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Appendix D2:

Preconstruction Bat Scoping Assessment

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Scoping Report: Pre-construction Bat Monitoring Assessment for the Proposed De Rust Wind Energy Facility near Pofadder, Northern Cape

November 2022

Prepared For

EnergyTeam

Prepared by

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Disclaimer by specialists

We,

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declare, that the work presented in this report is our own and has not been influenced in any way by the developer or the EAP. At no point has the developer asked us as specialists to manipulate the results in order to make it more favourable for the proposed development. We consider ourselves bound to the rules and ethics of the South African Council for Natural Scientific Professions (SACNASP) and the EIA Regulations (2014, as amended). We have the necessary qualifications and expertise (*Pr. Sci. Nat. Zoological Science)* in conducting this specialist report.

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GLOSSARY OF TERMS

Acoustic monitoring: Recording and analyses of echolocation calls to determine bat species composition and abundance.

ACR: African Chiropteran Report.

PA: Project Area, the area that is affected by the proposed development.

B1-9: Names for deployed Bat Detectors.

Basic Assessment (BA): To follow the processes set out in regulations 19 of GN 326 of 7 April 2017.

Bat call: An echolocation call emitted by a bat used to detect its surroundings and navigate through the habitat it inhabits.

Bat detector: Electronic device for the recording of bat echolocation calls. Also called a bat song meter.

Bat roost: A structure, natural or manmade, were bats roost during the day. This includes caves, trees, rocky outcrops, buildings and culverts.

BESS: Battery Energy Storage System.

Blade tip sweep height: Height between ground level and the lowest point of the rotor sweep zone.

Buffer zone: A zone established around areas that are identified as sensitive for bats and includes flyways, foraging areas and bat roosts.

Cumulative Impact: Impacts created due to past, present and future activities and impacts associated with these activities.

Echolocation: Navigation through the use of ultrasound.

Environmental Impact Assessment (EIA): The process of identifying environmental impacts due to activities and assessing and reporting these impacts.

EMPr: Environmental Management Programme: A legally binding working document, which stipulates environmental and socio-economic mitigation measures which must be implemented by several responsible parties throughout the duration of the proposed project.

Endemic: A species that is restricted to a particular area.

EPTHOT: Bat species *Eptesicus hottentotus.*

IUCN: International Union for Conservation of Nature.

LAECAP: Bat species *Laephotis capensis*;

MINNAT: Bat species *Miniopterus natalensis.*

Pre-construction phase: The period prior to the construction of a wind energy facility.

Pulse: A single emission of a sound by a bat.

R1-R27: Names for potential bat roost locations.

Red data species: Species included in the endangered, vulnerable or rare categories as defined by the IUCN.

Renewable Energy EIA Application EEA (REEA): latest spatial data for renewable energy applications for environmental authorisation in South Africa.

Renewable Energy Development Zones (REDZ): Areas were wind and solar photovoltaic power development can occur in concentrated zones.

RHIDAM: Bat species *Rhinolophus damarensis*

Rotor blades: The air foil of a wind turbine that catches the wind and rotates.

Rotor swept area: The area through which rotor blades rotate.

SABAA: South African Bat Assessment Association.

SACNASP: South African Council for Natural Scientific Professions.

SANBI: South African National Biodiversity Institute.

SAUPET: Bat species *Sauromys petrophilus*.

SD card: A storage device for song meter recordings.

Scoping Report: A report contemplated in regulation 21 of the NEMA amended EIA regulations R326 dated 7 April 2017.

WEF: Wind Energy Facility.

TADAEG: Bat species *Tadarida aegyptiaca.*

ToPS: Threatened or Protected Species.

UV: Ultraviolet

VPD: Vapour pressure deficit.

1 INTRODUCTION

1.1 PROJECT DETAILS AND BACKGROUND

Enviro-Insight CC was commissioned by EnergyTeam (Pty) Ltd to conduct a pre-construction bat survey for a proposed wind energy facility (WEF) and associated infrastructure which will be known as the De Rust WEF. Approximately 70 wind turbines will be constructed, each with a generation capacity up to 7.5 MW with a hub situated 150 m above ground level and a rotor diameter of up to 175 m (blade tip sweep height: 62.5 m above ground level). Turbines will be connected with underground and above-ground cabling and each turbine will be built on a concrete foundation, using a formal adjacent laydown area. Additional infrastructure includes a network of roads between turbines, two battery energy storage systems (BESS), permanent workshop area, office, up to 4 sub-substations and a guard cabin. This report serves as a pre-construction assessment of the bat activity and bat species present in the Project Area (PA) of the proposed De Rust WEF.

1.2 PROJECT LOCATION AND PROJECT AREA

The proposed De Rust WEF (boundary in Figure 1-1) is located 13 km south-south-east of Pofadder and 47 km east of Aggeneys in the Khâi-Ma Local Municipality in the Northern Cape Province of South Africa. It is accessed from the R358 from Pofadder, which bisects the PA (defined as the boundary shown in Figure 1-1). The minimum convex hull of the preferred turbine placement (B), with an 87.5 m buffer (to account for rotor sweep), covers an area of *ca.* 7,731 ha. The only land use in the area is sheep ranching due to the lack of rainfall and nearby permanent water sources, and several occupied farm smallholdings are present within or near to the PA. The closest existing WEF is the Kangnas WEF, which is situated approximately 85 km west-south-west of the proposed De Rust WEF PA (the current project).

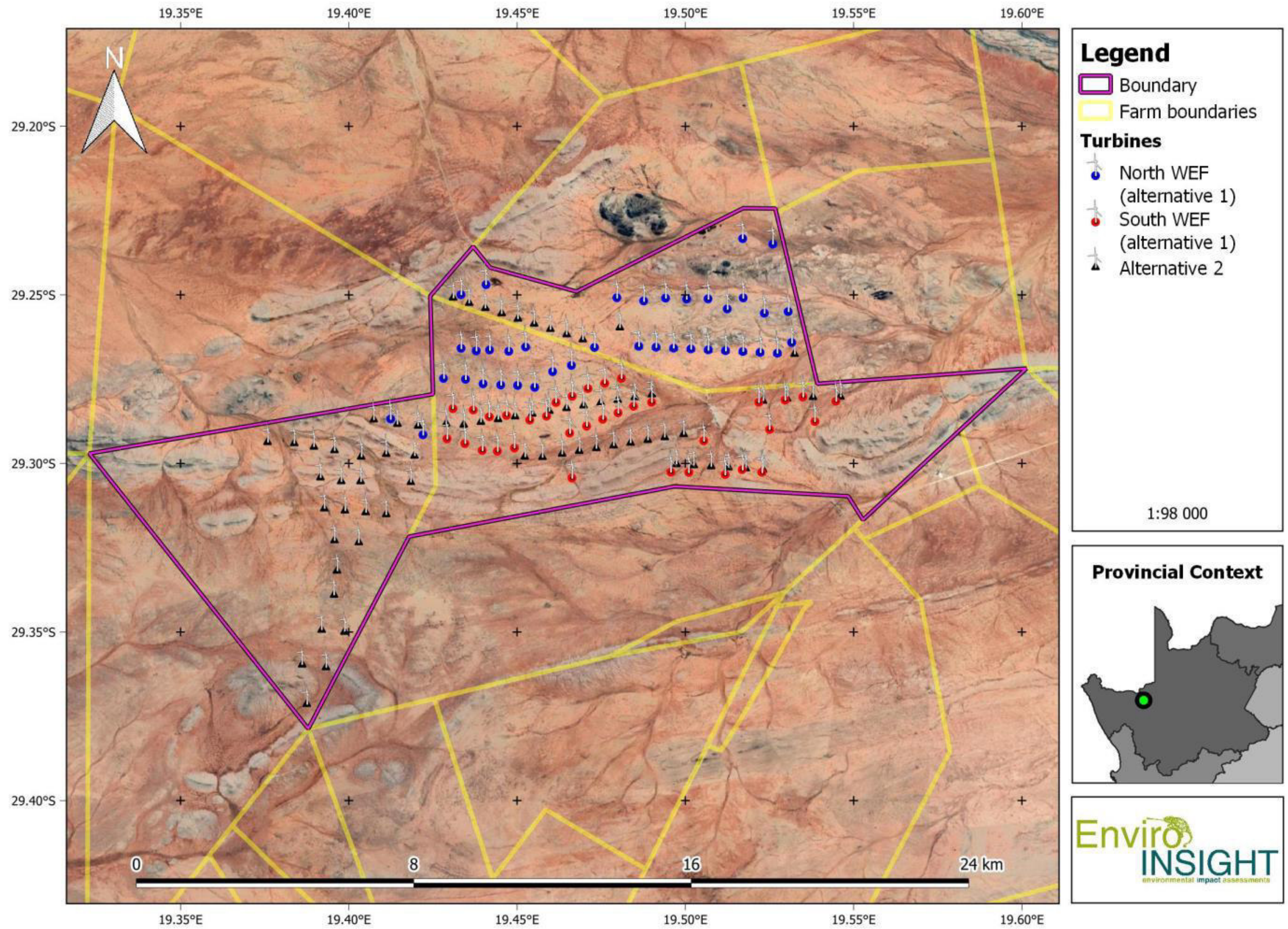

Figure 1-1: Location of the project area (WEF boundary) for the proposed De Rust WEF development, showing proposed turbine layout alternatives and associated infrastructure.

1.3 DESCRIPTION OF THE AFFECTED ENVIRONMENT

The project area (PA) consists various vegetation types, with Bushmanland Arid Grassland and Aggeneys Gravel Vygieveld, covering the most area in the low-lying parts of the PA, Bushmanland Inselberg Shrubland and Namaqualand Klipkloppe Shrubland on the quartzite ridges/hills, and Bushmanland Basin Shrubland to the north west near the dolerite outcrops (SANBI 2018, Figure 1-2). However, structural differences in vegetation between the vegetation types was not obvious during site visits, except for the vegetation associated with the quartzite ridges/hills. Watercourses are typically poorly defined but usually have denser and larger bushes than the surrounding landscapes. There are no large/perennial streams or rivers close to the PA, but there are numerous small ephemeral watercourses, some with extensive alluvial plains, that drain towards the west, north and east. These systems do not form deep valleys or in-cut banks. The PA has varied terrain, consisting of a relatively flat plain with small quartzite ridges and koppies that form linear hilly regions across the PA, with especially large hills in the south east, and dolerite outcrops forming small to large conical koppies in the north east (Figure 1-3; Figure 1-4). There are some rocky areas on the flats that are not associated with higher terrain, located in the northern central portion of the PA.

The PA is situated in an arid region between the summer and winter rainfall zone, with rainfall being highly variable in the region. The nearby town of Pofadder receives most of its rainfall between February and April (data from 1985; https://www.meteoblue.com/), and recent data (2009-2021) indicates that most rainfall occurs from October to March, with a mean annual rainfall of 135 mm (https://wapor.apps.fao.org/). The warmest months are October through to April with a mean daily maximum of 33 °C and minimum of 17°C (February) and winter maximum temperatures of 18 °C and minimum 2 °C (July; https://www.meteoblue.com/).

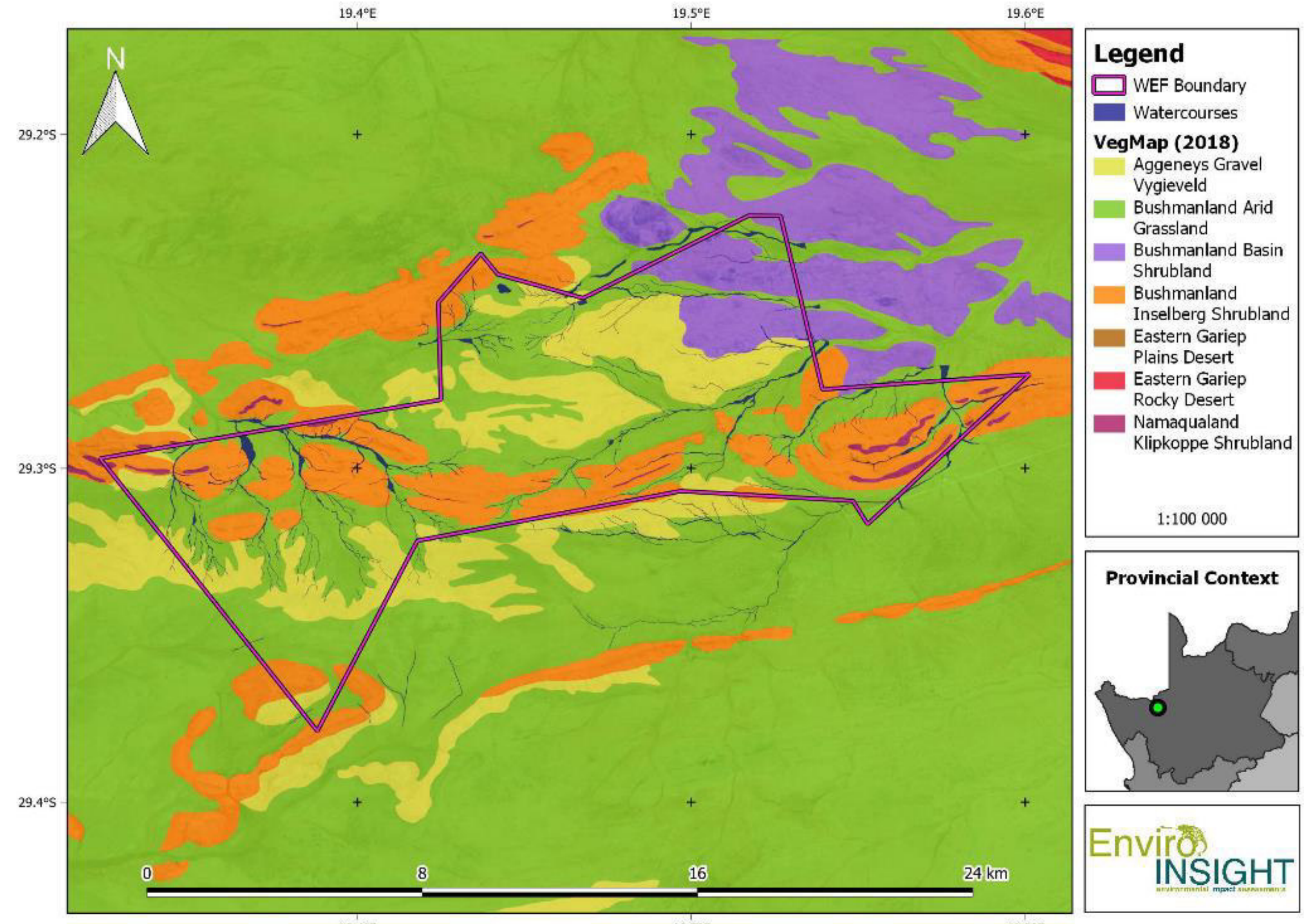

Figure 1-2: The proposed De Rust Wind Energy Facility (WEF boundary) in relation to major vegetation types and aquatic habitats.

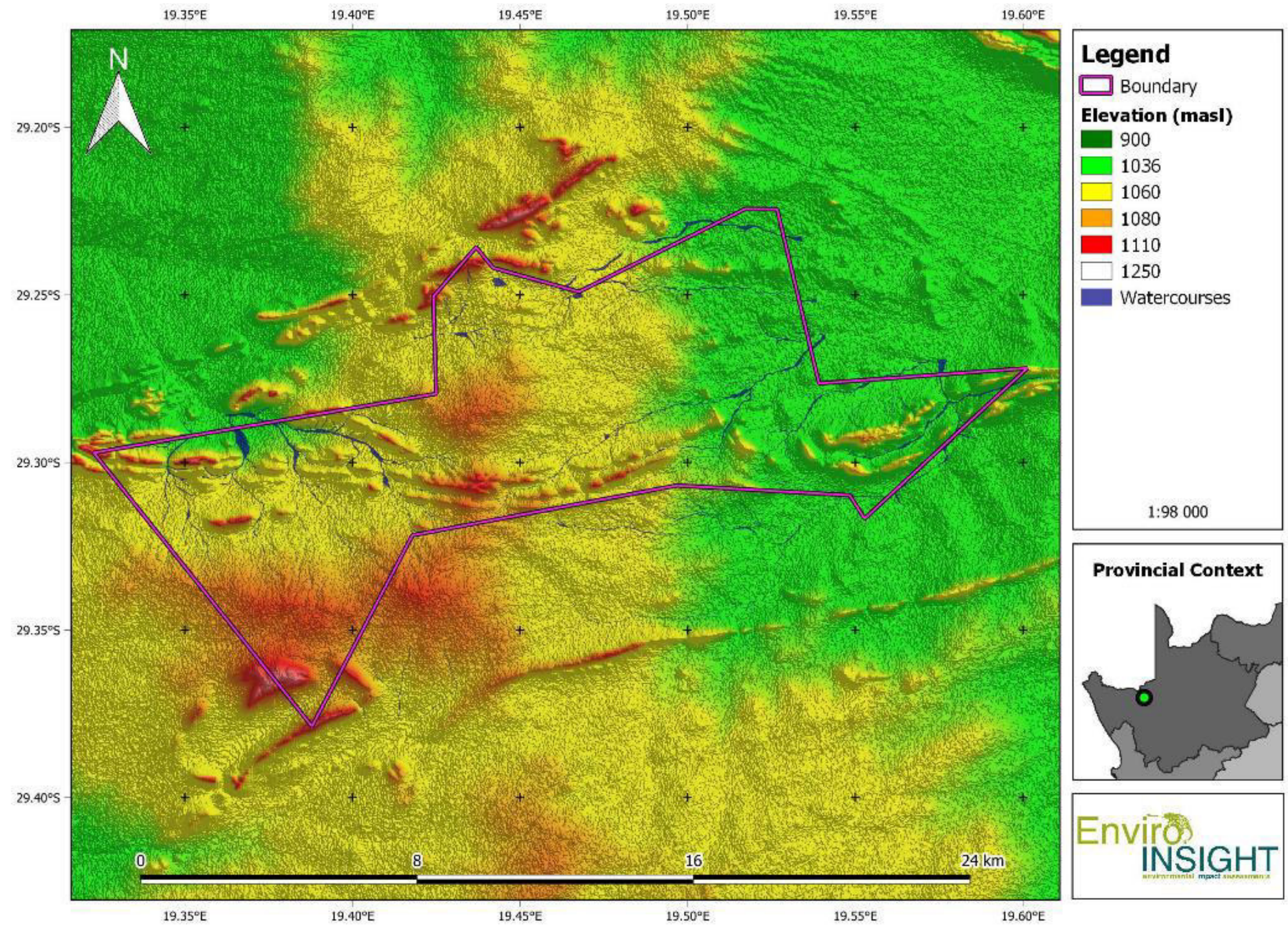

Figure 1-3: The proposed De Rust Wind Energy Facility (WEF boundary) in relation to the terrain elevation and aquatic habitats.

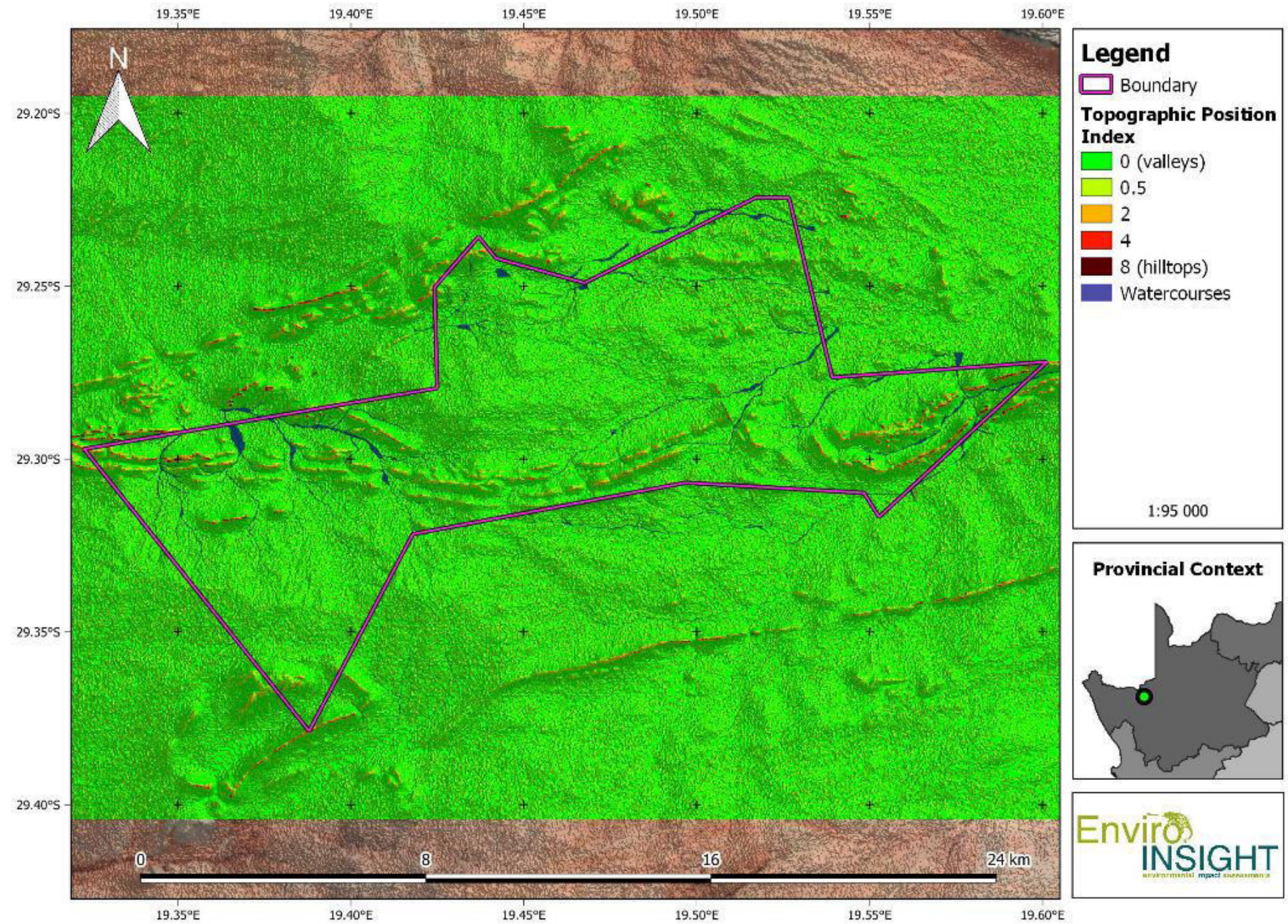

Figure 1-4: The proposed De Rust Wind Energy Facility (WEF boundary) in relation to the topographic position index and aquatic habitats.

1.4 BAT STUDY VALIDITY PERIOD

The results obtained from the current survey are valid for a period of five years as stipulated in the SABPG (MacEwan *et al*., 2020b). If an application for environmental authorisation is only submitted after this five-year period an additional six months of monitoring will have to be conducted from October to April. An amended impact assessment will have to be conducted after comparison of data gathered during the original 12-month survey (the final EIA report to follow this scoping report) and the additional six-month study.

1.5 ASSUMPTIONS AND LIMITATIONS

Distribution records of bats in southern African are poorly documented, especially for some species. In addition, migratory patterns, breeding behaviour and maternal colony formation are largely unknown for many South African bat species. Studies have reported that bats do migrate, but the exact routes followed are not known (Pretorius *et al*., 2020).

WEF pre-construction monitoring reports on bats depend on data derived mostly from echolocation calls and the identification of species from these calls, but without echolocation call libraries accurate identification is not always possible. Published libraries created from release and handheld calls of captured bats are available, but limited, for southern Africa. Acoustic monitoring records vast numbers of bat passes with repertoires of calls which have not been captured by handheld calls, and calls may vary geographically within species (Monadjem *et al.*, 2017). As such these call libraries cannot accurately identify all echolocations, and there are too many calls to identify manually, resulting a certain amount of error that must be expected and interpreted along with the data.

A number of problems resulted in extended periods of inactivity (or downtime) for some of the passive bat detectors.

- Bat detector memory card slot failure and SD card corruption;
- The mast on which bat detector 3 was mounted collapsed around (1 February 2022) due to the soft substrate and high rainfall, and was dismantled and removed because the PA had been reduced in size due to the presence of nesting birds and bat detector 3 was no longer placed within the WEF developable area. This event does not affect the monitoring requirements of the current study as the WEF developable area has been reduced.

Microphones at height were placed at 65 m and 110 m, while the proposed turbines are expected to have a rotor sweep zone from 62.5 – 237.5 m above ground. The meteorological masts had a maximum height of 120 m, and bat detector microphone placements were limited by this maximum height. Therefore, bat activity was only monitored at the lower limit of the rotor sweep zone. Bats are expected to be more active closer to the ground, so it is likely (but not certain) that bat activity will be overestimated for this height zone in general.

Bat detectors are not always effective in recording echolocation calls for all bat species, and some species may be missed e.g., some fruit bat species that do not echolocate. Other species, such as *Nycteris thebaica*, emit low intensity calls and are not expected to be recorded by bat detectors. Bat detectors are also limited in the range over which a call can be recorded, and this can be further influenced by environmental conditions such as humidity and wind. In addition, the microphones that are coupled to the detectors are not omnidirectional and recording quality and number of recordings is influenced by the orientation of the call relative to the microphone.

2 METHODOLOGY

2.1 REGULATORY AND GUIDELINE REQUIREMENTS

Amendments were made to the NEMA: EIA Regulations of 2014: GNR 326 EIA Regulations; GNR 327 Listing Notice 1; GNR 325 Listing Notice 2; GNR 324 Listing Notice 3 which pertains to WEF and the activities surrounding their construction. Under Listing Notice 2 it is stated that a Scoping and Environmental Impact Assessment (EIA) is required for WEF with an electricity output 20 MW or more and which is not located in an urban area or on existing infrastructure. Only a Basic Assessment (BA) is, however, required in cases where the entire boundary of the proposed WEF is located in a Renewable Energy Development Zone (REDZ). The proposed De Rust WEF is not located in a REDZ, and accordingly an EIA process must be followed. The South African Best Practice Guidelines for Pre-construction Monitoring of Bats at Wind Energy Facilities - ed 5 (SABPG, MacEwan *et al*., 2020b) does not differentiate between areas located within or outside of a REDZ, and as such all measures outlined in the Guidelines must be followed and applied. Monitoring of bats must be conducted before the final BA or EIA is submitted. All methods used to inform desktop studies and conduct field surveys were implemented according to the SABPG (MacEwan *et al*., 2020b).

MacEwan (2020b) stipulates the minimum number of bat detectors at height (>50 m) to be one per 10,000 ha. This was made clear during discussions with the client and it was agreed that 20,000 ha would not be exceed as only 2 meteorological masts would be construction. The current project area of influence combined with the proposed Houmoed WEF (submitted as a standalone report), calculated as a convex hull of the turbine layout, is less than 20,000 ha, and the 3 bat detector stations on both meteorological masts are sufficient for the pre-construction monitoring survey. However, future turbine placement adjustments must be limited to within a total area of 20,000 ha.

2.2 DESKTOP SURVEY

A thorough desktop study was undertaken to estimate the likelihood of specific species of bats being present at the proposed WEF PA. This included investigations into available literature, including Bats of Southern and Central Africa (Monadjem *et al*., 2020), the African Chiroptera Report (ACR, 2021) and any other bat surveys or monitoring reports for nearby WEF applications (see Table 2-1) as determined from the Renewable Energy EIA Application (REEA, 2022 Q1) information. Available reports were searched for online and post-construction monitoring reports were requested from the nearby Kangnas WEF through SABAA (first request sent on 12 July 2022), which culminated in a non-disclosure agreement (NDA) being signed between Enviro-Insight and Kangnas WEF, but no report being received in time for evaluation and inclusion in this report. It is also questionable whether any information could have been used since the NDA Enviro-Insight had to sign was very restrictive in terms of which information could be shared. Lack of public access to existing monitoring reports for WEFs is a recurring problem in the industry and one that severely hampers pre-construction monitoring studies and the recommendations therein, a problem to be addressed by relevant NGOs and the governmental institutions.

