACT NO. 107 OF 1998) AND ENVIRONMENTAL IMPACT REGULATIONS, 2014 (AS AMENDED) - REQUIREMENTS FOR SPECIALIST REPORTS (APPENDIX 6)

Regulation GNR 326 of 4 December 2014, as amended 7 April 2017, Appendix 6	Section of Report
1. (1) A specialist report prepared in terms of these Regulations must contain- a) details of- i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	Section 1 and Appendix 2
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Appendix 4
c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 1
(cA) an indication of the quality and age of base data used for the specialist report;	Section 1 and 6.1
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 6.2.
d) the date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 6.1 and 6.3
e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 1.2
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 alternative;	Sections 3.3, 6 and 7
g) an identification of any areas to be avoided, including buffers;	Section 7
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;	Section 7
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 2
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;	Section 10
k) any mitigation measures for inclusion in the EMPr;	Section 9
l) any conditions for inclusion in the environmental authorisation;	Section 9
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 9
n) a reasoned opinion- i. (as to) whether the proposed activity, activities or portions thereof should be authorised; (iA) regarding the acceptability of the proposed activity or activities; and ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Section 12
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	Section 1.2
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	n.a. No comments relating to bats (including impacts) received to date.
q) any other information requested by the competent authority.	n.a. No specific information requested by the competent authority to date.
2) Where a government notice *gazetted* by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	n.a.

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Definitions	
Bat monitoring systems	Ultrasonic recorders used to record bat calls
Torpor	A state of physical inactivity associated with lower body temperature and metabolism
SM4BAT	Wildlife Acoustics' full spectrum ultrasonic bat monitoring recorder
SMMU2	Wildlife Acoustic's ultrasonic microphones for recording bat sounds
Threshold	Bat activity threshold as provided by SABAA

List of Abbreviations	
BA	Basic Assessment
BESS	Battery Energy Storage System
CBA	Critical Biodiversity Area
CDF	Cumulative Distribution Function
COD	Commercial Operation Date
DEA	Department of Environmental Affairs
DFFE	Department of Forestry, Fisheries and the Environment
EA	Environmental Authorisation
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
IPP	Independent Power Producer
IRP	Integrated Resource Plan
kV	Kilovolt (s)
MET	Meteorological
ms	milliseconds
MW	Megawatt(s)
REDZ	Renewable Energy Development Zone
REF	Renewable Energy Facility
PV	Photovoltaic
WEF	Wind Energy Facility
SABAA	South African Bat Assessment Association
SSVR	Site Sensitivity Verification Report

1. INTRODUCTION

South Africa Mainstream Renewable Power Developments (Pty) Ltd (hereafter called Mainstream) proposes the construction of a 240 megawatt (MW) Wind Energy Facility (WEF) to be known as the Kraaltjies Wind Energy Facility (WEF). The project site is located near Beaufort West within the Beaufort West Local Municipality in the Central Karoo District Municipality, in the Western Cape Province. The proposed WEF has an estimated 20 turbines and associated infrastructure, within a larger study area of approximately 3 995 ha.

SiVEST SA (PTY) LTD (hereafter known as SiVEST) is undertaking this project's prerequisite environmental assessment applications**.** Stephanie Dippenaar Consulting, trading as EkoVler, has been appointed to assess the potential impact of the proposed development on bats in the area and to inform final design and management strategies. This is achieved by identifying measures that would mitigate direct, indirect, and cumulative impacts of the development and associated infrastructure. The bat specialist will also provide recommendations for inclusion in the Environmental Management Programme (EMPr) for the Environmental Impact Assessment Process (EIA). A notice signed in 2021 identified the Beaufort West area as a strategic area for solar PV and large-scale wind energy facilities known as a Renewable Energy Development Zone (REDZ). The proposed development, therefore, falls in line with the strategic planning for the area.

This report presents baseline information regarding the environment with respect to bats and is informed by a bat monitoring programme conducted from 15 August 2021 to 12 November 2022. A Site Sensitivity Verification Report (SSVR) has been appended in Annexure 1.

This bat monitoring report comprises the following sections:

- Section 1: Introduction which contains the Terms of Reference, Specialist Credentials and Assessment Methodology;
- Section 2: Assumptions and Limitations;
- Section 3: Technical description;
- Section 4: Legal requirements and guidelines;
- Section 5: Description of the receiving environment;
- Section 6: Specialist findings/ identification and assessment of impacts;
- Section 7: Bat sensitivity zones;
- Section 8: Cumulative impact;
- Section 9: Proposed mitigation measures;
- Section 10: Description of the project aspects relevant to the bat impact assessment;
- Section 11: Comparative assessment of alternatives; and
- Section 12 Conclusion and summary.

1.1 TERMS OF REFERENCE

The *South African Best Practice Guidelines for Pre-construction Monitoring of Bats at Wind Energy Facilities* (MacEwan, et al, 2020) guided the bat monitoring programme that informs this assessment. Based on these Guidelines, acoustic monitoring of the echolocation calls of bats was used to determine the seasonal and diurnal activity patterns of bats at the proposed Kraaltjies WEF. The following South African guideline documents were used in conjunction with the Pre-Construction Guidelines:

- Good Practice Guidelines for Operational Monitoring for Bats at Wind Energy Facilities (Aronson, et al, 2020);

- Mitigation Guidance for Bats at Wind Energy Facilities in South Africa (Aronson, et al, 2018); and
- South African Bat Fatality Threshold Guidelines (MacEwan, et al, 2018).

The following Terms of Reference are applicable to the monitoring exercise, as informed by the most current Pre-Construction Guidelines:

- Gathering information on bat species that inhabit the site, noting higher, medium, or lower risk species groups; as indicated in Table 4, p16, of the Guidelines (MacEwan et al, 2020);
- Recording relative frequency of use by different species throughout the monitoring year;
- Monitoring the spatial and temporal distribution of activity for different species;
- Identifying locations of roosts within and close to the site;
- Collecting details on how the surveys have been designed to determine the presence of rarer species; and
- Describing the type of use of the site by bats; for example, their relative position from the turbine locations in terms of foraging, commuting, migrating, and roosting, as can be observed through the monitoring data and site visits.

1.2 METHODOLOGY

1.2.1 *Desktop investigation of the development area as well as the surrounding environment*

A desktop study was undertaken of the site, using the information provided by Mainstream as the developer, as well as information gathered through a literature review. The literature review included existing reports and other studies for the area, as well as the SANBI GIS database. Conservation areas in the vicinity were investigated and information from other developments in the area, particularly renewable energy projects and wind farms, were noted to understand cumulative effects. Relevant guidelines and legislation were also consulted. The study area was visited seasonally to further inform the background assessment of the site. During fieldwork, physical surveys were conducted to identify the location of possible roosts. Interviews were also conducted with people staying on-site or close to the site, to establish if they are aware of any roosts in the vicinity, or general bat occurrences.

Background was provided regarding ecosystem services and the impact of a loss of bats on the broader environment and the local and global conservation status of all identified and potential bat species was determined.

Information was gathered from other wind farm developments in the close vicinity of the proposed Kraaltjies WEF site to assess the cumulative impact of the WEFs.

1.2.2 *Site visit*

A reconnaissance site visit was conducted as part of the initial project screening phase which included the installation of bat-detecting equipment. Three additional site visits were conducted, during which seasonal surveys and day-time investigations were conducted, and a fifth site visit was undertaken to mend bat monitoring equipment on the met mast. The site visits included investigations of all the various biotopes on the project site.

Interviews were conducted with the landowner(s) as well as workers of the proposed Kraaltjies WEF regarding possible bat occurrence on the property and the surroundings.

1.2.3 *Passive Acoustic Monitoring Systems*

Monitoring is essential to enable the assessment of the relative importance and temporal changes of features, locations, and potential migratory routes (MacEwan et al, 2020). Data about the bats present on the site were gathered primarily using automated bat detector systems. The number of detectors required was calculated based on the surface area of the proposed site (approximately 3 995 ha) and the different biotopes present on site. The monitoring equipment was installed and verified so as to ensure that they are operational. Data was downloaded throughout the monitoring year during field visits.

The monitoring systems deployed in the study area included four Wildlife Acoustics SM4BAT full spectrum bat detectors powered by 12 V 7 Amp-h sealed lead acid batteries replenished by photovoltaic solar panels (

Table 1: Summary of Passive Detectors deployed at the proposed Kraaltjies WEF site

Detector	Situation	Coordinates	Micro-phone	Divi-sion ratio	High pass filter	Gain	Format	Trigger window	Calibration (on chirp) at microphone when deployed
SM4BAT (Met N)	Met mast: mic at 98 m	32o50’49,05” S 22o34’29,96” E	SMM-U2	8	16k Hz	12 dB	FS, WAV@ 384 kHz	1 sec	Drop to approximately -8 dB at the microphone
SM4BAT (Met O)	Met mast: mic at 52 m	32o50’49,05” S 22o34’29,96” E	SMM-U2	8	16k Hz	12 dB	FS, WAV@ 384 kHz	1 sec	Drop to approximately -8 dB at the microphone
SM4BAT (Met P)	Met mast: mic at 8 m	32o50’49,05” S 22o34’29,96” E	SMM-U2	8	16 kHz	12 dB	FS, WAV@ 384 kHz	1 sec	Drop to approximately -8,8 dB at the microphone
SM4BAT (Mast Q)	Temporary mast: mic at 10 m	32o53’41,62” S 22o34’40,26” E	SMM-U2	8	16k Hz	12 dB	FS, WAV@ 384 kHz	1 sec	Drop to approximately -7,9 dB at the microphone

). Two SD memory cards, class 10 speed, with a capacity of 64 GB or 128 GB were utilized in each detector to ensure substantial memory space with high-quality recordings, even under conditions of multiple false environmental triggers. Each detector was set to operate in continuous trigger mode, from dusk each evening until dawn. Times were correlated with latitude and longitude and set to trigger half an hour (30 minutes) before sunset. The trigger mode setting for the bat detectors, which record frequencies exceeding 16 kHz and -18 dB, was set to record for the duration of the sound and 1 000 milliseconds (ms) after the sound ceased; this period is known as the trigger window (see

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).

Data were collected at various fixed locations and varying altitudes, representative of the area in general, and of each biotope present within the proposed study area. The position of the Met mast was determined by the developer and the bat monitoring systems on the Met mast represent the biotope associated with the plains of the Karoo (SANBI, 2012) vegetation type. Several factors informed the positions of temporary masts for the bat monitoring equipment. This included representation of the different biotopes on site, proximity to possible bat conducive areas and accessibility for installation of a mast.

The location of the monitoring systems is shown in **Error! Reference source not found.**. The monitoring equipment (Systems N, O and P) on the Met mast, which represents the northern part of the wind farm and the Karoo plains, are depicted in **Error! Reference source not found.**. System Q (**Error! Reference source not found.**), is situated next to an open farm dam, which may attract bats while there is water in the dam. The system is situated within a valley, with limited Karoo riverine vegetation typical of the area, and between two hills on both sides of the valley. Bats might roost in the rock formations along the hilly valley sides, and then traverse the valley to drink water. Valleys are also ecological corridors which bats might use as a flight path. The farm is grazed by livestock, and the droppings of the animals at the drinking trough close to system Q might attract some flies, which could serve as a food source for bats.

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SM4BAT (Mast Q)	Temporary mast: mic at 10 m	32º53'41,62" S 22º34'40,26" E	SMM-U2	8	16k Hz	12 dB	FS, WAV@ 384 kHz	1 sec	Drop to approximately -7,9 dB at the microphone

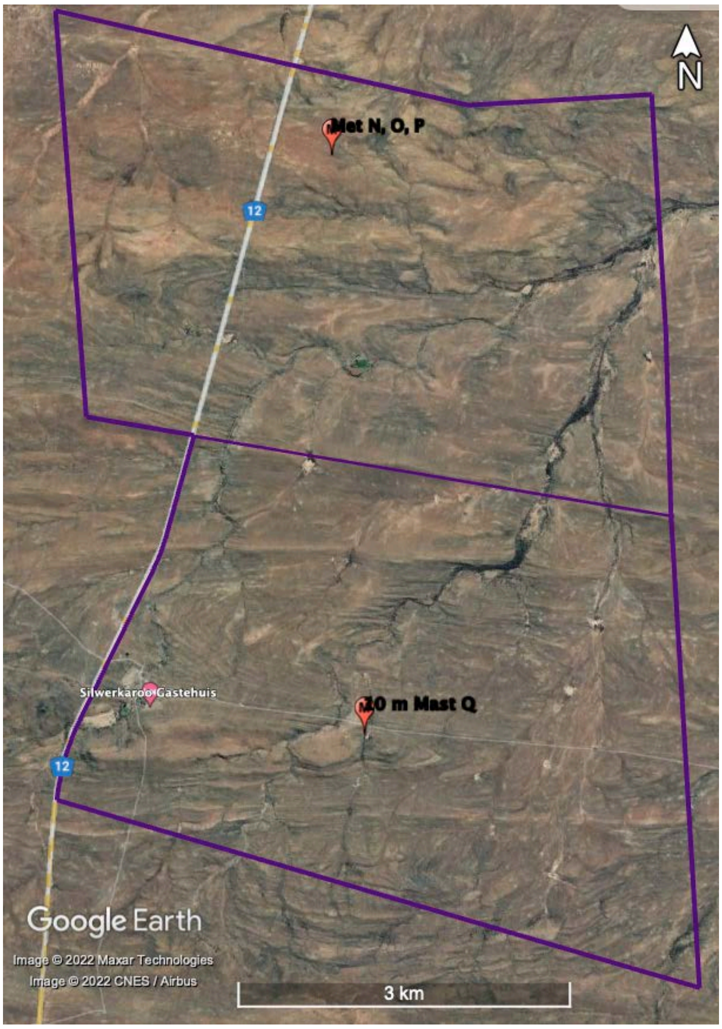


Figure 1: Positions of monitoring stations at the proposed Kraaltjies WEF

Figure 2: Bat monitoring equipment on the met mast

Figure 3: 10 m mast situated an open water source in a valley amongst two koppies with rock formations

1.2.4 *Roost Surveys*

Roost surveys were conducted when the bat specialist visited the site, and any known roosts were inspected. While areas, where possible roosts could be situated, were investigated, all roosting areas were not accessible, as bats sometimes roost in crevices or roofs with limited ceiling space. It should be noted that the site was large and searching the whole site for roosts was not possible within the time span and limitations of the bat monitoring study. The results of roost searches are discussed in Section 5.3.

1.2.5 *Driven transects*

Manual activity surveys, such as driven transects, are necessary to gain a spatial understanding of the bat species utilising the site. This is especially the case for the identification of key features, potential commuting routes and overall activity within and surrounding the site. Transects complement static monitoring surveys in terms of spatial coverage.

Depending on the season, some transects were performed during field visits. A SM4BAT full spectrum recorder with the microphone mounted on a pole was used for transects (Figure 4). Starting at sunset up to approximately two hours after sunset, the vehicle was driven at a speed between 10 to 20 km/h along a set route. As far as possible, transect routes were kept the same to allow for the comparison of data. Results from the transects are provided in Section 6.10.

Figure 4: Microphone mounted on a vehicle for transects

1.2.6 *Data Analysis*

Data were downloaded manually approximately once every three to four months. Acoustic files downloaded from the detectors were analysed for bat activity with respect to the number of bat passes and the bat species. The latest version of Wildlife Acoustics Kaleidoscope Pro was used for analysing large quantities of data. In cases where there is uncertainty about details of a call (which is confirmed as a bat calling), the call was classified as Unclear.

1.2.7 *Sources of Information*

The following information sources were used to inform this study:

- South African Bat guidelines as prescribed by the South African Bat Assessment Association, particularly South African Good Practice Guidelines for Surveying Bats in Wind Energy Facility Developments – Pre-construction Monitoring of Bats at Wind Energy Facilities. MacEwan *et al.* 2020.
- Bats of Southern and Central Africa: A Biogeographic and Taxonomic Synthesis. University of the Witwatersrand, Johannesburg. Monadjem *et al*. 2010, as well as the 2020 editions.
- Academic references and papers, as per the reference list (Section 13).
- **Climate and precipitation data sourced from various websites:** AccuWeather; Meteoblue; Climate.org, MSN.com, World Weather Online, Yr.no.

Environmental and other related Legislation:

- Department of Forestry, Fisheries and the Environment: https://egis.environment.gov.za/data_egis/data_download/current South African Energy Integrated Resource Plan 2010-2030 promulgated 3/2011 (www.Energy.gov.za)

Personal conversation:

- Personal conversations during field work sessions were conducted with the landowners of the WEF site, to establish if they are aware of any bat roosts on the properties and whether there are certain times of the year when there is higher bat activity on the proposed site.

Process information sourced from the client:

- Satellite images.
- Google Earth: https://www.google.com/earth/download/html.

Vegetation:

- Red List of South African Plants (SANBI).
- South African National Biodiversity Institute (SANBI), 2012: Vegetation Map of South Africa, Lesotho and Swaziland [vector geospatial dataset] 2012. Available from the Biodiversity GIS website: http://bgis.sanbi.org/SpatialDataset/Detail/18
- The Vegetation of South Africa, Lesotho and Swaziland, Strelitzia 19, South African National Biodiversity Institute, Pretoria. Mucina, L., and Rutherford, M.C., 2006.

1.3 IMPORTANCE OF BATS

Bats are the second largest group of mammals after rodents (Pennisi, 2020). Approximately 62 bat species occur in Southern Africa (De Villiers, 2022). Bats can be classified into three broad functional groups based on their wing morphology and echolocation call structure, namely: clutter, clutter-edge, and open-air foragers. Of these three groups, open-air foragers (i.e. bats with a wing design and echolocation calls adapted to flying fast and high above the vegetation) are at the most risk from wind turbine developments. However, all species that migrate over the proposed development will be at risk, regardless of their foraging behaviour.

Bats in general play important functional roles as insect predators, as well as pollinators and seed dispersers, in the case of fruit bats. Fruit bats are the main pollinators of numerous cacti species in the world because these plants open their flowers during the night (National Science Foundation, 2012).

In addition to the mortality and disturbance resulting from wind turbine developments, the major threats faced by bats include habitat destruction and change, roosting disturbance, and natural disasters (Geda and Balakrishnan 2013). Bat populations are sensitive to changes in mortality rates and tend to recover slowly from declines. In general, environment-related risks for bats associated with human behaviour include the reduction in food resources, overhunting of bats for bush meat, the maltreatment of bats due to misguided fears, such as those related to Covid-19, killing bats that roost in roofs, and a rise in the use of pesticides (MacFarland and Rocha, 2020; Geda and Balakrishnan, 2013). According to scientists, bats are one of the most endangered groups of animals on our planet (Bottollier-Depois et al., 2021).

The economic consequences of wide-spread loss of bat populations could be substantial, even more so in sensitive semi-desert environments. Although the loss of bats in Southern Africa has not been quantified in economic terms, literature indicates that insectivorous bats play a crucial role in the disruption of population cycles of agricultural pests (Boyles et al., 2011; National Park Service, 2020), resulting in a reduced cost of pesticides (see Figure 5 below). The cost of reduced pesticide usage stemming from bats controlling pests in the USA has been quantified, resulting in a saving of more than an estimated $3,7 billion (National Park Service, 2020).

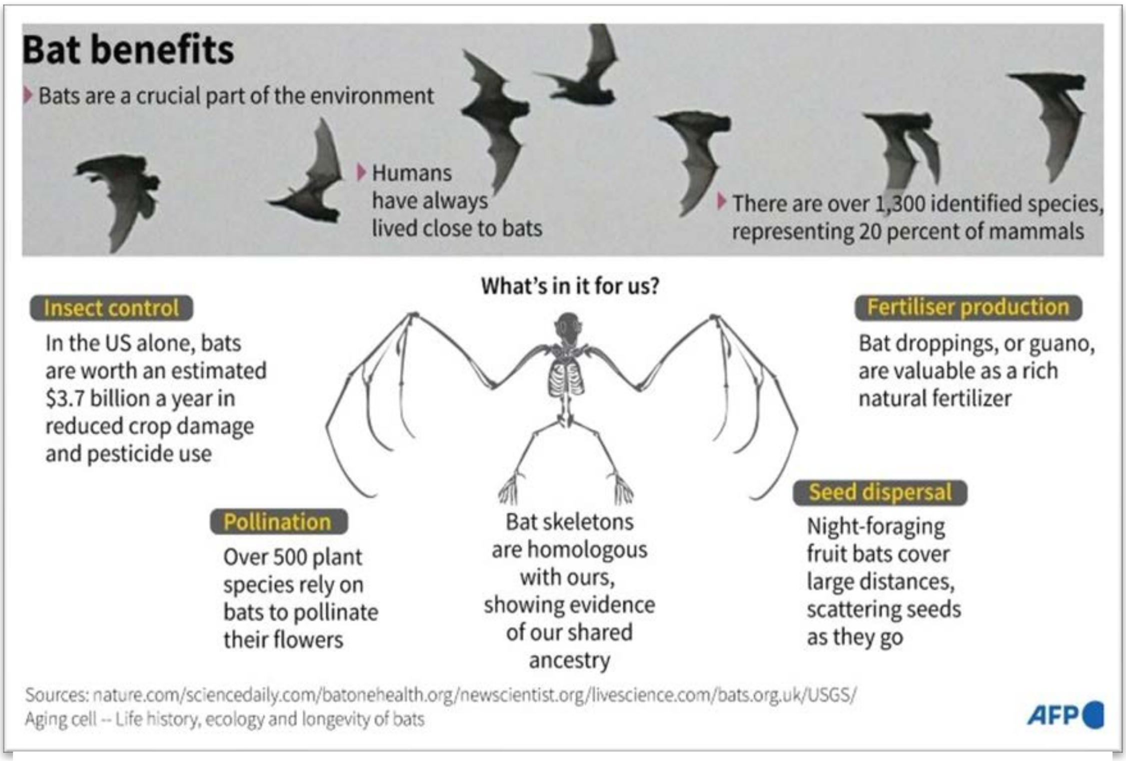


Figure 5: The importance of bats

The consumption of insects by insectivorous bats also plays a role in the control of diseases that afflict humans, such as malaria and dengue. Insectivorous bat species consume large numbers of mosquitoes (typically equivalent to their own body weight per night) and flies, the most important vectors in the transmission of these diseases (Monadjem et al., 2010; National Science Foundation, 2012). Malaria afflicts millions of people in Africa and the contribution bats make to reduce the number of insects that transmit diseases should not be underestimated (Monadjem et al., 2010).

Several distinctive attributes of bats, including the membranes of bat wings and their echolocation, were the inspiration behind some technology-related breakthroughs within the field of engineering, such as drones with navigating sonar systems (National Park Service, 2020; National Science Foundation, 2012). Further examples are base jumper wingsuits, sonar navigation for ships and ultrasound.

Studies have revealed that blind people, as well as those that are visually impaired, use echolocation to establish the position of an object (Science Daily, 2013). Researchers also assessed the saliva of vampire bats as practicable medication to treat strokes in humans (ESA, 2011), as the enzyme that prevents blood from coagulating when vampire bats feed can be used to prevent or break down blood clots in stroke patients. The drug known as “Draculin” has since been derived.

1.4 DOMINANT BAT SPECIES AT THE PROPOSED KRAALTJIES WEF

1.4.1 *Tadarida aegyptiaca*

In the Karoo environment, and at the proposed Kraaltjies WEF project site, *Tadarida aegyptiaca*, has proven to be the species with the highest risk of negative impact from wind developments to date. This bat species is known to forage over a wide variety of habitats (an approximate range of occurrence of 1,340,000 km^2) (Eiting, 2020; Monadjem *et al*., 2020). Generally, *T. aegyptiaca* flies effortlessly above the vegetation's canopy, including agriculture-related fields, grassland, savanna, semi-desert scrub, and desert habitats (Monadjem *et al*., 2020). *T. aegyptiaca* consumes insects in the orders Lepidoptera (butterflies and moths) and Hymenoptera (sawflies, wasps, bees and ants), which are considered pest insects in agricultural systems (Eiting, 2020). This bat species tends to move away from clutter and is a true open-air forager. Within arid environments, the presence of these bats is associated with water bodies that do not dry up and/or standing water that attracts concentrated densities of insects. *T. aegyptiaca* females only give birth to a single pup annually.

In previous years, before the increase in WEFs, *T. aegyptiaca* was not perceived to be under threat (MacEwan *et al*., 2016), as their distribution is widely spread over Southern Africa. However, currently, there is a serious cumulative threat from WEFs. Furthermore, the possibility that *T. aegyptiaca* could be subdivided into more than one species or sub-species, is at present being debated amongst zoologists and genetics specialists. If this is the case, wind farms concentrated on certain biomes in South Africa, could threaten a species or sub-species that have not been described yet. Of all the South African bat species, data indicate that *T. aegyptiaca* presents the highest fatality, and with a sharp increase in WEFs, one could expect that this trend will continue.

1.4.2 *Neoromicia capensis*

When compared to all other bats from Southern Africa, it is likely that *N. capensis* (the Cape Serotine bat) has the most wide-ranging distribution; an approximate range of 1,392,522 km^2 within Southern Africa (Monadjem et al., 2020; Monadjem et al., 2016). This bat species occurs in every part of the Southern African region (Monadjem et al., 2016). *N. capensis* seems to exploit a variety of environmental conditions, which include arid semi-desert localities, as well as montane grasslands, forests, savanna, and to a smaller extent, low-lying savanna. They also seem to forage at various altitudes, and even though they are seen as a clutter-edge forager, a high number of carcasses of this species have been collected at wind farms to date, indicating that they do forage in the open air. The static data collected from high altitudes also confirm the presence of this species within the sweep of the turbine blades.

The females of this bat species have their birthing period once a year, during which twins are frequently born; although a single pup, triplets, as well as quadruplets, have been documented in the past (Monadjem et al., 2020). Even though *N. capensis* currently has large population numbers, a continuous, gradual decline in population numbers in certain areas can be expected, based on the number of confirmed deaths from wind turbines (Monadjem et al., 2020; Monadjem et al., 2016).

N. capensis, with its clutter-edge foraging style, has a particular role to play in controlling insect populations that damage crops (Monadjem et al., 2016). Individuals of the species have been formally recorded hunting insects in groups, frequently gathering above water sources. This could be a particularly effective strategy in mosquito control.

1.4.3 *Sauromys petrophilus*

S. petrophilus (Roberts' flat-headed bat) has an extensive, albeit patchy, distribution all through Southern Africa (Monadjem et al., 2020; Jacobs et al., 2022). The dispersion of *S. petrophilus* expands towards the south into the Western Cape and towards the east along the northern border of South Africa.

S. petrophilus is closely connected with rocky habitats, which accounts for its uneven distribution within its range (Jacobs et al., 2022). These habitats are typically found in dry woodland areas within mountain fynbos, or localities with arid scrubs, such as the arid areas in the western part of southern Africa. *S. petrophilus* is largely confined to rocky regions, requiring narrow rock crevices, as well as fissures and exfoliating rock slabs (underneath which they roost) for roosting during the day, where they normally roost together in small groups of up to 10 bats (Monadjem et al., 2020).

S. petrophilus is an open-air forager (Monadjem et al., 2020; Jacobs et al., 2022) and feeds primarily on Diptera, Hemiptera, and Coleoptera, thus helping to control insect populations that can destroy crops (Jacobs et al., 2022).

It was observed in Namibia that these species need frequent access to water resources due to high levels of heterothermy (Monadjem et al., 2020; Jacobs et al., 2022).

The direct fatality risk of this species is increasing with the potential increase in wind farms, particularly in the Western Cape and along the Northern Cape coastline (Jacobs et al., 2022). A further risk is that an increase in renewable energy developments in specific areas may reduce the habitat available to this species in the Northern, as well as Western Cape.

Little data exist about the reproductive ecology of this bat species; however, there is evidence of a pregnant and lactating *S. petrophilus* female in the middle of November in Zimbabwe (Monadjem et al., 2020; Jacobs et al., 2022).

1.4.4 *Miniopterus natalensis*

Miniopterus natalensis is listed as a Near Threatened species and is a widespread insectivorous cave-dependent bat species. In South Africa they may be experiencing a localised decline. Their presence is influenced by suitable cave roosting sites (Monadjem, et al., 2020). They occur in large colonies, often as part of mixed-species colonies. The extent of occurrence is calculated as 1 387 139 km^2 (MacEwan, et al., 2016).

Males are larger than females. Breeding occurs seasonally with mating in late autumn to winter. Females give birth to a single pup in spring to summer after 3-4 months gestation and the mother carries and nurses her pup while foraging till the pup transitions to solid food. Migration, up to 150 km, occurs from winter to spring and summer.

