Bat Impact Assessment Report for the proposed Part 2 EA Amendment, Final Layout and EMPR approval process for the Karreebosch Wind Energy Facility (WEF)

Turbine layout changes and update of the EMPr

For the Karreebosch Wind Energy Facility (WEF) Northern Cape, South Africa

ANiMALiA

Compiled by

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PREPARED FOR:

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By

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i) APPOINTMENT OF SPECIALIST

Specialist Company:	Animalia Consultants (Pty) Ltd
Fieldwork conducted by:	Werner Marais
Report done by:	Werner Marais
Appointed by:	WSP Group Africa (Pty) Ltd
For:	Bat Impact Assessment Report for the proposed Part 2 EA Amendment, Final Layout and EMPR approval process for the Karreebosch Wind Energy Facility (WEF).

Independence

Animalia Consultants (Pty) Ltd has no connection with the developer. Animalia Consultants (Pty) Ltd is not a subsidiary, legally or financially of the developer; remuneration for services by the developer in relation to this proposal is not linked to approval by decision-making authorities responsible for permitting this proposal and the consultancy has no interest in secondary or downstream developments as a result of the authorisation of this project.

Applicable Legislation

Legislation dealing with biodiversity applies to bats and includes the following:

NATIONAL ENVIRONMENTAL MANAGEMENT: BIODIVERSITY ACT, 2004 (ACT 10 OF 2004; Especially sections 2, 56 & 97). The Act calls for the management and conservation of all biological diversity within South Africa. Bats constitute an important component of South African biodiversity and therefore all species receive attention, in addition to those listed as Threatened or Protected.

THE SOUTH AFRICAN BEST PRACTICE GUIDELINES for preconstruction studies recommends sensitivity map buffer rules and mitigation by avoidance. 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 - ed 5*. South African Bat Assessment Association.

THE BAT MORTALITY THRESHOLD GUIDELINES imposes sustainable bat mortality thresholds for operating wind farms, indicating when wind farms need to apply active mitigation measures. 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.

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1 OBJECTIVES AND TERMS OF REFERENCE FOR THE STUDY

- A review of the original 12-months pre-construction bat monitoring EIA study (undertaken by Animalia in 2014) that was done for the original authorisation and relevant amendments (EA Ref: 14/12/16/3/3/2/807/AM3).
- An update of the bat impact assessment to ensure that any changes to the impacts as a result of the proposed final layout and amendments are captured, where applicable.
- A review and update of the impact assessment to ensure International Finance Corporation (IFC) compliance, which states:
  - Comply with the relevant gazetted protocols, which replaces the requirements of Appendix 6 of the EIA regulations (2014, as amended), as well as SA Best Practice Guidelines.
  - Comply with the IFC Performance Standards (PSs) 1 and 6 and IFC General EHS and Sector specific Guidelines, where relevant.
- An update of the original specialist input into the EMPr in relation to the proposed amendments, associated site walkdown results and applicable most recent South African Best Practice Guidelines for Pre-construction Monitoring of Bats at Wind Energy Facilities (MacEwan, et al., Edition 5, 2020), and South African Bat Fatality Threshold Guidelines (MacEwan, et al., Edition 2, October 2018).
- Concluding impact statement.

2 INTRODUCTION

Karreebosch Wind Farm (RF) (Pty) Ltd (the Applicant) applied for Environmental Authorisation (EA) for the proposed Karreebosch WEF in 2015. The original Environmental Impact Assessment (EIA) was undertaken in September of 2015 for up to 71 wind turbines with a hub height of up to 100m and a rotor diameter of up to 140m including associated infrastructure. Environmental authorisation (EA) for 65 turbines was granted on 29 January 2016 (EA Ref: 14/12/16/3/3/2/807). The project underwent subsequent amendments (EA Ref: 14/12/16/3/3/2/807/AM1, 14/12/16/3/3/2/807/AM2, 14/12/16/3/3/2/807/AM3) which included increases in the hub height (up to 125m), rotor diameter (up to 160m), blade length (up to 80m), and minor amendments to the wording of certain conditions of the authorisation, as well as an extension of the validity of the EA to 2026.

Animalia Consultants (Pty) Ltd) completed the 12-months pre-construction bat monitoring for the Karreebosch Wind Energy Facility (WEF) in 2014. The final preconstruction bat impact report also served as the EIA phase bat report and was submitted in 2015. It included the assessments of impacts as required for the EIA phase.

The authorised Karreebosch WEF and associated infrastructure is currently undergoing a Part 2 EA Amendment Process with the proposed amendments tabulated in Table 2.1 below. Condition 16 of the original EA (EA Ref: 14/12/16/3/3/2/807) requires that the final development layout plan be made available for public comment and thereafter submitted to Department of Forestry, Fisheries and Environment (DFFE) for approval. Condition 18 of the original EA (Ref: 14/12/16/3/3/2/807) states that the Environmental Management Programme (EMPr) submitted as part of the Final EIA Report (2015) was not approved and must be amended to include the final layout which has undergone micro siting and walkdowns by relevant specialists, be made available for public comment and thereafter re-submitted to the DFFE for final approval.

Therefore, the assessment of the final turbine layout, bat sensitivity map and on-site verification, in relation to impacts on bats, considered the proposed number of turbines and the associated turbine dimensions (hub height of up to 140m and a rotor diameter of up to 170m).

Table 2.1: Proposed amendments to the Karreebosch EA (DFFE Ref: 14/12/16/3/3/2/807/AM3).

