CHAPTER 3

Supplementary Material: Specialist Report

Bat report

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Bat Specialist Assessment

for the

Strategic Environmental Assessment

of the

Proposed Boegoebaai Port and SEZ (Special Economic Zone), Northern Cape, South Africa

Compiled by:

Werner Marais

March 2025

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PREPARED FOR:

COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH (CSIR)
P.O. Box 395
Pretoria, Gauteng,
0001
South Africa

BY:

ANIMALIA CONSULTANTS
2015/364493/07
Somerset West
Cape Town
7130

www.animalia-consult.co.za

Ref: R-2503-23

APPOINTMENT OF SPECIALIST

Specialist Company:	Animalia Consultants (Pty) Ltd.
Fieldwork conducted by:	Werner Marais
Report done by:	Werner Marais
Appointed by:	Council for Scientific and Industrial Research (CSIR)

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Animalia Consultants (Pty) Ltd has no connection with the developer or any other party who stands to gain financially should the proposed development be approved by the relevant decision-making authorities. Animalia Consultants (Pty) Ltd is not a subsidiary, legally or financially, of the developer. Animalia Consultants (Pty) Ltd's remuneration for services by the developer in relation to this proposal is not linked to the approval by the decision-making authorities responsible for permitting this proposal.

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1. INTRODUCTION

Animalia Consultants (Pty) Ltd (hereafter 'Animalia') has been appointed by the Council for Scientific and Industrial Research (CSIR) to conduct a bat sensitivity assessment for determination of the feasibility for the development, construction, and operation of a deep-water port with associated landside port facilities in Boegoebaai, Northern Cape. The proposed new port development is primarily for the enablement of the Northern Cape's Provincial Economic Development strategy including the Green Hydrogen Strategy and expanding the mining and industrial base in the Northern Cape.

A Strategic Environmental Assessment (SEA) has been initiated through a collaboration between the South African National Energy Development Institute (SANEDI), Northern Cape Economic Development Trade and Investment Promotion Agency (NCEDA), and Transnet National Ports Authority (TNPA) (the Project Steering Committee (PSC)). The Council for Scientific and Industrial Research (CSIR) has been appointed to undertake an independent SEA. The overarching purpose of the SEA is to develop an integrated decision-making framework to guide the planning of the proposed Boegoebaai Port and Special Economic Zone covered in this report, and the wider Namakwa region (covered in the future Work Package 2 report).

1.1 Terms of reference

The objectives and terms of reference for the impact assessment are undertake the following:

- Describe the existing baseline characteristics of the study area, including existing impacts on the site, and place this in a regional context;
- Identify and assess each potential impact of the project, including impacts associated with the construction and operation phases;
- Recommend mitigation measures to avoid and/or minimise impacts and/or optimise benefits associated with the proposed project.

1.2 The bats of South Africa

Bats form part of the order Chiroptera and are the second largest group of mammals after rodents. They are the only mammals to have developed true powered flight and have undergone various skeletal changes to accommodate this. The forelimbs are elongated, whereas the hind limbs are compact and light, thereby reducing the total body weight. This unique wing profile allows for the manipulation of wing camber and shape, exploiting functions such as agility and manoeuvrability. This adaption surpasses the static design of bird wings in function and enables bats to utilise a wide variety of food sources, including, but not limited to, a large diversity of insects (Neuweiler 2000). Species-based facial features may differ considerably as a result of differing lifestyles, particularly in relation to various feeding and echolocation navigation strategies. Most South African bats are insectivorous and are capable of consuming vast quantities of insects on a nightly basis (Taylor 2000, Tuttle and Hensley 2001) however, they have also been found to feed on amphibians, fruit, nectar and other invertebrates. As a result, insectivorous bats are the predominant predators of nocturnal flying insects in South Africa and contribute greatly to the suppression of these numbers. Their prey also includes agricultural pests such as moths and vectors for diseases such as mosquitoes (Rautenbach 1982, Taylor 2000).

