# Scoping phase assessment with regards to bat (Chiroptera) sensitivity

- **For the proposed Walker Bay Wind Energy Facility in the Western Cape**

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## Terms of Reference

The scoping phase assessment aims to assess the sensitivity of the bat communities in the study area, and undertake a desktop review of the site and surrounding area to identify bat species potentially present. A brief review of national and international literature on bat-wind energy facility interactions is also to be included, together with a desktop based Sensitivity Map indicating potential areas of bat sensitivity (to be reviewed in the Environmental impact assessment (EIA) phase). Provide descriptions of the impacts and issues foreseen so far in relation to the proposed wind energy facility and its associating impacts. Draw up suggested terms of Reference for further work to assess/address the identified issues in the EIA phase (detailed phase).

## Appointment of Specialist

Animalia Zoological & Ecological Consultation CC was appointed by Savannah Environmental (Pty) Ltd to undertake a specialist scoping phase bat sensitivity study for the proposed Walker Bay Wind Energy Facility in Eastern Cape. The study was conducted by Werner Marais (CV available on request).

## Independence:

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

## Applicable Legislation:

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

NATIONAL ENVIRONMENTAL MANAGEMENT: BIODIVERSITY ACT, 2004 (ACT 10 OF 2004; Especially sections 2, 56 & 97)

The act calls for the management and conservation of all biological diversity within South Africa. Bats constitute an important component of South African biodiversity and therefore all species receive attention additional to those listed as Threatened or Protected.

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## 1. INTRODUCTION

### 1.1 Study Area

Renewable Energy Systems (RES) Southern Africa is proposing to establish a commercial wind energy facility and associated infrastructure on a site located approximately 18 km north east inland from Gansbaai within the Western Cape and Overstrand Municipality (**Figure 1**). The site is crossed once by the Uitkraals stream towards the south eastern part of the site. The turbines are proposed to be on the high lying ground in the far north west of the site (**Figure 2**).

The site area is 912 hectares in extent and comprises the farm Grootvlei 687, portion 3. The proposed facility is proposed to accommodate a cluster of up to 11 wind turbines with a capacity of up to 3 Mega Watts (MW) each. A maximum capacity of 18 MW is proposed for the facility due to local grid limitations. The basic infrastructure associated with the facility would include:

- Wind turbines (between 80 m – 120 m hub height) and concrete foundations or rock adaptors to support them.
- Possibly a small transformer outside each turbine tower. The transformer may be inside the tower depending on what make and model of turbine which is deemed most suitable for the site. An external transformer would have its own foundation and housing around it.
- Crane hard standings next to each turbine.
- Cabling between the turbines, to be laid underground where practical.
- Internal access roads to each turbine.
- Workshop area for control, maintenance and storage.
- Temporary and permanent wind monitoring masts for calibration and site monitoring.
- Small mast for telecommunications.
- An on-site substation to facilitate the connection between the wind energy facility and the grid.
- A new overhead power line to connect to Eskom's existing Stanford Substation, which is located approximately 10 km from the site


