TERRESTRIAL ECOLOGY ASSESSMENT FOR THE PROPOSED MIER RIETFONTEIN SOLAR PV, BATTERY STORAGE AND TELECOM TOWER PROJECT

Eskom Holdings SOC Ltd

Draft Report - July 2021

Submitted to:
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Executive Summary

Hawkhead Consulting was appointed by Golder Associates Africa (Pty) Ltd on behalf of Eskom Holdings SOC Ltd to undertake a terrestrial ecology assessment to inform a basic assessment process for the proposed Mier Rietfontein Solar PV, Battery Storage and Telecommunications Tower Project.

This specialist report will be included in the basic assessment report submitted to the authorities, the National Department of Forestry, Fisheries and the Environment (DFFE), in support of the application for environmental authorisation for the proposed Project.

The sites for the proposed Project are located near the towns of Rietfontein and Groot Mier, in the Dawid Kruiper Local Municipality, in the ZF Mgcawu District Municipality, in the Northern Cape Province. The proposed Solar PV and Battery Energy Storage System ('BESS') will be developed at a site located between Rietfontein town and the Rietfontein border post. Infrastructure consists of 12 independent PV blocks of 170 ("kW") kW each, with a total installed capacity of 2 040 kW (or 2.04 megawatts ("MW")). Other proposed Project components include, *inter alia*, 11 independent BESS of 140 kW (560 kWh) each, with a total installed capacity of 1 540 kW (or 1.54 MW) and 6 160 kWh (or 6.16 MWh). The study area assessed for these Project components is 19 ha (referred to as 'study area A' in this report), of which, the actual development footprint will be approximately 10 ha. The proposed telecommunication tower will be developed at a site 5.5 km south-east of Groot Mier village (i.e., 35 km to the west of Rietfontein). The proposed development footprint is small at only 0.0025 ha (or 225 m^2) and is referred to as 'study area B'. Proposed Project infrastructure at this site will include a 50 m high tower and an equipment container.

The National Web-based Environmental Screening Tool screening tool characterised the Animal Species Theme, Plant Species Theme and Terrestrial Biodiversity Theme for the site as 'Low Sensitivity'. In line with the assessment and reporting requirements, the terrestrial ecology assessment included a desktop review of available biodiversity and ecological literature and datasets, followed by a field programme that focused specifically on the proposed Solar PV and BESS site (study area A). The field programme comprised a single wet/growing season field survey, conducted over a three-day period from the 12-14th April 2021. Sampling focused on both flora and fauna communities. Birds were not considered, as a separate avifauna study has been completed for the proposed Project. A high-level habitat characterisation of the study area B landscape was developed based on aerial imagery, site photographs and a discussion with the farm owner Mr Willemse.

Study area A is located in Kalahari Karroid Shrubland (NKb5), while study area B is located in the Gordonia Plains Shrubland (SVk16), as delineated and described by Mucina and Rutherford (2011). Both vegetation types are considered 'Least Threatened' on the national list of threatened ecosystems. The Northern Cape Critical Biodiversity Areas map (2018) indicates that both study areas and most of the surrounding landscape are categorised as 'Other Natural Areas' the lowest priority category for non-transformed land.

Two vegetation communities were identified in study area A during the field visit. These are *Rhigozum trichotomum – Stipagrostis* Shrubland and Ephemeral Drainage Line Vegetation. The former community is the largest, covering approximately 17.3 ha of this study area. Ephemeral Drainage Line Vegetation comprises approximately 1.9 ha. Both communities are characterised by

open- to sparse shrubland, comprising of both woody and herbaceous vegetation. *Rhigozum trichotomum – Stipagrostis* Shrubland is a uniform vegetation community and well-represented across the surrounding landscape. It was rated as having a moderate biodiversity sensitivity. Ephemeral Drainage Line Vegetation plays an important functional role in ecosystem dynamics, and accordingly was rated as having high biodiversity sensitivity. Vegetation in the study area B landscape is characterised by open, arid shrubland that is typical of the Gordonia Plains Shrubland vegetation type

Two flora species (*Commiphora glandulosa* and *Hoodia gordonii*) recorded during the filed visit are listed as protected at a provincial and/or national level. *Commiphora glandulosa* is listed as protected at a provincial level and was recorded in study area A. *Hoodia gordonii* was recorded adjacent to the study area A, and is listed as a nationally protected species, according to the NEMBA ToPS (2007) list and a specially protected according to the Northern Cape Nature Conservation Act (2009). Based on available literature, additional flora species of conservation concern that may be present, particularly in the study area B landscape, include nationally protected trees such as *Boscia albitrunca* and *Vachellia erioloba.*

Mammal species confirmed to occur in and/or adjacent to study area A during the field visit include Cape or Scrub Hare (*Lepus capensis/saxatilis*), Ground Squirrel (*Xerus inauris*), Aardvark (*Orycteropus afer*), Cape serotine (*Neoromicia capensis*) and possibly the Egyptian slit-faced bat (*Nycteris thebaica*). Three reptile species were recorded in the study area during the field visit, namely the Anchieta's Agama (*Agama anchietae*), Plain Sand Lizard (*Pedioplanis inornata*) and Namaqua Sand Lizard (*Pedioplanis namaquensis*).

Several negative impacts on terrestrial ecology associated with the proposed Project have been identified. Of these, the loss and modification of natural habitat resulting from vegetation clearing and earth works during construction is the primary impact of concern. This is mainly a concern for the Solar PV and Battery Storage System site, where 10 ha of natural habitat will be cleared. Prior to mitigation this impact at this site will have a high impact significance and will impact all flora in the development footprint and all fauna that use these habitats as a foraging/breeding/refugia resource on-site. This impact can be reduced to a moderate significance by, *inter alia*, positioning all proposed Project infrastructure outside a 10 m buffer around the smaller drainage lines and outside a 30 m buffer around the large central drainage line in the study area, and limiting the extent of vegetation clearing to the minimum required for construction purposes.

To address the remaining residual impacts of habitat loss, additional conservation actions should be investigated and implemented. These should include actively controlling alien invasive flora species (*Prosopis* species) in drainage lines and around the farm dams that are located downstream of study area A, and implementing anti-erosion control measures (e.g., rock packs) at select points along downstream drainage lines.

Several additional impacts were identified and assessed for significance, including the spread of alien invasive species, dust generation, reduction in foraging habitat for bats, the loss of flora of conservation concern, and the killing/ injuring and disturbance of fauna (including bats). With the successful implementation of the recommended mitigation and management measures, these can be reduced to a low impact significance.

Based on the findings of this study, provided that the mitigation measures and monitoring requirements detailed in this report are adhered to, the Project may be authorised from a terrestrial ecology perspective.

Details of the Expertise of the Specialist

Specialist Information	
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Qualifications	M.Sc. Resource Conservation Biology B.Sc. Hons. Ecology and Conservation Biology B.Sc. Zoology and Grassland Science
Summary of Past Experience	Andrew Zinn is a terrestrial ecologist with Hawkhead Consulting. In this role, he conducts varied specialist ecology studies, including flora and fauna surveys, for baseline ecological assessments and ecological impact assessments. He has over a decade of experience working in the fields of ecology and conservation research. He has worked on projects in several African countries including Botswana, Democratic Republic of Congo, Ethiopia, Ghana, Mozambique, South Africa, Tanzania and Zambia.

Declaration of Independence by Specialist

I, Andrew Zinn, declare that I –

- Act as the independent specialist for the undertaking of a specialist section for the proposed Rietfontein Solar PV, Battery Storage and Telecom Tower Project;
- Do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed;
- Do not have, nor will have, a vested interest in the proposed activity proceeding;
- Have no, and will not engage in, conflicting interests in the undertaking of the activity; and
- Undertake to disclose, to the competent authority, any information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document.

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Acronyms and Abbreviations

Abbreviation	Explanation
AIS	Alien Invasive Species
BESS	Battery Energy Storage System
BODATSA	Botanical Database of Southern Africa
CARA	Conservation of Agricultural Resources Act
DFFE	Department of Forestry, Fisheries and the Environment
EMPr	Environmental Management Programme Report
ha	Hectare
IBA	Important Bird Areas
NEMA	National Environmental Management Act
NEMBA	National Environmental Management Biodiversity Act
NEMPA	National Environmental Management Protected Areas Act
NGO	Non-Government Organisation
SANBI	South African National Biodiversity Institute
SAPAD	South African Protected Areas Database
SABAA	South African Bat Assessment Association
ToPS	Threatened or Protected Species
QDS	Quarter Degree Squares

1. Introduction

Hawkhead Consulting was appointed by Golder Associates Africa (Pty) Ltd ("Golder") on behalf of Eskom Holdings SOC Ltd ("Eskom") to undertake a terrestrial ecology assessment to inform a basic assessment ("BA") process for the proposed Mier Rietfontein Solar PV, Battery Storage and Telecommunications Tower Project (hereafter referred to as the "Project").

2. This Report

The purpose of this report is to present a baseline terrestrial ecology characterisation of the proposed Project footprints (hereafter referred to as the "Study Area(s)") and conduct an impact assessment of proposed Project activities to inform the BA process.

The scope of work of this specialist study is as follows:

- Collate and review existing ecosystem and flora and fauna data pertaining to the study areas;
- Conduct a field survey to collect data on on-site flora and fauna communities;
- Assess potential negative impacts that may result from proposed Project activities;
- Recommend mitigation and management measures for inclusion in the Project's Environmental Management Programme (EMP).

This specialist report will be included in the basic assessment report ("BAR") submitted to the authorities, the National Department of Forestry, Fisheries and the Environment ("DFFE") in support of the application for environmental authorisation ("EA") for the proposed Project.

2.1. Structure of this Report

The structure of this report is largely based on the information requirements set out in the protocols and minimum report content requirements for environmental impacts on terrestrial animal species, terrestrial plant species (NEMA Section 24, No. 43855) and terrestrial biodiversity (NEMA Section 24, No. 43110).

The National Web-based Environmental Screening Tool characterised the Animal Species Theme, Plant Species Theme and Terrestrial Biodiversity Theme for the site as 'Low Sensitivity'. The terrestrial ecology assessment was thus conducted in line with the procedures for assessment and minimum criteria for reporting on these themes.

Table 1 provides a summary of report structure.

Table 1: Information to be included in specialist report.

Section	Requirements	Section addressed in report
1.(1)	A specialist report prepared in terms of these Regulations must contain	
(a)	Details of	
(i)	the specialist who prepared the report; and	Preceding Page
(ii)	the expertise of that specialist to compile a specialist report including a curriculum vitae	Preceding Page
(b)	a declaration that the specialist is independent in a form as may be specified by the competent authority	Preceding Page

(c)	an indication of the scope of, and the purpose for which, the report was prepared;	Section 1.0 and 2.0
(cA)	an indication of the quality and age of base data used for the specialist report;	Section 5.0
(cB)	a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 7.0
(d)	the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 5.2
(e)	a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 5.0
(f)	details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 8.0
(g)	an identification of any areas to be avoided, including buffers;	Section 8.0
(h)	a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 8.0
(i)	a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 11.0
(j)	a description of the findings and potential implications of such findings on the impact of the proposed activity (including identified alternatives on the environment) or activities;	Section 8.0
(k)	any mitigation measures for inclusion in the EMPr;	Section 9.0
(l)	any conditions for inclusion in the environmental authorisation;	Section 11.0
(m)	any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 10.0
(n)	a reasoned opinion—	
(i)	(as to) whether the proposed activity, activities or portions thereof should be authorised;	Section 11.0
(iA)	regarding the acceptability of the proposed activity or activities; and	
(ii)	if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	
(o)	a description of any consultation process that was undertaken during the course of preparing the specialist report;	N/A

(p)	a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	N/A
(q)	any other information requested by the competent authority.	N/A
2.	Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	N/A

3. Project Location

The sites for the proposed Project are located near the towns of Rietfontein and Groot Mier, in the Dawid Kruiper Local Municipality ("DKLM"), in the ZF Mgcawu District Municipality, in the Northern Cape Province.

- The proposed PV blocks and battery storage system site is located between Rietfontein town and the Rietfontein border post. The study area for this proposed facility (hereafter referred to as 'study area A') is about 19 ha, of which, it is anticipated that about 10 ha will be required for development; and
- The proposed Telecommunications Tower site located adjacent to the R31 arterial road, approximately 5.5 km south-east of Groot Mier and 35 km to the west of Rietfontein. This site is relatively small (0.0025 ha or 225 m^2) and referred to as 'study area B'.

Refer to Figure 1 for a map showing the regional location of the study areas.

4. Project Overview

The proposed Project will consist of 12 independent PV blocks of 170 ("kW") kW each, with a total installed capacity of 2 040 kW (or 2.04 megawatts ("MW")). The proposed Project will also consist of 11 independent battery energy storage systems ("BESS") of 140 kW (560 kWh) each, with a total installed capacity of 1 540 kW (or 1.54 MW) and 6 160 kWh (or 6.16 MWh).

The installation of these PV blocks and BESS will be staggered according to the expected growth in electrical demand:

- Initial installation of 5 x 170 kW PV blocks and 4 x 140 kW BESS for the "electrification scenario"
- Installation of an additional 3 x 170 kW PV blocks and 3 x 140 kW BESS for the "LPUs scenario"
- Installation of an additional 4 x PV blocks and 4 x 140 kW for the "unforeseen demand scenario"

In addition to the PV blocks and BESS, the proposed Project will also include the following main infrastructure:

- 12 x 200 kW inverters to convert the direct current ("DC") electricity from the PV modules to the alternative current ("AC") electricity at grid frequency;

- 12 x LV/MV step-up transformers to step up the voltage from low voltage (“LV”) at the output of the inverter to the required medium voltage (“MV”) at the point of connection;
- Transmission Yard and underground cables to connect the proposed PV and BESS to the Mier switching station, and overhead cables connecting to the Rietfontein 33kV feeder;
- Admin Block, Control & Storeroom, Workshop & Storeroom, and parking area; and
- Access road, service road, and internal roads (all gravel).

The Telecommunications (Telecom) Tower development will include a 50 m high tower with four communication dishes. The tower will be linked to an equipment container via a feeder gantry. All infrastructure will be positioned within a 225 m^2 site (0.0025 ha), that will be enclosed with a fence.

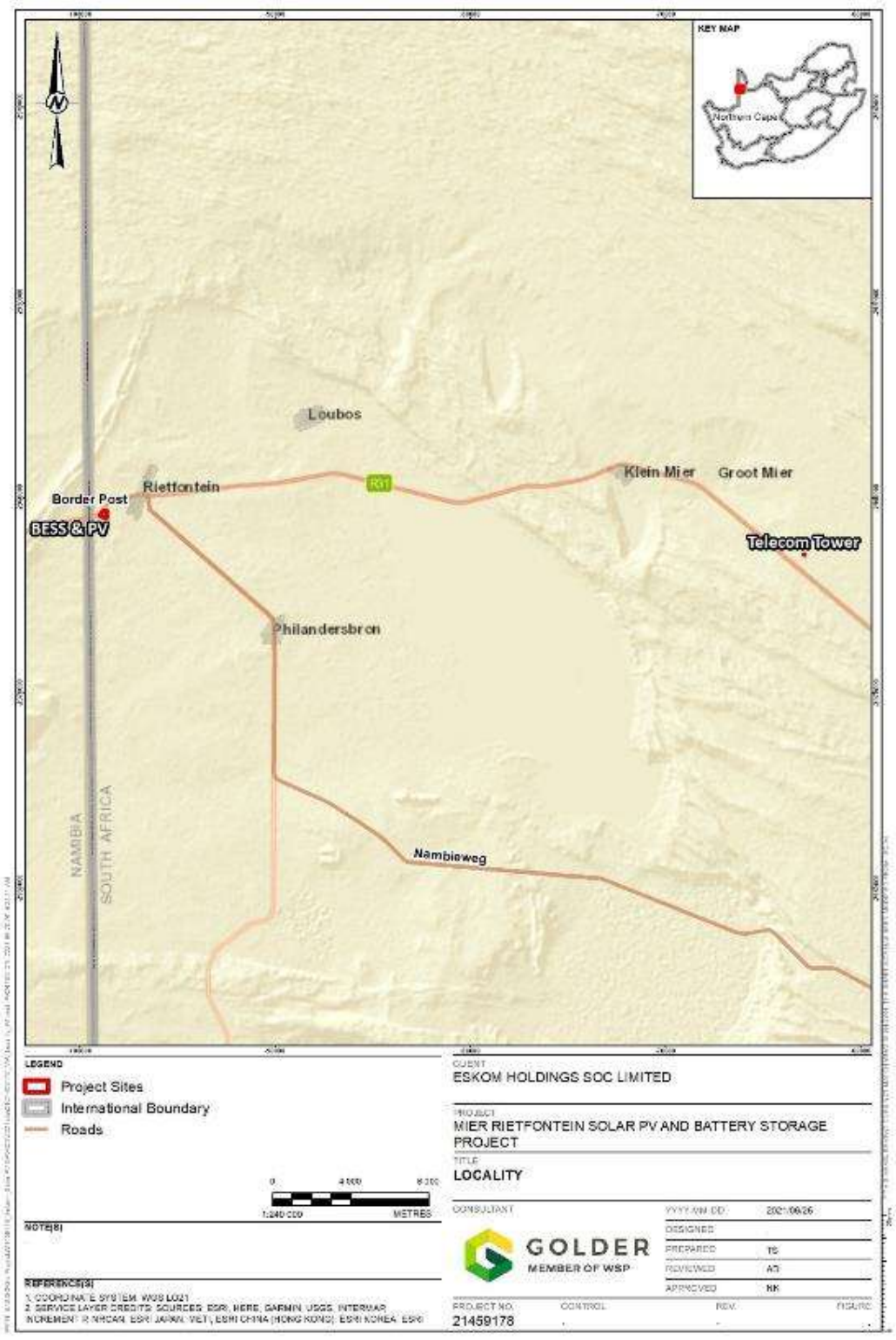

Figure 1: Regional location of the study areas.

5. Approach and Methodology

The terrestrial ecology assessment took cognisance of Government Notice No. 320, published in 2020 under the National Environmental Management Act (1998) concerning 'Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Theme in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act (1998), when applying for Environmental Authorisation'.

Prior to commencing with the terrestrial ecology assessment, the site was assessed using the National Web-based Environmental Screening Tool. The screening tool characterised the Animal Species Theme, Plant Species Theme and Terrestrial Biodiversity Theme for the site as 'Low Sensitivity'.

In line with the assessment and reporting requirements, the terrestrial ecology assessment included two main study components; a desktop literature review, followed by a field programme. The objectives and tasks associated with these components are described below:

5.1. Literature Review

The aim of the desktop literature review component was to collate and review pertinent ecological information related to biodiversity and conservation features in the landscape, key ecological processes and function, and the likely composition and structure of local flora and fauna communities.

5.1.1. Ecosystem Attributes and Conservation Context

- General habitat descriptions relevant to the study areas and the surrounding region were obtained from Mucina and Rutherford (2011);
- The formal conservation context of the region at a provincial and national level was established based on:
    - The Northern Cape Critical Biodiversity Map (2018);
    - The National List of Threatened Ecosystems (NEMBA Threatened Ecosystems, 2018);
- The presence of protected areas in the broader region was determined based on the South African Protected Areas Database website (SAPAD, 2021). This database contains a register of protected areas (legally gazetted) and conservation areas (managed for biodiversity conservation, but not legally declared) in South Africa; and
- The presence of Important Bird Areas (IBA) in the region was also determined by consulting (Marnewick, *et al*., 2015). Birds have been shown to be good indicators of biodiversity hotspots. The identification and conservation of IBA's therefore plays an important role in broader biodiversity conservation (Marnewick, *et al*., 2015).

5.1.2. General Floristics

- A list of flora species that have previously been recorded in the region encompassing the study areas and that may therefore occur at these sites was obtained from the SANBI's online Botanical Database of Southern Africa (BODATSA); and
- To determine the conservation status of flora species that are potentially present, the list was cross-referenced against both national and Northern Cape lists of threatened and/or protected flora (refer to Section 5.2.3).

5.1.3. Fauna Communities

Mammals -General

- A list of mammals that are known to occur in the broader region was compiled based on the historic distribution ranges in Stuart and Stuart (2007); and
- These were cross-referenced with mammal species listed for the Quarter Degree Squares (QDS) 2620CA, 2620CC and 2620CD on the MammalMAP database (FitzPatrick Institute of African Ornithology, 2021).

Bats

- A literature review of available information on bat presence and diversity within the general region was conducted. Reviewed data included international and South African Red Lists (IUCN, 2021-1; Child *et al*., 2016) for bat species present in the region, bat species distribution maps for South Africa (Monadjem *et al*., 2010), and any other available information on bat presence in the region; and
- Bat species and bat-supporting habitats with potential to occur in the study areas, as well existing threats or pressures to such species were identified through review of background biodiversity reports relating to the Project, available published literature, consideration of South Africa's national and provincial biodiversity legislation and policies as they pertain to bats, Non-Governmental Organisation (NGO) guidance documentation (Sowler & Stoffberg, 2014), and through application of the expertise of the bat survey and impact assessment team.

Herpetofauna (Reptiles and Amphibians)

- A list of herpetofauna that potentially occur in the region was compiled based on the distribution maps presented in Bates *et al*., (2014) for reptiles and Du Preez and Carruthers (2009) for amphibians; and
- Additional herpetofauna data were also sourced from ReptileMAP and FrogMAP for the QDS 2620CA, 2620CC and 2620CD (FitzPatrick Institute of African Ornithology, 2021).