They feed primarily on insects captured during flight such as moths, beetles and flies that destroy crops, foraging along clutter edges and in open areas. They roost in caves, such as De Hoop Guano Cave in the Western Cape, in their thousands, and in dark sheltered areas such as rock crevices or derelict mines (Monadjem, et al., 2020).

Peak nightly activity usually occurs 2-3 hours after sunset and sometimes during the last 3 hours before sunrise. Weather influences activity and heavy rains and wind shorten and prevent flights. Females leave the roost first at night and return later in the morning. Males are active during the middle of the night. The greatest female activity is due to increased food and water requirements during pregnancy and lactation (Smith, 1833).

It is important to consider the potential impact of renewable energy facilities on *M. natalensis* and their habitat regarding the development of renewable wind energy. As the species relies on caves and dark, sheltered areas for roosting, the timing of the construction of wind turbines and associated infrastructure could potentially disrupt their reproduction (Pretorius, et al., 2021), if construction activities take place close to a bat roost.

2. ASSUMPTIONS AND LIMITATIONS

The following limitations apply to this study:

- Knowledge of several ecological aspects and behaviours, such as migration distances, flying height, population sizes, temporal movement patterns, etc., of several South African species is limited. Consequently, the impact of WEFs on such bat species is also unknown.
- Monitoring bats with acoustic detectors is an internationally accepted method to assess bat activity levels and species richness; however, the use of bat detectors has limitations. Acoustic monitoring can only provide an estimate of relative bat activity levels and not provide total population estimates of how many individuals are present on site, as the same individual could pass the detector more than once.
- Due to an overlap of calls, it is not possible to provide an exact number of bats passing the recorder. Therefore, the number of bats passing is not an exact count, but rather indicates activity, and is as close as possible under the given circumstances and within the limitations of the survey technique applied.
- The recording of echolocation calls is dependent on the species being recorded (some species emit 'softer' calls than others) and weather conditions (high humidity and high wind speeds will reduce recording distance as it attenuates call intensity). Therefore, any monitoring based on echolocation calls covers only a limited area, depending on the type and intensity of the call.
- The accuracy of the species identification is also dependent on the quality of the calls. Species identification through echolocation calls is complex. Bats alter the frequencies and durations of their calls based on whether they are feeding, commuting, or migrating. They may also alter call characteristics based on the habitat and surrounding vegetation. There are several species with overlapping frequencies that makes identification challenging. For this study, if the species of a recording is unidentifiable, the species identification of the recording were marked as 'unclear'. Recordings for which the species identification was 'unclear' were still included in the analyses.
- Transects only provide a snapshot in time and do not convey enduring spatial distribution of bat activity across the project site. However, transects are useful in eliciting areas or time periods of high activity for the duration of the site visit.
- It is not possible to search the entire study area as well as the wider terrain for bat roosts; However, the project site was driven and walked through as thoroughly as possible, keeping in mind the time constraints of an environmental assessment.
- The data collected during this study provided a baseline of bat activity across the project site for the relevant monitoring period. Future bat activity patterns and inter-annual variations cannot be accurately inferred from this data, and as such, bat activity in the future could vary substantially from the results presented here.

3. TECHNICAL DESCRIPTION

3.1 PROJECT LOCATION

The proposed Kraaltjies WEF site is located on farmland in the Central Karoo in the Western Cape (Figure 6). The site lies to the east of the N12 national road, approximately 60 km south of the town of Beaufort West and 60 km east of Prince Albert, as the crow flies (32°54'53.66" S; 22°33'01.10" E - Google Maps, 2022). The Swartberg Mountain Range lies to the south of Kraaltjies Farm and the Nuweveldberge are located to the north.

The project site is located on Portion 10 and Portion 25 of the Farm Brits Eigendom No. 374 within the Beaufort West Municipality in the Central Karoo District Municipality, en route to Beaufort West.

Figure 6: Locality map for the proposed Kraaltjies WEF (Google Earth)

3.2 PROJECT DESCRIPTION

Mainstream proposes to construct and operate an up to 240 MW WEF and associated infrastructure.

The proposed project will cover an area of approximately 3 995 ha. The following project details are proposed for the development, see Figure 7:

- Up to 200 m hub height;
- Road servitude of 8 m;
- One new 11 kV - 33/132 kV on-site substation (including IPP & Eskom portions);
- A Battery Energy Storage System (BESS);
- One construction laydown/staging area of up to approximately 3 ha is to be located on the site identified for the substation; and
- Operation and Maintenance buildings.

Grid connection infrastructure will consist of an overhead power line up to 132 kV and a 33 kV/132 kV project on-site substation. The BESS, IPP and Eskom portion of the on-site substation will cover a surface area of up to 25 ha. The 132 kV grid connection and Eskom switchyard portion will form part of a separate Basic Assessment (BA) process and are therefore not included in this WEF and associated infrastructure EIA application. The bat assessment will focus to a large extent on the turbine layout as this is the aspect of the proposed project that impacts bats specifically.

The proposed development is informed by the South African national, regional, and municipal proposition in the Integrated Resource Plan (IRP) 2010-2030 that 17 800 MW of renewable energy capacity should be secured by 2030 (energy.gov.za).

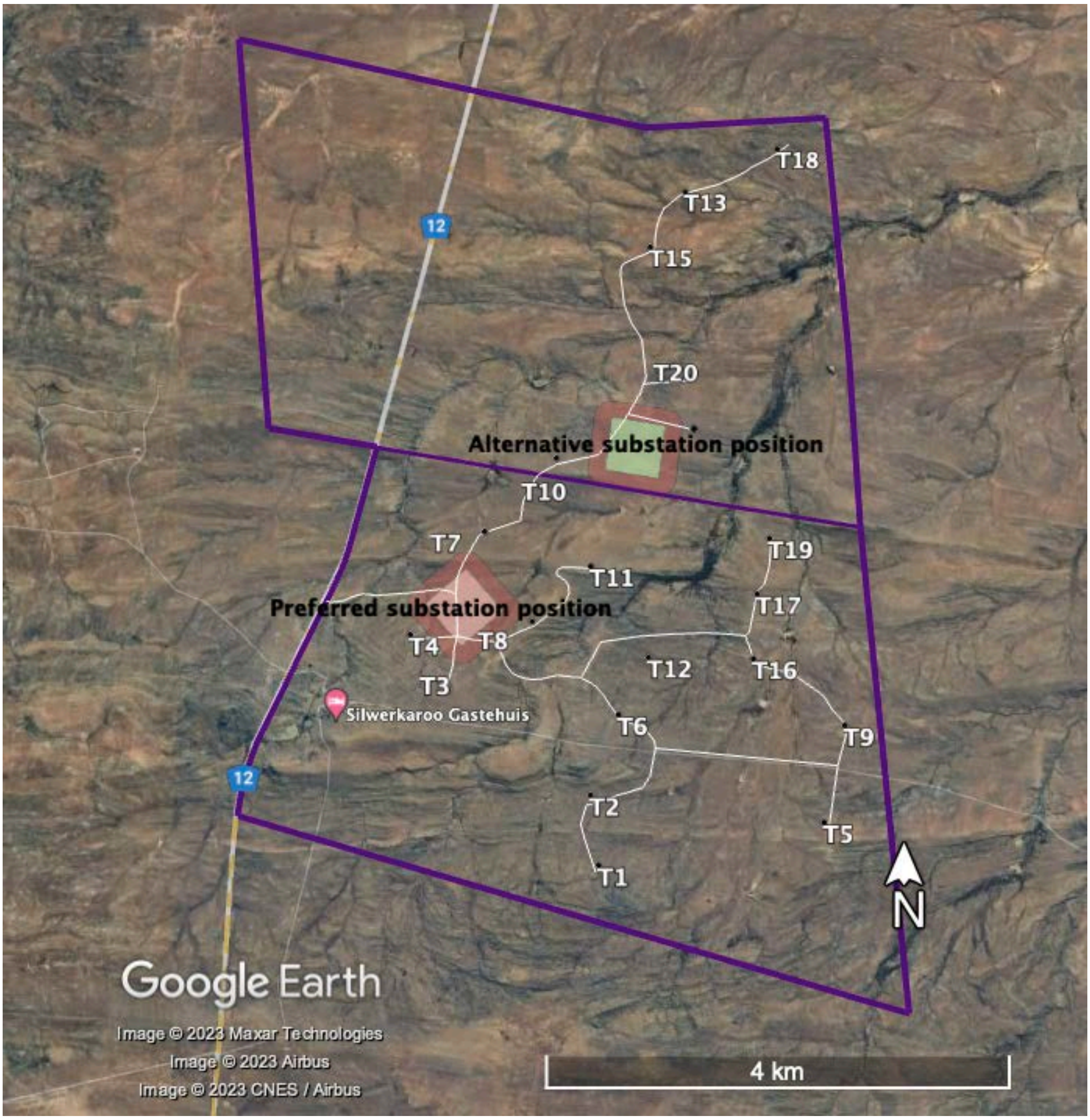


Figure 7: The proposed Kraaltjies WEF

4. LEGAL REQUIREMENTS AND GUIDELINES

Environmental law in the form of legislation, policies, regulations, and guidelines guide and manage development practices to ensure informed decision-making and sound risk management of current and future projects, i.e., the impact of the proposed development on the ambient bat environment. The applicable legislation is listed below.

- Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996);
- National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended (NEMA);
- National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004);
- Northern Cape Nature Conservation Act, 2009 (Act No. 9 of 2009);
- Convention on the Conservation of Migratory Species of Wild Animals (1979);
- Convention on Biological Diversity (1993);
- The Equator Principles (2013);
- The Red List of Mammals of South Africa, Swaziland, and Lesotho (2016);
- National Biodiversity Strategy and Action Plan (2005); and
- Aviation Act (Act no 74 of 1962).

In terms of the Environmental Impact Assessment (EIA) Regulations, which were published on 04 December 2014 [GNR 982, 983, 984 and 985) and amended on 07 April 2017 [promulgated in Government Gazette 40772 and Government Notice (GN) R326, R327, R325 and R324 on 7 April 2017], various aspects of the proposed WEF development are considered listed activities under GNR 327 and GNR 324 which may have an impact on the environment and therefore require authorisation from the National Competent Authority, namely the Department of Forestry, Fisheries and the Environment (DFFE), prior to the commencement of such activities. Based on this, a full EIA Process is being undertaken to identify and assess the impacts associated with the proposed WEF, including measures to mitigate and/or address potential impacts. Specialist studies have also been commissioned as part of this process to assess and verify the project under the new Gazetted specialist protocols.

The proposed development is informed by the South African national, regional, and municipal proposition in the Integrated Resource Plan (IRP) 2010-2030 that 17 800 MW of renewable energy capacity should be secured by 2030 (energy.gov.za).

In addition to the laws indicated above, guidelines have also been developed by the South African Bat Assessment Association (SABAA) to inform wind energy development:

- The South African Good Practice Guidelines for Surveying Bats in Wind Farm Developments – Pre-Construction (MacEwan *et al.*, 2020);
- Mitigation Guidance for Bats at Wind Energy Facilities in South Africa (Aronson *et al*., 2018);
- South African Bat Fatality Threshold Guidelines (MacEwan *et al*., 2018); and
- Good Practice Guidelines for Operational Monitoring for Bats at Wind Energy Facilities (Aronson *et al*., 2020).

5. DESCRIPTION OF THE RECEIVING ENVIRONMENT

5.1 BACKGROUND INFORMATION

A literature review of existing reports, studies and guidelines, legislation and SANBI and SA government GIS database, as well as site visits relevant to the study area, were conducted to establish a background study of the site and associated environment.

5.2 REGIONAL VEGETATION AND CLIMATE

5.2.1 *Climate*

The weather details are provided for Beaufort West, situated approximately 60 km, as the crow flies, from the terrain.

The summers in the area are hot and the winters are cold, dry, and windy, with average temperatures varying from 4 °C to 33 °C (Figure 8). The hottest months of the year are January and February, while the coldest months of the year are June and July. While it is mostly dry and clear year-round, rain can fall throughout the year. Highest rainfall on average is in March, with lowest average rainfall in July (Meteoblue, 2021). Humidity levels are consistently low throughout the year. The highest windspeeds are experienced from September to March, with average wind speeds of more than 13 km/hour. The windiest month of the year is December, with an average hourly wind speed of 15 km/hour.

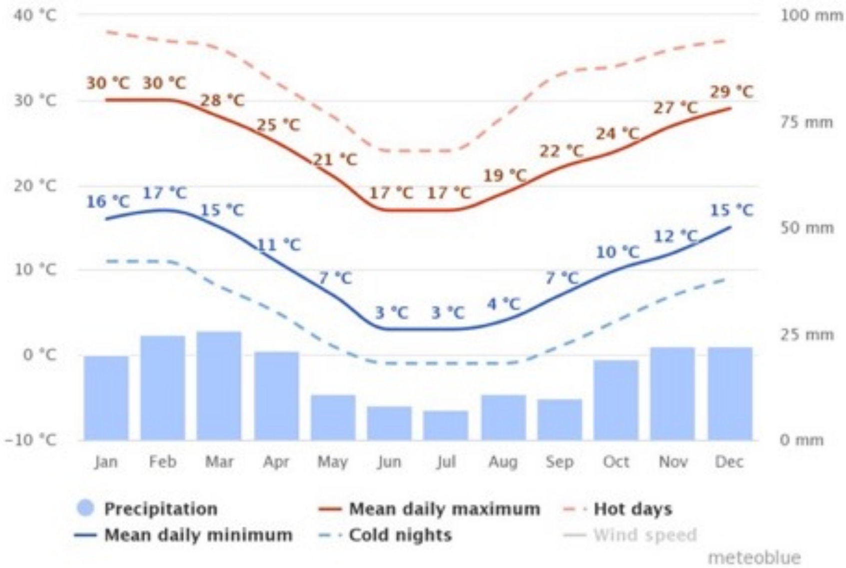


Figure 8: Climate of Beaufort West (Modified after Meteoblue, 2022)

5.2.2 *Vegetation*

The proposed study area falls within the Nama Karoo Biome, which is regionally situated within the Lower Karoo Bioregion, with Gamka Karoo (Figure 9) being the single dominant vegetation type found within the study area

(SANBI, 2012). The Gamka Karoo vegetation unit occurs mainly in the Western and Eastern Cape Provinces, between the Great Escarpment (Nuweveld Mountains) in the north and the Cape Fold Belt mountains (mainly the Swartberg Mountains) in the south. The landscape is comprised of slightly undulating plains, covered with dwarf spinescent shrubland and low trees. Following good rains, drought-resistant grasses may dominate on the sandy basins. The Gamka Karoo is considered one of the most arid units of the Nama Karoo Biome. Rainfall occurs mainly in summer and autumn, with a peak in March/April. Although only 2% of this vegetation type is formally conserved in the Karoo National Park, very little is transformed and is therefore considered Least Threatened (Mucina & Rutherford, 2012).

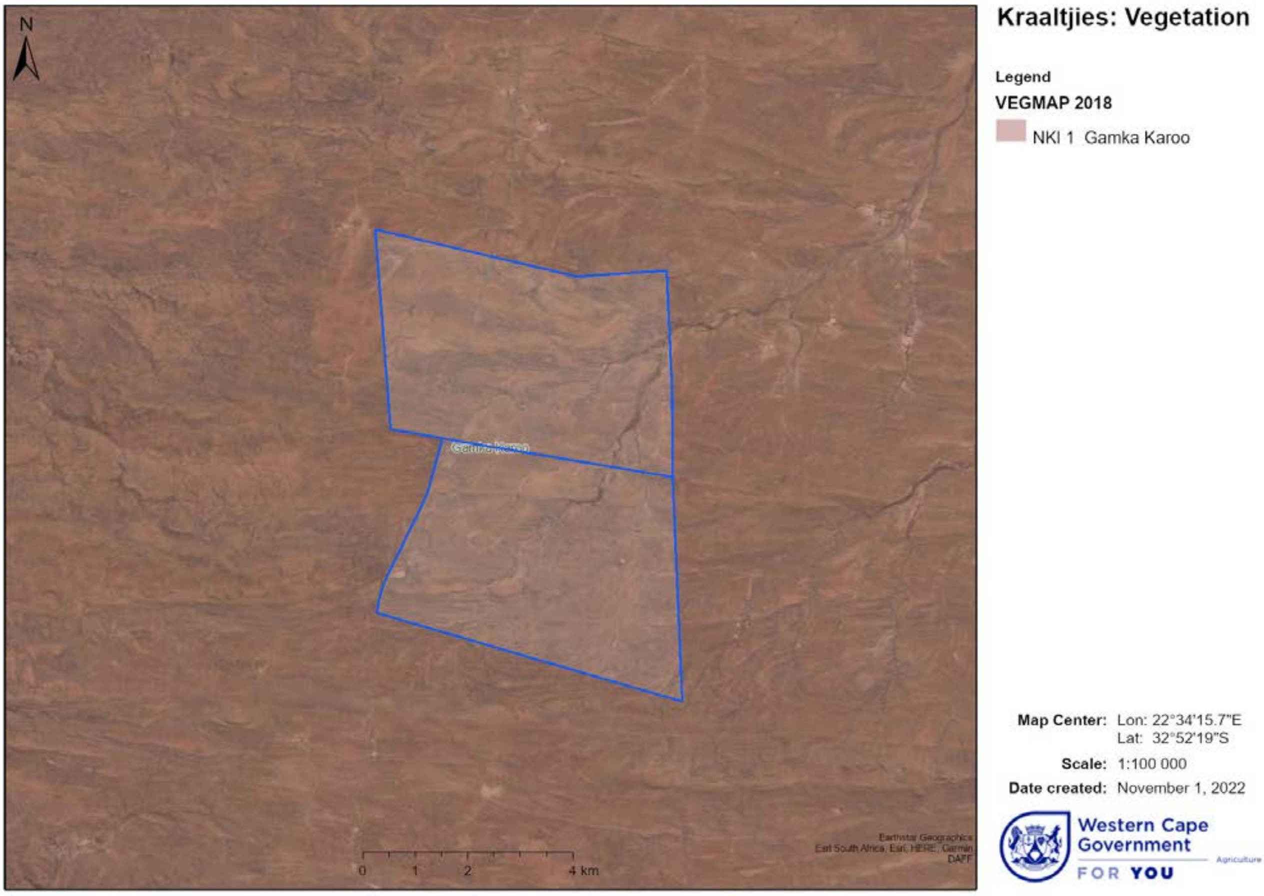


Figure 9: Vegetation Zones at the proposed Kraaltjies WEF site (WCG 2021)

5.2.3 Protected areas

Although not situated close to any formally protected areas, various protected areas are located towards the south of the site, in the vicinity of the Swartberg mountains (

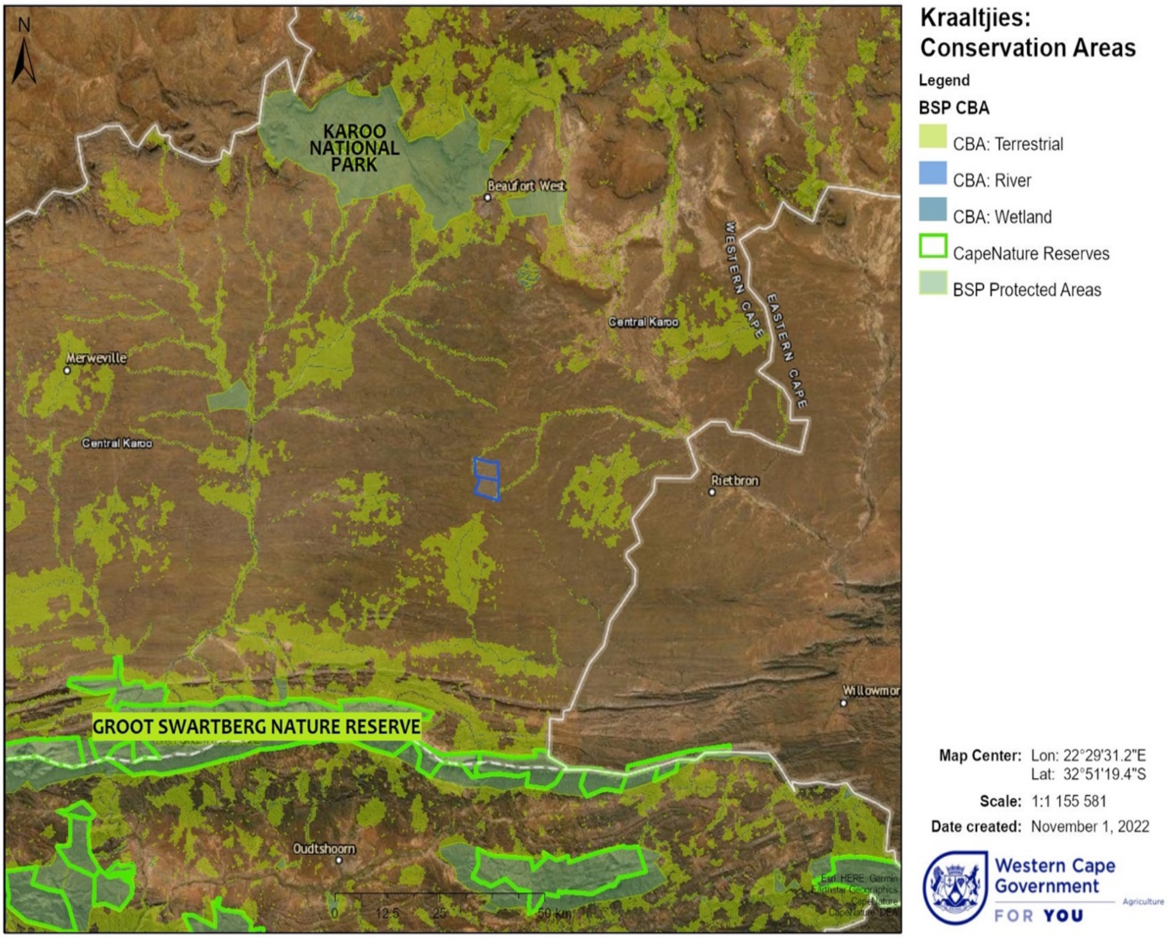


Figure 10). As the crow flies, the Henry Kruger Private Reserve, the nearest registered reserve, is situated 60 km to the northwest and the Karoo National Park is situated approximately 70 km to the north. There is a large Critical Biodiversity Area (CBA) to the south and southeast of the proposed Kraaltjies WEF site, but no CBA on the actual WEF site itself.

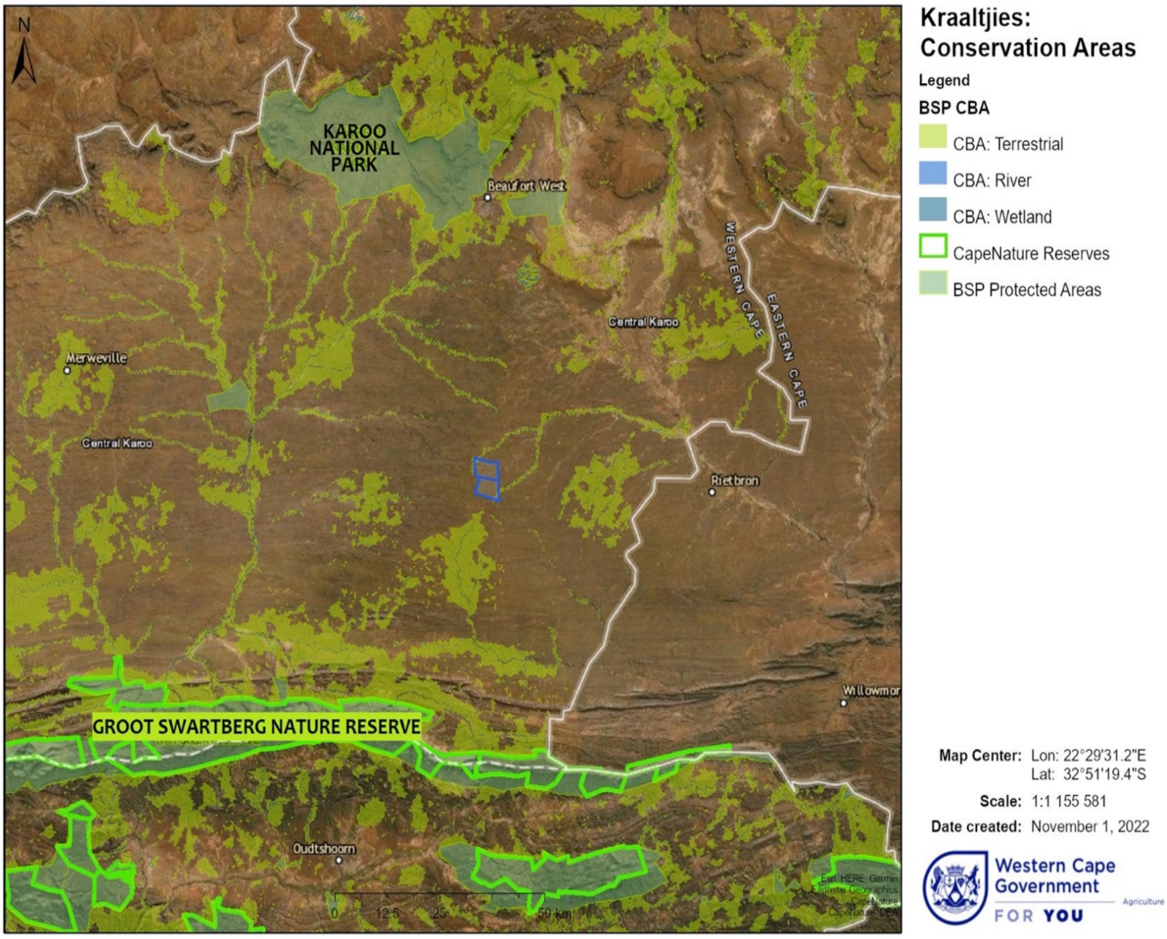


Figure 10: Conservation areas in proximity to the proposed Kraaltjies WEF

5.2.4 Land use

The towns in the areas are spread-out and the area supports large, dispersed farm units. Because of the low average annual rainfall, the carrying capacity in the Kraaltjies area is low, resulting in large farm units (Figure 11). The soil on site is bluish-coloured shallow shale and the fine-grained sedimentary rock supports thinly dispersed and stunted vegetation. Merino and Dorper sheep and Angora goats are the most common livestock in the area, as the vegetation can sustain small livestock numbers. Many of the farmers now concentrate on game (https://www.karoo-southafrica.com/koup/; 2019).

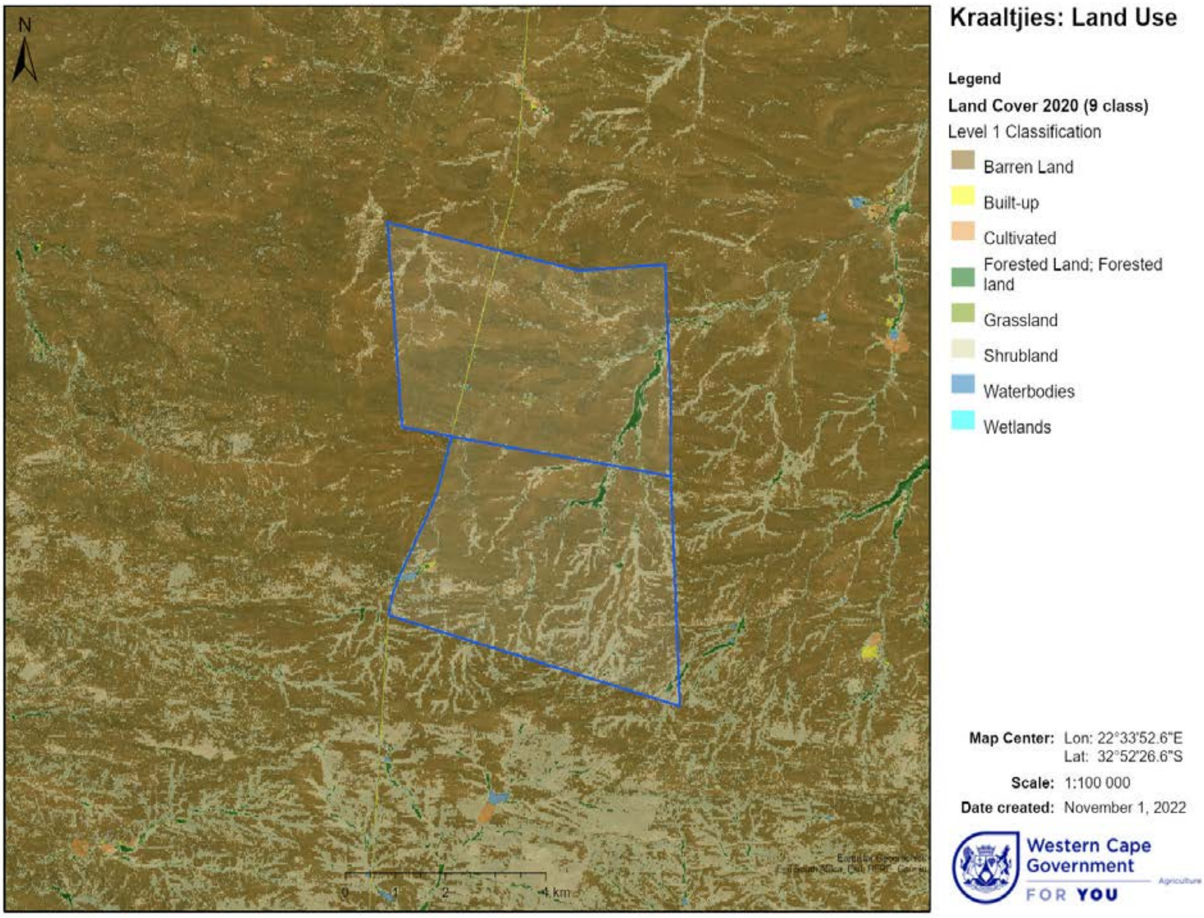


Figure 11: Different types of land use in and around the proposed Kraaltjies WEF

5.2.5 Water resources

Although there are no permanent waterbodies on the development terrain, there are numerous dry water courses and non-perennial water bodies, see Figure 12. During rainy spells, water collects in these non-perennial ditches, depressions, and farm dams. Not only could these temporary open water sources provide water for bats to drink, but stagnant water could be a breeding ground for insects, which in its turn attracts bats.

