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BAT MONITORING & IMPACT ASSESSMENT REPORT FOR THE SOYUZ 3 WIND ENERGY FACILITY IN THE BRITSTOWN WIND FARM CLUSTER, NORTHERN CAPE PROVINCE

On behalf of

Soyuz 3 (Pty) Ltd

March 2023

Prepared By:

Arcus Consultancy Services South Africa (Pty) Limited (an ERM Group Company)

240 Main Road
1st Floor Great Westerford
Rondebosch
7700

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

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Authors	Craig Campbell		
Signature			
Arcus Review and Approval	Ashlin Bodasing		
Signature			
ERM Review and Approval	Dieter Rodewald		
Signature			

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Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	Government Notice No. 320 has been gazetted, and a verification report aligned with the requirements have been included in the submitted scoping report.

1 INTRODUCTION

Soyuz 3 (Pty) Ltd is considering the development of an up to 480 MW wind energy facility ('WEF') in the Northern Cape. The proposed WEF will form part of the Britstown WEF Cluster, which will comprise of a cluster of six WEF's. The development site for the cluster is approximately 125,000 ha in extent and is located approximately 15 km south of the Britstown town centre. Arcus Consultancy Services South Africa (Pty) Ltd (an ERM Group Company) was appointed to conduct the pre-construction bat monitoring for the projects, the results of which have informed the final monitoring and specialist impact assessment process required for environmental authorisation in terms of the National Environmental Management Act, 1998 (Act 107 of 1998, as amended) (NEMA) and associated EIA regulations of 2014 as amended (EIA regulations). The final results and anticipated impacts for Soyuz 3 WEF are assessed in this report.

The aim of the bat monitoring programme was to document bat activity in the area of interest and, based on this activity, assess the proposed WEF cluster with regards to potential impacts to bats and the risk to development consent. These data establish a pre-construction baseline of bat species diversity and activity and are used to inform the impact assessments. The monitoring data also assists in providing solutions to avoid and mitigate impacts by informing the final design and construction and operational management strategy of the WEF's. The baseline will also be used to compare impacts to bats during the operational phase of the projects.

This impact assessment report includes the results from the bat activity monitoring undertaken between 6 October 2021 and 2 November 2022 (392 nights). These data were used to provide an assessment of potential impacts for the Soyuz 3 WEF.

1.1 Description of Proposed Development

The applicant Soyuz 3 (Pty) Ltd is proposing the development of a commercial WEF and associated infrastructure on a site located approximately 35 km South of Britstown within the Emthanjeni Local Municipality and the Pixley ka Seme District Municipality in the Northern Cape Province (Figure 1).

Five additional WEF's are concurrently being considered on the surrounding properties and are assessed by way of separate impact assessment processes contained in the 2014 Environmental Impact Assessment Regulations (GN No. R982, as amended) for listed activities contained in Listing Notices 1, 2 and 3 (GN R983, R984 and R985, as amended). These projects are known as Soyuz 1 WEF, Soyuz 2 WEF, Soyuz 4 WEF, Soyuz 5 WEF and Soyuz 6 WEF.

A preferred project site with an extent of approximately 125,000 ha was identified as a technically suitable area for the development of the six WEF projects. It is proposed that each WEF will comprise of up to 75 turbines with a combined contracted capacity of up to 480 MW. It is anticipated that each WEF will have an actual (permanent) footprint of up to 150 ha.

The Soyuz 3 WEF project site covers approximately 23,800 ha and comprises the following farm portions:

- Portion 4 of the Farm No. 143;
- Remaining Extent of Portion 1 of the Farm No. 143;
- Portion 9 of the Farm Combuisfontein No. 142;
- Portion 8 of the Farm Combuisfontein No. 142;
- Portion 4 of the Farm Combuisfontein No. 142;
- Portion 3 (a portion of Portion 1) of the Farm Combuisfontein No. 142;
- Portion 6 (a portion of Portion 1 – Gemsbokdam) of the Farm Combuisfontein No. 142;

- Portion 2 of the Farm Combuisfontein No. 142;
- Portion 2 of the Farm No. 2;
- Portion 0 of Farm No. 144;
- Portion 1 of the Farm No. 2;
- Remaining Extent of the Farm No. 2; and
- Remaining Extent of Portion 13 of the Farm Welgedagt No. 3.

The Soyuz 3 WEF project site is proposed to accommodate the following infrastructure, which will enable the WEF to supply a contracted capacity of up to 480 MW:

- Up to 75 wind turbines with a maximum hub height of up to 160 m and a rotor diameter of up to 200 m;
- A transformer at the base of each turbine;
- Concrete turbine foundations of up to 1024 m^2 each;
- Permanent Crane hardstand / blade and tower laydown area / crane boom erection area with a combined maximum footprint 5000 m^2 at each WTG;
- Temporary concrete batch plants to be located at the construction camp area and the satellite laydown areas;
- Battery Energy Storage System (with a footprint of up to 5 ha);
- Internal up to 132 kV overhead lines between substations[1]. A 300 m wide corridor (150 m on either side of the proposed route) has been considered to allow for any technical and environmental sensitivity constraints identified during micro-siting prior to layout finalisation. Permanent service roads will be required for the construction and maintenance of the overhead lines. In areas where these overhead lines do not follow an existing or proposed road, additional roads of up to 3 m in width will be required. Temporary construction areas beneath each overhead line tower position will also be required;
- Medium voltage (33 kV) cables/powerlines running from wind turbines to the facility substations. The routing will follow existing/proposed access roads and will be buried where possible. If the use of overhead lines is required, the Avifaunal Specialist will be consulted timeously to ensure that a raptor friendly pole design is used, and that appropriate mitigation is implemented pro-actively;
- Up to six permanent met masts;
- Three substations and operation and maintenance (O&M) facilities (up to 4 ha each), as well as a laydown area (8 000 m^2) at each substation for the electrical contractor. O&M facilities include a gate house, security building, control centre, offices, warehouses and workshops;
- Three temporary main construction camp areas (up to 12.25 ha each);
- Twelve temporary satellite laydown areas (5 000 m^2 each); and
- Access roads to the site and between project components inclusive of stormwater infrastructure. A 200 m road corridor is being applied for to allow for slight realignments pending technical and environmental sensitivity constraints identified during micro-siting prior to layout finalisation. The final road will have maximum width of 12 m (within the 200 m corridor).

In order to evacuate the energy generated by the WEF to the national grid, a separate Basic Assessment application will be submitted to assess the grid connection and is not further assessed in this report.

1.2 Terms of Reference

The aim of this report is to present the baseline environment with respect to bats that may be influenced by the development and operation of the WEF. Based on this baseline, a

[1] Internal overhead lines will connect the two on-site substations and are fully enclosed within the study under assessment.

description and evaluation of the potential impacts the project may pose to bats is provided. The following terms of reference were utilised for the preparation of this report:

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

1.3 Assumptions and Limitations

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

- The knowledge of certain aspects of South African bats including natural history, population sizes, demographics, local and regional distribution patterns, spatial and temporal movement patterns (including migration and flying heights) and how bats may be impacted by wind energy, including cumulatively, is very limited for many species.
- Bat echolocation calls (i.e. ultrasound) operate over ranges of metres therefore acoustic monitoring samples only a small amount of space (Adams et al. 2012). Recording a bat using sound is influenced by the type and intensity of the echolocation call produced, the species of bat, the bat detector system used, the orientation of the signal relative to the microphone and environmental conditions such as humidity. One must therefore adopt a precautionary approach when extrapolating data from echolocation surveys over large areas due to the limited sample size (i.e., only small areas are actually sampled).
- There can be considerable variation in bat calls between different species and within species. The accuracy of the species identification is dependent on the quality of the calls used for identification. Species call parameters can often overlap, making species identification difficult.
- Automatic bat classifiers in Kaleidoscope Pro Version 5.4.7 (Wildlife Acoustics, Inc) were used to identify bat species. Post-processing was used to manually verify the performance of the classifiers but owing to the large number of files recorded, not all recordings could be verified manually. There may be instances where the software was unable to identify species or made incorrect identifications.
- Bat activity recorded by bat detectors cannot be used to directly estimate abundance or population sizes because detectors cannot distinguish between a single bat flying past a detector multiple times or between multiple bats of the same species passing a detector once each (Kunz et al. 2007a). This is interpreted using the specialists' knowledge and is presented as relative abundance.
- The potential impacts of wind energy on bats presented in this report represent the current knowledge in this field. New evidence from research and consultancy projects may become available in future, meaning that impacts and mitigation options

presented and discussed in this report may need to be adjusted if the project is developed.
- While the data presented in this report provides a baseline of bat activity for the period sampled, it does not allow for an understanding of interannual variation in bat activity. It is therefore possible that during the lifespan of the facility, bat activity could be significantly different (lower or higher) compared to the baseline presented here.

1.4 Applicable Legislation, Policies, Treaties, Guidelines and Standards

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

- The Equator Principles (2013);
- International Finance Corporation Environmental, Health, and Safety Guidelines for Wind Energy (2015);
- Convention on the Conservation of Migratory Species of Wild Animals (1979);
- Convention on Biological Diversity (1993);
- Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996);
- National Environmental Management Act, 1998 (NEMA, Act No. 107 of 1998);
- National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004);
- National Biodiversity Strategy and Action Plan (2005);
- South African Best Practise Guidelines for Surveying Bats in Wind Energy Facility Developments – Pre-Construction (2020) & Post-Construction (2020);
- Species Environmental Assessment Guidelines (2022); and
- Government Notice No. 320 has been gazetted, therefore a verification report aligned with the requirements was included in the submitted scoping report.

