ARCUS

BAT FINAL EIA REPORT FOR THE PAULPUTS WIND ENERGY FACILITY AND ASSOCIATED GRID CONNECTION, NORTHERN CAPE PROVINCE

On behalf of

PAULPUTS WIND ENERGY FACILITY (RF) (PTY) LTD

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Prepared By:

Arcus Consultancy Services South Africa (Pty) Limited

Office 220 Cube Workspace
Icon Building
Cnr Long Street and Hans Strijdom Avenue
Cape Town
8001

T +27 (0) 21 412 1529 l **E** paulputs@arcusconsulting.co.za
W www.arcusconsulting.co.za

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(o) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	None received as yet
(p) any other information requested by the competent authority	None received
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

1 INTRODUCTION

Paulputs Wind Energy Facility (RF) (Pty) Ltd are proposing to develop the Paulputs Wind Energy Facility (WEF), to be located approximately 50 km east of Pofadder in the Northern Cape Province. Arcus have been appointed to conduct the pre-construction bat monitoring for the WEF, the results of which will feed into the impact assessment process.

The aim of the monitoring is to document bat activity in the area of interest and, based on this activity, assess the proposed WEF with regards to potential impacts to bats and the risk to development consent. These data will establish a pre-construction baseline of bat species diversity and activity and be used to undertake an environmental impact assessment. The monitoring data will also assist in providing solutions to mitigate impacts, if required, by informing the final design, construction and operational management strategy of the WEF. The baseline should also be used to compare impacts to bats during the operational phase of the project.

This final EIA report includes the results from the bat activity monitoring undertaken between 23 February 2018 and 11 April 2019. These data were used to provide an assessment of potential impacts of the WEF to bats.

2 SCOPE OF STUDY

2.1 Terms of Reference

The aim of this report is to present the baseline environment with respect to bats that may be influenced by the development of the WEF and associated infrastructure, including the 132 kV grid connection. Based on this baseline, a description and evaluation of the potential impacts the project may pose to bats is provided. The following terms of reference were utilised for the preparation of this report:

- Describe the baseline environment of the project and its sensitivity with regard to bats;
- Identify the nature of potential impacts (positive and negative, including cumulative impacts) of the proposed project on bats during construction, operation and decommissioning;
- Conduct a significance rating and impact assessment of identified impacts;
- Conduct an assessment of any alternatives where relevant;
- Identify information gaps and limitations; and
- Identify potential mitigation or enhancement measures to minimise impacts to bats.

This specialist report complies with Appendix 6 of the EIA Regulations 2014, as amended.

2.2 Assumptions and Limitations

The following assumptions and limitations relevant to this study are noted:

- The knowledge of certain aspects of South African bats including natural history, population sizes, local and regional distribution patterns, spatial and temporal movement patterns (including migration and flying heights) and how bats may be impacted by wind energy is very limited for many species.
- Bat echolocation calls (i.e. ultrasound) operate over ranges of metres therefore acoustic monitoring samples only a small amount of space (Adams et al. 2012). Recording a bat using sound is influenced by the type and intensity of the echolocation call produced, the species of bat, the bat detector system used, the orientation of the signal relative to the microphone and environmental conditions such as humidity. One must therefore be cautious when extrapolating data from echolocation surveys over large areas because only small areas are actually sampled.
- There can be considerable variation in bat calls between different species and within species. The accuracy of the species identification is also very dependent on the quality

of the calls used for identification. Species call parameters can often overlap, making species identification difficult.

- Bat activity recorded by bat detectors cannot be used to directly estimate abundance or population sizes because detectors cannot distinguish between a single bat flying past a detector multiple times or between multiple bats of the same species passing a detector once each (Kunz et al. 2007a). This is interpreted using the specialists' knowledge and presented as relative abundance.
- There is currently no standard scale to rate bat activity as low, medium or high. Following Adams et al. (2015) and Lintott et al. (2017), percentiles were used to provide an objective assessment of relative bat activity levels using presence-only data (i.e. only nights with bat activity). Data from this study were compared 1) to data from 16 other locations across the country (i.e. National comparison), 2) to data from six other locations in the (Nama- and Succulent) Karoo biomes (i.e. Regional comparison), and 3) across the Paulputs sampling locations only (i.e. Site comparison). Six percentile thresholds were defined as follows:
  - low activity: 0-20th percentiles;
  - low to moderate activity: 21st-40th percentiles;
  - moderate activity: 41st-60th percentiles;
  - moderate to high activity: 61st-80th percentiles;
  - high activity: 81st-95th percentiles; and
  - very high activity: 95th-100th percentiles.
- The potential impacts of wind energy on bats presented in this report represent the current knowledge in this field. New evidence from research and consultancy projects may become available in future, meaning that impacts and mitigation options presented and discussed in this report may be adjusted if the project is developed.
- While the data presented in this report provides a baseline of bat activity for the period sampled, it does not allow for an understanding of interannual variation in bat activity. It is therefore possible that during the lifespan of the facility, bat activity could be significantly different (lower or higher) compared to the baseline presented here.

2.3 Legislative Context

The following legalisation, policies, regulations and guidelines are all relevant to the project and the potential impact it may have on bats and habitats that support bats:

- Convention on the Conservation of Migratory Species of Wild Animals (1979)
- Convention on Biological Diversity (1993)
- Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996)
- National Environmental Management Act, 1998 (NEMA, Act No. 107 of 1998)
- National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)
- Northern Cape Nature Conservation Act, 2009 (Act No. 9 of 2009)
- The Equator Principles (2013)
- The Red List of Mammals of South Africa, Swaziland and Lesotho (2016)
- National Biodiversity Strategy and Action Plan (2005)
- South African Good Practise Guidelines for Surveying Bats in Wind Energy Facility Developments – Pre-Construction (2017)
- South African Good Practise Guidelines for Operational Monitoring for Bats at Wind Energy Facilities (2014)

3 METHODOLOGY

3.1 Desktop Review

A desktop study of available bat locality data, literature and mapping resources was undertaken to determine the likelihood of bats being present at the proposed project. Literature was also sought to understand the current state of knowledge of wind energy-bats impacts globally. Very little published research on this regard is available for the South African context. Data sources included:

- Academic sources such as research papers and published texts;
- Information on bat activity at other nearby renewable energy developments such as from pre-construction monitoring reports, EIA Reports and EMPrs;
- Bat distribution records and maps; and
- A review of the habitats on the site to identify, if possible, habitats, roosts and features which may be associated with bats.

3.2 Field Surveys

The pre-construction monitoring was designed to monitor bat activity across the entire area of interest encompassed by the proposed WEF. The baseline environment was investigated by using acoustic monitoring to document bat activity between 23 February 2018 and 11 April 2019 (412 sample nights).

The monitoring was undertaken in accordance with South African best practice[1]. Sampling of bat activity took place at four locations (Figure 1) using Song Meter SM3 and SM4 bat detectors (Wildlife Acoustics, Inc.). Ultrasonic microphones were mounted on masts at 12 m at each location. An additional ultrasonic microphone was also mounted at 100 m on a meteorological mast (METHigh). All detectors were configured to record every night from 30 minutes before sunset until 30 minutes after sunrise.

The distribution of monitoring locations across the site was determined based on vegetation types, land-use, and topography with the aim to sample bat activity in areas where bat activity was expected to be higher (e.g. near water and buildings, along riparian vegetation) but also in areas where bat activity was expected to be lower (e.g. away from water and buildings, in open areas with low habitat complexity).

In addition to the acoustic monitoring, potential structures that bats could use as roosts were investigated during the day for the presence or evidence of roosting bats (e.g. guano and culled insect remains, etc.) whenever the Arcus team was on site. These included buildings, rocky outcrops and trees.

3.3 Data Analysis

Bats emit ultrasonic echolocation calls for orientation, navigation and foraging. These calls can be recorded by bat detectors enabling bat species to be identified from various features in their calls (e.g. the frequency of the call). A sequence of calls is a bat pass defined as two or more echolocation calls separated from other calls by more than 500 milliseconds (Hayes 1997; Thomas 1988). Quantifying the number of bat passes recorded can be used to quantify the relative abundance of bat species.

Acoustic data from each bat detector were analysed using Kaleidoscope (Version 5.1.6, Wildlife Acoustics, Inc.). Bat species were automatically identified from their echolocation calls using the embedded echolocation call library in the software. The results were vetted by randomly or selectively (for certain species) manually identifying recordings. Most files

[1] Sowler, S., Stoffberg, S., MacEwan, K., Aronson, J., Ramalho, R., Potgieter, K., Lötter, C. 2016. South African Good Practice Guidelines for Surveying Bats at Wind Energy Facility Developments - Pre-construction: 4th Edition. South African Bat Assessment Association. The monitoring also meets the requirements of edition 4.1 of the guidelines published in 2017.

contained only a single bat pass and therefore the total number of files was used as a proxy for the number of bat passes. This would underestimate bat activity if any files contained more than one bat pass.

4 BASELINE ENVIRONMENT

4.1 Habitats

The proposed WEF falls entirely within the Bushmanland Arid Grassland vegetation type in the Nama-Karoo biome. The National Road N14 runs through the site from the southwest to the northeast. The predominant land use on the site is low intensity sheep grazing.

The topography of the site is uniformly flat with small scattered rocky outcrops. Several of these were investigated for the presence of roosting bats and although none were found, these outcrops were assessed as providing moderate roosting potential (Figure 1). Other resources present within the site that are important for bats include a low number of farm dams and wetlands with associated trees, perennial rivers and drainage areas (which are dry for most of the year), and buildings. Low trees scatter the site and attempts were made to map as many of these trees as possible (Figure 1) which include *Boscia foetida* subsp. *foetida* and *Parkinsonia africana*.

4.2 Bat Species

Approximately 12 species of bat can potentially occur at the proposed site (African Chiroptera Report 2013; Monadjem et al. 2010). It is possible that more (or fewer) species may be present because the distributions of some bat species in South Africa, particularly rarer species, are poorly known. Analysis of the acoustic monitoring data suggests that at least five species of bat are present (Table 1). An additional one or two species may be present at the site but these could not be distinguished based on their echolocation data. Based on these data, either the Cape horseshoe bat, or Darling's horseshoe bat (or both) are present on the site. For analysis purposes these species were grouped bringing the total number of species recorded to six. These include three high risk species based on their foraging and flight ecology and/or migratory behaviour.

Table 1: Bat Species Recorded at the Project and their Sensitivity to WEFs

Species	Species Code	# Bat Passes	Conservation Status[2]		Likelihood of Risk
			National	International	
Egyptian free-tailed bat *Tadarida aegyptiaca*	EFB	14,777	Least Concern	Least Concern	High
Natal long-fingered bat *Miniopterus natalensis*	NLB	60	Least Concern	Least Concern	High
Roberts's flat-headed bat *Sauromys petrophilus*	RFB	2,071	Least Concern	Least Concern	High
Cape serotine *Neoromicia capensis*	CS	755	Least Concern	Least Concern	High
Long-tailed serotine *Eptesicus hottentotus*	LTS	4,613	Least Concern	Least Concern	Medium
Horseshoe Bat Species *Rhinolophus spp.*	HSB	5	Least Concern	Least Concern	Low

4.3 Spatio-Temporal Bat Activity Patterns

A total of 22,281 bat passes were recorded from 412 sample nights across the six species and across all bat detectors (Table 2). Across the site, bats were recorded on 95 % of all

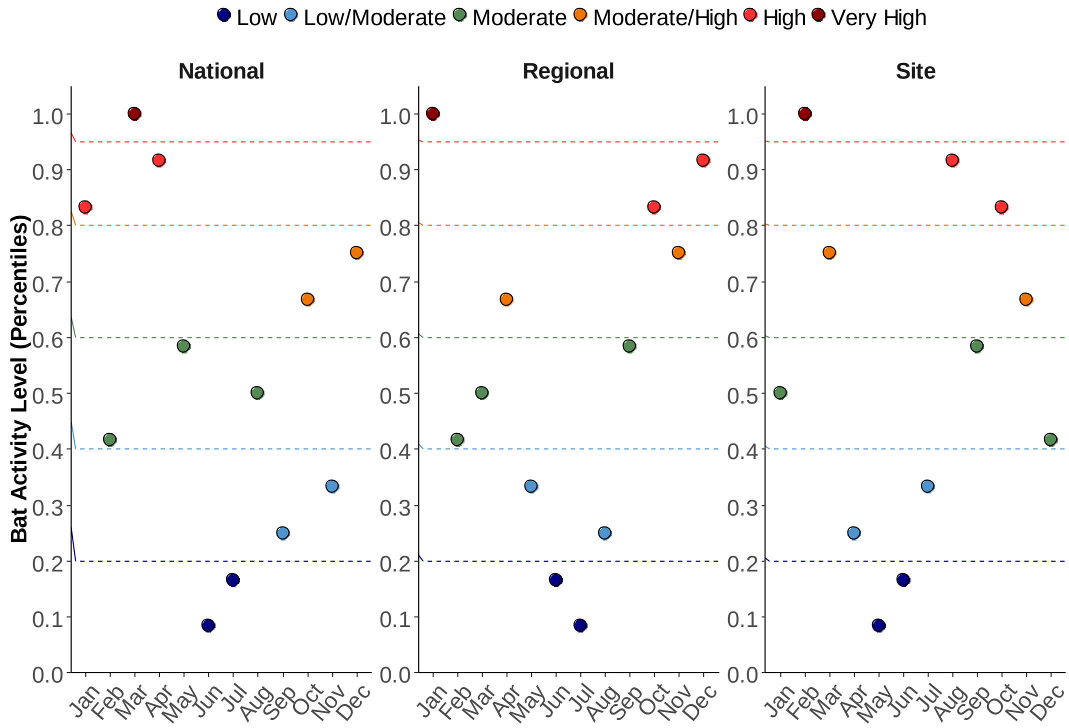
[2] Child, M.F., Roxburgh, L., Do Linh San, E., Raimondo, D., Davies-Mostert, H.T. eds., 2016. The Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.

sample nights. Of these sample nights ca. 61 % had low to moderate activity, ca. 14 % had high activity, and ca. 5 % had very high activity.