ASPECT TO BE AMENDED	AUTHORISED	PROPOSED AMENDMENT
Number of Turbines	Up to 65 with a foundation of 25m in diameter and 4m in depth	Up to 40 turbines with a foundation of 30m in diameter and 5m in depth
Turbine generating capacity	Up to 5.5 MW	up to 7.5 MW in capacity each
Turbine Hub Height	A range up to and including 125m	All turbines up to 140m
Rotor Diameter	A range up to and including 160m	All turbines up to 170m
Blade length	~80m	~85m

Area occupied by transformer stations/ substation	• Two 33/132kV Substation 100m x 200m • Extension of the existing 400kV substation at Komsberg • Transformer art each turbine: total area <1500m^2 (2 m^2 per turbine up to 10m^2 at some locations)	• one 33/132kV substation 150m x 200m (3ha) • Extension of the existing 400kV substation at Komsberg • Transformer at each turbine: 6m x 3m= 720m^2 total area <0.4ha (up to 10mX10m at some locations)
Capacity of on-site substation	132kV	33/132kV
Areas occupied by construction camp	300 x 300m = 90 000m^2	Areas occupied by construction camp and laydown areas up to 14ha. Crane pads and turbine footprints up to 41ha.
Area occupied by laydown areas	Operation: (70 x 50) x 71 =248 500m^2	
Areas occupied by buildings	~10 000m^2	~10 000m^2 and will be located within the construction camp for use during the operational phase
Length of (new) internal access roads	~40 km	~77 km of new internal access roads and up to ~14 km of 4x4 access tracks . ~30km of existing access roads which are 4m wide will be widened by up to 9m.
Width of internal roads	Up to 12m	Internal Access roads up to 12m wide (turns will have a radius of up to 55m) with additional yet associated servitudes/ reserve for above/underground cabling installation and maintenance where needed. 200m wide road corridor along the internal access roads for micro-siting during construction. Internal 4x4 tracks associated with the 33kV and 132kV OHPLs will be up to 4m wide and substation access roads of up to 9m.
Height of fencing	Up to 3m	Up to 4m

3 METHODOLOGY

Animalia Consultants (Pty) Ltd) completed the 12-months pre-construction bat monitoring for the Karreebosch Wind Energy Facility (WEF) in 2014. The sensitivity map for the Karreebosch WEF site was then updated in October 2018 (**Figure 4.1**), and a site visit was conducted on 13 September 2021 by Animalia Consultants (Pty) Ltd to verify the final turbine layout in relation to the approved bat sensitivity map.

The current Best Practice Guidelines (MacEwan *et al.*, 2020) requires turbine blade length to be outside the high sensitivity buffers, to allow for no turbine blade length overhang into these buffers. For a turbine where the proposed blade length of 85m intrude into the high bat sensitivity buffer (only Turbine 17), the three-dimensional spatial orientation of the turbine was considered to calculate the actual distance from blade tip to the high bat sensitivity. The low vegetation of the high bat sensitivity buffer areas made this approach feasible. On a flat surface the distance from a high sensitivity must be 250m for the Karreebosch bat sensitivity map, which constitutes the high sensitivity buffer. According to the latest Best Practice Guidelines this distance can be a minimum of 200m, in the Karreebosch sensitivity map, a buffer of 200m has been used to allow for blade length amendments. Therefore, based on a rotor diameter of up to 170m (blade length of up to 85m), the turbine base position must be 285m or more from any high bat sensitivities and 35m from the current 250m high sensitivity buffers. However, in this case the actual bat sensitivities are at a lower elevation in valleys and the turbines are proposed on the ridges. In case of Turbine 17, a formula was applied to consider the proposed hub height of up to 140m, up to 85m blade length and difference in elevation of turbine base and sensitivity. In order to calculate the distance of the base to the buffer required for maintaining a minimum of 200m from a blade tip to an actual sensitivity.

Formula used: $b=\sqrt{((200+bl)2 -(hh+ed)2)}$, derived from Mitchell-Jones & Carlin (2009).

Where:
b= horizontal distance required from turbine base to high sensitivity
bl = blade length
hh= hub height
ed= elevation difference between turbine base and actual sensitivity

4 RESULTS

According to the passive bat activity data collected on site during the preconstruction study, bat activity at 50m height was significantly less than activity at a lower height of 10m. The proposed amendment will increase the minimum rotor swept height from 45m above ground to 55m above ground. This increase in the lowest rotor swept height can have a positive influence in lowering the probability of bats being impacted. However, it is not significant enough to influence the assessments of the impacts as identified in the EIA phase bat assessment report. Therefore, the impact assessments remain unchanged. Turbines are allowed inside moderate bat sensitivities and their buffers.

The proposed turbine layout respects the bat sensitivity map, it also respects the current guideline criteria which requires turbine blade length to be outside the high sensitivity buffers, except for Turbine 17.

