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TERRESTRIAL BIODIVERSITY IMPACT ASSESSMENT FOR THE PROPOSED 40MW PHOTOVOLTAIC PLANT (PHASE 2) ON THE FARM GOUDMYN 337-KT NEAR STEELPOORT IN THE LIMPOPO PROVINCE

prepared by

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this report was prepared for:

Royal HaskoningDHV
Enhancing Society Together

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SECTION A: EXECUTIVE SUMMARIES

1 BACKGROUND TO THE PROJECT

The client is planning to develop a Photovoltaic (PV) Solar Plant with a total generating capacity of 100 MW on selected portions of the Farms Goudmyn 337-KT and Olifantspoortje 319-KT at the Samancor Tubatse Ferrochrome Smelter in Steelpoort in the Limpopo Province. The application for the initial five (5) sites (collectively comprising 161.4 ha) (hereon termed Phase 1) was submitted to Department of Forestry, Fisheries and the Environment (DFFE) in 2021 and the Environmental Authorisation (EA) was granted on 25 April 2022 (DFFE Ref: 14/12/16/3/3/2/2079). Site 1 is no longer considered as a feasible option for the Solar PV development, which implied that only 60 MW output can be generated from the authorised Phase 1 sites (2 – 5). To achieve the objective of 100 MW generation power, TFC Solar (Pty) Ltd, therefore proposed the development of an additional 40 MW (Solar PV) from Sites 2B, 3B, 3C, 4B and 5B (hereon termed Phase 2).

To assist the client with a realistic evaluation of terrestrial biodiversity components for Phase 2 of the project, with specific reference to the landscape ecological, botanical and faunal disciplines[1], Bathusi Environmental Consulting cc was commissioned to establish the ecological sensitivity of the sites and determine the significance of likely and potential impacts on the terrestrial biodiversity receiving environment. Attributes and certain plant and animal species highlighted in the Site Sensitivity Screening Report (2024/02/26) were afforded specific attention. Site inspections were conducted during Phase 1 of the project between 28th of April 2021 and 1st of May 2021, and information gathered were considered suitable and representative for Phase 2 of the process as the sites are situated in close proximity and generally represent similar habitat. Additional brief site inspections were conducted on 2nd October 2023 and 12th to 13th February 2024 to supplement available information for this assessment report where necessary. No survey limitations were identified, although no nocturnal surveys were conducted for the faunal surveys. Climatic, seasonal and environmental conditions were regarded optimal to establish the nature and sensitivity of the sites and inform the project accordingly.

2 TERRESTRIAL BIODIVERSITY THEME SENSITIVITY (LANDSCAPE ECOLOGY AND CONSERVATION)

The National Environmental Screening Report (2024/02/26) recognised a Very High Sensitivity for the terrestrial biodiversity sensitivity theme, with specific reference to the following attributes:

Very High Sensitivity: Ecological Support Area 1; and

Very High Sensitivity: Endangered (EN) Ecosystem – Sekhukhune Plains Bushveld.

The following local and regional attributes are considered relevant to the terrestrial biodiversity (landscape ecology) sensitivity theme for the proposed development footprints:

⇒ Land use within the larger region is decidedly rural, characterised by commercial agriculture and extensive livestock farming.

⇒ The proposed sites comprise mostly natural and semi-natural woodland habitat, exhibiting moderate to severe levels of habitat deterioration cause by commercial, mining and industrial land use activities from the surrounds.

⇒ The region around Steelpoort is under severe pressure from chrome and platinum mining and other industrial activities, also with associated urbanisation. These pressures on remaining areas of natural (untransformed) habitat are likely to increase in near future.

⇒ The proposed sites are spatially situated within the Sekhukhune Centre of Plant Endemism. One of the characteristic trees of this bushveld type is *Kirkia wilmsii*, a species that is relatively rare in other parts of the Mixed Bushveld, occurs abundantly in parts of the proposed development footprints, notably in portions of Site 2B.

[1] *Excluding the avifaunal discipline, which is addressed as a 'stand-alone assessment*

⇒ The genus *Aloe* is particularly prolific in the SCPE; the development footprints also reflect this diversity and abundance of *Aloe* species.

⇒ The sites are not situated within, or in proximity to, any informal or declared protected area (SAPAD, SACAD, NPAES), although the presence of smaller private nature reserves are noted to the north and northeast of the proposed sites. Impacts on these areas are not anticipated.

⇒ A brief review of the Limpopo Critical Biodiversity Areas map (2018) indicates the designation of remaining areas of natural habitat within the development footprints and surrounding areas as ESA1 habitat, which is considered an accurate depiction of the status and sensitivity of the local region.

A review of information ultimately indicates a moderate to high ecological status and sensitivity of remaining habitat within the proposed sites, with specific reference to the following aspects:

⇒ While most of the proposed sites are situated in an ecological type that is considered endangered (Sekhukhune Plains Woodland), these areas generally exhibit moderate to high deterioration levels and poor integrity, caused by local land use patterns. Reparation and restoration of the principle ecological attributes and status of these areas are not reasonably anticipated considering continued development and exacerbated anthropogenic impacts from the Steelpoort town and wider region.

⇒ Small portions of the proposed sites are situated in an ecological type that is considered least concern (Sekhukhune Mountains Woodland). In contrast, these areas generally exhibit a high ecological integrity and status and are therefore generally considered sensitive.

⇒ The Limpopo Bioregional Conservation Plan (2018) categorised much of the remaining portions of natural habitat as ESA1, which is generally considered an accurate and acceptable assessment.

⇒ The local area (immediate to, and including the proposed development footprints) are not recognised for existing and high conservation potential. However, natural habitat situated to the south and east of the proposed sites, which mostly relates to the Sekhukhune Mountains Woodland, are recognised as being of high ecological integrity and status and also worthy of conservation efforts with a high biodiversity value.

⇒ Existing land use patterns and activities, with specific reference to mining and other industrial activities in the proximity to the proposed sites, provides for persistent and continually increasing impacts on the terrestrial biodiversity environment that detracts from the status and value of remaining portions of natural habitat.

3 PLANT SPECIES THEME SENSITIVITY (BOTANICAL ATTRIBUTES)

The National Environmental Screening Report (2024/02/26) indicates a Medium Sensitivity for plant species of conservation concern for the site and immediate surrounds, with specific reference to eight (8) plant species of conservation importance.

The following botanical attributes are relevant to the proposed development sites and general study area:

⇒ NEWPOSA (2021) provides for the known presence of approximately 573 plant species within the wider region around the study area, which is considered an accurate reflection of the local and regional floristic diversity.

⇒ Surveys conducted during 2021 and 2023 indicated a floristic species richness of 196 plant species, which corresponds (numerically) to approximately 34.2 % of the sampling records from the wider region, and also reflecting a high floristic diversity, notwithstanding the comparative small size of the survey areas and the instantaneous nature of the surveys.

⇒ Despite the savannoid nature of the study areas, herbaceous and graminoid life forms dominate the species richness with 36 and 34 species, respectively. Trees (22 species), shrubs (20 species) and small trees (17 species) comprise lower species richness, although dominating the physiognomy. The succulent diversity of the areas is

noted with a total of 22 species, while life forms of lower abundance include dwarf shrubs, climbers, prostrate herbs and geophytes.

⇒ A review of the type and status of habitat within the development footprints indicates that none of the species highlighted by the Environmental Screening Report are considered likely to occur within the study area.

⇒ A total of 11 protected plant species (NFA, LEMA) has nonetheless been identified within the sites. It is emphasised that valid permits need to be obtained from LEDET and DFFE prior to the removal, damage, relocation, or any other activity that might affect these species. These species include:

- *Adenia fruticosa* (Near Threatened, IUCN. Protected Plant Schedule 12, LEMA);
- *Aloe burgersfortensis* (Sekhukhune endemic);
- *Aloe wickensii* (Near Threatened, IUCN);
- *Balanites maughamii* (Protected Tree (NFA);
- *Boscia albitrunca* (Protected Tree, NFA);
- *Dicliptera fruticosa* (Near Threatened, IUCN);
- *Elaeodendron transvaalense* (Near Threatened, IUCN. Protected Tree, NFA);
- *Eulophia petersii* (Protected Plant Schedule 12, LEMA);
- *Sclerocarya birrea* subsp. *caffra* (Protected Tree, NFA);
- *Spirostachys africana* (Protected Plant Schedule 12, LEMA);
- *Stapelia gigantea* (Protected Plant Schedule 12, LEMA);

⇒ The following broad-scale habitat types and variations were recognised from the study areas and the immediate surrounds (with floristic sensitivities):

- Artificial Impoundments (low floristic sensitivity);
- Deteriorated Open Shrubland Types (medium-low floristic sensitivity);
- Drainage Lines and Variable Shrubland Banks (medium-high floristic sensitivity);
- Steelpoort River, Tall Closed Riparian Banks and *Phragmites* Levees (medium-high floristic sensitivity);
- Tall Closed Riparian Bushland (medium-high floristic sensitivity);
- Natural Woodland and Bushveld Types, including:
  - Closed Mixed Thicket and Bushland (medium-high floristic sensitivity);
  - Variable Mixed Shrubland – Mountain Bushveld (high floristic sensitivity);
  - Variable Mixed Shrubland – Plains Bushveld (medium-high floristic sensitivity); and
- Transformed Areas, Infrastructure, Industries, Roads, etc. (low floristic sensitivity).

The botanical assessment concluded that the study sites generally comprise of a highly variable woodland, which do reflect the dominant biophysical attributes, as well as the response on significant anthropogenic disruptive activities, e.g. intensive mining, industrial and commercial land uses. Remaining portions of natural woodland resultantly exhibit varying levels of correlation to the regional types, nut nonetheless exhibit high floristic diversity patterns. Although a high incidence of plant taxa of conservation concern has been recorded across most of the sites, no threatened plant taxa has been recorded. Habitat types within the proposed development footprints are common to the wider region. It is anticipated that losses of habitat will be of moderate concern, while losses of conservation important plant taxa is considered a significant impact, although localised.

The following key conclusions are presented:

⇒ Ecological attributes of the study site are regarded common and ubiquitous to the wider region;

⇒ A number of protected species were recorded within the site during the site investigation, occurring at moderate to high abundance within the site as well as the wider region;

⇒ No threatened plant species were recorded within the site during the site investigation, or are considered likely to occur within any of the development footprints;

⇒ No habitat type within the site are regarded restricted on a local or wider scale. The site also does not exhibit any biophysical feature of rarity or particularly ecological importance, although footslopes of the mountainous areas correlating to the Sekhukhune Mountain Bushveld are considered sensitive;

⇒ Anticipated habitat loss of only minor to moderate importance are likely to result from the development;

⇒ Losses of plant taxa of conservation concern is considered significant, although these species generally occur abundantly in the wider region; and

⇒ Ultimately, the presence of numerous plant taxa of conservation importance and concern within the area, warrants the elevation of the Plant Species Theme Sensitivity to High, as opposed to Medium Sensitivity prescribed in the Environmental Screening Report.

4 ANIMALS SPECIES THEME SENSITIVITY (FAUNAL ATTRIBUTES)

The National Environmental Screening Report (2024/02/26) indicates a Medium Sensitivity for the Animal Species Theme for the site and immediate surrounds, with specific reference to six fauna taxa, including mammal, reptile and invertebrate species (excluding avifauna).

The following results were obtained from the faunal assessment:

⇒ The expected mammal richness on the study area and immediate surroundings was approximately 63 species, of which only 10 species have been documented for the QDS 2430CA quarter degree grid (QDS) that is sympatric to the larger part of the the study area.

⇒ Approximately 49 mammal species (78 % of the expected richness) have a high probability to be present on the study area, of which 16 of these species (31 % of species with a high probability of occurrence) were confirmed during the initial surveys (April/May 2021).

⇒ Mammal richness on the study areas is therefore considered relatively poor, which is best explained by a high degree of industrial and human-induced activities in the area.

⇒ Domestic cats (*Felis catus*) are prevalent on the study area, posing an eminent threat to extant small vertebrate fauna within the wider area. The occurrence of domestic cats may also result in genetic contamination of the indigenous feline population, in particular the African Wild Cat (*F. sylvestris*) due to inbreeding.

⇒ The presence of surface outcrops immediately east and south of Site 2B provided micro-habitat for small mammal taxa with rupicolous affinities as well as large mammal taxa with large home range sizes. These features also provide foraging habitat for an overlooked sub-population of Southern Mountain Reedbuck (*Redunca f. fulvorufula*).

⇒ The study area provides habitat for three threatened and four near threatened mammal species. Four of these species exhibit a high probability of occurrence, of which the endangered Southern Mountain Reedbuck *Redunca f. fulvorufula*) was confirmed during previous surveys, while Brown Hyaena (*Parahyaena brunnea*) is considered a likely inhabitant.

⇒ The amphibian richness on the study area is considered low, with only 14 frog species expected to occur. No amphibian species of conservation concern is likely to occur within the study areas.

⇒ The reptile composition on the study area is poorly known with only 23 species currently known from the wider study area, although the expected richness was predicted to be as high as 54 species.

⇒ The reptile composition on the study site is poorly known with only 23 species currently known from the wider area.

⇒ The Environmental Screening Report (2024/02/26) highlighted the potential presence of Nile Crocodile (*Crocodylus niloticus*) and Lobatse Hinged Tortoise (*Kinixys lobatsiana*) as potential inhabitants for the local region. A review of the habitat preferences of these species indicates a low probability of occurrence for Nile Crocodile, while the Hinged Tortoise exhibit a high likelihood of occurrence for, particularly, Site 2B.

⇒ No invertebrate species of conservation concern have been recorded from the study area, or is considered likely to occur.

⇒ Results of the environmental screening report (2024/02/26) highlighted a medium sensitivity for the animal theme on the study area with the potential occurrence of one shieldback katydid (Family Tettigoniidae): Brown False Shieldback (*Aroegas fuscus*). A low probability of occurrence for this species is estimated as a result of absence of suitable habitat.

⇒ The following faunal sensitivities were estimated for broad-scale habitat types:

- Artificial Impoundments (medium faunal sensitivity);
- Deteriorated Open Shrubland Types (medium-low faunal sensitivity);
- Drainage Lines and Variable Shrubland Banks (medium-high faunal sensitivity);
- Steelpoort River, Tall Closed Riparian Banks and *Phragmites* Levees (high faunal sensitivity);
- Tall Closed Riparian Bushland (high faunal sensitivity);
- Natural Woodland and Bushveld Types, including (medium-high floristic sensitivity):
  - Closed Mixed Thicket and Bushland (medium faunal sensitivity);
  - Variable Mixed Shrubland – Mountain Bushveld (high faunal sensitivity);
  - Variable Mixed Shrubland – Plains Bushveld (medium faunal sensitivity); and
- Transformed Areas, Infrastructure, Industries, Roads, etc. (low faunal sensitivity).

Ultimately, the confirmed presence of at least one mammal species of conservation concern, the likely presence of another mammal species, as well as lower probabilities for other animal taxa of conservation concern within mountainous parts of the study area (notably Site 2B), warrants the elevation of the Animal Species Theme Sensitivity of these parts to High, as opposed to Medium Sensitivity. In contrast, parts of the local region that exhibits high deterioration and fragmentation rates and high human disturbance factors generally represent poor faunal habitat types, and is acceptably categorized as Medium and Low Sensitivity.

5 SITE ECOLOGICAL IMPORTANCE, IMPACT SIGNIFICANCE AND CONCLUDING STATEMENT

The SEI derived for the various habitat types are as follows:

Habitat Tye	SEI
Deteriorated Open Shrubland Types	Low
Drainage Lines and Variable Shrubland Banks	High
Closed Mixed Thicket and Bushland	Medium
Variable Mixed Shrubland – Mountain Bushveld	Very High
Variable Mixed Shrubland – Plains Bushveld	Medium
Transformed Areas, Infrastructure, Industries, Roads, etc.	Very Low

<u>Site 2B:</u>

While parts of this proposed site are considered deteriorated and heavily infested with exotic and invasive plants, the northern portions comprise natural and highly sensitive savanna habitat that is also representative of the regional ecological types, and losses of remaining natural habitat in these parts are therefore an important consideration. Ultimately, the abundant presence of several protected plants, notably the vulnerable *Adenia fruticosum*, as well as the confirmed presence of the endangered Southern Mountain Reedbuck renders the remaining natural vegetation comparatively sensitive; losses of these conservation important species and habitat is an important consideration on a local scale. Anticipated impact significance is considered to be moderately high, the introduction of generic and site-specific mitigation measures, notably a dedicated invasive species management programme will result in some amelioration of high significance impacts to a more acceptable level. However, the approval of these areas for development purposes should be done with circumspection.

Site 3B and Site 3C

These sites comprise largely natural shrubveld habitat that is moderately representative of the regional ecological types. Considering that the regional type is categorised as endangered, and also with the known presence of conservation important plants within this site, the ecological sensitivity is considered moderately high. Losses of conservation important species and natural savanna habitat is therefore considered significant on a local scale and the implementation of a generic mitigation approach, notably the relocation of conservation important plants from the site, will only render the post-mitigation significance of anticipated impacts moderate, albeit mostly localised.

Site 4B:

This site comprises natural shrubveld habitat that is representative of the regional ecological types. Considering that the regional type is categorised as endangered, and also with the known presence of conservation important plants within this site, the sensitivity is considered moderately high. Losses of conservation species and natural savanna habitat is therefore considered significant on a local scale and the implementation of a generic mitigation approach, notably the relocation of conservation important plants from the site, will only render the post-mitigation significance of anticipated impacts moderate, albeit mostly localised.

Site 5B:

Site 5B constitutes deteriorated woodland; results of the site inspection indicated a low presence of protected plant species on this site. Anticipated impacts from a botanical perspective is therefore likely to be moderate, mostly as a result of the minor losses of remaining natural woodland from the site (also in context with the location of the proposed site adjacent to existing transformed areas). The introduction of a generic mitigation approach, but with specific reference to the management and control of invasive plant species from the site, is likely to reduce the anticipated impacts significance to acceptably low levels.

Comments on cumulative Impacts from a regional perspective:

A brief review of cumulative impacts pertaining to renewable energy (RE) projects from the wider region (30 km radius) indicates that, apart from the authorised Phase 1 of this Samancor PV Project, no other RE project exists, or have been applied for within the wider region. Furthermore, placing anticipated impacts on natural habitat and species in context to devastating losses of natural habitat and species associated with mining activities in the wider region, the anticipated significance of cumulative impacts of this particular project is therefore considered negligible.

Concluding Statement:

This report concludes that the study sites comprise of savanna habitat of varying status and sensitivity, which is consistent with natural habitat in proximity to the intensive anthropogenic and disruptive land use activities noted around Steelpoort. As most of the project sites are situated in proximity to, or are surrounded by, industrial infrastructure or areas where human activities are relatively of high frequency, remaining portions of natural habitat conforms to short, open and deteriorated woodland habitat or habitat that are fragmented. Extensive parts of the proposed sites comprise of deteriorated types that are characterised by unspecialised and generalist taxa and communities that are also well represented in the wider region. Portions of the proposed sites are considered diverse and sensitive, and retaining these areas for conservation purposes is highly recommended, although technical considerations for the proposed development might not allow for much mitigation in this sense. The presence of numerous and abundant conservation important plant and animal species, which provides for an elevated ecological sensitivity and importance of certain parts, are noted throughout the study areas. An existing offset plan has been prepared for Phase 1 of the project; it is strongly recommended that previous recommendations be augmented to compensate for the loss of these sensitive areas, should the authorities grant the application.

The nature of the activity dictates that natural habitat will be lost through unavoidable land clearance, and the application of a recommended mitigation approach will allow for some moderation of anticipated impacts. It is predicted that impacts on the ecological environment will generally be of high to moderate significance, notably with regards to the anticipated loss of conservation important plant species and habitat that is associated with animal species of conservation concern.

In light of the conclusions reached in this report, and despite concerns that are raised about the loss of minor portions of highly sensitive habitat associated with southern sections of Site 2B, no specific objections to the project are raised in its current configuration. This is however with the explicit understanding that the suggested mitigation protocol is timeous and comprehensively implemented during all phases of the project, including the use of an offset strategy to compensate for these losses.

SECTION B: ADMIN & BACKGROUND INFORMATION

6 PROJECT MINUTIAE

Table 1: Project details	
Client:	Royal HaskoningDHV, on behalf of Samancor Chrome Limited
Report name:	Terrestrial Biodiversity Impact Assessment for the proposed 40 MW Photovoltaic Plant (Phase 2) on the Farm Goudmyn 337-KT near Steelpoort in the Limpopo Province
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Compiled by:	Riaan A. J. Robbeson (Pr.Sci.Nat.), Bathusi Environmental Consulting cc
Reviewed by:	Dewald Kamffer (Pr.Sci.Nat.)

7 REPORT REFERENCE & CITATION

When used as a reference, or included as an addendum, this report should be cited as:

Bathusi Environmental Consulting cc (2024). Terrestrial Biodiversity Impact Assessment for the proposed 40 MW Photovoltaic Plant (Phase 2) on the Farm Goudmyn 337-KT near Steelpoort in the Limpopo Province. BEC Reference: RHD–SPV–2024/08. Version: 2024.03.07.02.

8 LEGAL CONSIDERATIONS

8.1.1 RELEVANT LEGISLATION

Applicable legislation considered for this project is presented in **Table 2.**

Table 2: Legislative considerations relevant to this project	
Legislation	*Relevance*
Conservation of Agricultural Resources (Act No. 43 of 1983) as amended in 2001	Declared Weeds and Invaders in South Africa are categorised according to one of the following categories: o Category 1 plants: are prohibited and must be controlled. o Category 2 plants: (commercially used plants) may be grown in demarcated areas providing that there is a permit and that steps are taken to prevent their spread. o Category 3 plants: (ornamentally used plants) may no longer be planted; existing plants may remain, as long as all reasonable steps are taken to prevent the spreading thereof, except within the floodlines of watercourses and wetlands.
Constitution of the Republic of South Africa (Act 108 of 1996)	The Bill of Rights, in the Constitution of South Africa (No. 108 of 1996), states that everyone has a right to a non-threatening environment and requires that reasonable measures are applied to protect the environment. This protection encompasses preventing pollution and promoting conservation and environmentally sustainable development. These principles are embraced in NEMA and given further expression.
Convention on Biological Diversity, 1995	South Africa became a signatory to the United Nations Convention on Biological Diversity (CBD) in 1993, which was ratified in 1995. The CBD requires signatory states to implement objectives of the Convention, which are the conservation of biodiversity; the sustainable use of biological resources and the fair and equitable sharing of benefits arising from the use of genetic resources. According to Article 14 (a) of the CBD, each Contracting Party, as far as possible and as appropriate, must introduce appropriate procedures, such as environmental impact assessments of its proposed projects that are likely to have significant adverse effects on biological diversity, to avoid or minimize these effects and, where appropriate, to allow for public participation in such procedures.

Table 2: Legislative considerations relevant to this project	
Legislation	*Relevance*
Environmental Management Act (No. 107 of 1998)	NEMA is the framework environmental management legislation, enacted as part of the government's mandate to ensure every person's constitutional right to an environment that is not harmful to his or her health or wellbeing. It is administered by the Department of Forestry, Fisheries and the Environment (DFFE) but several functions have been delegated to the provincial environment departments. One of the purposes of NEMA is to provide for co-operative environmental governance by establishing principles for decision-making on matters affecting the environment. The Act further aims to provide for institutions that will promote cooperative governance and procedures for coordinating environmental functions exercised by organs of state and to provide for the administration and enforcement of other environmental management laws. EMA requires, inter alia, that: o "development must be socially, environmentally, and economically sustainable"; o "disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimised and remedied", o "a risk-averse and cautious approach is applied, that considers the limits of current knowledge about the consequences of decisions and actions".
Limpopo Environmental Management Act (Act No.7 of 2003)	To consolidate and amend the environmental management legislation of or assigned to the Province, and to provide for matters incidental thereto, also with specific consideration of the following: o Schedule 1 – Protected Areas; o Schedule 2 – Specially protected wild animals; o Schedule 3 – Protected wild animals; o Schedule 11 – Specially protected plants; and o Schedule 12 – Protected plants.
National Environmental Management: Biodiversity Act (Act No 10 of 2004) (NEMBA)	To provide for management and conservation of South Africa's biodiversity within the framework of the National Environmental Management Act 1998; the protection of species and ecosystems that warrant national protection; the sustainable use of indigenous biological resources; the fair and equitable sharing of benefits arising from bioprospecting involving indigenous biological resources; the establishment and functions of a South African National Biodiversity Institute; and for matters connected therewith.
National Environmental Management Act (No 10 of 2004)	As the principal national act regulating biodiversity protection, NEMBA (DFFE), is concerned with the management and conservation of biological diversity, as well as the use of indigenous biological resources in a sustainable manner. In terms of NEMBA, the developer has a responsibility for: o The conservation of endangered ecosystems and restriction of activities according to the categorisation of the area (not just by listed activity as specified in the EIA regulations). o Promote the application of appropriate environmental management tools in order to ensure integrated environmental management of activities thereby ensuring that all development within the area are in line with ecological sustainable development and protection of biodiversity. o Limit further loss of biodiversity and conserve endangered ecosystems. Chapter 4 of the Act relates to threatened or protected ecosystems or species. According to Section 57 of the Act, "Restricted activities involving listed threatened or protected species": o A person may not carry out a restricted activity involving a specimen of a listed threatened or protected species without a permit issued in terms of Chapter 7. Such activities include any that are "of a nature that may negatively impact on the survival of a listed threatened or protected species". This section also provides for the consideration of the following: o Alien and invasive species, as depicted by various Acts and relevant legislation; o Government Notice No. 1002 of 2011: National List of Ecosystems that are Threatened and in need of protection; o GNR 151: Critically Endangered, Endangered, Vulnerable and Protected Species List; o GNR 1187: Amendment of Critically Endangered, Endangered, Vulnerable and Protected Species List; and o Government Notice No. 40733 of 2017: Draft National Biodiversity Offset Policy.
National Environmental Management Protected Areas Act, No. 57 of 2003	To provide for the protection and conservation of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascapes; for the establishment of a national register of all national, provincial, and local protected areas; for the management of those areas in accordance with national norms and standards; for intergovernmental co-operation and public consultation in matters concerning protected areas; and for matters in connection therewith.
National Forest Act of 1998	Provides for the protection of certain tree species, groups of trees, woodland or forests as declared by the minister and prohibits the destruction of indigenous trees in any natural forest without a licence

8.1.2 ECOSYSTEM ENVIRONMENTAL ASSESSMENT GUIDELINES (2020)

The national environmental screening tool (DFFE) is intended to allow for pre-screening of sensitivities in the landscape to be assessed within the EA process by implementing the mitigation hierarchy that allow developers to adjust their proposed development footprint to avoid (anticipated) sensitive areas. The Screening Tool report will indicate these anticipated environmental sensitivities that intersect with the proposed development footprint, as well as the relevant Protocols that the applicant would need to adhere to. Specialist requirements linked to the different Protocols differ for areas identified as low, medium, high or very high sensitivity (refer Table 3).

Table 3: Description of the different Screening Tool sensitivity ratings

Sensitivity Rating	*Description of sensitivity rating*
Very High	Habitat for species that are endemic to South Africa, where all the known occurrences of that species are within an area of 10 km² are considered Critical Habitat, as all remaining habitat is irreplaceable. Typically these include species that qualify under Critically Endangered (CR), Endangered (EN), or Vulnerable (VU) D criteria of the IUCN or species listed as Critically/ Extremely Rare under South Africa's National Red List Criteria. For each species reliant on a Critical Habitat, all remaining suitable habitat has been manually mapped at a fine scale.
High	Recent occurrence records for all threatened (CR, EN, VU) and/or rare endemic species are included in the high sensitivity level. Spatial polygons of suitable habitat have been produced for each species by intersecting recently collected occurrence records (those collected since the year 2000) that have a spatial confidence level of less than 250 m with segments of remaining natural habitat.
Medium	Model-derived suitable habitat areas for threatened and/or rare species are included in the medium sensitivity level. Two types of spatial models have been included. The first is a simple rule-based habitat suitability model where habitat attributes such as vegetation type and altitude are selected for all areas where a species has been recorded to occur. The second is a species distribution model which uses species occurrence records combined with multiple environmental variables to quantify and predict areas of suitable habitat. The models provide a probability-based distribution indicating a continuous range of habitat suitability across areas that have not been previously surveyed. A probability threshold of 75 % for suitable habitat has been used to convert the modelled probability surface and reduce it into a single spatial area which defines areas that fall within the medium sensitivity level.
Low	Areas where no SCC are known or expected to occur.

Biodiversity studies are (inter alia) required to comply with provincial and national legislation, specifically with the following aspects indicated in the National Environmental Management Act, 1998 (Act No. 107 of 1998):

⇒ Section 3(c) – Protocol for the assessment and reporting of environmental impacts on terrestrial animal;

⇒ Section 3(d) – Protocol for the assessment and reporting of environmental impacts on terrestrial plants; and

⇒ Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial biodiversity.

8.1.3 MINIMUM REPORT REQUIREMENTS

Prior to commencing with specialist assessments, the current use of the land and the anticipated environmental sensitivity of the site under consideration must be identified by the national web based environmental screening tool (DFFE)[2] and downloaded in an Environmental Screening Report (ESR). These sensitivities must be confirmed by undertaking a site sensitivity verification study, with the following to be considered as a minimum:

1.1 The site sensitivity verification must be undertaken by an environmental assessment practitioner or a specialist.

1.2 The site sensitivity verification must be undertaken through the use of:

(a) a desk top analysis, using satellite imagery;

(b) a preliminary on -site inspection; and

(c) any other available and relevant information.

1.3 The outcome of the site sensitivity verification must be recorded in the form of a report that:

[2] https://screening.environment.gov.za/screeningtool/#/pages/welcome

(a) confirms or disputes the current use of the land and the environmental sensitivity as identified by the screening tool, such as new developments or infrastructure, the change in vegetation cover or status, etc.;

(b) contains a motivation and evidence (e.g., photographs) of either the verified or different use of the land and environmental sensitivity; and

(c) is submitted together with the relevant assessment report prepared in accordance with the requirements of the Environmental Impact Assessment Regulations1 (EIA Regulations).

Upon identification, or confirmation, of sensitivities, the client must conduct detailed specialist assessments to determine the extent and significance of impacts on the relevant aspects (those identified as high or very high sensitivity), as follows.

8.1.4 SPECIALIST REQUIREMENTS AND DETAILS

It is a legal requirement for specialists that conduct biological surveys and compile reports that they are suitably registered at SACNASP in the relevant field(s) for the assessment. In terms of the Natural Scientific Professions Act, 2003 (Act No. 27 of 8 2003), it is illegal to practice in a professional (paid) consulting capacity without appropriate SACNASP registration. Registration with SACNASP further ensures adherence to their code of conduct.

The Natural Scientific Professions Act (South Africa, No. 27 of 2003) aims to 'provide for the establishment of the South African Council of Natural Scientific Professions (SACNASP), and for the registration of professional, candidate and certified natural scientists; and to provide for matters connected therewith'. Quoting the South African Council for Natural Scientific Professions Act revised 2019), specialists must:

"5 Only undertake natural scientific work which their education, experience or background have rendered them competent to perform; and

8 Not knowingly misrepresent or permit misrepresentation of their own or their associates' academic or professional qualifications, neither exaggerate their own degree of responsibility for any work of a natural scientific nature."

Quoting the Natural Scientific Professions Act of 2003: '*Only a registered person may practice in a consulting capacity*' (20(1) – pg 14). SACNASP registration details and professional affiliations of the specialists that contributed to this project is presented in Table 4.

Table 4: Biodiversity specialist for this project

Ecological Specialist:	*Riaan Robbeson (Pr.Sci.Nat.)*
Qualification:	M.Sc. (Botany), UP
Affiliation:	South African Council for Natural Scientific Professions (SACNASP)
Fields of Expertise:	Botanical Scientist & Ecological Scientist (Pr.Sci.Nat.)
Fields of Expertise:	Zoological Scientist (Cert.Nat.Sci.)
Registration Number:	[redacted]
Affiliation:	Grassland Society of Southern Africa
Affiliation:	South African Association of Botanists
Affiliation:	South African Wildlife Management Association
Affiliation:	Zoological Society of Southern Africa
Report Review:	*Dewald Kamffer (Pr.Sci.Nat.)*
Qualification:	M.Sc. (Conservation Biology), University of Pretoria
Affiliation:	South African Council for Natural Scientific Professions
Fields of expertise:	Ecological Scientist & Zoological Scientist
Registration number:	[redacted]

9 REPORT COMPLIANCE

Specialist reports must comply with Appendix 6 of EIA Regulations 2014 (as amended) as indicated below.

A specialist report prepared in terms of the EIA Regulations must contain-	Checklist for Compliance
a) details of- (i) the specialist who prepared the report; and (ii) the expertise of that specialist to compile a specialist report including a curriculum vitae;	✓
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	✓
c) an indication of: (i) the quality and age of the base data used for the specialist report; (ii) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change; d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment e) an indication of the scope of, and the purpose for which, the report was prepared; 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;	✓
g) an identification of any areas to be avoided, including buffers;	✓
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;	✓
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	✓
j) a description of the findings and potential implications of such findings on the impact of the proposed activity or activities	✓
k) any mitigation measures for inclusion in the Environmental Management Programme (EMPr);	✓
l) any conditions for inclusion in the environmental authorisation;	✓
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	✓
n) a reasoned opinion- (i) whether the proposed activity, activities or portions thereof should be authorised; and (ii) regarding the acceptability of the proposed activity or activities; and (iii) 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;	Not applicable
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	Not applicable
q) any other information requested by the competent authority.	Not applicable
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.	✓

10 DECLARATION OF INDEPENDENCE

I, the undersigned, acting in a capacity as a specialist biodiversity consultant, and the legal representative of Bathusi Environmental Consulting, declare that:

- ⇒ I shall execute my duties as an independent specialist consultant conducting the biodiversity impact assessments and preparing the reports;
- ⇒ I shall perform all activities associated with the project in line with relevant legislation and comply with ethical requirements related to our profession;
- ⇒ At the time of presenting this proposal, I did not have any interest, hidden or otherwise, in the proposed development or activity, as outlined in this document, other than expecting fair financial compensation for work performed in a professional capacity, as specified by the National Environmental Management Act (No 107 of 1998) (2014) Regulations GNR 983 and GNR 986, as amended in 2017;
- ⇒ As an affiliated member, I consider myself bound to the rules and ethics of the South African Council for Natural Scientific Professions (SACNASP);
- ⇒ BEC is not a subsidiary, legally or financially, of any other company;
- ⇒ I shall not be affected in any manner by the outcome of the environmental process of which the reports and biodiversity assessments form part of, other than being part of the general public;
- ⇒ While I am committed to the conservation of biodiversity, I also concomitantly acknowledge and recognize the need for economic development and the sustainable utilisation of natural resources;
- ⇒ I do not necessarily object to or endorse the proposed development from a personal perspective, but aim to present facts and recommendations based on scientific data and relevant professional experience;
- ⇒ I do not have any influence over decisions made by the governing authorities; and
- ⇒ I undertake to disclose to the competent authority, any material 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 required in terms of the Environmental Impact Assessment Regulations, 2005.

Riaan A. J. Robbeson (Pr.Sci.Nat.)
(Bathusi Environmental Consulting cc)
7th March 2024

11 BACKGROUND TO THE PROJECT

11.1 SITE LOCATION

Country:	South Africa
Province:	Limpopo Province
District Municipality:	Sekhukhune District Municipality
Local Municipality:	Fetakgomo-Greater Tubatse Local Municipality
Nearest town:	Steelpoort
Extent:	Approximately 59.23 ha (collectively)
Site access:	The sites are spatially arranged east and west of Steelpoort, comprising scattered land portions, and with direct access from the R555.

An indication of the regional location is provided in **Figure 1** and aerial imagery of the site and local surrounds are provided in **Figure 2** and **Figure 3**.

11.2 PROJECT LAYOUT AND COMPONENTS

The client is planning to develop and operate a Photovoltaic (PV) Solar Plant with a total generating capacity of 100 MW on selected portions of the Farms Goudmyn 337-KT and Olifantspoortje 319-KT. A number of sites were assessed during previous phases of the project, but the 100 MW requirement for generation capacity could not be achieved from the initial layout, which necessitated the identification and assessment of additional areas that are situated in proximity to the initial sites to enable collective consideration of layouts, footprints, and infrastructure. The sites are situated around the town of Steelpoort in the Limpopo Province and will be spread over several land portions, comprising of the following infrastructure (*inter alia*):

⇒ Solar PV panels that will deliver electricity of up to 40 MW to the Samancor grid;
⇒ Inverters that convert direct current (DC) generated by the PV modules into alternating current (AC) to be exported to the electrical grid;
⇒ Inverter and transformer combination – each power block will have a centralised inverter that converts DC power generated by the PV panels, to AC power, as well as a transformer that transforms power to a higher voltage (33 kV) to facilitate transmitting power over longer distances to connect to East and West Plant Substations; and
⇒ Instrumentation and Control consisting of hardware and software for remote plant monitoring and operating the facility.

Appurtenant infrastructure will also include:

⇒ Mounting structures for the solar panels in a fixed tilt of rotating tracking configuration;
⇒ Cabling between the structures, to be lain underground where practical;
⇒ New 33 kV powerlines (either overhead lines or underground cables) between the various sites and the Tubatse East and West substation buildings;
⇒ Local substation and transformer yard at each PV site;
⇒ Containerized switchgear substation at Tubatse East and West MV substations for connecting to the Tubatse substation busbars;
⇒ Water provision infrastructure (i.e. pipeline/s, storage tank/s, etc.) for PV panel cleaning;
⇒ Battery Energy Storage System (BESS) (not considered for this particular phase); and
⇒ Internal access roads, making use of existing roads where practically feasible, fencing, gates and access control.

Table 5: Technical specifications and dimensions of the PV plant arrays and facility components (Phase 2)	
Facility Component	*Description*
Height of PV panels	Approximately 5 m
Total Site Extent	59,23 ha
Length of internal roads	Varies
Width of internal roads	Approximately 6 m
Number of inverters/transformers	3
Area occupied by inverter/ transformers (inverters are combined with transformers on each site)	200 m²
Height of and type of fencing	Security fencing approximately 3 m high
Overhead powerline length	Varies
Overhead powerline capacity	33 kV (40 MVA Site 2 to East Substation)
Overhead powerline servitude	50 m corridor to be assessed in the EIA Study. Overhead line or underground cable technology can be used for the power evacuation in these corridors
Overhead powerline tower height	Power lines comprising of a wood pole tower construction is proposed for the 33 kV power lines. In cases where there is a double Power Corridor, either two wood pole lines will be used or a single steel monopole with a double circuit configuration. The height of the single circuit wood pole construction is 11 m – 13 m and the steel monopoles are typically 20 m tall
Underground cables	Varies in length according to site location and connection point
Switching Station	One switching stations is proposed. A 33 kV switching station 40 MVA – 100 m²
Chemical Toilets	Chemical toilets will be provided per 15 people which will be serviced at a minimum of once every week.
On-site substations	○ Existing capacity - Tubatse East = 62.5 MW, Tubatse West = 37.5 MW ○ 33kV indoor switchgear blocks will be added to the Tubatse East- and West Substations with a footprint of approximately 300m2 respectively
Laydown areas	Phase 1 to be used
Construction camp	Phase 1 to be used
Access roads	Only internal roads
BESS	No BESS considered for Phase 2
Water	Water used in this project is mainly for cleaning photovoltaic modules. Water will be transported by tankers, and the supply is from the TFC Water Plant; further recommendations of Samancor and RHDHV will be implemented. Total water consumption for a single cleaning is approximately 1,200m³. The main pollutant for the panel is dust. Wastewater from washing panels will be discharged to the ground naturally through infiltration.
Water provision	○ Water will be required during the construction activities as well as during the operational phase for panel cleaning. During construction, it is estimated that 2 x 15,000 ℓ water tankers will be used for dust suppression and other construction activities. During operations, it is estimated that the proposed PV plant will require approximately 1,200m³ per cleaning cycle (based on best practice). The cleaning cycle depends on the type of technology, the pollution at the location as well as the seasonality. ○ Water will be obtained from the TFC process and no raw water sources will be required. ○ Water availability - The proposed PV plant will require approximately 20 kℓ x 60 = 1.2 Mℓ per cleaning cycle (based on best-practice and to be confirmed with the concept (envelope) design). The cleaning cycle depends on the type of technology, the pollution at the location as well as the seasonality. Lastly, it also depends on the maintenance regime of the operator. Allowance is made for two (2) cleaning cycles per month, based on typical global approach. Water can be provided by the TFC Smelter based on the amount of industrial water available and the quality of water required as well as the conditions of the current WUL. Industrial water may need to be demineralized before it can be used on the panels.
Water balance	○ During both the construction and operation phases no permanent water supply by borehole or river abstraction will take place nor will wastewater removal be installed on the site. ○ During construction, water will be brought in by tanker. ○ During operation, panels will be cleaned by water brought in by tanker. Water will be supplied from the TFC process. Runoff water from washing the panels will discharge to the ground and will either infiltrate, evaporate or runoff into the environment. This is acceptable as it is considered clean water. ○ In terms of domestic use, portable toilets with a conservancy tank will be placed on site and will periodically be removed and emptied. No sewage network will be installed on site.

A basic illustration of the spatial arrangement of the proposed sites and appurtenant road and powerline infrastructure is presented in **Figure 2** and **Figure 3**. For a detailed schematic layout of the project in its totality, also including previously assessed areas, roads, project components, BESS, facilities, substations, and overhead powerlines and connections, the reader is referred to the main project document.

11.3 PREVIOUS ASSESSMENTS AND REPORTS

The following assessments and reports conducted by Bathusi Environmental Consultants cc are relevant to this report:

⇒ Terrestrial Biodiversity Scoping Assessment for the proposed 60 MW Photovoltaic Plant at the Tubatse Ferrochrome Plant, situated near Steelpoort in the Limpopo Province. Reference Number RHD–SPV–2021/10. Version 2021.05.22.03.

⇒ Terrestrial Biodiversity EIA Assessment for the proposed 100 MW Photovoltaic Plant at the Tubatse Ferrochrome Plant, situated near Steelpoort in the Limpopo Province. Reference Number RHD–SPV–2021/15. Version 2021.10.10.02.

⇒ Biodiversity Offset Feasibility Assessment for the proposed 100 MW Photovoltaic Plant at the Tubatse Ferrochrome Plant, situated near Steelpoort in the Limpopo Province. Reference Number RHD–SPV–2021/17. Version 2021.10.26.02.

⇒ Protected and Conservation Important Plant Species Survey and Permitting Requirements for the Tubatse Ferrochrome 100 MW Photovoltaic (PV) Development at Steelpoort in the Limpopo Province. Reference Number RHD–SPS–2022/10, Version 2022.08.03.01.

⇒ Terrestrial Biodiversity Scoping Assessments for the Tubatse Ferrochrome 40 MW Photovoltaic Development on Sites 2B, 3B, 3C, 4B & 5B, situated in Steelpoort in the Limpopo Province. Reference Number RHD–SPV–2023/11. Version 2023.10.10.01.

Observations, results, recommendations and discussions presented in these reports are selectively used in this report and was augmented with site-specific observations from the additional areas where necessary.