Table 2: Acoustic Monitoring Summary

Detector	Altitude (masl)	# of Sample Nights	% of Sample Nights with Bat Activity	Median; Mean # of Bat Passes/night	Total number of Bat Passes
PAU1	987	411	67.3	2; 7.4	3,051
PAU2	940	412	86.2	8; 19.8	8,165
PAU3	938	412	71.4	3; 8.7	3,565
METLow	972	348	79.3	4; 14.0	4,868
METHigh	1,072	348	45.0	1; 7.6	2,632

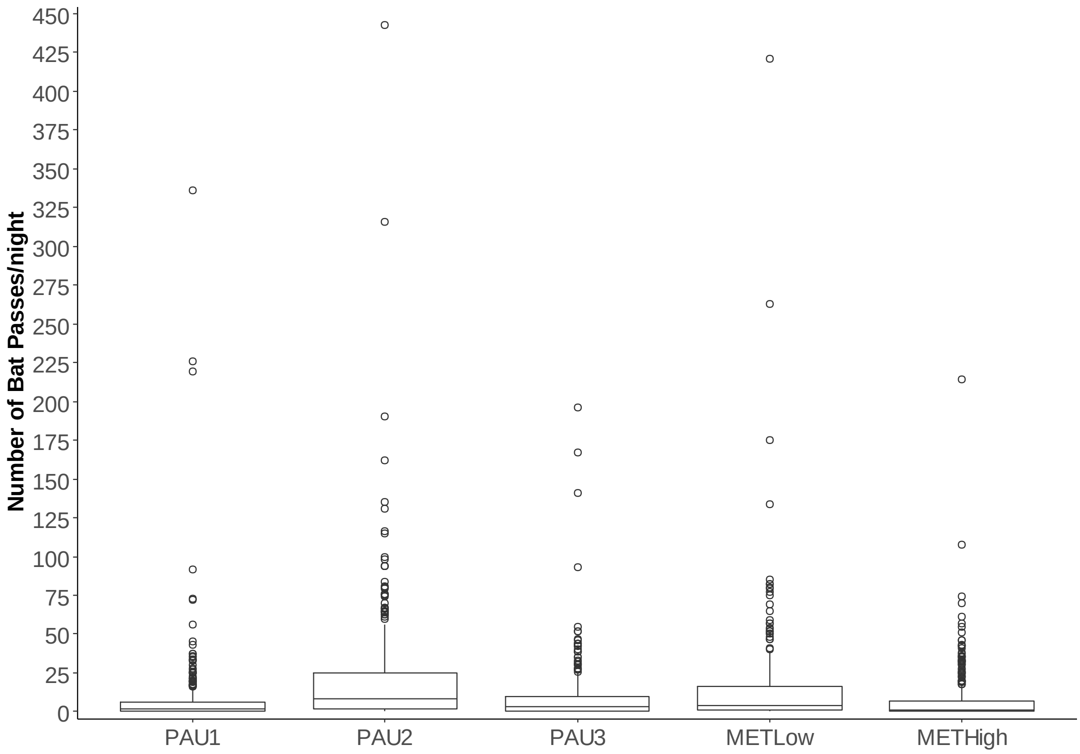
Bat activity at Paulputs was very high in February whereas nationally and regionally, activity in February tended to be moderate (Graph 1). High activity was recorded at Paulputs in August and October whereas nationally and regionally activity tends to be low/moderate and moderate respectively (Graph 1). Comparatively lower activity was recorded at Paulputs in April, May, December and January compared to national and regional activity.



Graph 1: The activity level (percentile) of bats recorded each month at Paulputs (Site) and compared to other sites nationally and regionally.

The Egyptian free-tailed bat was recorded most often with a median of 10 bat passes per night. Roberts' flat-headed bat and the Long-tailed serotine had a median of 1 bat pass per night while the remaining species all had medians of zero. Most activity of the Egyptian free-tailed bat was in spring (median = 23 bat pass per night) and winter (median = 20.5 bat pass per night).

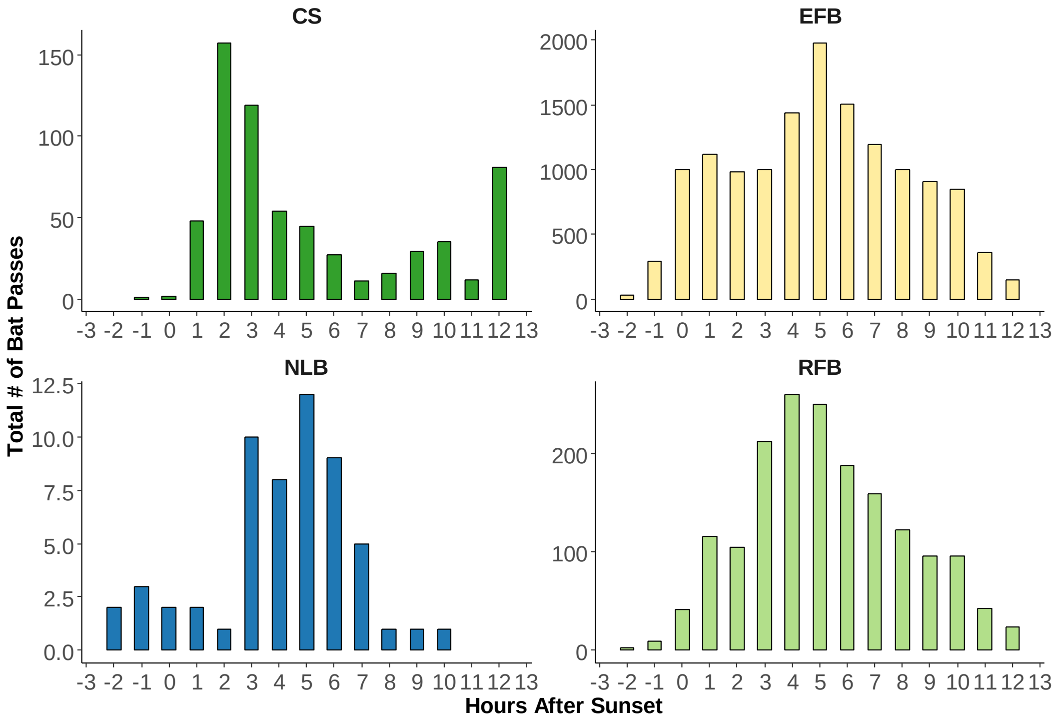
Bat activity was highest at PAU2 followed by METLow, with a median of 8 and 4 bat passes per night respectively. The range in bat activity as well as the maximum number of passes per night, was greatest at PAU2 (Graph 2). Lowest median activity was at the met mast and there was more activity at the 12 m microphone (MetLow) compared to the 100 m microphone (MetHigh).



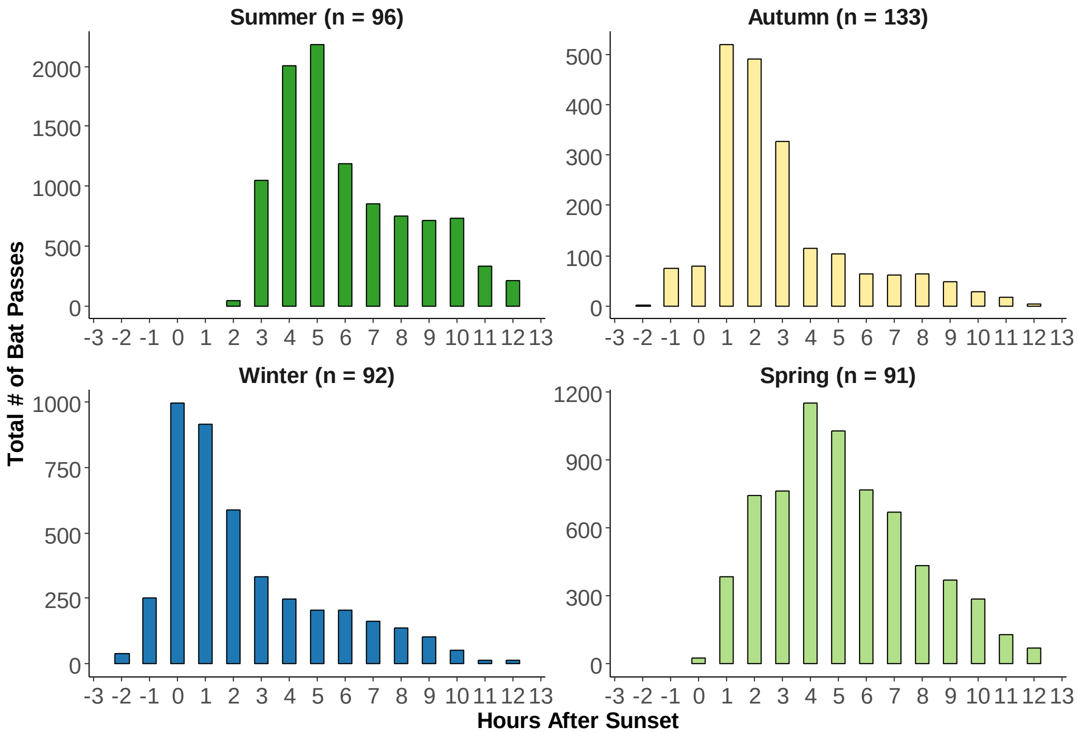
Graph 2: Box and Whisker plot showing the distribution of bat passes at each site.

Bats were recorded at the site between 17:20 and 08:05. The Cape serotine and Egyptian free-tailed bats were recorded earlier in the evening compared to the Natal long-fingered bat and Roberts's flat-headed bat, at three hours before sunset (Graph 3). Peak activity for the Cape serotine was two hours after sunset with a smaller peak 12 hours after sunset. The Egyptian free-tailed bat had peak activity five hours after sunset but had more consistent activity levels, with less obvious peaks across the night compared to the Cape serotine. The Natal long-fingered bat was recorded mostly between three and seven hours after sunset, and Roberts's flat-headed bat between three and five hours after sunset.

There were seasonal differences in peak activity times (Graph 4). Activity commenced earlier in winter at three hours before sunset and continued until 12 hours after sunset (16 active hours). In autumn, activity commenced two hours before sunset and continued until 12 hours after sunset (15 active hours). In spring, activity commence later, at sunset only, and continued for 15 hours, while in summer activity commenced only two hours after sunset and lasted only 13 hours.



Graph 3: The total number of bat passes with time since sunset, where sunset is at 0, for the four species recorded most often.



Graph 4: The total number of bat passes with time since sunset, where sunset is at 0, per season.

4.4 Discussion

The main findings of the bat monitoring is that approximately two thirds of the sample nights had low to moderate activity, activity was higher in summer and spring (accounting for ca. 40 % and 30 % of total activity respectively), and activity was dominated by the Egyptian free-tailed bat. Spatially, activity was lower activity at height compared to closer to ground level and bat activity was higher at PAU2.