Turbine 17 has been identified to have a proposed foundation position of 250m from a high bat sensitivity (**Figure 4.2**), which means that a blade overhang of 35m will be present if a minimum high sensitivity buffer of 200m is considered. However, when applying the spatial formula described in Section 3, and considering an elevation difference of 20m between the turbine base point and the high bat sensitivity, this turbine base point must be at least 235.8m from the high bat sensitivity (on a two-dimensional map plane) to allow for the blade tip to be 200m from the high bat sensitivity. Currently the turbine base point is 250m from the sensitivity, <u>and therefore no further amendment is required to the location of Turbine 17 and it is considered acceptable.</u>

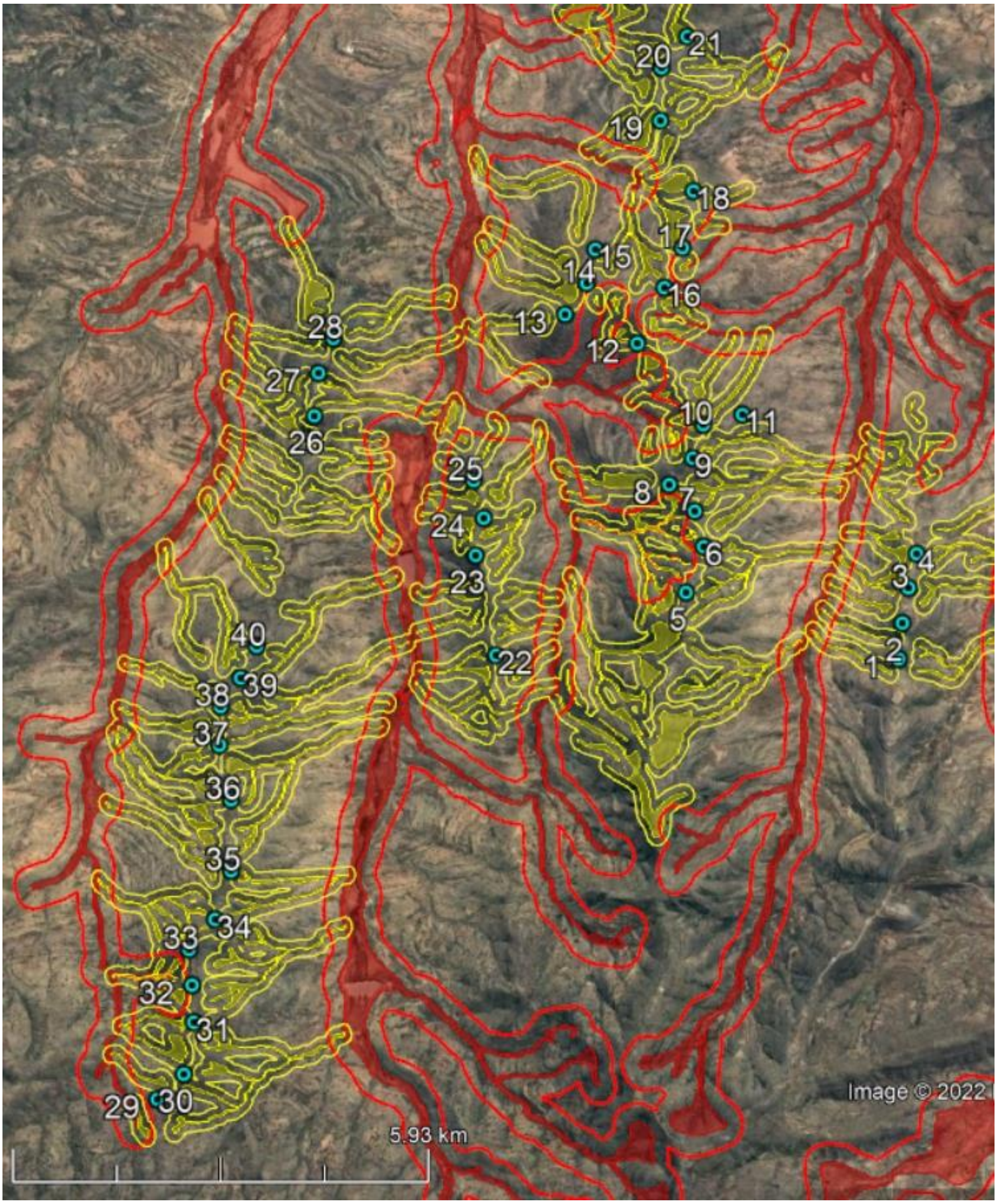

Figure 4.1: Bat sensitivity map in relation to the proposed turbine layout. Shaded red = high bat sensitivity; Red line = 250m High bat sensitivity buffer; Shaded yellow = Moderate bat sensitivity; Yellow line = moderate bat sensitivity buffer.

Figure 4.2: Close-up of Turbine 17 in relation to the high bat sensitivity and it's 250m buffer. Shaded red = high bat sensitivity; Red line = 250m High bat sensitivity buffer.

5 CUMULATIVE ASSESSMENT

The South African government gazetted eight (8) areas earmarked for renewable energy development in South Africa. These areas are known as Renewable Energy Development Zones (REDZ) and this project falls within the Komsberg REDZ. The purpose of the REDZ is to cluster development of renewable energy facilities in order to streamline the grid expansion for South Africa, i.e. connect zones to one another as opposed to a wide scatter of projects. Therefore, a number of renewable energy developments within the surrounding area which have submitted applications for environmental authorisation (some of which have been approved). It is important to note that the existence of an approved EA does not directly equate to actual development of the project.

The surrounding projects that have not already been awarded Preferred Bidder (PB) status under the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) Bid window 5 or the Risk Mitigation IPP procurement programme (RMIPPPP), are still subject to the REIPPPP bidding process or subject to securing an off taker of electricity through an alternative process. Some of the surrounding proposed WEFs secured EAs several years ago but have not obtained PB status and as such have not been developed. The approval statuses of these projects are indicated below in **Table 4.1.**

Table 4.1: Renewable energy projects and their development status within 30km of the Karreebosch WEF.

