NOBLESFONTEIN WIND ENERGY FACILITY
BAT BASIC ASSESSMENT IMPACT REPORT

On behalf of

Terramanzi Group (Pty) Ltd

May 2021

Prepared By:

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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.	Appendix 3

1 INTRODUCTION

Noblesfontein WEF, located approximately 7.5 km north-west of Three Sisters in the Western and Northern Cape Provinces, was approved for 44 wind turbine generators (WTGs) (DEFF 12/12/20/1993/1), but currently only has 41 installed with an output capacity of 2 MW per WTG. Noblesfontein Wind Farm is now seeking to submit an Basic Assessment (National Environmental Management Act of 1998 as amended) application for the construction of two wind turbines and associated infrastructure. Terramanzi Group (Pty) Ltd (hereafter referred to as 'Terramanzi', acting as the EAP) have contracted Arcus to undertake an assessment of the specifications with respect to potential impacts to bats.

The project description relevant to the proposed development are summarised as follows:

- Hub height to **up to** 137.5m;
- Blade length to **up to** 82.5m;
- Rotor diameter to **up to** 165m;
- Total turbine height will be a maximum of **up to** 220m;
- Total rotor swept area will be a maximum of 21,382.5m^2;
- Maximum sound output will be **up to** 104.9dB;
- Rated power of turbines to between 4 MW and 5.6MW per WTG (with a total output of up to 10 MW;

Arcus assumes that "up to" implies that any size of hub height and rotor diameter that is appropriate (based on the client's needs) and available to be supplied by turbine manufacturers may be selected for the Noblesfontein WEF project as long as it does not exceed the maximum dimensions assessed and authorised.

2 SCOPE OF STUDY

2.1 Terms of Reference

The National Gazette, No. 43110 of 20 March, 2020: "National Environmental Management Act (107/1998) Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of sections 24 (5) (a) and (h) and 44 of the Act, when applying for Environmental Authorisation", where a specialist assessment is required and no specific environmental theme protocol has been prescribed, the impact assessment followed Appendix 6 of the EIA Regulations 2014, as amended. This study was undertaken in accordance with these regulations.

The aim of this report is to assess the baseline environment and initial impacts with relation to bats of the Noblesfontein WEF. Based on this, a description and evaluation of the potential impacts an additional two turbines may pose to bats is provided. The following terms of reference were utilised for the preparation of this report:

- An assessment of all impacts related to the new turbines;
- Measures to ensure avoidance, management and mitigation of impacts associated with such additions; and
- Advantages and disadvantages of the proposed additions in relation to bats.

2.2 Project Team

Craig Campbell 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.

Mark Hodgson is a junior ecologist at Arcus and focus on bat surveys and assessments. Having obtained his Bachelor of Sciences Degree (Genetics, Ecology and Evolution) and BSc Honours (Applied Biology) from the University of Cape Town, his Honours thesis focused on the migrational patterns of the Natal Long-fingered bat in the Western Cape. He has experience ranging from aquatic and terrestrial ecological surveys, using molecular tools for tracking, and water drainage monitoring. Since then he has spent time as a volunteer researcher at the Knysna Basin Project assisting with various Masters and Honours projects, Knysna seahorse censuses, aquatic plant life mapping and river drainage monitoring. Currently he is working on pre- and post-construction monitoring of bird and bat populations at Wind Energy Facilities. He is also skilled in statistical analysis pertaining to ecological projects.

Michael Brits has been employed at Arcus for over two years as an Ecologist focussing on bat assessments. He has designed and implemented bat pre-construction monitoring studies as per guidelines and is skilled in identifying bat calls and doing the analysis. He has worked on various pre- and post-construction bird and bat monitoring projects for Wind Energy Facilities, he is skilled in various analytical techniques relevant to ecological projects, including four years of GIS experience. He also has a wide range of ecological expertise including experience with insects, amphibians, birds and other mammals. He has developed monitoring plans to assist conservation bodies in adaptively managing wetlands, implemented baseline freshwater ecology monitoring plans and managed urban-wildlife conflicts, specifically with baboons and local residents in the City of Cape Town.

Ashlin Bodasing is a Technical Director at Arcus Consultancy Services South Africa (Pty) Ltd. Ashlin is a registered EAP. Having obtained her Bachelor of Social Science Degree (Geography and Environmental Management) from the University of Kwa-Zulu Natal; she has over fourteen experience in the environmental consulting industry in southern Africa. She has gained extensive experience in the field of Integrated Environmental Management, environmental impact assessments and public participation. She has also been actively involved in a number of industrial and infrastructural projects, including electricity power lines and substations; road and water infrastructure upgrades and the installation of telecommunication equipment, green and brown field coal mines, as well as renewable energy facilities, both wind and solar. Ashlin has excellent Project Management experience and has gained major project experience in the development of Environmental Impact Assessments, Environmental Management Plans and the monitoring of construction activities. Her areas of expertise include project management, environmental scoping and impact assessments, environmental management plans, environmental compliance monitoring and environmental feasibility studies. Experience also includes International Finance Corporation Performance Standards and World Bank Environmental Guidelines environmental due diligence reviews. She has worked in Mozambique, Namibia, Botswana, Lesotho and Zimbabwe.