A search was conducted to identify any protected areas present within 100 km of the proposed WEF project area using the South African Protected Area Data (SAPAD, 2022 Q1[1]).

[1] available from: https://egis.environment.gov.za/

Table 2-1: Bat reports for Wind Energy Facilities (and other developments) in the region of the proposed De Rust WEF.

Project	Report details	Consultant
Kangnas WEF (Aurecon, 2012)	Proposed Wind and Solar (Photovoltaic) Energy Facilities on Kangnas Farm near Springbok in the Northern Cape: Final EIR. (Completed before current guideline were in place, limited data collection).	Werner Marias (Animalia Zoological and Ecological Consultation)
Kangnas WEF (Bio^3 & Savannah Environmental, 2013)	Bat and Bird Community Monitoring. Interim Status Report (Pre-construction). For Mainstream. (Completed before current guideline were in place, limited data collection).	Unknown (Bio^3 & Savannah Environmental)
Korana WEF (Savannah Environmental, 2015a)	Final EIAr Korana WEF (14/12/16/3/3/2/682). Bat appendix not available online.	Jonathan Aronson & Jennifer Slack (Arcus Consultancy Services)
Khai-Ma WEF (Savannah Environmental, 2015b)	Final EIAr Khai-Ma WEF (14/12/16/3/3/2/680). Bat appendix not available online.	Jonathan Aronson & Jennifer Slack (Arcus Consultancy Services)
Poortjies WEF (Savannah Environmental, 2015c)	Final EIAr Poortjies WEF (14/12/16/3/3/2/681). Bat appendix not available online.	Jonathan Aronson & Jennifer Slack (Arcus Consultancy Services)
Korana WEF (Stephanie Dippenaar Consulting, 2019a)	Korana WEF Bat Impact Assessment Amendment. Change to larger turbine design. Literature review only, no new data collection.	Monika Moir (Stephanie Dippenaar Consulting)
Khai-Ma WEF (Stephanie Dippenaar Consulting, 2019b)	Khai-Ma WEF Bat Impact Assessment Amendment. Change to larger turbine design. Literature review only, no new data collection.	Monika Moir (Stephanie Dippenaar Consulting)
Paulputs WEF (Arcus Consulting, 2019)	Final EIAr Paulputs WEF. For Paulputs Wind Energy Facility.	Jonathan Aronson (Arcus Consulting)
Poortjies WEF (Camissa Sustainability Consulting, 2021)	Poortjies WEF Bat Impact Assessment Amendment Part 2. Change to larger turbine design. For Savannah Environmental. Literature review only, no new data collection.	Unknown (Camissa Sustainability Consulting)

Sol Invictus Overhead Powerline (Inkululeko Wildlife Services, 2021)	Bat Impact Assessment for the proposed Sol Invictus Overhead Powerline. For The Biodiversity Company. Desktop only.	Caroline Lötter & Kate MacEwan
Red Sands WEF (Enviro-Insight 2022-in prep.)	Pre-construction Bat Monitoring Assessment for the Proposed Red Sands Wind Energy Facility near Aggeneys, Northern Cape	Alex Rebelo & Luke Verburgt, reviewed by Low de Vries

2.3 FIELD SURVEYS

All methods used for field surveys were performed in accordance with SABAA's document on best practice guidelines for pre-construction monitoring of bats at wind energy facilities in South Africa (MacEwan *et al*., 2020b).

2.3.1 Site Visits

Several site visits were completed (Table 2-2) spanning a full year and therefore encompassing all seasons. Photos of the deployed bat detectors and respective habitats are shown in section 2.3.3.

Table 2-2. Summary of site visits and work conducted.

Season and Dates	Methods	Weather and veld conditions
Autumn: 9-12th March 2021	Walkdown; rapid roost inspection	Dry, warm conditions, veld parched and appearing lifeless.
Spring: 11-14th October 2021	Deployment of bat detectors, transect drives, farmstead roost inspections.	Moderate temperatures with some cloudy days and first rains in a long time, veld still parched and appearing lifeless.
Summer: 13-19th January 2022	Passive detector data retrieval, transect drives, farmstead roost inspections.	Warm temperatures with sporadic cloudy days and rainfall events throughout visit (on/off from October through to February). Veld with some green growth beginning on shrubs, but limited grass.
Autumn: 25-31th May 2022	Passive detector data retrieval, transect drives, farmstead roost inspections.	Cool temperatures, veld green and abundant new grass cover.
Winter: 5-7th August 2022	Transect drives, targeted roost inspections.	Clear skies and warm temperatures. Shrubs still green and grasses present.

2.3.2 Walkover Survey

A survey was performed by walking and driving across the project area as a ground truthing exercise to identify suitable areas for the placement of bat detectors, identify potential bat roosting sites and other sensitive areas, and evaluate the level of monitoring that would be required. This was performed prior to the deployment of the bat detectors.

2.3.3 Passive Bat Detectors

Twelve months of Pre-Construction Monitoring are required for => 20 MW WEFs both inside and outside of a REDz. As the proposed De Rust WEF exceeds 20 MW, bat detectors were deployed for the full 12 months. Nightly recordings of bats from dusk to dawn were captured using the Wildlife Acoustics Song Meter SM4BAT FS Ultrasonic Recorders (hereafter referred to as "bat detectors"). As per the SABPG (MacEwan *et al*., 2020b), one bat detector must be deployed at a height of 7 - 10 m per 5 000 ha or for every significant biotope on the PA and one detector must be deployed at a height of 50 – 80 m per 10 000 ha for masts that are 80 m tall. If a mast is taller than 80 m an additional bat detector must be deployed as close to the top of the mast as possible. As described above, the proposed WEF (including the proposed Houmoed WEF) has a turbine development area of less than 20 000 ha[2] and therefore 4 bat detectors at 7-10 m and 2 bat detector stations at a height of 50 – 80 m are sufficient. Five bat detectors were deployed with microphones positioned at 10 m above ground level (two of these at meteorological masts- only two meteorological masts were constructed for the site), each meteorological mast with a 10 m, 65 m and 110 m microphone (Figure 2-1; Table 2-3). All devices were scheduled to record from 30 min before sunset to 30 min after sunrise at the location of the bat detector. During this time, the device is 'armed' and will begin a recording if a 'trigger' is detected. A trigger is defined as a sound within the set frequency range (Default: >16 kHz) amplitude (Default: 18 dB) for a minimum duration (Default: 1.5 ms). The recording then continues for the duration of the Trigger Window (Default: 3 second) after the last Trigger, and then saves the recorded data. If there are constant Triggers, the recording will save and close after the maximum length of a recording file (Default: 00m:15s). The bat detectors were connected to a 12 V (7.2 A) battery and a 20 W solar panel. On the meteorological masts all three bat detectors were connected to the same battery and solar panel. The bat detectors were serviced on a quarterly (seasonal) basis where all data were copied from the SD cards and backed up before formatting and replacing the SD cards. The equipment was also checked for faults and repaired if necessary.

Table 2-3: Details of the deployed bat detectors.

Name	ID	Meteorological Mast	Microphone Height above ground (m)	Latitude (°)	Longitude (°)	Date deployed
B1	S4U10652	No	10	-29.245444°	19.507455°	23/10/2021
B2	S4U10667	No	10	-29.291209°	19.533712°	23/10/2021
B3	S4U10678	No	10	-29.309858°	19.396272°	08/10/2021

[2] Note that this differs from the WEF boundary area in Figure 1-1 which has a surface area of 31,600 ha

B4	S4U11304	MM1	10	-29.274161°	19.460981°	09/10/2021
B5	S4U11290	MM1	65	-29.274161°	19.460981°	09/10/2021
B6	S4U11361	MM1	110	-29.274161°	19.460981°	09/10/2021
B7	S4U11265	MM2	10	-29.338486°	19.406775°	09/10/2021
B8	S4U11356	MM2	65	-29.338486°	19.406775°	09/10/2021
B9	S4U11341	MM2	110	-29.338486°	19.406775°	15/10/2021

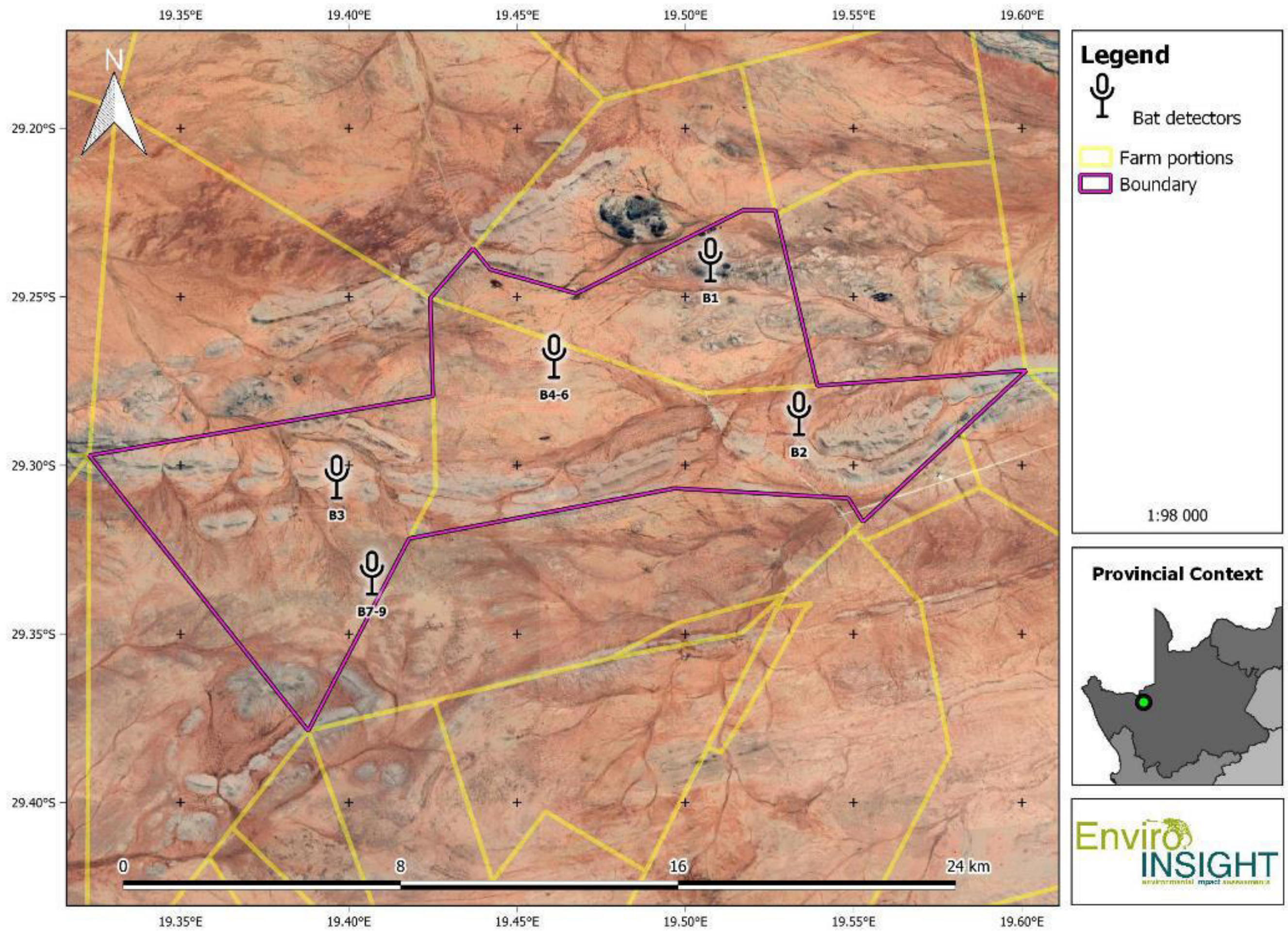

Figure 2-1: Locations for the nine passive bat detectors deployed within the proposed De Rust WEF boundary.

A total of nine bat detectors were deployed across the PA, triplets at two meteorological masts and three singletons on individual 10 m masts (Figure 2-1). The two meteorological masts were constructed at locations predefined by the client, but the 10 m masts were spatially arranged within the proposed PA to represent the major habitat types. The major habitats include flat gravel or sandy plains, raised quartzite ridges with outcrop crests of quartzite and smaller plants and more succulents on their slopes, and stacked dolerite boulder outcrops and cones. Some bedrock is present within low-lying parts of the PA, appearing to be of igneous origin and having weathered extensively, but still forming outcrops, stacked boulders and crevices in some locations. Watercourses are ephemeral and typically have larger bushes or small trees within their drainage lines, with denser vegetation than in the surrounding landscape. One of the watercourses near the main farmstead has been dammed and maintains some level of water for an extended period after rain.

Detector B1 was located on a sandy plain, 160 m north of the alluvial plain of a dry watercourse and 240 m south of a medium-sized dolerite outcrop. The vegetation cover was very sparse and low to the ground, with a few small scattered bushes and small grasses coming up after the rains (Figure 2-2).

Figure 2-2: Passive bat detector B1 showing immediate surrounding habitat.

Detector B2 was located on a sandy plain 140 m from a dry watercourse and adjacent (150 m) to the start of a quartzite ridge/hill with a rocky crest. The vegetation cover was sparse and low, but numerous small bushes grew after the rain. The watercourse had larger and denser bushes, while the quartzite ridge was very sparsely covered with vegetation (Figure 2-3).

Figure 2-3: Passive bat detector B2 showing immediate surrounding habitat.

Detector B3 was located on a sandy plain with two adjacent small dry watercourses (80 m and 170 m away). The detector was removed before the end of the study (see above), and the vegetation after the rain was not documented, but the vegetation at the time of installation was very limited, with denser and larger bushes confined to the dry watercourses (Figure 2-3).

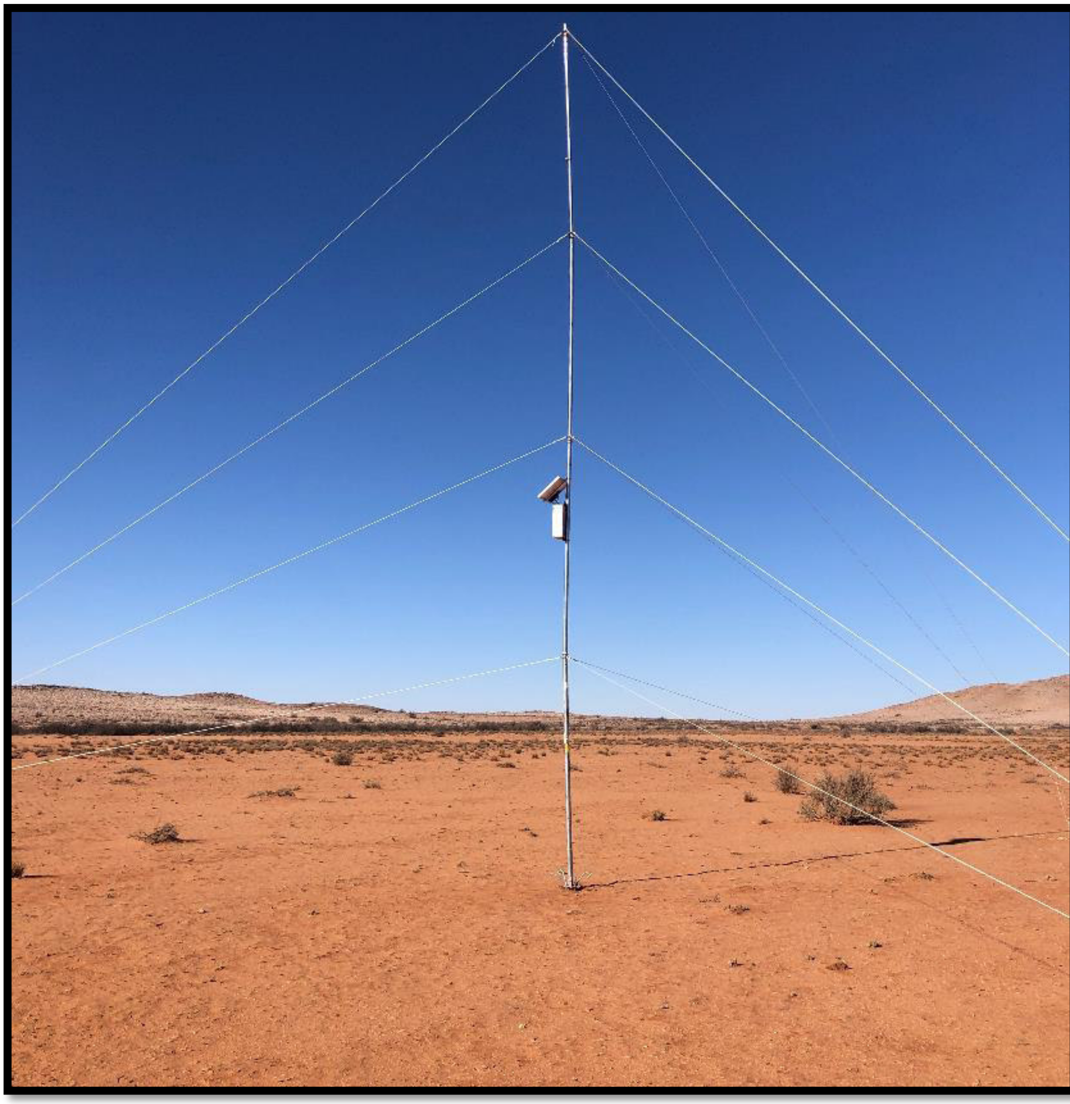

Figure 2-4: Passive bat detector B3 showing immediate surrounding habitat.

Detectors B4-6 were located on a flat open plain gravel plain with medium sized scrub bushes and abundant grasses emerging after the rainfall on site (Figure 2-5). No nearby watercourses or hills were present in the immediate vicinity.

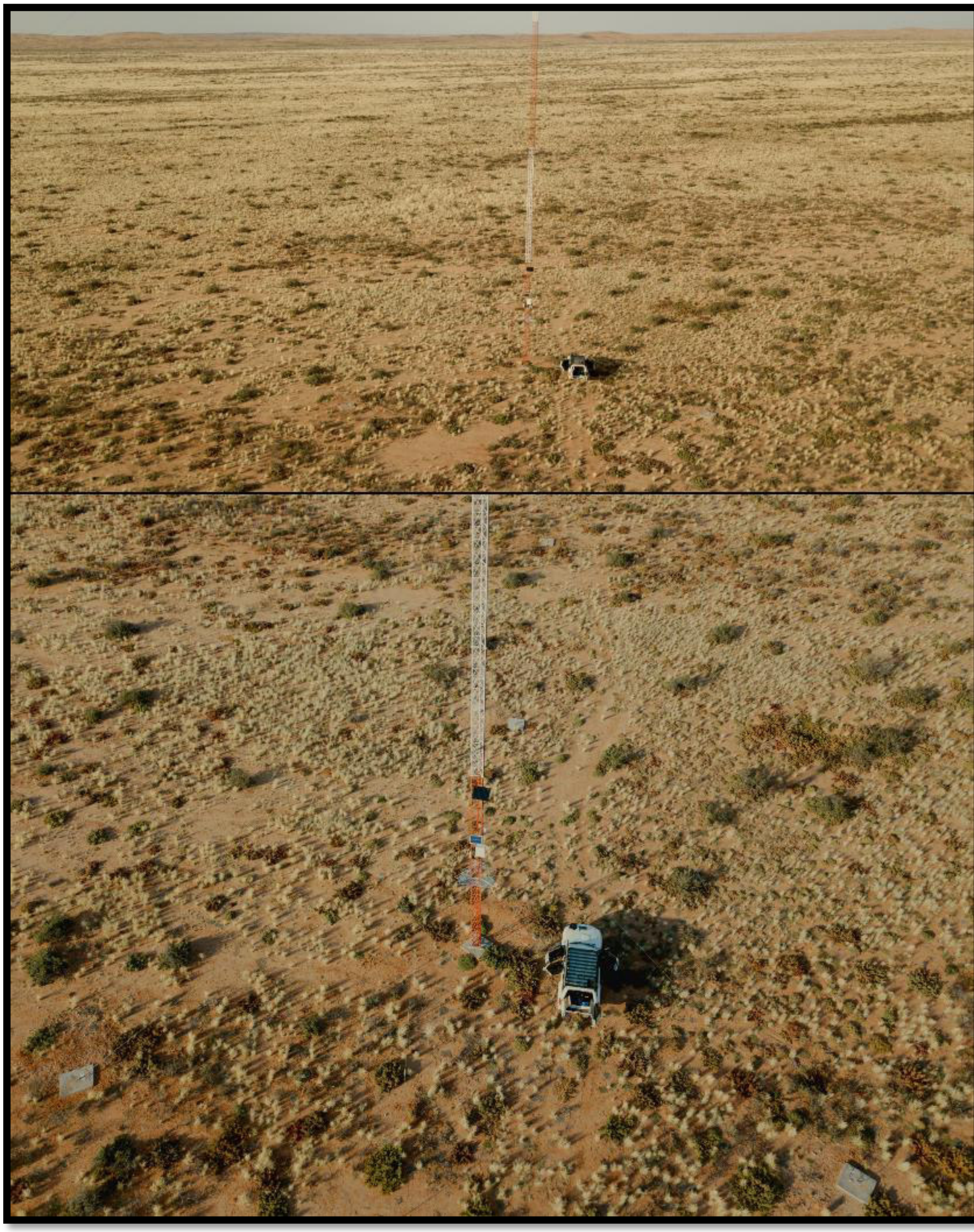

Figure 2-5: Passive bat detector B4-6 showing immediate surrounding habitat.

Detectors B7-9 were located on a flat open plain gravel plain with very sparse and low vegetation, and some small patches of slightly denser vegetation, possibly due to small depressions, and some denser grassy areas a distance away (Figure 2-6). A small watercourse begins about 300 m from the mast with some scattered medium-sized scrub bushes.

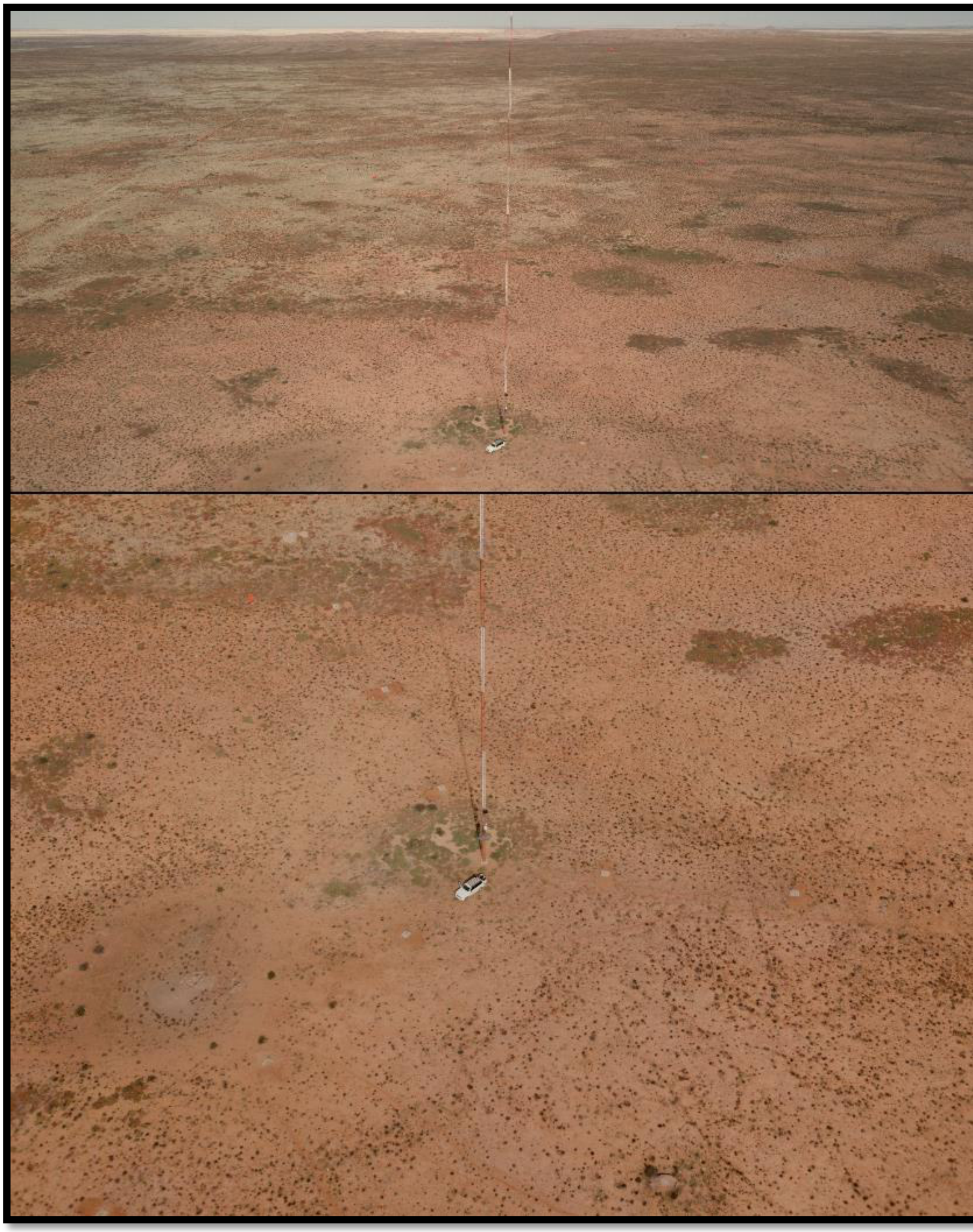

Figure 2-6: Passive bat detector B7-9 showing immediate surrounding habitat.

2.3.4 Active Transects

Transects were driven for a minimum of two nights per season across the PA (Table 2-4), no additional walk transects were conducted as the road network was extensive and intersected with all major habitats within the PA. The transect durations satisfied the requirements outlined in the SABPG (MacEwan *et al*., 2020b), with at least 2.5 hour duration per night and a total transect duration of at least 5 h per season over 2 nights. Transects were only conducted under fair weather conditions where possible (nights with rain or strong winds were avoided, some transects did have moderate winds but no rain). Three different transect routes were driven each night per season due to the large size of the study area. Bats were recorded using a bat detector with the microphone attached to a pole held outside the vehicle approximately 3 m above the ground (Figure 2-7), while driving at an average speed of 20 km/h (maximum < 30 km/h) along the same transect routes between survey periods. All transects were tracked using a handheld GPS.

Table 2-4: Details of completed bat transects.

Season	Date	Type	Start time	End time	Duration	Season total duration
Spring	10/10/2021	Drive	19:03	21:33	02:30	
Spring	12/10/2021	Drive	19:04	21:31	02:27	
Spring	14/10/2021	Drive	19:04	21:36	02:32	**07:29**
Summer	14/01/2022	Drive	19:46	22:35	02:49	
Summer	17/01/2022	Drive	19:45	22:15	02:30	
Summer	18/01/2022	Drive	19:56	22:28	02:32	**07:51**
Autumn	27/05/2022	Drive	17:57	20:27	02:30	
Autumn	29/05/2022	Drive	17:56	20:28	02:32	
Autumn	30/05/2022	Drive	18:13	20:34	02:21	**07:23**
Winter	05/08/2022	Drive	18:15	20:51	02:36	
Winter	09/08/2022	Drive	18:22	20:52	02:30	
Winter	10/08/2022	Drive	18:18	20:52	02:34	**07:40**
				Grand Total Duration		**30:32**

Figure 2-7: Bat detector microphone deployed on a vehicle for use during driven bat transects.

