BAT MONITORING & IMPACT ASSESSMENT REPORT FOR THE MULILO NEWCASTLE WIND POWER (PTY) LTD WIND ENERGY FACILITY, KWAZULU-NATAL PROVINCE

On behalf of

CES – ENVIRONMENTAL AND SOCIAL ADVISORY SERVICES

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Regulation GNR 326 of 4 December 2014, as amended 7 April 2017, Appendix 6	Section of Report
(a) details of the specialist who prepared the report; and the expertise of that specialist to compile a specialist report including a *curriculum vitae*;	Appendix 1
(b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Appendix 1
(c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 1
(cA) an indication of the quality and age of base data used for the specialist report;	Section 1
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 4
(d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 1, Section 3
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 2
(f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 4
(g) an identification of any areas to be avoided, including buffers;	Section 4, Figure 2
(h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Figure 2
(i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 1.3
(j) a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment, or activities;	Section 3
(k) any mitigation measures for inclusion in the EMPr;	Section 4
(l) any conditions for inclusion in the environmental authorisation;	Section 4
(m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 4
(n) a reasoned opinion— i. as to whether the proposed activity, activities or portions thereof should be authorised; iA. Regarding the acceptability of the proposed activity or activities; and ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr or Environmental Authorization, and where applicable, the closure plan;	Section 4, Section 5
(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.	Government Notice No. 320 has been gazetted, and a site sensitivity verification report aligned with the requirements of Part A of GN 320 has been submitted with the final scoping report.

1 INTRODUCTION

Mulilo Renewable Project Developments (Pty) Ltd. ('Mulilo') are considering the development of a wind energy facility ('WEF'), with a generating capacity of up to 200 MW, and including an associated grid connection. Mulilo Newcastle Wind Power (Pty) Ltd. (hereafter referred to as 'MNWP') is approximately 2,963 ha in extent and is located approximately 15 km north west of the town of Newcastle in the Kwazulu-Natal Province. Arcus was appointed to conduct the pre-construction bat monitoring for the project, the results of which have informed this impact assessment process required for environmental authorisation in terms of the National Environmental Management Act,1998 (Act 107 of 1998, as amended) (NEMA) and associated EIA regulations of 2014 as amended (EIA regulations).

The aim of the monitoring was to document bat activity in the areas of interest and, based on this activity, assess the proposed wind farm with regards to potential impacts to bats and the risk to development consent. This data establishes a pre-construction baseline of bat species diversity and activity and is used to inform this impact assessment. The monitoring data also assists in providing solutions to avoid and mitigate impacts by informing the final design and construction and operational management strategy of the wind farm. The baseline will also be used to compare impacts to bats during the operational phase of the project.

This monitoring and impact assessment report includes the results from the bat activity monitoring undertaken between 17 August 2021 and 4 December 2022. This data has been used to provide an assessment of potential impacts for the project.

1.1 Description of Proposed Development

Mulilo Renewable Project Developments (Pty) Ltd. is proposing to develop a wind energy generating project, comprised of:

- Mulilo Newcastle Wind Power (Pty) Ltd. WEF, including up to 37 Wind Turbine Generators, one IPP Substation and O&M building complex, one concrete batching footprint, one temporary construction yard, one temporary wind turbine laydown area and internal access roads; and
- Associated grid connection (132kV overhead line) and switching station.

The proposed WEF will be located approximately 15 km north west of the town of Newcastle in the Kwazulu-Natal Province. The study area is situated in Ward 1 of the Newcastle Local Municipality (LM) within the Amajuba District Municipality (ADM). The associated grid connection will connect to the existing Eskom Incandu MTS within Ward 1.

The proposed up to 200 MW Mulilo Newcastle Wind Power (Pty) Ltd. WEF will comprise of up to thirty-seven (37) turbines with unspecified individual turbine output capacity with locations currently based on technical considerations such as wind resource and access. Although up to 37 wind turbines are to be constructed, a total of 45 wind turbines are being assessed in this report for approval. The properties affected by the WEF are all zoned as Agriculture and mostly used for stock grazing. Woodlands or afromontane forests occur in the ravines. Infrastructure required for the MNWP WEF includes operational and maintenance buildings, internal roads, underground electrical cabling linking turbines, an IPP substation and an on-site switching station.

In addition to the MNWP WEF, an overhead line (132 kV) to an Eskom substation will also be developed. The distance of the overhead line (132 kV) will be approximately 20-25 km to an Eskom Incandu Substation, near Newcastle. Two alternatives are also being considered, extending over a similar area and ending at the same Eskom Incandu

Substation. An assessment of the grid connection and potential impacts to bats will be dealt with under a separate application and Basic Assessment process.

1.2 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 and operation of the wind farm. 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 receiving environment in and surrounding the site, including a description of key no-go areas or features or other sensitive areas to be avoided;
- Describe the methodology and processes used to source information, collect baseline data, generate models and the age or season when the data was collected;
- Describe any assumptions made and any uncertainties or gaps in knowledge;
- Describe relevant legal matters, policies, standards and guidelines.
- Identify potentially significant environmental impacts that may arise in the construction, operation and decommissioning phases of the project, including cumulative impacts;
- Conduct an impact assessment of identified impacts under the pre-mitigation and post-mitigation scenarios;
- Conduct an assessment of any alternatives, where relevant, and the No-Go alternative;
- Provide a discussion on the overall impact and a reasoned opinion as to whether the proposed activity, or portions of the activity can be authorised; and
- Identify potential mitigation or enhancement measures to minimise impacts to bats.

1.3 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, demographics, local and regional distribution patterns, spatial and temporal movement patterns (including migration and flying heights) and how bats may be impacted by wind energy, including cumulatively, is 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 adopt a precautionary approach when extrapolating data from echolocation surveys over large areas due to the limited sample size (i.e. 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 dependent on the quality of the calls used for identification. Species call parameters can often overlap, making species identification difficult.
- Automatic bat classifiers in Kaleidoscope Pro Version 5.4.7 (Wildlife Acoustics, Inc) were used to identify bat species. Post-processing was used to manually verify the performance of the classifiers but owing to the large number of files recorded, not all recordings could be verified manually. There may be instances where the software was unable to identify species or made incorrect identifications.
- 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 is presented as relative abundance.

- 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 need to 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.

1.4 Applicable Legislation, Policies, Treaties, Guidelines and Standards

The following items provide a governance framework and guidelines for the consideration and management of impacts to biodiversity and are applicable to the development of infrastructure, including wind farms, which may result in such impacts:

- The Equator Principles (2013)
- International Finance Corporation Environmental, Health, and Safety Guidelines for Wind Energy (2015)
- 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)
- National Biodiversity Strategy and Action Plan (2005)
- South African Best Practise Guidelines for Surveying Bats in Wind Energy Facility Developments – Pre-Construction (2020)
- Government Notice No. 320 has been gazetted, therefore a verification report aligned with the requirements have been included in the submitted scoping report.

2 METHODOLOGY

2.1 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 and operational 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.

2.2 Field Surveys

The pre-construction monitoring was designed to monitor bat activity across a study area comprising of two wind energy facilities, namely: Mulilo Newcastle Wind Power (Pty) Ltd. and Mulilo Newcastle Wind Power 2 (Pty) Ltd. – the latter of which is being subjected to a separate Environmental Impact Assessment process for authorisation. This complete area comprising both WEF's is collectively known as the Newcastle WEF complex. Monitoring was subsequently designed to cover the Newcastle WEF complex as a whole, as well as a broader study area representative of habitats within the overall WEF complex itself, with the results informing each individual WEF specialist bat impact assessment. A broader study area was used because bats are mobile animals and may cross the wind farm boundary to access resources. The monitoring was undertaken in accordance with South African best practice[1]. Sampling of bat activity took place at six locations (Figure 1) using Song Meter SM4 bat detectors (Wildlife Acoustics, Inc.). Sampling was initially conducted at four locations, after which an additional two locations were then added in late July 2022 to gather additional information within relevant habitats. Ultrasonic microphones were mounted on masts at 12 m ("ground level") at four locations. In addition, ultrasonic microphones were mounted at 12 m, 55 m and 110 m respectively on one meteorological mast ("at height"), and at 12m and 55m on a second meteorological mast. 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, on top or ridges, in open areas with low habitat complexity).