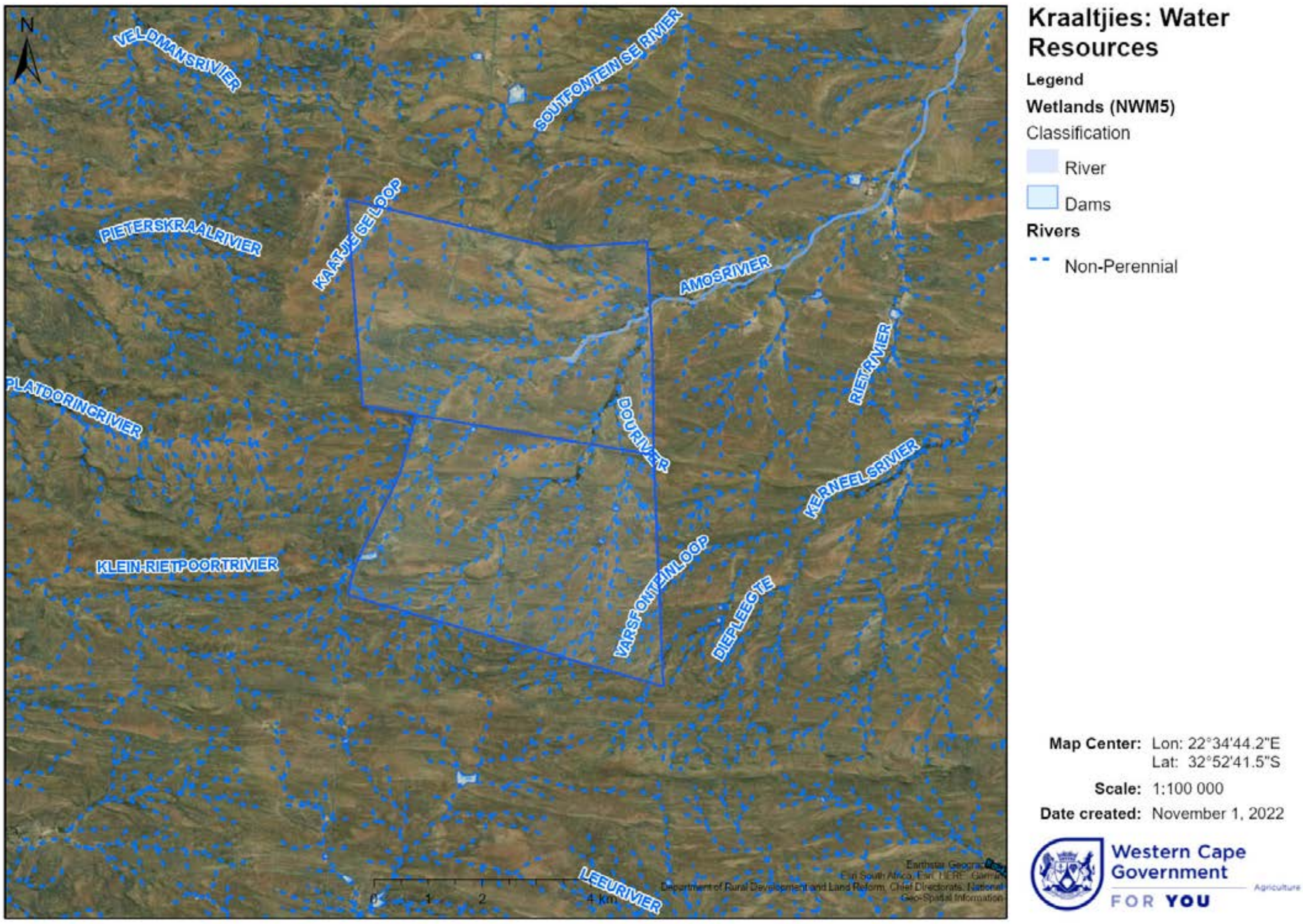


Figure 12: Natural non-perennial water courses

5.3 FEATURES CONDUCIVE TO BATS AT THE WEF

Bats are dependent on suitable roosting sites provided mainly by human structures, vegetation, exfoliating rock, rocky outcrops, derelict mine and aardvark holes and caves (Monadjem et al., 2020). The foraging utility of a site is further determined by water availability and availability of food. Thus, the vegetation, geomorphology and geology of an area are important predictors of bat species diversity and activity levels.

5.3.1 Vegetation

Although most of the site is covered in Gamka Karoo vegetation typical of the area, trees situated in the non-perennial riverbeds could provide roosting opportunities for bats that prefer roosting in vegetation or under the bark of trees (Figure 13).

Figure 13: Relatively dense vegetation along the dry riverbeds

5.3.2 Rock formations and rock faces

Rock formations along the hill tops and along the river valleys provide ample roosting opportunities for bats. Bats can also make use of abandoned burrows as roosts. Figure 14 depicts examples of rock formations and a derelict aardvark hole is shown in Figure 15.

Figure 14: Rock formations along the hill tops

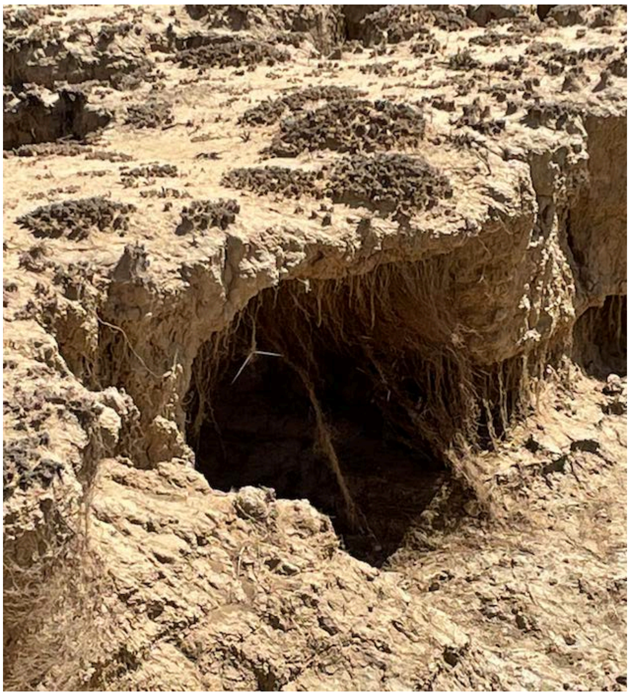


Figure 15: Animal burrows or possible aardvark holes that could provide roosting opportunities for bats

5.3.3 Human dwellings

Where roofs are not sealed off, human dwellings could provide roosting space for some bat species. Evidence of bats were found in more than one of the farm buildings situated within the borders of the proposed Kraaltjies WEF site. Bat droppings were seen at farm dwellings (Figure 16). Although no roost activities were found at culverts and stone walls situated on Kraaltjies, these could also provide roosting opportunities (Figure 17 and Figure 18).

Figure 16: Signs of bat roosts at the farm dwelling at Silwer Karoo

Figure 17: Possible roosting structures

Figure 18: Stone walls at the farmhouse providing roosting opportunities for bats

5.3.4 Open water sources

Water troughs for the livestock and open dams and cement reservoirs provide permanent, open water sources for bats throughout the year (Figure 19). In the dry Nama-Karoo environment, these manmade water resources play an important role in bat activity on site. Figure 12 depicts the water resource and drainage system within the proposed Kraaltjies WEF area. Two relatively large rivers with Karoo riverine vegetation, the Amos- and the Dou rivers, occur in the eastern and north-eastern sections of the proposed WEF. Although these are non-perennial rivers, water collects in the riverbeds during rainy spells. The potential attraction of insects together with ample vegetation cover, provide ideal flight corridors and roosting opportunities for bats, especially those species that prefer to forage amongst vegetation.

Figure 19: Permanent, open water source

5.3.5 Food sources

During the few spells of rain, stagnant water that usually collects in small pans and dry ditches could serve as breeding grounds for insects which could serve as food for bats. High insect activity results in higher bat presence after sporadic rainy periods. Livestock also attracts flies, which in turn could serve as a food source for bats.

5.4 BACKGROUND TO BATS IN THE AREA

The extent to which bats may be affected by the proposed wind farm will depend on the extent to which the proposed development area is used as a foraging site or as a flight path by local bats.

A summary of bat species distribution, their feeding behaviour, preferred roosting habitat, and conservation status is presented in **Error! Reference source not found.**. The bats identified in **Error! Reference source not found.** have distribution ranges that include the proposed Kraaltjies WEF development site and bat presence confirmed on the site itself, or other wind farms in the area, are marked as such. The proposed WEF is located within the distribution range of six families and approximately 12 species. **Error! Reference source not found.** is informed by the most recent distribution maps of Monadjem, et al. (2010 and 2020). The information in **Error! Reference source not found.** will be updated as required, based on the outcomes of the monitoring programme.

Of the 12 species with distribution ranges that include the proposed development area, four have a conservation status of Near Threatened and one Vulnerable in South Africa, while three have a global conservation status of Near Threatened. *Eptesicus hottentotus* (the Long-tailed serotine), *Cistugo seabrae* (the Angolan wing-gland bat) and *Rhinolophus capensis* (Cape horseshoe bat) are endemic to Southern Africa and have limited suitable habitat left, mainly due to agricultural activities (Monadjem, et al., 2020).

According to the likelihood of fatality risk, as indicated by the latest pre-construction guidelines (MacEwan, 2020) four species, namely *Miniopterus natalensis* (Natal long-fingered bat), *T. aegyptiaca* (Egyptian free-tailed), *S. petrophilus* (Roberts's flat-headed bat) and *N. capensis* (Cape serotine) have a high risk of fatality. The high risk of fatality for *T. aegyptiaca* and *S. petrophilus* is due to their foraging habitat at high altitudes, while *N. capensis*, though known as a clutter-edge forager, tends to forage at various altitudes, including within the sweep of turbine blades. *Myotis tricolor* (Temminck's myotis bat) has a medium to high risk of fatality while *E. hottentotus* has a medium risk of fatality.

The two Pteropodidae species, with a medium to high risk of fatality, are not expected to roost on the proposed Kraaltjies WEF development, as this environment is not expected to be their preferred habitat; however, they could traverse over the project site during migration and are therefore included.

Table 2: Potential bat species occurrence at the proposed Kraaltjies WEF site. Highlighted yellow cells indicate confirmed presence at the development site. Information about the species is from Monadjem, et al. 2010 and 2020

Family	Species	Common Name	SA conserva-tion status	Global conserva-tion status (IUCN)	Roosting habitat	Functional group (type of forager)	Migratory behaviour	Likelihood of fatality risk*	Bats confirmed in vicinity
PTEROPODIDAE	*Eidolon helvum*	African straw-coloured fruit	Not evaluated	Least Concern	Little known about roosting behaviour	Broad wings adapted for clutter. Studies outside of South Africa list fruit and flowers in its diet.	Migrater. Recorded migration up to 2 518 km in 149 days, and 370 km in one night.	Medium-High	
	Rousettus aegyptiacus	Egyptian rousette	Least Concern	Least Concern	Caves	Broad wings adapted for clutter. Fruit, known for eating Ficus species.	Seasonal migration up to 500 km recorded. Daily migration of 24 km recorded.	Medium-High	
MINIOPTERIDAE	*Miniopterus natalensis*	Natal long-fingered bat	Near Threatened	Near Threatened	Caves	Clutter-edge, insectivorous	Seasonal, up to 150 km	High	✓
NYCTERIDAE	*Nycteris thebaica*	Egyptian slit-faced bat	Least Concern	Least Concern	Cave, Aardvark burrows, road culverts, hollow trees. Known to make use of night roosts.	Clutter, insectivorous, Avoid open grassland, but might be found in drainage lines	Not known	Low	

Family	Species	Common Name	SA conserva-tion status	Global conserva-tion status (IUCN)	Roosting habitat	Functional group (type of forager)	Migratory behaviour	Likelihood of fatality risk*	Bats confirmed in vicinity
MOLOSSIDAE	*Tadarida aegyptiaca*	Egyptian free-tailed bat	Least Concern	Least Concern	Roofs of houses, caves, rock crevices, under exfoliating rocks, hollow trees	Open-air, insectivorous	Not known	High	✓
	Sauromys petrophilus	Robert's Flat-headed bat	Least Concern	Least Concern	Narrow cracks, under exfoliating of rocks, crevices.	Open-air, insectivorous		High	✓
RHINOLOPHIDAE	*Rhinolophus capensis*	Cape horseshoe bat (endemic)	Near Threatened	Near Threatened	Caves, old mines. Night roosts used	Clutter, insectivorous	Not known	Low	
	Rhinolophus clivosus	Geoffroy's horseshoe bat	Near Threatened	Least Concern	Caves, old mines. Night roosts used	Clutter, insectivorous		Low	
VESPERTILIO-NIDAE	*Neoromicia capensis (now Laephotis capensis)*	Cape serotine	Least Concern	Least Concern	Roofs of houses, under bark of trees, at basis of aloes	Clutter-edge, insectivorous	Not known	High	✓
	Myotis tricolor	Temminck's myotis	Near Threatened	Least Concern	Roosts in caves, but also in crevices in rock faces,	Limited information available	Not known	Medium-High	

Family	Species	Common Name	SA conserva-tion status	Global conserva-tion status (IUCN)	Roosting habitat	Functional group (type of forager)	Migratory behaviour	Likelihood of fatality risk*	Bats confirmed in vicinity
					culverts and manmade hollows				
	Eptesicus hottentotus	Long-tailed serotine (endemic)	Least Concern	Least Concern	Caves, rock crevices, rocky outcrops	Clutter-edge, insectivorous	Not known	Medium	✓
	Cistugo seabrae	Angolan wing-gland bat (endemic)	Vulnerable	Near Threatened	Possibly buildings, but no further information	Clutter-edge, insectivorous	Not known	Low	

**Likelihood of fatality risk as indicated by the pre-construction guidelines (MacEwan et al., 2020)*

*** Nycteris thebaica has been re-classified in Monadjem et al., (2020)*

6. SPECIALIST FINDINGS / IDENTIFICATION AND ASSESSMENT OF IMPACTS

6.1 STATIC RECORDERS

Passive monitoring data for the period between 15 August 2021 and 12 November 2022 are included in this report. It is important to note that static recordings have limitations, as discussed in Section 2, but do provide a scientifically sound method of assessing the bat situation on site. The bat species identified and the number of bat passes during static recordings are sufficient for EIA purposes. They are by no means an exact identification or indication of the number of bats present, but rather an indication of bat activity on site. True bat identification can only be made by specialist bat biologists when the bat or the bat carcass is physically available. Some of these identified species will be confirmed during the carcass searches in the operational phase.

Data gaps occurred at System N, due to microphone breakdowns. Although the ideal would have been to have more comprehensive data from the system at 98 m, the 52 m microphone was also situated within the prospective sweep of the turbine blades and there is enough data to make an informed decision for EIA purposes. The data gaps are shown below in Table 3.

Table 3: Availability of data collected from the various systems

Available Data	Gaps
15 Aug 2021 - 15 Oct 2021	None
16 Oct 2021 - 27 Apr 2022	100m Met High (N): 25 Jan 2022 - 27 Apr 2022
28 Apr 2022 - 26 Sept 2022	100m Met High (N): 28 Apr 2022 - 25 Jul 2022
27 Sept 2022 - 12 Nov 2022	None

The 98 m and the 52 m monitoring stations (Systems N and O respectively) are the most important systems due to their placement within the rotor-swept area of the turbine blades. Data from one of these systems, depending on the situation of the weather monitors, are compared with weather data to assess the weather's influence on the bats occurring within the sweep of the turbine blades.

6.1.1 Bat Species Diversity

Calls like five of the 12 species that have distribution maps overlaying the proposed development site, had been recorded by the static recorders during the monitoring period (see Table 2 andFigure 20).

The data from the static recordings confirm some of the species on the distribution maps of the region. 63% of the calls of all the combined systems represent *T. aegyptiaca*, which is the dominant species on site. *T. aegyptiaca* is a high-risk species, physiologically adapted with a narrow wingspan to fly high, in the vicinity of the turbine blades. Due to this foraging preference, the risk of collision and barotrauma is high. Three more species have a significant presence: 13% of the activity was from the Near Threatened *M. natalensis. N. capensis* represents 15% of the species present, and *S. petrophilus* was represented at 9%. The occurrence of the endemic *E. hottentotus* was not statistically significant, but this bat was recorded on site. Note that when a species is not statistically significant, although the activity recorded is relatively low, the bat species is still deemed important for the bat diversity on site.

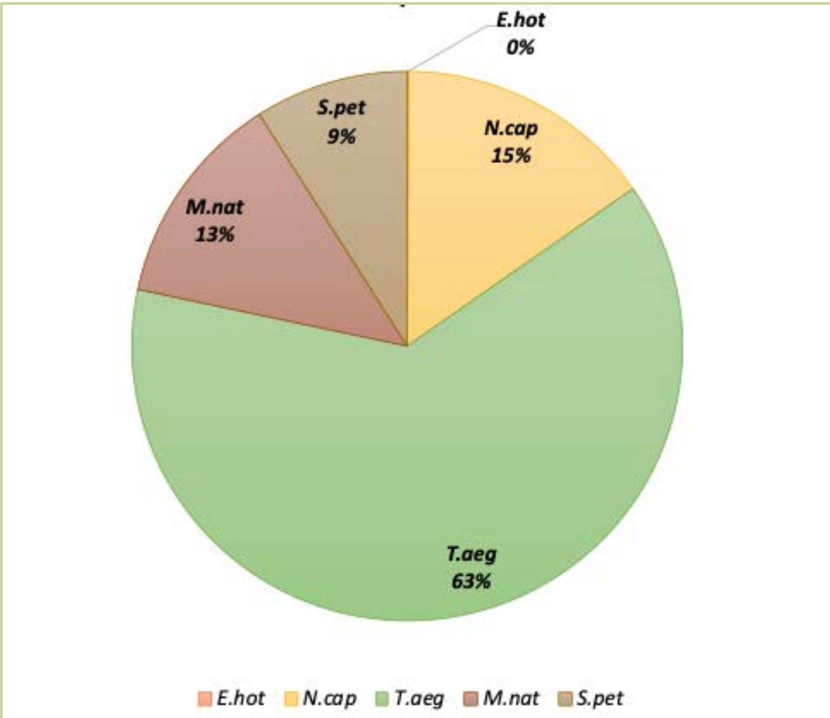


Figure 20: Bat species present at the proposed Kraaltjies WEF

The species diversity is often higher at lower altitudes, which is demonstrated by Figure 21. Although *T. aegyptiaca* is still the dominant species recorded, the percentage activity by species other than *T. aegyptiaca* is higher at the near ground systems. At the proposed Kraaltjies WEF site, the Molossidae family is more dominant at the high-altitude systems, with the Molossids *S. petro*philus and *T. aegyptiaca* comprising nearly 100% of all the activity recorded at height (Systems N and O). Both these species are classified as high-risk species and one could therefore derive that Molossids run the highest risk of being killed by the turbine blades.

The remainder of the calls represent *N. capensis, M. natalensis* and *E. hottentotus*. Although *T. aegyptiaca* depicts the highest activity at all monitoring stations, the above three species portray a higher proportion at the near ground masts, particularly at the 10 m Mast (Q), where *N. capensis* (26%) and *M. natalensis* (22%) make up a significant proportion of the bats present. This is noteworthy in the case of *M. natalensis*, as it has a Near Threatened status.

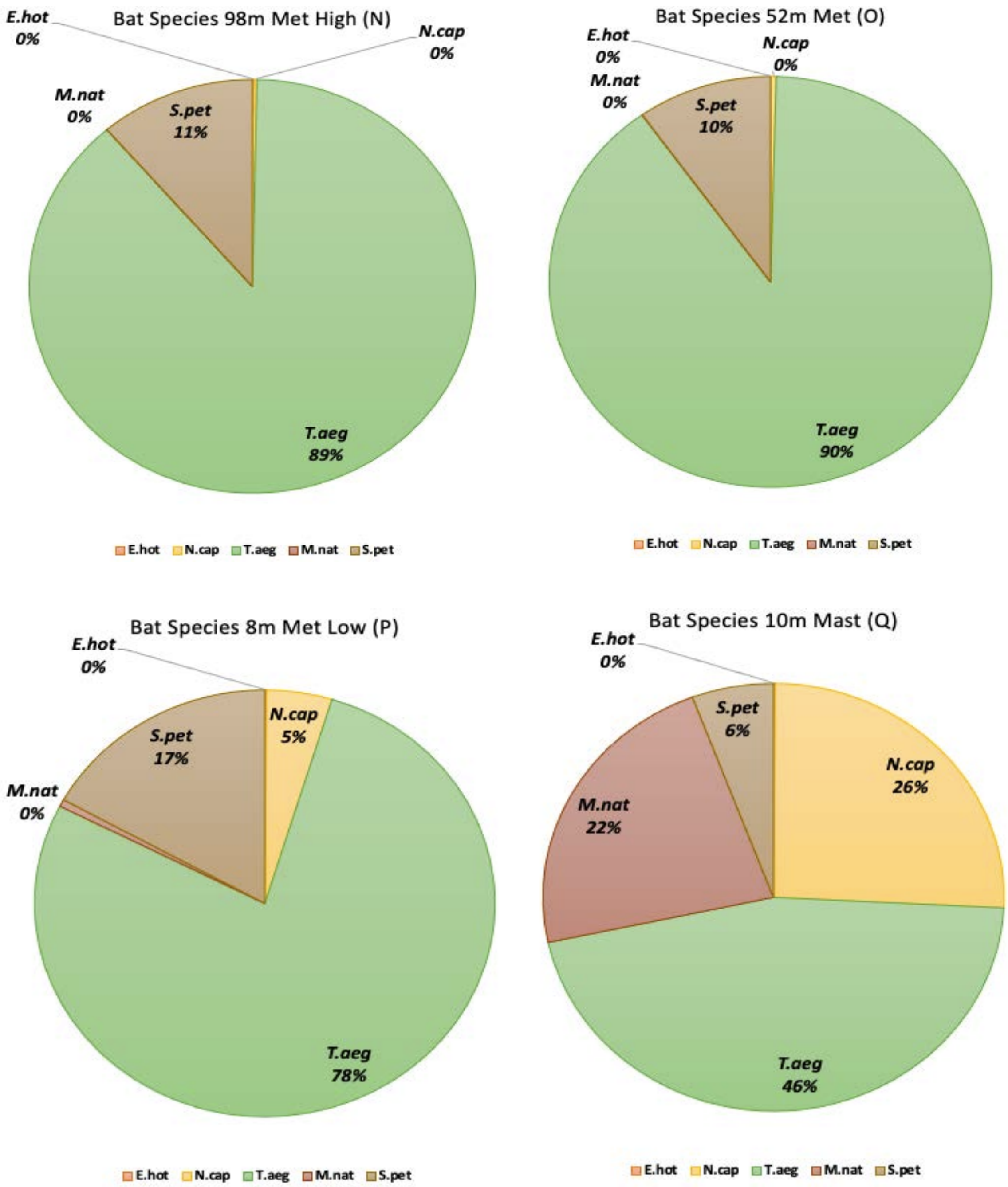


Figure 21: Species diversity as indicated by the static recorders at the proposed Kraaltjies WEF

6.1.2 *The activity of different species*

Figure 22 depicts the nightly medium for the species recorded on site over the whole monitoring period. As mentioned in the previous section, relatively high activity can be observed for *T. aegyptiaca*, followed by *N.*

capensis. Less activity has been recorded for *S. petrophilus* and *M. natalensis*, with low activity by *E. hottentotus*, but the significance of the distribution of calls recorded from the red data *M. natalensis* is discussed in Section 6.1.2.

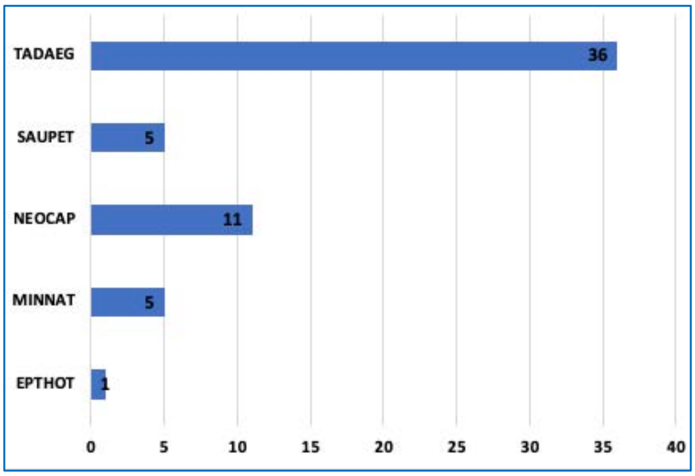


Figure 22: Nightly median of recorded species over the monitoring period

6.1.3 Species distribution over the monitoring period

Figure 23 portrays the weekly temporal distribution of bat passes over the monitoring period. The light blue histogram depicts higher activity, indicating the higher occurrence of *T. aegyptiaca*, consistently over the whole monitoring period, but especially during the late spring and summer months: December 2021 to March 2022, with another peak in activity in October 2022. *N. capensis* and *S. petrophilus* follow the pattern of *T. aegyptiaca* to a large extent, although at a much lower overall rate. A notable sudden increase in activity that remains consistently high between April (2022) and June (2022), with a peak in early May, is depicted by *M. natalensis.* This is especially noteworthy for two reasons: this species has very low activity for the remainder of the year, in addition, this period of peak activity for the *M. natalensis* species corresponds to a period where there is a drop in activity from all other species. This is a migrating species and this could be an indication of a migration route. All species depict very little activity between June (2022) and August (2022), the winter months.