2.3.5 Bat Roosts

Potential bat roosts, including rocky outcrops, buildings, trees and other infrastructure, were visited and visually inspected during the day for signs of bats, which included searching for faecal material and conducting acoustic monitoring with a handheld bat detector (if considered necessary). No caves were found on or near the site. There are also small mountains present ~18 km to the north, which may also have potential for caves and small bat colonies, but no caves have been reported nearby from other studies.

Three sites were selected for short-term passive acoustic activity monitoring to ascertain if bats were using these habitats for roosting sites. This was necessary as the habitats could not be adequately surveyed using visual inspections due to deep cracks or inaccessible spaced between rocks and boulders. Bat detectors and microphones were deployed at ground level (~ 1 m high) for at least 2 nights close to the potential roost habitat. Recordings were identified and plotted against time to determine if activity patterns indicated resident bats using the features as roosts, such as a spike in activity at dusk and dawn when bats emerge or retreat to their roosts.

2.4 DATA ANALYSES

2.4.1 Passive Bat Detectors

The sound files recorded by the bat detectors (song meters) were processed using Kaleidoscope Pro v5.4.0 (www.wildlifeacoustics.com). Recordings for all bat detectors were analysed in a single batch, by running the auto-id analysis in Kaleidoscope Pro. The auto-id feature (using the Bats of South Africa v5.4.0 library) provides an identification for each call pulse, which can be useful to help identify bat species, but is unsatisfactory due to the absence of a comprehensive bat call library (the classifier only includes 19 bat species in the subregion) and occasional misclassification of species result due to limited training data and variety of noise recordings. The results here are only used as a rapid analysis for the purpose of this scoping report and will be done more thoroughly in the final report. This is because the full analysis is very time consuming and would have need to be repeated once all the data were available. Only species or representative genera expected in the project area were included in the auto-id analysis to reduce misclassification. The signal parameters in Kaleidoscope were left as default for the auto-id analysis:

- Minimum Frequency Range: 8kHz
- Maximum Frequency Range: 120kHz
- Minimum Length of Detected Pulses: 2 ms
- Maximum Length of Detected Pulses: 500 ms
- Maximum inter-syllable gap: 500 ms
- Minimum number of pulses: 2

The recording times for each hour were calculated according to the dawn and dusk times of the location and date where the bat detector was deployed and used to correct the number of passes for hours that were less than 60 min in duration (MacEwan *et al*., 2020b). The mean and median bp/h were calculated in two ways, one to show the hourly activity patterns only, and the other as the standardised bp/h over each night (as per MacEwan *et al*., 2020b). The former simply used the corrected number bp/h, in combination with either the species or the bat detector id, to calculate the median and average bat passes, and was only used to display patterns at hourly intervals through the night. The latter calculation took the total number of bat passes per night, divided this by the time recorded for that night (in hours), and finally the median and mean number of bat passes were then calculated from all the nights combined (in combination with the other variables e.g. month, season, species, bat detector, height) and this was used as the standardised measure for bat activity. Environmental variables correlates were calculated as averages for temperature and wind speed, where recordings were taken from more than one meteorological mast.

2.4.2 Active Transects

All sound files recorded during transects were analysed using the auto-id feature in Kaleidoscope Pro v5.4.0 with the same parameters defined for the passive recordings. However, this auto-identification feature of bat calls was found to be unreliable due to high levels of background noise created by wind and the vehicle. Furthermore, the small sample size precludes the use of a basic cluster analysis and thus all potential calls (and noise files) from bats were manually investigated and identified in Kaleidoscope. Recordings with at 2 or 3 individuals of bats calling were duplicated to better represent bat activity. All identified bat passes were then matched to their respective GPS timestamp to obtain a geographic coordinate to allow spatial mapping of each bat pass. In addition, the survey effort was calculated from the GPX tracks by taking the sum of the inverse of the average speed (m/s) per transect within hexagonal grid cells (diameter ~ 550 m), correcting for the speed driven due to differences in terrain, gate opening etc. The bat passes per unit effort (BPUE) was calculated for each hexagonal grid cell in total and for each season, dividing the total bat passes by the survey effort. Seasonal and total corrected bat activity was plotted to highlight any seasonal activity trends. Comparisons between general habitats present in the PA (vegetated watercourse, rocky habitats and hills/ridges) were made by intersecting the hexagonal grid cells and their BPUEs and calculating these averages across seasons.

2.4.3 Sensitive Habitat Delineation

Acoustic surveys (both passive and active) and roost survey results were consulted to determine which habitats could be considered sensitive for WEF development regarding bats, for either roosting or foraging activity. Pans and waterbodies are known to attract bats, especially in dry regions, and these features were delineated and marked as sensitive irrespective of the acoustic data because these features are too small to correlate with bat activity.

Sensitive bat habitats were delineated using information from site visits, satellite imagery and watercourse delineations from the aquatic specialist (who used ALOS PALSAR DEM, NBA 2018 and manual delineation from site visits).

3 RESULTS

3.1 BASIC HABITAT DESCRIPTION

The following major habitat features were delineated and given the appropriate buffer (as per the guidelines: MacEwan *et al*., 2020b).

3.1.1 Quartz hills and ridges

These are the most prominent habitat features within the PA, comprising hills and ridges of varied sizes and often an exposed solid quartz outcrop at the crest. The slopes are typically gentle and are strewn with medium to small quartz rocks and pebbles, often with an expansive flat base made up of small quartz pebbles and few plants. This habitat is easy to distinguish using satellite imagery due to the lighter ('white') colouration of the quartz rocks, which contrasts with the redder sands in the lowlands, and the change in elevation associated with the hills. However, eroded quartz hills may be flat and begin to mix with other substrate. These areas were excluded from the habitat delineation as the structure of the habitat is no longer present. No buffer was given to this habitat to assess bat activity, due to the expansive area that the bases covered. Bat activity does not indicate that these general habitat features require buffering in terms of habitat sensitivity (see below).

3.1.2 Brown bedrock

Exposed bedrock is present within parts of the PA, with a brown colouration and igneous properties, often showing advanced stages of weathering. These rocks are not associated with hills in the PA, but may form some small koppies where boulders are stacked. This habitat is difficult to distinguish using satellite imagery, as it is similar in colour to the surrounding landscape and because exposed bedrock can also occur in flat expanses which lack the structural components assigned to this habitat. Extensive surveys of the rocks were undertaken to identify areas that possess potential cracks and crevices suitable for bat roosting sites and these delineations were used to define this habitat. The habitat was buffered by 200 m for the purposes of assessing bat activity associated with this habitat. However, because bats were shown to roost in this habitat a buffer 500 m should be applied (MacEwan *et al*., 2020b).

3.1.3 Dolerite koppies

These rocky features are immediately recognisable by the black colouration of the dolerite boulders. They consist of large piles, outcrops or even large conical hills consisting of large stacked boulders. Some areas have boulders with a browner colouration, but the boulders are similar, which are large and rounded, and often with expansive cavities between the boulders that extend into the centre of the feature. While these outcrops are easily recognised in satellite imagery from their dark colouration, site verification was also necessary as some areas have boulders embedded in the substrate, rather than forming deep cavities when boulders are stacked in a large pile. These outcrops (with cavities) were buffered by 200 m for the purposes of assessing bat activity associated with this habitat. Because bats (*Rhinolophus damarensis*) were shown to have roost in this habitat they should be buffered by 500 m (MacEwan *et al*., 2020b).

3.1.4 Vegetated watercourses

Watercourses often form an important habitat feature for bats, which use them for movement corridors as well as foraging areas as the lush vegetation and water often associated with these areas increases the insect abundance and therefore the foraging potential for bats.

Dense vegetation was calculated using a median NDVI value from Sentinel 2 imagery (between July 2017- July 2022). The median was taken due to the pronounced effect of patchy and isolated rainfall events on vegetation growth, and low NDVI values over the dry seasons. The NDVI values were manually inspected against Google satellite imagery to select cut-off values to indicate a high density of vegetation, and cells with values above 0.121 were reclassified into a high NDVI category. A Sieve filter (threshold: 10; 8-connectedness: true) was performed on the output raster to remove small slivers and spots of dense vegetation and this resulting raster was then vectorised.

Watercourses, as delineated by the aquatic ecologist, were utilised to delineate potential foraging habitat for bats by clipping all dense vegetation (calculated above) within a 500 m buffer of the watercourses. This dense riparian vegetation was then buffered by 200 m. We chose a relatively wide buffer of the watercourse to select riparian associated vegetation because the drainage line vegetation was sometimes indistinct within the PA, and this reduced the potential for watercourses that may have been overlooked or too small for delineation. All other watercourses between sections of dense vegetation were considered as potential flyways and buffered by 200 m, and combined together and formed part of the vegetated watercourses habitat feature. Watercourses with no dense vegetation in their upper catchments were not included or buffered.

3.1.5 Minor habitat types

Additional 'micro' habitats were also delineated and buffered for sensitivity accordingly. These included the following:

- Confirmed or likely bat roosts (500 m buffer – small bat roosts);
- Dams likely to have surface water (200 m buffer);
- Building infrastructure likely to have roosting potential (200 m buffer);
- Exposed bedrock and pans likely to have surface water (200 m buffer);

and Tree clumps likely to be associated with foraging activity (200 m buffer).

3.2 LITERATURE REVIEW

3.2.1 Previous Studies in the Region:

All nearby existing and proposed WEFs were searched for online to find additional data regarding important bat findings that might be of importance to the proposed De Rust WEF. Some EIA reports and bat specialist reports were available online and these are reported on below, but despite requesting additional reports from SABAA, bat appendices and some additional reports were not available (e.g. Namies WEF).

3.2.1.1 Kangnas WEF

Constructed and operational. The bat specialist study as included in the EIAr (Aurecon, 2012) noted the following:

- One species was confirmed in the study area (*Tadarida aegyptiaca*) and additional recordings were tentatively identified as *Cistugo seabrae*.
- Two caves located in the study area, to the north of the turbines, in the rocky inselberg small mountains about 30 km to the west of the current study site, bat roosting was confirmed by the presence of bat guano (Figure 3-1).
- Potential impact of the proposed WEF on bats of low significance without mitigation.

The interim status report (Bio^3 & Savannah Environmental, 2013) reported the following:

- Site is homogenous, no distinct biotopes could be assessed.
- No bat echolocations could be identified to species-level, but the following families and genera were likely present based on the recordings: Molossidae, Verpertilionidae and Miniopteridae. A possible echolocation of *Vansonia rueppellii* was recorded. No sonograms or spectrograms for these calls were provided in the report for external review.
- Bats are expected to be most abundant in spring and summer due to greater availability of food at higher temperatures, but no trends were observed from the limited (2 months) passive bat acoustic monitoring results.

Further monitoring needed to determine areas of high risk for bat collisions.

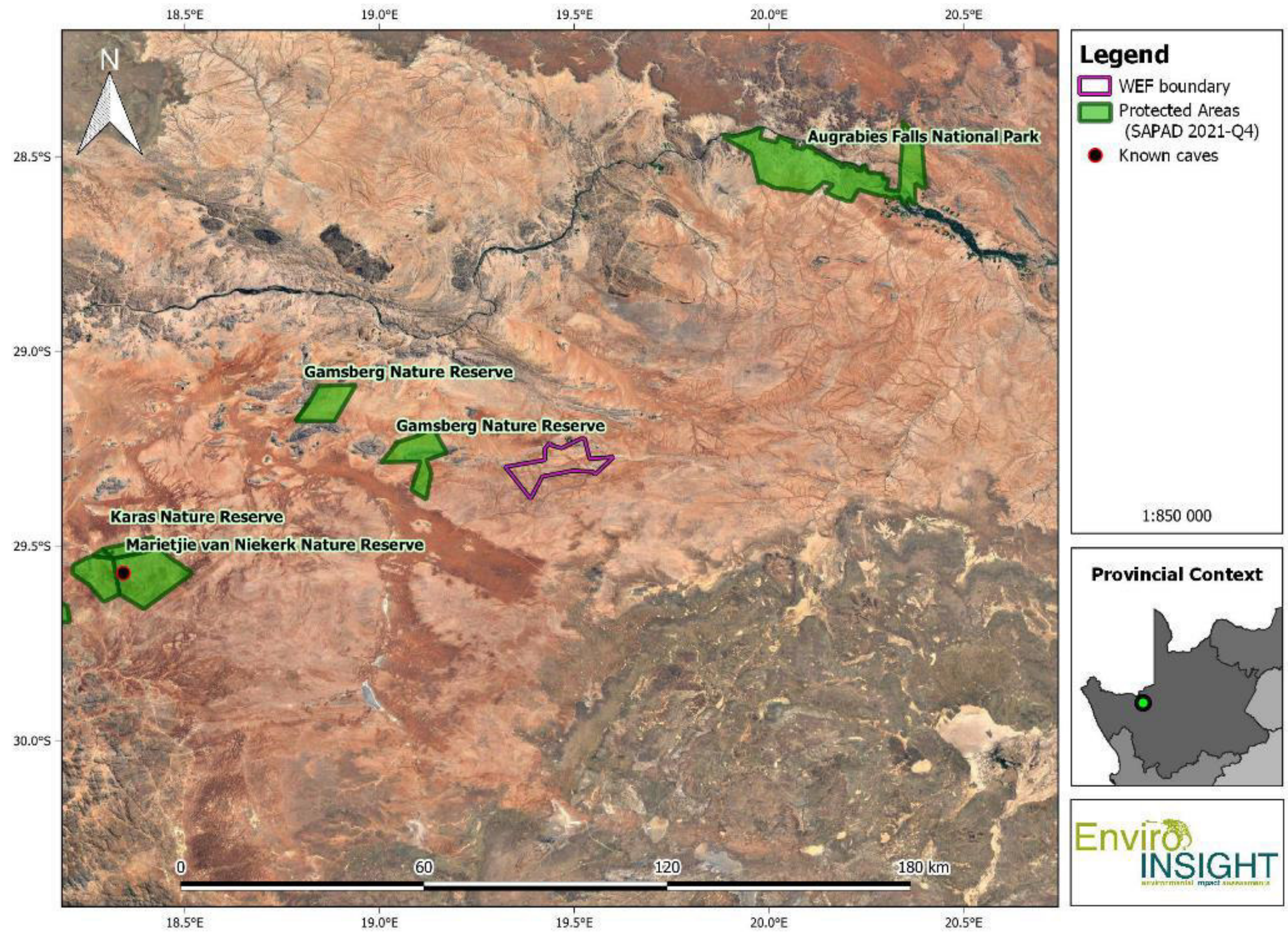

Figure 3-1: Location of protected areas and known caves in relation to the proposed De Rust WEF boundary.

3.2.1.2 Korana WEF:

To be constructed. The bat specialist study summarised in the EIAr (Savannah Environmental, 2015a) and Bat Impact Assessment Amendment (Stephanie Dippenaar Consulting, 2019a) noted the following:

- Bat species detected included *Eptesicus hottentotus*, *Laephotis capensis*, *Miniopterus natalensis* and *T. aegyptiaca. Tadarida aegyptiaca* being the most abundant species.
- Bat activity was low over the winter season, and peaked in January.
- Bat activity was greater in the early evening, just after sunset, with a second peak around 02:00 – 04:00 am.
- Bat roosts buffered by 300 or 500 m and no turbines should enter these buffers.

3.2.1.3 Khai-Ma WEF:

To be constructed. The bat specialist study summarised in the EIAr (Savannah Environmental, 2015b) and Bat Impact Assessment Amendment (Stephanie Dippenaar Consulting, 2019b) noted the following:

- Outcrops and inselberg on the perimeter of the site is suitable for bat roosting
- Potential for migrants of *Eidolon helvum* foraging in fruit trees of farmers.
- Bat species recorded by passive bat detectors predominantly *E. hottentotus*, *L. capensis* and *T. aegyptiaca. Miniopterus natalensis* was also detected with a low abundance.
- Bat activity not strongly associated with specific parts of the site.
- Bat activity was greater closer to the ground than at rotor sweep height.
- 'Moderate' level of bat activity (specialist experience).
- Highest activity in summer, with very little activity during other season except at one location where roosts were in close proximity.
- Bat activity was mostly concentrated in the early evening.
- Following design modifications and implementation of mitigation measures allow for acceptable risk to bats.

3.2.1.4 Poortjies WEF

To be constructed. The bat specialist study summarised in the EIAr (Savannah Environmental, 2015c) noted the following:

- Most abundant bat species detected included *E. hottentotus*, *L. capensis* and *T.aegyptiaca. Miniopterus natalensis* was also detected with a low abundance.
- No evidence for migration of *M. natalensis* through the study site was detected over the 12-month monitoring period.
- Bat roosts limited to farm steads, rocky outcrops in nearby inselbergs and large (alien) trees.

No data were reported on in the Amendment Report (Camissa, 2021).

3.2.1.5 Sol Invictus Overhead Powerline

A desktop study for an overhead powerline connecting the Sol Invictus Photo Voltaic Solar Energy Facility. The bat impact assessment (Inkululeko Wildlife Services, 2021) noted that *L. capensis* and *T. aegyptiaca* are likely to be common, and that *E. hottentotus, M. natalensis, S. petrophilus* and *N. thebaica* may also be present in the area. No fieldwork was done to confirm these predictions. No nearby caves or significant roosts were reportedly known from the nearby area. Seasonal watercourses, all surface water and ephemeral watercourses were considered as sensitive areas for bat foraging.

3.2.1.6 Paulputs WEF

To be constructed. The bat specialist study (Arcus Consulting, 2019) noted the following:

- *Tadarida aegyptiaca* was the most common bat species by far, followed by *E. hottentotus* and *S. petrophilus*. *Laephotis capensis* were relatively uncommon in comparison and *M. natalensis*, and *Rhinolophus* spp. were rare.
- Bat activity was greater closer to the ground;
- Trees and shrubs and proximity to wetlands are associated with higher bat activity at one of the bat detectors;
- Curtailment parameters proposed for specific high activity months (if fatality threshold exceeded) for warm temperature, low wind speeds and specific relative humidity parameters.
- Low to moderate bat activity overall, but with high or very high activity in February, August and October. Bat fatality is predicted to be of high significance before mitigation and medium after mitigation.
- Outcrops and inselberg on the perimeter have moderate roosting potential, but no roosting bats were confirmed.

3.2.2 Expected Species

Based on Monadjem *et al.* (2020), the ACR (2021) and previous surveys conducted for WEFs in the region (Table 2-1), 13 bat species could potentially occur on the PA (Table 3-1). However, only 10 species are considered to have a medium to high probability of occurrence given their roost requirements and known distribution, all of which are classified as Least Concern by the IUCN and not of conservation importance, with the exception of *C. seabrae* which is poorly known (few locations) and was previously considered to be Vulnerable (but is now Least Concern). The likely risk of fatality from turbines is high for the open-air foragers (*Sauromys petrophilus* & *T. aegyptiaca*), medium / high for clutter-edge foragers (*E. hottentotus, L. capensis* & *M. natalensis*) and low for the clutter foragers and species with restricted ranges (remaining spp.). Roosting requirements for species requiring caves, rocky outcrops and large trees are absent from the PA and only species known to utilise man-made infrastructure, such as buildings and walls are likely to roost in the area, including: *Cistugo seabrae*, *L. capensis*, *Nycteris thebaica, Rhinolophus clivosus* and *T. aegyptiaca*.

Table 3-1: Bat species that could potential occur on the proposed De Rust WEF Project Area. Bold fields indicate noteworthy or unique categories. Species of conservation concern are highlighted in red. Med: Medium.

Taxon name	Common name	Likelihood of Occurrence	Closest records (ACR 2021)	CI [3]	Conservation Status [4]	Risk of Impact [5]	Echolocate?	Foraging habits	Day roosting habits and migrations.
Cistugo seabrae	Seabra's wing-gland bat	**Med**	100 km	**1**	LC	Low	Y	Clutter-edge	Unknown, may roost in buildings. Migration unknown
Eidolon helvum	Straw-coloured Fruit-bat	Low	200 km		**NT**	High	**N**	Frugivore	Trees. Migratory
Eptesicus hottentotus	Long-tailed serotine	**Med**	200 km		LC	Med	Y	Clutter-edge	Small groups in caves and rock crevices of rocky outcrops. Migration unknown
Laephotis capensis	Cape serotine	**Med**	200 km		LC	High	Y	Clutter-edge	Single or small groups in trees, aloe leaves and in the rooves of houses. No migration
Miniopterus natalensis	Natal longfingered bat	Low	300 km		LC	High	Y	Clutter-edge	Cave dependent, high cavities in cave ceiling. Late winter/spring to warmer maternity roosts and back at summers end
Myotis tricolor	Temminck's myotis	**Med**	200 km		LC	Med - High	Y	Clutter-edge	Gregarious, vertical crevices in caves. Summer maternity roosts
Nycteris thebaica	Egyptian slit-faced bat	**High**	50 km		LC	Low	**N** [6]	Clutter	Caves, aardvark burrows, road culverts, large tree trunks and buildings. No migration
Rhinolophus capensis	Cape horseshoe bat	Low	200 km	**1**	LC	Low	Y	Clutter	Gregarious, caves and mine adits, free-hanging from ceiling deep in darkness. No migration
Rhinolophus clivosus	Geoffroy's horseshoe bat	**High**	50 km		LC	Low	Y	Clutter	Gregarious, caves and mine adits, free-hanging from ceiling deep in darkness as well as dark spaces in buildings. No migration
Rhinolophus damarensis	Damara horseshoe bat	**High**	50 km		LC	Low	Y	Clutter	Medium sized colonies in caves and mine adits, and singly or smaller groups in culverts and boulder pile cavities. No migration
Sauromys petrophilus	Robert's flat-headed bat	**High**	100 km		LC	High	Y	Open-air	Small groups in narrow rocky crevices, including boulders at ground level, and under exfoliating rocks. No migration
Tadarida aegyptiaca	Egyptian free-tailed bat	**Med**	200 km		LC	High	Y	Open-air	Small to medium-sized groups in horizontal rock crevices, caves, bark and hollows of trees and buildings (especially roofs). Maternity colonies occupied from November, but migrations not documented
Vansonia rueppellii	Rüppell's bat	**Med**	200 km		LC	Med - High	Y	Clutter-edge	Unknown, possibly associated with trees. Migration unknown

[3] Conservation Importance: includes threatened, rare or range-restricted species (MacEwan *et al.*, 2020a)
[4] LC: Least Concern; NT: Near-Threatened
[5] The likelihood of fatalities from turbines due to broad ecological traits, excluding migration (MacEwan *et al.*, 2020b)
[6] Does echolocate, but not for foraging where it listens for sounds produced by insects

The nearby Gamsberg Nature Reserve is divided into two areas and is located 15 km to the west and 45 km to the west-north-west, Augrabies Falls National Park is located 85 km to the north-east of the proposed WEF, and Kara and Marietjie van Niekerk Nature Reserve to the west-south-west of the proposed WEF (Figure 3-1).

3.3 ACOUSTIC BAT MONITORING

3.3.1 Passive Acoustic Monitoring

3.3.1.1 Overview

Nine static bat detectors were deployed for the pre-construction monitoring, three with microphones at 10 m and three bat detectors for each meteorological mast, each including microphones at 10 m, 65 m, and 110 m respectively (Table 2-3). The bat detectors were deployed for a total of 2143 days and recorded data for a total of 25 986 hours and captured 127 495 bat passes (Figure 3-2). However, because B3 was removed and no longer required for the WEF area, the acoustic coverage was calculated without this detector as This represents an average of approximately 84 % acoustic coverage across the current monitoring period, which is above the minimum requirements of 75 %.

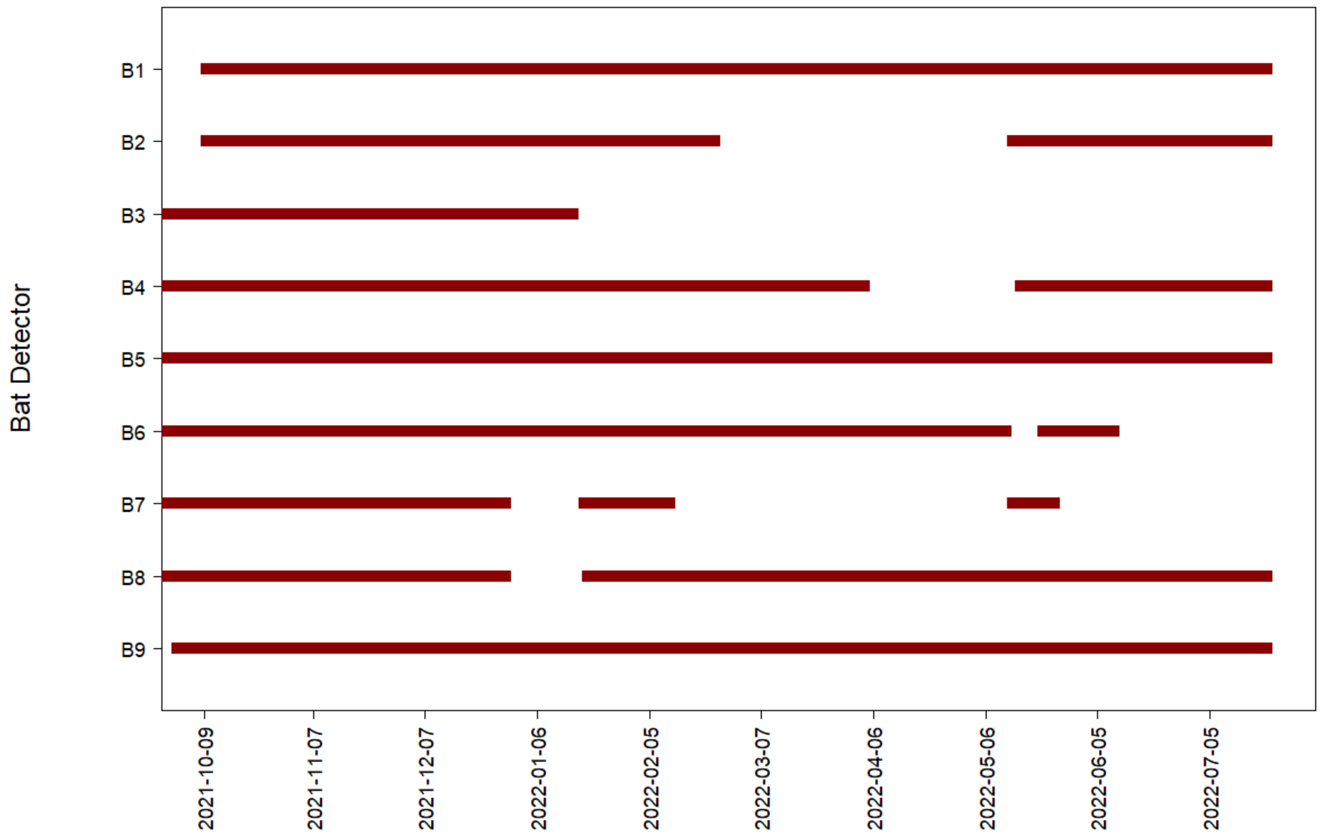

Figure 3-2: Recording times for the nine bat detectors deployed at De Rust WEF (solid red lines indicate periods that were recorded). B1-4 & 7 had microphones at 10 m, B5 & 8 at 65 m and B6 & 9 at 110 m.

Standardised measures of bat activity across the entire monitoring period indicate that the PA has an overall **Medium** level of fatality risk from turbines at near-ground level (10 m), according the Nama Karoo Ecoregion thresholds (MacEwan et al., 2020b) within which the PA is situated, with a median nightly value of 0.60 bp/hr and average of 6.64 bp/hr. At 65 m there is a **High** level of fatality risk from turbines, with median nightly value of 0.73 bp/hr and average of 3.95 bp/hr. At 110 m there is a **High** level of fatality risk from turbines, with median nightly value of 0.46 bp/hr and average of 2.18 bp/hr. The higher average values indicate that there are large spikes of activity, and these periods are likely to result in high numbers of fatalities without suitable mitigation.