The increased activity in summer and spring is expected based on better meteorological conditions (e.g. higher temperatures) compared to winter and autumn. These conditions promote insect activity which in turn provides better foraging conditions for bats. In addition, vegetation at the site, specifically the *Boscia foetida* subsp. *foetida* trees, were flowering in summer (and possibly in spring too) attracting many insects (pers. obvs.), increasing their suitability in acting as foraging focal points for bats and promoting higher activity. Bat activity occurred later into the night in summer and spring compared to winter and autumn, when bats appeared to restrict most of their activity to approximately three hours (Graph 4).

The higher activity around PAU2 is likely because of the better habitat at this location compared to the other bat detectors. There are a number of trees and shrubs at PAU2, and it is also located ca. 20 m from a wetland area. The trees can be used by some species as roosts, and the trees and water availability will also attract insects. This creates a more favourable foraging area for bats compared to the other detectors which have less diverse microhabitats. Therefore, avoiding areas with landscape features that are important for bats, must be used as an initial mitigation measure to design the layout of the facility in such a way to limit the potential for bats to encounter wind turbines during foraging and commuting. Searches for bats roosting in trees around PAU2, and other parts of the site, did not reveal any evidence of roosting bats.

To limit potential impacts to bats, buffer zones have been created around landscape features that are important for bats (Figure 2). These include hydrological features, including wetlands, farms dams, rivers (200 m buffer) and drainage lines (100 m buffer) which are important for connectivity. Potential roosts such as rocky crevices, trees, and old buildings have also been buffered (200 m buffer). No parts of the turbines, including the blade tips, should enter these buffers therefore an additional buffer of 90 m was placed around all buffers. Based on these buffers, no turbines are located within any bat buffers (Figure 2).

An additional mitigation measures that should be considered is the design of the turbine itself. Taller towers have a positive relationship between the numbers of bats killed at some wind energy facilities in Greece and Canada (Barclay et al. 2007; Georgiakakis et al. 2012). However there are no published data on this relationship in South Africa but unpublished data from other pre-construction monitoring reports suggest that bat activity at height in South Africa is lower. Bat activity at Paulputs was also higher at lower heights but bats were recorded at 100 m. There is no information on activity above 100 m at the site. Bats are known to forage much higher than this, with evidence of bat activity at 200 m (Nguyen et al. 2019), 600 m (Fenton and Griffin 1997), and even up to 1000 m above ground level (McCracken et al. 2008). Nguyen (et al. 2019) showed that bat activity at 100 m and 200 m was higher than at ground level for the Wrinkle-lipped free-tailed bat, while both Fenton and Griffin (1997) and McCracken et al. (2008) showed that the vertical profile of bat activity can have two peaks; one between the ground and 100 m, and the second between 200 m and 500 m. This could suggest that there may be an ideal height band in which is to place wind turbine rotor blades that would limit impacts to bats. However, our current knowledge of bat activity in the aerosphere is too limited to determine this.

It is difficult to determine an appropriate turbine size that would reduce impacts to both high and low flying species. In addition, bats actively forage around and investigate wind turbines (Horn et al. 2008; Cryan et al. 2014; Foo et al. 2017). The installation of turbines in the landscape may alter bat activity patterns, either by increasing activity at height and/or increasing the diversity of species making use of higher airspaces. Some species in South Africa that are not adapted for flight at height have suffered mortality suggesting that some bats may be killed in the lower edge of the rotor swept zone. Therefore, it would be preferential to ensure the blades to do not sweep down close to the ground. Based on the turbine dimensions being applied for the turbines would sweep down to 30 m above the ground. This increases the risk to lower flying bats and the risk of residual impacts, and hence the requirement to mitigate these impacts, will be greater. This can be mediated by increasing the lower sweep of the turbine blades to 40 m or 50 m for example. In addition to blade length, the height of the turbine tower will also influence bat mortality. For example, limiting the hub height might protect higher flying species but it is likely that additional residual impacts would occur even with managing risk through turbine design and placement, especially if the turbine blades sweep down to 30 m.

Beyond these avoidance measures, more active mitigation to reduce residual impacts may be needed and ultrasound deterrents and curtailment are two options available. Curtailment, which involves limiting the amount of time turbine blades spin, is the most effective way to reduce residual impacts to bats (Arnett and May 2016; Hayes 2019) whereas deterrent technology is still in testing stages and its effect on reducing bat fatality less known (Arnett 2013). A curtailment regime can be developed by examining the relationship between bats and meteorological conditions such as wind speed, temperature and humidity. For example, bat activity is typically supressed at higher wind speeds and increases with temperature. This information can be used to develop a curtailment schedule that can be applied when bat activity is high so that potential encounters by bats with wind turbine blades can be reduced. Meteorological data from the mast on site was used for this purpose.

Bat activity was highest in February, August and October and there may therefore be greater residual impacts to bats in these months. Therefore the relationship between meteorological conditions and bat activity was investigated in these months as they are the periods in which curtailment should be applied. Based on our analysis, curtailment should be applied during specific time periods and under specific meteorological conditions (Table 3) when bat fatality threshold are exceeded (MacEwan et al. 2018). For example, in February curtailment should be applied between four and five hours after sunset when the temperature is between 11 °C and 27 °C, or wind speed is between 4 ms^{-1} and 11 ms^{-1}, or relative humidity is between 20 % and 40 % if fatality threshold were exceeded. This curtailment plan is based on only one year of bat activity and must be updated based on additional data collected the operational phase of the development. The plan should be continuously refined and adapted based on incoming bat fatality data.

Table 3: Curtailment Parameters for the Paulputs Wind Farm

	February	**August**	**November**
Time Period	Between 4 and 5 hours after sunset	1 hour after sunset	Between 4 and 5 hours after sunset
Temperature (°C)	11 – 27	10 – 27	16 – 27
Wind Speed (ms^{-1})	4 – 11	4 – 13	5 – 13
Relative Humidity (%)	20 – 40	5 – 25	10 – 30

5 IMPACT ASSESSMENT

5.1 Description of Activity

The proposed WEF is approximately 11 813 hectares (Figure 1) in extent with a developable area of less than 10 000 hectares. The WEF will consist of up to 75 turbines each with a generation capacity of between 3 and 6 MW. The turbines will have a maximum hub height of 140 m, a maximum blade length of 90 m and a rotor diameter of up to 180 m. The turbines will have a maximum and minimum tip height of 230 m and 30 m respectively.

Three 132 kV substation locations are being applied for and each will cover approximately 4 hectares for a maximum total substation footprint of 12 hectares. The permanent laydown area and the temporary construction laydown area will both be approximately 1 hectare each. An operations and maintenance complex, which includes the substation, office, laydown areas and a parking area will be 200 m x 200 m. An estimated 80 km of internal roads (maximum 12 m wide) will be required.

5.2 Identification of Potential Impacts

WEFs have the potential to impact bats directly through collisions (with spinning turbine blades) and barotrauma resulting in mortality (Horn et al. 2008; Rollins et al. 2012), and indirectly through the modification of habitats (Kunz et al. 2007b; Millon et al. 2018). Similarly, the grid connection may also impact bats directly through collisions (with transmission lines), and indirectly through habitat modification. Modification of habitat includes roost destruction, roosts disturbance, and displacement from foraging areas and/or commuting routes. Direct impacts pose the greatest risk to bats and, in the context of the project, habitat modification impacts should not pose a significant risk because the project footprint (i.e. turbines, roads) is small compared to the size of the project and because of limited roosting spaces at the site.

Direct impacts to bats posed by the turbines at the proposed WEF will be limited to species that make use of the airspace in the rotor-swept zone of the wind turbines. Five of the bat species that were recorded on site exhibit behaviour that may bring them into contact with wind turbine blades. They are thus potentially at risk of negative impacts if not properly mitigated. This includes three high risk species (Egyptian free-tailed bat, Natal long-fingered bat and Robert's free-tailed bat) and one medium-high risk species (Cape serotine). The Egyptian free-tailed bat, Natal long-fingered bat and Cape serotine have all suffered mortality at operational wind energy facilities in South Africa. Direct impacts of the grid connection transmission lines would primarily be limited to fruit bats.

5.3 Assessment of Impacts

The potential impacts of the construction and operation of the WEF and the grid connection are described in more detail and assessed in the following sections. A significance rating and impact assessment was done for each impact and mitigation measures for each provided where appropriate. The potential impacts are assessed based on a methodology adapted from Hacking (1998). The impacts to bats during the decommissioning phase (for both the wind energy facility and the associated grid connection) are likely to be restricted to disturbance. This impact should be low and therefore not assessed in any further detail.

For each impact, the significance was determined by identifying the extent, duration, intensity, probability of occurrence, and reversibility of the impact as well as the irreplaceability of resource loss, in the absence of any mitigation ('without mitigation'). Mitigation measures were identified and the significance was re-rated, assuming the effective implementation of the mitigation ('with mitigation').

For the WEF, the assessment 'without mitigation' assumes the worst case scenario in which all proposed 75 turbines are constructed. The assessment 'with mitigation' assumes that all turbines are constructed outside of bat no-go areas, and all additional mitigations are also adequately implemented. No-go areas are presented in Figure 2 and no turbines, including the blades, should be placed inside these buffers.

Cumulative impacts were assessed as the incremental impact of the proposed activity on the baseline, when added to the impacts of other past, present or reasonably foreseeable future activities in a 50 km radius.

5.3.1 Wind Energy Facility

5.3.1.1 Roost Disturbance

Impact Phase: Construction							
Possible Impact or Risk: Roost disturbance							
WEFs have the potential to impact bats directly through the disturbance of roosts during construction. Relevant activities include the construction of roads, Operation and Maintenance (O&M) buildings, sub-station(s), internal transmission lines and installation of wind turbines. Excessive noise and dust during the construction phase could result in bats abandoning their roosts, depending on the proximity of construction activities to roosts. This impact will vary depending on the species involved; species that may roost in trees are likely to be impacted more (e.g. Cape serotine and Egyptian free-tailed bats; Monadjem et al. 2010) because tree roosts are less buffered against noise and dust compared to roosts in buildings and rocky crevices. Roosts are limiting factors in the distribution of bats and their availability is a major determinant in whether bats would be present in a particular location. Reducing roosting opportunities for bats is likely to have negative impacts. However, it is unlikely that this impact will occur as there are low numbers of roosting spaces where development is planned and no bats were found roosting in trees on site. Therefore, the significance of this impact would be low.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	Low	Low	Low	Negative	Low	Low	Medium
With Mitigation	Low	Low	Low	Negative	Low	Low	Medium
Can the impact be reversed?	UNKNOWN						
Will impact cause irreplaceable loss of resources?	NO						
Can impact be avoided, managed or mitigated?	YES						
Mitigation measures to reduce residual risk or enhance opportunities: 1) It may be possible to limit roost abandonment by avoiding construction activities near roosts. No confirmed roosts have been found at the project but there are potential roosts that bats may be using including trees, rocky crevices and buildings. 2) It is recommended that potential roosts, specifically trees, buildings and rocky crevices, are buffered by 200 m, inside which no construction activities may take place. These buffers have been mapped (Figure 2).							

5.3.1.2 Roost Destruction

Impact Phase: Construction							
Possible Impact or Risk: Roost destruction							
WEFs have the potential to impact bats directly through the physical destruction of roosts during construction. Relevant activities include the construction of roads, O&M buildings, sub-station(s), grid connection transmission lines and installation of wind turbines. Potential roosts that may be impacted by construction activities include trees, crevices in rocky outcrops and buildings. Roost destruction can impact bats either by removing potential roosting spaces which reduces available roosting sites or, if a roost is destroyed while bats are occupying the roost, this could result in bat mortality. Reducing roosting opportunities for bats or killing bats during the process of destroying roosts will have negative impacts. However, a low numbers of roosts will likely need to be destroyed resulting in the significance of this impact being low after mitigation.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**

Without Mitigation	Low	High	Low	Negative	Low	Low	Medium
With Mitigation	Low	Low	Low	Negative	Low	Low	High

Can the impact be reversed?	NO
Will impact cause irreplaceable loss of resources?	YES
Can impact be avoided, managed or mitigated?	YES

Mitigation measures to reduce residual risk or enhance opportunities:

1) The WEF must be designed and constructed in such a way as to avoid the destruction of potential and actual roosts, particularly trees, rocky crevices (if blasting is required) and buildings.
2) It is recommended that potential roosts, specifically trees, buildings and rocky crevices, are buffered by 200 m, inside which no construction activities may take place. These buffers have been mapped (Figure 2).