LABEL	DFFE REFERENCE	PROJECT TITLE	STATUS
1	12/12/20/1782/1/AM5	140MW Rietrug Wind Energy Facility near Sutherland, Northern Cape Province.	Preferred Bidder Round 5
2	12/12/20/1782/2/AM6	140MW Sutherland 1 Wind Energy Facility near Sutherland, Northern Cape and Western Cape Provinces.	Preferred Bidder Round 5
3	12/12/20/1782/3/AM3	140 MW Sutherland 2 Wind Energy Facility near Sutherland, Northern Cape Provinces.	Preferred Bidder Round 5
4	12/12/20/1783/1/AM5	150MW Perdekraal West Wind Energy Facility, Western Cape Province.	Approved

5	12/12/20/1783/2/AM5	147MW Perdekraal East Wind Energy Facility, Western Cape Province.	Preferred Bidder Round 4, Operational
6	12/12/20/1988/1/AM6	140MW Roggeveld Phase 1 Wind Farm, North of Matjiesfontein, Northern Cape and Western Cape Provinces.	Preferred Bidder Round 4, Operational
7	12/12/20/2370/1/AM6	140 MW Karusa Wind Energy Facility,Phase 1, Karoo Hoogland Municipality, Northern Cape Province.	Preferred Bidder Round 4, Operational
8	12/12/20/2370/2/AM6	140MW Soetwater Wind Farm Phase 2, Karoo Hoogland Municipality, Northern Cape Province.	Preferred Bidder Round 4, Operational
9	12/12/20/2370/3/AM5	140MW Great Karoo Wind Energy Facility Phase 3, Karoo Hoogland Municipality, Northern Cape Province.	Approved
10	14/1/1/16/3/3/1/2318	310MW Pienaarspoort Wind Energy Facility Phase 1, Witzenberg local Municipality, Western Cape Province.	Approved
11	14/12/16/3/3/1/2441	360MW Pienaarspoort Wind Energy Facility Phase 1, Witzenberg local Municipality, Western Cape Province.	Approved
12	14/12/16/3/3/1/1976/1/AM3	226MW Kudusberg Wind Energy Facility between Matjiesfontein and Sutherland in Western and Northern Cape Provinces.	Approved
13	14/12/16/3/3/1115	325WM Rondekop Wind Energy Facility between Matjiesfontein and Sutherland in Western and Northern Cape Provinces	Approved
14	14/12/16/3/3/1/1977/AM3	183MW Rietkloof Wind Energy Facility near Matjiesfontein in the Western Cape Province.	Preferred Bidder Round 5
15	14/12/16/3/3/1/2542	200 MW Esizayo Wind Energy Facility Expansion near Laingsburg, Western Cape.	In Process
16	14/12/16/3/3/2/2009/AM1	Oya Energy Facility	Preferred Bidder Risk Mitigation Independent Power Producer Procurement Programme (RMIPPPP)
17	14/12/16/3/3/2/826	140MW Gunsfontein Wind Energy Facility Karoo Hoogland Municipality, Northern Cape Province.	Approved

18	**14/12/16/3/3/2/856** **/AM4**	**275MW Komsberg West near Laingsburg, Western Cape Provinces**	**Approved**
19	**14/12/16/3/3/2/857/AM4**	**275 Komsberg East near Laingsburg, Western Cape Provinces.**	**Approved**
20	**14/12/16/3/3/2/900/AM2**	**140MW Brandvalley Wind Energy Facility, WITHIN THE Laingsburg and Witzenberg Local Municipalities in the Western and Northern Cape Province.**	**Preferred Bidder Round 5**
21	**14/12/16/3/3/2/962/AM1**	**140MW Maralla East Wind Energy Facility, Namakwa and Central Karoo District Municipalities, Western and Northern Cape Provinces.**	**Approved**
22	**14/12/16/3/3/2/963/AM1**	**140Maralla West Wind Energy Facility, Karoo Hoogland local Municipality, Northern Cape Province.**	**Approved**
23	**14/12/16/3/3/2/967/AM3**	**140MW Esizayo Wind Farm, Laingsburg Local Municipality Western Cape Province.**	**Approved**
24	**12/12/20/2235**	**10MW Inca Photovoltaic Facility near Sutherland, Northern Cape Province.**	**Approved**

The bat specialist conducting the operational bat mortality monitoring must calculate the cumulative sustainable bat mortality threshold for all operating wind farms in a 30km radius, including the Karreebosch WEF. If the total mortalities of all these wind farms exceed the acceptable cumulative sustainable threshold it will lower the acceptable threshold of the Karreebosch WEF. However, it's the responsibility of each operating wind farm to maintain bat mortalities below its calculated sustainable mortality threshold.