2.3 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, local and regional distribution patterns, spatial and temporal movement patterns (including migration and flying heights) and how bats may be impacted by wind energy is very limited for many species
- There is currently no standard scale to rate bat activity as low, medium or high. Activity was therefore classed based Arcus' experience of bat activity at projects (including operational facilities) in South Africa.

- The potential impacts of wind energy on bats presented in this report represent the current knowledge in this field. New evidence from research and consultancy projects may become available in future, meaning that impacts and mitigation options presented and discussed in this report may be adjusted if the project is developed.
- The conclusions in this report are based on baseline monitoring data and reports for Noblesfontien WEF that were not conducted by Arcus and it is assumed that the data in these reports are accurate.

2.4 Legislative Context

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

- Convention on the Conservation of Migratory Species of Wild Animals (1979)
- Convention on Biological Diversity (1993)
- Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996)
- National Environmental Management Act, 1998 (NEMA, Act No. 107 of 1998)
- National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)
- Environmental Impact Assessment Regulations, 2014, as amended
- Ciskei Nature Conservation Act (1987)
- The Equator Principles (2013)
- The Red List of Mammals of South Africa, Swaziland and Lesotho (2016)
- National Biodiversity Strategy and Action Plan (2005)
- South African Good Practise Guidelines for Surveying Bats in Wind Energy Facility Developments – Pre-Construction (2020)
- South African Good Practise Guidelines for Operational Monitoring for Bats at Wind Energy Facilities (2020)
- South African Bat Fatality Threshold Guidelines for Operational Wind Energy Facilities (2018)

3 METHODOLOGY

In carrying out this assessment, Arcus conducted a literature review on bats and wind energy impacts with a focus on the relationship between turbine size and bat fatality. The literature review was carried out using the Web of Science® and Google Scholar using the following search terms:

bat OR fatality OR wind energy OR turbine OR wind turbine OR fatalities OR mortality OR mortalities OR kill* OR tower height OR height OR rotor swept zone OR rotor zone OR rotor swept area OR blades OR turbine blades OR influence OR increas* OR trend OR positive OR decreas* OR relation* OR wind farm OR wind energy facility OR carcass* OR chiroptera OR rotor diameter OR correlat* OR size*

In addition to the outputs from the above search, the following documentation were reviewed and used to provide context for the impact assessment:

- Environmental Authorisation (DEA REF 12/12/20/1993/1),
- Bioinsight (2018). Noblesfontein Wind Farm – Operational phase bat monitoring. Third year of operation. Final Monitoring Report (Year 3) 2014/2017, and
- Bioinsight (2020). Noblesfontein Wind Farm – Operational phase bat monitoring. Fifth year of operation. Final Monitoring Report (Year 5) 2014/2019.
- Savannah (2012). Noblesfontein Wind Energy Facility on a Site South of Victoria West, Northern Cape Province. Construction & Operation Environmental Management Plan. Revision 2 – October 2012 Updated in terms of the requirements of the Environmental Authorisation.

4 REVIEW – TURBINE SIZE AND BAT FATALITY

The core issue relevant to this assessment is the impact to bats of adding two additional turbines with the proposed physical dimensions at the Noblesfontein WEF. The Basic Assessment would result in additional turbines with a greater rotor swept area per turbine and hence a potentially greater likelihood that bats would collide with turbine blades or experience barotrauma. Currently, the rotor swept area for each existing turbine at Noblesfontein WEF is 7,853.98 m^2 but based on the Basic Assessment being applied for, the two additional turbines would have an increased rotor swept area of up to 21,382.5 m^2 per turbine. As such, the only impacts assessed in this report are bat mortality due to collision or barotrauma associated with turbine blades and cumulative impacts. All other impacts to bats previously assessed for Noblesfontein WEF will not change significantly and are not assessed in this report (Table 1)

Table 1: Summary of relevant impact assessments and indication of changes due to the proposed development

Phase	Impact	Significance with mitigation will change due to proposed development (Y/N)	Reason for No Change
Construction	Roost Disturbance	N	Construction area will not significantly impact roosts or potential roost features nearby
	Roost Destruction	N	Construction area will not significantly impact roosts or potential roost features nearby
	Habitat Modification	N	Construction footprint is not large enough to significantly change environment for bats
Operation	Light Pollution	N	New structures will not emit enough light to significantly change bat foraging behaviour

Numerous studies support the hypothesis that taller wind turbines are associated with higher numbers of bat fatalities. Rydell et al. (2010) found a significant positive correlation between bat mortality with both turbine tower height and rotor diameter in Germany. However, there was no significant relationship between bat mortality and the minimum distance between the rotor and the ground. The maximum tower height in their study was 98 m and data on rotor diameter were not given. In addition, there was no relationship between bat fatality and the number of turbines at a wind energy facility. However, the largest wind energy facility in this study only has 18 turbines (Rydell et al. 2010) which is significantly fewer than the Noblesfontein WEF, which currently has 41 turbines.