Invertebrates

- Reviewed invertebrate data focused on baboon spiders (Family Theraphosidae), rock scorpions (Genus Hadogenes) and burrowing scorpions (Genus Opistophthalmus), as these are of conservation concern in the Northern Cape. Species that occur in the Northern Cape and that potentially occur in the region were assessed using Dippenaar-Schoeman (2014) for spiders, and Leeming (2003) for scorpions.

To determine the conservation status of fauna species that potentially occur in the study areas, the various lists of potentially present fauna were cross-referenced against both national and Northern Cape lists of threatened and/or protected fauna (refer to Section 5.2.3).

5.2. Field Programme

The field programme comprised a single wet/growing season field survey, conducted over a three-day period from the 12-14th April 2021. The field survey, which considered both flora and fauna communities (excluding birds[1]), focused on study area A, which is the larger proposed development

[1] Bird communities were assessed as part of a separate, stand-alone avifauna study.

site at 19 ha. No field work was conducted at study area B, which has a very small proposed development footprint of only 0.0025 ha (or 225 m^2). Site photographs related to the study area B landscape were obtained from Mr A.J. Willemse (photos taken on the 30th June and 1st July 2021). Mr Willemse is the owner of the farm on which this site is located. These, along with a discussion with Mr Willemse, were used to develop a high-level habitat characterisation for this site. Despite the late wet season field conditions, it was noted that grass productivity across the entire region was high as a result of good seasonal rains.

5.2.1. Flora Surveys

- Vegetation transects were used to assess flora structure and composition in study area A. Transects were approximately 2 X 20m and sited at representative sites in the two vegetation communities that were preliminarily identified at a desktop level using available Google Earth imagery prior to the field visit - five transects were located in drainage line habitat and five transects in shrubland habitat (refer to Appendix A for the co-ordinates of the vegetation transects);
- Study area A was also traversed on foot and any unrecorded plant species were documented;
- Reference works used to identify flora species included Van Wyk and Van Wyk (1997), Van Oudtshoorn (1999), Coates Palgrave (2002), and Van Rooyen and Van Rooyen (2019);
- Flora nomenclature is based on Germishuizen, *et al*., (2006) or more recent name changes, as presented in Van Rooyen and Van Rooyen (2019); and
- For descriptive purposes, the structural classification system developed by Edwards (1983) for vegetation was used as a guide.

5.2.2. Fauna Surveys

Fauna field surveys considered mammals (general), bats and herpetofauna, with observational notes taken on the possible presence of select arachnids:

5.2.2.1.Mammals

General mammal sampling was undertaken using both active and passive methods:

- Active sampling included the use of baited motion-triggered camera traps placed at two selected fauna survey sites in study area A (refer to Appendix A for co-ordinates);
- One camera trap was placed on an old telephone line pole in shrubland the centre of the study area. The other camera trap was placed in a drainage line immediately north of the study area. Camera traps were re-baited each morning of the field visit with raw chicken pieces. Camera traps were in place for three consecutive nights;
- Camera trap data were augmented with data obtained through:
    - Opportunistic observations of mammals made in study area A and the surrounding landscape throughout the duration of the field visit; and
    - The identification of mammal tracks, faeces, burrows and feeding signs in study area A and surrounding landscape; and
- To determine the general character and suitability of habitat for mammals in the landscape, land to the south-east of study area A, including the downstream drainage lines and farm dams, was traversed in a vehicle and on foot.

5.2.2.2.Bats

Bat Habitat Suitability Assessment

- Habitats within study area A were examined for the presence of features with bat roosting potential, such as rocky outcrops, culverts, and mature and decaying trees. Daytime surveys of the study area also focussed on the identification of areas with good foraging potential for bats, including natural habitats with diverse structure/topography, and potential water sources e.g., drainage lines, dams.

Active Monitoring

- Driven transects were not conducted due to the lack of accessible/safe tracks through study area A;
- A walked, manual activity survey was conducted from 30 minutes before sunset, to 1 hour 30 minutes after sunset on the first night (12 April 2021). The walked route included the northern and southern sections of study area A, with the aim of covering different habitats on site, while adhering to health and safety requirements. Since no echolocation activity was detected during this survey, it was not repeated on the following nights.

Passive Monitoring

- Passive monitoring was carried out with the use of a SM2BAT+ bat detector. The bat detector was mounted on a derelict telephone line pole in the centre of study area A for two nights, and in a drainage line to the north of the study area for one night (three consecutive nights) at the points shown in the figure in Appendix A.
- The detector was set to operate in continuous trigger mode. When triggers are enabled, recording is suspended until a trigger event is detected. Recording then continues until no trigger event is detected for the specified period of time. For this survey, the trigger was set to record any sound whose frequency exceeds 16 KHz and 18 dB, for the duration of the sound plus 500 ms after the sound has ceased. All signals were recorded in WAC0 lossless compression format. Weatherproof ultrasound SMXU1 microphones were used.
- The SM2+ was configured to commence recording from 30 minutes before sunset (sunset time = 18:26), for four hours, ceasing recording at 22:26; and from four hours before sunrise (sunrise time = 06:55) until 30 minutes afterwards. Temperatures ranged from approx. 33 – 35 °C at sunset, dropping to overnight lows of approx. 17°C. Humidity was low, and weather conditions were calm and dry throughout. No limitations in term of climactic factors therefore affected the survey.

Analysis of Passive Monitoring Data

Raw data files created by the SM2+ were downloaded from the SD cards and converted to zero crossing files using Kaleidoscope software. The files were then analysed for bat echolocation calls using AnalookW software.

5.2.2.3.Herpetofauna

- Herpetofauna were sampled using active searches and the recording of opportunistic observations made while walking in study area A. Due to the very rocky nature of the study area and the short duration of the field visit, trapping arrays were not considered;

5.2.2.4.Invertebrates

- Inveterate work comprised an observational scan for burrows indicating the potential presence of baboon spiders and scorpions. No detailed invertebrate sampling was conducted.

Note: Bird communities were assessed as part of a separate, stand-alone avifauna study.

5.2.3. Assessment of Species of Conservation Concern

5.2.3.1.Threatened, Near Threatened and/or Protected Species Status

Species of conservation concern (SCC) were based on the national Red Lists of threatened/near threatened flora and fauna species, and the Protected status of species, as per national and provincial legislation. These included:

- Red List of South African Plants Version (SANBI, 2021);
- Red List of Mammals of South Africa, Lesotho and Swaziland (Child *et al*., 2016);
- Atlas and Red List of the Reptiles of South Africa, Lesotho and Swaziland (Bates *et al*., 2014);
- IUCN Red List of Threatened Species for amphibians (IUCN, 2021-1);
- National Environmental Management: Biodiversity Act (Act No. 10 of 2004) - Threatened or Protected Species List (Notice 389 of 2013) (NEMBA ToPS List, 2007);
- National Forest Act (Act No. 84 of 1998) list of protected tree species; and
- Northern Cape Nature Conservation Act (2009), specifically schedules concerning specially protected and protected flora and fauna.

5.2.3.2.Habitat Suitability Assessments for Species of Conservation Concern

Based on the lists of species of conservation concern potentially present, a 'probability of occurrence' of a species in the study areas was determined by conducting habitat suitability assessments. This was done only for those species considered threatened/near threatened or protected at a national level. The following parameters were used in the assessments:

- Habitat requirements: Most threatened and endemic species have very specific habitat requirements. The presence of these habitats in the study areas was evaluated;
- Habitat status: The status or ecological condition of available habitat in the area was assessed. Often a high level of habitat degradation will negate the potential presence of sensitive species; and
- Habitat linkage: Dispersal and movement between natural areas for breeding and feeding are important population-level processes. Habitat connectivity within the study areas and to surrounding natural habitat and corridors was evaluated to determine the likely persistence of species of concern in the study areas.

Probability of occurrence is presented in the following categories:

- **Confirmed**: Any species of conservation concern observed/documented in the study area.

- **Probable**: the species is likely to occur on the site due to suitable habitat and resources being present on the site;
- **Possible:** The species may occur on the site, or move through the site (in the case of mobile species), due to potential habitat and/or resources; and
- **Unlikely**: the species will not likely occur on the site due to lack of suitable habitat and resources, or significant differences in its Area of Occupancy (AOO)[2] compared to its Extent of Occurrence (EOO)[3] .

5.2.4. Alien Invasive and Medicinal Flora Species

- Alien invasive plant species were categorised according to the National Environmental Management: Biodiversity Act (NEMBA) (Act No. 10 of 2004) - 2016 listing of declared alien invasive species; and
- Flora of medicinal value were based on the purported uses described in Van Wyk, *et al*., (2009).

5.3. Biodiversity Sensitivity Analysis

The biodiversity sensitivity of habitats in the study areas was determined by subjectively assessing the ecological integrity and conservation importance of identified habitats. The rating criteria presented in Table 2 developed by Golder were used to guide the analysis and the matrix used to derive a biodiversity sensitivity score is presented in Table 3.

Table 2: Criteria for rating habitat sensitivity

Score	Ecological Integrity	Conservation Importance
High	Habitats of high ecological integrity have compositional, structural and functional characteristics that are close to the natural/sustainable state (i.e., reference conditions). As such, they have a combination of the following attributes: • Key floral and faunal indictors are present or highly likely to be present; • Large habitat patch that is mostly unfragmented and has a high level of connectivity to adjacent natural habitat patches; • Has little to no evidence of anthropogenic disturbances (pollution, earth works, etc.); and • Little or no alien invasive species establishment.	Habitats of high conservation importance or irreplaceability have one or a combination of the following attributes: • Pristine or relatively undisturbed habitat displaying high species richness; • Areas playing an important functional role in ecological processes at a landscape scale (e.g., high levels of connectivity, source patches, water attenuation, etc.); • Niche or relatively rare/unique habitat within the landscape that contributes to overall habitat heterogeneity; • Areas designated by provincial or national authorities as having high conservation importance, sensitivity or irreplaceability; and

[2] Area of occupancy refers to the area within a species' 'extent of occurrence' (see below), which is occupied by that species, excluding cases of vagrancy. The measure reflects the fact that a species will not usually occur throughout the area of its extent of occurrence, which may contain unsuitable or unoccupied habitats.
[3] Extent of occurrence refers to the known global range of a species.

Score	Ecological Integrity	Conservation Importance
		• Areas with confirmed presence or high probability of occurrence of Red List species.
Moderate	Habitats of moderate ecological integrity have a combination of the following attributes: • Moderate levels of anthropogenic disturbance; and • Despite disturbances, habitat maintains much of the same functional attributes as areas in a natural/sustainable state.	Habitats of moderate conservation importance have a combination of the following attributes: • Homogenous with, and well-represented, across the broader landscape (i.e., not unique within the immediate landscape); • Intermediate levels of species richness; • Moderate probability of occurrence of Red List species as determined by critical habitat assessments; • Disturbed areas that are situated adjacent to habitat of high ecological integrity and/or conservation importance and therefore may play a role as ecological support or refuge habitat.
Low	Habitats of low ecological integrity have a combination of the following attributes: • Highly modified from natural state as a consequence of anthropogenic activities, with poor species richness and all or most key floral and faunal indicators absent; • Highly fragmented areas, with little or no connectivity to adjacent natural habitat; • High incidence of alien species establishment; and • Successful rehabilitation may restore some degree of habitat integrity.	Habitats of low conservation importance are typically disturbed, with low ecological integrity. These areas are species poor and in their current form, play only a minor role in ecological processes and thus cannot contribute significantly toward biodiversity conservation.
Very Low	Severely modified or completely transformed with little- to no natural habitat remaining and limited scope for rehabilitation.	Severely modified or completely transformed completely transformed with little- to no natural habitat remaining and limited scope for rehabilitation and no ability to contribute toward biodiversity conservation.

Table 3: Matrix used to derive a Biodiversity Sensitivity Score

Biodiversity Sensitivity		Conservation Importance			
		High	**Moderate**	**Low**	**Very Low**
Ecological Integrity	**High**	High	Moderate	Moderate	Low
	Moderate	High	Moderate	Low	Low
	Low	Moderate	Moderate	Low	Very Low
	Very Low	Low	Low	Very Low	Very Low

6. Applicable Legislation, Policies and Guidelines

6.1. National Legislation and Guidelines

The following national legislation were consulted during the study:

- National Environmental Management Act (NEMA) (Act No. 107 of 1998) including Section 24, concerning Procedures for the assessment and minimum criteria for reporting on identified themes in terms of Sections 24(5)(a) and (h) and 44 of the NEMA, when applying for environmental authorisation;
    - Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial animal species;
    - Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial plant species;
- National Environmental Management: Biodiversity Act (NEMBA) (Act No. 10 of 2004);
- National Environmental Management: Protected Areas Act (NEMPA) (Act No. 57 of 2003);
- Environment Conservation Act (ECA) (Act No. 73 of 1989); and
- Conservation of Agricultural Resources Act (CARA) (Act No. 43 of 1983).

6.2. Provincial Legislation and Guidelines

The principle provincial legislation pertaining to biodiversity conservation in the Northern Cape is the Northern Cape Nature Conservation Act, 2009 (Act No. 9 of 2009). The Northern Cape Nature Conservation Act makes provision for the following key aspects, and related matters:

- The sustainable utilisation of wild animals, aquatic biota and plants;
- The implementation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora;
- Offences and penalties for contravention of the Act;
- The appointment of nature conservators to implement the provisions of the Act; and
- The issuing of permits and other authorisations.

The Act lists a significant number of flora and fauna species as Specially Protected and Protected under Schedule 1 and 2 of the Act, and which restricts the hunting, import/export, transport, keeping, breeding or trading of listed species without a permit, with certain provisions for landowners, hunting seasons, hunting licenses, bag limits, and acceptable hunting methods.

It is noted that many of the known distributions of species listed in the Act do not overlap with the Northern Cape province and as such are considered highly unlikely to occur in the study areas.

6.3. South African Bat Assessment Association Guidance

The South African Bat Assessment Association (SABAA) is a membership based non-government organization (NGO) which lists among its objectives the aim to ensure that any development in South Africa proceeds with the least possible impact on bats, set standards for bat surveys, and provide guidance in relation to bats and development.

Although the SABAA indicates that there is no evidence to suggest that photovoltaic (PV) solar developments constructed at ground level pose a direct fatality impact on bats; there remains a possibility that key habitats could be at risk, and as such, a specialist should conduct a site visit during the appropriate season (SABAA, 2020).

7. Description of the Baseline Conditions

7.1. Regional Vegetation Characteristics

Study area A is located in the Nama-Karoo Biome and according to the regional mapping of South Africa's vegetation types by Mucina and Rutherford (2011), it is characterised by Kalahari Karroid Shrubland (NKb5) (shown in Figure 2). Study area B on the other hand, is characterised by Gordonia Plains Shrubland (SVk16) of the Savanna Biome. Descriptions of these vegetation types, and the Nama-Karoo and Savanna Biomes are presented below:

7.1.1. Biome Context

The Nama-Karoo Biome is extensive and located on the central plateau of the western half of South Africa. It is an arid biome, and apart from the Orange River, most rivers are non-perennial (Mucina & Rutherford, 2011). Vegetation comprises short shrubland, intermixed with grasses, succulents, geophytes and annual forbs (Mucina & Rutherford, 2011). Floristically, this biome is not species rich and contains no centres of plant endemism. Consistent with other arid regions, the Asteraceae, Fabaceae and Poaceae are the dominant flora families (Mucina & Rutherford, 2011). Fire is for the most part, extremely rare as the low and erratic rainfall results in a depauperate and discontinuous fuel load. The arid conditions favour mostly vagile herbivores that are able to migrate large distances in search of suitable grazing (Mucina & Rutherford, 2011).

The Savanna Biome is the largest biome in South Africa, covering approximately 35% of the country's land surface (Scholes and Walker, 1993). Savannas are characterised by a dominant grass layer, over-topped by a discontinuous, yet distinct woody plant component. Primary determinants of savanna composition, structure and functioning are; fire, a distinct seasonal climate, substrate type, and browsing and grazing by large herbivores (Scholes and Walker, 1993). Compositionally, Africa's savannas are distinguished as either fine-leafed savannas or broad-leafed savannas. The distribution of these forms is based primarily on soil fertility (Scholes and Walker, 1993); fine-leafed savannas occur on nutrient rich soils and are dominated by microphyllous woody species of the Fabaceae family (most commonly *Acacia's*). These savannas have a productive and diverse herbaceous layer that is dominated by grasses, and can support large populations of mammalian herbivores (Scholes and Walker, 1993). Conversely, broad-leafed savannas usually occur on nutrient poor soils and are dominated by macrophyllous woody species from the Combretaceae family (common genera: *Combretum* & *Terminalia*). Compared to fine-leafed savannas, broad-leafed savannas are less productive and support a lower herbivore biomass (Scholes and Walker, 1993).

7.1.2. Kalahari Karroid Shrubland

In South Africa, this vegetation community is confined to the North Cape Province, where it occurs in belts alternating with Gordonia Duneveld on the broad plains to the north of Upington (Figure 2). Vegetation is characterised by low karroid shrubland on flat, gravel plains. Flora species comprise both Karoo-related elements, as well as northern floristic elements, and thus indicates a transition from the Karoo to the sandy soils of the Kalahari (Mucina & Rutherford, 2011). The region is particularly dry, with mean annual precipitation (MAP) recorded at 100-200 mm. Rainfall occurs mainly in the late summer and early autumn. Temperatures range from a mean maximum of 39.5^{0}C in January to a mean minimum of -4.2^{0}C in July (Mucina & Rutherford, 2011).

The geology is dominated by Cenozoic Kalahari Group sands and small patches of intermittent rivers (known as 'mekgacha') occurring on calcrete outcrops and screes, and Dwyka Group tillite outcrops. Soils are deep, red-yellow, apedal and free draining (Mucina & Rutherford, 2011).

Mucina & Rutherford (2011) list the following flora species as being important or characteristic taxa in the Kalahari Karroid Shrubland vegetation type:

Small Trees and Shrubs: *Senegalia mellifera, Parkinsonia africana, Boscia foetida, Rhigozum trichotomum, Tapinanthus oleifolius, Hermannia spinosa, Limeum aethiopicum, Phaeoptilum spinosum, Aizoon schellenbergii, Aptosimum albomarginatum, Aptosimum lineare, Aptosimum marlothii, Barleria rigida, Hermannia modesta* and *Phyllanthus maderaspatensis.*

Herbs: *Dicoma capensis, Chamaesyce inaequilatera, Amaranthus praetermissus, Barleria lichtensteiniana, Amaranthus praetermissus, Chascanum garipense, Cleome angustifolia, Cucumis africanus, Geigeria ornativa, Indigastrum argyraeum, Tribulus cristatus* and *Gisekia africana.*

Grasses: *Aristida adscensionis, Enneapogon desvauxii, Stipagrostis obtusa, Aristida congesta, Eragrostis annulata, Eragrostis porosa, Schmidtia kalahariensis, Stipagrostis anomala, Stipagrostis ciliata, Stipagrostis hochstetteriana, Stipagrostis uniplumis, Tragus berteronianus* and *Tragus racemosus.*

7.1.3. Gordonia Plains Shrubland

Gordonia Plains Bushveld mainly occurs across a north-south band to the west of the Langeberg and Korannaberg Mountains, and to the east of the Kalahari duneveld area (Mucina & Rutherford, 2011). This vegetation type is characterised by flat, open grassy plains, with occasional shrubs and trees, such as *Grewia flava, Rhigozum trichotomum, Vachellia haematoxylon* and *Vachellia erioloba.* Like Kalahari Karroid Shrubland, the climate is very dry, with mean annual precipitation between 180 and 280 mm (Mucina & Rutherford, 2011).

Small Trees and Shrubs: *Senegalia mellifera, Grewia flava, Rhigozum trichotomum, Vachellia erioloba, Jatropha erythropoda, Plinthus sericeus and Requienia sphaerosperma.*

Herbs: *Acanthosicyos naudinianus, Cucumis africanus, Dicoma capensis, Harpagophytum procumbens, Heliotropium ciliatum, Hermannia tomentosa, Ipomoea hackeliana* and *Senna italica, Sericorema remotiflora*.

