Bat Assessment for the Proposed Skywalk Tourist Development at God's Window, Mpumalanga

Compiled By:

Inkululeko WILDLIFE SERVICES

2 Balmoral Ave
Hurlingham
Johannesburg
South Africa
2196
Tel: +27 (0) 11 783 8597
Mobile: +27 (0) 79 175 1758
Fax: +27 (0) 86 549 2322

Compiled For:

S·E·F
STRATEGIC ENVIRONMENTAL FOCUS

Leading Sustainability through Innovation

Pretoria Head Office
Tel: +27 12 349 1307
Fax: +27 12 349 1229

Kwazulu-Natal
Tel: +27 31 266 1277
Fax: +27 31 266 6880

Cape Region
Tel: +27 21 979 3822
Fax: +27 21 979 3830

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Declaration of Independence

Inkululeko Wildlife Services (Pty) Ltd (IWS) is an independent consultancy. IWS has no legal or financial connection with the developer or the environmental assessment practitioner (EAP), except for fulfilling the tasks required for this assessment. Remuneration to IWS by the developer or the EAP for conducting this assessment is not linked to the authorisation of the project by the competent authority. In addition, IWS has no interest or connection to any secondary or future development associated with the approval of this project. Kate MacEwan was the lead bat specialist on this project. She is registered with the South African Council for Natural Scientific Professions (SACNASP).

Signed:

Kate MacEwan

for Inkululeko Wildlife Services (Pty) Ltd

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1. Project Introduction

The Mpumalanga Tourism and Parks Agency (MTPA), in association with the Industrial Development Corporation (IDC) intend on developing, as a tourist attraction, a Skywalk at God's Window, at the edge of the Blyde River Canyon Nature Reserve, on the Drakensberg Escarpment, in Mpumalanga (**Figure 1-1**). Strategic Environmental Focus (SEF) are conducting and managing the environmental authorisation process for the project and through their initial biodiversity assessments, identified that bats may be at potential risk due the development project. Hence, SEF commissioned Inkululeko Wildlife Services (IWS) to conduct a bat assessment for the project. As far as IWS understands, the tourist development will consist of:

- A U-shaped walkway, extended out over the cliff edge, to the south east of the existing carpark. The walkway will be reinforced and self-standing, so there will not be additional support poles or cables extending below or above the walkway. Hence, the main disturbance areas will be at the points where the walkway U-shape starts and ends;
- An upgrade to the existing parking facility;
- An upgrade to the existing ablutions facilities; and
- Potentially some additional tourism offices and buildings.

The objective of this assessment was to determine whether bats would be impacted on and the significance of any impacts during the construction and operation of the proposed skywalk and associated infrastructure.

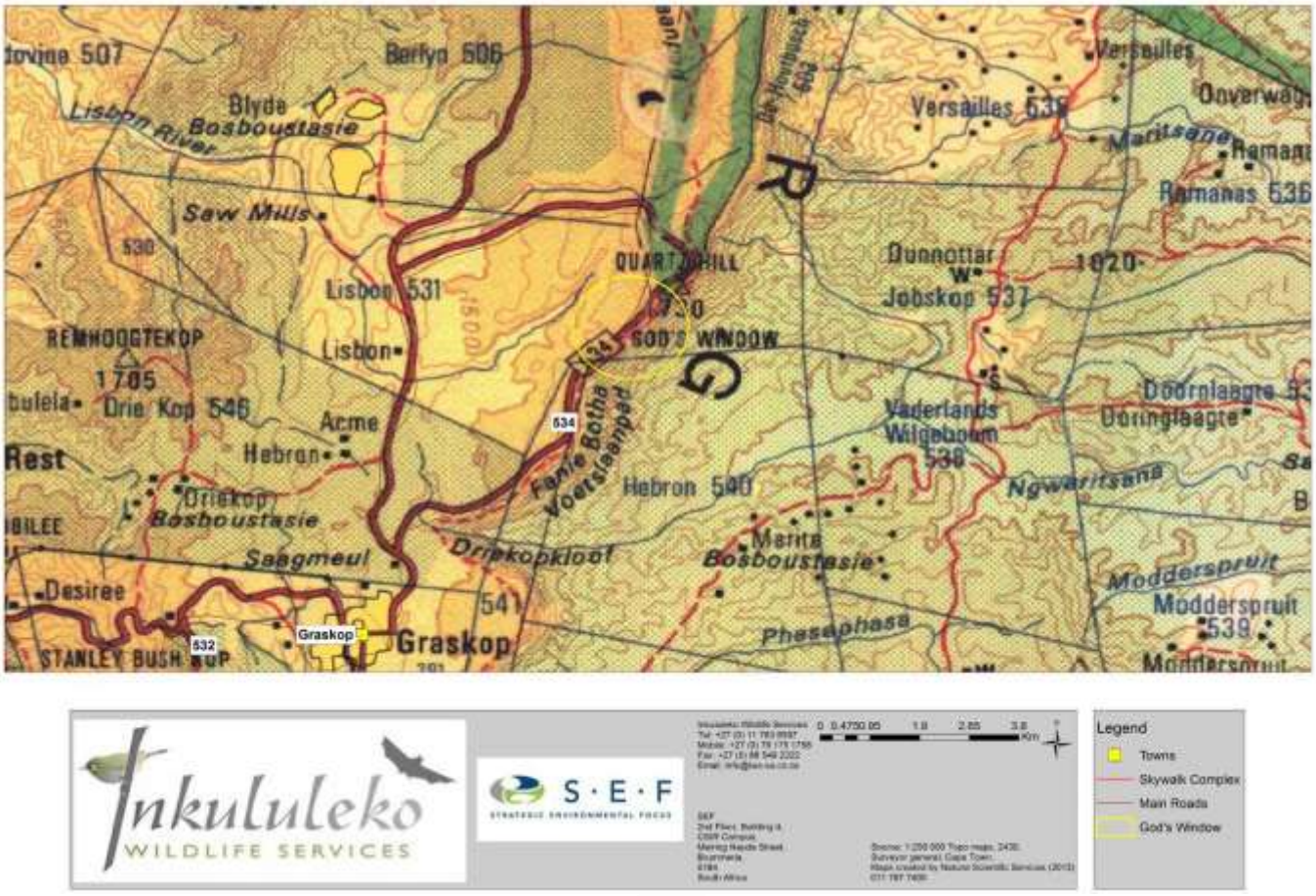

Figure 1-1 **Locality Map – God's Window Skywalk**

2. Bat Assessment Team

Inkululeko Wildlife Services (Pty) Ltd. (IWS), the former bat division of Natural Scientific Services CC (NSS) was the bat specialist consultancy for the God's Window Skywalk Bat Assessment. The IWS team through both their time with NSS and IWS have conducted over 20 long-term pre-construction bat monitoring studies and 3 current long-term operational bat monitoring studies for wind energy development in South Africa. The team members have also been involved in numerous other bat specialist and inventory assessment for mines and protected areas. The team directly involved in the assessment are described below and photographs are provided in **Figure 2-1**.

2.1 Kate MacEwan

Kate MacEwan was a founding member of NSS over 11 years ago and is now the founding Director of IWS. She is a SACNASP registered zoologist and environmental scientist and holds a BSc (Honours) in Zoology from Wits University. She has over 15 years of zoological and practical bat conservation experience. Kate is currently the chairperson for the South African Bat Assessment Advisory Panel (SABAAP), a contributing editor to the 3rd edition South African Good Practise Guidelines for Surveying Bats in Wind Farm Developments (Sowler and Stoffberg, 2014) and a co-author on the 1st edition South African Good Practice Guidelines for Operational Monitoring for Bats at Wind Energy Facilities (Aronson, J., Richardson, E., MacEwan, K., Jacobs, D., Marais, W., Aiken, S., Taylor, P., Sowler, S. and Hein, C., 2014). In addition, she is has Rope Access Level 1 certified and Fall Arrest and Rescue accredited.

2.2 Trevor Morgan

Trevor Morgan worked at NSS for over 3 years as the senior technical specialist on the bat monitoring projects and moved across to IWS in October 2014. He has served as an active member on the Executive Committee of the GNorBIG for several years. He is very knowledgeable on South African bats and has extensive experience with bat detectors, their related software, mist-netting and harp-trapping. By trade, Trevor is an electrician and an inventor, and has constructed his own harp trap and heterodyne bat detector. Trevor's considerable field-based involvement in all long-term bat monitoring studies performed by NSS and IWS has been invaluable. In addition, he is Fall Arrest and Rescue accredited.

2.3 Gustav Janse van Rensberg

Throughout most of his working career, Gustav Van Rensberg has been involved with Rope Access. He is a Level 2 Rope Access Technician and a Rock Climbing Instructor and Guide. For the last 15 years he has been the owner and director of Roc 'n Rope Adventures CC that offers the following:

- Specialist rock climbing and abseiling training and guiding
- Consultation to adventure hospitality industry and adventure race organisers
- Providing rigging and access solutions to film stunt and rigging services as well as general construction contractors.

2.4 Lloyd Mhlongo

Lloyd Mhlongo worked for NSS full time from July 2012 to July 2014, after which time he continues to be a sub-contractor to both NSS and IWS. He obtained a B.Sc. in Environmental Management, a B.Sc. Life Sciences (Zoology and Botany) and a B.Sc. (Honours) in Botany through UNISA. Furthermore, Lloyd has obtained a diploma in Project Management from Varsity College. He is an Honorary Officer with the Ezemvelo KZN Wildlife Honorary Officer Corps. Through his time with NSS and IWS and his voluntary work, he has achieved the following courses Fall Arrest and Basic Rescue certification for climbing heights over 3m, basic bat identification course, bat trapping (using mist nets and harp traps) and other faunal and floral field sampling techniques.

Kate MacEwan

Trevor Morgan

Gustav Janse van Rensberg

Lloyd Mhlongo

Figure 2-1 Photographs of the IWS God's Window Bat Assessment Team

3. Background Environmental Information

In order to interpret the results from the assessment and to get a better understanding of the potential impacts of the proposed development, it is important to have an understanding of the regional and local habitats on site from a bat perspective. This section provides a brief description of the regional environmental parameters relevant to bats.

3.1 Regional Vegetation

The God's Window tourist visitor area lies in a unique strip consisting of Northern Escarpment Afromontane Fynbos on the high lying flat escarpment areas and Northern Mistbelt Forest on the slopes and in the river valleys according to Mucina & Rutherford (2006) (Figure 3-1).