**Figure 1:** Map with an indication of the site (blue outline), and an overview map with the site locality (red dot).

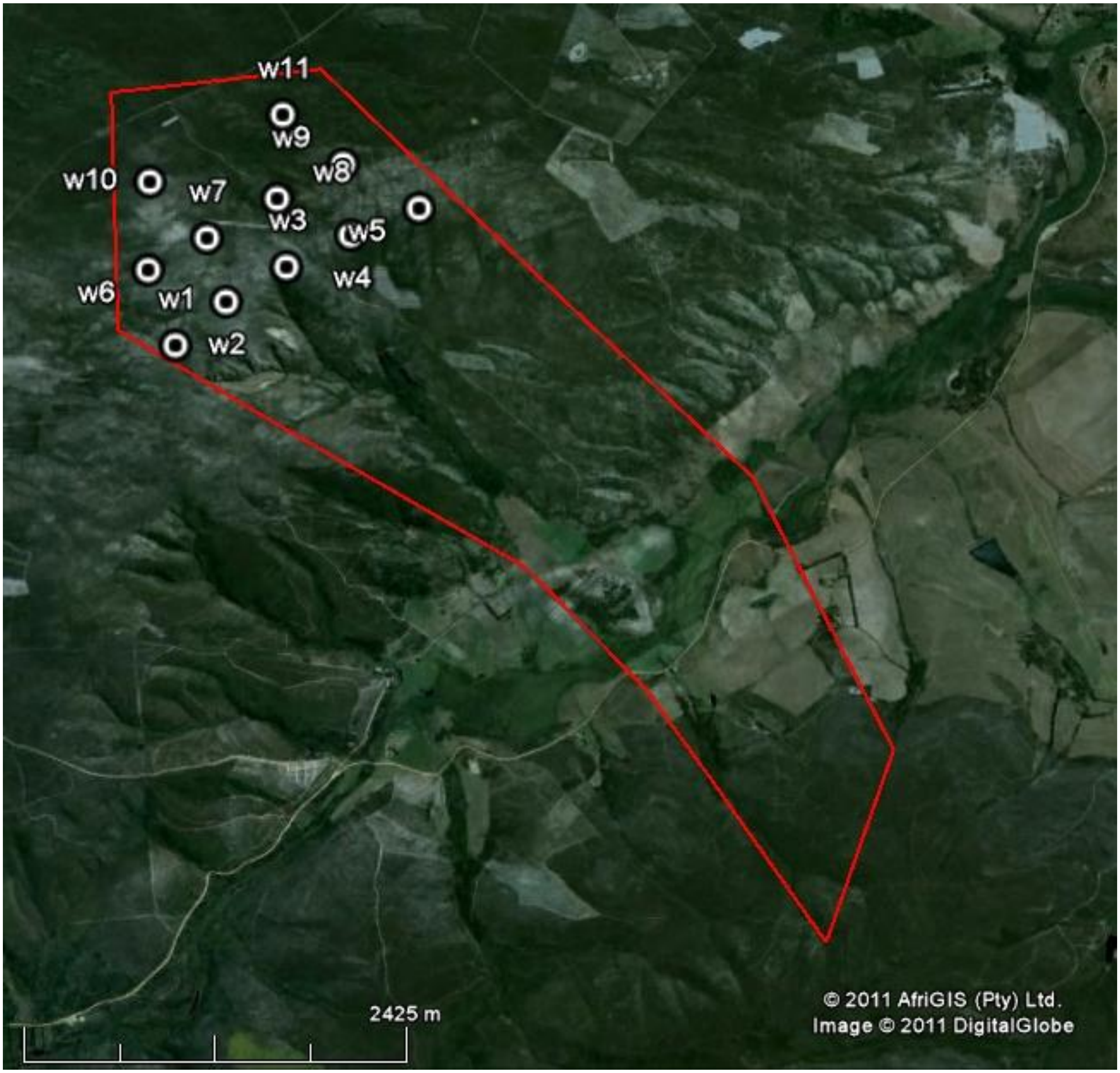



**Figure 2:** Satellite image of the site and indicative turbine localities, the boundary is indicated in red. The light green wetland area of the Uitkraals stream can be seen crossing the site. All satellite images retrieved from Google Earth™.

## 1.2 Limitations and assumptions

The available literature on South African bat behaviour and ecology is limited, especially on behavioural acts pertaining to large geographical regions. Additionally, technological limitations hinder the research and observation of bat movements, even on relatively short nightly movements. Much of the knowledge of bat behaviour is therefore still relatively uncertain in comparison to more charismatic species of animals.

Areas on the site to be designated as having a higher bat activity and/or diversity, is deemed as such based on the occurrences of certain environmental and terrain features that will be favourable to bats.

## 1.3 Land use and existing impacts on the study area

The existing impacts on the study site are limited to some agricultural practices, primarily cattle and some crops. Little major developmental modifications are present.

## 1.4 Vegetation units, geology and climate

Five different vegetation units are present in the study area, only the first two will be discussed in detail since the proposed turbines are located within them or very close (**figure 3**).

The Overberg Sandstone Fynbos dominates the area where the turbines is proposed. This vegetation unit is found only in the Western Cape province on altitudes from 20-1167 meters. The landscape contains low mountains and undulating plains supporting moderately tall shrublands, with acidic soils derived from sandstones of the Table Mountain Group. The climate is a winter rainfall area peaking from May to August with a Mean Annual Precipitation (MAP) of 450-830mm, mist precipitation is brought in by clouds on higher altitudes during summer. The mean daily maximum and minimum temperatures is 25°C and 6°C for January and July respectively, with only 2 or 3 days of frost incidence per year (Mucina & Rutherford, 2006).