2 METHODOLOGY

2.1 Desktop Review

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

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

2.2 Field Surveys

The pre-construction monitoring was designed to monitor bat activity across the proposed project site, but mainly within the full extent of the Britstown WEF cluster area – the results of which will inform all six proposed Soyuz WEF's. The monitoring was undertaken in accordance with South African best practice[2]. Sampling of bat activity took place at 25 locations (Figure 1) using Song Meter SM4 bat detectors (Wildlife Acoustics, Inc.). Ultrasonic microphones were mounted on masts at 12 m ("ground level") at nineteen locations. In addition, ultrasonic microphones were mounted at 12 m, 55 m and 100 m

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

respectively on six meteorological masts ("at height"). All detectors were configured to record every night from 30 minutes before sunset until 30 minutes after sunrise.

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

In addition to the acoustic monitoring, potential structures that bats could use as roosts were investigated during the day for the presence or evidence of roosting bats (e.g. guano and culled insect remains, etc.) whenever the Arcus team was on site. These included buildings, rocky outcrops and trees. Potentially sensitive geographical features from GIS databases were also ground-truthed whenever the Arcus team were on site to refine the bat sensitivity buffers.

2.3 Data Analysis

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

Acoustic data from each bat detector were analysed using Kaleidoscope® Pro (Version 5.4.7, Wildlife Acoustics, Inc.). Bat species were automatically identified from their echolocation calls using the embedded echolocation call library in the software. The results were vetted by random or selective (for certain species) checks through manually identifying recordings to verify the results. The total number of files was used as a proxy for the number of bat passes, which is a standard approach to quantifying bat activity.

3 BASELINE ENVIRONMENT

3.1 Habitats

The proposed WEF cluster is spread across the gently sloping flats and planes of the Eastern Upper Karoo and Northern Upper Karoo vegetation types with interspersed hills of Upper Karoo Hardeveld in the Nama Karoo ecoregion. Approximately 14, 000 ha of Upper Karoo Hardeveld is found on the steep and rocky slopes of mid-eastern boundary and is interspersed throughout the area, which is comprised mainly of dwarf karoo scrub. The Soyuz 3 site is comprised of the Northern Upper Karoo vegetation type in the west, Eastern Upper Karoo bisecting from north to south through the centre and Upper Karoo Hardveld ridges at the western boundary with some isolated slopes at the site centre. Topography is mostly flat in the north to undulating in the south, with steep slopes of the Upper Karoo Hardveld ridges on the eastern border. The region's climate is harsh and droughts are common. There are no known bat roosts in the area.

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

The availability of roosting space is a critical factor for bats (Kunz and Lumsden 2003) and a major determinant of whether bats will be present in a landscape, as well as the diversity of species that can be expected. There are no confirmed roosts in the study area. Based on unpublished data from the South African Bat Assessment Association, the nearest major bat roost is located ca. 93 km north of the site. There are, however, several potential roosting features on site that may be used by bats. These include buildings and trees (which are mainly associated with the farmsteads) and rocky outcrops.

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

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

Bats are known to use linear landscape features for commuting routes to get to and from foraging sites, roost sites and to access water sources. Linear landscape elements, such as tree lines and edge habitats, provide protection to bats from predators, shelter from wind, orientation cues as well as foraging habitat (Verboom and Huitema 1997; Verboom 1998). The primary linear landscape features are drainage lines, which typically (but not always) are associated with vegetation, providing linear and edge habitats that bats can access. Rivers, tree lines, and other edge habitats might also be used as commuting routes or navigation cues.

3.2 Bat Species

Approximately twelve bat species can potentially occur at the proposed site (African Chiroptera Report 2018; Monadjem et al. 2010). It is possible that more (or fewer) species may be present because the distributions of some bat species in South Africa, particularly rarer species, are poorly known. Analysis of the acoustic monitoring data suggests that at least nine bat species may have been recorded on site (Table 1).

Activity was dominated by the Egyptian free-tailed bat and Cape serotine which accounted for 84 % and 13 % of total bat passes respectively. The remaining species were recorded relatively infrequently.

Table 1: Bat Species List for Britstown WEF Cluster and their Sensitivity

Species	Species Code	# Bat Passes	Conservation Status[3]		Likelihood of Risk
			National	International	
Egyptian free-tailed bat *Tadarida aegyptiaca*	TADAEG	273,803	Least Concern	Least Concern	High
Roberts's flat-headed bat *Sauromys petrophilus*	SAUPET	480	Least Concern	Least Concern	High
Cape serotine *Neoromicia capensis*	NEOCAP	44,807	Least Concern	Least Concern	High
Zulu Pipistrelle Bat *Neoromicia zuluensis*	NEOZUL	117	Least Concern	Least Concern	High
Straw-coloured Fruit Bat *Eidolon helvum*	EIDHEL	-	Least Concern	Near Threatened	High
Long-tailed serotine *Eptesicus hottentotus*	VES30	4,858	Least Concern	Least Concern	Medium
Yellow-bellied house bat *Scotophilus dinganii*			Least Concern	Least Concern	Medium-High
Lesueur's wing-gland bat** *Cistugo lesueuri*	CISLES	28	Least Concern	Least Concern	Low
Darling's horseshoe bat *Rhinolophus darlingi*	RHIDAR	-	Least Concern	Least Concern	Low
Geoffroy's horseshoe bat *Rhinolophus clivosus*	RHICLI	4	Least Concern	Least Concern	Low
Egyptian slit-faced bat *Nycteris thebaica*	NYCTHE	-	Least Concern	Least Concern	Low
Natal long-fingered bat *Miniopterus natalensis*	MINNAT	586	Least Concern	Least Concern	High

** Endemic to South Africa.

3.3 Spatio-Temporal Bat Activity Patterns

Data obtained from the full monitoring campaign yielded a total of 324,683 bat passes recorded across all detectors (Table 1). Percentage of nights with bat activity ranged from low to high, with bats recorded between 12.1 % and 94.6 % of sample nights (Table 2). Height-specific bat activity and fatality risk within the Nama Karoo terrestrial ecoregion is defined within MacEwan et al. (2020) as:

Near Ground

- Low Risk: < 0.18 median bat passes per hour.
- Medium Risk: 0.18 – 1.01 median bat passes per hour.
- High Risk: > 1.01 median bat passes per hour.

Rotor Sweep

- Low Risk: < 0.03 median bat passes per hour.
- Medium Risk: 0.03 – 0.42 median bat passes per hour.
- High Risk: > 0.42 median bat passes per hour.

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

Table 2: Acoustic Monitoring Summary

Detector	Date Installed	# of Sample Nights	% of Sample Nights with Bat Activity	Mean Passes/Night; Median Bat Passes/hour	Total Bat Passes
B1_MET_12M	06/10/2021	264	85.6	31.1; 1.07	8 183
B1_MET_50M	06/10/2021	384	82.3	26.3; 0.64	10 105
B1_MET_100M	06/10/2021	372	70.2	14.0; 0.22	5 216
B2_MET_12M	07/10/2021	390	84.9	33.6; 0.94	13 108
B2_MET_50M	07/10/2021	391	85.9	30.6; 0.70	11 989
B2_MET_100M	07/10/2021	110	27.3	6.1; 0.00	683
B3_MET_12M	07/10/2021	389	86.4	35.2; 0.88	13 701
B3_MET_50M	07/10/2021	356	82.3	27.8; 0.59	9 999
B3_MET_100M	07/10/2021	347	43.8	11.2; 0.00	3 892
B4_MET_12M	12/10/2021	387	86.8	47.51; 1.28	18 388
B4_MET_50M	13/10/2021	375	85.3	43.89; 1.01	16 852
B4_MET_100M	14/10/2021	379	43.3	13.85; 0.00	5 209
B5_MET_12M	08/10/2021	379	82.8	25.06; 0.67	9 499
B5_MET_50M	08/10/2021	391	79.5	18.13; 0.37	7 087
B5_MET_100M	08/10/2021	279	72.0	14.49; 0.41	4 042
B6_MET_12M	08/10/2021	379	87.3	34.4; 1.12	13 039
B6_MET_50M	08/10/2021	357	78.2	15.77; 0.36	5 631
B6_MET_100M	08/10/2021	380	87.1	29.86; 0.92	11 348
B7	12/10/2021	341	78.0	18.88; 0.37	6 475
B8	11/10/2021	384	85.9	22.25; 1.18	8 543
B9	06/10/2021	388	84.3	24.73; 1.05	9 569
B10	09/10/2021	238	12.2	26.61; 0.11	10 485
B11	09/10/2021	258	45.7	18.62; 0.60	6 108
B12	14/10/2021	377	80.4	30.5; 0.98	11 499
B13	14/10/2021	124	77.4	10.51; 0.34	1 303
B14	12/10/2021	384	65.1	17.31; 0.34	6 647
B15	12/10/2021	290	93.1	60.78; 1.81	17 627
B16	13/10/2021	387	76.2	61.8; 1.57	23 915
B17	13/10/2021	184	87.5	31.39; 0.99	5 776
B18	10/10/2021	308	84.7	21.77; 0.87	6 704
B19	13/10/2021	311	72.7	8.13; 0.17	2 528
B20	11/10/2021	254	84.6	16.5; 0.61	4 190
B21	11/10/2021	226	94.7	36.87; 1.31	8 333
B22	13/10/2021	158	79.1	12.46; 0.44	1 969
B23	13/10/2021	376	84.6	13.6; 0.56	5 115
B24	09/10/2021	260	86.9	36.23; 2.00	9 419
B25	14/10/2021	200	79.5	52.86; 2.59	10 572

* Green cells indicate Low Risk, while Orange cells indicate Moderate Risk and Red cells indicate High Risk for the Nama Karoo ecoregion