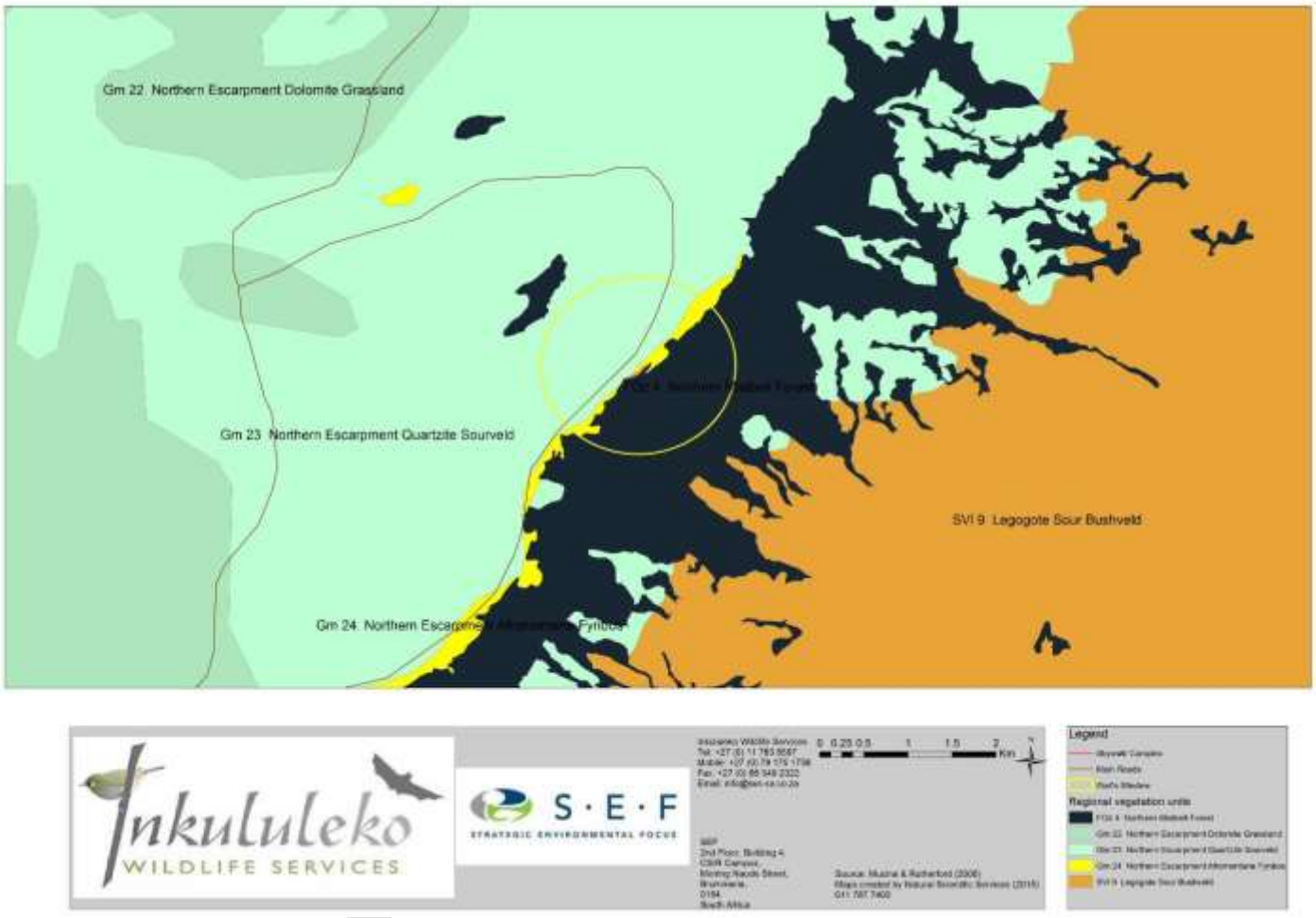

Figure 3-1 Regional Vegetation Map for God's Window

3.2 Geology

As one of the main roost features of concern, the presence of caves whereby large bat colonies could roost were under investigation, therefore, geology of the area is of importance. The majority of South Africa large caves hosting significant bat colonies are formed in Dolomite. As can be seen in **Figure 3-2**, whilst there is Dolomite to the north, north-west and west of the site, the main geological type for God's Window is Shale.

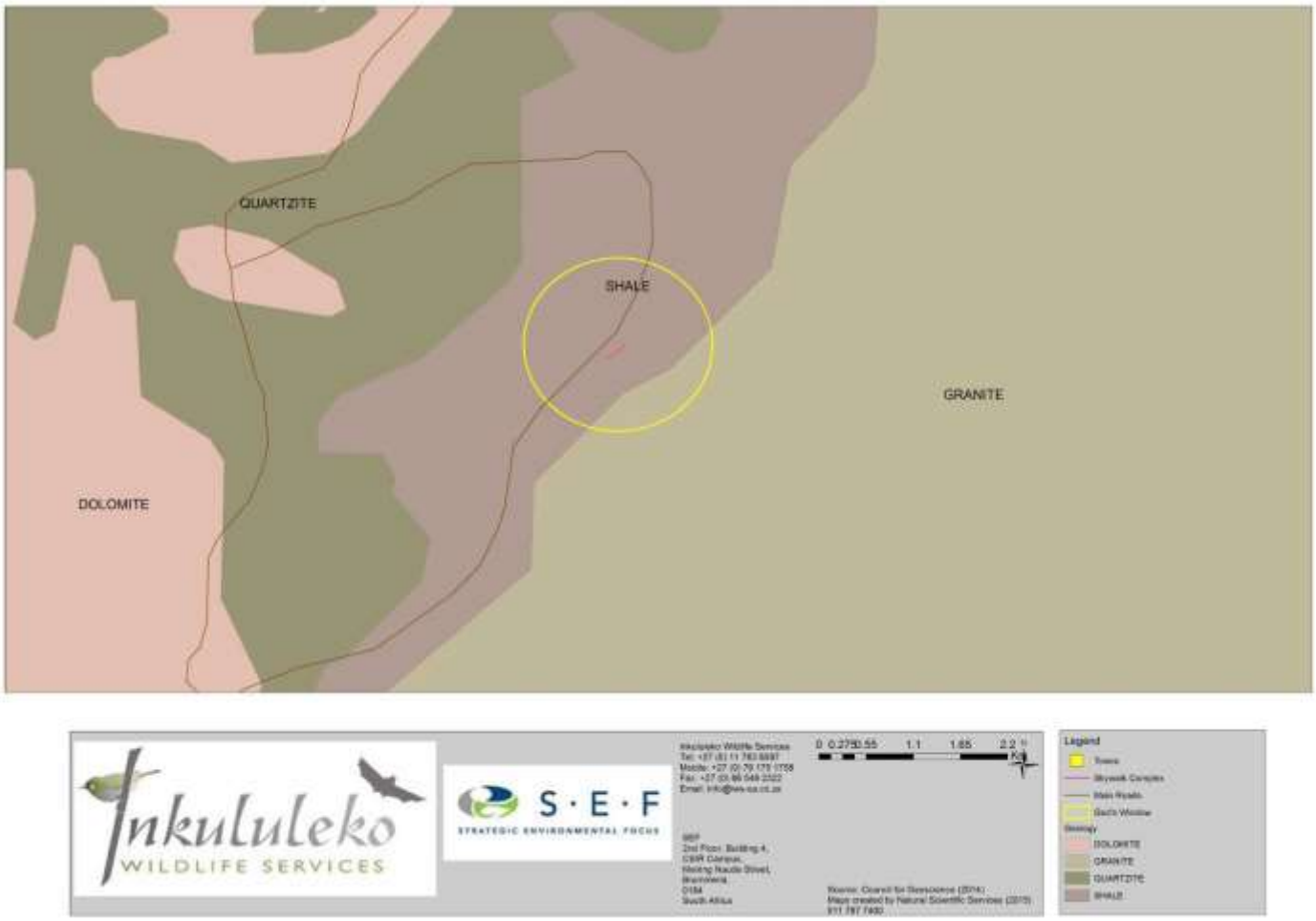

Figure 3-2 Regional Geology Map for God's Window

3.3 Hydrology

The site occurs on a watershed, with the Lisbon River system to the north-west and the Marite River system to the south-east (**Figure 3-3**). There are no significant bodies of open water on site, however, the drainage areas running from site do provide refuge and foraging potential. The irrigated farm lands to the north-west of the site also provide valuable foraging areas for the bats living in the rocks and trees nearer to site.

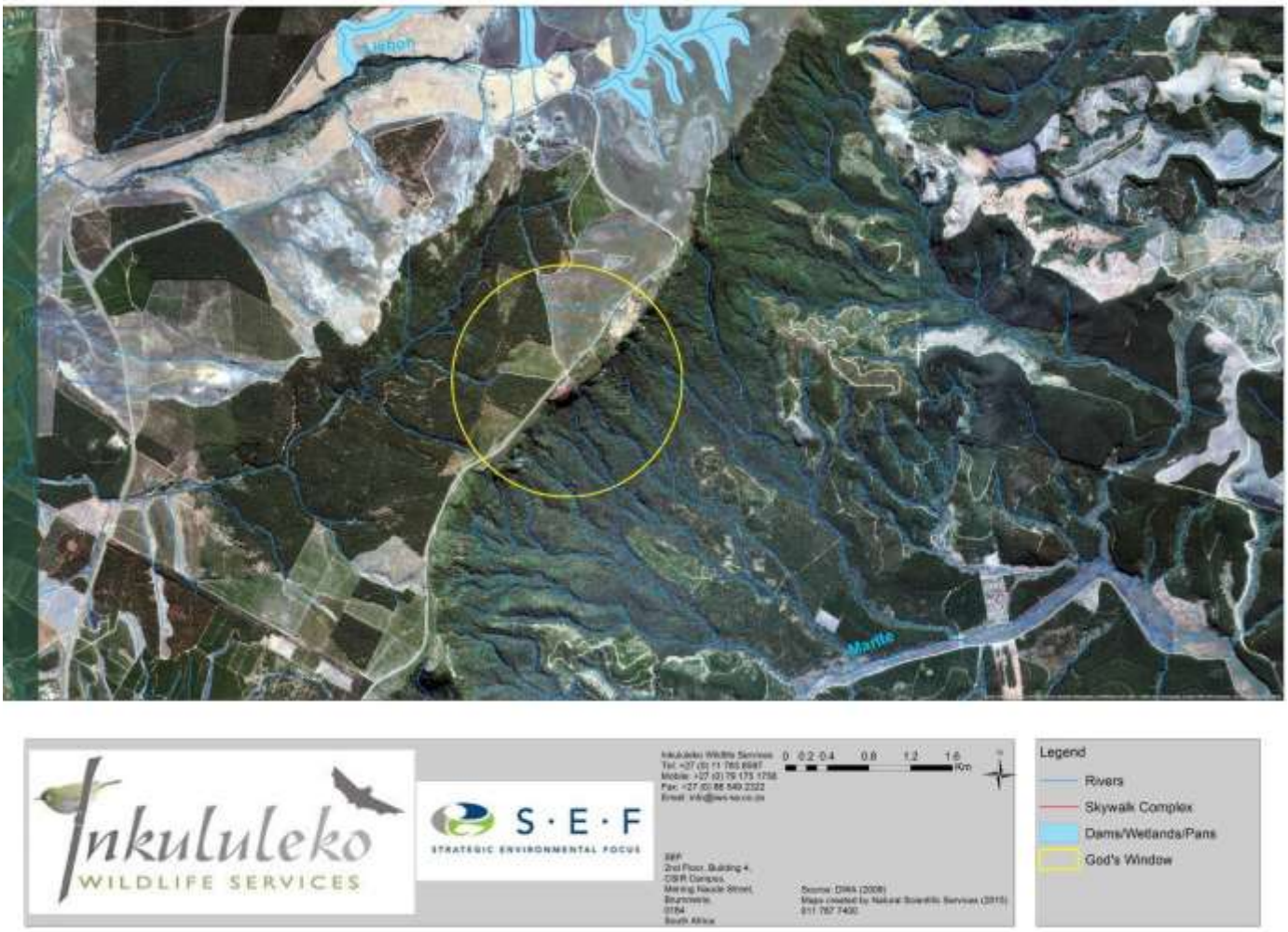

Figure 3-3 Main Surface Water Features for God's Window

4. Methodology

4.1 Desktop Review

A desktop review of literature and the Likelihood of Occurrence (LoO) of specific species has commenced. The LoO was done according to the species distribution maps provided in Monadjem et al. (2010). The LoO was categorised as follows:

- If a species has been historically recorded on or near the site, it was assigned a High LoO;
- If a species' range could include the site due to favourable environmental variables, the species was assigned a Moderate LoO;

- If the site is adjacent to an area where a species range extends, that species was assigned a Low LoO, and
- Species known to definitely not occur within the study area were not listed.