Nightly bat activity started off low in October 2021, and began to increase in mid-December and reached the highest activity at the start of February 2022, and high activity was maintained until mid-March after which a moderate level of bat activity persisted until June before dropping back down to similar values recorded in October 2021. A few notable activity spikes were detected across all recording data, taking place in Summer and Autumn only, with large spikes (>40 bp/h) taking place on 1, 4, 16, 22 February 2022, 6 & 27 March 2022 and smaller spikes (>5 bp/h) on 19 December 2021., 8, 15, 19 January 2022, 12 & 17 April 2022, and 12,& 25 May 2022.

Five potential bat species were recorded during the passive acoustic monitoring, *L. capensis*, *M. natalensis* and *T. aegyptiaca* were identified with certainty, while *E. hottentotus* and *S. petrophilus* were only tentatively identified. The majority of bat activity was represented by *T. aegyptiaca* and/or *S. petrophilus* (Table 3-3), open-air foragers, and few clutter-edge foragers and very few clutter-foragers, as can be expected from the low vegetation and the flat terrain where the masts were erected. Bat activity at ground level was highest at meteorological mast 2 (B7-9; median of 1.24 bp/h) and was roughly comparable between the other bat detectors (0.38-0.59 bp/h; Table 3-2). Although recorders at meteorological mast 2 had more downtime during periods of low bat activity and will be biased toward higher values, the activity was still higher than other detectors at ground level during periods where all detectors were recording (Figure 3-6).

No signs of large bat roosts were detected from patterns in the passive acoustic data, and while there is some evidence for bats using the watercourses as foraging routes, most of the activity is spread out temporally. There was no evidence of bat migrations, but large and regular activity spikes of *T. aegyptiaca* and/or *S. petrophilus* during summer and autumn suggest that these open-air foragers are foraging widely during these seasons and appear to congregate on isolated nights.

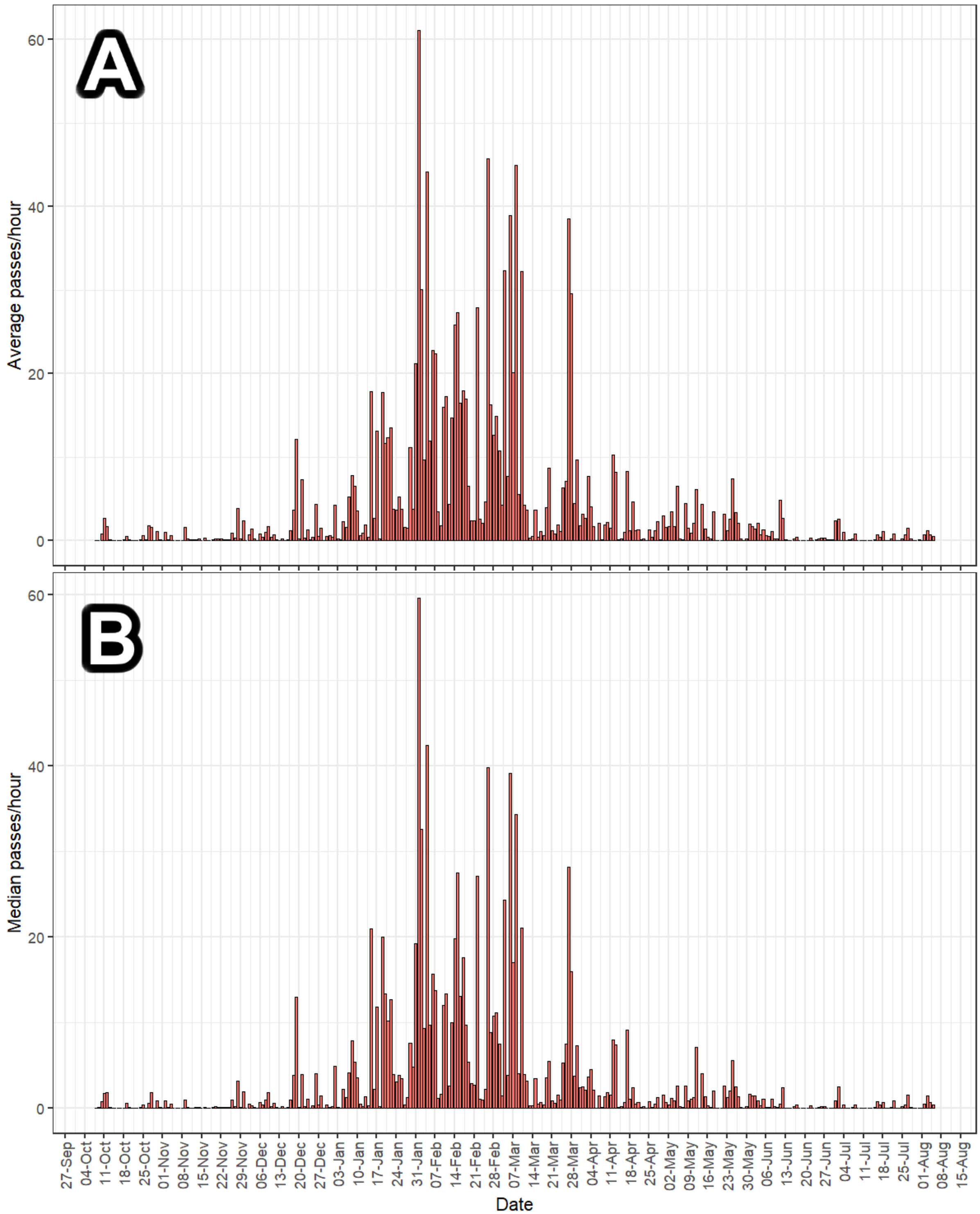

Figure 3-3: Combined median and average nightly bat passes/hour for all bat detectors. A] average passes/hour B] median passes/hour.

3.3.1.2 Passes by Bat Detector

3.3.1.2.1 Hourly

Hourly activity is only depicted as an average because the median values were mostly zero at this fine temporal resolution. Bat activity steadily increased from sunset and reaches a plateau (21:00 - 03:00), decreasing dramatically by 04:00, with almost no activity thereafter (Figure 3-4).

B2, B4 and B7 show the greatest amount of bat activity, the latter two bat detectors were positioned on meteorological masts with their microphones situated at 10 m, indicating more activity closer to the ground. However, overall bat activity levels were not dramatically different, with the exception of B3 which was only recording for a short time period. B1, B8 and B9 show a small early evening (21:00) spike in activity, which may indicate a bat roosting site nearby, due to bat activity being high as bats exit their day-time roosts. B1 is positioned in the vicinity of black dolerite outcrops which was demonstrated to be a bat roost for *Rhinolophus* and an important foraging/social feature in section 3.4. B8 and B9 are detectors at height at meteorological mast 2, with B7 being the ground level detector. Interestingly B7 does not show a similar early night peak, but this pattern is not observed in the detectors at meteorological mast 1 (B4-6), so perhaps bats are using meteorological mast 2 for social interactions early in the night, especially if it is positioned close to a foraging flyway.

Across all microphones, bat activity stays consistently high for a prolonged period (21:00-03:00), but then declines, which may indicate that the majority of bats are not roosting nearby if they don’t forage until dawn, similar to the findings at the nearby Botterblom proposed WEF (Enviro-Insight, 2022).

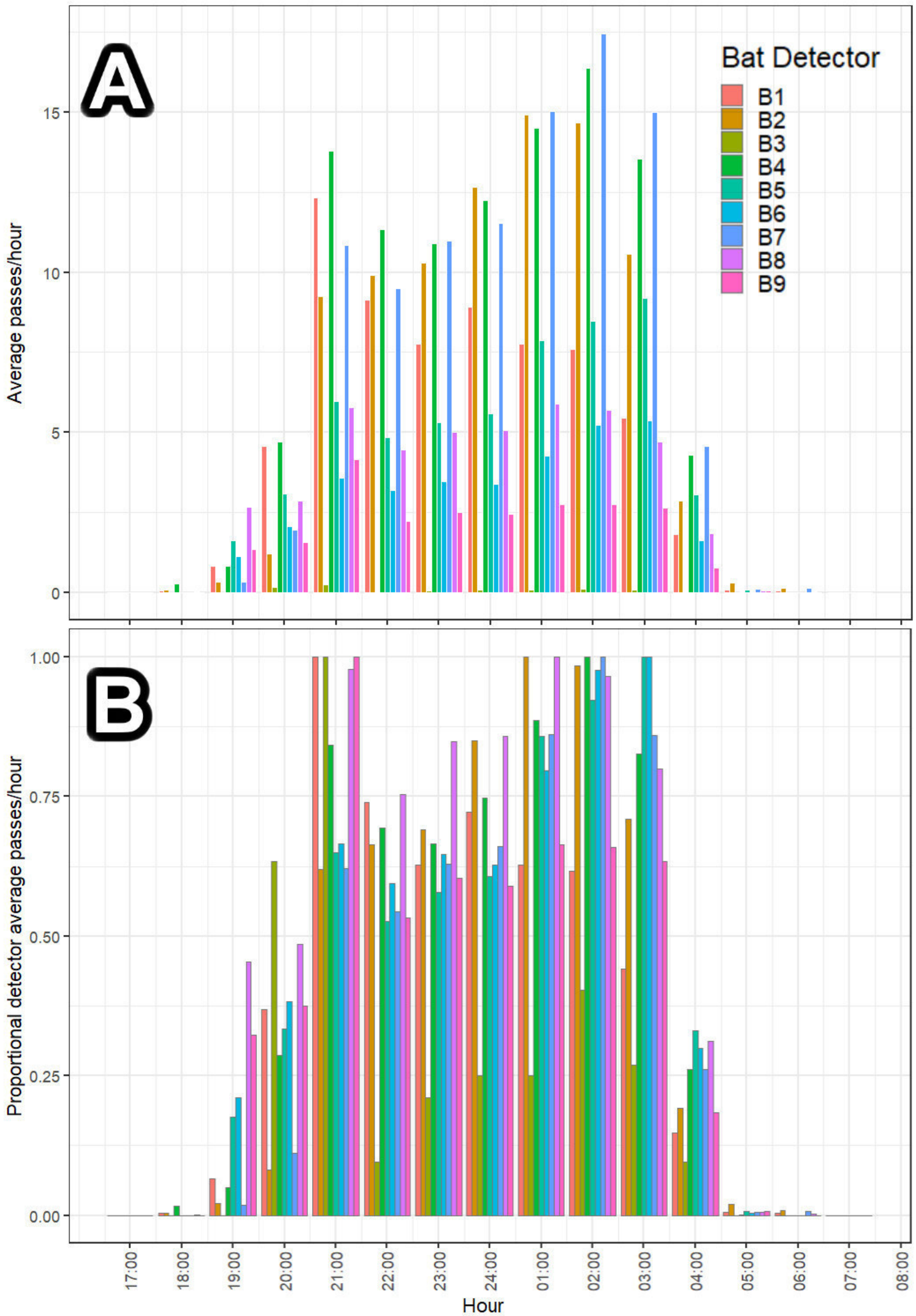

Figure 3-4: Average hourly activity of bats per bat detector. A] average passes/hour B] proportional average passes/hour.

3.3.1.2.2 Yearly

Bat detectors ranged from a median of 0.37 to 1.17 bp/hr over the entire monitoring period (excluding data from B3, see above). Detectors recorded similar median bp/h with B1 recording the highest median values, but average values indicated that B4 and B7 recorded the greatest activity, followed by B2 and B1 (Table 3-2; Figure 3-5). However, detector downtime in B2 and B7 during some of the peak activity period is likely to have resulted in an underestimate for these detectors, and their maximum activity values indicate that bat activity was likely higher at these sites than the others. Detectors B5-6 and B8-9 had microphones at height and these are discussed in section 3.3.1.4.

Table 3-2: Bat detector recording time and bat pass summary.

Bat detector	Microphone Height (m)	Summed bat passes	Time recorded (hours)	Overall median bp/hr	Overall average bp/hr
B1 - S4U10652	10	19065	3413.54	0.93	5.37
B2 - S4U10667	10	23838	2554.19	1.17	9.04
B3 - S4U10678	10	167	1542.21	0.00	0.11
B4 - S4U11304	10	26751	3171.20	0.82	8.21
B5 - S4U11290	65	16311	3589.69	0.76	4.36
B6 - S4U11361	110	8269	3093.63	0.63	2.62
B7 - S4U11265	10	14391	1771.48	0.70	8.16
B8 - S4U11356	65	12065	3336.10	0.60	3.51
B9 - S4U11341	110	6638	3514.54	0.37	1.81

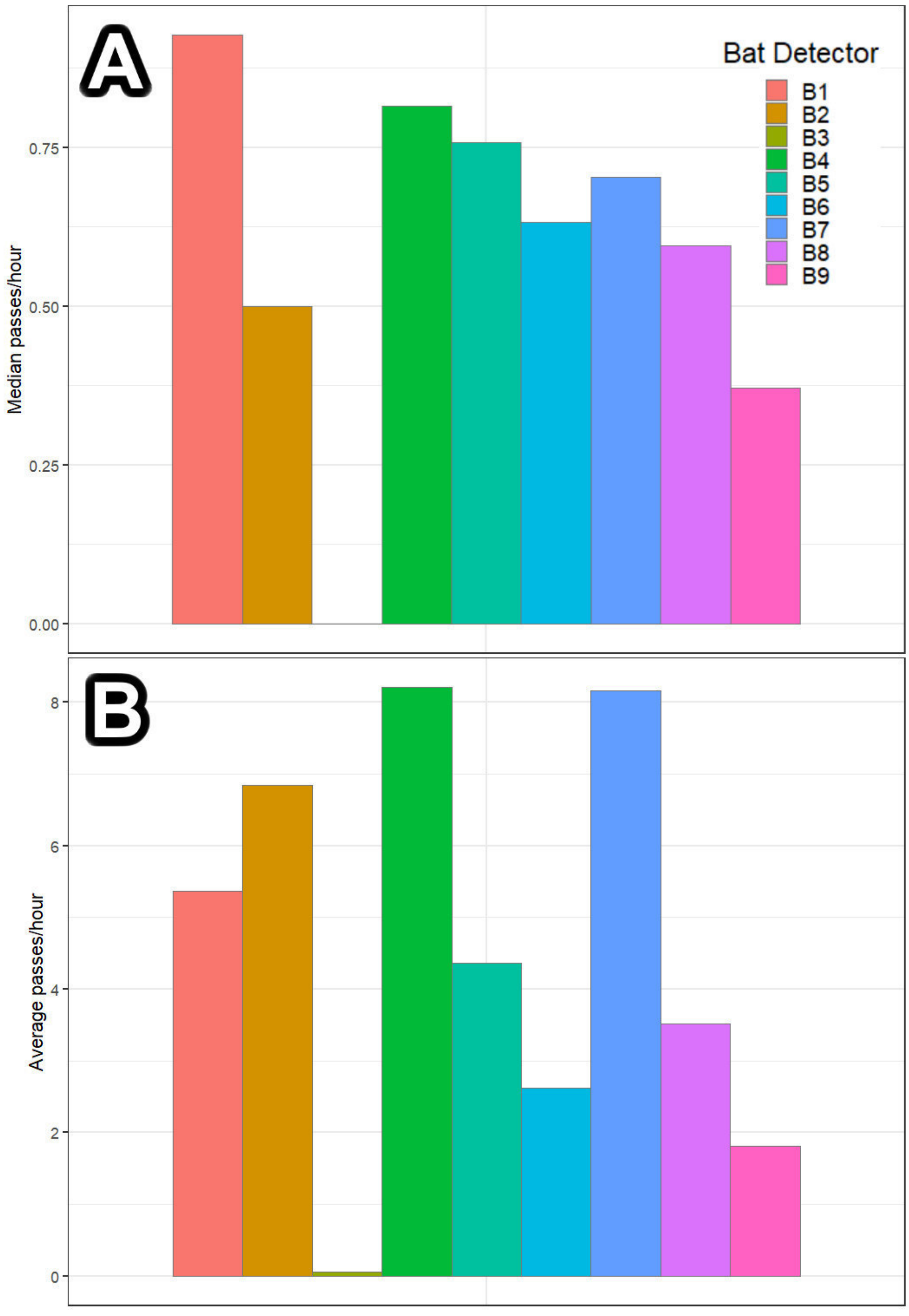

Figure 3-5: Yearly recordings of echolocation calls of bats per bat detector (median calculated from sum per night). A] median passes/hour B] average passes/hour.

Habitat differences between the bat detectors are mostly geomorphological, as vegetation is predominantly sparse and low throughout the PA. However, habitat differences between bat detectors does not appear to have a large effect on bat activity, although this could also be attributed to detectors being placed some distance away from significant habitat features.

Detector B1 was placed in proximity (240 m) to a series of small dolerite koppies and 160 m from a dry watercourse alluvial plain. Both short-term acoustic monitoring at the large dolerite koppies, and active transects indicated that these dolerite koppies are associated with elevated levels of bat activity (as well as roosting for *Rhinolophus* in the former), however, the passive bat detector did not record greater levels of bat activity than the other detectors. This may be due to the detector being placed a short distance away from this habitat. Detector B2 was placed between a well vegetated watercourse (140 m) and the start of a quartz ridge with quartz outcrops on its crest (150 m). This detector recorded slightly higher activity levels in comparison to other near-ground level detectors. This may be due to bats foraging close to the denser vegetation along the nearby watercourse and/or roosting in the nearby quartzite outcrops or even using the orographic uplift associated with these features themselves (O'Mara et al. 2021) or possibly to pursue foraging on dispersing volant insects using these uplifts. Detector B3 was removed shortly after deployment after collapsing and subsequent update of the turbine development area.

Detectors B4-6 were placed on meteorological mast 1, located on a flat open plain with no notable terrain or watercourses nearby. Despite this, activity at B4 was slightly higher than at B1 and comparable to B2. Detectors B5 and B6 also showed slightly higher activity at height than the detectors B8 and B9 on meteorological mast 2. Detectors B7-9 were also situated on a wide flat plain (just outside of the PA), but with very sparse and low vegetation interspersed with small scattered circular depressions with denser vegetation (which appear to be ephemeral water pans) and it is situated at the headwaters of a small dry watercourse.

The lack of a large difference between bat activity at mostly featureless plains and other habitats may have been offset by the large meteorological mast structures being an attractant to bats, potentially because, as the review by Guest et al. (2021) suggests, bats use meteorological masts to mark and seek scents, or use it as a navigation point or landmark for mating, some bats forming aggregations, and thus recording a higher activity of bats than might be expected without the structure. However, without greatly elevated bat activity at these met masts, as recorded at the nearby proposed Red Sands WEF (Enviro-Insight, 2022), it is possible that bat activity is simply more uniform across the PA than anticipated.

3.3.1.2.3 Monthly/Seasonally

Monthly activity is very congruent between bat detectors, showing very low bat activity from October to December 2021, which then increases from mid December 2022 and reaches the annual maximum in early February and March, before decreasing slightly to moderate activity levels for April and May and returning to very low activity for June to July 2022 (Figure 3-7). **Seasonal patterns** of bat activity in the PA are starkly contrasted and follows the same trend between detectors: bat activity increases drastically in late summer and stays high in early autumn before decreasing to very low levels over winter and spring (Figure 3-8).

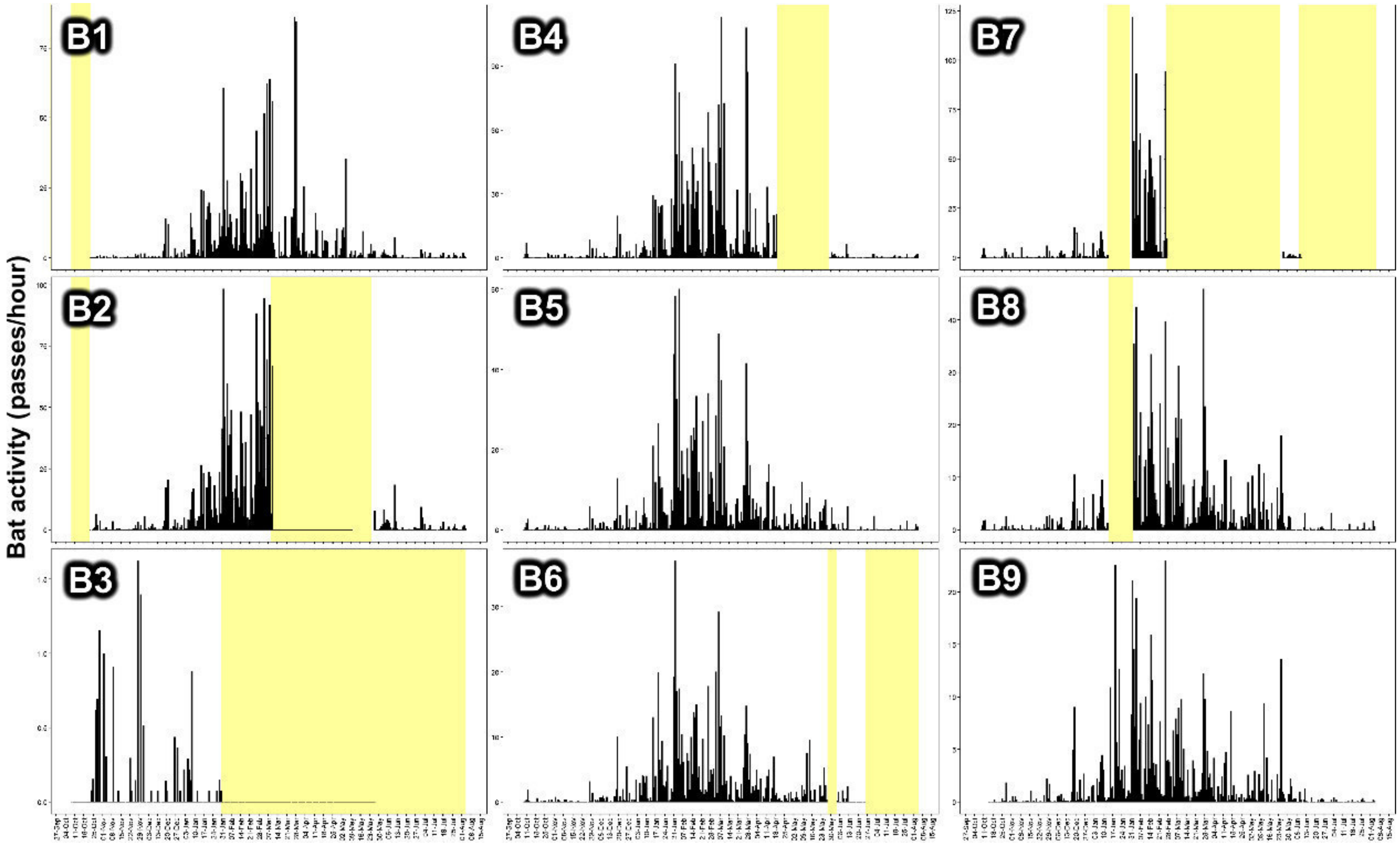

Figure 3-6: Daily activity of all bat species per bat detector and all detectors combined. The scale of bat activity (y-axis) differs between recorders, but the dates (x-axis) are aligned. Yellow shaded areas indicate recorder downtime. Bat activity calculated as the median of the nightly average of passes per hour for each night.

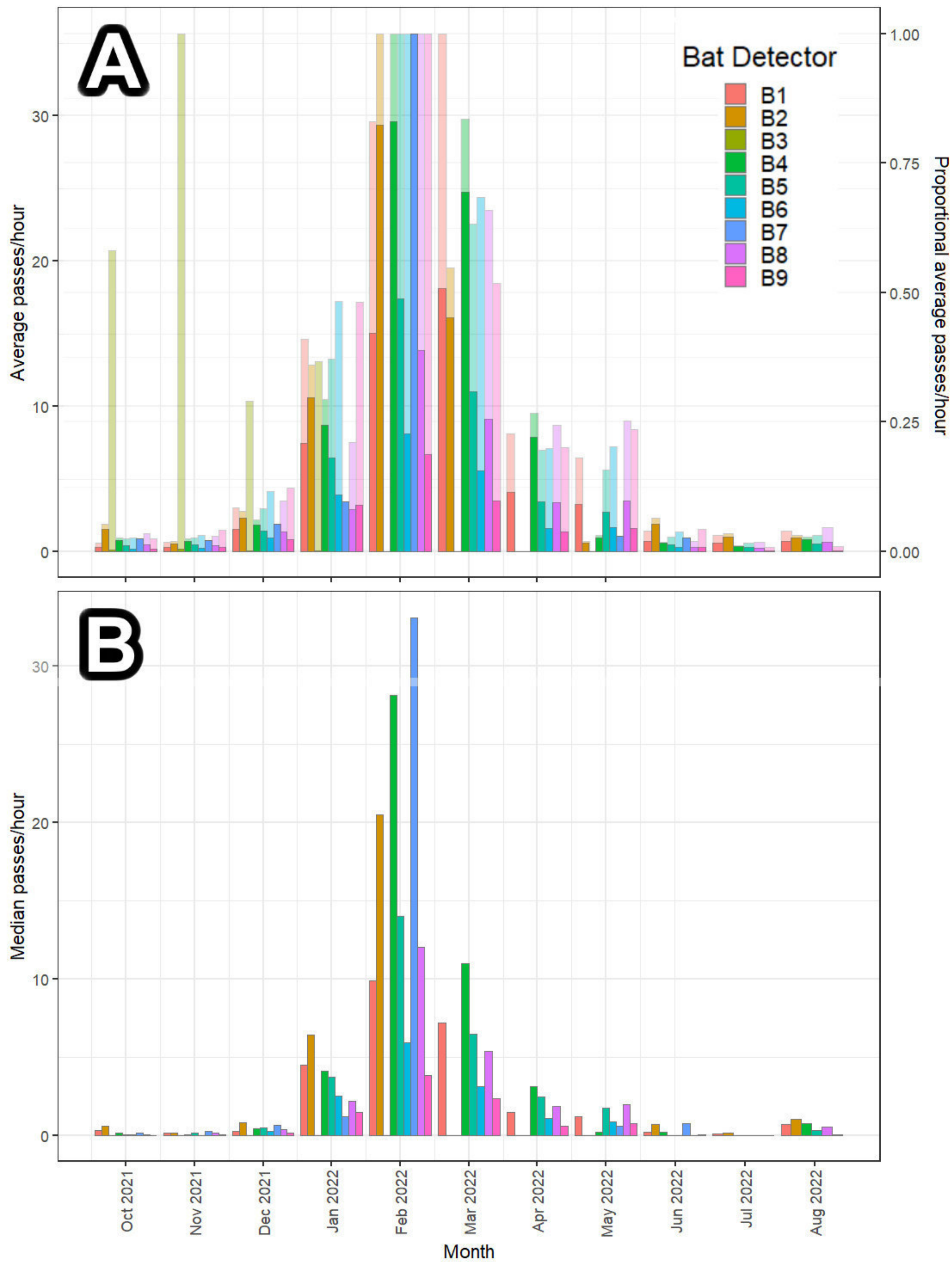

Figure 3-7: Monthly recordings of echolocation calls of bats per bat detector. A] average and proportional average (opaque) passes/hour B] median passes/hour.