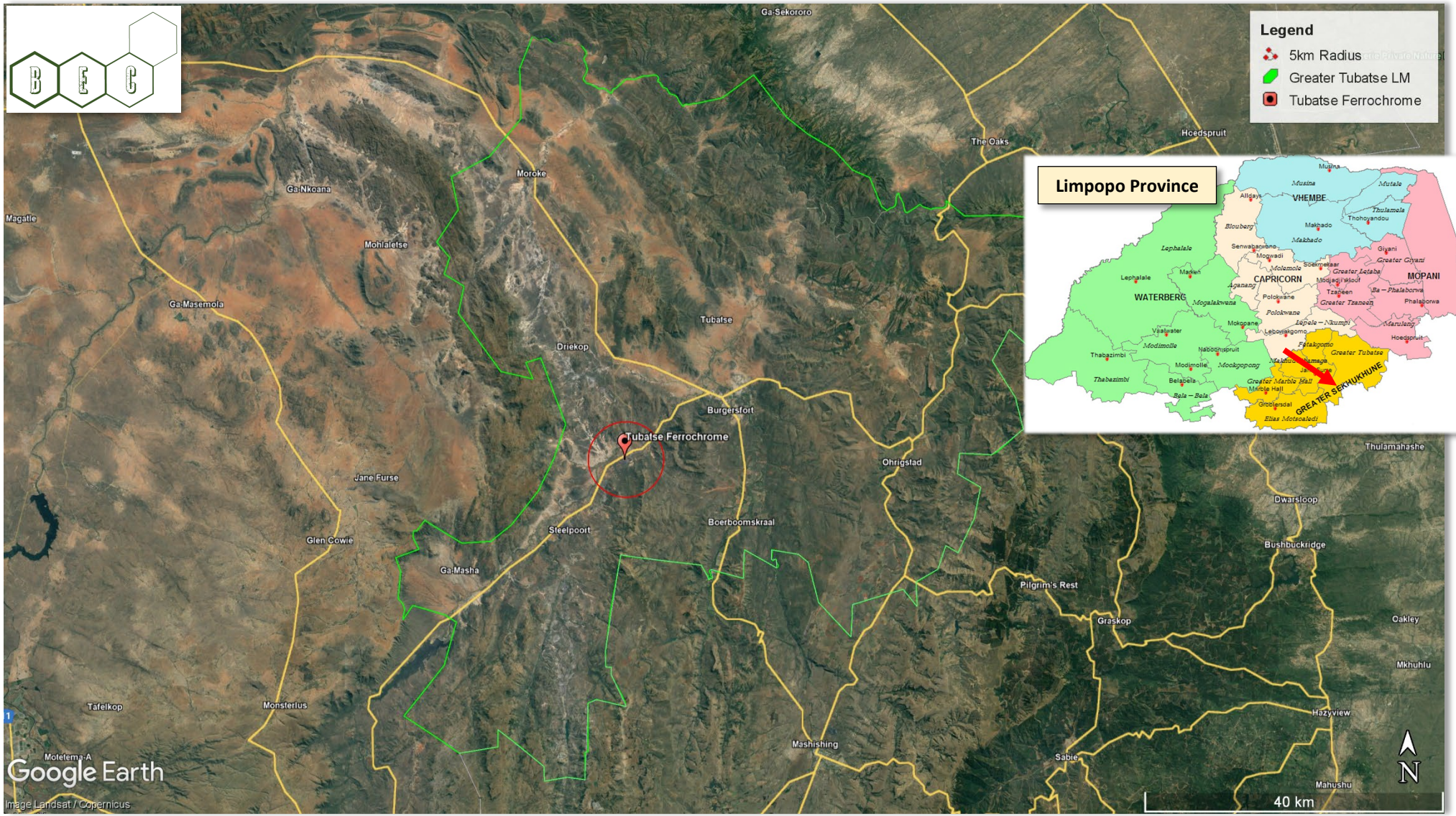


Figure 1: Regional location of the study area

imagery courtesy of Google Earth© (2021), note insert for municipalities within Limpopo Province and red arrow for approximate site location

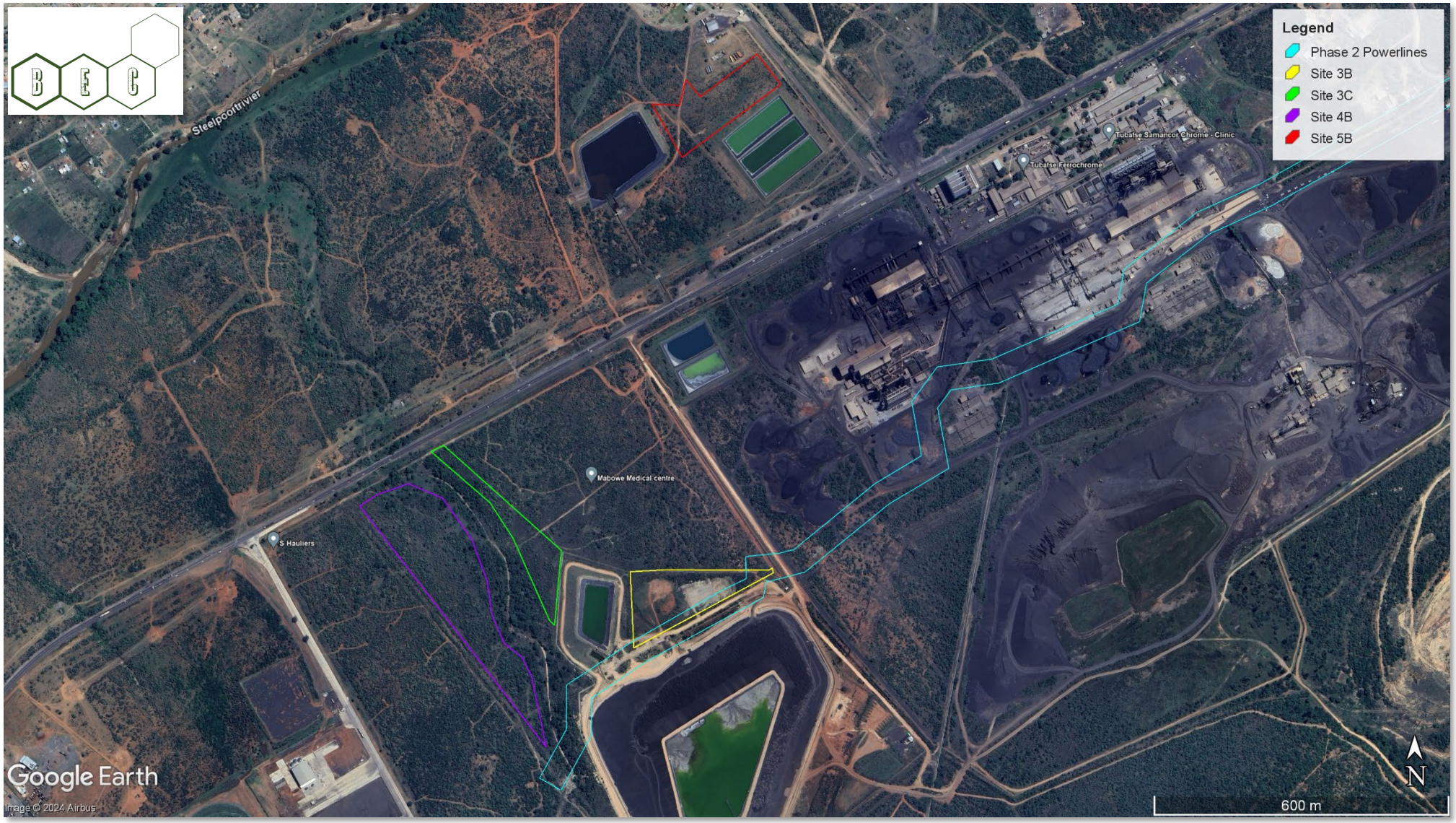


Figure 2: Aerial imagery of the site and immediate surrounds (Sites 3, 4 & 5)

Figure 3: Aerial imagery of the site and immediate surrounds and schematic layout of the project (Site 2)

SECTION C: BIOPHYSICAL ATTRIBUTES OF THE AREA

12 LAND COVER & LAND USE

BGIS (2021) information source indicates the extent of the (Fetakgomo) Greater Tubatse Local Municipality as approximately 459,900 ha of which roughly 85 % remains untransformed, although anecdotal evidence indicates that high levels of habitat deterioration might have contributed to losses of natural habitat that are greater than the levels reflected by the BGIS information dataset. Consolidated urban areas in this municipality include Steelpoort, Burgersfort and Ohrigstad. These towns function as service centres of the surrounding villages and commercial farms, which have very low economic bases and urbanisation of people from surrounding villages to the major towns represent a significant migration pattern and are serviced by moderately developed linear road and railway infrastructure.

Land use within the larger region is decidedly rural, characterised by commercial agriculture and extensive livestock farming. Numerous small villages are sprawled across the landscape, notably along the Steelpoort River and major roads, characterised by deteriorated and transformed areas in the immediate surrounds. Mining and associated beneficiation industries account for major industrial type of land uses of the immediate region, which is particularly prevalent in the Steelpoort area. Steelpoort town comprises mainly mining (inclusive of mineral processing and beneficiation plants) and other industrial land use types as well as medium density housing (peri-urban) and a small retail/ commercial component.

Table 6: Distribution of land use in Greater Tubatse Municipality

Land Cover Category	*Extent*
Permanent commercial dryland	48.1 %
Temporary commercial irrigated	0.8 %
Degraded: thicket and bushland	0.1 %
Degraded: unimproved grassland	0.3 %
Forest and woodland	0.1 %
Plantation	0.2 %
Mines and quarries	2.1 %
Thicket and bushland	5.6 %
Unimproved grassland	40.9 %
Urban	1.8 %
Waterbodies	0.1 %

**Source: Housing Development Agency (2013)*

Aerial imagery of the wider and local region (<2 km, refer **Figures 1 to 3**) reflects a moderately transformed local region that is also characterised by moderate levels of deterioration of remaining portions of natural habitat, which is a typical response to intensive industrial and residential/ commercial land use activities around Steelpoort (south and southwest). Significant losses of habitat and associated impacts are evident from rural villages and intensive utilisation of natural resources for subsistence purposes (northwest and west). Impacts associated with subsistence agriculture and persistent and high grazing pressure to the north of the site is evident from a severely deteriorated woody component of the area and a poorly developed and depauperate herbaceous stratum is often present. Commercial agricultural practices of the region is strongly correlated with the Steelpoort River, Speekboom and other smaller, perennial rivers from which water is extracted for irrigation purposes (mainly citrus). Severe erosion patterns are also noted from drainage channels, nearby banks and floodplains, notably to the northwest of the sites, exhibiting severe erosion and the effects of persistent and inappropriate utilisation (GTLM SDF, 2007).

Available imagery indicates that extensive areas of natural habitat remain in the wider region; these areas are typically associated with land uses and activities based on the preservation of natural habitat, such as wildlife farming and livestock grazing. Topographically complex habitat that creates low accessibility and mountainous terrain results in low habitation and cultivation. Conversely, most of the formal and informally exploited areas correlate to 'plains' and 'flatland' areas

that are typically highly accessible. Local and regional fragmentation and habitat isolation patterns correlate to these land use patterns, manifesting as fragmented and isolated parcels in proximity to nodal development areas as well as the linear infrastructures (roads), while lower fragmentation and isolation patterns are associated with land use patterns that are conducive to preservation principles, resulting in comparatively high ecological connectivity between areas of natural habitat.

The proposed sites comprise mostly natural and semi-natural woodland habitat, but because of proximity to the Steelpoort town area, do exhibit moderate levels of habitat deterioration that stems from typical and surrounding land use activities. Anthropogenic impacts that cause deterioration and transformation habitat include severe and persistent grazing pressure, inappropriate fire regimes, typical pressures and effects from industrial land uses (surface mining, beneficiation plants, industrial activities, ponds and impoundments, spoils heaps, etc.), roads and railway lines, informal and illegal sand mining activities, residential areas and rural townships and associated commercial activities. However, most of the remaining natural woodland from the wider surrounds, notably to the south, exhibit ecological attributes that correspond to the wider regional ecological types.

13 GEOLOGY & SOILS

The site is located in the Eastern limb of the Bushveld Igneous Complex and is underlain by the rocks of the Rustenburg Layered Suite, largely comprising the Dwars River Norites and Vermont Hornfels (refer **Figure 4**) as well as small portions of the Lakenvlei Formation in the southern parts of Site 2B. Norite is a mafic intrusive igneous rock (magna forced into older rocks at depths) composed largely of the calcium-rich plagioclase labradorite, orthopyroxene and olivine, and is predominantly composed of orthopyroxenes, largely high magnesian enstatite or an iron bearing intermediate hypersthene. The Vermont Formation is composed mainly of hornfels[3]), with subordinate quartzite, dolomitic limestone and chert. The Lakenvlei Formation is bounded by a gradational lower and sharp upper contact, and consists chiefly of fine-to medium-grained sandstones.

Weathering of these geological formations produces soils that are included in the Ib192 and Ea88 land types (refer **Figure 5**). The Ea88 land type indicates land with high base status, dark coloured and/ or red soils, usually clayey, associated with basic parent materials, often described as dark, swelling clays. A land type more than half of which is covered by soil forms with vertic, melanic and red structured diagnostic horizons qualifies for inclusion in unit Ea provided it does not qualify for inclusion in units A, B, or C. Land types in which these soils cover less than half of the area may also qualify for inclusion (i) where duplex soils occur in the non-rock land but where unit Ea soils cover a larger area than the duplex soils, or (ii) where exposed rock covers more than half the land type. The Arcadia soil form predominates in this unit. Ib types refer to land with a soil pattern difficult to accommodate elsewhere, at least 60 % of which comprises pedologically youthful, deep (more than 1,000 mm to underlying rock) unconsolidated deposits. Common soil forms are Dundee and Oakleaf. Specifically, Ib indicates land types with exposed rock (exposed country rock, stones or boulders) covering 60 – 80 % of the area.

High variability of soils across the proposed development footprints were noted, ranging between rocky and gravelly soils in upland areas, red, sandy and loamy soils in midland positions and soils of a dark, clayey and structured disposition in bottomland positions while upland positions are dominated by rocks and boulders.

[3] A hornfel is a metamorphic rock formed by the contact between mudstone/ shales, or other clay-rich rock, and a hot igneous body, and represents a heat-altered equivalent of the original rock. The process is termed contact metamorphism

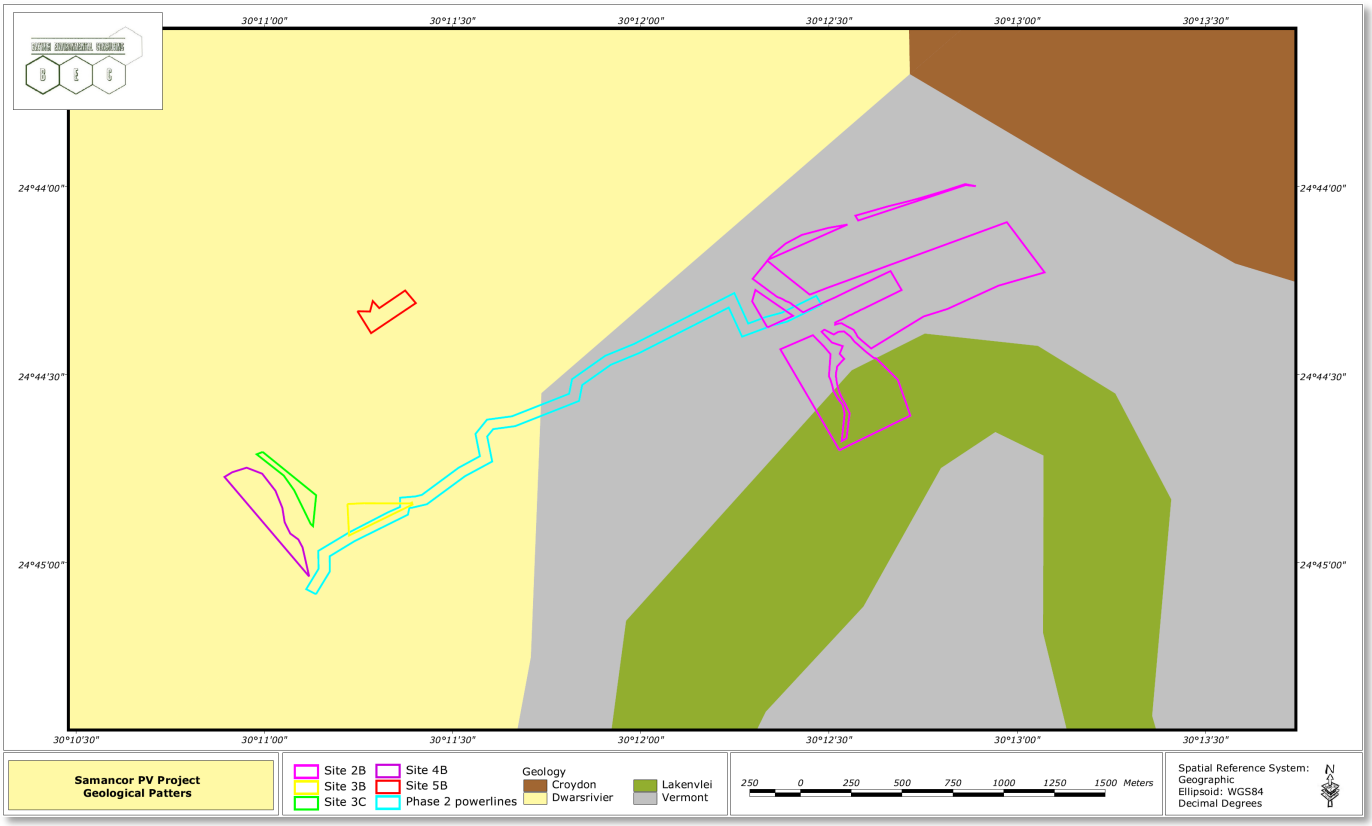


Figure 4: Geological patterns of the immediate surrounds

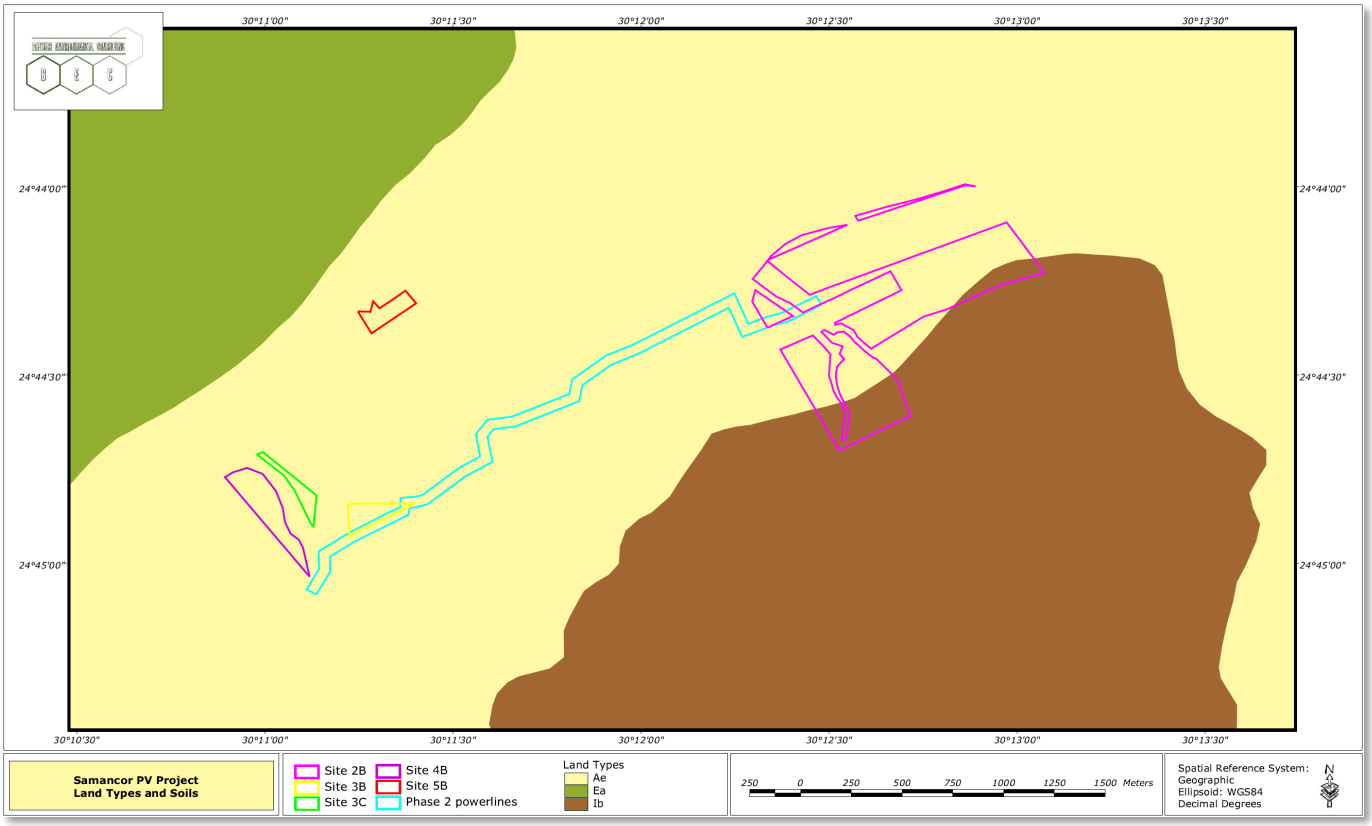


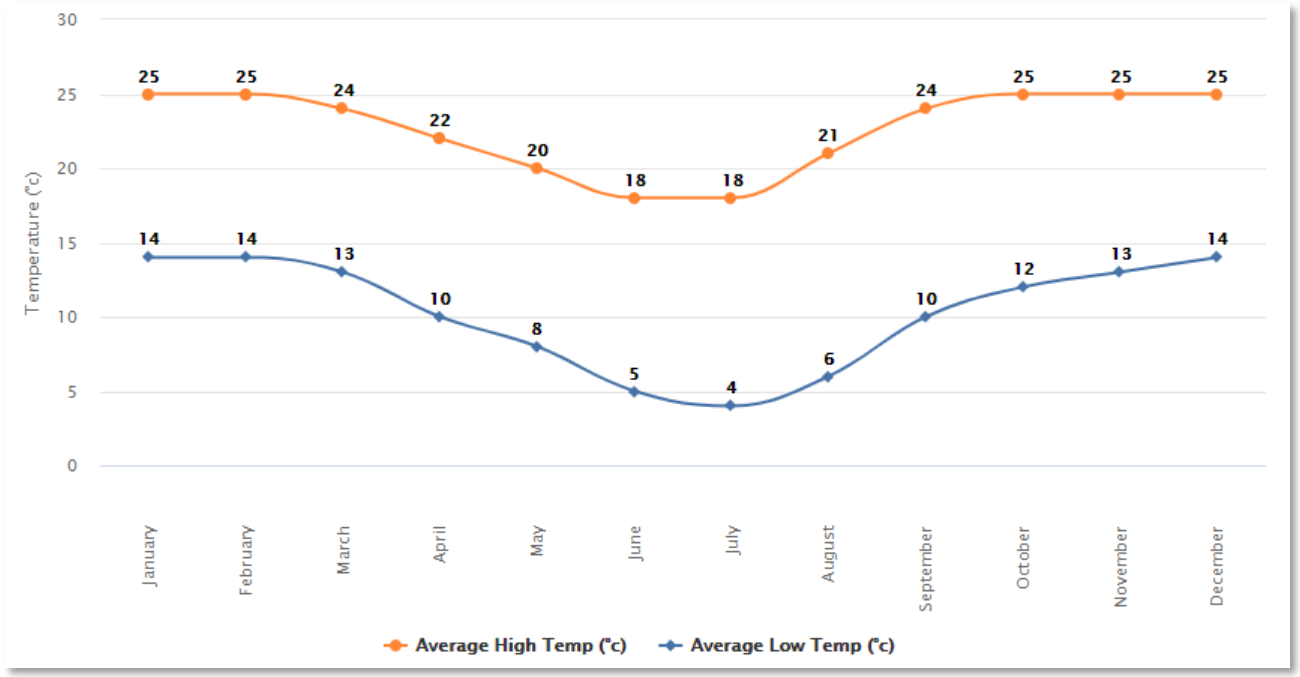
Figure 5: Land types of the immediate surrounds

14 CLIMATE

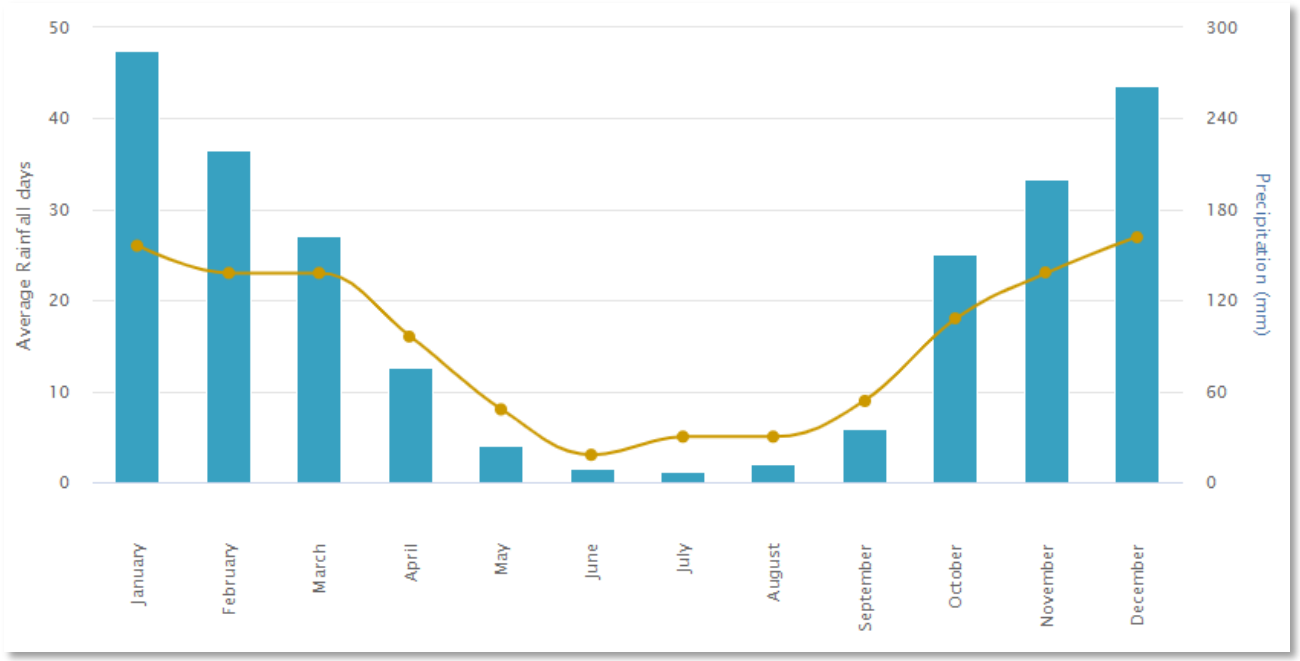
The Steelpoort climate is warm and temperate. The Köppen-Geiger chart describes the prevailing climate in Steelpoort as a local steppe climate (BSh, hot semi-arid climate). Throughout the year, the average daily maximum temperatures in the region range between 18°C (June, July) and 25°C (October - February), while daily minimum temperatures range from 14°C (December – February) and a low of round 4°C in July (refer **Graph 1**) (*www.worldweatheronline.com*) Frost and hail in the region is rare.

The Mean Annual Precipitation (MAP) in the vicinity of the sites was estimated to be approximately 606 mm per annum, which occur mostly in the form of severe thundershowers during summer (refer **Graph 2**), mainly during the months of October and March with the peak period being January. The average precipitation during the winter season is significantly less than that of the summer periods and precipitation between May and September is generally low, representing the 'dry period'.

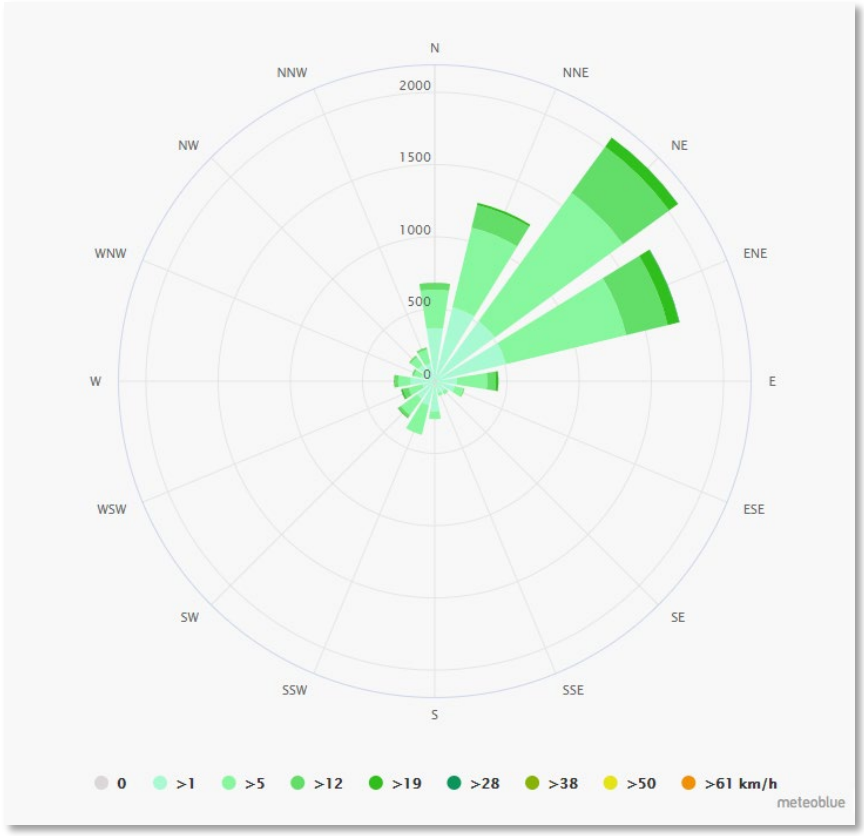
Winds are predominantly in a north-eastern direction (refer **Graph 3**) with significant windspeeds ranging between 12 and 28 km/h, rarely exceeding 28 km/hr (www.meteoblue.com). Higher wind speeds were also recorded during winter and spring months.



Graph 1: Average daily maximum and minimum temperatures
Courtesy of www.worldweatheronline.com



Graph 2: Average monthly rainfall and rainfall days
Courtesy of www.worldweatheronline.com



Graph 3: Average wind speed and direction
Image courtesy of www.meteoblue.com

15 TOPOGRAPHY, RELIEF AND SLOPES

Spatially heterogeneous habitat types provide critically important services in the habitat preferences of numerous fauna and flora species. High biodiversity levels are therefore a typical feature of hills and ridges, which also represent important habitat types for numerous sensitive species. The preservation and effective management of these landscape features on a local and regional scale will therefore provide impetus for successful conservation of sensitive habitat types and biodiversity.

The Steelpoort region is highly mountainous and topographically complex. Intensive anthropogenic activities and land uses therefore occurs mostly in valleys, while ridges and mountains form linear dividers between settlements (from a wider perspective), which is particularly noticeable from transformation and habitation along the Steelpoort River. Ridges are also known to divide the municipal areas creating pockets of homogenous compositions, which determine growth and development potential.

The proposed sites are situated on the slightly undulating plains around Steelpoort. Local and minor drainage patterns and topographical features include shallow and incised drainage lines that are often characterised by steep banks, although these smaller drainage channels and non-perennial streams have been excluded from the proposed development. The land generally slopes in a northwestern direction towards the Steelpoort River and the topographical elevation varies between approximately 761 m (Site 5B) and 872 m (Site 2B) (refer **Figure 6, red arrow**). The Steelpoort River drains in a northeastern direction. In particular, the southern portion of Site 2B is situated on the lower slopes of the mountainous areas that characterize much of the remaining natural habitat further to the south of Steelpoort.

No site-specific and accurate contours were available for the sites at the time of this report.

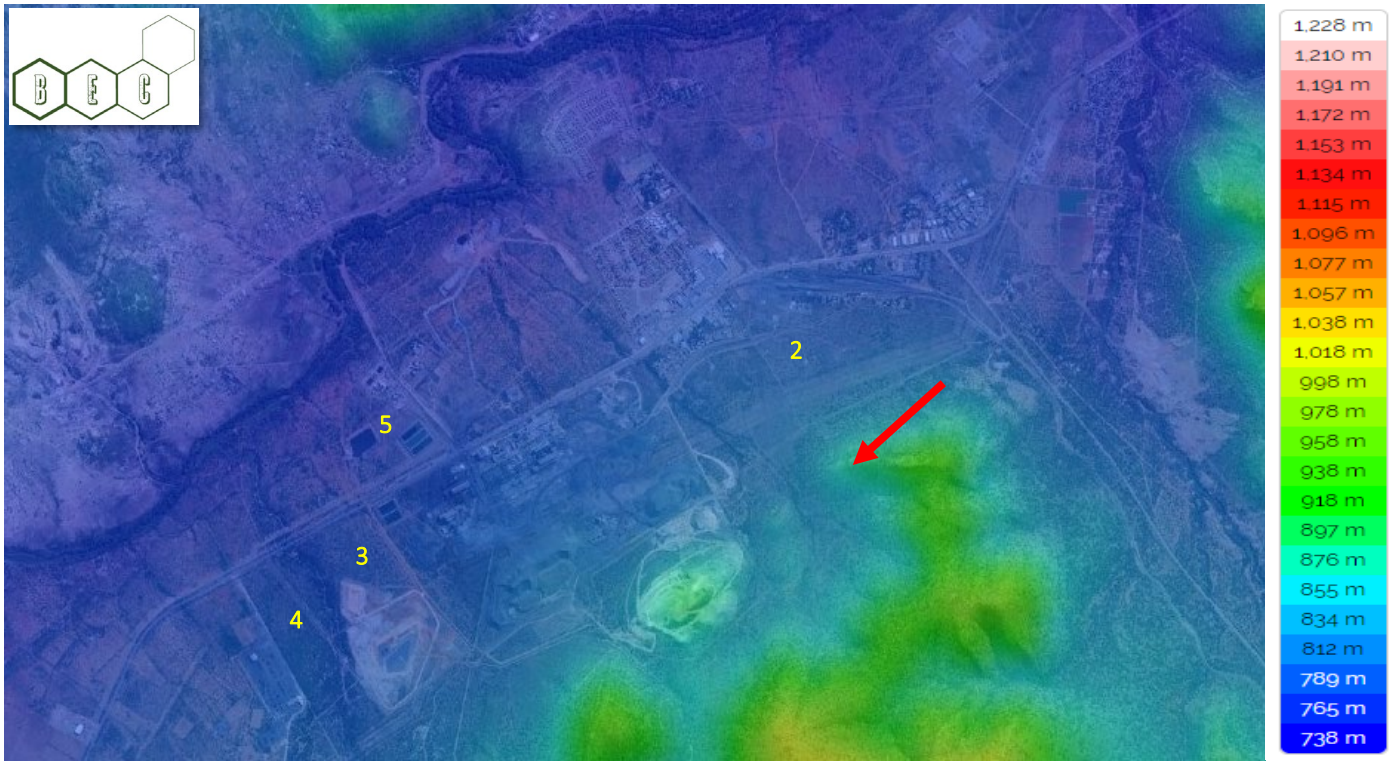


Figure 6: Topographical variations on a local scale
Numbers provide a rough indication of the site alternatives

16 WETLANDS AND SURFACE HYDROLOGY

Water, salt and processes linked to concentration of both are the major controls of the creation, maintenance and development of peculiar habitats. Habitats formed in and around flowing and stagnant freshwater bodies, experiences waterlogging (seasonal or permanent) and flooding (regular, irregular, or catastrophic), leading to the formation of special soil forms and unique habitat types. Invariably, both waterlogged and salt-laden habitats appear as 'special', deviating strongly from the typical surrounding zonal vegetation. They are considered to be of azonal character (Mucina & Rutherford, 2006). Water, in conjunction with geology, soil, topography and climate, is responsible for the creation of remarkably many types of habitats. Water chemistry, temperature and temporary changes in both, together with the amount of water (depth of water column), timing of occurrence (regular tides or irregular floods) and speed of its movement (discharge, flow and stagnation) are the major factors shaping the ecology of biotic communities occupying such habitats (VEGMAP, 2006).

Ecotones (areas or zones of transition between different habitat types) are occupied by species occurring in both the bordering habitats, and are generally rich in species due to the confluence of habitats. In addition to the daily visitors that utilise the water sources on a frequent basis, some flora and fauna species are specifically adapted to exploit the temporal or seasonal fluctuation in moisture levels in these areas, exhibiting extremely low tolerance levels towards habitat variation. Ecotonal interface areas form narrow bands around areas of surface water, and they constitute extremely small portions when calculated on a purely mathematical basis. However, considering this high species richness, these areas are extremely important on a local and regional scale. Rivers also represent important linear migration routes for a number of fauna species as well as an important distribution method for plant seeds.

The study area is situated in the Olifants-North Primary Catchment area. There are no RAMSAR site within proximity to the site, or in the Greater Tubatse Municipality. The BGIS information source indicates the Steelpoort River as the main river of the local region, with typical non-perennial drainage lines and valleys that feed into the river. Despite being non-perennial, these drainage lines feature represent significant topographical features in the form of channelled streambeds and incised low valleys with banks that may exceed 5 m in places and are either devoid of a prominent vegetatal layer, or exhibiting a composition that is similar to the surrounding terrestrial environment, hence reflecting the highly irregular occurrence of water in the system (mostly only subsequent to significant raining events. In lower topographical placements where the slopes are flatter, these drainage features conforms to wide and deep, sandy streambeds that are dominated by reedbeds, which have developed as a result of the long-term presence of a high moisture regime during the raining period.

Because of the proximity to the Steelpoort River (100 m to the north of Site 5B) and the spatial presence of several smaller non-perennial drainage lines and rivers within the sites, realistic impacts are expected on this habitat type. Site observations indicated a moderate to severe deterioration of general habitat conditions within the Steelpoort River, notably as a result of illegal sand mining operations. Furthermore, severe and persistently high grazing pressure resulted in altering the dominant vegetation to a sub-climax status that is also characterised by a high infestation by weeds and declared invasive species.

Figure 7 provides a rough indication of the spatial placement of the study sites in relation to the Steelpoort River and tributary and non-perennial drainage lines. For a comprehensive assessment of the status and nature of the wetland features on the site, the reader is referred to the relevant specialist report.

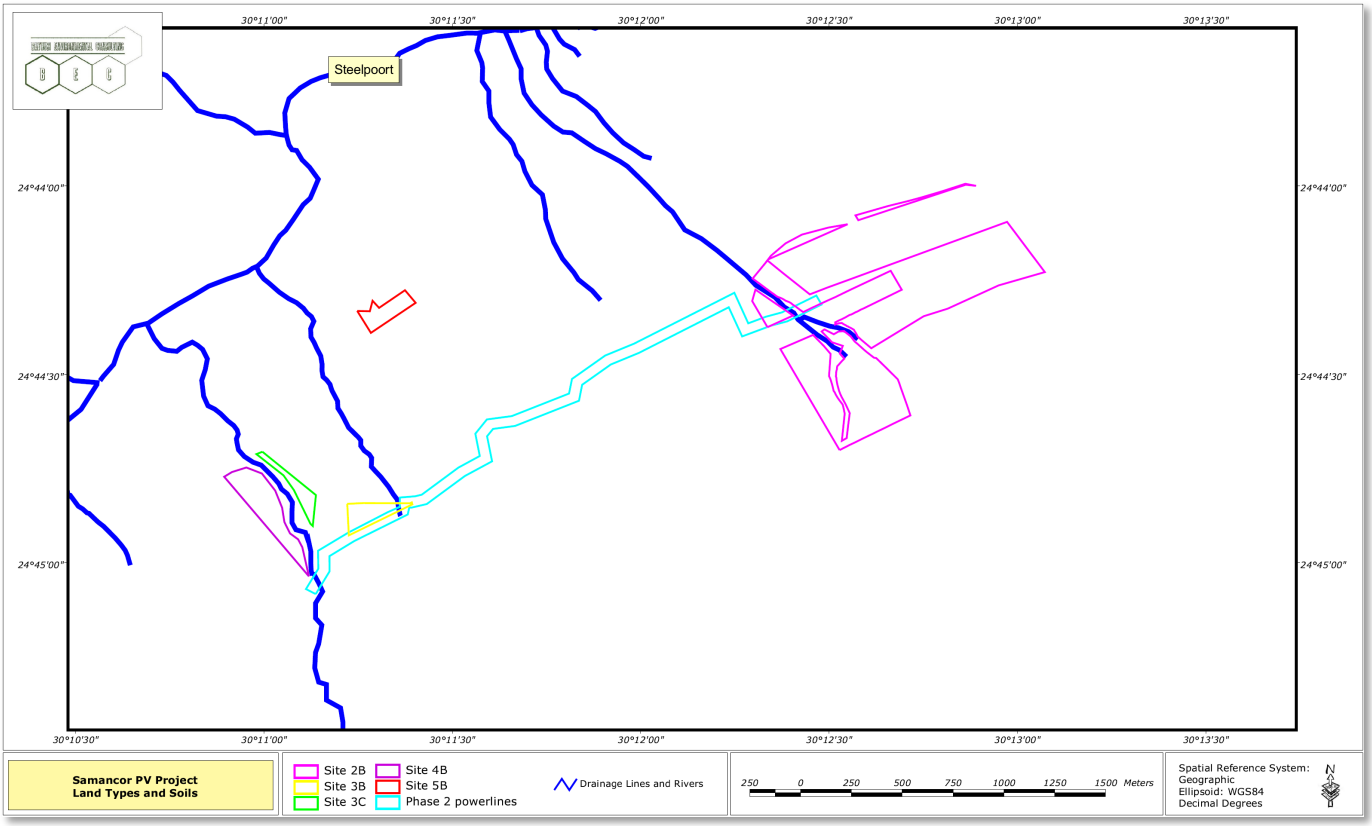


Figure 7: Rivers and non-perennial streams in the surrounds of the study sites

SECTION D: REGIONAL ECOLOGICAL SENSITIVITIES AND CONSERVATION EFFORTS

17 TERRESTRIAL BIODIVERSITY THEME SENSITIVITY - NATIONAL ENVIRONMENTAL SCREENING REPORT

The National Environmental Screening Report (2024/02/26) indicates a Very High Sensitivity for the terrestrial biodiversity sensitivity theme (refer **Figure 8**), with specific reference to the following attributes:

Very High Sensitivity: Ecological Support Area 1; and
Very High Sensitivity: Endangered (EN) Ecosystem – Sekhukhune Plains Bushveld.

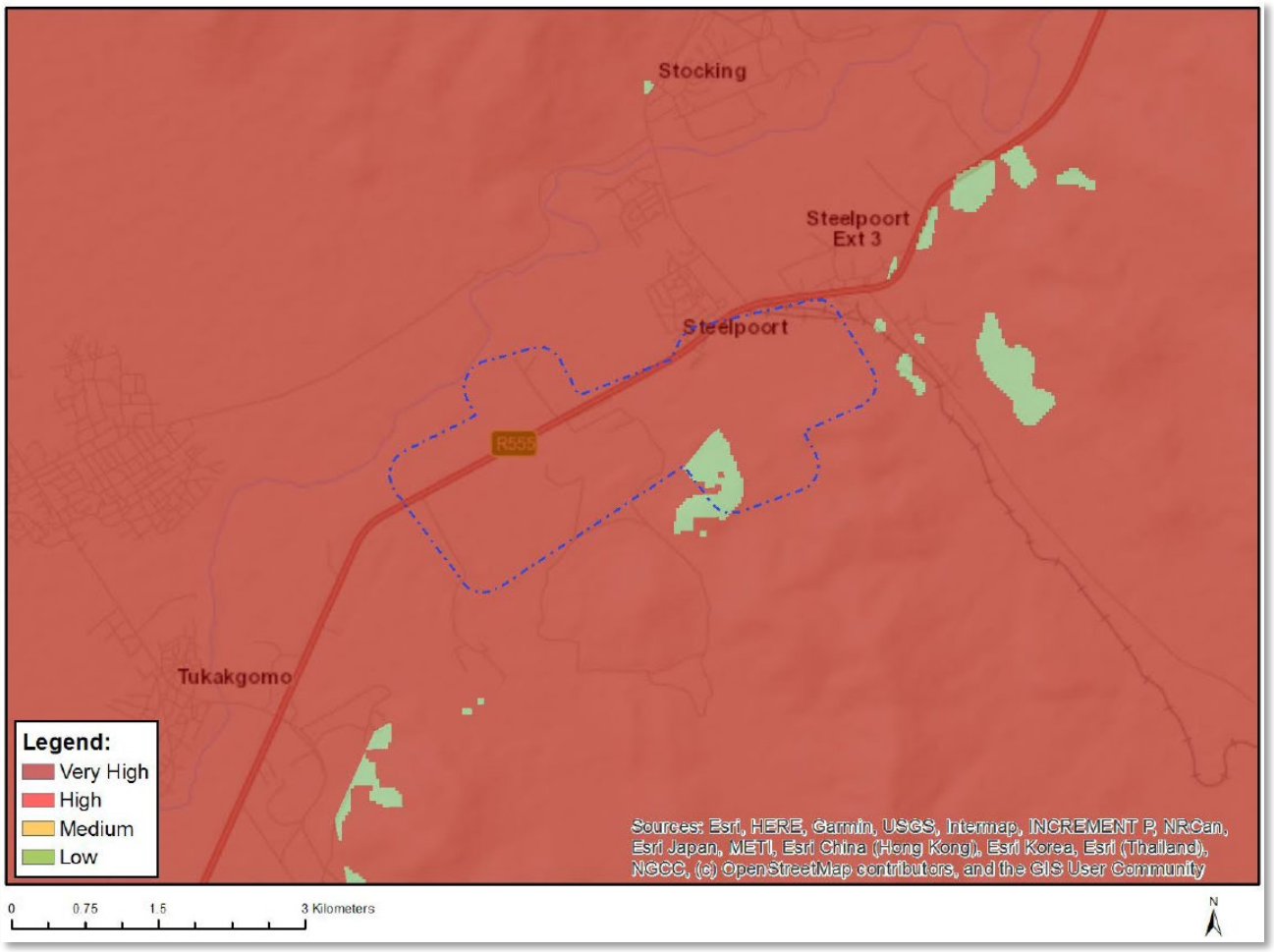


Figure 8: Terrestrial biodiversity theme sensitivity (Environmental Screening Report, 2024)

18 SEKHUKHUNELAND CENTRE OF PLANT ENDEMISM (SCPE)

The proposed site is spatially situated within the Sekhukhune Centre of Plant Endemism. The SCPE comprises a mountainous region with flat to undulating valleys. Sekhukhuneland is known for its parallel belts or rocky ridges and mountains, including the Leolo and Dwars River ranges. The core of the Centre is formed by the surface outcrops of the Rustenburg Layered Suite of the eastern Bushveld Complex. The area is bordered by the Highveld Escarpment to the south, Strydpoort Mountains to the north, the Steenkampsberg and Drakensberg to the east and the Springbok Flats to the west.

Valleys have a sub-tropical climate with little or no frost in the winter, whereas in the mountains, conditions become more temperate with increasing altitude. Fire is an important natural factor in the mountains, affecting both vegetation structure and plant biology. Soils in the SCPE tend to be rich in clay; whereas granite gives rise to 'normal' soils and

serpentinite to toxic soils, norite contains slightly higher concentrations of heavy metals than granite, thus giving rise to heavy metal soils. In the SCPE the ultramafic substrates, norite, anorthosite and pyroxenite, show a significant positive correlation with percentage endemism (Siebert, 1998).

Little is known of the vegetation of the SCPE, but the bushveld is unique and deserves recognition as a separate type. One of the characteristic trees of this bushveld type is *Kirkia wilmsii*, a species that is relatively rare in other parts of the Mixed Bushveld. Vegetation differences between the north- and south-facing aspects of the mountains are often striking. Intriguing vegetation anomalies associated with heavily eroded soils are present throughout the region. These areas (not serpentinite) are very sparsely vegetated with a distinctive, though highly impoverished flora including, for example *Searsia keetii, Euclea linearis* and *Amphiglossa triflora*. The origin and chemical composition of these eroded areas, which are natural features, are not known.

Many apparent endemic species of the SCPE are awaiting formal description (e.g. in *Acacia, Boscia, Polygala* and *Stylochiton*). The genus *Lydenburgia* (Celastraceae), represented by *Lydenburgia cassinoides* (= *Catha transvaalensis*), is near-endemic to the region, also included in the 'Vulnerable' conservation category (POSA, 2012). Succulents abound in the hot, arid valleys of the SCPE. The genus *Aloe* is particularly prolific, with many of the species being shared with the adjacent Wolkberg Centre. The area around Burgersfort is reputed to have the highest concentration of *Aloe* species in the world.

Despite it scenic landscapes, there is only one official nature reserve in the SCPE, namely Potlake Nature Reserve. Owing to the ruggedness of the terrain, however, the mountainous parts of the SKC are still fairly intact, with many private land owners keen to promote ecotourism in the region. Overgrazing by domestic livestock has seriously degraded the vegetation in the densely populated areas in around the Leolo Mountains. Population pressure is also adversely affecting the flora of the Steelpoort River Valley, particularly in the Steelpoort-Burgersfort-Maandagshoek area. Efforts to conserve high-priority areas in the SCPE must acquire an increased urgency in light of the unusual natural features of these areas, such as the rich phytodiversity of the ultramafic soils. Conservation of this botanically important area should receive the highest priority, not only from a biodiversity point of view, but also because of its importance as a water catchment area.

19 DECLARED AREAS OF CONSERVATION AND CONSERVATION IMPORTANCE

19.1 PROTECTED AREAS

The site is not situated within, or in proximity to, a declared protected area (SAPAD, SACAD, NPAES).