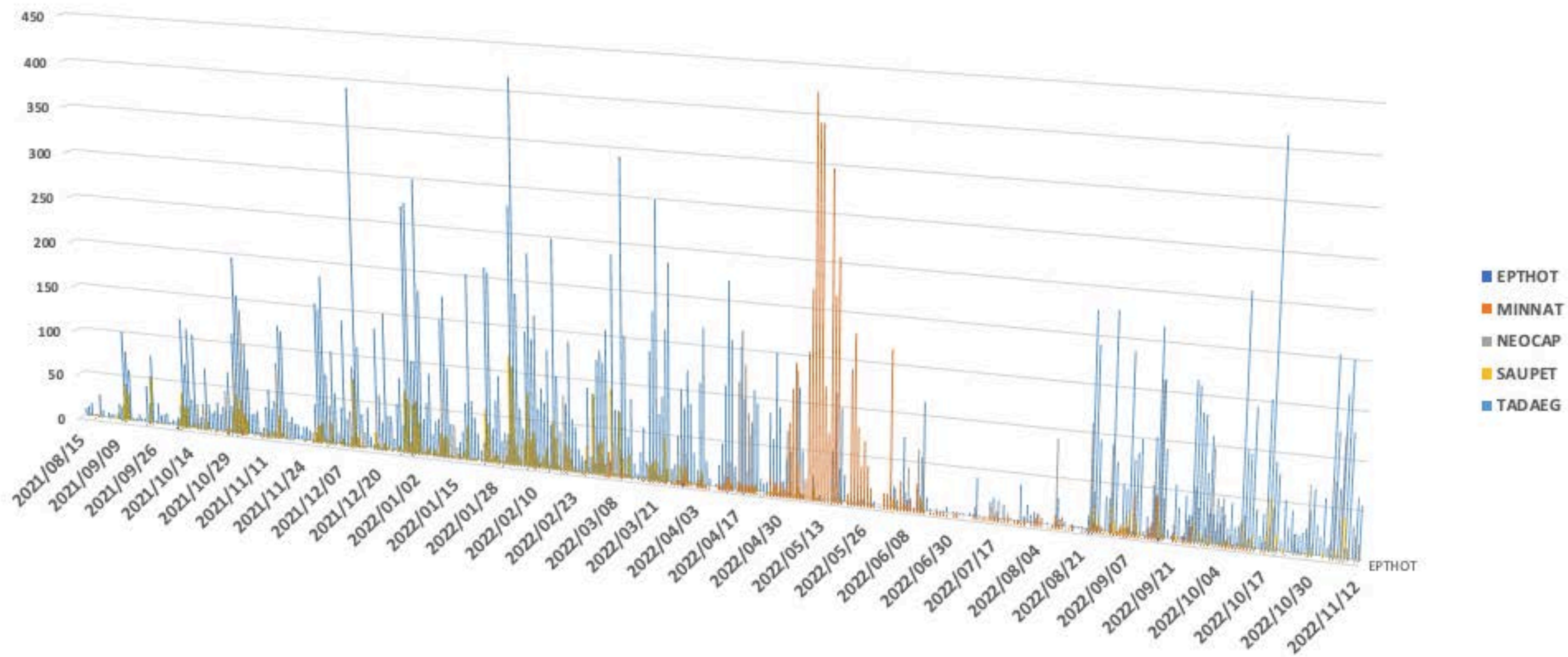
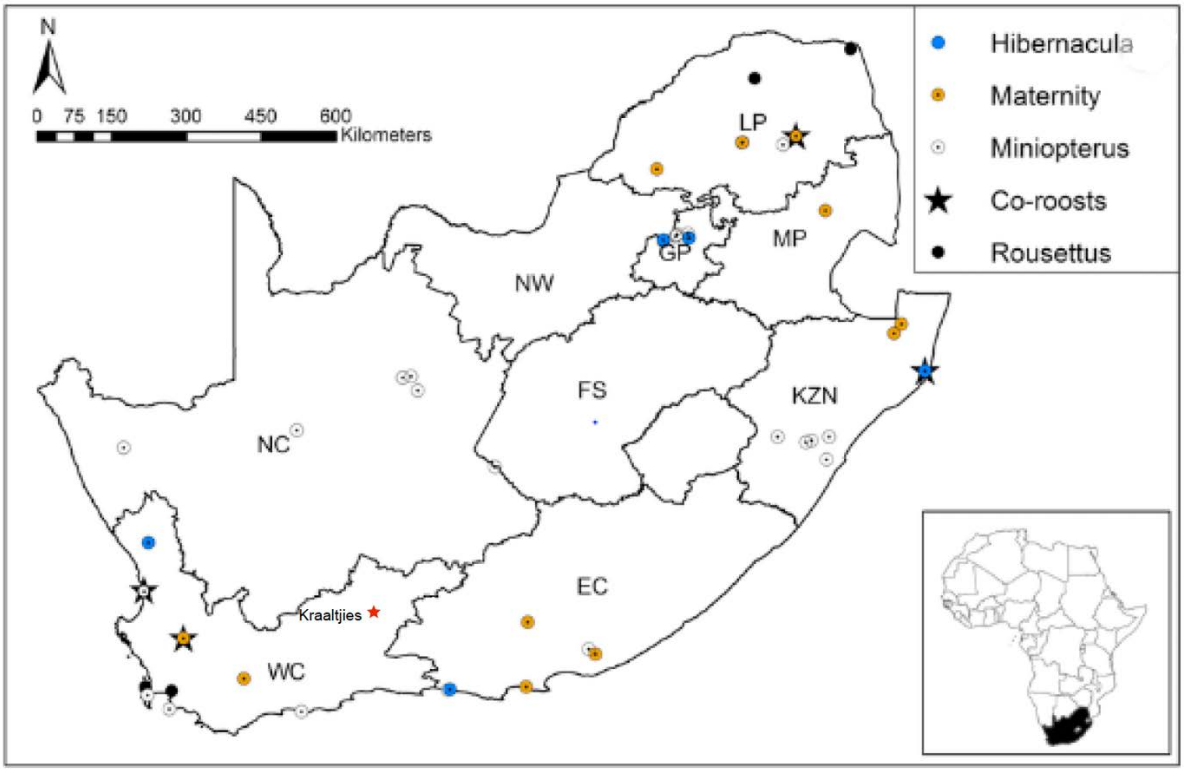


Figure 23: Species distribution and activity over the monitoring period

Figure 24 indicates recorded roosts of *M. natalensis* and *Rousettus aegyptiacus* in South Africa. The closest *M. natalensis* recorded cave roost is De Hoop, which is further than the noted 150 km migration distance. The fact that *M. natalensis* has been recorded to migrate up to 150 km, does not mean that this species will not cover larger distances. It has simply not been recorded to migrate over larger distances up to now.



Roosts for Miniopterus natalensis (open circles) and Rousettus aegyptiacus (black circles) throughout South Africa. Important sites (maternity and wintering roosts) for Miniopterus natalensis are indicated in yellow and blue respectively. Locations where both species roost together are indicated by black stars (Co-roosts)

Figure 24: Miniopterus natalensis roosts in South Africa (Pretorius, et al, 2021).

M. natalensis a cave dwelling species and several potential cave structures and derelict mines occur within a 100 km radius of the proposed Kraaltjies WEF, see Figure 25; especially towards the south, in the Swartberg mountain range. Calcrete deposits in these mountainous areas tend to support cave structures. Although these structures are not necessarily the size and grandeur of the Cango caves, smaller structures might house *M. natalensis*.

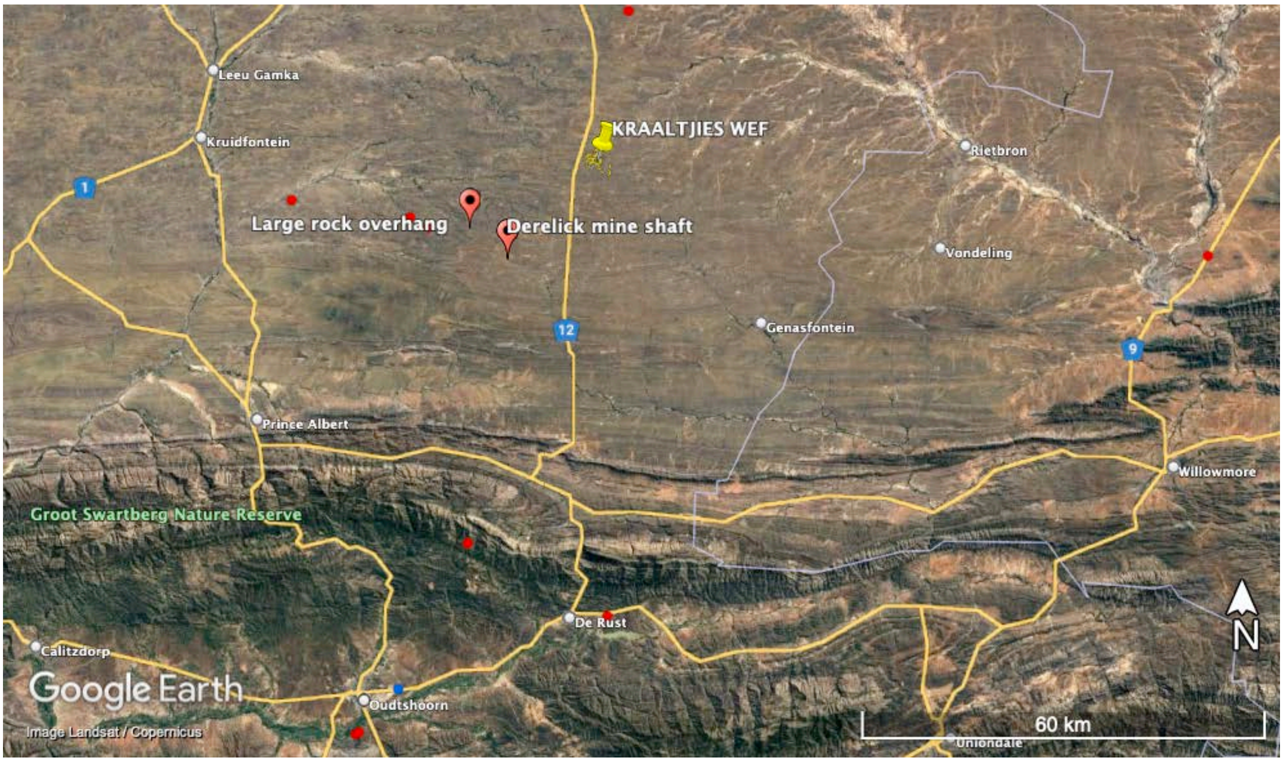


Figure 25: Red dots indicate all the derelict mines identified in the area around the proposed Kraaltjies WEF

Figure 26 provides a summary of Figure 23, clearly demonstrating the monthly changes in bat activity on the proposed Kraaltjies WEF. What is highlighted is a low record of activity in August, which is late winter, with a steady increase in activity from September (spring) until a peak in activity is recorded in February (summer). After February there is a steep decline in activity, with much lower records from May to August (winter). A jump in activity is once again evident in September 2022, as spring approaches and bats come out to forage. Unusually, there is a decline in activity over October and November (2022) at this site, while spring 2021 indicates a steady increase in activity from September to the summer months.

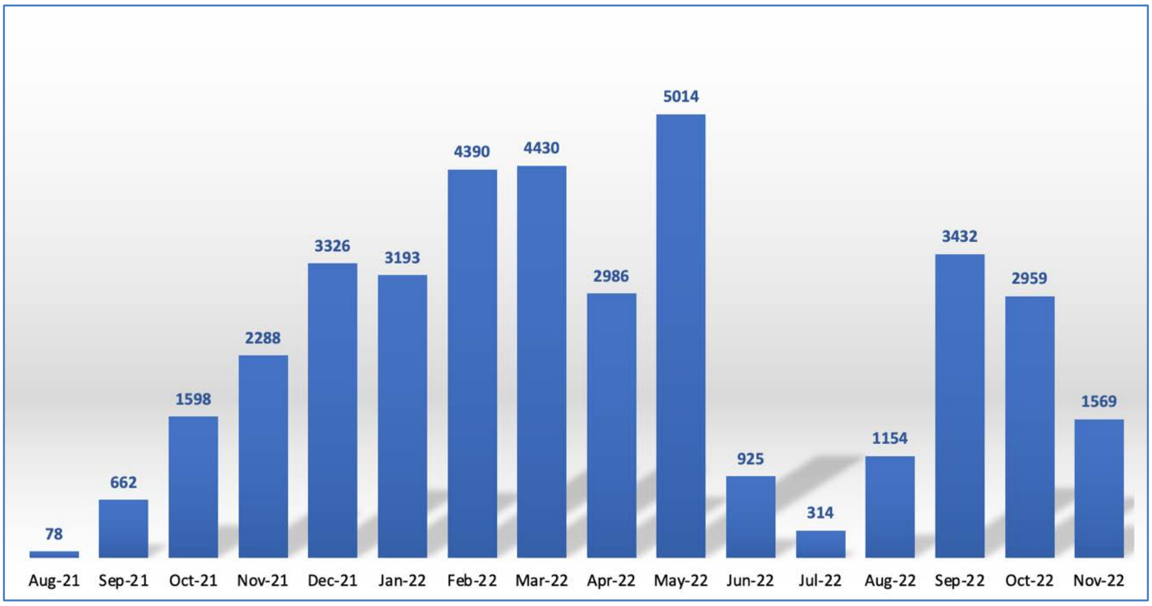


Figure 26: Monthly average bat activity for the proposed Kraaltjies WEF

Figure 27 highlights the seasonal variation in bat activity at the proposed Kraaltjies WEF. Summer and autumn have the highest proportional activity, with activity in autumn marginally higher than in summer. This may be because there is often an increase in activity before winter, when bats need to stock up for the winter months. If there is a migration of *M. natalensis* crossing the site, this could contribute to the relatively higher activity in autumn. Spring has slightly less activity, but still considerably more than winter.

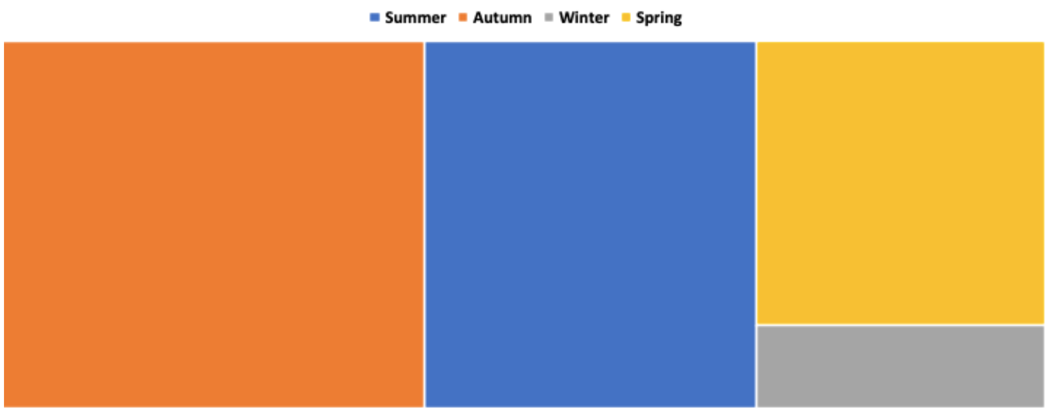


Figure 27: Seasonal proportions of average bat activity

The average monthly bat activity of *M. natalensis* is indicated in Figure 28, showing the sudden increase in May. The high presence of *M. natalensis* is noticeable when the figure below is compared to Figure 26, with the monthly activity of *M. natal*ensis at 3 666 in May 2022, and the total highest average bat activity of the combined bats at 5 014 in the same month.

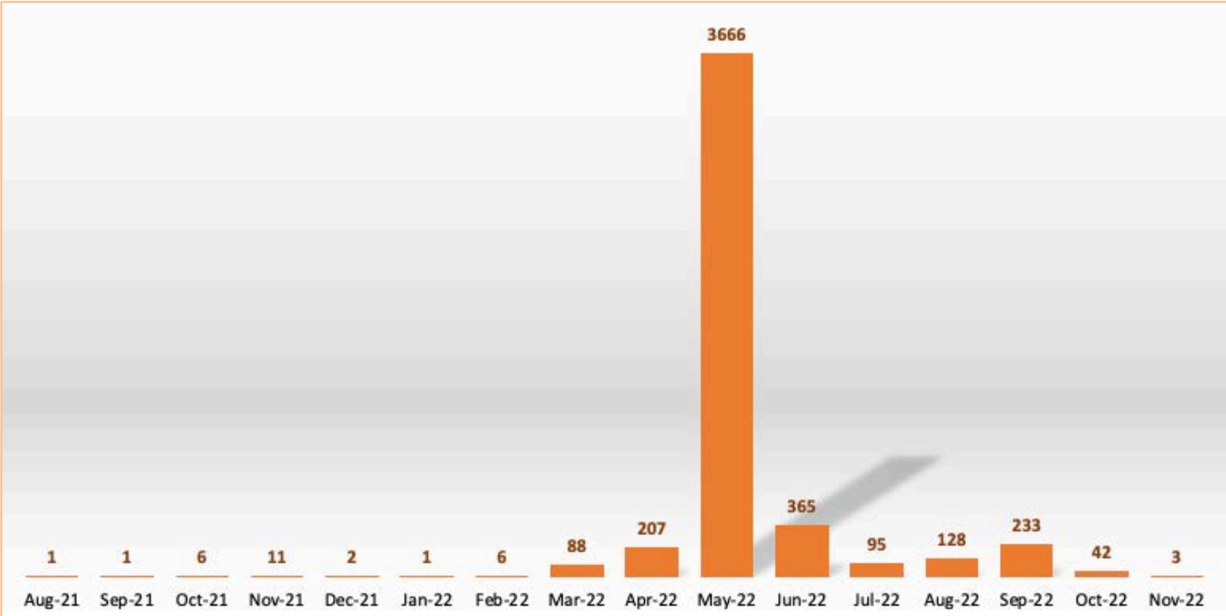


Figure 28: Monthly average bat activity of *M. natalensis*

Nearly all *M. natalensis* activity was recorded exclusively at the 10 m system Q, and hardly any activity of this species was recorded from systems N and O, situated within the sweep of the turbine blades. This indicates that the activity was not recorded at height around the Met mast and that certain areas on the site did not portray the relatively high activity of *M. natalensis*. As the microphones on the 10 m systems could record up to a 30 m range in optimal weather conditions, bats flying at 40 m altitudes could have been recorded. If the lowest tip of the turbines is between 14,5 m and 30 m, then these bats are flying within the lower part of the sweep of the turbine blades and will be at risk of collision or barotrauma. Due to the prevailing precautionary principle underpinning the EIA process, one must consider mitigation for this red data species.

The sudden relatively high spike of *M. natalensis* was not recorded during bat monitoring at the Heuweltjies 240 MW WEF, situated south of the proposed Kraaltjies WEF. The bat specialist contacted Animalia who conducted bat monitoring at proposed wind farms in the close vicinity of Kraaltjies WEF, namely Trakas and Beaufort West WEFs, but they indicated that they have not recorded similar spikes during the bat monitoring.

6.1.4 Bat activity per monitoring station

If the median hourly bat activity of the various bat monitoring stations is compared, see Figure 29, it is clear that the monitoring station (System Q) situated in a valley, close to a cement dam which provides permanent open water, see Section 1.2.2, recorded substantially higher activity than the other systems. System N, situated at 98 m, recorded the lowest bat activity. This high activity at System Q, which was situated in relatively optimum conditions for bats, confirms the need for the incorporation of buffers around the valleys with Karoo riverine vegetation. The developer has already incorporated these buffers in the layout as discussed in Section 7.

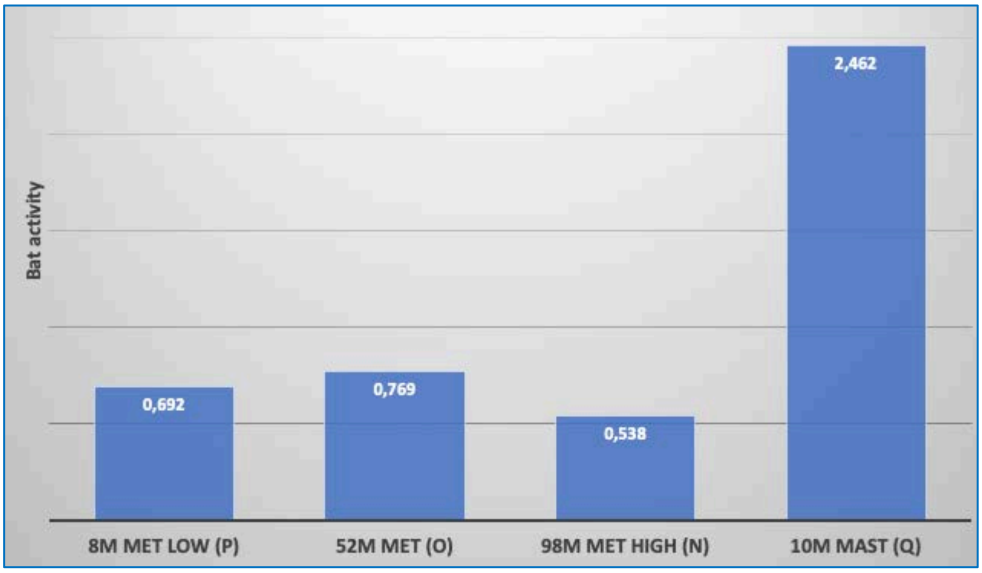


Figure 29: Median hourly bat activity per monitoring system for the monitoring year

6.1.5 *Nightly distribution of bat activity*

Figure 30 provides insight into the general distribution of bat activity within the project site during each night, from sunset to sunrise. What is depicted is a sudden increase in activity two hours after sunset, with bat activity increasing steadily until a peak at about five to six hours after sunset. This pattern of activity is normal, as bats are generally more active after sunset as they come out to forage for food and drink. Thereafter, activity begins to decline steadily up to three to five hours before sunrise, until little activity is portrayed just before sunrise, when bats have returned to their roosts.

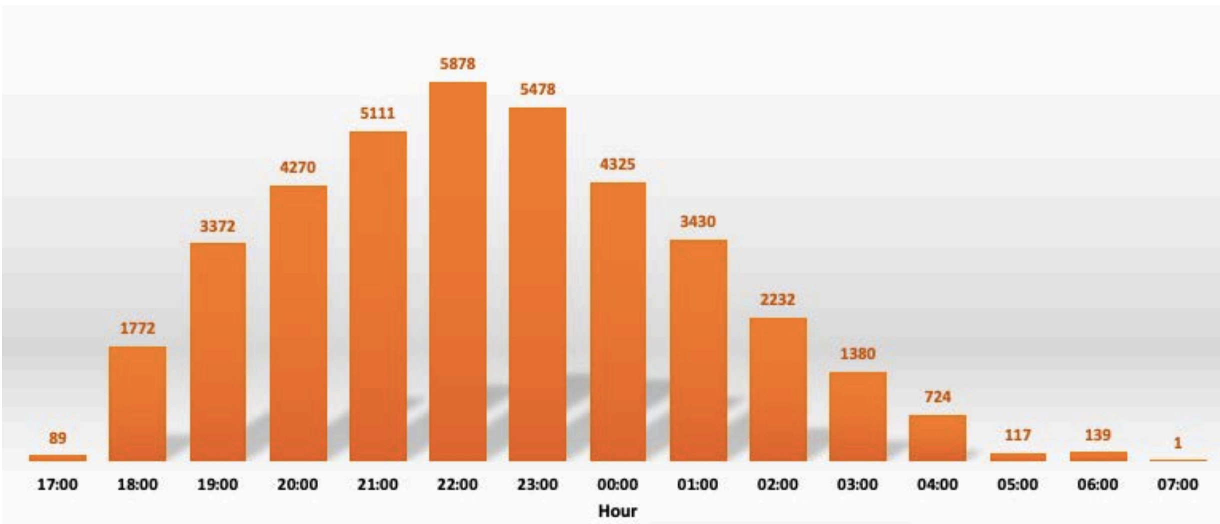


Figure 30: Hourly bat passes during the course of a night, at the proposed Kraaltjies WEF

Figure 31 elaborates on the previous figure in that it also depicts the hourly bat activity over the course of one night but specifies activity for each mast. System Q on the 10 m mast has proportionally higher activity across the course of the whole night. In addition, the activity remains consistently higher between one to two hours after sunset up to about five to six hours after sunset. The other three systems recorded a similar pattern of activity, with a steady increase in activity from approximately one to two hours after sunset, until a peak at 22:00, after which there is a decline in activity until approximately three hours before sunrise. As sunrise approaches very little activity is recorded. System N at the highest altitude (98 m Met High) depicts the lowest activity over the course of the night and has its peak earlier than the other two systems, at 21:00. However, System Q at 10 m, has the earliest peak at 19:00, which is of note as this is earlier than is generally observed.

Overall, these patterns are of importance if mitigation measures are to be developed, as they indicate the most active periods during the night.

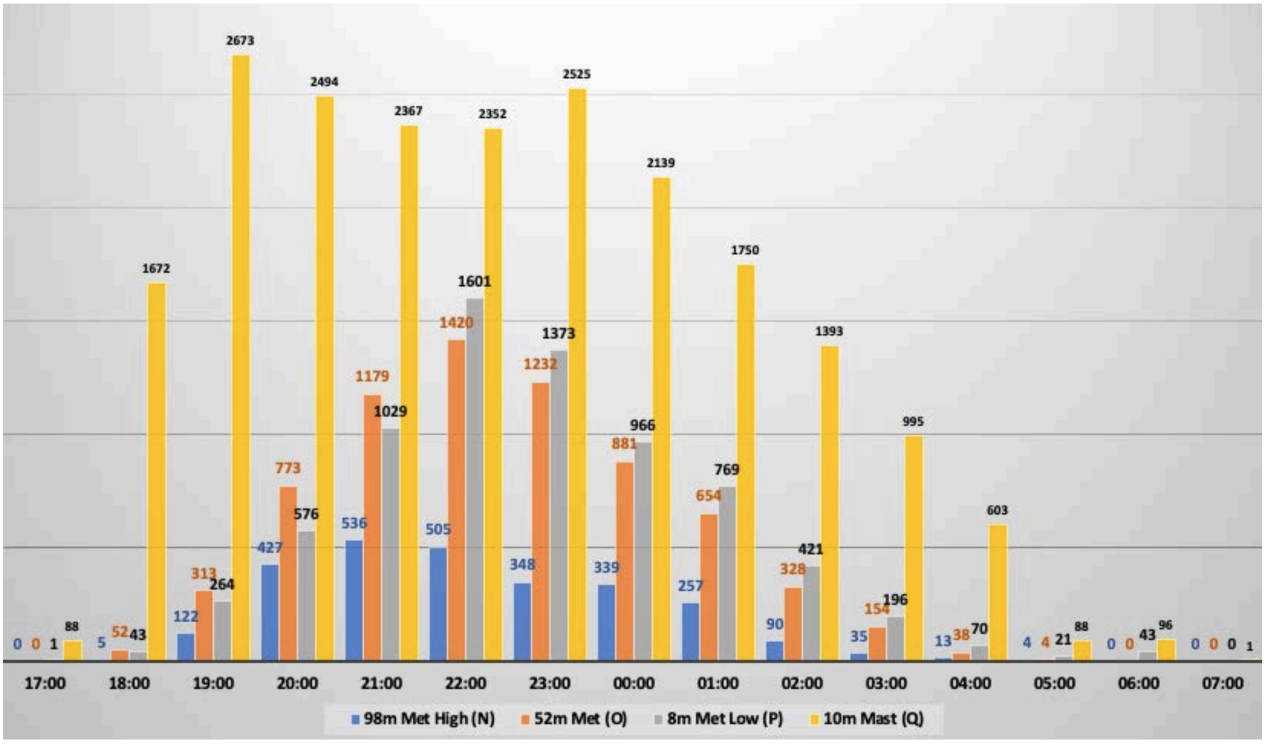


Figure 31: Hourly bat activity, for each mast

6.2 BAT THRESHOLD

The South African Bat Fatality Threshold (MacEwan *et al*., 2018) and the South African Bat Best Practice Guidelines (MacEwan *et al*., 2020) report results from early operational facilities in South Africa that show a linear increase in bat fatalities as more turbines are monitored. Threshold guidelines are calculated based on proportional bat occupancy per hectare for each of South Africa's terrestrial ecoregions to predict impacts on bat fatalities posed by WEFs. These biomes and ecoregions are identified by diverse biodiversity patterns determined by climate, vegetation, geology, and landforms (Dinerstein *et al*., 2017; Olson *et al*., 2001). Threshold calculations add natural population dynamics and bat losses due to anthropogenic pressures to the sum to gauge the number of bat fatalities that may lead to population decline. Table 4 below indicates the height-specific bat activity and fatality risk according to the South African pre-construction bat guidelines (MacEwan et al., 2020) together with the median of hourly bat activity at height over the monitoring period, from Systems O, at 52 m and System N, at 98 m, and near ground level, from Systems Q and P, between 8 m and 10 m respectively. The combined median bat activity per hour at near-ground level is 1,35, which is within the high-risk category, while the combined median bat activity per hour within the rotor sweep area is 0,39, which falls within the medium-risk category. The latter is of particular importance, as this represents the overall hourly bat activity within the proposed sweep of the turbine blades, and thus in the area of the highest expected collision risk. According to the bat threshold guidelines, fatality minimisation measures should be recommended during pre-construction and should be applied from the commencement of turbine rotation.

