



Lesedi Power Company
75 MW Humansrus Photovoltaic (PV) 1 Solar Power Facility: Northern Cape Province
Terrestrial Fauna Species Review

February 2023



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Specialist Qualification & Declaration

Barbara Kasl (CV summary attached as Appendix A):

- Holds a PhD in Animal, Plant and Environmental Sciences from the University of the Witwatersrand;
- Is a registered SACNASP Professional Ecological and Environmental Scientist (Pr.Sci.Nat. Registration No.: 400257/09), with expertise in faunal ecology; and
- Has been actively involved in the environmental consultancy field for over 14 years.

I, Barbara Kasl, confirm that:

- I act as independent consultant and specialist in the field of ecology and environmental sciences;
- I have no vested interest in the project other than remuneration for work completed in terms of the Scope of Work;
- I have presented the information in this report in line with the requirements of the Animal Species and Terrestrial Biodiversity Protocols as required under the National Environmental Management Act (107/1998) (NEMA) as far as these are relevant to the specific subject and Scope of Work;
- I have taken NEMA Principals into account as far as these are relevant to the Scope of Work; and
- Information presented is, to the best of my knowledge, accurate and correct within the restraints of stipulated limitations.



02-02-2023

Acronyms

ADU	Animal Demographic Unit
AI(S)	Alien Invasive (Species)
BGIS	Biodiversity Geographic Information System
CBA	Critical Biodiversity Areas
ESA	Ecological Support Area
IUCN	International Union for Conservation of Nature
NEMA	National Environment Management Act, 1998 (Act No. 107 of 1998)
NFEPA	National Freshwater Ecosystem Priority Area
NPAES	National Protected Area Expansion Strategy
PA	Protected Area
PES	Present Ecological State
QDGS	Quarter Degree Grid Square
RIVCON	River Condition
RL	Red-listed
SANBI	South African National Biodiversity Institute
SCC	Species of Conservation Concern
SEI	Site Ecological Importance
SWSA	Strategic Water Source Area
TOP(S)	Threatened or Protected (Species)
UNESCO	United Nations Educational, Scientific and Cultural Organization
VMUS	Virtual Museum

Table of Contents

1. Introduction & Background.....	1
1.1 Scope of Work & Methodology.....	6
1.2 Limitations.....	8
2. Results.....	9
2.1 Summary of Biodiversity Features & Impact Statements.....	12
2.2 Summary of TOP Fauna & Impact Statements.....	14
3. Conclusion and Recommendations.....	18
4. References & Bibliography.....	20
4.1 Literature.....	20
4.2 Internet Sources.....	21

List of Tables

Table 1: Scope as per GN1150 (2020) & GN320 (2020).....	6
Table 2: Site habitat characterisation.....	9
Table 3: Desktop ecologically significant features & impact statements.....	12
Table 4: Species confirmed on site or assumed confirmed based on fauna signs.....	17
Table 5: Historically recorded and likely vertebrates of conservation concern (pre-development).....	17

List of Plans

Plan 1: Local setting of the Lesedi (north and south focus area) Power Plant Projects within the property boundary.....	3
Plan 2: Google Earth image (March 2019) of the Lesedi Solar Project area indicating originally planned infrastructure and existing (as-built) infrastructure.....	4
Plan 3: Google Earth image (August 2005) of the Lesedi Solar Project area indicating originally planned infrastructure and existing (as-built) infrastructure.....	5
Plan 4: Lesedi Power Project development area (red outline) within the farm boundary (black outline) in relation to NFEPA features (SANBI Map Viewers).....	14

List of Appendices

Appendix A: CV, Qualification, SACNASP registration

Appendix B: Desktop fauna records (mainly from ADU and iNaturalist)

1. Introduction & Background

Oakleaf Investment Holdings 79 (RF) (Pty) Ltd (trading as Lesedi Power Company) have constructed a solar PV plant, called the Lesedi Power Project, [Humansrus Solar Power (PV1) Farm adjacent to the Humansrus Solar Power (PV2) Farm called the Jasper Power Project]. The Lesedi Power Project is located off the R385 on the farm Humansrus 469 (Plan 1), 26km east of Postmasberg, within the Tsantsabane Local Municipality (Siyanda District), Northern Cape Province. Detailed background info for the project was provided by EARTHnSKY and is included below (items relevant to this scope are underlined and indicated in Plan 2):

“On 29 August 2011, an Environmental Authorisation was issued by the National Department of Environmental Affairs for the construction of the 160MW Humansrus Solar Power Farm on the Farm Humansrus 469 (DEA Reference: 12/12/20/1903). Due to Eskom’s restrictions in terms of the Renewable Energy IPP Procurement Programme (REIPPPP), an amendment application was lodged to split the 160MW Humansrus Solar Power Farm into two separate 75MW solar facilities (for Lesedi- and Jasper Power Projects), and therefore two separate Environmental Authorisations. This amendment application relates to the Environmental Authorisation granted for the 75 MW Humansrus Photovoltaic (PV) 1 Solar Power Facility (referred to as Lesedi Power Company), as issued on 23 February 2012 (DEA Reference: 12/12/20/1903/1). A subsequent Environmental Authorisation amendment was granted on 11 July 2012 to change the holder of the Environmental Authorisation from Intikon Energy (Pty) Ltd. to Oakleaf Investment Holdings 79 (Pty) Ltd (DEA Reference: 12/12/20/1903/1).