Urban development and agricultural practices have contributed to the deterioration of bat populations on a global scale. Public participation and funding of bat conservation are often hindered by negative public perceptions and unawareness of the ecological importance of bats. Some species choose to roost in domestic residences, causing disturbance and thereby decreasing any esteem that bats may have established. Other species may occur in large communities in buildings, posing as a potential health hazard to residents in addition to their nuisance value. Unfortunately, the negative association with bats obscures their importance as an essential component of ecological systems and their value as natural pest control agents, which actually serves as an advantage to humans.

Many species of bats roost in large communities and congregate in small areas. Therefore, any major disturbances within and around the roosting areas may adversely impact individuals of different communities concurrently (Hester and Grenier 2005). Secondly, nativity rates of bats are much lower than those of most other small mammals. This is because, for the most part, only one or two pups are born per female per annum. Under natural circumstances, a population's numbers may accumulate over long periods of time. This is due to the longevity of up to 30 years (O'Shea *et al*. 2003) and the relatively low predation of bats when compared to other small mammals. However, bat populations are not able to adequately recover after mass mortalities and major roost disturbances.

1.3 Bats and Green Hydrogen and Ammonia facilities

Currently there is no evidence of these facilities posing a direct threat of fatality impact on bats during operation. However, roosting and foraging habitats may be destroyed during the construction phase. This is primarily due the fact that such facilities require areas of land to be cleared, and in some cases, earthworks are required for levelling purposes. This can result in habitat that is suitable for micro roosts, such as rocky outcrops being destroyed, which can also be fatal to bats residing in such roosts. Natural vegetation can support higher insect food quantities and diversity than cleared land, therefore foraging habitat can also be displaced.

The presence of security lights on and around these facilities creates significant light pollution that can impact bat feeding habits and species compositions negatively, by artificially discouraging photophobic (light averse) species and favouring species that readily forage around insect-attracting lights.

2. ASSESSMENT METHODOLOGY

The site was evaluated by considering man-made structures, surface rock (possible roosting space), topography (influencing surface rock in most cases), climate (can influence insect numbers), and presence of surface water and drainage areas (influences insects and acts as a source of drinking water) to identify habitats that may be frequently used by bat species. These considerations principally involved studying the literature, available satellite imagery and vegetation descriptions. One site visits was conducted on 18 February 2025 to provide an understanding of the environmental setting of the site.

Species probability of occurrence based on the above-mentioned factors were estimated for the site and the surrounding larger area, but species historically confirmed on site as well as surrounding areas were also considered.

With regards to the sensitivity map, Google Earth satellite imagery and verifications during a site visit were used to spatially demarcate areas of the site with Very High, High and Medium sensitivities relating to bat species ecology and habitat preferences (refer to **Figure 4-1**). The map considers man-made structures and habitat alterations (such as dams), as well as natural terrain features that are likely to offer roosting and foraging opportunities for bat species found in the broader site area. With regards to hydrology features, distinction has been made between permanent and seasonal water sources.

2.1 Assumptions and Limitations

As with any environmental study, there are certain assumptions and limitations that exist around the current knowledge we possess regarding bats and their behaviour, movements and distribution. Some important points are discussed briefly below:

- Distribution maps of South African bat species still require further refinement, thus the bat species listed as occurring on the site (but not detected in the area yet) should be considered precautionary. If a species has a known distribution proximal to the site, it was assumed to occur in the area.

- The sensitivity map is based partially on satellite imagery and one site visit. There is always the possibility that what has been mapped may differ slightly to what is on the ground.