Graminoids*: Aristida meridionalis, Centropodia glauca, Eragrostis lehmanniana, Schmidtia kalahariensis, Brachiaria glomerata, Bulbostylis hispidula, Eragrostis pallens* and *Stipagrostis uniplumis.*

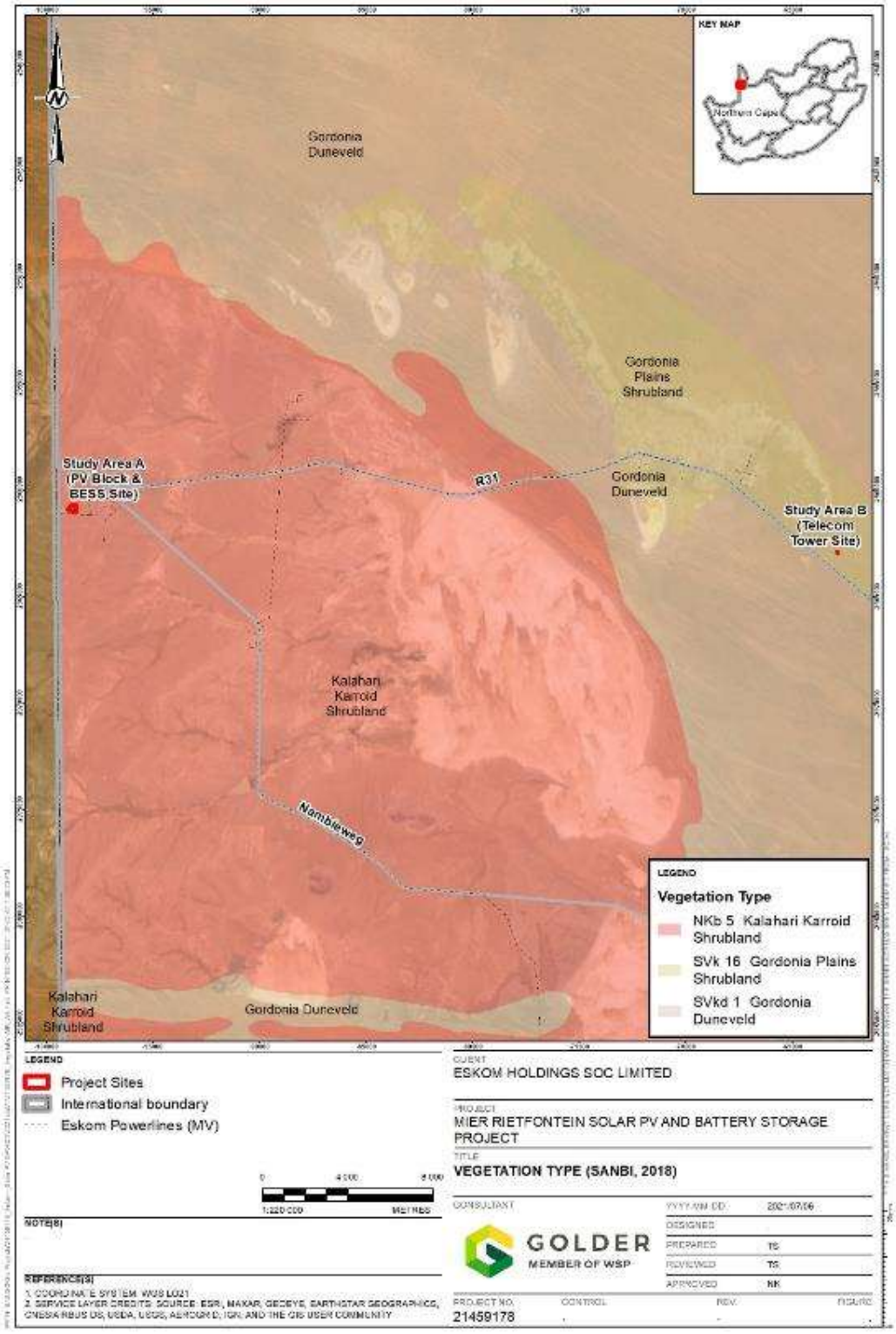

Figure 2: Study areas in relation to the Mucina and Rutherford (2011) regional vegetation types.

7.2. Formal Conservation Context

7.2.1. Nationally Threatened Ecosystems

According to Mucina & Rutherford (2011), across their ranges only a small proportion of Kalahari Karroid Shrubland and Gordonia Plains Shrubland have been transformed. These authors note however, that very little of Kalahari Karroid Shrubland has been formally conserved, with Augrabies Falls National Park the only conservation area in which this vegetation type is formally protected. They also note that the placement of roads through areas of Kalahari Karroid Shrubland has led to the introduction and subsequent spread of alien flora, most notably *Prosopis* species (Mucina & Rutherford, 2011). Gordonia Plains Shrubland is under statutory protection in Kgalagadi Transfrontier Park. Both Kalahari Karroid Shrubland and Gordonia Plains Shrubland are considered 'Least Threatened' on the national list of threatened ecosystems (NEMBA Threatened Ecosystems, 2018) – refer to Figure 3.

7.2.2. Northern Cape Critical Biodiversity Areas

According to the Northern Cape Critical Biodiversity Areas (2018), at a provincial level both study areas and most of the surrounding landscapes are categorised as 'Other Natural Areas' – the lowest priority category for non-transformed land (Figure 4).

It is noted that a portion of land between the two study areas is classified as Critical Biodiversity Area One (CBA 1) and CBA 2 – shown in Figure 4. This land is associated with a large drainage and pan system.

7.2.3. Protected Areas

Study area A and B are located about 70 km and 40 km south-west of the southern boundary of the Kgalagadi Transfrontier Park (KTP), respectively. The KTP is an extensive protected area, comprising the Kalahari Gemsbok National Park in South Africa and the Gemsbok National Park in Botswana (SAPAD, 2021). The reserve is a popular tourism destination and home to an intact wildlife assemblage, including several large predators (e.g., Lion *Panthera leo*) and ungulates.

Kalahari Gemsbok National Park is also a globally recognised important bird area (IBA), with the following globally threatened trigger species; White-backed Vulture (*Gyps africanus*), Lappet-faced Vulture (*Torgos tracheliotos*), White-headed Vulture (*Aegypius occipitalis*), Secretary bird (*Sagittarius serpentarius*), Martial Eagle (*Polemaetus bellicosus*), Kori Bustard (*Ardeotis kori*), Ludwig's Bustard (*Neotis ludwigii*) and the Lanner Falcon (*Falco biarmicus*) (Marnewick, *et al*., 2015).

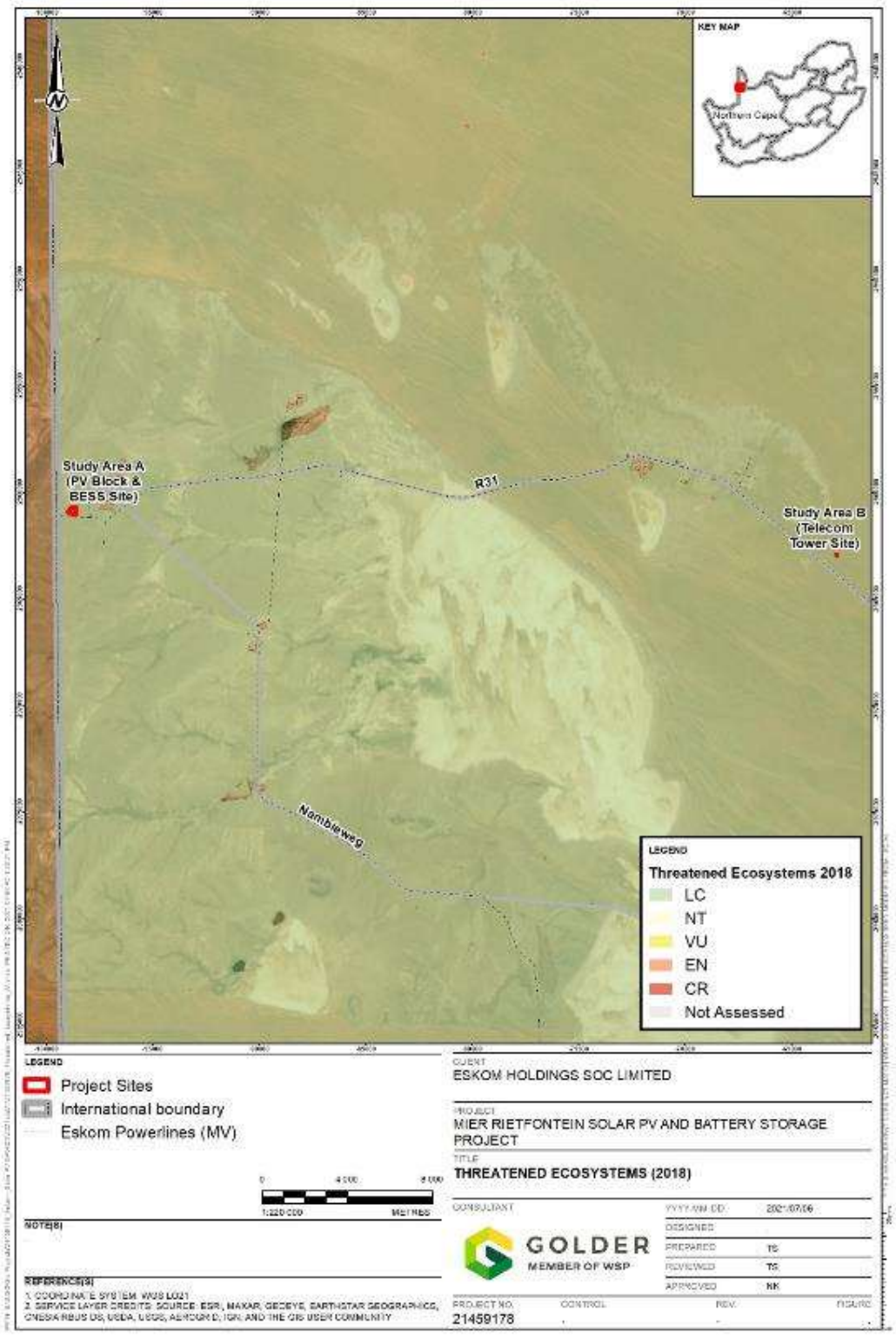

Figure 3: Study areas and the delineation of nationally threatened ecosystems.

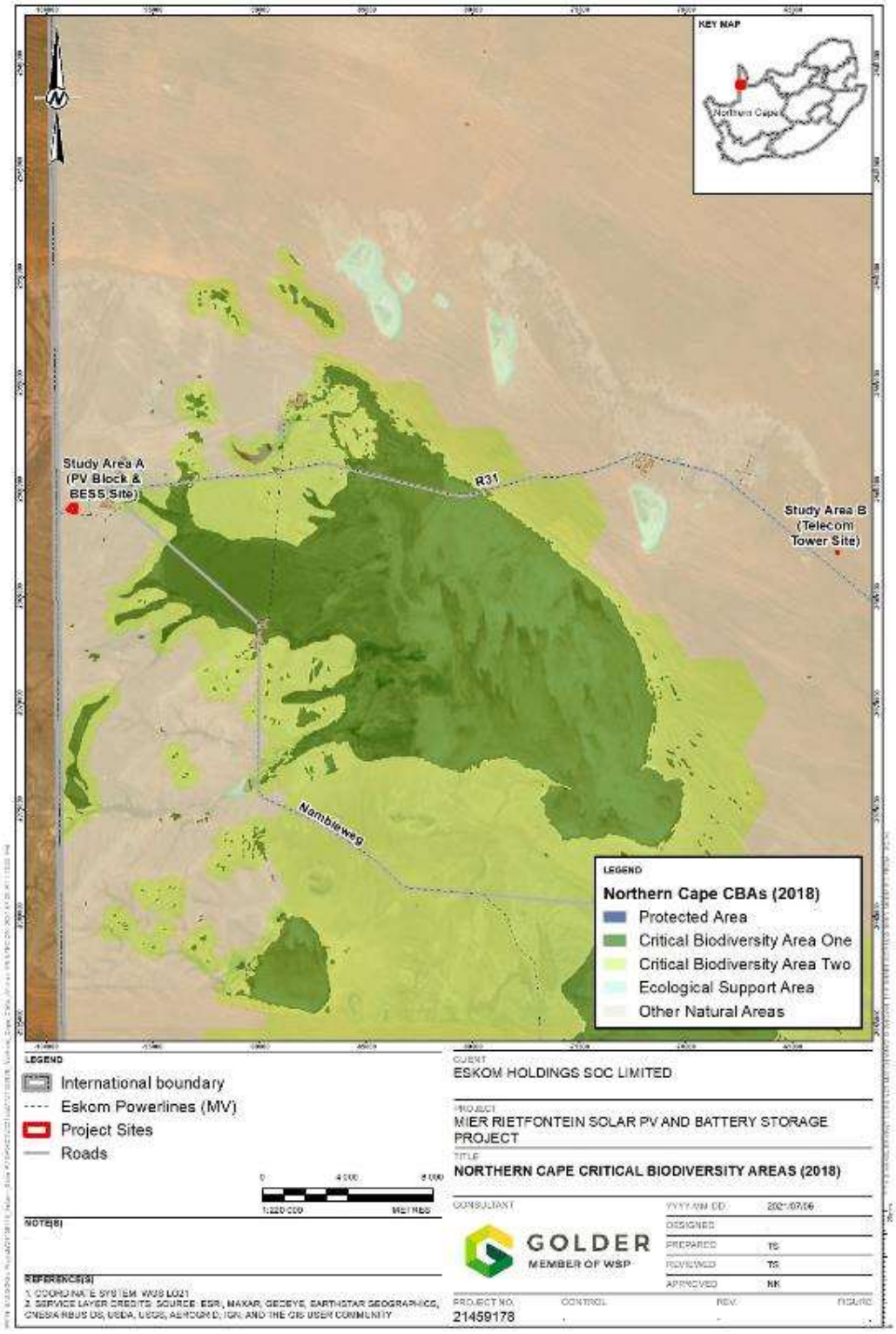

Figure 4: Study areas in the context of the Northern Cape's Critical Biodiversity Areas (2018).

7.3. Landscape Context and Existing Impacts

The following notes summarise the key features and character of the broader landscape surrounding study area A and study area B:

Study Area A

- Study area A and most of the immediate surrounding landscape comprises open, natural habitat that is typical of the region. According to the 2018 national land cover classification dataset (GTI, 2018), this study area and surrounding land is dominated by 'barren land' – shown in Figure 5**Error! Reference source not found.**.
- Outside of nearby developed areas, there are limited overt disturbances to natural habitat. Certain drainage areas are colonised by the alien and invasive taxa, such as *Prosopis* tree species;
- Rietfontein village and its outlying urban residences and the Rietfontein border post are the closest developed areas to this site. The R31 arterial road, linking the village to the border post, runs along the north-western boundary of this study area. A livestock-fence runs parallel to the R31 on both sides of the road;
- Prominent seasonal/ephemeral drainage channels are located 257 m to the north-east (shown in Figure 6) and to the south of study area A. These drain in a south-easterly direction across the landscape and are intersected by several smaller drainage lines. Small farm dams are located on each of the main drainage features downstream of this study area. At the time of the field visit, these were carrying water (Figure 7);
- The topography of study area A is a gentle slope toward the east and the main drainage system. A series of low hills is located to the west of this study area (mainly in Namibia); and
- The prevailing land use of natural habitat in the landscape is livestock grazing, with both cattle and goats observed in the surrounding landscape during the field visit (Figure 8).

Study Area B

- Aerial imagery and site photographs indicate that study area B is located in a large area of open, natural habitat with little sign of habitat disturbance or transformation. The prevailing land cover, according to the GTI (2018) dataset, is 'shrubland' (Figure 5);
- The topography of the site, as well as the surrounding landscape, is generally flat, with only minor undulations at the landscape scale;
- Anthropogenic features in close proximity to the site include the tarred R31 arterial road, which is bounded on both sides by livestock fences. There is also a municipal water reservoir which is located adjacent to the R31, to the south-west of the study area;
- The village of Groot Mier is located approximately 5 km north-west of the site. Groot Mier is the nearest noteworthy human settlement and comprises a few scattered houses; and
- The prevailing land use is livestock (cattle and sheep) farming (Pers. Comm. A.J. Willemse) (Figure 9).

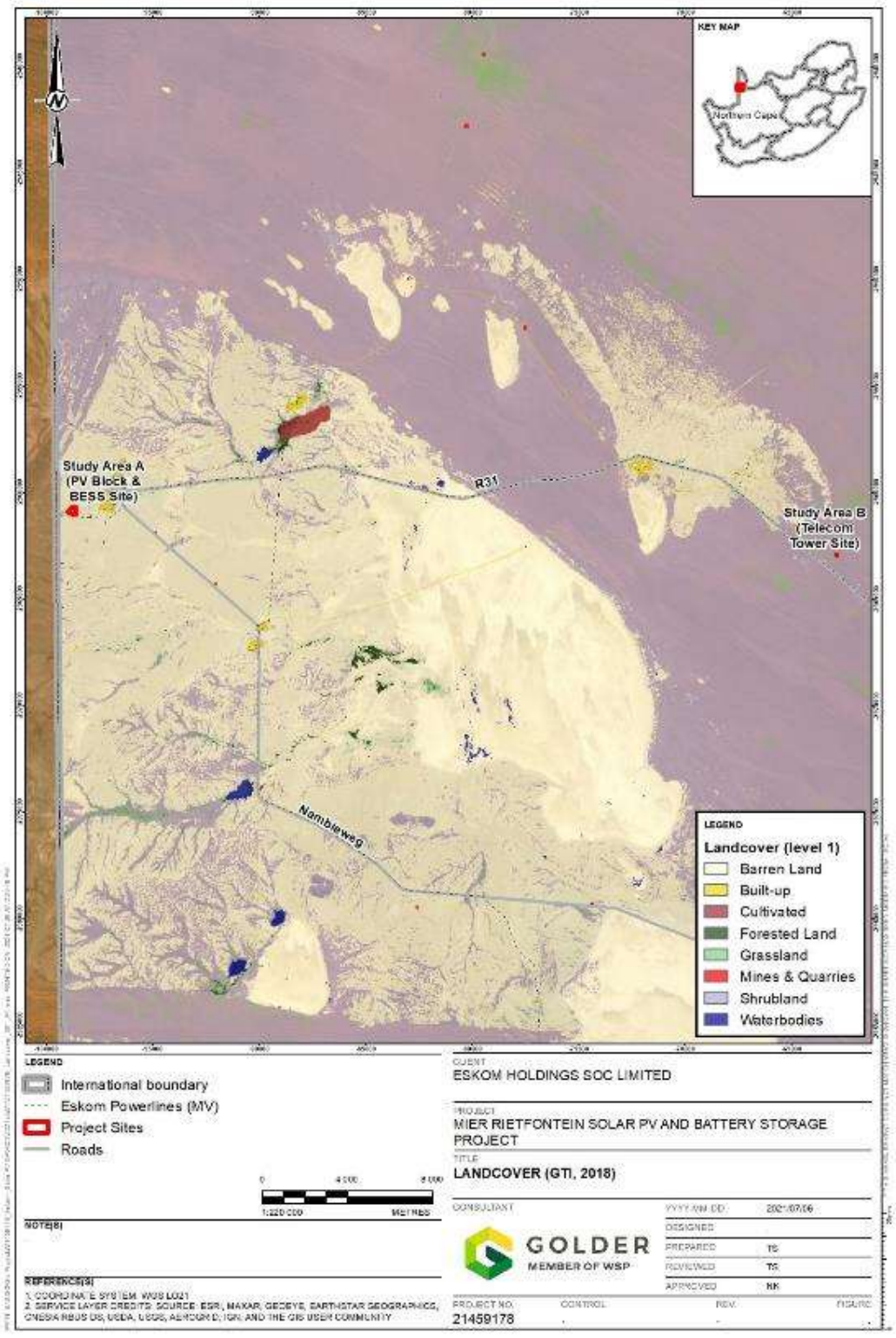

Figure 5: Land cover of the study areas and surrounding landscape.

Figure 6: Drainage channel to the to the north of study area A.

Figure 7: Farm dam located along the drainage channel, downstream (south-east) of study area A.

Figure 8: Cattle observed grazing in sandy grassland to the south-east of study area A.

Figure 9: Cattle and sheep farm on which study area B is located.

7.4. Vegetation Communities and Floristics

The vegetation of study area A is fairly homogenous, with two vegetation communities identified, namely *Rhigozum trichotomum* – *Stipagrostis* Shrubland and Ephemeral Drainage Line Vegetation. A description of each community, along with representative photographs is presented in Section 7.4.1 and Section 7.4.2, with a vegetation map of study area A shown in Figure 10.

General comment, based on aerial imagery and site photographs, of the habitat characteristics of the study area B landscape, is provided in Section 7.4.3.