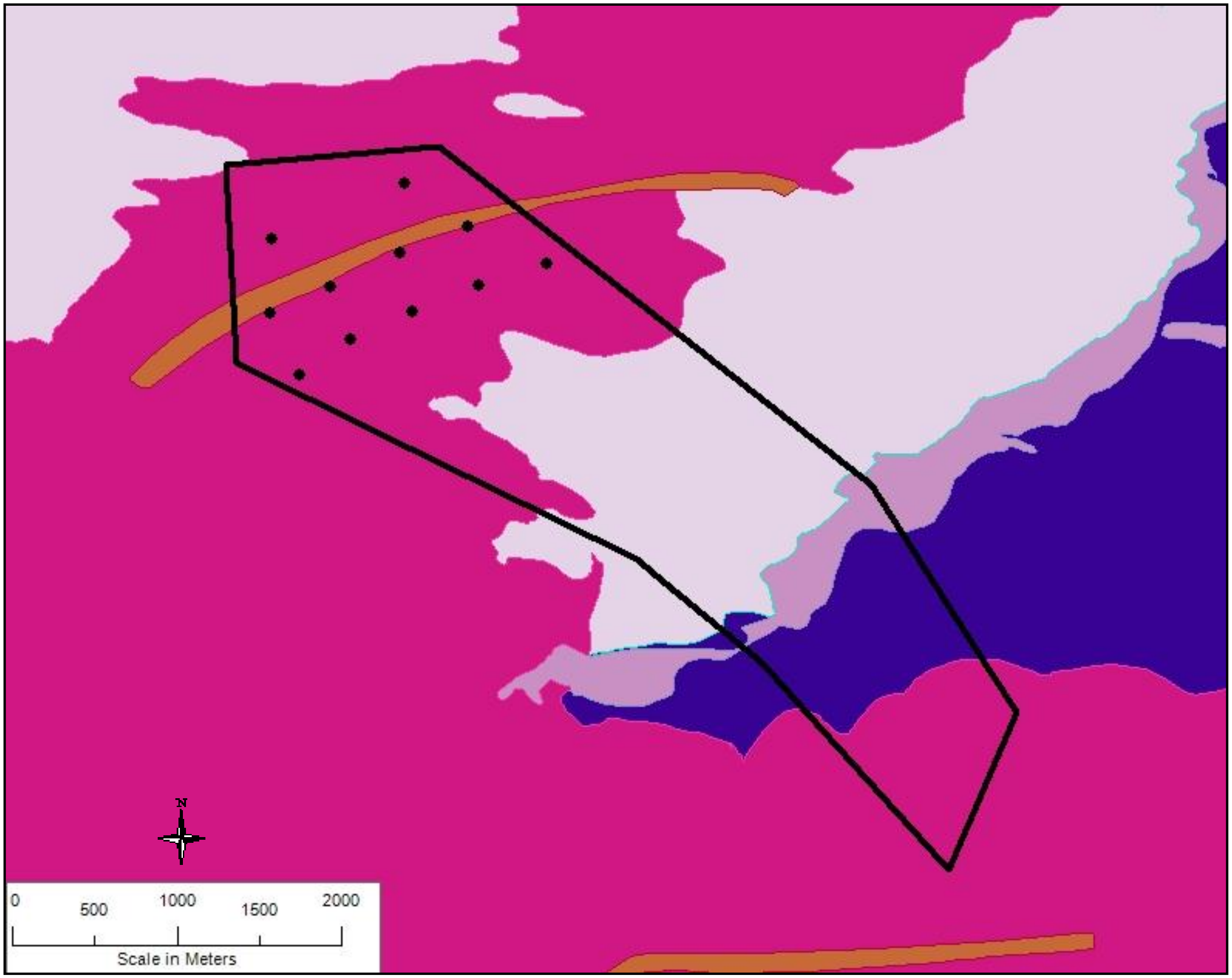
A small strip of Western Coastal Shale Band Vegetation is adjacent a row of turbines and essentially an island within the Overberg Sandstone Fynbos on the site. This unit is restricted to the Western Cape only and occurs up to an altitude of 1800m. It is a linear feature of 80-200m wide that is smooth and flat in profile compared to surrounding terrain. The band supports diverse renosterveld and fynbos shrublands. It's climate would be very similar to that of the surrounding vegetation unit (Mucina & Rutherford, 2006).

The south eastern facing slope descending from the turbine area towards the Uitkraals stream, consists predominantly of Agulhas Limestone Fynbos. This unit have low hills and plains and is only found up to an altitude of 400m. Vegetation structures are fynbos shrubland of medium tallness, it's MAP is 410-660mm (Mucina & Rutherford, 2006).

The Uitkraals stream and wetland is classified as the Cape Lowland Freshwater Wetlands and is found on the edges of water bodies and in vleis. Flats and landscape depressions with tall reeds, restios and sedges with temporary and permanent water is common. Substrates are fine, sandy and clayey, in places due to salt leeching from the Malmesbury Group Shales the water can acquire a brackish character (Mucina & Rutherford, 2006).