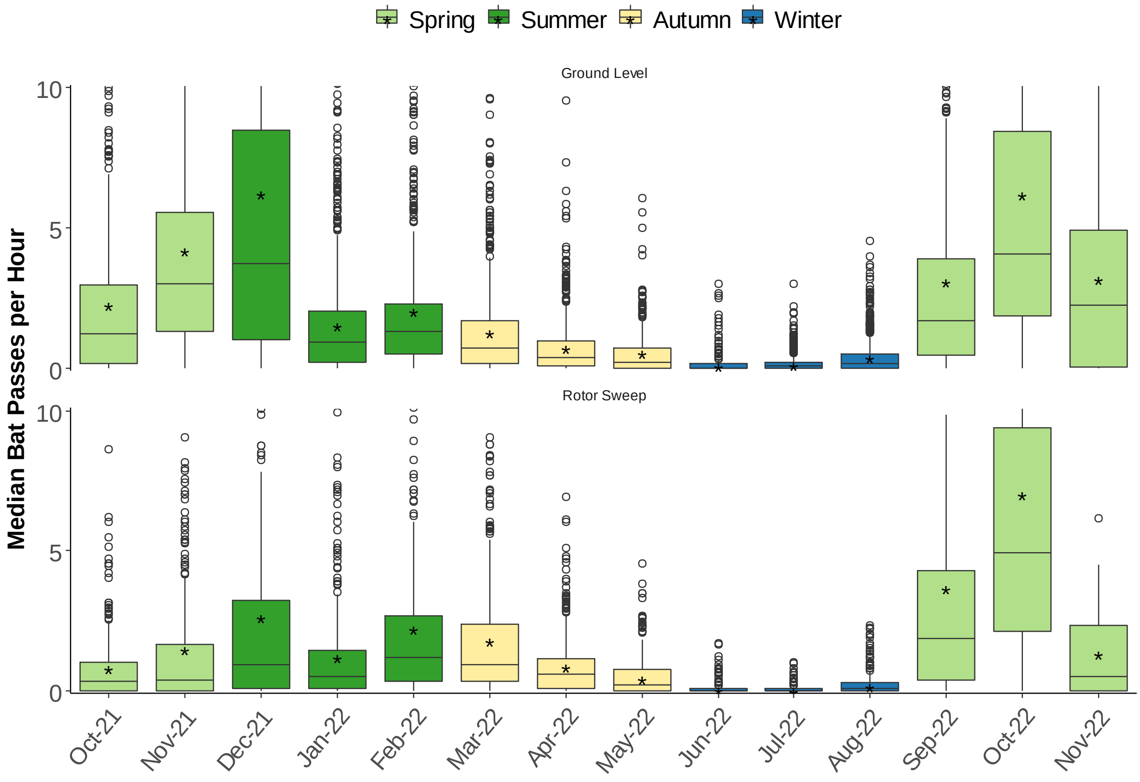
Overall, activity in spring was high at ground level and high at rotor sweep (2.46 and 1.15 median passes/hour respectively) and high at both ground level and rotor sweep in summer (1.44 and 0.82 median passes/hour respectively). Activity in Autumn was moderate at ground level and high at rotor height (0.38 and 0.55 median passes/hour), while winter yielded the lowest activity levels of all four seasons, having low activity levels at both ground level and rotor height (0.06 and 0.00 median passes/hour) (Table 3).

Table 3: Median bat passes per hour at ground level and rotor height per season

	Summer	Autumn	Winter	Spring
Ground Level	1.44	0.38	0.06	2.46
Rotor Sweep	0.82	0.55	0.00	1.15

* Green cells indicate Low Risk, while Orange cells indicate Moderate Risk and Red cells indicate High Risk for the Nama Karoo ecoregion

Activity was low in June, July and August for both height bands (ground level and rotor height) and increased in September until peaking in October (4.05 median passes/hour at ground level and 4.94 median passes/hour at rotor height) (Graph 1; Table 4). Activity remained relatively high during the summer months (December, January and February) until gradually decreasing to moderate levels during autumn (March, April and May) and low levels in Winter (Graph 1; Table 4).



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

Activity distribution within the rotor sweep height band also differed slightly between the two sampled heights (50m and 100m) (Graph 2; Table 4). Activity at 100 m was predominantly high in spring, peaking in October (3.48 median passes/hour) before declining to moderate levels shortly thereafter. High activity was then observed in late summer and early autumn, where median bat passes/hour were recorded to be 0.87 in February and 0.56 in March. Activity then declined steadily until low activity levels were recorded in late autumn and for the entire duration of the winter period (June to August) (Table 4). Activity at 50m was predominantly high for most of the monitoring campaign, with the highest levels recorded in September and October (spring) – 2.33 and 6.07 median bat passes/hour, respectively. Activity remained high until declining to moderate levels in May, and low levels in June and July. Activity then started increasing again to moderate levels in August, until reaching high levels in September once again (Table 4).

Overall, the results show a trend for activity (and subsequent risk of impacts) to be high during spring and summer, moderate during autumn and low during the winter period.

Table 4: Median bat passes per hour per microphone per month

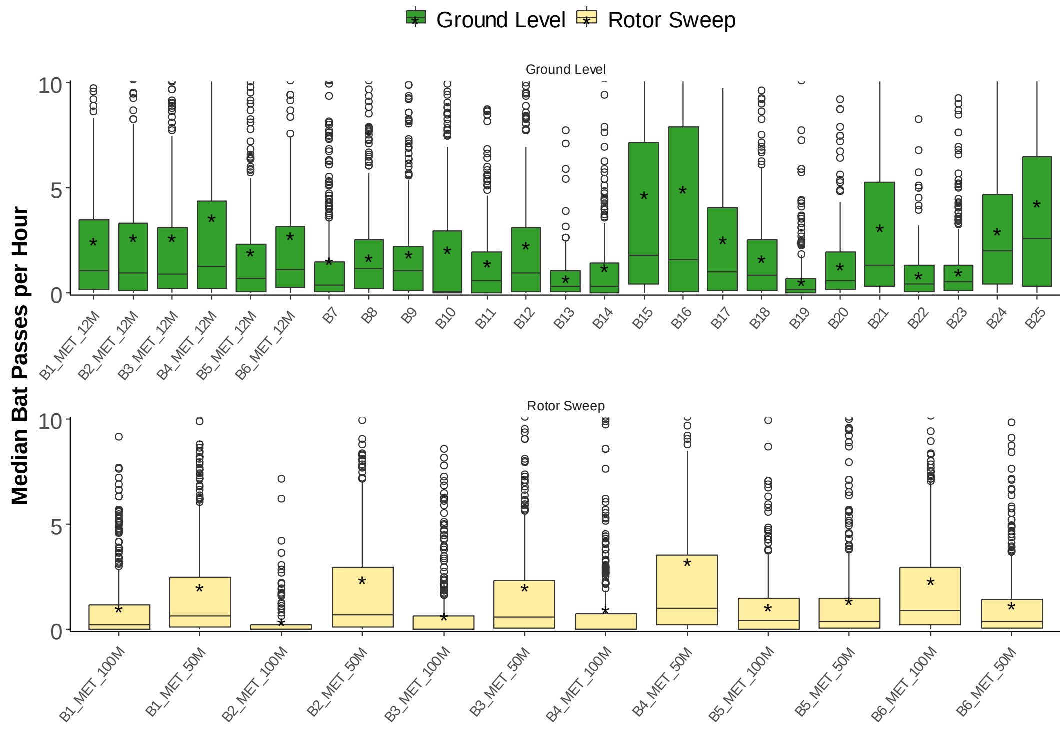
	Oct-21	Nov-21	Dec-21	Jan-22	Feb-22	Mar-22	Apr-22	May-22	Jun-22	Jul-22	Aug-22	Sep-22	Oct-22	Nov-22
Ground Level	1.23	3.01	3.74	0.89	1.28	0.71	0.36	0.21	0.00	0.07	0.15	1.67	4.05	2.22
Rotor Sweep	0.34	0.39	0.92	0.52	1.20	0.94	0.58	0.21	0.00	0.00	0.07	1.88	4.94	0.51
50m	0.51	0.87	1.74	0.76	1.56	1.14	0.62	0.31	0.00	0.00	0.07	2.33	6.07	0.77
100m	0.24	0.04	0.27	0.26	0.87	0.56	0.22	0.00	0.00	0.00	0.00	1.59	3.48	0.00

* Green cells indicate Low Risk, while Orange cells indicate Moderate Risk and Red cells indicate High Risk for the Nama Karoo ecoregion

At ground level and at overall rotor sweep height (50 m – 100 m)[4], collectively, a similar distribution of bat activity was observed over the study period (Graph 2). There were however clear differences in how bat activity varied according to height above the ground. Most activity was recorded at 12 m, while at the met masts, the microphone at 50 m recorded more bat activity than those positioned at 100 m. Generally, activity declined with height (Graph 2).

Median bat activity per hour was almost evenly distributed between moderate and high risk at ground level, although exhibiting a slight tendency towards moderate risk (n=2 Low Risk; n=13 Moderate Risk; n=10 High Risk) (Graph 2, Table 2). Activity within the rotor sweep was mostly recorded at high risk levels at 50m, with the exception of two monitoring stations (B5_MET_50m and B6_MET_50m), which exhibited a moderate risk (Table 2). At 100m, activity levels within this rotor sweep zone were mostly low (Table 2) – indicating an overall tendency for bat activity to decrease with height.