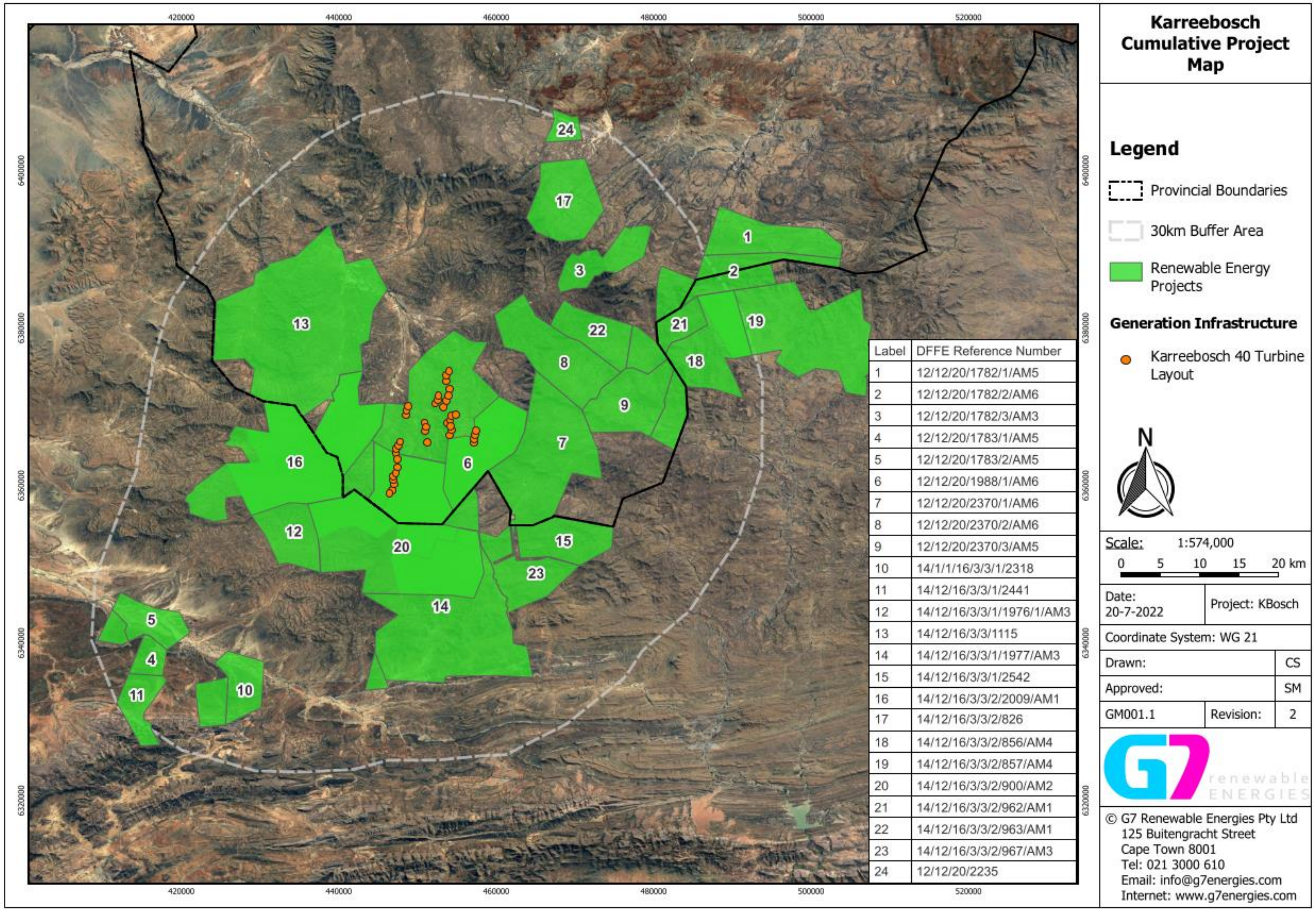

Figure 4.1: Renewable energy projects (by approval status) within a 30km radius of the authorised Karreebosch WEF

6 RECOMMENDED MITIGATION OPTIONS PERTAINING TO THE EMPr

The available options to minimise bat mortalities are discussed in this section. Details on how each option must be implemented is explained in the step-by-step Mitigation Action Plan in Section 7.

6.1 Minimisation of light pollution

A mitigation to consider in the design of the Karreebosch WEF is to keep artificial lighting to a minimum on the infrastructure (O&M buildings and on wind turbines), while still adhering to safety and security requirements. For example, this can be achieved by having floodlights down-hooded, installing passive motion sensors onto lights around buildings and possibly utilising lights with lighting colours (also referred to as lighting temperatures) that attract fewer insects. Light pollution will impact bat feeding habits and species compositions negatively, by artificially discouraging photophobic (light averse) species and favouring species that readily forage around insect-attracting lights.

The likelihood of bats being killed by moving turbine blades increases significantly when they are attracted to their proximity when it has become an improved foraging airspace due to the presence of artificial light.

6.2 Curtailment to prevent freewheeling

Freewheeling occurs when the turbine blades are rotating in wind speeds below the generator cut-in speed (also called the **manufacturer's cut-in speed**), thus no electricity is being produced and only some blade momentum is maintained.

Since bat activity tends to be negatively correlated with wind speed, it means that high numbers of bats are likely to be flying and impacted on in low wind speeds where freewheeling may occur. If turbine blades are feathered below the generator cut-in speed to prevent freewheeling (i.e. the angle of the blades may be changed to be parallel to the wind), it can result in a very significant reduction of bat mortalities with minimal energy production loss.

6.3 Curtailment that increases the cut-in speed

The activity levels of South African bats generally decrease in weather conditions with increased wind speeds. However, in scenarios where above sustainable numbers of bats are being killed, and these bats fly in wind speeds above the turbine manufacturer's cut-in speed, the turbine's computer control system (referred to as the Supervisory Control and Data Acquisitions or SCADA system) can be programmed to a cut-in speed higher than the manufacturer's set speed. The new cut-in speed will then be referred to as the **mitigation cut-in speed** and can be determined from studying the relationship between long term (12-month) bat activity patterns on site and wind speed. This sustainable threshold of bat mortalities will be calculated according to the *South African Bat Fatality Threshold Guidelines* (MacEwan, *et al.*, Edition 2, October 2018).

Turbines are curtailed in this manner by means of blade feathering (i.e. the angle of the blades may be changed to be parallel to the wind), to render the blades almost motionless in wind speeds below the mitigation cut-in speed.