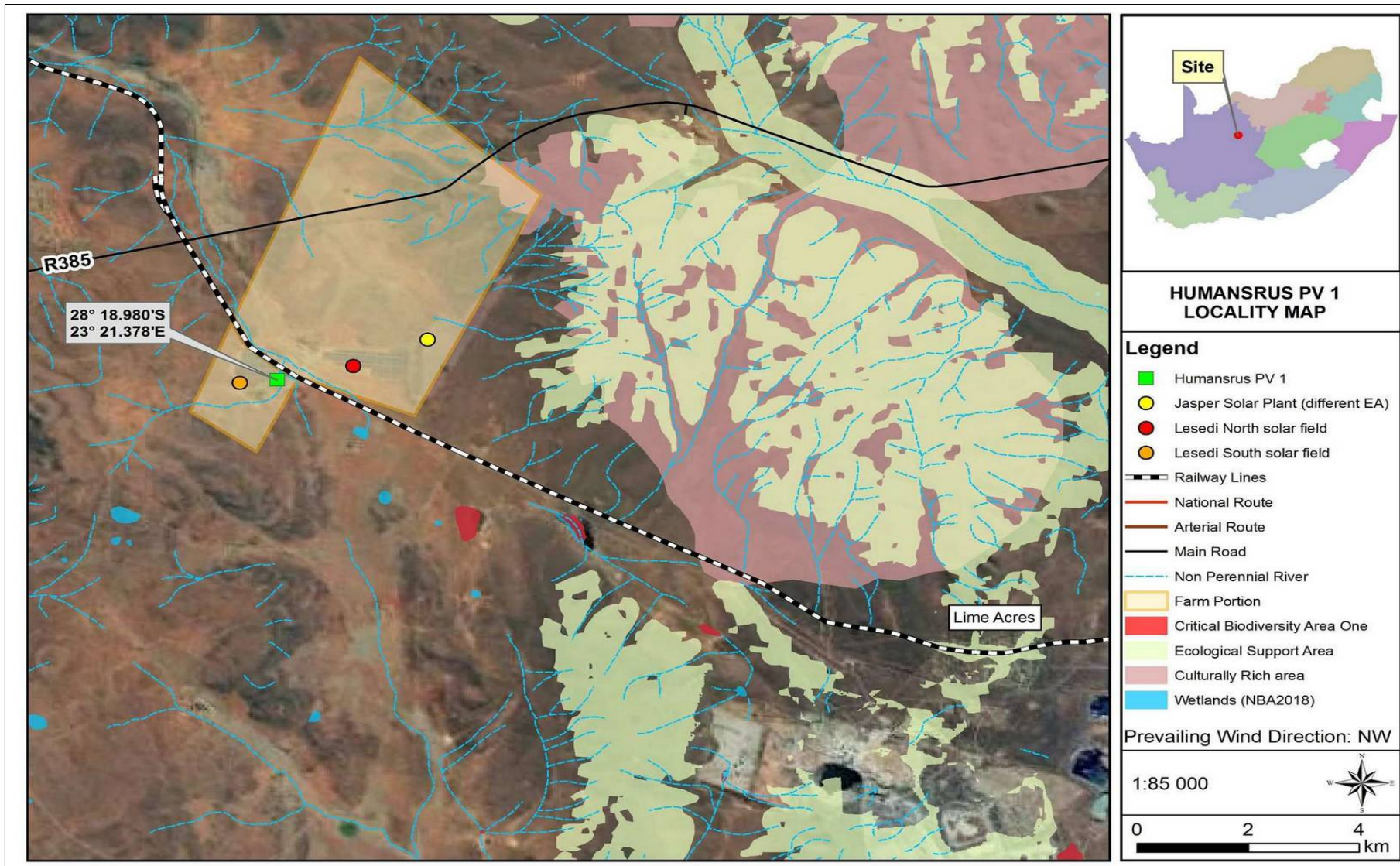
In 2017, a further Environmental Authorisation amendment application was submitted (DEA Reference: 12/12/20/1903/AM3). The purpose of this application was to align the Environmental Authorisation to the infrastructure that had been built on site, as some layout and design changes were made subsequent to the Environmental Authorisation having been granted. This application was, however, never completed, as it was determined that authorization was first required for Section 21 (c), (i) and (f) water uses in terms of the National Water Act, 1998). A Water Use Registration Record No. 25065811 was issued by the Department of Water and Sanitation on 26 April 2019 for one road crossing a water course. This Registration Certificate was revised by the Department of Water and Sanitation on 24 June 2021 to include two additional access roads and the overhead powerline crossing watercourses (File No. 27/2/2/D173/18/1). The Department of Water and Sanitation also issued a letter, dated 13 July 2021 (File No. 27/2/2/C591/55/1), confirming that sewage effluent discharge on site falls within the ambit of a General Authorization under section 21(f) and is a permissible water use under section 22 of the NWA.

This current Environmental Authorisation amendment application will be lodged in order to finalise the application that was initiated but not completed in 2017.

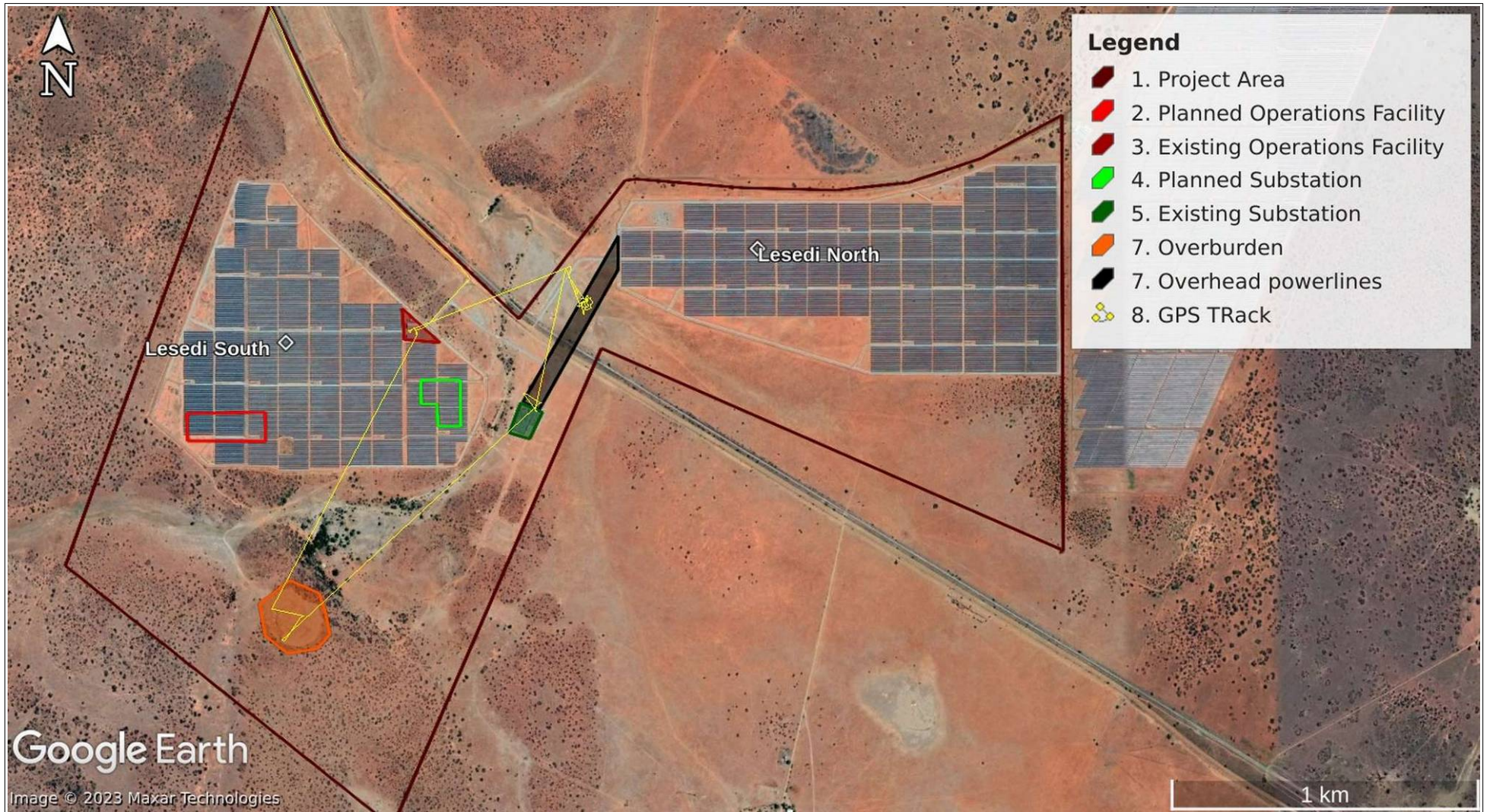
Environmental Authorisation amendment is sought for the following:

- i. Confirmation of change of the contact person for Oakleaf Investment Holdings 79 (Pty) Ltd. (Trading as Lesedi Power Company (Pty) Ltd.);*
- ii. To amend the size and location of the substation, and indicate that the substation area comprises a control room, external 132kV transformers, electric switch gear, capacitor banks and is fenced for security and safety;*
- iii. To indicate the location of the operations and maintenance facility, and to show this consists of an office and storage buildings, security, ablution facilities, parking, outdoor storage area and water treatment facility;*
- iv. To include aboveground 22kV power lines between the northern solar field and the substation, i.e. across the railway line and D3381 road;*
- v. Relaxation of the 200m visual buffer (condition 29 of the Environmental Authorisation) and the 50m buffer (condition 30 of the Environmental Authorisation) for the aboveground 22kV power lines between the northern solar field and the substation that cross the railway line and D3381 road;*
- vi. To show PV arrays of up to 1km in length across the south solar field and up to 1,5km in length across the north solar field, and made up of approximately 100m sections;*
- vii. To accommodate the temporary storage of up to 300 waste solar PV modules on site, in compliance with the 2013 National Norms and Standards for the storage of waste, as per National Environmental Management: Waste Act Regulations (a Norms and Standard Registration application will also be lodged with the National Department of Forestry, Fisheries and the Environment for the storage of the waste solar PV modules);*
- viii. To align the authorised development footprint with the farm boundary, to accommodate the overburden storage area, and to indicate that a small borrow pit on site was not needed during the construction phase, as excess overburden was used for filling;*
- ix. To indicate that the solar irradiation measuring panel (approximately 16m² in size) was in place during the feasibility stage, to collect data on the solar resource which informed the layout of the facility, but is not permanent, and was removed prior to commencement of operations;*
- x. To include three autonomous weather stations (aws), approximately 4m in height, for continuous monitoring of local conditions during the operational phase, and three soiling stations consisting of two PV panels each, measuring approximately 4m² in size each, to monitor and determine operational efficiencies;*
- xi. Approval of the as-built drawings and layout plans for the entire operations, as well as access roads used to the solar fields and substation."*

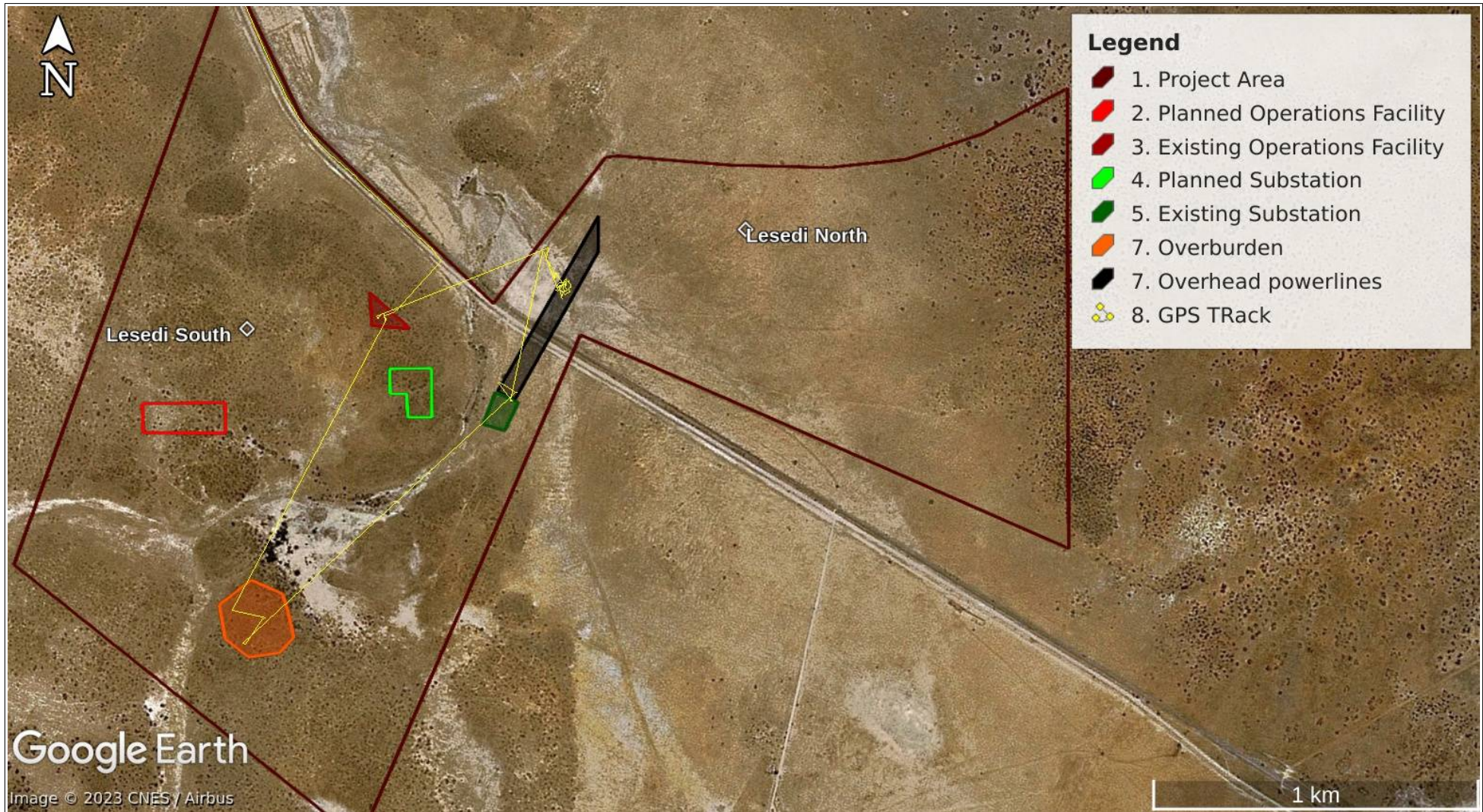
A previous ecological assessment and report was completed by Prof. P. J. du Preez in January 2011 as part of the original application. The report represents the baseline status of the area and has been considered for pre-development status as represented in this compliance statement.