3. BASELINE DESCRIPTION OF THE RECEIVING ENVIRONMENT

3.1 Land Use, Vegetation, Climate and Topography

The project area's land use type is predominantly mining and to a lesser degree livestock farming practices. Modification due to mining activities are more pronounced closer to the coastal regions than inland. Vegetation units and geology are of great importance to a study such as this, as these provide insight on suitable sites for the roosting of bats and support of their foraging habits (Monadjem *et al.* 2020). The sparse buildings may also serve as suitable roosting spaces (Taylor 2000; Monadjem *et al.* 2020). The general area has a winter rainfall regime with a Mean Annual Precipitation (MAP) of 50–80 mm. Frequent sea fog at night contributes significantly to more frequently available moisture in the ecology. High wind speeds and moving sand dunes (especially in disturbed areas) play significant ecological roles.

Two dominant vegetation units are present within the site boundaries, the Richtersveld Coastal Duneveld and Northern Richtersveld Yellow Duneveld, (VegMap 2018), within the Succulent Karoo Biome and Namaqualand Sandveld Bioregion (Mucina & Rutherford 2006, VegMap 2018).

Richtersveld Coastal Duneveld on site is generally flat terrain, with the exception of the Boegoe Twins koppies. Northern Richtersveld Yellow Duneveld has undulating dune terrain with interspersed flat sand shields.

3.2 Previously recorded as well as literature-based bat species of occurrence

Table 3-1. Table of species that have been previously recorded in the area and may be occurring based on literature. Possible roosting or foraging habitats in the study area are also briefly described (Monadjem *et al.* 2020; ACR, 2020).

Species	Common name	Occurrence in area	Conservation status (2016 Regional Listing)	Possible roosting habitat on or near site	Possible foraging habitat utilised on or near site
Tadarida aegyptiaca	Egyptian free-tailed bat	Confirmed within 100km of site	Least Concern	Roosts in rock crevices of exposed rocky cliffs. The species has also taken to roosting in roofs of buildings.	It forages over a wide range of habitats; its preferences of foraging habitat seem independent of vegetation. It seems to forage in all types of natural and urbanised habitats.
Laephotis capensis	Cape serotine	Confirmed within 100km of site	Least Concern	Roosts in the roofs of houses and buildings.	It appears to tolerate a wide range of environmental conditions from arid semi-desert areas to montane grasslands, forests, and savannahs. But is predominantly a medium height clutter edge forager.
Miniopterus natalensis	Natal long-fingered bat	Not confirmed	Near Threatened (2004 National Listing)	Cave and hollow dependent, closest possible known cave roost over 21km from site. Will also roost in small groups or individually in culverts and other hollows such as in culverts. Upon inspection no bats or roosting space were found in the Holgat road culvert.	Clutter-edge forager. May forage in more open terrain during suitable weather.
Cistugo seabrae	Angolan wing-gland bat	Not confirmed	Near Threatened (2004 National Listing)	May roost in building structures, the Holgat rocky ravine, or the Boegoe Twins koppies, but little is known about roosting habits. Restricted to arid regions of the country.	Clutter edge forager preferring terrain near open water, may therefore possibly be found at the open water near the Boegoe Twins koppies, or in the Holgat rocky ravine.
Eptesicus hottentotus	Long-tailed serotine	Not confirmed	Least Concern	It is a crevice dweller roosting in rock crevices, as well as other crevices in buildings. Exposed rocky cliffs.	It generally seems to prefer foraging on the clutter edge of vegetation, such as the vegetated drainage areas and also over open water sources such as pans.