Table 4: The bat fatality risk threshold for Nama Karoo with the median from within the sweep of the proposed turbine blades and from lower near ground monitoring systems (MacEwan et al., 2018)

Ecoregion	Height category*	Low risk (Median bat passes/hour)	Medium risk (Median bat passes/hour)	High risk (Median bat passes/hour)
Nama Karoo	Near ground	<0,18	0,18 – 1,01	>1,01
	Rotor sweep	<0,03	0,03 – 0,42	>0,42

Height of monitoring systems at the proposed Kraaltjies WEF site	Median of hourly bat activity for the monitoring period
Combined activity from 10 m systems (Q, P) near ground.	1,35
Combined activity from 52 m (O) and 98 m (N) in the rotor sweep area.	0,39

*Near-ground = 3 to 11 m above ground level, Rotor sweep = 50 to 110 m above ground level.

6.3 WEATHER CONDITIONS AND BAT ACTIVITY

The information provided in this section describes the relationship between weather conditions and bat activity, in particular activity within the rotor-swept area of the turbine blades. Lower monitoring systems follow the same pattern to a large extent, but as weather monitors are close to the high microphone, and the high microphone is within the rotor swept area of the turbine blades, this system provides more accurate data to plot with the weather data. This data is used to compile a mitigation schedule for sensitive areas, which, if necessary, could be implemented from the onset of operation of the WEF. Weather conditions, especially temperature, wind, humidity and barometric pressure have an influence on bat activity. Literature (Arnett, *et al*. 2008, Baerwald, *et al*. 2009, Kunz, *et al*. 2007), as well as observations from personal experience, indicate that bats tend to be more active at lower wind speeds and higher temperatures. Therefore, bats tend to be more active on warm, quiet nights, combined with elevated humidity; especially when there is an abundance of food, such as termites. Higher activity has also been reported during dark moon.

Weather data from the systems on the Met mast were used for the statistical analyses below, as these sampling systems are situated in the area of collision. This data was also used to inform the mitigation recommendations. Statistical analysis between weather and bat activity was also conducted with the combined 8 and 10 m systems, thus systems P and Q combined. The near-ground data will not inform the mitigation measures, as the only available weather data is from the Met mast, and the samples were taken far from the bat monitoring sampling points. The following weather data from the Met mast was used:

- Temperature data from 140 m;
- Wind data from 100 m;
- Humidity data from 140 m; and
- Barometric pressure data from 140 m.

6.3.1 Linear Regression

Results of a linear regression between weather conditions and bat activity are provided in Table 5 and graphically represented in Figure 32. There is a small sample size of bat data from all the monitoring systems over the 12 month period. Furthermore, bats are not necessarily active during various weather conditions. Linear regressions therefore could sometimes result in inadequate variation; Nevertheless, it provides an indication as to the positive or negative relationship between weather conditions and bat activity. During the post-construction phase, when more data are available, linear regression analyses should be applied to the data again.

Table 5: Summary of linear regression

	Correlation Coefficient	
Temperature with bat activity at System N (98 m Met High)	0.406	A strong positive relationship between temperature and bat activity. As temperature increases so does the bat activity.
Wind with bat activity at System N (98 m Met High)	-0.246	A negative relationship between wind speed and bat activity. As wind speed increases the bat activity decreases.
Humidity with bat activity System N (98 m Met High)	-0.057	A weak negative relationship between humidity and bat activity. As humidity increases the bat activity also increases.
Barometric pressure with bat activity at System N (98 m Met High)	-0.147	A negative relationship between barometric pressure and bat activity. As barometric pressure increases the bat activity decreases.

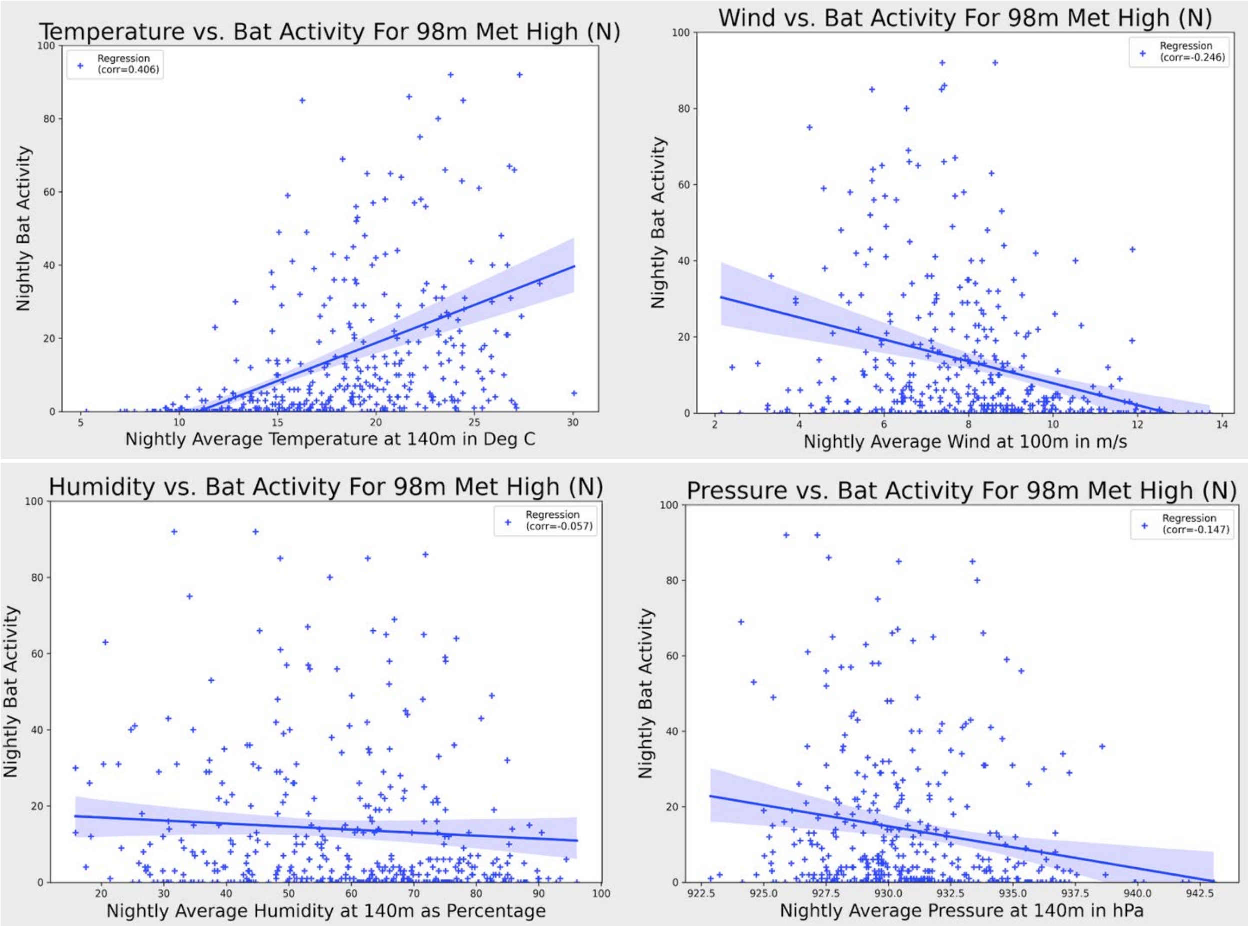


Figure 32: Linear regression of temperature, wind speed, humidity, and barometric pressure as predictors of the distribution of bat activity.

6.3.2 Cumulative distribution functions (CDF)

Figure 33 below illustrates the cumulative distribution functions, where cumulative means an increased quantity by successive additions, and cumulative bat activity recorded is plotted with temperature, wind speed, humidity, and barometric pressure. The cumulative percentages at the 98 m Met High (N) indicate the following results:

- More than 80% of the bat activity was recorded above 15 °C;
- More than 80% of the bat activity was recorded below 9 m/s wind speed;
- Approximately 70% of the bat activity was recorded between 40% and 80% humidity; and
- More than 80% of the bat activity occurred below 932.5 hPa.

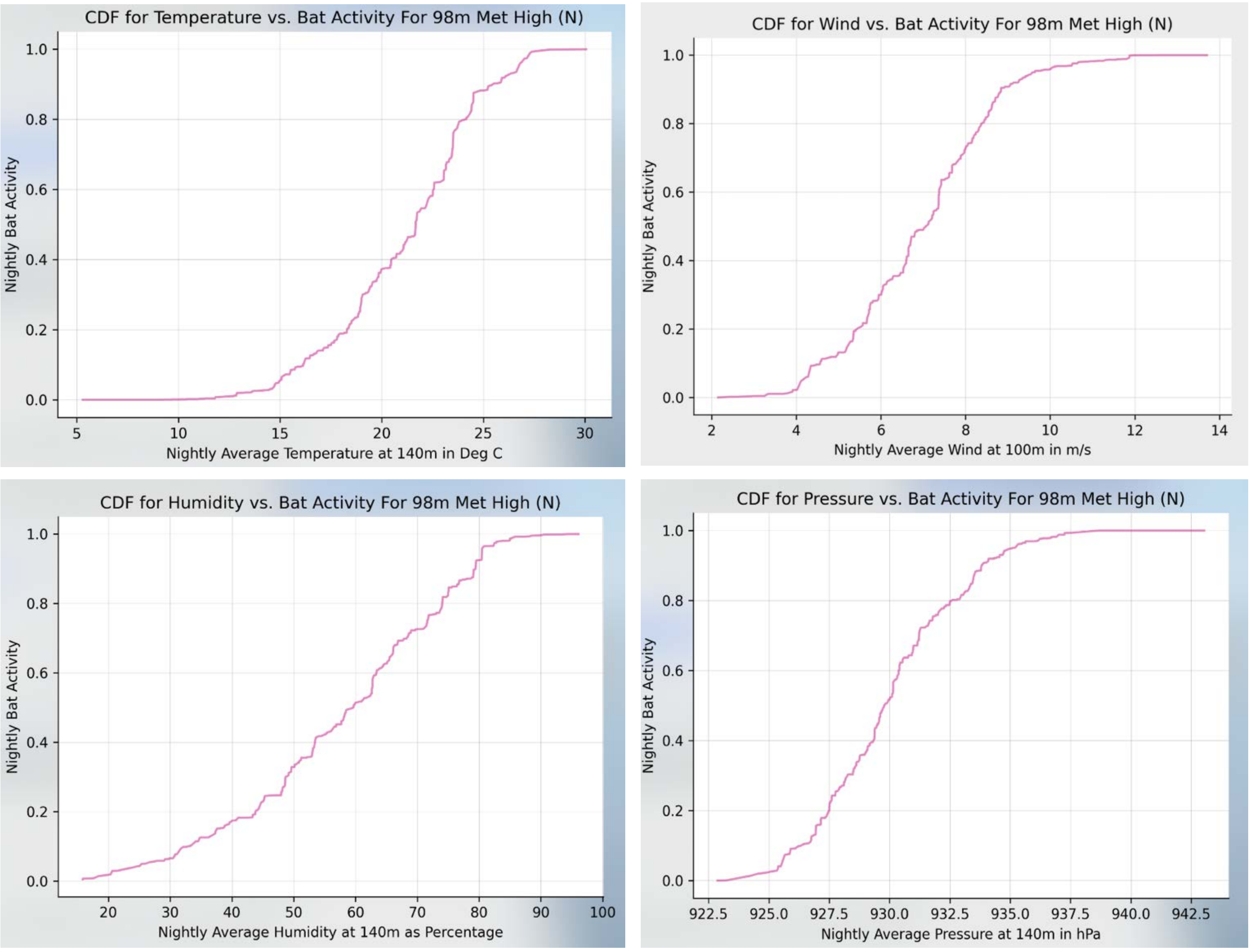


Figure 33: Cumulative distribution function for weather and bat activity at System N, 98 m on the met mast.

6.3.3 *Cumulative distribution function heat maps*

Cumulative Distribution Function (CDF) heat maps, see Figure 34, provide a better visualisation of the concentration of bat activity when plotted with weather conditions and confirms the results from the previous section (Section 6.3.2). Darker areas indicate a concentration of activity.

The density of bat passes at certain temperatures, wind speed ranges, humidity, and pressure for the 98 m Met High (System N) can be clearly observed when CDF heat maps are plotted. The following could be derived:

- Nightly average activity and temperature: A concentration of bat activity occurred between 15 °C and 20 °C, but activity density is observed as high as 25 °C;
- Nightly average activity and wind speed: A concentration of bats occur below 7 m/s, with another, more distinct concentration between 7,5 m/s and 9 m/s;
- Nightly average activity and humidity: Bat activity at the proposed Kraaltjies WEF shows pockets of concentration above 44% humidity, with a stronger pocket of concentration between 60% and 80% humidity; and

- Nightly average activity and barometric pressure: A concentration of bat activity occurs between 926 hPa and 931 hPa, with another occurring between 931 hPa and 933 hPa.

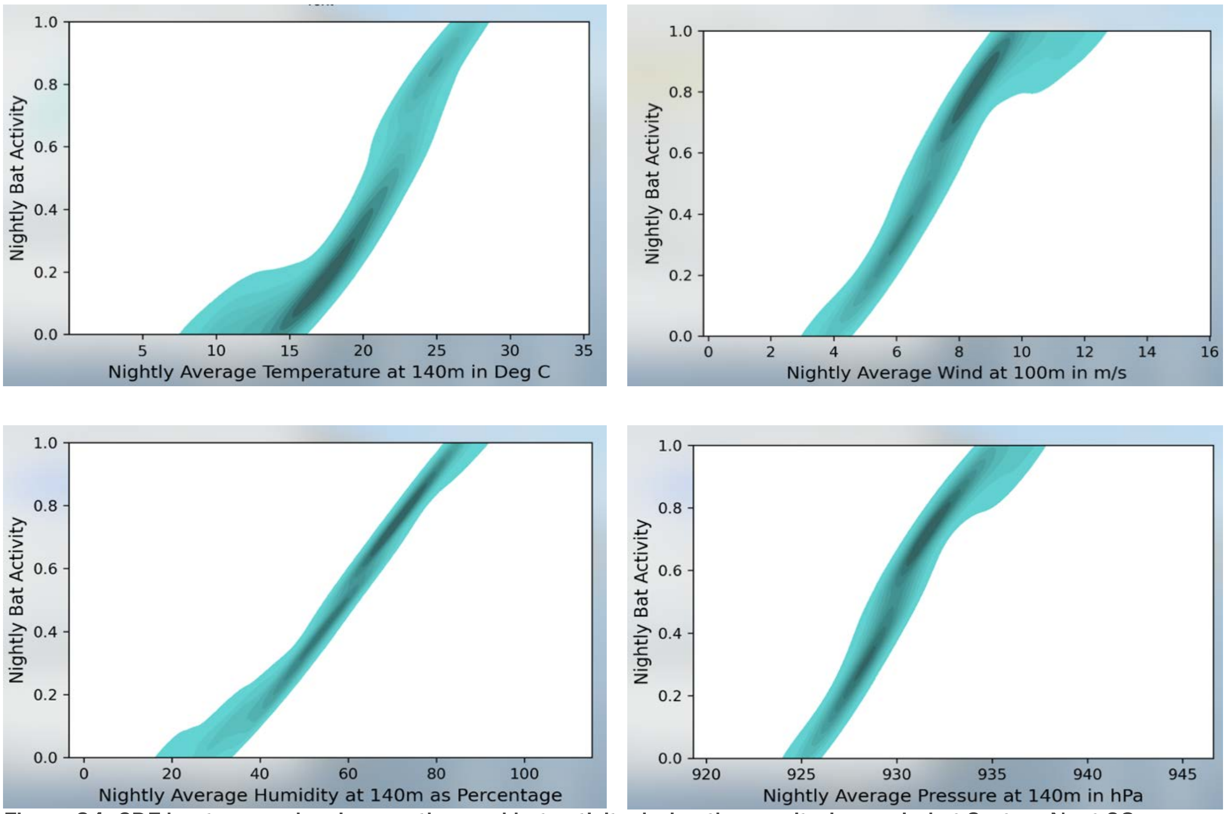


Figure 34: CDF heat maps showing weather and bat activity during the monitoring period at System N, at 98 m on the mast

6.4 TRANSECTS

Although transects are a snapshot in time the data can confirm species present at site. The transect route, with the stationary monitoring points, is depicted in Figure 35. A SM4 GPS was linked to the detectors so that the route is recorded while driving. The detector was calibrated each time at the start of the transect. A transect was conducted during November 2021, under optimal weather conditions, but no bats were recorded during the transect.

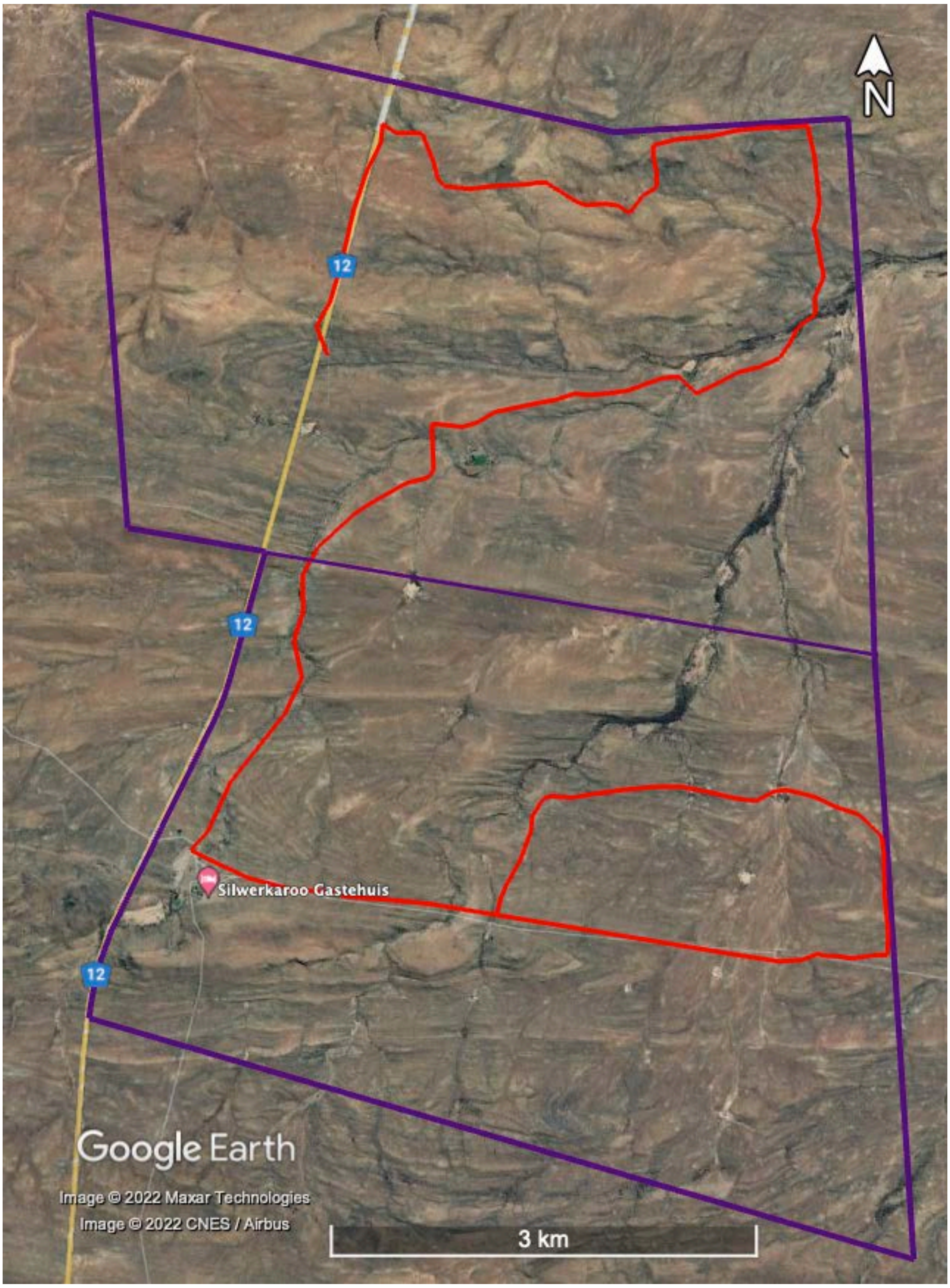


Figure 35: Transect route

7. BAT SENSITIVITY

Sensitivity zones are based on buffer zones, as indicated by the *South African Good Practice Guidelines for Surveying Bats at Wind Energy Facility Developments – Pre-construction* (MacEwan, *et al*. 2020). These zones are refined through field visits and physically visiting the bat-conducive environments occurring at the development site, as well as static and active monitoring data.

The minimum buffer recommendation from SABAA is a 200 m buffer around all potentially bat-important features. Figure 36 has therefore incorporated 200 m buffers as a minimum.

Although no turbines at the proposed Kraaltjies WEF are situated in sensitivity zones, it should be mentioned that sensitivity zones are relevant to all components of the turbines, including the tips of the turbine blades; therefore, should a turbine be installed within close proximity to a medium sensitivity zone, with the turbine tip within the sensitivity zone, then the mitigation of the medium zone should be applied to that turbine.

In cases of high bat sensitivity zones, it is recommended that these areas constitute ‘no-go’ development areas, i.e., where turning turbine components are not allowed, but some supporting infrastructures could occur; whereas medium sensitivity zones could be developed (turbines and associated infrastructure), but with mitigation. No medium zones have been identified in the terrain.

7.1 HIGH SENSITIVITY ZONES

High sensitivity zones are areas which should be avoided at all costs. This applies to placing turbine positions, but as far as possible also for laydown areas and other supporting infrastructure, with the exception of roads and overhead powerlines. ‘No-go’ zones for turbine placement are recommended for the following:

- Hilly areas with rock formations and rocky ridges;
- Dry riverbeds with historical riparian shrub;
- Clumps of trees;
- Any other features conducive to bat roosts:
- 500 m buffer around human dwellings; and
- 200 m buffer around water sources, including water troughs for livestock, reservoirs, dams, and some clumps of isolated trees. Some of these features could be historic, and might not present riparian shrub at present, but the precautionary principle is valid for periods with increased rainfall, as per the bat guidelines.

7.2 MEDIUM SENSITIVITY ZONES

Medium zones are areas that could be considered for development, but with mitigation. The developer has already mitigated medium sensitivity zones through careful placement of turbines so that no development occur in medium sensitivity zones, see Figure 36.

7.3 LOW SENSITIVITY ZONE

According to the SABAA (MacEwan, 2020) threshold for Nama Karoo the bat activity within the sweep of the turbine blades is medium, but high near the ground for the proposed Kraaltjies WEF site, see Section 6.2. There is a clear spike in activity during autumn, indicating a possible migration route of *M. natalensis*. However, until there is clarity on this aspect, no mitigation is recommended for low-sensitivity areas and these areas can be developed without turbine-specific mitigation at this stage of the project. The general mitigation measures for the project site, as described above must be implemented. As soon as there is clarity on the *M. natalensis* patterns, the bat sensitivity map will be updated. It is recommended that the developer budget for mitigation, such as bat deterrents or curtailment software, so that specific turbines could be targeted for operational mitigation when more data is available.

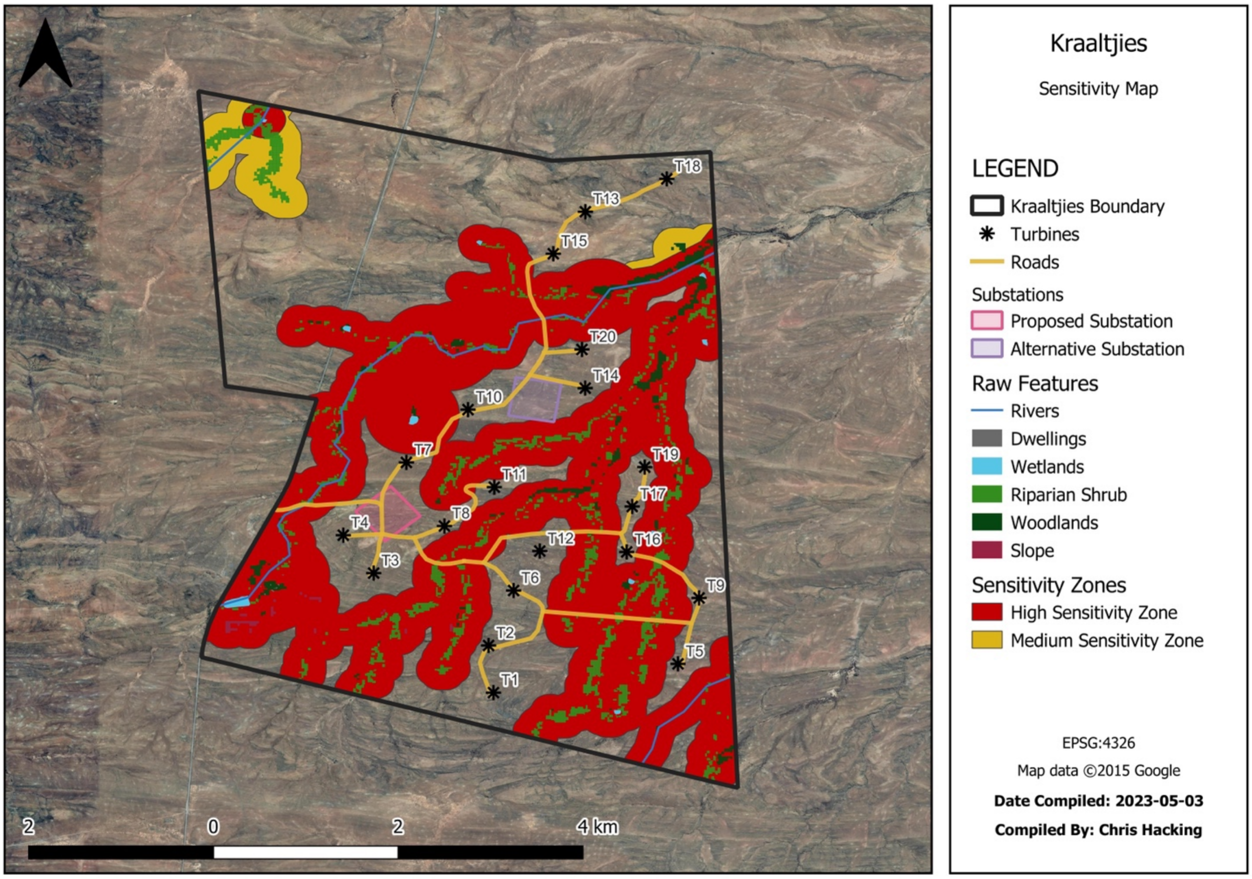


Figure 36: The bat sensitivity map for the proposed Kraaltjies WEF site

8. CUMULATIVE IMPACT

Strategic planning for the renewable energy portfolio of South Africa urges that our future energy systems be powered with clean electricity. The benefits of wind energy need to be assessed against the obligation for bat conservation concerns. All involved parties need to be informed of the trade-offs of the cumulative impacts of wind turbines on biodiversity and bat populations in their natural habitat, as the potential for wind turbines to affect bat populations should not be underestimated. Evaluating the potential effects and interactions between bat activity at wind facilities will inform decision-making to prevent or reduce the cumulation of negative impacts as wind energy development expands (Madders & Whitfield, 2006 in BioInsight 2014). NEMA protocol (32)(2)(k)(i) advises that EIA and BA processes identify and avoid "existing and potential impacts from similar or diverse activities or undertakings in the area".

Currently, in 2023, the Department of Environment, Forestry and Fisheries (DEFF), requires a regional combined impact assessment of bat fatalities on other renewable energy facilities within a 35 km radius of the site as migratory and resident bats could cover large distances (Jacobs & Barclay, 2009; MacEwan, et al., 2018 and NEMA Regulations, 2022). **Error! Reference source not found.** contains a summary of features specific to the proposed Kraaltjies WEF and of bats confirmed on site. **Error! Reference source not found.** displays a view of the regional wind energy development featuring the proposed Kraaltjies WEF surrounded by renewable energy facilities within a 35 km radius. **Error! Reference source not found.** provides a summary of renewable energy facilities within a 35 km radius of the proposed Kraaltjies WEF, allowing for assessment of the nature of the cumulative effect on bats as per the South African Good Practice Guidelines for Pre-construction Monitoring of Bats (Sowler, et al., 2017 and 2020) as well as South African Bat Fatality Threshold Guidelines (MacEwan, et al., 2020).