19.2 INFORMAL PROTECTED AREAS

The site is not situated within, or in proximity to any informal protected area. However, the following Private Nature Reserves are situated to the northwest of the proposed sites (refer **Figure 9**):

⇒ Apiesboomen Private Nature Reserve (6 km northeast);

⇒ Luiperdhoek Private Nature Reserve (6.5 km northeast); and

⇒ Glen Ora Private Nature Reserve (9 km east)

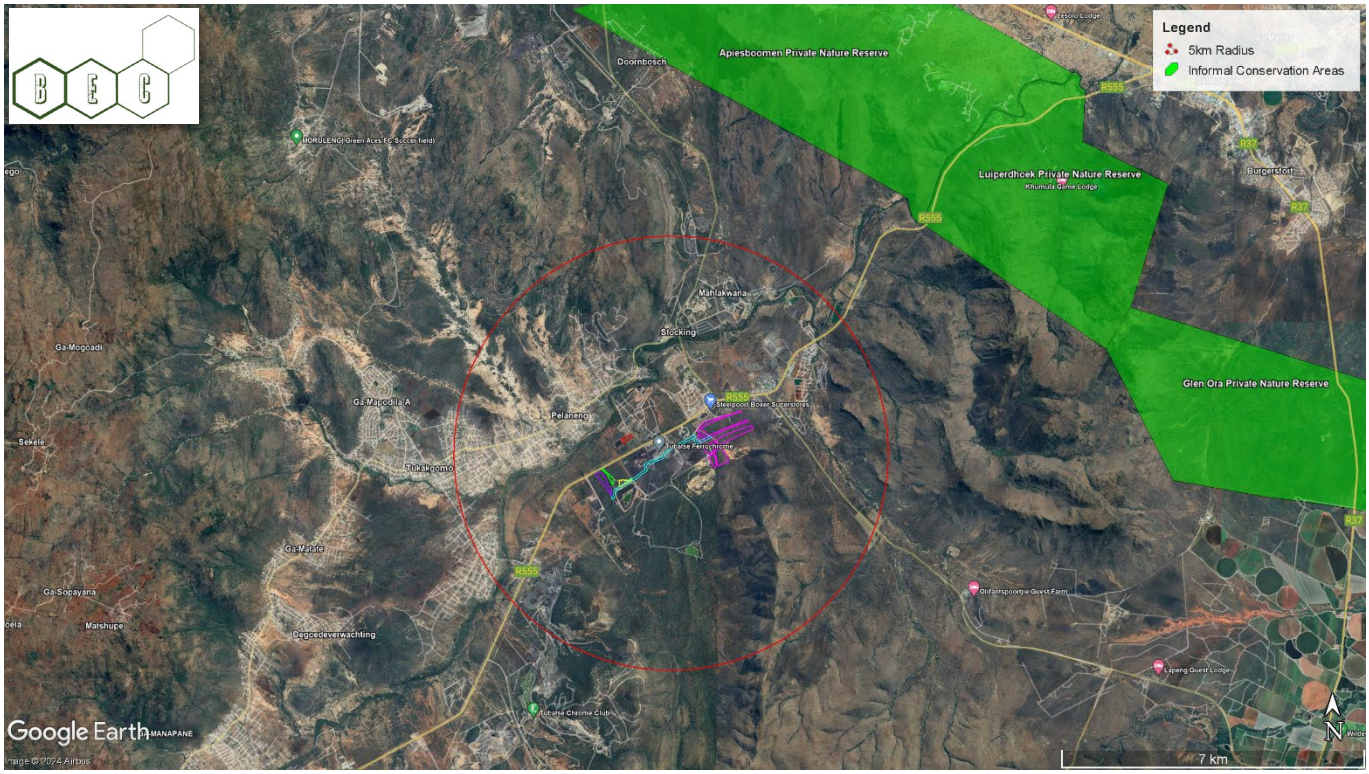


Figure 9: Spatial presence of informal declared conservation areas in the region

20 LIMPOPO CRITICAL BIODIVERSITY AREAS MAP (2018)

This bioregional plan was developed in 2018 and is based primarily on datasets and information available at the time, notably from the Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs) that were identified and delineated for the Limpopo Conservation Plan V2 (LCPv2, 2013). It should be noted that, since is the first bioregional plan for the Sekhukhune District Municipality, it does not replace any other bioregional plans, but serves as the primary biodiversity information source to a range of planning and land-use authorisation processes.

The purpose of a bioregional plan is to facilitate the safeguarding of biodiversity within identified biodiversity priority areas that fall outside of the Protected rea (PA) Network, as well as providing a map of biodiversity priorities with accompanying land use planning and decision-making guidelines to inform land-use planning, environmental assessment and authorisations, and natural resource management.

One of the outputs of this bioregional plan is the updating of the LCPv2 in response to potential losses and threats that were identified during the alignment process undertaken during the development of the Sekhukhune District Bioregional Plan, the CBAs and ESAs of the LCPv2 to ensure that biodiversity targets remained intact within the District. Specifically the following:

⇒ Losses due to land uses that result in irreversible modification of natural habitat;

⇒ Threat due to altered land uses; and

⇒ Threats due to incompatible DSDF zonation.

The following categories were implemented for the Plan:

⇒ ***Protected Areas:*** Declared and formally protected areas under the Protected Areas Act, such as National Parks, Nature Reserves, World Heritage Sites and Protected Environments that are secured by appropriate legal mechanisms. Recommendations for this category include maintaining of the current status or obtaining formal conservation protection.

⇒ ***Critical Biodiversity Areas (CBAs):*** Sites that are required to meet biodiversity targets for ecosystems and species and need to be maintained in good ecological condition. The majority of the CBAs in the Sekhukhune District are CBA1, which can be considered irreplaceable in that there is little choice in terms of areas available to meet targets. If CBA1 areas are not maintained in a natural state, then targets cannot be achieved. Those areas falling within CBA2 are considered optimal. Although they represent areas where there are other spatial options for achieving targets, the selected sites are the ones that best achieve targets of the systematic biodiversity plan. Recommendations for this category include obtaining formal conservation protection where possible, and the implementation of appropriate zonation to avoid loss of intact habitat or intensification of land use.

⇒ ***Ecological Support Areas (ESAs):*** Areas that are important for supporting the ecological functioning of CBAs and protected areas and for meeting biodiversity targets for ecological processes. This category has also been split into ESA1s and ESA2s on the basis of land cover. ESA1s are in a largely natural state, and are important for supporting CBAs, while ESA2s are no longer intact, but potentially retain significant importance from an ecological process perspective (e.g. agricultural land maintaining landscape connectivity). Recommendations for this category include implementation of appropriate zoning and land management guidelines to avoiding impacting of ecological processes, avoiding intensification of land use and avoiding fragmentation of the natural landscape, also avoiding conversion of agricultural land to more intensive land uses, which may have a negative impact on threatened species or ecological processes.

⇒ ***Other Natural areas (ONAs):*** Areas that still contain natural habitat but that are not required to meet biodiversity targets. Recommendations for this category is subject to town and regional planning guidelines and policies.

⇒ ***No Natural Habitat Remaining (NNRs):*** Areas without any remaining intact habitat remaining, entirely transformed. Recommendations for this category is subject to town and regional planning guidelines and policies.

The BRP information source designated the remaining areas of natural habitat within the development footprints and surrounding areas as ESA1 habitat (refer **Figure 10**). In comparison with the older version (Limpopo Province Conservation Plan (v2)) that categorised much of the remaining areas as CBA1, CBA2 and ESA1 status, the BRP categorisation is considered a more accurate and appropriate categorisation of remaining areas of natural habitat within the development footprints. It has captured some of the recent land transformation and habitat deterioration that is associated with the fragmented and isolated portions of woodland habitat in the immediate surrounds of Steelpoort. However, as this map is a static representation of a dynamic environment, some discrepancies are evident on finer inspection, which generally is the result of recent changes in land use and activities that have not yet been captured in the latest version.

Figure 10: Limpopo Bioregional Conservation Plan (2018) for the immediate region

21 NATIONAL THREATENED ECOSYSTEMS[4]

The Biodiversity Act (Act 10 of 2004) provides for listing of threatened or protected ecosystems, in one of four categories, namely Critically Endangered (CR), Endangered (EN), Vulnerable (VU) or protected. The list of nationally threatened terrestrial ecosystems in South Africa was gazetted in December 2011 (NEMBA: National List of ecosystems that are threatened and in need of protection, G34809, GN 1002), with the aim of reducing the rate of ecosystem and species extinction by preventing further degradation and loss of structure, function and composition.

A review of the BGIS information source (Threatened Ecosystems 2011_Original Extent) indicates the spatial presence of the sites within the Sekhukhune Mountains Bushveld (Svcb28) (LC)[5] and the Sekhukhune Plains Bushveld (Svcb29) [6] (refer **Figure 11**). The assessment of remnant patches, as part of EIA studies, are required to establish the presence and condition of remaining natural habitat on proposed development sites. The Sekhukhune Mountains Bushveld (Svcb28) is estimated to have an original extent of approximately 231,616 ha, of which 78 % is considered untransformed and therefore exhibits comparatively low rates of natural habitat loss and biotic disruptions, placing this ecosystem at low risk of collapse. In contrast, the Sekhukhune Plains Bushveld (Svcb29) have an original extent of approximately 252,284 ha, of which only 46 % remains untransformed. These comparatively high transformation rates, and also considering that only approximately 1.9 % is formally conserved, provides evidence of the Endangered status of this type.

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[4] The revised list of threatened ecosystems was developed between 2016 and 2020, incorporating the best available information on terrestrial ecosystem extent and condition, pressures and drivers of change and is based on assessments that followed the International Union for Conservation of Nature (IUCN) Red List of Ecosystems Framework (version 1.1) and covers all 456 terrestrial ecosystem types described in South Africa (Mucina and Rutherford 2006; with updates described in Dayaram et al., 2019). The revised list identifies 120 threatened terrestrial ecosystem types (55 Critically Endangered, 51 Endangered and 14 Vulnerable types). The Red List of Ecosystem 2021 replaces the current 2011 National Environmental Management: Biodiversity Act (NEMBA) (Act 10 of 2004): National List of Ecosystems Threatened or in Need of Protection.

[5] https://bgis.sanbi.org/Ecosystems/home/Detail/505

[6] http://bgis.sanbi.org/Ecosystems/home/Detail/260

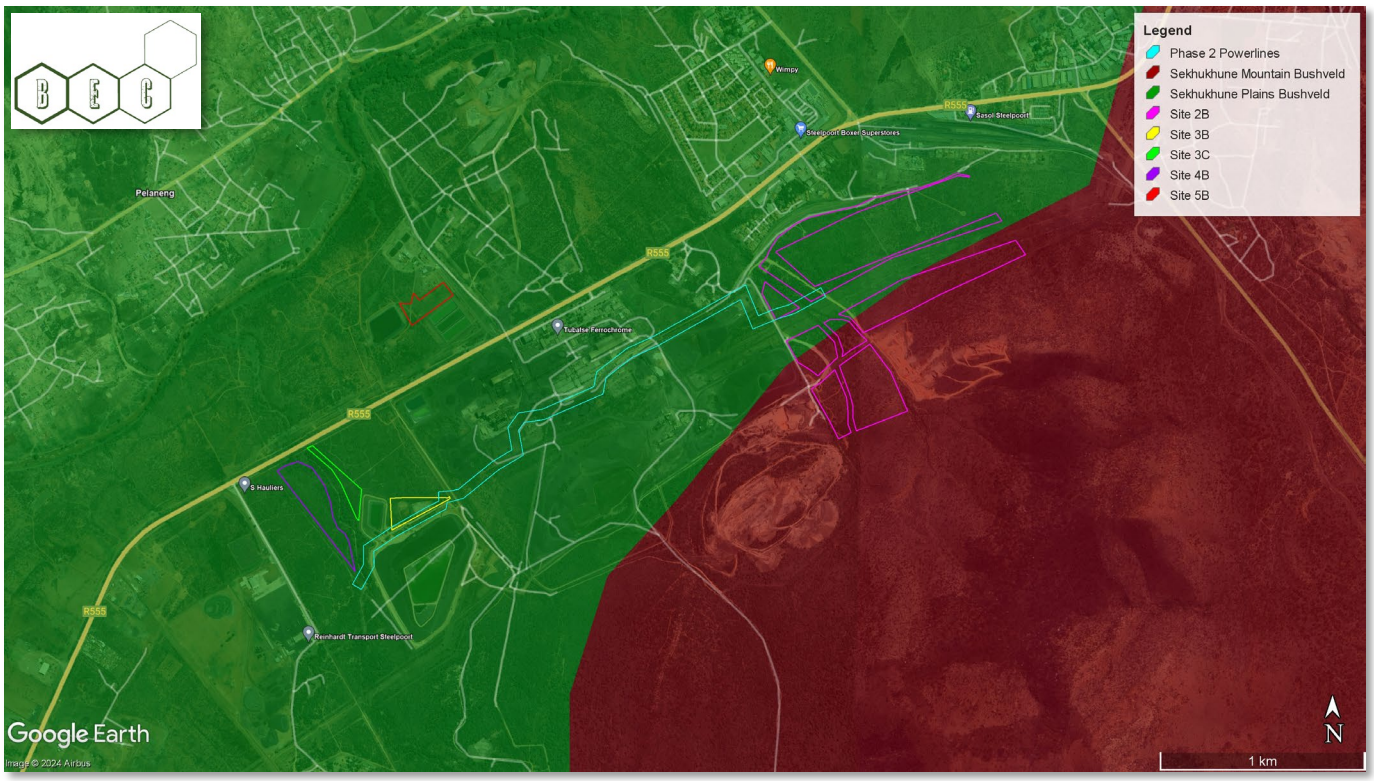


Figure 11: Spatial placement of the study site in relation to original extent of Vegmap ecological types (Mucina & Rutherford 2008)

Figure 12 illustrates the remaining portions of natural habitat in the surrounds of the study areas, although a measure of inaccuracies in the spatial data is noted from areas that could be considered as natural habitat, but being excluded from the assessment.

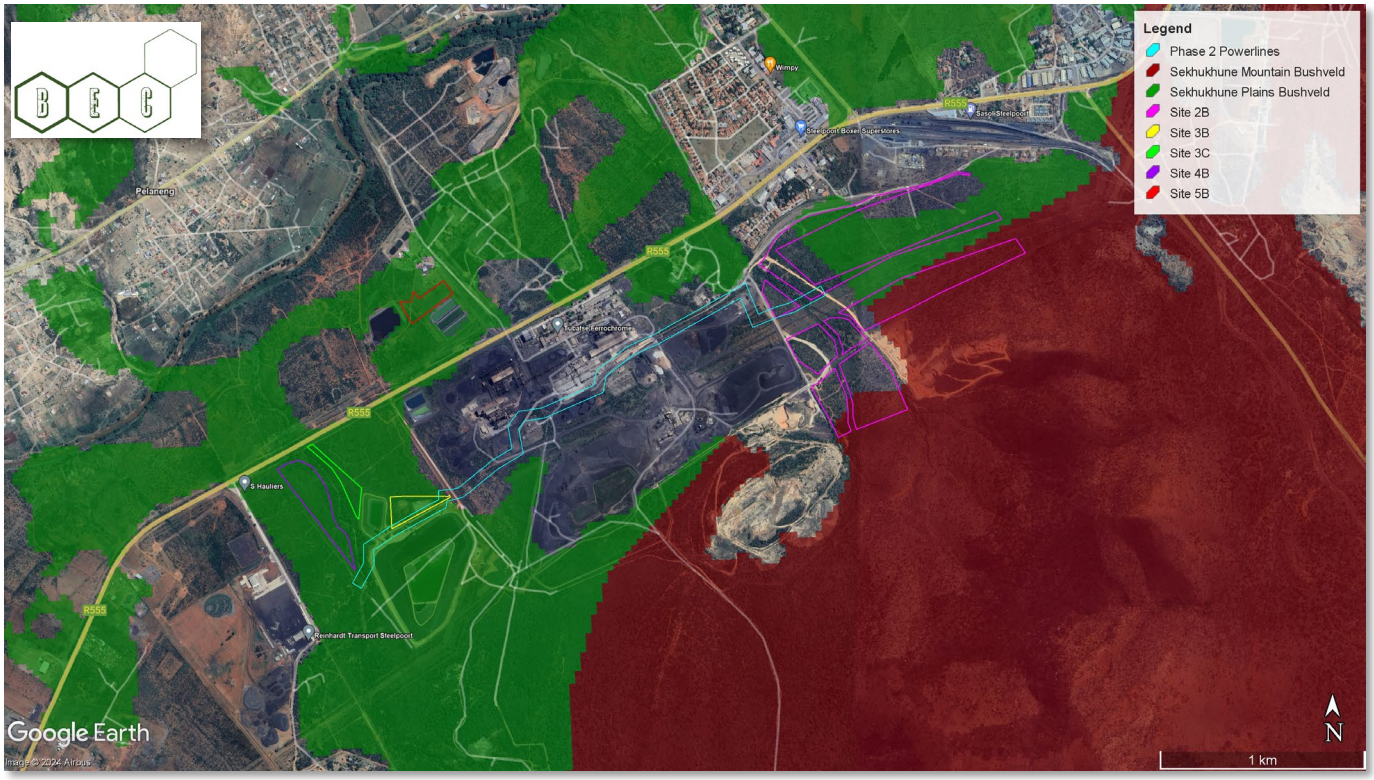


Figure 12: Spatial placement of the study site in relation to the remaining extent of Vegmap ecosystems

22 KEY EXTRACTS - TERRESTRIAL BIODIVERSITY SENSITIVITIES

A review of information sources in preceding sections that provides a landscape perspective of ecological and biophysical attributes (relating to the terrestrial biodiversity theme), indicates a moderate to moderate-high ecological status and sensitivity of the proposed sites, with specific reference to the following aspects:

⇒ While most of the proposed sites are situated in an ecological type that is considered endangered (Sekhukhune Plains Woodland), these areas generally exhibit moderate to high deterioration levels, which mostly stems from local land use patterns. Reparation and restoration of the principle ecological attributes and status of these areas are not reasonably anticipated considering continued development and exacerbated anthropogenic impacts from the Steelpoort town and wider region.

⇒ Minor portions of the proposed sites are situated in an ecological type that is considered least concern (Sekhukhune Mountains Woodland), although most of these areas exhibit a high ecological integrity and status.

⇒ The Limpopo Bioregional Conservation Plan (2018) categorised much of the remaining portions of natural habitat as ESA1, which is generally considered an accurate and acceptable depiction.

⇒ The local area (immediate to, and including the proposed development footprints) are not recognised for existing and high conservation potential. However, natural habitat situated to the south of the proposed development, which mostly relates to the Sekhukhune Mountains Woodland are recognised as being of high ecological integrity and status and also worthy of conservation efforts with a high biodiversity value.

⇒ Existing land use patterns and activities, with specific reference to mining and other industrial activities in the proximity to the proposed sites, provides for existing impacts on the terrestrial biodiversity environment and detracts from the status and value of remaining portions of natural habitat.

SECTION E: BOTANICAL ATTRIBUTES OF THE SITES

23 TERMS OF REFERENCE FOR THE BOTANICAL ASSESSMENT

Based on the Scope of Works, this botanical assessment is guided by:

⇒ Assimilating and appraise existing records, data and information that is available for the project area and wider region;

⇒ Establish the areas' botanical attributes and ecological receiving environment by means of strategic site investigations, with reference to national guidelines and protocols for biodiversity studies;

⇒ Providing a clear description of the broad floristic attributes of the study areas and immediate surrounds. The following shall be identified and described where appropriate:

- Community and ecosystem level;
- Species level; and
- Other pattern issues;

⇒ Define and map different broad-scale habitat types based on an evaluation of available aerial imagery and site investigations from the respective sites, also being cognisant of results obtained from previous assessments;

⇒ Present a preliminary species inventory of species that were recorded within the proposed development site during the various phases of the project;

⇒ Identifying key natural resources, with specific reference to floristic attributes of elevated importance or sensitivity, that exist or may exist within the development areas;

⇒ Identifying ecologically valuable (threatened, protected and Red Data) species, communities and habitat types;

⇒ Providing a clear description of perceived floristic sensitivity of the environment, from both a local and regional perspective;

⇒ Presenting the preliminary floristic sensitivity of the receiving environment as well as contributing elements of the floristic importance towards the Site Ecological Importance assessment;

⇒ Providing a prediction, assessment, and evaluation of potentially significant direct and indirect impacts in terms of botanical nature, ecological processes, species, and ecosystem services of concern, where relevant (refer Section G); and

⇒ Review the anticipated Plant Species Theme Sensitivities, as indicated by the National Environmental Screening Report.

This botanical assessment will be informed by (*inter alia*) the following information sources:

⇒ Satellite imagery;

⇒ IUCN and Regional Red List information;

⇒ NEWPOSA, BODATSA;

⇒ National Vegetation Map;

⇒ Available reports (previous phases) and biodiversity assessments;

⇒ Various field guides; and

⇒ BGIS information source.

24 PLANT SPECIES THEME SENSITIVITY - NATIONAL ENVIRONMENTAL SCREENING REPORT

The National Environmental Screening Report (2024/02/26) indicates a Medium Sensitivity for plant species of conservation concern for the site and immediate surrounds (refer **Figure 13**), with specific reference to the following species:

Medium Sensitivity: Sensitive Species 1252;
Medium Sensitivity: Sensitive Species 1033;
Medium Sensitivity: Sensitive Species 587;
Medium Sensitivity: *Asparagus fourei*;
Medium Sensitivity: *Polygala sekhukhuniensis*;
Medium Sensitivity: *Searsia batophylla*;
Medium Sensitivity: *Searsia sekhukhuniensis*; and
Medium Sensitivity: *Combretum petrophilum*.

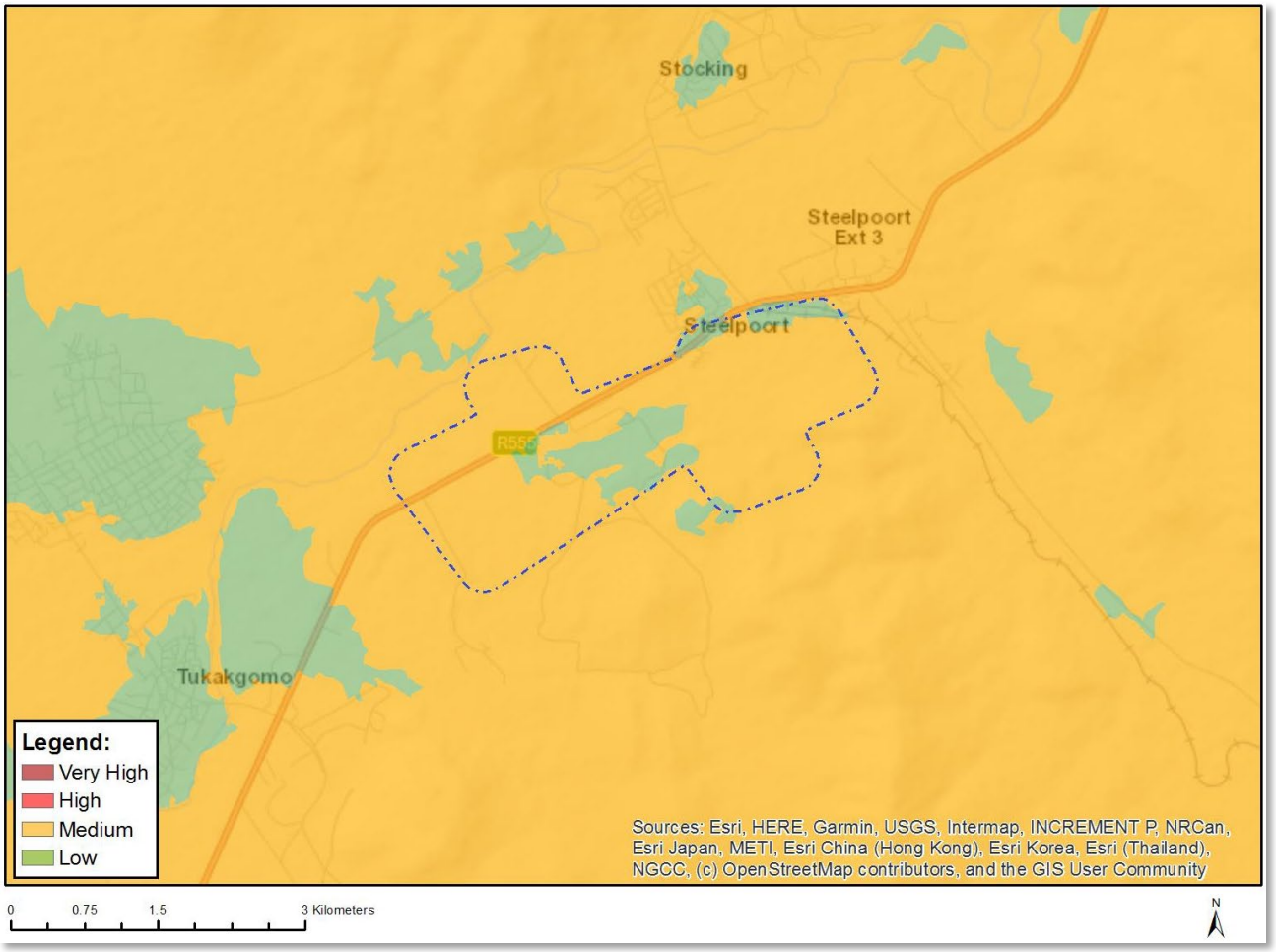


Figure 13: Plant species theme sensitivity (Environmental Screening Report, 2024)

A review of the likelihood of these species occurring within the development footprint is presented in **Section 26.3.4.** A review of the anticipated plant species sensitivity theme, based on results from this assessment, is presented in **Section 36.**

25 REGIONAL FLORISTIC PATTERNS

25.1 BACKGROUND TO THE SAVANNA ECOLOGY

A biome is broadly defined as a distinct geographical region that is characterised by specific climatic, vegetation and faunal patterns and attributes. It consists of a biological community that has formed in response to its physical environment and regional climate and may also span across continents. A biome encompasses multiple (smaller) ecosystems within its boundaries. South Africa is divided into 9 biomes; the Savanna Biome is the largest biome in southern Africa, covering about 46 % of its area. The term savanna generally describes vegetation with a well-developed grassy layer and a dominant upper layer of woody plants. South African savannas of nutrient-poor substrates are characteristically broad-leaved and without thorns, while those of nutrient-rich substrates are fine-leaved and thorny (Knobel, 1999), although microphyllous species are encroaching in many areas due to inappropriate management and over-exploitation (pers. obs.).

Biodiversity levels in African savanna are exceptional, comprising more than 13,000 plant species, of which 8,000 are savanna endemics. More specifically, dry savannas have more than 3,000 endemic species. This diversity equals that of South African grassland regions and is exceeded only by the Fynbos Biome (Knobel 1999). Similarly, in respect of animal diversity, savannas are without peer, including approximately 167 mammals (15 % endemism), 532 birds (15 % endemism), 161 reptiles (40 % endemism), 57 amphibians (18 % endemism) and an unknown number of invertebrates (Knobel, 1999). Flagship species include the Starburst Horned Baboon Spider (*Ceratogyrus bechuanicus*), ground Hornbill (*Bucorvus leadbeateri*), Cape Griffon (*Gyps coprotheres*), Wild dog (*Lycaon pictus*), Short-Eared Trident Bat (*Cloeotis percivali*) and the White Rhino (*Ceratotherium simum*) (EWT, 2002).

Conservation within, and of, the Savanna Biome is good in principle, mainly due to the presence of a number of wildlife reserves. Urbanisation is currently not a significant threat, perhaps because the hot, dry climate and diseases prominent in the savanna areas have hindered extensive urban development. Much of the savanna regions are used for game farming and the importance of tourism and big-game hunting in the conservation areas must not be underestimated. Savannas are the basis of the African wildlife and ecotourism industry and play a major role in the meat industry, but surprisingly little is known about the vegetation as most studies have been done in nature reserves and game farms.

Much of the area is used for game farming and big game hunting, illustrating that utilisation and conservation of an area are not mutually exclusive. The savanna biome is the core of the wildlife, ecotourism and meat-production industries. Threats include rapidly expanding development of settlements for impoverished human populations and the associated need for firewood and building materials, diminishing water supply, agriculture and over-grazing (Knobel, 1999).

25.1.1 SEKHUKHUNE MOUNTAINS BUSHVELD (SVCB28)

Southern sections of Site 2B comprise the Sekhukhune Mountains Bushveld (LC)[7] (refer **Figure 11**), manifesting as open to closed woodland of the mountains and hills to the south of Steelpoort. **Figure 12** provides an illustration of the remnant portions of this type on a regional scale. The low transformation rates on a regional scale is evident.

The Sekhukhune Mountains Bushveld type is situated in the mountains and undulating hills above the lowlands of the Sekhukhune Plains Bushveld, including parts of the steep slopes of the Leolo Mountains, the Dwars River Mountains and Thaba Sekhukhune, as well as a number of isolated smaller mountains (e.g. Phepane and Morone). It also comprises the undulating small hills in the valley of the Steelpoort River up to and along the Klip River flowing past Roossenekal at altitude ranges between 900 and1,600 m.

[7] https://bgis.sanbi.org/Ecosystems/home/Detail/505

The vegetation conforms to dry, open to closed microphyllous and broad-leaved savanna on hills and mountain slopes that form concentric belts parallel to the northeastern escarpment. The open bushveld is often associated with ultramafic soils on southern aspects, while bushveld on ultramafic soils may contain a high diversity of edaphic specialists. Bushveld of the mountain slopes are generally taller than in the valleys, with a well-developed herb layer and bushveld of valleys and dry northern aspects usually comprise dense vegetation similar to thickets, with an herb layer comprising many short-lived perennials. Dry habitats of this unit contain a number of species with xerophytic adaptations, such as succulence and underground storage organs. Both man-made and natural erosion dongas occur on footslopes of clays rich in heavy metals.

This mountain bushveld is part of the Sekhukhuneland Centre of Plant Endemism (Van Wyk & Smith 2001), more specifically the Steelpoort Subcentre. Because of comparatively low disturbance factors, the vast range of habitat still harbours high plant diversity with many endemics, many of which still await formal description (Siebert et al. 2001). In terms of floristic diversity, species richness and vegetation structure, it is related to Sekhukhune Plains Bushveld, Norite Koppies Bushveld and Ohrigstad Mountain Bushveld (Siebert et al. 2002b, c).

The conservation level of this unit is Least Concern, and while none is conserved in statutory conservation areas, only 0.4 % is conserved in Potlake Nature Reserve. This unit is experiencing low rates of natural habitat loss and biotic disruptions, placing the ecosystem at low risk of collapse, although nearly 15 % has been irreversibly transformed by cultivation, mining, and urban transformation, notably some portions to the south of the Steelpoort. Erosion is at moderate to high levels, with donga formation in places. An increasing area along the Dwars River Subsuite is under pressure from mining activities and its associated urbanisation (Siebert et al. 2002d).

Important taxa for this unit include:

Tall Tree:	*Senegalia nigrescens*
Small Trees:	*Senegalia senegal* var. *leiorhachis, Combretum apiculatum, Kirkia wilmsii, Terminalia prunioides, Vitex obovata* subsp. *wilmsii, Ziziphus mucronata, Bolusanthus speciosus, Boscia albitrunca, Brachylaena ilicifolia, Combretum molle, Commiphora mollis, Croton gratissimus, Cussonia transvaalensis, Hippobromus pauciflorus, Ozoroa sphaerocarpa, Pappea capensis, Schotia latifolia, Sterculia rogersii.*
Succulent Tree:	*Aloe marlothii* subsp. *marlothii*
Tall Shrubs:	*Dichrostachys cinerea, Euclea crispa* subsp. *crispa, Combretum hereroense, Euclea linearis, Pavetta zeyheri, Tinnea rhodesiana, Triaspis glaucophylla.*
Low Shrubs:	*Elephantorrhiza praetermissa, Grewia vernicosa, Asparagus intricatus, Barleria saxatilis, B. senensis, Clerodendrum ternatum, Commiphora africana, Hermannia glanduligera, Indigofera lydenburgensis, Jatropha latifolia* var. *angustata, Melhania prostrata, Phyllanthus glaucophyllus, Psiadia punctulata, Searsia keetii, Rhynchosia komatiensis.*
Succulent Shrubs:	*Aloe castanea, A. cryptopoda.*
Woody Climbers:	*Clematis brachiata, Rhoicissus tridentata, Acacia ataxacantha.*
Woody Succulent Climber:	*Cynanchum (Sarcostemma) viminale*
Graminoids:	*Aristida canescens, Heteropogon contortus, Panicum maximum, Setaria lindenbergiana, Themeda triandra, Aristida transvaalensis, Cymbopogon pospischilii, Diheteropogon amplectens, Enneapogon scoparius, Loudetia simplex, Panicum deustum, Setaria sphacelata.*
Herbs:	*Berkheya insignis, Commelina africana, Cyphostemma woodii, Kyphocarpa angustifolia, Senecio latifolius.*
Geophytic Herbs:	*Hypoxis rigidula, Sansevieria hyacinthoides.*
Succulent Herb:	*Huernia stapelioides.*

Biogeographically Important Taxa[8] include:

Small Tree:	*Lydenburgia cassinoides*[SK]
Tall Shrub:	*Searsia sekhukhuniensis*[SK]
Low Shrubs:	*Euclea sekhukhuniensis*[SK], *Petalidium oblongifolium*[CB], *Plectranthus venteri*[Z], Searsia *batophylla*[SK].
Woody Climbers:	*Asparagus sekukuniensis*[SK], *Rhoicissus sekhukhuniensis*[SK].
Geophytic Herbs:	*Chlorophytum cyperaceum*[SK], *Raphionacme chimanimaniana*[Z].
Small Tree:	*Vachellia ormocarpoides(e)*
Succulent Tree:	*Euphorbia sekukuniensis(e)*
Soft Shrub:	*Plectranthus porcatus(e)*

25.1.2 SEKHUKHUNE PLAINS BUSHVELD (SVCB27)

Most of the proposed development footprints is situated in the Sekhukhune Plains Bushveld (EN)[9] (refer **Figure 11**), and is encountered on the plains and flat areas around Steelpoort, noticeably with a modified and deteriorated appearance as a result of anthropogenic disturbances and high utilisation factors. **Figure 12** provides an illustration of the remnant portions of this type on a regional scale. Significant and high transformation rates on a regional scale is evident with only small portions of natural habitat remaining on a regional scale.

This ecological type is geographically placed in the lowland areas from Burgersfort and the lower basin of the Steelpoort River in the south, northwards through the plains of the Motse River basin to Jobskop and Legwareng (south of the Strydpoort Mountains), and continuing up the basin of the Olifants River to around Tswaing and the valleys of the Lepellane and Mohlaletsi Rivers. The vegetation conforms to mainly semi-arid plains and open valleys between chains of hills and small mountains running parallel to the escarpment. It is characterised by a predominantly short, open to closed thornveld with an abundance of *Aloe* species and other succulent plants. Although locally heavily degraded because of over-exploitation for cultivation, mining and urbanisation, much remains in a natural and pristine state. Both man-made and natural erosion dongas occur in areas containing clays rich in heavy metals. Encroachment by indigenous microphyllous trees and invasion by alien species is common throughout the area.

The 2021 Ecosystem Status Assessment (refer footnote on page 37) categorises the conservation level of this as **Endangered** (previously Vulnerable). With a target of 19 %, only 2 % is statutorily conserved in Potlake, Bewaarkloof and Wolkberg Caves Nature Reserves. Approximately 25 % of this area has already been transformed and is mainly under dry-land subsistence cultivation. A small area, notably around the Steelpoort area, is under significant pressure from chrome and platinum mining activities and associated urbanisation, and depending on commodities, this threat is likely to increase in near future. There is a high level of degradation of much of the remaining vegetation as a result of unsustainable harvesting, utilisation and exploitation. Erosion is widespread at usually high to very high levels with donga formation, but also expansive sheet and rill erosion (*pers. obs.*). Alien *Agave* species, *Caesalpinia decapetala*, *Lantana camara*, *Melia azedarach*, *Nicotiana glauca*, *Opuntia* species, *Verbesina encelioides* and *Xanthium strumarium* are widespread but scattered, often with strong correlation with drainage lines and rivers.

This semi-arid bushveld is a disturbed and degraded system with many erosion dongas, although much of the erosion can be attributed to inherent edaphic properties. It is situated in the Sekhukhuneland CE (Van Wyk & Smith 2001) and a paucity of comprehensive floristic knowledge is noted; several endemic taxa of this unit still require formal description (Siebert et al. 2001). A high correlation is indicated with the nearby Sekhukhune Mountain Bushveld (SVcb28), Polokwane

[8] (*[N]Northern Sourveld endemic, [CB]Central Bushveld endemic, [SK]Sekhukhune endemic, [Z]Link to Zimbabwe) and Endemic Taxa (e)*
[9] http://bgis.sanbi.org/Ecosystems/home/Detail/260

Plateau Bushveld (SVcb23) and Springbokvlakte Thornveld (SVcb15) in terms of floristic diversity, species richness and vegetation structure (Breebaart & Deutschländer 1997, Siebert et al. 2002b).

Typical and important taxa for this unit include:

Tall Trees:	*Vachellia erioloba* (NFA, 2014), *Philenoptera violacea* (NFA, 2014).
Small Trees:	*Senegalia mellifera* subsp. *detinens*(d), *Vachellia nilotica* (d), *Vachellia tortilis* subsp. *heteracantha*(d), *Boscia foetida* subsp. *rehmanniana*(d), *Vachellia grandicornuta*, *Albizia anthelmintica*, *Balanites maughamii* (NFA, 2014), *Combretum imberbe* (NFA, 2014), *Commiphora glandulosa*, *Maerua angolensis*, *Markhamia zanzibarica*, *Mystroxylon aethiopicum* subsp. *schlechteri*, *Ptaeroxylon obliquum*, *Schotia brachypetala*, *Ziziphus mucronata*.
Succulent Tree:	*Euphorbia tirucalli*(d).
Tall Shrubs:	*Searsia engleri*(d), *Cadaba termitaria*, *Dichrostachys cinerea*, *Ehretia rigida* subsp. *rigida*, *Grewia bicolor*, *Karomia speciosa*, *Maerua decumbens*, *Rhigozum brevispinosum*, *R. obovatum*, *Tinnea rhodesiana*, *Triaspis glaucophylla*.
Low Shrubs:	*Felicia clavipilosa* subsp. *transvaalensis*(d), *Seddera suffruticosa*(d), *Gnidia polycephala*, *Gossypium herbaceum* subsp. *africanum*, *Jamesbrittenia atropurpurea*, *Jatropha latifolia* var. *latifolia*, *Lantana rugosa*, *Melhania rehmannii*, *Monechma divaricatum*, *Myrothamnus flabellifolius*, *Pechuel-Loeschea leubnitziae*, *Plinthus rehmannii*.
Succulent Shrubs:	*Aloe cryptopoda*(d), *Euphorbia enormis*(d), *Kleinia longiflora*(d), *Aloe castanea*, *A. globuligemma*.
Woody Succulent Climber:	*Sarcostemma viminale*.
Herbaceous Climbers:	*Coccinia rehmannii*, *Decorsea schlechteri*.
Graminoids:	*Cenchrus ciliaris*(d), *Enneapogon cenchroides*(d), *Panicum maximum*(d), *Urochloa mosambicensis*(d), *Aristida adscensionis*, *A. congesta*, *Eragrostis barbinodis*, *Paspalum distichum*, *Schmidtia pappophoroides*, *Stipagrostis hirtigluma* subsp. *patula*, *Tragus berteronianus*.
Herbs:	*Becium filamentosum*(d), *Phyllanthus maderaspatensis*(d), *Blepharis integrifolia*, *Corchorus asplenifolius*, *Hibiscus praeteritus*, *Ipomoea magnusiana*.
Geophytic Herbs:	*Drimia altissima*, *Sansevieria pearsonii*.

Biogeographically Important Taxa[10] include:

Small Tree:	*Lydenburgia cassinoides*[SK].
Tall Shrub:	*Nuxia gracilis*[D].
Low Shrubs:	*Amphiglossa triflora*[D], *Asparagus fourei*[N], *Hibiscus barnardii*[SK], *Orthosiphon fruticosus*[CB], *Petalidium oblongifolium*[CB], *Rhus batophylla*[SK].
Woody Climber:	*Asparagus sekukuniensis*[SK].
Herb:	*Aneilema longirrhizum*[SK].
Geophytic Herb:	*Chlorophytum cyperaceum*[SK].
Succulent Herb:	*Piaranthus atrosanguineus*[CB].

[10] ([N]Northern Sourveld endemic, [CB]Central Bushveld endemic, [SK]Sekhukhune endemic, [D]Broadly disjunct distribution)

26 BOTANICAL SPECIES RICHNESS

26.1 REGIONAL SPECIES RICHNESS

NEWPOSA (2021) provides for the known presence of approximately 573 plant species within the immediate region of the study area. Data records were selected within the immediate region from an area between S24.6°, E30.1° and S24.8°, E30.3° (refer **Figure 14**) (approximately 0.2 x 0.2 degrees, 450 km²)[11].

The known floristic richness of the region reflects the high regional floristic richness context of the Savanna Biome, as well as the regional ecological type (Sekhukhune Plains Bushveld). It is therefore reasonable to expect that untransformed and natural (indigenous) vegetation within the immediate region is likely to exhibit similarly high floristic richness and diversity patterns. However, because of extensive and large-scale deterioration of the savanna types in the local region, much of the area does not reflect the natural status of the savanna type, but rather a somewhat depauperate and depleted species composition that strongly reflects the deteriorated and altered vegetatal structures. In particular, the removal of the woody layer (through wood harvesting, noted to the north of the Steelpoort River) and intensive land-use practices, which includes persistent and high grazing patterns and inappropriate fire regimes as well as erosion on a landscape level, results in the deteriorated and altered nature of the local vegetation, and therefore locally depleted floristic species richness and diversity patterns.

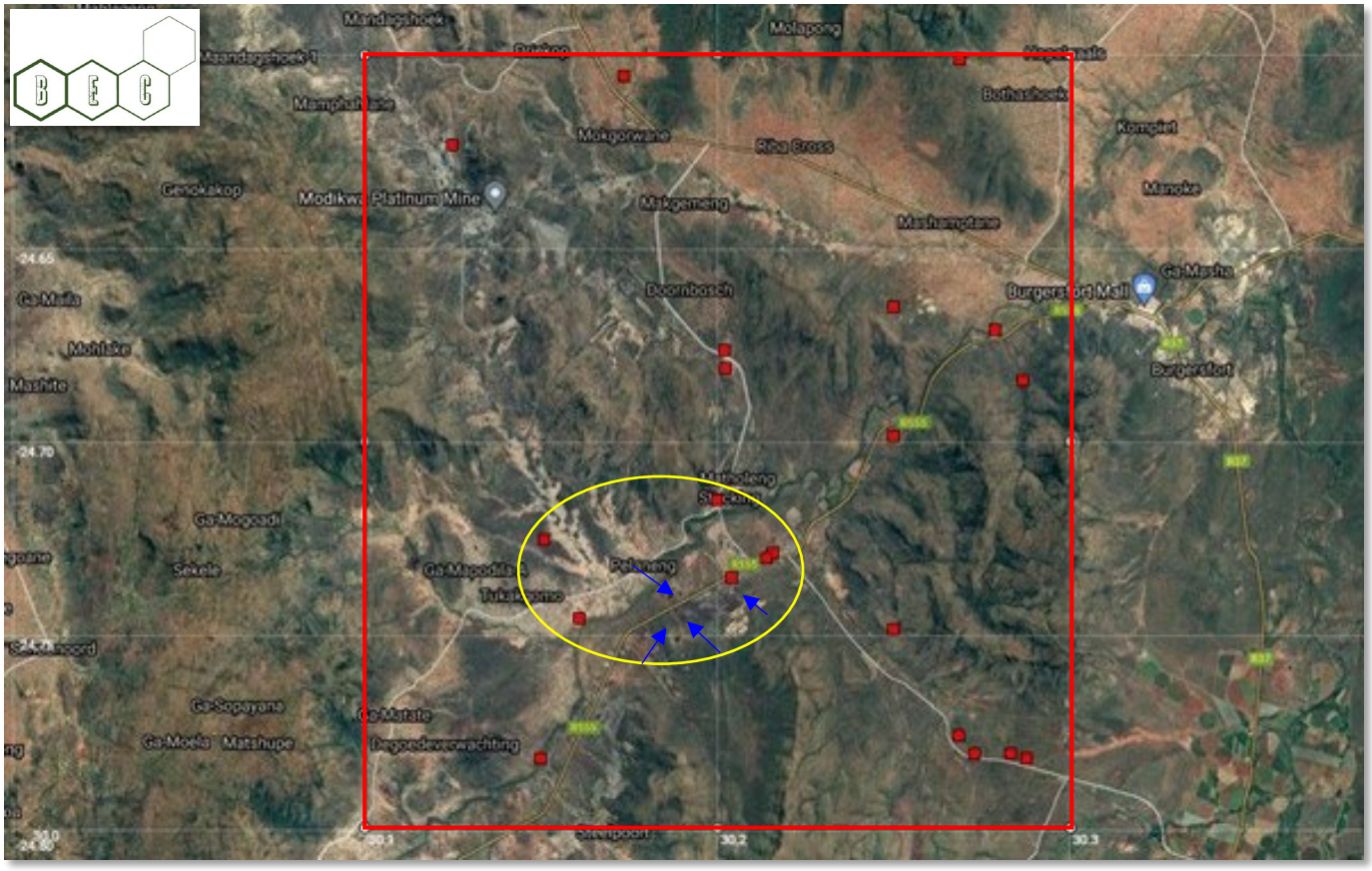


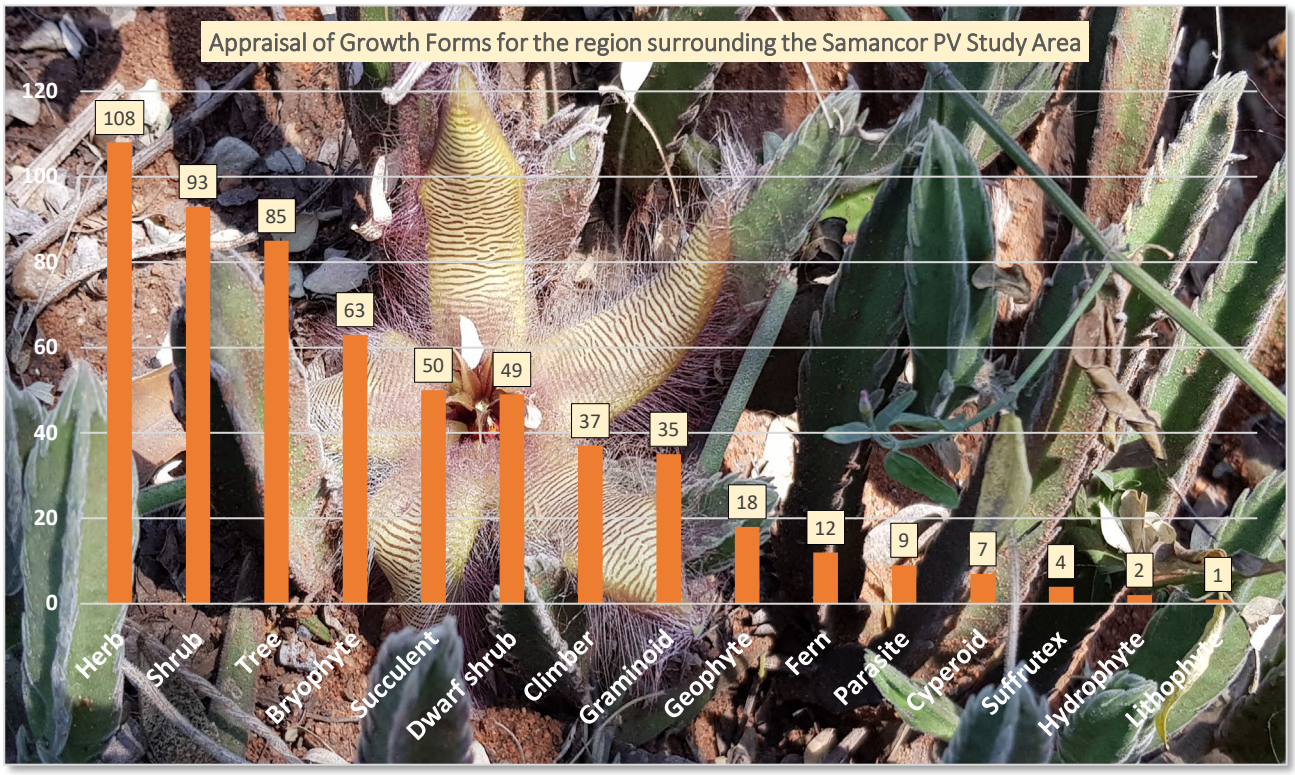
Figure 14: Floristic data records for the local region (red rectangle)

Note red rectangle for selection area, blue arrows for approximate location of study sites, yellow circle for the location of local collection localities. Red dots indicate sampling record localities within the selected area.