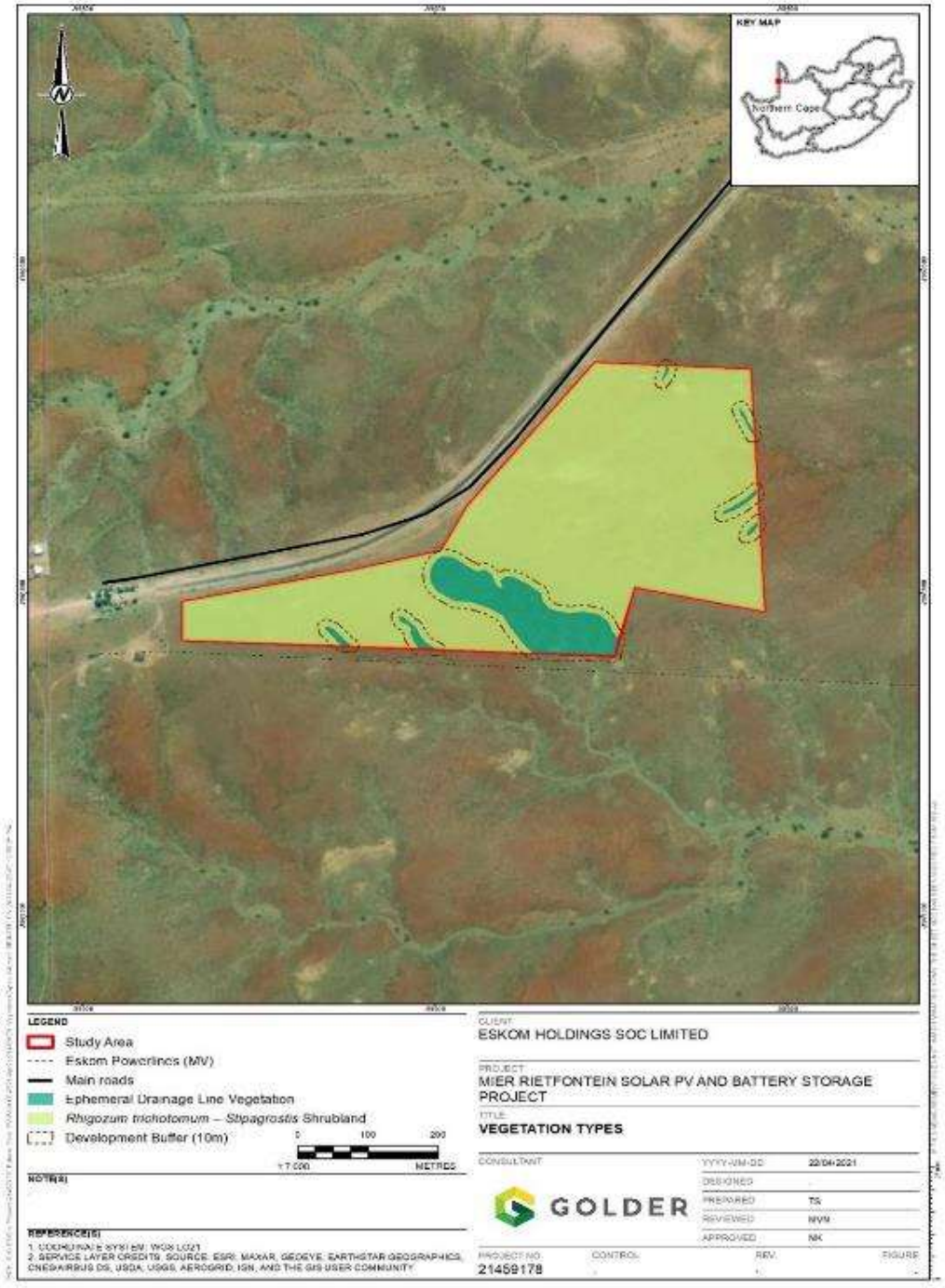

Figure 10: Vegetation map of study area A.

7.4.1. *Rhigozum trichotomum – Stipagrostis* Shrubland

Rhigozum trichotomum – Stipagrostis Shrubland is the dominant vegetation community in study area A, covering approximately 17.3 ha, or 90.1 % of the site. The soil surface is very rocky and gravelly. As per Edwards (1983) structural classification, vegetation structure across the site is short open- to sparse shrubland, comprising of both woody and herbaceous vegetation (Figure 11).

In terms of composition, woody vegetation is dominated by the short (<1m), spiny shrub *Rhigozum trichotomum,* which generally grow as scattered individual plants, although a few, small and closely-spaced aggregations were also noted. Other common woody species include *Phaeoptilum spinosum* and *Polygala leptophylla subsp. armata.* Although not abundant, larger (<2 m) woody species recorded in the community include *Commiphora glandulosa* and *Parkinsonia africana*.

The herbaceous layer is grass dominated, with *Stipagrostis* species - most notably *Stipagrostis hirtigluma* and *Stipagrostis uniplumis*, and *Enneapogon desvauxii* the most dominant taxa. The prevalence of the latter species suggests this study area has been subject to overgrazing by livestock. Other commonly observed grass species include *Aristida adscensionis, Aristida congesta* subsp. *congesta* and *Schmidtia kalahariensis*. Other frequently recorded species in this vegetation community include a variety of dwarf shrubs including *inter alia*, *Aptosimum spinescens, Geigeria ornativa, Roepera pubescens* and *Tatraena microcarpa*, as well as creepers such as *Tribulus cristatus*. Refer to Appendix B for a list of all flora species recorded in this community.

Small, localised areas denuded of vegetation were noted. These possibly indicate of some form of historic anthropogenic disturbance (Figure 12). Be that as it may, overall, this community remains in stable condition, and the ecological integrity is rated high. The provincially protected *Commiphora glandulosa* was noted in this community. *Rhigozum trichotomum – Stipagrostis* Shrubland is a uniform community and is well-represented across the area. Accordingly, the conservation importance of this vegetation community is rated moderate.

Figure 11: Typical Rhigozum trichotomum – Stipagrostis Shrubland vegetation, which dominates most of study area A.

Figure 12: Area of Rhigozum trichotomum – Stipagrostis Shrubland with low grass cover, possibly the result of historic disturbance.

7.4.2. Ephemeral Drainage Line Vegetation

This vegetation community is associated with the small dry drainage features that are present along the periphery and across the centre of study area A (Figure 10). These areas are characterised by either very shallow linear depressions (Figure 13) or fairly well-defined drainage channels (Figure 14). They are likely to carry water only after sporadic heavy rainfall events. In comparison to the adjacent rocky surfaces, the soil surface in drainage lines comprises a mixture of sand and rocks. Collectively, the ephemeral drainage line community comprises 1.9 ha (9.9%) of study area A.

Both structurally and compositionally, vegetation in this community is similar to *Rhigozum trichotomum – Stipagrostis* Shrubland community. Vegetation structure is generally short open- to sparse shrubland, although in certain areas grass productivity was notably higher than adjacent areas of shrubland. Compositionally, *Rhigozum trichotomum* and *Stipagrostis* grasses remain common and often dominant taxa. Other flora species that were more prevalent in ephemeral drainage line habitat than the adjacent *Rhigozum trichotomum – Stipagrostis* Shrublands, include occasional *Ziziphus mucronata* trees, as well as the smaller woody species such as *Catophractes alexandri, Cryptolepis decidua, Hermannia burchellii* and *Justicia australis,* and grasses such as *Aristida congesta subsp. congesta* and *Eragrostis trichophora*. Refer to Appendix B for a list of all flora species recorded in this community.

This community remains in stable condition, and the ecological integrity is rated high. In an arid region such as that where this study area is located, drainage features are functionally very important. Not only do they play an important hydrological role, but they also *inter alia*, increase broader landscape heterogeneity and provide movement and dispersal corridors for fauna. These communities are also susceptible to alien invasive species establishment and colonisation. Accordingly, the conservation importance of this vegetation community is rated high.

Figure 13: Shallow poorly-defined drainage line in study area A.

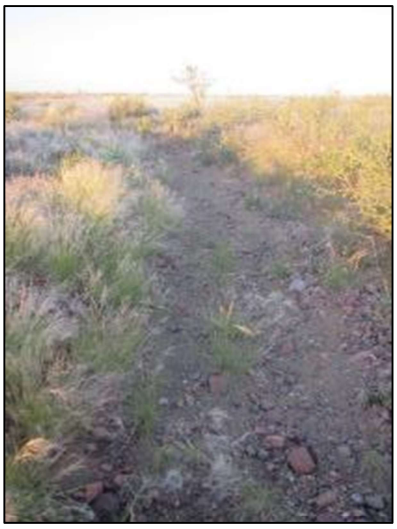

Figure 14: Well-defined drainage line.

7.4.3. Habitat Characteristics of the Study Area B Landscape

Based on imagery and site photographs collected by farmer Mr A.J. Willemse, the vegetation of the study area B landscape is characterised by very open, arid shrubland occurring on red Kalahari sands that is typical of the Gordonia Plains Shrubland vegetation type, as described by Mucina and Rutherford (2011)

Vegetation is homogenous across the immediate landscape, with little structural variation. Woody plants are generally short and occur as scattered individual plants, although isolated taller trees are also present. Refer to Figure 15 and Figure 16 for landscape photographs, as well Figure 17 for an aerial image depicting the uniform, sparse vegetation cover.

Common woody species that are noted to occur in the area include, *inter alia*; *Boscia albitrunca*, *Rhigozum trichotomum, Senegalia mellifera* and *Vachellia erioloba* (*Pers. Comm.* A.J. Willemse). The grass layer was unusually well-developed, following the high seasonal rains (*Pers. Comm.* A.J. Willemse).

Figure 15: Habitat in the study area B landscape.

Figure 16: Open, arid savanna with woody vegetation comprised of low, scattered shrubs/trees.

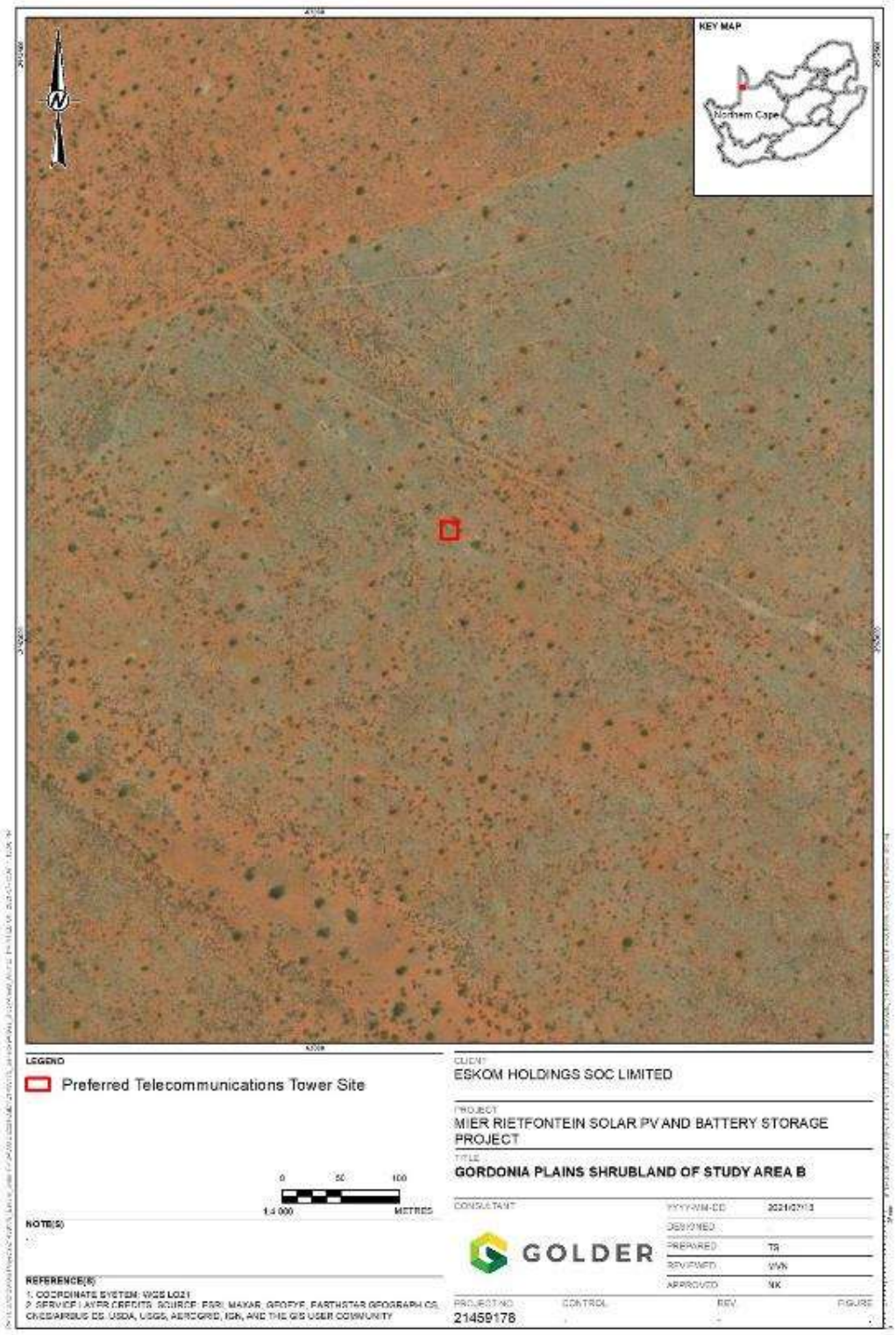

Figure 17: Aerial image showing the uniform sparse vegetation cover of typical Gordonia Plains Shrubland that is associated with the proposed Telecom Tower Site

7.4.4. Floristic Analysis

Forty-four flora species, representing 18 families were identified in study area A during the field visit. The most represented family is the Poaceae with 13 species, followed by the Fabaceae with four species. Grasses and dwarf shrubs are the most abundant growth form with 13 species recorded for each. The next most represented growth form are trees and creepers, with four species each. Two succulents, one herb and one geophyte were recorded (Appendix B).

7.4.4.1.Flora Species of Conservation Concern

None of the flora species recorded in study area A during the field visit are listed on the national Red List. Two recorded species, namely *Commiphora glandulosa* and *Hoodia gordonii* are however, listed as protected at a provincial and/or national level:

- *Commiphora glandulosa* is listed, along with all *Commiphora* species, as protected at a provincial level according to the Northern Cape Nature Conservation Act (2009). Small specimens were observed in study area A.
- *Hoodia gordonii* is listed as a nationally protected species, according to the NEMBA ToPS (2007) list. It is also listed as specially protected at a provincial level, under the Northern Cape Nature Conservation Act (2009). Although not recorded in study area A itself, a single *Hoodia gordonii* was recorded immediately adjacent to this study area. Several specimens of an unidentified geophyte (no flowering material) were also observed during the field visit. These are also likely to be listed as protected on the Northern Cape Nature Conservation Act (2009).

A review and cross-referencing of flora species documented on the BODATSA database for the broader region encompassing both study area indicates that an additional ten flora species of conservation concern are potentially present. These include three nationally protected trees (*Boscia albitrunca, Vachellia erioloba* and *Vachellia haematoxylon*), and seven provincially protected and one specially protected flora species (Table 4). None of these are listed as threatened or near threatened on the national Red List.

Based on documented habitat preferences, a probability of occurrence in the two study areas is indicated. In instance where there is very limited species-specific habitat information, a precautionary approach is followed, and a species is assigned ‘possible’ probability of occurrence.

Table 4: Flora species listed as nationally and/or provincially Protected or Specially Protected that may occur in the study areas.

Family	Scientific Name	Northern Cape Status (2009)	Protected Tree Species (National Forest Act 1998)	Probability of Occurrence
Aizoaceae	*Aizoon schellenbergii*	Protected		Possible
Apiaceae	*Deverra denudata subsp. aphylla*	Protected		Unlikely: Dwarf shrub species, occurs widely in Northern Cape. Favours sandy to clayey soils in dry river beds.
Amaryllidaceae	*Nerine laticoma*	Protected		Possible – Study Area B: Geophyte, growing in large colonies on deep, red sandy soils.
Capparaceae	*Boscia albitrunca*	Protected	Protected	Possible – Study Area A and B: Tree species, occurs widely throughout southern Africa. Favours deep sandy to loamy soils. Recorded in sandy habitat to the south-east of the study area A during the field visit.
Capparaceae	*Boscia foetida subsp. foetida*	Protected		Possible – Study Area A. Shrub or small tree species, found in arid areas where it favours rocky ridges and calcrete outcrops.
Fabaceae	*Lessertia macrostachya var. macrostachya*	Specially Protected		Possible – Study Area B: Herb, favours sandy, red soils in the Northern Cape.
Fabaceae	*Vachellia erioloba*		Protected	Possible – Study Area B: Single stem, large tree. Occurs in deep sandy soils in open savanna or alluvial soils in dry river beds.
Fabaceae	*Vachellia haematoxylon*		Protected	Probable – Study Area B: Shrub to medium-sized tree. Found on deep Kalahari sands, on dunes and sand flats between dunes.
Iridaceae	*Lapeirousia silenoides*	Protected		Possible
Scrophulariaceae	*Jamesbrittenia canescens var. canescens*	Protected		Possible

7.4.4.2. Declared Alien Invasive Species

No declared alien invasive species were recorded in study area A during the field visit. However, *Prosopis* trees were abundant in and around Rietfontein village, and were also observed at fairly high densities along the drainage features, downstream of this study area. *Prosopis* species (e.g., *P. glandulosa* and *P. velutina*) are large shrubs or small trees that are declared Category 3 invasive species in the Northern Cape, according to the NEMBA. *Prosopis* taxa readily hybridises with each other where they are sympatric. They invade river channels and drainage lines where they can form dense thickets.

7.4.4.3. Medicinal Flora Species

Two species recorded in/adjacent to study area A have medicinal value:

- The succulent *Hoodia gordonii*, which was not recorded in study area A, but was recorded immediately adjacent to it, is used to treat haemorrhoids, tuberculosis, diabetes, indigestion, hypertension and stomach ache (Van Wyk, *et al*., 2009); and
- The tree *Ziziphus mucronata* is used as an expectorant in cough and chest problems. It is also used to treat, amongst other ailments diarrhoea, dysentery, boils, sores and glandular swellings (Van Wyk, *et al*., 2009).

7.5. Fauna Communities

7.5.1. Mammals

7.5.1.1. Mammals Potentially Present in the Study Area

Based on historic distribution ranges presented in Stuart and Stuart (2007), up to 67 additional mammal species (excluding bats) are known from the region (Appendix C). Several of these are large predators and ungulates that despite their historic ranges, are likely to be mainly confined to formal conservation areas, such as the Kalagadi Transfrontier Park, which is situated to the north of the study areas.

7.5.1.2. Mammals Recorded in the Study Area

Three mammal species were noted to occur in and/or adjacent to study area A during the field visit; Cape or Scrub Hare (*Lepus capensis/saxatilis*)[4] and Ground Squirrel (*Xerus inauris*) were recorded on camera traps placed on the boundary of the study area -shown in Figure 18 and Figure 19, while evidence of a Aardvark (*Orycteropus afer*) burrow (Figure 20) was observed close to the farm dam to the south-east of study area A during the field visit.

All three species are fairly common taxa, with widespread distributions and none are listed as threatened or near threatened on the mammal Red List. However, at a provincial level, both Hare species and the Ground squirrel are listed as 'protected', while the Aardvark is listed as specially protected, according to the Northern Cape Nature Conservation Act (2009).

Despite the availability of suitable habitat in study area A and across the surrounding landscape, the low mammal abundance and richness recorded during the field visit is not unexpected. The arid nature of local habitat means that general mammal abundance is low. Moreover, the proximity of Rietfontein village and its likely attendant anthropogenic pressures, such as hunting with/by

[4] Camera trap images are not clear enough to positively determine which of these similar and sympatric species is present.

domestic and feral dogs, may also limit the extent to which mammals (such as small antelope), use habitat between the village and border post.

Considering its remote and relatively undisturbed location, and the probable lower levels of anthropogenic pressures, is anticipated that the mammal community associated with the study area B landscape is likely to be more abundant and richer than that of study area A.

Figure 18: Cape or Scrub Hare (Lepus capensis/saxatilis).

Figure 19: Ground Squirrel (Xerus inauris).

Figure 20: Aardvark (Orycteropus afer) burrow recorded in sandy habitat to the south-east of study area A.

7.5.1.3.Mammals of Conservation Concern

Of species potentially occurring in the study areas, ten are listed as threatened or near threatened on the national Red List and 11 are listed on the NEMBA ToPS list (2007) – refer to Table 5. Fifty-eight species are further listed as either 'specially protected' or 'protected' according to the Northern Cape Nature Conservation Act (2009) (Appendix C).

Table 5: Nationally threatened and/or protected mammal species (excluding bats) potentially occurring in the study areas.

Family	Scientific Name	Common Name	Red List – Regional Status (2016)	NEMBA ToPS List (2007)	Northern Cape Status (2009)	Probability of Occurrence
Canidae	*Vulpes chama*	Cape Fox	Least Concern	Protected	Specially Protected	Probable - Study Area A and B: suitable habitat present and may periodically use or move through the study areas.
Erinaceidae	*Atelerix frontalis*	South African Hedgehog	Near Threatened	Protected	Specially Protected	Possible: Suitable habitat present.
Felidae	*Acinonyx jubatus*	Cheetah	Vulnerable	Vulnerable	Specially Protected	Unlikely: Large predator, requiring a large prey base and large territory to meet its lifecycle requirements.
Felidae	*Felis nigripes*	Black-footed Cat	Vulnerable	Protected	Specially Protected	Probable - Study Area A and B: Suitable habitat present and may periodically use or move through the study area. A dead individual was observed on the R31 to the east of Rietfontein.
Felidae	*Panthera leo*	Lion	Least Concern	Vulnerable	Specially Protected	Unlikely: Large predator, Restricted to formal conservation areas.
Felidae	*Panthera pardus*	Leopard	Vulnerable	Vulnerable	Specially Protected	Unlikely: Large predator, requiring a large prey base.
Hyaenidae	*Crocuta crocuta*	Spotted Hyaena	Near Threatened	Protected	Specially Protected	Unlikely: Large predator, requiring a large prey base. Mostly restricted to formal conservation areas.
Hyaenidae	*Parahyaena brunnea*	Brown Hyaena	Near Threatened	Protected	Specially Protected	Possible - Study Area A and B: Suitable habitat present and may

						periodically move through these study areas.
Manidae	*Smutsia temminckii*	Temminck's Ground Pangolin	Vulnerable	Vulnerable	Specially Protected	Possible – Study Area A and B: Suitable habitat present, but this is a very rare species.
Muridae	*Parotomys littledalei*	Littledale's Whistling Rat	Near Threatened		Protected	Possible – Study Area A and B: Suitable habitat present.
Mustelidae	*Mellivora capensis*	Honey Badger	Least Concern	Protected	Specially Protected	Probable -- Study Area A and B: Suitable habitat present, and may periodically use or move through the study areas.
Mustelidae	*Poecilogale albinucha*	African Striped Weasel	Near Threatened		Specially Protected	Probable – Study Area A and B: Suitable habitat present, and may periodically use or move through the study areas.
Source: Based on the distribution presented in Stuart and Stuart (2007).						