Table 6: Site-specific information of cumulative impacts of the proposed Kraaltjies WEF and bats confirmed on site

Project size	3995 ha
Power Capacity	240 MW
Municipality and Province	Beaufort West Municipality, Central Karoo District Municipality in the Western Cape
Biome and Bioregion and Vegetation	Nama Karoo Ecoregion, Lower Karoo Bioregion with Gamka Karoo Vegetation
Land use	Game farming and small livestock farming (sheep)
Bat conducive features	Karoo riverine vegetation, numerous dry non-perennial water courses where water collects during rain and rocky outcrops
Period of high bat activity	January to March during late summer and early autumn
Period of low bat activity	Bat activity decreases during low temperatures in colder months and high winds
Bats confirmed on site	*T. aegyptiaca, N. capensis, S. petrophilus, M. natalensis, E. hottentotus*
Bat occurrence on site and in the region	5 bat species recorded on-site out of 12 bat species that occur in the region
Bats at risk of direct impact and barotrauma	Bats that use the airspace of the rotor swept zone of the turbines

Active and passive detection during the monitoring period at the proposed Kraaltjies WEF at near-ground level and rotor height confirmed bat occurrence and provided a year-round evaluation of bat activity. Open-air foragers with wing design and echolocation calls adapted to flying fast high above the vegetation and migratory species that fly over the proposed development site within the sweep of the turbine blades, regardless of their foraging behaviour, will mostly be at risk from turbine mortality. Reasons for high activity could be optimal weather conditions, insect emergence as well as passage routes between roosting locations, including maternity roosts.

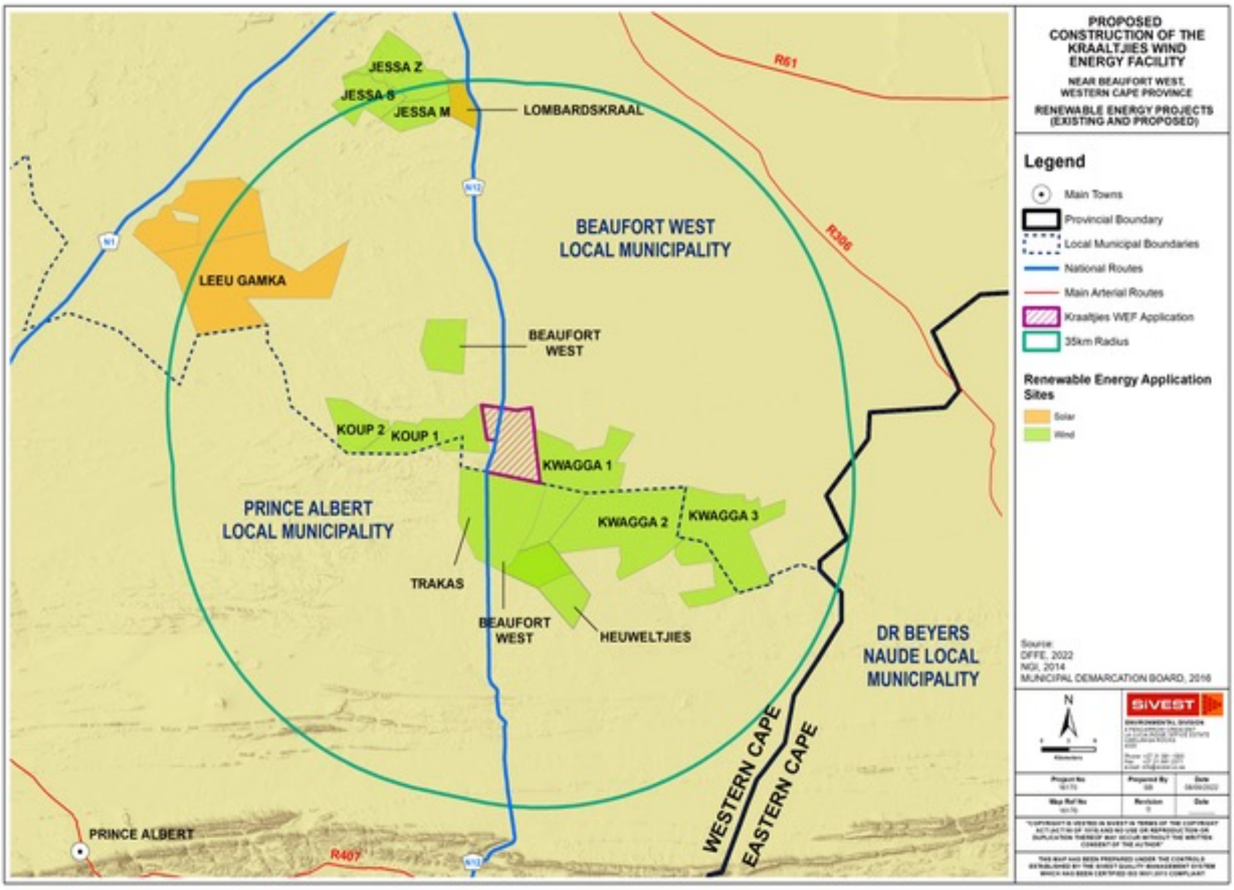


Figure 37: A larger zone of wind energy facilities (approved or at the proposal stage) within a 35 km radius of the proposed Kraaltjies WEF to show the cumulative impact amplified across the area

As clusters of wind turbine development are created, it is expected that the cumulative effect will further increase as more wind farms are added. The major concern of cumulative impacts is direct mortality caused by collision and barotrauma, as well as the indirect impact on ecological processes. Due to the back-to-back nature of the wind farms, the cumulative disturbance effect will be amplified across the area. These impacts could lead to the fragmentation of bat habitat and foraging and migration pathways, bat mortality and consequent bat population decline. Should there be a decline in bat populations, we could run the risk of elevated insect numbers and potential insect outbreaks, not only in the vicinity of the wind farms, but also in the larger region.

The South African Bat Fatality Threshold Guidelines (MacEwan, et al., 2018) and Best Practice Guidelines (Sowler, et al., 2017) report results from early operational facilities in South Africa that show a linear increase in bat fatalities as more turbines are monitored. The South African Bat Fatality Threshold Guidelines (2020), recommend that threshold guidelines be calculated based on a formula representing the proportional bat occupancy per hectare for each of South Africa's Terrestrial Ecoregions. Threshold calculations add natural population dynamics and data on bat losses due to anthropogenic pressures to the sum to gauge the number of bat fatalities that may lead to population decline.

Table 7: Individual and cumulative features of the WEF cluster with annual average and median bat passes per hour for the monitoring period, based on bat recordings and risk levels indicated by the current and previous South African Bat Association Guidelines (Sowler, et al., 2017 and 2020 & MacEwan, et al., 2020).

RISK LEVELS AS PER SABAA 2020 GUIDELINES											
REFs within 35km radius of Kraaltjies WEF	Energy Ouput MW	Total Project Size (ha)	Bat Index based on Average Bat passes per hour compared to bat fatality risk levels for Nama Karoo biome >1.15	Median Bat passes per hour per year at rotor sweep level	Bat fatality risk levels based on Nama Karoo ecoregion: rotor sweep category (50-110m)	Bat fatality risk levels based on Median bat activity at rotor sweep level	Median Bat passes per hour per year at near ground level	Bat fatality risk levels based on Nama Karoo ecoregion: near ground category (0-11m)	Bat fatality risk levels based on Median bat activity at near ground level	Threshold based on ecoregion and total project size (ha): number of bats that can be removed before population decline may arise
Kraaltjies WEF	240	3995	1,62	0,39	0.03-0.42	Medium	1,35	>1.01	High	42
Heuweltjies WEF	240	4017	1,36	0,42	0.03-0.42	Medium	0,85	0.18-1.01	Medium	43
Koup 1	140	4279	0,48							46
Koup 2	140	2477	0,41							26
Trakas	140	5340	1,30							57
Beaufort West	140	4123	0,79							44
Kwagga 1	279	5136	2,10							55
Kwagga 2	341	9214	2,10							98
Kwagga 3	205	9385	2,10							100
Total for all WEFs	1865	47966	21,2		>0.42	Medium/High		>1.01	High/Medium	510
Leeu Gamka SEF	50	19937				Low				
Lombardskraal	20	1278				Low				
Total for all REFs	1935	69181	21,2		>0.42			>1.01		510

Error! Reference source not found. evaluates the potential cumulative impact of the WEF cluster surrounding the proposed Kraaltjies WEF. Some risk levels, such as at Koup 1, may be low, although the collective bat impact risk is high. The project-specific risk level for the proposed Kraaltjies WEF is high and it further increases the collective bat impact risk to a significantly high risk. The cumulative bat impact risk level based on average bat passes for the cluster of WEFs within a 35 km radius of the proposed Kraaltjies WEF is high, at 21.1 bats per hour. Even though the collective surface areas are large, it places the cumulative effect in the high category for the estimated turbine-related fatality risk levels for Nama-Karoo. Adding additional wind and solar energy facilities (approved and proposed) within 35 km of the proposed Kraaltjies WEF increases the total area to a much larger area or cluster of 69 181 ha and potential energy output to approximately 1935 MW.

Other Renewable Energy facilities, including Leeu Gamka and Lambertskraal solar energy facility (SEFs) are also situated within the required 35 km radius of the proposed Kraaltjies WEF. Large areas of solar PV panels destroy natural habitat and although there is an indirect impact of a loss of foraging area, the direct potential impact on bats is low and was not included in the cumulative calculations.

Occasional inconsistencies occur in the methodologies applied across sites, such as uniform measurements of recording conditions and location of bat detectors as well as the calculation of size of the project or the footprint of the development. These inconsistencies limit the exactness of calculating thresholds to gauge the extent of the cumulative impact. Project size rather than footprint size is used in these threshold calculations. It is furthermore noteworthy that the data available from some of the previously recorded studies recommend that bat activity levels be recorded and reported above 40 m height for bat fatality risk rating instead of below 11 m and above 52 m as presented in this report. Some of these previous studies indicated that between 1.8

and 6.5 fewer bats were recorded at 60 m than at 40 m height. Bat activity recorded at above 40 m could potentially be an accurate result for bat activity at rotor sweep (Marais, 2015).

Bat activity calculations for studies of approved WEFs adjacent to the proposed Kraaltjies WEF and regional wind farms comply with previous and current guidelines. Therefore, **Error! Reference source not found.** presents bat activity indices based on average and median calculations. For the proposed Kraaltjies WEF the 'near ground' median is 1.35 and the 'rotor sweep' median is 0.39. The median bat activity is high compared to the bat fatality risk levels for the Nama Karoo. The recorded average bat index based on total bat activity is high at 1,62 and above the upper levels of the estimated turbine-related bat fatality risk of 1.15. Although bat indexes based on average bat passes are not required by the current 2020 bat monitoring guidelines for the proposed Kraaltjies WEF, it is recorded in Table 2 to accommodate comparison with wind farm bat monitoring completed under the previous guidelines. The bat indices calculations (average and median bat passes per hour per year) for the proposed Kraaltjies WEF are based on recordings done between August 2021 and November 2022 and are much higher than the bat indices of surrounding WEFs recorded in previous years (between 2015 to late 2018). In previous years of investigation in the region, severe drought prevailed which caused a reduction in bat activity. The region received widespread rain in 2021 and 2022 and bat activity increased. Bat activity reacts swiftly to weather condition fluctuations in semi-dessert regions and bat specialists investigating regional WEFs with previous lower bat activity are currently monitoring higher bat activity than shown in Table 7. Due to changing weather conditions, wind farms that recorded low activity during preconstruction bat monitoring, could experience unexpectedly increased bat fatality during operations. These fluctuations in bat activity should be considered when turbine development takes place.

Cumulative threshold calculations used in this report do not involve the number of turbines or MW but are based on fatality risk levels of each of South Africa's terrestrial ecoregions thresholds (MacEwan, et al., 2017 and 2020; Sowler, et al., 2020). The project size is used in this table and the threshold for the proposed Kraaltjies WEF is 42 bats, while the threshold for the total project size of all the WEFs within the 35 km radius area investigated is 510 bats. This is the number of bats which, in addition to natural population losses, can be removed from the area before their conservation status or the ecosystem services they provide to the environment are severely affected. These threshold calculations can be applied to any development that may result in bat fatalities (MacEwan, et al., 2020). Population decline thresholds are subject to ongoing discussion as little is known about fecundity rates, migration routes and population numbers (SABAA.org.za). The threshold calculations derived from natural population dynamics and bat occupancy per ecoregion for the proposed Kraaltjies WEF for insectivorous bats should not exceed 42 bats per annum per family or species. Further mitigation measures, apart from those in this report, will have to be implemented where site-specific thresholds (43 bats per annum) thresholds are exceeded at the proposed Kraaltjies WEF. Threshold calculations for cumulative impacts on bats at the proposed Kraaltjies WEF and surrounding WEFs within a 35 km radius should not exceed 510 bats per annum. Should the proposed development be approved, a monitoring program during the operational phase must include bat carcass searches to provide data to quantify bat fatalities.

Specialist reports from WEFs (Beaufort West and Trakas) considered in this assessment rate the impact high negative without mitigation which was reduced to low negative with proposed mitigation. Cumulative bat mortality due to direct collision or barotrauma during foraging of resident bats is rated high before mitigation and it remains high after mitigation. The conservation of widespread insectivorous bats in South Africa, that feature as Least concern on the IUCN Red List of Threatened species, is of importance. Bats rely on caves and dark, sheltered areas for roosting, the construction of wind turbines and associated infrastructure could potentially modify and destroy natural habitats and disrupt their roosts and roosting behaviour. Pregnant and lactating females will often seek out warmer, more sheltered roosting sites with stable temperatures for their offspring. Large-scale disturbance to roosting sites or foraging areas during the breeding season can have significant negative impacts on reproductive success. It is crucial to consider the timing of wind energy development and associated activities close to roosting sites to avoid disrupting the breeding cycle of particularly red data species, such as *M. natalensis* (Monadjen, et al., 2017 and Petit & O'Keefe (2017) in Pretorius, et al., 2020 and 2021).

Stephanie Dippenaar has completed four two-year post-construction monitoring projects on other wind farms in the Nama-Karoo. These wind farms have a combined output of 360 MW. The combined average general estimated true fatality of these three wind farms is approximately 232 bats per year. Should this approach be applied to the proposed Kraaltjies WEF together with the other WEFs within the 35 km radius over a 20-year lifespan, the total estimated true fatality could amount to approximately 2088 bats/year, with a total combined mortality of 41 760 bats over a 20-year lifespan. This is speculation at this point and the wind farms are situated in different areas and are affected by many variables. It is thus acknowledged that this is not a scientific way of calculating fatality over the lifespan of a wind farm. However, it gives an indication of fatalities that may occur over the lifespan of a cluster of wind farms. As it is expected that the cumulative effect will increase as more wind farms are developed, this provides an indication of the severity of the cumulative impact over decades of wind energy generation. The application of mitigation measures at all the proposed WEFs will reduce the risk of bat population disturbance from a high to a lower impact, which can be verified through post-construction monitoring.

9. PROPOSED MITIGATION MEASURES

9.1 TURBINE POSITIONS

The first step in mitigating the potential negative impacts of a proposed WEF on bats is to site turbines outside of sensitive areas. The sensitive southern parts of the project site have already been avoided during the planning of the area for development. The bat sensitivity map, Figure 36, was provided to the developer and after all specialists' input was considered, the developer re-arranged turbine positions to move all turbines out of high sensitivity as well as medium sensitivity areas. The first line of mitigation has thus already been applied during the design phase of the development and an updated bat sensitivity map is provided in Figure 36, with no further infringement of turbine positions.

Mitigation and enhancement options may be adjusted as this project develops to the operational phase, with growing knowledge in this field of study based on research and evidence gained from current development projects.

9.2 FEATHERING OF ALL TURBINES BELOW CUT-IN SPEED

Normally, operating turbine blades are at right angles to the wind. To avoid bat fatality when turbines are not generating power, feathering as a mitigation measure is applied and the angle of the blades is pitched parallel with the wind direction so that the blades only spin at very low rotation and there is no risk to bats. The turbines will not come to a complete standstill, but the movement of the turbines would be minimal.

The cut-in speed is the lowest wind speed at which turbines generate power. Freewheeling occurs when turbine blades are allowed to rotate below the cut-in speed and thereby increase the risk of collision in areas already sensitive to bat activity. As bats are more active at low wind speeds, mortality during freewheeling should be prevented as much as possible, and to an extent that bat mortality is avoided below cut-in speed. It is recommended that this mitigation measure commences immediately after the installation of turbines, after the necessary tests on turbines have been concluded, but before the commercial operation date, and for the duration of the project. Turbine blades are usually feathered around 90 degrees to prevent freewheeling, but the angle will depend on the turbine make and model.

9.3 TURBINE SPECIFIC RECOMMENDATIONS DURING THE OPERATIONAL PHASE

Currently, the most reliable and effective mitigation is curtailment (Arnett and May, 2016; Hayes, 2019). Curtailment entails locking or feathering the turbine blades during high bat activity periods to reduce the risk of bat mortality via barotrauma and collision with blades. This results in a reduction of the power generation during conditions when electricity would usually be supplied. Curtailment regimes are developed by examining the relationship between relative bat activity levels and weather conditions. Bat activity is typically reduced at higher wind speeds, lower temperatures, and a site-specific range of humidity and barometric pressure. Unfortunately, personal experience and unpublished data in South Africa indicate that *Molossidae* bats in Southern Africa fly at higher wind speeds than originally expected. Nevertheless, lower wind speeds and warmer temperatures typically correlate with higher bat activity levels, as seen in Section 6.3, and a percentage of bats could be saved by using weather conditions to predict bat activity.

This relationship between bats and weather conditions as well as seasonal activity and nightly activity patterns are used to inform curtailment schedules that should be applied when bat activity is high, to reduce potential encounters of bats with wind turbine blades. These relations are presented in Section 6.3 of this report and were used to compile the below curtailment schedule.

Close observation during the bat monitoring to be conducted during the post-construction phase, should inform, and refine the curtailment schedule, and apply it to specific turbines, as necessary. If curtailed turbines show consistently low activity through static recordings as well as mortality in the low threshold range, the bat specialist could adapt curtailment again.

At the proposed Kraaltjies WEF, there seems to be a clear correlation between bat activity and temperature and wind, and some correlation between bat activity and barometric pressure. Due to a very low correlation between humidity and bat activity, the latter has not been applied to the curtailment recommendations. If this is proven otherwise during operational monitoring, humidity could be added for further refinement of curtailment.

Although no curtailment is recommended at present, due to the high influx of *M. natalensis*, turbine-specific curtailment might need to be recommended once more information is available. If this is the case, Table 8, should be used as a starting point for discussions.

Table 8: Curtailment schedule to apply as necessary during the operational phase

Months	Time period	Temperature (°C)	Atmospheric pressure	Curtailment
Dec, Jan, February, March, May	3 hours after sunset, up to 7 hours after sunset	Above 15 °C	Between 926 hPa and 933 hPa	Raise cut-in speed to 6 m/s

9.4 BAT DETERRENTS

Bat deterrent suppliers indicate that Molossidae bats react well to deterrents. This could be an option for mitigation as nearly 100% of all bat activity recorded by the systems situated within the sweep was Molossidae bats. At present only one study has been released that is related to South African bats and it seems to be cautiously positive about the effectiveness of bat deterrents. It is believed that the new supplier of bat deterrents in South Africa will be able to not only drive the research in deterrents and South African bat species but also make deterrents more readily available to developers.

9.5 AVOID CREATING BAT CONDUCIVE AREAS

The aim of mitigation recommendations is to try to protect the current bat population, while avoiding creating any features that might attract bats to the development site. It is therefore recommended that:

- The roofs of all new buildings are sealed, keeping in mind that a small bat could enter a hole of one square centimetre. If no bats are residing in the current building on site, the developer could discuss the situation with the landowner and propose to also seal the corrugated roofs of existing buildings to avoid any bat roosts in future.
- Any new quarries or burrow pits which could collect standing water must be rehabilitated.
- Apart from bat roosts at the farm buildings of Silverkaroo farm, no roosts were found during the 12-month bat monitoring study, but if any roost are found during the construction or operational phase, a bat specialist should be consulted immediately.

9.6 OPERATIONAL BAT MONITORING

Operational bat monitoring should be conducted for at least two years, as per the latest SABAA operational bat guidelines of the time. Bat monitoring, including carcass searches, must start at the turn of the turbine blades, after testing on turbines have been completed, as the highest mortality is often experienced in the first year of a WEF. It is therefore important that the bat specialist is appointed before COD.

9.7 EXTENDED BAT MONITORING FOR THE PRESENCE OF *M. NATALENSIS*

Mitigation might be required due to the high activity of the Near Threatened *M. natalensis* which was recorded during autumn 2022. System Q, which recorded this spike in activity, was situated in a valley which are excluded from development; Thus, no turbine positions were placed in that area. One will have to establish if this spike in activity is occurring in a more extended area than just the river valley where it was recorded. To refine possible mitigation and establish which turbines are affected, if any, it is proposed that, extended monitoring is undertaken, and several bat-detecting systems are deployed at turbine-specific locations from September 2023 up to the beginning of June 2024. Not only will this approach inform whether this spike repeats during the next season but one will also be able to target specific turbine numbers, if necessary. This need to not hinder decision making on the current EIA application, and where additional mitigation measures may be required following extended monitoring, this can be integrated into an updated EMPr post-authorisation.

10. DESCRIPTION OF PROJECT ASPECTS RELEVANT TO BAT IMPACT

10.1 COMPONENTS OF THE PROJECT WHICH COULD IMPACT BATS

Components of the proposed Kraaltjies WEF which could negatively impact bats, directly through mortality or roost destruction during construction and operation, and indirectly, through the loss of foraging habitat, are as follows:

- The noise of construction activities;
- Clearance of natural vegetation for electrical connections, upgrading of access roads, creating hard-standing areas or laydown areas;
- Demolition of existing buildings;
- Creation of new buildings, such as the substation and BESS complex;
- Excavating areas or creating borrow pits (if required);
- Operation of wind turbines;
- Artificial lighting; and
- Decommissioning activities.

10.2 POTENTIAL IMPACT ON BATS

Bats are long-lived mammals and females often produce only one pup per year, resulting in a life strategy characterised by slow reproduction (Barclay and Harder, 2003). Because of this, bat populations are sensitive to changes in mortality rates and their populations tend to recover slowly from declines.

The potential impact on bats includes the following:

Construction phase:

- *Loss of existing roosts and/or potential roosts*: Some of the bat species that occur on the proposed site are known to roost in rock formations, crevices, derelict aardvark holes and under the bark of trees (Table 2). Any disturbance of these natural roosting opportunities might have a negative impact on bats. Demolition of any existing buildings or bat habitat with active roosts, will kill a number of bats (Barclay and Harder, 2003).
- *Attracting bats by artificially creating new roosting areas*: The presence of new buildings within the study area may provide additional roost sites for those species making use of man-made structures. Quarries created during construction could serve as a further source of open water, and food if insects collect in these areas, which could attract bats.

Operational phase:

- *Direct collisions with rotating turbine blades:* The most important feature of the project that affects bats adversely are the operation of wind turbines, particularly direct collisions from the operational rotating blades.

- *Fatalities from barotrauma:* As the air moves over the turning turbine blades, an area of low pressure is created. Barotrauma occurs when bats experience a sharp decrease in atmospheric pressure near rotating turbine blades. This pressure drop causes a rapid expansion of the lungs, which is unable to be remedied through proper exhalation (Baerwald et al., 2008), thus resulting in haemorrhage of the lungs and ultimately mortality.
- *Loss of foraging habitat:* The turbines, during operation, will influence the natural foraging space of bats. Disturbance resulting from operational activities, such as noise after sunset from engines or generators might also deter bats, resulting in loss of feeding habitat.

The ideal with respect to managing the impact of WEFs on bats throughout the project's lifespan is to maintain bat populations as they occur on-site and avoid attracting more bats to the area of a potential collision.

10.3 DESIGN

See Appendix 4 for an explanation of the symbols used in the tables below.

Table 9: Rating of impacts that could potentially occur during the design phase.

Environmental Parameter	Issue / Impact / Environmental Effect/ Nature	Environmental Significance Before Mitigation									Environmental Significance After Mitigation								
		E	P	R	L	D	I/M	Total	Status (+/ -)	S	E	P	R	L	D	I/M	Total	Status (+/ -)	S
DESIGN PHASE																			
Turbine positions	Placing turbine positions in sensitive bat habitat	2	2	2	3	3	2	24	-	Medium	1	1	1	1	3	1	7	-	Low
MITIGATION MEASURE: ▪ Developer has already applied the mitigation measure of placing turbine position outside bat sensitive areas.																			

10.4 CONSTRUCTION

Table 10: Rating of impacts that could potentially occur during the construction phase.

Environmental Parameter	Issue / Impact / Environmental Effect/ Nature	Environmental Significance Before Mitigation									Environmental Significance After Mitigation								
		E	P	R	L	D	I/M	Total	Status (+/ -)	S	E	P	R	L	D	I/M	Total	Status (+/ -)	S
CONSTRUCTION PHASE																			
Clearing and excavation of natural habitat.	The destruction of active bat roost and features that could serve as bat roosts, such as rock formations, removal of trees on site, destruction of derelict holes and fragmentation of habitat.	2	3	3	3	3	2	28	-	Medium	1	2	2	2	2	1	9	-	Low

MITIGATION MEASURES:

- Apart from access roads and overhead powerlines, construction activities to be kept out of all high bat sensitive areas.
- It is preferable that the substation, laydown areas and the subsequent infrastructure be kept out of high sensitivity areas, but if there is an encroachment of these buffers, it is recommended that the limited trees or any other structures where bat roosts could occur, are avoided.
- Rock formations occurring along the ridge lines should be avoided during construction.
- Destruction of trees should be avoided as far as possible and in cases where trees have to be destroyed, care should be taken not to destroy bat roosts.
- Care should be taken if any dense bushes are destroyed so that no roosts are disturbed or destroyed.
- Aardvark holes or any large derelict holes or excavations should not be destroyed before careful examination for bats.

Environmental Parameter	Issue / Impact / Environmental Effect/ Nature	Environmental Significance Before Mitigation									Environmental Significance After Mitigation								
		E	P	R	L	D	I/M	Total	Status (+/ -)	S	E	P	R	L	D	I/M	Total	Status (+/ -)	S
CONSTRUCTION PHASE																			
▪ The Environmental Control Officer (ECO), or a responsible appointed person, should contact a bat specialist before construction commences so that they know what to look out for during construction.																			
Creating features which attract bats	Creating new habitat amongst turbines which might attract bats. This includes buildings with roofs that could serve as roosting space and open water sources from quarries or excavation where water could accumulate.	2	3	2	2	3	2	24	-	Medium	1	1	1	1	1	1	5	-	Low
MITIGATION MEASURES: ▪ Completely seal off roofs of new buildings (e.g., substations and site buildings). Note, a small bat species could enter a hole the size of 1 cm^2. ▪ Roofs need to be regularly inspected during the lifetime of the WEF, and any new holes need to be sealed. ▪ Excavation areas, quarries or any other artificial depressions should be filled and rehabilitated to avoid creating new areas of open water sources which could attract bats during rainy spells.																			
Construction activities	Construction noise, especially at night as well as light disturbance.	1	3	2	2	1	2	18	-	Low	1	2	1	1	1	1	6	-	Low
MITIGATION MEASURES: ▪ Nightly construction activities should be avoided, or if necessary, minimised to the shortest period possible.																			

Environmental Parameter	Issue / Impact / Environmental Effect/ Nature	Environmental Significance Before Mitigation									Environmental Significance After Mitigation								
		E	P	R	L	D	I/M	Total	Status (+/ -)	S	E	P	R	L	D	I/M	Total	Status (+/ -)	S
CONSTRUCTION PHASE																			
▪ Except for compulsory civil aviation lighting, artificial lighting during construction should be minimised, especially bright lights or spotlights. ▪ Lights should avoid skyward illumination. ▪ Turbine tower lights should be switched off when not in operation, where possible.																			

10.5 OPERATION

Table 11: Rating of impacts that could potentially occur during the operational phase.