[11] *The selection of a suitable area took note of collection records to obtain a minimum of 500 plant species collection records, but also with reference to comparable habitat types and status. The study sites are therefore not necessarily centred in the selection area.*

An appraisal of the growth forms of the region (refer **Graph 4**) indicates that herb species (108 species, 18.8 %) numerically dominate the vegetation as a growth form. However, shrubs (93 species, 16.2 %) and trees (85 species, 14.8 %), in addition to comprising a high percentage of the species composition, is also physiognomically dominant, dictating the woodland and savanna physiognomy of the region. It would appear that a detailed and comprehensive survey pertaining to bryophyte species has been conducted in the region as this life form comprises an impressive 63 species (11.0 %) of the species composition of the region. Life forms of secondary importance include succulents and dwarf shrubs. Surprisingly, grasses comprise a comparatively low abundance of species, i.e. only 35 species (6.1 %).

A total of 118 plant families have been recorded in the wider study region, numerically dominated by Fabaceae (50 species, 8.7 %), while Asteraceae (42 species, 7.3 %), Poaceae (35 species, 6.1 %) and Lamiaceae (25 species, 4.4 %) are prominently represented.



Graph 4: Growth form patterns for the region surrounding the study sites

26.2 LOCAL SPECIES RICHNESS – SURVEY RESULTS (2021, 2023)

Surveys conducted during 2021 and 2023 indicates a floristic species richness of 196 plant species (refer **Appendix 1**), which corresponds (numerically) to approximately 34.2 % of the sampling records from the wider study area (refer **Section 26.1**), reflecting a high floristic diversity, notwithstanding the comparative small size of the survey areas and the instantaneous nature of the surveys. A total of 96 species that have been recorded during the relevant site surveys have not previously been recorded from the wider study area, indicating under sampling or identification discrepancies; further verification/ sampling during seasonally appropriate (reproductive) times and more intensive assessments that take cognisance of habitat diversity, will likely result in higher accuracies from both the existing SANBI information source and results of local studies. The moderate correlation to the regional species richness is also explained by the comparatively natural status of the remaining natural vegetation, despite localised deterioration patterns. A collage of images of selected plant species is presented in **Appendix 2.**

A review of growth forms recorded from the site assessments provides insight into the physiognomy, species richness and diversity patterns on a local scale (refer **Graph 5**). Despite the savannoid nature of the study areas, the herbaceous and graminoid life forms dominate the species richness with 36 species (18.4 %) and 34 (17.3 %), respectively. Trees (22 species, 11.2 %), shrubs (20 species, 10.2 %) and small trees (17 species, 8.7 %) comprise lower species richness, but typically dominates the physiognomy of the receiving area. The succulent diversity of the areas is noted with a total of 22 species (11.4 %), while life forms of lower abundance include dwarf shrubs, climbers, prostrate herbs and geophytes.

A total of 54 plant families were recorded during the various surveys, dominated by the Poaceae family (grasses, 35 species, 18.1 %), Fabaceae (24 species, 12.4 %), Asteraceae (15 species, 7.8 %) and Malvaceae (13 species, 6.7 %). Families with lower representation include Euphorbiaceae, Apocynaceae, Asphodelaceae, Lamiaceae, Cactaceae, Capparaceae, Acanthaceae and Combretaceae. A total of 37 plant families are represented by either 1 or 2 species.

Graph 5: Plant life forms recorded from the study areas during 2021

26.3 PLANT SPECIES OF CONSERVATION CONCERN

26.3.1 BACKGROUND

The following information sources were consulted as background information for a brief evaluation of plant species of conservation concern:

1 SANBI Distribution data (NEWPOSA), (IUCN Criteria);

2 National Forest Act of 1998 (protected tree species) (refer **Appendix 3**); and

3 Limpopo Environmental Management Act (Act No 7 of 2003, including Schedule 11 (Specially protected plants) and Schedule 12 (Protected plants) (Refer **Appendix 4**).

South Africa's Red List system is based on the IUCN Red List Categories and Criteria Version 3.1 (finalized in 2001) (http://www.iucnredlist.org), amended to include additional categories to indicate species that are of local conservation concern. The IUCN Red List system is designed to detect risk of extinction. Species that are at risk of extinction, also

known as threatened or endangered species are those that are classified in the categories Critically Endangered (CR), Endangered (EN) and Vulnerable (VU). The South African Red List contains three additional categories (Critically Rare, Rare and Declining) to highlight plant species that are not in danger of extinction, but are of local conservation concern because they are rare, or there are threatening processes affecting their populations (refer **Figure 15**).

These categories have been developed to highlight those taxa classified as Least Concern according to the IUCN system, should be considered in conservation prioritization processes. It is important to emphasize that the South African categories Critically Rare, Rare and Declining are intended for use in local conservation prioritization processes only. In submission to the IUCN Red List of Threatened Species, these taxa have to be categorized according to the IUCN system and therefore their global status will be Least Concern.

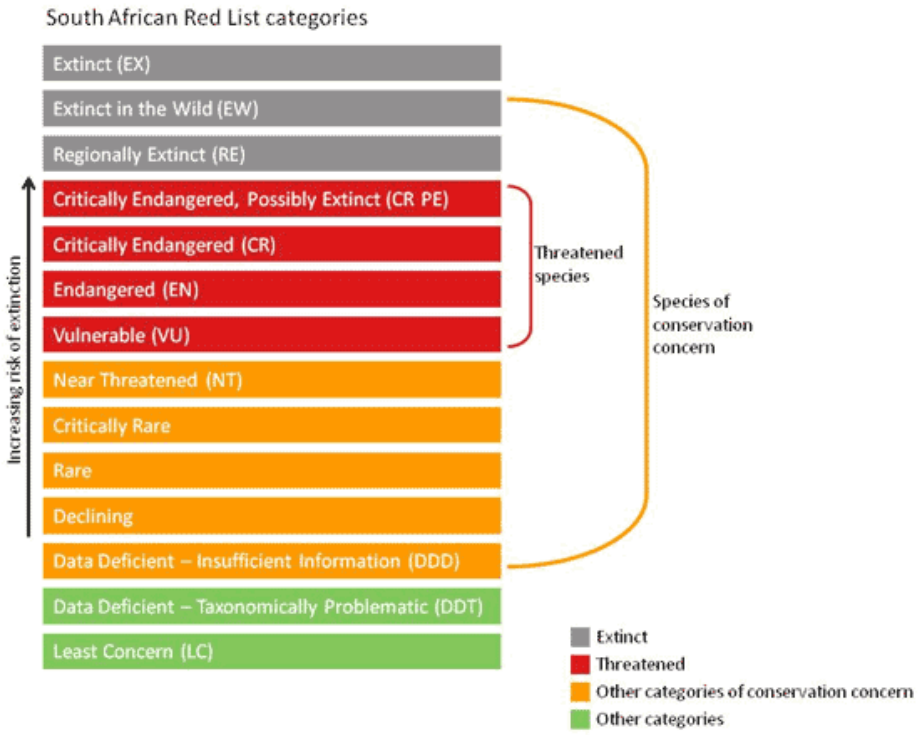


Figure 15: South African Red List Categories (courtesy of SANBI)

Guidelines for the assessment of Red List species include (although not necessarily limited to):

⇒ A botanical specialist with local botanical and ecological knowledge and experience should undertake the survey;

⇒ A suitable survey should be undertaken; in the summer-rainfall areas of the country, botanical surveys should take place October to April while in the winter-rainfall areas they should take place between August and October;

⇒ Prior to visiting the site, the specialist consultant should download a list of species that could potentially occur at the site from POSA;

⇒ It is important that specimens are collected as part of the botanical survey, especially for taxonomic groups likely to be of conservation concern;

⇒ Plants should be identified to species level wherever possible, not genus level;

⇒ Once specimens are collected, they should be identified at an herbarium. Potential species of conservation concern sampled should be identified by a taxonomist specializing in the plant group in question; and

⇒ Specialist botanists should also include in their reports a list of species of conservation concern that may occur at a site but may be dormant as a result of unfavourable environmental conditions, for example species that were not seen because the vegetation at a site has not been burnt for many years.

⇒ Species that may be dormant should also be reported;

26.3.2 PLANT SPECIES OF CONSERVATION CONCERN – REGIONAL RECORDS (NEWPOSA, 2021)

Table 7 provides a list of SCC plants that have been recorded from the immediate region surrounding the study site (refer Figure 14 for an indication of the geographical extent of sampling records). While the dataset indicates a comparative high diversity of SCC known from the region, systemic and long-term anthropogenic impacts on the vegetation of the areas, and accelerated deterioration that resulted from severe and persistent grazing and utilisation pressure, as well as the absence of local and regional conservation efforts, generally implies that a lower diversity is likely.

Table 7: Plant species of conservation concern recorded in the region (NEWPOSA, 2021)

Taxon	*Family*	*Status*
Acalypha caperonioides Baill. var. *caperonioides*	Euphorbiaceae	DD (IUCN)
Adenia fruticosa* Burtt Davy subsp. *fruticosa	**Passifloraceae**	**NT (IUCN), LEMA (Schedule 12)**
Aloe castanea Schonland	Asphodelaceae	LC (IUCN), LEMA (Schedule 12)
Aloe longibracteata Pole-Evans	Asphodelaceae	LEMA (Schedule 12)
Aloe pienaarii Pole-Evans	Asphodelaceae	LEMA (Schedule 12)
Aloe pretoriensis Pole-Evans	Asphodelaceae	LC (IUCN), LEMA (Schedule 12)
Aloe verecunda Pole-Evans	Asphodelaceae	LC (IUCN), LEMA (Schedule 12)
Asparagus intricatus (Oberm.) Fellingham & N.L.Mey.	Asparagaceae	DD (IUCN)
Balanites maughamii* Sprague subsp. *maughamii	**Zygophyllaceae**	**Protected tree (NFA, 2014)**
Bonatea antennifera Rolfe	Orchidaceae	LC (IUCN), LEMA (Schedule 12)
***Boscia albitrunca* (Burch.) Gilg & Gilg-Ben.**	**Brassicaceae**	**Protected tree (NFA, 2014)**
Catha edulis (Vahl) Forssk. ex Endl.	Celastraceae	LC (IUCN), Protected tree (NFA, 2014)
Ceropegia ampliata E.Mey. var. *ampliata*	Apocynaceae	LC, LEMA (Schedule 12)
Chlorophytum cyperaceum (Kies) Nordal	Agavaceae	LC, Regional importance (Central Bushveld endemic, Vegmap)
Delosperma rileyi L.Bolus	Aizoaceae	DD (IUCN)
Dicliptera fruticosa K.Balkwill	Acanthaceae	NT (IUCN)
Elephantorrhiza praetermissa J.H.Ross	Fabaceae	LC (IUCN), LEMA (Schedule 12)
Eulophia petersii (Rchb.f.) Rchb.f.	Orchidaceae	LC (IUCN), LEMA (Schedule 12)
***Eulophia speciosa* (R.Br. ex Lindl.) Bolus**	**Orchidaceae**	**LC (IUCN), LEMA (Schedule 12)**
Eulophia streptopetala Lindl.	Orchidaceae	LC (IUCN), LEMA (Schedule 12)
Euphorbia barnardii A.C.White, R.A.Dyer & B.Sloane	Euphorbiaceae	EN (IUCN), LEMA (Schedule 12)
Huernia kirkii N.E.Br.	Apocynaceae	LC (IUCN), LEMA (Schedule 12)
Huernia zebrina N.E.Br. subsp. *insigniflora* (C.A.Maass) Bruyns	Apocynaceae	LC (IUCN), LEMA (Schedule 12)
Myrothamnus flabellifolius Welw.	Myrothamnaceae	DD (IUCN)
Nuxia gracilis Engl.	Stilbaceae	LC (IUCN), Regional importance (Disjunct distribution, Vegmap)
Orbea melanantha (Schltr.) Bruyns	Apocynaceae	LC (IUCN), LEMA (Schedule 12)
Orthosiphon fruticosus Codd	Lamiaceae	LC, (IUCN), Regional importance (Central Bushveld Endemic, Vegmap)
Papillaria africana (Mull.Hal.) A.Jaeger	Meteoriaceae	LEMA (Schedule 12)
Petalidium oblongifolium C.B.Clarke	Acanthaceae	LC, (IUCN), Regional importance (Central Bushveld Endemic, Vegmap)
Polygala sekhukhuniensis Retief, S.J.Siebert & A.E.van Wyk	Polygalaceae	VU (IUCN)
Riocreuxia sp.	Apocynaceae	LEMA (Schedule 12)
Satyrium cristatum Sond. var. *cristatum*	Orchidaceae	LC (IUCN), LEMA (Schedule 12)
***Sclerocarya birrea* (A.Rich.) Hochst. subsp. *caffra* (Sond.) Kokwaro**	**Anacardiaceae**	**LC (IUCN), Protected tree (NFA, 2014)**
Searsia batophylla (Codd) Moffett	Anacardiaceae	VU (IUCN), LEMA (Schedule 12), Regional importance (Sekhukhune endemic, Vegmap)
***Spirostachys africana* Sond.**	**Euphorbiaceae**	**LC (IUCN), LEMA (Schedule 12)**
Stapelia gettliffei R.Pott	Apocynaceae	LC (IUCN), LEMA (Schedule 12)

Results of the site inspections indicated the presence of several of these species within the proposed development footprints and impacts on these species are likely to be significant, although of localised extent.

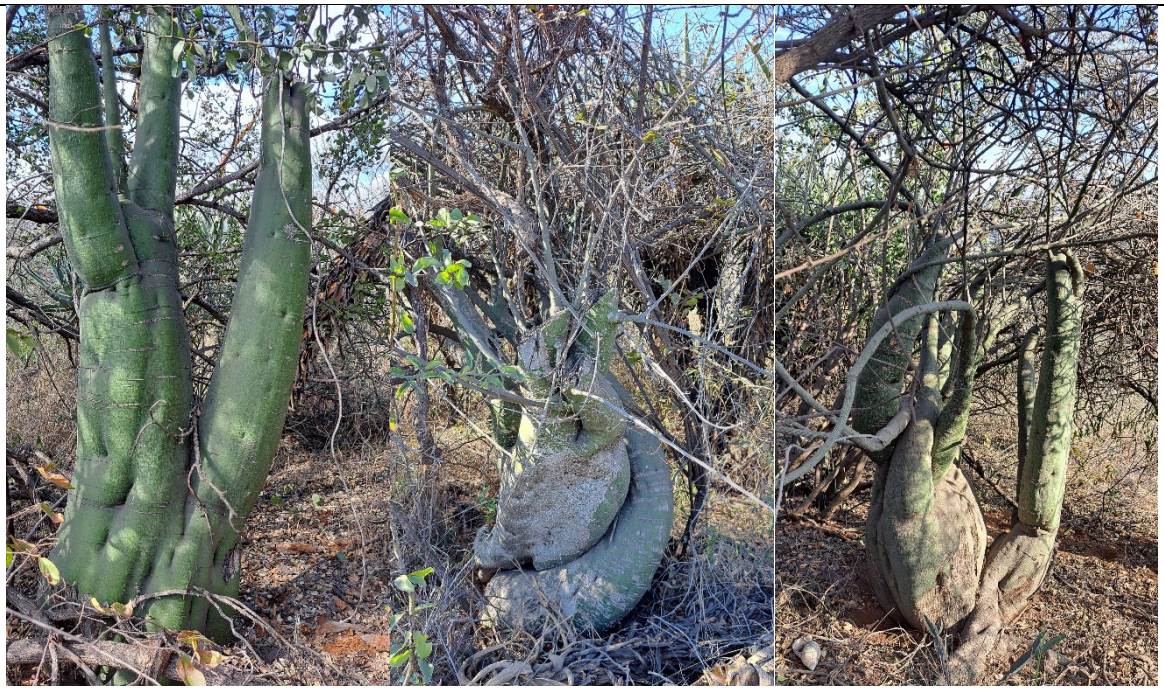
26.3.3 Plant Species of Conservation Concern – Survey Results (2021)

Table 8 provides a list of protected and conservation important plant species that were recorded from the proposed development footprints. It is emphasised that valid permits need to be obtained from LEDET and DFFE prior to the removal, damage, relocation, or any other activity that might affect these species. Considering the threat level and abundance of conservation important plant species within the proposed development footprints, the previous Offset Assessment (BEC, 2022) might require amendment to allow for exacerbated impacts on plant species of conservation concern as well as the loss of sensitive habitat.

Table 8: Plant species of conservation concern recorded in the respective development footprints

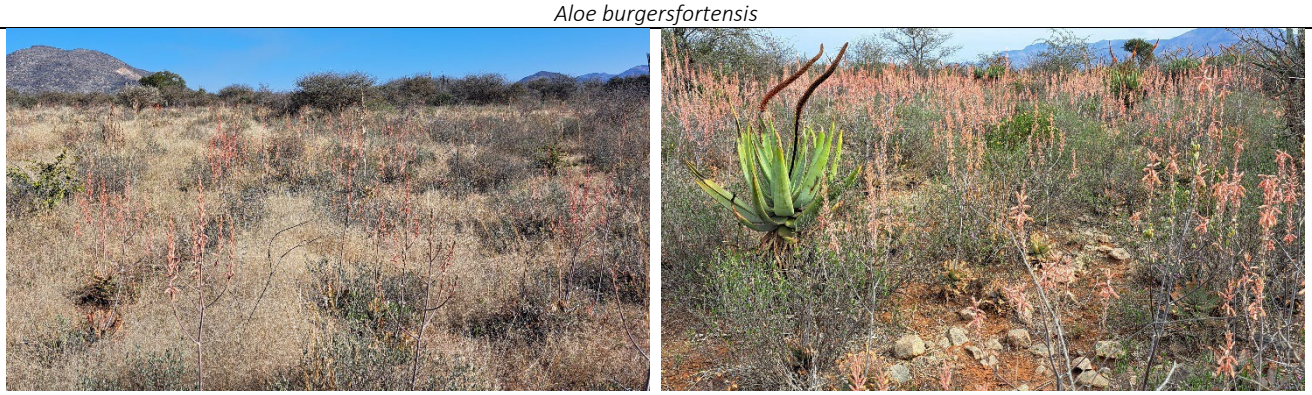
Species Name	*Family*	*Conservation/ Invasive Status*	*Abundance/ Note*
Adenia fruticosa Burtt Davy subsp. *fruticosa*	Passifloraceae	Near Threatened (IUCN). Protected Plant Schedule 12 (Limpopo Environmental Management Act 7 of 2003)	Low to moderate abundance, widely distributed outside the development footprints
Aloe burgersfortensis Reynolds	Asphodelaceae	Least Concern (IUCN). Sekhukhune endemic.	Abundant, widely distributed, also outside the development footprints
Aloe wickensii Pole-Evans	Asphodelaceae	Near Threatened (IUCN)	Abundant, widely distributed, also outside the development footprints
Balanites maughamii Sprague	Balanitaceae	Least Concern (IUCN). Protected Tree (National Forest Act, 1998)	Abundant, widely distributed, also outside the development footprints
Boscia albitrunca (Burch.) Gilg & Gilg-Ben.	Capparaceae	Least Concern (IUCN). Protected Tree (National Forest Act, 1998)	Low abundance, although widely distributed
Dicliptera fruticosa K.Balkwill	Acanthaceae	Neat Threatened (IUCN)	Abundant, widely distributed
Elaeodendron transvaalense (Burtt Davy) R.H.Archer	Celastraceae	Near Threatened (IUCN). Protected Tree (National Forest Act, 1998)	Low abundance, isolated individuals
*Eulophia petersii (*Rchb.f.) Rchb.f.	Orchidaceae	Least Concern (IUCN). Protected Plant Schedule 12 (Limpopo Environmental Management Act 7 of 2003)	Moderately abundant, localised distribution
Sclerocarya birrea (A.Rich.) Hochst. subsp. *caffra* (Sond.) Kokwaro	Anacardiaceae	Least Concern (IUCN), Protected Tree (National Forest Act, 1998)	Low abundance, although widely distributes outside the development footprints
Spirostachys africana Sond.	Euphorbiaceae	Least Concern (IUCN). Protected Plant Schedule 12 (Limpopo Environmental Management Act 7 of 2003)	Low abundance, not recorded within development areas, but only from riparian habitat in nearby localities
Stapelia gigantea N.E.Br.	Apocynaceae	Least Concern (IUCN). Protected Plant Schedule 12 (Limpopo Environmental Management Act 7 of 2003)	Moderately abundant, localised distribution

Survey conditions during this and previous surveys were considered to be optimal, and the site inspections were conducted during seasonal periods that coincided with the flowering period of most plant taxa that could reasonably be expected to occur in the region. It is emphasised that valid permits need to be obtained from DFFE and LEDET prior to the removal, damage, relocation, or any other activity that might affect these species.

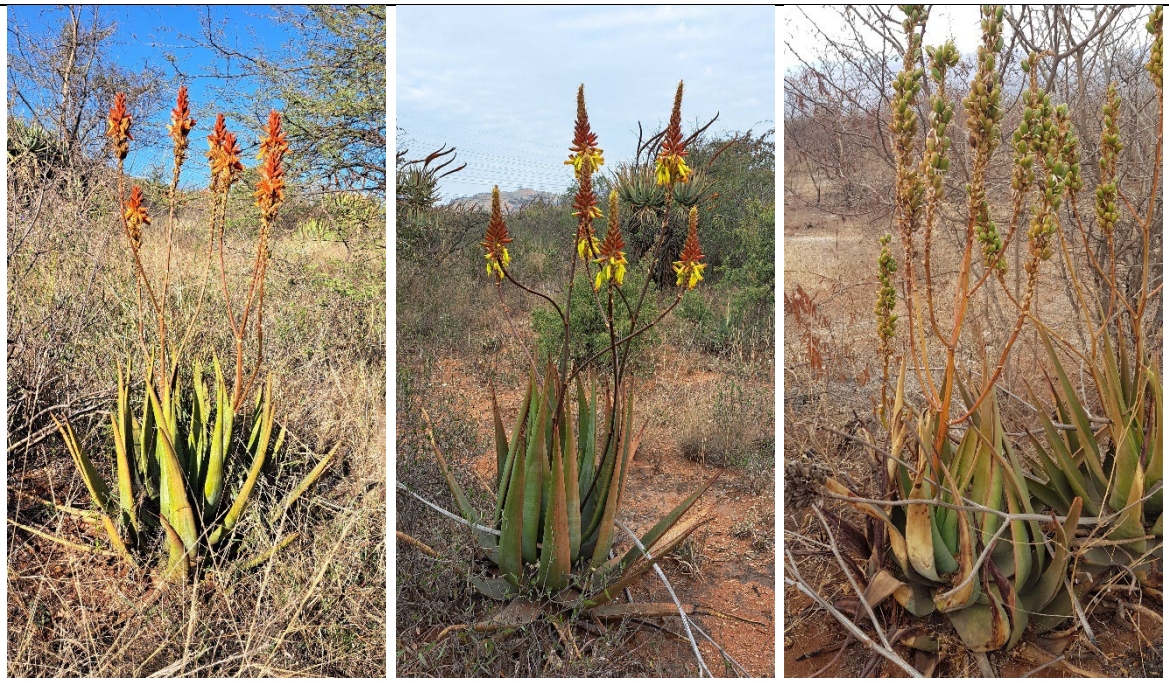


Adenia fruticosa

Aloe burgersfortensis



Aloe burgersfortensis



Aloe wickensii

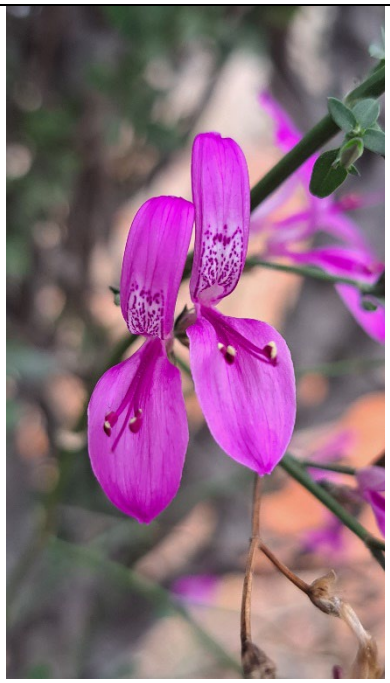
Balanites maughamii





Boscia albitrunca





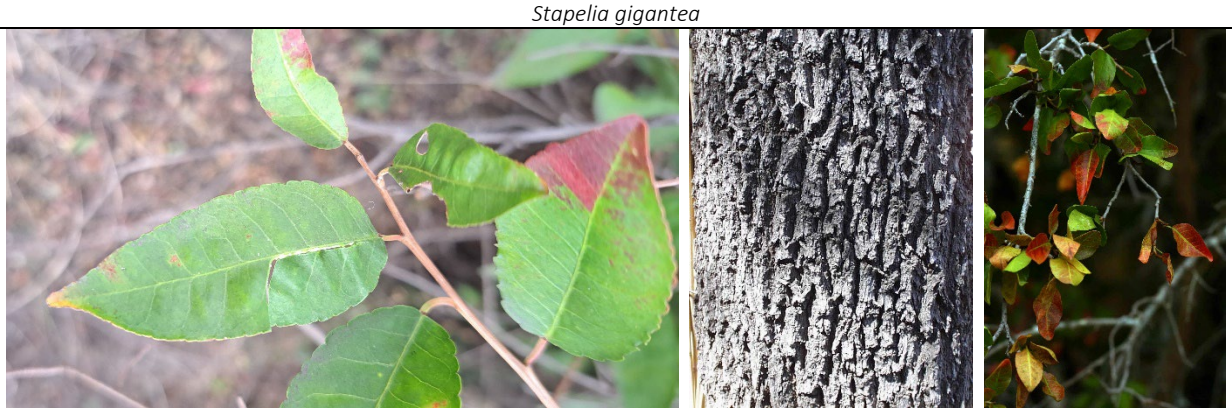
Dicliptera fructicosa

Elaeodendron transvaalense

Eulophia petersii

Sclerocarya birrea

Stapelia gigantea



Spirostachys africana

Figure 16: Images highlighting plant taxa of conservation concern that were recorded from the sites and wider surrounds

26.3.4 ANNOTATIONS ON SCC HIGHLIGHTED IN THE NATIONAL ENVIRONMENTAL SCREENING REPORT

The following plant species of conservation concern are highlighted as being likely to occur in the region. A brief evaluation of the likelihood of occurrence is presented for each of the species, based on a review of habitat status and requirements for the species.

Table 9: Conservation important species highlighted by the National Environmental Screening Report

Species Name	*Family*	*Status*	*Environmental Sensitivity*	*Note*
Sensitive species[12] 1252	Dioscoreaceae	Vulnerable[13]	Medium Sensitivity	Habitat within footprints vary between unsuitable to moderately suitable. A moderate to low likelihood of this species occurring is estimated for the project area. No individuals recorded during various surveys.
Sensitive species 1033	Euphorbiaceae	Endangered[14]	Medium Sensitivity	Suitable habitat include closed woodland on rocky summits and slopes and succulent dominated vegetation with low grass and tree cover. Habitat within development footprints are not suitable and a low to moderate-low potential of occurrence is estimated. No individuals were recorded during various surveys.
Sensitive species 587	Euphorbiaceae	Rare[15]	Medium Sensitivity	Usually restricted to specialised habitat with steep slopes, large boulders and rocky outcrops. Habitat within development footprints does not confirm to habitat requirements and a low probability of occurrence is estimated for the development area.
Asparagus fourei (VU)	Asparagaceae	Vulnerable	Medium Sensitivity	Range-restricted Sekhukhuneland endemic species that is restricted to dolerite outcrops. Habitat within development footprints does not conform to requirements for this species and a low probability of occurrence is estimated for this species. No individuals were recorded during various surveys.
Polygala sekhukhuniensis (VU)	Fabaceae	Vulnerable	Medium Sensitivity	Range-restricted and edaphic specialist species that prefers sparsely vegetated and heavy-metal rich soils on lower slopes and valley bottoms, also on erodible, clayey soils. Habitat within development footprints does not conform to requirements for this species and a low probability of occurrence is estimated for this species. No individuals were recorded during various surveys.
Searsia batophylla (VU)	Anacardiaceae	Vulnerable	Medium Sensitivity	Most often in dry savanna in low-lying areas and along watercourses and shallow soils. Habitat within development footprints is considered poorly to moderately suitable for this species. A population situated approximately 5 km from the development footprints have been noted. No individuals were recorded during various surveys.
Searsia sekhukhuniensis (Rare)	Anacardiaceae	Rare	Medium Sensitivity	Habitat specialist in arid savanna areas in Sekhukhuneland region (SA endemic species). Occurring on rocky hillsides, on pyroxenitic substrates. Habitat within development footprints does not conform to requirements for this species and a low probability of occurrence is estimated for this species. No individuals were recorded during various surveys.
Combretum petrophilum (Rare)	Combretaceae	Rare	Medium Sensitivity	Habitat specialist in arid savanna areas in Sekhukhuneland region (SA endemic species). Occurring on rocky outcrops and shrubby savanna in mountain bushveld. Habitat within development footprints are considered moderately to poorly suited for this species and a moderate-low to low probability of occurrence is estimated for this species. No individuals were recorded during various surveys.

[12] Please note that the National Environmental Screening report includes lists of animal and plant species of conservation concern that are known or expected to occur on the proposed development footprint. Some of these SCC are sensitive to illegal harvesting. As per the best practise guideline that accompanies the protocol and screening tool, **names of the sensitive species may therefore not appear in the final EIA report, or any specialist reports released into the public domain**. It should be referred to as '*sensitive species'*.

[13] A species is Vulnerable when the best available evidence indicates that it meets at least one of the five IUCN criteria for Vulnerable, indicating that the species is facing a high risk of extinction

[14] A species is Endangered when the best available evidence indicates that it meets at least one of the five IUCN criteria for Endangered, indicating that the species is facing a very high risk of extinction

[15] A species is Rare when it meets at least one of four South African criteria for rarity, but is not exposed to any direct or plausible potential threat and does not qualify for a category of threat according to one of the five IUCN criteria

26.4 DECLARED INVASIVE SPECIES & COMMON WEEDS

Table 10 denotes a list of common weeds species as well as declared alien and invasive species that were recorded on the study site during the site investigation.

Table 10: List of common weeds and declared alien and invasive plant species within the study area

Species Name	*Family*	*Status*	*Abundance/ Threat*
Achyranthes aspera L. var. *aspera*	Amaranthaceae	Naturalised exotic, weed. Not Evaluated	Moderately abundant, low threat
Agave sisalana Perrine	Agavaceae	Declared Invader - NEMBA (Category 2). CARA (Category 2).	Abundant, high threat
Argemone ochroleuca Sweet subsp. *ochroleuca*	Papaveraceae	Declared Invader - NEMBA (Category 1B). CARA (Category 1). GBIF Listed.	Moderately abundant, low threat
Bidens pilosa L.	Asteraceae	Naturalised exotic, weed. Not evaluated	Moderately abundant, low threat
Catharanthus roseus (L.) G.Don	Apocynaceae	Declared Invader - NEMBA (Category 1B)	Low abundance, low threat
Cereus jamacuru (L.) Mill.	Cactaceae	Declared Invader - CARA (Category 1). NEMBA (Category 1B). GBIF listed	Moderately abundant, high threat
Datura stramonium L.	Solanaceae	Declared Invader - CARA (Category 1), NEMBA (Category 1B), GBIF listed.	Moderately abundant, low threat
Flaveria bidentis (L.) Kuntze	Asteraceae	Declared Invader - NEMBA (Category 1B. AIP, 2016). Not GBIF listed. Not listed for CARA.	Moderately abundant, low threat
Melia azedarach L.	Meliaceae	Declared Invader - CARA (Category 3), NEMBA (a. Category 1b b. Category 3 in urban areas). GBIF listed.	Low abundance in riparian woodland, high threat
Morus alba L.	Moraceae	Declared Invader - NEMBA (Category 3). GBIF listed. CARA Category 3.	Moderate abundance in riparian woodland, high threat
Nicotiana glauca Graham	Solanaceae	Declared Invader - CARA 2002 (Category 1), NEMBA – (Category 1B). GBIF listed. CARA Category 1.	Moderate abundance in riparian woodland, high threat
Opuntia ficus-indica (L.) Mill.	Cactaceae	Declared Invader - NEMBA (Category 1B). CARA (Category 1). GBIF listed.	Low abundance in riparian woodland, high threat
Opuntia humifusa (Raf.) Raf.	Cactaceae	Declared Invader - CARA 2002 – Category 1 NEMBA – Category 1B	Low abundance, moderate threat
Opuntia leucotricha DC.	Cactaceae	Declared Invader - CARA 2002 – Category 1 NEMBA – Category 1B	Low abundance, moderate threat
Pennisetum clandestinum Chiov.	Poaceae	Declared Invader - NEMBA (Category 1B in protected areas and wetlands in which it does not already occur).	Low abundance, moderate threat
Populus x *canescens* (Aiton) Sm.	Salicaceae	Declared Invader - NEMBA (Category 2), CARA (Category 2). Originally from America, used for timber. GBIF listed.	Low abundance, moderate threat
Ricinus communis L. var. *communis*	Euphorbiaceae	Declared Invader - NEMBA (Category 2)	Moderate abundance, moderate threat
Salix babylonica L.	Salicaceae	Naturalised exotic, Not evaluated	Low abundance, low threat
Schkuhria pinnata (Lam.) Cabrera	Asteraceae	Naturalised exotic. Not Evaluated	Low abundance, low threat
Senna didymobotrya (Fresen.) H.S.Irwin & Barneby	Fabaceae	Declared Invader - CARA 2002 (Category 1) . NEMBA (a. 1B in Eastern Cape, KwaZulu-Natal, Limpopo, Mpumalanga and Western Cape. b. Not listed elsewhere).	Low abundance, moderate threat
Sesbania bispinosa (Jacq.) W.Wight var. *bispinosa*	Fabaceae	Currently unlisted	Low abundance, low threat
Sesbania punicea (Cav.) Benth.	Fabaceae	Declared Invader - NEMBA (Category 1B). CARA (Category 1). GBIF listed.	Low abundance, moderate threat
Solanum elaeagnifolium Cav.	Solanaceae	Declared Invader - NEMBA (Category 1B)	Low abundance, low threat
Tagetes minuta L.	Asteraceae	Not NEM:BA listed. GBIF listed.	Low abundance, low threat
Tecoma stans (L.) Juss. ex Kunth var. *stans*	Bignoniaceae	Declared Invader - CARA 2002 (Category 1). NEMBA (Category 1B)	Low abundance, moderate threat
Typha capensis (Rohrb.) N.E.Br.	Typhaceae	Naturalised exotic, Not evaluated	Moderate abundance, low threat
Xanthium strumarium L.	Asteraceae	Declared Invader - CARA 2002 (Category 1). Proposed legislation: NEMBA (Category 1B)	Moderate abundance, low threat

26.5 PLANTS WITH TRADITIONAL MEDICINAL USES

Table 11 lists plants with popular traditional and medicinal uses that were recorded on the sites.

Table 11: List of popular traditional and medicinal plant species recorded within the site and immediate surrounds

Species Name	*Common Name*	*Status/ Uses*
Adenia fruticosa Burtt Davy subsp. *fruticosa*	Sekhukhune Green-stem (e), Sekoekoenie-bobbejaangif (a)	Poisonous fruit, edible leaves
Aloe castanea Schönland	Cat's-tail Aloe (e), Katstertaalwyn (a)	Harvested for ornamental purposes
Aloe marlothii A.Berger subsp. marlothii	Mountain Aloe (e), Bergaalwyn (a)	Ornamental, heavily harvested
Argemone ochroleuca Sweet subsp. *ochroleuca*	White-flowered Mexican poppy (e), Bloudissel (a), Hlaba-hlabane-e-putsoa (s)	Possible toxicity to animals and humans, medicinal uses, irritant
Balanites maughamii Sprague	Greenthorn (e), Groendoring (a)	Potentially poisonous parts for fish, fruits are edible, traditional and medicinal uses
Bolusanthus speciosus (Bolus) Harms	Elephant Wood (e), Tree Wisteria (e), Vanwykshout (a)	Roots used medicinally, traditional and practical uses
Boscia albitrunca (Burch.) Gilg & Gilg-Ben.	Sheperd's Tree (e), Witgat (a), Matoppie (a), Mohlopi (ns)	Important fodder, traditional uses, traditional medicinal uses
Boscia foetida Schinz subsp. *rehmanniana* (Pestal.) Toelken	Bushveld Shepherd Tree (e), Stinkwitgat (a), Mopipi (ns)	Medicinal uses, browsing value
Carissa bispinosa (L.) Desf. ex Brenan	Forest num-num (e), Bosnoemnoem (a)	Edible parts, medicinal uses
Catharanthus roseus (L.) G.Don	Madagascar periwinkle (e), Begraafplaasblom (a)	Traditional medicinal uses, originally from Madagascar, ornamental
Cissus cactiformis Gilg	Cactus vine (e)	Traditional medicinal uses
Combretum apiculatum Sond. subsp. *apiculatum*	Red bushwillow (e), Rooibos (a), Mogoeleri (ss)	Traditional medicinal uses, seeds possibly poisonous but consumed by Brown-headed Parrots, leaves eaten by game, firewood
Combretum erythrophyllum (Burch.) Sond.	River bushwillow (e), Vaderlandswilg (a)	Medicinal uses, ornamental in urban areas
Commelina africana	Yellow Wandering Jew (e), Geeleendagsblom (a)	Medicinal properties
Croton gratissimus Burch. var. *gratissimus*	Lavender fever-berry (e), Laventelkoorsbessie (a)	Medicinal uses, larval food for *Charaxes candiope candiope*
Cynanchum viminale (L.) Bassi subsp. *viminale*	Viny milkweed (e), Melktou (a)	Medicinal uses, potentially poisonous
Dalechampia galpinii Pax	Lowveld Wildhop (e)	Traditional medicinal uses
Datura stramonium L.	Common thorn apple (e), Malpitte (a), Letjoi (s)	Originally from Mexico, North America. Seed poisonous to animals and humans, medicinal uses
Dichrostachys cinerea (L.) Wight & Arn. subsp. *africana* Brenan & Brummitt	Small-leaved Sickle Bush (e), Kleinblaar-sekelbos (a), Ugagake (z)	Encroacher species, traditional medicinal uses, firewood, pods browsed extensively by game and stock
Dicoma anomala Sond.	Maagbitterwortel (a)	Medicinal uses
Dicoma capensis	Koorsbossie (a)	Medicinal uses
Dombeya rotundifolia (Hochst.) Planch. var. *rotundifolia*	Wild Pear (e), Drolpeer (a)	Wood is used for traditional purposes, bark, roots and root is used medicinally
Ehretia rigida (Thunb.) Druce subsp. *nervifolia* Retief & A.E.van Wyk	Puzzle Bush (e), Deurmekaarbos (a)	Roots are used medicinally
Euclea natalensis A.DC. subsp. *angustifolia* F.White	Bushveld hairy guarri (e), Bosveld harige guarrie (a)	Traditional and medicinal uses, edible parts
Euclea undulata Thunb.	Common Guarri (e), Gewone ghwarrie (a)	Firewood, edible fruit, traditional medicinal uses
Euphorbia ingens E.Mey. ex Boiss.	Giant euphorbia (e), Naboom (a)	Latex is toxic and caustic, used medicinally and as a fish poison
Gardenia volkensii K.Schum. subsp. *volkensii* var. *volkensii*	Bushveld gardenia (e), Bosveldkatjiepiering (a)	Fruit and root are used medicinally, traditional uses
Geigeria burkei Harv. subsp. *fruticulosa* Merxm.	Vermeerbos (a)	Potentially poisonous
Grewia bicolor Juss. var. *bicolor*	White-leaved Raisin (e), Witrosyntjie (a)	Medicinal uses, edible parts, highly variable
Gymnosporia buxifolia (L.) Szyszyl.	Common spike-thorn (e), Gewone pendoring (a)	Traditional uses, toxic parts, medicinal uses
Kalanchoe rotundifolia (Haw.) Haw.	Nentakalanchoe (e), Nentabos (a)	Medicinal uses, potentially poisonous
Kleinia stapeliiformis (E.Phillips) Stapf	--	Harvested for ornamental purposes

Table 11: List of popular traditional and medicinal plant species recorded within the site and immediate surrounds		
Species Name	*Common Name*	*Status/ Uses*
Leonotis ocymifolia (Burm.f.) Iwarsson	Minaret Flower (e), Wildedagga (a)	Medicinal uses, colours & dyes
Melia azedarach L.	Seringa (e), Persian lilac (e), Gewone sering (a)	Originally from Asia, Australia. Poisonous seeds, ornamental
Momordica balsamina L.	Balsam Pear (e), Laloentjie (a), Balsam Peer (a)	Rigorous climber, edible parts, traditional medicinal uses
Opuntia ficus-indica (L.) Mill.	Sweet Prickley pear (e), Turksvy (a), Torofeiee (s)	Originally from Mexico. Edible parts, medicinal uses. Cladodes poisonous when fed to cattle in large quantities, irritants
Peltophorum africanum Sond.	Weeping wattle (e), Huilboom (a)	Medicinal properties
Pergularia daemia (Forssk.) Chiov. subsp. *daemia*	Bobbejaankambro (a), Kgaba	Medicinal uses
Polydora poskeana (Vatke & Hildebr.) H.Rob.sens.lat.	Vernonia (a)	Medicinal uses
Pouzolzia mixta Solms	Soap-nettle (e), Seepnetel (a)	Traditional and traditional medicinal uses
Ricinus communis L. var. *communis*	Castor-oil plant (e), Kasterolie (a)	Poisonous parts
Schkuhria pinnata (Lam.) Cabrera	Dwarf Marigold (e), Bitterbossie (a)	Medicinal uses, weed (S. America)
Searsia pyroides Burch. var. *pyroides*	Common wild currant (e), Gewone taaibos (a)	Edible parts, medicinal uses
Selaginella dregei (C.Presl) Hieron.	Resurrection Plant (e)	Medicinal uses
Senegalia mellifera (Vahl) Seigler & Ebinger subsp. *detinens* (Burch.) Kyal. & Boatwr.	Black Thorn (e), Swarthaak (a)	Declared indicator of encroachment, medicinal uses, poison source
Senna italica Mill. subsp. *arachoides* (Burch.) Lock	Wild senna (e), Elandsertjie (a)	Medicinal uses
Sesamum triphyllum Welw. ex Asch. var. *triphyllum*	Wild sesame (e), Brandboontjie (a)	Edible parts, essential oils
Smilax anceps Willd.	Thorny Rope (e), Doringtou (a)	Medicinal uses, irritant
Stapelia gigantea N.E.Br.	Giant Carrion Flower (e), Reeuseaasblom (a)	Traditional medicinal uses
Stylochaeton natalensis Schott	Bushveld Arum (e), Bosveld Varkoor (a)	Root and leaves used for traditional medicinal purposes
Tribulus terrestris L.	Common Dubbeltjie (e), Gewone Dubbeltjie (a)	Medicinal uses
Typha capensis (Rohrb.) N.E.Br.	Bulrush (e), Papkuil (a)	Cosmopolitan weed, edible parts, medicinal uses
Vachellia nilotica (L.) P.J.H.Hurter & Mabb. subsp. *kraussiana* (Benth.) Kyal. & Boatwr.	Scented-pod Thorn (e), Lekkerruikpeul (a)	Dyes and tans, traditional and medicinal uses
Vachellia tortilis (Forssk.) Gallaso & Banfi subsp. *heteracantha* (Burch.) Kyal. & Boatwr.	Curly-pod Acacia (e), Haak-en-steek (a), Isishoba (z)	Medicinal uses (bark). Often regarded as an encroacher species
Volkameria glabra (E.Mey.) Mabb. & Y.W.Yuan	Smooth Tinderwood (e), Bitterblaar (a)	Traditional and medicinal uses. Flowers attract birds and butterflies
Ziziphus mucronata Willd. subsp. *mucronata*	Buffalo-thorn (e), Blinkblaar-wag-'n-bietjie (a)	Edible parts, traditional medicinal uses, traditional uses

27 FLORISTIC HABITAT TYPES OF THE PROPOSED SITES AND IMMEDIATE SURROUNDS

Historically, regional floristic patterns are the result of complex interacting biophysical driving forces that include climate, geology (soil), topography and moisture gradients that characterise a region. However, anthropogenic land use activities have caused, and accelerated, the intensity of changes to the principal floristic patterns. The extent and nature of impacts and developmental factors on vegetation include the severe, immediate and complete decimation of flora for developments, to gradual, peripheral and long-term changes, such as increased grazing pressure, altered moisture regimes, altered fire and burning patterns, changes in natural resource utilisation, etc. Alterations to the principal flora of a site are therefore often difficult to quantify and detect, specifically from the perspective of instantaneous observations or without the benefit of a quantified assessment with a regional perspective. The flora of a site is therefore often portrayed as altered and variable types that exhibit floristic and vegetatal attributes different to the local, regional types, or historic descriptions of the ecological types. Therefore, and to a certain extent, some of the minor changes that are relatable to anthropogenic impacts are interpreted in the context of the original, natural vegetation, and only in cases where significant changes have resulted that from these impacts, notably structural changes that are accompanied by significant compositional changes, are categorised as 'distinctive' units.

The development footprints for the proposed activity provides evidence of the range of anthropogenic impacts that resulted from disruptive and transformative industrial and associated activities over an extensive time period. Irremediable changes in vegetatal structure, species abundance, presence, absence, and composition resulted from land clearance activities in some parts, often recent, while other parts comprise natural and pristine bushland and shrubland types.

The following broad-scale habitat types[16] and categories were recognised from the study areas and the immediate surrounds (refer **Figure 17 and Figure 18**):

- ⇒ Artificial Impoundments;
- ⇒ Deteriorated Open Shrubland Types;
- ⇒ Drainage Lines and Variable Shrubland Banks;
- ⇒ Tall Closed Riparian Bushland;
- ⇒ Natural Woodland and Bushveld Types, including:
  - o Closed Mixed Thicket and Bushland;
  - o Variable Mixed Shrubland – Mountain Bushveld;
  - o Variable Mixed Shrubland – Plains Bushveld; and
- ⇒ Transformed Areas, Infrastructure, Industries, Roads, etc.

The proposed development footprints for Phase 2 of the project do not necessarily comprise all of these habitat types, a brief discussion of each site and the habitat types relevant to the site is provided separately in **Section 28**.

27.1 ARTIFICIAL IMPOUNDMENTS

A number of artificial impoundments were constructed as part of the existing operations. As these areas comprise no natural vegetation, they were excluded from the surveys and a low floristic sensitivity was ascribed.

[16] *The structural classification proposed here is independent of, but complementary to floristic, habitat and ecological classifications of vegetation (Edwards 1983).*

27.2 DETERIORATED OPEN SHRUBLAND TYPES

The various types of (anthropogenic) land-use activities represent the major developmental force for this habitat type, typically causing immediate direct as well as medium-term indirect impacts that affected the status of extensive portions of the regional shrubland types, both compositionally as well as structurally. Most of these areas are situated in the Sekhukhune Plains Bushveld and is geographically accessible from the nearby settlements and therefore intensively uses for harvesting of natural resources as well as for grazing purposes. The dominant floristic attributes of these parts therefore no longer correlate to the regional ecological types, although a measure of correlation in terms of composition is still noted. Activities such as bush clearance within powerline servitudes and recent and historic surface disturbances from industrial and residential land use activities resulted in an altered and dynamic/ transitional floristic status, ultimately rendering the floristic status of these parts compromised and poor.