6.4 Acoustic bat deterrents

This technology is developed well enough to be tested on site and may be recommended during operational monitoring, if mortality data indicate bat mortalities above the sustainable threshold for the wind farm. This threshold will be calculated according to the *South African Bat Fatality Threshold Guidelines* (MacEwan, *et al.*, Edition 2, October 2018). Initial experiments with this technology on wind farms in South Africa are yielding positive results that may indicate the effectiveness of the devices in the correct scenarios.

Current data on the South African trials is still limited to a small sample set, and the technology will not necessarily be effective in all mitigation scenarios and for all bat species. Therefore, it should be considered and tested on a case-by-case basis if possible, and it is highly recommended that adequate monitoring continues concurrently, to assess the effectiveness of the devices in reducing bat mortalities.

7 MITIGATION ACTION PLAN FOR INCLUSION INTO THE EMPr

7.1 Step 1: Minimisation of light pollution (refer to Section 6.1)

During the planning phase for the Karreebosch WEF it must become mandatory to only use lights with low sensitivity motion sensors that switch off automatically when no persons are nearby, to prevent the creation of regular insect gathering pools, where practically possible without compromising security requirements. This applies to the turbine bases (if applicable) and other infrastructure/buildings. Aviation lights should remain as required by aviation regulations. Floodlights should be down-hooded and where possible, lights with a colour (lighting temperature) that attract less insects should be used. This mitigation step is a simple and cost-effective strategy to effectively decrease the chances of bat mortality on site.

Bi-annual visits to the facility at night must be conducted for the operational lifetime of the facility by operational staff of the facility, to assess the lighting setup and whether the passive motion sensors are functioning correctly. The bat specialist conducting the operational bat mortality monitoring must conduct at least one visit to site during nighttime to assess the placement and setup of outside lights on the facility. When lights are replaced and maintenance on lights is conducted, this Mitigation Action Plan must be consulted.

7.2 Step 2: Appointment of bat specialist to conduct operational bat mortality monitoring

As soon as the Karreebosch WEF facility becomes operational, a bat specialist must be appointed to conduct a minimum of 2 years of operational bat mortality monitoring. The methodology of this monitoring must comply with the *South African Good Practice Guidelines for Operational Monitoring for Bats at Wind Energy Facilities - 2nd Edition June 2020* (Aronson *et al.* 2020), or any newer version of the applicable guidelines that may be in force at the start of operation of the facility.

The results of the bat mortality study may be used to develop mitigation measures focused on specific problematic turbines. The results of the operational monitoring must be made available, on request, to other bat specialists conducting operational and preconstruction monitoring on WEF's in South Africa.

7.3 Step 3: Curtailment to prevent freewheeling (refer to Section 6.2)

Based on high bat activity detected during the 12-month preconstruction study, from 15 November to 31 March every night for the lifetime of the facility, curtailment must be applied to all turbines by ninety-degree feathering of blades when operating below the **manufacturer's cut-in speed**, so it is exactly parallel to the wind direction and minimises freewheeling blade rotation as much as possible without locking the blades. This can significantly lower probability of bat mortalities. Influence on productivity is minimal since no power is generated when below the manufacture's cut-in speed.

7.4 Step 4: Additional mitigation by curtailment or acoustic deterrents (refer to Sections 6.3 and 6.4)

If mitigation steps 1 – 3 are followed, and the bat mortality monitoring study detects bat mortalities that are above the sustainable threshold for the Karreebosch WEF, then additional mitigation will need to be implemented to bring bat mortalities to or below the sustainable threshold. According to the *South African Bat Fatality Threshold Guidelines* (MacEwan, *et al.*, Edition 2, October 2018), this threshold is calculated by considering the hectare size of the WEF area of turbine influence and the value of 2% of bats/10ha/year for the ecoregions that the WEF is located in, to give an annual number of sustainable bat mortalities that is acceptable for the WEF. The area of turbine influence of a wind farm is dictated by the turbine layout and is a tight fitting polygon around the turbine layout (**Figure 7.1**). In this version of the guidelines the acceptable sustainable threshold is calculated as 0.04 bats/10ha/annum for the Succulent Karoo ecoregion which occupies most of the turbine area of influence, and a small portion of the area of influence is covered by the Montane Fynbos and Renosterveld with a sustainable threshold calculated as 0.08 bats/10ha/annum. The calculated annual acceptable sustainable threshold of bat mortalities for each ecoregion and the total