5.3.1.3 Habitat Modification

Impact Phase: Construction

<u>Possible</u> Impact or Risk: Habitat modification

Bats can be impacted indirectly through the modification or removal of habitats (Kunz et al. 2007b) and can also be displaced from foraging habitat by wind turbines (Millon et al. 2018). The removal of vegetation during the construction phase can impact bats by removing vegetation cover and linear features that some bats use for foraging and commuting (Verboom and Huitema 1997). The modification of habitat could create linear edges which some bats to commute or forage along. This modification could also create favourable conditions for insects upon which bats feed which would in turn attract bats. The footprint of the facility is small relative to the remaining habitat available in the surrounding area and as such the removal of vegetation is not likely to result in a significant impact. This impact can be reduced even further by limiting the removal of vegetation as far as possible.

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	Low	Medium	Low	Negative	Low	Low	Medium
With Mitigation	Low	Medium	Low	Negative	Low	Low	Medium

Can the impact be reversed?	YES
Will impact cause irreplaceable loss of resources?	YES
Can impact be avoided, managed or mitigated?	YES

Mitigation measures to reduce residual risk or enhance opportunities:

1) During construction laydown areas and temporary access roads should be kept to a minimum in order to limit direct vegetation loss and habitat fragmentation. Construction should, where possible, be situated in areas that are already disturbed.
2) This impact must be reduced by limiting the removal of vegetation, particularly trees, as far as possible.
3) Following construction, rehabilitation of all areas disturbed (e.g. temporary access tracks and laydown areas) must be undertaken and a habitat restoration plan must be developed by a specialist and included within the EMPr.

5.3.1.4 Habitat Creation in High Risk Locations

Impact Phase: Operational

<u>Possible</u> Impact or Risk: Habitat creation in high risk locations

The construction of a WEF and associated building infrastructure may inadvertently provide new roosts for bats, attracting them to the area and indirectly increasing the risk of negative mortality impacts. It has been suggested that some bats may investigate wind turbines for their potential roosting spaces (Cryan et al. 2014; Horn et al. 2008; Kunz et al. 2007b) and bats could therefore be attracted to WEFs, increasing the chance of wind turbine-induced mortality. Bats may also be attracted to roosting

opportunities in new buildings and other infrastructure such as road culverts at WEFs (J. Aronson, personal observation), or be attracted to lights at the WEF as potential new foraging areas. The probability of large numbers of bats roosting in infrastructure at the project is low. However, if any bats do manage to do so, they would be at greater risk of mortality due to the proximity to wind turbines.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	Low	Medium	Low	Negative	Medium	Medium	Medium
With Mitigation	Low	Medium	Low	Negative	Low	Low	Medium
Can the impact be reversed?	YES						
Will impact cause irreplaceable loss of resources?	YES						
Can impact be avoided, managed or mitigated?	YES						

Mitigation measures to reduce residual risk or enhance opportunities:

1) Bats should be prevented from entering any possible artificial roost structures (e.g. roofs of buildings, road culverts and wind turbines) by ensuring that they are sealed in such a way as to prevent bats from entering. If bats colonise WEF infrastructure, a suitably qualified bat specialist should be consulted before any work is undertaken on that infrastructure or attempting to remove bats. Ongoing maintenance and inspections of buildings and road culverts must be carried out to ensure no access to bats or actively roosting bats.

5.3.1.5 Bat Mortality during Commuting and/or Foraging

Impact Phase: Operational							
Possible Impact or Risk: Bat mortality during commuting and/or foraging							
The major potential impact of wind turbines on bats is direct mortality resulting from collisions with turbine blades and/or barotrauma (Grodsky et al. 2011; Horn et al. 2008; Rollins et al. 2012). These impacts will be limited to species that make use of the airspace in the rotor-swept zone of the wind turbines. All species of bat that were recorded at the project exhibit behaviour that may bring them into contact with wind turbine blades and so they are potentially at risk of negative impacts.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	Medium	High	High	Negative	High	Medium	Medium
With Mitigation	Low	High	Low	Negative	Low	Low	Medium
Can the impact be reversed?	NO						
Will impact cause irreplaceable loss of resources?	YES						
Can impact be avoided, managed or mitigated?	YES						

Mitigation measures to reduce residual risk or enhance opportunities:

1) Designing the layout of the project to avoid areas that are more frequently used by bats may reduce the likelihood of mortality and should be the primary mitigation measure. These areas include key microhabitats such as water features, trees, buildings, and rocky crevices. This has been adhered to as all turbines adhere to buffer zones around these features (Figure 2). All buffers are to blade tip.
2) The height of the lower blade swept area must be maximised.
3) Operational acoustic monitoring and carcass searches for bats must be performed, based on best practice, to monitor mortality and bat activity levels. Acoustic monitoring should include monitoring at height (from more than one location i.e. such as on turbines) and at ground level.
4) Apply curtailment during February, August and October based on Table 3 if mortality occurs beyond threshold levels as determined based on applicable guidance (MacEwan et al. 2018)

5.3.1.6 Bat Mortality during Migration

Impact Phase: Operational

Possible Impact or Risk: Bat mortality during migration

It has been suggested that some bats may not echolocate when they migrate (Baerwald and Barclay 2009) which could explain the higher numbers of migratory species suffering mortality in WEF studies in North America and Europe. Therefore, the direct impact of bat mortality may be higher when they migrate compared to when they are commuting or foraging. This is therefore considered here as a separate impact of the WEF on the Natal long-fingered bat, which is the only species recorded during pre-construction monitoring known to exhibit long-distance migratory behaviour.

The majority of bat mortalities at WEFs in North America and Europe are migratory species. However, evidence from the pre-construction monitoring does not suggest migratory behaviour through the site. It is therefore unlikely that mortality will occur during migration periods but during the operating lifespan of the WEF it may be possible that migration patterns and species distributions may change in response to climactic and/or habitat shifts. There may also be inter-annual variation in bat movement patterns which cannot be observed with a single year of data collection.

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	High	High	High	Negative	Medium	Low	Medium
With Mitigation	Medium	High	Low	Negative	Low	Low	Medium

Can the impact be reversed?	NO
Will impact cause irreplaceable loss of resources?	YES
Can impact be avoided, managed or mitigated?	YES

Mitigation measures to reduce residual risk or enhance opportunities:

1) Designing the layout of the project to avoid areas that are more frequently used by bats may reduce the likelihood of mortality and should be the primary mitigation measure. These areas include key microhabitats such as water features, trees, buildings, and rocky crevices. This has been adhered to as all turbines adhere to buffer zones around these features (Figure 2). All buffers are to blade tip.
2) The height of the lower blade swept area must be maximised.
3) Operational acoustic monitoring and carcass searches for bats must be performed, based on best practice, to monitor mortality and bat activity levels. Acoustic monitoring should include monitoring at height (from more than one location i.e. such as on turbines) and at ground level.
4) Apply curtailment during February, August and October based on Table 3 if mortality occurs beyond threshold levels as determined based on applicable guidance (MacEwan et al. 2018)

5.3.1.7 Light Pollution

Impact Phase: Operational

Possible Impact or Risk: Light pollution

Currently the local region experiences very little light pollution from anthropogenic sources and the construction of a WEF will marginally increase light pollution. This excludes turbine aviation lights which do not appear to impact bats (Baerwald and Barclay 2011; Horn et al. 2008; Jain et al. 2011; Johnson et al. 2003). During the operation of the WEF, it is assumed that the only light sources would be motion sensor security lighting for short periods and lighting associated with the substation.

This artificial lighting would impact bats indirectly via the mortality of their insect prey thereby reducing foraging opportunities for certain bat species. Lighting attracts (Blake et al. 1994; Rydell 1992; Stone 2012) and can cause direct mortality of insects. These local reductions in insect prey may reduce foraging opportunities for bats, particularly for species that avoid illuminated areas. This impact is likely to be low after mitigation because, relative to the large area in the region that would not be developed that likely supports large numbers of insects, the prey resource for bats is likely to be sufficient.

Other bat species actively forage around artificial lights due to the higher numbers of insects which are attracted to these lights (Blake et al. 1994; Rydell 1992; Stone 2012). This may bring these species into the vicinity of the project and indirectly increase the risk of collision/barotrauma particularly for species that are known to forage around lights. These include the Cape serotine and the Egyptian free-tailed bat (Fenton et al. 2004; J. Aronson, personal observation). This impact is likely to be low

with mitigation but must be carefully considered because the consequence could be severe without mitigation. Lighting at the project should be kept to a minimum and appropriate types of lighting should be used to avoid attracting insects, and hence, bats.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	Medium	Medium	Low	Negative	Medium	Medium	Medium
With Mitigation	Low	Medium	Low	Negative	Low	Low	High
Can the impact be reversed?	YES						
Will impact cause irreplaceable loss of resources?	YES						
Can impact be avoided, managed or mitigated?	YES						

Mitigation measures to reduce residual risk or enhance opportunities:

1) This impact can be mitigated by using as little lighting as possible, and only where essential for operation of the facility.
2) Where lights need to be used such as at the substation and switching station and elsewhere, these should have low attractiveness for insects such as low pressure sodium and warm white LED lights (Rydell 1992; Stone 2012). High pressure sodium and white mercury lighting is attractive to insects (Blake et al. 1994; Rydell 1992; Svensson & Rydell 1998) and should not be used as far as possible.
3) Lighting should be fitted with movement sensors to limit illumination and light spill, and the overall lit time. In addition, the upward spread of light near to and above the horizontal plane should be restricted and directed to minimise light trespass and sky glow.
4) Increasing the spacing between lights, and the height of light units can reduce the intensity and volume of the light to minimise the area illuminated and give bats an opportunity to fly in relatively dark areas between and over lights.

5.3.2 Grid Connection

5.3.2.1 Roost Disturbance

Impact Phase: Construction

Possible Impact or Risk: Roost disturbance

The grid connection infrastructure may impact bats directly through the disturbance of roosts during construction. Excessive noise and dust during the construction phase could result in bats abandoning their roosts, depending on the proximity of construction activities to roosts. This impact will vary depending on the species involved; species that may roost in trees are likely to be impacted more (e.g. Cape serotine and Egyptian free-tailed bats; Monadjem et al. 2010) because tree roosts are less buffered against noise and dust compared to roosts in buildings and rocky crevices. Roosts are limiting factors in the distribution of bats and their availability is a major determinant in whether bats would be present in a particular location. Reducing roosting opportunities for bats is likely to have negative impacts.

	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	Low	Low	Low	Negative	Low	Low	Medium
With Mitigation	Low	Low	Low	Negative	Low	Low	Medium
Can the impact be reversed?	UNKNOWN						
Will impact cause irreplaceable loss of resources?	NO						
Can impact be avoided, managed or mitigated?	YES						

Mitigation measures to reduce residual risk or enhance opportunities:

1) As this impact is unlikely to occur, no mitigation options are required.

5.3.2.2 Roost Destruction

Impact Phase: Construction

Possible Impact or Risk: Roost destruction							
The grid connection infrastructure may impact bats directly through the physical destruction of roosts during construction. Roosts are limiting factors in the distribution of bats and their availability is a major determinant in whether bats would be present in a particular location. Reducing roosting opportunities for bats is likely to have negative impacts. Potential roosts that may be impacted by construction activities include rocky crevices. Roost destruction can impact bats either by removing potential roosting spaces which reduces available roosting sites or, if a roost is destroyed while bats are occupying the roost, this could result in bat mortality. Reducing roosting opportunities for bats or killing bats during the process of destroying roosts will have negative impacts. However, no or a low number of roosts will likely need to be destroyed resulting in the significance of this impact being low after mitigation.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	Low	High	Low	Negative	Medium	Low	Medium
With Mitigation	Low	Low	Low	Negative	Low	Low	Medium
Can the impact be reversed?				NO			
Will impact cause irreplaceable loss of resources?				YES			
Can impact be avoided, managed or mitigated?				YES			
Mitigation measures to reduce residual risk or enhance opportunities: 1) As this impact is unlikely to occur, no mitigation options are required.							

5.3.2.3 Bat Mortality through Collision with Transmission Lines

Impact Phase: Operational							
Possible Impact or Risk: Bat mortality through collision with transmission lines							
Insectivorous bats are unlikely to collide with transmission lines due to their ability to echolocate. They are therefore able to detect and avoid obstacles in their path, such as electrical cabling. Fruit bats do not echolocate in the same manner and can collide and become electrocuted by transmission lines. There is no published evidence of this in South Africa but these events do occur globally. The existence of suitable caves for roosting and fruit trees along or across this route may increase the likelihood that fruit bats will be present however there are none of these features along the proposed grid connection routes.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	Low	Medium	Low	Negative	Low	Low	Medium
With Mitigation	Low	Medium	Low	Negative	Low	Low	Medium
Can the impact be reversed?				NO			
Will impact cause irreplaceable loss of resources?				YES			
Can impact be avoided, managed or mitigated?				YES			
Mitigation measures to reduce residual risk or enhance opportunities: 1) As this impact is unlikely to occur, no mitigation options are required.							