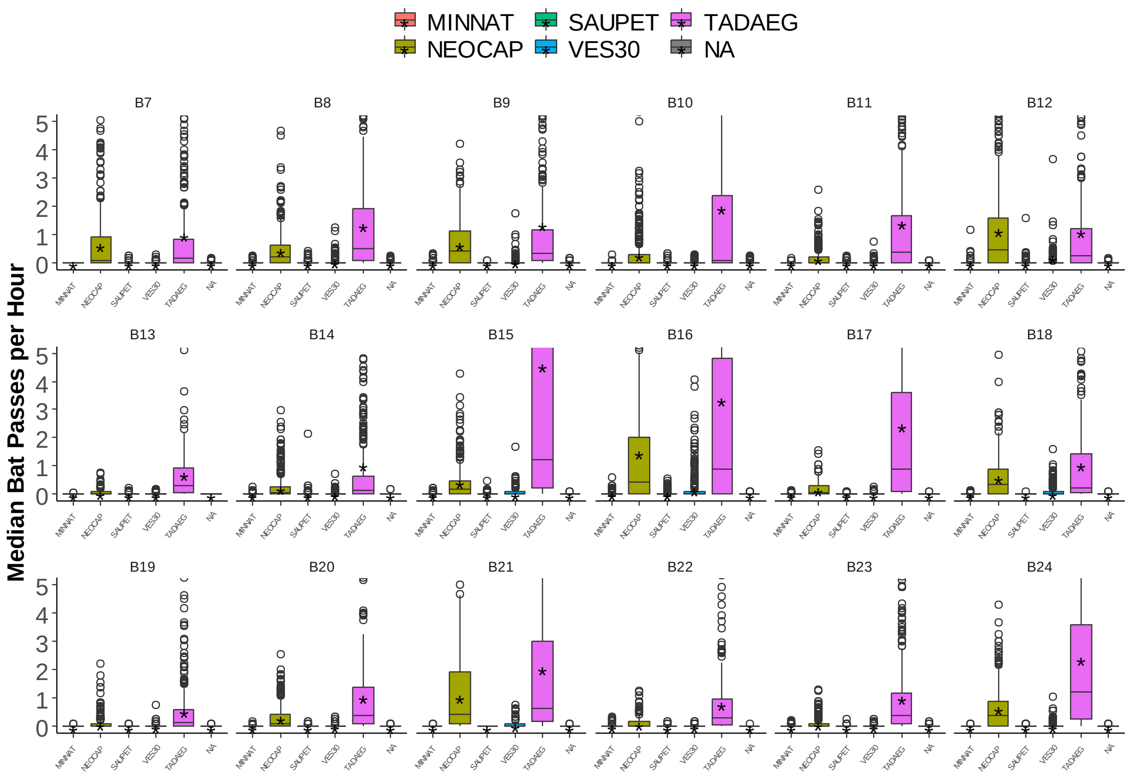
[4] MacEwan, K., Sowler, S., Aronson, J. and Lötter, C., 2020. South African best practice guidelines for pre-construction monitoring of bats at wind energy facilities.



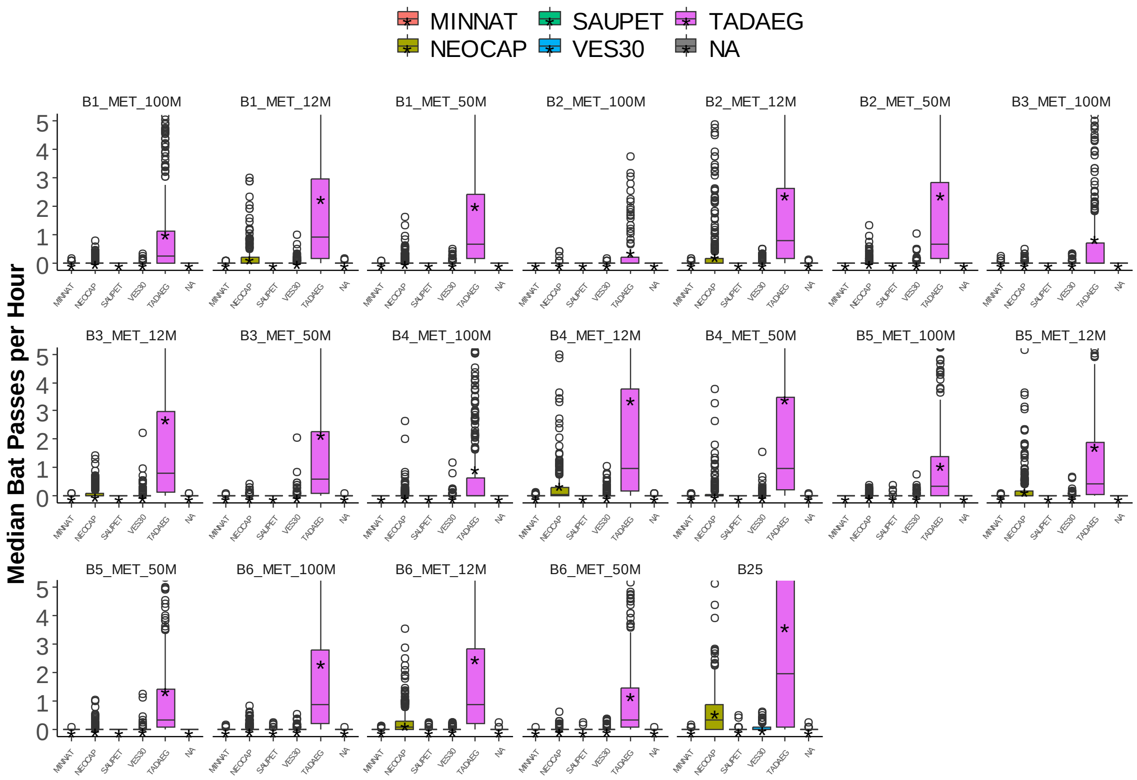
Graph 2: Boxplot showing the median number of bat passes per detector per hour at Rotor Sweep and Ground Level.

Among the met masts, a total of 92,053 bat passes were recorded at height, with 67 % recorded at 50 m and 33 % at 100 m. Of all bat species that were recorded height, approximately 97 % of all activity was attributed to the Egyptian free-tailed bat (Graph 3; Graph 4). The Cape Serotine accounted for approximately 1.9 % of activity at rotor height, while the remainder of species were at recorded a low levels, below 1 %.

At ground level, the Egyptian free-tailed bat accounted for the majority of activity observed, making up approximately 79 % of all bat passes recorded. The Cape Serotine then accounted for approximately 18.5 % of activity at ground level, while species from the VES30 group made up approximately 1.8 % of the overall activity. Thereafter, the remainder of species recorded were noted to occur at very low levels, below 1 % (Graph 3; Graph 4).

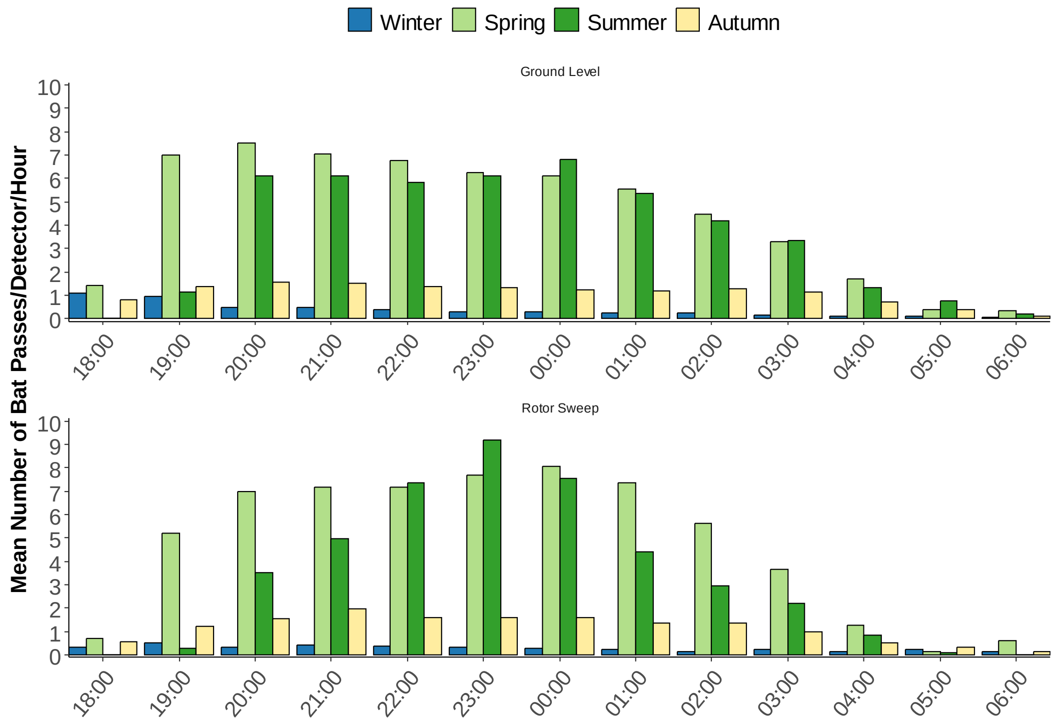


Graph 3: Boxplot showing the median number of bat passes per hour, per species, at each sampling location (B7-B24).



Graph 4: Boxplot showing the median number of bat passes per hour, per species, at each sampling location (B1-B6; B25).

At ground level in spring, activity commenced at 18:00, increased rapidly to peak at 20:00 and thereafter decreased gradually until sunrise. At rotor sweep height activity in spring also commenced at 18:00, increased rapidly until 19:00, and then continued gradually increasing until it peaked at 00:00, whereby it then declined until sunrise (Graph 5). In summer, ground level activity commenced at 19:00 and rose rapidly at 20:00 where it continued to remain high (peaking at 00:00), after which it then started declining until 06:00. At rotor height, activity started at 19:00 and increased gradually until 23:00, before declining until 05:00 (Graph 5). In Autumn, activity at both ground level and rotor height showed a similar pattern, whereby activity levels were relatively low – peaking at approximately 21:00. At both heights, bat emergence was recorded at 18:00 after which all activity stopped at 06:00 (Graph 5). In Winter, activity levels were at their lowest at both ground and rotor height. This activity started at 18:00 and ended at 06:00, for both ground and rotor height. Activity levels during winter peaked very early, with most activity recorded at 18:00 (ground level) and 19:00 (rotor height) (Graph 5). Overall, spring and summer showed a clear pattern for bat activity to be higher throughout most of the night period – indicating a higher risk for potential impacts during these two seasons.