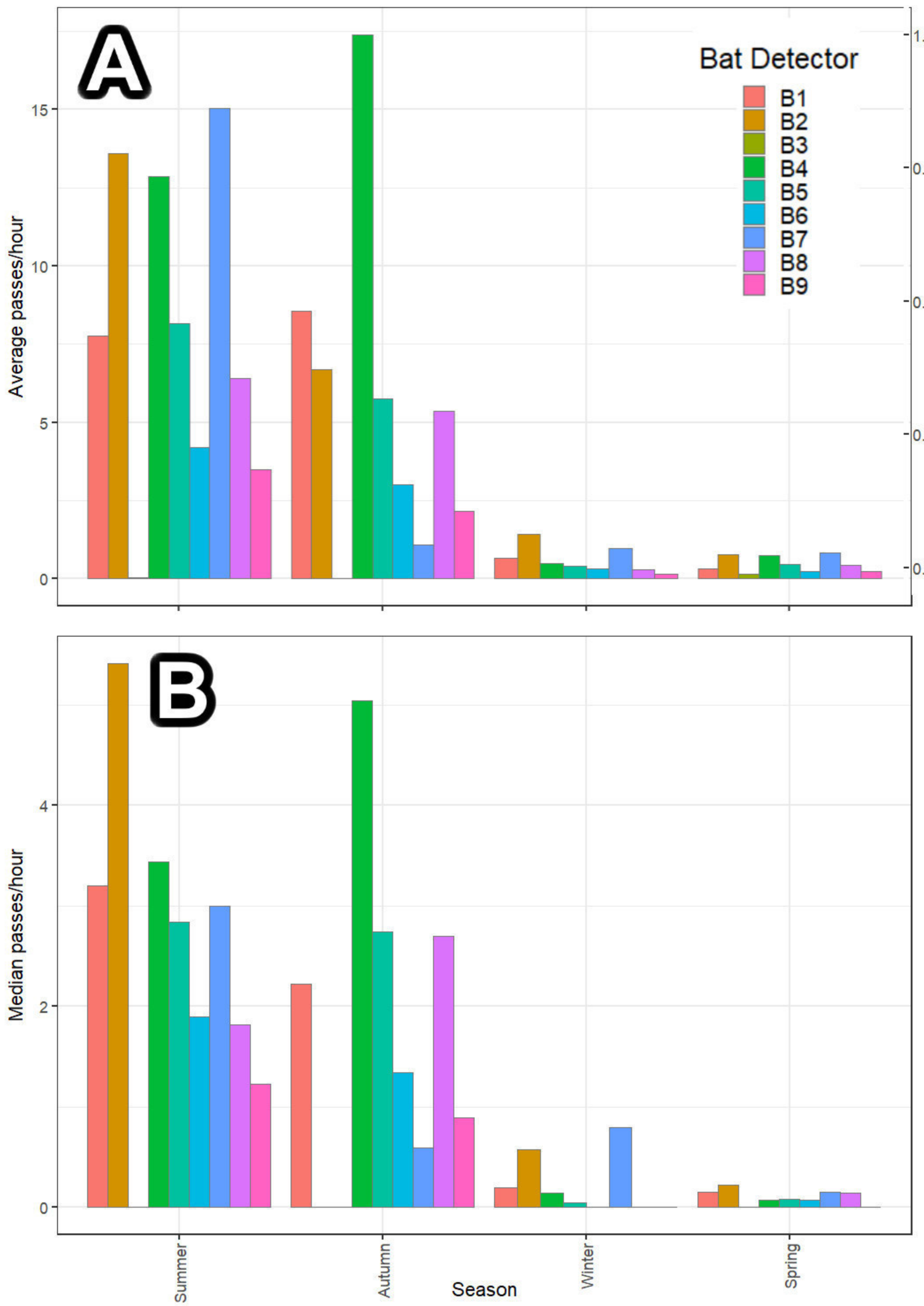

Figure 3-8: Mean seasonal recordings of bats per bat detector (median calculated from sum per night). A] average passes/hour B] median passes/hour.

3.3.1.3 Passes by Species

Calls from potentially five species of bats were recorded and confirmed on the passive bat detectors, namely: *L. capensis*, *E. hottentotus, M. natalensis*, *S. petrophilus* and *T. aegyptiaca*, and *R. damarensis* was only detected during the additional roost acoustic surveys (Figure 3-9).

From the total of 127 495 bat passes recorded during the survey period to date, most passes were identified as *T. aegyptiaca* (83 690), *S. petrophilus* (40 559), *E. hottentotus* (3 092), *M. natalensis* (90), and lastly *L. capensis* (64; Table 3-3; Figure 3-14). All of these species are listed as Least Concern on the IUCN Red Data List and are not regarded as ToPS species. Some species have a high risk of turbine fatality, such as *T. aegyptiaca*, *S. petrophilus* and *M. natalensis,* while *E. hottentotus* is medium risk and *L. capensis* is low risk. Species are at greater risk if they fly within the rotor sweep area (open-air foragers) or are known to migrate. It is clear that the open-air foragers are by far the most abundant bat species in the PA, representing at least 97 % of all bat passes, and this indicates that fatality due to turbines is highly likely to occur due to the foraging behaviour of these species.

The clutter-edge foragers, *L. capensis* and *M. natalensis*, and clutter foraging *R. damarensis*. were recorded in the PA (the later only in short-term acoustic monitoring), but were detected at very low densities. It is likely that most of the habitat in the PA is too dry and vegetation too short for these species to forage effectively, with the clutter-edge forager *M. natalensis* being recorded very infrequently. Furthermore, the lack of caves close to the PA is also likely to limit roosting opportunities for species preferring caves, especially some species of *Rhinolophus*. *Nycteris thebaica* emits low intensity echolocation and thus will not be detected by acoustic monitoring, but has a high likelihood of occurring on site due to suitable roosts (buildings) and nearby roosting individuals found 70 km from the PA (Figure 3-10). Another non-echolocating species known from the region is *Eidolon helvum*, but this species is highly unlikely to be present on site due to the lack of suitable fruit trees for foraging. *Laephotis capensis* was only detected in low numbers in the PA, but is a locally abundant species in other locations in the Northern Cape province. The geographic distribution of this species does appear to have a gap over the dry sandy regions of Namaqualand, with some records along the Orange River to the north (Monadjem *et al.,* 2020) and its low abundances is likely due to the sparse vegetation of the PA. *Cistugo seabrae* was predicted to have a medium likelihood of being present in the PA and was reported from surveys performed at the Kangas WEF (100 km away), but no vocalisations from this survey could be assigned to this species. It is a species worthy of note as one fatality per annum triggers additional mitigation measures for a WEF (MacEwan *et al*., 2020a), but the call is quite distinct and therefore recognisable from the other species recorded and this will be checked during the call identification in the final report.

Table 3-3: Total number of passes per bat species and their conservation status.

Species	Number of passes	Median number of passes/hour	IUCN Red List Status	CITES listed	NEM:BA ToPS	Likely risk of wind turbine fatality	Endemic/other important considerations?
T. aegyptiaca	83690	0.46	LC	No	No	High	No
S. petrophilus	40559	0.08	LC	No	No	High	No
E. hottentotus	3092	0.00	LC	No	No	Medium	No
M. natalensis	90	0.00	LC	No	No	High	No
L. capensis	64	0.00	LC	No	No	Low	No
Total	**127 495**						

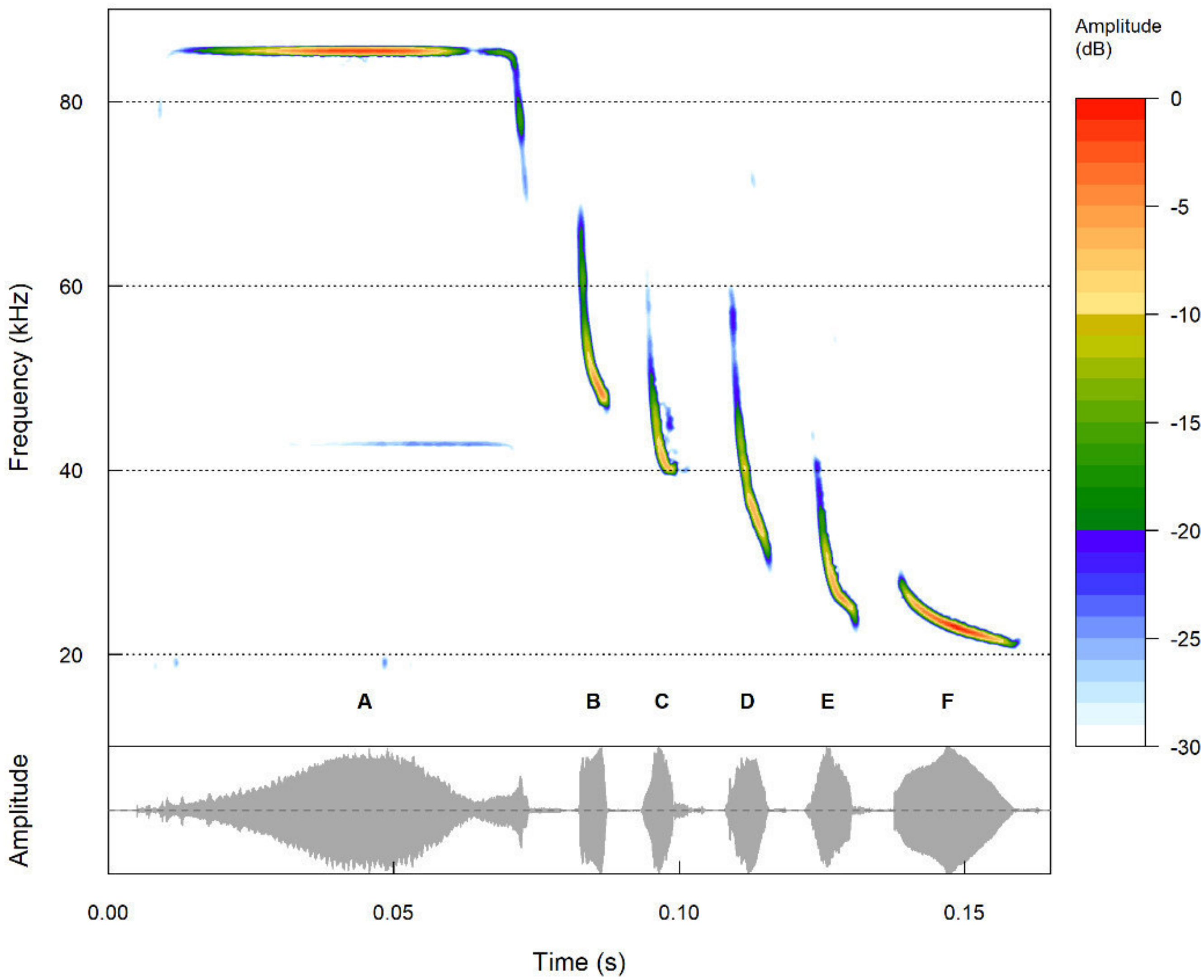

Figure 3-9: Exemplar recordings for each of the six (tentative) bat species recorded during pre-construction monitoring [7]**.**

[7] A: *Rhinolophus damarensis*; B: *Miniopterus natalensis*; C: *Laephotis capensis*; D: *Eptesicus hottentotus*; E: *S. petrophilus*; F: *Tadarida. aegyptiaca*.

Figure 3-10: Photo of a roosting Egyptian Slit-faced Bat (Nycteris thebaica) photographed by a farmer in R4 just outside the PA, with reportedly 5 individuals roosting in the farmstead.

3.3.1.3.1 Hourly

Hourly activity patterns differed between some of the species groups identified (Figure 3-11). *Tadarida aegyptiaca* and *S. petrophilus* were the dominant active species, with *E. hottentotus*. present in low numbers and *M. natalensis* and *L. capensis* with exceptionally low activity levels. Although *R. damarensis* are known to be present in the PAOI (section 3.4.1), none were recorded by the bat detectors (which were never placed directly in cluttered habitats).

The general trend across species is a slow increase in activity from dusk to 21:00 PM, followed by either sustained or diminished activity and a sharp drop-off after 04:00 AM. The open-air foragers, *T. aegyptiaca* and *S. petrophilus,* maintain activity levels later into the night, being most active at 02:00 AM and sharply decreasing activity by 04:00 AM. The clutter-edge foragers, *E. hottentotus, M. natalensis* and *L. capensis* differ by their activity declining earlier in the night, with *M. natalensis* peaking at 12:00 AM, and *E. hottentotus* peaking between 21:00-22:00 AM and decreasing most drastically of the three species thereafter.

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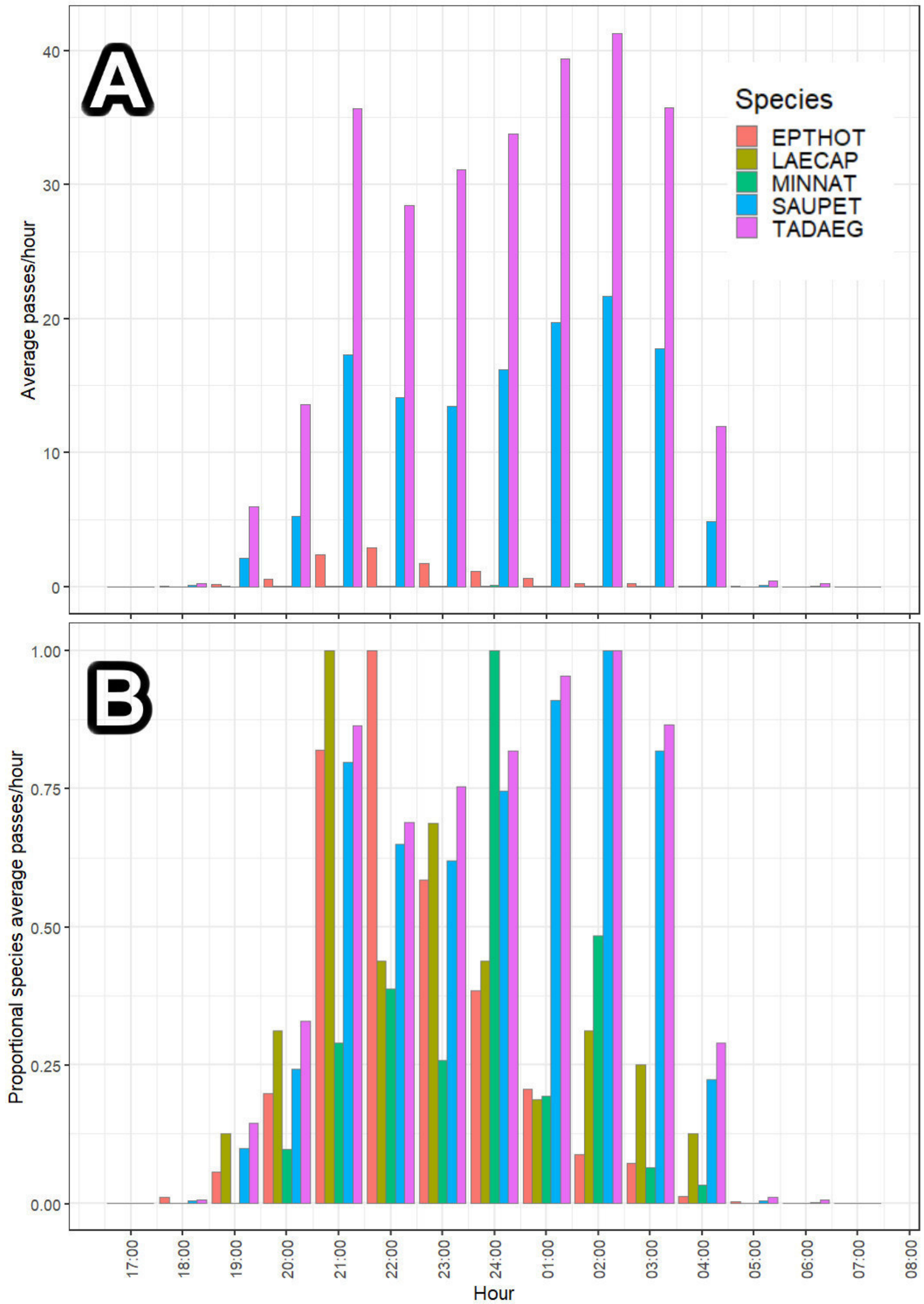

Figure 3-11: Average bat passes per hour at all bat detectors for detected species groups. A] average passes/hour B] proportional average passes/hour[8].

[8] Species acronyms: EPTHOT: *Eptesicus hottentotus*; MINNAT: *Miniopterus natalensis*; SAUPET: *Sauromys petrophilus*; TADAEG: *Tadarida aegyptiaca*

3.3.1.3.2 Monthly/Seasonally

Monthly activity is relatively congruent between bat species, especially in *E. hottentotus*, *S. petrophilus* and *T. aegyptiaca*, with a large peak (~15x higher) in activity from late-summer to early autumn (late January to March 2022) and comparably low levels of activity during the rest of the monitoring period (Figure 3-12). Some differences in seasonal activity were observed for the (locally) rare species: *L. capensis* were more active than other species in October and November 2021 and *M. natalensis* had slightly less concentrated activity from January to March 2022 than other species. Because most of the bat species recorded appear to share the same pattern it seems likely that the peak activity is a feeding response to increased availability of food that is hunted by all these species, such as large eruptions of small volant insects like dipterans, termite alates and certain moth species. These eruptions are seasonal and probably linked to rainfall and temperature (to be investigated further in the final EIA report), and might explain the large regular spikes in bat activity. It seems plausible that a number of non-resident bats are foraging in the PA during the peak season, due to the lack of nearby cave roosts and (expected) low availability of food during the drier seasons, than resident bats just being more active. There are likely to be larger colonies of bats roosting in inselbergs and koppies within a few 100 kilometres of the PA, especially close to the Orange River which probably provides a stable source of food during the dry months. The species *Tadarida brasiliensis* have been observed flying at exceptionally high altitudes and have remarkable capabilities for covering long distances in a short amount of time (Williams *et al.,* 1973), so it is possible that *T. aegyptiaca* shares some of these characteristics and may be searching for erupting volant insects and feeding intensively when these phenomena are encountered, as hypothesised for the nearby Red Sands WEF (Enviro-Insight, 2022).

Tadarida aegyptiaca (the most abundant species) migrates to maternity colonies around November and gives birth in November or December (Monadjem *et al.,* 2020), but activity is relatively low over this time, suggesting that the PA is not sought out for maternal roosts. One possibility is that maternity roosts are only occupied slightly later in this area, and that the peak activity in mid summer is due to mating behaviour, while the peaks in February and March probably indicate the pups becoming volant. However, there was no evidence for maternity roosts during roost inspections. Hibernating bats are known to prefer warm humid roosts in summer, but will move to cool roosts in winter to induce torpor and conserve energy (Monadjem *et al.,* 2020), such as deep caves or mine adits. However, it is evident that this species is active throughout the year within the PA and that extended hibernation does not take place. Short periods of hibernation (up to 9 days) have been recorded in *T. aegyptiaca* during the cool season and periods of low food availability (Toussaint *et al.*, 2009). It is therefore possible that the small peaks in activity during winter and spring are short breaks in hibernation for the resident bats. The primary land use in the region is sheep ranching. It is therefore unlikely that activity patterns of bats are linked to changes in land use as may be expected in cultivation agricultural areas.

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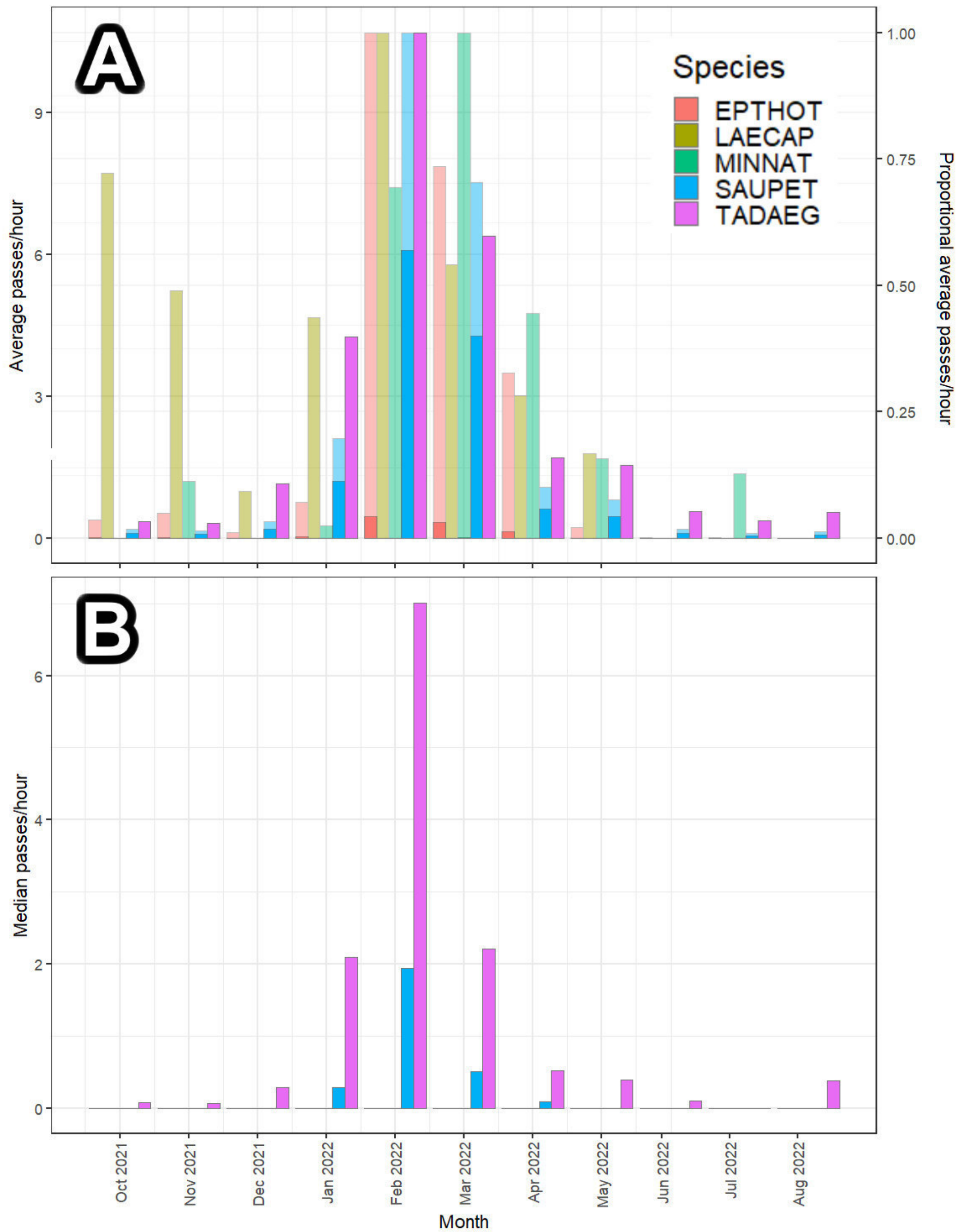

Figure 3-12: Monthly recordings of echolocation calls of bats per bat species (median calculated from sum per night). A] average passes/hour and proportional average passes/hour (opaque) B] median passes/hour[9].

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[9] Species acronyms: EPTHOT: *Eptesicus hottentotus*; MINNAT: *Miniopterus natalensis*; SAUPET: *Sauromys petrophilus*; TADAEG: *Tadarida aegyptiaca*

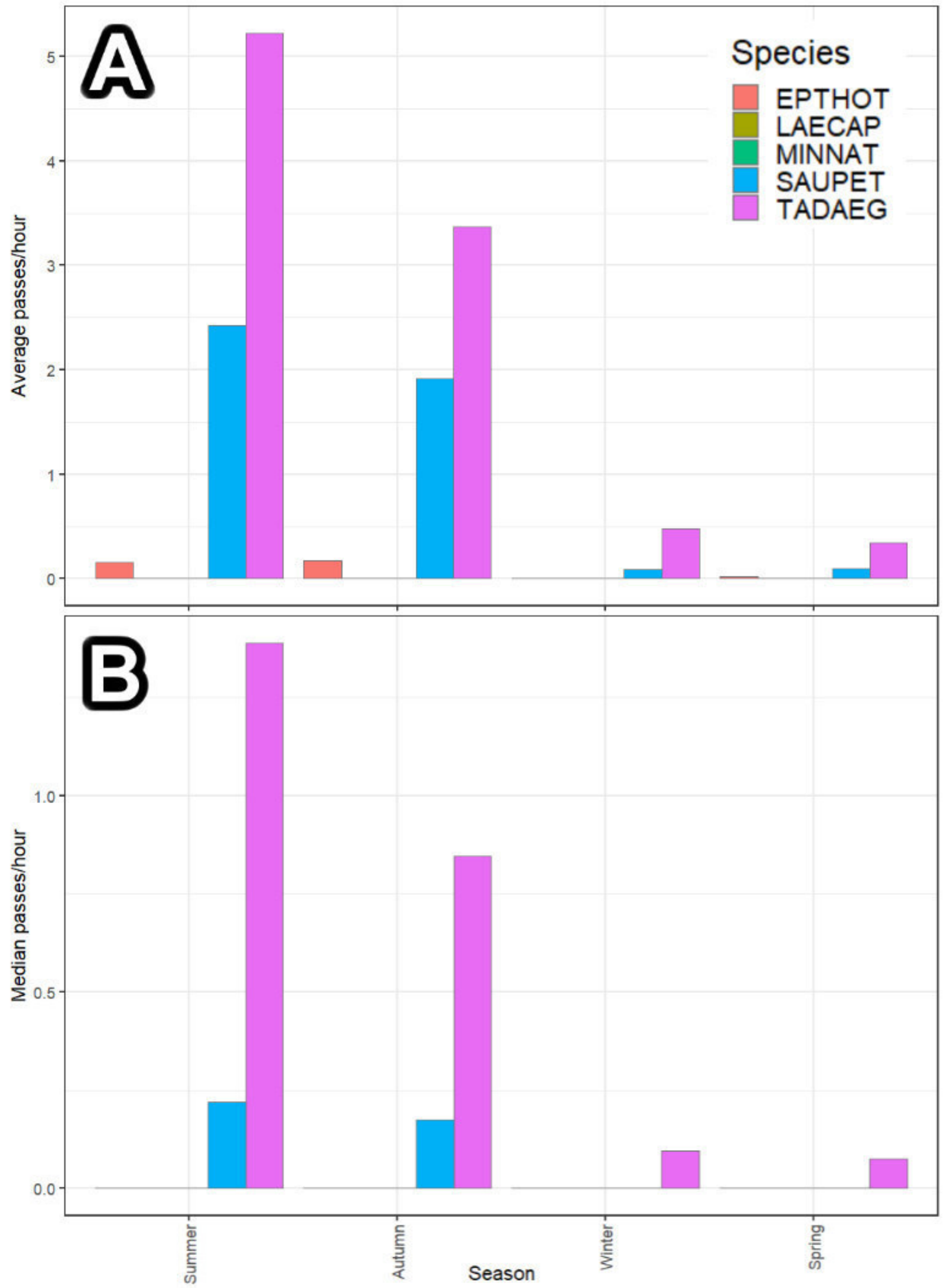

Figure 3-13: Seasonal recordings of bats per bat species (median calculated from sum per night). A] average passes/hour B] median passes/hour[10].