The Elim Ferricrete Fynbos is located on the north western facing slope ascending up from the Uitkraals. This unit is only found up to 300m and consists of undulating plains and hills covered with dwarf shrublands. Also a winter rainfall regime with a MAP of 350-770mm.

It should be noted that climate descriptions are given for the larger extent of the specific vegetation unit, but are still indicative of the environmental factors that dictate the vegetation on the site.




Site boundary
Western Coastal Shale Band
Elim Ferricrete Fynbos
Turbine localities
Agulhas Limestone Fynbos
Overberg Sandstone Fynbos
Cape Lowland Freshwater

**Figure 3:** Vegetation units present in the study area (Mucina & Rutherford, 2006).

### 1.5 The bats of South Africa

Bats are mammals from the order Chiroptera, and are the second largest group of mammals after the rodents. There are more than 117 species of bats in the Southern African sub-region, of which 5 species have a global Red list status of Vulnerable and 12 are classified as Near Threatened (Monadjem, et al. 2010). Out of the 117 species more than 50 species occur in South Africa (Taylor, 2000; Monadjem, et al. 2010).

Bats are the only mammals to have developed true powered flight and they have undergone various skeletal changes to accommodate this. The forelimbs are elongated, whereas the hind limbs are dramatically reduced and shortened to lessen the total body weight. This unique wing support frame allows bats to alter the camber of their wings in order to adapt the wing shape to different flight conditions while maximizing agility and maneuverability. This adaptability and versatility of the bat wing surpasses the more static design of the bird wings and enables bats to utilise a wide variety of food sources and diversity of insects (Neuweiler, 2000). The facial characteristics between species may differ considerably to suit the requirements of their life style especially with regard to their feeding and echolocation navigation strategies. The majority of South African bats are insectivorous, and can consume vast numbers of insects on a nightly basis (Taylor, 2000; Tuttle and Hensley, 2001), but may also consume other invertebrates, amphibians, fruit and nectar.

Insectivorous bats are therefore the only major predators of nocturnal flying insects in South Africa and contribute greatly in the control of their numbers. Their prey also includes agricultural insect pests, such as moths and vectors for diseases such as mosquitoes (Rautenbach, 1982; Taylor, 2000).

Urban development and agricultural practices have contributed to the decline in bat numbers globally. Public participation and funding of bat conservation are often hindered by the negative images of bats created by a lack of knowledge and certain misconceptions about bats. The fact that some species roost in domestic residences also contributes to the negative reputation of bats. Some species may occur in large numbers in buildings and besides being a nuisance, may become a health risk to the residents. Unfortunately, the negative association people have towards bats, obscures the fact that they are an essential component of the ecology and by en large beneficial to humans.

Many bat species roost in large aggregations and concentrate in small areas. Therefore, any major disturbance to that area can adversely impact many individuals of a population at the same time (Hester and Grenier, 2005). Secondly, the reproduction rates of bats are much lower than those of most other small mammals, because usually only one or two pups are born per female annually. According to O’Shea et al. (2003), bats may live for up to 30 years. Under natural circumstances, a population’s numbers can build up over a long period of time, due to their longevity and the relatively low predation on bats, when compared to other small mammals. Therefore, the rate of recovery of bat populations is slow after major die-offs and roost disturbances.

### 1.6 Bats and wind turbines

Since bats have highly sophisticated navigation by means of their echolocation, it is puzzling as to why they would get hit by rotating turbine blades. It may be theorized that under natural circumstances their echolocation is designed to track down and pursue smaller insect prey or avoid stationary objects, not primarily focused on unnatural objects moving sideways across the flight path. Apart from physical collisions, a major cause of bat mortality at wind turbines is barotrauma. This is a condition where the lungs of a bat collapse in the low air pressure around the moving blades, causing severe and fatal internal hemorrhage. One study done by Baerwald, et al. (2008) showed that 90% of bat fatalities around wind turbines involved internal hemorrhaging consistent with barotrauma. A study done by Arnett (2005) recorded a total of 398 and 262 bat fatalities were found during searches at Mountaineer Wind Energy Center in Tucker County, near Thomas, West Virginia, and at the Meyersdale Wind Energy Center in Somerset County near Meyersdale, Pennsylvania, respectively. This was during a 6-week study period from 31 July 2004 to 13 September 2004.

Some studies (Horn *et al.*, 2008) suggests that bats may be attracted to the large turbine structure as roosting space, and popular believe indicates that swarms of insects get trapped in low air pockets around the turbine and subsequently attract bats.