Graph 5: Bar graph showing the mean number of bat passes per detector per hour at Ground Level and Rotor Sweep.

3.4 Discussion

The key findings from the full bat pre-construction monitoring campaign are that bat overall activity was moderate to high for most of the study period across the site at both ground level and rotor sweep. Activity was particularly high at all heights in spring and summer, with the highest activity levels recorded in October. Thus, based on the data available, bats are at greatest risk to wind energy impacts during specific parts of spring and summer.

Bats were mostly active at ground level (in relation to rotor height) across almost every month (with some minor exceptions in March, April, September and October), while activity decreased with an increase in height. Despite this, and because the risk for bats increases at the rotor sweep height band, the relatively high bat activity at 50 m throughout the monitoring period indicates a high risk to bats at this height for the site. At 100 m, however, although four notable high activity months were observed, the remainder of activity was documented to be either moderate or low risk. As such, it is likely that bats would be highly susceptible to impacts at the lower rotor swept zone – where activity was recorded to be high. Turbine design is therefore considered to be an important aspect when considering impacts to bats.

Despite the high bat activity observed in spring and summer, the number of passes changed with respect to time of night. Overall, activity was recorded throughout most of the night among all four seasons. However, spring and summer activity had a tendency to peak later in the evening before declining until sunrise, while the activity in autumn and winter tended to peak very early (at low levels) and remain relatively constant throughout the night. This information is considered important for the development of a suitable curtailment, in the event that it may be required to mitigate any residual impacts.

Species diversity is typical for arid regions in South Africa (Cooper-Bohannon et al. 2016) and is also consistent with respect to other projects in the area, where the Egyptian free-tailed bat was the most recorded species, followed by the Cape serotine. Several other bat species that are also susceptible to wind energy impacts are present in the study area. This includes four high risk species (Robert's flat-headed bat, Zulu pipistrelle, Straw-coloured fruit bat and Natal long-fingered bat), one medium-high risk species (Yellow-bellied house bat), one medium risk species (Long-tailed serotine) and four low risk species (Lesueur's wing-gland bat, Darling's horseshoe bat, Geoffroy's horseshoe bat and Egyptian slit-faced bat). All of these species have a Red List conservation status of "Least Concern", barring the Straw-coloured Fruit Bat – which is considered to be "Near Threatened" on a global scale. Wind energy is however an emerging impact, which may not be fully considered yet by the Red List of Mammals of South Africa and IUCN Red List. Fatality records of the Egyptian free-tailed bat and Cape serotine, specifically, are known from operating WEF's across parts of South Africa (Doty and Martin 2012; Aronson et al. 2013; MacEwan 2016).

The Egyptian free-tailed bat accounted for 84 % of the total bat activity during the sample period and 97 % of rotor sweep height activity. This species is classified as high risk to wind energy developments because of their foraging ecology, which allows for activity in open areas, high above the ground where they may encounter wind turbine blades. At the met masts, Egyptian free-tailed bat activity (at both 100 m and 50 m) accounted for approximately 97 % of all activity recorded. This was marginally higher than that recorded at ground level (79 %), indicating the importance of this species' flight behaviours and probability to encounter spinning turbine blades – both in the lower and higher sweep zones.

Within the Soyuz 3 boundary, bat activity at B15 (adjacent to rocky outcrops), B25 (in open land and within 1 km of NFEPA wetlands) and B4_MET (next to rocky outcrops) was mostly high for the Nama Karoo ecoregion (although activity at B4_MET_12m was recorded as being low). The remainder of sampling locations (B11, B13, B14 and B17), mostly associated with drainage lines and rocky outcrops, had moderate activity levels. The data therefore suggests that these topographies are considered important in terms of their sensitivity to bats, and that activity is generally considered to be spread relatively evenly throughout the WEF site.

Due to the predominantly moderate and high activity levels recorded across the extent of the study area to date, measures to avoid risks to bats will be needed. Mitigation options that can be incorporated into the project to minimise potential risks can be categorised into avoidance and minimisation techniques. Avoidance includes buffering key habitats and considering turbine design so that potential interactions between bats and wind turbines are spatially limited as much as possible. As such, key habitats have been buffered (200 m) in accordance with the most recent version of the South African best practice guidelines for pre-construction monitoring of bats at wind energy facilities (MacEwan et al., 2020). Such habitats include watercourses, rocky outcrops, buildings, trees, water features, wetlands, cultivated lands and orchards/vineyards (Figure 2). All buffers associated with these features are to be completely avoided from turbine placement (inclusive of the full blade length). Minimisation relates to mitigating residual impacts to bats primarily through various forms of curtailment[5] or by using ultrasonic deterrents. Minimisation may be considered, as needed, during the projects' operational phase monitoring programme – once real impacts are being measured against fatality thresholds.

4 IMPACT ASSESSMENT

WEFs have the potential to impact bats directly through collisions and barotrauma resulting in mortality (Horn et al. 2008; Rollins et al. 2012), and indirectly through the modification of habitats and disturbance/displacement effects (Kunz et al. 2007b), during the construction, operation and decommissioning of wind turbines and associated infrastructures. Direct impacts pose the greatest risk to bats and, in the context of the Soyuz 3 WEF, habitat modification and disturbance/displacement may pose a risk, particularly in a sense of disturbing bats during peak foraging/commuting hours and disturbing potential roosting habitats, especially if bats are reluctant to leave this roost upon being subjected to the impact. This said, with the information gathered to date, no confirmed roosts have been identified on site during the monitoring campaign, either through the evaluation of existing spatial data, or by specialist on-site observations. In addition to these impacts, cumulative impacts are also likely, in the event that the local, regional or national bat population is also subjected to the same impacts – which may cause unrecoverable loss to the bat species being affected over time.

4.1 Design Phase

Although impacts to bats are experienced during the construction, operation and decommissioning phases of the project, a key element to the success of preventing impacts to bats is realised during the earlier stages of the project. Mortality due to wind turbine collision and/or barotrauma (experienced during the operational phase) should be mitigated during the design phase already. Such impacts are likely to be limited to species that make use of the airspace within the rotor swept zone of the wind turbines, during foraging, commuting and/or migration activities. These impacts would likely also be further exacerbated with potential light pollution that would be present during operational activities. Certain bat species actively forage around artificial lights due to the higher numbers of insects which are attracted to these lights. This would bring these species into the vicinity of the operating turbines and increase the risk of collision/barotrauma for these species.

Suitable mitigation would include the placement of all turbines (as well as their full blade length) in such a manner that avoids all high sensitivity areas, as defined and illustrated in Figure 2. Additionally, lighting at the project should be kept to a minimum at all associated infrastructures. Appropriate types of lighting are to be used to avoid attracting insects, and hence, bats. This includes downward facing low-pressure sodium and warm white LED lights. A summary of these mitigation measures is provided in Table 5, below.

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

Table 5: Summary of impacts and associated mitigation measures for consideration during the project's design phase

Impact	Description	Mitigation Measures
Mortality due to wind turbine collision and/or barotrauma (experienced during the operational phase)	Bats can be impacted during the operational phase by means of collision with wind turbines and/or barotrauma. These impacts will be limited to species that make use of the airspace within the rotor swept zone of the wind turbines, during foraging, commuting and/or migration activities.	The placement of all turbines, as well as their full blade length, should avoid high sensitivity areas (Figure 2).
	Impacts to bats may be further exacerbated with potential light pollution that would be present during operational activities. Certain bat species actively forage around artificial lights due to the higher numbers of insects, which are attracted to these lights. This would bring these species into the vicinity of the operating turbines and increase the risk of collision/barotrauma for these species	Lighting at the project should be kept to a minimum at all associated infrastructures. Appropriate types of lighting are to be used to avoid attracting insects, and hence, bats. This includes downward facing low-pressure sodium and warm white LED lights.

4.2 Construction Phase

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

In terms of habitat modification, bats can be impacted through the removal or alteration of habitats (particularly vegetation or other natural resources) and can also be displaced from foraging habitat by the construction of wind turbines and associated infrastructures. The removal of vegetation during the construction phase can impact bats by removing vegetation cover and linear features that some bats use for foraging and commuting. This modification could subsequently also create favourable conditions for insects, upon which bats feed, which would in turn attract bats to the proposed WEF area. For disturbance/displacement effects, WEF's have the potential to impact bats indirectly when conducting construction activities (for wind turbines and associated infrastructures) during hours of important bat foraging activities. Additionally, excessive noise and dust during the construction phase could also result in bats abandoning their roosts, depending on the proximity of construction activities to roosts. No roosts, however, have been positively identified to occur within the project area. Nonetheless, suitable habitat may still be available to accommodate bats in this regard. As per Table 6, indirect impacts such as habitat modification and disturbance/displacement effects are anticipated to have a moderate negative significance before mitigation, and a low negative significance after mitigation.