The floristic nature of these parts is highly variable, and depends on the nature and timing of the disruptive events, varying between areas where the woody layers appear depleted and shrubby, generally conforming to (deteriorated) open savannoid types, to areas where a secondary development of the woody layer is present, but with a composition that comprises mostly microphyllous (*Acacia* and *Dichrostachys*) type indigenous encroacher species and not the typical broad-leaf species that are encountered in natural shrubland of the immediate regions. Similarly, the herbaceous and grass layers exhibit a low species richness and diversity and is generally dominated by poor quality *Aristida* species. The depleted and deteriorated nature of the herbaceous stratum also strongly reflects the severity and persistently high grazing pressure to which these parts are often subjected. Coupled with a poor fire management regime, the poor (and atypical) composition of the herbaceous and woody strata ultimately render the floristic sensitivity of these parts medium-low (refer Figure 19 and Figure 20). It was also noted that conservation important species occur at considerably lower abundance levels in these parts.

27.3 DRAINAGE LINES AND VARIABLE SHRUBLAND BANKS

Apart from the prominent Steelpoort River that is situated further to the north of the sites, several small and medium sized (non-perennial) drainage lines are noted in the study area. These features generally drains northwards into the Steelpoort River. Although these areas are generally excluded from the proposed development, minor (indirect) impacts could potentially result in adverse effects on these features, such as erosion, siltation, etc.

Smaller drainage lines are generally shallow and comparatively narrow, and due to the rapid evacuation of rainwater along these features, the highly infrequent and periodic presence of water in these features does not allow for the development of a mesic vegetation type that would be characterised by the presence of hydrophilic plant types, such as along the Steelpoort River. Therefore, although categorised as a riparian habitat type, the dominant vegetation does not necessarily exhibit typical mesic or riparian characteristics, but rather reflections the terrestrial surrounding variable shrubland types, notably the woody (trees and shrubs) component, which may be locally slightly denser compared to the surrounding terrestrial areas. Channelled bottoms are often comprised of exposed rock, with thin layers of overlying, loose sand. The herbaceous composition of the streambeds and banks are often quite poor and sparse, but may comprise a selection of succulent species such as *Aloe*, *Euphorbia*, *Kalanchoe, Kleinia* and *Stapelia* species that are able to withstand the periodic disruptive events. Grass species that typically occupy these parts are most often pioneer and poor-quality species, including *Aristida* species.

The drainage line situated between Sites 3 and 4 and across Site 5 is a significant feature; the width is in excess of 50 m in places and the depth may exceed 5 m. This drainage line is characterised by deeply incised (sometimes eroded) banks and a wide, flat and clayey stream bottom from which the overlying sandy layers have been removed. Vegetation of the banks reflect the surrounding (terrestrial) variable woodland types and not necessarily a mesic type, while the wide

streambed is characterised by a secondary and transitional climax sere that features prominent and diverse herbaceous and woody species, comprising of trees and shrubs that is able to survive periodic flooding. It is thought that anthropogenic development of the wider area have resulted in severe alteration of the flow patterns within this area; ultimately ameliorating the severe nature of flood events and therefore facilitating the formation of a transitional climax vegetation layer. Evidence of erosion is noticeable from the banks of this feature. *Spirostachys africana* (Tamboti) is a characteristic tree species that is strongly associated with only the streambanks, corresponding to the temporary wet conditions of the streambanks, and parts where soils are characterised by slightly higher clay content.

The flora of these drainage features strongly reflect the surrounding variable shrublands, appearing locally deteriorated, notably the larger drainage line between Sites 3 and 4. Although likely to be **ecologically** more significant, particularly the larger drainage line, the floristic sensitivity is not considered to be high and was ascribed a medium-high floristic sensitivity (refer **Figure 19 and Figure 20**). No specific floristic feature of importance or sensitivity is associated with these features, and protected and conservation important species only occur sporadically within these features at lower abundance values compared to the surrounding variable shrubland.

27.4 STEELPOORT RIVER, TALL CLOSED RIPARIAN BANKS AND *PHRAGMITES* LEVEES

The perennial Steelpoort River and associated tall and dense wooded banks, as well as the seasonally inundated *Phragmites* levees, form a distinctive topographical and ecological feature of the area. While macro elements of this unit, such as the large trees and (southern) riverbanks, are considered comparatively natural, the undergrowth, levee areas, and smaller topographical features exhibit significant evidence of deterioration from high utilisation and resource plundering (informal sand mining practices). Numerous and prominent weeds and invasive species, poor water quality, high grazing pressure and poor fire management resulted in a moderately deteriorated status of this unit.

Species that characterise the riverbanks along the Steelpoort River include the indigenous trees *Combretum erythrophyllum* and *Senegalia galpinii* as well as other lower strata species such as *Cyphostemma* species, *Grewia* species*, Gymnosporia buxifolia, Senegalia* and *Vachellia* species and dense, localised stands of the grasses *Cymbopogon validus, Dichanthium aristatum,* and *Panicum maximum* that manifests as dense and low, overhanging vegetation into the Steelpoort River. The deteriorated status of this ecosystem is indicated by the significant presence of exotic and invasive woody species such as *Melia azedarach, Morus alba, Populus* x *canescens, Salix babylonica, Senna didymobotrya, Sesbania bispinosa, S. punicea* and *Tecoma stans,* as well as the invasive herbs *Xanthium strumarium, Flaveria bidentis* and the grass *Pennisetum clandestinum.*

Localised levees that are situated immediately upland of the riverbanks, and which are typically inundated during high flood periods, comprise a closed, thicket-type shrub layer that is locally dominated by tall, dense stands of *Phragmites australis, Datura stramonium, Ricinus communis* and *Sida cordifolia* and tall grass stands comprising *Digitaria eriantha, Dactyloctenium giganteum, Dichanthium aristatum* and several forb s. Vegetation along the riverbanks is particularly dense.

The Steelpoort River ecosystem represents a system that has restricted presence on a wider scale and could therefore be considered **ecologically sensitive**. However, no floristic aspects of particular importance, and or species of conservation importance was recorded from this unit, a medium-high floristic sensitivity is thus ascribed (refer **Figure 19 and Figure 20**).

27.5 TALL CLOSED RIPARIAN BUSHLAND

Terrestrial woodland habitat that is situated in proximity to the Steelpoort River is characterised by a prominent and dense layer of tall '*Acacia'* vegetation, prominent species include *Dichrostachys cinerea, Vachellia nilotica* and *V. tortilis*, but also comprising other woody species such as *Ehretia rigida, Euclea natalensis, Grewia bicolor, G. flava, G. vernicosa, Gymnosporia buxifolia,* as well as a well-developed herbaceous stratum that includes a high occurrence of species that are strongly correlated to the wider terrestrial habitat types (variable woodland), such as *Aloe* species and the grasses *Aristida diffusa, A. rhiniochloa, Digitaria eriantha, Eragrostis capensis, Perotis patens* and *Stipagrostis hirtigluma.*

The prominent *Vachellia* component reflects a higher clay content of the deeper soils on lower topographical positions, ultimately rendering the vegetation 'sweet' and more palatable compared to surrounding habitat that comprise more sandy soils. The dense nature of the vegetation results in poor access for grazing animals, providing some protection against severe grazing pressure, although the ground layer appear depleted and open in parts of this unit, mostly attributed to periodic flooding and localised surface erosion.

The sporadic presence of the protected tree *Balanites maughamii* is noted in this unit, and also because of the association with the nearby riparian habitat and a comparatively natural status, albeit not pristine, a medium-high floristic sensitivity is ascribed to these parts of the site (refer Figure 19 and Figure 20).

27.6 CLOSED MIXED THICKET AND BUSHLAND

Isolated parts of the sites comprise particularly dense (closed) thickets and bushland where the cover of shrubs and trees often exceed 60 %, and is mostly situated in the Sekhukhune Plains Bushveld type, with a species composition that, although variable, correlates to the regional type. The tree and shrub layer is dominant, comprising species such as *Commiphora pyracanthoides, Dichrostachys cinerea, Ehretia rigida, Gymnosporia buxifolia, Senegalia erubescens, Terminalia prunioides, Vachellia grandicornuta, Ximenia caffra, Balanites maughamii, Boscia albitrunca, Croton gratissimus, Peltophorum africanum, Sclerocarya birrea, Senegalia nigrescens, Senegalia senegal, Vachellia nilotica* and *Vachellia tortilis.* The herbaceous stratum, although variable, is comparatively diverse and includes notable species such as the grasses *Aristida diffusa, A. rhiniochloa, Enneapogon cenchroides, Eragrostis capensis, E. rigidior, Fingerhuthia africana, Heteropogon contortus, Panicum maximum, Schmidtia pappophoroides* and *Themeda triandra,* and the succulent species *Aloe castanea, A. marlothii, Euphorbia ingens, Kleinia longiflora, K. stapeliiformis* and *Stapelia gigantea.* A prominent growth form in this unit include climber species, such as *Cissus cactiformis, Clematis brachiata, Cynanchum viminale, Dalechampia galpinii, Peponium caledonicum* and *Senecio pleistocephalus.*

The reason for the excessive densification of the woody layer is unclear, and is possibly attributed to variation in management or exclusion of fire for a prolonged period. Despite some structural differences between this and the nearby Variable Mixed Shrubland types, the species composition is comparatively similar, providing some evidence that these types were historically similar types, generally correlating to the regional Sekhukhune Plants Bushveld type.

A relative high abundance of protected and conservation important species were recorded in this unit, including the vulnerable *Adenia fruticosa,* and the protected trees *Balanites maughamii, Boscia albitrunca* and *Sclerocarya birrea*. As a result, and despite a moderate level of deterioration, a medium-high floristic sensitivity is ascribed to these parts (refer Figure 19 and Figure 20).

27.7 TRANSFORMED AREAS, INFRASTRUCTURE, INDUSTRIES, ETC.

Parts of the region where natural habitat has been entirely replaced by infrastructure, mining and industrial areas, residential areas, etc. No, or minimal natural, vegetation remain in these parts. No surveys have been conducted in these parts and a low floristic sensitivity is ascribed to these parts (refer Figure 19 and Figure 20).

27.8 VARIABLE MIXED SHRUBLAND

This type represents the natural and dominant habitat bushveld/ shrubland types within the wider area, manifesting as variable shrublands with woody cover ranging between 20 % and 65 % and the average height of shrubs and trees between 3 m and 10 m. Two major types are recognised, representing the regional types of Sekhukhune Plains Bushveld and Sekhukhune Mountain Bushveld.

The Plains Bushveld type conforms to an admixture of open to closed microphyllous and broad-leafed variation and is situated on the plains where soils are most often deeper and where surface rock occur only highly sporadically. Because of a high utilisation factor, significant deterioration in the flora is noted. Typically, the local species composition is highly variable, ranging between areas of dense grass layers, dominated by tall grass species such as *Digitaria eriantha, Cenchrus ciliaris* and *Digitaria eriantha,* but mostly to an open and sparse grass cover that are dominated by *Aristida* species, *Urochloa mossambicensis*, *Stipagrostis hirtigluma* and other poor-quality species that signify a deteriorated status caused by high utilisation factors. Similarly, the woody layer is dominated by a range of species; the species composition and structure often reflecting management history and utilisation/ harvesting practices, thus varying between comparatively natural to moderately deteriorated. Locally the extensive presence of invasive species is also noted, specifically the succulent *Agave sisalana.* Prominent woody species include the shrubs *Boscia foetida, B. albitrunca, Commiphora pyracanthoides, Dichrostachys cinerea, Combretum hereroense, Ehretia rigida, Euclea undulata, Grewia* species, *Searsia* species, *Terminalia prunelloides, Senegalia mellifera, Vachellia grandicornuta,* and the larger trees *Balanites maughamii, Peltophorum africanum, Sclerocarya birrea, Senegalia nigrescens, Vachellia nilotica, V. tortilis* and *Volkameria glabra.*

The herbaceous stratum is particularly diverse, comprising numerous succulents such as the tall *Aloe castanea* and the low-growing *Aloe burgersfortensis*, *Euphorbia schinzii, E. lydenburgensis, Kalanchoe* species, *Kleinia longiflora* and *Stapelia gettliffei,* and notable herbs such as *Clematis brachiata, Blepharis subvolubilis, Ledebouria* species, *Flaveria bidentis, Hibiscus cannabinus, Holubia saccata, Kyphocarpa angustifolia, Petalidium oblongifolium, Polydora poskeana, Rhynchosia totta, Sida* species, *Tephrosia* species, *Waltheria indica, Sansevieria hyacinthoides* and *Senna italica.* The floristic status of this type varies considerably. Portions of the study north of the R555 is generally considered moderately deteriorated due to harvesting practices and inappropriate grazing practices and poor fire regimes, while areas that are protected by security fences exhibit more natural attributes, albeit highly moribund with extremely high biomass.

Localised infestation by *Agave sisalana* and *Opuntia* species and isolated surface disturbances detract from the ecological integrity and status of these parts, although the notable presence of protected trees *Sclerocarya birrea, Balanites maughamii,* and *Boscia albitrunca,* as well other (provincially) protected species such as *Eulophia petersii, Stapelia* species and the vulnerable (IUCN) *Adenia fruticosa* ultimately renders the floristic sensitivity of these areas medium-high (refer Figure 19 and Figure 20).

Because of dissimilar topographic, edaphic and moisture related attributes, a distinct separation is recognised between the plains and mountain woodland types of the local region. While the Sekhukhune Plains Bushveld generally comprises the plains areas where deeper soils prevail, the Sekhukhune Mountain Bushveld is found in the southern parts of Site 2B, situated on the footslope of the low mountains, and comprising topographically complex areas where rocks and shallow, sandy soils prevail. Distinct floristic differences are noted between these units, which are also considered partly a factor

of the higher deterioration of the plains areas, while flora of the mountain areas were found to exhibit a higher status and integrity. The prominent presence of *Aloe* species in the plains appears to be much lower in the mountainous parts, with mainly *Aloe marlothii,* while the notable presence of the characteristic tree *Kirkia wilmsii* clearly delineates the mountains flora. Other typical species noted in the mountain bushveld type include the *Combretum* species, *Vitex obovata, Sterculia rogersii, Elephantorrhiza burkei, Sansevieria hyacinthoides.* Also occurring in this variation are *Croton gratissimus* and *Pouzolzia mixta*, both of which appear to be associated with high rockiness, but also occurring in rocky streambed of the large non-perennial drainage line between Sites 3 and 4. The grass component, because of steeper slopes, shallow soils and high rockiness is lower in diversity compared to the woodland plains. These areas, based on a high integrity and floristic status, as well as a high connectivity to pristine natural woodland further south and the presence of protected plant species, are considered floristically sensitive (high sensitivity, refer Figure 20).

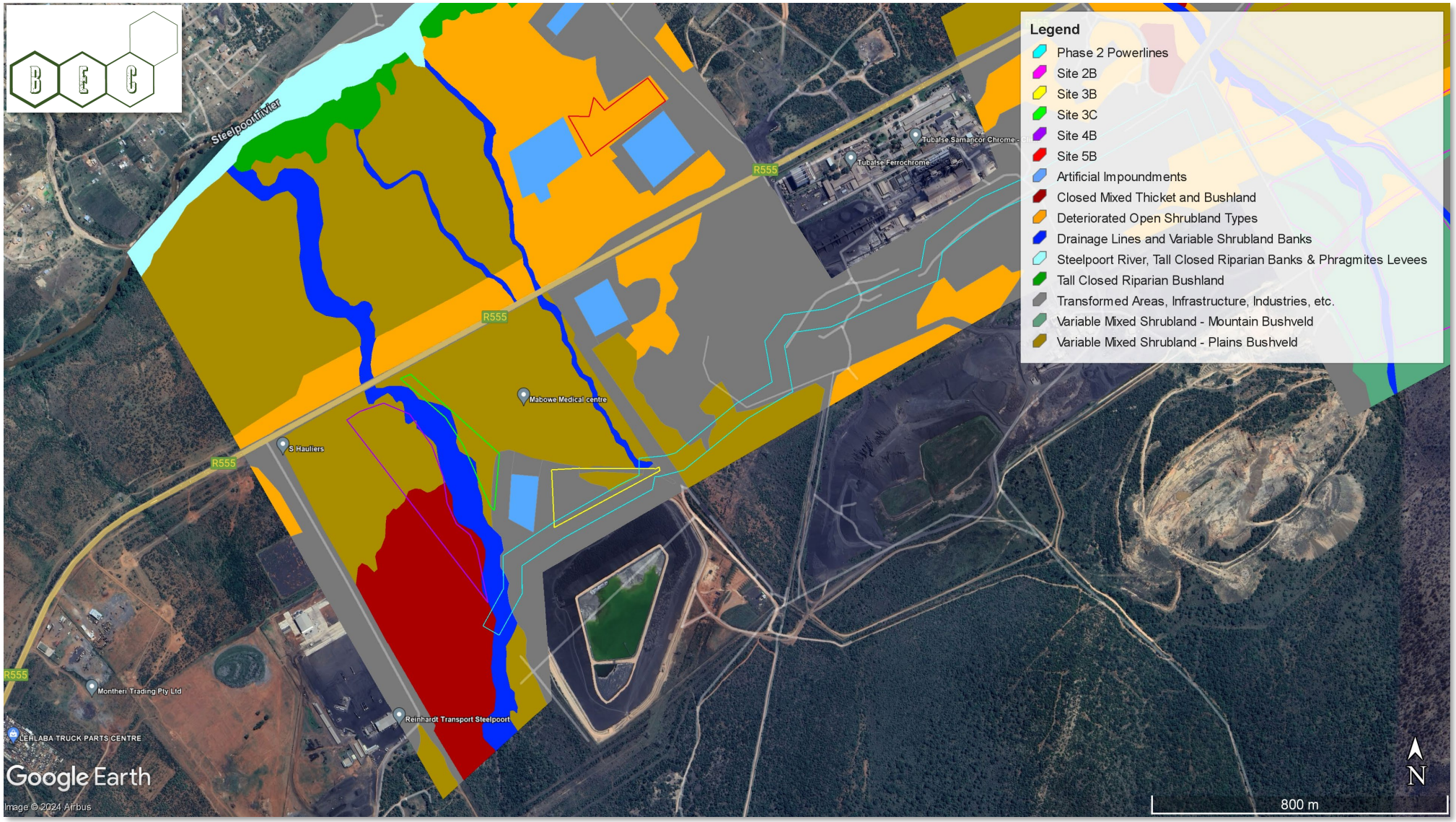


Figure 17: Broad-scale habitat types of the study areas and immediate surrounds (Sites 3, 4 & 5) and powerline servitude

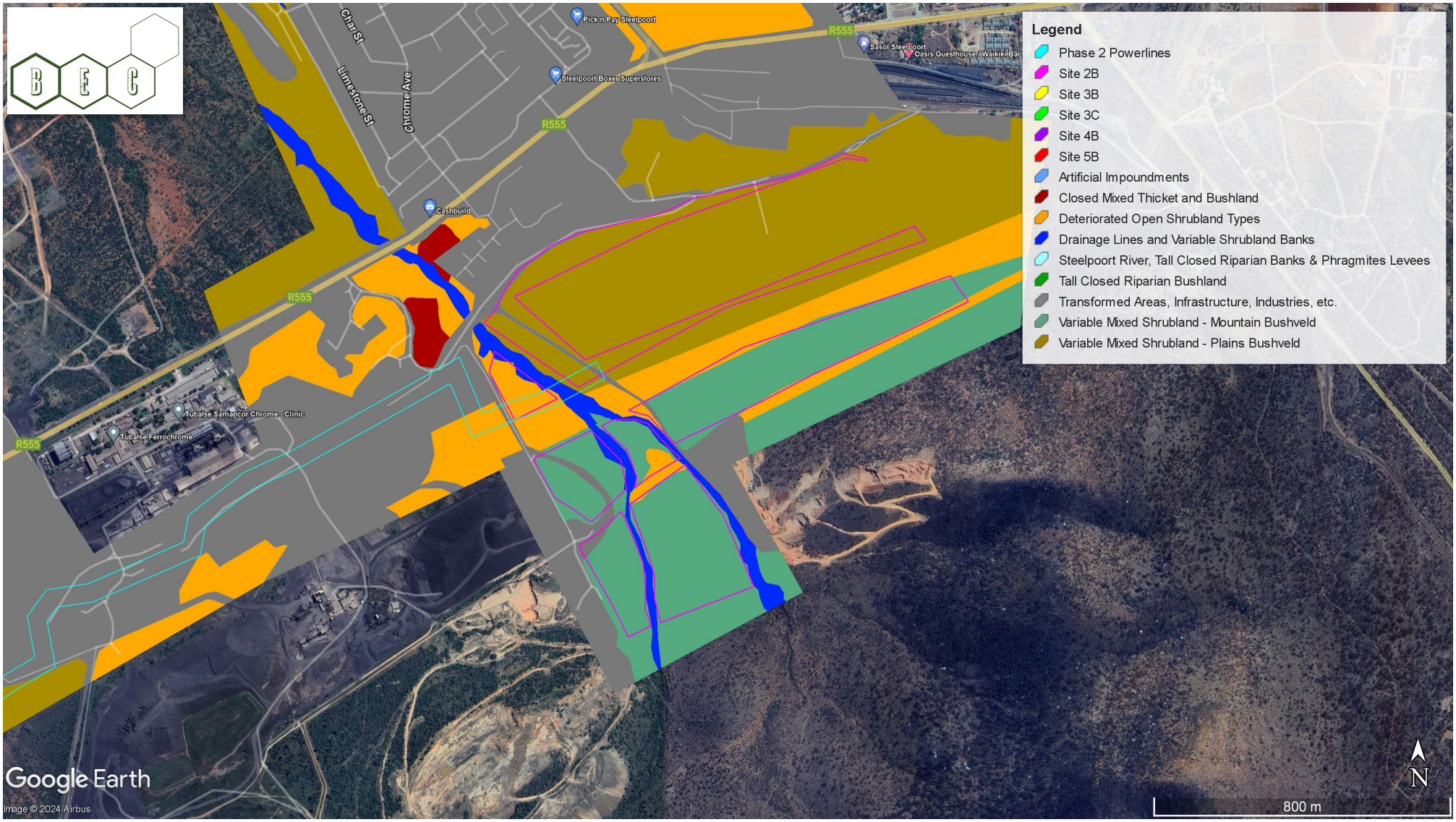


Figure 18: Broad-scale habitat types of the study areas and immediate surrounds (Site 2) and powerline servitude

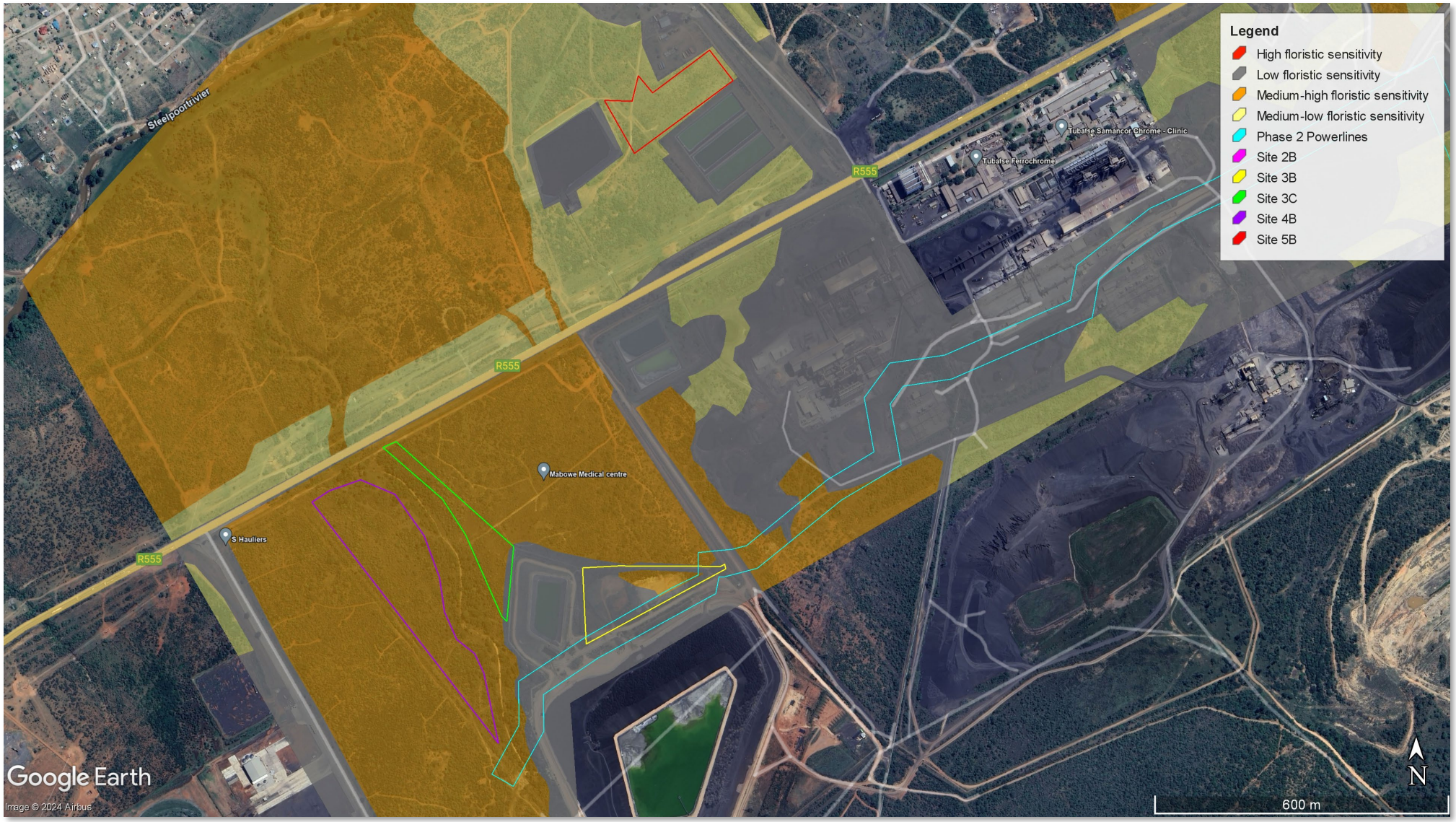


Figure 19: Floristic sensitivity of the study areas and immediate surrounds (Sites 3, 4 & 5) and powerline servitude

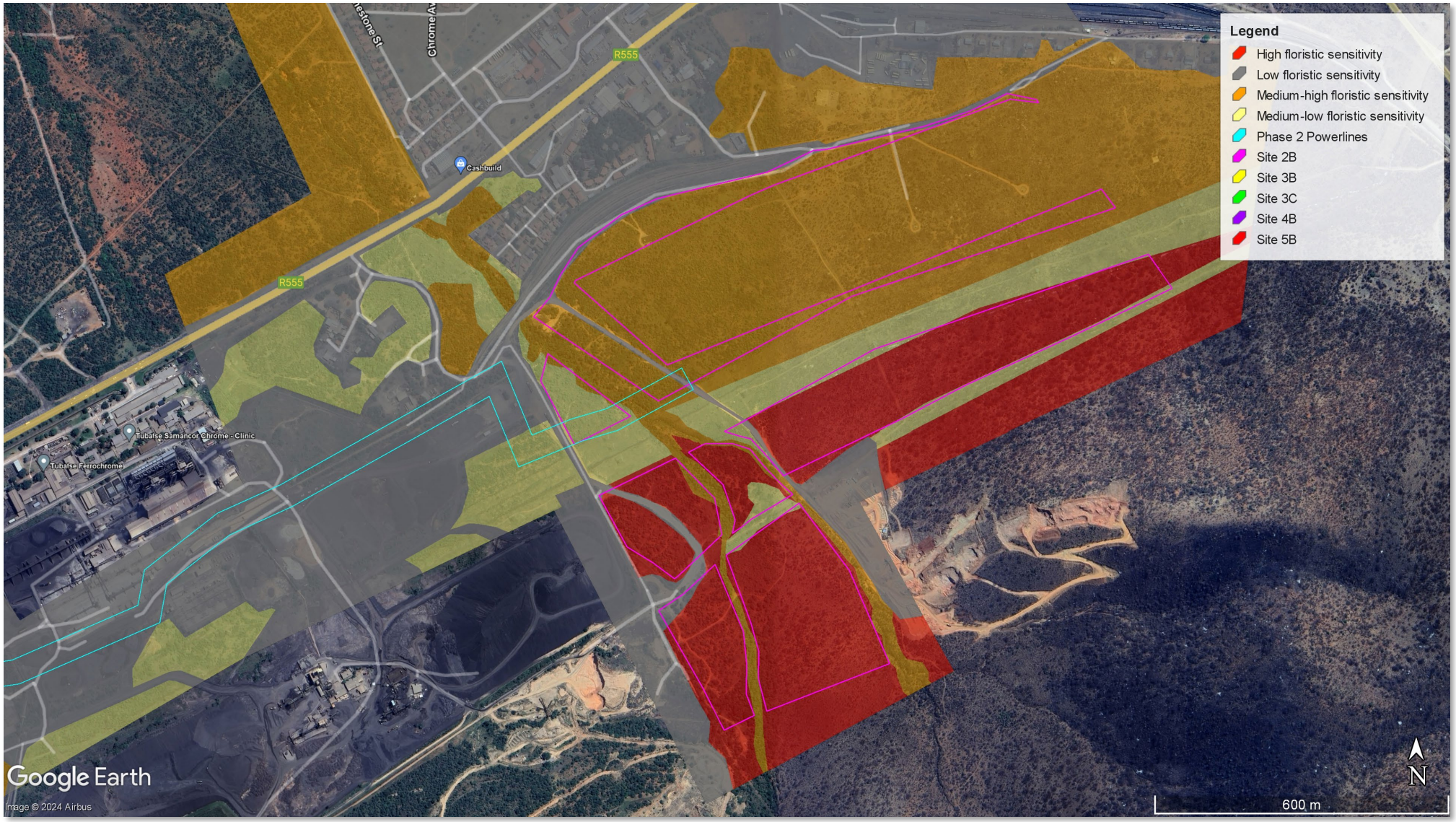


Figure 20: Floristic sensitivity of the study areas and immediate surrounds (Site 2) and powerline servitude

28 ANNOTATIONS ON FLORISTIC ATTRIBUTES OF THE RESPECTIVE DEVELOPMENT FOOTPRINTS

28.1 SITE 2B

Site 2B comprises various smaller portions to augment and fill in the original Site 2 and therefore also comprising of various habitat types, including:

⇒ Deteriorated Open Shrubland Types;

⇒ Drainage Lines and Variable Shrubland Banks;

⇒ Natural Woodland and Bushveld Types, including:

- Variable Mixed Shrubland – Mountain Bushveld;
- Variable Mixed Shrubland – Plains Bushveld;

⇒ Transformed Areas, Infrastructure, Industries, Roads, etc.; and

Of importance in the southern sections of this site is the plains bushveld habitat type that correlates with the low foothills of the mountainous areas further to the south of the study area. The presence of the tree *Kirkia wilmsii*, provide an accurate indication of the floristic division between this and the plains bushveld that comprises the northern sections of Site 2Bal location. In addition, the presence of species such as *Senegalia nigrescens, S. senegal var. leiorhachis, Terminalia prunioides, Bolusanthus speciosus, Boscia albitrunca, Dichrostachys cinerea* and *Grewia vernicosa* are also noted, although elements of these species are also present in the plains woodland areas. These areas exhibit varying level of integrity but as a result of high integrity and connectivity, are afforded a sensitivity varying between medium-high and high. In particular, parts of Site 2B situated in the ridge area is considered pristine and sensitive. The obvious presence of mining activities in the local environment is a cause of concern, detracting from a potentially very high sensitivity and integrity.

A deterioration factor is noted in the plains areas, with several invasive exotic species, such as *Agave sisalana, Cereus jamacuru, Opuntia ficus-indica, O. humifusa, O. leucotricha* as well as indigenous encroacher microphyllous species is noted across these parts. This, in association with a poor grass component and the extensive presence of a weedy disposition of much of the herbaceous layer, ultimately detract from the floristic status, although some parts are considered comparatively natural and representative of the regional type. The presence of several protected and conservation important plants, such as the vulnerable *Adenia fruticosa* and the protected trees *Balanites maughamii, Boscia albitrunca* and *Sclerocarya birrea* and a high connectivity to pristine savanna types to the south of the site, renders the floristic sensitivity medium-high.

Table 12: Species recorded from Site 2B (also including Site 2, Phase 1)

Growth Form	*Species Name*
Climbers	*Cissus cactiformis* Gilg, *Clematis brachiata* Thunb., *Cynanchum viminale* (L.) Bassi subsp. *viminale*, *Jasminum fluminense* Vell. subsp. *fluminense*, *Momordica balsamina* L.
Dwarf shrubs	*Blepharis subvolubilis* C.B.Clarke, *Dicoma tomentosa* Cass., *Geigeria burkei* Harv. subsp. *fruticulosa* Merxm., *Leucosphaera bainesii* (Hook.f.) Gilg, *Solanum elaeagnifolium* Cav.
Ferns	*Selaginella dregei* (C.Presl) Hieron.
Grasses	*Aristida adscensionis* L., *A. congesta* subsp. *barbicollis*, *A. diffusa* Trin. subsp. *burkei* (Stapf) Melderis, *Digitaria eriantha* Steud., *Enneapogon cenchroides* (Roem. & Schult.) C.E.Hubb., *Eragrostis lehmanniana* Nees var. *lehmanniana*, *E. rigidior* Pilg., *Fingerhuthia africana* Lehm., *Heteropogon contortus* (L.) Roem. & Schult., *Panicum maximum* Jacq., *Schmidtia pappophoroides* Steud., *Setaria sphacelata* (Schumach.) Stapf & C.E.Hubb. ex M.B.Moss var. *torta* (Stapf) Clayton, *Sporobolus ioclados* (Trin.) Nees
Herbs	*Abutilon* species, *Achyranthes aspera* L. var. *aspera*, *Cleome gynandra* L., *Hibiscus microcarpus* Garcke, *Indigofera* species, *Justicia flava* (Vahl) Vahl, *Kyphocarpa angustifolia* (Moq.) Lopr., *Leucas* species, *Ocimum obovatum* E.Mey. ex Benth. subsp. *obovatum*, *Petalidium oblongifolium* C.B.Clarke, *Polydora poskeana* (Vatke & Hildebr.) H.Rob.sens.lat., *Requienia sphaerosperma* DC., *Rhynchosia totta* (Thunb.) DC. var. *totta*, *Schkuhria pinnata* (Lam.) Cabrera, *Senna italica* Mill. subsp. *arachoides* (Burch.) Lock, *Sesamum triphyllum* Welw. ex Asch. var. *triphyllum*, *Sida cordifolia* L.
Perennial herbs	*Sansevieria hyacinthoides* (L.) Druce

Prostrate herbs	*Tribulus terrestris* L.
Sedges	*Bulbostylis burchellii* (Ficalho & Hiern) C.B.Clarke
Shrubs	*Asparagus* species, *Commiphora pyracanthoides* Engl., *Grewia flava* DC., *G. flavescens* Juss., *G. vernicosa* Schinz
Small trees	***Adenia fruticosa*** **Burtt Davy subsp. *fruticosa***, *Boscia foetida* Schinz subsp. *rehmanniana* (Pestal.) Toelken, *Dichrostachys cinerea* (L.) Wight & Arn. subsp. *africana* Brenan & Brummitt, *Ehretia rigida* (Thunb.) Druce subsp. *nervifolia* Retief & A.E.van Wyk, *Searsia pentheri* (Zahlbr.) Moffett, *Senegalia erubescens* (Welw. ex Oliv.) Kyal. & Boatwr., *S.mellifera* (Vahl) Seigler & Ebinger subsp. *detinens* (Burch.) Kyal. & Boatwr., *Terminalia prunioides* M.A.Lawson, *Vachellia exuvialis* (I.Verd.) Kyal. & Boatwr., *V. grandicornuta* (Gerstner) Seigler & Ebinger, *Ximenia caffra* Sond. var. *caffra*
Succulents	*Agave americana* L. subsp. *americana* var. *americana*, ***Aloe burgersfortensis*** **Reynolds,** *A. castanea* Schönland, *A. globuligemma* Pole-Evans, *A. marlothii* A.Berger subsp. *marlothii*, *Cereus jamacuru* (L.) Mill., *Euphorbia ingens* E.Mey. ex Boiss., *Kleinia longiflora* DC., *K. stapeliiformis* (E.Phillips) Stapf, *Opuntia ficus-indica* (L.) Mill., *O. humifusa* (Raf.) Raf., *O. leucotricha* DC.
Trees	***Balanites maughamii*** **Sprague,** ***Boscia albitrunca*** **(Burch.) Gilg & Gilg-Ben.,** ***Sclerocarya birrea*** **(A.Rich.) Hochst. subsp. *caffra*** **(Sond.) Kokwaro**, *Senegalia nigrescens* (Oliv.) P.J.H.Hurter, *Sterculia rogersii* N.E.Br., *Vachellia tortilis* (Forssk.) Gallaso & Banfi subsp. *heteracantha* (Burch.) Kyal. & Boatwr.







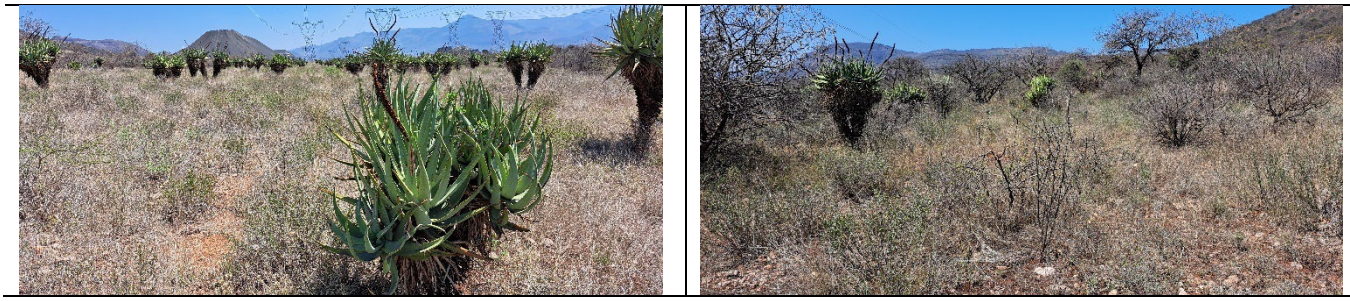



Figure 21: Collage of images of habitat conditions within Site 2B

28.2 SITE 3B AND SITE 3C

Site 3B and Site 3C comprise mostly of the Variable Mixed Shrubland (plains bushveld), some transformed areas (from industrial activities), while Site 3C is situated adjacent to the large non-perennial drainage line exhibiting moribund and dense vegetation. The nature of the remaining portions of natural woodland is correlates to the regional ecological type with minor deterioration noted in places. The woody layer is dominant with densities ranging between 20 and 45 %; notable species include *Adenia fruticosa, Boscia foetida*, *Balanites maughamii*, *Boscia albitrunca*, *Combretum hereroense*, *Commiphora pyracanthoides, Dichrostachys cinerea*, *Grewia* species, *Sclerocarya birrea*, *Senegalia nigrescens, S. senegal* and *Terminalia prunioides*. The grass sward provides an indication of historic utilisation and is dominated by *Aristida* species, *Enneapogon cenchroides, Eragrostis chloromelas, E. rigidior, Heteropogon contortus, Schmidtia pappophoroides* and *Stipagrostis hirtigluma*(d). The herbaceous layer is comparatively diverse; prominent species include the climbers *Cissus cactiformis, Clematis brachiata, Peponium caledonicum,* and *Senecio pleistocephalus,* the forbs *Blepharis subvolubilis, Dicoma tomentosa, Eulophia petersii, Holubia saccata, Petalidium oblongifolium, Sansevieria hyacinthoides* and the succulent species *Aloe* species, *Euphorbia* cf. *lydenburgensis, E. ingens, E. schinzii, Kalanchoe* species and *Stapelia* species. Invasion by exotic species is generally low, with isolated occurrences of *Cereus jamacuru.*

Comparatively high densities of protected and conservation important plants were recorded from this site, including the vulnerable *Adenia fruticosa,* the provincially protected *Eulophia petersii, Aloe burgersfortensis, Stapelia* species and the protected trees *Balanites maughamii, Boscia albitrunca* and *Sclerocarya birrea* occur in the remaining portions of natural woodland.

The small drainage line on the eastern perimeter conforms to the xeric surrounding shrubland, but with a shallow streambed where the overlying sandy soils were removed to expose the underlying rocky substrate. The vegetation does not correlate to a mesic environment and the herbaceous layer is somewhat depleted, while the woody stratum correlates to the surrounding shrubveld. A major drainage line is situated on the western perimeter of the site, but is not spatially included in the site.

Table 13: Species recorded from Site 3B and Site 3C (also including Site 3, Phase 1)

Growth Form	*Species Name*
Climbers	*Cissus cactiformis* Gilg, *Clematis brachiata* Thunb., *Cyphostemma* species, *Dalechampia galpinii* Pax, *Momordica balsamina* L., *Peponium caledonicum* (Sond.) Engl., *Senecio pleistocephalus* S.Moore
Dwarf shrubs	*Blepharis subvolubilis* C.B.Clarke, *Dicoma tomentosa* Cass., *Geigeria burkei* Harv. subsp. *fruticulosa* Merxm., *Leucosphaera bainesii* (Hook.f.) Gilg
Geophytes	*Eulophia petersii* (Rchb.f.) Rchb.f, *Stylochaeton natalensis* Schott
Grasses	*Aristida adscensionis* L., *A. congesta* subsp. *barbicollis*, *A. diffusa* Trin. subsp. *burkei* (Stapf) Melderis, *A. rhiniochloa* Hochst., *Cenchrus ciliaris* L., *Digitaria eriantha* Steud., *Enneapogon cenchroides* (Roem. & Schult.) C.E.Hubb., *Eragrostis chloromelas* Steud., *E. rigidior* Pilg., *Fingerhuthia africana* Lehm., *Heteropogon contortus* (L.) Roem. & Schult., *Panicum maximum* Jacq., *Schmidtia pappophoroides* Steud., *Sporobolus ioclados* (Trin.) Nees, *Stipagrostis hirtigluma* (Steud.) De Winter subsp. *patula* (Hack.) De Winter

Herbs	*Abutilon* species, *Cleome* species, *Commelina erecta* L., *Hibiscus microcarpus* Garcke, *Holubia saccata* Oliv., *Indigofera* species, *Jamesbrittanea aurantiaca*, *Kyphocarpa angustifolia* (Moq.) Lopr., *Petalidium oblongifolium* C.B.Clarke, *Requienia sphaerosperma* DC., *Sida* species
Perennial herbs	*Sansevieria hyacinthoides* (L.) Druce, *Zinnia peruviana* (L.) L.
Shrubs	*Asparagus* species, *Commiphora pyracanthoides* Engl., *Grewia bicolor* Juss. var. *bicolor*, *G. flava* DC., *G. flavescens* Juss., *G. vernicosa* Schinz, *Karomia speciosa* (Hutch. & Corbishley) R.Fern., *Pouzolzia mixta* Solms, *Rhigozum brevispinosum* Kuntze
Small trees	***Adenia fruticosa*** **Burtt Davy subsp.** ***fruticosa***, *Bolusanthus speciosus* (Bolus) Harms, *Boscia foetida* Schinz subsp. *rehmanniana* (Pestal.) Toelken, *Combretum hereroense* Schinz, *Dichrostachys cinerea* (L.) Wight & Arn. subsp. *africana* Brenan & Brummitt, *Ehretia rigida* (Thunb.) Druce subsp. *nervifolia* Retief & A.E.van Wyk, *Searsia pentheri* (Zahlbr.) Moffett, *Senegalia mellifera* (Vahl) Seigler & Ebinger subsp. *detinens* (Burch.) Kyal. & Boatwr., *Terminalia prunioides* M.A.Lawson, *Vachellia exuvialis* (I.Verd.) Kyal. & Boatwr., *V. grandicornuta* (Gerstner) Seigler & Ebinger, *Ximenia caffra* Sond. var. *caffra*
Succulents	***Aloe burgersfortensis*** **Reynolds,** *A. castanea* Schönland, A. *marlothii* A.Berger subsp. *marlothii, A.* species, *Cereus jamacuru* (L.) Mill., *Euphorbia* cf. *lydenburgensis* Schweick. & Letty, *E. ingens* E.Mey. ex Boiss., *E. schinzii* Pax, *E.* species, *Kalanchoe luciae* Raym.-Hamet subsp. *luciae*, *K. paniculata* Harv., *K. rotundifolia* (Haw.) Haw., *Kleinia longiflora* DC., *K. stapeliiformis* (E.Phillips) Stapf, *Opuntia ficus-indica* (L.) Mill., ***S. gigantea*** **N.E.Br.**
Trees	***Balanites maughamii*** **Sprague,** ***Boscia albitrunca*** **(Burch.) Gilg & Gilg-Ben.,** *Peltophorum africanum* Sond., ***Sclerocarya birrea*** **(A.Rich.) Hochst. subsp.** ***caffra*** **(Sond.) Kokwaro**, *Senegalia nigrescens* (Oliv.) P.J.H.Hurter, *S. senegal* (L.) Britton var. *leiorhachis* (Brenan) Kyal. & Boatwr., *Vachellia nilotica* (L.) P.J.H.Hurter & Mabb. subsp. *kraussiana* (Benth.) Kyal. & Boatwr., *V. tortilis* (Forssk.) Gallaso & Banfi subsp. *heteracantha* (Burch.) Kyal. & Boatwr.

Figure 22: Collage of images of habitat conditions within Site 3B and Site 3C

28.3 SITE 4B

Site 4 correlates largely to the regional Sekhukhune Plains Bushveld, but historic management practices, specifically the exclusion of fire for a prolonged period, resulted in significant densification of the shrub layer, which allowed the development of the Closed Mixed Thicket and Bushland habitat in the southern extent of the site. The northern part of the site conforms to the Variable Mixed Shrubland, but with varying levels of deterioration. A major drainage line is situated on the eastern perimeter of the site, but is not spatially included in the site.

The dense thickets of the southern part of the site is dominated by an admixture of co-dominant woody species that include *Carissa bispinosa*, *Commiphora pyracanthoides*(d), *Euclea* species, *Grewia* species(d), *Dichrostachys cinerea*(d), *Ehretia rigida*, *Senegalia erubescens*(d), *S. mellifera*, *Terminalia prunioides*(d), *Ximenia caffra, Balanites maughamii*, *Carissa bispinosa, Boscia albitrunca*, *Sclerocarya birrea* and *Senegalia nigrescens.* As a result of the dense woody layer and the subsequent shade effect, the herbaceous layer is not as diverse or developed as the Variable Mixed Shrubland, but notable species include the grasses *Aristida* species(d), *Enneapogon scoparius*(d), *Heteropogon contortus*(d), *Panicum maximum*(d) and *Themeda triandra,* as well as the herbaceous species *Cynanchum viminale, Peponium caledonicum, Aloe* species(d), *Kleinia longifolia*(d), *Euphorbia ingens* and *Dicoma tomentosa.* Sporadic occurrences of the invasive *Opuntia ficus-indica* and *Cereus jamacuru* is noted.