[10] Species acronyms: EPTHOT: *Eptesicus hottentotus*; MINNAT: *Miniopterus natalensis*; SAUPET: *Sauromys petrophilus*; TADAEG: *Tadarida aegyptiaca*

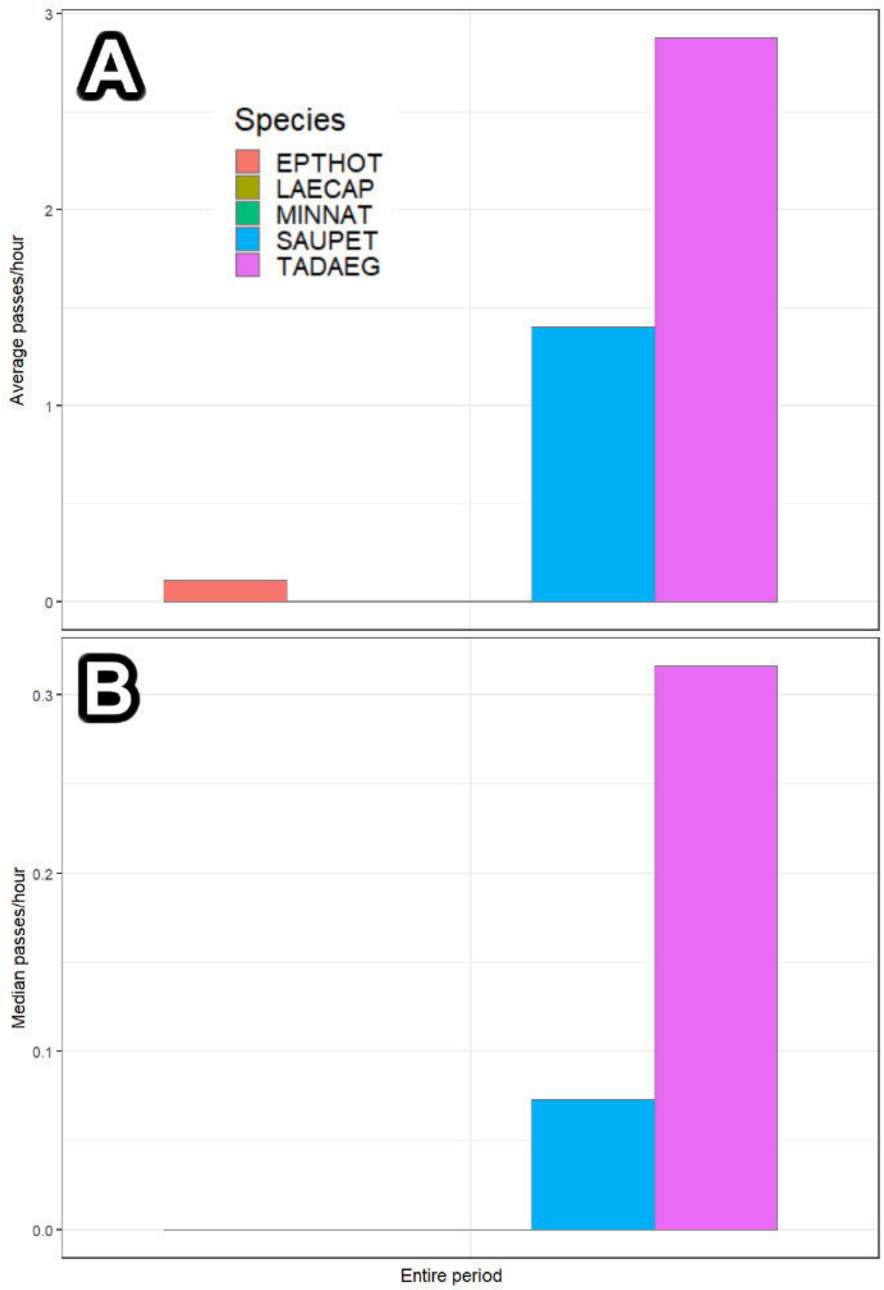

Figure 3-14: Yearly recordings of echolocation calls of bats per bat detector (median calculated from sum per night). A] average passes/hour B] median passes/hour[11].

[11] Species acronyms: EPTHOT: *Eptesicus hottentotus*; MINNAT: *Miniopterus natalensis*; SAUPET: *Sauromys petrophilus*; TADAEG: *Tadarida aegyptiaca*

3.3.1.4 Passes at Height

The proposed turbines have a hub height of 150 m with a rotor diameter of up to 175 m (blade length of up to 87.5 m), and the rotor swept heights are thus within the range 62.5 – 237.5 m above ground. Therefore, bat detectors with microphones at 65 m and 110 m above ground are considered to be within the rotor sweep area.

When considering all bat detectors together, bat activity decreased as the distance above ground increased (Figure 3-15). Average bp/h showed a more linear decrease in activity with the increase in height above ground, indicating that detectors at near-ground level tended to record more frequent or larger spikes in bat activity than those at height. Interestingly this difference is less pronounced than recorded at the nearby proposed Red Sands WEF (Enviro-Insight, 2022). It is important to take recorder downtime into account here, which is illustrated in Figure 3-3. Detector B3 (10 m) was taken down before the peak activity period , it has thus been removed from the comparisons below. Detector B7 (10 m) did not record during some of the peak activity period Therefore it is likely that the bat activity near-ground level has been slightly underestimated.

Hourly bat activity indicates that bats are most active at height (60 or 110 m) earlier in the night than at ground level for meteorological mast 2 (B7-9), but this is not shown for meteorological mast 1 (B4-6; Figure 3-4). Species-specific patterns show that *T. aegyptiaca* flies proportionally most within the rotor sweep heights (~70% of ground level activity at 65 m; ~40% at 110 m), followed by *S. petrophilus* (~45% at 65 m; ~25% at 110 m), *L. capensis* (20% at 65 m; 30% at 110 m), *E. hottentotus* (10% at 65 m; 5% at 110 m), and *M. natalensis* (5% at 65 m; 5% at 110 m; Figure 3-15). This is as expected based on the foraging habits of these species, with the exception of *L. capensis*, but this is probably an artefact of low number of detected passes for this species. This pattern of low activity at height may suggest that open-air foragers are not migrating over the PA, as this is usually done high above the ground.

According to the Nama Karoo Ecoregion thresholds (MacEwan et *al*., 2020b) the PA has a **Medium** level of fatality risk from turbines at ground level (10 m above ground) with a median nightly value of 0.90 bp/hr and average of 7.49 bp/hr, a **High** risk at 65 m with median nightly value of 0.73 bp/hr and average of 3.95 bp/hr, and a **High** risk at 110 m with median nightly value of 0.46 bp/hr and average of 2.18 bp/hr. These values are likely to decrease slightly as the final few months of monitoring data are collected, which are likely to represent low activities levels of bats. There are also considerable peaks in bat activity at rotor sweep heights at B7-9 (noticeable from the high average values) and these peaks are likely to result in high bat fatality and will require mitigation to limit impacts to acceptable levels.

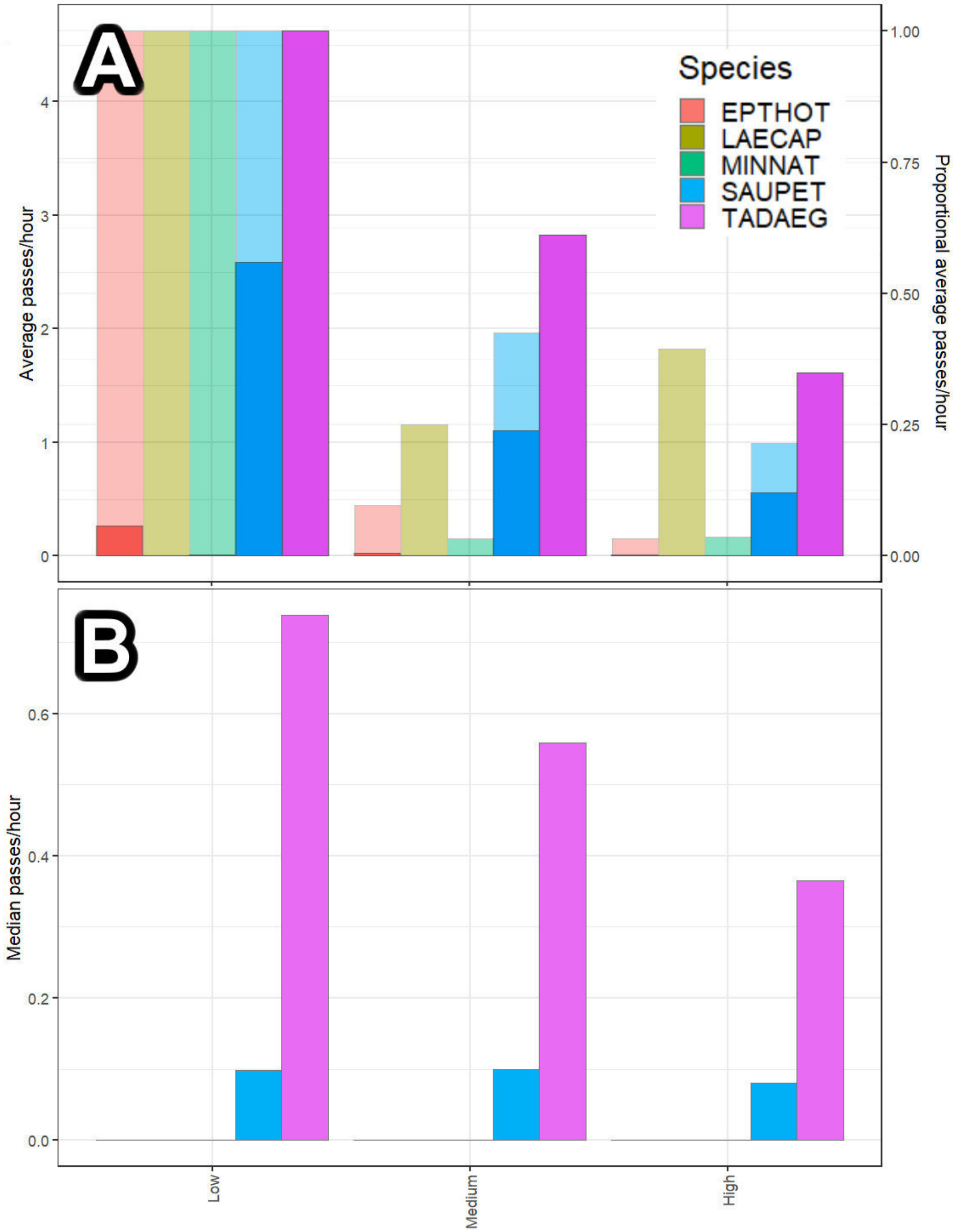

Figure 3-15: Comparison of bat species activity between microphone height for all bat detectors combined. A] average passes/hour and proportional average (opaque) B] median passes/hour[12]. Excluding B3.

[12] Species acronyms: LAECAP: *Laephotis capensis*; EPTHOT: *Eptesicus hottentotus*; MINNAT: *Miniopterus natalensis*; SAUPET: *Sauromys petrophilus*; TADAEG: *Tadarida aegyptiaca*

3.3.2 Active Acoustic Monitoring

A total of 665 bats vocalisation from only three species/group (*T. aegyptiaca* or *S. petrophilus; S. petrophilus* or *E. hottentotus;* and *M. natalensis*) were recorded during active monitoring (including calls duplicated where more than one bat was vocalising; Table 3-4, Figure 3-16). *Tadarida aegyptiaca* or *S. petrophilus* were by far the most dominant group recorded during active acoustic monitoring, representing about 94% of all bat passes. *Sauromys petrophilus* or E. hottentotus were far less abundant, with a total of only 40 passes, 33 of which were recorded during Summer. It is possible that (one, two or both of) these species are breeding here, or that breeding vocalisations are more distinct and can be distinguished from *T. aegyptiaca* more readily during this period. It is also possible that some of these are misidentifications, which will be clarified in the final EIA report. *Miniopterus natalensis* was only recorded once during active surveys, and only in Autumn. Seasonal activity was highest in Summer, with less than half the activity in Autumn and Winter, and lowest activity in Spring. Similar to the passive acoustic monitoring results, late summer and early autumn had the highest bat activity, and spring and winter had the lowest bat activity.

Table 3-4: Bat passes recording during driven transects per season[13].

Season	Month-Year	Total passes	Passes/hour	Total time recorded (HH:MM)	TADAEG or SAUPET		MINNAT		SAUPET or EPTHOT	
					Passes/ hour	Total Passes	Passes/ hour	Total Passes	Passes/ hour	Total Passes
Spring	Oct-21	53	7.08	07:29	6.28	47	0.00	0	0.80	6
Summer	Jan-22	342	43.57	07:51	39.36	309	0.00	0	4.20	33
Autumn	May-22	154	20.86	07:23	20.72	153	0.00	0	0.14	1
Winter	Aug-22	116	15.13	07:40	15.00	115	0.13	1	0.00	0
	Total	**665**	**86.64**	**30:23**		**624**		**1**		**40**

[13] Species acronyms: EPTHOT: *Eptesicus hottentotus*; MINNAT: *Miniopterus natalensis*; SAUPET: *Sauromys petrophilus*; TADAEG: *Tadarida aegyptiaca*

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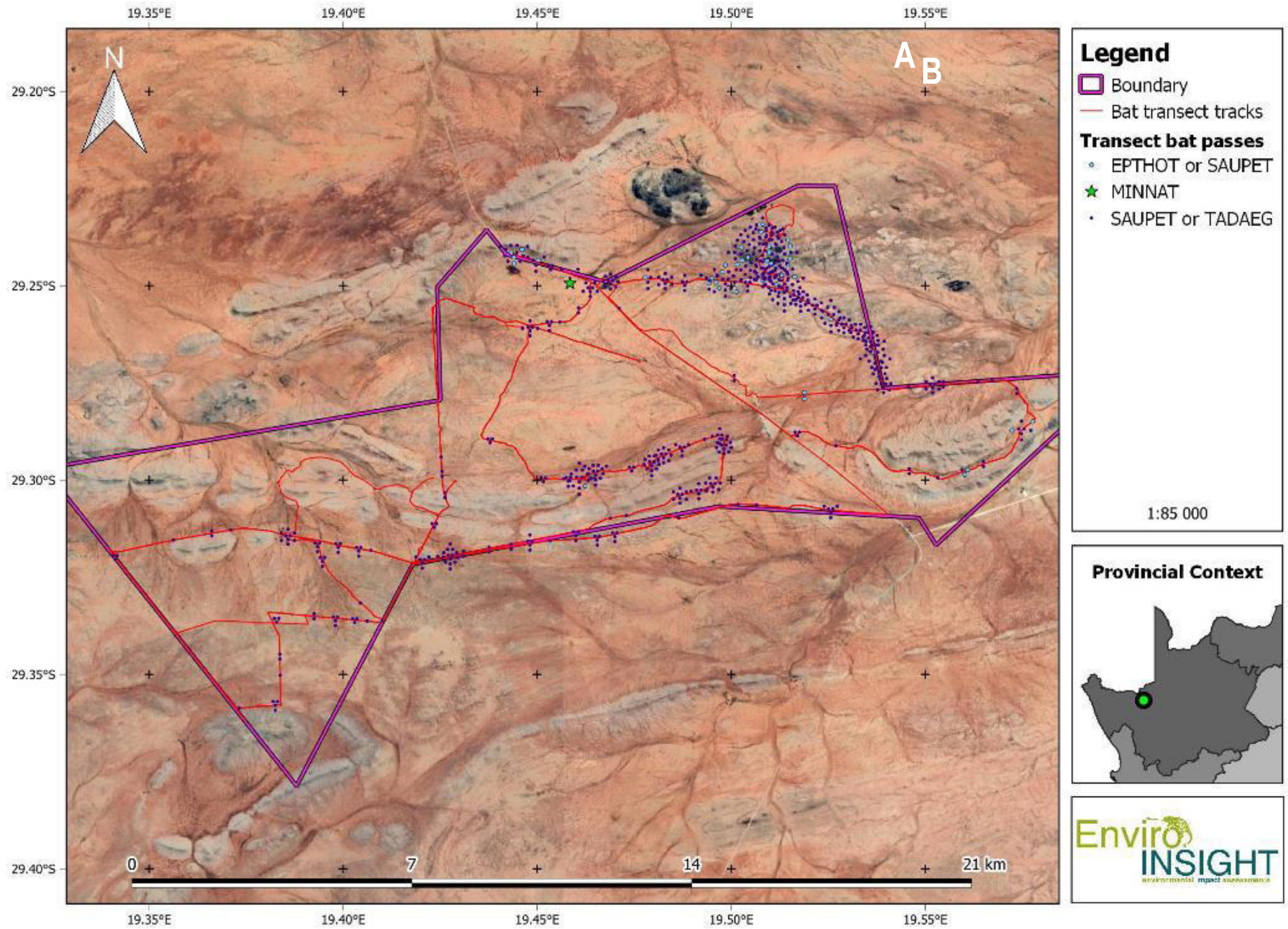


Figure 3-16: Detections of bat passes by species groups during active transect surveys. Bat passes are displayed in a spread-out fashion to enable better visualisation of point densities.

Seasonal and habitat specific activity are summarised in Table 3-5 and Figure 3-17 below.

Spring had the lowest activity, with lower than average activity around rocky areas and hills and greater activity in the vegetated watercourses. This may have been influenced by the delayed effect of rainfall that fell during and after this period, where bats favour vegetated watercourses for foraging where insect abundance is likely higher where some plant growth can persist. Activity was quite dispersed across the PA, but bats appeared to be absent from the western portions of the PA.

Summer showed the greatest levels of activity, double that of any other season, and as in Spring, was absent from the western portions of the PA. Bat activity was highly concentrated around the dolerite outcrops intercepted by the transect surveys, and it is likely that these stacked dolerite koppies represent maternal roosts for *T. aegyptiaca*, *S. petrophilus* and/or *E. hottentotus*, with bats foraging in the vegetated watercourses near to the dolerite koppies.

Autumn activity decreased slightly from Summer, but bat activity shifted away from the dolerite koppies (although the Autumn transect cut out a section through the dolerite habitat and may have missed some activity in this habitat) and became more widespread, with more activity around the brown rocks (with numerous temporary pools) and quartz hills and ridges, and less in the vegetated watercourses.

Winter activity decreased from Autumn, showing the most dispersed activity across the PA, especially in the west, with little activity in the east, except around the dolerite koppies which had higher than average activity.

Across all seasons, brown bedrock had lower, dolerite koppies - exceptionally higher, quartz hills and ridges – comparable to, and vegetated watercourses - slightly higher compared to overall bat activity. The high activity levels at these dolerite koppies during Summer could indicate some sort of social interaction taking place here, a greater abundance of food or temporary roosting sites during this period.

It is important to note that the transect data alone may not provide accurate measures of spatial utilisation by bats and should be interpreted together with the passive acoustic monitoring data. The transect data is congruent with the general seasonal pattern of bat activity for the passive acoustic monitoring. The Summer transects took place on two days of low and one day of moderate activity, and was too early in the season to capture one of the high activity spikes. Therefore, transect data should be interpreted with caution as day to day fluctuations can influence transect activity measures. This is discussed further in section 3.5 with regards to bat sensitive features and buffering.

Table 3-5: Bat passes per unit effort recording during driven transects per season for different habitats. Green shades indicate increases above overall activity and red shades indicate decreases.

Season	Month-Year	Average passes per unit effort				
		Overall	Brown bedrock (200 m)	Dolerite koppies (200 m)	Quartz hills and ridges	Vegetated watercourses
Spring	Oct-21	1.23	0.89	0.00	0.95	1.84
Summer	Jan-22	4.98	0.99	73.40	0.84	5.98
Autumn	May-22	2.69	4.33	0.00	3.93	2.30
Winter	Aug-22	1.82	1.08	5.49	1.86	2.14
	Average	**2.68**	**1.82**	**19.72**	**1.89**	**3.07**

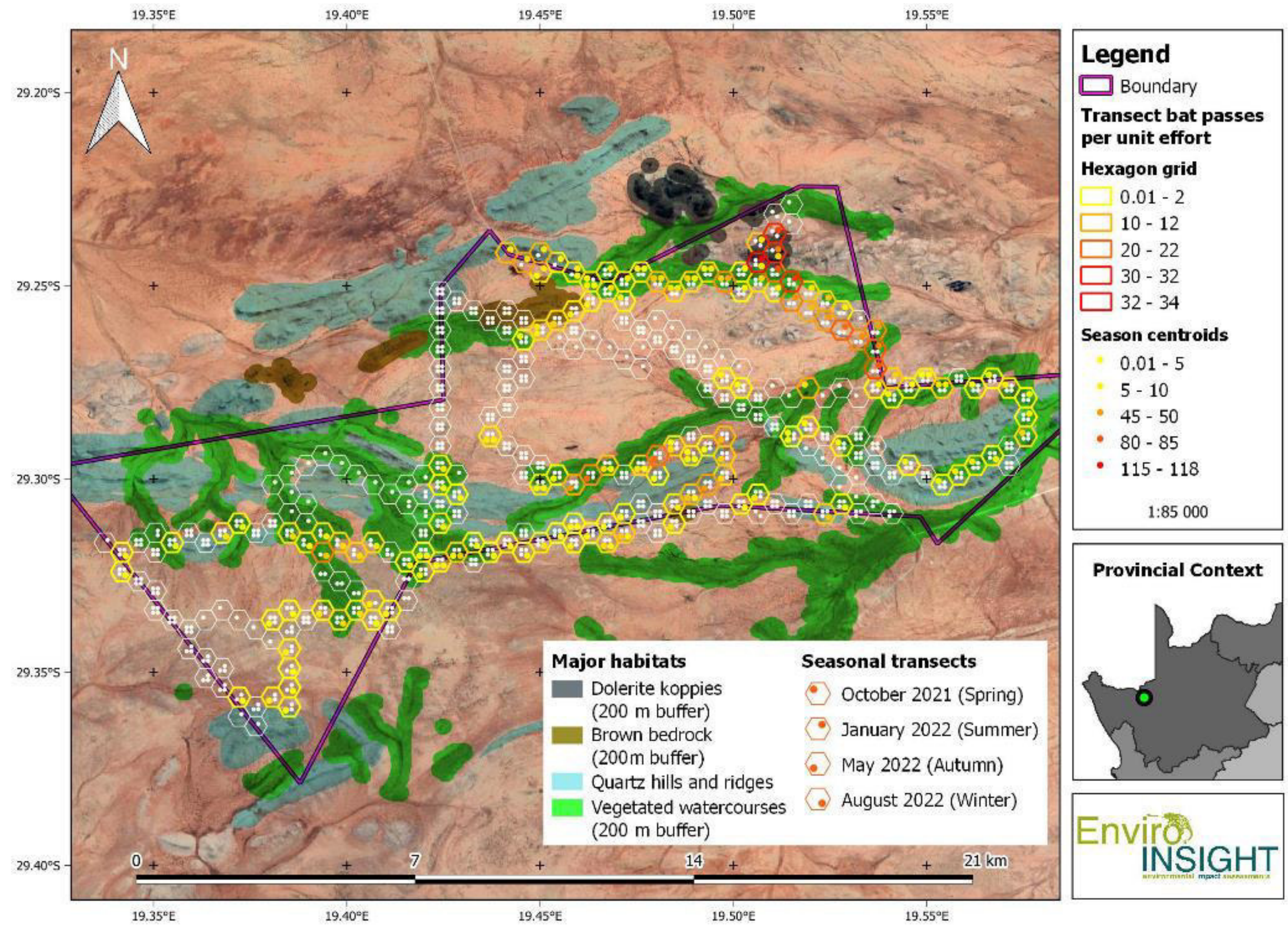


Figure 3-17: Bat transect abundance corrected for sampling effort for each season (dots) and across all seasons combined (hexagons) in relation to major habitats. White dots and grids indicate no recorded bats.

3.4 ROOSTING SITES

Twenty-nine potential roosting sites/habitats were investigated for the presence of bats during the survey period (Table 3-6, Figure 3-18). No cave systems were identified within or close to the PA during the desktop or site visits, but rocky outcrops were present in some parts of the PA and these are addressed below. These rocky outcrops are natural roosting sites, but man-made infrastructure is likely to offer the best roosting opportunities for bats in the PA. Storerooms and abandoned farm houses are ideal as they have many access points and refugia within. Inhabited farmhouses also have opportunities in the rooves and walls. Bats were confirmed to be roosting at the inhabited farmhouse (Figure 3-18; R4) and short-term acoustic monitoring suggests that bats are using rocky habitats as roosts, but no signs of bats were detected at any site during day inspections. The recording of only a single *Rhinolophus damarensis* (which is known to roost in rocky outcrops, not just caves) during roost inspections but no recordings from passive bat detectors or transects on the PA and very low numbers of *M. natalensis* further substantiates that cave roosts are not present within or in close proximity to the PA.

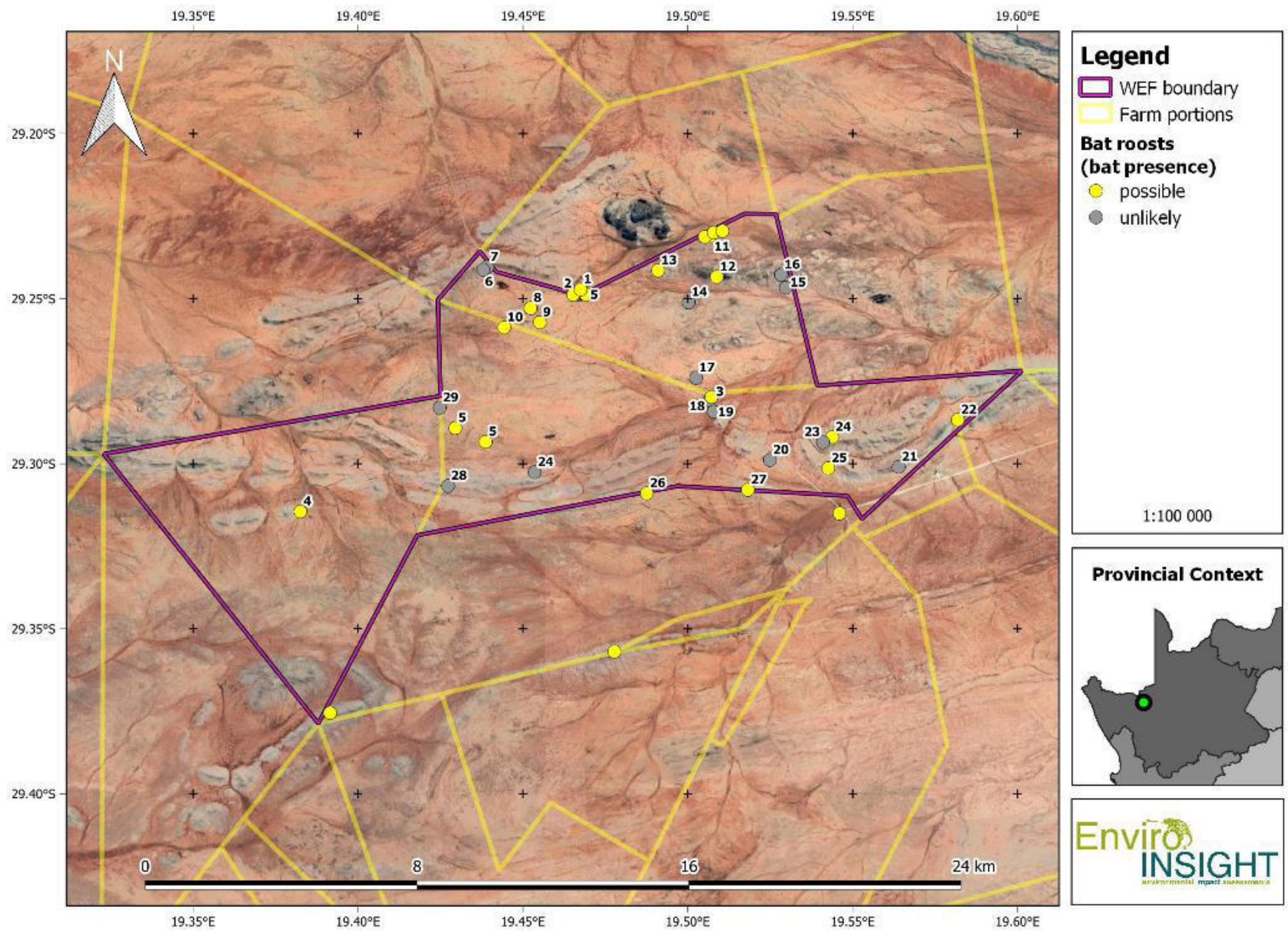


Figure 3-18. Location of bat roosts surveys and likelihood of roosting bats, showing roost id as labels.