In Greece, Georgiakakis et al. (2012) found that fatalities were significantly positively correlated with tower height but not with rotor diameter. In their study, maximum tower height and rotor diameter were 60 m and 90 m respectively. In Minnesota and Tennessee, USA, both Johnson et al. (2003) and Fiedler et al. (2007) showed that taller turbines with a greater rotor swept area killed more bats. The maximum heights of turbines in these two studies were 50 m and 78 m respectively. In Alberta, Canada, bat fatality rates differed partly due to differences in tower height but the relationship was also influenced by bat activity (Baerwald and Barclay 2009). For example, sites with high activity but relatively short towers had low bat fatality and sites with low activity and tall towers also had low bat fatality. At sites with high bat activity, an increase in tower height increased the probability of fatality. Maximum turbine height and rotor diameter in this study was 84 m and 80 m respectively. Despite the above support for the hypothesis that taller wind turbines kill more bats, in a review of 40 published and unpublished studies in North America, Thompson et al. (2017) found no evidence that turbine height or the number of turbines influences bat mortality. Berthinussen et al. (2014) also found no evidence of modifying turbine design to reduce bat fatalities. The relationship between bat mortality and turbine size, or number of turbines at a wind energy facility, is therefore equivocal.

Turbine size has increased since the above studies were published and no recent data of the relationship between bat fatality and turbine size is available. The maximum size of the turbines in the literature reviewed (where indicated in each study) for this assessment had towers of 98 m and rotor diameters of 90 m. Some towers were as short as 44 m and had blade tips extending down to only 15 m above ground level.

The towers and blades under consideration in this assessment are significantly taller than this. The existing turbine dimensions at the Noblesfontein WEF have a ground clearance of 30 m, with a hub height of 80 m and a rotor diameter of 100 m. This Basic Assessment would, however, result in the two additional turbines having their blade tips extending from 55 m above ground level to 220 m, based on the maximum dimensions being applied for (i.e. a turbine with 82.5 m blades and a 137.5 m hub height). The minimum and maximum tip heights will change depending on the size of the turbines used.

It is possible that some bats species, particularly those not adapted to use open air spaces, are being killed at the lower sweep of the turbine blades so increasing the blade length and having a shorter distance between the ground and the lowest rotor point may have a negative impact and potentially place a greater diversity of species at risk. In South Africa, evidence of fatality for species which typically do not forage in open spaces high above the ground, is available from several wind energy facilities (Aronson et al. 2013; Doty and Martin 2012; MacEwan 2016). Although Rydell et al. (2010) did not find a significant relationship between bat mortality and the minimum distance between the rotor and the ground, data from Georgiakakis et al. (2012) suggested that as the distance between the blade tips and the ground increases, bat fatality decreases.

It is not known what the impact of the two additional turbines of the size proposed for the Noblesfontein WEF would be on bats because of a lack of published data from wind energy facilities with turbines of a comparative size. Hein and Schirmacher (2016) suggested that bat fatality should continue to increase as turbines intrude into higher airspaces because bats are known to fly at high altitudes (McCracken et al. 2008; Peurach et al. 2009; Roeleke et al. 2018). However, McCracken et al. (2008), who recorded free-tailed bats in Texas from ground level up to a maximum height of 860 m, showed that bat activity was greatest between 0 and 99 m. This height band accounted for 27 % of activity of free-tailed bats, whereas the 100 m to 199 m height band only accounted for 6 %.

In South Africa, simultaneous acoustic monitoring at ground level and at height is a minimum standard for environmental assessments at proposed wind energy facilities. Based on unpublished data from 16 such sites Arcus has worked at, bat activity and species diversity is greater at ground level than at height. Therefore, even though bats are recorded at heights that would put them at risk from taller turbines, the proportion of bats that would be at risk might be less. Further, the number of species that might be impacted would decrease because not all bat species use the airspace congruent with the rotor swept area of modern turbines owing to morphological adaptations related to flight and echolocation. Bats that are adapted to use open air space, such as free-tailed and sheath-tailed bats, would be more at risk.

In the United Kingdom, both Collins and Jones (2009) and Mathews et al. (2016) showed that fewer species, and less activity, were recorded at heights between 30 m and 80 m compared to ground level. In two regions in France, Sattler and Bontadina (2005) recorded bat activity at ground level, 30 m, 50 m, 90 m and 150 m and found more species and higher activity at lower altitudes. Roemer et al. (2017) found that at 23 met masts distributed across France and Belgium, 87 % of bat activity recorded was near ground level. However, the authors also showed a significant positive correlation between a species preference for flying at height and their collision susceptibility, and between the number of bat passes recorded at height and raw (i.e. unadjusted) fatality counts. In a similar study in Switzerland, most bat activity was recorded at lower heights for most species but the European free-tailed bat had greater activity with increasing height (Wellig et al. 2018). These results suggest that on average, bat activity is greater at lower heights but that there are important differences across species – those species adapted to using open air spaces are at greater risk.

5 IMPACT ASSESSMENT

As per the above findings, the overall consensus is that in the South African context, shorter blades are mostly preferred to longer ones (providing a smaller rotor swept area, and therefore a lower probability of impacts), while a higher lowest blade tip is preferred over a lower one. The acceptability of the two additional turbines (with increased physical specifications) needs to be assessed.