7.5.2. Bats

7.5.2.1. Bats Species Potentially Present in the Study Area

Based on the desktop review of available data, 13 bat species have distributions within the region; however suitable roosting and/or foraging conditions for all of these species may or may not be present within study area A. An assessment of likelihood of occurrence of each species, based on the habitat assessment conducted during the field visit, is presented in Table 6.

Table 6: Bat species distributed in the region and likelihood of roosting/foraging in the study areas.

Scientific Name	Common Name	Red List – Regional Status (2016)	Probability of Occurrence
Charaephon nigeriae	Nigerian free-tailed bat	-	Unlikely – typically associated with woodlands, particularly those that are *Brachystegia* dominated or associated with permanent water.
Cistugo seabrae	Angolan wing-gland bat	Near Threatened	Possible – it typically is found in riverine vegetation in desert/semi desert conditions, and is suspected to occasionally roost in buildings, having been collected in a church in Berseba, Namibia.
Eptesicus hottentottus	Long-tailed serotine	Least Concern	Possible – although it roosts in crevices associated with rocky outcrops, it is linked to miombo woodland in gorges and granitic hills.
Laephotis namibensis	Namibian long-eared bat	Vulnerable	Possible – poorly known species considered endemic to South Africa and Namibia. It uses narrow crevices in vertical rock faces for roosting purposes, and is associated with arid desert and fynbos, however it has only been captured near water.
Miniopterus natalensis	Natal long-fingered bat	Least Concern	Unlikely – obligate cave rooster and closely associated with savannas and grasslands
Neoromicia capensis	Cape serotine	Least Concern	Probable – has been previously recorded in the region, can roost singly or in small groups under the bark of trees, and forages in a wide range of habitats, including arid semi-desert.
Nycteris grandis	Large slit-faced bat	-	Unlikely - prefers rainforest and savanna near riparian forest and woodland.
Nycteris thebaica	Egyptian slit-faced bat	Least Concern	Probable – has been recorded throughout the northern extent of the Northern Cape, and is known to roost in culverts, occurring throughout savanna and karoo biomes. Forages by flying low above the ground gleaning prey from the surfaces of shrubs.

Pipistrellus rupellii	Rüppell's pipistrelle	Least Concern	Unlikely – although an isolated record at Augrabies Falls exists, it is believed to be associated with large rivers and wetland in dry savanna or woodland habitat.
Rhinolophus darlingii	Darling's horseshoe bat	Least Concern	Probable – it has been recorded on the Namibia/South African border approx. 400 km south of the site, roosts in small groups in culverts (as well as colonies in caves) and is known to occur in arid savanna.
Rhinolophus denti	Dent's horseshoe bat	Near Threatened	Probable – it has been recorded in the northern extent of the Northern Cape, roosts in crevices in rocky outcrops and is known to roost in culverts and thatched buildings, and is associated with arid habitats.
Sauromys petrophilus	Robert's flat-headed bat	Least Concern	Possible – roosts in narrow crevices and is closely associated with rocky habitats, usually in arid scrub, dry woodland or fynbos.
Tadarida aegyptiaca	Egyptian free-tailed bat	Least Concern	Possible – roosts in caves, crevices; forages high over vegetation canopy, including in desert areas and semi-arid scrub.
Source: Distribution based on Monadjem, *et al*. (2010)			

7.5.2.2. Bats Species Potentially Present in the Study Area

Just three bat call trigger events were detected during three nights of monitoring, which represents a very low level of bat activity in study area A. One of these was identified as a probable Cape Serotine (*Neoromicia capensis*) call (Figure 21), with the other two being unidentifiable from the sonograms.

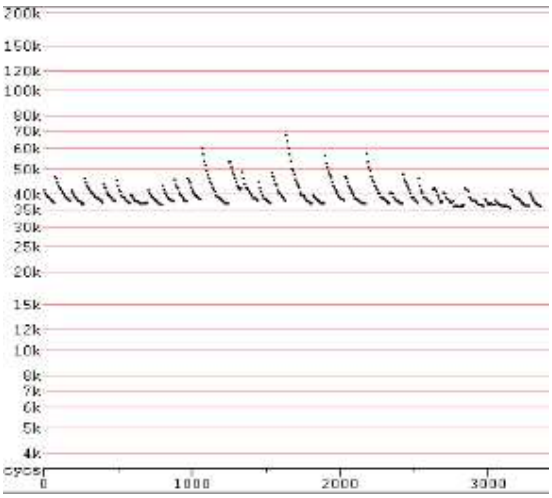

Figure 21: Sonogram depicting classic 'hockey stick' shape of vesper bat call.

No bat calls were recorded during the manual activity survey on 12 April 2021; however, a single bat was observed flying very low to the ground, fluttering between shrubs near a drainage line in the southern extent of study area A, at approximately 1 m height. Based on the observed foraging behaviour, and the fact that no echolocation calls were picked up by the detector, it is considered highly probable that this species is Egyptian slit-faced bat (*Nycteris thebaica*), which has very quiet calls (the Nycterid family are known as 'whispering bats'), and forages in this manner (Monadjem *et al.*, 2010).

7.5.2.3.Bat Roosting Potential

A few stunted trees typical of arid conditions occur within study area A; none of these were found to have any roosting bats at the time of survey, nor were they considered likely to support roosting bats. The proposed development site is therefore considered to be of limited importance for roosting bats. Several culverts pass beneath the road adjacent to the eastern extent of this study area. These were searched for evidence of roosting bats; however, no evidence of bat presence was observed. A rocky ridge lies approximately 1.5 km to the northwest of the study area, which has good potential to support crevice-roosting bats locally. Nearby buildings such as those at the border post, and Kalahari accommodation centre may also support some roosting bat species.

7.5.2.4.Bat activity patterns in habitats within the study area

Insufficient levels of activity were detected by the passive monitors to make any inferences about habitat-linked bat activity patterns within study area A. The arid-shrub vegetation is likely to be a seasonally-important foraging resource for a low number of individual bats in the locality, with vegetation associated with drainage lines forming a potential foraging/commuting habitat for bats traversing the landscape. The main water source for bats in study area A is the dam to the east of the site; this is likely to dry up during the winter and the importance of the adjoining habitats in the locality for foraging bats are expected to decrease accordingly.

7.5.2.5.Sensitivity of Bat Habitat to Development

The sensitivity of the arid shrubland to development in the context of available bat habitat is considered moderate, since although it provides foraging habitat for bats, it is availed of by a very low number of bats, on a seasonal basis. The loss of approximately 10 ha of this habitat to the proposed development is considered minimal in the context of the vast expanse of similar habitat in the region, and is not expected to affect foraging or roosting bats detrimentally.

The sensitivity of the drainage line vegetation to development is considered high. Increased vegetation density in this habitat feature, plus the occasional presence of water, enhance its support of flying invertebrate species on which the bat species that occur in this region forage compared to other habitats in study area A, as well as providing a preferred commuting route for echolocating bats moving from roosting to foraging areas

7.5.2.6.Bat Species of Conservation Concern

Both bat species recorded during the survey (Cape serotine and Egyptian slit-faced bat) are of Least Concern in terms of conservation status.

Of those considered most likely to be present, one species of conservation importance, Dent's horseshoe bat (*Rhinolophus denti* – Near Threatened) may occur. It has been recorded in the northern extent of the Northern Cape, roosts in crevices in rocky outcrops as well as thatched

buildings and culverts, and is associated with arid habitats (Monadjem *et al*., 2010). There is a potential for this species to roost in the rocky outcrop 1.5 km to the northwest of study area A, the culverts beneath the road adjacent to this study area, and the thatched roofs of nearby buildings (e.g., the Kalahari information centre); and the species could use the study area for foraging purposes.

7.5.3. Herpetofauna (Reptiles and Amphibians)

7.5.3.1.Reptiles recorded and Potentially Present in the Study Area

Based on the reptile distribution maps presented in Bates *et al*., (2014) and ReptileMAP records for the relevant QDS, at least 55 additional reptile species occur in the region and thus potentially occur in the study areas (Appendix D). Of these, two are specially protected and 13 are listed as protected in the Northern Cape – presented in Appendix D. None are listed as nationally threatened or protected.

Three reptile species were recorded in study area A during the field visit. These are the Anchieta's Agama (*Agama anchietae*), Plain Sand Lizard (*Pedioplanis inornata*) and Namaqua Sand Lizard (*Pedioplanis namaquensis*). In terms of the Northern Cape Nature Conservation Act (2009), both the Plain Sand Lizard and Namaqua Sand Lizard are protected in the province (all species from the Family Lacertidae are protected).

7.5.3.2.Amphibians Potentially Present in the Study Area

No amphibians were recorded in study area A during the field visit. This notwithstanding, based on published distribution maps, 12 species are known from the broader region (Appendix D). All of these are either protected, or in the case of the Giant Bullfrog (*Pyxicephalus adspersus*), specially protected, according to the Northern Cape Nature Conservation Act (2009).

The Giant Bullfrog is further listed as protected at a national level, in terms of the NEMBA ToPS list (2007). Giant Bullfrog inhabit seasonal, shallow pans, as well as sandy dams and waterholes (Minter *et al.*, 2004). These habitats are not present in either study area and therefore it is unlikely that this species is present.

7.5.4. Invertebrates

According to historic distribution maps, two baboon spider species (Family Theraphosidae) (Dippenaar-Schoeman, 2014); two rock scorpions (Genus *Hadogenes*) and three burrowing scorpions (Genus *Opistophthalmus*) (Leeming, 2003) have ranges that extend into the far northern Cape, and thus may occur in the study area – listed in Table 7. At a provincial level, taxa from these groups are considered either 'specially protected' or 'protected', according to the Northern Cape Nature Conservation Act (2009). No evidence indicating the presence of these taxa was observed in study area A. However, it is possible that some of these taxa are present in both study areas.

Table 7: Baboon spiders, burrowing scorpions and rock scorpions potentially occurring in the study area.

Family	Species Name	Northern Cape Status (2009)
Ischnuridae	*Hadogenes tityrus*	Protected
Ischnuridae	*Hadogenes phyllodes*	Protected
Scorpionidae	*Opistophthalmus carinatus*	Protected
Scorpionidae	*Opistophthalmus wahlbergii*	Protected
Scorpionidae	*Opistophthalmus opinatus*	Protected

Theraphosidae	*Ceratogyrus darlingi*	Specially protected
Theraphosidae	*Harpactira namaquensis*	Specially protected

7.6. Key Ecological Processes

7.6.1. Habitat Linkages and Corridors

Outside of the towns of Rietfontein and Groot Mier, the broader landscapes surrounding both study area A and study area B comprise fairly homogenous natural vegetation, with limited fragmentation caused by direct habitat modification/transformation. These landscapes are however, fragmented by livestock-fences, which may limit the movement of some larger fauna taxa. This notwithstanding, it is anticipated that smaller and/or more vagile fauna taxa will be able to move across these barriers.

Several dry drainage features traverse the landscape surrounding study area A. These ultimately flow into a large pan located about 14.5 km south-east of the study area. These drainage features will provide important movement and dispersal corridors for a fauna, and increase overall habitat heterogeneity. Aerial imagery suggests that there are no prominent drainage features in the landscape surrounding study area B.

Overall, despite the presence of livestock fences and both gravel and tarred roads, habitat connectivity across the broader landscapes in which both study areas are located is considered high.

7.6.2. Processes and Drivers of Change

Grazing and Overgrazing

Both study areas are located in a very dry, desert-like environment. Rainfall is low and infrequent. As a result, the productivity of herbaceous vegetation (i.e., grasses) is generally low and the region is unable to support large sedentary herds of wildlife or livestock. This notwithstanding, livestock (sheep, goats and cattle) are farmed in the region. The abundance of the small grass *Enneapogon desvauxii* noted in study area A during the field visit suggests that overgrazing, probably by goats, has occurred at this site in the past. Overgrazing is a common cause of dryland degradation, leading to one or several recognised syndromes (*sensu*. Scholes, 2009), including a change in plant species composition that manifests as a combination of bush encroachment, a reduction in palatable grasses, and a reduction in grass productivity (Scholes, 2009).

Fire

Considering the overall low grass productivity rendered by low and erratic rainfall, fire is likely to be very infrequent in the landscapes of both study areas. This was confirmed by Mr Willemse *apropos* the study area B landscape. Fire is therefore not considered a frequent disturbance agent and driver of change in the local ecology. However, it is noted that when fire does occur in the region, it can have severe negative consequence for the structure and composition of vegetation, which unlike more mesic savanna and grasslands, is not adapted to fire.

Alien Invasive Species Colonisation

Predicated on observations made during the field visit, alien invasive plant species establishment in dry, upland habitat across the region is not a major concern. However, in low lying depression and drainage areas where there is elevated soil moisture, and along road sides and other disturbed sites, alien *Prosopis* trees are problematic and often establish as the dominant large woody species.

If not controlled, it is likely that the continued colonisation and densification of *Prosopis* trees along water courses and drainage lines will become highly problematic and potentially compromise ecological functioning.

7.7. Summary of Biodiversity Sensitivity

Table 8 provides comment on the biodiversity sensitivity of habitats that will be potentially impacted by proposed Project activities. The biodiversity sensitivity of study area A in relation to the proposed infrastructure layout is shown in Figure 22.

Table 8: Summary of Biodiversity Sensitivity

Vegetation Community	Character and Sensitivity Aspects
Rhigozum trichotomum – Stipagrostis Shrubland	Largest vegetation community in the study area. Uniform and well-represented across immediate surrounding landscape. Ecological integrity is rated high and conservation importance moderate. Vegetation community therefore has a moderate biodiversity sensitivity.
Ephemeral Drainage Line Vegetation	Small vegetation community, both within the study area and across the surrounding landscape. Plays an important functional role in ecosystem dynamics, including regulating local hydrology, providing movement/dispersal corridors for fauna and increasing local habitat heterogeneity. Ecological integrity is rated high and conservation importance high. Vegetation community therefore has a high biodiversity sensitivity. Negative impacts associated with the proposed Project on this vegetation community should be avoided.
Study Area B - Gordonia Plains Shrubland	Habitat within the small footprint of the proposed Telecom Tower is uniform with, and well-represented across surrounding landscape, and based on site photographs corresponds to typical Gordonia Plains Shrubland. Ecological integrity is rated high and conservation importance moderate. Vegetation community therefore has a moderate biodiversity sensitivity.

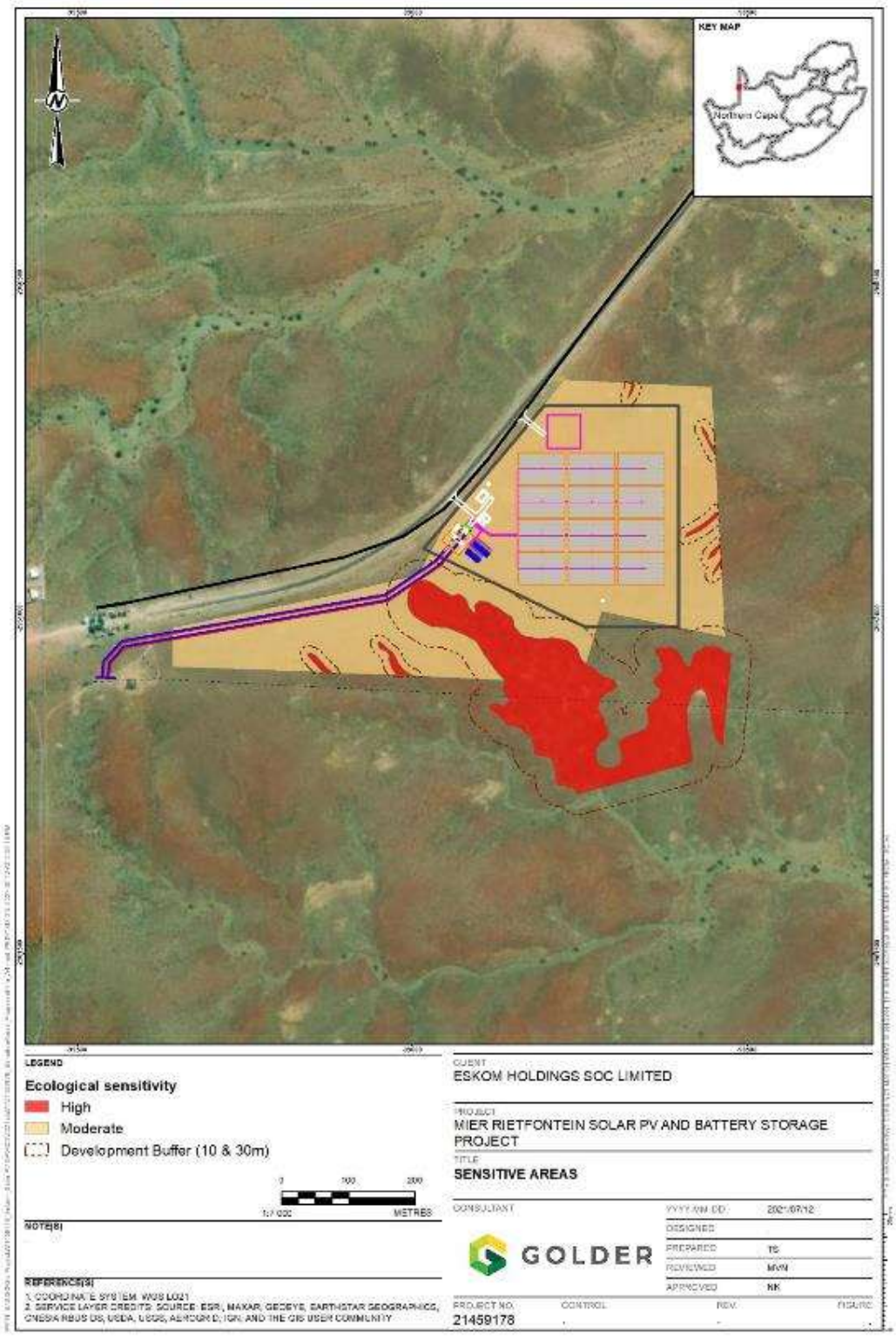

Figure 22: Biodiversity sensitivity of study area A in relation to the proposed infrastructure layout.

8. Impact Assessment

8.1. Approach to Impact Assessment

The impact assessment was undertaken using a matrix selection process, the most used methodology, for determining the significance of potential environmental impacts/risks. This methodology is based on the minimum requirements as outlined in Appendix 3 of the EIA Regulations of 2014. The methodology incorporates four aspects for assessing the potential significance of impacts, namely direction, severity, probability of occurrence, and reversibility, which are further sub-divided as follows (Table 9).

Table 9: Impact assessment factors

Direction	**Severity**			**Probability**	**Reversibility**
Positive/ negative	Magnitude	Duration	Scale/extent	Probability of occurrence	Reversible/ irreversible

To determine the significance of each potential impact/risk, the following four ranking scales are used (Table 10).

Table 10: Impact assessment scoring methodology

Value	**Description**
Magnitude	
10	Very high/unknown (of the highest order possible within the bounds of impacts that could occur. In the case of adverse impacts, there is no possible mitigation that could offset the impact, or mitigation is difficult, expensive, time-consuming or some combination of these. Social, cultural, and economic activities of communities are disrupted to such an extent that these come to a halt).
8	High
6	Moderate (impact is real, but not substantial in relation to other impacts that might take effect within the bounds of those that could occur. In the case of adverse impacts, mitigation is both feasible and easily possible. Social, cultural, and economic activities of communities are changed, but can be continued (albeit in a different form). Modification of the project design or alternative action may be required).
4	Low (impact is of a low order and therefore likely to have little real effect. In the case of adverse impacts, mitigation is either easily achieved or little will be required, or both. Social, cultural, and economic activities of communities can continue unchanged.)
2	Minor
Duration	
5	Permanent (Permanent or beyond closure)
4	Long term (more than 15 years)
3	Medium-term (5 to 15 years)
2	Short-term (1 to 5 years)
1	Immediate (less than 1 year)
Scale	
5	International
4	National
3	Regional

2	Local
1	Site only
0	None
Probability	
5	Definite/unknown (impact will definitely occur)
4	Highly probable (most likely, 60% to 90% chance)
3	Medium probability (40% to 60% chance)
2	Low probability (5% to 40% chance)
1	Improbable (less than 5% chance)
0	None
5	Definite/unknown (impact will definitely occur)

Significance = (Magnitude + Duration + Scale) x Probability

Table 11: Significance of impact based on point allocation

Points	Significance	Description
SP>75	High environmental significance	An impact which could influence the decision about whether or not to proceed with the project regardless of any possible mitigation.
SP 30 – 75	Moderate environmental significance	An impact or benefit which is sufficiently important to require management, and which could have an influence on the decision unless it is mitigated.
SP<30	Low environmental significance	Impacts with little real effect and which will not have an influence on or require modification of the project design.
+	Positive impact	An impact that is likely to result in positive consequences/effects.