Table 3-6: Details of sites inspected for roosting bats.

Site Name, location, dates inspected, bat evidence, habitat and likelihood of roosting bats.	**Site Photos and any evidence of bats**
R1 Latitude: -29.247262° Longitude: 19.467489° **Dates inspected, recordings & signs of bats:** 14/10/2021 – rec., no bat evidence **Habitat Description:** Oom Gert's resident house. Garage has tin roof with no ceiling, buildings are cleanly plastered with limited cracks and crevices in building material. Other structures around the house have openings and cracks. **Bat likelihood:** No evidence of bats was found during inspections and there are limited roost opportunities, but it is possible that a few bat individuals are roosting in some of the infrastructure.	   
R2 Latitude: -29.248835° Longitude: 19.465222° **Dates inspected, recordings & signs of bats:** 11/10/2021 – rec., no bat evidence 19/01/2022 – rec., no bat evidence	 

31/05/2022 – rec., bat dropping seen in garage **Habitat Description:** Main house (Thys). Storerooms have tin rooves with iron girders or wooden poles and no ceiling. Most walls are cleanly plastered but some walls are old bricks with spaces between. Storerooms are full of items that don't get moved often, with lots of refugia available. There are multiple other structures around the house and debris lying around. **Bat likelihood:** The are ample roosting opportunities for bats. Bat droppings were observed below the cracks of the iron girders in May 2022.	 
R3 Latitude: -29.279796° Longitude: 19.507154° **Dates inspected, recordings & signs of bats:** 11/10/2021 – rec., no bat evidence 19/01/2022 – rec., no bat evidence 31/05/2022 – rec., no bat evidence **Habitat Description:** Witkoppies farmhouse. The buildings have tin rooves, and the main house has a ceiling with degrading awnings while other structures do not. The walls are cleanly plastered. There are various other small structures with openings and stored items, and debris lying on the ground. **Bat likelihood:** No evidence of bats was found during	   

the inspection. However, there are ample roosting opportunities for bats, especially within the closed ceilings and awnings and bats are expected to roost at this site.	
R4 Latitude: -29.314524° Longitude: 19.382506° **Dates inspected, recordings & signs of bats:** 11/10/2021 – rec., no bat evidence 18/01/2022 – rec., no bat evidence 31/05/2022 – rec., no bat evidence **Habitat Description:** Western Farmhouse (Gert Kruger). Most buildings have tin rooves and wooden beams with no awnings or ceilings, but one structure does have a degraded awning. The walls are cleanly plastered or bricks without gaps, but some walls have cracks. There are various small structures with openings or cracks and stored equipment and debris lying on the ground.	   
Bat likelihood: No evidence of bats was found during the inspection. However, there are some roosting opportunities for bats, such as in cracks in the walls and between walls and wooden beams. The farmer reported and photographed bats (*N. thebaica*) roosting inside the store.	

R5

Latitudes:

-29.289215°; -29.293389°

Longitudes:

19.429482°; 19.438685°

Dates inspected, recordings & signs of bats:

05/08/2022 – no signs of bats, no vocalisations detected.

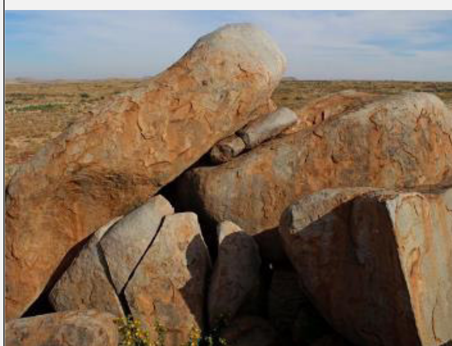
Habitat Description:

Two similar isolated koppies of large igneous boulders. The boulders are rounded and stacked, sometimes with large cracks and fissures. Cavities are formed between stacked boulders and appear to be relatively deep in places.

Bat likelihood:

Although no signs of bats were found, many spaces and cracks were inaccessible during inspection – being too confined and also one containing a beehive. It is likely that a few bats use these koppies as roosts for at least some time during the year, especially in deep crevices hidden in cavities between boulders.






R6

Latitude: -29.241246°

Longitude: 19.437968°

Dates inspected, recordings & signs of bats:

09/03/2021 – photographed from distance


Habitat Description: Large quartzite outcrop on top of hill, large angular boulders with various cracks and crevices. **Bat likelihood:** The site was not searched, only photographed from a distance. The rock is very broken and unlikely to be suitable for bat roosts.	
R7 Latitude: -29.240434° Longitude: 19.439175° **Dates inspected, recordings & signs of bats:** 09/03/2021 – no bat evidence **Habitat Description:** Quartzite outcrop on top of hill, small rocks and boulders lying on or embedded in a stony soil matrix with few or only shallow cracks and crevices. **Bat likelihood:** No bats or evidence of bats were observed in or around any rock cracks and the habitat was not considered to be suitable for bat roosts, the few rock cracks present being too shallow and exposed.	
R8 – 'Brown Bedrock' Latitude: -29.252859° Longitude: 19.452296° **Dates inspected, recordings & signs of bats:** 12/03/2021 – no bat evidence 16&17/08/2022 – roost recordings taken	

Habitat Description:

Large expanse of exposed bedrock (brown and grainy texture). The larger exposed outcrops have small-medium sized cracks and crevices between rocks.

Bat likelihood: see R10.

R9 – 'Brown Bedrock'

Latitude: -29.257206°

Longitude: 19.455121°

Dates inspected, recordings & signs of bats:

11/03/2021 – no bat evidence

16&17/08/2022 – roost recordings taken

Habitat Description:

Large expanse of exposed bedrock (brown and grainy texture). The larger exposed outcrops have small-medium sized cracks and crevices between rocks.

Bat likelihood: see R10.

R10 – 'Brown Bedrock'

Latitude: -29.258717°

Longitude: 19.444309°

Dates inspected, recordings & signs of bats:

12/03/2021 – no bat evidence

16&17/08/2022 – roost recordings taken

Habitat Description:

Large expanse of exposed bedrock (brown and grainy texture). The larger exposed outcrops have small-medium sized cracks and crevices between rocks. Difficult to inspect visually.

Bat likelihood:

The entire bedrock area was surveyed in August 2022 to identify outcrops with suitable crevices for roosts. Short-time acoustic monitoring was conducted and the results indicate that some bats are using these features for roosting: **3.4.1.1.**

R11 – 'Dolerite Outcrops'

Latitude: -29.230838°

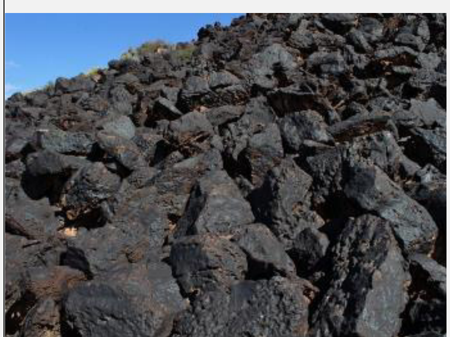
Longitude: 19.507059°

Dates inspected, recordings & signs of bats:

08/08/2022 – bat droppings found and roost recordings taken.

Habitat Description:

Group of large conical hills of exposed outcrops of black rounded dolerite boulders and rocks, embedded in sand on the edges but stacked boulders with many spaces and gaps in-between which appear to form deeper cavities in the centre of the outcrops go deep into the centre.



Bat likelihood: Due to the small size of the gaps and cavities between the rounded boulders it is not possible to adequately visually assess whether any bats are roosting within these outcrops. However, these cavities appear to be some of the most suitable natural roosting habitats in landscape with limited alternative roosting habitats and it is likely that bats and possibly even small colonies are roosting in these outcrops. Bat droppings were found deep in some of the gaps between boulders. See additional surveys confirming roosting bats: **3.4.1.2**	 
R12 – 'Dolerite Outcrops' Latitude: -29.243394° Longitude: 19.508776° **Dates inspected, recordings & signs of bats:** 09/03/2021 – no bat evidence **Habitat Description:** Medium-sized exposed outcrops of black rounded dolerite boulders and rocks, embedded in sand on the edges but stacked boulders with many spaces and gaps in-between which appear to form deeper cavities in the center of the outcrops go deep into the centre. **Bat likelihood:** Due to the small size of the gaps and cavities between the rounded boulders it is not possible to adequately visually assess whether any bats are roosting within these outcrops. However, these cavities appear to be some of the most suitable natural roosting habitats in landscape with limited alternative roosting habitats and it is likely that bats and possibly even small colonies are	   

roosting in these outcrops.

R13 – Dolerite Koppies

Latitude: -29.241489°

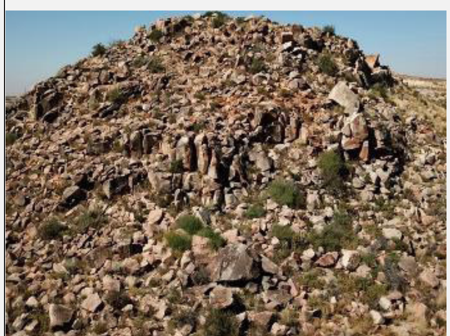
Longitude: 19.490975°

Dates inspected, recordings & signs of bats:

07/08/2022 – no bat evidence

Habitat Description:

Group of medium conical hills of exposed outcrops of light brown dolerite boulders and rocks, embedded in sand on the edges but stacked in places and exposed bedrock near the crest with many deep cracks and crevices.



Bat likelihood:

Due to the extensive rocky habitat and difficulty in searching deep or internal cracks in the rock, the lack of bat evidence during visual surveys is not sufficient to rule out bat roosts. The habitat appears suitable for bat roosts and there is likely to be a few roosting bats in this habitat.

R14

Latitude: -29.251118°

Longitude: 19.500211°

Dates inspected, recordings & signs of bats:

12/03/2021 – no bat evidence

Habitat Description:

A small white quartz outcrop which is surrounded by small rocks and pebbles of quartz lying on a sandy matrix. The exposed outcrop is blocky and solid with few cracks or crevices. The few cracks present are often very shallow and narrow.

Bat likelihood:

No bats or evidence of bats were observed in or around the small outcrop and the habitat is unsuitable for bat roosts.

R15

Latitude: -29.246680°

Longitude: 19.529712°

Dates inspected, recordings & signs of bats:

12/03/2021 – no bat evidence

Habitat Description:

Small hill with ridge of quartz outcrops, the scree slope and surroundings are covered in small rocks and pebbles of quartz lying on a sandy matrix. The exposed outcrops are blocky and solid with few cracks. Crevices between blocks in the outcrops are usually quite exposed and do not form consistent narrow widths.

Bat likelihood:

No bats or evidence of bats were observed in or around the small outcrop and the habitat is mostly unsuitable for bat roosts.

R16

Latitude: -29.242799°

Longitude: 19.528292°

Dates inspected, recordings & signs of bats:

12/03/2021 – no bat evidence

Habitat Description:

Slight hill with heavily eroded ridge of quartz outcrops, the surroundings are covered in small rocks and pebbles of quartz lying on a sandy matrix. The small, exposed outcrops are blocky and solid with few cracks and no notable crevices.

Bat likelihood:

No bats or evidence of bats were observed in or around the small outcrops and the habitat is unsuitable for bat roosts.




R17

Latitude: -29.273977°

Longitude: 19.502466°

Dates inspected, recordings & signs of bats:

10/03/2021 – no bat evidence

Habitat Description:

Small, eroded quartz ridge with bedrock quartz exposed above red sands and smaller quartz rocks and pebbles lying on the surface. The exposed boulders are blocky and have no small cracks or fissures and the gaps between them are exposed and not of consistent widths.

Bat likelihood:

No bats or evidence of bats were observed around the small outcrops and the habitat is unsuitable for bat roosts.




R18

Latitude: -29.280777°

Longitude: 19.506519°

Dates inspected, recordings & signs of bats:

10/03/2021 – no bat evidence

Habitat Description:

Small hill with a prominent quartz outcrop ridge with very large blocky boulders, the steep scree slope has large quartz boulders and rocks embedded in a very sandy matrix. The quartz outcrops have no cracks or fissures in the boulders, but some large crevices are formed where the boulders contact one another, but these crevices do not have consistent and narrow widths and are usually quite exposed. Most crevices at ground level have been filled by sand or other debris.

Bat likelihood:

No bats or evidence of bats were observed in or around the outcrop. The habitat is unsuitable for bat roosts.




R19

Latitude: -29. 284252°

Longitude: 19. 507798°

Dates inspected, recordings & signs of bats:

07/08/2022 – no bat evidence


Habitat Description:

Small hill with a prominent quartz outcrop ridge with very large blocky boulders, the steep scree slope has large quartz boulders and rocks embedded in a very sandy matrix. The quartz outcrops have few cracks or fissures in the boulders, but these are limited, usually very shallow, and quite exposed.

Bat likelihood:

No bats or evidence of bats were observed in or around the outcrop. The habitat is not considered to be suitable for bat roosts.

R20

Latitude: -29.298907°

Longitude: 19.524865°

Dates inspected, recordings & signs of bats:

11/03/2021 – no bat evidence

Habitat Description:

Series of small ridges with highly eroded quartz outcrops on the crest with slopes covered in small quartz rocks and pebbles on a sandy medium. The quarts crests have medium to small angular quarts rocks and some exposed bedrock. There are no cracks or fissures in the rocks and any crevices between rocks are very exposed and shallow.

Bat likelihood:

No bats or evidence of bats were observed around the ridges checked and the habitat is unsuitable for bat roosts.

R21

Latitude: -29.300985°

Longitude: 19.563907°

Dates inspected, recordings & signs of bats:

12/03/2021 – no bat evidence

Habitat Description:

A large quartzite hill/ridge with steep slopes and various strata of exposed quartz sills at different positions along the slope. The slope is covered in medium to small quartz rocks and pebbles with a small amount of sand in-between. The exposed quartz intrusions have intact bedrock and medium to large boulders with some cracks and crevices, but these are limited and often filled in with debris and quite shallow. In general the quartz are blocky and solid.

Bat likelihood:

No bats or evidence of bats were observed around the quartz outcrops and boulders checked and the habitat is unsuitable for bat roosts.

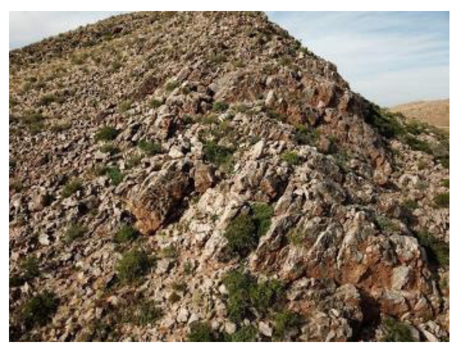
R22

Latitude: -29.286565°

Longitude: 19.582869°

Dates inspected, recordings & signs of bats:

06/08/2022 – only photographed.



Habitat Description:

A large quartzite hill/ridge with steep slopes and a particularly large outcrop exposed quartzite on the east side. The outcrop has partially consolidated bedrock. The slope is covered in medium to small quartz rocks and pebbles. The exposed quartz outcrops have large vertical cracks and crevices . These crevices have not been observed up close but they appear to be quite deep, the quartz rocks themselves are blocky and solid.

Bat likelihood:

The outcrop has not been searched for evidence of bats, but the photographs suggest that habitat is ideal for bats to utilise as roost sites. Therefore, the Precautionary Principal is followed and it is assumed that some bat individuals are roosting in this habitat.

R23

Latitude: -29.293515°

Longitude: 19.541002°

Dates inspected, recordings & signs of bats:

10/03/2021 – no bat evidence

Habitat Description:

A large quartzite hill/ridge with steep slopes and a crest of eroded quartz intrusion. The slope is covered in medium to small quartz rocks and pebbles with a small amount of sand in-between. The exposed quartz intrusions consist of broken rocks and boulders of small to medium size. While cracks and crevices are quite abundant, especially under rocks, they are quite small or shallow and relatively exposed. In general the quartz rocks are blocky and solid.

Bat likelihood: No bats or evidence of bats were observed around the quartz outcrops checked and the habitat is unsuitable for bat roosts.	
R24 Latitude: -29.29194° Longitude: 19.54378° **Dates inspected, recordings & signs of bats:** 10/03/2021 – no bat evidence **Habitat Description:** A large quartzite outcrop with intact bedrock and large rocks and boulders situated along the top of a quartzite hill/ridge. There are numerous crevices between boulders and formed by the way the exposed bedrock has weathered. The outcrops are solid rock and the crevices are not filled by sand and other debris **Bat likelihood:** No bats or evidence of bats were observed around the outcrop, but the deeper crevices cannot be easily checked and it is possible that a few bats utilised the outcrop for roosting.	  
R25 Latitude: -29.306712° Longitude: 19.427250° **Dates inspected, recordings & signs of bats:** not inspected	 

Habitat Description:

A quartz outcrop at the top of a large hill/ridge. The exposed outcrop has large, stacked quartz boulders and some of the rocks appear to have deep crevices and probably cavities been the boulders.

Bat likelihood:

The habitat was not surveyed on the ground but appears to have suitable roosting habitat from drone photographs and the precautionary approach is taken assuming that bats do roost here.


R26

Latitude: -29.308984°

Longitude: 19.487507°

Dates inspected, recordings & signs of bats:

06/08/2022 – no bat evidence


Habitat Description:

Large expanse of exposed igneous rock exposed on the side of a small hill, with a small quartz ridge above. The rock forms large boulders with varying degrees of weathering. Some parts have small hollow caverns, while some large boulders are solid with deep crevices and other boulder outcrops are extensively fissured with internal cracks.

Bat likelihood:

Due to the difficulty in searching deep or internal cracks in the rock, the lack of bat evidence during visual surveys is not sufficient to rule out bat roosts. The habitat appears suitable for bat roosts and there is likely to be a few roosting bats in this habitat.


R27

Latitude: -29.307938°

Longitude: 19.518168°

Dates inspected, recordings & signs of bats:

07/08/2022 – no bat evidence


Habitat Description:

Large expanse of exposed igneous rock exposed on the side of a small hill. The rock forms large boulders with varying degrees of weathering. Large boulders are solid with deep crevices and other boulder outcrops are extensively fissured with internal cracks

Bat likelihood:

No bats or evidence of bats were observed around the outcrop, but the deeper crevices and cavities cannot be easily checked and it is possible that a few bats utilised the outcrop for roosting.


R28

Latitude: -29.306712°

Longitude: 19.427250°

Dates inspected, recordings & signs of bats:

09/03/2021 – no bat evidence


Habitat Description: A small quartzite hill/ridge with gentle slopes covered in medium to small quartz rocks and pebbles. The exposed quartz intrusions at the crest of the hill are small and have some cracks and crevices between rocks, but these are few and seem to be quite shallow. **Bat likelihood:** The cracks were not checked for evidence of bats as they were not considered to be suitable for bat roosts at the time they were photographed.	
R29 Latitude: -29.283057° Longitude: 19.424734° **Dates inspected, recordings & signs of bats:** 12/03/2021 – no bat evidence **Habitat Description:** Isolated patch of exposed doleritic bedrock with some larger boulders spaced widely apart from one another. The boulders have weathered in a round fashion, but a few have cracked forming deep crevices. **Bat likelihood:** No bats or evidence of bats were observed in cracks of the boulders and since all cracks could easily be checked it was confirmed that no bats appear to be using them as roost sites.	 

3.4.1 Short-term Passive Acoustic Monitoring

The exposed brown bedrock and dolerite outcrops were searched visually and no evidence of roosting bats were found. However, concealed cavities and crevices in the rocks could not be effectively searched using this method and bat detectors were deployed to provide a more robust assessment for roosting bats (Figure 3-19 & Figure 3-20). At the time sunset was 18:11 PM and sunrise and 07:26 AM.

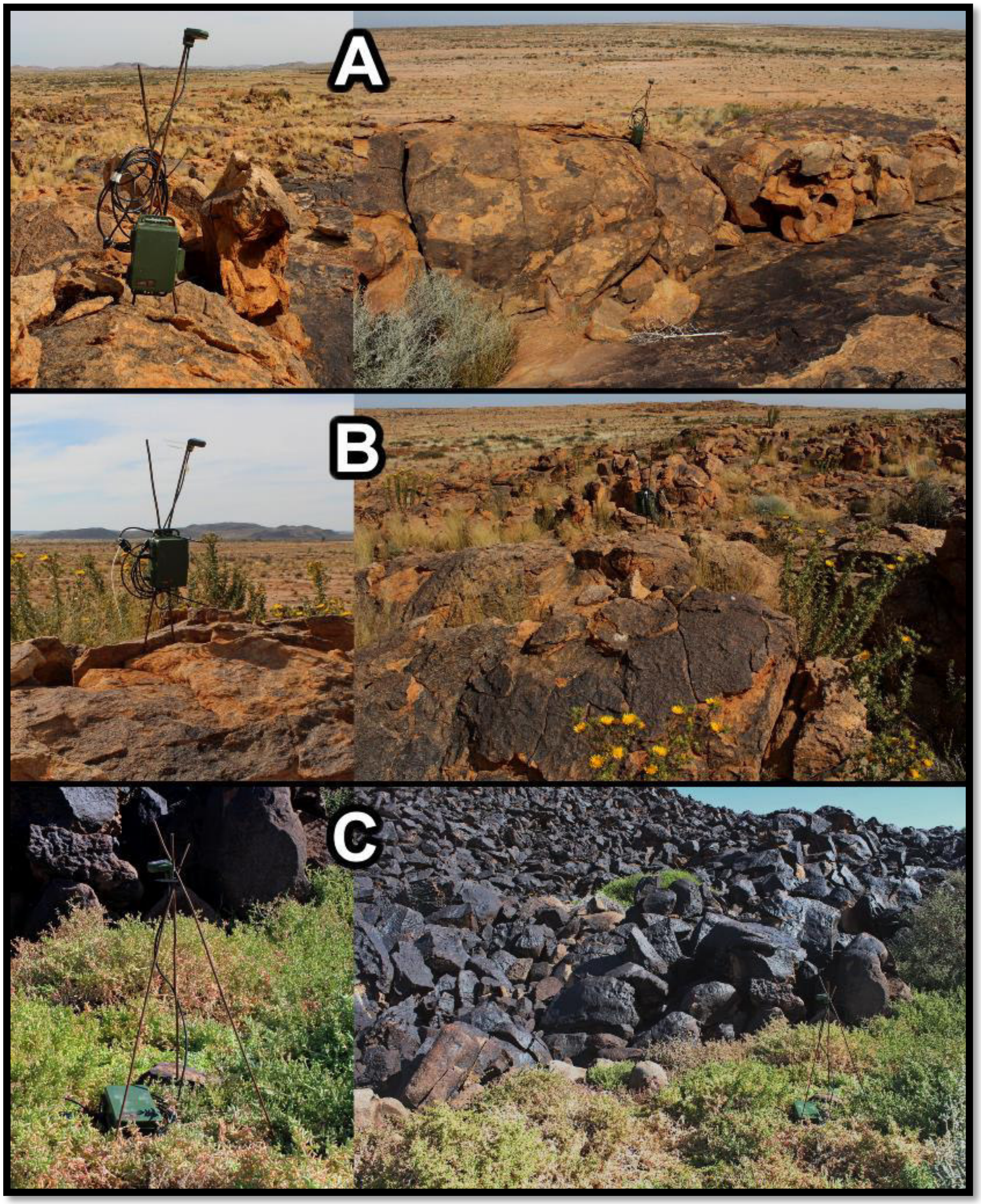


Figure 3-19. Short-term acoustic monitoring setups at potential bat roosting habitats[14].

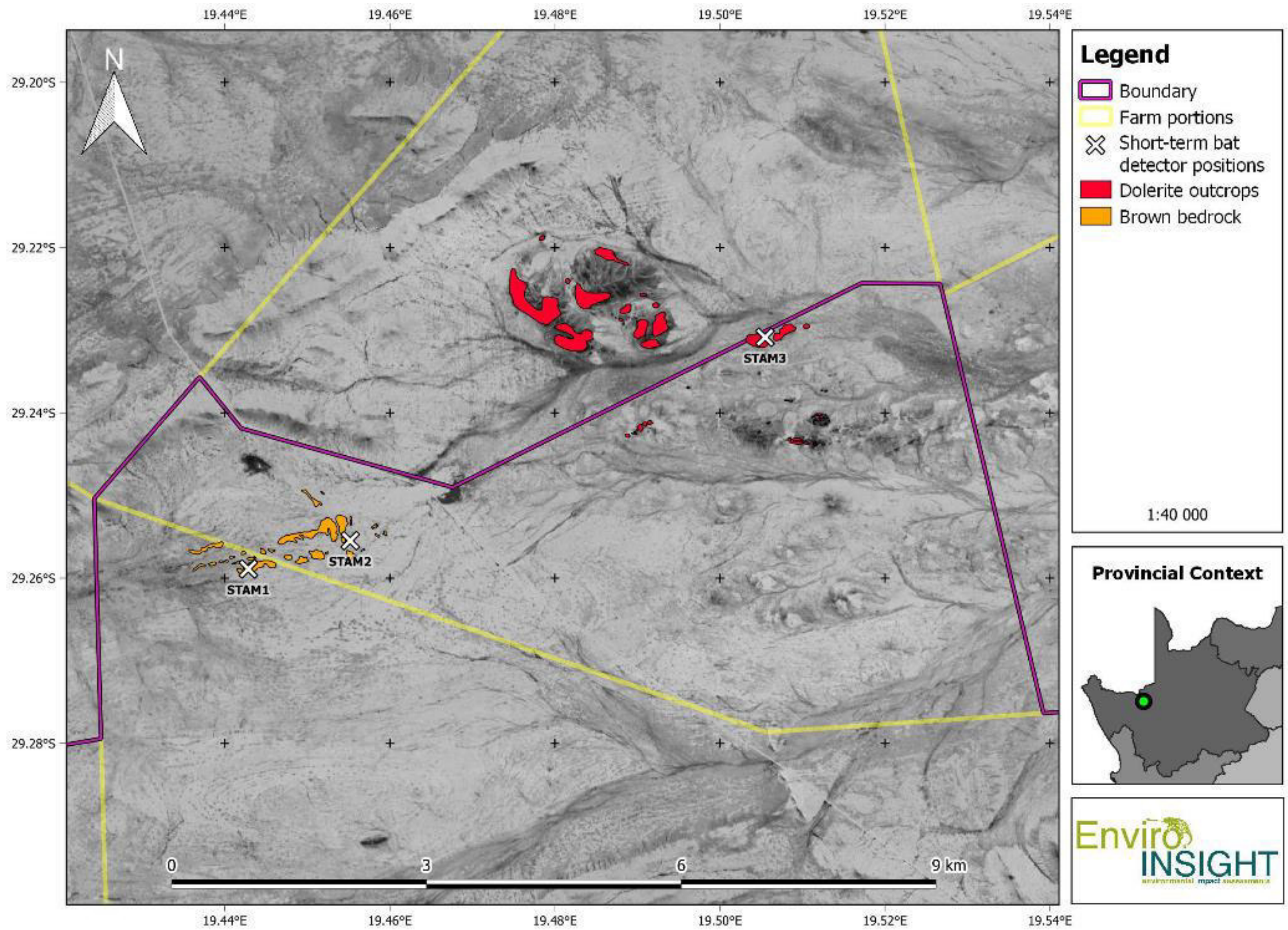


Figure 3-20. Locations for short-term acoustic monitoring setups within the northern part of the PAOI.