4.2 Fieldwork

A three-day/ two-night field visit was conducted from the 8th to the 10th December 2014. During the field visit, various bat assessment tasks were performed. These are described below and the positions of where the various assessment techniques were performed are shown in **Figure 4-1**.

Figure 4-1 Bat Monitoring and Roost Search Positions

4.2.1 Active Bat Roost Surveys

At seven points long the escarpment cliff edge, Kate Macewan and Gustav Van Rensberg descended approximately 40m using rope access techniques to survey rock crevices, overhangs and vegetation for the presence or evidence of presence of bats (**Figure 4-2**). In addition, trees, bushes and buildings were surveyed during the day.

Figure 4-2 Photographs of Active Roost Surveys

4.2.2 Active live bat capture

Under the permission of Kate MacEwan's permit with the MTPA to catch/ collect and convey animals (including bats) for scientific purposes, live bat capture techniques using mist-nets and harp traps were conducted on the nights of 8 and 9 Dec 2014 at the positons shown in **Figure 4-1**. Photographs of the live capture techniques, taken on site, are displayed in **Figure 4-3**.

4.2.1 Active transects

Using a hand held bat Wildlife Acoustics Echo Meter 3 (EM3) bat detector; walked transects and point sampling was conducted in the carpark area at God's Window on the 8th and 9th December 2014.

Figure 4-3 **Live Bat Capture Techniques at God's Window**

4.2.2 Passive recording of bat calls

At three positions along the escarpment, Wildlife Acoustics Song Meter 2 bat detectors (SM2BATs) were set up permanently for the three day and two night field visit. The three positons are shown in **Figure 4-1** and photographs of the set up shown in **Figure 4-4**.

Figure 4-4 Photographs of the SM2 Set-up at God's Window

4.3 Data Analysis and Report Compilation

Call data recorded by the SM2BATs and EM3 as .WAC files were downloaded by IWS onto a hard drive for analysis and storage. The .WAC files were converted, using Wildlife Acoustics' Kaleidoscope programme to both .WAV and Zero Crossing (.ZC) files for analysis in the following two ultrasound analysis software programmes:

- BatSound Pro by Pettersson. This software allows for the detailed analysis of .WAV sound files. It provides call peak frequency, call duration, bandwidth, etc. In order to convert and scrub the .WAC files produced by the SM2 to .WAV files suitable for BatSound Pro, the Wildlife Acoustics Kaleidoscope conversion software was used.
- AnalookW Version 3.9s by Titley Electronics is used for analysing large quantities of .ZC files.

The call data, roost search data and live capture data was used to compile species presence lists and to gain an understanding of the utilization of the site by bats. From this information, an assessment of the potential impacts on bats due to the proposed skywalk development was possible.

5. Results

5.1 Likelihood of Species Occurrence

Purely based on historical records and modelled distributions (Monadjem et al., 2010), 35 bats, presented in **Table 5-1** have the potential to occur at God's Window, but vary in their LoO. – 4 highly likely, 4 moderately likely and 3 with a low likelihood but possible.

Table 5-1 Likelihood of Species Occurrence

				CONSERVATION STATUS	
FAMILY	SPECIES	COMMON NAME	LoO	National	Global
PTEROPODIDAE	*Epomophorus crypturus*	Peter's epauletted fruit bat	Moderate	LC	LC
PTEROPODIDAE	*Epomophorus wahlbergi*	Wahlberg's epauletted fruit bat	High	DD	LC
PTEROPODIDAE	*Rosettus aegyptiacus*	Egyptian Rousette	Moderate	LC	LC
HIPPOSIDERIDAE	*Cloeotis percivali*	Percival's short-eared trident bat	Moderate	CR	LC
RHINOLOPHIDAE	*Rhinolophus darlingi*	Darling's horseshoe bat	High	NT	LC
RHINOLOPHIDAE	*Rhinolophus clivosus*	Geoffroy's horseshoe bat	High	NT	LC
RHINOLOPHIDAE	*Rhinolophus fumigatus*	Rüppell's horseshoe bat	Low	NT	LC
RHINOLOPHIDAE	*Rhinolophus cohenae*	Cohen's horseshoe bat	Moderate	NE	NE
RHINOLOPHIDAE	*Rhinolophus simulator*	Bushveld horseshoe bat	High	LC	LC
RHINOLOPHIDAE	*Rhinolophus swinnyi*	Swinny's horseshoe bat	Moderate	EN	LC
EMBALLONURIDAE	*Taphozous mauritianus*	Mauritian tomb bat	Moderate	LC	LC
NYCTERIDAE	*Nycteris thebaica*	Egyptian slit-faced bat	High	LC	LC
MOLOSSIDAE	*Chaerephon ansorgei*	Ansorge's free-tailed bat	Low	LC	LC
MOLOSSIDAE	*Chaerephon pumilus*	Little free-tailed bat	High	LC	LC
MOLOSSIDAE	*Mops condylurus*	Angolan free-tailed bat	Moderate	LC	LC
MOLOSSIDAE	*Mops midas*	Angolan free-tailed bat	Moderate	LC	LC
MOLOSSIDAE	*Tadarida aegyptiaca*	Egyptian free-tailed bat	High	LC	LC
MINIOPTERIDAE	*Miniopterus fraterculus*	Lesser long-fingered bat	Moderate	NT	LC
MINIOPTERIDAE	*Miniopterus inflatus*	Greater long-fingered bat	Low	NE	LC
MINIOPTERIDAE	*Miniopterus natalensis*	Natal long-fingered bat	High	NT	LC
VESPERTILIONIDAE	*Eptesicus hottentotus*	Long-tailed serotine	Moderate	LC	LC
VESPERTILIONIDAE	*Hypsugo anchietae*	Anchieta's pipistrelle	Low	NT	LC
VESPERTILIONIDAE	*Kerivoula lanosa*	Lesser woolly bat	Moderate	NT	LC
VESPERTILIONIDAE	*Laephotis botswanae*	Botswanan Long-eared bat	Low	V	LC
VESPERTILIONIDAE	*Myotis bocagii*	Rufous myotis	Low	DD	LC
VESPERTILIONIDAE	*Myotis tricolor*	Temminck's myotis	High	NT	LC
VESPERTILIONIDAE	*Myotis welwitschii*	Welwitsch's myotis	Low	NT	LC
VESPERTILIONIDAE	*Neoromicia capensis*	Cape serotine bat	High	LC	LC
VESPERTILIONIDAE	*Neoromicia nana*	Banana bat	Moderate	LC	LC
VESPERTILIONIDAE	*Neoromicia zuluensis*	Zulu serotine	Moderate	LC	LC
VESPERTILIONIDAE	*Nycticeinops schlieffeni*	Schleiffen's twilight bat	Low	LC	LC

VESPERTILIONIDAE	*Pipistrellus hesperidus*	Dusky pipistrelle	Moderate	LC	LC
VESPERTILIONIDAE	*Pipistrellus rusticus*	Rusty pipistrelle	Moderate	NT	LC
VESPERTILIONIDAE	*Scotophilus dinganii*	Yellow-bellied house bat	High	LC	LC
VESPERTILIONIDAE	*Scotophilus viridis*	Green house bat	Moderate	LC	NE

5.2 Bat Habitats

There are three main factors driving the presence of bats at a site – roosting habitat availability, food availability and water availability. Different bat species have different roosting and foraging requirements.

At God's Window, the roosting potential that was discovered consisted of:

- Rock crevices and small overhang type shallow caves in the cliff face and gorges.
- Small trees and bushes
- The ablution building roofs

Within a 100km radius, several well-known large bats roosts are known, e.g. Sudwala and Echoe caves. However, no large cave-type (cavern) roosts were discovered on site, only crevice or overhang –type potential posts in the cliff face. Despite the abundance of rock face and narrow crevices investigated that were suitable for bats to roost, no bats were found. This is not to say that we reached all the crevices and is not to say they are roosting there due to the shy and inconspicuous nature of bats. Many of the species confirmed favour such roosting conditions, so they are utilizing the greater cliff face somewhere. *P. rusticus* was found to be either roosting in the buildings or more likely, the trees around the ablution area at God's window.

The foraging potential consisted of mainly cluttered, highly vegetated areas along the cliff edge and below. Clutter-edge and open-air foragers would need to fly above this clutter or in the parking area and above mowed lawns to feed. To the north-west across the road for the main God's Window tourist area, vast, irrigated farm lands exist, providing great foraging potential for clutter-edge and open-air foragers.

The only open water found on site were small pools of stagnant water associated with a burst sewer pipe. Further down in the valleys and gorges, and much further north, more open water exists, but this is not directly relevant to the proposed development and the permanent presence of bats on site.

Some typical roosting habitat views are displayed in **Figure 5-1**.

Figure 5-1 Potential Bat Roosting Habitats

5.3 Weather Conditions

God's Window is situated in a high rainfall region of the country that often experiences mist in summer. During the field assessment from 8 to 10 December 2014, the nightly temperatures recorded on the SM2BATs ranged from a low of 14.1°C to a high of 20.8°C. There was significant mist and light during the day and early hours of the morning, however, the nights were generally clear skies.

5.4 Confirmed Bat Species

Of the 35 potentially occurring bats, eight have been confirmed at God's Window through call analyses and live capture and release and three more or alternative species have the potential to occur based on calls recorded similar to their known call structure. The confirmed and potential species, their foraging and roosting ecology and conservation status is presented in **Table 5-2**. Screen clips of actual bat calls from God's Window are displayed in **Appendix 10.1** and the raw call data is displayed in **Appendix 10.2**. None of the species confirmed or suspected are threatened by extinction, however, five are near-threatened (NT).

All bat species confirmed are insectivorous foragers.

Please Note: Whilst bat call structure is a useful tool in identifying bat species occurrence, the call structure of certain species can overlap, as well as there being geographic variances in calls of the same species. Therefore, whilst IWS is relatively certain of the confirmed list provided, the additional/ alternative species possibilities have also been provided due to the reasons provided.