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

2.3 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 bat calls is termed 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® Pro (Version 5.4.7, 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 random or selective (for certain species) checks through manually identifying recordings to verify the results. The total number of files was used as a proxy for the number of bat passes which is a standard approach to quantifying bat activity.

3 BASELINE ENVIRONMENT

3.1 Habitats

The proposed Newcastle WEF complex is spread across the Low Escarpment Moist Grassland, KwaZulu-Natal Highland Thornveld, Southern Mistbelt Forest and Northern KwaZulu-Natal Moist Grassland vegetation types, within the Drakensberg Montane Grasslands, Woodlands and Forests ecoregion. MNWP is mostly dominated by the Low Escarpment Moist Grassland vegetation type. This vegetation is dominated by *Hyparrhenia hirta* and *Themeda triandra* grasses, as well as *Protea caffra* communities and patches of

[1] Sowler, S., MacEwan, K., Aronson, J. and Lötter, C., 2020. South African best practice guidelines for pre-construction monitoring of bats at wind energy facilities.

Leucosidea scrub. The area experiences summer rainfall, which peaks from December to January, with frequent fog that adds to the overall precipitation.

For foraging bats, one of the most important ecological constraints is clutter; objects (e.g. vegetation) that have to be detected and avoided by bats during flight (Schnitzler and Kalko 2001). Clutter presents perceptual and mechanical problems for bats. Perceptually, bats are constrained by their sensory capabilities to find prey amongst clutter (e.g. having an echolocation system adapted to find prey in dense vegetation versus in the open). Mechanically, bats are constrained by their flight ability (e.g. adaptations in wing morphology that enable flight in dense vegetation versus in the open). Habitats can therefore be defined according to clutter conditions. These include uncluttered space (open spaces, high above the ground and far from vegetation), background cluttered space (near the edges of vegetation, in vegetation gaps, and near the ground or water surfaces), and highly cluttered space (very close to surfaces such as leaves or the ground). Habitat complexity is therefore an important consideration for bats because areas that offer a variety of clutter conditions are more likely to support a greater diversity of bat species. The relative uniformity of the landscape, with a limited degree of clutter complexity, will reduce the diversity of species present on the site. Despite this, there is a range of suitable habitat for bats that can be used for roosting, foraging and commuting in the study area.

The availability of roosting space is a critical factor for bats (Kunz and Lumsden 2003) and a major determinant of whether bats will be present in a landscape, as well as the diversity of species that can be expected. There are no known/confirmed roosts at MNWP or in the broader area. Based on unpublished data from the South African Bat Assessment Association, the nearest major bat roosts are located ca. 97 km east and 104 km south west of the Newcastle WEF complex, respectively. There are however, several potential roosting features on site that may be used by bats. These include buildings and trees, although investigations on site to date did not reveal any signs of roosting bats.

A number of bat species can make use of rocky crevices (Monadjem et al. 2010) and others, such as the Cape serotine and Egyptian free-tailed bat, readily make use of buildings as roosts (Monadjem et al. 2010). There do not appear to be any large caves in the study area which suggests that there may not be large colonies of bats however several hundred bats may occupy building roosts in the study area. Investigations on site did not reveal any signs of roosting bats.

Water sources are important for bats as a direct resource for drinking and because these areas tend to attract insects and promote the growth of vegetation (e.g. riparian vegetation). Therefore, besides providing drinking water, bats can also be attracted to water sources as potential foraging and roosting sites (Greif and Siemers 2010; Sirami et al. 2013). There are numerous wetlands and rivers (perennial and non-perennial) in the study area that will be attractive to bats, including for foraging and commuting purposes. Some of these water resources are non-perennial and may therefore only be available to bats during some parts of a year. This could then restrict potential impacts to bats to periods when key resources are available. Limited areas of cultivation areas are present which are important foraging areas as some species forage over agricultural fields to hunt insect pests (Noer et al. 2012; Taylor et al. 2011).

Bats are known to use linear landscape features for commuting routes to get to and from foraging sites, roost sites and to access water sources. Linear landscape elements, such as tree lines and edge habitats, provide protection to bats from predators, shelter from wind, orientation cues as well as foraging habitat (Verboom and Huitema 1997; Verboom 1998). The primary linear landscape features are drainage lines and dense woodlands, providing linear and edge habitats that bats can access for foraging and/or roosting purposes. Rivers and other edge habitats might also be used as commuting routes or navigation cues.

3.2 Bat Species

Approximately 21 bat species can potentially occur at the proposed site (African Chiroptera Report 2018; 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 thirteen bat species are present (Table 1). Recent taxonomic research suggests that the Egyptian free-tailed bat may be at least two separate species (D. Jacobs, pers. Comm, 2020) but is considered as one for the purposes of this report and until its taxonomic status is clarified further.

Activity was dominated by the Egyptian free-tailed bat which accounted for approximately 75 % of the total bat passes recorded. The remaining species were recorded relatively infrequently, aside from Cape Serotine and Natal Long-fingered Bat, which accounted for approximately 14 % and 4 % of all calls, respectively.

Table 1: Bat Species List for Newcastle WEF Complex and their Sensitivity

Species	Species Code	Group	# Bat Passes	Conservation Status[2]		Likelihood of Risk	Recorded on Site
				Regional	Global		
Straw-coloured Fruit Bat *Eidolon helvum*	EIDHEL	-	-	Least Concern	Near Threatened	High	No
Wahlberg's Epauletted fruit bat *Epomophorus wahlbergi*	EPOWAH	-	-	Least Concern	Least Concern	High	No
Lesser long-fingered bat *Miniopterus fraterculus*	MINFRA	-	4	Least Concern	Least Concern	High	Yes
Natal long-fingered bat *Miniopterus natalensis*	MINNAT	-	1,895	Least Concern	Least Concern	High	Yes
Egyptian free-tailed bat *Tadarida aegyptiaca*	TADAEG	-	34,779	Least Concern	Least Concern	High	Yes
Midas Mops bat *Mops midas*	MOPMID	-	52	Least Concern	Least Concern	High	Yes
Welwitsch's Hairy bat *Myotis welwitschii*	MYOWEL	-	1	Least Concern	Least Concern	Medium-High	Yes
Cape serotine *Neoromicia capensis*	NEOCAP	-	6,421	Least Concern	Least Concern	High	Yes
Egyptian slit-faced bat *Nycteris thebaica*	NYCTHE	-	-	Least Concern	Least Concern	Low	No
Large-eared giant mastiff's bat *Otomops martiensseni*	OTOMAR	-	-	Near Threatened	Near Threatened	High	No
Blasius's horseshoe bat *Rhinolophus blasii*	RHIBLA	-	1	Near Threatened	Least Concern	Low	Yes
Geoffroy's horseshoe bat *Rhinolophus clivosus*	RHICLI	-	7	Least Concern	Least Concern	Low	Yes
Darling's horseshoe bat *Rhinolophus darlingi*	RHIDAR	-	-	Least Concern	Least Concern	Low	No
Bushveld horseshoe bat *Rhinolophus simulator*	RHISIM	-	255	Least Concern	Least Concern	Low	Yes
Mauritian tomb bat *Taphozous mauritianus*	TAPMAU	-	13	Least Concern	Least Concern	High	Yes
Long-tailed serotine *Eptesicus hottentotus*	EPTHOT	VES30	2,015	Least Concern	Least Concern	Medium-High	Yes
Yellow-bellied house bat *Scotophilus dinganii*	SCODIN			Least Concern	Least Concern		
Lesueur's wing-gland bat *Cistugo lesueuri*	CISLES	VES40	698	Least Concern	Least Concern	Low	Yes
Zulu Serotine *Neoromicia zuluensis*	NEOZUL			Least Concern	Least Concern		
Anchieta's pipistrelle *Hypsugo anchietae*	HYPANC	VES50	3	Least Concern	Least Concern	Medium-High	Yes
Dusky pipistrelle *Pipistrellus hesperidus*	PIPHES			Least Concern	Least Concern		

[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.