5.3.3 Cumulative Impacts

The cumulative impact on bats was considered by searching for current and potential future development of wind energy facilities within a 50 km of the project. There are no wind energy facilities, planned or approved, within this radius based on the Department of Environmental Affairs Renewable Energy Development Database Quarter One 2019. The closest wind energy facility is the Namies Wind Farm, approximately 57 km south west.

It is important to consider cumulative impacts across the entire scale potentially affected animals are likely to move, especially mobile animals like bats. Impacts at a local scale could have negative consequences at larger scales if the movement between distant populations is impacted (Lehnert et al. 2014; Voigt et al. 2012). For example, Lehnert et al. (2014) demonstrated that among Noctule bats collected beneath wind turbines in eastern Germany, 28 % originated from distant populations in the Northern and North-eastern parts of Europe. This is particularly relevant to bats that migrate. One migratory bat was recorded on the site but relatively seldom so a larger cumulative impact area was not considered at this stage.

The cumulative impacts could be lower for species that do not migrate over such large distances or resident species that are not known to migrate. Five of the six species recorded during the pre-construction monitoring do not migrate over such large distances. The sphere of the cumulative impact would then likely be restricted to the home ranges and foraging distances of different species, which can range from 1 km to at least 15 km for some insectivorous bats (Jacobs and Barclay 2009; Serra-Cobo and Sanz-Trullen 1998) and up to at least 24 km for some fruit bats (Jacobsen et al. 1986).

Cumulative impacts on bats could increase as new facilities are constructed (Kunz et al. 2007b) but are difficult to accurately predict or assess without baseline data on bat population size and demographics (Arnett et al. 2011; Kunz et al. 2007b) and these data are lacking for many South African bat species. It is possible that cumulative impacts could be mitigated with the appropriate measures applied to wind farm design and operation. Cumulative impacts could result in declines in populations of even those species of bats currently listed as Least Concern, if they happen to be more susceptible to mortality from wind turbines (e.g. high-flying open air foragers such as free-tailed and fruit bats) even if the appropriate mitigation measures are applied. Further research into the populations and behaviour of South African bats, both in areas with and without wind turbines, is needed to better inform future assessments of the cumulative effects of WEFs on bats.

Possible Impact or Risk: Cumulative Bat Mortality Impacts

Cumulative indirect impacts to bats, such as those relating to changes to the physical environment (e.g. roost and habitat destruction) are likely to be low across the cumulative impact regions. Cumulative direct impacts to bats, specifically those related to bat mortality, are likely to be higher.

For non-migratory species cumulative direct impacts could have a medium or high significance before mitigation but could reduce to medium or low with appropriate turbine siting and operational mitigation if determined as being necessary based on operational monitoring. Direct impacts on migratory species (i.e. the Natal long-fingered bat) may be high before mitigation but could also reduce to low or medium with appropriate turbine siting and operational mitigation. However, these ratings would be dependent on all other surrounding wind energy facilities also adopting similar mitigation strategies to reduce impacts to bats.

There are no operational wind energy facilities in the cumulative impact area, and thus currently impacts to bats are negligible. Pre-construction monitoring at the Namies Wind Farm rated impacts to bats as low with mitigation[3]. However, pre-construction monitoring data of bat activity are not a good predictor of the impacts that may be expected at operational wind farms (Hein et al. 2013), limiting their use in understanding and predicting cumulative impacts. However, because of a lack of published data on the impact of wind energy facilities on bats in South Africa, and limited baseline data on bat population size and demographics, the confidence in this assessment is medium.

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	High	High	Medium	Negative	Medium	Low	Medium
With Mitigation	High	High	Low	Negative	Low	Low	Medium

Can the impact be reversed?	NO
Will impact cause irreplaceable loss of resources?	YES
Can impact be avoided, managed or mitigated?	YES

[3] Only the EA Amendment report for this project could be located and this report did not describe the pre-mitigation impact rating for bats, nor the mitigation requirements for bats for this project.

Mitigation measures to reduce residual risk or enhance opportunities:

1) At operational wind energy facilities where impacts to bats are high, or exceed threshold values[4], mitigation strategies such as curtailment or deterrents must be used.
2) The operation of lights at substations should be limited to avoid attracting bats to the area. Where lights need to be used such as at the substation and switching station and elsewhere, these should have low attractiveness for insects such as low pressure sodium and warm white LED lights (Rydell 1992; Stone 2012). High pressure sodium and white mercury lighting is attractive to insects (Blake et al. 1994; Rydell 1992; Svensson & Rydell 1998) and should not be used as far as possible.
3) Lighting should be fitted with movement sensors to limit illumination and light spill, and the overall lit time. In addition, the upward spread of light near to and above the horizontal plane should be restricted and directed to minimise light trespass and sky glow.
4) Increasing the spacing between lights, and the height of light units can reduce the intensity and volume of the light to minimise the area illuminated and give bats an opportunity to fly in relatively dark areas between and over lights.

6 CONCLUSION

Bat activity at the proposed Paulputs WEF is mostly low to moderate but was either high or very high in February, August and October. Therefore, the significance ratings for the majority of the impacts to bats posed by the development are predicted to be low or medium before mitigation. After mitigation, all impacts (besides cumulative impacts) are predicted to be low. Impacts related to bat mortality, and cumulative impacts, are predicted to be of high consequence, and high significance before mitigation. After mitigation these impact are predicted to be of medium consequence, and low significance for bat mortality, and low significance for cumulative impacts.

The mitigation measures are related to the design of the proposed WEF and associated grid connections and avoiding the placement of turbines in areas that bats are most active based on the pre-construction monitoring data. The current turbine layout adheres to the bat sensitivity map, with no blades intruding into bat buffers (Figure 2). Additional mitigation measures that must be considered are the choice of turbine model. The minimum distance between the blades and the ground must be maximised. Monitoring of bat activity and bat fatality during the operational phase of the WEF is needed to determine if any additional mitigation measures are needed. Attention must be given to bat fatality levels during operation of the facility which should be assessed relative to threshold levels. Mitigation options may include using deterrents or an operational minimization strategy (i.e. curtailment) during specific seasons and time periods for specific turbines coincident with periods of increased bat activity and fatality. It is likely that residual impacts to bats will be greater in February, August and October as this is when bat activity was high. The curtailment plan should be revised based on additional bat activity and bat fatality data collected during the operational phase of the project.

The bat monitoring data collected and analysed suggest that the development of the Paulputs WEF can be achieved without unacceptable risks to bats. In addition, based on the layout assessed in this report, all turbines currently adhere to the sensitivity buffers.

7 REFERENCES

ACR, 2013. African Chiroptera Report 2013. AfricanBats, African Chiroptera Project, Pretoria. i-xix + 6330 pp.

[4] MacEwan, K., Aronson, J., Richardson, E., Taylor, P., Coverdale, B., Jacobs, D., Leeuwner, L., Marais, W., Richards, L. 2018. South African Bat Fatality Threshold Guidelines for Operational Wind Energy Facilities – ed 2. South African Bat Assessment Association.

Adams, A.M., Jantzen, M.K., Hamilton, R.M., Fenton, M.B., 2012. Do you hear what I hear? Implications of detector selection for acoustic monitoring of bats. Methods in Ecology and Evolution 3, 992-998.

Arnett, E.B., May, R.F., 2016. Mitigating Wind Energy Impacts on Wildlife: Approaches for Multiple Taxa. Human–Wildlife Interactions: Vol. 10: Iss. 1, Article 5.

Arnett, E.B., Hein, C.D., Schirmacher, M.R., Baker, M., Huso, M.M.P., Szewczak., J.M., 2011. Evaluating the effectiveness of an ultrasonic acoustic deterrent for reducing bat fatalities at wind turbines. A final report submitted to the Bats and Wind Energy Cooperative. Bat Conservation International. Austin, Texas, USA.

Arnett, E. B., C. D. Hein, M. R. Schirmacher, M. M. P. Huso, and J. M. Szewczak. 2013. Evaluating the Effectiveness of an Ultrasonic Acoustic Deterrent for Reducing Bat Fatalities at Wind Turbines. PloS one 8(6).

Baerwald, E.F., Barclay, R.M.R., 2009. Geographic variation in activity and fatality of migratory bats at wind energy facilities. Journal of Mammalogy 90, 1341-1349.

Barclay, R.M.R., Baerwald, E.F., Gruver, J.C., 2007. Variation in bat and bird fatalities at wind energy facilities: assessing the effects of rotor size and tower height. Canadian Journal of Zoology 85, 381-387.

Barclay, R.M.R., Harder, L.D., 2003. Life histories of bats: Life in the slow lane, In Bat Ecology. eds T.H. Kunz, M.B. Fenton, pp. 209-253. The University of Chicago Press, Chicago.

Cryan, P.M., Gorresen, P.M., Hein, C.D., Schirmacher, M.R., Diehl, R.H., Huso, M.M., Hayman, D.T.S., Fricker, P.D., Bonaccorso, F.J., Johnson, D.H., Heist, K., Dalton, D.C., 2014. Behavior of bats at wind turbines. Proceedings of the National Academy of Sciences 111, 15126-15131.

Fenton, B. M. and D. R. Griffin. 1997. High-altitude pursuit of insects by echolocating bats. Journal of Mammalogy 78:247-250.

Foo, C.F., Bennett, V.J., Hale, A.M., Korstian, J.M., Schildt, A.J., Williams, D.A., 2017. Increasing evidence that bats actively forage at wind turbines. PeerJ 5, e3985-e3985.

Georgiakakis, P., Kret, E., Carcamo, B., Doutau, B., Kafkaletou-Diez, A., Vasilakis, D., Papadatou, E., 2012. Bat fatalities at wind farms in north-eastern Greece. Acta Chiropterologica 14(2), 459-468.

Grodsky, S.M., Behr, M.J., Gendler, A., Drake, D., Dieterle, B.D., Rudd, R.J., Walrath, N.L., 2011. Investigating the causes of death for wind turbine-associated bat fatalities. Journal of Mammalogy 92, 917-925.

Hacking, T., 1998. An innovative approach to structuring environmental impact assessment reports. In: IAIA SA 1998 Conference Papers and Notes.

Hayes, J.P., 1997. Temporal Variation in Activity of Bats and the Design of Echolocation-Monitoring Studies. Journal of Mammalogy 78, 514-524.

Hayes, M., L. Hooton, K. Gilland, C. Grandgent, R. Smith, S. Lindsay, J. Collins, S. Schumacher, P. Rabie, J. Gruver, and J. Goodrich-Mahoney. 2019. A smart curtailment approach for reducing bat fatalities and curtailment time at wind energy facilities. Ecological Applications.

Hein, C.D., Gruver, J., Arnett, E.B., 2013. Relating pre-construction bat activity and post-construction bat fatality to predict risk at wind energy facilities: a synthesis. A report submitted to the National Renewable Energy Laboratory. Bat Conservation International, Austin, TX, USA.

Horn, J.W., Arnett, E.B., Kunz, T.H., 2008. Behavioral responses of bats to operating wind turbines. The Journal of Wildlife Management 72, 123-132.

Jacobs, D.S., Barclay, R.M.R., 2009. Niche Differentiation in Two Sympatric Sibling Bat Species, Scotophilus dinganii and Scotophilus mhlanganii. Journal of Mammalogy 90, 879-887.

Jacobsen, N.H.G., Viljoen, P.C., Ferguson, W., 1986. Radio tracking of problem fruit bats (Rousettus aegyptiacus) in the Transvaal with notes on flight and energetics. . Zeitschrift fuer Saeugetierkunde 51, 205-208.

Kunz, T.H., Arnett, E.B., Cooper, B.M., Erickson, W.P., Larkin, R.P., Mabee, T., Morrison, M.L., Strickland, M.D., Szewczak, J.M., 2007a. Assessing impacts of wind-energy development on nocturnally active birds and bats: A guidance document. The Journal of Wildlife Management 71, 2449-2486.

Kunz, T.H., Arnett, E.B., Erickson, W.P., Hoar, A.R., Johnson, G.D., Larkin, R.P., Strickland, M.D., Thresher, R.W., Tuttle, M.D., 2007b. Ecological impacts of wind energy development on bats: questions, research needs, and hypotheses. Frontiers in Ecology and the Environment 5, 315-324.