Comparatively high densities of protected and conservation important plants were recorded from this site, including the vulnerable *Adenia fruticosa,* the provincially protected *Eulophia petersii, Aloe burgersfortensis, Stapelia* species and the protected trees *Balanites maughamii, Boscia albitrunca* and *Sclerocarya birrea.*

Table 14: Species recorded from Site 4B (also including Site 4, Phase 1)

Growth Form	*Species Name*
Climbers	*Cissus cactiformis* Gilg, *Clematis brachiata* Thunb., *Cynanchum viminale* (L.) Bassi subsp. *viminale*, *Dalechampia galpinii* Pax, *Peponium caledonicum* (Sond.) Engl., *Senecio pleistocephalus* S.Moore
Dwarf shrubs	*Blepharis subvolubilis* C.B.Clarke, *Dicoma tomentosa* Cass.
Forbs	*Dicliptera* species
Geophytes	***Eulophia petersii (*Rchb.f.) Rchb.f**, *Stylochaeton natalensis* Schott
Grasses	*Aristida congesta* subsp. *barbicollis*, *A. diffusa* Trin. subsp. *burkei* (Stapf) Melderis, *A. rhiniochloa* Hochst., *Cenchrus ciliaris* L., *Enneapogon cenchroides* (Roem. & Schult.) C.E.Hubb., *Eragrostis capensis* (Thunb.) Trin., *E. rigidior* Pilg., *Fingerhuthia africana* Lehm., *Heteropogon contortus* (L.) Roem. & Schult., *Panicum maximum* Jacq., *Schmidtia pappophoroides* Steud., *Sporobolus ioclados* (Trin.) Nees, *Themeda triandra* Forssk.
Herbs	*Achyranthes aspera* L. var. *aspera*, *Helichrysum* species, *Hibiscus microcarpus* Garcke, *Justicia flava* (Vahl) Vahl, *Leucas* species, *Petalidium oblongifolium* C.B.Clarke, *Requienia sphaerosperma* DC., *Sida* species
Shrubs	*Asparagus* species, *Carissa bispinosa* (L.) Desf. ex Brenan, *Commiphora pyracanthoides* Engl., *Euclea natalensis* A.DC. subsp. *angustifolia* F.White, *Euclea* species, *Grewia flava* DC., *G. flavescens* Juss., *G. vernicosa* Schinz, *Gymnosporia polyacantha* (Sond.) Marais, *Phyllanthus* species
Small trees	***Adenia fruticosa* Burtt Davy subsp. *fruticosa***, *Dichrostachys cinerea* (L.) Wight & Arn. subsp. *africana* Brenan & Brummitt *Ehretia rigida* (Thunb.) Druce subsp. *nervifolia* Retief & A.E.van Wyk, *Gymnosporia buxifolia* (L.) Szyszyl., *Senegalia erubescens* (Welw. ex Oliv.) Kyal. & Boatwr., *S. mellifera* (Vahl) Seigler & Ebinger subsp. *detinens* (Burch.) Kyal. & Boatwr., *Terminalia prunioides* M.A.Lawson, *Vachellia grandicornuta* (Gerstner) Seigler & Ebinger, *Ximenia caffra* Sond. var. *caffra*
Succulents	*Aloe castanea* Schönland, *A. marlothii* A.Berger subsp. *marlothii*, *Euphorbia ingens* E.Mey. ex Boiss., *Kalanchoe paniculata* Harv., *Kleinia longiflora* DC., *K. stapeliiformis* (E.Phillips) Stapf, *Opuntia ficus-indica* (L.) Mill., ***Stapelia gigantea* N.E.Br.**
Trees	***Balanites maughamii* Sprague, *Boscia albitrunca* (Burch.) Gilg & Gilg-Ben.,** *Croton gratissimus* Burch. var. *gratissimus* *Peltophorum africa*num Sond., ***Sclerocarya birrea* (A.Rich.) Hochst. subsp. *caffra* (Sond.) Kokwaro,** *Senegalia nigrescens* (Oliv.) P.J.H.Hurter, *S. senegal* (L.) Britton var. *leiorhachis* (Brenan) Kyal. & Boatwr., *Vachellia nilotica* (L.) P.J.H.Hurter & Mabb. subsp. *kraussiana* (Benth.) Kyal. & Boatwr., *V. tortilis* (Forssk.) Gallaso & Banfi subsp. *heteracantha* (Burch.) Kyal. & Boatwr.

Figure 23: Collage of images of habitat conditions within Site 4B

28.4 SITE 5B

Site 5B is characterised by the Deteriorated Open Shrubland type, comprising a modified habitat where most of the original woody vegetation has been removed for development purposes. Remaining vegetation on this portion does not correlate to the Sekhukhune Plains Bushveld type, although the presence of a low number of *Sclerocarya birrea* remains on the site.

Table 15: Species recorded from Site 5B

Growth Form	*Species Name*
Climbers	*Clematis brachiata* Thunb., *Cyphostemma* species, *Momordica balsamina* L., *Pergularia daemia* (Forssk.) Chiov. subsp. *daemia, Smilax anceps* Willd.
Dwarf shrubs	*Acalypha* species, *Blepharis subvolubilis* C.B.Clarke, *D. capensis, Geigeria burkei* Harv. subsp. *fruticulosa* Merxm. *Hermannia* species, *Jamesbrittenia burkeana* (Benth.) Hilliard, *Leonotis ocymifolia* (Burm.f.) Iwarsson, *Rhynchosia* species, *Xanthium strumarium* L.

Grasses	*Aristida adscensionis* L., *A. bipartita* (Nees) Trin. & Rupr., *A. congesta* subsp. *barbicollis, A. congesta* subsp. *congesta, A. diffusa* Trin. subsp. *burkei* (Stapf) Melderis, *A. rhiniochloa* Hochst., *Cymbopogon validus* (Stapf) Stapf ex Burtt Davy, *Cynodon dactylon* (L.) Pers., *Dactyloctenium giganteum* Fisher & Schweick., *E. rigidior* Pilg., *Heteropogon contortus* (L.) Roem. & Schult., *Hyperthelia dissoluta* (Nees ex Steud.) Clayton, *Panicum maximum* Jacq., *Pennisetum clandestinum* Chiov., *Schmidtia pappophoroides* Steud., *Sporobolus ioclados* (Trin.) Nees, *S. pyramidalis* P.Beauv., *Stipagrostis hirtigluma* (Steud.) De Winter subsp. *patula* (Hack.) De Winter, *Themeda triandra* Forssk., *Urochloa mosambicensis* (Hack.) Dandy
Herbs	*Abutilon* species, *Achyranthes aspera* L. var. *aspera, Bidens pilosa* L., *Cleome* species, *Commelina africana, Datura stramonium* L., *Flaveria bidentis* (L.) Kuntze, *Gossypium herbaceum* subsp. *africanum, Indigofera filipes* Benth. ex Harv., *Kyphocarpa angustifolia* (Moq.) Lopr., *Ocimum obovatum* E.Mey. ex Benth. subsp. *obovatum, Polydora poskeana* (Vatke & Hildebr.) H.Rob.sens.lat., *Rhynchosia totta* (Thunb.) DC. var. *totta, Schkuhria pinnata* (Lam.) Cabrera, *S. italica* Mill. subsp. *arachoides* (Burch.) Lock, *Sida alba* L., *S. cordifolia* L., *S.* species, *Tagetes minuta* L., *Tephrosia* species, *Waltheria indica* L.
Perennial herbs	*Argemone ochroleuca* Sweet subsp. *ochroleuca, Zinnia peruviana* (L.) L.
Prostrate herbs	*Cucumis zeyheri* Sond., *Ipomoea* species
Shrubs	*Carissa bispinosa* (L.) Desf. ex Brenan, *Catharanthus roseus* (L.) G.Don, *Commiphora pyracanthoides* Engl., *Elephantorrhiza burkei Benth*., *Euclea natalensis* A.DC. subsp. *angustifolia* F.White, *Grewia bicolor* Juss. var. *bicolor, G. flava* DC., *G. flavescens* Juss., *G. vernicosa* Schinz, *Nicotiana glauca* Graham, *Phyllanthus* species, *Ricinus communis* L. var. *communis, Sesbania bispinosa* (Jacq.) W.Wight var. *bispinosa, Tecoma stans* (L.) Juss. ex Kunth var. *stans*
Small trees	*Boscia foetida* Schinz subsp. *rehmanniana* (Pestal.) Toelken, *Dichrostachys cinerea* (L.) Wight & Arn. subsp. *africana* Brenan & Brummitt, *Ehretia rigida* (Thunb.) Druce subsp. *nervifolia* Retief & A.E.van Wyk, *Gymnosporia buxifolia* (L.) Szyszyl. *Searsia pentheri* (Zahlbr.) Moffett, *Senegalia mellifera* (Vahl) Seigler & Ebinger subsp. *detinens* (Burch.) Kyal. & Boatwr., *Terminalia prunioides* M.A.Lawson, *Vachellia exuvialis* (I.Verd.) Kyal. & Boatwr., *V. grandicornuta* (Gerstner) Seigler & Ebinger, *Ximenia caffra* Sond. var. *caffra, Ziziphus mucronata* Willd. subsp. *mucronata*
Succulents	***Aloe burgersfortensis*** **Reynolds,** *Kalanchoe paniculata* Harv., *K. rotundifolia* (Haw.) Haw., *Kleinia longiflora* DC., *Opuntia ficus-indica* (L.) Mill.
Trees	***Balanites maughamii*** **Sprague,** *Combretum apiculatum* Sond. subsp. *apiculatum, C. erythrophyllum* (Burch.) Sond., *Dombeya rotundifolia* (Hochst.) Planch. var. *rotundifolia, Gardenia volkensii* K.Schum. subsp. volkensii var. *volkensii, Kirkia wilmsii* Engl., *Melia azedarach* L., *Morus alba* L., *Peltophorum africanum* Sond.l, *Populus* x *canescens* (Aiton) Sm., *Salix babylonica* L., ***Sclerocarya birrea*** **(A.Rich.) Hochst. subsp.** ***caffra*** **(Sond.) Kokwaro**, *S. nigrescens* (Oliv.) P.J.H.Hurter, *Vachellia nilotica* (L.) P.J.H.Hurter & Mabb. subsp. *kraussiana* (Benth.) Kyal. & Boatwr., *V. tortilis* (Forssk.) Gallaso & Banfi subsp. *heteracantha* (Burch.) Kyal. & Boatwr.




Figure 24: Collage of images of habitat conditions within Site 5

29 REVIEW OF THE PLANT SPECIES SENSITIVITY THEME

While the National Environmental Screening Report indicates an anticipated Medium Sensitivity for the plant species theme, with specific reference to plant taxa of conservation concern (refer Section 24), a review of habitat type and status indicated that none of the species are considered likely inhabitants of the proposed development areas. However, the presence of several other plant taxa of conservation concern has been established within the development footprints, which would naturally elevate the sensitivity of the receiving environment. Significant portions of the local area has been subjected to disruptive anthropogenic land uses that led to severe deterioration of the original habitat. A lower sensitivity is therefore considered appropriate and accurate for most of these areas, specifically in view of the proximity to commercial and industrial activities. Minor portions of natural woodland habitat exhibit high floristic integrity and status, notably portions that correspond to the Sekhukhune Mountain Bushveld; these areas are considered sensitive, and development should be allowed with circumspection.

Ultimately, the presence of numerous plant taxa of conservation importance and concern within the area, warrants a slight elevation of the Plant Species Theme Sensitivity to High, as opposed to Medium Sensitivity, although being cognisant of deterioration factors.

SECTION F: FAUNAL ATTRIBUTES OF THE SITES

Please note that the avifaunal component of the project has been addressed as a stand-alone assessment. This assessment therefore focuses specifically on the mammalian, amphibian, reptilian, and invertebrate disciplines.

30 TERMS OF REFERENCE FOR THE FAUNAL ASSESSMENT

The study aims to provide a description of the terrestrial fauna discipline of the area as delineated on the accompanying maps. The main objective of the study is to provide an overview of the faunal diversity and the potential occurrence of conservation important animal taxa. Specific tasks that were undertaken during the assessment included:

⇒ Identification of terrestrial faunal compositions on the study sites and their association with particular broad-scale habitats and in context of identified floristic communities;

⇒ Providing an evaluation of their importance and sensitivity, with particular reference to rare and/or threatened species;

⇒ Identification of habitat units or discrete habitat areas that are considered locally important for faunal species that are threatened or near-threatened (Red Data);

⇒ An evaluation of the importance of the site as foraging/ /breeding habitat for charismatic (iconic) animal species and large mammalian carnivores (such as Leopard *Panthera pardus*);

⇒ A brief examination of the ecological relationships/associations between recorded species and taxa, and the different habitat types in which they are found; and

⇒ An identification of any specific areas in the study site that may require special protective measures to avoid future degradation or environmental damage.

31 ANNOTATIONS ON THE NATIONAL WEB-BASED ENVIRONMENTAL SCREENING TOOL

The National Environmental Screening Report (2024/02/26) indicates a Medium Sensitivity for the Animal Species Theme for the site and immediate surrounds (refer **Figure 25**), with specific reference to the following species (excluding avifauna):

Medium Sensitivity:	Mammalia – *Crocidura maquassiensis*;
Medium Sensitivity:	Mammalia – *Dasymys robertsii*;
Medium Sensitivity:	Mammalia – *Lycaon pictus*;
Medium Sensitivity:	Reptilia – *Crocodylus niloticus*;
Medium Sensitivity:	Reptilia – *Kinixys lobatsiana*; and
Medium Sensitivity:	Inverterbrate – *Aroegas fuscus*.

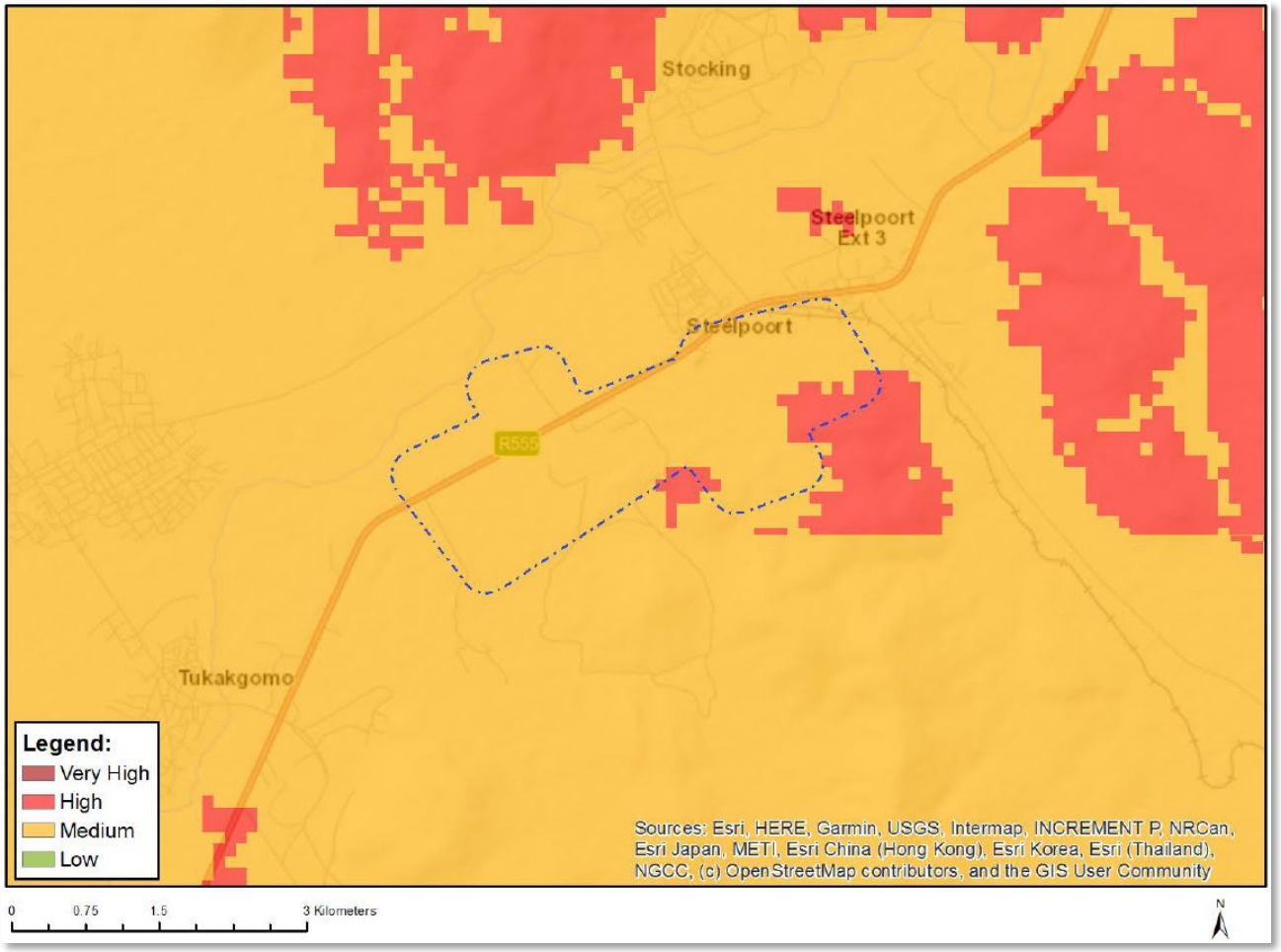


Figure 25: Animal species sensitivity of the wider study area

32 METHODS AND APPROACH

Faunal attributes in the study site were investigated by Lukas Niemand (Pr.Sci.Nat.) between 28th of April 2021 and 1st of May 2021 (Phase 1) with the objective to realistically evaluate the terrestrial faunal structure, diversity, and conservation value of the natural habitat units on the study area. Additional brief observations were made during Phase 2 by D Kamffer (Pr.Sci.Nat) on 12th and 13th February 2024, to augment species inventories.

32.1 SURVEYS, LITERATURE REVIEW AND DATABASE ACQUISITION

32.1.1 MAMMALS

⇒ The potential (expected) occurrence and conservation status of mammal taxa were based on the IUCN Red List (2021) and the national Red Data Book by Child et al. (2016), while mammalian nomenclature was informed by Stuart and Stuart (2015) and Child et al. (2016), unless otherwise indicated.

⇒ The historical and extant (contemporary) distribution ranges of mammal taxa sympatric to the study sites were sourced from MammalMap (c. 2430CA and bordering grids 2430CA, 2430CB, 2430CD and 2430CC; refer Figure 26);

⇒ The online dataset of iNaturalist, along with applicable field guides, in particular Stuart & Stuart (2015), Skinner & Chimimba (2005), Child et al. (2016) and Friedmann & Daly (2004) were consulted.

⇒ As a result of the accessibility of the proposed sites (to humans), only one camera was deployed at Site 3 (Phase 1) to detect nocturnal mammal taxa based on available cover[17]. Site 3 was the only site that is surrounded by a security fence structure (refer **Figure 27** and **Figure 28**); the locality of the trap was selected to minimise the risk of possible theft. Areas with human activities/presence were avoided to prevent possible tampering, theft, or damage to the traps.

⇒ Mammal scats and pellets were used to identify the presence of mammal taxa and to identify rodent taxa present in the study area. Scats and droppings were randomly acquired and identified during field surveys.

⇒ *Ad hoc* observations of all mammals observed during the survey were noted along with their geographic coordinates and habitat preference. Observations were obtained by means of driving, walking and active searching.

⇒ Particular attention was afforded to important dispersal or migratory routes and spoor within the study area or within the immediate region. These will invariably be relative to larger herbivores and carnivores.

⇒ It is extremely unlikely that all mammal species known to occur in the study area will be recorded during a brief baseline survey. An estimated 'Likelihood of Occurrence' review was therefore applied for the purpose of this assessment. A summary of expected and observed mammals, as well as those species of conservation concern are provided, with a simple probability of occurrence attached thereto.

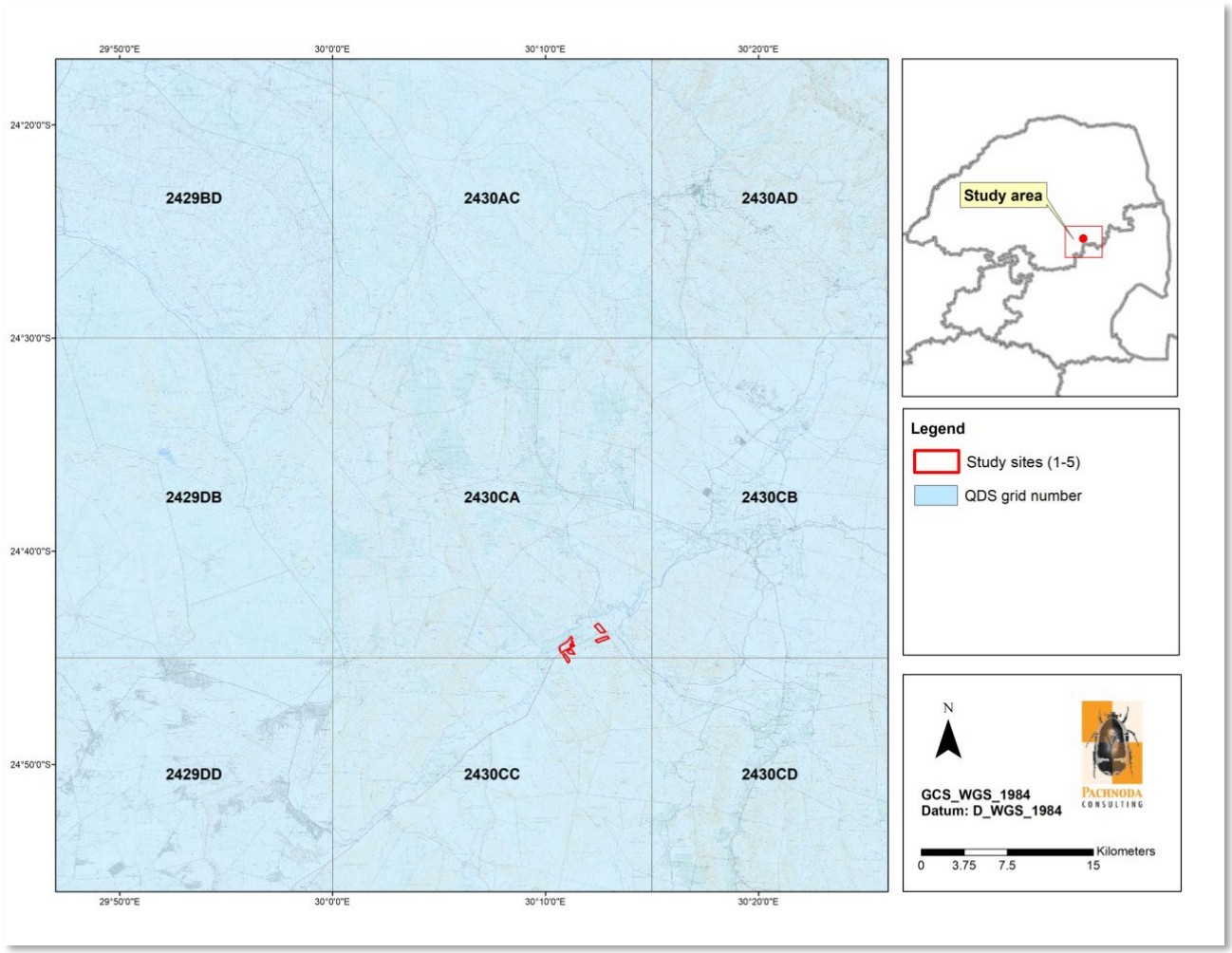


Figure 26: Quarter-degree grid squares (sensu ADU and SABAP1) relevant to the wider study area

[17] *The localities for camera trap deployment were dependent on dominant habitat, the probability for detecting nocturnal mammals and accessibility.*

Figure 27: Satellite image of the study area illustrating the spatial locality of a remote trail camera

Figure 28: An example of a remote trail camera deployed on Site 3

32.1.2 HERPETOFAUNA

⇒ Red List categories for reptile species were chosen according to the conservation assessment conducted by Bates et al. (2014).

⇒ Red List categories and listings of amphibian taxa follow Minter et al. (2004) and Measey (2010).

⇒ The distribution of reptile and amphibian species was verified against the ADU's database consisting of ReptileMap and FrogMap (c. QDS 2430CA, 2430CB, 2430CD and 2430CC; refer **Figure 26**) along with the online web-based database iNaturalist.

⇒ Possible burrows, or likely reptile habitat (termitaria, stumps, or rocks) were inspected for any inhabitants.

⇒ Amphibians were also identified by their vocalisations (if any) and through likely habitat types (e.g. water features, drainage lines, etc.).

⇒ The main approach used for the identification of reptile species involved direct searching techniques by turning rocks and logs.

32.1.3 INVERTEBRATE TAXA OF CONSERVATION CONCERN AND BUTTERFLIES

⇒ The occurrence of butterfly taxa was verified on areas comprising of suitable habitat by means of standard handnetting procedures and was verified by means of hand collecting and digital photography (using a digital camera with 'stacking' capabilities).

⇒ To determine the occurrence of threatened katydids (genera *Aroegas* species) following field techniques are typically advised:

- *Active searching*: Katydids (Tettigoniidae) may be sampled by means of active searching at night using a flashlight. This technique may be used from sunset to approximately 22h00, which proved to be the most successful method to detect and collect stridulating males of a similar species (c. *Arytropteris basalis*) from the vegetation canopy by hand.
- *Auditory searches*: Nocturnal auditory searches can be useful to locate katydid species (Tettigoniidae) and to capture individuals by hand. It proved to be a highly effective way to locate and capture a similar species (c. *Arytropteris basalis*).
- *Light trapping*: A simple light trap consisting of a battery operated (12V DC) ultraviolet fluorescent tube and a white fluorescent tube suspended in front of a white sheet can be useful to attract nocturnal katydids. Light trapping should be employed from sunset until 22h00. However, light trapping of flightless katydids are often unsuccessful, probably since most of the SCC katydids may need to travel long distances to reach the light trap.

⇒ The occurrence of threatened butterfly taxa (if applicable) was based on Woodhall (2005), while Mecenero et al. (2013) was consulted regarding their conservation status.

⇒ The SABCA database (c. LepiMap) provided a preliminary list of butterflies for the study area (QDS 2430CA, 2430CB, 2430CD and 2430CC, including bordering grids; see refer **Figure 26**).

⇒ The online web-based database iNaturalist was consulted.

⇒ The potential occurrence and conservation status of shieldback katydids (with specific reference to *Aroegas fuscus*) was sourced from Bazelet & Naskrecki (2014), Naskrecki (1996) and the online Orthoptera Species File (http://orthoptera.speciesfile.org/).

32.2 FAUNAL IMPORTANCE AND SENSITIVITY

The ecological sensitivity of any piece of land is based on its inherent ecosystem service (e.g. wetlands) and overall preservation of biodiversity. In addition, the sensitivity of any piece of land is a key consideration when identifying impacts.

32.2.1 ECOLOGICAL FUNCTIONALITY & CONNECTIVITY AND BIODIVERSITY IMPORTANCE

The extent to which a site is ecologically connected to surrounding areas is an important determinant of its sensitivity. Systems with a high degree of landscape connectivity amongst one another are perceived to be more sensitive and will be those contributing to better ecosystem service (e.g. wetlands) or overall preservation of biodiversity. Therefore, any environmental management plan must include mitigation measures to ensure that negative environmental impacts do not interfere with the natural ecological process of the area.

Biodiversity importance relates to species diversity, endemism (unique species or unique processes) and the high occurrence of threatened and protected species or ecosystems protected by legislation.

32.2.2 SENSITIVITY SCALE/ CATEGORIZATION

High	Sensitive ecosystems with either low inherent resistance or low resilience towards disturbance factors or highly dynamic systems considered being important for the maintenance of ecosystem integrity. Most of these systems represent ecosystems with high connectivity with other important ecological systems OR with high species diversity and usually provide suitable habitat for a number of threatened or rare species. These areas should be protected;
Moderate	These are slightly modified systems which occur along gradients of disturbances of low-medium intensity with some degree of connectivity with other ecological systems OR ecosystems with intermediate levels of species diversity but may include potential ephemeral habitat for threatened species; and
Low	Degraded and highly disturbed/transformed systems with little ecological function and are generally poor in species diversity (many species are exotic or weeds).

33 RESULTS & DISCUSSION

33.1 MAMMALS

33.1.1 TAXONOMIC OVERVIEW & DIVERSITY

According to the presence of suitable habitat and the extant (or known) distribution ranges of mammal taxa in the study area (sensu MammalMap, Child et al., 2016 and Stuart & Stuart, 2015), the expected mammal richness on the study sites and immediate surroundings is approximately 63 species (refer **Table 16**), of which only 10 species have so far been documented for QDS 2430CA which is sympatric to the majority of the study sites. It implies that the mammal richness on the study sites is poorly documented given the higher number of species that is anticipated.

Approximately 49 species (78 % of the expected richness) have a high probability to be present on the study sites (refer **Table 16**), of which 16 of these species (~33 % of species with a high probability of occurrence) were confirmed during the survey, include the following groups (refer **Table16** and **Figure 29**):

⇒ four (4) rodents;
⇒ four (4) bovid antelopes;
⇒ one (1) canid (jackals);
⇒ one (1) primate (monkeys and baboons);
⇒ one (1) herpestid (mongoose);
⇒ one (1) viverrid (genet);
⇒ one (1) leporid (hares and rabbits);
⇒ one (1) orycteropid (aardvark); and
⇒ two (2) suids (pigs).

One of the confirmed species (c. Southern Mountain Reedbuck *Redunca f. fulvorufula*) is endangered.

Thirty (30) mammal species are reasonably expected to be present with the sites and immediate areas. Furthermore, a total of five (5) species were confirmed during the surveys that have not been previously observed within the study area (sensu MammalMap), even though some of these species are considered to be widespread and relatively abundant within their respective distribution ranges. Furthermore, eleven (11) of the expected species indicates a moderate probability of occurrence (17.5 %), of which two species are considered to be regular in the area (c. Serval *Leptailurus serval* and Brown Hyaena *Parahyaena brunnea*), while three (3) of the expected species have a low probability of occurrence (5 %). The latter species (species with low probabilities of occurrence) either share distribution ranges peripheral to the study sites or optimal foraging and roosting habitat were absent, thereby rendering their presence on the site as uncertain or questionable. It is worth mentioning that the Leopard (*Panthera pardalis*) could be an occasional foraging visitor to the study area given the high number of MammalMap records for the QDS sympatric to the study area, although it is believed that most of these records stem from remote mountainous areas north and south of the study area.

During the baseline survey it became evident that large bodied species were rare on the study sites, which is attributed to the intensity of human and industrial activities, the presence of nearby settlements and a high degree of fragmentation (dispersal barriers) in the area and high disturbance factors, such as mining activities. Areas, e.g. the southern parts of Site 2B, that exhibit a high connectivity to large expanses of natural woodland areas, will occasionally be occupied by a slightly higher diversity of mammal species, with particular reference to large bodied species.

Table 16: An inventory of mammalian taxa predicted to occur on the study sites (and immediate surroundings)
based on the presence of suitable habitat and with known distribution ranges sympatric to the site (sensu MammalMap and professional judgement)
**- sensu Child et al (2016)*

Family	*Scientific name*	*Common name*	*Conservation Status**	*Probability of Occurrence*
Bathyergidae	***Cryptomys cf. pretoriae (=hottentotus)***	**Highveld Mole-rat**	**Least Concern**	**High (confirmed)**
Bovidae	*Aepyceros melampus*	Impala	Least Concern	Moderate
Bovidae	***Redunca fulvorufula***	**Mountain Reedbuck**	**Endangered**	**High (confirmed)**
Bovidae	***Raphicerus campestris***	**Steenbok**	**Least Concern**	**High (confirmed)**
Bovidae	***Sylvicapra grimmia***	**Common Duiker**	**Least Concern**	**High (confirmed)**
Bovidae	*Tragelaphus scriptus*	Bushbuck	Least Concern	High
Bovidae	***Tragelaphus strepsiceros***	**Greater Kudu**	**Least Concern**	**High (confirmed)**
Canidae	***Canis mesomelas***	**Black-backed Jackal**	**Least Concern**	**High (confirmed)**
Cercopithecidae	***Chlorocebus pygerythrus***	**Vervet Monkey**	**Least Concern**	**High (confirmed)**
Cercopithecidae	*Papio ursinus*	Chacma Baboon	Least Concern	High
Emballonuridae	*Taphozous perforatus*	Egyptian Tomb Bat	Least Concern	High
Felidae	*Caracal caracal*	Caracal	Least Concern	Moderate
Felidae	*Felis sylvestris cafra*	African Wild Cat	Least Concern	Moderate
Felidae	*Leptailurus serval*	Serval	Near Threatened	Moderate
Felidae	*Panthera pardus*	Leopard	Vulnerable	Low-Moderate
Galagidae	*Galago moholi*	Southern Lesser Galago	Least Concern	High
Galagidae	*Otolemur crassicaudatus*	Thick-tailed Galago	Least Concern	Moderate
Gliridae	*Graphiurus (Graphiurus) platyops*	Rock Dormouse	Least Concern	Low
Herpestidae	*Atilax paludinosus*	Marsh Mongoose	Least Concern	High
Herpestidae	*Helogale parvula*	Dwarf Mongoose	Least Concern	Moderate
Herpestidae	***Herpestes sanguineus***	**Slender Mongoose**	**Least Concern**	**High (confirmed)**
Herpestidae	*Ichneumia albicauda*	White-tailed Mongoose	Least Concern	High
Herpestidae	*Mungos mungo*	Banded Mongoose	Least Concern	High
Hyaenidae	*Parahyaena brunnea*	Brown Hyena	Near Threatened	Moderate-High
Hystricidae	***Hystrix africaeaustralis***	**Cape Porcupine**	**Least Concern**	**High (confirmed)**
Leporidae	***Lepus victoriae (=saxatilis)***	**African Savanna Hare**	**Least Concern**	**High (confirmed)**
Macroscelididae	*Elephantulus brachyrhynchus*	Short-snouted Sengi	Least Concern	Moderate
Miniopteridae	*Miniopterus natalensis*	Natal Long-fingered Bat	Least Concern	High
Molossidae	*Tadarida aegyptiaca*	Egyptian Free-tailed Bat	Least Concern	High
Muridae	*Aethomys ineptus*	Tete Veld Rat	Least Concern	High
Muridae	*Dendromus melanotis*	Grey Climbing Mouse	Least Concern	High
Muridae	*Dendromus mystacalis*	Chestnut Climbing Mouse	Least Concern	High
Muridae	***Gerbilliscus cf. leucogaster***	**Bushveld Gerbil**	**Least Concern**	**High (confirmed)**
Muridae	*Lemniscomys rosalia*	Single-striped Grass Mouse	Least Concern	High
Muridae	*Mastomys sp.*	Multimammate Mice	Least Concern	High
Muridae	*Mus minutoides*	Pygmy Mouse	Least Concern	High
Muridae	***Otomys angoniensis***	**Vlei Rat**	**Least Concern**	**High (confirmed)**
Muridae	*Otomys auratus*	Southern African Vlei Rat (Grassland type)	Near Threatened	Moderate-low
Muridae	*Rhabdomys pumilio*	Four-striped Grass Mouse	Least Concern	High
Muridae	*Saccostomus campestris*	Pouched Mouse	Least Concern	High
Muridae	*Steatomys pratensis*	Fat Mouse	Least Concern	High
Muridae	*Thallomys paedulcus*	Acacia Rat	Least Concern	High
Mustelidae	*Aonyx capensis*	Cape Clawless Otter	Near Threatened	Low
Mustelidae	*Ictonyx striatus*	Striped Polecat	Least Concern	High
Mustelidae	*Mellivora capensis*	Honey Badger	Least Concern	High
Myoxidae	*Graphiurus murinus*	Woodland Dormouse	Least Concern	Moderate
Orycteropodidae	***Orycteropus afer***	**Aardvark**	**Least Concern**	**High (confirmed)**
Pedetidae	*Pedetes capensis*	Southern African Springhare	Least Concern	High
Pteropodidae	*Epomophorus wahlbergi*	Wahlberg's Epauletted Fruit Bat	Least Concern	High
Rhinolophidae	*Rhinolophus cohenae*	Cohen's Horseshoe Bat	Vulnerable	Low
Sciuridae	*Paraxerus cepapi*	Tree Squirrel	Least Concern	High
Soricidae	*Crocidura cyanea*	Reddish-grey Musk Shrew	Least Concern	High
Soricidae	*Crocidura hirta*	Lesser Red Musk Shrew	Least Concern	High
Soricidae	*Myosorex various*	Forest Shrew	Least Concern	High

Table 16: An inventory of mammalian taxa predicted to occur on the study sites (and immediate surroundings)
based on the presence of suitable habitat and with known distribution ranges sympatric to the site (sensu MammalMap and professional judgement)
**- sensu Child et al (2016)*

Family	*Scientific name*	*Common name*	*Conservation Status**	*Probability of Occurrence*
Suidae	***Phacochoerus africanus***	**Common Warthog**	**Least Concern**	**High (confirmed)**
Suidae	***Potamochoerus larvatus koiropotamus***	**Bushpig**	**Least Concern**	**High (confirmed)**
Thryonomyidae	*Thryonomys swinderianus*	Greater Cane-rat	Least Concern	High
Vespertilionidae	*Myotis welwitschii*	Welwitsch's Hairy Bat	Least Concern	High
Vespertilionidae	*Neoromicia capensis*	Cape Serotine Bat	Least Concern	High
Vespertilionidae	*Scotophilus dinganii*	Yellow-bellied House Bat	Least Concern	High
Viverridae	*Civettictis civetta*	African Civet	Least Concern	High
Viverridae	*Genetta genetta*	Small-spotted Genet	Least Concern	High
Viverridae	***Genetta maculata***	**Common Large-spotted Genet**	**Least Concern**	**High (confirmed)**

Table 17: An inventory of observed mammalian taxa recorded on the study sites during the April-May 2021 and February 2024 site visits
**- sensu Child et al (2016)*

Family	*Scientific name*	*Common name*	*Conservation Status**	*Observed indicators*
Bathyergidae	*Cryptomys cf. pretoriae (=hottentotus)*	Highveld Mole-rat	Least Concern	Soil heaps
Bovidae	*Redunca fulvorufula*	Mountain Reedbuck	Endangered	Droppings
Bovidae	*Raphicerus campestris*	Steenbok	Least Concern	Visual sightings & droppings
Bovidae	*Sylvicapra grimmia*	Common Duiker	Least Concern	Visual sightings & droppings
Bovidae	*Tragelaphus strepsiceros*	Greater Kudu	Least Concern	Tracks and droppings
Canidae	*Canis mesomelas*	Black-backed Jackal	Least Concern	Scats & spoor
Cercopithecidae	*Chlorocebus pygerythrus*	Vervet Monkey	Least Concern	Visual sightings
Herpestidae	*Herpestes sanguineus*	Slender Mongoose	Least Concern	Visual sightings
Hystricidae	*Hystrix africaeaustralis*	Cape Porcupine	Least Concern	Quills& diggings
Leporidae	*Lepus victoriae (=saxatilis)*	African Savanna Hare	Least Concern	Visual sightings & droppings
Muridae	*Gerbilliscus cf. leucogaster*	Bushveld Gerbil	Least Concern	Burrows
Muridae	*Otomys angoniensis*	Vlei Rat	Least Concern	Grass clippings
Orycteropodidae	*Orycteropus afer*	Aardvark	Least Concern	Burrows (dens)
Suidae	*Phacochoerus africanus*	Common Warthog	Least Concern	Visual sightings
Suidae	*Potamochoerus larvatus koiropotamus*	Bushpig	Least Concern	Spoor & diggings
Viverridae	*Genetta maculata*	Common Large-spotted Genet	Least Concern	Spoor


African Savanna Hare (*Lepus victoriae*)


Common Duiker (*Sylvicapra grimmia*)

Aardvark (*Orycteropus afer*) diggings (with tail imprint)

Highveld Mole-rat (*Cryptomys cf. pretoriae*)

Domestic Cat (*Felis cf. catus*)

Vlei Rat (*Otomys cf. angoniensis*)

Mountain Reedbuck (*Redunca cf. fulvorufula*)

Greater Kudu (*Tragelaphus strepsiceros*)

Figure 29: Examples of observed mammal indicators

33.1.2 BIODIVERSITY VALUE AND ECOLOGICAL CONSIDERATIONS

The following key observations were made:

⇒ It is evident that the mammal richness on the study area is relatively poor, which is best explained by the high degree of industrial and human-induced activities in the area as well as habitat fragmentation and poor connectivity.

⇒ Domestic cats (*Felis catus*) are prevalent on the study area and may pose an eminent threat to the extant small vertebrate fauna within the wider area. The occurrence of domestic cats may also result in genetic contamination of the indigenous feline population, in particular the African Wild Cat (*F. sylvestris*), due to inbreeding.

⇒ The relative ruggedness and high spatial heterogeneity along with the presence of surface outcrops north of the Steelpoort River (further to the north of the study areas) and immediately east and south of Site 2B provide micro-habitat for small mammal taxa with rupicolous affinities as well as large mammal taxa with large home range sizes.

⇒ These habitat features provide occasional foraging habitat for large charismatic carnivores and scavenging (c. Leopard *P. pardus* and Brown Hyaena *P. brunnea*), which also provides suitable habitat for threatened taxa and an overlooked sub-population of Southern Mountain Reedbuck (*Redunca f. fulvorufula*).

33.1.3 THREATENED AND NEAR-THREATENED MAMMAL TAXA

Three regionally threatened and four near threatened mammal species are known to be present in the wider study region (sensu MammalMap; Child et al., 2016) (refer Table 16). Two (2) of these species exhibit a high or moderate-high probability of occurrence within the study areas, of which one species was confirmed during previous surveys (2021).

Brown Hyaena (*Parahyaena brunnea*):

The Brown Hyaena is listed as near threatened on the global IUCN Red List (Wiesel et al., 2008) since it requires extensive areas (sometimes in excess of 1,000 km^2) to maintain a viable population, especially where inter-specific competition for resources is fierce with other predator taxa. Such massive home ranges often coincide with livestock and agricultural areas where they are heavily persecuted by farmers. These persecution impacts and the loss of habitat due to agricultural intensification are some of the primary threats to this species.

It is regarded as a regular foraging visitor to all the study sites (apart from Site 5B), and is probably overlooked due to its secretive habitat. Although it was not observed on the study area during the survey periods, it has a moderate to high likelihood of occurrence. This species could utilise virtually every (natural) habitat type on the study area due to its opportunistic behaviour. The Brown Hyaena has also been recorded from habitat corresponding to the wider study area (c. 63 records from four bordering QDS grids) (sensu MammalMap).

Southern Mountain Reedbuck (*Redunca f. fulvorufula*):

The Mountain Reedbuck population in South Africa experienced a drastic decline as a result of habitat fragmentation and genetic bottlenecks, which spurred the recent dramatic upgrade of its conservation status from least concern to endangered (Taylor et al., 2016a). This species prefers mountainous and hilly habitat dominated by grassland, with a preference for rocky grassland and savannoid grassland types.

The presence of Mountain Reedbuck in the study area and local surrounds was confirmed during the 2021 survey (refer Figure 30) from variable open woodland on rocky soils corresponding to an area adjacent to Site 2B. It was evident that the open rocky woodland provides extensive habitat for this species, and it is anticipated that the proposed construction activities could result in the displacement of this species from the wider study are (away from Site 2B), although this could be interpreted as a minor loss (in terms of size) of habitat in the context of extensive areas of natural and similar habitat to the south of the development.

Nonetheless, the southern parts of Site 2B is considered optimal habitat for this species; this area also exhibits high connectivity to natural and pristine habitat where low disturbance factors can be noted further south of the site. The presence of this species within comparative close proximity to human activities demonstrates their presence in the wider region.

Figure 30: Satellite imagery illustrating evidence of the endangered Southern Mountain Reedbuck (*Redunca f. fulvorufula*) adjacent to the study area

* *Observation by Pachnoda (2021)*

33.1.4 NOTES REGARDING OTHER THREATENED AND NEAR-THREATENED SPECIES

Leopard (*Panthera pardus*):

Although occurring widespread and being notoriously adaptable, Leopard is listed as vulnerable (Child et al., 2016). The global population estimate for *P. pardus* is unknown or very unreliable, which is responsible for its placement in a threatened category. Furthermore, increased competition for space along with frequent human encounters (near human settlements) has seriously reduced the global number of subpopulations.

Leopard is regarded as a likely and occasional foraging visitor to the study area, based on the high number of observations of this species in the past, which include six records corresponding to the QDG that is sympatric to the study area, and 78 records from the wider study area. Although invariably displaced from the study area due to the high frequency of human activities, the high rural setting north of the study area (e.g. Leolo Mountains) and the tall ranks riparian vegetation along the Steelpoort River renders a low-moderate probability for this species to occur.

Cohen's Horseshoe Bat (*Rhinolophus cohenae*):

This species was only recently described (c. 2012) as a formal species where it was initially part of the *R. hildebrandtii* complex (Cohen et al., 2016). The total population is inferred to be less than 1,000 individuals with ~40 individuals being the highest number counted at a single locality (at an old mine adit), thereby placing this species in the vulnerable category. It is known to occur along the Mpumalanga escarpment from Mariepskop to Barberton but was also known to be present within the wider study area on QDS 2430CD where it is confined to higher-lying mountains terrain with outcrops and sheetrock habitat (refer **Figure 32**). Due to the absence of suitable roosting and breeding habitat on the study site, the probability that this species could be present on the study area is low.