The first key point to consider is the overall dimensions of the authorised rotor swept area vs. the new overall rotor swept area (considering the additional turbines). In terms of the Environmental Authorisation received for Noblesfontein WEF, the wind farm was authorised for 44 turbines with a maximum rotor diameter of 110 m. This translates into a total authorised rotor swept area of 418,146.08 m^2. However, only 41 turbines were constructed, with a rotor diameter of 100 m. As such, the existing Noblesfontein WEF currently has a total rotor swept area of approximately 322,013.18 m^2. The new overall rotor swept area, considering the additional turbines, would add an additional 42,765 m^2 to the existing facility. As such, the total rotor swept area for Noblesfontein WEF with the addition of the two new turbines would be 364,778.18m^2. Therefore, although two turbines are proposed to be added with this basic assessment, the overall final rotor swept area for the entire facility is still noted to be lower than that which was originally authorised.

Based on the pre-construction monitoring campaign, the activity data across all the detectors combined showed higher activity in summer, than in autumn and spring, with low activity during winter. Most bat activity was detected at ground level and only about 29 % of the overall bat activity was detected at rotor height. In addition, there was a clear influence of specific vegetation types on bat activity. For example, greater activity was recorded within the Southern Karoo Riviere and Upper Karoo Hardeveld. The proposed turbines are located within Upper Karoo Hardeveld.

Three bat species were confirmed in the study area during the pre-construction monitoring campaign, inclusive of the Cape Serotine, Natal long-fingered bat and the Egyptian free-tailed bat. A potential of twelve other species were noted to have a potential occurrence at the site. The highest activity observed was during the summer season during the pre-construction monitoring. Analysis of recordings through passive detection indicated a higher frequency of occurrence of species with a higher collision risk, representing approximately 64% of the total bat activity detected. Species with a medium-high risk of collision were the second most frequently detected bat species (33%), while those with a medium and low risk of collision represented the lowest frequency of detection (3%). The area in general was classified as having a low sensitivity for bats (Bioinsight 2018).

During the post-construction phase, bat activity monitoring was conducted during the first three years of projects' operation. Results from this campaign confirmed at least six bat species using the study area, including the Egyptian free-tailed bat, Cape Serotine, Natal long-fingered Bat, Long-tailed Serotine, Geoffroy's horseshoe bat and Cape horseshoe bat. Results also indicated that activity was largely influenced by seasonality across all monitoring years. The highest activity observed was during the spring and summer seasons. These results were noted to indicate that the presence of the WEF has not greatly disrupted bat presence in the area. Analysis of recordings through passive detection indicated a higher frequency of occurrence of species with a higher collision risk, representing approximately 55% of the total bat activity detected. Species with a medium-high risk of collision were the second most frequently detected bat species (37%), while those with a medium and low risk of collision represented the lowest frequency of detection (9%). The same proportions were observed both in the pre-construction and operational phases of the respective monitoring campaigns (Bioinsight 2018).

In addition to the operational phase activity monitoring, relevant carcass searches and fatality estimates were also conducted in Year 1, Year 2, Year 3 and Year 5. Results from this indicated an observed mortality of 16 bat fatalities, of which the Egyptian free-tailed accounted for approximately 63% of these fatalities. The remainder of bats were identified as Vespertillionidae bats, with some that were unidentifiable due to their physical state at the time (i.e. lacking diagnosing characteristics as a result of collision damages or decomposition). Taking into account the relevant searcher efficiency and carcass persistency trials conducted, it was determined (by means of the Huso Fatality Estimator and Korner Nievergelt's Fatality Estimator) that a total of between 3.1 – 4.3 bats are killed at each wind turbine, per year (Bioinsight 2020). These values exceed the defined threshold limits, and are taken into consideration in this assessment.

The exact turbine dimensions being applied for are up to 137.5 m for the hub height, and up to 165 m for the rotor diameter. Within this range, the impacts to bats and associated buffer zones needed to limit impacts (as an initial mitigation) will vary depending on the size of the turbines used. Turbines with a lower ground clearance will need to be placed further away from buffers than turbines with a higher ground clearance. For example to determine the buffer distances required to ensure that no turbine blades enter the bat buffers, the following formula should be used (Mitchell-Jones and Carlin 2014):

$$b = \sqrt{(bd + bl)^2 - (hh - fh)^2}$$

Where: bd = buffer distance, bl = blade length, hh = hub height and fh = feature height (zero in this instance). "b" is the distance required between the base of the turbine and the edge of the buffer area, to ensure no blade overhang into the buffer area.

Thus, based on the above, assuming a buffer of 200 m for example, a turbine with a rotor diameter of 165 m and hub height of 137.5 m (i.e. 55 m ground clearance) will need to be 247 m ("b") away from the buffered feature (i.e. base of turbine must be positioned 247 m away from the buffered feature).