Lehnert, L.S., Kramer-Schadt, S., Schönborn, S., Lindecke, O., Niermann, I., Voigt, C.C., 2014. Wind farm facilities in Germany kill noctule bats from near and far. PloS one 9, e103106.

MacEwan, K., Aronson, J., Richardson, E., Taylor, P., Coverdale, B., Jacobs, D., Leeuwner, L., Marais, W., Richards, L. 2018. South African Bat Fatality Threshold Guidelines for Operational Wind Energy Facilities – ed 2. South African Bat Assessment Association.

McCracken, G. F., E. H. Gillam, J. K. Westbrook, Y.-F. Lee, M. L. Jensen, and B. B. Balsley. 2008. Brazilian free-tailed bats (*Tadarida brasiliensis*: Molossidae, Chiroptera) at high altitude: links to migratory insect populations. Integrative and Comparative Biology 48:107-118.

Miller-Butterworth, C.M., Jacobs, D.S., Harley, E.H., 2003. Strong population substructure is correlated with morphology and ecology in a migratory bat. Nature 424, 187-191.

Millon, L., Colin, C., Brescia, F., Kerbiriou, C., 2018. Wind turbines impact bat activity, leading to high losses of habitat use in a biodiversity hotspot. Ecological Engineering 112, 51-54.

Monadjem, A., Taylor, P.J., Cotterill, F.P.D., Schoeman, M.C., 2010. Bats of Southern and Central Africa: A Biogeographic and Taxonomic Synthesis. Wits University Press, Johannesburg.

Nguyen, T. N., A. Ruangwiset, and S. Bumrungsri. 2019. Vertical stratification in foraging activity of Chaerephon plicatus (Molossidae, Chiroptera) in Central Thailand. Mammalian Biology 96:1-6.

Rollins, K.E., Meyerholz, D.K., Johnson, G.D., Capparella, A.P., Loew, S.S., 2012. A forensic investigation into the etiology of bat mortality at a wind farm: barotrauma or traumatic injury? Veterinary Pathology Online 49, 362-371.

Serra-Cobo, J., Sanz-Trullen, J.P., 1998. Migratory movements of Miniopterus schreibersii in the north-east of Spain. Acta Theriologica 43, 271-283.

Sirami, C.l., Jacobs, D.S., Cumming, G.S., 2013. Artificial wetlands and surrounding habitats provide important foraging habitat for bats in agricultural landscapes in the Western Cape, South Africa. Biological Conservation 164, 30-38.

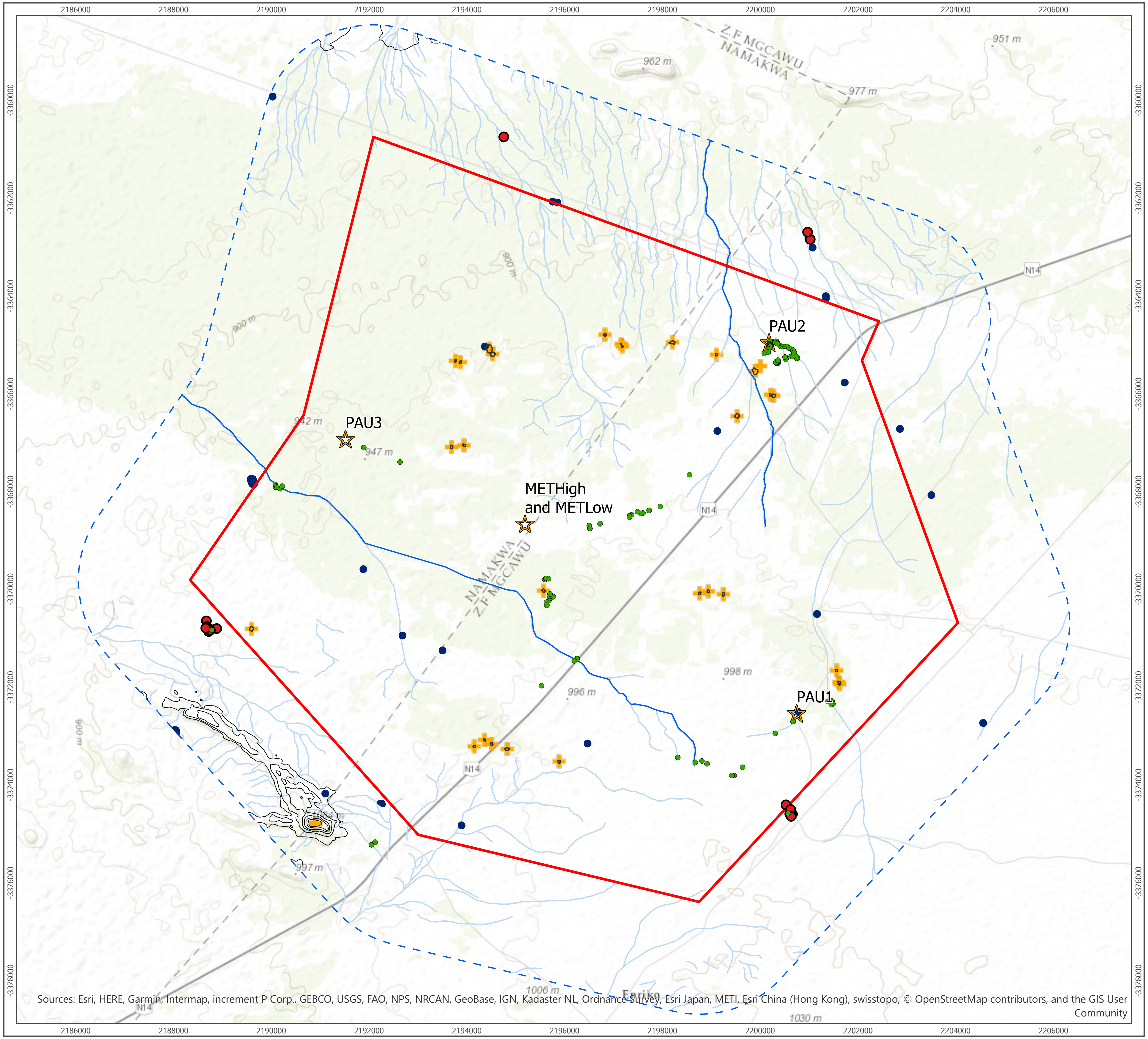
Thomas, D.W., 1988. The distribution of bats in different ages of Douglas-Fir forests. The Journal of Wildlife Management 52, 619-626.

Thompson, M., Beston, J.A., Etterson, M., Diffendorfer, J.E., Loss, S.R., 2017. Factors associated with bat mortality at wind energy facilities in the United States. Biological Conservation 215, 241-245.

Verboom, B., Huitema, H., 1997. The importance of linear landscape elements for the pipistrelle Pipistrellus pipistrellus and the serotine bat Eptesicus serotinus. Landscape Ecology 12, 117-125.

Voigt, C.C., Popa-Lisseanu, A.G., Niermann, I., Kramer-Schadt, S., 2012. The catchment area of wind farms for European bats: A plea for international regulations. Biological Conservation 153, 80-86.

FIGURES



S:\GIS\Projects\2940 Paulputs\2940 Paulputs.aprx\2940-REP-009 Bat Rescource Map

ARCUS

- Site Boundary
- Assessment Area
- Bat Detector Location

Water Resources

- Drainage Line
- NFEPA River
- Water Reservoir
- Dam, Non-Perennial Pan/NFEPA Wetland

Roosting and/or Foraging Resources

- House/Old Building
- Tree
- Rocky Outcrop/Boulder Pile

Bat Roost Assessment

- Moderate

1:75 000 Scale @ A3

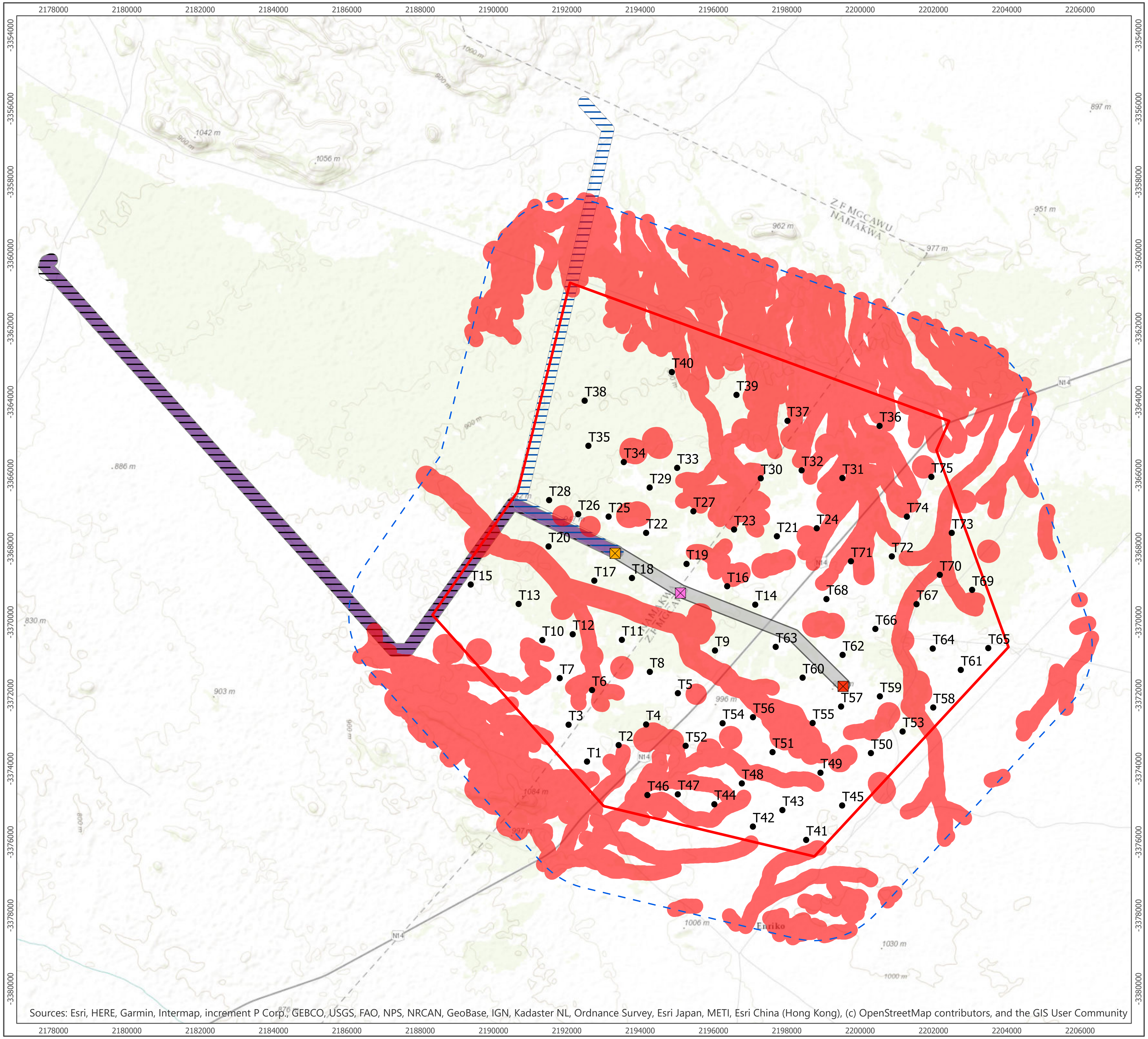
0 1,5 3 km

NORTH

Produced By: JA	Ref: 2940-REP-013
Checked By: AB	Date: 22/04/2019

Bat Resource Map
Figure 1

Bat Final EIA Report
Paulputs Wind Energy Facility
Northern Cape



ARCUS

- Assessment Area
- Site Boundary
- Proposed Turbine
- Substation Compound Option A
- Substation Compound Option B
- Substation Compound Option C
- No Go Areas (Inclusive of Blade Buffer)

Grid Connection Corridors

- OHPL Connecting Substation Options A, B, C
- Option A
- Option B
- Option C

1:100 000 Scale @ A3

0 2,5 5 km NORTH

Produced By: JA	Ref: 2940-REP-014
Checked By: AB	Date: 03/Jul/2019

Bat Sensitivity Map
Figure 2

Bat Final EIA Report
Paulputs Wind Energy Facility
Northern Cape

S:\GIS\Projects\2940 Paulputs\2940 Paulputs.aprx\2940-REP-010 Bat Sensitivity Map

APPENDIX 1 - EXTERNAL REVIEW AND CV

Postal Address: PostNet Suite #10134
Private Bag X7005
Hillcrest, KZN, 3650
Mobile: +27 (0) 79 175 1758
Email: info@iws-sa.co.za
Website: www.iws-sa.co.za

Attention: Ryan David-Andersen
Arcus Consulting
Office 220 Cube Workspace
Cnr Long Street and Hans Strijdom Road
Cape Town
8001

16 July 2019_revised 27 August 2019
IWS Project Ref: 3094rev1

Dear Ryan

INDEPENDENT REVIEW OF THE BAT FINAL EIA REPORT FOR THE PAULPUTS WIND ENERGY FACILITY AND ASSOCIATED GRID CONNECTION, NORTHERN CAPE PROVINCE

Our email correspondence on the 15th July 2019 and 27th August 2019, including the Bat Final EIA Report (Arcus Consulting, July 2019 and revised in August 2019) has reference. Overall, the study is well done and the field work was performed according to the South African Best Practise Guidelines (Sowler *et al.*, 2017). I do, however, have some comments on the data analyses and mitigation recommendations.