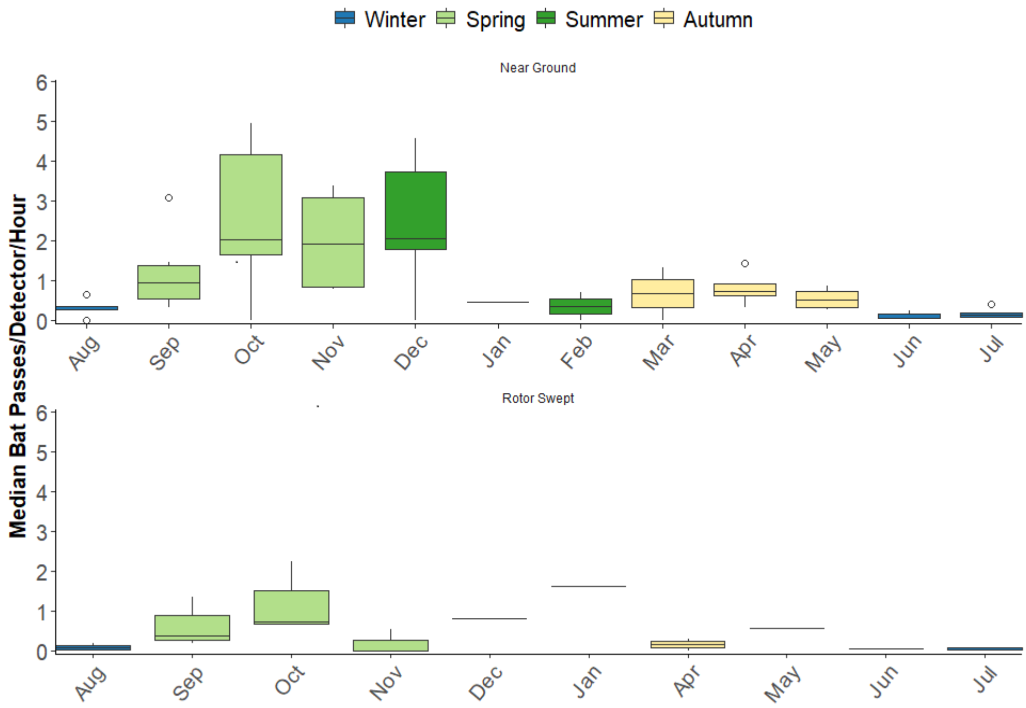
3.3 Spatio-Temporal Bat Activity Patterns

A total of 46,144 bat passes recorded across all detectors. Overall, activity in spring and summer was relatively high at ground level (3.3 and 3.8 median passes/hour, respectively) and moderate-high within the rotor sweep (1.4 and 2.1 median passes/hour). Recorded activity for winter was low at both ground level and rotor height (0.37 and 0.30 median passes/hour, respectively). Data for autumn yielded moderate activity at ground level and rotor height (1.1 and 0.98 median passes/hour, respectively).

Bat activity recorded on site, at both ground level and rotor height, showed similar results. Activity tended to be low in winter and increased through spring and early summer, then declining into autumn (Graph 1). A peak of activity was recorded at ground level in December (with 4.5 median passes/hour being observed). July was the month with the least observed activity, with ground level activity of 0.23 passes/hour and 0.11 median passes/hour being recorded at rotor height.

Activity distribution between the two height bands, within the overall rotor swept height, also yield different activity levels, with activity at 110 m being lower than that recorded at 55 m between (Table 2). These results appear to show a trend that activity levels may decrease into the higher air spaces.

At ground level, activity was moderate-high throughout the campaign to date, with high activity recorded during spring and summer – indicating a higher risk to wind farm impacts, with respect to the Drakensberg Montane Grasslands, Woodlands and Forests ecoregion[3] (Table 2). For the overall rotor swept height, activity was moderate during winter, and high during spring, summer and autumn, indicating a higher risk to wind farm impacts during these periods.



Graph 1: Boxplot showing the temporal distribution of median bat passes per detector per hour.

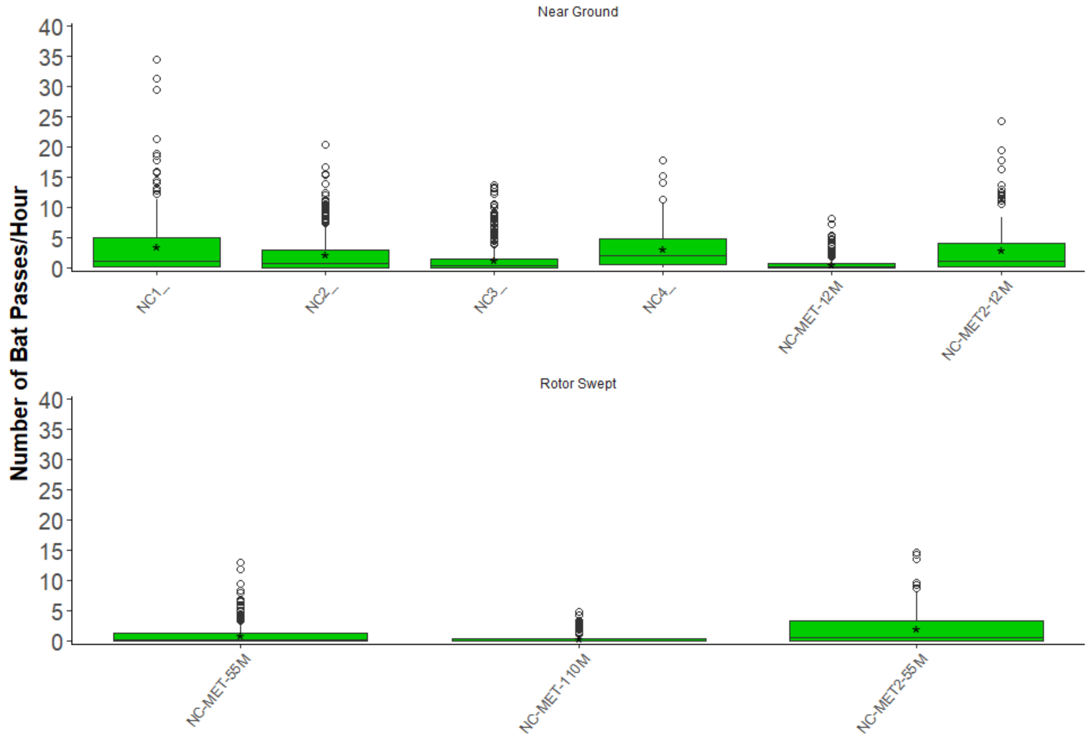
[3] MacEwan, K., Sowler, S., Aronson, J. and Lötter, C., 2020. South African best practice guidelines for pre-construction monitoring of bats at wind energy facilities.

Table 2: Median bat passes per hour per microphone per month

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Near Ground	3.9	0.82	1.5	1.3	0.83	0.23	0.23	0.50	2.1	3.9	4.0	4.5
Rotor Swept	2.8			0.82	1.1	0.16	0.11	0.38	1.1	2.1	1.0	1.4
110 m				0.09				0.20	0.45	1.3		
55 m	2.8			1.0	1.1	0.16	0.11	0.49	1.5	2.4	1.1	1.4
12 m	3.9	0.82	1.5	1.3	0.83	0.23	0.23	0.50	2.1	3.9	4.0	4.5

**Orange cells indicate Moderate Risk and Red cells indicate High Risk for the Drakensberg Montane Grasslands, Woodlands and Forests ecoregion.*

There were clear differences in how bat activity varied according to height above the ground. Most activity was recorded at 12 m, while at met masts the microphones at 55 m recorded more bat activity than at 110 m. Generally, activity declined with height (Graph 2).



Graph 2: Boxplot showing the number of bat passes per detector per hour at Rotor Sweep and Ground Level.

Overall, median bat activity per hour was moderate at most monitoring locations for ground level and within the rotor sweep height (Table 3).