Table 5-2 Confirmed Species for God's Window

FAMILY	SPECIES	COMMON NAME	CONSERVATION STATUS (National)	CONSERVATION STATUS (Global)	HABITAT AND FORAGING BEHAVIOUR (Monadjem, *et al.* 2010)	CONFRIMATION METHOD
RHINOLOPHIDAE	*Rhinolophus clivosis*	Geoffroy's horseshoe bat	NT	LC	Roosts in caves and mine adits and can reach numbers of thousands. It is a clutter forager, eating mainly Lepidoptera and Coleoptera	**Confirmed – calls only**
MOLOSSIDAE	*Chaerephon ansorgei*	Ansorge's free-tailed bat	LC	LC	Occurs mainly in dry woodland savannah in rugged hills and mountains with rocky cliffs. Roosts in small to medium-sized groups in narrow cracks in cliff faces, buildings and bridges. It is a fast-flying, open-air forager.	**Confirmed through call analysis and correct habitat and distribution , however, call similar to low frequency calls of *T. aegyptiaca***
MOLOSSIDAE	*Tadarida aegyptiaca*	Egyptian free-tailed bat	LC	LC	Crevice dwelling species, commonly associated with granite hills and the numerous cracks provided in such terrain. Aerial open-air foragers	**Confirmed – calls only**
MINIOPTERIDAE	*Miniopterus fraterculus*	Lesser long-fingered bat	NT	LC	It is a cave-dependant species that predominantly occurs in montane grasslands of the eastern parts of the country. It is a clutter-edge forager.	**Confirmed – calls only**
MINIOPTERIDAE	*Miniopterus natalensis*	Natal long-fingered bat	NT	LC	Its core distribution is in the savannas and grasslands of southern Africa. It is cave dependent and hence the availability of suitable roosting sites may be more critical in determining its presence in an area than the surrounding vegetation. Aerial clutter-edge forager, known to migrate long distances between roost caves. It feeds on a variety of prey – Diptera, Hemiptera, Coleoptera, Lepidptera and Isoptera.	**Potential through call analysis**
VESPERTILIONIDAE	*Eptesicus hottentotus*	Long-tailed serotine bat	LC	LC	Roosts in small groups of 2-4 in caves and rock crevices. Aerial clutter-edge forager.	**Confirmed through call analysis, however call structure similar to *S. dinganii***

VESPERTILIONIDAE	*Myotis tricolor*	Temminck's myotis	NT	LC	Roosts gregariously in caves. Associated only with mountainous habitat, not flat areas. It is a clutter edge forager.	**Confirmed – calls only**
VESPERTILIONIDAE	*Nycticeinops schlieffini*	Schlieffin's twilight bat	LC	LC	Associated with low-lying savannah and riparian vegetation. Roosts in trees and houses. It is a clutter edge forager.	**Potential through call analysis**
VESPERTILIONIDAE	*Pipistrellus hesperidus*	Dusky pipistrelle	LC	LC	Although its roosting habitat is largely unknown, it is typically associated with well-wooded habitats associated with rivers and forests. It is a clutter edge forager.	**Confirmed – calls only**
VESPERTILIONIDAE	*Pipistrellus rusticus*	Rusty pipistrelle	NT	LC	Associated with water bodies and rocky habitat in savannah woodland. Roosts mainly in tree crevices and buildings. It is a clutter edge forager.	**Confirmed – calls and live capture**
VESPERTILIONIDAE	*Scotophilus dinganii*	Yellow-bellied house bat	LC	LC	Occurs in a wide range of habitats, but is mostly associated with the savannah biome. It roosts in mainly trees and buildings and is a clutter-edge forager.	**Potential through call analysis – call structure similar to *E. hottentotus***

5.1 Live Captured Bats

Over 20 *P. rusticus* were captured in the 12m mist net and harp near the ablution areas on the night of 9 December 2014 (**Figure 5-2**). The majority of the bats that were measured and released were males.

Figure 5-2 Different Rusty pipistrelles captured and released on the 9th Dec 2014 at God's Window

5.2 Some Observed Trends from the Call Data

The total bat calls recorded per species at each of the three stations is shown in **Figure 5-3**. However, it must be noted that due to a battery issue on the night of the 8th Dec 2014 at Station G1, this station only had 10.5 hours of actual recording time, compared with the 20.5 hours at G2 and 21 hours at G3 respectively. Therefore, a more accurate display of the species composition along the cliff edge is shown in **Figure 5-4**, whereby the species composition is displayed at percentages. *P. rusticus* dominates at all stations. It is suspected that this is due to the roost of over 20 individuals living in or near the ablution buildings. Free-tailed bats consisting of *T. aegyptiaca* and/ or *C. ansorgei* are also relatively abundant.

As displayed in **Figure 5-5**, the majority of bats were active from sunset for two hours, with a smaller peak of activity between 03h00 and 04h00. However, some level of activity remained throughout the night.