Based on my experience and discussions with the Department of Environmental Affairs, mitigation measures, presented both in the EIA and the EMPr, need to be very clearly defined, otherwise they cannot be enforced. Furthermore, from a project finance perspective, it is much harder to perform adaptive mitigation than to allow for it from the start. Therefore, it is very hard to convince operators/ project owners to apply such measures during the operational phase and the impacts continue to occur unmitigated. My comments are supplied below:

- Section 4.3, Graphs 3 and 4: I find it very strange that bats would be active 2 hours before sunset. Are you sure those times correct? Why not display the graphs as the actual times, rather than hours before and after sunset? Minor comment for Graph 3, I would show what the abbreviations of the species are.
- Section 4.4. paragraph 6 states: “This can be mediated by increasing the lower sweep of the turbine blades to 40 m or 50 m for example.”

  Here you are specific on heights. Yet, in Section 5.3.1.5, Mitigation Measure 2 is vague and says: “The rotor diameter must be minimised and an appropriate hub height used such that the minimum distance between the blades and the ground is maximised.” Be more specific as in Section 4.4.
- Section 4.4. Table 3: I understand the temperature range in which curtailment should be implemented within, but I don't understand the wind range? For a range of 4 - 11m/s, does that mean cut-in is at 4m/s and it stays until 11m/s. Normally they are looking for the minimum cut-in wind speed, i.e. 4m/s or 5m/s, below which the turbines do not spin/ are feathered, etc. This minimum could be selected using the percentage of bat activity occurring below a certain wind speed. Presenting a range is confusing and will not lead to a specific mitigation measure.

Section 4.4. Paragraph 8: There are a few comments I have regarding this paragraph:

- Be specific, after presenting ranges, set specific numbers.
- A good curtailment regime uses wind speed and temperature and possibly also humidity in conjunction with each other. Not one or the other. Please take out the word "or".
- In this revised report, curtailment is dependent on operational monitoring. Therefore, if there are any challenges with the operational monitoring and the modelling of the fatality estimates or the threshold value comes under question, the operator will refuse to implement the measures and there is no legal way to enforce this. If the measures are stated clearly in the EIA and EMPr, they are enforceable. The data is there from preconstruction, why not use it?
- Set the threshold now, so it is in the EMP. It is easy to calculate.
- If curtailment is now only dependant on operational monitoring, mitigation must not only be restricted to the months of February, August and October. Mitigation must be applied in the highest fatality months. February, August and October was the starting point and should be adapted.
- If you are going to keep it as this, then set threshold and set some specific operational monitoring parameters that must be met. If it is not spelled out in the EIA and EMPr, it can not be audited or enforced.

- Section 5.3.1.5 and 5.3.1.6 Mitigation Measure 4: Same comments as above. Initial mitigation should not be dependent on operational monitoring only, set a specific wind speed cut-in and set a fatality threshold.
- Section 5.3.1.5 and 5.3.1.6. Mitigation Measure 3 states: "Lighting should be fitted with movement sensors to limit illumination and light spill, and the overall lit time. In addition, the upward spread of light near to and above the horizontal plane should be restricted and directed to minimise light trespass and sky glow."

  How? Specific measures must be put in – i.e. all lights should be down-hooded
- Section 6: Leaving the mitigation measures up to the developer and/or operator in the operational phase is problematic and not enforceable due to reasons given above. The operational monitoring programme and the mitigation plan need to be clearly defined in the EIA and EMPr.

I trust that the above comments are helpful. If you wish to discuss any of them, please do not hesitate to contact me.

Kind regards

Kate MacEwan
for Inkululeko Wildlife Services (Pty) Ltd.

KATE LOUISE MACEWAN (NEÉ PIGOTT)

Curriculum Vitae

Name of Firm: Inkululeko Wildlife Services (Pty) Ltd

Position: Senior Zoologist and Managing Director

Date of Birth: 28 April 1975

Nationality: South Africa/ United States of America

Languages: English (mother tongue), Afrikaans

Mobile No: +29 (0) 79 175 1758

Email: kate@iws-sa.co.za

Postal Address: PostNet Suite # 10134, Private Bag X7005, Hillcrest, 3650, South Africa

SUMMARY

Kate MacEwan is accredited as a Professional Natural Scientist (SACNASP: 400123/05) in the field of Zoology and Environmental Science. She holds a BSc (Honours) in Zoology from Wits University, has over 22 years of environmental management, zoological and practical bat conservation experience, has run her own biodiversity consultancy businesses for over 15 years and has a wide diversity of contacts with various global academics and biologists. Through her two businesses, Kate has conducted over 35 long-term pre-construction bat monitoring studies and 10 current or recently completed long-term operational bird and bat monitoring studies for wind energy developments in South and southern Africa, including bat specialist and inventory assessments for mines and protected areas in South Africa, Zambia and the DR Congo. Under her leadership, her team has also performed biodiversity surveys and management plans in Zambia, Mozambique, Libia, Sao Tome and Principe and Ethiopia.

Kate is currently the chairperson for the South African Bat Assessment Advisory Panel (SABAAP) for over 4 years and sits on the executive committee of the Gauteng and Northern Regions Bat Interest Group (GNorBIG) for over 14 years. She is a co-author of the South African Good Practise Guidelines for Surveying Bats in Wind Farm Developments: Edition 4.1 (Sowler et al 2017), South African Bat Fatality Threshold Guidelines: 2nd Edition (MacEwan et al 2018) and the South African Good Practice Guidelines for Operational Monitoring for Bats at Wind Energy Facilities: 1st Edition (Aronson et al 2014). She is also the co-author on several bat species accounts in the latest southern African Red Data mammal listings (Child et al 2016). Kate is Fall & Rescue certified to perform working tasks at height and First Aid Level 1 certified.

EDUCATIONAL QUALIFICATIONS

- B Sc Hons (Zoology) University of the Witwatersrand, Johannesburg (1998
- B Sc University of the Witwatersrand, Johannesburg (1997)

EMPLOYMENT EXPERIENCE

- Managing Director & Senior Zoologist: Inkululeko Wildlife Services (Pty) Ltd (October 2014-present)
  - Project management and fieldwork for numerous specialist ecological and bat assessments
  - Tender and proposal compilation
  - Administration and marketing

- Liaison with clients and government officials
- Financial management

- Member & Senior Zoologist: Natural Scientific Services CC (October 2003-September 2014)
  - Project management and fieldwork for numerous environmental and ecological assessments
  - Project management for various Environmental Impact Assessments, Environmental Programme Reports and Water Use Licence applications for the Conservation, Mining, Waste and Industrial sectors.
  - Remediation audits within the industrial sector
  - Tender and proposal compilation
  - Administration and marketing
  - Liaison with clients and government officials
  - Environmental Education
- Environmental Scientist: Jones & Wagener Civil Engineers (March 2000-September 2003)
  - Project management for various Environmental Impact Assessments, Environmental Programme Reports and Water Use Licence applications for the Mining, Waste and Industrial sectors
  - Fieldwork for surface water quality and ecological assessments
  - Tender and proposal compilation
  - Liaison with clients and government officials
- Area Manager (contract post): Working for Water – Kruger National Park (October 2000-January 2001)
  - Management of Alien Plant Clearing operations; Project / Financial administration; People management
- Zoo Keeper: Johannesburg Zoological Gardens (September 1998-March 2000)
  - Husbandry of carnivores, pachyderms and ungulates; Rearing of injured or orphaned animals of all kinds; Environmental Education; Waste Management; People Management – employees and public

PUBLICATIONS

- Richards, L.R., **MacEwan, K.**, Jacobs, D.S. and Richardson, E.J. 2019. Age and sex-related mortality of bats from wind energy facilities in the Eastern Cape province of South Africa. Presented at the Zoological Society of Southern Africa conference in July 2019, Skukuza, RSA.
- **MacEwan, K.**, Aronson, J., Richardson, E., Taylor, P., Coverdale, B., Jacobs, D., Leeuwner, L., Marais, W., Richards, L. 2018. South African Bat Fatality Threshold Guidelines – ed 2. South African Bat Assessment Association
- **MacEwan, K.**, Lotter, C., Pierce, M & Morgan, T. Bat Activity in South Africa Ecoregions. In Press
- Sowler, S., Stoffberg, S., **MacEwan, K.,** Aronson, J., Ramalho, R., Forssman, K., Lötter, C. 2017. South African Good Practice Guidelines for Surveying Bats at Wind Energy Facility Developments - Pre-construction: Edition 4.1. South African Bat Assessment Association Guidelines.
- Primary author on the following 3 bat species accounts in Child MF, Roxburgh L, Do Linh San E, Raimondo D, Davies-Mostert HT, editors. The Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa:
  - **MacEwan, K**., Jacobs D, Schoeman C, Richards L, Cohen L, Monadjem A, Sethusa T, Taylor PJ. 2016. A conservation assessment of Tadarida aegyptiaca. In Child MF, Roxburgh L, Do Linh San E, Raimondo D, Davies-Mostert HT, editors. The Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.

- **MacEwan, K.**, Schoeman C, Monadjem A, Cohen L, Jacobs D, Richards L, Sethusa T, Taylor PJ. 2016. A conservation assessment of Miniopterus fraterculus. In Child MF, Roxburgh L, Do Linh San E, Raimondo D, Davies-Mostert HT, editors. The Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.

- **MacEwan, K.**, Richards LR, Cohen L, Jacobs D, Monadjem A, Schoeman C, Sethusa T, Taylor PJ. 2016. A conservation assessment of Miniopterus natalensis. In Child MF, Roxburgh L, Do Linh San E, Raimondo D, Davies-Mostert HT, editors. The Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.

- Co-author on an additional 56 species accounts in Child MF, Roxburgh L, Do Linh San E, Raimondo D, Davies-Mostert HT, editors. The Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.
- **MacEwan, K.** 2016. Fruit bats and wind turbine fatalities in South Africa. African Bat Conservation News 42: 3-5.
- **MacEwan, K.** 2014. Bats and Wind Energy in South Africa. Article published in the March/ April 2014 edition of Footprint Limited magazine.
- Aronson, J., Richardson, K, **MacEwan, K.**, Jacobs, D., Marais, W., Aiken, S, Taylor, P., Sowler, S. and Hein, C. 1st South African Good Practise Guidelines for Operational Monitoring for Bats at Wind Energy Facilities. South African Bat Assessment Advisory Panel.
- Scholes, R.J., Gureja, N., Giannecchinni, M., Dovie, D., Wilson, B., Davidson, N., **Pigott, K.**, McLoughlin, C., van der Velde, K., Freeman, A., Bradley, S., Smart, R., Ndala, S. 2001. The environment and vegetation of the flux measurement site near Skukuza, Kruger National Park. Koedoe 44:73–83

RECENT CONFERENCES

- ***2019 -*** Zoological Society of Southern Africa conference July 2019, Skukuza, RSA (Paper to presented)
- ***2017*** – Southern African Bat Research Conference, Cape Town, South Africa (Scientific Committee, Presenter and Organising Committee)
- ***2016*** – International Bat Research Conference, Durban, South Africa (Presenter – Wind Energy & Bats)
- ***2015*** – Windaba, Cape Town, South Africa (Presenter – Wind Energy & Bats)
- ***2013*** – International Association for Impact Assessment (IAIA) South Africa, Free State Province, South Africa (Presenter – Wind Energy & Bats)
- ***2013*** – Windaba, Cape Town, South Africa (Presenter – Wind Energy & Bats)
- ***2013*** – Zoological Society of South Africa, Limpopo, South Africa (Presenter – Wind Energy & Bats)

PROFESSIONAL & CONSERVATION ORGANISATIONS

- South African Council for Natural Scientific Professions (PrSciNat) – Zoology and Environmental Science
- South African Bat Assessment Association Panel (SABAAP) – current Chairperson
- Zoological Society of Southern Africa (ZSSA)
- Gauteng & Northern Regions Bat Interest Group (GNorBIG) Research Committee Member
- BatsKZN
- Endangered Wildlife Trust (EWT)
- BirdLife South Africa

APPENDIX 2 - SPECIALIST CV AND DECLARATION OF INDEPENDENCE

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

Paulputs 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:	Arcus Consultancy Services South Africa (Pty) Ltd			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	4	Percentage Procurement recognition	100%
Specialist name:	Jonathan Aronson			
Specialist Qualifications:	Master of Science (Zoology)			
Professional affiliation/registration:	SACNASP #400238/14 South African Bat Assessment Association			
Physical address:	Office 220 Cube Workspace Cnr Long Street and Hans Strijdom Road Cape Town			
Postal address:	Office 220 Cube Workspace Cnr Long Street and Hans Strijdom Road Cape Town			
Postal code:	8001	Cell:	0790988595	
Telephone:	0214121535	Fax:	n/a	
E-mail:	JonathanA@arcusconsulting.co.za			

2. DECLARATION BY THE SPECIALIST

I, Jonathan Aronson , 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.