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

Table 6: Construction Phase Impacts

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

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

4.3 Operational Phase

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

In terms of bat mortality due to collision/barotrauma, these direct impacts will be limited to species that make use of the airspace in the rotor-swept zone of the wind turbines. Of the nine potential species that can occur on site, five exhibit behaviour that may bring them into contact with wind turbine blades and they are potentially at risk of negative impacts if not properly mitigated. Indirect impacts, including disturbance/displacement effects, have the potential to impact bats when conducting O&M activities during hours of important bat foraging activities. Additionally, excessive noise and dust during the operational phase could also result in bats abandoning their roosts, depending on the proximity of construction activities to roosts. No roosts, however, have been positively identified to occur within the project area. Nonetheless, suitable habitat may still be available to accommodate bats in this regard. As per Table 7, bat mortality impacts due to collision/barotrauma are anticipated to have a high negative significance before mitigation, and a moderate negative significance after mitigation, while disturbance/displacement impacts are anticipated to have a moderate negative significance before mitigation, and a low negative significance after mitigation.

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

In terms of mitigation measures for mortality impacts; blade feathering must be implemented as soon as operation begins (as this mitigation has no impact on energy production). Blade feathering considers stopping all turbines at low wind speeds (up to the manufacturers cut-in speed) to prevent free-wheeling. This is important as bat fatality impacts are still able to occur within wind speeds below the relevant cut-in speeds. Lighting at the project should be kept to a minimum at all associated infrastructures. Appropriate types of lighting are to be used to avoid attracting insects, and hence, bats. This includes downward facing low-pressure sodium and warm white LED lights. Furthermore, avoidance mitigation techniques have been incorporated by buffering key habitat features for bats. These include potential roosting structures, foraging resources and commuting resources. The sensitivity of each buffer was determined relative to the different infrastructure elements incorporated into the project. Buildings, wetlands, linear river systems, reservoirs, rocky outcrops, woodlands, orchards/vineyards and cultivated lands have all been buffered by 200 m and are considered as no-go for the placement of wind turbines (including the full blade length), as per best practise guidelines (Figure 2). Of the assessed WTG layout provided (n = 75 turbines), there are presently four wind turbines within 100 m (blade length) of highly sensitive areas (Figure 2). This however considers the maximum blade length under consideration for the development and is subject to change following final decision of turbine dimensions. Presently, no turbine bases are located within high sensitivity areas. Upon finalising the turbine specifications, consideration must be made for the blade length not to encroach into any pre-defined sensitive areas. A specialist walk-through will be required to confirm turbine positions (including proposed dimensions) and micro-siting prior to construction taking place, in order to determine the acceptability of the suggested turbine positions, in terms of sensitivities and impacts to bats. It is mandatory for the final turbine selection to consider the restrictions associated with these buffers, as described above, in order to determine the acceptability of the suggested turbine positions, in terms of sensitivities and impacts to bats.

Roost searches have been conducted in all accessible areas on site during the monitoring campaign. However, no roosts were positively identified to exist within the development area. While the aforementioned buffers may be effective in helping to avoid and/or minimise interactions between clutter-edge bats and wind turbines, the open-air bats, particularly the Egyptian free-tailed bat, were also largely active within the rotor swept heights. An additional mitigation that could be used to avoid impacts to bats is the choice of wind turbine technology. Evidence of a relationship between turbine size and bat fatality is equivocal. Some evidence suggests that larger turbines kill more bats (Baerwald and Barclay 2009), or that as the distance between the blade tips and the ground increases, bat fatality decreases (Georgiakakis et al. 2012). However, other studies have found no evidence that turbine height or the number of turbines influences bat mortality (Berthinussen et al. 2014; Thompson et al. 2017). Some species in South Africa that are not adapted for flight at height have suffered mortality from wind turbines (e.g. the Cape serotine), suggesting that some bats may be killed in the lower edge of the rotor swept zone. The data presented in this report corroborates this as higher activity was seen at ground level when compared to that recorded at height. However, overall activity at 50 m on site is also relatively high for the Nama Karoo ecoregion. Therefore, using taller towers and limiting the rotor diameter so that the minimum distance between the blades and the ground is maximised could help to mitigate some impacts and reduce the likelihood of reaching bat fatality thresholds, as turbines with a lower ground clearance run the risk of reaching the fatality thresholds sooner. In terms fatality thresholds, it must be noted that the proposed Soyuz 3 WEF has a threshold limit of 476 'least concern' microbat fatalities per year. This is calculated in accordance with the Bat Monitoring Threshold Guidelines (MacEwan et al. 2018), whereby bat occupancy per 10 ha within the Nama Karoo ecoregion is 9.94 bats. 2 Percent (the value in which bat populations start to decline slowly at a rate of approximately 0.1 % per annum) of bats therefore equates to an annual threshold limit of 0.20 'least concern' microbats per 10 ha. Calculated as: [2 % of bats per 10 ha] x [project boundary area/10 ha]. Therefore, 0.20 x (23,800/10) = 476 bat fatalities.

As such, should the estimated number of 'least concern' microbat fatalities reach the annual threshold limit of 476 bats per annum, then further mitigation will be required, in the form of turbine curtailment and/or acoustic deterrence mechanisms. Furthermore, should one or more observed fatalities (during a 12-month monitoring period) of any frugivorous bats, conservation important or rare/range-restricted bats occur, then the same mitigation will also apply. Threshold calculations must be done at a minimum of once per quarter (i.e. not only after the first year of operational monitoring) and by an appropriate bat specialist so that mitigation can be applied as quickly as possible, should thresholds be reached. If curtailment or deterrents are needed based on threshold values being exceeded, their use would be confined to specific periods of the year and under specific meteorological conditions.

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

Table 7: Operational Phase Impacts

Potential Issue	Description / Source of Impact	Nature	Type	Consequence	Extent	Duration	Probability	Reversibility	Irreplaceable Loss	Mitigation Potential	Significance without Mitigation	Mitigation Measures	Significance with Mitigation
Operational Phase													
Mortality due to wind turbine collision and/or barotrauma	Bats can be impacted during the operational phase by means of collision with wind turbines and/or barotrauma. These impacts will be limited to species that make use of the airspace within the rotor swept zone of the wind turbines, during foraging, commuting and/or migration activities. Such impacts would also be further exacerbated with potential light pollution that would be present during operational activities. Certain bat species actively forage around artificial lights due to the higher numbers of insects which are attracted to these lights. This would bring these species into the vicinity of the operating turbines and increase the risk of collision/barotrauma for these species.	Negative	Direct, cumulative	Severe	Regional	Long Term	Probable	Reversible	Resource may be partly lost	Achievable	**High -**	Implement an operational phase bat monitoring programme, in accordance with the most recent version of the operational phase bat monitoring guidelines. Implement blade feathering (up to the manufacturers cut-in speed) as soon as operation begins, to prevent free-wheeling. The placement of all turbines, as well as their full blade length, should avoid high sensitivity areas, to be considered from the outset of the design phase. If residual impacts reach the threshold limit (at any wind turbine), then appropriate minimisation measures should be implemented (turbine curtailment and/or acoustic deterrence mechanisms). Lighting at the project should be kept to a minimum at all associated infrastructures. Appropriate types of lighting are to be used to avoid attracting insects, and hence, bats. This includes downward facing low-pressure sodium and warm white LED lights. To be considered from the outset of the design phase.	**Moderate -**

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

4.4 Decommissioning Phase

Impacts anticipated during the decommissioning phase of the project include disturbance/displacement effects. WEF's have the potential to impact bats indirectly during this phase, through the disturbance of roosts or when conducting decommissioning activities during hours of important bat foraging activities. Excessive noise and dust during the decommissioning phase could also result in bats abandoning their roosts, depending on the proximity of decommissioning activities to such roosts. No roosts, however, have been positively identified to occur within the project area. Nonetheless, suitable habitat may still be available to accommodate bats in this regard. As per Table 8, such disturbance/displacement effects are anticipated to have a moderate negative significance before mitigation, and a low negative significance after mitigation.

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

Table 8: Decommissioning Phase Impacts

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

4.5 Cumulative Impacts

At least 7 facilities are being considered according to the DFFE Renewable Energy database (Q3 2022), within a 50 km region of the Soyuz 3 WEF. In accordance with this database, three of these facilities are listed as wind energy facilities, while four are listed as wind and solar PV energy facilities. However, an additional five neighbouring wind energy facilities are also known, namely; Soyuz 1 WEF, Soyuz 2 WEF, Soyuz 4 WEF, Soyuz 5 WEF and Soyuz 6 WEF. These facilities are currently being submitted for environmental authorisation. These additional five project sites are located directly adjacent (or in close proximity) to the Soyuz 3 WEF, increasing the likelihood of cumulative impacts. Cumulative impacts on bats could increase as new facilities are constructed (Kunz et al. 2007b) but are difficult to accurately predict or assess without baseline data on bat population size and demographics (Arnett et al. 2011; Kunz et al. 2007b) and these data are lacking for many South African bat species. It is possible that cumulative impacts could be mitigated with the appropriate measures applied to WEF design and operation. Cumulative impacts could result in declines in populations of even those species of bats currently listed as Least Concern, if they happen to be more susceptible to mortality from wind turbines (e.g. high-flying open air foragers such as free-tailed and fruit bats) even if the appropriate mitigation measures are applied. Further research into the populations and behaviour of South African bats, both in areas with and without wind turbines, is needed to better inform future assessments of the cumulative effects of WEFs on bats. As presented in Table 9, the impact is likely to be high negative without mitigation, and moderate negative with mitigation. All mitigation measures relevant for operational phase bat mortality due to collisions and/or barotrauma are applicable to mitigate cumulative impacts. Additionally, the project should collaborate with other developments (current and proposed) in the broader project area. Companies in the area should share lessons learnt, align strategies and agree to coordinated approaches when responding to environmental issues. A data sharing agreement should be setup with other wind farm projects in the region to share operational monitoring data. Data should be shared with regulators and interested stakeholders to allow cumulative impacts to be documented and to inform adaptive management processes across projects.