Plan 1: Local setting of the Lesedi (north and south focus area) Power Plant Projects within the property boundary



Plan 2: Google Earth image (March 2019) of the Lesedi Solar Project area indicating originally planned infrastructure and existing (as-built) infrastructure



Plan 3: Google Earth image (August 2005) of the Lesedi Solar Project area indicating originally planned infrastructure and existing (as-built) infrastructure

1.1 Scope of Work & Methodology

Separate avifauna protocols and specialist assessment are required in terms of Solar PV projects and powerlines and the avifauna has been excluded from this review. Where this report refers to terrestrial fauna, this explicitly excludes avifauna.

According to Environmental Screening Tool Report, the following is relevant in terms of the site:

- The site ranks as low sensitivity for animal species.
- The greater area ranks as very high sensitivity for aquatic and terrestrial biodiversity, largely due to aquatic features associated with SWSAs and NFEPA catchments, not within the terrestrial species scope but considered in terms of terrestrial fauna in terms of habitat and water provision..

Due to the overall low sensitivity rank for animal species, and the fact that the site is already established, a compliance statement process has been followed in compiling this review and professional opinion for terrestrial fauna as per the requirements for the Assessment and Reporting of Environmental Themes (GN1150 & GN320 of 2020) (Table 1), published under the National Environment Management Act, 1998 (Act No. 107 of 1998) (NEMA). A site verification was completed.

Table 1: Scope as per GN1150 (2020) & GN320 (2020)

Common requirements	Section
Contact details, SACNASP registration number and curriculum vitae.	Appendix A
A signed statement of independence by the specialist.	Page i
Statement on the duration, date and season of the site inspection.	Section 2
Impact management actions and outcomes / monitoring requirements.	Section 3
Assumptions, uncertainties, gaps in knowledge or data.	Section 1.2
Any conditions to which the compliance statement is subjected.	Section 3
GN1150 Terrestrial Animal Species: Section 3	
5.3.4: Methodology used to undertake the site survey.	Section 1.1
5.3.5: Mean density of observations / number of samples sites.	Table 2
GN320 Terrestrial Biodiversity (as relevant to terrestrial fauna only): Section 3	
4.3.4: Baseline profile description of biodiversity and ecosystems.	Table 3
4.3.5: Methodology used to verify the sensitivities of biodiversity features.	N/A – existing site
4.3.6: In the case of a linear activity, opinion that the land can be returned to the current state within two years of completion of the construction phase.	N/A

Although no trigger SCCs are listed, a high level threatened and protected (TOP) species assessment was undertaken. The TOP species in this report includes threatened (Vulnerable, Endangered, Critically Endangered) Red-listed and IUCN (IUCNredlist.org) species (Near Threatened species are not included, but status is indicated where species is listed as threatened under another listing). Distribution and general information as presented in this report were sourced for:

- Mammals [sourced from Child, *et al.* (2016) as presented in the mammal Red-list on SANBI.org.za, and the Endangered Wildlife Trust Red-listed mammal fact sheets on ewt.org.za/reddata; supplemented by Stuart and Stuart (2013), Stuart and Stuart (2015), Murray (2011), Monadjem *et al.* (2010a) and Monadjem *et al.* (2010b)].
- Reptiles [Bates, *et al.* (2014). Although an Atlas Project and not strictly a Red-listed species book, provides recent taxonomic names and more recent listings to the prior outdated Red-Data Book of 1988. Reptile information was supplemented by Tolley and Burger (2012)]
- Frogs [sourced from Minter, *et al.* (2004) as presented in the frog Red-lists on FrogMap.adu.org.za and supplemented by du Preez and Carruthers (2009)].
- Invertebrates [also supplemented by Picker *et al.* (2012), Woodhall (2005) and SANBI Biodiversity Advisor Animal Checklists for ants, millipedes, Orthoptera and scarabs]:
 - Butterflies [Mecenero *et al.* (2013) as obtained from the South African Butterfly Conservation Association lists].
 - Dragonflies (Samways & Simaika, 2016).
 - Spiders (Dippenaar-Schoeman *et al.*, 2010).
 - Scorpions (Leeming, 2019).

The likelihood of TOP species occurring on site was generally assessed as follows, and likely species have been included where relevant:

- Likely: Distribution of the species occurs over the site; the site and immediate surrounds provide broad habitat units of the specific species. There is nothing to prevent the species from residing on site for a length of time (season or year).
- Possible: Distribution of the species occurs over the sites but the broader habitat requirements are absent or sparse on site, but are present in the greater surrounds. Species are not likely to reside on site, but may forage over or traverse the site. Species population is at low density over site.
- Unlikely: Distribution is on the edge of or just outside the site and broad habitat requirements are absent or sparse on the site and surrounds. Species population is at low density and erratic over site. No recent records occur in the area.

In addition to NEMA, the following Acts (and their regulations and notices) are relevant to biodiversity and are considered in this report where relevant:

- The National Environmental Management: Biodiversity Act, 2004. (Act 10 of 2004) (NEM:BA).
- The National Environmental Management: Protected Areas Act (Act 57 of 2003) (NEM:PA).

In addition, the Northern Cape Nature Conservation Act No.9 of 2009 provides for the regulation of nature conservation within the province. Although the development does not intend specific activities involving the handling of any fauna species, this legislation must be complied with should circumstances arise that require the handling of any fauna on site.

1.2 Limitations

During the habitat verification assessment, the GPS signal was intermittently lost between sites while travelling in vehicles; survey areas were however captured accurately (Plan 2).

The focus of the project is to determine if any additional impacts may have occurred to terrestrial fauna due to layout changes (Plan 2) which requires extrapolation of surrounding habitat and utilisation of Google Earth historical imagery (Plan 3).

It must be stressed that the survey area is a much smaller area within the larger QDGS utilised for desktop species, and species presented in the citizen science databases may not have been recorded at the specific site.

Larger herbivores have not been fully discussed within this report as these species are actively fenced in and managed within selected areas. Rhinos and elephants (not expected on site) are completely excluded due to sensitivity of information. As these species are largely restricted to reserves and farms this is not seen as a significant omission.

Some species are confirmed through signs rather than actual sightings. This is not always ideal as the age of the signs are not always known and many species have similar scat / tracks / marks on the environment and species cannot always be fully determined. The more signs the more confidence in the identification of the animal. This limitation must be kept in mind where species are included based on signs.

There are inherent errors in mapping programmes which must be considered with all mapping information presented.





Citizen Science projects were used for animal (ADU and iNaturalist) baseline data and, although there is a degree of vetting of data, the pitfalls of Citizen Science projects must be kept in mind.