Species	Common name	Occurrence in area	Conservation status (2016 Regional Listing)	Possible roosting habitat on or near site	Possible foraging habitat utilised on or near site
Sauromys petrophilus	Roberts's flat-headed bat	Confirmed within 100km of site	Least Concern	It is a crevice dweller roosting in rock crevices, as well as other crevices in buildings. Exposed rocky cliffs.	Open air forager.
Myotis tricolor	Temmink's myotis	Not confirmed	Near Threatened (2004 National Listing)	Cave and hollow dependent, closest possible known cave roost over 21km from site. Will also roost in small groups or individually in culverts and other hollows such as in culverts. Upon inspection no bats or roosting space were found in the Holgat road culvert.	Clutter-edge forager. May forage in more open terrain during suitable weather.
Rhinolophus clivosus	Geoffroy's horseshoe bat	Not confirmed	Least Concern (2016 Regional Listing)	Cave and hollow dependent, closest possible known cave roost over 21km from site. Will also roost in small groups or individually in culverts and other hollows such as in culverts. Upon inspection no bats or roosting space were found in the Holgat road culvert.	Vegetation clutter forager, not much vegetation clutter on site.
Rhinolophus capensis	Cape horseshoe bat	Confirmed within 100km of site	Near Threatened (2004 National Listing)	May utilise man-made hollows, Aardvark burrows or hollows formed by rocky boulder koppies.	Vegetation clutter forager, not much vegetation clutter on site.
Nycteris thebaica	Egyptian slit-faced bat	Confirmed within 100km of site	Least Concern (2016 Regional Listing)	Roosts in hollows, aardvark burrows and culverts under roads. Upon inspection no bats or roosting space were found in the Holgat road culvert.	It appears to occur throughout the savannah and karoo biomes, but avoids open grasslands. Not much vegetation clutter on site.

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4. RESULTS AND DISCUSSION

4.1 Specialist Sensitivity Mapping

Figure 4-1 depicts the sensitive areas of the site, based on features identified to be important (Table 4-1) for foraging and roosting of the species that most commonly occur in the area. Table 4-22 describes the implications of the sensitivity criteria. Thus, the sensitivity map is based on species ecology and habitat preferences. Details regarding the buffers of the sensitivity features identified in the map are provided in Table 4-3.

Table 4-1. Description of parameters used in the construction of the sensitivity map

Sensitivity	Sensitivity Feature	Motivation
Very High Sensitivity	Rocky outcrops and rocky Holgat drainage ravine	Rocky habitat can offer bat roosting habitat in the form of crevices and hollows. Additionally, they provide shelter from wind and adverse weather, allowing insect congregations and thereby attracting insectivorous bats.
	Aquatic water sources with exposed surface water	These areas can hold water and moisture longer and may therefore also attract insect food. Additionally, they can serve as a source of drinking water for bats in an arid environment.
High Sensitivity	Temporal water sources capable of holding more water	Available water and moisture will attract insect food seasonally.
Medium Sensitivity	Non-perennial washes, pans and other seasonal water sources	Some seasonally available moisture may attract limited insect food. Sensitivity layers compiled by an aquatic specialist were consulted for guidance.
	Livestock aggregation areas and kraals	The presence of livestock with associated dung and urine promotes insect activity, and thereby bat activity temporarily when in use for livestock.
	Terrain with regular undulating dunes, interspersed livestock aggregations and occasional high points	Terrain, vegetation and insect activity can be higher in such areas. Promoting bat activity.

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2 **Table 4-2.** The significance of sensitivity map categories for each infrastructure component for the WEF

Sensitivity	All infrastructure (except roads, underground cables and pipes)	Roads, underground cables and pipes
Very High Sensitivity and buffers	These areas are 'no-go' zones and infrastructure may not be placed in these areas and their buffers.	Allowed, but preferably keep to a minimum within these areas where practically feasible.
High Sensitivity and buffers	Only infrastructure with no artificial lighting may be placed in these areas	Allowed inside these areas.
Medium Sensitivity and buffers	Keep to a minimum in these areas, preferably no outside lighting in these areas if practically feasible.	Allowed inside these areas.

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4 **Table 4-3.** Specific buffer details of features highlighted in the sensitivity map.