For the methodology outlined above, the following definitions were used:

- **Direction** of an impact may be positive, neutral, or negative with respect to the impact
- **Magnitude** is a measure of the degree of change in a measurement or analysis (e.g., the severity of an impact on human health, well-being, and the environment), and is classified as none/negligible, low, moderate, high, or very high/unknown
- **Scale/geographic extent** refers to the area that could be affected by the impact and is classified as site, local, regional, national, or international
- **Duration** refers to the length of time over which an environmental impact may occur i.e., immediate/transient, short-term, medium term, long-term, or permanent
- **Probability** of occurrence is a description of the probability of the impact occurring as improbable, low probability, medium probability, highly probable or definite
- **Reversibility** of an impact, which may be described as reversible or irreversible

8.2. Construction Phase

8.2.1. Impact 1: Habitat Loss and Modification

Habitat loss and modification refers to the removal or degradation of natural habitat. In terrestrial ecosystems this occurs primarily through vegetation clearing and earth works during construction. The development of proposed Project infrastructure will require vegetation clearing and earth works across the entire development footprints of both study areas. This will affect all flora occurring in each development footprint, as well as all fauna (including bats) that use on-site habitat and resources. As the extent of habitat loss/modification at the two study areas varies, each site is analysed separately:

In study area A, the estimated extent of clearance is about 10 ha. This will result in the potential loss of both *Rhigozum trichotomum – Stipagrostis* shrubland and ephemeral drainage line vegetation. In study area B, only about 0.0025 ha (225 m^2) will be cleared.

The impact of habitat loss and modification in study area A associated with the PV Block and BESS infrastructure prior to mitigation is considered to be of high magnitude, permanently affecting vegetation in the site, but also potentially habitat at the local scale through the loss of drainage line habitat. It is considered definite, resulting in an impact of "high" significance. With mitigation, which includes avoiding the ephemeral drainage line areas by placing all infrastructure outside a 10 m buffer around the smaller drainage lines and a 30 m buffer around the large central drainage line, and limiting the disturbance footprint to the absolute minimum required for construction purposes, the magnitude of the impact can be reduced to moderate, although it will remain a definite impact at the site scale. This results in an after-mitigation impact of "moderate" significance.

Considering the small extent of habitat loss associated with the development of the proposed Telecom Tower in study area B, prior to mitigation impact magnitude is low. Duration is permanent and it has a definite probability. The spatial extent will be local. Prior to mitigation, this impact is rated of "low" significance. After mitigation, habitat loss can be reduced to a minor magnitude, affecting the site only. Probability will however, remain definite. After mitigation, habitat loss and modification in study area B is rated an impact of "low" significance.

8.2.2. Impact 2: Establishment and Spread of Alien Invasive Species

Disturbances caused by vegetation clearing and earth works during construction can facilitate the establishment and spread of alien invasive vegetation. Alien plant infestations can spread exponentially, suppressing or replacing indigenous vegetation. This may result in a breakdown of ecosystem functioning and a loss of biodiversity. Declared invasive *Prosopis* trees (NEMBA Category 3) are present in the landscape surrounding the study areas, and it is possible that these species will colonise areas disturbed by construction activities.

Before mitigation, impact magnitude is high, while duration is long term and it has a high probability. The spatial extent of alien invasive species spread is local. Prior to mitigation, the establishment and spread of alien invasive species is rated an impact of "moderate" significance. With the implementation of active control during the construction phase, this impact can be reduced to a low magnitude, with a long-term duration. Spatial extent will be reduced to the site only and the probability of the impact occurring as predicted would be reduced to low. After mitigation, this impact is rated to be of "low" significance.

8.2.3. Impact 3: Mortality and Disturbance of ground-dwelling Fauna

Large and mobile fauna will move off to avoid disturbances caused by construction activities. However, smaller and less mobile species may be trapped, injured and killed during vegetation clearing and earth works. Susceptible fauna includes, amongst others, burrowing mammals nesting birds, reptiles and amphibians. Other common causes of fauna death or injury include vehicle collisions along access roads, hunting and snaring by workers, and trapping of fauna in fences, excavations and trenches.

Before mitigation, impact magnitude is high, while duration is immediate and it has a high probability. The spatial extent will be local. Prior to mitigation, the mortality and disturbance of fauna is rated an impact of "moderate" significance. After mitigation, which includes, *inter alia*, active supervision by an environmental control officer (ECO) during the construction phase, this impact can be reduced to a low magnitude, with an immediate duration. The spatial extent will be maintained at local, but probability will be reduced to low. After mitigation the killing or injuring of fauna is rated of "low" significance.

8.2.4. Impact 4: Loss/disturbance of roosting bat individuals

Site clearance prior to construction could result in direct impacts including mortality and injury of bat individuals that may occasionally roost in the trees or rocky crevices in the study areas. This is considered to be an impact of low significance, given the limited importance of the study area for roosting bats, and the subsequent low magnitude and likelihood of the impact occurring. The risk can be further minimised by conducting work during the dry season, when bats will not be able to use the site for foraging, and as such will be even less likely to utilise trees/rocky crevices of the site as temporary roosts.

8.2.5. Impact 5: Reduction in extent of foraging habitats for bats

The loss of natural vegetation within study area A during site clearance will result in a reduction of approximately 10 ha of available foraging habitat for bats. The predicted reduction in extent of the vegetation types providing low-moderate value, seasonal foraging habitat within the study area is considered of low magnitude in the context of the availability of large areas of similar habitat in the surrounding landscape; nevertheless, the overall significance of the impact of habitat loss is rated as moderate. The application of the recommended mitigation measures should ameliorate potential effects on bat foraging habitat to low significance.

8.2.6. Impact 6: Dust Generation

Vegetation clearing, earth works and vehicle activity are likely to result in dust generation, which may negatively impact both local flora and fauna communities. Before mitigation, impact magnitude is low, while duration is long-term and it has a high probability. The spatial extent will be local. Prior to mitigation, dust generation is rated an impact of "moderate" significance. After mitigation, which includes, *inter alia*, active suppression of dust during the construction phase, this impact can be reduced to a minor magnitude, with a short duration. Spatial extent will be maintained at local, but probability will be reduced to low. After mitigation, dust generation is rated an impact of "low" significance.

8.2.7. Impact 7: Loss of Flora of Conservation Concern

Vegetation clearing and earth works can result in the direct loss of flora species of conservation concern. Although no threatened (Red List) flora species were observed in the study area A, some recorded plants (e.g., *Commiphora glandulosa*) and some species with a 'possible/probable' probability of occurrence are 'protected' in the Northern Cape or nationally, and it will be necessary to obtain a clearing permit from the relevant authority for their removal and/or relocation.

Before mitigation, impact magnitude is moderate, while duration is immediate. It has a high probability of occurrence. The spatial extent of the impact is at the site scale. Prior to mitigation, this impact is rated of "moderate" significance. This impact can be reduced to a minor magnitude, and will remain of immediate in duration. Spatial extent will be maintained at the site only, but probability will be reduced to improbable. After mitigation this impact is rated to be of "low" significance.

Table 12 presents a summary of the potential impacts/risks during the construction phase.

8.3. Operational Phase

8.3.1. Impact 1: Security Lighting Disturbing Bats and Other Nocturnal Fauna

Predicted operational phase impacts relate to disturbance of typical bat foraging patterns caused by ongoing activities at the facility (e.g., security lighting at night).

The proposed PV and BESS development is likely to be well-lit at night for security purposes. This is expected to cause disturbance to nocturnal faunal species in surrounding areas. Disturbance may mean that some species are attracted to the lights to prey upon the insects that are attracted to the lights (particularly some common bat species such as Cape serotine or Egyptian free-tailed bat); other more sensitive bat species (such as horseshoe bats) and other nocturnal fauna may be deterred from well-lit areas. The magnitude of the effects is expected to be moderate, on a site only scale. The predicted impact is thus considered to be of moderate significance prior to mitigation. Once the recommended mitigation measures are applied, the magnitude of effects on nocturnal fauna can be reduced, reducing the significance of the overall impact to low.

8.3.2. Impact 2: Establishment and Spread of Alien Invasive Species

The potential establishment of alien invasive species in, and immediately adjacent to, the study areas will continue to be an impact of concern during the operational phase. Before mitigation, impact magnitude is high, while duration is long term and it has a high probability. The spatial extent of alien invasive species spread is local. Prior to mitigation, the establishment and spread of alien invasive species is rated an impact of "moderate" significance. With the continued implementation of an active alien species control programme during the operational phase this impact can be reduced to a low magnitude, with a long-term duration. Spatial extent will be reduced to the site only and probability at low. After mitigation, this impact is rated to be of "low" significance.

8.3.3. Impact 3: Dust Generation

During the operational phase, the study areas will be kept free of vegetation through active control. This may promote dust generation from exposed soil surfaces. Before mitigation, impact magnitude is low, while duration is long-term and it has a high probability. The spatial extent will be local. Prior to mitigation, dust generation is rated an impact of "low" significance. After mitigation, this impact

can be reduced to a minor magnitude, with a short duration. Spatial extent will be maintained at local, but probability will be reduced to low. After mitigation, dust generation is rated an impact of "low" significance.

Table 12 presents a summary of the potential impacts/risks during the operational phase.

8.4. Decommissioning and Closure Phase

8.4.1. Impact 1: Establishment and Spread of Alien Invasive Species

The potential establishment of alien invasive species in, and immediately adjacent to, the study areas will continue to be an impact of concern during the decommissioning and closure phase. Before mitigation, impact magnitude is high, while duration is long term and it has a high probability. The spatial extent of alien invasive species spread is local. Prior to mitigation, the establishment and spread of alien invasive species is rated an impact of "moderate" significance. With the continued implementation of an active alien species control programme for a period after site closure, this impact can be reduced to a low magnitude, with a short-term duration. Spatial extent will be reduced to the site only and probability at low. After mitigation, this impact is rated to be of "low" significance

8.4.2. Impact 2: Dust Generation

The decommissioning and removal of Project infrastructure during the closure phase may result in dust generation. This may persist until the site revegetates naturally. Before mitigation, impact magnitude is low, while duration is short-term and it has a medium probability. The spatial extent will be local. Prior to mitigation, the dust generation is rated an impact of "moderate" significance. After mitigation, this impact can be reduced to a minor magnitude, with a short duration. Spatial extent will be maintained at local, but probability will be reduced to low. After mitigation, dust generation is rated an impact of "low" significance.

Table 12 presents a summary of the potential impacts/risks during the decommissioning and closure phases.

Table 12: Summary of the potential impacts/risks during the construction, operational, decommissioning and closure phases.

Aspect	Potential Impact	Impact Assessment Factors		Probability	Significance without mitigation	Impact Assessment Factors		Probability	Significance with mitigation
Construction phase									
Terrestrial ecology	Habitat loss and modification – Study Area A	*Direction:*	Negative	Definite/ Unknown	High	*Direction:*	Negative	Definite/ Unknown	Moderate
		Magnitude:	High			*Magnitude:*	Moderate		
		Duration:	Permanent			*Duration:*	Long Term		
		Scale:	Local			*Scale:*	Site Only		
		Reversibility:	Reversible			*Reversibility:*	Reversible		
Terrestrial ecology	Habitat loss and modification – Study Area B	*Direction:*	Negative	Definite/ Unknown	Low	*Direction:*	Negative	Definite/ Unknown	Low
		Magnitude:	Low			*Magnitude:*	Minor		
		Duration:	Permanent			*Duration:*	Long Term		
		Scale:	Local			*Scale:*	Site Only		
		Reversibility:	Reversible			*Reversibility:*	Reversible		
Terrestrial ecology	Establishment and spread of alien invasive species	*Direction:*	Negative	Highly Probable	Moderate	*Direction:*	Negative	Low Probability	Low
		Magnitude:	High			*Magnitude:*	Low		
		Duration:	Long Term			*Duration:*	Long Term		
		Scale:	Local			*Scale:*	Site Only		
		Reversibility:	Reversible			*Reversibility:*	Reversible		
Terrestrial ecology	Mortality and disturbance of fauna	*Direction:*	Negative	Highly Probable	Moderate	*Direction:*	Negative	Low Probability	Low
		Magnitude:	High			*Magnitude:*	Low		
		Duration:	Immediate			*Duration:*	Immediate		

Aspect	Potential Impact	Impact Assessment Factors		Probability	Significance without mitigation	Impact Assessment Factors		Probability	Significance with mitigation
		Scale:	Local			*Scale:*	Local		
		Reversibility:	Irreversible			*Reversibility:*	Reversible		
Terrestrial ecology	Loss and disturbance of individual bats	*Direction:*	Negative	Low Probability	Low	*Direction:*	Negative	Improbable	Low
		Magnitude:	Minor			*Magnitude:*	Minor		
		Duration:	Permanent			*Duration:*	Long Term		
		Scale:	Site Only			*Scale:*	Site Only		
		Reversibility:	Reversible			*Reversibility:*	Reversible		
Terrestrial ecology	Reduction in extent of foraging habitats for bats	*Direction:*	Negative	Definite / Unknown	Moderate	*Direction:*	Negative	Medium Probability	Low
		Magnitude:	Low			*Magnitude:*	Minor		
		Duration:	Long Term			*Duration:*	Long Term		
		Scale:	Site Only			*Scale:*	Site Only		
		Reversibility:	Reversible			*Reversibility:*	Reversible		
Terrestrial ecology	Dust generation	*Direction:*	Negative	Highly Probable	Moderate	*Direction:*	Negative	Low Probability	Low
		Magnitude:	Low			*Magnitude:*	Low		
		Duration:	Long Term			*Duration:*	Immediate		
		Scale:	Local			*Scale:*	Local		
		Reversibility:	Reversible			*Reversibility:*	Reversible		
Terrestrial ecology	Loss of flora of conservation concern	*Direction:*	Negative	Highly Probable	Moderate	*Direction:*	Negative	Improbable	Low
		Magnitude:	Moderate			*Magnitude:*	Minor		
		Duration:	Immediate			*Duration:*	Immediate		

Aspect	Potential Impact	Impact Assessment Factors		Probability	Significance without mitigation	Impact Assessment Factors		Probability	Significance with mitigation
		Scale:	Site Only			*Scale:*	Site Only		
		Reversibility:	Irreversible			*Reversibility:*	Irreversible		
Operational phase									
Terrestrial ecology	Security lighting disturbing nocturnal fauna	*Direction:*	Negative	Medium Probability	Low	*Direction:*	Negative	Low Probability	Low
		Magnitude:	Low			*Magnitude:*	Low		
		Duration:	Long Term			*Duration:*	Long Term		
		Scale:	Local			*Scale:*	Local		
		Reversibility:	Reversible			*Reversibility:*	Reversible		
Terrestrial ecology	Establishment and spread of alien invasive species	*Direction:*	Negative	Highly Probable	Moderate	*Direction:*	Negative	Low Probability	Low
		Magnitude:	High			*Magnitude:*	Low		
		Duration:	Long Term			*Duration:*	Long Term		
		Scale:	Local			*Scale:*	Site Only		
		Reversibility:	Reversible			*Reversibility:*	Reversible		
Terrestrial ecology	Dust generation	*Direction:*	Negative	Low Probability	Low	*Direction:*	Negative	Low Probability	Low
		Magnitude:	Low			*Magnitude:*	Minor		
		Duration:	Long Term			*Duration:*	Short-term		
		Scale:	Local			*Scale:*	Local		
		Reversibility:	Reversible			*Reversibility:*	Reversible		
Decommissioning and closure phases									
		Direction:	Negative		Moderate	*Direction:*	Negative		Low

Aspect	Potential Impact	Impact Assessment Factors		Probability	Significance without mitigation	Impact Assessment Factors		Probability	Significance with mitigation
Terrestrial ecology	Establishment and spread of alien invasive species	*Magnitude:*	High	Highly Probable		*Magnitude:*	Low	Low Probability	
		Duration:	Long Term			*Duration:*	Short Term		
		Scale:	Local			*Scale:*	Site Only		
		Reversibility:	Reversible			*Reversibility:*	Reversible		
Terrestrial ecology	Dust generation	*Direction:*	Negative	Medium Probability	Moderate	*Direction:*	Negative	Low Probability	Low
		Magnitude:	Moderate			*Magnitude:*	Low		
		Duration:	Long Term			*Duration:*	Short-term		
		Scale:	Local			*Scale:*	Local		
		Reversibility:	Reversible			*Reversibility:*	Reversible		

9. Proposed Mitigation Measures

The following section presents the proposed impact management actions to avoid, minimise and/or manage the potential impacts/risks which were assessed Section 8.

As with the assessment of potential impacts/risks, the impact management actions have been arranged according to the following project phases:

- Pre-construction
- Construction
- Operational
- Closure (including decommissioning)
- Post-closure

For each impact management action, the following information is provided:

- Category: The category within which the potential impact/risk occurs
- Potential impact/risk: Identified potential impact/risk resulting from the pre-construction, construction, operation, and closure of the proposed Project
- Description: Description of the possible impact management action
- Prescribed standards or practices: Prescribed environmental standards or practices with which the impact management action must comply. Note that only key standards or practices have been listed
- Mitigation type: The type of mitigation measure. This includes the following:
    - Avoidance
    - Minimisation
    - Rehabilitation or restoration
    - Offsetting
- Time period: The time period when the impact management actions must be implemented
- Responsible persons: The persons who will be responsible for the implementation of the impact management actions.

Table 13 presents a summary of the proposed impact mitigation actions during the pre-construction, construction, operational, and closure (including decommissioning) phases of the project.

Table 13: Summary of proposed impact mitigation actions.

Ref No.	Category	Potential impact/risk	Description	Prescribed standards or practices	Mitigation type	Time period	Responsible person
1. Pre-construction phase							
1.1	Terrestrial Flora Communities	Habitat loss and modification	• At the PV Blocks and BESS site, all proposed Project infrastructure should be positioned outside a 10 m buffer around the smaller drainage lines and outside a 30 m buffer around the large central drainage; and • The layout the Telecom Tower site should be positioned to avoid clearing any large, protected trees (e.g., *Vachellia erioloba*).	N/A	Avoidance	Prior to construction phase	Project manager
2. Construction phase							
2.1	Terrestrial Flora Communities	Habitat loss and modification	• Vegetation clearing for the Project, including the contractor site office and laydown area, should be restricted to the proposed Project footprints only, with no clearing permitted outside of these areas; • The footprints to be cleared should be clearly demarcated prior to construction to prevent unnecessary clearing outside of these areas. No heavy vehicles should travel beyond the marked works zone; • Preferably, clearance in advance of construction should be done during the dry season (April to September); and	N/A	Minimisation	During construction phase	Project manager

Ref No.	Category	Potential impact/risk	Description	Prescribed standards or practices	Mitigation type	Time period	Responsible person
			• Removed topsoil should be stockpiled and used to rehabilitate all non-operational disturbed areas. • Native species planting (where possible with regard to safety and not hindering firebreak outs near solar panels) should be used to aid in the reduction of soil erosion and additional loss of vegetation beyond the footprint of cleared areas; and enhance landscape connectivity around the cleared solar farm footprint.				
2.2	Terrestrial Flora Communities	Establish and spread of alien invasive species	An alien invasive species control programme must be developed for the Project. It is recommended that the programme include: • A combined approach using both chemical and mechanical control methods; • Periodic follow-up treatments, informed by regular monitoring; and • A focus on all areas immediately adjacent to the Project footprints, and in particular, areas of Ephemeral Drainage Line Vegetation adjacent to study area A.	N/A	Minimisation	During construction phase	Project manager

Ref No.	Category	Potential impact/risk	Description	Prescribed standards or practices	Mitigation type	Time period	Responsible person
2.3	Terrestrial Fauna Communities	Mortality and disturbance of fauna	• An ECO should be on-site during vegetation clearing to monitor and manage any wildlife-human interactions. The ECO should be trained in *inter alia*, snake handling, species identification and identifying potential bat roosting sites; • A low-speed limit (recommended 20-40 km/h) should be enforced on site to reduce wildlife collisions; • The handling, poisoning and killing of on-site fauna by contractors must be strictly prohibited.	N/A	Avoidance / Minimisation	During construction phase	ECO
2.4	Bats	Loss/disturbance of bat individuals	Preferably, conduct vegetation clearance during dry season (April to September).	N/A	Minimisation	During construction phase	Project manager
2.5	Bats	Reduction in extent of foraging habitat for bats	*See mitigation measures for Habitat loss and modification*	N/A	Minimisation	During construction phase	Project manager
2.6	Terrestrial Flora and Fauna Communities	Dust generation	Active dust suppression using suitable dust suppressant should be implemented during construction, if dust levels become problematic.	N/A	Minimisation	During construction phase	Project manager

Ref No.	Category	Potential impact/risk	Description	Prescribed standards or practices	Mitigation type	Time period	Responsible person
2.7	Terrestrial Flora Species	Loss of flora of conservation concern	• Surveys of each development footprint should be conducted to identify and record the number of protected flora species that require clearing; • Clearing and/or relocation permits should be obtained from the provincial authority to clear or remove provincially protected flora species occurring on-site; and • If possible, rescued plants (e.g., small succulents/geophytes) should be relocated to an adjacent area of natural habitat.	N/A	Avoidance / Minimisation	Prior to construction phase	Project manager
3. Operational phase							
3.1	Bats and other nocturnal mammals	Security lighting disturbing bats and other nocturnal fauna activity	Site lighting options should be managed to minimise effects on flying bats and other nocturnal fauna. Options that should be considered and applied where feasible include: • Use of security lighting that is movement-activated rather than permanently switched on; • Directional shading to prevent excessive light spillage; and • Use of light bulbs that are not as attractive to insects (e.g., LED bulbs).	N/A	Minimisation	During operational phase	Facility manager

Ref No.	Category	Potential impact/risk	Description	Prescribed standards or practices	Mitigation type	Time period	Responsible person
3.2	Terrestrial Flora Communities	Establish and spread of alien invasive species	Active alien invasive species control should continue throughout the operational phase. Control actions should be informed by the findings of monitoring.	N/A	Minimisation	During operational phase	Facility manager
3.3	Terrestrial Flora and Fauna Communities	Dust generation	Active dust suppression using suitable dust suppressant should be implemented during the operational phase, if required.	N/A	Minimisation	During operational phase	Facility manager
4. Decommissioning and Closure phase							
4.1	Terrestrial Flora Communities	Establish and spread of alien invasive species	Active alien invasive species control should continue during the decommissioning phase and follow up control should be carried out for a five- year period following closure.	N/A	Minimisation	During closure and for a five-year period after closure	Facility manager
4.2	Terrestrial Flora and Fauna Communities	Dust generation	The site should be actively rehabilitated using indigenous and locally sourced grass species. Seeding should be conducted prior to the first summer rains.	N/A	Minimisation / Rehabilitation	During closure phase	Facility manager
4.3	Terrestrial Fauna Communities	General habitat restoration	Restoration/rehabilitation of the Project footprint should include consideration of compatible measures for habitat enhancement for bat species. Such measures include planting of native species trees and shrubs; and demarcation of rehabilitated areas as conservation areas only.	N/A	Minimisation / Rehabilitation	During closure phase	Facility manager

10. Proposed Monitoring Actions

The following section presents the proposed monitoring actions for monitoring and reporting on the implementation of the impact mitigation actions presented in the preceding Section 9.