The Noblesfontein WEF site contains numerous sensitive features, particularly relating to the presence of potential roosting structures for bats, such as buildings, large trees, rocky outcrops and steep cliffs. Other sensitive features considered potentially important, particularly for their suitability for foraging activities, are farm dams/reservoirs, drainage lines, rivers, wetlands and cultivated fields (Figure 1). Based on specialist knowledge of the area and these features, a minimum buffer of 200 m has been applied around all features, apart from steep cliffs (which is to be buffered by 500 m in accordance with the relevant EMPr) and confirmed roosts. In the Year 3 final monitoring report (Bioinsight 2018), it was noted that a total of ten roosts were monitored for indication of bat presence. Of these ten roosts, eight of them were confirmed to have the presence of bats, of which five of them were located less than 2 km from the WEF. As such, due to the size of the roosts and sensitivity of the bat species identified, a buffer distance of 1,000 m has been applied around all confirmed roosts for this assessment.

All of the aforementioned buffers need to be completely avoided by turbine placement, including the entire length of the proposed blades, in accordance with the relevant best practise guidelines. Therefore, the distance between these features and the turbine base ("b") will need to be calculated using the Mitchell-Jones and Carlin equation once the exact turbine size is selected. Any turbines within bat buffers will need to be relocated. This must be considered and addressed during the detailed design phase. The delineated bat buffers are no-go areas for turbines only, and turbines (including turbine blades) must not be placed in these buffer areas. It should be noted that these buffers apply only to turbines and not associated infrastructure such as roads and powerlines.

5.1 Assessment of New Layout

Arcus have created a sensitivity map using the National Geo-Spatial Information Topographic dataset (2015), and the National Freshwater Ecosystems Priority Areas database (2011). The updated sensitivity map (Figure 1) shows that both proposed turbines fall within bat sensitive areas – particularly that related to relevant 1,000m roosting buffers. It is recommended for the Mitchell-Jones and Carlin equation to be used to adjust the positioning of these turbines to the appropriate distance, during the design phase, in order to avoid these sensitive areas. Should it not be possible to move these two turbines, then certain strict mitigation measures, which includes curtailment should be defined and implemented as soon as turbines are erected.

No bat activity data is available for the area between the heights of 10 m and 80 m or over 80 m, because activity at these heights was not monitored. Despite the available pre-construction monitoring data showing that bat activity at 80 m is low, it would be preferential to maximise the distance between the ground and blade tips by using turbines with the shortest possible blades and the highest possible hub height. This would reduce the number of species potentially impacted upon by turbine blades during the operation phase. More specifically, it is recommended for the lowest blade tip height to not encroach any lower than 30m above ground, in order to reduce the chance of bat fatalities reaching the relevant fatality thresholds sooner. It would also be preferential to use shorter blades so that they don't intrude into higher airspaces and in so doing reduces the potential impact to high flying species such as free-tailed bats. Despite the relatively low activity at height, in comparison to that recorded at ground height, increasing evidence suggests that bats actively forage around wind turbines (Cryan et al. 2014; Foo et al. 2017) so the installation of turbines in the landscape may alter bat activity patterns, either by increasing activity at height and/or increasing the diversity of species making use of higher airspaces.

5.2 Updated Impact Assessment

In terms of impacts being identified, only mortality of species due to collision with turbine blades or barotrauma, and cumulative impacts are being considered relevant for this assessment. The significance of the impact would be dependent on the size of the turbines chosen. The assessments here (Table 1 and Table 2) are based on the scenario where turbines of the maximum dimensions being applied for are used. This would increase risk to high flying species such as free-tailed bats, as the turbine blades would extend higher into the air.

Table 1: Impact Assessment Table for two additional wind turbines at the Noblesfontein WEF

Nature: Mortality of bats due to collision with turbine blades or barotrauma caused by turbine operation.		
	Without Mitigation	With Mitigation
Extent	Local (2)	Local (2)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (7)	Low (4)
Probability	Highly probable (4)	Probable (3)
Significance	**52 (Medium)**	**30 (Low)**
Status (positive or negative)	Negative	Negative
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	-
Mitigation: Mitigation measures • All currently proposed mitigation measures proposed in the Nobelsfontein WEF EMPr / EA must be adhered to. This includes adhering to the updated sensitivity map (Figure 1) which will require repositioning turbines (and their blades) that intrude into sensitive buffers. These buffers are regarded as no-go areas for turbine components only, and other infrastructure (roads, cables etc) are permissible. These areas include 1000m around all confirmed roosts, 500m around all cliff lines and 200m around all other important bat features. • Should it not be possible to relocate these turbines, then certain strict mitigation measures, which includes curtailment, should be defined and implemented as soon as turbines are erected. • In the event that turbines can be micro-sited, then a bat specialist must map the final turbine layout before micro-siting and assess whether all turbines are appropriately sited in such a way that their blades do not encroach into any bat sensitive buffers. • All mitigation measures to protect bats proposed in the EMPr (Savannah 2012) must be adhered to. Additional mitigation measures • The impacts presented can be mitigated by using turbines which maximise the ground clearance as much as possible, and by minimising the tip height (i.e. the distance between the ground and the blade tip at its highest point). The lowest tip should not encroach any lower than 30m above ground, in order to reduce the risk of bat mortalities from reaching the specified estimated threshold limits of 44.3 bats per annum. To be included in the EA: a minimum buffer **to blade tip** for all bat buffer zones is required. Additionally, a full operational phase monitoring campaign, inclusive of fatality monitoring and estimates, is to commence as soon as the wind turbines are erected, and in accordance with latest version of the bat monitoring guidelines. This is to take place for the entire Noblesfontein WEF. Based on results from this monitoring campaign, should the estimated bat fatalities for the entire Noblesfontein WEF exceed the threshold of 44.3 bats per annum, then strict curtailment measures will need to be implemented – to be defined and monitored by an appropriate bat specialist.		
Cumulative Impact: see Table 2		
Residual Impacts: Residual impacts may still remain even if the high sensitivity buffers are adhered to and by using turbines of an appropriate size to limit bat fatalities. Bat fatalities are a widely occurring phenomenon having been reported across Europe, North America, Central America, Brazil, India, Australia and South Africa (Baerwald and Barclay 2011; Barros et al. 2015; Hein and Schirmacher 2016; Kumar et al. 2013; Rodríguez-Durán and Feliciano-Robles 2015; Rydell et al. 2010). Furthermore, evidence has shown that pre-construction monitoring data may not be able to adequately predict post-construction fatality risk (Hein et al. 2013), and that bats actively investigate and forge around turbines (Cryan et al. 2014; Foo et al. 2017). This suggests that there may still be fatality impacts. Residual impacts can likely be reduced if curtailment is used when appropriate and this has been shown to be one of the most effective mitigation measures (Arnett and May 2016).		