Karreebosch WEF is indicated in

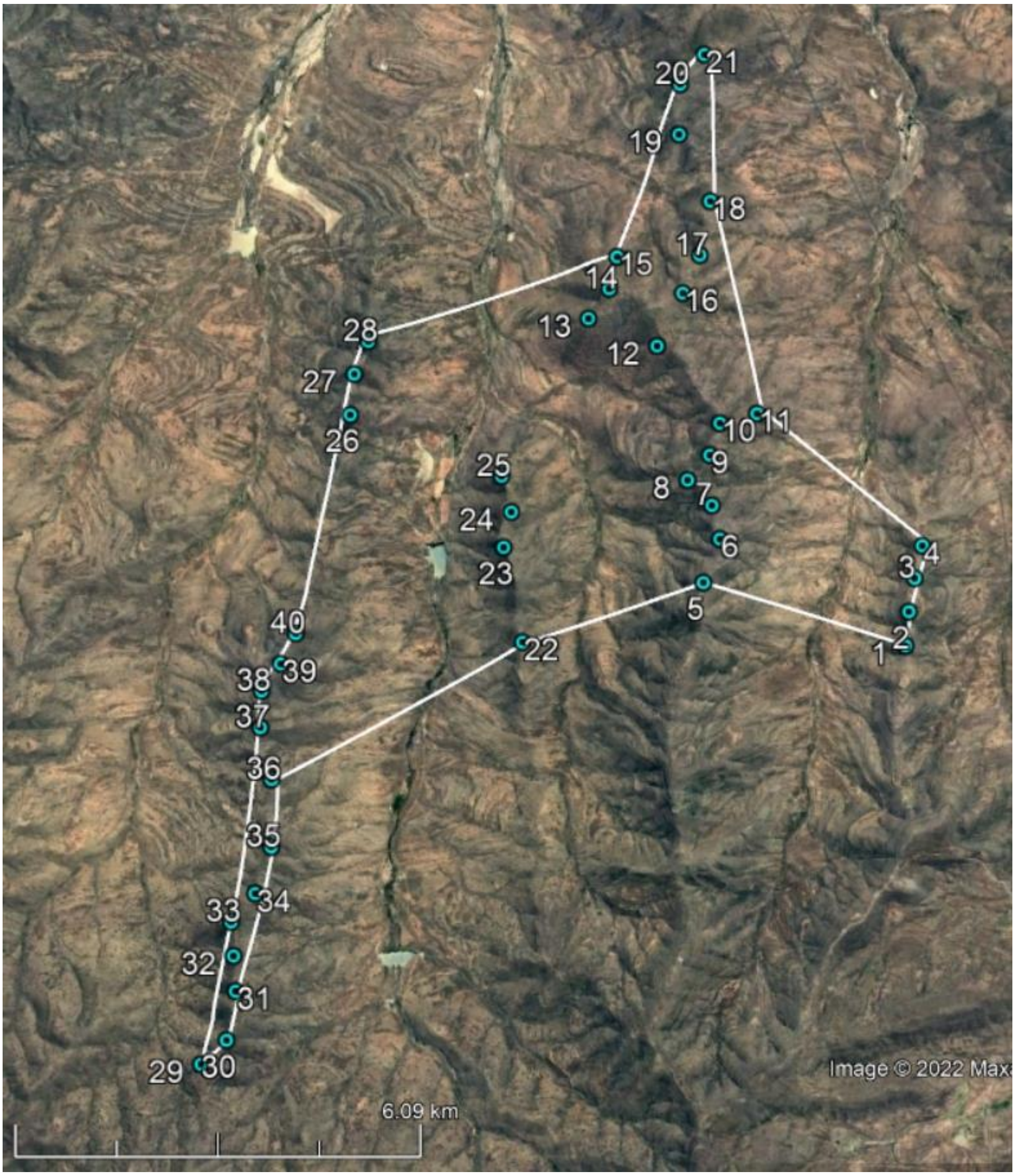

Figure 7.1: The turbine area of influence used to calculate the area applicable to the acceptable bat mortality thresholds.

Table 7.2 below. Note that a newer version of the Threshold Guidelines or another similar applicable document may be adopted during the operation of the WEF.