Sensitivity Feature	Details
Very High sensitivity	Assigned a 200m no-go zone buffer
High sensitivity	Assigned a 200m buffer
All Medium sensitivities	Assigned a 150m buffer

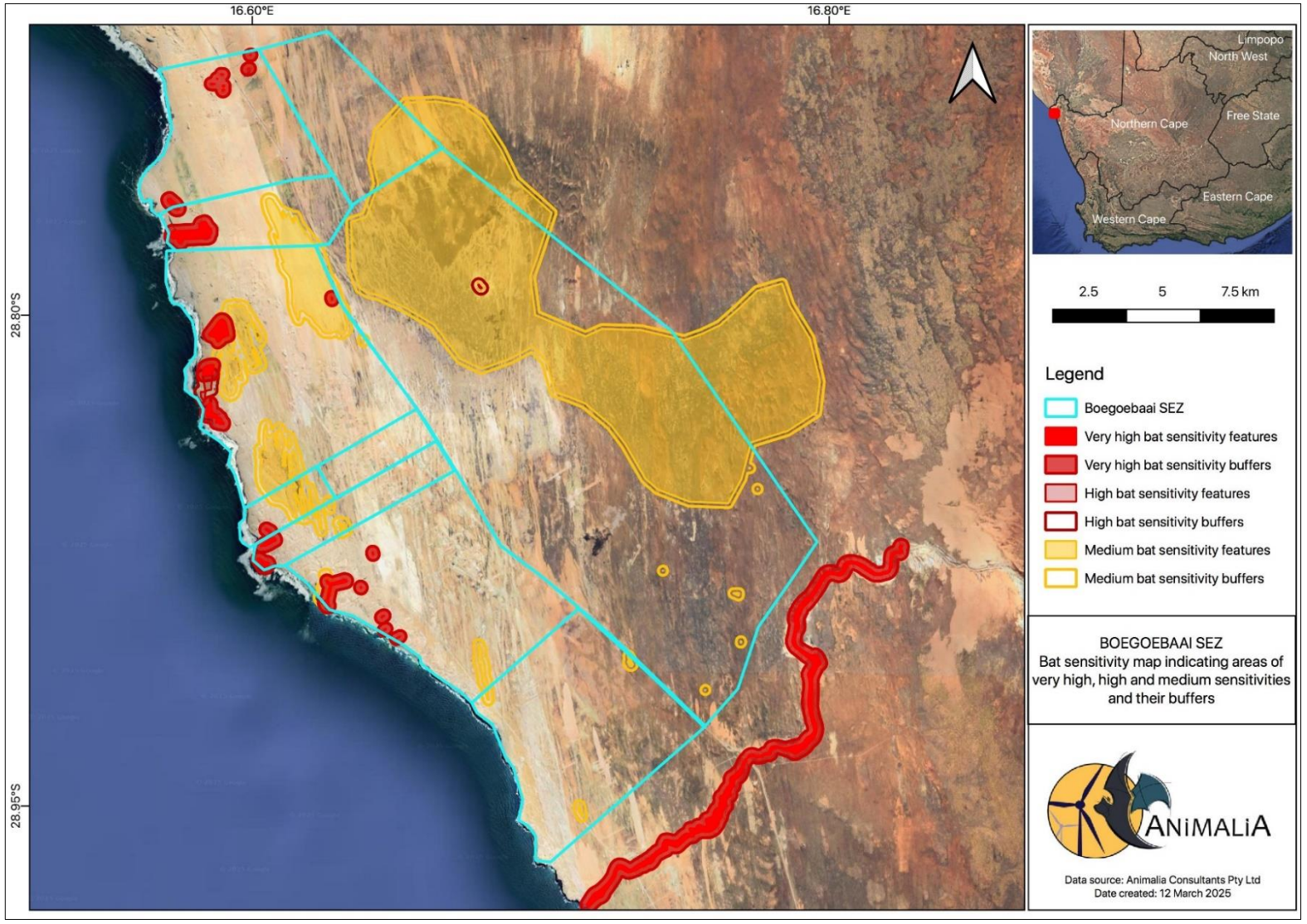

Figure 4-1. Bat sensitivity map of the proposed Boegoebaai Port and SEZ development.

5. BAT IMPACT ASSESSMENT

An outline of the potential impacts the Boegeoebaai Port and SEZ development may have on bats is provided below. Four impacts have been identified and assessed for the construction and operational phases.