Table 2: Cumulative Impact Assessment

Nature: Cumulative mortality of bats due to collision with turbine blades or barotrauma caused by turbine operation across multiple wind energy facilities. The cumulative impacts will depend on the number of wind energy facilities in the region, the species involved, the levels of bat mortality and mitigation measures implemented at each wind energy facility. Bats reproduce slowly (Barclay and Harder 2003) and their populations can take long periods of time to recover from disturbances so the cumulative impacts can be high if appropriate management and mitigation is not implemented. There are approximately 3 wind energy facilities planned within a 30 km radius of the Noblesfontein WEF. The assessment below assumes all 3 facilities implement appropriate mitigation measures.		
	Without Mitigation	With Mitigation
Extent	Regional (3)	Regional (3)
Duration	Long term (4)	Long term (4)
Magnitude	High (9)	Moderate (6)

Probability	Definite (4)	Probable (3)
Significance	**64 (High)**	**39 (Medium)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	-

Mitigation:

Mitigation measures

- All currently proposed mitigation measures proposed in the Noblesfontein WEF EMPr / EA should be adhered to. This includes adhering to the updated sensitivity map (Figure 1) which will require repositioning turbines (and their blades) that intrude into sensitive buffers. These buffers are regarded as no-go areas for turbine components only, and other infrastructure (roads, cables etc) are permissible. These areas include 1000m around all confirmed roosts, 500m around all cliff lines and 200m around all other important bat features.
- Should it not be possible to relocate these turbines, then certain strict mitigation measures, which includes curtailment, should be defined and implemented as soon as turbines are erected.
- In the event that turbines can be micro-sited, then a bat specialist must map the final turbine layout before micro-siting and assess whether all turbines are appropriately sited in such a way that their blades do not encroach into any bat sensitive buffers.
- All mitigation measures to protect bats proposed in the Noblesfontein WEF EMPr (Savannah 2012) must be adhered to.

Additional mitigation measures

- The impacts presented can be mitigated by using turbines which maximise the ground clearance as much as possible, and by minimising the tip height (i.e. the distance between the ground and the blade tip at its highest point). The lowest tip should not encroach any lower than 30m above ground, in order to reduce the risk of bat mortalities from reaching the specified estimated threshold limits of 44.3 bats per annum. Additionally, a full operational phase monitoring campaign, inclusive of fatality monitoring and estimates, is to commence as soon as the wind turbines are erected, and in accordance with latest version of the bat monitoring guidelines. This is to take place for the entire Noblesfontein WEF. Based on results from this monitoring campaign, should the estimated bat fatalities for the entire Noblesfontein WEF exceed the threshold of 44.3 bats per annum, then strict curtailment measures will need to be implemented – to be defined and monitored by an appropriate bat specialist.

Residual Impacts: Residual impacts may still remain even if the high sensitivity buffers are adhered to and by using turbines of an appropriate size to limit bat fatalities. Bat fatalities are a widely occurring phenomenon having been reported across Europe, North America, Central America, Brazil, India, Australia and South Africa (Baerwald and Barclay 2011; Barros et al. 2015; Hein and Schirmacher 2016; Hull and Cawthen 2012; Kumar et al. 2013; Rodríguez-Durán and Feliciano-Robles 2015; Rydell et al. 2010). Furthermore, evidence has shown that pre-construction monitoring data may not be able to adequately predict post-construction fatality risk (Hein et al. 2013), and that bats actively investigate and forge around turbines (Cryan et al. 2014; Foo et al. 2017). This suggests that there may still be fatality impacts. Residual impacts can likely be reduced if curtailment is used when appropriate as this has been shown to be one of the most effective mitigation measures (Arnett and May 2016).