3.4.1.1 Brown bedrock (STAM1&2)

Two detectors were positioned at either end of the brown bedrock extent and recorded on the 5th and 6th August 2022. This was done to ensure that if bats were roosting in the nearby farmhouse to the east and immediately dispersing through the area, that they would be recorded at STAM2 first, and then at STAM1. The bat passes showed:

STAM1 recorded 43 bat passes and STAM2 recorded 17 bat passes over the two nights of recording. All bat passes were *T. aegyptiaca* and/or *S. petrophilus* with the exception of one pass of a *Rhinolophus damarensis that* was recorded at 06:09 AM by STAM2. it is possible that this one individual was foraging far from its roost (see below). Activity patterns at both detectors show a spike in activity in the evening during the sunset hour (18:00 PM), with activity declining and then some activity at STAM1 during the night and activity tailing off towards the morning (Figure 3-21). It is clear that bat activity did not originate in the east

[14] A: STAM1; B: STAM2; C: STAM3.

from the farmstead, with the western STAM1 detecting bat activity first. These activity patterns, early evening peak and lack of a clear directional movement, suggest that bats are roosting nearby - probably within the brown bedrock. Only a few bats were detected over the 2 nights recorded and thus this habitat probably only supports a small number of bat roosts, and areas supporting suitable roosting sites within this habitat should be buffered by 500 m.

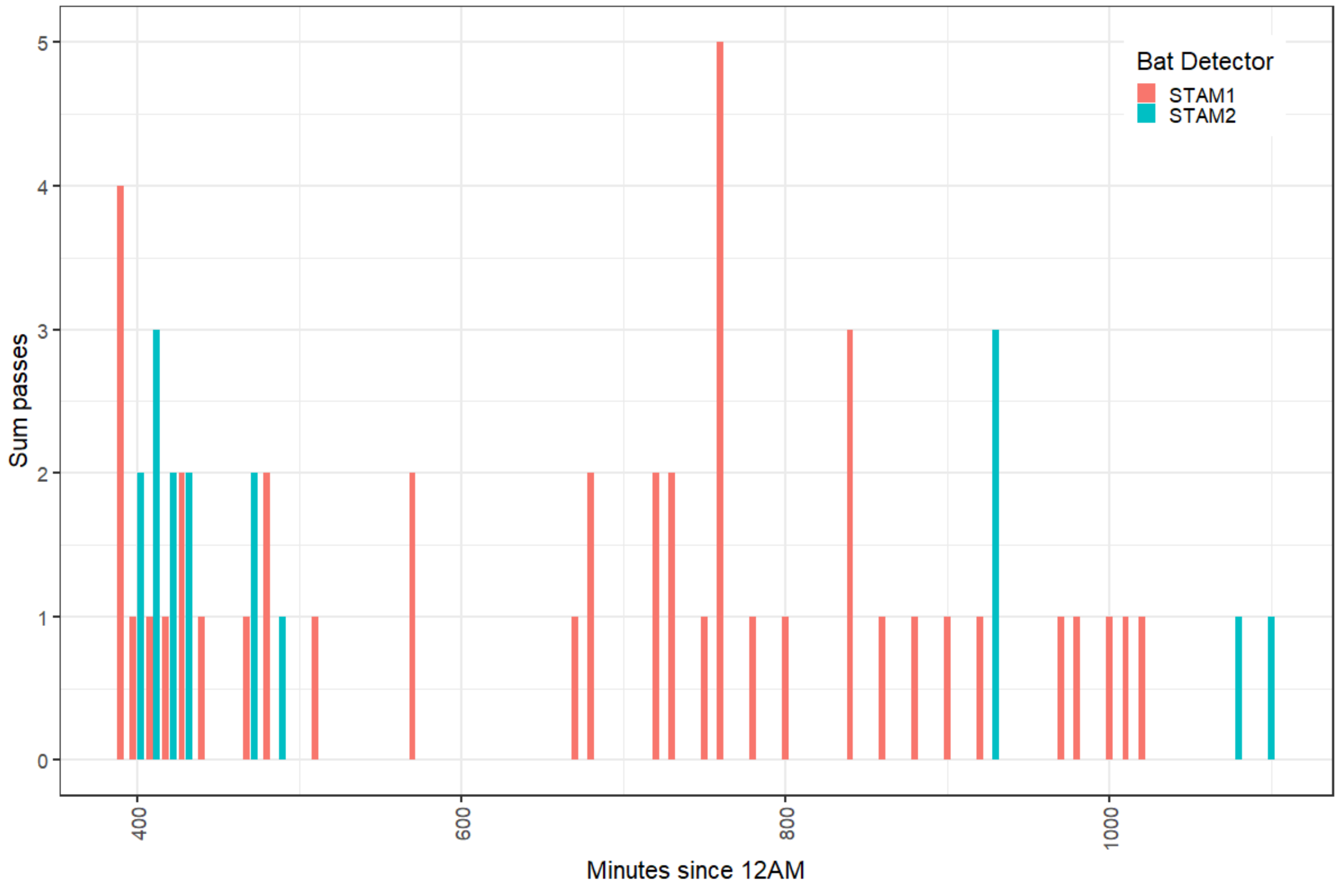


Figure 3-21. Bat activity for short-term acoustic monitoring setups STAM1&2 summed every 10 minutes. The initial time (400 minutes since 12:00 AM) is 18:00 PM.

3.4.1.2 Dolerite outcrop (STAM3)

A single detector was positioned adjacent to the large conical hill of dolerite boulders from the 7th August until the morning of the 13th August 2022. A particularly deep space beneath the boulders was identified close to this position and it looked promising for bat roosts. While other smaller rock outcrops to the south are unlikely to have as deep spaces between boulders, the habitat is expected to be homologous to some degree. The detector recorded 462 bat passes over the 6 nights, which is considerably high for the region. *Tadarida aegyptiaca* and/or *S. petrophilus* made up 389 of the passes, *R. damarensis* 46*, M. natalensis* 20 and *E. hottentotus* and/or *S. petrophilus* 7. The remarkably high abundance of clutter/clutter-edge foraging species either not encountered or in low densities elsewhere in the study area is noteworthy. The hourly activity indicates that *R. damarensis* is likely to roost in the cavities within the dolerite outcrops, with a large peak of activity in the early evening (18:00) and lower sustained activity thereafter (Figure 3-22). Other species do not show this pattern, instead their activity tends to increase later in the evening, indicating that these species are roosting elsewhere but are congregating in this area for foraging or social activities. The static bat detector (B1) positioned within 230 of these dolerite outcrops did not support this, possibly because bats were only active close to the outcrops. These dolerite outcrops are clearly an important roosting site for *R*. damarensis as well as a major attractant for nightly bat activity and should be buffered accordingly.

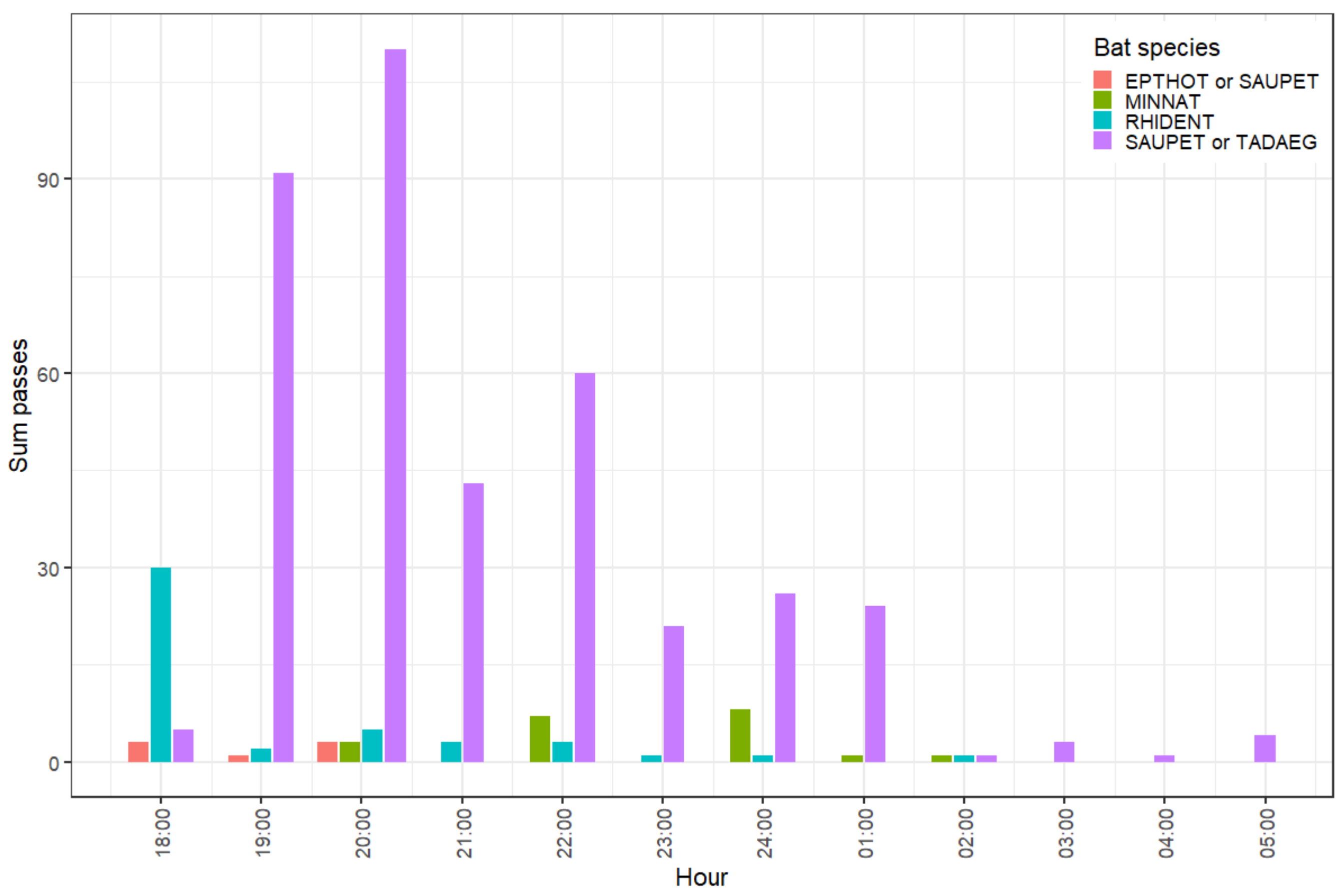


Figure 3-22. Bat activity per species for short-term acoustic monitoring setups STAM3 summed every hour.

3.5 BAT SENSITIVE FEATURES

The PA is very arid with ephemeral watercourses and one non-perennial dam, with a generally flat terrain with exposed dolerite koppies, bedrock and long chains of quartzite ridges, sometimes crested with quartz outcrops. Anthropogenic activities include sheep and some cattle ranching. Vegetation is limited, and when present is usually sparse and low to the ground, including grass clumps and low scrub bushes. Trees are very sparsely distributed, but occasionally *Vachellia* trees are present along dry watercourses, pans or dams and near to farmsteads and kraals, and larger bushes are often associated with the ephemeral watercourses. Bedrock pans are limited to the surface bedrock plains, but these are usually very small. The large dolerite outcrops that form conical stacks of large black rounded boulders are associated with species-specific bat roosts as well as general bat activity. Wetlands in arid areas are important foraging areas and drinking sites for bats and have higher activity levels than surrounding habitats (Loumassine *et al*., 2020). This is also likely to be true for the pans present in the PA. Man-made infrastructure is sparse and scattered throughout the site, all of the farmsteads were occupied, and are likely to support small numbers of roosting bats.

Watercourses are ephemeral and generally have denser vegetation owing to the greater/prolonged availability of moisture in the soil. Bats are known to forage along watercourses, as a greater abundance of insect activity is generally associated with plant growth and open water, and watercourses are natural corridors of vegetation where bats can maximise their foraging success. While transect data indicated that bat activity was only slightly higher in vegetated watercourses (outside of autumn), the La Niña event and associated rainfall leading to the uncharacteristic presence of a widespread abundance of plants may have reduced bat reliance on these vegetated watercourses. Consequently, it is strongly recommended that the applied buffers are maintained as these habitats are expected to be used more frequently under normal (non-La Niña) conditions. Post-construction acoustic and carcass monitoring will need to further investigate bat activity according to these habitat types to better inform adaptive mitigation. Buffered sensitive bat features, grouped by the type of feature, are shown in Figure 3-23.

Features identified as attractants for foraging bats have been buffered by 200 m, and features with confirmed or high likelihood of supporting bat roosts have been buffered by 500 m (Figure 3-23), as per the minimum requirements of the SABPG (MacEwan *et al.,* 2020b). These buffers should be considered as No-Go areas, where no part of the turbines should enter (including blade tips) (Figure 3-24). Turbines intersecting with these buffers should be relocated outside of the buffer zones. Of the current layouts (1 and 2), 1 is the preferred layout with no turbines within the sensitive buffers (including turbine blades), as 2 has 44[15] turbines within the sensitive buffers. Therefore 1 is the preferred turbine layout and does not require further adjustments to the turbine positions (Figure 3-24).

[15] #3.1; #2.1; #1.2; #2.3; #1.3; #2.4; #1.4; #2.5; #1.5; #3.6; #2.6; #1.6; #3.7; #2.7; #1.7; #3.8; #2.8; #3.9; #2.9; #3.10; #2.10; #3.11; #3.12; #3.13; #2.13; #3.14; #2.14; #3.15; #2.16; #3.17; #2.17; #2.18; #3.19; #3.20; #1.20; #3.21; #2.21; #3.22; #2.22; #3.23; #3.24; #3.26; #3.27; #2.33.

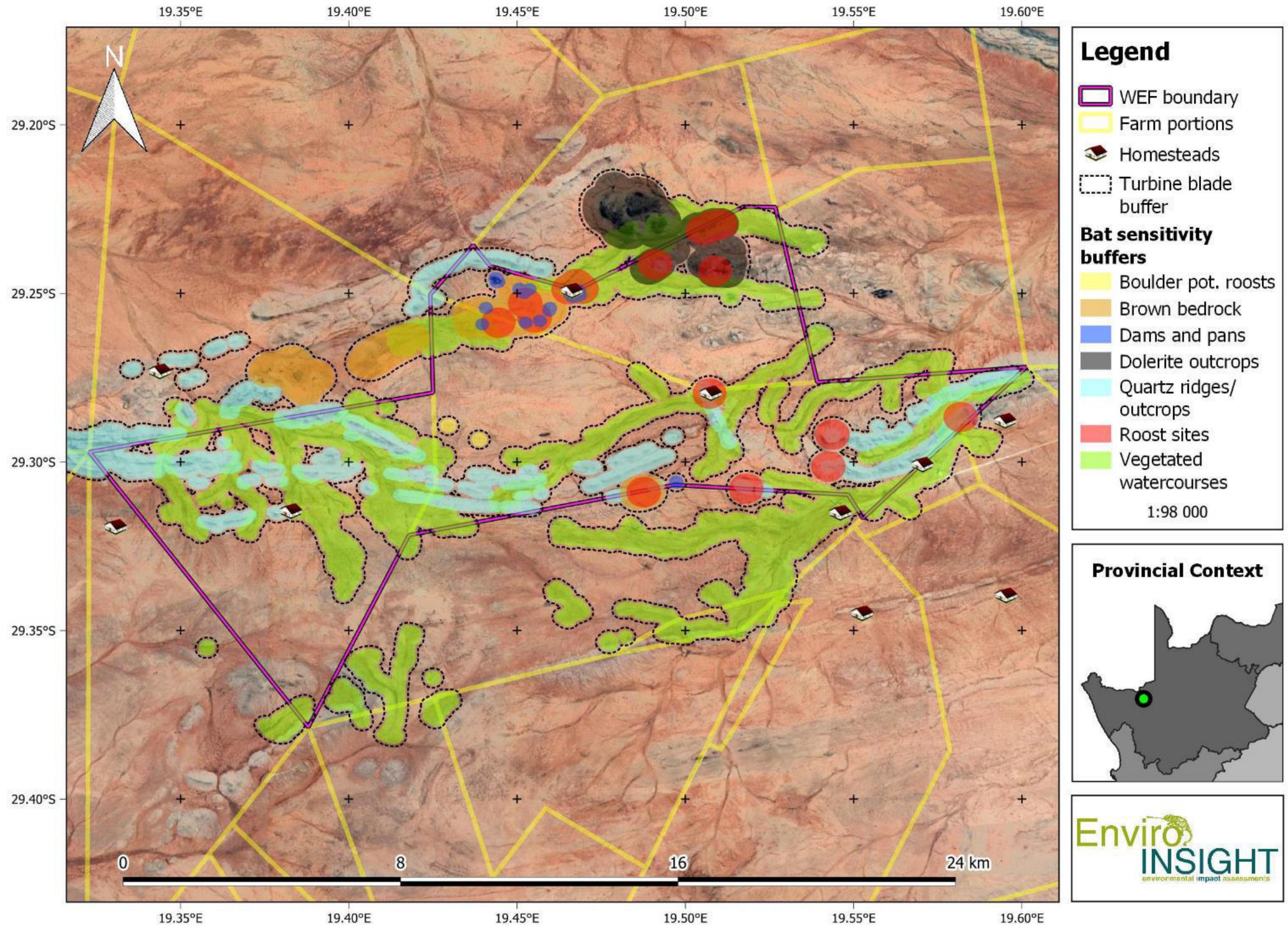


Figure 3-23: Sensitive bat features within the study area showing the appropriate buffers in relation to the alternative turbine layouts. No movement corridors were detected during transect surveys (requiring 500 m buffers), but confirmed or likely bat roosts were buffered by 500 m, while a 200 m buffer was implemented around areas potentially utilised by bats (such as vegetated drainage lines, dams, infrastructure, outcrops, pans and trees).

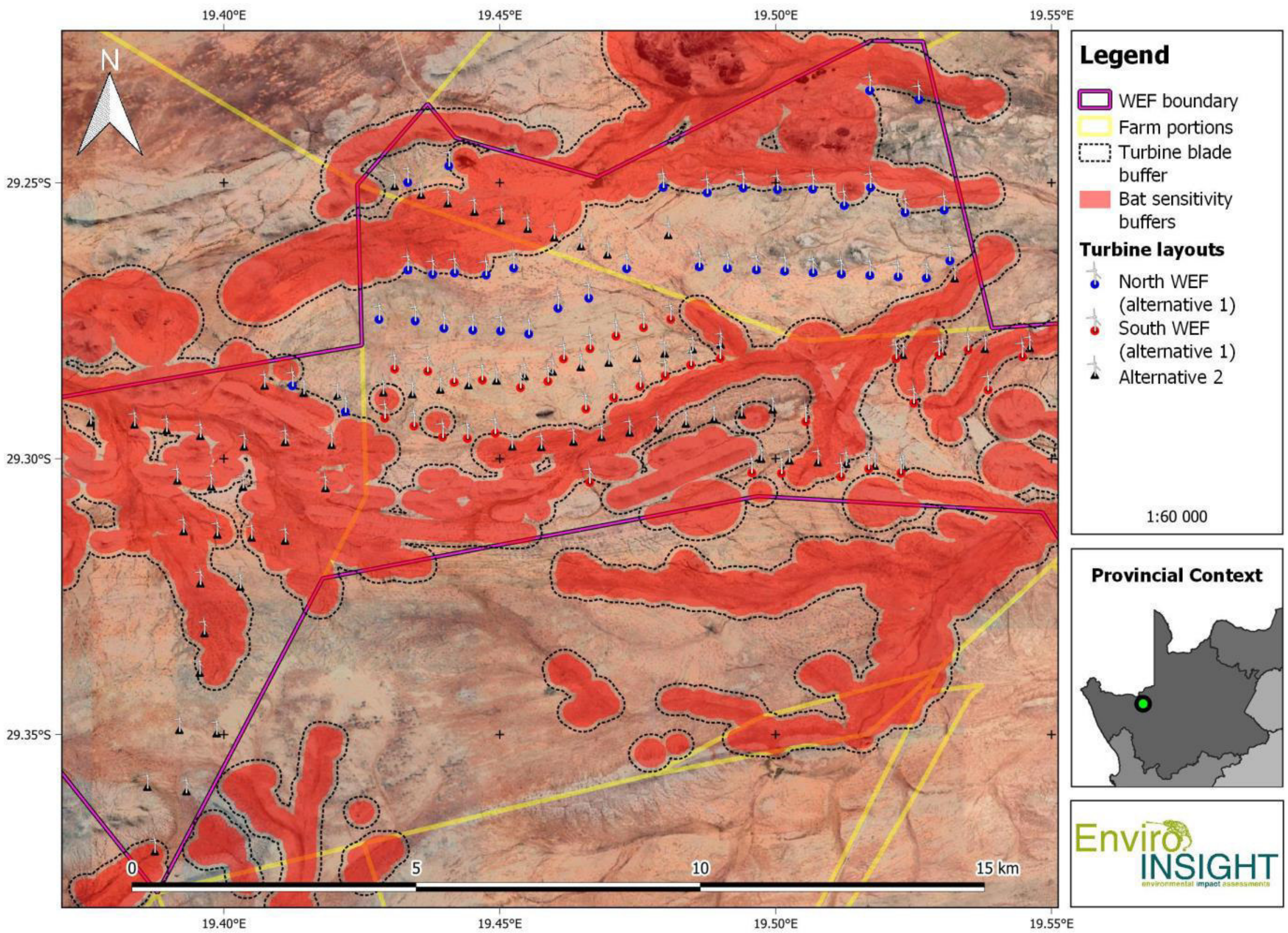


Figure 3-24: Sensitive bat features within the study area showing the appropriate buffers in relation to the turbine layouts. These are considered to be No-Go areas.

4 DISCUSSION AND CONCLUSION

This scoping report shows the preliminary findings (scoping) conducted for the pre-construction bat monitoring which will span the period from October 2021 to October 2022 wherein data were collected from three 10 m masts with single bat detectors and two meteorological masts each with 3 bat detectors.

A total of six bat species were detected during the survey period, namely *L. capensis*, *M. natalensis, E. hottentotus, R. damarensis, T. aegyptiaca* and *S. petrophilus*, but *N. thebaica* is also expected to occur based on sightings nearby. The project area falls within the Nama Karoo biome, and, based on the SABPG (MacEwan *et al*., 2020b), a median bat passes per hour greater than 1.01 bp/hr at 'near ground' level is considered as a High Risk for bat fatalities, and above 0.18 as a Medium Risk. Different thresholds for fatality risk are applied to bat activity within the 'rotor sweep' height, with High Risk above 0.42 bp/hr and a Medium Risk above 0.03 bp/hr. This overall median for bat activity on the project area (at near-ground level only – 10 m) was 0.90 bp/hr, classifying this PA as Medium Risk. The detectors at 10 m recorded comparable measures of bat activity, with the exception of B7 which recorded considerably more activity. For bat detectors recording within the rotor sweep zone, the median bat activity was 0.73 bp/hr (65 m) and 0.46 bp/hr (110 m), classifying the PA as High Risk for bat fatality at these heights. Large spikes in activity were recorded during the peak activity period, and these appeared to be congruent between different bat detectors. Environmental variable correlates will be investigated for the final EIA report to attempt to find specific conditions to inform mitigation measures, as mitigation can be especially effective if these activity spikes can be predicted and anticipated. Mitigation will be an important aspect for the proposed WEF, especially as activity spikes and outlying values are "diluted" in median calculations, and the fatality risk according to median values is already classified as High for rotor-sweep heights (MacEwan et al., 2020b).

Post-construction monitoring will play a vital role in determining when mitigation measures should be implemented and evaluation of the effectiveness of these measures, especially if preconstruction analysis cannot find good environmental predictors of bat activity. Mitigation measures to be implemented will include higher cut in speeds and curtailment (possibly including targeted turbine shutdowns) if required. However, if monitoring data indicate that fatalities thresholds are not being exceeded, curtailments may be relaxed or even removed. Sensitive bat features and their buffers have all been defined as No-Go areas and turbine blades must not encroach within these buffers, which should assist in reducing bat mortality by roosting and foraging bats.

In summary, the current location of the project area falls in a High Risk area for bat fatalities, and sporadic peaks of bat activity in late summer and early autumn will likely require specific and targeted mitigation. These findings are preliminary and may change as additional analyses are completed and thorough bat vocalisation identification are performed once all data are available for the preconstruction report.

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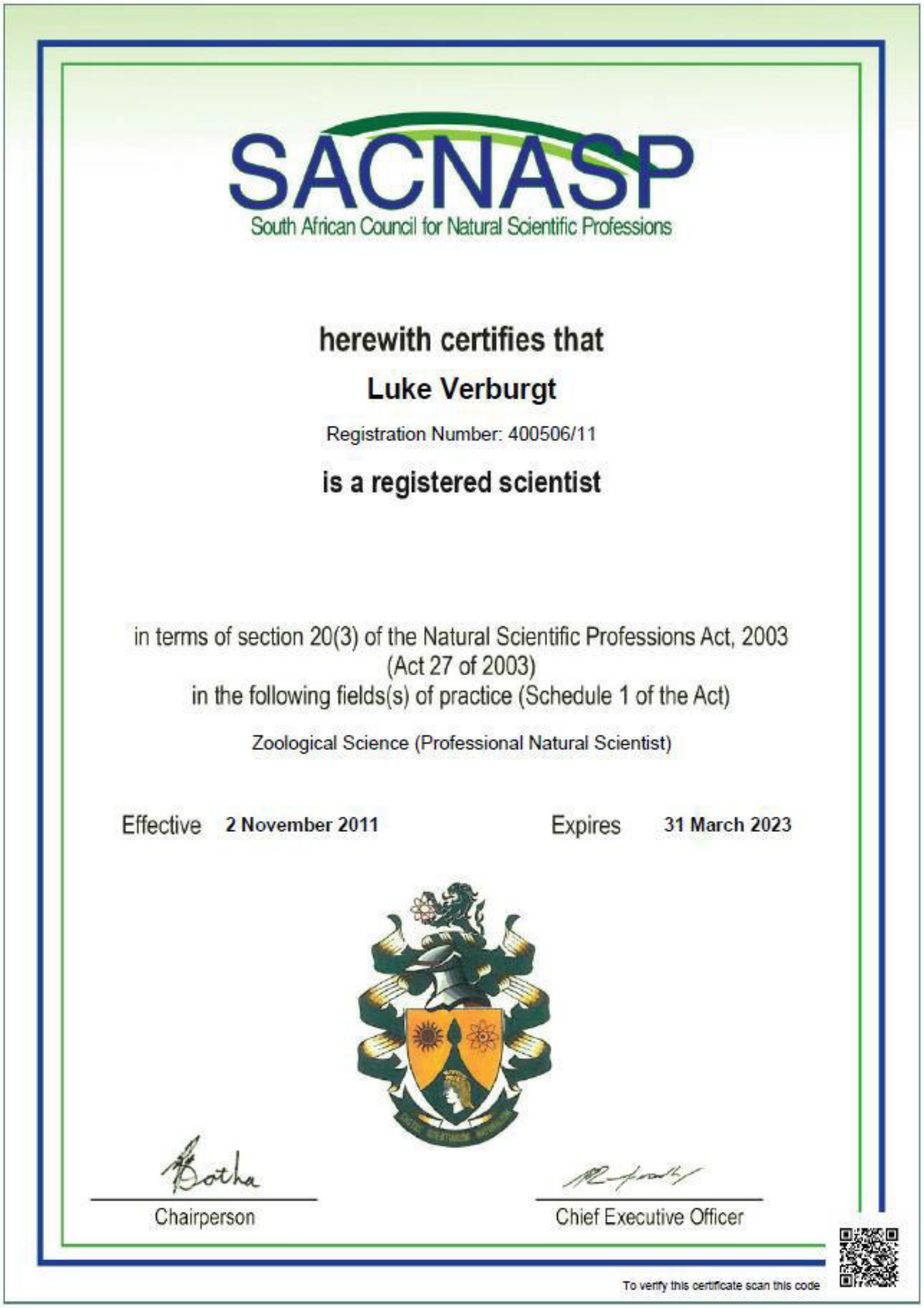
6 APPENDIX



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