Table 5-1. Identified potential impacts during construction and operation of the Boegoebaai Port and SEZ.

Infrastructure aspect / SEZ subzone	Potential impact	Spatial extent of receiving environment of concern
Operational phase		
Outside lights and floodlights in the Port and SEZ	Light pollution affecting light averse bat species	The SEZ development area as well as directly adjacent areas
Green Ammonia (GH2) water cooling tower blowdown, after demineralisation of seawater	Possible bat mortalities/injuries due to hot steam discharge	Acute localised impacts at water cooling towers
Construction phase		
Earthworks during construction in the Port and SEZ	Foraging habitat destruction	Areas marked as Very High, High and Medium in the bat sensitivity map, as well as their demarcated buffer zones.
Earthworks during construction in the Port and SEZ	Roosting habitat destruction	Areas marked as Very High in the bat sensitivity map, as well as their demarcated buffer zones.

5.1 Light pollution affecting light averse bat species and creating artificial foraging habitats

Light pollution will impact bat feeding habits and species compositions negatively, by artificially discouraging photophobic (light averse) species and favouring species that readily forage around insect-attracting lights. Therefore, during the operational phase strong artificial lights will alter the bat species composition and insect food resource availability for the Port, SEZ and directly adjacent areas, favouring certain species of bats and being disadvantageous to other species.

5.2 Possible bat mortalities/injuries due to hot steam/water discharge at Green Hydrogen water cooling tower blowdown

This impact is only applicable if the design and mechanism of the water-cooling towers are allowing for exposed wind cooled radiators which receives steam/hot water. The specialist has personally observed bat mortalities due to such a design for a Concentrated Solar Plant (CSP) water cooling system. If the radiator design is exposed, bats can move in-between the radiator fins overnight and once hot steam/water is released onto/in the radiator, bat mortalities and injuries can occur in acute large numbers.

5.3 Foraging habitat destruction

Foraging habitat will be permanently lost by construction of the Port and SEZ infrastructure. Temporary foraging habitat loss will occur during construction due to storage areas and movement of heavy vehicles.

5.4 Roosting habitat destruction

Probable roosting spaces on site are mostly in the form of rocky outcrops and man-made structures, as well as the rocky ravine of the Holgat drainage system to the south-east of the site. Such roosting spaces can be destroyed during construction by earthworks, causing harm or injury to bats residing on site.

6. MITIGATION TO MINIMISE THE PREDICTED IMPACTS

6.1 Avoidance of creating artificial foraging habitat

Artificial foraging habitat can unintentionally be created by the presence of outside lights attracting insects.

A mitigation to apply in the design of the Port and SEZ is to keep artificial lighting to a minimum on the infrastructure, while still adhering to safety and security requirements. For example, this can be achieved by having floodlights down-hooded, installing passive motion sensors onto lights around buildings and possibly utilising lights with lighting colours (also referred to as lighting temperatures) that attract fewer insects. Such lights generally are "warm white", yellow or amber and have a colour temperature below 4000k (Kelvin).

6.2 Possible bat mortalities/injuries due to hot steam/water discharge at Green Hydrogen water cooling tower blowdown

If the design and mechanism of the water-cooling towers are allowing for exposed wind cooled radiators which receives steam/hot water, this potential impact will be applicable. In such cases the water cooling radiators must be closed up with mesh/grid with a diameter of 10mm or less, to prevent bats and other wildlife from taking refuge inside radiator spaces. Mild latent heat in such structures can also attract many species of wildlife during cold weather conditions.

6.3 Bat foraging habitat destruction

Adhering to the bat sensitivity map as a mitigation is adequate. Additionally, keep to designated areas when storing building materials, resources, components and/or construction vehicles and keep to designated roads with all construction vehicles. Damaged areas should be rehabilitated by an experienced vegetation succession specialist after construction.