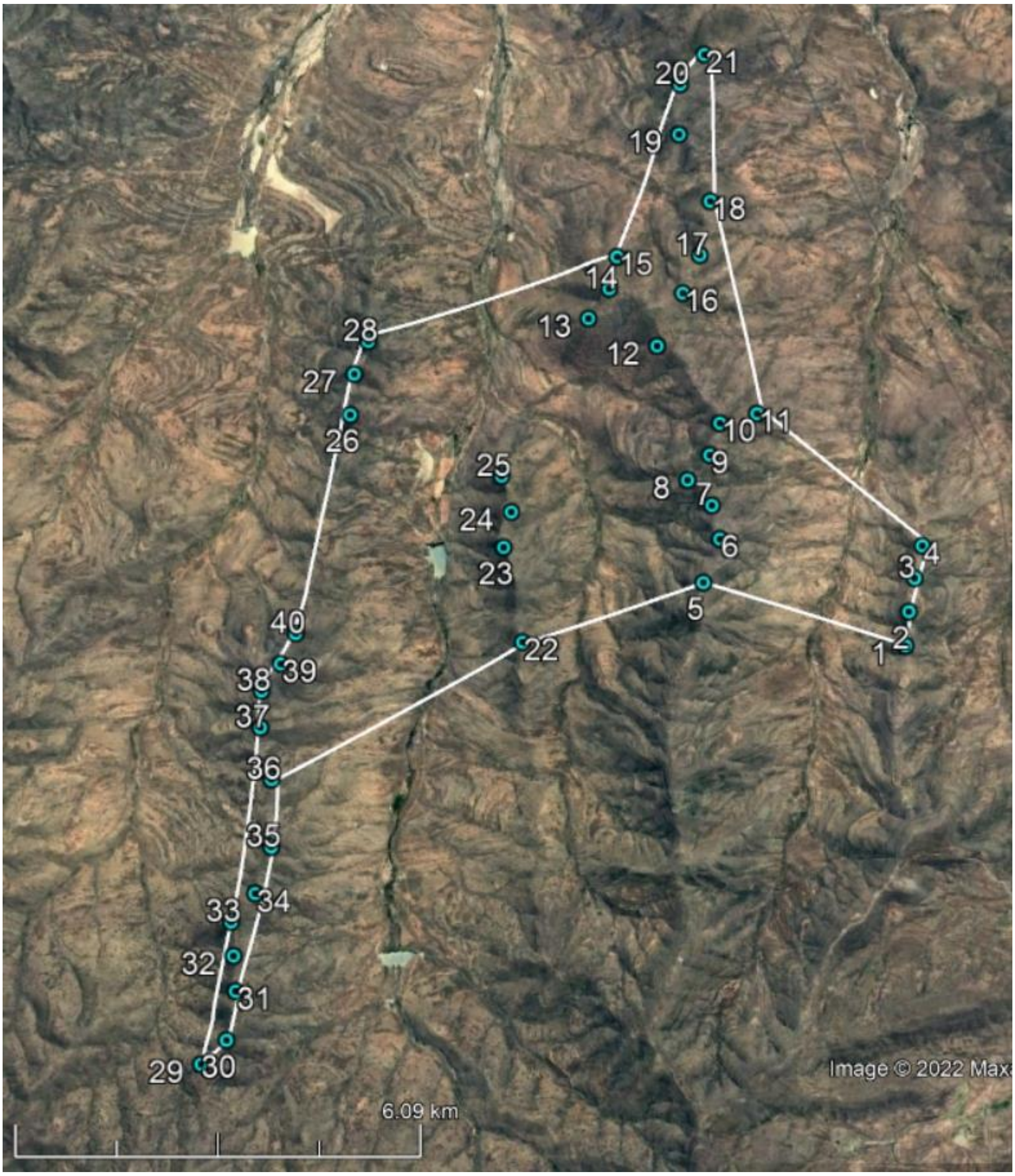

Figure 7.1: The turbine area of influence used to calculate the area applicable to the acceptable bat mortality thresholds.

Table 7.2: The sustainable acceptable mortality thresholds of the authorised Karreebosch wind farm.

	Area of influence of wind turbines (hectares)	**Acceptable annual mortality of bats**
Karreebosch WEF (Succelent Karoo bioregion)	4 761	0.04 x (4761/10) = 0.04 x 476.1 = **19 bats**
Karreebosch WEF (Montane Fynbos and Renosterveld bioregion)	143	0.08 x (143/10) = 0.08 x 14.3 = **1 bat**
Karreebosch WEF total (sum of both ecoregions	4904	**20 bats**

Such additional mitigation measures may be to curtail problematic turbines according to the **mitigation cut-in speed** (Section 6.3), and/or to utilise acoustic deterrents on problematic turbines (Section **Error! Reference source not found.**).

Preliminarily, it is advised that any additional mitigation measures that may be required be applied during the months of November to March, and must be applied to any turbines or group of turbines identified as causing the wind farm's mortalities to be above the sustainable threshold levels. This time period is based on high bat activity months as detected during the 12-month preconstruction study.

The bat specialist conducting the operational bat monitoring may recommend other time periods for additional mitigation, based on robust mortality data. If required, the bat specialist may make use of climatic data to allow for an active and adaptable mitigation schedule.

7.5 Step 5: Auditing of bat mortalities for the lifetime of the facility

During the implementation of mitigation Steps 1 – 4, it is crucial for the facility to determine and monitor bat mortalities in order to implement, maintain and adapt mitigations as efficiently as possible. For the duration of the lifetime of the facility, the impacts on bats must be audited/monitored by reliable methods of carcass searching and/or electronic devices capable of automatically counting bat mortalities. Such auditing should occur every 5 years (after the end of the initial 2-year operational study) for all turbines on site, and continuously for turbines where mitigations discussed in Step 4 (Sections **Error! Reference source not found.** and **Error! Reference source not found.**) are implemented.

8 CONCLUSION

Animalia Consultants (Pty) Ltd) completed the 12-months pre-construction bat monitoring for the Karreebosch WEF in 2014. The sensitivity map for the Karreebosch WEF site was then updated in October 2018, and a site visit was conducted on 13 September 2021 by Animalia Consultants (Pty) Ltd to verify the final turbine layout in relation to the approved bat sensitivity map.

According to the passive bat activity data collected on site during the preconstruction study, bat activity at 50m height was significantly less than activity at a lower height of 10m. The proposed amendments (**Table 2.1**) will increase the minimum rotor swept height from 45m above ground to 55m above ground. This increase in the lowest rotor swept height can have a positive influence in lowering the probability of bats being impacted. However, it is not significant enough to influence the assessments of the impacts as identified in the EIA phase bat assessment report. Therefore, the impacts assessed during the EIA phase remain unchanged.

The proposed final turbine layout respects the bat sensitivity map, it also respects the current guideline criteria which requires turbine blade length to be outside the high sensitivity buffers, except for Turbine 17. Turbine 17 has been identified to have a proposed foundation position of 250m from a high bat sensitivity (**Figure 4.2**), which means that a blade overhang of 35m will be present if a minimum high sensitivity buffer of 200m is considered. However, when applying the spatial formula described in Section 3, and considering an elevation difference of 20m between the turbine base point and the high bat sensitivity, this turbine base point must be at least 235.8m from the high bat sensitivity (on a two-dimensional map plane) to allow for the blade tip to be 200m from the high bat sensitivity. Currently the turbine base point is 250m from the sensitivity, and therefore no further amendment is required to the location of Turbine 17 and it is considered acceptable.

In summary, the proposed amendments and proposed final layout is acceptable from a bat sensitivity perspective if all conditions of the EA are adhered to, an operational bat impact monitoring study is conducted for a minimum of 2 years and the Mitigation Action Plan is adhered to (Section 7).

Werner Marais

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(Zoological Science)

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