Whatever the reason for bat mortalities around wind turbines, the facts indicate this to be a very serious and concerning problem. During a study by Arnett, *et al*. (2009), 10 turbines monitored over a period of 3 months showed 124 bat fatalities in South-central Pennsylvania (America), which can cumulatively have a catastrophic long term effect on bat populations, if such a rate is persistent. Most bat species only reproduce once a year, bearing one young per female, meaning their numbers are slow to recover. Mitigation measures are being researched and experimented with globally, but are still only effective on a small scale. An exception to this is a mitigation measure called curtailment, where the turbine cut-in speed is raised to a higher wind speed. This relies on the principle that bats will be less active in strong winds due to the fact that their insect food can't fly in strong wind speeds, and  the small insectivorous bat species need to use more energy to fly in strong winds. Therefore they are less likely to be impacted by a fast moving turbine blade than a slow moving blade, however this mitigation is not as effective yet to move this threat to a category of low concern.

## 2. METHODOLOGY APPROACH OF THE STUDY

Three factors need to be present for most South African bats to be prevalent in an area:
1. availability of roosting space,
2. food (insects/arthropods or fruit), and
3. accessible open water.

However, the dependence of a bat on each of these factors depends on the species and its biology, and different species of bats make use of different types of roosting spaces. But nevertheless if all three of these factors are very common in an area the bat activity and abundance will also most likely be higher since these environmental factors have a synergistic effect on bat occurrence.

Concerning species of bats that may be impacted by wind turbines, the proposed site was evaluated by comparing the amount of:

- surface rock (possible roosting space),
- topography (influencing surface rock in most cases),
- vegetation (possible roosting spaces and food in the case of fruit bats),
- climate (can influence insect numbers and availability of fruit), and
- presence of surface water (influence insects and act as drinking water for bats).

Species probability of occurrence based on the above mentioned factors and distribution maps were also estimated for the site and the surrounding larger area.

These comparisons were done mainly by studying the geographic literature of the site and satellite imagery, as well as personal bat experience with some of the terrain types.

## 3. RESULTS

### 3.1 Species probability of occurrence

**Table 1:** Table of species that may be roosting or foraging in the proposed study area, the possible area specific roosts, and their probability of occurrence. LC = Least Concern; NT = Near Threatened; V = Vulnerable (Monadjem *et al.*, 2010).

| Species | Common name | Probability of occurrence | Conservation status | Possible habitat to be utilised on study area |
|---|---|---|---|---|
| *Epomophorus wahlbergi* | Wahlberg's Epauletted fruit bat | Low | LC | Site is within distribution range, but fruiting trees on site and especially in turbine area very limited. |
| *Rousettus aegyptiacus* | Egyptian Rousette | Low | LC | Site is within distribution range, but fruiting trees on site and especially in turbine area very limited. Roosts in caves, no known caves in direct vicinity of study site, but still possible. |
| *Cloeotis percivali* | Percival's short-eared trident bat | Very low | V | Roosts in caves, no known caves in direct vicinity of study site, but still possible. Additionally no museum records are present from the western cape, although the site is within the literature distribution range. |
| *Hipposideros caffer* | Sundevall's leaf-nosed bat | Very low | LC | No museum records are present from the western cape, although the site is within the literature distribution range. It roosts in a variety of natural and anthropogenic hollows, but avoid open terrain. |
| *Rhinolophus capensis* | Cape horseshoe bat | Medium | NT | Roosts in caves, no known caves in direct vicinity of study site, but still possible. Well within distribution range. |
| *Rhinolophus clivosus* | Geoffroy's horseshoe bat | High | LC | Roosts in caves and hollows, no known caves in direct vicinity of study site, but still possible. Suitable hollows may be present in the valley areas. Museum |

| Species | Common name | Probability of occurrence | Conservation status | Possible habitat to be utilised on study area |
|---|---|---|---|---|
| | | | | records from area present. |
| *Rhinolophus swinnyi* | Swinny's horseshoe bat | Very low | NT | Roosts in caves, no known caves in direct vicinity of study site, but still possible. Additionally no museum records are present from the western cape, although the site is within the literature distribution range. |
| *Taphozous mauritianus* | Mauritian tomb bat | Medium | LC | Needs large trees and rock faces for roosting, but also roosts on the sides of buildings. On edge of distribution. |
| *Nycteris thebaica* | Egyptian Slit-faced bat | High | LC | Roosts in any suitable hollows such as culverts, burrows and manmade hollow structures. |
| *Sauromys petrophilus* | Robert's flat-headed bat | High | LC | Roosts in rock crevices, some crevices present in valley area and area surrounding the site. Also found in mountain Fynbos. |
| *Tadarida aegyptiaca* | Egyptian free-tailed bat | Very High | LC | Crevices, buildings, rock crevices in valley and surrounding mountainous area. Common species. |
| *Miniopterus natalensis* | Natal long-fingered bat | Medium | NT | Roosts in caves, no known caves in direct vicinity of study site, but still possible. The De Hoop Guano Cave is a well known large roost for this species and approximately 79km to the east of the site. Additionally this species have wide foraging ranges and do migrations. The precautionary approach is advised and will be discussed later. |
| *Eptesicus hottentotus* | Long-tailed serotine | High | LC | Crevice dweller and in buildings and caves/rock hollows. No known caves in direct vicinity of study site, but still possible. Farm house building next to the Uitkraals stream. |