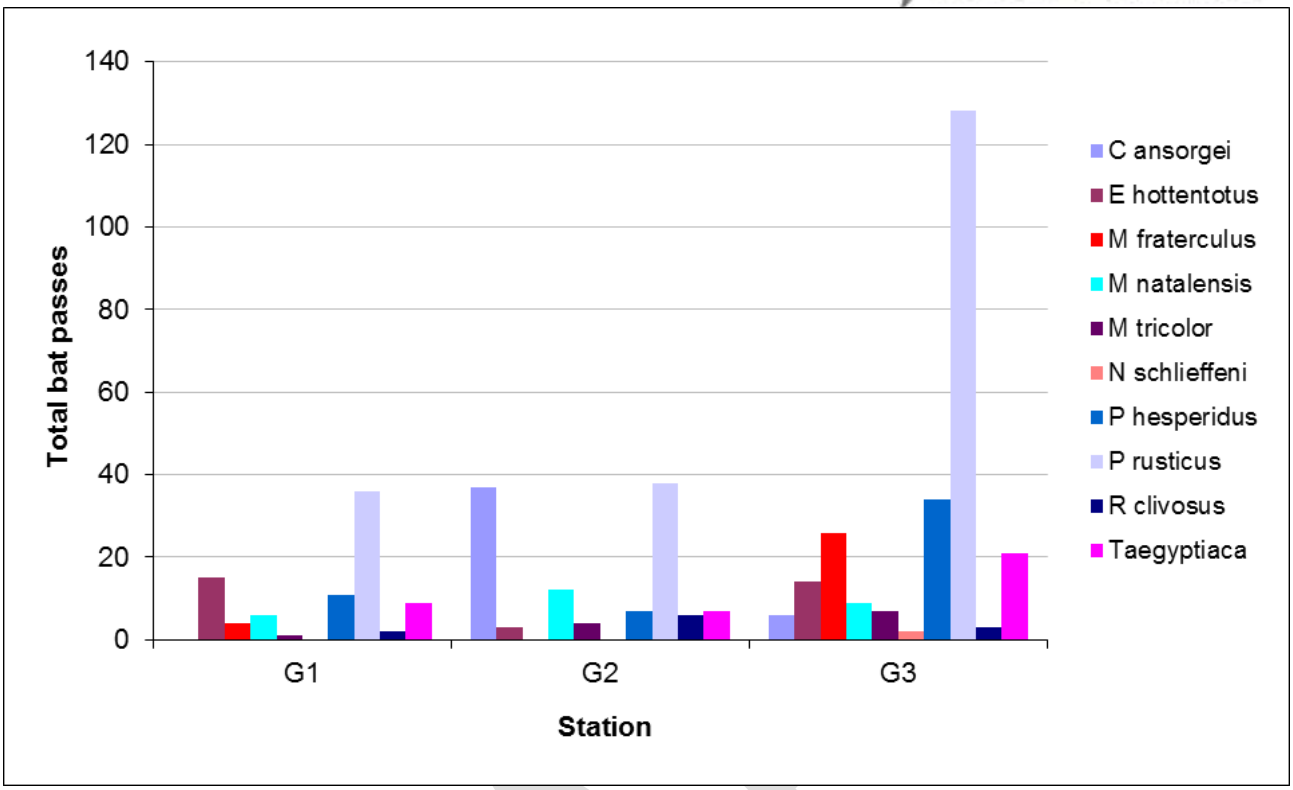

Figure 5-3 Total Bat Passes per Species per Station

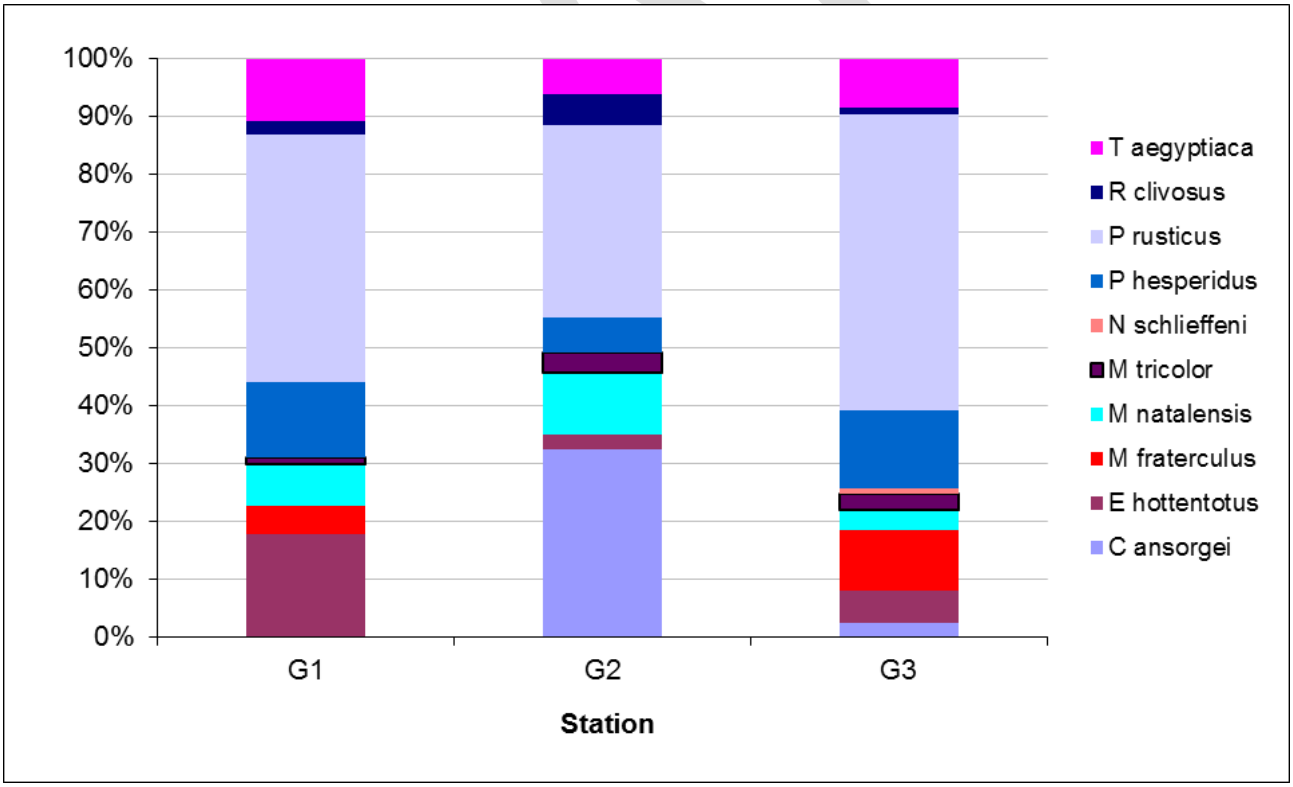

Figure 5-4 Percentage Bat Passes per Species per Station

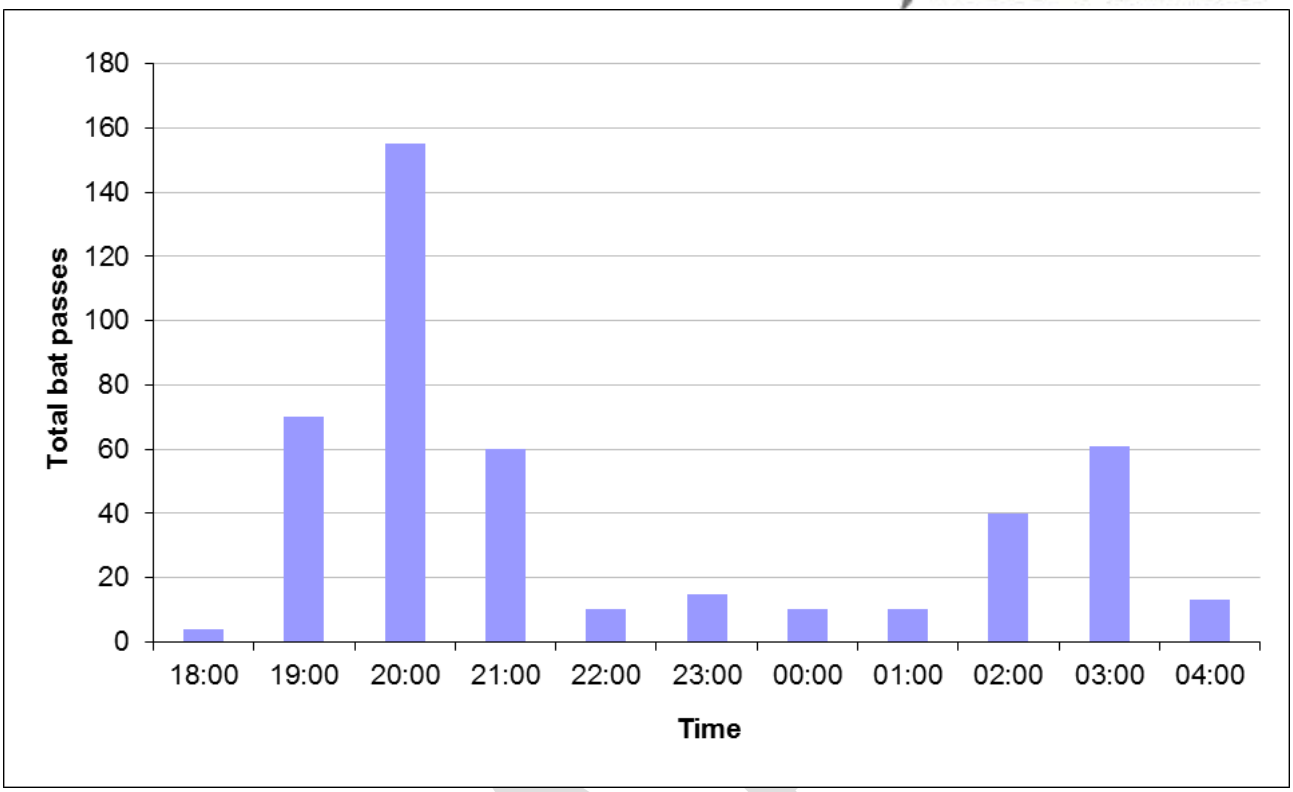

Figure 5-5 Bat Passes over Time of Night

6. Bat Sensitivity

A bat sensitivity map was compiled based on confirmed and potential bat roosts and forging habitat identified during the fieldwork and the potential presence of conservation important bat species. Whilst the God's Window/ Blyde River Canyon/ Drakensberg Escarpment areas are biodiversity rich areas, with the occurrence of several conservation important plant and animal species, including bats, no areas of High bat sensitivity were identified on the proposed development site. The bat sensitivity classes identified on site are displayed in **Figure 6-1.** The assessment focused on the escarpment area where most of the construction activity will take place and took into consideration to a depth of approximately 40m down the cliff face into the forest habitat. Areas of Medium bat sensitivity were associated with:

- Rocky, forested gorge areas where small to medium overhangs were found;
- Areas where taller trees exist on the escarpment; and
- The area associated with the ablution buildings to the south-west of the existing parking area.

The remaining site was considered to be of Low-Medium sensitivity. A small number of bats are roosting on site and some bats are utilizing this area for foraging but the nature of the developed in not considered to have a significant impact on the bats, particularly post-construction.

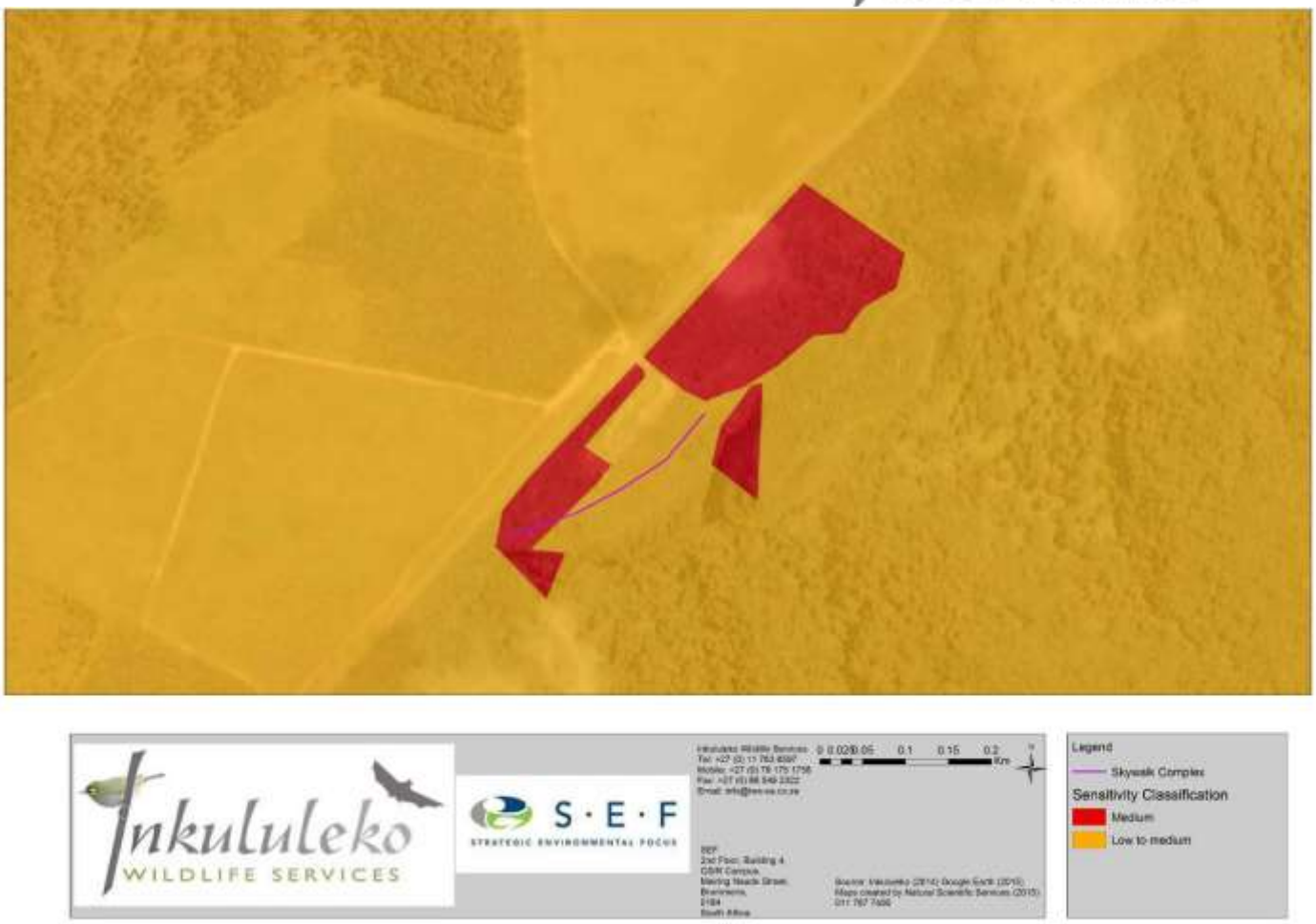

Figure 6-1 Bat Sensitivity Map for God's Window

7. Bat Impact Assessment and Mitigation

Due to no significant bat roosts being found in the vicinity of the proposed Skywalk, the overall significance of impacts on bats due to the proposed Skywalk development are assessed as Low to Moderate. The potential impacts that IWS have identified are described below according the construction and operational phases.

7.1 Construction Phase Impacts

7.1.1 Disturbance to and/ or destruction of bat roosts

- Bat roosts likely to be affected by the construction of the skywalk, would be narrow rocky crevices and trees near to the edge of the cliff face at the footprint of the foundations and along the paths traversed by the construction team. No large cave-type roosts, with hundreds to thousands of bats were found. This possible impact is assessed as site specific, short-term with a low intensity, the overall significance being low.
- Should the ablution block and surrounding trees be demolished, the *P.rusticus* population utilizing that area will need to relocate. This likely impact is assessed as site-specific and having a medium to long-term duration, with a medium intensity. The overall impact is assessed as moderate.

- Dust and noise will also create disturbance to bat roosts around the development footprint. This may cause bats to temporarily abandon these roosts until the dust and noise is reduced. This likely short-term impact is assessed as local with a medium intensity. The overall impact is assessed as moderate.

7.1.2 Disturbance to and/ or destruction of bat foraging habitat

The construction phase will most likely require that vegetation is cleared at the footprint and that buildings and the parking area are upgraded. Due to the relatively small footprint and vast surrounding areas for foraging, this short to long-term impact is assessed as site-specific, with a low-intensity. The overall significance being low.

7.2 Operational Phase Impacts

7.2.1 Displacement of bats from roosts due the presence and operation of the Skywalk

Whilst the skywalk will be a relatively big structure, it is very localised. In addition, it is IWS's opinion that only a few bats, if any will be displaced by the structure, especially if developed in an area of low-moderate bat sensitivity (**Figure 6-1**). This definite impact is assessed as permanent with a low intensity. The overall significance assessed as low.

7.2.2 Fragmentation of foraging habitat

Whilst the skywalk will be a relatively big structure, it is very localised. It is IWS's opinion that bats will adapt to foraging around the structure and that there are vast surrounding areas for foraging. This definite impact is assessed as permanent with a low intensity. The overall significance assessed as low.

7.3 Mitigation Recommendations

- All development to be contained to areas of low bat sensitivity (**Figure 6-1**).
- Keep the development footprint to as small an area as possible.
- Little to no removal of larger trees and bushes.
- Construction phase to be completed in as short a time as possible and over summer or winter, not over autumn and spring, when bats are moving and potential seeking new roosts.
- Strict monitoring and awareness regarding containment of litter.
- Tourist visiting hours should be kept during daylight hours. No nocturnal visits.
- Nocturnal lighting to be kept to a minimum, only minimal security lighting in the carpark area, if at all.
- Visitors should remain on demarcated walkways and not into undisturbed vegetated and rocky areas.

8. Conclusions

After a three day and two night field visit and a brief desktop review

- Of the 35 potentially occurring bats, eight have been confirmed at God's Window through call analyses and live capture and release and three more or alternative species have the potential to occur based on calls recorded similar to their known call structure. None of the species confirmed or suspected are threatened by extinction, however, five are near-threatened (NT).
- The only confirmed bat roost was a *P. rusticus* roost at or near the ablution area. Over 20 bats emerged at sunset. The upgrading of the ablution area is likely to cause these bats to disperse temporarily or permanently, depending on the level of tree clearance and the new structures built.
- Due to no significant bat roosts being found in the vicinity of the proposed Skywalk on at the cliff edge, the overall significance of impacts on bats due to the proposed Skywalk development are assessed as Low to Moderate.
- Mitigation measures are mainly associated with the construction phase, in terms of reduced development footprints and construction periods. However, during operation, it is recommended that tourists are only permitted on site during the day, that they stick to the demarcated paths and that nocturnal lights are kept to a minimum.