Signature of the Specialist

Arcus Consultancy Services South Africa (Pty) Ltd

Name of Company:

09/07/2019

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

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

[signature]

Signature of the Specialist

Arcus Consultancy Services South Africa (Pty) Ltd

Name of Company

09/07/2019

Date

[signature]

Peter Hugh Martyn Cohen
Commissioner of Oaths
Practising Attorney SA
ENSafrica
1 North Wharf Square
Loop Street Cape Town 8001

Signature of the Commissioner of Oaths

09/07/2019

Date

CURRICULUM VITAE

Jonathan Aronson MSc Pr.Sci.Nat

Senior Ecologist

Email:JonathanA@arcusconsulting.co.za

Specialisms

- Ecological Impact Assessments
- Pre-construction and Operational monitoring at wind energy developments
- Data analysis and statistical assessment of ecological data
- GIS mapping and Analysis

Summary of Experience

Jonathan has 12 years of experience studying and researching bats and has presented at the International Bat Research Conference and local bat workshops. He has been at the forefront of bats and wind energy research in South Africa and has worked on more than 40 WEF projects in South Africa, Kenya, Mozambique, Zambia and the UK undertaking pre-construction monitoring, operational monitoring, impact assessments and mitigation strategy design. He is a co-author of the Good Practise Guidelines for Surveying Bats at Wind Energy Facilities in South Africa, is the lead author on the operational monitoring guidelines for bats and is a founding member of the South African Bat Assessment Advisory Panel (SABAAP). He has experience managing wind energy facility projects including developing survey strategies, implementing field surveys, data analysis and report writing. He has provided extensive input to Environmental Impact Assessments (EIA) and post-construction Environmental Management Plans (EMP) for bats.

Professional History

2019 to current - Senior Ecologist, Arcus Consultancy Services Ltd, Cape Town
2013 to 2019 - Ecology Specialist, Arcus Consultancy Services Ltd, Cape Town
2011 to 2013 - Director, Gaia Environmental Services Pty (Ltd), Cape Town
2008 to 2008 - Research Assistant, Percy Fitzpatrick Inst. of African Ornithology, Cape Town

Qualifications and Professional Affiliations

- **University of Cape Town, 2009-2010**
  Msc Zoology
- **University of Cape Town, 2007**
  BSc (Hons) Freshwater Biology
- **University of Cape Town, 2003-2006**
  BSc Zoology
- Member of Society for Conservation Biology (2011 to present)
- South African Bat Assessment Advisory Panel (2013 to 2018)
- South African Bat Assessment Association (2013 to present)
- Professional Natural Scientist (Ecological Science) – SACNASP Registration #400238/14

Project Experience

Pre-Construction Bat Monitoring and Environmental Impact Assessments

- Pienaarspoort Wind Energy Facility (ABO Wind renewable energies (Pty) Ltd).
- Nuweveld Wind Energy Facility (Red Cap Energy (Pty) Ltd).
- Banna Ba Phifu Wind Energy Facility (WKN Windcurrent SA (Pty) Ltd).
- Choje Wind Farm (Wind Relic (Pty) Ltd).
- Kwagga Wind Energy Facility (ABO Wind renewable energies (Pty) Ltd).
- Wind Farm in Zambia (SLR Consulting).
- Namaacha Wind Farm (Consultec).
- Beck Burn Wind Farm. Post-construction Monitoring. (EDF Energy).
- Paulputs Wind Energy Facility (WKN Windcurrent SA (Pty) Ltd).
- Putsonderwater Wind Energy Facility (WKN Windcurrent SA (Pty) Ltd).
- Zingesele Wind Energy Facility (juwi Renewable Energies (Pty) Ltd).
- Highlands Wind Energy Facility (WKN Windcurrent SA (Pty) Ltd).
- Kap Vley Wind Energy Facility (juwi Renewable Energies (Pty) Ltd).
- Universal and Sonop Wind Energy Faculties (JG Afrika).
- Kolkies and Karee Wind Energy Facility (Mainstream Renewable Power South Africa).
- Komsberg East and West Wind Energy Facility (African Clean Energy Developments Pty Ltd).
- Pofadder Wind Energy Facility (Mainstream Renewable Power South Africa).
- Elliot Wind Energy Facility (Rainmaker Energy).
- Spitskop West Wind Energy Facility (RES Southern Africa/Gestamp).
- Spitskop East Wind Energy Facility (RES Southern Africa).
- Patryshoogte Wind Energy Facility (RES Southern Africa).
- Swartberg Wind Energy Facility (CSIR).
- Clover Valley and Groene Kloof Wing Energy Facility (Western Wind Energy).

CURRICULUM VITAE

Jonathan Aronson MSc Pr.Sci.Nat

Senior Ecologist

Email:JonathanA@arcusconsulting.co.za

Operational Bat Monitoring Studies

- West Coast One Wind Energy Facility. Post-construction Monitoring (Aurora Wind Power (RF) (Pty) Ltd).
- Fazakerly Waste Water Treatment Works. Post-construction Monitoring. (United Utilities).
- Gouda Wind Energy Facility (Blue Falcon 140 (Rf) Pty Ltd)
- Hopefield Wind Farm (Umoya Energy).

Ecological Surveys

- Killean Wind Farm. Bat acoustic surveys including a driven transect and commissioning of bat detectors for this proposed site in Scotland, UK. (Renewable Energy Systems Ltd).
- Maple Road, Tankersely. Bat acoustic surveys including a walked transect for this proposed site near Barnsley, UK (Rula Developments).

Due Diligence

- Due Diligence of Bat Monitoring at the Excelsior, Golden Valley and Perdekraal Wind Farm (IBIS Consulting).
- Due Diligence of Bat Monitoring at the Copperton Wind Enery Facility (SLR Consulting).
- Due Diligence of Bat Monitoring at the Roggeveld Wind Farm (IBIS Consulting).
- Due Diligence of Bat Monitoring at the Kangas, Excelsior and Golden Valley Wind Farms (ERM).

Amendment Applications

- Ukomeleza Wind Energy Facility (CES - Environmental and social advisory services).
- Great Kei Wind Energy Facility (CES - Environmental and social advisory services).
- Motherwell Wind Energy Facility (CES - Environmental and social advisory services).
- Dassiesridge Wind Energy Facility (CES - Environmental and social advisory services).
- Great Karoo Wind Energy Facility (Savannah Environmental (Pty) Ltd).
- Gunstfontein Wind Energy Facility (Savannah Environmental (Pty) Ltd).
- Komserberg East and West Wind Energy Facilities (Aurecon South Africa (Pty) Ltd).
- Soetwater Wind Energy Facility (Savannah Environmental (Pty) Ltd).
- Karusa Wind Energy Facility (Savannah Environmental (Pty) Ltd).
- Zen Wind Energy Facility (Savannah Environmental (Pty) Ltd).

Peer Review

- Peer Review for Three Bat Monitoring Reports for the Bokpoort II Solar Developments (Golder Associates)
- Peer Review of Operational Monitoring at the Jeffreys Bay Wind Farm, including updating the operational mitigation strategy for bats (Globeleq South Africa Management Services (Pty) Ltd).
- Oyster Bay Wind Energy Facility. Reviewing a pre-construction bat monitoring study and providing input into a stand-alone study (RES Southern Africa).
- Review and design mitigation strategies for bats at the Kinangop Wind Park, Kenya (African Infrastructure Investment Managers).

Feasibility Studies

- Feasibility assessment for four potential wind farms in the Northern Cape (ABO Wind renewable energies (Pty) Ltd).
- Feasibility assessment for four potential wind farms in Mozambique (Ibis Consulting (Pty) Ltd).
- Assessment of the Feasibility of a Wind Farm in the Northern Cape (juwi Renewable Energies (Pty) Ltd).
- Assessment of the Feasibility of a Wind Farm in the Eastern Cape (WKN Windcurrent SA (Pty) Ltd).

Research Projects

- Darling National Demonstration Wind Farm Project. Designed and implemented a research project investigating bat fatality in the Western Cape.

Publications

- Aronson, J.B., Shackleton, S., and Sikutshwa, L. (2019). Joining the puzzle pieces: reconceptualising ecosystem-based adaptation in South Africa within the current natural resource management and adaptation context. Policy Brief, African Climate and Development Initiative.
- MacEwan, K., **Aronson, J.**, Richardson, E., Taylor, P., Coverdale, B., Jacobs, D., Leeuwner, L., Marais, W., Richards, L. South African Bat Fatality Threshold Guidelines for Operational Wind Energy Facilities – South African Bat Assessment Association (1st Edition).
- **Aronson, J.B.** and Sowler, S. (2016). Mitigation Guidance for Bats at Wind Energy Faculties in South Africa.
- **Aronson, J.B.**, Richardson, E.K., MacEwan, K., Jacobs, D., Marais, W., Aiken, S., Taylor, P., Sowler, S. and Hein, C (2014). South African Good Practise Guidelines for Operational Monitoring for Bats at Wind Energy Facilities (1st Edition).
- Sowler, S. and S. Stoffberg (2014). South African Good Practise Guidelines for Surveying Bats in Wind Energy Facility Developments - Pre-Construction (3rd Edition). Kath Potgieter, K., MacEwan, K., Lötter, C., Marais, M., **Aronson, J.B**., Jordaan, S., Jacobs, D.S, Richardson, K., Taylor, P., Avni, J., Diamond, M., Cohen, L., Dippenaar, S., Pierce, M., Power, J. and Ramalho, R (eds).
- **Aronson, J.B.**, Thomas, A. and Jordaan, S. 2013. Bat fatality at a Wind Energy Facility in the Western Cape, South Africa. *African Bat Conservation News* 31: 9-12.

Workshops, Seminars, Conferences and Courses

- Conference on Wildlife and Wind Energy Impacts, Stirling, August 2019.
- GenEst Carcass Fatality Estimator Workshop, Stirling, August 2019.
- GenEst Carcass Fatality Estimator Workshop, Kirstenbosch Research Centre (KRC), October 2018.
- The Ecosystem Approach and Systems Thinking Course, United Nationals Environment Programme.
- Bats and Wind Energy Workshop, The Waterfront Hotel & Spa, Durban, July 2016.
- Why Carbon Footprinting Makes Business Sense, African Climate and Development Initiative Seminar, September 2016.
- The Age of Sustainable Development Course, The SDG Academy, 2016.
- Planetary Boundaries and Human Opportunities Course, The SDG Academy, 2015.
- Endangered Wildlife Trust (EWT) Bats and Wind Energy Training Course, October 2013.
- Ecological Networks Course, Kirstenbosch Research Centre (KRC), July 2013.
- Social and Economic Network Analysis Course, online via Stanford University, 2013.
- Social Network Analysis Course, online via University of Michigan, 2013.
- Introduction to Complexity Science Course, online via Santa Fe Institute, 2013.
- Introduction to Spatial Analysis using R, Kirstenbosch Research Centre (KRC), May 2013.
- Google Geo Tools for Conservation, University of Cape Town, February 2013.
- Endangered Wildlife Trust (EWT) Bats and Wind Energy Training Course, January 2012.
- 15th International Bat Research Conference, Prague, August 2010.
- Statistical Modelling Workshop for Biologists, University of Cape Town, September 2010.
- ESRI Virtual Campus Online GIS Courses, 2010.
- WAYS/ScholarShip IT Workshop: Remote Sensing and GIS Course, March 2009.