| Species | Common name | Probability of occurrence | Conservation status | Possible habitat to be utilised on study area |
|---|---|---|---|---|
| *Hypsugo anchietae* | Anchieta's pipistrelle | Low | LC | Associated with riparian woodland habitat. Inside distribution range but far from collected museum specimens. |
| *Kerivoula argentata* | Damara woolly bat | Low | LC | Associated with riparian woodland and woodland habitats. Inside distribution range but far from collected museum specimens. |
| *Kerivoula lanosa* | Lesser woolly bat | Low | LC | Associated with riparian woodland and woodland habitats. Inside distribution range but far from collected museum specimens. |
| *Myotis tricolor* | Temmink's Myotis | Medium | LC | Roosts in caves, no known caves in direct vicinity of study site, but still possible. |
| *Neoromicia capensis* | Cape Serotine bat | High | LC | Roofs of buildings, bark of large exotic trees, very common species. Farm buildings in area, and some large Bluegum trees in the south east of the site. |
| *Pipistrellus hesperidus* | Dusky pipistrelle | Low | LC | Associated with well wooded areas, but also roosts in rock crevices. Some crevices in valley areas. Inside distribution range but far from collected museum specimens. |

### 3.2 Surface rock, topography, climate, surface water and vegetation

The proposed Walker Bay site overall has a relatively high occurrence of open surface water, these are in the valley on the south east facing slope, the wetland around the Uitkraals and on the north western facing slope. These waterways and open water bodies will have a higher insect diversity and numbers and therefore attract more insectivorous bats, additionally most bats will need to drink water from open surface water. Rainfall is moderate and insect numbers should be sufficient to support bat communities in the low lying moist and drainage parts of the site

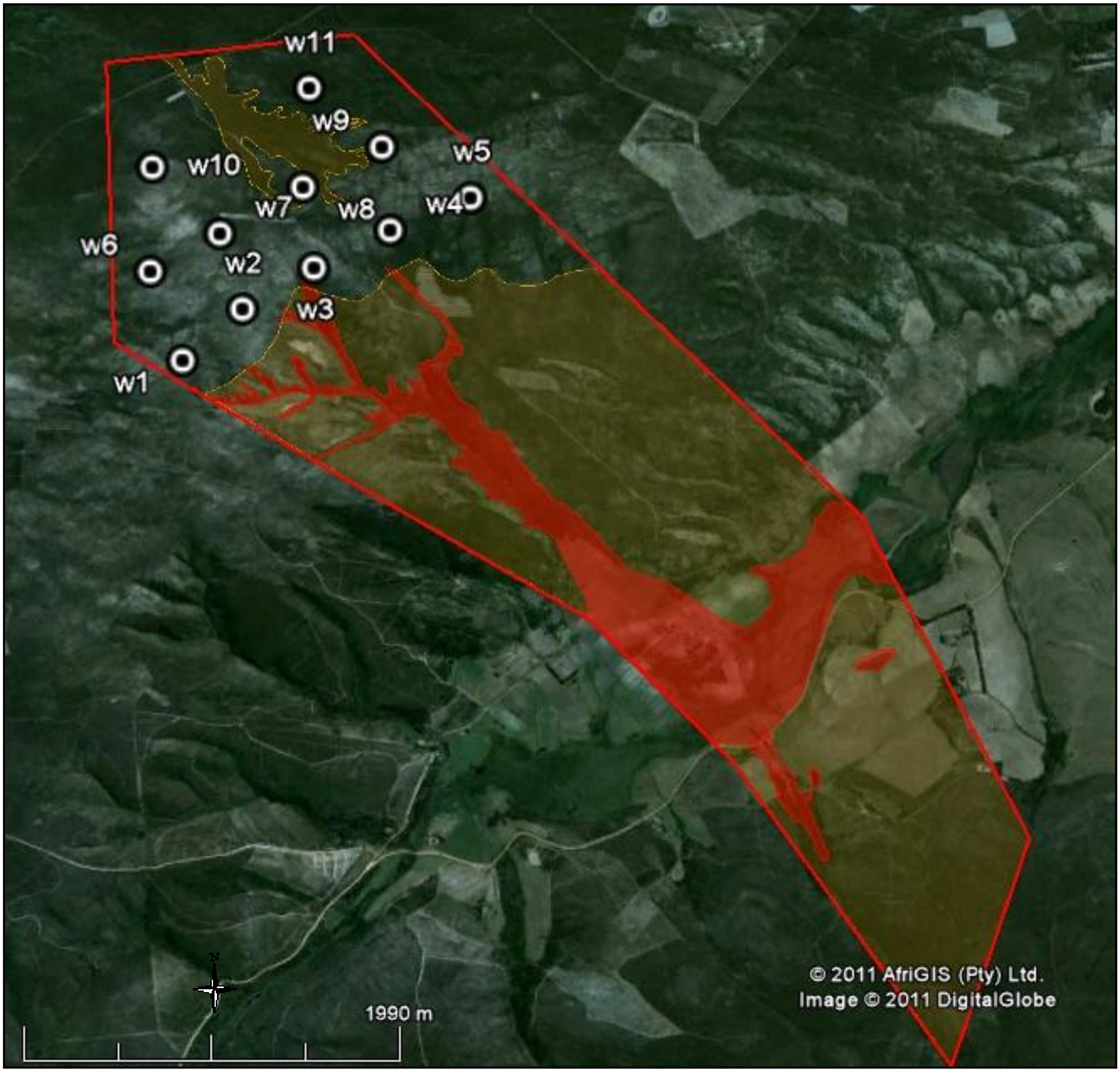
Surface rock coverage is average for Fynbos terrain, but surface rock that can provide sufficient roosting spaces for bats is basically limited to the valley on the south eastern facing slope.