9. References

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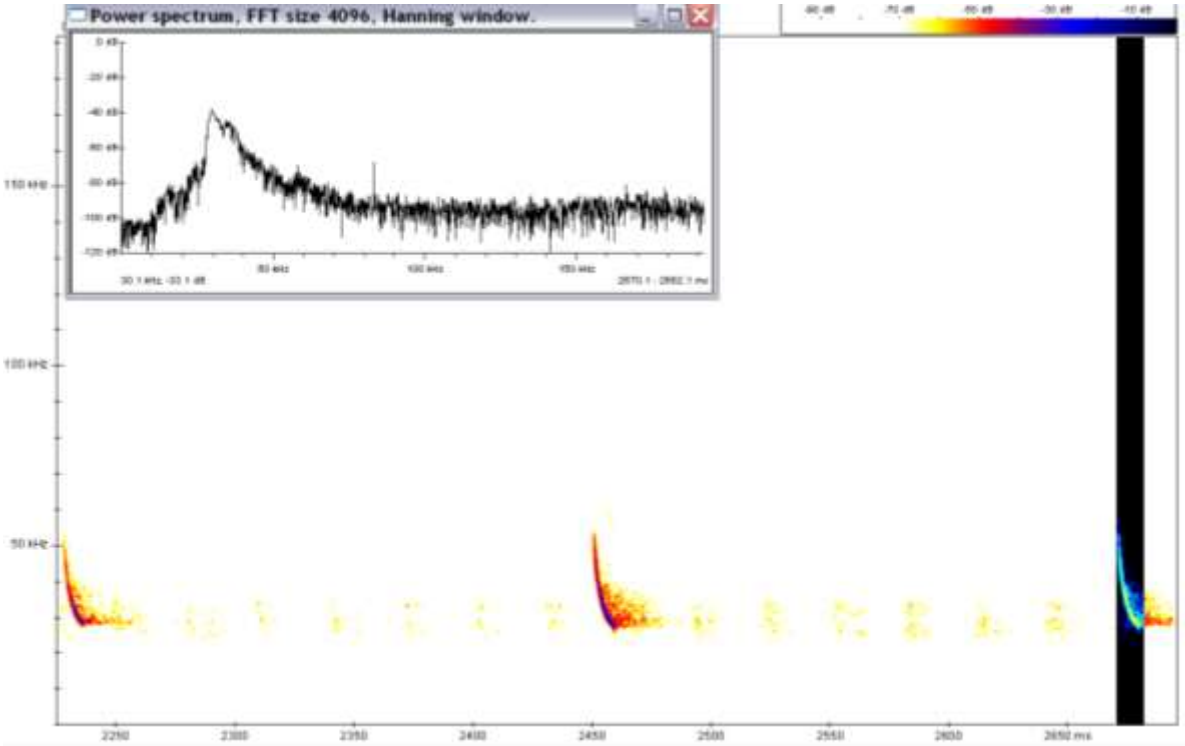
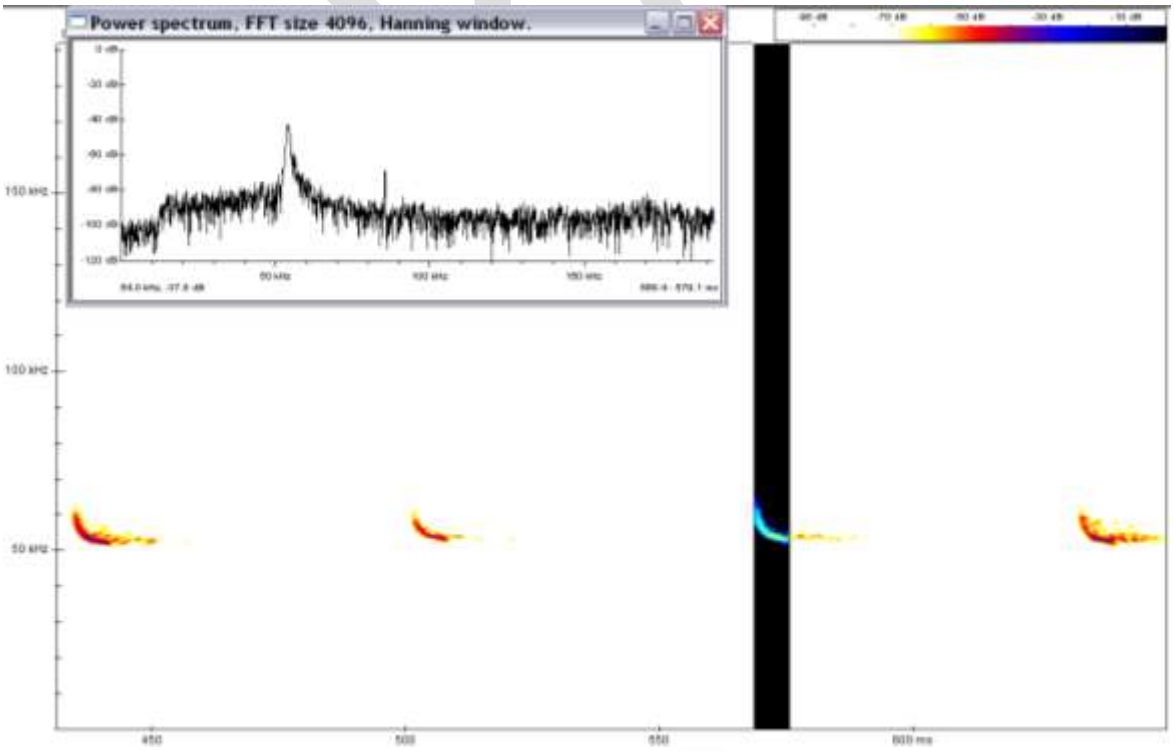
- TAYLOR PJ, STOFFBERG S, MONADJEM A, SCHOEMAN MC, BAYLISS J, ET AL. (2012) Four New Bat Species (*Rhinolophus hildebrandtii* Complex) Reflect Plio-Pleistocene Divergence of Dwarfs and Giants across an Afromontane Archipelago. PLoS ONE 7(9): e41744. doi:10.1371/journal.pone.0041744