Table 9: Cumulative Impacts

Potential Issue	Description / Source of Impact	Nature	Type	Consequence	Extent	Duration	Probability	Reversibility	Irreplaceable Loss	Mitigation Potential	Significance without Mitigation	Mitigation Measures	Significance with Mitigation
Cumulative Impacts during the Operational Phase													
Bat Fatality Impacts on a Cumulative Scale	Multiple WEF's impacting bats collectively, could have the potential to cause significant loss to affected species over a regional or national scale with an inability for the affected species to recover from such loss. This is likely to be most significant through bat mortality as a result of wind turbine collisions and/or barotrauma during the projects' operational phase, particularly during bat foraging/commuting activities. Presently, at least 4 onshore wind and solar PV facilities, as well as 3 wind energy facilities are being considered according to the DFFE Renewable Energy database (Q3 2022), within a 50 km region of the proposed Soyuz 3 WEF. Five additional wind energy facilities (Soyuz 1 WEF, Soyuz 2 WEF, Soyuz 4 WEF, Soyuz 5 WEF and Soyuz 6 WEF) are however known to be presently under assessment for EA application.	Negative	Indirect	Severe	National	Long Term	Probable	Reversible	Resource may be partly lost	Achievable	**High -**	All mitigation measures, as listed in Table 7, are highly recommended for WEFs in the greater (50 km^2) Project area, to reduce the probability of significant mortality impacts occurring at Soyuz 3 WEF, and subsequently on a cumulative scale as well. The project should collaborate with other developments (current and proposed) in the broader project area. Companies in the area should share lessons learnt, align strategies and agree to coordinated approaches when responding to environmental issues. A data sharing agreement should be setup with other wind farm projects in the region to share operational monitoring data. Data should be shared with regulators and interested stakeholders to allow cumulative impacts to be documented and to inform adaptive management processes across projects.	**Moderate -**

4.6 No-go Alternative

The no-go alternative has been assessed for bats, considering the proposed development under consideration, together with its associated impacts. As reflected in Table 10, the impact on bats already existing in the area would be negligible, in the event that the facility is not constructed – as no change is anticipated to occur.

Table 10: No-go Alternative Impacts

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

5 CONCLUSION

Bat activity at the proposed Soyuz 3 WEF was generally moderate to high, overall, throughout the duration of the full bat monitoring campaign. Bat activity was particularly high (subsequently posing a high risk to bats) during spring and summer. Free-tailed bats are likely to face the highest risk of impacts at the proposed site due to their prevalence. Sensitive design and mitigation will be needed to reduce risk to these (and other) bats.

An assessment of potential impacts relevant for bats at the proposed WEF yielded that impacts are likely to occur during the construction, operation and decommissioning phases of the project. Indirect impacts, such as habitat modification, disturbance and displacement effects were identified to occur in most project phases, while more significant direct impacts, such as bat mortality due to collisions and/or barotrauma, are expected to occur during the projects' operational phase. All mitigation measures, as defined in Section 4 are to be strictly adhered to. With regards to bat mortality, it can be highlighted that all high sensitive areas (including those used by bats for foraging, roosting and commuting) defined for the Soyuz 3 WEF (Figure 2) should be avoided from turbine placement (inclusive of the full blade length). Presently, four turbines (T26, T46, T49 and T50) are situated within 100m (maximum blade length under consideration) of high sensitive areas. These turbines will need to be micro-sited to avoid overlapping with such sensitive areas, should the maximum blade length be utilised. All associated infrastructures (i.e. laydown areas, construction camps, O&M buildings etc.) are permitted to be placed in high sensitive areas, provided that all construction, operational and decommissioning activities adhere to the mitigation measures defined in Section 4.

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

Blade feathering[6] should be implemented from the start of operation, as this mitigation has no impact on energy production. Curtailment and acoustic deterrents are the remaining mitigation measures to reduce residual impacts to bats during operation and must be continuously refined and adapted based on incoming bat fatality data. The need for curtailment and/or deterrents to address residual impacts will only be determined during operations, following analysis of the operational phase monitoring results by the project bat specialist. A suitable curtailment plan with relevant parameters must be drawn up at the time that the requirement becomes necessary. It is considered mandatory for the Soyuz 3 WEF to undertake a suitable operational phase bat monitoring programme, by an appropriately qualified bat specialist, particularly in the first two years of project operation. Thereafter, this monitoring programme must be repeated in the fifth year, and every five years thereafter – for the lifespan of the facility. All monitoring must be undertaken in accordance with the most relevant/recent operational phase bat monitoring and threshold guidelines available at the time.

The data suggests that there could be a risk to bats posed by the Soyuz 3 WEF, particularly during spring and summer. At this stage, however, with the information gathered to date from the full bat pre-construction monitoring campaign, the development of the proposed Soyuz 3 WEF and its associated infrastructures is not expected to cause irreplaceable loss to bat biodiversity on site, provided that the above considerations are met. All avoidance/mitigation measures are to be strictly adhered to. Once all project specifications

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

have been finalised (turbine layouts and dimensions), a bat specialist site walk-though is required to take place, prior to construction, to confirm the final turbine layout (including proposed turbine dimensions), in order to determine the acceptability of the suggested turbine positions, in terms of sensitivities and impacts to bats. It is the specialist's opinion, based on information contained in this report, that the proposed development can be authorised.

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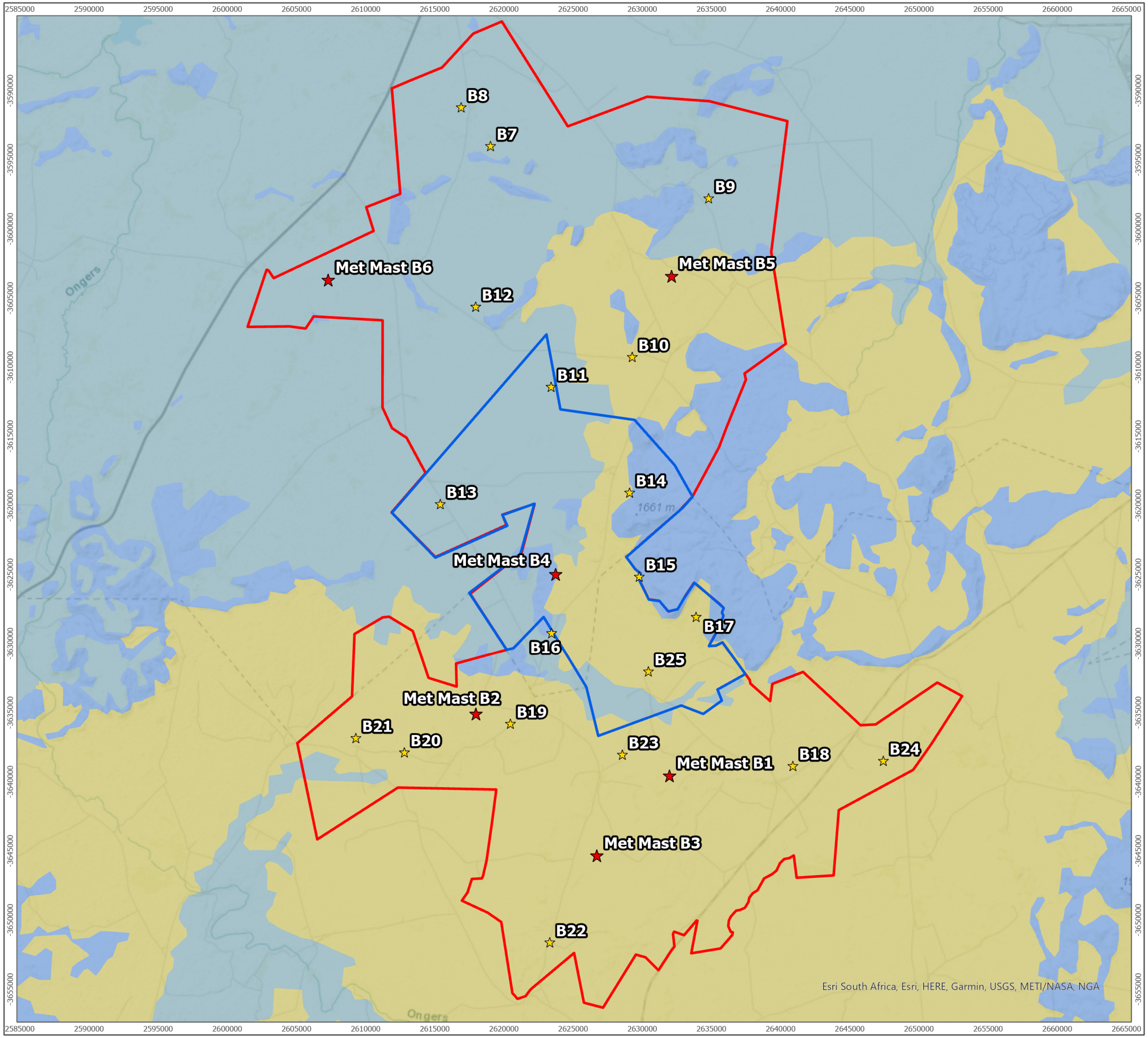
Figures