The topography that consists of the Uitkraals stream and wetland valley and the valley on the south eastern facing slope (Houtboskloof), as well as a small drainage system just north west of the proposed turbine cluster, can all offer suitable foraging corridors for bats. Additionally the hilly terrain of the larger area can offer some roosting space to a certain extent.

The general vegetation in the proposed turbine area is not sufficient to offer suitable roosting space for any bats, and only the valleys and drainage lines have large enough trees to offer bat roosting space. An exception to this is the Blue Gum trees close to the farm house in the south eastern part of the site. No fruiting trees have been noticed.

This site has a moderate potential for supporting bat communities, although there exists a contrast in this potential between the different habitat types on the site. Refer to Figures 4 & 5.

### 3.3 Desktop based sensitivity map




High Sensitivity     Moderate Sensitivity

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zoological & ecological consultation

**Figure 4:** Desktop based sensitivity map of the study site.


High Sensitivity    Moderate Sensitivity

**Figure 5:** Desktop based sensitivity map of the area where the cluster of turbines is proposed.

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In figures 4 & 5 the areas where bats are most likely to forage and roost have been marked as having a high sensitivity (red shading), and includes the valleys, open water bodies and the Uitkraals water system. The lower lying areas of the site as well as the drainage area in the north west have been designated a moderate sensitivity, this is mainly due to the fact that these areas will have less wind and/or more moisture, supporting more prey insects.

It will be noted that the proposed localities of turbines 3 and 8 border high and moderate sensitive areas respectively. If at all practical these two turbine localities should preferably be moved elsewhere, alternatively they should be prioritised and more aggressively mitigated during operation.

It is important to note that this desktop based sensitivity map is not intended to govern the ideal locations of wind turbines with regards to bat sensitivity yet, but rather to highlight areas that will require special attention during the EIA phase assessment and to assist in decision making.

## 4. FORESEEN IMPACTS OF THE PROPOSED OPERATION DEVELOPMENT AND PROPOSED TERMS OF REFERENCE FOR ASSESSING/ADDRESSING THE ISSUES

### 4.1 Bat mortalities due to blade collisions and barotrauma during foraging

In section 1.6 the concern of bats and possible wind turbine blade collisions/barotrauma have been mentioned, but yet international research and experiments are unable to suggest sustainable large scale mitigation measures that can move this threat to a category of no concern. This is a negative regional direct impact that can have a cumulative effect, effective for the lifetime of the wind farm. The probability for this impact to occur on site is considered moderate.