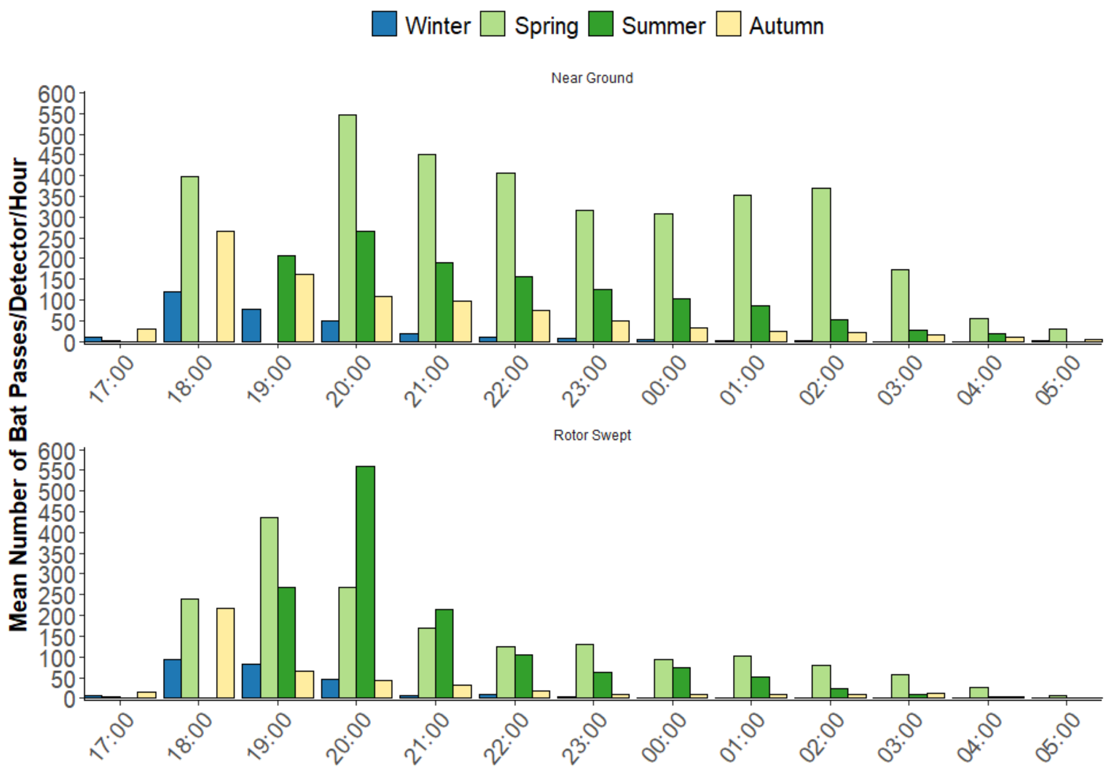
For the met masts, a total of 8,202 bat passes were recorded at height, with 90 % recorded at 55 m and 10 % at 110 m. Of all species of bats that were recorded at 55 m and 110 m, approximately 94 % of all activity at height was attributed to the Egyptian free-tailed bat.

Table 3: Acoustic Monitoring Summary

Detector	Date Installed	# of Sample Nights	% of Sample Nights with Bat Activity	Mean Passes/Night; Median Bat Passes/hour	Total Bat Passes
NC1	16/08/2021	229	89.5	47.5 ; 3.9	10,883
NC2	16/08/2021	328	79.0	28.4 ; 2.4	9,315
NC3	16/08/2021	432	84.3	17.7 ; 1.5	7,638
NC4	31/07/2022	127	95.3	40.4 ; 3.3	5,128
NCMET_12m	16/08/2021	208	67.8	9.6 ; 0.73	2,007
NCMET_55m	16/08/2021	370	76.2	12.9 ; 1.0	4,767
NCMET_110m	16/08/2021	141	61.0	6.1 ; 0.47	854
NCMET2_12m	31/07/2022	127	90.6	38.2 ; 3.2	4,861
NCMET2_55m	31/07/2022	89	76.4	29.0 ; 2.2	2,581

*Green cells indicate Low Risk, Orange cells indicate Moderate Risk and Red cells indicate High Risk for the Drakensberg Montane Grasslands, Woodlands and Forests ecoregion.

At ground level in autumn and winter, activity commenced at 17:00, peaked at 18:00 and tended to decrease from then onwards. Spring yielded a significant peak at 20:00 where it remained elevated until 02:00. Thereafter, it declined until 05:00. Summer activity showed a rapid start at 19:00, after which it peaked at 20:00 before steadily declining until sunrise (Graph 3). Activity at rotor height showed a spring peak at 19:00 and summer peak at 20:00. During spring, activity at height started at 18:00 and peaked at 19:00, where it then declined until sunrise. Summer activity started at 19:00, peaking at 20:00, after which it then declined relatively quickly until 05:00. Winter yielded relatively low activity levels at rotor height, with trend of emergence observed at 17:00 (Graph 3). Autumn activity levels peaked around 18:00 and then decreased rapidly thereafter until reaching very low activity at about 23:00.



Graph 3: Bar graph showing the mean number of bat passes per detector per hour at Ground Level and Rotor Sweep.

3.4 Discussion

The key findings from the full bat monitoring campaign are that overall bat activity was moderate for most of the study period across the site for the Drakensberg Montane Grasslands, Woodlands and Forests ecoregion. Activity was higher at all heights in spring and summer. Thus, based on the data available, bats are at greatest risk to wind energy impacts during these seasonal periods. However, risk levels may also vary across height, species, location, a night, and meteorological conditions.

Bats were most active at ground level across almost every month, while activity decreased with height. Despite this, and because the risk for bats increases at the rotor sweep height band, the moderate-high bat activity at 55 m indicates the potential for a moderate to high risk to bats at this height for this site. At 110 m however, activity was observed to be low-medium risk at the site for the monitoring period.

Despite the higher bat activity observed in summer and spring, the number of passes changed with respect to time of night. At ground level, activity tended to peak at 20:00 in the evening in spring and remained relatively constant until 02:00. In summer, a noticeable peak occurred at 20:00 after which it declined soon thereafter. Winter yielded an early peak and declined completely by 00:00. Activity emergence within the rotor sweep height followed an early peak across all seasons between 18:00 and 20:00 but declined steadily thereafter, with overall lower activity being recorded, particularly within the early hours of the mornings.

The Egyptian free-tailed bat was the most recorded species on site, at all sampling locations and heights. Several other bat species that are also susceptible to wind energy impacts are present in the study area. These include nine high risk species which, due to their particular foraging and flight ecologies, put them at greater risk to encounter spinning turbine blades. Such species include Egyptian free-tailed bat, Wahlberg's Epauletted fruit bat, Lesser long-fingered bat, Natal long-fingered bat, Egyptian free-tailed bat, Midas Mops bat, Cape Serotine, Large-eared giant mastiff's bat (possible) and the Mauritian tomb bat. Of these species, the Egyptian free-tailed bat is considered to be abundant in the area, as their total activity to date accounts for approximately 75 % of all bat activity recorded on site. Five medium-high risk species are also present in the area; including the Welwitsch's hairy bat, Long-tailed serotine, Yellow-bellied house bat, Anchieta's pipistrelle and the Dusky pipistrelle. These species were only recorded in relatively low numbers, however, and are therefore unlikely to experience significant negative impacts from the development.

Fatality records of the Egyptian free-tailed bat and Cape serotine specifically are known from operating wind farms across parts of South Africa (Doty and Martin 2012; Aronson et al. 2013; MacEwan 2016). All of these species have a Red List conservation status of least-concern; however, wind energy is an emerging impact which may not be fully considered yet by the Red List of Mammals of South Africa and IUCN Red List.

The Egyptian free-tailed bat accounted for approximately 75 % of the total bat activity at MNWP during the sample period, and 94 % of total rotor sweep height activity. This species is classified as high risk to wind energy developments because its foraging ecology allows for activity in open areas, high above the ground where it may encounter wind turbine blades. Recordings of this species at ground level accounted for 78 % of its own activity, compared to 22 % recorded at rotor height, suggesting that free-tailed bats may have reduced chances of encountering wind turbine blades because more of their activity is closer to ground level, below the rotor swept zone. Regardless, 20 % of this species' activity was recorded at 55 m, placing them at a high risk.

Due to the moderate activity observed, measures to avoid risks to bats will be needed. Mitigation options that must be incorporated into the project to minimise the potentially higher risk during spring and summer can be categorised into avoidance and minimisation techniques. Avoidance includes buffering key habitats and considering turbine design so that potential interactions between bats and wind turbines are spatially limited as much as possible. Minimisation relates to mitigating residual impacts to bats primarily through various forms of curtailment[4] or by using ultrasonic deterrents.