6.4 Bat roosting habitat destruction

Adhering to the bat sensitivity map as a mitigation is adequate. Additionally, if undiscovered bat roosts are encountered during construction, the Environmental Compliance Officer (ECO) on site must be notified immediately and a bat specialist consulted to advise the appropriate action.

7. CONCLUSION

Overall, the impacts on bat species for the proposed development are expected to be low and limited to the four impacts identified in Section 5, with light pollution being the most significant. However, if the water cooling towers are equipped with exposed radiator designs, acute and high bat mortality impacts may occur. **It is critical that a bat specialist be notified of and consulted in the intended design of the water cooling towers.** The outlined mitigation measures must be adhered to, and the sensitivity map respected by the applicable infrastructure components.

According to available information consulted during this study and up to date, there are no fatal flaws from a bat sensitivity perspective which should prevent the proposed development from proceeding towards the Environmental Impact Assessment process.

8. REFERENCES

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APPENDIX 1: SPECIALIST INFORMATION

Specialist Company Name:	Animalia Consultants (Pty) Ltd			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	4	Percentage Procurement recognition	100%
Specialist name:	Werner Marais			
Specialist Qualifications:	MSc Biodiversity & Conservation			
Professional affiliation/registration:	SACNASP *Pr.Sci.Nat* (Zoological Science)			
Physical address:	25 Bakkerskloof Road, Lynn's View, Somerset West, 7130			
Postal address:	25 Bakkerskloof Road, Lynn's View, Somerset West			
Postal code:	7130	Cell:	078 190 3316	
Telephone:		Fax:		
E-mail:	werner@animalia-consult.co.za			

1 # APPENDIX 2: SPECIALIST CURRICULUM VITAE

2 # WERNER CRISTIAAN MARAIS

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Summary of qualifications	2008 *University of Johannesburg,* **MSc (Biodiversity and Conservation) – Cum laude** 2006 *University of Johannesburg,* **Hons (Biodiversity and Conservation)** 2005 *University of Johannesburg,* **BSc (Zoology and Botany)**
Affiliations to professional bodies and societies	• Pr.Sci.Nat.– SACNASP (South African Council for Natural Scientific Professions) in the field of Zoological Science, registration number 400169/10. • Serves on the steering committee panel of the SABAA (South African Bat Assessment Association). • Served on the research committee of the Gauteng and Northern Regions Bat Interest Group (GNoRBIG). • **Served on the steering committee of the Zoological Society of the University of Johannesburg.**
Experience	2008 – Current Founder of Animalia Consultants (Pty) Ltd (conversion from Closed Corporation to Private Company in 2015) Animalia has completed more than **600 specialist reports and numerous large-scale projects in the renewable energy sector**, as specialist consultants in the EIA process and energy facility operational phase, under the supervision and lead of Werner Marais. 2015 – Current Founder of Lightbulb Innovation (Pty) Ltd. Lightbulb Innovation is developing new inventions and products invented by Werner Marais. 2008 University of Johannesburg • Sensitivity and biodiversity surveys of five caves in the Cradle of Humankind World Heritage Site (COHWHS) and Pretoria areas. • Preliminary survey to investigate the correlation between insectivorous bats and prey insects in the Krugersdorp Game Reserve. 2007, 2008 Bertie van Zyl (Pty) Ltd. (ZZ2 Tomato Farms), UJ Two-year project to research the biological pest control method of utilizing

insectivorous bats in agriculture. Required to conduct an in-depth study of bat (Microchiroptera) behavior and ecologically important factors.

2006 University of Johannesburg

Six-month survey of cave dwelling arthropods in the Cradle of Humankind World Heritage Site.