Suggested Terms of Reference for assessing/addressing the issue

The correct placement of wind farms and of individual turbines can significantly lessen the impacts on bat fauna in an area (refer to the sensitivity map, Figure 4 & 5). Therefore it is proposed that areas of higher bat activity be identified in the EIA assessment and site visit with nocturnal monitoring, and these areas preferable be avoided in turbine placement. Affordable preconstruction long term monitoring data can be correlated with meteorological data and consequently provide more accurate data for implementation of mitigation measures, such as the ideal wind speed to use as a cut in speed. Last mentioned is more favourable than post construction monitoring, since some bat fatalities may already occur before the mitigation measures are perfected for the site. Additionally the areas identified in the desktop phase where implementation of mitigation measures are likely to be prioritized, must receive special attention in the EIA phase.

### 4.2 Bat mortalities due to blade collisions and barotrauma during migration

The migration paths of South African bats in the Cape Provinces are virtually unknown. Cave dwelling species like *Miniopterus natalensis* and *Myotis tricolor* undertakes annual migrations, although no caves are known to be in close proximity to the study area. However the De Hoop Guano Cave is situated approximately 79km east of the site and is home to the largest aggregation of bats in South Africa, with a calculated 300 000 bats roosting there (McDonald, *et al.*, 1990). It is also a very important nursery cave, and the colony consumes an estimated 100 tons of insects annually, making an invaluable contribution to the pest control on farms in the Bredasdorp area (Cape Nature, 2004; Patterson, 2004). This is a negative, direct and potentially cumulative (especially if other proposed wind farms are also considered) national impact, that is effective for the operation of the wind farm. Due to a great lack in local knowledge of the South African bat migration routes, this impact needs to be conservatively anticipated to have a moderate probability of occurrence.

<u>Suggested Terms of Reference for assessing/addressing the issue</u>

Even though no known caves are in close proximity, it will be beneficial to collaborate with academic institutions to promote research on the subject. It is essential to establish that the site is not within any bat migration routes, and if so during what time and season of the year does migration take place. This can be achieved by doing affordable long term preconstruction monitoring and quantifying the risks more accurately. After which, if the site falls in line with a migration route, aggressive mitigation measures can be applied during the established times of bat migrations. An example of such a very aggressive mitigation measure would be to keep turbines static at night during periods of bat migrations, which can be several weeks at a time and occurring at least twice a year.

### 4.3 Destruction of foraging habitat

Some foraging habitat will be destroyed by the construction of the turbines and associated infrastructure. This impact is a negative and local impact that will be more significant during construction than during the operation of the wind farm. This impact has a definite probability of occurrence.

Suggested Terms of Reference for assessing/addressing the issue

Areas of high bat foraging activity should be identified and these areas be treated with more caution and unnecessary habitat clearance avoided. Turbines should not be placed in the areas identified as having a high bat sensitivity during the full detail EIA phase.

### 4.4 Destruction of roosts

During the construction phase of the project possible bat roosts may be impacted by earthworks and large machinery. Diggings related to the placement of underground cables can also damage unknown bat roosts, although subterranean roosts are unlikely on this site. This is a negative local impact being applicable only during construction phase, on the contrary this may be perceived as a neutral local impact after construction since the new turbines and associated structure will provide additional roosting space for some species of bats. But it is important to understand that this may be upsetting to the ecology since the new structures will benefit only a few species unnaturally.

Suggested Terms of Reference for assessing/addressing the issue

All diggings and earthworks must be kept to a minimum especially in rocky outcrop areas, and blasting should be minimized.

## 5. CONCLUSION

The site displays a relatively high level of open surface water and moisture, and a low level of surface rock suitable for bat roosting. The vegetation outside the valley areas are not suitable for supporting bat roosts or to act as a source of food to fruit bats . From **Table 1** it can be concluded that special attention needs to be given to the possible presence of *Miniopterus natalensis* during the full detailed EIA phase site visit, and the possibility of the site being in a migration route must be investigated by means of a long term preconstruction study. If substantial scientific literature on the movements of the bats at De Hoop Guano Cave becomes available, and it indicates a possible threat by the proposed facility, the developer will need to be notified immediately and suitable mitigations set in place regardless of the phase of the project. Such mitigations will have to be determined according to the instigating literature. At the time of this study no substantial scientific literature of thorough research could be found on the migrations and large scale movements of the bats from De Hoop Guano Cave.

The sensitivity maps indicated in **Figures 4 & 5** should be treated as guidance for directing focus and special attention during future EIA assessments and preliminary decision making, it is not intended to govern final decision making. The proposed Terms of Reference for further detailed studies described in Section 4 should be carried out in the EIA assessment phase.

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