4 IMPACT ASSESSMENT

4.1 Identification of Impacts and Mitigation Measures

WEFs have the potential to impact bats directly through collisions and barotrauma resulting in mortality (Horn et al. 2008; Rollins et al. 2012), and indirectly through the modification of habitats and disturbance/displacement effects (Kunz et al. 2007b), during the construction, operation and decommissioning of wind turbines and associated infrastructures. Direct impacts pose the greatest risk to bats and, in the context of the MNWP WEF, habitat modification and disturbance/displacement may pose a risk, particularly in a sense of disturbing bats during peak foraging/commuting hours and disturbing potential roosting habitats, especially if bats are reluctant to leave this roost upon being subjected to the impact. With the information gathered to date, no confirmed roosts have however been identified on site during the monitoring campaign, either through the evaluation of existing spatial data, or by specialist on-site observations. In addition to these impacts, cumulative impacts are also likely, in the event that the local, regional or

[4] Curtailment – the act restricting normal operation of a wind turbine by slowing or stopping blade rotation for a period of time.

national bat population is also subjected to the same impacts – which may cause unrecoverable loss to the bat species being affected over time.

Construction Phase:

Impacts anticipated during the construction phase of the project include habitat modification and disturbance/displacement effects.

In terms of habitat modification, bats can be impacted through the removal or alteration of habitats (particularly vegetation or other natural resources) and can also be displaced from foraging habitat by the construction of wind turbines and associated infrastructures. 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. This modification could subsequently also create favourable conditions for insects, upon which bats feed, which would in turn attract bats to the proposed wind farm area. For disturbance/displacement effects, wind farms have the potential to impact bats indirectly when conducting construction activities (for wind turbines and associated infrastructures) during hours of important bat foraging activities. Additionally, excessive noise and dust during the construction phase could also result in bats abandoning their roosts, depending on the proximity of construction activities to roosts. No roosts, however, have been positively identified to occur within the project area. Nonetheless, suitable habitat may still be available to accommodate bats in this regard. As per Table 4, indirect impacts such as habitat modification and disturbance/displacement effects are anticipated to have a moderate negative significance before mitigation, and a low negative significance after mitigation.

Mitigation measures include limiting the removal or alteration of natural vegetation and man-made buildings in all high sensitive areas, as far as possible, and reduced across the project site in all other areas. Additionally, construction activities should be limited to daylight hours, and no construction activities are to take place within potential roosting habitats, if identified at the time when construction activities (for wind turbines and associated infrastructures) take place. No confirmed roosts have been identified on site to date, although it is recommended for a final specialist site walk-through to take place prior to construction to confirm this. Aside from wind turbines, due to the small extent and temporary nature of (some) project associated infrastructures, such infrastructures may be sited in high and medium sensitive areas, provided that all mitigation measures defined in section 4.2 are adhered to.

Operational Phase:

Impacts anticipated during the operational phase of the project include direct impacts, such as mortality due to wind turbine collision and/or barotrauma, as well as indirect impacts, including disturbance/displacement effects.

In terms of bat mortality due to collision/barotrauma, these direct impacts will be limited to species that make use of the airspace in the rotor-swept zone of the wind turbines. Of the fourteen potential species that could have been recorded on site, several exhibit behaviour that may bring them into contact with wind turbine blades and they are potentially at risk of negative impacts if not properly mitigated. Indirect impacts, including disturbance/displacement effects, have the potential to impact bats when conducting operational and maintenance activities during hours of important bat foraging activities. Additionally, excessive noise and dust during the operational phase could also result in bats abandoning their roosts, depending on the proximity of construction activities to roosts. No roosts, however, have been positively identified to occur within the project area.

Nonetheless, suitable habitat may still be available to accommodate bats in this regard. As per Table 5, bat mortality impacts due to collision/barotrauma are anticipated to have a high negative significance before mitigation, and a moderate negative significance after mitigation, while disturbance/displacement impacts are anticipated to have a moderate negative significance before mitigation, and a low negative significance after mitigation.

An initial mandatory step to implement for the operational phase, would be the implementation of an operational phase bat monitoring campaign. This monitoring campaign must be carried out in accordance with the latest version of the South African Bat Assessment Association (SABAA) bat operational monitoring guidelines available at the time, and carried out by a suitably qualified bat specialist, as soon as turbines become operational. This must include a minimum of two years of operational bat activity and fatality monitoring (inclusive of searcher efficiency and scavenger removal bias trials), which is to be repeated again in year 5 and then every five years thereafter, for the lifespan of the facility.

In terms of mitigation measures for mortality impacts; blade feathering must be implemented as soon as operation begins (as this mitigation has no impact on energy production). Blade feathering considers stopping all turbines at low wind speeds (up to the manufacturers cut-in speed) to prevent free-wheeling. This is important as bat fatality impacts are still able to occur within wind speeds below the relevant cut-in speeds. Lighting at the project should be kept to a minimum at all associated infrastructures. Appropriate types of lighting are to be used to avoid attracting insects, and hence, bats. This includes downward facing low-pressure sodium and warm white LED lights. Furthermore, avoidance mitigation techniques have been incorporated by buffering key habitat features for bats. These include potential roosting structures, foraging resources and commuting resources. The sensitivity of each buffer was determined relative to the different infrastructure elements incorporated into the project. Buildings, wetlands, perennial rivers and cultivated lands have all been buffered by 200 m and are considered as no-go for the placement of wind turbines (including the full blade length), as per best practise guidelines. Smaller non-perennial rivers have not been deemed as significantly important to the bat community on site, due to their small extent and inability to hold water for significant periods of the year, and have therefore been buffered by 50 m, in alignment with Natural England Guidance, where a 50 m buffer from turbine blade tip to the nearest bat important feature is required (Mitchell-Jones & Carlin, 2009) (Figure 2). Woodland habitats were also buffered by 200m, but are considered as medium sensitivity for turbine development (Figure 2), following specialist site visits which determined that such features consist of invasive Black Wattle (*Acacia mearnsii*) which showed to have very little potential for bats in terms of roosting habitat. Nonetheless, these features may be relevant for bat foraging/commuting activities, and therefore maintain a medium sensitivity rating. Such medium sensitivity buffers are to be avoided from turbine placement, as far as possible. However, placement of turbines is allowed within these buffered areas in the event that such features associated with these buffers are removed during the construction phase. Alternatively, if these features aren't removed, placement of turbines (including the full blade length) are allowed to be sited within medium sensitivity buffers, provided that strict minimisation techniques (i.e. turbine curtailment and/or acoustic deterrence mechanisms) are implemented as soon as the first turbine has been erected and starts spinning. Of the assessed WTG layout provided (n = 45 turbines), there are presently no wind turbines sited in highly sensitive areas, and 19 turbines located in medium sensitive areas (Figure 2). This however only considers the turbine bases, and consideration of the final selected blade length will be required to be considered when finalising the turbine layout, so as to ensure that turbine blades do not encroach into sensitive areas, as per the recommendations listed above. It is mandatory for final turbine selection to consider the restrictions associated with these buffers, as described above.