10. Appendices

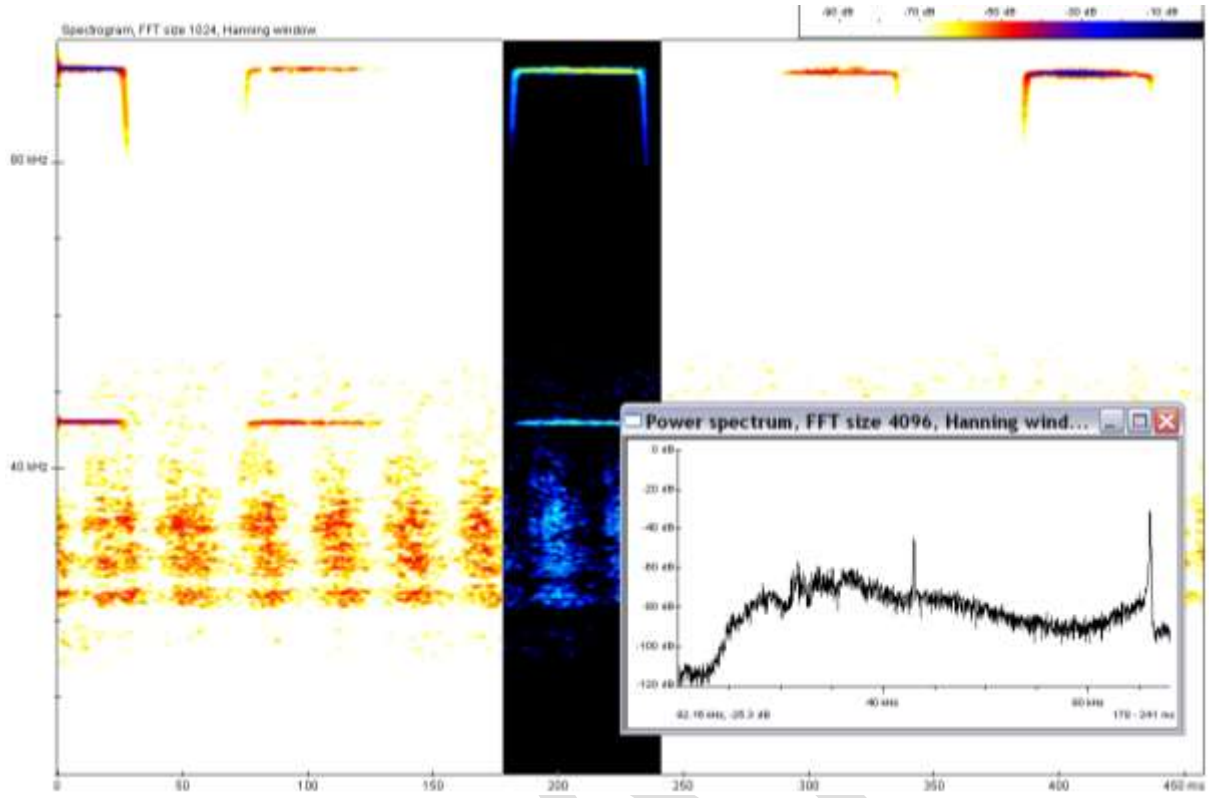
10.1 God's Window Bat Calls



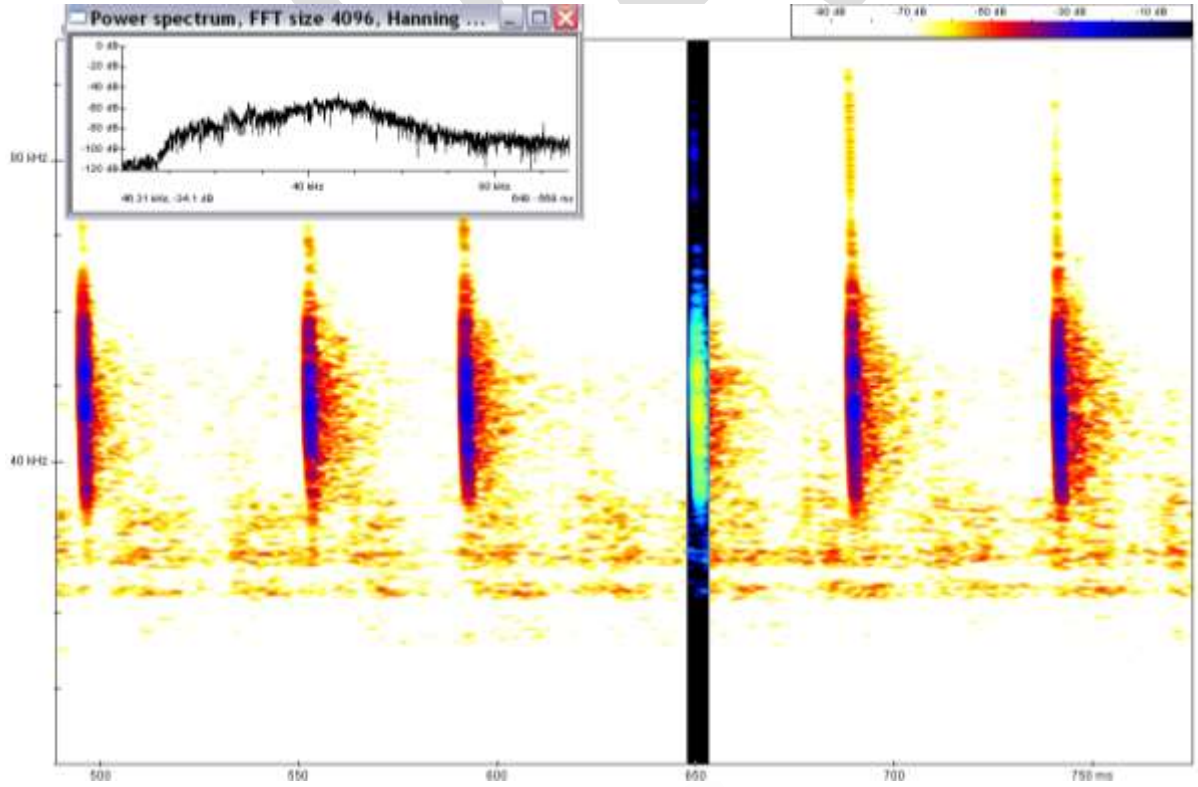
S dinganii



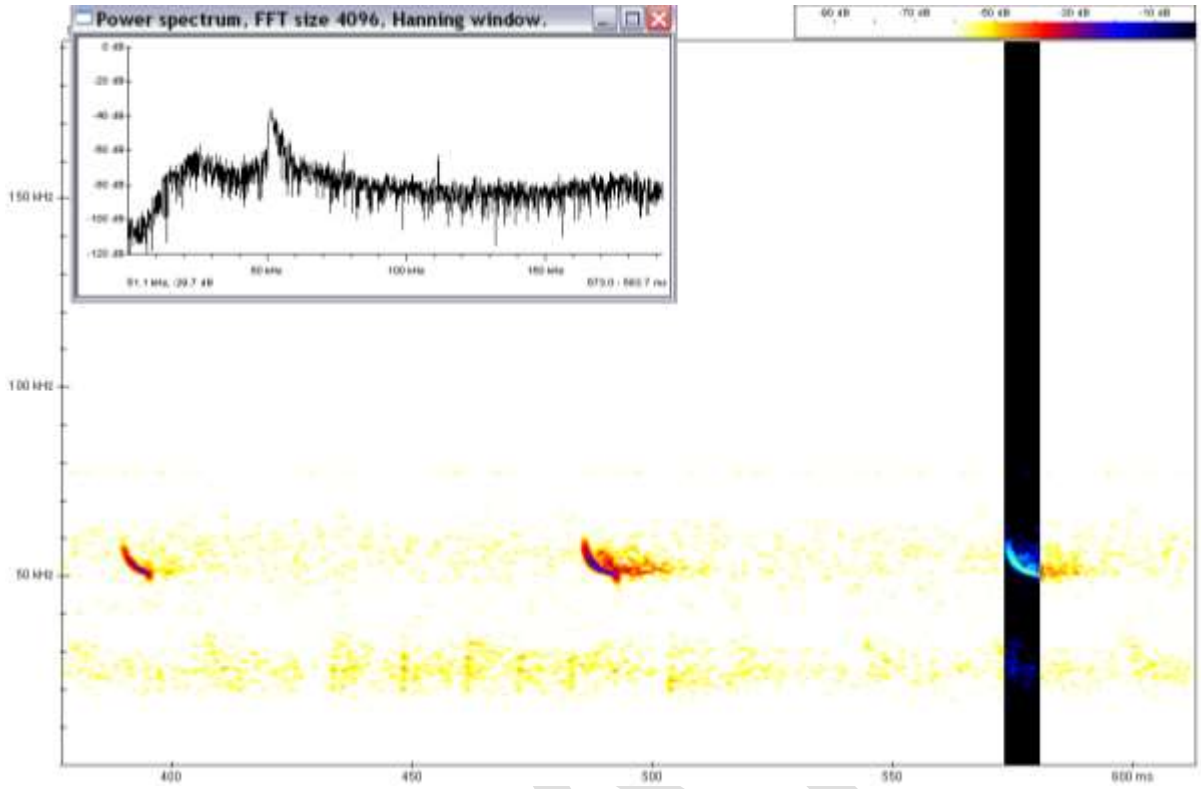
M natalensis ?



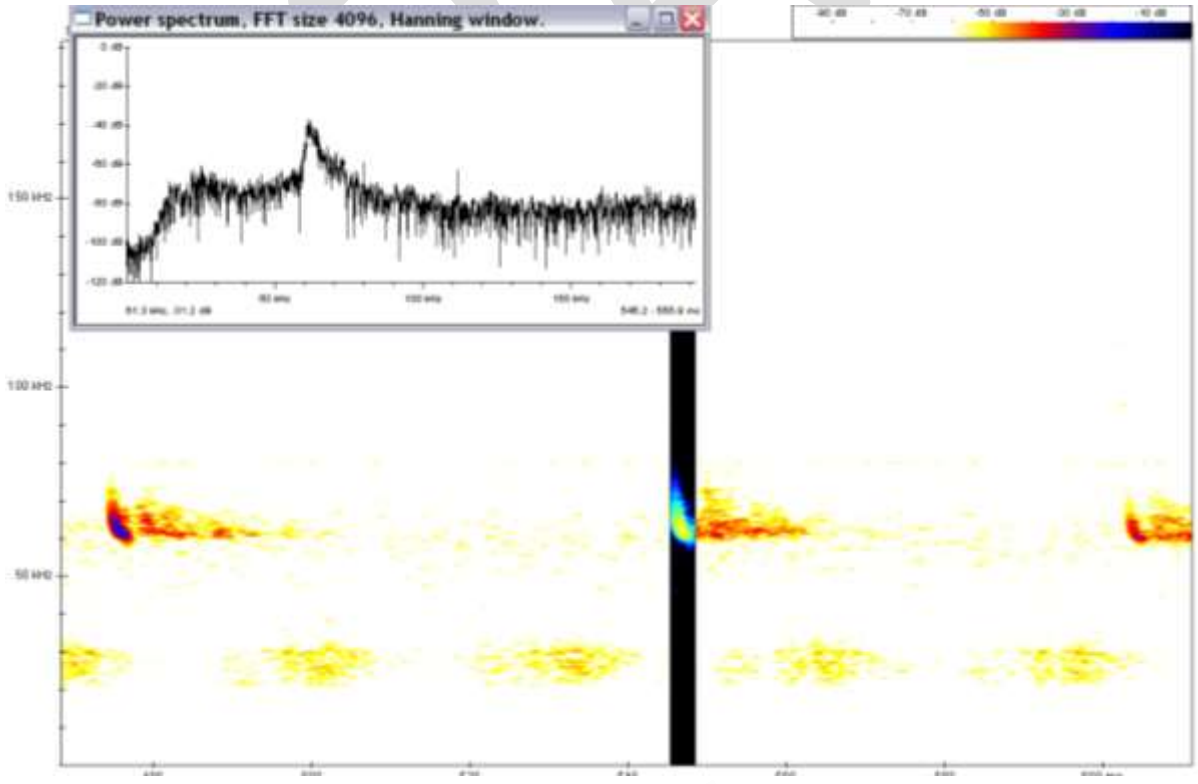
R. clivosus



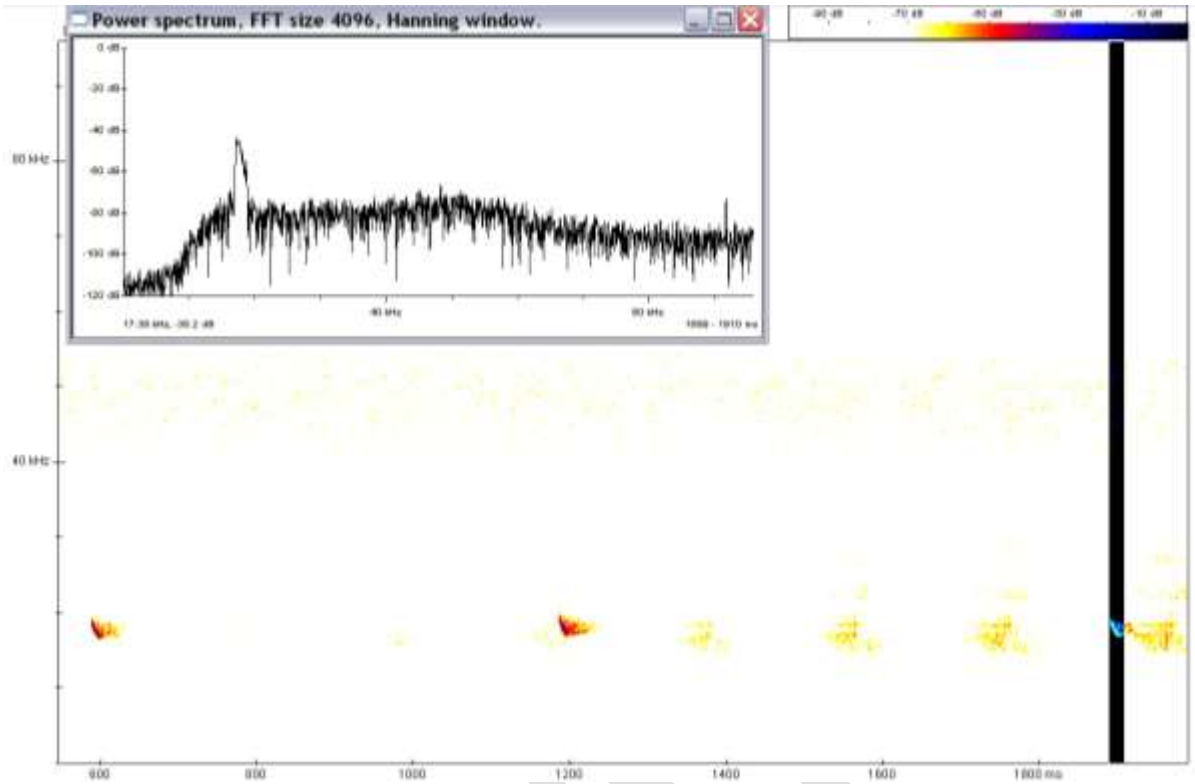
M. tricolor



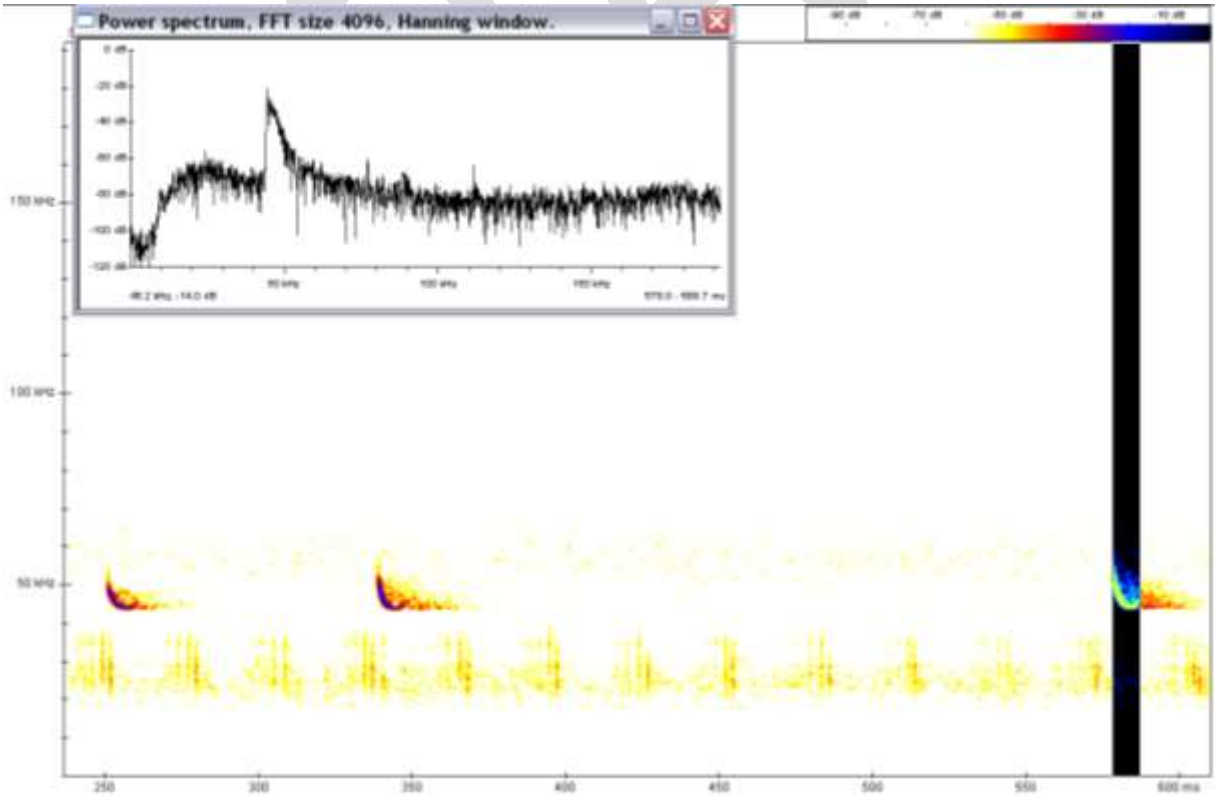
P. hesperidus



M. fraterculus



C. ansorgei?



P. *rusticus*

10.2 Raw Call Data

Day	Station	Time	*Cansorg*	*Ehottent*	*Mfraterc*	*Mnatalen*	*Mtricolo*	*Nschlief*	*Phesperi*	*Prusticu*	*Rclivosu*	*Taegypti*	Grand Total
2014/12/08	G1	19:24							1				1
		19:43								2			2
		19:48								1			1
		19:49		2									2
		19:51							1				1
		19:55							1	1			2
		19:56								2			2
		19:57								1			1
		20:00								2			2
		20:01							1	1			2
		20:03							1	2			3
		20:05		2									2
		20:06								1			1
		20:08								1			1
		20:11								1			1
		20:12		2									2
		20:13								1			1
		20:14							2				2
		20:16		1									1
		20:17		1									1
		20:23		2					1				3
		20:24								1			1
		20:25								2			2
		20:26								2	1		3
		20:29								1			1
		20:31								1			1
		20:32								1			1
		20:33								1			1
		20:47								1			1