6 CONCLUSION

Compared to the current turbine layout and dimensions of Noblesfontein WEF, it is likely that the addition of the two turbines would (without mitigation) slightly increases mortality impacts on bats. This is primarily because of an increased overall rotor swept area relative to that which is currently present at Noblesfontein WEF, with the additional blades extending higher into the air, as well as the location of turbines in bat sensitive areas – placing bats (particularly those using open spaces for commuting and foraging) at a higher risk. Based on bat activity and fatality levels, as assessed from post-construction monitoring data, impacts to bats are likely to be of a medium significance before mitigation and low after mitigation. Cumulative impacts are likely to be of a high significance before mitigation and medium after mitigation. The magnitude of bat impacts may differ based on the exact dimensions of the turbines chosen. Turbines with longer blades that reach lower to the ground would likely have a greater impact by putting a greater diversity of species, and greater magnitude of individual bats, at risk. Longer blades will also extend higher into the air and place open air species such as free-tailed bats at greater risk.

It is also important to note that the proposed placement of the two additional turbines in high bat sensitive roosting areas warrants further consideration. The key initial mitigation measure that should be implemented at the Noblesfontein WEF would be adherence to the updated sensitivity map (Figure 1), and for all high bat sensitive areas to be avoided from turbine placement. Due to technical constraints, these turbines cannot be micro-sited out of the sensitivity area. As this is not specifically a no-go the it is the specialist opinion that these turbines can be placed in this area with specific mitigation measures.

As a result of the above, it is recommended maximising the ground clearance and minimising the tip height (i.e. the distance between the ground and the blade tip at its highest point) as much as possible. More specifically, it is not recommended for the lowest blade tips to encroach any lower than 30 m above ground, as turbines with a lower ground clearance run the risk of reaching the fatality thresholds sooner. Additionally, due to the presence of the two turbines in high sensitive areas, it is recommended for strict mitigation measures, which includes curtailment, to be defined and subsequently implemented as soon as the turbines are erected.

A full operational phase monitoring campaign, inclusive of fatality monitoring and estimates, is to commence as soon as the wind turbines are erected, and in accordance with latest version of the operational bat monitoring guidelines. This is to take place for the entire Noblesfontein WEF. Based on results from this monitoring campaign, should the estimated bat fatalities for the entire Noblesfontein WEF exceed the threshold of 44.3 bats per annum, then strict curtailment measures will need to be implemented (aside from that already mandatory for the two additional turbines) – to be defined and monitored by an appropriate bat specialist.

If all mitigation measures listed in this report are strictly adhered to, then it is not anticipated for any change in impacts, relative to that currently taking place at the authorised WEF, to be significant. Therefore, from a bat perspective, the proposed development considered can proceed, provided that all mitigation measures are adhered to.

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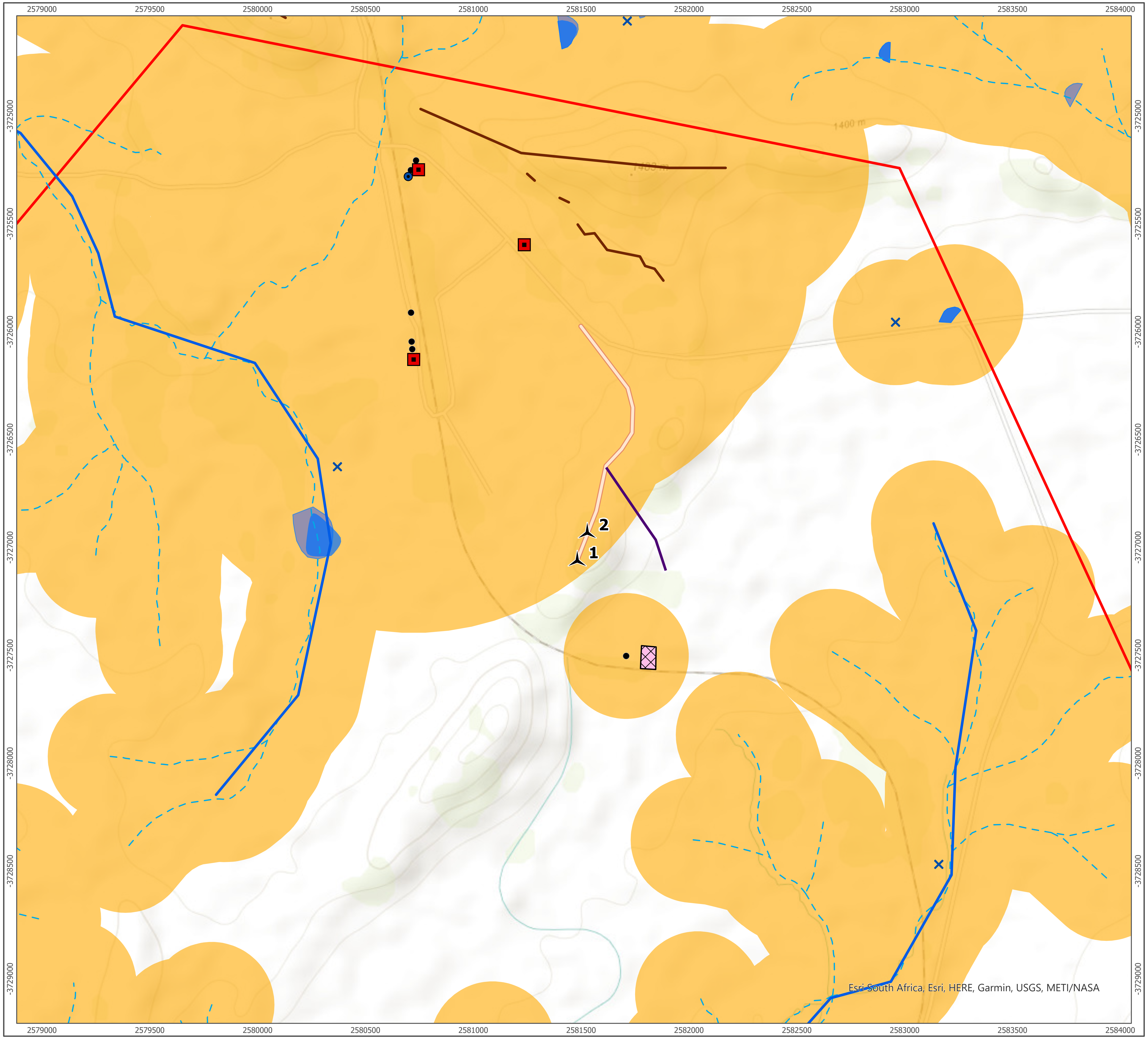
APPENDIX 1: FIGURES