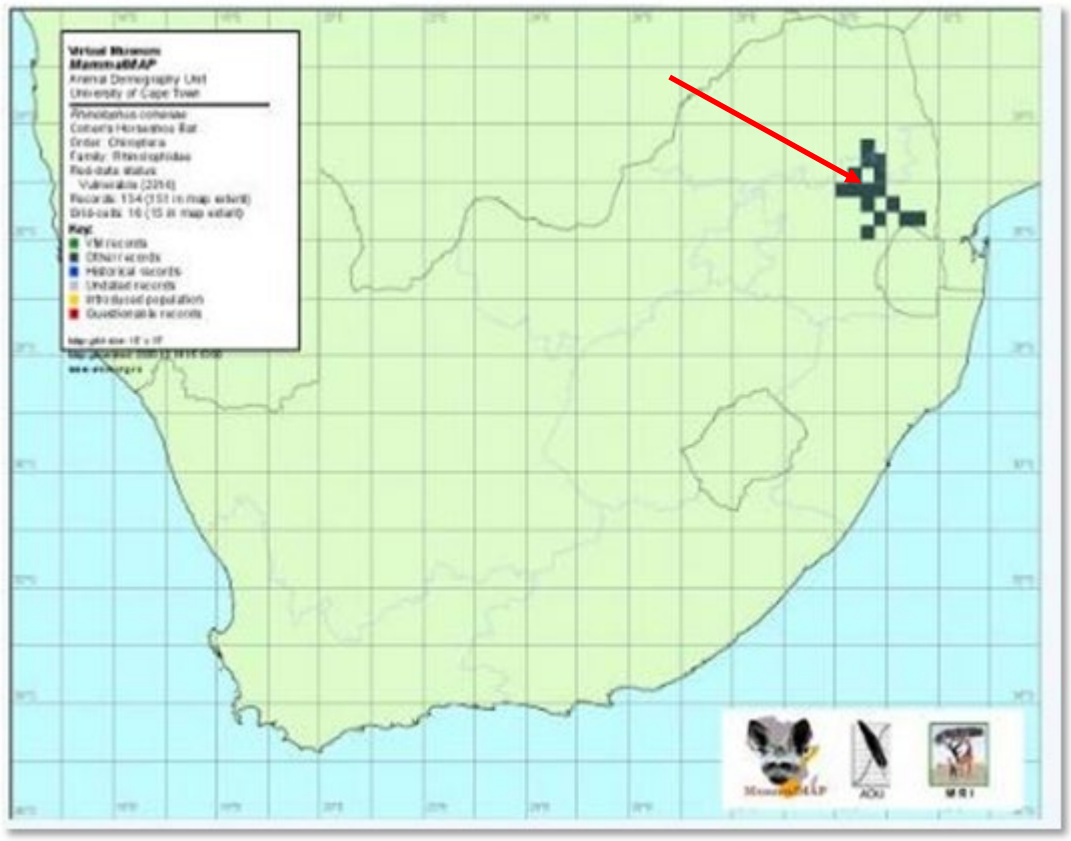


Figure 31: The extant (known) distribution of the vulnerable Cohen's Horseshoe Bat (*Rhinolophus cohenae*) in relation to the study area (see arrow)

Highveld Vlei Rat (*Otomys auratus*):

This species was previously included in the *O. irroratus* group, although recent molecular studies showed that it is in fact a valid species that is closely associated with the Grassland Biome. *O. auratus* is a seemingly widespread rodent confined to moist grassland and the verges of high altitude vleis (mainly within the Grassland Biome), where it feeds voraciously on members of the Cyperaceae and other grasses, thereby leaving behind distinct runways littered by piles of discarded grass clippings. Although widespread, it has declined regionally owing to the loss of habitat and wetland deterioration, especially through climate change, overgrazing and agricultural intensification (Child et al., 2016). Its habitat is becoming increasingly isolated and fragmented which constrain dispersal. The latter is eminent through climate change (which is also accelerated through anthropogenic activities) where it appears that increased modification of grassland into thicket and woodland habitat at higher altitudes (e.g. proliferation by *Seriphium plumosum* shrubland) is responsible for the colonization of *Otomys angoniensis* and displacement of *O. auratus*. It is however considered to be uncommon to rare on the study area, where it could occur within the rank grassland (part of the tall closed riparian thickets) along the Steelpoort River. It is only known from two old records corresponding to the wider study area (sensu MammalMap).

33.1.5 NOTES REGARDING MAMMAL SPECIES LISTED BY THE ENVIRONMENTAL SCREENING REPORT

Results of a screening report as per the outcome of the Environmental Screening Tool (2024/02/26) produced a medium sensitivity for the animal species theme on the study area, with reference to the potential occurrence of the following species:

Robert's Marsh Rat (*Dasymys robertsii*):

There are no recent records or observations of Robert's Marsh Rat (*Dasymys robertsii*) from the study area (sensu MammalMap). The Robert's Marsh Rat (*Dasymys robertsii*) is listed as regionally vulnerable (sensu Child et al., 2016), although Taylor (1998) stated that it is probably not as rare as previously thought, at least within KwaZulu-Natal where

the KZN population is considered form part of the genetically distinct species *D.* cf *incomtus*. Marsh rats have been recorded in a wide variety of habitat types, although it prefers well-vegetated wetland habitat. Skinner and Smithers (1990) also reported that they also utilise reedbeds along rivers and streams. It is therefore possible that this species was previously overlooked based on its shy and elusive habits and life history traits which explains its ominous absence from many parts of South Africa. However, the tall rank grassland and *Phragmites* reedbeds along the Steelpoort River could provide suitable habitat for this species to occur, but no habitat is considered particularly suitable from Phase 2 areas.

Maquassie Musk Shrew (*Crocidura maquassiensis*):

The occurrence of the endangered African Wild Dog (*Lycaon pictus*) on the study sites are regarded as unlikely and highly opportunistic (vagrant). It has not been observed in recent times on the wider area, and considering the high number of human settlements in the area, it is more likely to be displaced from the study area, although suitable habitat is present in the more remote areas to north and south of the study area/ Steelpoort town region. The sub-population in the wider area probably stems from a free-roaming wild population that occurs in parts of the Limpopo Province (Davies-Mostert et al., 2016).

African Wild Dog (*Lycaon pictus*):

The occurrence of the vulnerable Maquassie Musk Shrew (*Crocidura maquassiensis*) on the study area could not be determined since it was not possible to deploy live small mammal traps in the area due to the risk of theft. However, there are no recent or historical collection records of this species from the study area or the wider surrounds (Taylor et al, 2016b), thereby rendering the occurrence of this species on the study area as low and highly unlikely. However, since this species exhibits a strong correlation to moist and rocky grassland (mainly in montane grassland), it is highly recommended that all drainage lines and the riparian zone along the Steelpoort be preserved (along with appropriate buffer zones as recommended by the aquatic/wetland specialists).

33.2 REPTILES

33.2.1 TAXONOMIC OVERVIEW & DIVERSITY

The reptile composition on the study site is poorly known with only 23 species currently known from the wider area (c. QDS 2430AC, sensu ReptileMap, including personal observations) (refer Table 18). The expected reptile richness is underestimated for the study sites (and surrounds), and predicted that the richness could be as high as 54 species (refer Table 18). However, reptiles remained to be rather uncommon on the respective study sites with Leopard Tortoise (*Stigmochelys pardalis*), Southern Tree Agama (*Acanthocercus atricollis*), Distant's Ground Agama (*Agama aculeata distanti*), Striped Skink (*Trachylepis striata*), Water Monitor (*Varanus niloticus*) and Variable Skink (*Trachylepis varia*) being prominent. The absence of prominent rock outcrops and sheetrock excludes the occurrence of obligatory taxa pertaining to the genera *Platysaurus, Smaug* and *Cordylus*, which could potentially inhabit mountainous parts of Site 2B.

Table 18: An inventory of reptile taxa that are sympatric to the study area (sensu ReptileMap) (inclusive of personal observations)

Family	*Scientific name*	*Common name*	*Conservation Status*	*Probability of occurrence*
Agamidae	*Acanthocercus atricollis*	Southern Tree Agama	Least Concern	High
	Agama aculeata distanti	Distant's Ground Agama	Least Concern	High
	Agama atra	Southern Rock Agama	Least Concern	High
Chamaeleonidae	*Chamaeleo dilepis*	Common Flap-neck Chameleon	Least Concern	High
Colubridae	*Dasypeltis scabra*	Rhombic Egg-eater	Least Concern	High
	Philothamnus semivariegatus	Spotted Bush Snake	Least Concern	High
	Telescopus semiannulatus semiannulatus	Eastern Tiger Snake	Least Concern	High
Elapidae	*Dendroaspis polylepis*	Black Mamba	Least Concern	High
	Naja mossambica	Mozambique Spitting Cobra	Least Concern	High

Table 18: An inventory of reptile taxa that are sympatric to the study area (sensu ReptileMap) (inclusive of personal observations)

Family	*Scientific name*	*Common name*	*Conservation Status*	*Probability of occurrence*
Gekkonidae	*Afroedura leoloensis*	Sekhukhuneland Flat Gecko	No evaluated	Low
	Chondrodactylus turneri	Turner's Gecko	Least Concern	High
	Hemidactylus mabouia	Common Tropical House Gecko	Least Concern	High
	Homopholis wahlbergii	Wahlberg's Velvet Gecko	Least Concern	Moderate
	Lygodactylus capensis	Common Dwarf Gecko	Least Concern	High
	Lygodactylus nigropunctatus	Black-spotted Dwarf Gecko	Least Concern	High
	Pachydactylus affinis	Transvaal Gecko	Least Concern	High
	Pachydactylus vansoni	Van Son's Gecko	Least Concern	Moderate
Gerrhosauridae	*Gerrhosaurus flavigularis*	Yellow-throated Plated Lizard	Least Concern	High
Lacertidae	*Heliobolus lugubris*	Bushveld Lizard	Least Concern	Moderate
	Meroles squamulosus	Common Rough-scaled Lizard	Least Concern	High
	Nucras holubi	Holub's Sandveld Lizard	Least Concern	High
	Nucras ornata	Ornate Sandveld Lizard	Least Concern	Moderate
Lamprophiidae	*Aparallactus capensis*	Black-headed Centipede-eater	Least Concern	High
	Atractaspis bibronii	Bibron's Stiletto Snake	Least Concern	High
	Boaedon capensis	Brown House Snake	Least Concern	High
	Lamprophis guttatus	Spotted House Snake	Least Concern	
	Psammophis brevirostris	Short-snouted Grass Snake	Least Concern	High
	Psammophis crucifer	Cross-marked Grass Snake	Least Concern	Low
	Psammophis mossambicus	Olive Grass Snake	Least Concern	Moderate
	Psammophis subtaeniatus	Western Yellow-bellied Sand Snake	Least Concern	High
	Psammophis trinasalis	Fork-marked Sand Snake	Least Concern	High
	Psammophylax rhombeatus	Spotted Grass Snake	Least Concern	Moderate
	Psammophylax tritaeniatus	Striped Grass Snake	Least Concern	Moderate
Leptotyphlopidae	*Leptotyphlops jacobseni*	Jacobsen's Thread Snake	Least Concern	High
	Leptotyphlops scutifrons conjunctus	Eastern Thread Snake		High
Pelomedusidae	*Pelomedusa subrufa*	Central Marsh Terrapin	Least Concern	High
Pythonidae	*Python natalensis*	Southern African Python	Least Concern	Moderate-High
Scincidae	*Mochlus sundevallii*	Sundevall's Writhing Skink	Least Concern	High
	Panaspis maculicollis	Spotted-neck Snake-eyed Skink	Least Concern	High
	Panaspis wahlbergii	Wahlberg's Snake-eyed Skink	Least Concern	High
	Trachylepis capensis	Cape Skink	Least Concern	Moderate
	Trachylepis margaritifera	Rainbow Skink	Least Concern	High
	Trachylepis sp. (Transvaal varia)	Skink sp. 1	Not evaluated	Status uncertain
	Trachylepis striata	Striped Skink	Least Concern	High
	Trachylepis varia sensu lato	Common Variable Skink Complex	Least Concern	High
Testudinidae	*Kinixys lobatsiana*	Lobatse Hinged Tortoise	Vulnerable	Moderate
	Stigmochelys pardalis	Leopard Tortoise	Least Concern	High
Typhlopidae	*Afrotyphlops bibronii*	Bibron's Blind Snake	Least Concern	High
	Rhinotyphlops lalandei	Delalande's Beaked Blind Snake	Least Concern	Moderate
Varanidae	*Varanus albigularis albigularis*	Rock Monitor	Least Concern	High
	Varanus niloticus	Water Monitor	Least Concern	High
Viperidae	*Bitis arietans arietans*	Puff Adder	Least Concern	High
	Causus defilippii	Snouted Night Adder	Least Concern	Moderate
	Causus rhombeatus	Rhombic Night Adder	Least Concern	High

33.2.2 NOTES REGARDING THREATENED AND NEAR THREATENED REPTILE SPECIES LISTED BY THE ENVIRONMENTAL SCREENING REPORT

The Environmental Screening Report (2024/02/26) highlighted the potential presence of Nile Crocodile (*Crocodylus niloticus*) and Lobatse Hinged Tortoise (*Kinixys lobatsiana*) as potential inhabitants for the local region.

Nile Crocodile (*Crocodylus niloticus*):

Although categorised as Least Concern (IUCN, 2021), it is considered a species of concern in the National Environmental Screening Report. This species would be confined to the Steelpoort River and immediate terrestrial surrounds, and because it is a highly opportunistic species, is considered possible, although unlikely, to persist within the Steelpoort River. It is widely distributed across South Africa, with strong, documented populations in many countries in eastern and southern Africa. A low likelihood of occurrence for Phase 2 areas is ascribed to this species.

Hinged Tortoise (*Kinixys lobatsiana*)

This species is considered a likely inhabitant of, particularly, the variable open woodland on rocky slopes confined to the southern parts of Site 2B and along certain sites where surface outcrops are prominent (mainly variable open woodland along some of the larger drainage lines). This species is categorised as Vulnerable since most of its global distribution corresponds to the Limpopo Province of which already 15 % of previously suitable habitat is currently developed or degraded (Hofmeyr and Boycott, 2018). The remaining 85 % of similar habitat occurs in Kruger National Park, where this species does not occur. It also occurs in hills and rocky grassland in Gauteng northwards to the south of the Soutpansberg and is strongly associated with outcrops and hills, which often results in fragmented subpopulations due to plain and valley habitat, which are often degraded or transformed. It is threatened by habitat transformation (e.g., urbanisation, agriculture, and mining) along with inappropriate veld management (many are killed during veld fires). In addition, it is invariably collected as food and for cultural purposes which may result in local extinctions (Mifsud and Stapleton, 2014).

33.1 AMPHIBIANS

33.1.1 TAXONOMIC OVERVIEW & DIVERSITY

The amphibian richness on the study area is considered low, with 14 frog species known to occur in the wider region. Only six of these exhibit a moderate probability of occurrence on the study Phase 2 sites (refer Table 19), which generally relates to the periodic inundation of the non-perennial drainage lines that are situated in close proximity to the sites.

Table 19: An inventory of frog taxa predicted to occur on the study area (and immediate surroundings)
Based on the presence of suitable habitat and with known distribution ranges sympatric to the sites (sensu FrogMap and professional judgement)

Family	*Scientific name*	*Common name*	*Conservation Status*	*Probability of occurrence*
Brevicepitidae	*Breviceps adspersus*	Bushveld Rain Frog	Least Concern	Moderate
Bufonidae	*Schismaderma carens*	Red Toad	Least Concern	Moderate
Bufonidae	*Sclerophrys capensis*	Raucous Toad	Least Concern	Moderate
Bufonidae	*Sclerophrys gutturalis*	Guttural Toad	Least Concern	Moderate
Bufonidae	*Sclerophrys pusilla*	Flatbacked Toad	Least Concern	Low
Hyperoliidae	*Hyperolius marmoratus*	Painted Reed Frog	Least Concern	Low
Hyperoliidae	*Kassina senegalensis*	Bubbling Kassina	Least Concern	Low
Phrynobatrachidae	*Phrynobatrachus natalensis*	Snoring Puddle Frog	Least Concern	Low
Pipidae	*Xenopus laevis*	Common Platanna	Least Concern	Low
Ptychadenidae	*Ptychadena anchietae*	Plain Grass Frog	Least Concern	Low
Ptychadenidae	*Ptychadena mossambica*	Broadbanded Grass Frog	Least Concern	Low
Pyxicephalidae	*Amietia delalandii*	Delalande's River Frog	Least Concern	Low
Pyxicephalidae	*Strongylopus grayii*	Clicking Stream Frog	Least Concern	Moderate
Pyxicephalidae	*Tomopterna natalensis*	Natal Sand Frog	Least Concern	Moderate

33.1.2 THREATENED AND NEAR THREATENED FROG SPECIES

No frog species of conservation concern is expected to be present on the study area.

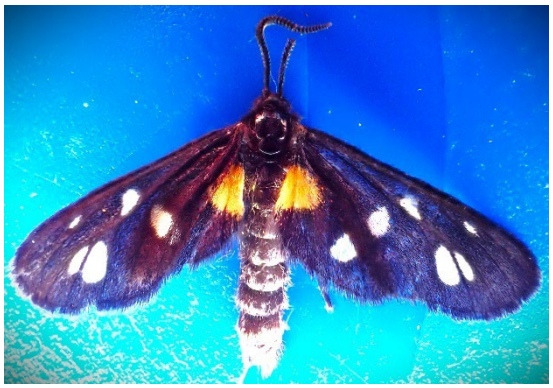
33.2 INVERTEBRATES

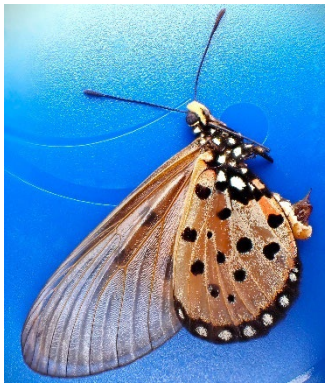
33.2.1 BUTTERFLIES AND INVERTEBRATES

No invertebrate species of conservation concern have been recorded from the study area, or are considered likely to occur. Table 20 provides a list of species that were recorded during the February 2024 survey, with photographic images presented of some invertebrate species in Table 21. It should be noted that this list was compiled from brief observations within the study areas and not from detailed survey methods such as pitfall traps, sweepnetting, nocturnal light traps, etc. The invertebrate diversity of the area is therefore considered to be much higher than indicated in these results.

Table 20: List of invertebrate species recorded within the study area during February 2024

Order	*Family*	*Binomial*	*English*
Araneae	Araneidae	*Argiope lobata*	Black-lobed Garden Orb-web Spider
Coleoptera	Buprestidae	*Amblysterna natalensis*	Jewel Beetle
	Coccinellidae	*Cheilomenes lunata*	Lunate Ladybird
	Coccinellidae	*Exochomus flavipes*	Black Mealybug Predator
	Meloidae	*Mylabris oculata*	CMR Beetle
Hymenoptera	Apidae	*Apis mellifera scutellata*	East African Lowland Honey Bee
	Apidae	*Xylocopa caffra*	Carpenter Bee
Lepidoptera	Erebidae	*Asinusca atricornis*	Orange-spot Maiden
	Lycaenidae	*Acraea neobule neobule*	Wandering Donkey Acraea
	Lycaenidae	*Lepidochrysops patricia*	Patrician Giant Cupid
	Lycaenidae	*Zizula hylax*	Gaika Blue
	Nymphalidae	*Acraea aglaonice*	Clear-spotted Acraea
	Nymphalidae	*Byblia ilithyia*	Spotted Joker
	Nymphalidae	*Danaus chrysippus*	African Plain Tiger
	Nymphalidae	*Hamanumida daedalus*	Guineafowl
	Nymphalidae	*Hypolimnas misippus*	Common Diadem
	Nymphalidae	*Junonia hierta cebrene*	Yellow Pansy
	Nymphalidae	*Junonia orithya madagascariensis*	African Blue Pansy
	Nymphalidae	*Vanessa cardui*	Painted Lady
	Papilionidae	*Papilio demodocus demodocus*	Citrus Swallowtail
	Papilionidae	*Papilio nireus lyaeus*	Narrow Green-banded Swallowtail
	Pieridae	*Belenois aurota*	Pioneer Caper White
	Pieridae	*Catopsilla florella*	African Migrant
	Pieridae	*Colotis evagore antigone*	Small Orange Tip
	Pieridae	*Colotis evenina evenina*	African Orange Tip
	Pieridae	*Colotis pallene*	Bushveld Orange Tip
	Pieridae	*Eurema brigitta brigitta*	Broad-bordered Grass Yellow
	Pieridae	*Pinacopteryx eriphia eriphia*	Zebra White
Odonata	Libellulidae	*Palpopleura lucia*	Lucia Widow
	Libellulidae	*Pantala flavescens*	Wandering Glider

Table 21: Photographic images of invertebrate species recorded from the study sites during February 2024	
Name	*Images*
Argiope lobata Black-lobed Garden Orb-web Spider*	
Amblysterna natalensis Jewel Beetle*	  
Asinusca atricornis Orange-spot Maiden*	

Acraea neobule neobule Wandering Donkey Acraea	
Lepidochrysops patricia Patrician Giant Cupid*	 
Zizula hylax Gaika Blue*	
Acraea aglaonice Clear-spotted Acraea*	

Byblia ilithyia Spotted Joker*	 
Junonia orithya madagascariensis African Blue Pansy	
Catopsilla florella African Migrant	
Colotis evenina evenina African Orange Tip*	 

** Photocredits Mr. D Kamffer (2024)*

33.2.2 NOTES REGARDING INVERTEBRATE TAXA OF CONSERVATION CONCERN LISTED BY THE ENVIRONMENTAL SCREENING REPORT

Results of the environmental screening report (2024/02/26) highlighted a medium sensitivity for the animal theme on the study area with the potential occurrence of one shieldback katydid (Family Tettigoniidae): Brown False Shieldback (*Aroegas fuscus*). This species is globally endangered due to its small area of occupancy of approximately 10 km^2, where it is only known from two localities confined to the highland areas of Mpumalanga and Limpopo Provinces. These particular localities are threatened by livestock and wildlife grazing, afforestation, cultivation and floristic changes (especially the distribution of its host plant) due to climate change. It occurs at an elevation above 1,200 m in Mesic Highveld Grassland (Bazelet, C. & Naskrecki, 2014). Considering the habitat preferences of this species, it is of the opinion that *Aroegas fuscus* has a low probability of occurrence due to an absence of suitable habitat. Most of the study area falls within the Savanna Biome and at an elevation that is below 1,200 m (c. 740-800 m above sea level).

Male (lateral view)

Male (dorsal view))

Female (lateral view)

Figure 32: Examples of preserved material of *Aroegas fuscus* obtained from the Orthoptera Species File (http://orthoptera.speciesfile.org/)
This specimen was collected from Woodbush (S 23.7833°, E 30.0667°) in the Limpopo Province during December 1924 (collector G. v. Dam).

34 FAUNAL IMPORTANCE (SENSITIVITY)

The faunal importance of the study sites was based on the inherent biodiversity value and ecological function of the respective habitat units corresponding to each site. Major emphasis was placed on the following functional aspects during the sensitivity grading process:

⇒ *Presence of habitat of high vertical heterogeneity*: Area with intact variable or riparian woodland tend have taller tree canopies. Habitat containing taller canopy structure will provide a higher niche space for bird and arboreal animal species through an ecological process of niche packing. Therefore, it allows species with similar guilds (e.g. insectivorous foliage gleaners in birds) to co-occur without too much inter-specific competition for recourses. The result is that more species could occur in habitat with high vertical heterogeneity.

⇒ *Presence of specialised habitat*: The presence of wetland, riparian or aquatic habitat (including functional manmade impoundments) provide habitat for stenotropic animals species with high affinities to either moist conditions or inundated habitat. Many of these habitat units are either spatially limited (azonal) and hence uncommon in the region. Typical species include facultative wetland taxa, such as shorebirds and waterbirds, which will collectively contribute towards the overall species diversity in the area.

⇒ *Ecological connectivity*: Intact habitat that are located along drainage lines and rivers (Steelpoort River), will promote animal dispersal, thereby allow for more species to utilise the habitat units at a particular site.

The faunal sensitivities of the various habitat types is illustrated in **Figure 33 and Figure 34.**

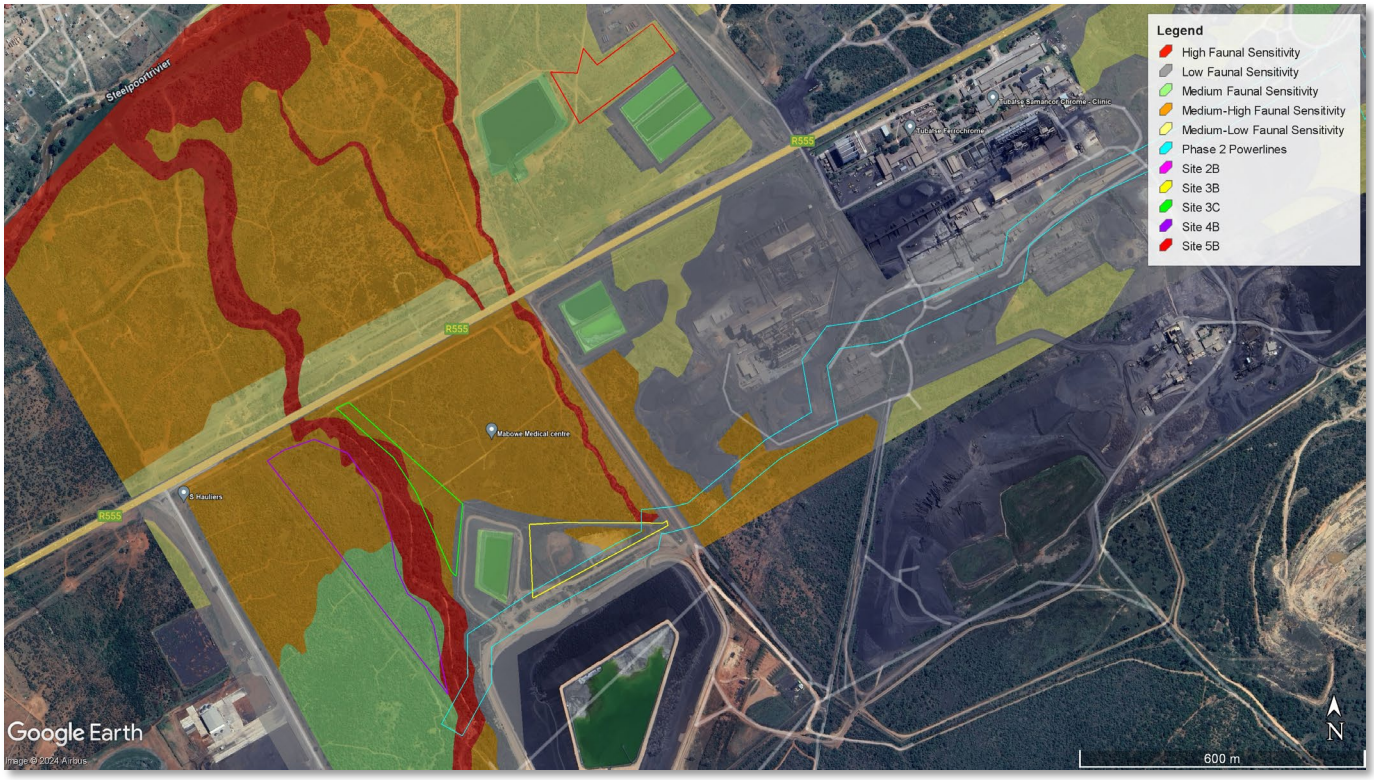


Figure 33: Faunal importance and sensitivity based on the occurrence of terrestrial fauna (Sites 3-5)

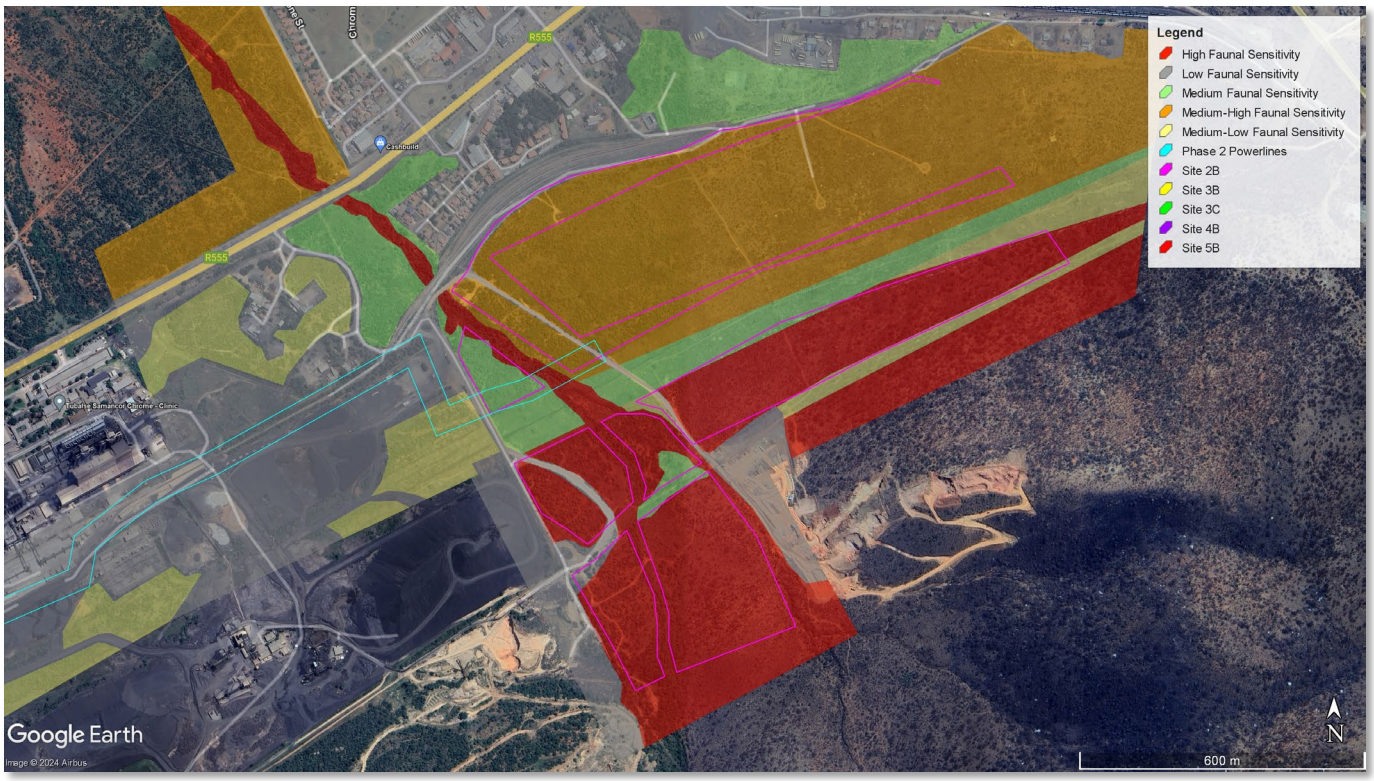


Figure 34: Faunal importance and sensitivity based on the occurrence of terrestrial fauna (Site 2)

35 REVIEW OF THE ANIMAL SPECIES SENSITIVITY THEME

A Medium Sensitivity for the animal species theme is indicated by the National Environmental Screening Report, with specific reference to certain mammal, reptile and invertebrate species of conservation concern (refer Section 31). Results indicated that none of these particular species exhibit a very high likelihood of occurrence within the study area, although the presence of the Endangered Southern Mountain Reedbuck has been confirmed for parts of the study area, while the Brown Hyaena (*Parahyaena brunnea*) is considered a likely inhabitant, which would naturally elevate the sensitivity of the receiving environment. Minor portions of natural woodland habitat exhibit high ecological integrity and status, notably portions that correspond to the variable open mountain woodlands; these areas are considered sensitive, and development should be allowed with circumspection. However, significant portions of the area are subjected to disruptive anthropogenic land uses that cause severe deterioration with high disturbance factors. In perspective of the proximity to commercial and industrial activities, a lower sensitivity is considered appropriate and accurate for most of these parts.

Ultimately, the confirmed presence of at least one mammal species of conservation concern, as well as lower probabilities for other animal taxa of conservation concern, within mountainous parts of the study area (notably Site 2B), warrants the elevation of the Animal Species Theme Sensitivity of these parts to High, as opposed to Medium Sensitivity. In contrast, parts of the local region that exhibits high deterioration and fragmentation rates and high human disturbance factors is acceptably categorized as Medium and Low Sensitivity.

SECTION G: Site Ecological Importance & Impact Assessment

The "Site Ecological Importance" (SEI) of various habitat types is derived through the analysis as prescribed by the "Guidelines for the implementation Terrestrial Fauna and Terrestrial Flora Species Protocols for environmental impact assessments in South Africa" (SANBI, 2022) (refer **Appendix 5**), specifically in relation to the proposed project (including the project footprint and project related activities).

The intention of this assessment is not to replace any of the national conservation or bioregional plans or initiatives in the province, but rather to compliment these resources with more site-specific ecological assessments and recommendations that are linked to the study area, and also to guide the layout of the proposed project activities (e.g. placement of the solar arrays and associated infrastructure). A Site Ecological Importance (SEI) analysis is one of the most important components of a specialist assessment as it provides a basis for assessing the significance of potential project related impacts on the receiving environment.

The general ecology of the study area exhibit attributes of varying status; the confirmed presence of several plant and animal species of conservation concern elevates the importance of certain parts, ultimately rendering the SEI **HIGH**. In contrast, high deterioration and disturbance factors, as well as the negative contribution of disruptive and intensive anthropogenic activities detracts from the importance of certain parts of the sites; a **Very Low SEI** for these parts of the site was derived from the assessment (refer **Table 22**, generally indicating a highly modified and highly deteriorated environment.

Table 22: Assessment of preliminary Site Ecological Importance
Derived through a preliminary high-level evaluation of the Conservation Importance and Functional Integrity to derive Biodiversity Importance and consequently using Biodiversity importance and Receptor Resilience to obtain Site Ecological Importance

Parameter	*Association*	*Reasoning*	*Rating*
Conservation Importance			
Deteriorated Open Shrubland Types		Low abundance of protected plant taxa, unlikely presence of threatened fauna taxa Regional type categorised as **endangered**, although considered to exhibit high deterioration and disruption rates	Medium
Drainage Lines and Variable Shrubland Banks		Presence of NT and protected plant taxa, potential presence of threatened fauna taxa Regional type categorised as least concern, although considered to exhibit moderate to low deterioration and disruption rates Habitat likely to support SCC	High
Closed Mixed Thicket and Bushland		Presence of NT and protected plant taxa, potential presence of threatened fauna taxa Regional type categorised as endangered, although considered to exhibit low deterioration and disruption rates, but with high fragmentation levels	Medium
Variable Mixed Shrubland – Mountain Bushveld		Presence of NT and protected plant taxa Confirmed presence of threatened fauna taxa, although with >0.01 % of EOO Likely presence of protected fauna taxa Regional type categorised as **least concern**, although with high ecological integrity, low disruption rates	High
Variable Mixed Shrubland – Plains Bushveld		Presence of NT and protected plant taxa, potential presence of threatened fauna taxa Regional type categorised as endangered, although considered to exhibit moderate deterioration and disruption rates	Medium
Transformed Areas, Infrastructure, Industries, Roads, etc.		No range-restricted species present, or likely to occur No natural vegetation remaining Regional type categorised as least concern	Very Low
Functional Integrity			
Deteriorated Open Shrubland Types		Habitat considered semi-intact, although continued decline anticipated Poor habitat connectivity and integrity on local and landscape level Several existing ecological impacts	Low

Table 22: Assessment of preliminary Site Ecological Importance

Derived through a preliminary high-level evaluation of the Conservation Importance and Functional Integrity to derive Biodiversity Importance and consequently using Biodiversity importance and Receptor Resilience to obtain Site Ecological Importance

Parameter	*Association*	*Reasoning*	*Rating*
Drainage Lines and Variable Shrubland Banks		Comprising limited surface area Moderate ecological connectivity and integrity Mostly minor to moderate ecological impacts Representing linear migration routes and ecological corridors	High
Closed Mixed Thicket and Bushland		Habitat largely intact Moderate to high connectivity and integrity Moderate ecological impacts	High
Variable Mixed Shrubland – Mountain Bushveld		Habitat intact High ecological integrity and connectivity High functionality Moderate to low ecological impacts	High
Variable Mixed Shrubland – Plains Bushveld		Habitat largely intact Moderate to poor ecological integrity and connectivity Moderate to high ecological impacts	Medium
Transformed Areas, Infrastructure, Industries, Roads, etc.		High transformation and fragmentation rates Significant ecological impacts	Very Low
Biodiversity Importance			
Deteriorated Open Shrubland Types		Medium * Low	Low
Drainage Lines and Variable Shrubland Banks		High * High	High
Closed Mixed Thicket and Bushland		Medium * High	Medium
Variable Mixed Shrubland – Mountain Bushveld		High * High	High
Variable Mixed Shrubland – Plains Bushveld		Medium * Medium	Medium
Transformed Areas, Infrastructure, Industries, Roads, etc.		Very Low * Very Low	Very Low
Receptor Resilience			
Deteriorated Open Shrubland Types		Habitat will recover slowly (~more than 10 years) to restore > 70 % of the current species composition and functionality of the receptor functionality, or species that have a moderate likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a moderate likelihood of returning to a site once the disturbance or impact has been removed	Medium
Drainage Lines and Variable Shrubland Banks		Habitat will recover slowly (~more than 10 years) to restore > 70 % of the current species composition and functionality of the receptor functionality, or species that have a moderate likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a moderate likelihood of returning to a site once the disturbance or impact has been removed	Medium
Closed Mixed Thicket and Bushland		Habitat that is unlikely to be able to recover fully after a relatively long period: > 15 years required to restore ~less than 50 % of the current species composition and functionality of the receptor functionality, or species that have a low likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a low likelihood of returning to a site once the disturbance or impact has been removed	Low
Variable Mixed Shrubland – Mountain Bushveld		Habitat that is unable to recover from major impacts, or species that are unlikely to remain at a site even when a disturbance or impact is occurring, or species that are unlikely to return to a site once the disturbance or impact has been removed	Very Low
Variable Mixed Shrubland – Plains Bushveld		Habitat will recover slowly (~more than 10 years) to restore > 70 % of the current species composition and functionality of the receptor functionality, or species that have a moderate likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a moderate likelihood of returning to a site once the disturbance or impact has been removed	Medium
Transformed Areas, Infrastructure, Industries, Roads, etc.		Transformed habitat that do not indicate any resilience factors	Very High

Site Ecological Importance		
Deteriorated Open Shrubland Types	Low * Medium	Low
Drainage Lines and Variable Shrubland Banks	High * Medium	High
Closed Mixed Thicket and Bushland	Medium *Medium	Medium
Variable Mixed Shrubland – Mountain Bushveld	High * Very Low	Very High
Variable Mixed Shrubland – Plains Bushveld	Medium *Medium	Medium
Transformed Areas, Infrastructure, Industries, Roads, etc.	Low * Very High	Very Low

A review of the evaluation of local and regional information sources indicates a moderate to moderate-high ecological status and sensitivity of the proposed sites, which correlates with preliminary floristic and faunal results obtained from the various survey results, particularly the following key results:

⇒ Botanical diversity, importance and sensitivity – moderate-high and high sensitivities of areas of remaining natural woodland, notably also as a result of the known abundance of several plant SCC;

⇒ Faunal diversity, importance and sensitivity – although a relatively poor compliment of terrestrial fauna species have previously been recorded, mostly the effect of significant anthropogenic impacts from surrounding land use activities, including industrial, peri-urban, residential, commercial and severe utilisation, remaining portions of habitat that exhibit a high connectivity to areas of natural habitat in the wider region, are considered suitable for a natural and diverse compliment of animal taxa, including animal SCC;

⇒ Biophysical and regional sensitivity and importance, indicated by the Sekhukhune District Bioregional Conservation Plan; and

⇒ Context of the proposed industrial development on a temporal and spatial scale.

While a significant extent of the proposed sites exhibit a modified and deteriorated status, some parts are considered natural, with a high correlation to the regional ecological types. However, in the context of intensive and persistent industrial expansion and development patterns around Steelpoort, these areas does not exhibit high conservation potential, in spite of a comparatively high ecological sensitivity and integrity. Impacts and pressures of surrounding land use activities are persistent, severe and a continuous decline of remaining portions of natural habitat within the peri-urban areas of Steelpoort (inclusive of the proposed development footprints) is reasonably expected should the development not take place. As with any type of industrial development within a region of natural habitat, the loss of habitat and species from direct impacts (footprint clearance, etc.) and significant indirect impacts will undoubtedly occur, notably in areas where the presence of endangered fauna taxa has been confirmed. Three aspects of concern are raised at this stage:

1 The loss of natural and sensitive natural woodland habitat, including:
   1.1 Plains woodland, which is categorized as endangered on a regional scale, albeit considered deteriorated;
   1.2 Mountain woodland, although categorized as least concern, is considered highly representative of the regional types, and exhibiting high levels of ecological functionality, also representing habitat for endangered fauna taxa;
2 Loss of numerous plant SCC; and
3 Loss of habitat typically associated with animal SCC.

While these factors represent aspects of concern, they do not represent a Fatal Flaw, and the application of the 'Mitigation Hierarchy' (refer **Figure 38**) will likely allow for amelioration of anticipated impacts. It is also important to

note that the statement specifically refers to areas of elevated Site Ecological Importance (i.e. very high and high), while areas of lower ecological sensitivities are generally considered more acceptable for the proposed development activities and will likely result in less significant impacts on the terrestrial biodiversity receiving environment. The Site Ecological Importance of the various habitat types is illustrated in **Figure 35 and Figure 36.**

Figure 35: Site Ecological Importance of broad-scale habitat types (Sites 3-5)

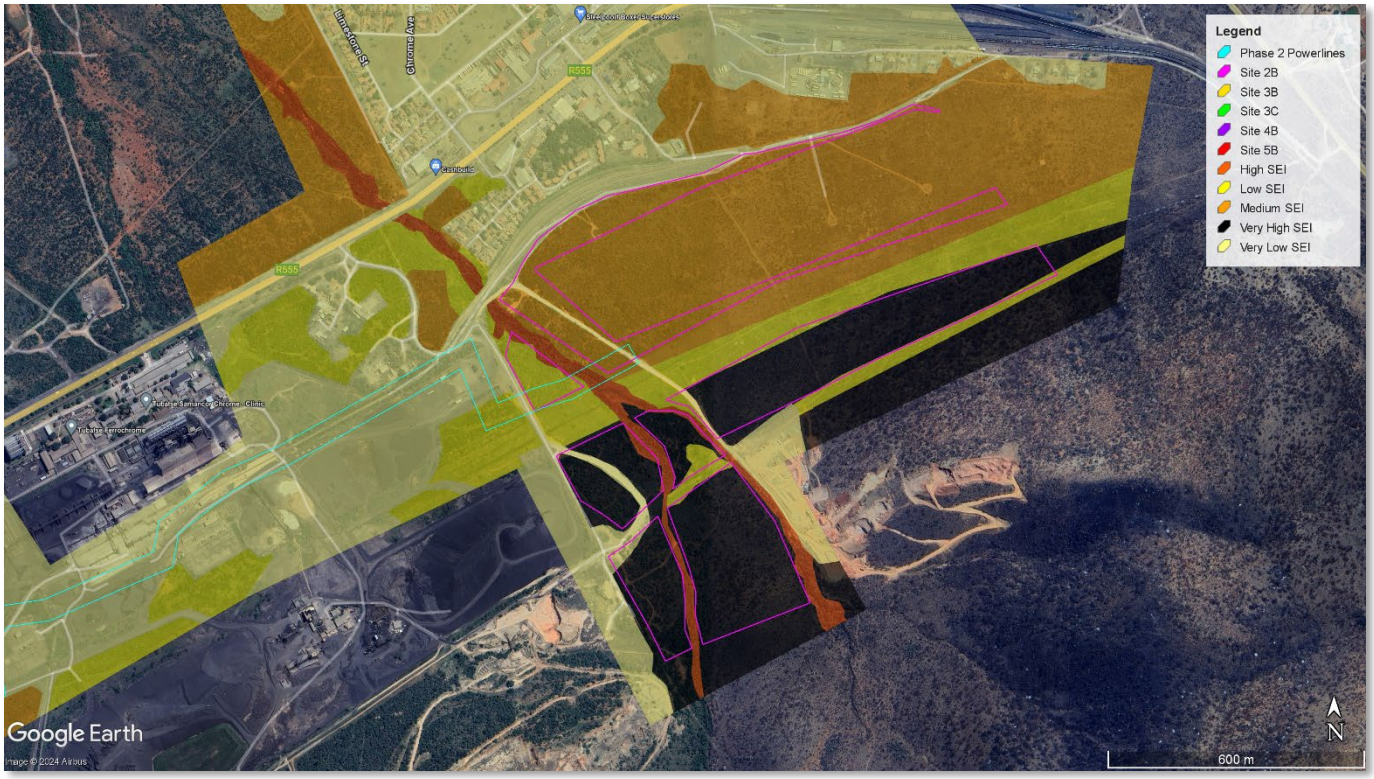


Figure 36: Site Ecological Importance of broad-scale habitat types (Site 2)

36 IMPACT ASSESSMENT

The approach to quantify the severity/ significance of anticipated impacts on the botanical and ecological receiving environment is presented in Appendix 6. It is mentioned that this assessment considers the biodiversity disciplines collectively.

36.1 ASSUMPTIONS

⇒ 'Pre-mitigation Impact Significance' is considered with the assumption that the activity will take place in its entirety, i.e. the development will not be divided into separate parts/ sections that can be developed and operated individually or in isolation.

⇒ 'Pre-mitigation Impact Significance' of impacts is also considered with the assumption that a standard, generic and industry acceptable standard mitigation approach is applied for the development, although not necessarily cognisant of detailed mitigation actions.

⇒ 'Post-Mitigation Impact Significance' assumes the complete, timeous, and comprehensive implementation of all recommended mitigation measures from this report for this project and also maintained throughout the life of the development.

36.2 ANTICIPATED IMPACTS

Based on the anticipated activities and required infrastructure, the following categories of impacts on the landscape ecological features are anticipated:

a) Direct Impacts;

b) Indirect Impacts; and

c) Cumulative and Induced Impacts.

Direct Impacts

Direct impacts are principally caused by land clearance and construction activities as well as those that affect existing environmental or social receptors directly (e.g. land taken for construction of the residence and associated infrastructures, roads, etc.). Naturally, activities that involve the complete removal of existing vegetation/ habitat from the footprint are locally destructive and devastating on habitat and vegetation, while the unavoidable killing of animal taxa that are unable to vacate a site (sessile taxa) comprehends an important direct impact on the faunal component.

Impacts of a direct nature therefore include the variety of immediate and devastating effects on natural habitat types, locally endemic species, populations and species and populations of conservation importance, as well as habitat associated with these taxa. Also included are adverse impacts on local floristic and faunal/ avian species richness, diversity, and abundance. These impacts also frequently include effects on genetic variability, population dynamics, overall species existence or health and ecosystem changes, although these types are problematic to quantify accurately. Lastly, losses of sensitive habitat, spatially restricted habitat types, and protected habitat types are also included in this category.

These impacts are generally easy to identify and are measurable, and since they are predictable and also immediately visible (after the fact), they can be quantified with an acceptable level of certainty. It is however notoriously difficult to prevent (apart from preventing the activity in its entirety by means of the "No-Go Option") or mitigate against the severity of the anticipated direct impacts.

Potential and likely impacts of a direct nature therefore include the following:

Impact 1: Direct impacts on/ losses of taxa of conservation importance and habitat associated with these taxa;

Impact 2: Direct losses and deterioration of natural and sensitive habitat types, including essential habitat refugia, atypical and unique/ restricted habitat types; and

Impact 3: Direct impacts on local diversity patterns and depletion of local diversity, depletion of local and regional biodiversity.

Indirect Impacts

Indirect impacts include those which are not directly caused by an activity, but are usually a result of complex pathways, such as dust deposition on vegetation which causes a reduction in photosynthetic rates, or high disturbance factors for animals that utilises habitat near to the activity.

Indirect impacts are therefore not always immediately evident and can consequently not be measured at a specific moment in time. These 'spill-over effects' or 'edge effects' are spatially (realising outside the site perimeter) and temporally removed from the actual activity/ development footprint (occurring sometime after the actual impact, ranging between immediate to several years). Manifestations thereof are typically more subtle and not as locally devastating as direct impacts, but often at a scale exceeding the actual site (footprint) where the activity is undertaken, although usually restricted to a local scale (< 2 km), rarely regional.

A measure of estimation, extrapolation, interpretation of the characteristics of the development and nature of the receiving environment, and specialist knowledge is therefore required to evaluate the significance of indirect impacts, and it is usually an integrated factor of the sensitivity of the receiving surrounding environment, correlated against the severity and realistic expectations from the development. Indirect impacts typically result in adverse effects or deterioration of the surrounding areas, with effects that diminish from the edge of the impact, which is determined by the specific vectors of transport. For example, considering the nature of rivers, some impacts (such as pollution) are 'carried' much further than others, impacts that are related to increased dust levels might adversely affect within a radius of approximately 2 km, contaminated water and alien and invasive species (seeds) that are carried by rivers might affect areas as far away as 20 km or more, eventually. Notwithstanding the vector, in most cases it is the ecological functionality of the surrounding area that is adversely affected, as opposed to direct impacts on species level.