Day	Station	Time	*Cansorg*	*Ehottent*	*Mfraterc*	*Mnatalen*	*Mtricolo*	*Nschlief*	*Phesperi*	*Prusticu*	*Rclivosu*	*Taegypti*	Grand Total
		20:52								2			2
		20:56		1									1
		20:57								1			1
		20:59		1									1
		21:03							1				1
		21:04		1					1				2
		21:05							1				1
		21:51										1	1
		21:53		1									1
		22:53					1						1
		23:03								1			1
		23:29								2			2
	G1 Total			**14**			**1**		**11**	**32**	**1**	**1**	**60**
	G2	18:58								1			1
		19:55				1							1
		20:02				1							1
		20:07				1							1
		20:09				1							1
		20:54				3						1	4
		20:57								1			1
		20:58					1			1			2
		21:03								1			1
		21:04				1							1
		21:05							1				1
		21:08								1			1
		21:09								1			1
		21:13		1									1
		21:18								2			2
		21:21								1			1
		21:52										1	1
		21:53		1									1

Day	Station	Time	*Cansorg*	*Ehottent*	*Mfraterc*	*Mnatalen*	*Mtricolo*	*Nschlief*	*Phesperi*	*Prusticu*	*Rclivosu*	*Taegypti*	Grand Total
		22:06								1			1
		23:16										1	1
		23:31								1			1
		23:32								1			1
	G2 Total			**2**		**8**	**1**		**1**	**12**		**3**	**27**
	G3	18:50								1			1
		19:00								1			1
		19:02								1			1
		19:04								2			2
		19:05								1			1
		19:07								1			1
		19:17								1		1	2
		19:24							1				1
		19:25							1				1
		19:32							1				1
		19:34							1				1
		19:35							1				1
		19:38							2				2
		19:42			1								1
		19:44		1									1
		19:46								1			1
		19:47							2				2
		19:53							1				1
		19:55							1				1
		19:59							1				1
		20:03								1			1
		20:08								2			2
		20:15							1				1
		20:16							1				1
		20:18								1			1
		20:19							1				1

Day	Station	Time	*Cansorg*	*Ehottent*	*Mfraterc*	*Mnatalen*	*Mtricolo*	*Nschlief*	*Phesperi*	*Prusticu*	*Rclivosu*	*Taegypti*	Grand Total
		20:23				1				2			3
		20:24							1				1
		20:25										1	1
		20:30		1									1
		20:36		1									1
		20:39		1									1
		20:42								2			2
		20:43								1			1
		20:48								2			2
		20:52								1			1
		20:53								3			3
		20:54							1				1
		21:10		1									1
		21:11		1									1
		21:13		1									1
		21:16									1		1
		21:27							1				1
		21:34								1			1
		21:42		1									1
		21:52										1	1
		22:04								1			1
		22:14		1									1
		22:28		1									1
		23:00								2			2
		23:23										1	1
		23:37								1			1
	G3 Total			**10**	**1**	**1**			**18**	**29**	**1**	**4**	**64**
2014/12/08 Total				26	1	9	2		30	73	2	8	151
2014/12/09	G1	00:19										1	1
		01:17				1							1
		01:57				1							1

Day	Station	Time	*Cansorg*	*Ehottent*	*Mfraterc*	*Mnatalen*	*Mtricolo*	*Nschlief*	*Phesperi*	*Prusticu*	*Rclivosu*	*Taegypti*	Grand Total
		02:19								1			1
		02:35										1	1
		02:36				1							1
		02:46		1	1								2
		02:49										2	2
		02:50										2	2
		03:00			1	1							2
		03:05			1								1
		03:09										1	1
		03:10								1			1
		03:22				1							1
		03:30				1							1
		03:41			1								1
		03:58										1	1
		04:12								1			1
		04:19								1			1
		04:30									1		1
	G1 Total			**1**	**4**	**6**				**4**	**1**	**8**	**24**
	G2	00:46	2										2
		01:42					1						1
		02:07	2										2
		02:14	2										2
		02:35	1										1
		02:42	4									1	5
		02:45										1	1
		02:51	1										1
		03:01	1										1
		03:03	1										1
		03:09										1	1
		03:13	3										3
		03:18	1										1

Day	Station	Time	*Cansorg*	*Ehottent*	*Mfraterc*	*Mnatalen*	*Mtricolo*	*Nschlief*	*Phesperi*	*Prusticu*	*Rclivosu*	*Taegypti*	Grand Total
		03:20	3										3
		03:33	1										1
		03:46	2										2
		03:51	1										1
		03:54	3										3
		03:57	1										1
		04:30	1										1
		19:07								1			1
		19:45							2	1			3
		19:46							1				1
		19:50							1				1
		19:54							1				1
		20:01								1			1
		20:08									1		1
		20:16								1			1
		20:17								1			1
		20:25								1			1
		20:27								1			1
		20:33				1							1
		20:34								1			1
		20:35								1			1
		20:39								1			1
		20:42								1			1
		20:47								1			1
		20:48								2			2
		20:49								1			1
		20:51								2			2
		21:01								1			1
		21:06				2							2
		21:07									1		1
		21:08									3		3
		21:09		1									1

Day	Station	Time	*Cansorg*	*Ehottent*	*Mfraterc*	*Mnatalen*	*Mtricolo*	*Nschlief*	*Phesperi*	*Prusticu*	*Rclivosu*	*Taegypti*	Grand Total
		21:10								1			1
		21:11								1			1
		21:15								1			1
		21:16								1			1
		21:31								1			1
		21:33							1				1
		21:46					1						1
		22:00								1			1
		22:28									1		1
		23:21					1						1
	G2 Total		30	1		3	3		6	24	6	3	76
	G3	00:40								1			1
		00:57								1			1
		01:22								1			1
		01:24										1	1
		02:06			1								1
		02:09							1				1
		02:16							1				1
		02:29							1				1
		02:37								1			1
		02:38	2										2
		02:44										2	2
		02:49								1			1
		02:51										3	3
		02:54			1								1
		03:03						1					1
		03:04			1				1			1	3
		03:08			2								2
		03:11			1								1
		03:12			1								1
		03:13	1		1								2

Day	Station	Time	*Cansorg*	*Ehottent*	*Mfraterc*	*Mnatalen*	*Mtricolo*	*Nschlief*	*Phesperi*	*Prusticu*	*Rclivosu*	*Taegypti*	Grand Total
		03:18	1									1	2
		03:24								1			1
		03:28	1										1
		03:29	1										1
		03:31								1		2	3
		03:32										1	1
		03:34			1								1
		03:37								1			1
		03:41										1	1
		18:58								1			1
		18:59								1			1
		19:00									1		1
		19:10								1			1
		19:19								1			1
		19:25							1				1
		19:26		1									1
		19:29									1		1
		19:32							1				1
		19:34							1				1
		19:35							1				1
		19:38			1				1				2
		19:43			3								3
		19:44			1					1			2
		19:45				1				1			2
		19:47			1					1			2
		19:48							1	1			2
		19:49				1				1			2
		19:55		2									2
		19:58			1								1
		20:00								1			1
		20:02								1			1
		20:05								3			3

Day	Station	Time	*Cansorg*	*Ehottent*	*Mfraterc*	*Mnatalen*	*Mtricolo*	*Nschlief*	*Phesperi*	*Prusticu*	*Rclivosu*	*Taegypti*	Grand Total
		20:06								3			3
		20:07							1				1
		20:08								2			2
		20:09								1			1
		20:14								2			2
		20:18				1							1
		20:24								1			1
		20:25								1			1
		20:26								2			2
		20:27								2			2
		20:28								1			1
		20:29								1			1
		20:34								3			3
		20:35								3			3
		20:36						1		1			2
		20:38								5			5
		20:39								5			5
		20:41								1			1
		20:43								3			3
		20:44								1			1
		20:46								1			1
		20:47							1	1			2
		20:50								1			1
		20:52								5			5
		20:53					1			5			6
		20:56								3			3
		20:58							1				1
		21:02								1			1
		21:10								4			4
		21:11								6			6
		21:14								1			1
		21:18			1								1

Day	Station	Time	*Cansorg*	*Ehottent*	*Mfraterc*	*Mnatalen*	*Mtricolo*	*Nschlief*	*Phesperi*	*Prusticu*	*Rclivosu*	*Taegypti*	Grand Total
		21:19								2			2
		21:20					1			1			2
		21:21								1			1
		21:33							1				1
		21:34								1			1
		22:15			2								2
		22:30					1						1
		23:17					1						1
		23:20		1									1
		23:48				1							1
		23:49								1			1
	G3 Total		**6**	**4**	**19**	**4**	**4**	**2**	**14**	**94**	**2**	**12**	**161**
2014/12/09 Total			**36**	**6**	**23**	**13**	**7**	**2**	**20**	**122**	**9**	**23**	**261**
2014/12/10	G2	01:36	1										1
		01:54	1										1
		02:54								2			2
		02:59				1							1
		03:55	1										1
		04:01										1	1
		04:05	3										3
		04:07	1										1
	G2 Total		**7**			**1**				**2**		**1**	**11**
	G3	00:08					2						2
		00:09					1						1
		00:22				1							1
		00:44			1								1
		01:21				1							1
		01:32			1								1
		01:55				1							1
		02:38			1								1

Day	Station	Time	*Cansorg*	*Ehottent*	*Mfraterc*	*Mnatalen*	*Mtricolo*	*Nschlief*	*Phesperi*	*Prusticu*	*Rclivosu*	*Taegypti*	Grand Total
		02:52			1								1
		03:14			1								1
		03:21								1			1
		03:27							1				1
		03:30			1								1
		03:40							1				1
		03:43								1			1
		03:52										1	1
		03:56										3	3
		03:58										1	1
		04:08				1							1
		04:13								2			2
		04:17								1			1
	G3 Total				**6**	**4**	**3**		**2**	**5**		**5**	**25**
2014/12/10 Total			**7**		**6**	**5**	**3**		**2**	**7**		**6**	**36**
Grand Total			**43**	**32**	**30**	**27**	**12**	**2**	**52**	**202**	**11**	**37**	**448**