Due to the low resolution of some distribution maps and the mobility of animals, distribution data utilised to present animal lists are not 100% accurate. Proper distribution data for the TOP invertebrates is scant and it is difficult to conclusively state if every species does or does not occur in the area.

2. Results

A site habitat verification was completed on the 24 January 2023 to characterise the site (Table 2). Weather was warm and sunny with a slight breeze and considered good for fauna assessments.

Table 2: Site habitat characterisation

<p align="center">Overburden (single meander approximately 300m in length)</p> <p>Shrubs and grasses have established on the overburden dump and the area was recently grazed by cattle. Furthermore evidence of Cape Hare was observed on the dump and mongoose (scat and burrows) around the dump. No evidence of unique habitat was noted in the area and the area is utilised by fauna active in the area.</p>	
	
<p>Photograph 1: Overburden dump with established vegetation</p>	<p>Photograph 2: Overburden dump is <2m high (foreground) adjacent to shrubby bushveld with distinct clumps of shrubs</p>
	
<p>Photograph 3: Overburden (foreground), open grassland (lower lying area) and shrubby bushveld (background)</p>	<p>Photograph 4: Tributary of the Groenwaterspruit, north of the overburden dump with rocky bed and neighbouring grassland area</p>
<p align="center">Substation (single meander approximately 200m in length)</p> <p>Grasslands dominated the areas around the substation as the site is in a lower lying area. The habitat unit extends to the ephemeral tributaries and streams and is not considered unique and the surrounding area is utilised by fauna (most notably various invertebrates).</p>	



Photograph 5: Fenced-off substation with surrounding grasslands; lines feeding into the Eskom grid in the foreground



Photograph 6: Open grassland and scattered termite mounds around the substation.

Overhead powerlines (single meander approximately 320m in length)
 The Groenwaterspruit and adjacent grasslands dominate the area. The habitat unit extends along lower lying areas and ephemeral tributaries and streams and is not considered unique. Extensive signs of small mammal activity (small rodents, small antelope and small to medium carnivore activity) was noted in the area.



Photograph 7: Overhead powerlines from Lesedi North to the substation; originally planned as underground cables



Photograph 8: Tributary and grasslands crossed by overhead powerlines



Photograph 9: Bird diversions on powerlines, indicating previous fauna mitigation measures implemented on



Photograph 10: Fencing around solar panels; electrified component facing inwards toward discrete infrastructure

site	area
Operations facility	
The area is built up and provides grassy lawn and man-made habitats.	
	
<p>Photograph 11: Lesedi South panel area (left) and operations facility (background)</p>	<p>Photograph 12: Internal storage area (left) and outdoor storage area with water treatment (using new unGer technology).</p>
	
<p>Photograph 13: Guard house at entrance and recycling bins</p>	<p>Photograph 14: Sewage treatment area</p>

The site findings are in agreement with the prior ecological report (du Preez, 2011) which stipulated that the vegetation was relatively homogeneous throughout the study area [that study area encompassed the Lesedi and Jasper Power Project, as well as the Red Stone Concentrated Solar Power (CSP) plant, currently under construction] and no significant or sensitive features in terms of terrestrial fauna were noted; further supported by the historical Google Earth imagery (Plan 3). The habitat on site is fairly homogeneous and can be considered as dry shrubby bushveld with limited small trees and open grasslands in the lower lying areas and along the ephemeral tributaries and streams. Substrates were either rocky (usually the higher lying areas) or sandy soils (into the lower lying areas). Denser and taller trees were limited to the area around the old farmstead, just north of the overburden dump (Plan 3).

The activities on site are compact and tidy and active management was noted in terms of fauna (bird diversions on overhead powerlines at the stream-crossing, electrification of fences focussed toward infrastructure areas rather than outwards, fences established around discrete operational areas rather than across vast open spaces reducing edge effects and habitat fragmentation).

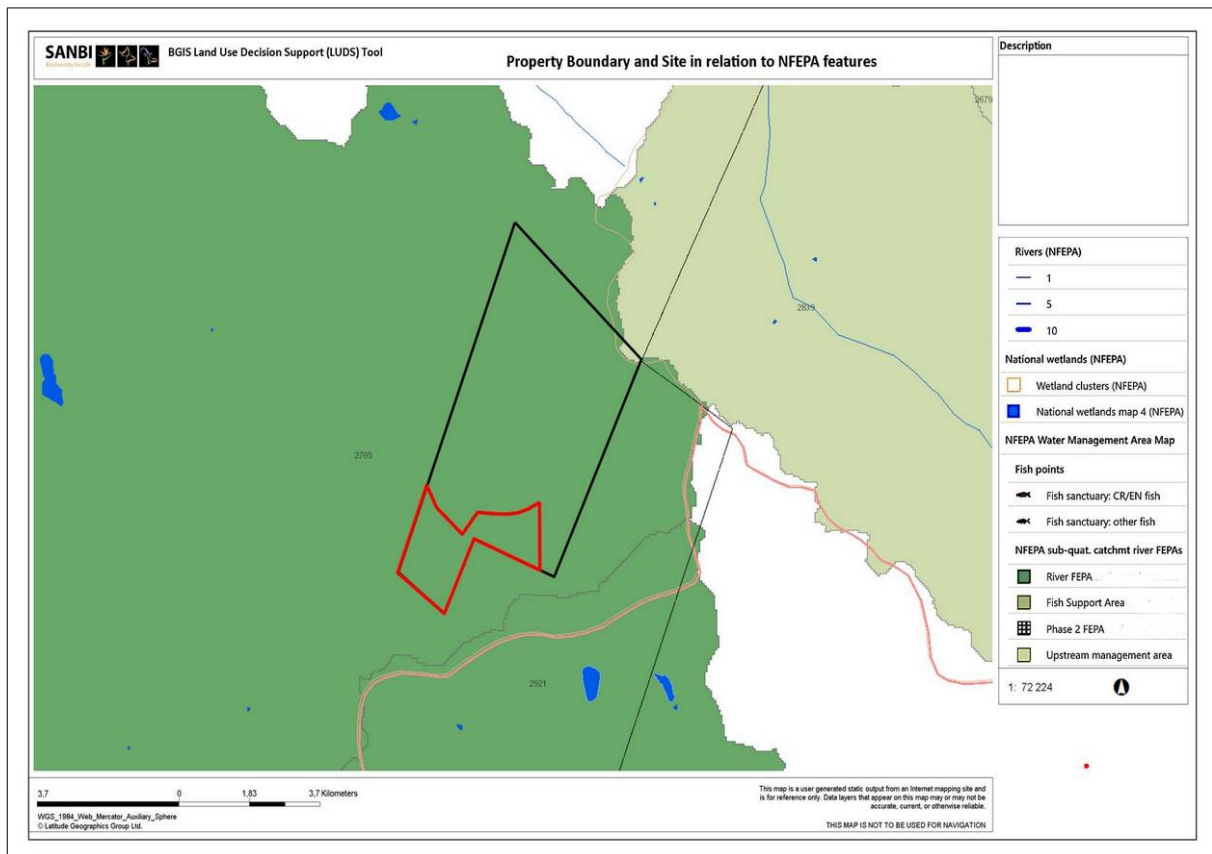
2.1 Summary of Biodiversity Features & Impact Statements

Table 3 summarises the desktop ecological features of the site, focussing on those in the biodiversity protocols that are of relevance to terrestrial fauna of the site. Table 3 also provides an impact statement as per the requirements of a compliance statement.