Environmental Parameter	Issue / Impact / Environmental Effect/ Nature	Environmental Significance Before Mitigation									Environmental Significance After Mitigation								
		E	P	R	L	D	I/M	Total	Status (+/-)	S	E	P	R	L	D	I/M	Total	Status (+/-)	S
OPERATIONAL PHASE																			
Direct collision or barotrauma	Fatality through direct collision or barotrauma of resident bats occupying the airspace amongst the turbines. The turning blades of the turbines during operation are the most important aspect of the project that would impact negatively on bats. High flying species have predominantly been confirmed at the proposed Kraaltjies WEF site.	3	4	3	4	3	3	51	-	High	3	4	3	3	3	2	32	-	Medium

MITIGATION MEASURES:

- All turbines and turbine components, including the rotor swept zone, should be kept out of all high sensitivity zones.
- Mitigation, as proposed in Section 9, should be applied as soon as the test period of turbines are completed and turbines start turning.
- A bat specialist should be appointed **before** the turbines start to turn, and operational bat monitoring should start when all the turbines start to turn, for a minimum of two years, or described by the latest South African bat guidelines.
- At least two years of post-construction bat monitoring is to be conducted and must be performed according to the South Africa Good Practice Guidelines for Operational Monitoring for Bats at Wind Energy facilities (Aronson, et.al., 2020), or later versions of the guidelines valid at the time of monitoring, as well as other relevant SABAA guidelines as applicable during the monitoring period.
- Prolonged post-construction mitigation, beyond the prescribed two years, might be necessary if advised by the operational bat specialist.
- Mitigation should be discussed between the bat specialist and developer during the operational phase and should be adapted and implemented without delay. Where high bat mortality occurs, turbine specific mitigation measures should be applied, using Section 9 as a starting point for discussions.
- Freewheeling, when turbines do not generate power, should be avoided, to a point where the turbines are not a threat to bats.

Environmental Parameter	Issue / Impact / Environmental Effect/ Nature	Environmental Significance Before Mitigation									Environmental Significance After Mitigation								
		E	P	R	L	D	I/M	Total	Status (+/-)	S	E	P	R	L	D	I/M	Total	Status (+/-)	S
OPERATIONAL PHASE																			
▪ Except for compulsory lighting required in terms of civil aviation, artificial lighting should be minimised, especially bright lights. Lights should rather be turned downwards. Turbine tower lights should be switched off when not in operation, if possible. ▪ It is understood that static bat monitoring equipment on turbines has a cost implication. Although it is not a requirement at this stage, as it depends on whether the Met mast will be deployed for the life span of the turbines. Having refined static data from sampling points at height, would aid in interpreting future bat fatality records of the proposed Kraaltjies WEF. Therefore, the installation of more than one monitoring system at height, is important.																			
Fatality of migratory bats	Bat fatality during migration. An autumn spike of activity by *Miniopterus natalensis*, a Near Threatened migration species, had been recorded. Not much research has been conducted on migration of bats in South Africa, and some of the other species occurring on site could also migrate.	3	4	2	3	3	3	45	-	High	3	3	3	2	3	2	28	-	Medium
MITIGATION MEASURES: ▪ Care should be taken during post construction monitoring to verify the activity of *M. natalensis*, especially within the rotor swept area of the turbine blades. Carcasses should be identified to establish the fatality of this species. ▪ A bat specialist should be appointed **before** the turbines start to turn, and operational bat monitoring should start when all the turbines start to turn, for a minimum of two years, or described by the latest South African bat guidelines. ▪ At least two years of post-construction bat monitoring is to be conducted and must be performed according to the South Africa Good Practice Guidelines for Operational Monitoring for Bats at Wind Energy facilities (Aronson, et.al., 2020), or later versions of the guidelines valid at the time of monitoring, as well as other relevant SABAA guidelines as applicable during the monitoring period. ▪ Prolonged post-construction mitigation, beyond the prescribed two years, might be necessary if advised by the operational bat specialist.																			

Environmental Parameter	Issue / Impact / Environmental Effect/ Nature	Environmental Significance Before Mitigation									Environmental Significance After Mitigation								
		E	P	R	L	D	I/M	Total	Status (+/-)	S	E	P	R	L	D	I/M	Total	Status (+/-)	S
OPERATIONAL PHASE																			
▪ Mitigation should be discussed between the bat specialist and developer during the operational phase and should be adapted and implemented without delay. Where high bat mortality occurs, turbine specific mitigation measures should be applied, using Section 9 as a starting point for discussions. ▪ Freewheeling, when turbines do not generate power, should be avoided, to a point where the turbines are not a threat to bats. ▪ Except for compulsory lighting required in terms of civil aviation, artificial lighting should be minimised, especially bright lights. Lights should rather be turned downwards. Turbine tower lights should be switched off when not in operation, if possible. ▪ It is understood that static bat monitoring equipment on turbines has a cost implication. Although it is not a requirement at this stage, as it depends on whether the Met mast will be deployed for the life span of the turbines. Having refined static data from sampling points at height, would aid in interpreting future bat fatality records of the proposed Kraaltjies WEF. Therefore, the installation of more than one monitoring system at height, is important.																			
Loss of bats of conservation value	Bat fatality of bat species of conservation value. Calls similar to the red data *Miniopterus natalensis* have been recorded, as well as the endemic *Eptesicus hottentotus*.	3	4	2	3	3	3	45	-	High	3	3	3	2	3	2	28	-	Medium
MITIGATION MEASURES: ▪ Loss of bats of conservation value. Activity indicating the red *data Miniopterus natalensis* has been recorded, as well as the endemic *E. hottentotus.* Proven mitigation measures, such as curtailment, should be timeously applied if high activity of bats of conservation value is recorded, or if high numbers of carcasses are collected, during post-construction. ▪ A bat specialist should be appointed **before** the turbines start to turn, and operational bat monitoring should start when all the turbines start to turn, for a minimum of two years, or described by the latest South African bat guidelines.																			

<table>
<tr><th rowspan="2">Environmental Parameter</th><th rowspan="2">Issue / Impact / Environmental Effect/ Nature</th><th colspan="9">Environmental Significance Before Mitigation</th><th colspan="9">Environmental Significance After Mitigation</th></tr>
<tr><th>E</th><th>P</th><th>R</th><th>L</th><th>D</th><th>I/M</th><th>Total</th><th>Status (+/-)</th><th>S</th><th>E</th><th>P</th><th>R</th><th>L</th><th>D</th><th>I/M</th><th>Total</th><th>Status (+/-)</th><th>S</th></tr>
<tr><td colspan="20">OPERATIONAL PHASE</td></tr>
<tr><td colspan="20">

At least two years of post-construction bat monitoring is to be conducted and must be performed according to the South Africa Good Practice Guidelines for Operational Monitoring for Bats at Wind Energy facilities (Aronson, et.al., 2020), or later versions of the guidelines valid at the time of monitoring, as well as other relevant SABAA guidelines as applicable during the monitoring period.
Prolonged post-construction mitigation, beyond the prescribed two years, might be necessary if advised by the operational bat specialist.
Mitigation should be discussed between the bat specialist and developer during the operational phase and should be adapted and implemented without delay. Where high bat mortality occurs, turbine specific mitigation measures should be applied, using Section 9 as a starting point for discussions.
Freewheeling, when turbines do not generate power, should be avoided, to a point where the turbines are not a threat to bats.
Except for compulsory lighting required in terms of civil aviation, artificial lighting should be minimised, especially bright lights. Lights should rather be turned downwards. Turbine tower lights should be switched off when not in operation, if possible.
It is understood that static bat monitoring equipment on turbines has a cost implication. Although it is not a requirement at this stage, as it depends on whether the Met mast will be deployed for the life span of the turbines. Having refined static data from sampling points at height, would aid in interpreting future bat fatality records of the proposed Kraaltjies WEF. Therefore, the installation of more than one monitoring system at height, is important.

</td></tr>
<tr><td>Fatal curiosity</td><td>Bat mortality due to the attraction of bats to wind turbines. Bats have been shown to sometimes be attracted to wind turbines out of curiosity or reasons still under investigation.</td><td>2</td><td>2</td><td>2</td><td>2</td><td>3</td><td>2</td><td>22</td><td>-</td><td>Low</td><td>2</td><td>2</td><td>1</td><td>2</td><td>2</td><td>1</td><td>9</td><td>-</td><td>Low</td></tr>
<tr><td colspan="20">
MITIGATION MEASURES:

Except for compulsory lighting required in terms of civil aviation, artificial lighting should be minimised, especially bright lights. Lights should rather be turned downwards. Turbine tower lights should be switched off when not in operation, if possible.
Little is known about this impact, and mitigation could be adapted if more research becomes available.

</td></tr>
</table>

Environmental Parameter	Issue / Impact / Environmental Effect/ Nature	Environmental Significance Before Mitigation									Environmental Significance After Mitigation								
		E	P	R	L	D	I/M	Total	Status (+/-)	S	E	P	R	L	D	I/M	Total	Status (+/-)	S
OPERATIONAL PHASE																			
Habitat loss	Loss of habitat and foraging space during operation of the wind turbines.	2	4	3	3	3	3	45	-	High	2	4	2	2	3	2	26	-	Medium

MITIGATION MEASURES:

- All turbines and turbine components, including the rotor swept zone, should be kept out of all high sensitivity zones.
- Mitigation, as proposed in Section 9, should be applied as soon as the test period of turbines are completed and turbines start turning.
- At least two years of post-construction bat monitoring is to be conducted and must be performed according to the South Africa Good Practice Guidelines for Operational Monitoring for Bats at Wind Energy facilities (Aronson, et.al., 2020), or later versions of the guidelines valid at the time of monitoring, as well as other relevant SABAA guidelines as applicable during the monitoring period.
- Prolonged post-construction mitigation, beyond the prescribed two years, might be necessary if advised by the operational bat specialist.
- Mitigation should be discussed between the bat specialist and developer during the operational phase and should be adapted and implemented without delay. Where high bat mortality occurs, turbine specific mitigation measures should be applied, using Section 9 as a starting point for discussions.
- Freewheeling, when turbines do not generate power, should be avoided, to a point where the turbines are not a threat to bats.
- Except for compulsory lighting required in terms of civil aviation, artificial lighting should be minimised, especially bright lights. Lights should rather be turned downwards. Turbine tower lights should be switched off when not in operation, if possible.
- It is understood that static bat monitoring equipment on turbines has a cost implication. Although it is not a requirement at this stage, as it depends on whether the Met mast will be deployed for the life span of the turbines. Having refined static data from sampling points at height, would aid in interpreting future bat fatality records of the proposed Kraaltjies WEF. Therefore, the installation of more than one monitoring system at height, is important.

Smaller genetic pool	Reduction in the size, genetic diversity, resilience and persistence of bat populations.	3	3	2	2	3	2	26	-	Medium	3	2	2	2	3	2	24	-	Medium

Environmental Parameter	Issue / Impact / Environmental Effect/ Nature	Environmental Significance Before Mitigation									Environmental Significance After Mitigation								
		E	P	R	L	D	I/M	Total	Status (+/-)	S	E	P	R	L	D	I/M	Total	Status (+/-)	S
OPERATIONAL PHASE																			
	Bats have low reproductive rates and populations are susceptible to reduction by fatalities other than natural death. Furthermore, smaller bat populations are more susceptible to genetic inbreeding.																		

MITIGATION MEASURES:

- A bat specialist should be appointed **before** the turbines start to turn, and operational bat monitoring should start when all the turbines start to turn, for a minimum of two years, or described by the latest South African bat guidelines.
- At least two years of post-construction bat monitoring is to be conducted and must be performed according to the South Africa Good Practice Guidelines for Operational Monitoring for Bats at Wind Energy facilities (Aronson, et.al., 2020), or later versions of the guidelines valid at the time of monitoring, as well as other relevant SABAA guidelines as applicable during the monitoring period.
- Prolonged post-construction mitigation, beyond the prescribed two years, might be necessary if advised by the operational bat specialist.
- Mitigation should be discussed between the bat specialist and developer during the operational phase and should be adapted and implemented without delay. Where high bat mortality occurs, turbine specific mitigation measures should be applied, using Section 9 as a starting point for discussions.
- Freewheeling, when turbines do not generate power, should be avoided, to a point where the turbines are not a threat to bats.
- Except for compulsory lighting required in terms of civil aviation, artificial lighting should be minimised, especially bright lights. Lights should rather be turned downwards. Turbine tower lights should be switched off when not in operation, if possible.
- It is understood that static bat monitoring equipment on turbines has a cost implication. Although it is not a requirement at this stage, as it depends on whether the Met mast will be deployed for the life span of the turbines. Having refined static data from sampling points at height, would aid in interpreting future bat fatality records of the proposed Kraaltjies WEF. Therefore, the installation of more than one monitoring system at height, is important.

10.6 DECOMMISSIONING

Table 12: Rating of impacts that could potentially occur during the decommissioning phase.

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I/M	Total	Status (+/ -)	S	E	P	R	L	D	I/M	Total	Status (+ /-)	S
DECOMISSIONING PHASE																			
Removal of turbines	Bat disturbance due to decommissioning activities and associated noise, especially during night-time.	1	3	1	2	1	1	8	-	Low	1	2	1	1	1	1	6	-	Low

MITIGATION MEASURES:

- Except for compulsory lighting required in terms of civil aviation, artificial lighting during decommissioning should be minimised, especially bright lights or spotlights.
- Night-time decommissioning activities should be avoided as far as possible.
- Develop a decommissioning and remedial rehabilitation plan and adhere to compliance monitoring plan.

10.7 'NO-GO' IMPACT

The landowners of the proposed Kraaltjies WEF both assured the bat specialist that they do not foresee any changes in the land use should the wind farm not be developed. Therefore, should the proposed WEF development not go ahead, none of the identified potential impacts would occur and the status quo would be maintained.

10.8 CUMULATIVE IMPACTS

See Section 6 for a discussion of the cumulative effect. The significance of the identified cumulative impacts are rated in Table 13 below, with mitigation measures also provided.

Table 13: Rating of cumulative impacts

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I/M	Total	Status (+/-)	S	E	P	R	L	D	I/M	Total	Status (+/-)	S
CUMULATIVE IMPACTS																			
Destruction of active roosts on several WEFs.	Cumulative effect of destruction of active roost of several WEFs as well as features that could serve as potential roosts.	3	3	3	2	3	2	28	-	Medium	3	3	2	2	3	2	26	-	Medium

MITIGATION MEASURES:

- Although the developer does not have any control over other wind energy development, project specific mitigation, as included in the respective Bat Impact Assessments of the projects in the surrounding area, mitigation should be adhered to for each renewable energy project. This can however only be enforced by the regulating authority.
- Post construction monitoring as per the relevant South African guidelines should be applied at all wind farms in the vicinity.

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I/M	Total	Status (+/-)	S	E	P	R	L	D	I/M	Total	Status (+/-)	S
Direct collision and barotrauma of several WEFs.	Cumulative bat mortality due to direct collision with the blades or barotrauma during foraging of resident bats at several WEF sites.	3	4	3	3	3	3	48	-	High	3	4	2	3	3	3	45	-	High
MITIGATION MEASURES: ▪ Although not enforceable by the Kraaltjies applicant, all REFs must adhere to their project specific mitigation measures, especially buffer zones and sensitivity areas and recommended mitigation, for each renewable energy project. ▪ Post construction monitoring, as per the relevant South African Bat Guidelines applicable at the time, is of crucial importance.																			
Mortality of several WEFs on migrating bats.	Cumulative bat mortality of migrating bats due to direct blade impact or barotrauma during foraging of migrating bats on several WEFs	3	3	3	3	3	3	45	-	High	3	3	2	3	3	3	39	-	Medium
MITIGATION MEASURES: ▪ Although not enforceable by the Kraaltjies applicant, all REFs must adhere to their project specific mitigation measures, especially buffer zones and sensitivity areas and recommended mitigation, for each renewable energy project. This can however only be enforced by the regulating authority. ▪ Post construction monitoring, as per the relevant South African Bat Guidelines applicable at the time, is of crucial importance.																			
Habitat loss over several WEFs	Several WEFs stretching over thousands of hectares.	3	4	3	3	3	3	48	-	High	3	4	2	3	3	2	30	-	Medium

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I/M	Total	Status (+/-)	S	E	P	R	L	D	I/M	Total	Status (+/-)	S
MITIGATION MEASURES: ▪ Although not enforceable by the Kraaltjies applicant, all REFs must adhere to their project specific mitigation measures, especially buffer zones and sensitivity areas and recommended mitigation, for each renewable energy project. This can however only be enforced by the regulating authority. ▪ Post construction monitoring, as per the relevant South African Bat Guidelines applicable at the time, is of crucial importance.																			
Reduction in the size, genetic diversity, resilience, and persistence of bat populations	Several wind farms with associated bat mortality reducing the size, genetic diversity, resilience, and persistence of bat populations over the lifespan of WEFs.	3	4	3	3	3	3	48	-	High	3	3	3	3	3	3	45	-	High
MITIGATION MEASURES: ▪ Although not enforceable by the Kraaltjies applicant, all REFs must adhere to their project specific mitigation measures, especially buffer zones and sensitivity areas and recommended mitigation, for each renewable energy project. This can however only be enforced by the regulating authority. ▪ Post construction monitoring, as per the relevant South African Bat Guidelines applicable at the time, is of crucial importance.																			

10.9 OVERALL IMPACT RATING

Although the combined impact during the operational phase, after mitigation, is predicted to be Medium Negative, it should be noted that the bat activity on the project site, according to the bat threshold for Nama Karoo, is medium to high and the negative impact on bats during the operational phase could thus be high. This must however be confirmed during operational bat monitoring.

The impact on bats from the proposed Kraaltjies WEF project site is predicted to be **Negative Medium,** with a combined significance rating of 36,6 before mitigation and 23, **Negative Low**, after mitigation (see Table 14).

Table 14: Summary table of expected impacts associated with the proposed Kraaltjies WEF

Summary of impacts (average of each section) on bats by the proposed Kraaltjies WEF according to the SiVEST impact rating		
Phase	**Impact before mitigation (negative)**	**Impact after mitigation (negative)**
Design	24(5-23) Medium	7(5-23) Low
Construction	23 (5-23) Medium	6,6 (5-23) Low
Operation	39(24-42) High	24,5(24-42) Medium
Decommissioning	8 (5-23) Low	6 (5-23) Low
Cumulative	43,4 (62-80) High	34,6 (24-42) Medium
Combined for the site	36,6 (24-42) Medium	23 (5-23) Low

11. COMPARATIVE ASSESSMENT OF ALTERNATIVES

11.1 'NO-GO' ALTERNATIVE

The landowners indicated that should the WEF development not take place, the same land-use activities would prevail; thus, the status quo would be maintained. No negative impact is expected on bats should the WEF development not take place.

11.2 LAYOUT ALTERNATIVES

No layout alternatives for the proposed Kraaltjies WEF have been proposed or assessed as the position of the wind turbines and overall layout of the WEF have been informed by the identified sensitivity areas. However, two site alternatives for the substation were proposed and have been comparatively assessed. Table 15 below provides the results of the comparative assessment.

Table 15: Comparative assessment of substation and laydown areas

Alternative	Preference	Reasons (incl. potential issues)
Substation site alternatives		
Substation Option 1	No preference	The area is situated in low-sensitivity zones and not close to any identified roost or roosting opportunity.
Substation Option 2	No preference	The area is situated in low-sensitivity zones and not close to any identified roost or roosting opportunity.

12. CONCLUSION AND SUMMARY

12.1 SUMMARY OF FINDINGS AND RECOMMENDATIONS

63% of the calls of all the combined systems represent *Tadarida aegyptiaca*, which is the dominant species on site. *T. aegyptiaca* is a high-risk species, physiologically adapted with a narrow wingspan to fly high, in the vicinity of the turbine blades. Due to this foraging preference, the risk of collision and barotrauma at a WEF is high. Three more high-risk species have a significant presence: 13% of the activity was for the Near Threatened *Miniopterus natalensis,* 15% was for *Neoromicia capensis*, and 9% was for *Sauromys petrophilus*. The endemic *Eptesicus hottentotus* was also recorded at the site. The Molossidae family is more dominant at the high-altitude systems, with the Molossids *S. petro*philus and *T. aegyptiaca* comprising nearly 100% of all the activity recorded at height (Systems N and O).

Although the presence of *M. natalensis* was relatively low during the year, with a bit of increased activity during spring, a sudden spike of activity was recorded during May 2022 at the 10 m system Q. This might indicate the presence of migrating bats.

The proposed Kraaltjies WEF has a low record of bat activity during winter, between June and August, with a steady increase in activity from September (spring). The highest activity had been experienced between October and May. The peak in activity experienced during October 2022, was not portrayed in October 2021, but several peaks in activity were recorded between November 2021 and May 2022, indicating high activity during the warmer summer and autumn months. After May there is a steep decline in activity as colder temperatures set in.

The general distribution of bat activity during each night, from sunset to sunrise, indicates a sudden increase in activity two hours after sunset, with bat activity increasing steadily until a peak at about five to six hours after sunset. Thereafter, activity declined steadily up to five to three hours before sunrise, until little activity is portrayed just before sunrise, when bats have returned to their roosts.

As indicated by the SABAA guidelines, the combined median bat activity per hour at near-ground level is 1,35, which is within the high-risk category, while the combined median bat activity per hour within the rotor sweep area is 0,39, which is in the medium-risk category. The latter is of particular importance, as this represents the overall hourly bat activity within the proposed sweep of the turbine blades, and thus in the area of expected collision risk.

Optimal conditions for bat activity on the terrain include temperatures above 15 °C, wind speeds below 9 m/s, humidity levels between 40% and 90% and barometric pressure levels below 932.5 hPa.

A bat sensitivity map classified no-go, high and medium sensitivity was presented. The client has shifted all turbine positions outside of high sensitivity as well as medium sensitivity zones so that no operating turbine components are placed in these areas. Supporting infrastructures, such as the laydown area, on-site sub-station, associated powerlines and Battery Energy Storage System may infringe on the sensitivity areas, if necessary, but care must be taken to avoid any destruction of possible bat roosts, as per the Environmental Management Program (EMPr).

Although no curtailment is recommended at present, a curtailment programme is provided in Section 9.3, Table 8, of the main document. This should appear in the operational bat monitoring program so that the operational bat specialist can adapt these recommendations as necessary.

Due to the spike of *M. natalensis* during autumn, curtailment of some turbines might be necessary. To refine possible mitigation and establish which turbines, if any, are affected, it is proposed that several bat-detecting systems are deployed at turbine-specific locations from September 2023 up to the beginning of June 2024 to allow for extended monitoring. This approach will indicate if the spike repeats during the next season and will allow for specific turbines to be targeted, if necessary. However, the requirement for extended monitoring need not prevent a decision on environmental authorisation being made and / or issued, as it can be done post-authorisation. Where additional or refined mitigation is required, this must be included in an updated EMPr.

Although the combined impact during the operational phase, namely after mitigation, is predicted to be Low Negative, it should be noted that the bat activity on the project site, according to the bat threshold for Nama Karoo, is medium to high, and there is a spike of activity in autumn from a Near Threatened species. This must be confirmed during bat monitoring in the operational phase, but the developer should not rule out turbine specific curtailment and/or installing bat deterrents when more information is available.

As indicated in the table below, the impact on bats from the proposed Kraaltjies WEF project site is predicted to be Negative Medium, with a combined rating of 36,6 before mitigation and Negative Low, with a combined rating of 23 after mitigation.

Summary of impacts (average of each section) on bats by the proposed Kraaltjies WEF according to the SiVEST impact rating		
Phase	**Impact before mitigation (negative)**	**Impact after mitigation (negative)**
Design	24(5-23) Medium	7(5-23) Low
Construction	23 (5-23) Medium	6,6 (5-23) Low
Operation	39(24-42) High	24,5(24-42) Medium
Decommissioning	8 (5-23) Low	6 (5-23) Low
Cumulative	43,4 (62-80) High	34,6 (24-42) Medium
Combined for the site	36,6 (24-42) Medium	23 (5-23) Low

The cumulative impacts on bat populations at the proposed Kraaltjies WEF, before mitigation, are predicted to be High Negative. This is due to the combined impact of all the proposed wind farms in the area. If all wind farms in the vicinity adhere to recommended mitigation measures, the combined cumulative impact is predicted to be reduced to Medium Negative.

It is recommended that the following mitigation measures be included in the Environmental Authorisation (EA):

- The final layout must be informed by the sensitivity map provided in Section 7.3 of the main report.
- A bat specialist must be appointed before the Commercial Operation Date (COD). A mitigation scheme, as per Section 9 in the main report, must form part of the operational management plan, and be applied.
- Extended, intensive bat monitoring, as described in Section 9.10 to establish whether species-specific and turbine-specific mitigation is necessary for the red data *M. natalensis.* This can be undertaken post-authorisation and any additional or refined mitigation measures must be included in an updated EMPr, where recommended.
- Turbines must be feathered below cut-in speed, and although they need not be at a complete standstill, there should be minimum movement so that bats are not at risk when turbines are not generating power.
- Mitigation measures must be applied as outlined in the impact tables, Section 10, of the main report and the EMPr.

- Where high fatality, above the fatality threshold of the relevant guidelines, be experienced during operation, curtailment, as indicated in Section 9 of the main report, must be adapted, or bat deterrents must be installed, as guided by the operational bat specialist.
- All newly built structures that have bat conducive features must be rehabilitated to discourage bat presence. This includes roofs of new buildings, open quarries and borrow pits. A regular investigation should establish if new roofs are still sealed.
- A minimum of two year's operational bat monitoring must be conducted after the commencement of operations at the WEF, as per the guidance of the latest operational South African Bat Assessment Association (SABAA) guidelines.

12.2 CONCLUSION AND IMPACT STATEMENT

The Site Sensitivity Verification Report indicates that the area proposed for the Kraaltjies WEF has areas of high bat sensitivity. Some of the drainage lines, with relatively larger trees and denser bushes, are particularly conducive to bat activity, confirmed in the Site Sensitivity Verification Report; however, areas between these high sensitivity zones, portrayed lower activity. This is confirmed by the 12-month bat monitoring study.

It should be noted that one year pre-construction bat monitoring is required by legislation in South Africa. However, the semi-desert Nama Karoo environment is subject to erratic weather conditions, which vary from year to year. As confirmed by operational wind farms, bat fatalities could fluctuate significantly, depending on weather conditions. These changes cannot be accounted for in a year of bat monitoring.

The overall potential negative impact of the proposed Kraaltjies WEF on bats, combined for all the development phases, is predicted to be **Medium Negative without mitigation**, and **Low Negative with mitigation**.

Based on the findings of the one-year pre-construction monitoring undertaken at the proposed Kraaltjies 240 MW WEF project site, the bat specialist is of the opinion that no fatal flaws exist which would prevent the construction and operation of the WEF. Environmental Authorisation may thus be granted, subject to the implementation of the recommendations made in this report.

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APPENDIX 1: SPECIALIST CV

ABBREVIATED CURRICULUM VITAE:

STEPHANIE CHRISTIA DIPPENAAR

Stephanie Dippenaar Consulting, trading as EkoVler

PROFESSION: ENVIRONMENTAL MANAGEMENT, SPECIALISING IN BAT IMPACT ASSESSMENTS

Nationality: South African

ID number: 6402040117089

CONTACT DETAILS

Postal Address: 8 Florida Street, Stellenbosch, 7600

Telephone Number: 021-8801653

Cell: 0822005244

e-mail: sdippenaar@snowisp.com

EDUCATION

1986 BA University of Stellenbosch

1987 BA Hon (Geography) University of Stellenbosch

1999 MEM (Masters in Environmental Management) University of the Free State

MEMBERSHIPS

- Steering committee of The South African Bat Assessment Association
- Member of the Southern African Institute of Ecologists and Environmental Scientists (SAIEES), since 2002.
- SACNASP registration in process.

EMPLOYMENT RECORD

- 1989: The Academy: University of Namibia. One-year contract as a lecturer in the Department of Geography.
- 1990: Windhoek College of Education. One-year contract as a lecturer in the Department of Geography.

    - Research assistant, Namibian Institute for Social and Economic Research, working on, amongst others, a situation analyses on women and children in Namibia, contracted by UNICEF.
    - Media officer for Earthlife African, Namibian Branch.
- 1991: University of Limpopo. One-year contract as a lecturer in the Department of Environmental Sciences.
- 1992: Max Planc Institute (Radolfzell-Germany). Mainly involved in handling birds and assisting with aviary studies.
- Swiss Ornithological Institute. Working in the Arava valley, Negev – Israel, as a radar operator on a project, contracted by Voice of America, involved in an Impact Assessment Study concerning shortwave towers on bird migration patterns.
- 1993 - 2004: University of Limpopo. Lecturer in the sub-discipline Geography, School of Agriculture and Environmental Sciences. Teaching post- and pre-graduate courses in environment related subjects in the Faculty of Mathematics and Natural Sciences, Faculty of Law, Faculty of Health and the Water and Sanitation Institute.
    - 2002-2004: Member of the Faculty Board of the Faculty of Natural Sciences and Mathematics.
    - 2002: Principal investigator of the Blue Swallow project, Northern Province, Birdlife SA.
    - 2002: Evaluating committee for the EMEM awards (award system for environmental practice at mines in South Africa)
    - 2001-2004: Private consultancy work, focussing on environmental management plans for game reserves.
- 2004-2011: CSIR, South Africa, doing environmental strategy and management plans and environmental impact assessments, mainly on renewable energy projects.
- 2011 onwards: Sole proprietor private consultancy.
- From 2015 to 2017: Teaching a part-time course in Environmental Management to Post-graduate students at the Department of Geography and Environmental Studies, University of Stellenbosch.