Roost searches have been conducted in all accessible areas on site during the monitoring campaign. However, no roosts were positively identified to exist within the development area. While the aforementioned buffers may be effective in helping to avoid and/or minimise interactions between clutter-edge bats and wind turbines, the open-air bats, particularly the Egyptian free-tailed bat, were also largely active within the rotor swept heights. An additional mitigation that could be used to avoid impacts to bats is the choice of wind turbine technology. Evidence of a relationship between turbine size and bat fatality is equivocal. Some evidence suggests that larger turbines kill more bats (Baerwald and Barclay 2009), or that as the distance between the blade tips and the ground increases, bat fatality decreases (Georgiakakis et al. 2012). However, other studies have found no evidence that turbine height or the number of turbines influences bat mortality (Berthinussen et al. 2014; Thompson et al. 2017). Some species in South Africa that are not adapted for flight at height have suffered mortality from wind turbines (e.g. the Cape serotine), suggesting that some bats may be killed in the lower edge of the rotor swept zone. The data presented in this report corroborates this as higher activity was seen at ground level when compared to that recorded at height. However, overall activity at 55 m on site is moderate for the Drakensberg Montane Grasslands, Woodlands and Forests ecoregion. Therefore, using taller towers and limiting the rotor diameter so that the minimum distance between the blades and the ground is maximised could help to mitigate some impacts and reduce the likelihood of reaching bat fatality thresholds, as turbines with a lower ground clearance run the risk of reaching the fatality thresholds sooner. In terms fatality thresholds, it must be noted that the proposed MNWP WEF has a threshold limit of 59.26 'least concern' microbat fatalities per year. This is calculated in accordance with the Bat Monitoring Threshold Guidelines (MacEwan et al. 2018), whereby bat occupancy per 10 ha within the Drakensberg Montane Grasslands, Woodlands and Forest ecoregion is 10.23 bats. 2 % (the value in which bat populations start to decline slowly at a rate of approximately 0.1 % per annum) of bats therefore equates to an annual threshold limit of 0.20 'least concern' microbats per 10 ha. As such:

- [2 % of bats per 10 ha] x [project boundary area/10 ha]
    - 0.20 x (2963/10) = 59.26 bat fatalities

As such, should the estimated number of 'least concern' microbat fatalities reach the annual threshold limit of 59.26 bats per annum, then further mitigation will be required, in the form of turbine curtailment and/or acoustic deterrence mechanisms. Furthermore, should one or more observed fatalities (during a 12-month monitoring period) of any frugivorous bats, conservation important or rare/range-restricted bats occur, then the same mitigation will also apply. Threshold calculations must be done at a minimum of once per quarter (i.e. not only after the first year of operational monitoring) and by an appropriate bat specialist so that mitigation can be applied as quickly as possible, should thresholds be reached. If curtailment or deterrents are needed based on threshold values being exceeded, their use would be confined to specific periods of the year and under specific meteorological conditions.

In terms of mitigation measures for disturbance/displacement effects; all operational and maintenance activities (for wind turbines and associated infrastructures) should be limited to daylight hours, and none of these activities are to take place within potential roosting habitats. No confirmed bat roosts have been identified on site to date, although it is recommended that a suitably qualified bat specialist (appointed to conduct the operational phase bat monitoring programme) is to further advise on refining these recommendations as new information becomes available, during the project's operational phase.

Decommissioning Phase:

Impacts anticipated during the decommissioning phase of the project include disturbance/displacement effects. Wind Farms have the potential to impact bats indirectly during this phase, through the disturbance of roosts or when conducting decommissioning activities during hours of important bat foraging activities. Excessive noise and dust during the decommissioning phase could also result in bats abandoning their roosts, depending on the proximity of decommissioning activities to such roosts. No roosts, however, have been positively identified to occur within the project area. Nonetheless, suitable habitat may still be available to accommodate bats in this regard. As per Table 6, such disturbance/displacement effects are anticipated to have a moderate negative significance before mitigation, and a low negative significance after mitigation.

Mitigation measures include limiting decommissioning activities (for wind turbines and associated infrastructures) to daylight hours, and no decommissioning activities are to take place within potential roosting habitats, if identified during the project's operational phase bat monitoring campaign. If such activities are to take place within roosting habitat, it will be required for the appointed bat specialist to be consulted on suitable management measures, should such decommissioning activities be required to take place in these areas.

Cumulative Impacts:

At least 3 facilities are being considered according to the DFFE Renewable Energy database (Q3 2022), within a 50 km region of the MNWP WEF. In accordance with this database, all three facilities are listed to be solar photovoltaic technologies, with no wind energy facilities being listed. However, a neighbouring wind energy facility, MNWP2, is presently the only known wind energy facility being planned in the area, and is currently being submitted for environmental authorisation. This project site is located directly adjacent to the MNWP WEF, increasing the likelihood of cumulative impacts. 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. As presented in Table 7, the impact is likely to be high negative without mitigation, and moderate negative with mitigation. All mitigation measures relevant for operational phase bat mortality due to collisions and/or barotrauma are applicable to mitigate cumulative impacts. Additionally, fatalities should be considered across all WEF's as far as possible, and transparency / data sharing of operational results is recommended to further consider cumulative impacts.

No-go Alternative:

The no-go alternative has been assessed for bats, considering the proposed development under consideration, together with its associated impacts. As reflected in Table 8, the impact on bats already existing in the area would be negligible, in the event that the facility is not constructed – as no change is anticipated to occur.

4.2 Assessment of Impacts

4.2.1 Construction Phase

Table 4: Construction Phase Impacts

Potential Issue	Description / Source of Impact	Nature	Type	Consequence	Extent	Duration	Probability	Reversibility	Irreplaceable Loss	Mitigation Potential	Significance without Mitigation	Mitigation Measures	Significance with Mitigation
Construction Phase													
Habitat modification	Bats can be impacted indirectly through the modification or removal of habitats, and can also be displaced from foraging habitat by the construction of wind turbines and associated infrastructures. 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. This modification could subsequently also create favourable conditions for insects upon which bats feed which would in turn attract bats to the proposed wind farm area.	Negative	Indirect	Moderate	Study area	Short Term	Probable	Reversible	Resource will not be lost	Achievable	**Moderate -**	The removal of vegetation and man-made buildings should be avoided in all high sensitive areas, as far as possible, and reduced across the project site in all other areas.	**Low -**

Potential Issue	Description / Source of Impact	Nature	Type	Consequence	Extent	Duration	Probability	Reversibility	Irreplaceable Loss	Mitigation Potential	Significance without Mitigation	Mitigation Measures	Significance with Mitigation
Construction Phase													
Disturbance / Displacement	Wind Farms have the potential to impact bats indirectly during the construction phase through the disturbance of roosts or when conducting activities during hours of important bat foraging activities. Relevant activities include the construction of roads, Operation and Maintenance (O&M) buildings, sub-station(s), internal transmission lines and the 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.	Negative	Indirect	Moderate	Study Area	Short Term	Probable	Reversible	Resource will not be lost	Achievable	**Moderate -**	Limit construction activities to daylight hours. Avoid all construction activities within potential roosting habitats, if identified at the time when construction activities (for wind turbines and associated infrastructures) take place. No confirmed roosts have been identified on site to date, although it is recommended for a final specialist site walk-through to take place prior to construction to confirm this.	**Low -**

4.2.2 Operational Phase

Table 5: Operational Phase Impacts

Potential Issue	Description / Source of Impact	Nature	Type	Consequence	Extent	Duration	Probability	Reversibility	Irreplaceable Loss	Mitigation Potential	Significance without Mitigation	Mitigation Measures	Significance with Mitigation
Operational Phase													
Mortality due to wind turbine collision and/or barotrauma	Bats can be impacted during the operational phase by means of collision with wind turbines and/or barotrauma. These impacts will be limited to species that make use of the airspace within in the rotor swept zone of the wind turbines, during foraging, commuting and/or migration activities. Such impacts would also be further exacerbated with potential light pollution that would be present during operational activities. Certain bat species actively forage around artificial lights due to the higher numbers of insects which are attracted to these lights. This would bring these species into the vicinity of the operating turbines and increase the risk of collision/barotrauma for these species.	Negative	Direct, cumulative	Severe	Regional	Long Term	Probable	Reversible	Resource may be partly lost	Achievable	**High -**	Implement blade feathering (up to the manufacturers cut-in speed) as soon as operation begins, to prevent free-wheeling. The placement of all turbines, as well as their full blade length, should avoid high sensitivity areas. The placement of all turbines, as well as their full blade length, should avoid medium sensitivity areas, as far as possible. However, if unavoidable, then the associated features should be removed prior to turbines becoming operational. Should these features not be removed, then strict minimisation techniques (i.e. turbine curtailment and/or acoustic deterrence mechanisms) are to be implemented as soon as the first turbine starts spinning. If residual impacts reach the threshold limit (at any wind turbine), then appropriate minimisation measures are to be implemented (turbine curtailment and/or acoustic deterrence mechanisms). Lighting at the project should be kept to a minimum at all associated infrastructures. Appropriate types of lighting are to be used to avoid attracting insects, and hence, bats. This includes downward facing low-pressure sodium and warm white LED lights.	**Moderate -**