Table 3: Desktop ecologically significant features & impact statements

Ecological feature / area	Description of feature relevant to the site
International Conservation	No World Heritage Sites or RAMSAR Wetlands occur within 50km of site. Impact Statement: <ul style="list-style-type: none"> No direct or indirect impacts have occurred to sites of international conservation due to the existing layout.
Protected Areas (PA) & National Protected Areas Expansion Strategy (NPAES)	No formal PAs, informal PAs or NPAES lie within 10km of the site. Impact Statement: <ul style="list-style-type: none"> No direct or indirect impacts have occurred to PAs, NPAES and PA buffer zones due to the existing layout. The site is not considered a significant satellite habitat for species dispersing from PAs; impact to dispersing species due to existing layout is of negligible significance.
National Freshwater Ecology Priority Areas (NFEPA) (Plan 4)	The site is within a NFEPA Catchment. No NFEPA wetlands occur on site; no Rank 1 or 2 Wetlands occur within a 10km of site. The site is within the upper catchment of the Moderately Modified (PES C) Soutloop River, although no NFEPA rivers occur on site. Local drainage is towards the Groenwaterspruit which flows north-west between Lesedi North and Lesedi South. Impact Statement: <ul style="list-style-type: none"> The existing substation is in closer proximity to the riverine area, but still located outside of the 1:100 year flood line (Knight Piesold Consulting, 2018). No new impacts are expected in terms of terrestrial fauna due to the overall existing layout. Impacts associated with potential contamination of land and downstream environments through stormwater runoff must continue to be managed in line with the approved Environmental Management Plan. It must be stressed that no obvious evidence of such impacts was noted during the site verification and the impact is considered to be of minor significance. Impact to the dispersal corridor of the Groenwaterspruit by overhead powerlines in terms of terrestrial fauna is considered negligible. Previous recommended mitigation measures (bird diversions) have been implemented for avifauna (du Preez, 2011).

Ecological feature / area	Description of feature relevant to the site
Biome and Ecosystem	<p>The area falls within the Savanna Biome and the Olifantshoek Plains Thornveld vegetation type, which is not a TOP ecosystem (NEM:BA, GN1002, 2011).</p> <p>Impact Statement:</p> <ul style="list-style-type: none"> The development has resulted in alteration of the vegetation type to man-made infrastructure and a slightly higher proportion of open grassland has been impacted by the existing substation locality (previously located in shrubby bushveld). Both habitat units are expansive adjacent to site and into the neighbouring areas; impact on terrestrial fauna habitat as a result of the existing layout is considered to be of negligible significance.
Strategic Water Source Areas (SWSA)	<p>The site falls within the Southern Ghaap Plateau strategic groundwater Source area.</p> <p>Impact Statement:</p> <ul style="list-style-type: none"> Groundwater impacts are outside the scope of study. In terms of terrestrial fauna, the impact to the water resource is not expected to be exacerbated by the existing layout, but water resources must be protected in line with the approved Environmental Management Plan.
Northern Cape Conservation Plan	<p>The entire site is within an area designated as “other natural area” and no Critical Biodiversity Areas (CBAs) or Ecological Support Areas (ESAs) occur on site or in close proximity to site.</p> <p>Impact Statement:</p> <ul style="list-style-type: none"> The development and existing layout has not contributed to any significant direct or indirect impacts to the CBAs or ESAs.



Plan 4: Lesedi Power Project development area (red outline) within the farm boundary (black outline) in relation to NFEPA features (SANBI Map Viewers)

2.2 Summary of TOP Fauna & Impact Statements

The site lies largely within QDGS 2823AD. All desktop data obtained from the citizen science sites have been sourced for this QDGS. Previously recorded species (ADU / iNaturalist) are indicated in Appendix B. In terms of the ADU lists and iNaturalist species the following is relevant:

- Species names are indicated as per sources referenced listed in Section 1.1.
- Unidentified and excluded ADU species have not been included in Appendix B.
- Hybrids or special breeds are excluded from Appendix B.
- iNaturalist species that are not considered Research Grade have not been included in Appendix B (*Aethomys chrysophilus*, *Tadarida aegyptiaca*, *Miniopterus natalensis* and *Laephotis capensis*).
- The iNaturalist sighting of *Proteles cristata* was a road-kill specimen.

Table 4 lists species confirmed on site (sighted, reported by land users, confirmed based on fauna signs). All are common species accustomed to a degree of human activity; none are TOP species and only the Common Mole-rat is endemic (with an expansive range in South Africa and is not restricted).

Table 5 lists the TOP and endemic species historically recorded in the area (QDGS) as obtained from citizen science sites (ADU and iNaturalist). In addition, the TOP species identified as highly likely (based on distribution and habitat) to have occurred in the area, pre-development, are also included in Table 5. The development area, regardless of specific layout, is likely to exclude most of these species (reduced habitat and prey and increased anthropogenic activity), but as habitat is available adjacent to the development areas, species may still be active in neighbouring areas or through open spaces on site (around the overburden dump and along corridors associated with the Groenwaterspruit and its tributaries).

Altitude on site varies between 1490-1550mamsl (Google Earth measurements). Species with preferences outside these ranges are considered as unlikely to occur on site.

The following is relevant regarding the species in Table 5:

- **Vertebrates:**
 - No SCCs are listed in the Environmental Screening Report for the area.
 - Southern African Hedgehog (*Atelerix frontalis*) (GN151 Protected) is the only historically recorded (ADU) TOP species and cannot be excluded from site. Main threats include habitat loss, degradation and fragmentation from urban sprawl and agriculture. Also threatened by illegal harvesting from the wild for food, or for sale as pets and traditional medicine (Light *et al.*, 2016). The species should be monitored on site and any populations protected from further impact.
 - TOP species with distribution over the area that may have occurred in the area, could still occur in the surrounding natural landscapes. As highly mobile species (other than the Giant Bullfrog), they are able to retreat to surrounding areas and escape from perceived threats and anthropogenic activity and are unlikely to suffer any direct impact.
 - The Giant Bullfrog is buried and therefore sedentary for much of the year. It has a preferences for seasonal, shallow, grassy pans and vleis (either absent or excluded from the development areas) but also uses rain-filled depressions in open flat areas (considered limited on site due to rocky and sandy nature of substrates). As a fairly conspicuous species during the breeding season (frog calls and swarming juveniles) it is easy to monitor and avoid further impact in future if the species is present on site or neighbouring areas.
 - The site is not part of an area of endemism for vertebrate species.
- **Vertebrate Impact Statement:**
 - **Impacts to vertebrates are unlikely to have differed significantly due to the variations of the existing layout and any impacts to vertebrates is considered to have been of negligible significance.**
- **Invertebrates:**
 - No invertebrate SCCs were listed for the project area.
 - No TOP Lepidoptera, Odonata, Hymenoptera, Coleoptera or Orthoptera have been recorded for the QDGS / general area.