The content of this section is largely based on the monitoring requirements outlined in Appendix 4 of the EIA Regulations, 2014.

For each monitoring action, the following information is provided:

- Category: The category within which the potential impact and/or risk occurs
- Potential impact/risk: Identified potential impact/risk resulting from the pre-construction, construction, operation, and closure of the proposed Project
- Method for monitoring : The method for monitoring the implementation of the recommended mitigation measures
- Time period: The time period over which the monitoring actions must be implemented
- Frequency of monitoring: The frequency of monitoring the implementation of the recommended mitigation measures
- Mechanism for monitoring compliance: The mechanism for monitoring compliance with the impact management actions
- Responsible persons: The persons who will be responsible for the implementation of the monitoring actions

As with the impact management actions, the proposed monitoring actions have been arranged according to the following project phases:

- Pre-construction
- Construction
- Operational
- Closure (including decommissioning)
- Post-closure

Table 14 presents a summary of the proposed monitoring actions during the construction, operational, closure (including decommissioning) phases.

Table 14: Summary of proposed monitoring actions

Ref. No.	Category	Method for monitoring	Time period	Frequency of monitoring	Mechanism for monitoring compliance	Responsible person
1. Construction phase						

1.1	Alien invasive species	• Annual on-site alien invasive species monitoring should be conducted. Monitoring should focus on
		  ○ All sites disturbed during the construction phase;
		  ○ Drainage lines emanating from study area A for length of approximately 30m;
		• Monitoring should assess species type and density. These data should inform the scope of ongoing alien invasive species control.
			Wet/growing season	Annual	Annual monitoring report	Project manager

2. Operational phase						
2.1	Alien invasive species	• Annual on-site alien invasive species monitoring should be conducted. Monitoring should focus on • All sites disturbed during the construction and operational phase activities, and • Drainage lines emanating from the study area A for length of approximately 30m.	Wet/growing season	Annual	Annual monitoring report	Facility manager

Ref. No.	Category	Method for monitoring	Time period	Frequency of monitoring	Mechanism for monitoring compliance	Responsible person
		• Monitoring should assess species type and density. These data should inform the scope of ongoing alien invasive species control.				
3. Closure phase						
3.1	Alien invasive species	• Alien invasive species monitoring should be conducted on a biannual basis during closure and every five years following closure. Monitoring should focus on o All sites disturbed by decommissioning and closure activities, and o Drainage lines emanating from study area A for length of approximately 30m. • Monitoring should assess species type and density. These data should inform the scope of future alien invasive species control.	Wet/growing season	Biannually during closure & every 5 years after closure	Annual monitoring report	Facility manager

11. Environmental Impact Statement

The following section presents a summary of the key findings of the study. Table 15Table 15: Summary of potential impact impacts/risks. presents a summary of the potential impacts/risks associated with the proposed Project in the construction, operational, and decommissioning and closure phases.

Table 15: Summary of potential impact impacts/risks.

Aspect	Potential Impact/Risk	Significance without Mitigation	Significance with Mitigation
Construction			
Vegetation communities	Habitat loss and modification – Study Area A	High	Moderate
Vegetation communities	Habitat loss and modification – Study Area B	Low	Low
Vegetation communities	Establishment and spread of alien invasive species	Moderate	Low
Fauna	Mortality and disturbance of fauna	Moderate	Low
Bats	Loss/disturbance of bat individuals	Low	Low
Bats	Reduction in extent of foraging habitat for bats	Moderate	Low
Flora and Fauna	Dust generation	Moderate	Low
Protected flora	Loss of flora of conservation concern	Moderate	Low
Operational Phase			
Bats, nocturnal fauna	Security lighting disturbing activity	Low	Low
Vegetation communities	Establishment and spread of alien invasive species	Moderate	Low
Flora and Fauna	Dust generation	Low	Low
Decommissioning and Closure			
Vegetation communities	Establishment and spread of alien invasive species	Moderate	Low
Flora and Fauna	Dust generation	Moderate	Low

11.1. Conditions to be Included in the Environmental Authorisation

In addition to the impact mitigation measures presented in Section 9, it is recommended that the following conditions be included in the EA:

- To protect the sensitive drainage line vegetation from disturbance or degradation, a 10 m buffer should be demarcated around the small drainage lines, and a 30 m buffer retained around the larger drainage line, within which no project infrastructure or activities will be permitted; and
- Significant residual impacts associated with the permanent loss of approximately 10 ha of natural habitat (*Rhigozum trichotomum – Stipagrostis* shrubland) need to be addressed through the implementation of additional conservation actions. These should include actively controlling alien invasive flora species (*Prosopis* species) in drainage lines and around the farm dams that

are located downstream of the study area, and implementing anti-erosion control measures (e.g., rock packs) at select points along downstream drainage lines.

11.2. Specialist Opinion

In accordance with the outcomes of the impact assessment (Section 8) and taking cognisance of the baseline conditions as presented in Section 7, as well as the impact management measures (Section 9), the proposed Mier Rietfontein Solar PV, Battery Storage and Telecommunications Tower Project, is not deemed to present significant negative environmental issues or impacts, and it should thus be authorised.

12. Assumptions, Uncertainties and Gaps in Knowledge

The following assumptions and limitations are applicable to the study:

- Field work was conducted over a three-day period in mid-April and thus represents a 'snap-shot' survey of on-site ecology, undertaken during the late-wet season. It is thus possible that small short-lived annuals, geophytes or very cryptic species that are only visible when in flower may be overlooked during field visit;
- The absence or non-recording of a specific fauna species, at a particular time, does not necessarily indicate that 1) the species does not occur there; 2) the species does not utilise resources in that area; or 3) the area does not play an ecological support role in the ecology of that species;
- The delineation of vegetation communities for the vegetation map was conducted using available Google Earth imagery, and is therefore limited to the spatial and resolution accuracy of the imagery; and
- Field work focused on study area A only. No flora and fauna sampling was conducted in the small footprint (225 m^2) of study area B.

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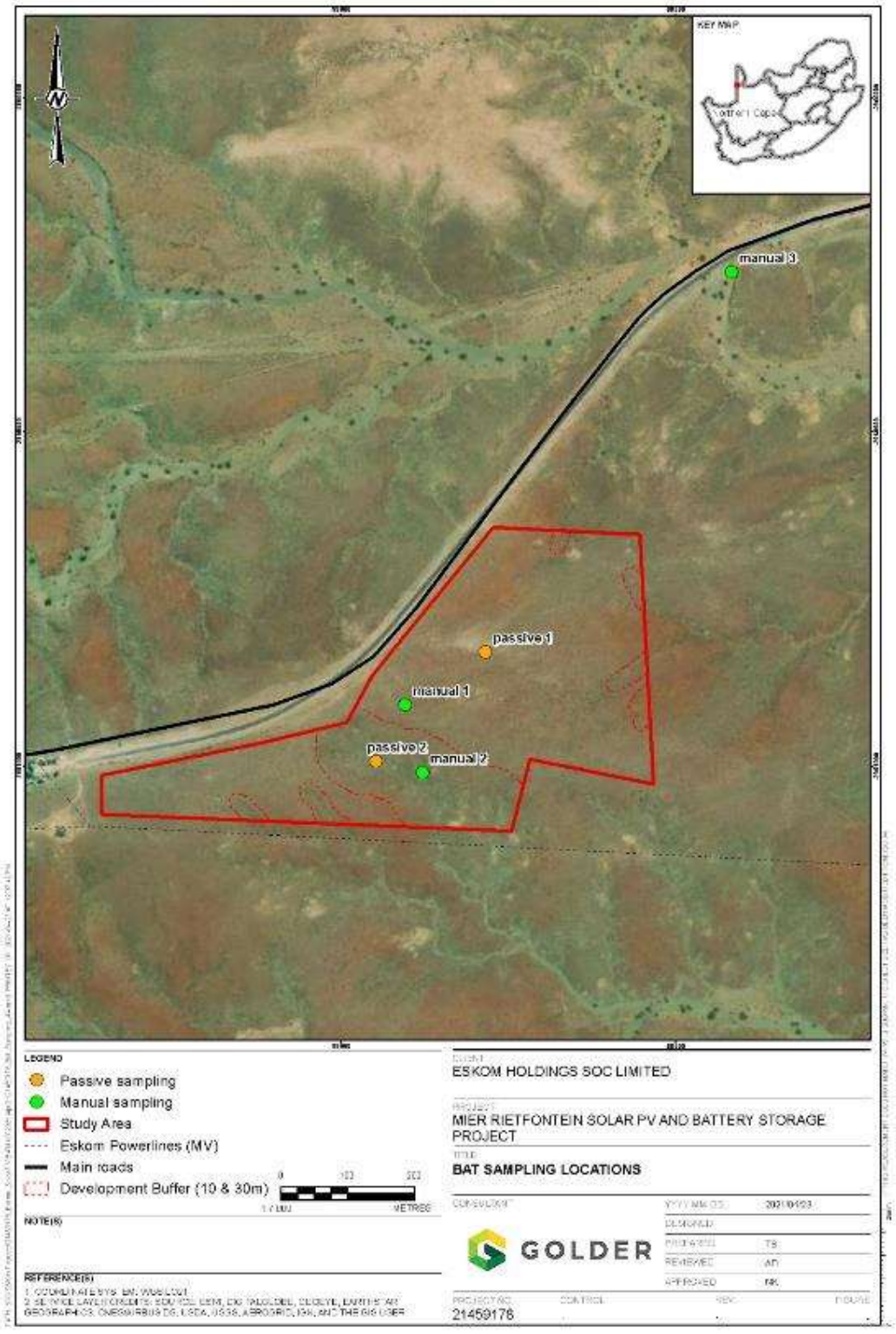
Appendix A

Co-ordinates of the vegetation transects and camera trap points.

Vegetation Transects Ref. No.	Habitat-Type	Co-ordinates
014	Drainage Line	26° 45.187 20° 00.482
002	Shrubland	26° 45.232 20° 00.463
005	Shrubland	26° 45.270 20° 00.509
016	Drainage Line	26° 45.225 20° 00.552
007	Shrubland	26° 45.333 20° 00.398
010	Shrubland	26° 45.369 20° 00.541
018	Drainage Line	26° 45.397 20° 00.549
020	Drainage Line	26° 45.317 20° 00.562
026	Drainage Line	26° 45.372 20° 00.327
027	Shrubland	26° 45.348 20° 00.267
Camera trap point		26° 45.276 20° 00.416
Camera trap point		26° 45.121 20° 00.520


KEY MAP
manual 3
passive 1
manual 1
passive 2
manual 2
LEGEND
Passive sampling
Manual sampling
Study Area
Eskom Powerlines (MV)
Main roads
Development Buffer (10 & 30m)
METRES
NOTE(S)
REFERENCE(S)
CLIENT
ESKOM HOLDINGS SOC LIMITED
PROJECT
MIER RIETFONTEIN SOLAR PV AND BATTERY STORAGE PROJECT
TITLE
BAT SAMPLING LOCATIONS
GOLDER
DESIGNED
PREPARED
TS
REVIEWED
AD
APPROVED
RK
PROJECT NO.
21459176

Appendix B

List of flora species recorded in study area A during the field visit

Family	Scientific Name	Growth Form	Conservation Status			Vegetation Community	
			Red List Status (2021)	NEMBA ToPS Status (2007)	Northern Cape Status	Shrubland	Drainage Line
Scrophulariaceae	*Aptosimum spinescens*	Dwarf Shrub	LC			x	x
Poaceae	*Aristida adscensionis*	Grass	LC				x
Poaceae	*Aristida congesta subsp. congesta*	Grass	LC			x	x
Poaceae	*Aristida sp.*	Grass	LC			x	
Asparagaceae	*Asparagus pearsonii*	Dwarf Shrub	LC			x	
Acanthaceae	*Blepharis mitrata*	Dwarf Shrub	LC			x	
Bignoniaceae	*Catophractes alexandri*	Shrub	LC			x	x
Burseraceae	*Commiphora glandulosa*	Tree	LC		Protected	x	x
Corbichoniaceae	*Corbichonia decumbens*	Herb	LC			x	
Apocynaceae	*Cryptolepis decidua*	Dwarf Shrub	LC			x	
Poaceae	*Enneapogon cenchroides*	Grass	LC				x
Poaceae	*Enneapogon desvauxii*	Grass	LC			x	x
Poaceae	*Eragrostis sp.*	Grass	LC				x
Poaceae	*Eragrostis trichophora*	Grass	LC				x
Asteraceae	*Geigeria ornativa*	Dwarf Shrub	LC			x	x
Poaceae	*Grass A*	Grass	LC			x	x
Malvaceae	*Hermannia burchellii*	Dwarf Shrub	LC				x
Apocynaceae	*Hoodia gordonii*	Succulent	DDD	Protected	Specially Protected		x
Fabaceae	*Indigofera alternans*	Creeper	LC			x	x
Acanthaceae	*Justicia australis*	Dwarf Shrub	LC				x
Asteraceae	*Kleinia longiflora*	Succulent	LC			x	x
Geraniaceae	*Monsonia cf. salmoniflora*	Dwarf Shrub	LC			x	
Graniaceae	*Monsonia umbellata*	Dwarf Shrub	LC			x	
Fabaceae	*Parkinsonia africana*	Tree	LC				x

Nyctaginaceae	*Phaeoptilum spinosum*	Shrub	LC			x	x
Polygalaceae	*Polygala leptophylla subsp. armata*	Shrub	LC			x	x
Fabaceae	*Prosopis glandulosa**	Tree	LC				
Bignoniaceae	*Rhigozum trichotomum*	Shrub	LC			x	x
Zygophyllaceae	*Roepera cf. pubescens*	Dwarf Shrub	LC			x	
Amaranthaceae	*Salsola tuberculata*	Dwarf Shrub	DDT			x	
Amaranthaceae	*Salsolla aelenii*	Dwarf Shrub	LC			x	
Poaceae	*Schmidtia kalahariensis*	Grass	LC			x	x
Poaceae	*Stipagrostis hirtigluma*	Grass	LC			x	x
Poaceae	*Stipagrostis hochstetteriana*	Grass	LC			x	
Poaceae	*Stipagrostis uniplumis*	Grass	LC			x	x
Zygophyllaceae	*Tatraena microcarpa*	Dwarf Shrub	LC			x	
Poaceae	*Tragus berteronianus*	Grass	LC			x	x
Zygophyllaceae	*Tribulus cristatus*	Creeper	LC			x	x
Fabaceae	*Vachellia hebeclada*	Shrub	LC				x
Rhamnaceae	*Ziziphus mucronata*	Tree	LC				x
	Unidentified geophyte (no flower)	Geophyte				x	
	Unidentified creeper 1 (no flowers)	Creeper				x	
	Unidentified creeper 2 (no flowers)	Creeper					

Appendix C

List of mammals occurring and potentially occurring in the region;

and

List of bat species listed as protected by Northern Cape Nature Conservation Act

Family	Scientific Name	Common Name	Red List – Regional Status (2016)	NEMBA ToPS List (2007)	Northern Cape Status
Bathyergidae	*Fukomys damarensis*	Damaraland Mole-rat	Least Concern		
Bathyergidae	*Cryptomys hottentotus*	Southern African Mole-rat	Least Concern		Protected
Bovidae	*Alcelaphus buselaphus caama*	Red Hartebeest	Least Concern		Protected
Bovidae	*Antidorcas marsupialis*	Springbok	Least Concern		Protected
Bovidae	*Connochaetes taurinus taurinus*	Blue Wildebeest	Least Concern		Protected
Bovidae	*Oryx gazella*	Gemsbok	Least Concern		Protected
Bovidae	*Raphicerus campestris*	Steenbok	Least Concern		Protected
Bovidae	*Sylvicapra grimmia*	Common Duiker	Least Concern		Protected
Bovidae	*Tragelaphus oryx*	Eland	Least Concern		Protected
Bovidae	*Tragelaphus strepsiceros*	Greater Kudu	Least Concern		Protected
Canidae	*Canis mesomelas*	Black-backed Jackal	Least Concern		
Canidae	*Otocyon megalotis*	Bat-eared Fox	Least Concern		Specially Protected
Canidae	*Vulpes chama*	Cape Fox	Least Concern	Protected	Specially Protected
Cercopithecidae	*Papio ursinus*	Chacma Baboon	Least Concern		
Erinaceidae	*Atelerix frontalis*	South African Hedgehog	Near Threatened	Protected	Specially Protected
Felidae	*Acinonyx jubatus*	Cheetah	Vulnerable	Vulnerable	Specially Protected
Felidae	*Caracal caracal*	Caracal	Least Concern		
Felidae	*Felis nigripes*	Black-footed Cat	Vulnerable	Protected	Specially Protected
Felidae	*Felis silvestris*	African Wildcat	Least Concern		Specially Protected
Felidae	*Leptailurus serval*	Serval	Near Threatened	Protected	Specially Protected
Felidae	*Panthera leo*	Lion	Least Concern	Vulnerable	Specially Protected
Felidae	*Panthera pardus*	Leopard	Vulnerable	Vulnerable	Specially Protected
Giraffidae	*Giraffa camelopardalis giraffa*	South African Giraffe	Least Concern		Protected
Herpestidae	*Cynictis penicillata*	Yellow Mongoose	Least Concern		Protected

Family	Scientific Name	Common Name	Red List – Regional Status (2016)	NEMBA ToPS List (2007)	Northern Cape Status
Herpestidae	*Herpestes sanguineus*	Slender Mongoose	Least Concern		Protected
Herpestidae	*Mungos mungo*	Banded Mongoose	Least Concern		
Herpestidae	*Suricata suricatta*	Suricate	Least Concern		Protected
Hyaenidae	*Crocuta crocuta*	Spotted Hyaena	Near Threatened	Protected	Specially Protected
Hyaenidae	*Parahyaena brunnea*	Brown Hyaena	Near Threatened	Protected	Specially Protected
Hyaenidae	*Proteles cristata*	Aardwolf	Least Concern		Specially Protected
Hystricidae	*Hystrix africaeaustralis*	Cape Porcupine	Least Concern		Protected
Leporidae	*Lepus capensis*	Cape Hare	Least Concern		Protected
Leporidae	*Lepus saxatilis*	Scrub Hare	Least Concern		Protected
Macroscelididae	*Elephantulus intufi*	Bushveld Sengi	Least Concern		Protected
Macroscelididae	*Elephantulus rupestris*	Western Rock Sengi	Least Concern		Protected
Macroscelididae	*Macroscelides proboscideus*	Karoo Round-eared Sengi	Least Concern		Protected
Manidae	*Smutsia temminckii*	Temminck's Ground Pangolin	Vulnerable	Vulnerable	Specially Protected
Muridae	*Aethomys chrysophilus*	Red Veld Rat	Least Concern		
Muridae	*Aethomys ineptus*	Tete Veld Rat	Least Concern		Protected
Muridae	*Desmodillus auricularis*	Short-tailed Gerbil	Least Concern		Protected
Muridae	*Gerbilliscus brantsii*	Highveld Gerbil	Least Concern		
Muridae	*Gerbilliscus leucogaster*	Bushveld Gerbil	Least Concern		
Muridae	*Gerbilliscus paeba*	Hairy-footed Gerbil	Least Concern		Protected
Muridae	*Gerbilliscus vallinus*	Brush-tailed Hairy-footed Gerbil	Least Concern		Protected
Muridae	*Mastomys coucha*	Multimammate Mouse	Least Concern		
Muridae	*Micaelamys namaquensis*	Namaqua Rock Mouse	Least Concern		
Muridae	*Mus indutus*	Desert Pygmy Mouse	Least Concern		Protected
Muridae	*Parotomys brantsii*	Brants' Whistling Rat	Least Concern		Protected
Muridae	*Parotomys littledalei*	Littledale's Whistling Rat	Near Threatened		Protected

Family	Scientific Name	Common Name	Red List – Regional Status (2016)	NEMBA ToPS List (2007)	Northern Cape Status
Muridae	*Rhabdomys pumilio*	Xeric Four-striped Mouse	Least Concern		Protected
Muridae	*Thallomys nigricauda*	Black-tailed Tree Rat	Least Concern		Protected
Muridae	*Thallomys paedulcus*	Tree Rat	Least Concern		
Muridae	*Zelotomys woosnami*	Woosnam's Desert Rat	Least Concern		Protected
Mustelidae	*Ictonyx striatus*	Striped Polecat	Least Concern		Specially Protected
Mustelidae	*Mellivora capensis*	Honey Badger	Least Concern	Protected	Specially Protected
Mustelidae	*Poecilogale albinucha*	African Striped Weasel	Near Threatened		Specially Protected
Nesomyidae	*Dendromus melanotis*	Grey Climbing Mouse	Least Concern		Protected
Nesomyidae	*Malacothrix typica*	Large-eared Mouse	Least Concern		Protected
Nesomyidae	*Petromyscus monticularis*	Brukkaros Pygmy Rock Mouse	Least Concern		Protected
Nesomyidae	*Saccostomus campestris*	Pouched Mouse	Least Concern		Protected
Orycteropodidae	*Orycteropus afer*	Aardvark	Least Concern		Specially Protected
Pedetidae	*Pedetes capensis*	Springhare	Least Concern		Protected
Sciuridae	*Xerus inauris*	Ground Squirrel	Least Concern		Protected
Soricidae	*Crocidura cyanea*	Reddish-grey Musk Shrew	Least Concern		Protected
Soricidae	*Crocidura hirta*	Lesser Red Musk Shrew	Least Concern		Protected
Suidae	*Phacochoerus africanus*	Common Warthog	Least Concern		Protected
Viverridae	*Genetta genetta*	Small-spotted Genet	Least Concern		Protected
Source: Based on the distribution presented in Stuart and Stuart (2007).					