Additional:

- Invited by the EWT (Endangered Wildlife Trust) and ESSA (Exploration Society of Southern Africa) to deliver presentations on current ecological issues regarding bats and wind energy.
- Co-author for the: "South African Bat Fatality Threshold Guidelines for Operational Wind Energy Facilities – ed 1. South African Bat Assessment Association. Sept 2017"
- Co-author for the: "South African Good Practice Guidelines for Operational Monitoring of Bats at Wind Energy Facilities. First Edition July 2014"; and draft edition October 2019
- Contributing editor for the: "South African Good Practice Guidelines for Surveying Bats at Wind Energy Facility Developments – Pre-construction; Edition 4.1, 2017"
- As a co-author, received the Dow Greeff price for best annual scientific publication: "Die karst-ekologie van die Bakwenagrot (Gauteng)" published in the Suid-Afrikaanse Tydskrif vir Natuurwetenskap en Tegnologie, Vol. 31(1), 2012.

Presented the following papers at conferences:

- The potential of using insectivorous bats (Microchiroptera) as a means of insect pest control in agricultural areas. The Zoological Society of Southern Africa's 50th Anniversary Conference. July 2009.
- Inseketende vlermuise (Microchiroptera) en vlermuishuise in landbougebiede. Suid Afrikaanse Akademie vir Wetenskap en Kuns se 100 jaar Eufees kongres. October 2009.

Interviewed for two popular magazine articles on ecological aspects of biological pest control utilising bats; published in two consecutive issues of Farmers Weekly. Interviewed on radio discussion about ecology and biology of bats.

Education

MSc (Biodiversity and Conservation)

- The potential of using insectivorous bats (Microchiroptera) as a means of insect pest control in agricultural areas – Passed with distinction
- Involved a large scale in-depth survey of the bat diversity in the Tzaneen and

Waterpoort areas, Limpopo.

- Understanding and observing the biology and behavior of local bat species.
- Designing and experimenting with artificial bat roosts.

Hons Biodiversity and Conservation

- Research project: Preliminary study of the terrestrial Arthropoda associated with caves of the Cradle of Humankind World Heritage Site – Passed with distinction
- Introduction to Environmental Management
- Herpetology
- Terrestrial and conservation ecology
- Resource management (incl. forestry, fire ecology, animal behavior)
- Practical fieldwork methodology (4X4, boat training and mapping)
- Mammalogy
- Population genetics and biosystematics
- Philosophy and research methodology: Zoology Nature conservation
- Parasitology
- Molecular evolution

BSc Zoology and Botany

- One-year course in animal diversity and identification
- Six-month course in basic and marine ecology
- Limnology and terrestrial ecology
- Coastal diversity excursion (Marine ecology)
- Introduction to SASS Freshwater pollution monitoring methodology
- Applied freshwater ecotoxicology
- Waterborne diseases
- Integrated animal physiology and processes
- General parasitology
- Cytology

	➢ Six-month course in the identification and diversity of South African flora ➢ Ethno and economical plants ➢ Biotechnology ➢ Plant physiology ➢ Plant pathology ➢ Cellular and molecular biology ➢ Introduction to organic and physical chemistry ➢ General chemistry ➢ Mineralogy and earth dynamics Additional: ➢ Experienced report writing skills, sufficient computer skills. ➢ Bioacoustics analysis. ➢ Sufficient in GIS. ➢ Fall Arrest Technician and Rescue qualification (for working at heights). ➢ First Aid Level 1 and Basic Firefighting. ➢ Autodesk Inventor Fundamentals course, and 3D modeling skills. ➢ Intermediate 3D printing skills. ➢ Snake Identification and Handling Course. ➢ Multiple training courses in bat related topics - Gauteng and Northern Regions Bat Interest Group (GNoRBIG). ➢ Advanced driving course in 4x4 off-road driving. ➢ Self-taught artist in the fine arts. ➢ Inventing, prototyping and product development skills.
Languages	Afrikaans / English – Full professional proficiency in both.

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Werner Marais

Zoologist and Ecologist

MSc Biodiversity & Conservation

Pr.Sci.Nat. – SACNASP registration no. 400169/10

(Zoological Science)

Rebecca Welch

Zoologist and Ecologist

PhD Ecology

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