- TOP Arachnida were recorded for the QDGS and general area:
 - *Harpactira* sp. (Araneae: Theraphosidae) (Baboon Spider) was recorded from ADU data for the QDGS.
 - *Opisthophthalmus pluridens* (Scorpiones: Scorpionidae) (Burrowing Scorpion) was recorded in the area on iNaturalist.
 - *Opisthophthalmus* sp. (Scorpiones: Scorpionidae) (Burrowing Scorpion) was recorded in the area on iNaturalist.
- Of the TOP invertebrate Taxons that were noted on site, none were TOP species:
 - *Camponotus fulvopilosus* (Hymenoptera: Formicidae)
 - *Phymateus* sp. (Orthoptera: Pyrgomorphidae).
 - *Spialia diomus* (Lepidoptera: Hesperidae).
 - *Zintha hintza hintza* (Lepidoptera: Lycaenidae).
 - *Vanessa cardui* (Lepidoptera: Nymphalidae) (no photograph).
 - *Belenois aurota aurota* (Lepidoptera: Pieridae) (unconfirmed; no photographic evidence).
- **Invertebrate Impact Statement:**
 - **The previously recorded TOP species may have been impacted but impacts are unlikely to have differed significantly due to the variations of the existing layout. The overall impact significance to invertebrates is considered low.**

No Alien invasive species or exotic species were recorded in the QDGS on the ADU data. Expected alien invasive fauna, such as scavenging rats, are common and often associated with human settlements in South Africa (Picker & Griffiths, 2011).

Table 4: Species confirmed on site or assumed confirmed based on fauna signs

Family	Common Name	Species	Endemism	GN151	Red-List	IUCN
MAMMALS						
Carnivora	Mongoose, Yellow (Burrows with scat)	<i>Cynictis penicillata</i>				
Cetartiodactyla	Gemsbok (Southern Oryx) (Land user)	<i>Oryx gazella</i>				
Cetartiodactyla	Duiker, Common (Scat)	<i>Sylvicapra grimmia</i>				
Cetartiodactyla	Steenbok (Suspected from skeletal remains)	<i>Raphicerus campestris</i>				
Lagomorpha	Hare, Cape (Scat & sighted by flora ecologist)	<i>Lepus capensis</i>				
Rodentia	Mole-rat, Common (Soil mounds)	<i>Cryptomys hottentotus</i>	Endemic			
Rodentia	Squirrel, Cape Ground (Land user)	<i>Xerus inauris</i>				
REPTILES						
Agamidae	Agama, Western Ground (Sighted)	<i>Agama aculeata aculeata</i>				
Varanidae	Monitor, Rock (Land user)	<i>Varanus albigularis albigularis</i>				

Table 5: Historically recorded and likely vertebrates of conservation concern (pre-development)

Family	Common Name	Species	Endemism	GN151	Red-List	IUCN	Likelihood
MAMMALS							
Cetartiodactyla	Blesbok	<i>Damaliscus pygargus phillipsi</i>	Endemic		NT		iNat
Eulipotyphla	Hedgehog, Southern African	<i>Atelerix frontalis</i>		PR	NT		ADU
Carnivora	Cat, Black-footed	<i>Felis nigripes</i>		PR	VU	VU	Likely
Carnivora	Honey Badger (Ratel)	<i>Mellivora capensis</i>		PR			Likely
Carnivora	Leopard	<i>Panthera pardus</i>		VU	VU	VU	Likely
Carnivora	Hyaena, Brown	<i>Parahyaena brunnea</i>		PR	NT	NT	Likely
Carnivora	Fox, Cape	<i>Vulpes chama</i>		PR			Likely
Cetartiodactyla	Wilbebeest, Black	<i>Connochaetes gnou</i>	Endemic	PR			Likely
Cetartiodactyla	Antelope, Sable	<i>Hippotragus niger niger</i>			VU		Likely
Cetartiodactyla	Reedbuck, Southern	<i>Redunca arundinum</i>		PR			Likely
Cetartiodactyla	Reedbuck, Southern Mountain	<i>Redunca fulvorufula</i>			EN	EN	Likely
Pholidota	Pangolin	<i>Smutsia temminckii</i>		VU	VU	VU	Likely
Rodentia	Mole-rat, Common	<i>Cryptomys hottentotus</i>	Endemic				Likely
REPTILES							
NONE							
FROGS							
Pyxicephalidae	Bullfrog, Giant	<i>Pyxicephalus adspersus</i>		PR	NT		

CR: Critically Endangered; EN: Endangered; VU: Vulnerable; PR: Protected; NT: Near Threatened

3. Conclusion and Recommendations

In terms of non-avian fauna species, the findings are in agreement that the site has low sensitivity for animal species. The site is also considered limited in terms of unique biodiversity features of relevance to non-avian terrestrial fauna, limited to ecological corridors associated with the Groenwaterspruit which have been marginally affected by stream crossings.

In terms of the terrestrial fauna, no potential additional significant impacts have been identified as a result of the existing layout and there should be no reason not to authorise and accept the existing layout of the development.

The following recommendations are included in addition to the measures stipulated in the prior ecology report and / or due to the exiting layout:

- Although no issues were reported to date by land users, electrified fences next to open spaces will be monitored daily (either by way of existing cameras or patrols) and all animal mortalities photographed and recorded.
 - The site has automated monitoring and any changes or breaks in currents at the electrified fences reports to a dedicated control room, and is investigated immediately. Therefore the current monitoring can be considered continuous.
 - Daily monitoring by way of patrols must be maintained if the automated control system is down for periods extending a day (breakdowns or maintenance for example).
 - Daily monitoring is required as predators are active in the area that may remove carcasses from site.
 - Additional barriers / alternative barriers (palisade fencing / loose gravel berm for example) will need to be considered if TOP species mortalities are noted.
 - This monitoring should be extended to include areas under the overhead powerlines.
- Generally monitor any TOP species (Section 2.2) that may occur on or enter the site (specifically the South African Hedgehog and Giant Bullfrog). If observed, do not hinder or harm the species but continue to monitor and ensure species are not under threat from activities. Where necessary adaptive management measures must be considered to prevent harm to these species. These can include:
 - Consulting necessary specialists.
 - Ceasing / adjusting scheduled activities and allow species to move off on their own accord.
 - Employ permitted specialists to relocate species.
- Environmental awareness training currently includes the following which must be ongoing:
 - Wildlife protection.
 - Toolbox talks which inform staff that animals may not be killed/harmed.