Bat species listed as protected by Northern Cape Nature Conservation Act (2009)

	Species name	Common name
1	*Chaerephon ansorgei*	Ansorge's free-tailed bat
2	*Chaerephon pumila*	Little free-tailed bat
3	*Cistugo lesueuri*	Lesueur's hairy bat
4	*Cistugo scabrai*	Angolan hairy bat
5	*Cloeotis percivali*	Shorteared trident bat
6	*Eidolon helvum*	Straw-coloured fruit bat
7	*Epomophorus gambianus*	Gambian epauletted fruit bat
8	*Epomophorus wahlbergi*	Wahlberg's epauletted fruit bat
9	*Eptesicus hottentotus*	Long-tailed serotine bat
10	*Glauconycteris variegata*	Butterfly bat
11	*Hipposideros caffer*	Sundevall's roundleaf bat
12	*Hipposideros commersoni*	Commerson's roundleaf bat
13	*Hypsugo anchietae*	Anchieta's pipistrelle
14	*Kerivoula argentata*	Damara woolly bat
15	*Kerivoula lanosa*	Lesser woolly bat
16	*Laephotis botswanae*	Botswana long-eared bat
17	*Laephotis wintoni*	De Winton's long-eared bat
18	*Miniopterus fruterculus*	Lesser long-fingered bat
19	*Miniopterus schreibersii*	Schreibers' long-fingered bat
20	*Mops condylurus*	Angolan free-tailed bat
21	*Mops midas*	Midas free-tailed bat
22	*Mormopterus acetabulosus*	Natal free-tailed bat
23	*Myotis bocagei*	Rufous mouse-eared bat
24	*Myotis tricolor*	Temminck's hairy bat
25	*Myotis welwitschiii*	Welwitsch's hairy bat
26	*Neoromicia capensis*	Cape serotine bat
27	*Neoromicia nanus*	Banana bat
28	*Neoromicia rendalli*	Rendall's serotine bat
29	*Neoromicia zuluensis*	Aloe serotine bat
30	*Nycteris hispida*	Hairy slit-faced bat
31	*Nycteris thebaica*	Egyptian slitfaced bat
32	*Nycteris woodi*	Wood's slit-faced bat
33	*Nycticeinops schlieffenii*	Schlieffen's bat

	Species name	Common name
34	*Otomops martiensseni*	Large-eared free-tailed bat
35	*Pipistrellus hesperidus*	African pipistrelle
36	*Pipistrellus rueppellii*	Rüppell's pipistrelle
37	*Pipistrellus rusticus*	Rusty pipistrelle
38	*Rhinolophus blasii*	Blasius's horseshoe bat
39	*Rhinolophus capensis*	Cape horseshoe bat
40	*Rhinolophus clivosus*	Geoffroy's horseshoe bat
41	*Rhinolophus darlingi*	Darling's horseshoe bat
42	*Rhinolophus denti*	Dent's horseshoe bat
43	*Rhinolophus fumigatus*	Rüppell's horseshoe bat
44	*Rhinolophus hildebrandtii*	Hildebrandt's horseshoe bat
45	*Rhinolophus landeri*	Lander's horseshoe bat
46	*Rhinolophus simulator*	Bushveld horseshoe bat
47	*Rhinolophus swinnyi*	Swinny's horseshoe bat
48	*Rousettus aegyptiacus*	Egyptian rousette
49	*Sauromys petrophilus*	Flat-headed free-tailed bat
50	*Scotoecus albofuscus*	Light-winged lesser house bat
51	*Scotophilus dinganii*	African yellow bat
52	*Scotophilus viridis*	Greenish yellow bat
53	*Tadarida aegyptiaca*	Egyptian free-tailed bat
54	*Tadarida fulminans*	Madagascan large free-tailed bat
55	*Tadarida ventralis*	African free-tailed bat
56	*Taphozous mauritianus*	Mauritian tomb bat
57	*Taphozous perforatus*	Egyptian tomb bat
Source: Northern Cape Nature Conservation Act (2009)		

Appendix D

List of reptiles and amphibians occurring and potentially occurring in the region.

Reptiles

Family	Scientific Name	Common Name	Red List Status (2014)	NEMBA TOPS List (2007)	Northern Cape Status (2009)	Endemic Status	Recorded in Study Area
Agamidae	*Acanthocercus atricollis atricollis*	Southern Tree Agama	-	-	-	-	
Agamidae	*Agama aculeata aculeata*	Western Ground Agama	-	-	-	-	
Agamidae	*Agama aculeata distanti*	Eastern Ground Agama	-	-	-	Endemic	
Agamidae	*Agama anchietae*	Anchieta's Agama	-	-	-	-	Confirmed
Agamidae	*Agama atra*	Southern Rock Agama	-	-	-	Near Endemic	
Amphisbaenidae	*Monopeltis mauricei*	Maurice's Worm Lizard	-	-	-	-	
Amphisbaenidae	*Zygaspis quadrifrons*	Kalahari Dwarf Worm Lizard	-		-	-	
Chamaeleonidae	*Chamaeleo dilepis*	Flap-neck Chameleon	-	-	Specially Protected	-	
Chamaeleonidae	*Chamaeleo namaquensis*	Namaqua Chameleon	-	-	Specially Protected	-	
Colubridae	*Dasypeltis scabra*	Rhombic Egg-eater	-	-	Protected	-	
Cordylidae	*Karusasaurus polyzonus*	Southern Karusa Lizard	-	-	Protected	Near Endemic	
Elapidae	*Dendroaspis polylepis*	Black Mamba	-	-	-	-	
Elapidae	*Naja nigricincta woodi*	Black Spitting Cobra	-	-	-	-	
Elapidae	*Naja nivea*	Cape Cobra	-	-	-	-	
Gekkonidae	*Chondrodactylus angulifer angulifer*	Common Giant Gecko	-	-	-	-	
Gekkonidae	*Chondrodactylus bibronii*	Bibron's Gecko	-	-	-	-	
Gekkonidae	*Chondrodactylus turneri*	Turner's Gecko	-	-	-	-	
Gekkonidae	*Colopus wahlbergii furcifer*	Striped Ground Gecko	-	-	-	-	

Family	Scientific Name	Common Name	Red List Status (2014)	NEMBA TOPS List (2007)	Northern Cape Status (2009)	Endemic Status	Recorded in Study Area
Gekkonidae	*Colopus wahlbergii wahlbergii*	Kalahari Ground Gecko	-	-	-	-	
Gekkonidae	*Lygodactylus bradfieldi*	Bradfield's Dwarf Gecko	-	-	-	-	
Gekkonidae	*Pachydactylus capensis*	Cape Gecko	-	-	-	-	
Gekkonidae	*Pachydactylus punctatus*	Speckled Gecko	-	-	-	-	
Gekkonidae	*Pachydactylus rugosus*	Common Rough Gecko	-	-	-	-	
Gekkonidae	*Ptenopus garrulus garrulus*	Common Barking Gecko	-	-	-	-	
Gekkonidae	*Ptenopus garrulus maculatus*	Spotted Barking Gecko	-	-	-	-	
Lacertidae	*Heliobolus lugubris*	Bushveld Lizard	-	-	Protected	-	
Lacertidae	*Meroles suborbitalis*	Spotted Desert Lizard	-	-	Protected	-	
Lacertidae	*Nucras tessellata*	Western Sandveld Lizard	-	-	Protected	-	
Lacertidae	*Pedioplanis inornata*	Plain Sand Lizard	-	-	Protected	-	Confirmed
Lacertidae	*Pedioplanis lineoocellata lineoocellata*	Spotted Sand Snake	-	-	Protected	-	
Lacertidae	*Pedioplanis namaquensis*	Namaqua Sand Lizard	-	-	Protected	-	Confirmed
Lamprophiidae	*Atractaspis bibronii*	Bibron's Stiletto Snake	-	-	-	-	
Lamprophiidae	*Boaedon capensis*	Common House Snake	-	-	-	-	
Lamprophiidae	*Dipsina multimaculata*	Dwarf Beaked Snake	-	-	-	-	
Lamprophiidae	*Prosymna sundevallii*	Sundevall's Shovel-snout	-	-	Protected	Near Endemic	
Lamprophiidae	*Psammophis notostictus*	Karoo Sand Snake	-	-	-	-	
Lamprophiidae	*Psammophis trinasalis*	Four-marked Sand Snake	-	-	-	-	
Lamprophiidae	*Pseudaspis cana*	Mole Snake	-	-	Protected	-	
Lamprophiidae	*Xenocalamus bicolor bicolor*	Bicoloured Quill-snouted Snake	-		-	-	

Family	Scientific Name	Common Name	Red List Status (2014)	NEMBA TOPS List (2007)	Northern Cape Status (2009)	Endemic Status	Recorded in Study Area
Leptotyphlopidae	*Leptotyphlops scutifrons*	Peter's Thread Snake	-	-	-	-	
Scincidae	*Acontias gariepensis*	Mier Kalahari Legless Skink	-	-	-	-	
Scincidae	*Acontias kgalagadi kgalagadi*	Kgalagadi Legless Skink	-	-	-	-	
Scincidae	*Mochlus sundevallii sundevallii*	Sundevall's Writhing Skink	-	-	-	-	
Scincidae	*Trachylepis capensis capensis*	Cape Skink	-	-	-	-	
Scincidae	*Trachylepis occidentalis*	Western Three-striped Skink	-	-	-	-	
Scincidae	*Trachylepis punctulata*	Speckled Sand Skink	-	-	-	-	
Scincidae	*Trachylepis sparsa*	Karasburg Tree Skink	-	-	-	-	
Scincidae	*Trachylepis striata*	Stripped Skink	-	-	-	-	
Scincidae	*Trachylepis spilogaster*	Kalahari Trees Skink	-	-	-	-	
Testudinidae	*Psammobates oculifer*	Serrated tent Tortoise	-	-	Protected	-	
Testudinidae	*Stigmochelys pardalis*	Leopard Tortoise	-	-	Protected	-	
Typhlopidae	*Rhinotyphlops schinzi*	Schinz's Beaked Blind Snake	-	-	-	-	
Varanidae	*Varanus albigularis albigularis*	Rock Monitor	-		Protected	-	
Viperidae	*Bitis arietans arietans*	Puff Adder	-	-	-	-	
Viperidae	*Bitis caudalis*	Horned Adder	-	-		-	
Source: Based on the distribution maps in Bates *et al.* (2014).							

Amphibians

Family	Scientific Name	Common Name	IUCN Status (2021)	NEMBA TOPS List (2007)	Northern Cape Status
Breviceptidae	*Breviceps adspersus*	Bushveld Rain Frog	-	-	Protected
Bufonidae	*Amietophrynus gutturalis*	Guttural Toad	-	-	Protected
Bufonidae	*Amietophrynus poweri*	Western Olive Toad	-	-	Protected
Bufonidae	*Vandijkophrynus gariepensis*	Karoo Toad	-	-	Protected
Bufonidae	*Kassina senegalensis*	Bubbling Kassina	-	-	Protected
Microhylidae	*Phrynomantis annectens*	Marbled Rubber Frog	-	-	Protected
Pipidae	*Xenopus laevis*	Common Platanna	-	-	Protected
Pyxicephalidae	*Amietia angolensis*	Common River Frog	-	-	Protected
Pyxicephalidae	*Cacosternum boettgeri*	Common Caco	-	-	Protected
Pyxicephalidae	*Pyxicephalus adspersus*	Giant Bullfrog	-	Protected	Specially Protected
Pyxicephalidae	*Tomopterna cryptotis*	Tremolo Sand Frog	-	-	Protected
Pyxicephalidae	*Tomopterna tandyi*	Tandy's Sand Frog	-	-	Protected
Source: Distributions as per Du Preez & Carruthers (2009).					

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Education & Qualifications

University of the Witwatersrand
M.Sc. Resource Conservation Biology (2013).

University of KwaZulu-Natal
BSc. Hons. Ecology and Conservation Biology (2005).

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University of KwaZulu-Natal
BSc. Zoology and Grassland Science (2004).

Bryanston High School, Johannesburg
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Profile

I am an ecologist with an M.Sc. Degree in Resource Conservation Biology and over 13 years of experience working in biodiversity consulting and ecological research. I am registered with the South African Council of Natural Scientific Professions as a Professional Natural Scientist. I currently work as an independent consulting ecologist, with Hawkhead Consulting. During my career I have worked on projects in remote areas in several African countries including South Africa, Botswana, Democratic Republic of the Congo, Ethiopia, Ghana, Mozambique, Tanzania and Zambia. I have also previously worked in the United Kingdom and the United Arab Emirates.

Work Experience

Independent Ecologist
Hawkhead Consulting, South Africa
September 2020 – Present

Consulting ecologist focusing on terrestrial ecology. I specialise in conducting baseline flora and fauna surveys, ecological impact assessments, and developing mitigation and management programmes for projects and operations in various industry sectors. Core services and responsibilities include, amongst others:

- ❑ Biodiversity study design and implementation;
- ❑ Biodiversity baseline and impact assessment reporting;
- ❑ Mitigation measure design and application;
- ❑ Vegetation surveys and vegetation community mapping;
- ❑ Fauna surveys for mammals, birds, reptiles and amphibians;
- ❑ Development of biodiversity management plans;
- ❑ Development of rehabilitation and revegetation plans; and
- ❑ Alien invasive species control and eradication plans.

Ecologist
Golder Associates Africa, South Africa
June 2011 – September 2020

Ecologist responsible for the management and implementation of baseline biodiversity studies and ecological impact assessments for development projects in the mining, power generation, transport, land development and industrial development sectors throughout sub-Saharan Africa.
Role responsibilities included project management, technical review, biodiversity study design and implementation, flora and fauna surveys, biodiversity baseline and impact assessment reporting, development of biodiversity management plans, rehabilitation plans and alien invasive species control and eradication plans. These studies were conducted to satisfy national environmental regulations and/or international financing requirements, including the International Finance Corporation's Performance Standard 6.

Affiliations

Member of the South African Wildlife Management Association

Member of the South African Council of Natural Scientific Professions – Professional Natural Scientist (400687/15).

Work Experience (continued)

Independent Ecologist
Subcontracted to KPMG, United Arab Emirates
March – April 2011

Subcontracted to KPMG as a subject matter expert (ecology) on the internal audit of Sir Bani Yas Island's Conservation Department (United Arab Emirates). The audit focused on evaluating the efficacy of the island's various conservation practices, including game management, feed provisioning, carnivore breeding and monitoring, veterinary care and vegetation maintenance.

Environmental Consultant
WSP Environment and Energy, South Africa
August 2008 – March 2011

Environmental consultant, responsible for a range of environmental projects and services including managing environmental authorisation processes (BAs and EIAs), facilitating stakeholder engagement processes, conducting compliance audits, developing environmental management programmes and conducting specialist ecological studies.

Research Technician
Yale University, Kruger National Park, South Africa
October 2007 – May 2008

Research technician on the Savanna Convergence Experiment (SCE). The SCE project was a long-term cross-continental study that investigated the role of mega-herbivores in fire-grazing interactions and their influence on vegetation dynamics. Responsible for collecting and analysing vegetation composition and productivity data, as well as herbivore distribution data.

Publications

- Zinn, A.D., D.E., Burkepile and D.I. Thompson (In prep). Impacts of fire and herbivores on tree seedling establishment in a South African savanna.
- Burkepile, D.E., C.E. Burns, E. Amendola, G.M. Buis, N. Govender, V. Nelson, C.J. Tambling, D.I. Thompson, A.D. Zinn and M.D. Smith (2013). Habitat selection by large herbivores in a southern African savanna: the relative roles of bottom-up and top-down forces. Ecosphere, 4(11):139.
- Knapp, A.K., D.L. Hoover, J.M. Blair, G. Buis, D.E. Burkepile, A. Chamberlain, S.L. Collins, R.W.S Fynn, K.P. Kirkman, M.D. Smith, D. Blake, N. Govender, P. O'Neal, T. Schreck and A. Zinn (2012). A test of two mechanisms proposed to optimize grassland aboveground primary productivity in response to grazing. Journal of Plant Ecology, 5, 357-365.
- Zinn, A.D., D. Ward and K. Kirkman (2007). Inducible defences in *Acacia sieberiana* in response to giraffe browsing. African Journal of Range and Forage Science, 24, 123-129.

Publications (continued)

- Zinn, A.D. (2007). Exploitation vs. Conservation: A Burgeoning Fifth Column. African Wildlife, 61, 9-11.
- Andrew Zinn (2006). Conflict Resolution. Africa Birds and Birding. Vol. 11, No. 5, 12-13.

forestry, fisheries & the environment

Department:
Forestry, Fisheries and the Environment
REPUBLIC OF SOUTH AFRICA

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

	(For official use only)
File Reference Number:	
NEAS Reference Number:	DEA/EIA/
Date Received:	

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

PROJECT TITLE

Mier Rietfontein Solar PV and Battery Storage Project

Kindly note the following:

1. This form must always be used for applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting where this Department is the Competent Authority.
2. This form is current as of April 2021. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.environment.gov.za/documents/forms.
3. A copy of this form containing original signatures must be appended to all Draft and Final Reports submitted to the department for consideration.
4. All documentation delivered to the physical address contained in this form must be delivered during the official Departmental Officer Hours which is visible on the Departmental gate.
5. All EIA related documents (includes application forms, reports or any EIA related submissions) that are faxed; emailed; delivered to Security or placed in the Departmental Tender Box will not be accepted, only hardcopy submissions are accepted.

Departmental Details

Online Submission:
EIAapplications@environment.gov.za or https://sfiler.environment.gov.za:8443/.

Please read the process for uploading files to determine how files are to submitted to this Department.

Postal address:
Department of Forestry, Fisheries and the Environment
Attention: Chief Director: Integrated Environmental Authorisations
Private Bag X447
Pretoria
0001

Physical address:
Department of Forestry, Fisheries and the Environment
Attention: Chief Director: Integrated Environmental Authorisations
Environment House
473 Steve Biko Road
Arcadia

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

1. SPECIALIST INFORMATION

Specialist Company Name:	Hawkhead Consulting			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)		Percentage Procurement recognition	
Specialist name:	Andrew Zinn			
Specialist Qualifications:	M.Sc. Resource Conservation Biology			
Professional affiliation/registration:	Member of the South African Council of Natural Scientific Professions - Pr.Sci.Nat. 400687/15			
Physical address:	58 Central Rd, Linden Ext, Johannesburg, Gauteng			
Postal address:	58 Central Rd, Linden Ext, Johannesburg, Gauteng			
Postal code:	2195	Cell:	083 361 0373	
Telephone:		Fax:		
E-mail:	andrew@hawkhead.co.za			

2. DECLARATION BY THE SPECIALIST

I, __Andrew Zinn_____, declare that –

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

Signature of the Specialist

Hawkhead Consulting

Name of Company:

12 July 2021

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

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

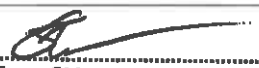
Signature of the Specialist

Golder Associates

Name of Company

12 July 2021

Date



Tracy Skinner
Commissioner of Oaths
Ex-Officio Professional GISc Practitioner (PGP 1356)
Magwa Crescent West, Waterfall City
Midrand

Signature of the Commissioner of Oaths

12 July 2021

Date