PROJECT EXPERIENCE RECORD

The following table presents an abridged list of project involvement, as well as the role played in each project:

Completion	Project description	Role
In progress	Preconstruction Bat monitoring at Khoe Wind Energy Facility	Bat specialist
In progress	Preconstruction Bat monitoring at Hugo Wind Energy Facility	Bat specialist
In progress	Operational bat monitoring at Kangnas Wind Farm	Bat specialist
In progress	Operational bat monitoring at Perdekraal East Wind Farm	Bat specialist
2022	Preconstruction Bat monitoring at Latrodex Wind Energy Facility, Haga Haga	Bat specialist
2022	Preconstruction Bat monitoring at Juno 2 and Juno 3 Wind Energy Facilities	Bat specialist

Completion	Project description	Role
2022	Background study for the impact on bats by Small Scale Wind Turbines in Cape Town Municipality	Bat specialist
In progress	Preconstruction bat monitoring at Patatskloof Wind Energy Facility	Bat specialist
In progress	Preconstruction bat monitoring at Karee Wind Energy Facility	Bat specialist
In progress	Operational bat monitoring at Excelsior Wind Farm	Bat specialist
2021	Preconstruction Bat monitoring at Koup 1 and Koup 2 Wind Energy Facilities	Bat specialist
In progress	Preconstruction bat monitoring for two wind energy facilities at Kleinzee	Bat specialist
2021	Preconstruction bat monitoring at Komas and Gromis Wind Energy Facilities	Bat specialist
In progress	Preconstruction bat monitoring at Kappa 1 and 2 Wind Energy Facilities	Bat specialist
2021	Desktop bat screening report: Calvinia renewable energy clusters	Bat specialist
2020	Preconstruction bat monitoring at Kokerboom 3 and 4 Wind Energy Facilities	Bat specialist
2020	Operational bat monitoring at Khobab Wind Farm	Bat specialist
2020	Operational bat monitoring at Loeriesfontein 2 Wind Farm	Bat specialist
In progress (year 6)	Operational bat monitoring at the Noupoort Wind Farm	Bat specialist
2019	Paalfontein bat screening study	Bat specialist
2019	12 Amendment reports	Bat specialist
2019	Preconstruction bat impact assessment for the Bosjesmansberg WEF	Bat specialist
2018	Preconstruction Bat Monitoring at the Tooverberg Wind Energy Facility	Bat specialist
2016	Bat “walk through” for the Hopefield Powerline associated with the Hopefield Community WEF	Bat specialist
2016	Environmental Management Plan for Elephants in Captivity at the Elephant Section, Camp Jabulani, Kapama Private Game Reserve.	Project Manager
2016	Environmental Management Plan for Hoedspruit Endangered Species Centre, Kapama Game Reserve.	Project Manager
2012-2013	Bat impact assessment for the Karookop Wind Energy Project EIA.	Bat specialist
2012	Bat specialist study for Vredendal Wind Farm EIA.	Bat specialist
2011-2012	Bat monitoring and bat impact assessment for the Ubuntu Wind Project EIA, Jeffreys Bay.	Bat specialist
2011	Bat specialist study for the Banna Ba Pifhu Wind Energy Development, Jeffrey’s Bay .	Bat specialist
2011(project cancelled)	Basic Assessment for the development of an air strip outside Betty’s Bay.	Project Manager
2011	Bat specialist study for the wind energy facility EIA at zone 12, Coega IDZ, Port Elizabeth.	Bat specialist
2010-2011	Bat specialist study for the Wind Energy Facility EIA at Langefontein, Darling.	Bat specialist
2010-2011	Bat specialist study for the EIA concerning four wind energy development sites in the Western Cape.	Bat specialist

Completion	Project description	Role
2010	Bat specialist study for Electrawinds Wind Project EIA, Port Elizabeth.	Bat specialist
2010	Environmental Management Plan for the Goukou Estuary.	Project Manager
2010	EIA for the 180 MW Jeffrey's Bay Wind Project, Eastern Cape (Authorisation received).	Project Manager
2010	EIA for 9 Wind Monitoring Masts for the Jeffrey's Bay Wind Project (Authorisation received).	Project Manager
2009-2010	EIA for the NamWater Desalination Plant, Swakopmund (Authorisation received).	Project Manager
2007 -2011	EIA for the proposed Jacobsbaai Tortoise reserve, Western Cape (Left CSIR before completion of project, Authorisation rejected).	Project Manager
2007-2008	Environmental Impact Assessment for the Kouga Wind Farm, Jeffrey's Bay, Eastern Cape (Authorisation received).	Project Manager
2006-2008	Site Selection Criteria for Nuclear Power Stations in South Africa.	Co-author
2005	Auditing the Environmental Impact Assessment process for the Department of Environment and Agriculture, Kwazulu Natal, South Africa	Project Manager
2005	Background paper on Water Issues for discussions between OECD countries and Developing Countries.	Author
2005	Integrated Environmental Education Strategy for the City of Tshwane.	Co- author
2005	Developing a ranking system prioritizing derelict mines in South Africa, steering the biodiversity section.	Contributor
2005	Policy and Legislative Section for a Strategy to improve the contribution of Granite Mining to Sustainable Development in the Brits-Rustenburg Region, North-West Province, South Africa.	Author
2005	Environmental Management Plan for the purpose of Leopard permits: Dinaka Game Reserve.	Project Manager in collaboration with Flip Schoeman✞
2004	Environmental Management Plan for the introduction of lion: Pride of Africa.	Project Manager in collaboration with Flip Schoeman✞
2004	Environmental Management Plan for the establishment of a Conservancy: Greater Kudu Safaris	Project Manager in collaboration with Flip Schoeman✞

MEMBERSHIPS, CONFERENCES, WORKSHOPS AND COURSES

- Member of the Steering Committee of the South Africa Bat Assessment Association.
- Member of the KZN Bat Rescue Group.
- Updated Basic Fall Arrest certification.
- Presenting a paper at the South African Bat Assessment Association conference, October 2017: Ackerman, C and S.C Dippenaar, 2017: Friend or Foe? The Perception of Stellenbosch Residents Towards Bats, 2017.
- Attend Snake Awareness, Identification and Handling course by Cape Reptile Institute, 2016.
- Attend a course in the management and care of bats injured by wind turbines by Dr. Eleanor Richardson, Kirstenbosch, 27 August 2014
- Mist netting and bat handling course by Dr. Sandie Sowler, Swellendam, 5 November 2013.

- Attendance and fieldwork to identify bat species and look at new AnalookW software with Chris Corben, the writer of the Analook bat identification software package and the Anabat Detector, during 10 and 11 October 2013.
- Attend yearly Bats and Wind Energy workshops.
- A four-day training course on Bat Surveys at proposed Wind Energy Facilities in South Africa, hosted by The Endangered Wildlife Trust, Greyton, between 22 and 26 January 2012.
- Presentation as a plenary speaker at the 4th Wind Power Africa Conference and Renewable Energy Exhibition, at the Cape Town International Convention Centre, on 28 May 2012. Title: *Bat Impact Assessments in South Africa: An advantage or disadvantage to wind development EIAs.*
- Anabat course by Dr. Sandy Sowler, Greyton, February 2011.
- Attending a Biodiversity Course for Environmental Impact Assessments presented by the University of the Free State, May 2010.

LANGUAGE CAPABILITY

Fluent in Afrikaans and English, very limited Xhosa

PEER REVIEWED PUBLICATIONS

Dippenaar, S, and Lochner, P (2010): EIA for a proposed Wind Energy Project, Jeffrey's Bay in SEA/EIA Case Studies for Renewable Energy.

Dippenaar, S. and Kotze, N. (2005): People with disabilities and nature tourism: A South African case study. Social work, 41(1), p96-108.

Kotze, N.J. and Dippenaar, S.C. (2004): Accessibility for tourists with disabilities in the Limpopo Province, South Africa. In: Rodgerson, CM & G Visser (Eds.), Tourism and Development: Issues in contemporary South Africa. Institute of South Africa.

APPENDIX 2: SITE SENSITIVITY VERIFICATION

Site Sensitivity Verification Report: Kraaltjies 240 MW Wind Energy Facility

In terms of Part A of the Assessment Protocols published in GN 320 on 20 March 2020

1. INTRODUCTION

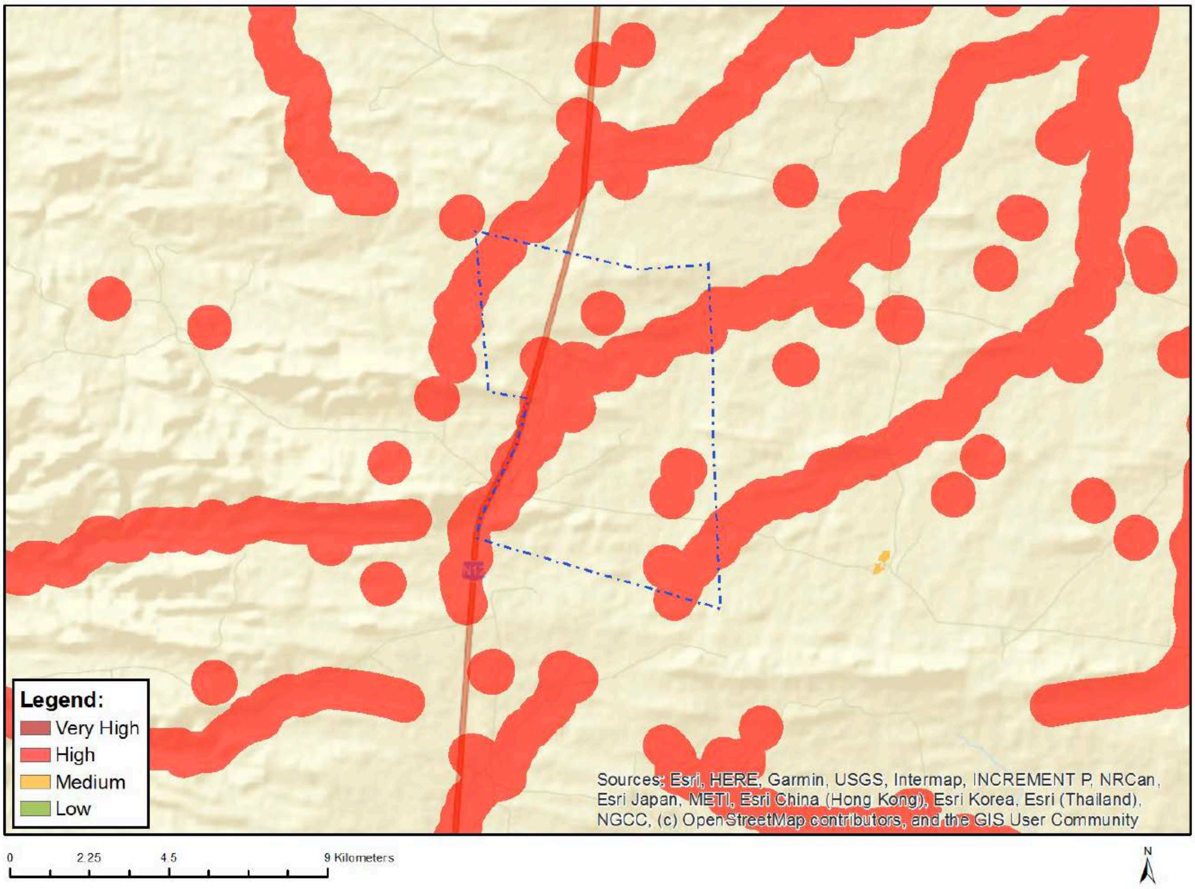
South Africa Mainstream Renewable Power Developments (Pty) Ltd is proposing to construct a 240 Megawatt (MW) Wind Energy Facility (WEF), known as the Kraaltjies 240 MW WEF, with associated infrastructure, close to Beaufort West in the Central Karoo.

The project site is located on Portion 10 and Portion 25 of the Farm Brits Eigendom No. 374, within the Beaufort West Local Municipality in the Central Karoo District Municipality. The site is located east of the N12 national road, en route to Beaufort West in the Western Cape Province. A 240 MW WEF with an estimated 20 turbines and associated infrastructure is proposed, covering a study area of 3 994.9 ha.

Stephanie Dippenaar Consulting, trading as EkoVler, was appointed to conduct a minimum of 12-month pre-construction bat monitoring, to inform the Environmental Assessment process for the proposed WEF. This pre-construction bat monitoring commenced in August 2021. Data included between 15 August 2021 and 12 November 2022 is included in this bat monitoring report.

2. SITE SENSITIVITY VERIFICATION

The national web-based environmental screening tool, as per the Specialist Assessment Protocols published in GN 320 on 20 March 2020, was applied to the study area. This was undertaken to confirm the current land use and environmental sensitivity of the proposed project area. It was determined that areas of high bat sensitivity are expected to occur within the project site, as shown in Figure A below.



Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
	X		

Sensitivity	*Features(s)*
High	Within 500 m of a river
High	Wetland
High	Within 500 m of a wetland
Medium	Croplands

Figure A: Expected bat-sensitive features at the Kraaltjies WEF, as depicted by the Screening Tool

To verify this classification, the following methods were applied as part of the 14-month pre-construction bat monitoring exercise:

- A desktop analysis was undertaken, based on available national and provincial databases, existing reports from the surrounding area, as well as digital satellite imagery (Google Earth Pro and QGIS).
- On-site inspections and roost searches were conducted by a bat specialist during fieldwork sessions.
- Data, consisting of nightly bat activity, was recorded from 15 August 2021 to 12 November 2022 from four static monitoring points, which were positioned, amongst others, within the sweep of the proposed turbine blades at heights of 8 m, 10 m, 52 m, and 98 m respectively. The systems represented the different biotopes within the project site.

- Interviews with landowners and investigations of farm dwellings were conducted.

3. THE OUTCOME OF THE SITE SENSITIVITY VERIFICATION

See Table A below for photos indicating bat conducive features at the Kraaltjies WEF project site.

Table A: Environmental features that may be favourable to bats

	**Vegetation** Although most of the project site is covered in the typical Karoo vegetation of the area, for those bats that might prefer roosting in vegetation or under the bark of trees, the relatively denser trees and bushes situated in the dry riverbeds provide roosting opportunities.
	**Rock formations and rock faces and animal burrows** Rock formations along the low hill tops and along the river valleys provide ample roosting opportunities for bats.
	**Derelict animal burrows** Bats can also make use of abandoned burrows or aardvark holes as roosts.
	**Human dwellings and farm buildings** Human dwellings could provide roosting space for some bat species and evidence of bats were found at Silver Karoo farm dwellings. Culverts and stone walls also provide roosting sites.
	**Open water and food sources** Water troughs for the livestock, farm dams and water collecting in the riverbeds not only provide water to drink for bats, but also promote insect activity which could result in relatively higher bat activity after rainy spells.

As indicated in the Screening Tool Site Sensitivity Map, Figure B, the project site is classified as high sensitivity mainly due to the availability of natural water resources. The 14 months of bat monitoring data analyses have confirmed the high sensitivity, with added sensitivity zones on the site sensitivity map, see Figure B. Some environmental features, amongst others, may be favourable to bats are indicated in Table A.

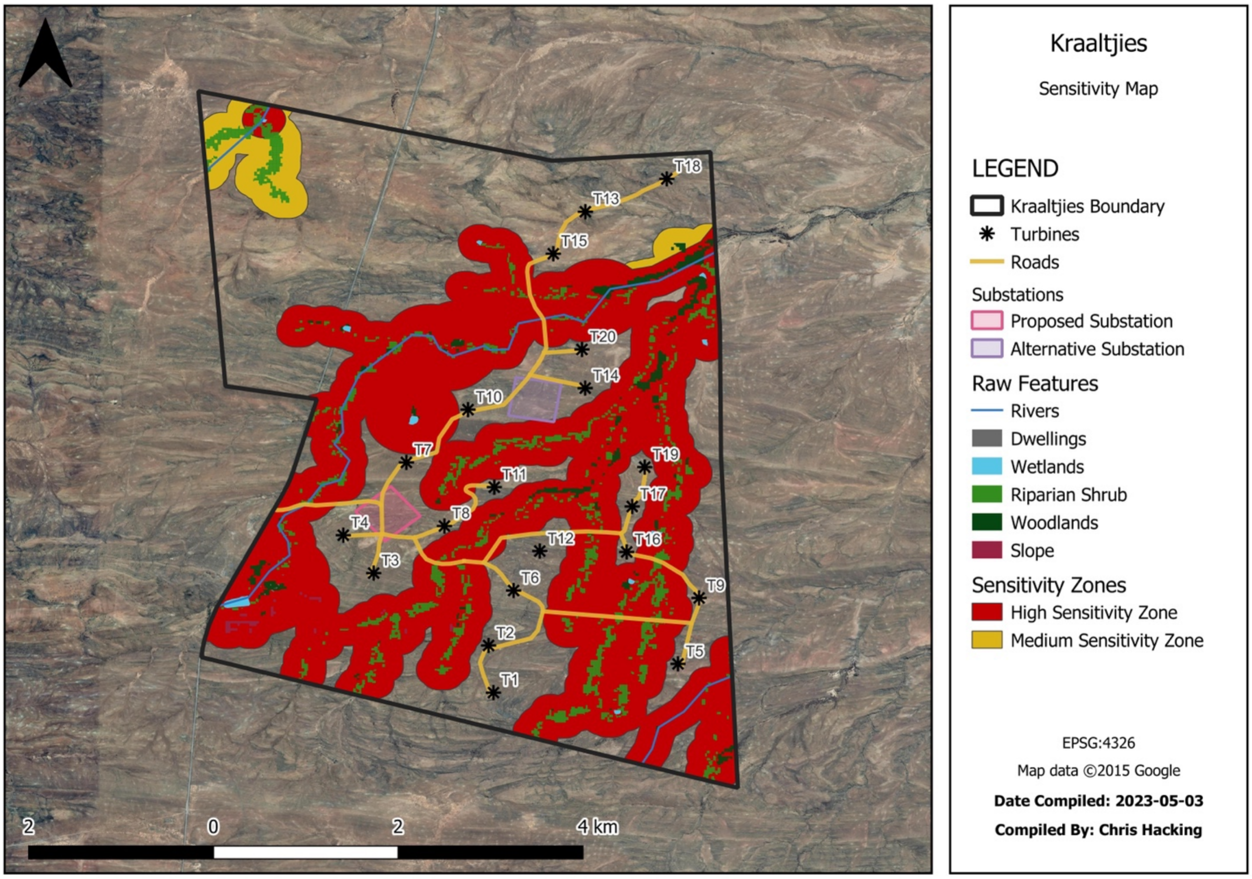


Figure B: Bat sensitivity map at the Kraaltjies WEF, as confirmed during the 9-months bat monitoring as described in the main report

Table B below indicates the height-specific bat activity and fatality risk according to the South African pre-construction bat guidelines (MacEwan et al., 2020) together with the median of hourly bat activity at height over the monitoring period, from Systems O, at 52 m and System N, at 98 m, and near ground level, from Systems Q and P, between 8 m and 10 m respectively. The combined median bat activity per hour at near-ground level is 1,35, which is within the high-risk category, while the combined median bat activity per hour within the rotor sweep area is 0,39, which is in the medium-risk category. Therefore, the site sensitivity as depicted by the Screening Tool, is partially correct, indicating areas of high sensitivity. There are, however, low sensitivity areas between these, as indicated by Figure B, where wind turbines could be developed.

Table B: The bat fatality risk threshold for Nama Karoo with the median from within the sweep of the proposed turbine blades and from lower near ground monitoring systems (MacEwan et al., 2020)

Ecoregion	Height category*	Low risk (Median bat passes/hour)	Medium risk (Median bat passes/hour)	High risk (Median bat passes/hour)
Nama Karoo	Near ground	<0,18	0,18 – 1,01	>1,01
	Rotor sweep	<0,03	0,03 – 0,42	>0,42
Height of monitoring systems at the proposed Kraaltjies WEF site			**Median of hourly bat activity for the monitoring period**	
Combined activity from 10 m systems (Q, P) near ground.			1,35	
Combined activity from 52 m (O) and 98 m (N) in the rotor sweep area.			0,39	

4. CONCLUSION

The Site Sensitivity Verification Report indicates that area proposed for the Kraaltjies WEF has high bat sensitivity. Some drainage lines, with relatively larger trees and denser bushes, are particularly conducive to bat activity. The site sensitivity as depicted by the Screening Tool, is partially correct, indicating areas of high sensitivity. There are, however, low sensitivity areas between these, as indicated by Figure B, where wind turbines could be developed.

APPENDIX 3: SPECIALIST DECLARATION

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

	(For official use only)
File Reference Number:	
NEAS Reference Number:	DEA/EIA/
Date Received:	

Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

PROJECT TITLE

Environmental Impact Assessment for the proposed Kraaltjies 240MW Wind Energy Facility

Kindly note the following:

1. This form must always be used for applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting where this Department is the Competent Authority.
2. This form is current as of 01 September 2018. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.environment.gov.za/documents/forms.
3. A copy of this form containing original signatures must be appended to all Draft and Final Reports submitted to the department for consideration.
4. All documentation delivered to the physical address contained in this form must be delivered during the official Departmental Officer Hours which is visible on the Departmental gate.
5. All EIA related documents (includes application forms, reports or any EIA related submissions) that are faxed; emailed; delivered to Security or placed in the Departmental Tender Box will not be accepted, only hardcopy submissions are accepted.

Departmental Details

Postal address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Private Bag X447
Pretoria
0001

Physical address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Environment House
473 Steve Biko Road
Arcadia

Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:
Email: EIAAdmin@environment.gov.za

1. SPECIALIST INFORMATION

Specialist Company Name:	Sole proprietor: Stephanie Dippenaar Consulting trading as EkoVler			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	5	Percentage Procurement recognition	80%
Specialist name:	Stephanie Dippenaar			
Specialist Qualifications:	MEM (Masters in Environmental Management)			
Professional affiliation/registration:	SAAIES			
Physical address:	8 Florida Street, Stellenbosch			
Postal address:	8 Florida Street, Stellenbosch			
Postal code:	7600	Cell:	0822005244	
Telephone:	0822005244	Fax:		
E-mail:	Sdippenaar@snowisp.com			

2. DECLARATION BY THE SPECIALIST

I, ________Stephanie C. Dippenaar______, declare that –

- I act as the independent specialist in this application;
- I will 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;
- 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 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;
- all the particulars furnished by me in this form 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.

S Dippenaar

Signature of the Specialist

Stephanie Dippenaar Consulting

Name of Company:

1 March 2023

Date

Details of Specialist, Declaration and Undertaking Under Oath

Page 2 of 3

3. **UNDERTAKING UNDER OATH/ AFFIRMATION**

I, ___Stephanie C. Dippenaar____, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

Stephanie Dippenaar Consulting

Name of Company

1 March 2023

Date

Signature of the Commissioner of Oaths

1/03/2023.

Date

Certify a true copy of the original document with reflects no apparent unauthorized alterations.
Gesertifiseer 'n ware afskrif van die oorspronklike dokument waarop geen klaarblyklike ongemagtigde wysigings aangebring is nie.

JL JULIUS 17453115

COMMISSIONER OF OATHS / KOMMISSARIS VAN EDE

DATE/DATUM: 1/03/2023.

APPENDIX 4: SiVEST IMPACT ASSESSMENT METHODOLOGY

1 ENVIRONMENTAL IMPACT ASSESSMENT (EIA) METHODOLOGY

The Environmental Impact Assessment (EIA) Methodology assists in evaluating the overall effect of a proposed activity on the environment. Determining of the significance of an environmental impact on an environmental parameter is determined through a systematic analysis.

1.1 Determination of Significance of Impacts

Significance is determined through a synthesis of impact characteristics which include context and intensity of an impact. Context refers to the geographical scale (i.e. site, local, national or global), whereas intensity is defined by the severity of the impact e.g. the magnitude of deviation from background conditions, the size of the area affected, the duration of the impact and the overall probability of occurrence. Significance is calculated as shown in **Table 1**.

Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The total number of points scored for each impact indicates the level of significance of the impact.

1.2 Impact Rating System

The impact assessment must take account of the nature, scale and duration of effects on the environment and whether such effects are positive (beneficial) or negative (detrimental). Each issue / impact is also assessed according to the various project stages, as follows:

- Planning;
- Construction;
- Operation; and
- Decommissioning.

Where necessary, the proposal for mitigation or optimisation of an impact should be detailed. A brief discussion of the impact and the rationale behind the assessment of its significance has also been included.

The significance of Cumulative Impacts should also be rated (As per the Excel Spreadsheet Template).

1.2.1 Rating System Used to Classify Impacts

The rating system is applied to the potential impact on the receiving environment and includes an objective evaluation of the possible mitigation of the impact. Impacts have been consolidated into one (1) rating. In assessing the significance of each issue the following criteria (including an allocated point system) is used:

Table 1: Rating of impacts criteria

ENVIRONMENTAL PARAMETER		
A brief description of the environmental aspect likely to be affected by the proposed activity (e.g. Surface Water).		
ISSUE / IMPACT / ENVIRONMENTAL EFFECT / NATURE		
Include a brief description of the impact of environmental parameter being assessed in the context of the project. This criterion includes a brief written statement of the environmental aspect being impacted upon by a particular action or activity (e.g. oil spill in surface water).		
EXTENT (E)		
This is defined as the area over which the impact will be expressed. Typically, the severity and significance of an impact have different scales and as such bracketing ranges are often required. This is often useful during the detailed assessment of a project in terms of further defining the determined.		
1	Site	The impact will only affect the site
2	Local/district	Will affect the local area or district
3	Province/region	Will affect the entire province or region
4	International and National	Will affect the entire country
PROBABILITY (P)		
This describes the chance of occurrence of an impact		
1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).
3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).
4	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).
REVERSIBILITY (R)		
This describes the degree to which an impact on an environmental parameter can be successfully reversed upon completion of the proposed activity.		
1	Completely reversible	The impact is reversible with implementation of minor mitigation measures
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible and no mitigation measures exist.
IRREPLACEABLE LOSS OF RESOURCES (L)		
This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.		
1	No loss of resource.	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in marginal loss of resources.
3	Significant loss of resources	The impact will result in significant loss of resources.
4	Complete loss of resources	The impact is result in a complete loss of all resources.
DURATION (D)		
This describes the duration of the impacts on the environmental parameter. Duration indicates the lifetime of the impact as a result of the proposed activity.		

1	Short term	The impact and its effects will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase (0 – 1 years), or the impact and its effects will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
2	Medium term	The impact and its effects will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).
3	Long term	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 50 years).
4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered transient (Indefinite).
INTENSITY / MAGNITUDE (I / M)		
Describes the severity of an impact (i.e. whether the impact has the ability to alter the functionality or quality of a system permanently or temporarily).		
1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.
2	Medium	Impact alters the quality, use and integrity of the system/component but system/ component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
3	High	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.
4	Very high	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired (system collapse). Rehabilitation and remediation often impossible. If possible rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.
SIGNIFICANCE (S)		
Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. This describes the significance of the impact on the environmental parameter. The calculation of the significance of an impact uses the following formula: **Significance = (Extent + probability + reversibility + irreplaceability + duration) x magnitude/intensity.**		

The summation of the different criteria will produce a non-weighted value. By multiplying this value with the magnitude/intensity, the resultant value acquires a weighted characteristic which can be measured and assigned a significance rating.

Points	Impact Significance Rating	Description
5 to 23	Negative Low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
5 to 23	Positive Low impact	The anticipated impact will have minor positive effects.
24 to 42	Negative Medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
24 to 42	Positive Medium impact	The anticipated impact will have moderate positive effects.
43 to 61	Negative High impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
43 to 61	Positive High impact	The anticipated impact will have significant positive effects.
62 to 80	Negative Very high impact	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws".
62 to 80	Positive Very high impact	The anticipated impact will have highly significant positive effects.

The table below is to be represented in the Impact Assessment section of the report. The excel spreadsheet template can be used to complete the Impact Assessment.