Potential Issue	Description / Source of Impact	Nature	Type	Consequence	Extent	Duration	Probability	Reversibility	Irreplaceable Loss	Mitigation Potential	Significance without Mitigation	Mitigation Measures	Significance with Mitigation
Operational Phase													
Disturbance / Displacement	Wind Farms have the potential to impact bats indirectly during the operational phase through the disturbance of roosts or when conducting operational or maintenance activities during hours of important bat foraging activities. Excessive noise and dust during the operational phase could also result in bats abandoning their roosts, depending on the proximity of operational activities to roosts.	Negative	Indirect	Moderate	Study Area	Short Term	Probable	Reversible	Resource will not be lost	Achievable	**Moderate -**	Limit operational/maintenance activities to daylight hours. Avoid all operational/maintenance activities for wind turbines and associated infrastructures within potential bat roosting habitats. No confirmed bat roosts have been identified on site to date, although it is recommended that a suitably qualified bat specialist (appointed to conduct the operational phase bat monitoring programme) is to further advise on refining these recommendations as new information becomes available, during the project's operational phase.	**Low -**

4.2.3 Decommissioning Phase

Table 6: Decommissioning Phase Impacts

Potential Issue	Description / Source of Impact	Nature	Type	Consequence	Extent	Duration	Probability	Reversibility	Irreplaceable Loss	Mitigation Potential	Significance without Mitigation	Mitigation Measures	Significance with Mitigation
Decommissioning Phase													
Disturbance / Displacement	Wind Farms have the potential to impact bats indirectly during the decommissioning phase through the disturbance of roosts or when conducting decommissioning activities during hours of important bat foraging activities. Excessive noise and dust during the decommissioning phase, as a result of decommissioning wind turbines and associated infrastructures, could also result in bats abandoning their roosts, depending on the proximity of decommissioning activities to roosts.	Negative	Indirect	Moderate	Study Area	Short Term	Probable	Reversible	Resource will not be lost	Achievable	**Moderate -**	Limit decommissioning activities to daylight hours. Avoid all decommissioning activities within potential roosting habitats, if identified during the projects' operational phase bat monitoring campaign, when decommissioning wind turbines and associated infrastructures. Consult with the appointed bat specialist on further management measures, should this be required.	**Low -**

4.2.4 Cumulative Impacts

Table 7: Cumulative Impacts

Potential Issue	Description / Source of Impact	Nature	Type	Consequence	Extent	Duration	Probability	Reversibility	Irreplaceable Loss	Mitigation Potential	Significance without Mitigation	Mitigation Measures	Significance with Mitigation
Cumulative Impacts during the Operational Phase													
Bat Fatality Impacts on a Cumulative Scale	Multiple wind farms impacting bats collectively, could have the potential to cause significant loss to affected species over a regional or national scale with an inability for the affected species to recover from such loss. This is likely to be most significant through bat mortality as a result of wind turbine collisions and/or barotrauma during the projects' operational phase, particularly during bat foraging/commuting activities. Presently, at least 3 onshore solar PV facilities are being considered according to the DFFE Renewable Energy database (Q3 2022), within a 50 km region of the proposed MNWP WEF. An additional wind energy facility, MNWP2, is however known to be presently under assessment for EA application.	Negative	Indirect	Severe	National	Long Term	Probable	Reversible	Resource may be partly lost	Achievable	**High -**	All mitigation measures, as listed in Table 5, are to be strictly adhered to, to reduce the probability of significant mortality impacts occurring at MNWP WEF, and subsequently on a cumulative scale as well. This will be relevant for the MNWP WEF, as well as all surrounding WEF's. Fatalities should be considered across all WEF's as far as possible, and transparency / data sharing of operational results is recommended to further consider cumulative impacts.	**Moderate -**

4.2.5 No-go Alternative

Table 8: No-go Alternative Impacts

Potential Issue	Description / Source of Impact	Nature	Type	Consequence	Extent	Duration	Probability	Reversibility	Irreplaceable Loss	Mitigation Potential	Significance without Mitigation	Mitigation Measures	Significance with Mitigation
No-go Alternative													
No impacts anticipated	No impacts anticipated	Positive	Direct	Slight	Localised	Short Term	Unsure	Reversible	Resource will not be lost	Easily Achievable	**Low +**	No mitigation required, in the event that the facility is not constructed.	**Low +**

5 CONCLUSION

Bat activity at the proposed MNWP WEF was generally moderate, overall, throughout the duration of the full bat monitoring campaign. The site did however have periods of high risk to bats, particularly during parts of the spring season. Activity was generally higher during spring and summer. Free-tailed bats are likely to face the highest risk of impacts at the proposed site due to their prevalence. Sensitive design and mitigation will be needed to reduce risk to these (and other) bats.

An assessment of potential impacts relevant for bats at the proposed wind energy facility yielded that impacts are likely to occur during all phases of the development. Indirect impacts, such as habitat modification, disturbance and displacement effects were identified to occur in most project phases, while more significant direct impacts, such as bat mortality due to collisions and/or barotrauma, are expected to occur during the projects' operational phase. All mitigation measures, as defined in Section 4.2 are to be strictly adhered to. With regards to bat mortality, it can be highlighted that all high sensitive areas (including those used by bats for foraging, roosting and commuting) defined for the MNWP WEF (Figure 2) must be avoided from turbine placement (inclusive of the full blade length). Medium sensitive areas should be avoided as far as possible (inclusive of the full blade length). If not possible to avoid, then turbines may be sited in these areas, provided that the features (associated with medium sensitivity buffers) are removed. If these features are not removed, then strict minimisation measures (such as wind turbine curtailment and/or acoustic deterrence mechanisms) must be implemented as soon as the first turbine has been erected and starts spinning. All associated infrastructures (i.e. laydown areas, construction camps, O&M buildings etc.) are permitted to be placed in high and medium sensitive areas, provided that all construction, operational and decommissioning activities adhere to the mitigation measures defined in Section 4.2.

It is recommended for the choice of turbine design, inclusive of the hub height and rotor diameter, to be carefully chosen to reduce potential interactions between bats and turbine blades, as far as possible. The hub-height should preferably be maximised with the height of the lowest possible blade tip being raised above the ground, as far as possible, as turbines with a lower ground clearance run the risk of reaching the fatality thresholds sooner.

Blade feathering[5] should be implemented from the start of operation, as this mitigation has no impact on energy production. Curtailment and acoustic deterrents are the remaining mitigation measures to reduce residual impacts to bats during operation and must be continuously refined and adapted based on incoming bat fatality data. The need for curtailment and/or deterrents to address residual impacts will only be determined during operations, following analysis of the operational phase monitoring results by the project bat specialist. A suitable curtailment plan with relevant parameters must be drawn up at the time that the requirement becomes necessary. It is considered mandatory for the MNWP WEF to undertake a suitable operational phase bat monitoring programme, by an appropriately qualified bat specialist, particularly in the first two years of project operation. Thereafter, this monitoring programme must be repeated in the fifth year, and every five years thereafter – for the lifespan of the facility. All monitoring must be undertaken in accordance with the most relevant/recent operational phase bat monitoring and threshold guidelines available at the time.

The data suggests that there could be a risk to bats posed by the MNWP WEF, particularly during spring and summer. At this stage, however, with the information gathered to date from the full bat pre-construction monitoring campaign, the development of the proposed

[5] Blade feathering includes facing the turbines into the wind below generation cut in speed, preventing the blades from turning unnecessarily.

MNWP WEF and its associated infrastructures is not expected to cause irreplaceable loss to bat biodiversity on site, provided that the above considerations are met. The application process may therefore proceed onto submission for environmental authorisation.