ARCUS

- Soyuz 3 Site Boundary
- Britstown Study Area
- Short Masts
- MET Masts

Vegetation Type

- Eastern Upper Karoo
- Northern Upper Karoo
- Upper Karoo Hardeveld

1:265,000 Scale @ A3

0 5 10 km

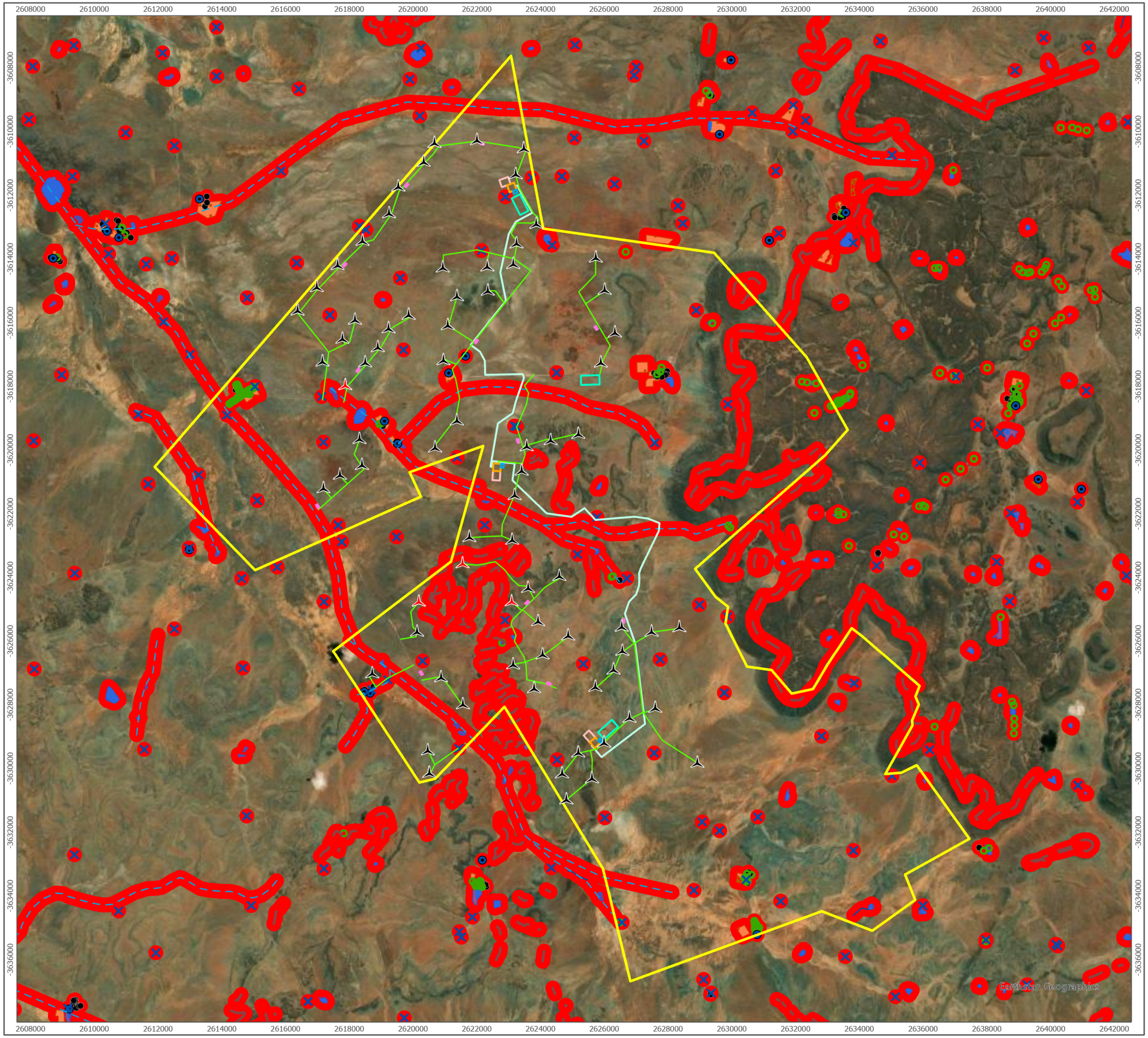
NORTH

Produced By: CC	Ref: 4331-GIS-024
Checked By: AB	Date: 12/6/2022

Site Location Map
Figure 1

Britstown WEF Cluster
Soyuz 3 WEF
Final Monitoring & IA Report

G:\Projects\4331 Britstown WEF Bat Monitoring\4331 Britstown WEF Bat Monitoring_Update.aprx\4331-GIS-024 Fig 1 FR Soyuz 3 Site Location Map



ARCUS

- Soyuz 3 Site Boundary
- Substation Laydown
- Substation
- Construction Camps
- Satellite Camps
- Internal Roads
- BESS
- 132kV OHL
- High Sensitivity (No-go) Buffers
- Furrow
- Non-Perennial River Centre line
- Rocky Outcrop
- House
- Tree
- Water Reservoir
- Wind Pump
- NFEPA Wetlands
- NBA Artificial Wetlands
- Cultivated Land
- Orchard / Vineyard
- Wind Turbines (outside of sensitive areas)
- Wind Turbines (within 100m of sensitive areas)

1:115,000 Scale @ A3

0 2 4 km

NORTH

Produced By: CC	Ref: 4331-GIS-025
Checked By: AB	Date: 2/16/2023

Bat Constraints Map
Figure 2

Britstown WEF Cluster
Soyuz 3 WEF
Final Monitoring & IA Report

G:\Projects\4331 Britstown WEF Bat Monitoring\4331 Britstown WEF Bat Monitoring_Update.aprx\4331-GIS-025 Fig 2 FR Soyuz 3 Bat Constraints Map

Appendix 1: Specialist Declaration and CV

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

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

	(For official use only)
File Reference Number:	14/12/16/3/3/2/2207
NEAS Reference Number:	DEA/EIA/
Date Received:	

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

PROJECT TITLE

SOYUZ 3 WIND ENERGY FACILITY (WEF), EMTHANJENI AND UBUNTU LOCAL MUNICIPALITIES, NORTHERN CAPE PROVINCE

Kindly note the following:

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

Departmental Details

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

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

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

CC

1. SPECIALIST INFORMATION

Specialist Company Name:	Arcus Consultancy Services South Africa (Pty) Ltd.			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	4	Percentage Procurement recognition	100%
Specialist name:	Craig Campbell			
Specialist Qualifications:	BSc (Conservation Ecology)			
Professional affiliation/registration:	SACNASP Professional Natural Scientist (Ecological Sciences) - 119649			
Physical address:	240 Main Road, 1st Floor Great Westerford, Rondebosch			
Postal address:	240 Main Road, 1st Floor Great Westerford, Rondebosch			
Postal code:	7700	Cell:	082 420 6467	
Telephone:	082 420 6467	Fax:	-	
E-mail:	craigc@arcusconsulting.co.za			

2. DECLARATION BY THE SPECIALIST

I, Craig Campbell, declare that –

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the Specialist

Arcus Consultancy Services South Africa (Pty) Ltd.

Name of Company:

14/12/2022

Date

CC

3. **UNDERTAKING UNDER OATH/ AFFIRMATION**

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

Signature of the Specialist

Arcus Consultancy Services South Africa (Pty) Ltd.

Name of Company

14/12/2022

Date

Signature of the Commissioner of Oaths

2022/12/14

Date

SOUTH AFRICAN POLICE SERVICE
COMMUNITY SERVICE CENTRE
14 DEC 2022
P.O. BOX 22, DURBANVILLE, 7551
TEL: 021 970 3831 · 021 970 3812
SOUTH AFRICAN POLICE SERVICE

cc

CURRICULUM VITAE

Craig Campbell *(Pr. Sci. Nat – Ecological Sciences)*

Ecologist

Email: craigc@arcusconsulting.co.za

Specialisms

- Bird and Bat baseline assessments
- Field Research
- Project Management
- Reporting and GIS analysis

Summary of Experience

Craig is an Ecologist at Arcus. He graduated with a Degree in Conservation Ecology from Stellenbosch University, South Africa. He is registered as a Professional Natural Scientist, in the field of Ecological Sciences (SACNASP). Since 2013, Craig has had extensive experience in ecological baseline studies, biodiversity monitoring surveys and due diligence on several renewable energy and other projects in South Africa, Mozambique, Portugal and Turkey. He has a sound background in management and ecology, and also focusses on project design & layout, GIS mapping, report compilation and stakeholder engagement.

Professional History

- Mar 2021 to present - Ecologist, Arcus Consultancy Services, Cape Town
- Aug 2017 to Mar 2021 – National Manager & Senior Ecologist, Bioinsight, Cape Town
- Nov 2013 to Aug 2017 – Ecologist, Bioinsight, Cape Town

Qualifications

University of Stellenbosch

2009-2013 BSc (hons) Conservation Ecology

2008-2009 Certificate in Aquaculture Production Management

Project Experience

Pre-Construction Monitoring and/or Impact Assessment

- Kudusberg Wind Energy Facility
- Sere Wind Energy Facility
- Boulders Wind Energy Facility
- Vredendal Wind Energy Facility
- Juno Wind Energy Facility
- Hartebeest Wind Energy Facility
- Rondekop Wind Energy Facility
- Noblesfontein 2 & 3 Wind Energy Facilities
- Haga Haga Wind Energy Facility
- Somerset East Wind Energy Facility
- Spitskop West Wind Energy Facility
- Witsand Wind Energy Facility
- Gouda 2 Wind Energy Facility
- Stormberg Wind Energy Facility
- Kruispad, Doornfontein and Heuningklip Photovoltaic Solar Energy Facilities
- Chelsea Photovoltaic Solar Energy Facility
- Springhaas Photovoltaic Solar Energy Facilities
- Kappa-Sterrekus Powerline Corridor Alignments
- Namaacha Wind Farm, Mozambique

Operational Monitoring – Wind Energy Facility

- Noblesfontein Wind Energy Facility
- Sere Wind Energy Facility
- Nxuba Wind Energy Facility
- West Coast 1 Wind Energy Facility

Due Diligence

- Bird monitoring at Kiyikoy Wind Energy Facility, Turkey