ARCUS

- Noblesfontein WEF Boundary
- Proposed Turbines
- Roads
- Overhead Powerlines
- Substation
- No-Go Area for Turbines

Important Bat Features
- House
- Ruin
- Tree
- Water Reservoir
- Wind Pump
- Confirmed Roosts
- NFEPA Rivers
- Drainage Lines
- Rocky Outcrops
- NFEPA Wetlands
- NBA Artifical Wetlands

1:17 000 Scale @ A3

0 0.25 0.5 km

NORTH

Produced By: MB	Ref: 4208-GIS-001
Checked By: CC	Date: 2021/04/23

Bat Sensitivity Map
Figure 1

Noblesfontein WEF Part 2 Amendment

Z:\GIS\Projects\4208 Noblesfontein WEF Part 2 Amendment\4208 Noblesfontein WEF Part 2 Amendment_20210421.aprx\4208-GIS-001 Fig 1 Bat Sensitivity Map

APPENDIX 2: SITE SENSITIVITY VERIFICATION REPORT

BATS SITE VERIFICATION STATEMENT

for the

PROPOSED NOBLESFONTEIN WIND ENERGY FACILITY EXPANSION, NORTHERN CAPE PROVINCE

Consultation with the information presented by the DFFE screening tool report[1] generated for the proposed development, revealed that Noblesfontein Wind Energy Facility ("WEF") **does not trigger any environmental sensitivities for the bat community on site**. Due to potential data deficiencies that may be associated with the relevant screening tool report, this can be disputed and should not necessarily be considered as being completely satisfactory in drawing up any final conclusions.

To determine if the proposed development footprint may pose a risk to bats, a site visit was conducted in March 2021. During the visit, the presence of bat roosting structures was confirmed in the immediate vicinity of the WEF, and could hold some importance for the general bat community. As such, it is more likely that the project site should be considered to have a "**Low**" sensitivity on the local bat community, with certain roosting features to be of a high sensitivity. An assessment report will be undertaken to consider the impacts to bats and proposed mitigation measures to possibly reduce risk, if any.

Craig Campbell

Ecologist, South Africa

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[1] https://screening.environment.gov.za/

APPENDIX 3: 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:	
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

Noblesfontein WEF BAR

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

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:	Icon Building, Cnr Long Street & Hans Strijdom Avenue, Cape Town 8001, South Africa			
Postal address:	Office 607 Cube Workspace, Cnr Long Street & Hans Strijdom Avenue, Cape Town 8001, South Africa			
Postal code:	8001	Cell:	074 789 6894	
Telephone:	074 789 6894	Fax:	n/a	
E-mail:	craigc@arcusconsulting.co.za			

1. 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:

2021-05-18

Date

2. 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

2021-05-18

Date

7210859-2
CST
T. LETLAILA

Signature of the Commissioner of Oaths

2021-05-18

Date

SUID-AFRIKAANSE POLISIEDIENS
D3447
SPEURDIENS
18 MAY 2021
DETECTIVE SERVICE
MILNERTON
SOUTH AFRICAN POLICE SERVICE

CURRICULUM VITAE

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

Ecologist

Email: craigc@arcusconsulting.co.za

ARCUS

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.

University of Stellenbosch, 2008-2008

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

Operational Monitoring – Wind Energy Facility

- Noblesfontein Wind Energy Facility
- Sere Wind Energy Facility
- Nxuba Wind Energy Facility

Due Diligence

- Bird monitoring at Kiyikoy Wind Energy Facility, Turkey