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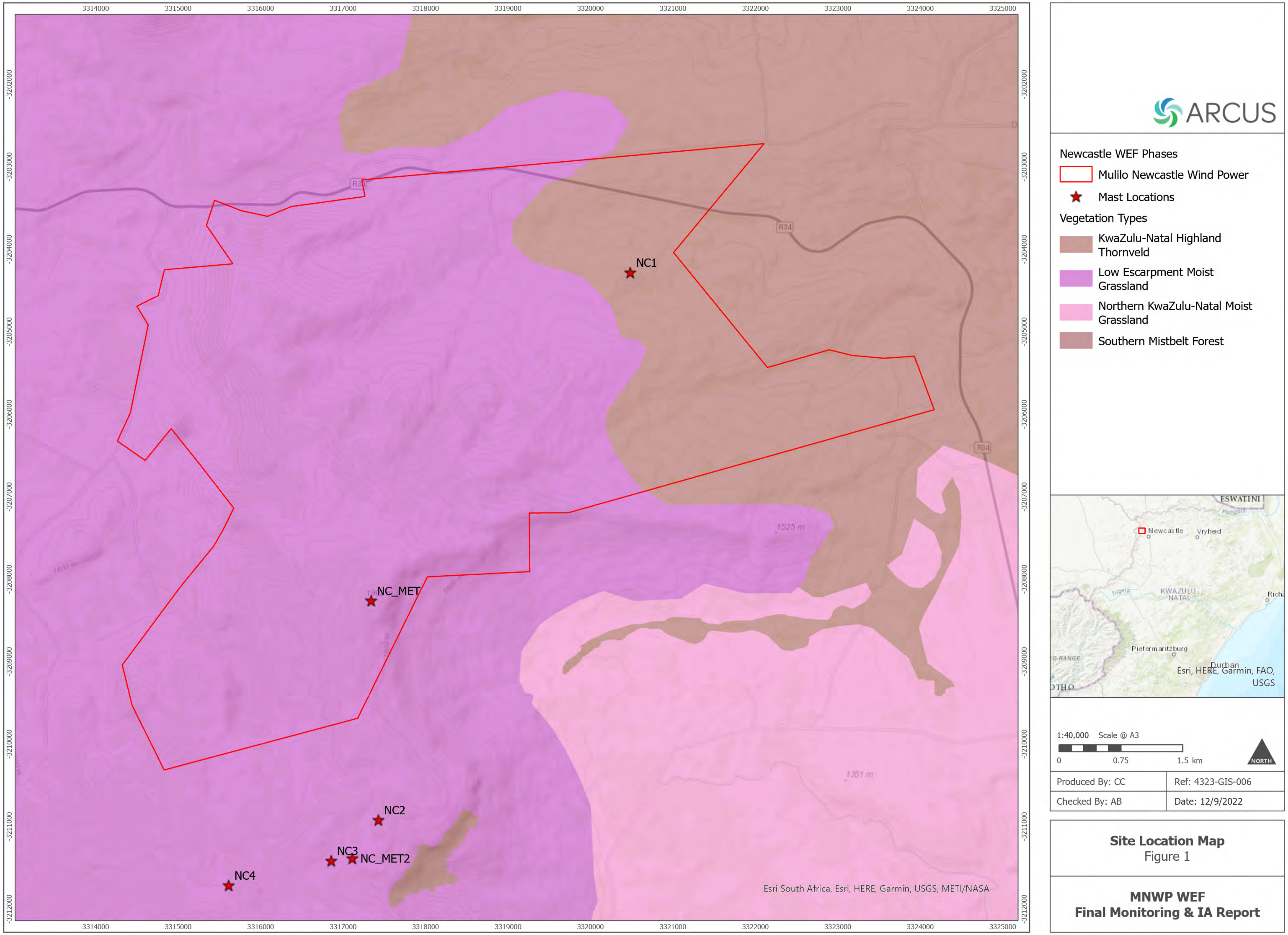
Figures

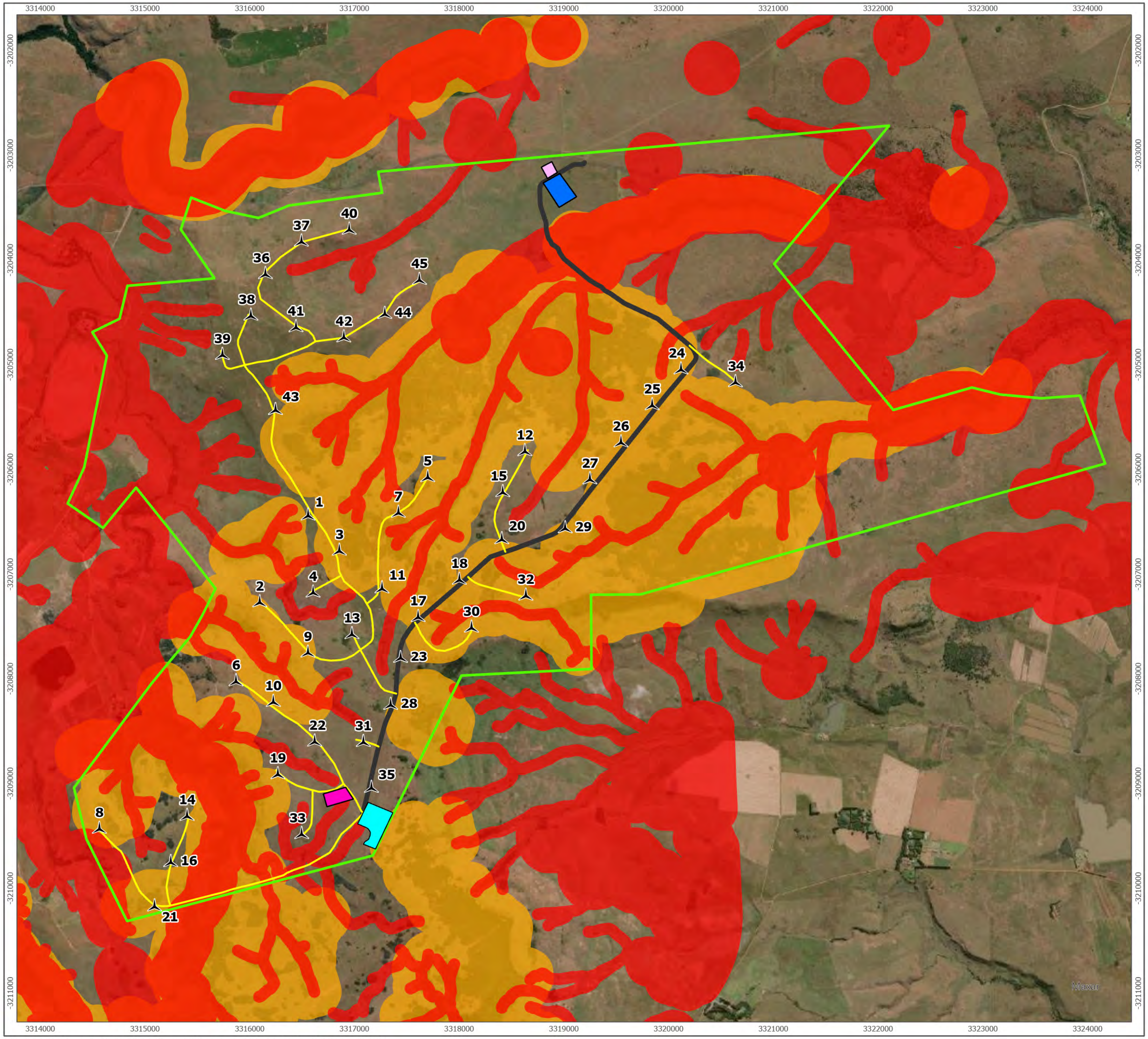
Appendix 1: Specialist Declaration & CV



Site Location Map
Figure 1

MNWP WEF
Final Monitoring & IA Report

G:\Projects\4323 Newcastle WEF Bats\4323 Newcastle WEF Bats.aprx\4323-GIS-006 Fig 1 MNWP Site Location Map



ARCUS

- Mulilo Newcastle Wind Power
- Turbine Layout
- Primary Access Road
- Access Road
- IPP Substation and O&M Building Complex
- Concrete Batching Footprint
- Temporary Construction/Office Yard
- Temporary WTG Laydown
- High Sensitivity Buffers
- Medium Sensitivity Buffers

1:35,000 Scale @ A3

0 0.65 1.3 km

NORTH

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Checked By: AB	Date: 12/9/2022

MNWP Bat Sensitivity Map
Figure 2

MNWP WEF
Final Monitoring & IA Report

G:\Projects\4323 Newcastle WEF Bats\4323 Newcastle WEF Bats.aprx\4323-GIS-008 Fig 2 MNWP Sensitivity Map