- Snakes in buildings are reported to and are removed and relocated by trained snake handlers.
- Additional Environmental awareness training which could be incorporated into the toolbox talks is information on how to identify and report sightings of the possible TOP species (Section 2.2).
- All potentially contaminating material (fuel, chemicals, waste, oils and lubricants, sewage, etc.) will continue to be stored and handled according to best practice and will never be needlessly exposed to the environment and accidental spillages will be reported and cleared immediately.

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- whc.unesco.org: for information on SA World Heritage Sites

Appendix A: Barbara Kasl: CV, Qualification, SACNASP registration

- 2010 – current: SACNASP Professional Environmental and Ecological Scientist
- 1999, 2001 & 2008 – current: Entomological Society of South Africa

Tertiary Education

University of the Witwatersrand

- 2002-2004: PhD (Animal, Plant and Environmental Sciences)
- 1999-2001: MSc (upgraded to PhD)
- 1998: B.Sc. Hon. (Zoology and Botany)
- 1995-1998: BSc (Zoology and Botany)

Professional Experience - ±15 years

02/2017 - Current: Self-employed as fauna specialist & environmental consultant

- Fauna impact assessments and management plans.
- Fauna assessment / input into a variety of environmental projects (SOE, EMPr, EMFs)
- Environmental consulting.

01/2008 - 02/2017: CABANGA CONCEPTS:

- Environmental Scientist / Principal Consultant & shareholder in Cabanga Concepts.
- Overall project manager and principal report reviewer.
- Experience with World Bank Standards, IFC Equator Principals.
- Compilation of various environmental applications and documents, including various audit reports.
- Stay current with environmental legislation and standards and norms.
- Review and comment on draft environmental legislation related to environmental sector.

09/2004 - 11/2007: DIGBY WELLS & ASSOCIATES (DIGBY WELLS ENVIRONMENTAL)

- Unit Manager for the Ecology Unit including management of a flora and wetland specialist.
- Acting Department Head and management of the Biophysical Department which included the Ecology Unit and Atmospheric Environment Unit.
- Responsible in completion of fauna assessments and managing ecological projects.
- Various South African and African environmental application and management projects.

Other Professional activities (details can be provided on request)

Mentorship programmes & tutelage

- Field-based tutelage to you professional zoologists.
- High level mentor in the MISA Mentorship Programme for SACNASP candidates.

Participation in legislative processes

- Review and comment on the alien invasive species legislation.
- Review and comment on the environmental themes legislation, specifically the terrestrial biodiversity and animal species protocols and associated guidelines.

Courses / Workshops / Conferences

- February 2022: SANBI Animal Species Guidelines Webinar: Invertebrate Focus Group
- December 2021: South African Science Forum. Attended.
- May 2020: IAIA Species Environmental Assessment Guideline: Webinar for the introduction of the SANBI species assessment guidelines for the animal and plant species protocols. 21 May 2020
- December 2018: South African Science Forum. Attended.
- December 2017: South African Science Forum. Attended.
- April 2017: Alien invasive species identification and management.
- June 2014: Waste Management Law Workshop.
- October 2010: NEM: Air Quality Act Workshop.
- August 2009: NEMA and NEMWA Workshop.
- November 2007: Environmental Impact Assessment Training.
- February/March 2007: Project Management.
- September 2006: Introduction to Managing Environmental Water Quality.
- September 2005: Non-credited course in River health and SASS5.
- May 2005: Snake Identification and Snakebite Treatment Course.
- July 2001: Entomological Society of Southern Africa (2-5 July 2001) Attended & presented talk.
- July 1999: Entomological Society of Southern Africa Conference (12-15 July 1999) Attended & presented poster
- July 1998: Zoological Society of Southern Africa Conference (6-10 July 1998) Attended & presented poster.



herewith certifies that
Barbara Kasl
Registration Number: 400257/09
is a registered scientist

in terms of section 20(3) of the Natural Scientific Professions Act, 2003
(Act 27 of 2003)
in the following fields(s) of practice (Schedule 1 of the Act)
Ecological Science (Professional Natural Scientist)
Environmental Science (Professional Natural Scientist)

Effective **11 November 2009** Expires **31 March 2023**



B. Botha
Chairperson

R. J. ...
Chief Executive Officer



To verify this certificate scan this code



UNIVERSITY OF THE WITWATERSRAND,
JOHANNESBURG

At a congregation of the University
held on 25 November 2004

Barbara Kasl
was admitted to the Degree of
Doctor of Philosophy



[Signature]
Dean, Faculty of Science

[Signature]
Vice-Chancellor and Principal

[Signature]
Registrar



Appendix B: Desktop fauna records (ADU and iNaturalist)

Family	Common name	Scientific name
Mammals		
Carnivora	Mongoose, Slender	<i>Herpestes sanguineus</i>
Carnivora	Aardwolf	<i>Proteles cristata</i>
Cetartiodactyla	Blesbok	<i>Damaliscus pygargus phillipsi</i>
Cetartiodactyla	Warthog, Common	<i>Phacochoerus africanus</i>
Eulipotyphla	Hedgehog, Southern African	<i>Atelerix frontalis</i>
Rodentia	Squirrel, Cape Ground	<i>Xerus inauris</i>
Reptiles		
Agamidae	Agama, Western Ground	<i>Agama aculeata aculeata</i>
Gekkonidae	Gecko, Cape	<i>Pachydactylus capensis</i>
Lacertidae	Lizard, Spotted Sand	<i>Pedioplanis lineocellata lineocellata</i>
Lamprophiidae	Snake, Striped Grass	<i>Psammophylax tritaeniatus</i>
Leptotyphlopidae	Snake, Peters' Thread	<i>Leptotyphlops scutifrons</i>
Scincidae	Skink, Wahlberg's Snake-eyed	<i>Afroablepharus (Panaspis) wahlbergii</i>
Scincidae	Skink, Cape	<i>Trachylepis capensis</i>
Testudinidae	Tortoise, Leopard / Mountain	<i>Stigmochelys pardalis</i>
Viperidae	Adder, Puff	<i>Bitis arietans arietans</i>
Frogs		
Bufonidae	Toad, Western Olive	<i>Amietophrynus (Sclerophrys) poweri</i>
Pyxicephalidae	River Frog, Poynton's	<i>Amietia poyntoni</i>