Impacts of an indirect and induced nature generally include the following:

Impact 4: Deterioration and changes to untransformed habitat in the surrounds, with specific reference to sensitive habitat types and habitat types of limited representation on a local scale;

Impact 5: Disruption of ecological processes, services, and infrastructure and altered ecological functionality (including fire, erosion) of surrounding areas and natural habitat, disruption of movement/ migration patterns, ecological interaction, and processes;

Impact 6: Introduction and exacerbation of exotic and invasive species to the area; and

Impact 7: Exacerbated decline in the aesthetic appeal of the landscape.

Induced and Cumulative Impacts

Cumulative impacts represent the totality of impacts in a given area resulting from this activity and related (similar projects or activities that could conceivably be regarded as 'spin-offs' from this project), and how these activities impact the ecology of a region. The exact nature, duration, significance, and scale of cumulative impacts are difficult to quantify and also extremely problematic to mitigate against. However, cumulative impacts are significant and require consideration during the process of mitigation and managing of the natural ecological environment of the region in the context of the activity.

Anticipated cumulative impacts of the proposed project on the ecology of the region include:

Impact 8: Increased plundering of natural resources due to increased human encroachment, as well as cumulative impacts on populations of plants and animals of conservation consideration, etc.;

Impact 9: Exacerbation of existing levels of habitat fragmentation and isolation; and

Impact 10: Cumulative impacts on local/ regional and national conservation targets and obligations (loss of natural habitat).

36.3 SUMMARIES OF IMPACT SIGNIFICANCE

Summaries of the anticipated impacts on the botanical receiving environment for each of the respective areas are provided.

36.3.1 SITE 2B

Table 23: Summary of Impact Significance for Site 2

Nature	Before Mitigation	After Mitigation
Impact 1: Impacts on/ losses of conservation important and protected species (individuals, stands, populations) as well as habitat that is associated with plants of conservation importance	23.0	19.0
Impact 2: Losses, and deterioration, of natural and sensitive habitat types, including essential habitat refugia, atypical and unique/ restricted habitat types	19.0	14.0
Impact 3: Depletion of local diversity and loss of rare species or communities	14.25	10.5
Impact 4: Deterioration and changes to untransformed habitat in the surrounds, with specific reference to sensitive habitat types and habitat types of limited representation on a local scale	19.0	9.75
Impact 5: Disruption of important ecological processes, services, and infrastructure and altered ecological functionality (including fire, erosion) of surrounding areas and natural habitat	11.25	5.0
Impact 6: Introduction of exotic and invasive species to the area, or exacerbating the spread of existing infestations	14.25	2.6
Impact 7: Exacerbated decline in the aesthetic appeal of the landscape	7.5	5.0
Impact 8: Inappropriate harvesting of natural resources and exacerbation of pressure on natural resources due to increased human encroachment, accessibility to the site, also considering changes in land use of surrounding areas that are not compatible to conservation efforts	10.5	4.0
Impact 9: Exacerbation of existing levels of habitat fragmentation and isolation, considering past, present and reasonably foreseeable future anthropogenic disruptive activities in the immediate region	14.25	7.5
Impact 10: Cumulative impacts on local/ regional and national conservation efforts, targets, and obligations (loss of natural habitat).	14.25	5.0

Discussion:

While parts of this proposed site are considered deteriorated and heavily infested with exotic and invasive plants, other portions comprise natural and highly sensitive savanna habitat that is also representative of the regional ecological types, and losses of remaining natural habitat is an important consideration. Ultimately, the abundant presence of several protected plants, notably the vulnerable *Adenia fruticosum*, as well as the confirmed presence of the endangered Southern Mountain Reedbuck renders the remaining natural vegetation comparatively sensitive, and losses of these conservation important species and habitat is an important consideration on a local scale. As this site is spatially situated on the perimeter of areas of existing transformation, including industrial and linear activities, the buffering role that this portion of land plays between these areas and pristine and natural habitat further to the south of the site is also considered important. While the anticipated impact significance is considered to be moderately high, the introduction of generic and site-specific mitigation measures, notably a dedicated invasive species management programme will result in amelioration of high significance impacts to a more acceptable level. However, the approval of these areas for development purposes should be done with circumspection.

36.3.2 SITE 3B AND SITE 3C

Table 24: Summary of Impact Significance for Site 3		
Nature	Before Mitigation	After Mitigation
Impact 1: Impacts on/ losses of conservation important and protected plant species (individuals, stands, populations) as well as habitat that is associated with plants of conservation importance	19.0	13.5
Impact 2: Losses, and deterioration, of natural and sensitive habitat types, including essential habitat refugia, atypical and unique/ restricted habitat types	15.0	13.0
Impact 3: Depletion of local floristic diversity and loss of rare species or flora communities	14.25	9.75
Impact 4: Deterioration and changes to untransformed habitat in the surrounds, with specific reference to sensitive habitat types and habitat types of limited representation on a local scale	14.25	9.75
Impact 5: Disruption of important ecological processes, services, and infrastructure and altered ecological functionality (including fire, erosion) of surrounding areas and natural habitat	7.5	4.5
Impact 6: Introduction of exotic and invasive species to the area, or exacerbating the spread of existing infestations	14.25	2.6
Impact 7: Exacerbated decline in the aesthetic appeal of the landscape	9.0	6.0
Impact 8: Inappropriate harvesting of natural resources and exacerbation of pressure on natural resources due to increased human encroachment, accessibility to the site, also considering changes in land use of surrounding areas that are not compatible to conservation efforts	10.5	4.0
Impact 9: Exacerbation of existing levels of habitat fragmentation and isolation, considering past, present and reasonably foreseeable future anthropogenic disruptive activities in the immediate region	15.0	6.75
Impact 10: Cumulative impacts on local/ regional and national conservation efforts, targets, and obligations (loss of natural habitat).	11.25	4.5

Discussion:

These sites comprise largely natural shrubveld habitat that is moderately representative of the regional ecological types. Considering that the regional type is categorised as endangered, and also with the known presence of conservation important plants within this site, the ecological sensitivity is considered moderately high. Losses of conservation important species and natural savanna habitat is therefore considered significant on a local scale and the implementation of a generic mitigation approach, notably the relocation of conservation important plants from the site, will only render the post-mitigation significance of anticipated impacts moderate, albeit mostly localised.

36.3.3 SITE 4B

Table 25: Summary of Impact Significance for Site 4		
Nature	Before Mitigation	After Mitigation
Impact 1: Impacts on/ losses of conservation important and protected plant species (individuals, stands, populations) as well as habitat that is associated with plants of conservation importance	19.0	18.0
Impact 2: Losses, and deterioration, of natural and sensitive habitat types, including essential habitat refugia, atypical and unique/ restricted habitat types	19.0	13.0
Impact 3: Depletion of local floristic diversity and loss of rare species or flora communities	14.25	9.75
Impact 4: Deterioration and changes to untransformed habitat in the surrounds, with specific reference to sensitive habitat types and habitat types of limited representation on a local scale	14.25	6.5
Impact 5: Disruption of important ecological processes, services, and infrastructure and altered ecological functionality (including fire, erosion) of surrounding areas and natural habitat	7.5	4.5
Impact 6: Introduction of exotic and invasive species to the area, or exacerbating the spread of existing infestations	14.25	2.6
Impact 7: Exacerbated decline in the aesthetic appeal of the landscape	9.0	6.0
Impact 8: Inappropriate harvesting of natural resources and exacerbation of pressure on natural resources due to increased human encroachment, accessibility to the site, also considering changes in land use of surrounding areas that are not compatible to conservation efforts	10.5	4.0
Impact 9: Exacerbation of existing levels of habitat fragmentation and isolation, considering past, present and reasonably foreseeable future anthropogenic disruptive activities in the immediate region	15.0	6.75
Impact 10: Cumulative impacts on local/ regional and national conservation efforts, targets, and obligations (loss of natural habitat).	11.25	4.5

Discussion:

This site comprises natural shrubveld habitat that is representative of the regional ecological types. Considering that the regional type is categorised as endangered, and also with the known presence of conservation important plants within this site, the sensitivity is considered moderately high. Losses of conservation species and natural savanna habitat is therefore considered significant on a local scale and the implementation of a generic mitigation approach, notably the relocation of conservation important plants from the site, will only render the post-mitigation significance of anticipated impacts moderate, albeit mostly localised.

36.3.4 SITE 5B

Table 26: Summary of Impact Significance for Site 5B		
Nature	Before Mitigation	After Mitigation
Impact 1: Impacts on/ losses of conservation important and protected plant species (individuals, stands, populations) as well as habitat that is associated with plants of conservation importance	7.5	2
Impact 2: Losses, and deterioration, of natural and sensitive habitat types, including essential habitat refugia, atypical and unique/ restricted habitat types	5	1
Impact 3: Depletion of local floristic diversity and loss of rare species or flora communities	5	2
Impact 4: Deterioration and changes to untransformed habitat in the surrounds, with specific reference to sensitive habitat types and habitat types of limited representation on a local scale	2.2	0.8
Impact 5: Disruption of important ecological processes, services, and infrastructure and altered ecological functionality (including fire, erosion) of surrounding areas and natural habitat	2	0.9
Impact 6: Introduction of exotic and invasive species to the area, or exacerbating the spread of existing infestations	11.25	2.2
Impact 7: Exacerbated decline in the aesthetic appeal of the landscape	5.5	1.4
Impact 8: Inappropriate harvesting of natural resources and exacerbation of pressure on natural resources due to increased human encroachment, accessibility to the site, also considering changes in land use of surrounding areas that are not compatible to conservation efforts	2	0.6
Impact 9: Exacerbation of existing levels of habitat fragmentation and isolation, considering past, present and reasonably foreseeable future anthropogenic disruptive activities in the immediate region	5.5	4.5
Impact 10: Cumulative impacts on local/ regional and national conservation efforts, targets, and obligations (loss of natural habitat).	2.2	0.9

Discussion:

Site 5B constitutes deteriorated woodland; results of the site inspection indicated a low presence of protected plant species on this site. Anticipated impacts from a botanical perspective is therefore likely to be moderate, mostly as a result of the minor losses of remaining natural woodland from the site (also in context with the location of the proposed site adjacent to existing transformed areas). The introduction of a generic mitigation approach, but with specific reference to the management and control of invasive plant species from the site, is likely to reduce the anticipated impacts significance to acceptably low levels.

37 CUMULATIVE IMPACTS RELATING TO RENEWABLE ENERGY PROJECTS FROM A REGIONAL PERSPECTIVE

Available information on existing and planned renewable energy (RE) projects within a 30 km radius (refer **Figure 37**), indicates that, apart from the authorised Phase 1 part of the Samancor PV Project, no other RE projects or activities are identified. The brief conclusion is therefore that the anticipated cumulative effects of this project on biodiversity attributes from a regional perspective are considered of low importance and significance.

The following comments are also relevant to the conclusion:

⇒ The proposed development will utilise, to a large extent, habitat that already exhibit moderate to high levels of deterioration and disturbance.

⇒ Minor portions of highly sensitive habitat are proposed for development.

⇒ The proposed sites does not comprise geographically isolated greenfield areas that are situated within larger expanses of natural and untransformed habitat; it therefore does not constitute a 'thin end of the wedge' in natural habitat/ areas.

⇒ The proposed project sites are situated in proximity to a commercial and industrial centre (Steelpoort) that is characterised by significant levels of transformation, fragmentation, and deterioration. The activity is therefore considered consistent with current land uses within an area that is already (ecologically) compromised to an extent, although being cognisant of the presence of several sensitive and conservation important plants and animals that persist.

⇒ In comparison with significant increases in industrial, and specifically mining related activities noted in the wider region, the contribution to habitat and species losses from this project are considered marginal. It is particularly evident, from a regional perspective, also with specific reference to mining activities immediately adjacent to Site 2B, that mining, probably, constitutes the most significant and devastating activity on natural and sensitive resources on a regional scale.

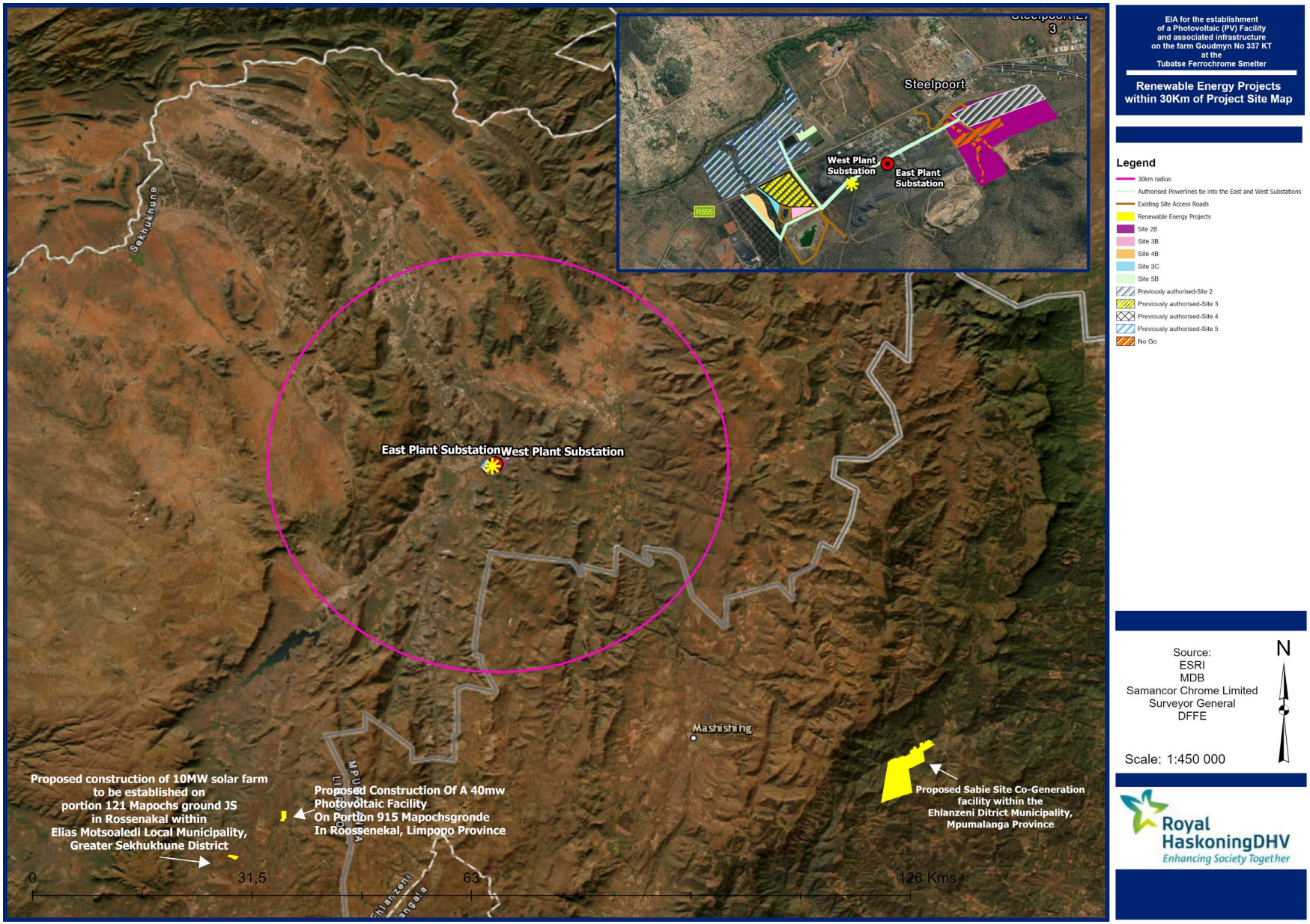


Figure 37: The spatial location of the project in relation to other RE projects in the wider region

38 CONCLUDING STATEMENT

This report concludes that the study sites comprise of savanna habitat of varying status and sensitivity, which is consistent with natural habitat in proximity to the intensive anthropogenic and disruptive land use activities noted around Steelpoort. As most of the project sites are situated in proximity to, or are surrounded by, industrial infrastructure or areas where human activities are relatively of high frequency, remaining portions of natural habitat conforms to short, open and deteriorated woodland habitat or habitat that are fragmented. Extensive parts of the proposed sites comprise of deteriorated types that are characterised by unspecialised and generalist taxa and communities that are also well represented in the wider region. Portions of the proposed sites are considered diverse and sensitive, and retaining these areas for conservation purposes is highly recommended, although technical considerations for the proposed development might not allow for much mitigation in this sense. The presence of numerous and abundant conservation important plant and animal species, which provides for an elevated ecological sensitivity and importance of certain parts, are noted throughout the study areas. An existing offset plan has been prepared for Phase 1 of the project; it is strongly recommended that previous recommendations be augmented to compensate for the loss of these sensitive areas, should the authorities grant the application.

The nature of the activity dictates that natural habitat will be lost through unavoidable land clearance, and the application of a recommended mitigation approach will allow for some moderation of anticipated impacts. It is predicted that impacts on the ecological environment will generally be of high to moderate significance, notably with regards to the anticipated loss of conservation important plant species and habitat that is associated with animal species of conservation concern.

In light of the conclusions reached in this report, and despite concerns that are raised about the loss of minor portions of highly sensitive habitat associated with southern sections of Site 2B, no specific objections to the project are raised in its current configuration. This is however with the explicit understanding that the suggested mitigation protocol is timeous and comprehensively implemented during all phases of the project, including the use of an offset strategy to compensate for these losses.

SECTION H: MITIGATION

39 MITIGATION HIERARCHY BACKGROUND

Mitigation aims to eliminate or reduce negative biodiversity impacts. Mitigation options should generally be considered in the following order of preference:

1. Avoidance of impacts altogether;
2. Reduction of impacts where unavoidable;
3. Restoration of habitats to their original state;
4. Relocation of affected species or habitats; or
5. Compensation for any residual, unavoidable damage.

The mitigation of negative impacts on biodiversity and ecosystem services is a legal requirement for authorisation purposes and must take on different forms, depending on the significance of the impact and the area being affected. Mitigation requires proactive planning that is enabled by following the mitigation hierarchy, illustrated in Figure 66. Its application, is intended to strive to first avoid disturbance of ecosystems and loss of biodiversity, and where this cannot be avoided altogether, to minimise, rehabilitate, and then finally offset any remaining significant residual negative impacts on biodiversity, where:

Avoiding or preventing impacts – refers to considering options in project location, siting, scale, layout, technology and phasing to avoid impacts on biodiversity, associated ecosystem services, and people. This is the best option but is not always possible if development/ construction is to take place. However, there are areas where the environmental and social constraints are too high, and development should not take place. Such areas are best identified early in the development life cycle, so that impacts can be avoided, and authorisations refused. In the case of areas where environmental constraints might be limiting, this includes some ecosystems, habitats, ecological corridors, or areas that provide essential ecosystem services and are of such significant conservation value or importance that their loss cannot be compensated for (i.e. there is no substitute). In such areas, it is unlikely to be possible or appropriate to rely on the latter steps in the mitigation hierarchy (e.g. rehabilitating or offsetting impacts) to provide effective remedy for impacts on biodiversity or ecosystem services. Information about the location of many such areas is available, often making it possible to avoid them.

Reduction of impacts where unavoidable – refers to considering alternatives in the project location, siting, scale, layout, technology, and phasing that would minimise impacts on biodiversity and ecosystem services. Even in areas where the environmental and social constraints are not particularly high for development to proceed/take place every effort should still be made to minimise impacts.

Restoration of habitats to their original state – refers to the rehabilitation of areas where impacts were unavoidable, and measures are taken to return impacted areas to a condition ecologically similar to their 'pre-development natural state' or an agreed land use after closure. Although rehabilitation is important and necessary, unfortunately even with significant resources and effort, rehabilitation is a limited process that usually falls short of replicating the diversity and complexity of a natural system. Instead, rehabilitation helps to restore some resemblance of ecological functioning in an impacted landscape, to avoid on-going negative impacts, and/or to provide some sort of aesthetic fix for a landscape. Rehabilitation should occur concurrently or progressively with the proposed activity, and/or on cessation of the activity.

Relocation of affected species or habitat – refers to the physical translocation of affected individuals within the footprint, or adjacent areas, where unavoidable and devastating effects are likely to occur. The translocation of individuals is generally subject to permitting requirements and should be based on a like-for like habitat, taking cognisance of potential impacts such as genetic populations, geographic isolation, etc. The relocation of habitat is generally in severely selective events where small, isolated, and biologically significant habitat can be realistically relocated

and reproduced outside the affected footprint. This approach can also be augmented by propagation of certain species.

Offset impacts/ Compensation for any residual, unavoidable damage –refers to compensating for remaining and unavoidable negative effects on biodiversity. When every effort has been made to minimise and then rehabilitate remaining impacts to a degree of no net loss of biodiversity against biodiversity targets, biodiversity offsets can provide a mechanism to compensate for significant residual negative impacts on biodiversity.

The mitigation hierarchy is inherently proactive, requiring the on-going and iterative consideration of alternatives of project location, footprint siting, scale, layout, technology and phasing until the proposed development best 'suits' and can be accommodated without significant negative impacts in the receiving environment. In cases where the receiving environment cannot support the development (e.g. there is insufficient water) or where the project will eradicate unique biodiversity, the development may not be feasible; the earlier the developing company knows of these risks, and can plan to avoid them, the better. In cases where biodiversity impacts are likely to be severe, the guiding principle should therefore be to "anticipate and prevent" rather than "assess and repair".

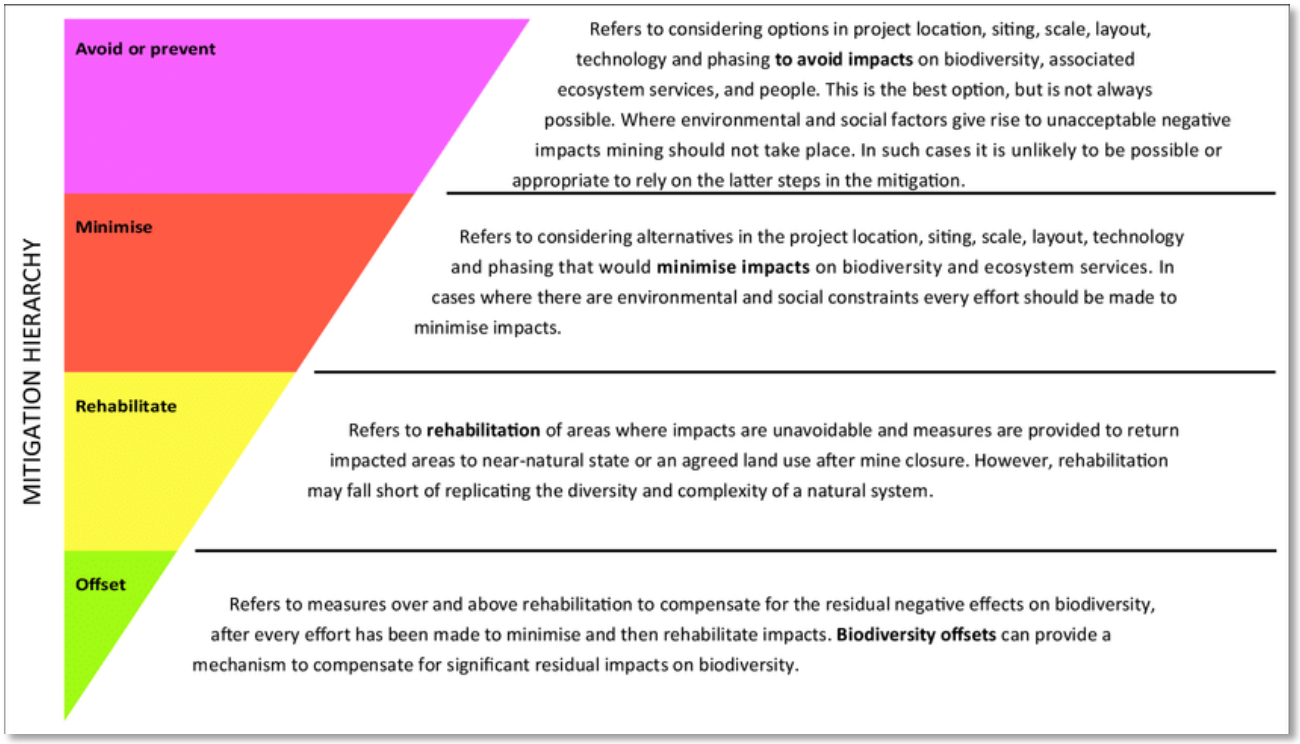


Figure 38: Mitigation hierarchy for dealing with negative impacts on biodiversity

The mitigation approach should be contained and elaborated in the Environmental Management Plan for the activity, notably for the construction phase, and should be regarded as a 'Living Document' that will be amended and updated as new information becomes available. The project should consider minimal disturbance and hazards to the surrounding natural environment. The proposed list of mitigation measures are not considered exhaustive and should be updated where additional or unprecedented impacts are noted during construction and operational phases, i.e. the document should be perceived as a 'living' document that addresses impacts, threats, and issues as it becomes evident.

40 APPLICATION OF THE MITIGATION HIERARCHY

To present the effect of impacts on sensitive areas as well as the need for mitigation strategies, the spatial location of development infrastructure in relation to ecological sensitivity is considered. The proposed sites exhibit a highly variable floristic nature (with moderate to moderate-high floristic sensitivities) and a range of impacts is anticipated, varying between minimal and potentially significant.

40.1 THE "NO-GO" OPTION

The 'No-Go' option is not regarded an appropriate recommendation for this development, based on the following:

1. The proposed development sites comprise comparatively small footprints of natural and deteriorated woodland habitat types within an environment that already exhibits moderate to significant levels of transformation.
2. The regional importance of broad-scale habitat types, despite categorised as Vulnerable, exhibit varying levels of deterioration; ultimately extremely little of the proposed sites provides a high correlation to pristine and natural woodland types.
3. Natural habitat on the site does not exhibit any aspect of uniquely high floristic or faunal diversity or ecological sensitivity and was mostly found to be in a moderately deteriorated condition with only selected parts representing woodland habitat of a pristine status.
4. Despite the presence of protected tree species and plants of conservation importance (notably *Adenia fruticosa*, Vulnerable) anticipated losses are not anticipated to trigger an exacerbation in the conservation status of any of these species. The application of a search and rescue operation for selected species is anticipated to ameliorate this impact acceptably.
5. The continuous, timeous and comprehensive implementation of the recommended mitigation approach is anticipated to ameliorate expected and likely impacts to an acceptable level.

Considering the status of the receiving environment and the anticipated significance of impacts on ecological attributes, the No Go alternative is not considered a requirement for this project. The dedicated application of a suitable mitigation approach is considered sufficient to ameliorate likely and anticipated impacts to an acceptable level.

40.2 OFFSET RECOMMENDATIONS

Biodiversity Offset recommendations will be presented should the provincial authority (LEDET) deem this necessary upon review of this report.

40.3 REHABILITATION APPROACH

The near-permanent nature of the proposed development (>20 years), and also considering continued expansion of mining activities and infrastructure within the existing perimeter, implies that it is extremely unlikely that the development will be decommissioned within the immediate future. Addressing unforeseen impacts that result from the development in adjacent natural habitat should be attended immediately and dealt with on a case-by-case basis. The implementation of a generic mitigation approach, which should be based on results and recommendations from a dedicated environmental monitoring programme is expected to be successful in preventing any undue impacts in the surrounding natural environment.

40.4 Exclusion and Avoidance of High Sensitivity Areas

Anticipated losses, from a numerical perspective, is low and effects are unlikely to trigger the exacerbation of existing conservation levels, either species or habitat. The proposed development plan represents an iteration of development considerations that took into consideration previous comments and recommendations pertaining to sensitive areas and successful avoidance of potentially sensitive areas have been achieved. The loss of sensitive areas is unavoidable, and should be compensated through the Offset Plan as no other technical feasible approach appears likely.

40.5 Minimization of Impacts

The recommended mitigation approach aims to minimize impacts caused by the development activity within the natural environment. The nature of the development dictates that natural habitat will be entirely compromised during land clearance activities (construction), and the resultant sterile environment will represent the status quo for the development footprint for a considerable time in future. The minimization approach will therefore have the objective to limit adverse effects of the development on the surrounding ecological receiving environment and address impacts outside the development footprint caused by the development on a case-by-case basis.

40.6 Avoidance or Prevention

The nature of the development and characteristics of natural attributes within the development footprint allows for limited avoidance and prevention strategies. Loss of individual protected plants should be avoided by means of a relocation strategy (for certain species), while relocation of certain plants are recommended.

Avoidance and prevention strategies will mostly be aimed at limiting the uncontrolled spread of impacts caused by the proposed activity into nearby/ adjacent natural habitat, notably for declared alien and invasive plant species.

40.7 Layout Redesign (Location Alternatives)

A number of capacity and layout iterations were considered for this project and were subsequently considered in term of the anticipated impacts on the terrestrial biodiversity environment.

40.8 Permitting Requirements & Search and Rescue Operations

⇒ The removal and damage of any protected and conservation important plant species on the site requires compliance in terms of national and provincial legislation. In particular, the National Forest Act (1998) and Limpopo Environmental Management Act (Act No 7 of 2003, including Schedule 11 (Specially protected plants) and Schedule 12 (Protected plants)), require that permits be obtained prior to the removal, damage, or destruction of certain plant species.

⇒ Timelines involving permit applications need to be considered, taking cognisance of the required time of the completion, submission, and approval of permit applications by relevant authorities. It is emphasised that no activity may commence that will adversely affect protected plant species, prior to the approval of all permitting requirements. The permitting process is also dependent on the Environmental Authorisation for the project as a whole and is included as an authorisation condition.

⇒ A suitable Search and Rescue operation needs to be executed prior to commencement of site clearance activities.

40.9 BOTANICAL MITIGATION RECOMMENDATIONS

⇒ Appoint the responsible officer (Environmental Officer, EO) prior to commencement of land clearance activities. Responsibilities should include, but not necessarily be limited to, ensuring adherence to the authorisation conditions, guidance of activities, planning and reporting. The appointment of an Environmental Officer for the project should consider a suitable knowledge of biological and biodiversity aspects of the site, surrounds, and the general region. The Environmental Officer should also establish communication with a suitable ecologist as soon as possible to communicate relevant project details and direct any questions in cases of uncertainties.

⇒ EO should delegate and oversee the final walkdown to identify and geolocate protected plant species for permitting purposes.

⇒ Apply for and secure all relevant permits from DFFE and LEDET for protected plant species that occur on the site prior to any activity being undertaken. No protected plant species may be affected, removed, excavated, relocated, or impacted in any manner, except under a valid permit granted by the relevant authority and under the supervision of the appointed EO.

⇒ Develop and execute a Search and Rescue operation for certain plants/ trees as per recommendations from the Final Walkdown Report. These plants should be relocated to a secure, suitable, and appropriate location, taking care to duplicate existing habitat conditions as far as possible. It should be noted that the transportation and relocation process of protected plant species is also subject to permitting requirements; this process should be guided by the EO and executed by a suitable horticultural specialist.

⇒ Develop and implement a biodiversity monitoring programme to establish long-term trends of floristic and faunal diversity patterns and the latent and immediate effects of mining on these receiving environments.

⇒ An Alien and Invasive Plant Management Programme should be developed and implemented with the onset of the construction phase. The aim of this programme should include (*inter alia*) the identification, control, and eradication of invasive plants from the site and immediate surrounds through a responsible, yet effective, management strategy that might involve a combination of physical removal methods and application of chemical treatments. The Environmental Officer shall compile relevant action plans to deal with the presence of alien and invasive species.

⇒ Provide consideration for the sensitive drainage lines and rivers in spatial proximity to the proposed development footprints. No effluent of a damaging nature should be released, or permitted to enter, natural drainage lines or rivers.

⇒ Stormwater management should aim to ameliorate destructive erosion events that will result in further deterioration of the drainage channels.

⇒ Erosion control should be prioritized, notably during the planning phase where slopes, runoff from paved and tarmac areas and stormwater control measures need to be highlighted and planned to prevent erosion of surrounding natural areas.

⇒ All development areas shall be demarcated, and no personnel or construction vehicle shall be allowed to access neighbouring properties for any purpose whatsoever.

⇒ Under no circumstances shall any natural area on neighbouring properties (outside the development site footprints) be impacted, degraded, cleared, or affected in any manner.

⇒ Cleared vegetation and debris that has not been utilised must be collected and disposed through an appropriate manner.

⇒ No painting or marking of rocks or vegetation (trees) to identify locality or other information shall be allowed, as it will disfigure the natural setting. Marking shall be done by steel stakes with tags, if required. All temporary markings will be removed upon completion of the construction.

⇒ Collection of branches, wood (dead or alive), shrubs or any vegetation for fire making purposes is strictly prohibited.

⇒ Prevent all open fires on site.

⇒ The irresponsible use of welding equipment, oxy-acetylene torches, and other naked flames, which could result in veld fires, or constitute a hazard should be guided by safe practice guidelines.

⇒ The burning of general waste material is not to be allowed.

⇒ Provide demarcated fire-safe zones, facilities, and suitable fire control measures.

⇒ Provide temporary and suitable on-site ablution, sanitation, litter and waste management and hazardous materials management facilities until such time that adequate permanent and operational facilities can be provided. Abluting anywhere other than in provided ablutions shall not be permitted. Under no circumstances shall use of the veld for ablution purposes be permitted.

⇒ A periodic (at least annual) clean-up of the surrounding natural environment should be undertaken to remove litter and prevent unwanted deterioration of the surrounding natural environment.

⇒ Site induction for contractors and workers should include a familiarization with all aspects relating to environmental components of the project.

⇒ Ensure the implementation of erosion control measures on the perimeter of the development, aimed at avoiding exacerbation of the existing erosion patterns.

⇒ The use of locally indigenous plant species for landscaping purposes is strongly recommended. Under no circumstances shall exotic and invasive plants be used for landscaping purposes.

⇒ Rehabilitation of areas where construction activities have been finalised, shall be prioritised.

40.10 FAUNAL MITIGATION RECOMMENDATIONS

40.10.1 LOSS OF HABITAT

⇒ Minimize area cleared for construction activities and erect a temporary fence to contain construction operations. This includes the area used by staff and labour during the construction phase and prevent an "overspill" of construction activities into adjacent habitat that is not part of the project footprint.

⇒ All sites should be fenced with a permeable fence structure to allow the free movement of smaller-bodied animal species.

⇒ Development on habitat with high faunal sensitivity should be avoided (riparian thickets and drainage lines).

⇒ Natural corridors (e.g. riparian thicket and drainage lines) must be retained between the sites to promote and allow for the movement of mobile fauna.

⇒ Rehabilitate as a continual process – this will maximise the viability of the natural seed bank and prevent the unnecessary loss of topsoil during storage.

⇒ The project footprint sites should be “screened” prior to, and during the construction phase for reptile species of conservation concern (especially for *Kinixys lobatsiana*) by a qualified herpetologist/zoologist. This person should also be capable of handling venomous snakes. All species found should be relocated to suitable habitat not more than 50 km from the study sites. In addition, the contractor should contact the ECO or herpetologist/zoologist should any snake (or reptile) species be found on or near the construction/operation site.

⇒ If any faunal species of conservation concern (as indicated in this report) is exposed during the construction phase, the ECO shall be informed, who shall then issue instructions for its capture, translocation and safe release to suitable habitat not more than 50 km from the study sites.

40.10.2 Displacement and Disturbance to Fauna (Especially Species of Conservation Concern)

⇒ Minimize the use of earthmoving equipment that results in noise generation, notably during the operational phase.

⇒ Due to the type of development, the type and nature of demarcation should not attempt to facilitate free movement of smaller animals as this could lead to unwanted presence (and accidental killing) of animals within the development site. Typical fencing employed for security purposes around the development is considered adequate.

⇒ The use of electric fences (particularly on ground level) is however discouraged.

⇒ The extent of the construction/operational footprint site should be demarcated on site layout plans (preferably on disturbed areas or those identified with low or medium conservation importance), and no construction personnel or vehicles may leave the demarcated area except those authorised to do so. Those areas surrounding the demarcated footprint sites should be considered as "no-go" areas for employees, machinery or even visitors.

⇒ Minimize exterior lighting and implement operational strategies to reduce "spill light" although with the balance to achieve safety and security of the solar facilities. Outside features should be illuminated by using "down-lighting" rather than "up-lighting" as far as possible. Where possible, outside lighting should apply UV filters to high pressure mercury vapour lamps or fluorescent lights to minimise the attraction of nocturnal invertebrates to the lights.

⇒ All domestic waste generated (if present) should be removed from the study site as soon as possible and be disposed at an authorised landfill to reduce the risk of colonization by feral mammals, scavengers or competitively superior bird species (e.g. Pied Crows *Corvus albus*).

⇒ Personnel and staff should be advised (by means of induction) by means of environmental awareness training on the biodiversity importance of the area. The intentional killing of any faunal species (in particular invertebrates, reptiles and snakes) should be avoided by means of awareness programmes presented to the labour force. The labour force should be made aware of conservation issues pertaining to the taxa occurring on the study site.

40.10.3 Increased Fragmentation & Loss of Ecological Connectivity

⇒ Natural corridors (e.g. drainage lines and riparian thicket) must be retained to promote the movement of fauna when a high rate of natural disruption is expected.

⇒ All linear units (drainage lines) must be clearly demarcated. Construction and operation should be located outside these areas.

⇒ Appropriate buffer zones must be implemented to the riparian zone and along drainage features to alleviate the effect of habitat fragmentation and edge effects (please refer to the wetland/aquatic report for advice on appropriate buffer sizes).

⇒ Where possible, existing access roads must be used and should preferably be perforated with road calming devices installed to prevent small-bodied or slow-moving animals from being killed, and to facilitate a safe means of dispersal.

⇒ Newly planned roads (and powerlines) should avoid crossing drainage lines where possible. It is also highly advisable to place new powerlines adjacent to existing powerline servitudes.

⇒ Run-off/stormwater control measures on either side of roads and at the solar facilities must be constructed so that small terrestrial animals can cross them. Ditches/trenches should have slopes of less than 45° rather than vertical sides.

40.10.4 POACHING, PLUNDERING OF NATURAL RESOURCES & INDISCRIMINATE KILLING OF ANIMALS

⇒ All labour or staff should be advised (induction) by means of environmental awareness training on the ecological significance of the area and its conservation importance.

⇒ Intentional killing of any faunal species (in particular invertebrates and snakes) should be avoided by means of awareness programmes presented to the labour force. The labour force should be made aware of the conservation issues pertaining to the taxa occurring on the study site. Any person found deliberately harassing any animal in any way should face disciplinary measures, following the possible dismissal from the site.

40.10.5 SECONDARY IMPACTS RELATED TO THE INFRASTRUCTURE ATTRACTING ANIMALS

⇒ Apply appropriate deterrent devices to prevent birds from nesting on important structures.

⇒ Monitor any nest-building activities and remove/trim nests that are a risk (fire risk or affecting the operations of the solar facilities) with the consent of the local Conservation Department. Trimming should only be conducted during the non-breeding season.

⇒ Apply nest boxes for owls along the perimeter of the facilities to assist with rodent control.

⇒ Apply appropriate space between consecutive PV panels to allow for sunlight to reach the basal vegetation.

⇒ Conduct regular screens to determine the occurrence/density of invader taxa (e.g. invader/alien rats and mice, domestic cats). If detected, a specialist in the field of pest control should be appointed to rectify the problem with the consent of the local Conservation Department.

⇒ No pets should be allowed on the premises, with specific reference to feral cats.

41 RECOMMENDED PROTOCOL FOR THE ECOLOGICAL MONITORING PROGRAMME (AS PART OF THE BIODIVERSITY MONITORING PROGRAMME)

41.1 GENERAL BOTANICAL ATTRIBUTES

As part of the proposed (annual) Monitoring Programme, the following aspects will be executed:

⇒ Selection of a suitable number of sampling points that is representative of the mining activities within a natural, receiving environment, with particular reference to sensitive habitat types and species of conservation concern;

⇒ Annual monitoring of vegetatal aspects during the active mining phase, including aspects of diversity, compositional and structural attributes as well as accumulation of impacts within nearby habitat;

⇒ Prevalence and continued persistence of plants of conservation concern;

⇒ Prevalence and continued persistence of plants with ethno-botanical properties;

⇒ Prevalence and management of alien and invasive plant species; and

⇒ Land change/ habitat loss and transformation.

Through implementation and execution of a botanical monitoring programme, the anticipated and actual impacts of the proposed activities within the floristic environment can be established and monitored. Collated information data and results will contribute towards a responsive management approach to minimize the impact footprints and associated spheres of influence.

Frequency: annual
Responsibilities client, Environmental Manager, appointed specialist(s);

The following phases are relevant:

1 Pre- construction environment – the baseline ecological report will suffice in highlighting existing conditions and terrestrial botanical attributes;

2 Construction phase – implementation of the botanical monitoring protocol at a frequency of at least annually, taking cognisance of seasonal variations; and

3 Post-construction environment – execution of the botanical monitoring protocol annually until such time that closure has been granted by the authorities.

While the details of a monitoring plan is subject to negotiations prior to appointment, the following aspects (inter alia) should form part of the monitoring protocol, as a minimum:

⇒ Fixed point monitoring should be applied as the preferred method of monitoring. The selection of monitoring points should consider the spatial layout of mining activities and infrastructure in relation to sensitive environments, also taking note of control points to provide a comparative assessment;

⇒ All data gathered should be measurable (qualitative and quantitative) – attention should be provided to species diversity and abundance;

⇒ Monitoring report should be repeatable and temporally and spatially comparable, with specific reference to seasonal variation;

⇒ Data, when compared to previous sets, should show spatial and temporal trends; and

⇒ General habitat unit overviews should also be undertaken to augment quantitative data.

The recommended terrestrial biodiversity monitoring protocol will comprise the following aspects, or a variation thereof:

1. Alien and Invasive plant species monitoring; and
2. Vegetation/ ecological monitoring.

These aspects should ideally be executed during an optimal period of the year, considering seasonal variation in vegetation attributes. Ultimately, the objectives are to demonstrate the stability of the surrounding environment and sensitive receptors, monitoring results should therefore ideally be repeated during the same time of year. The responsibility of the implementation and auditing of monitoring performance would remain with the client, notably the Environmental Manager.

Requirements for the appointed specialists should conform to the guidelines of the South African Council for Natural Scientific Professions Act (2019), and specifically adhere to regulations pertaining to the minimum requirements as per the National Environmental Management Act, 1998 (Act No. 107 of 1998).

41.2 ALIEN AND INVASIVE PLANT MANAGEMENT PLAN

⇒ Conduct a brief assessment of the legal framework pertaining to the management, responsibilities and requirements of the landowner pertaining to the occurrence of alien and invasive plants on the property and immediate surrounds;
⇒ Undertake a site assessment/ ground-truth to identify and record alien invasive vegetation, identify threats to the ecology of the area, etc.;
⇒ Compile GIS spatial maps to support the Control Compilation of an AIS Plan as per the requirements of the AIS Regulations, 2015 and Invasive Species List, 2016;
⇒ Spatially map the parcels of land within the immediate surrounds of the mining footprint, with reference to land use activities;
⇒ Compile a working inventory of Invasive Species for each management unit compartment;
⇒ Describe the prioritization of the land parcels in the management unit compartments in accordance with the categories as per the Alien and Invasive Listing, 2016;
⇒ Provide targets and timelines for the Control Plan;
⇒ Provide responsibilities and reporting requirements of the Control Plan;
⇒ Provide control and/or eradication methods for identified invasive species in the Control Plan;
⇒ Indicate how the Control Plan will be monitored and evaluated as part of the vegetation monitoring plan;
⇒ Provide a suitable report for implementation as part of the EMP for the development; and
⇒ Execute the AIP monitoring protocol on an annual basis.

Monitoring of the presence, abundance, and diversity of alien and invasive plants on the site, while forming an integral part of the terrestrial monitoring programme, is partly the responsibility of the following persons:

1 Environmental Manager (Project);
2 Subcontractor responsible for alien and invasive plant control; and
3 Vegetation/ Ecology Monitoring Programme subcontractor.

SECTION I: APPENDICES, BIBLIOGRAPHY AND SPECIALIST CV'S

APPENDIX 1: LIST OF PLANT SPECIES RECORDED WITHIN THE STUDY AREAS

Declared AIP species denoted with ********
Species indicated in ***bold*** *denotes species of conservation concern*

Species Name	Family	Growth Form	Status/ Uses	Conservation / Invasive Status	Common Name
Abutilon species	Malvaceae	Herb	--	--	--
Acalypha species	Euphorbiaceae	Dwarf shrub	--	--	--
Achyranthes aspera L. var. *aspera*	Amaranthaceae	Herb	Naturalised exotic	Naturalised exotic. Not Evaluated	Burrweed (e), Grootklitsbossie (a)
Adenia fruticosa* Burtt Davy subsp. *fruticosa	**Passifloraceae**	**Small tree**	**Poisonous fruit, edible leaves**	**Near Threatened (IUCN). Protected plant (LEMA Schedule 12)**	**Sekhukhune Green-stem (e), Sekoekoenie-bobbejaangif (a)**
Agave americana L. subsp. americana var. *americana* *	Agavaceae	Succulent	Originally from Mexico. Sap is a potential irritant. Medicinal uses	Declared Invader - NEMBA (Category 2). CARA (Category 2).	American agave (e), Blougaringboom (a), Lekhala (s)
***Aloe burgersfortensis* Reynolds**	**Asphodelaceae**	**Succulent**	**None**	**Least Concern (IUCN). Sekhukhune endemic species**	**Burgersfort Aloe (e), Burgersfortaalwyn**
Aloe castanea Schönland	Asphodelaceae	Succulent	Harvested for ornamental purposes	Least Concern (IUCN)	Cat's-tail Aloe (e), Katstertaalwyn (a)
Aloe cf. *ammophila* Reynolds	Asphodelaceae	Succulent	None	Least Concern (IUCN)	--
Aloe globuligemma Pole-Evans	Asphodelaceae	Succulent	None	Least Concern (IUCN)	Knoppiesaalwyn (a)
Aloe marlothii A.Berger subsp. *marlothii*	Asphodelaceae	Succulent	Ornamental, heavily harvested	Least Concern (IUCN)	Mountain Aloe (e), Bergaalwyn (a)
***Aloe wickensii* Pole-Evans**	**Asphodelaceae**	**Succulent**	**--**	**Near Threatened (IUCN)**	**Aloe (e), Aalwyn (a)**
Argemone ochroleuca Sweet subsp. *ochroleuca* *	Papaveraceae	Perennial herb	Possible toxicity to animals and humans, medicinal uses, irritant	Declared Invader - NEMBA (Category 1B). CARA (Category 1). GBIF Listed. Listed for Lesotho	White-flowered Mexican poppy (e), Bloudissel (a), Hlaba-hlabane-e-putsoa (s)
Aristida adscensionis L.	Poaceae	Grass	Poor grazing potential, Increaser IIC	Least Concern (IUCN)	Annual Three-awn (e) Eenjarige Steekgras (a)
Aristida bipartita (Nees) Trin. & Rupr.	Poaceae	Grass	Unpalatable, indicator of degraded veld, Increaser IIC	Least Concern (IUCN)	Rolling grass (e), Grootrolgras (a)
Aristida congesta ssp. *barbicollis*	Poaceae	Grass	Poor grazing potential, Increaser IIC	Least Concern (IUCN)	Spreading Three-awn (e), Lossteekgras (a)
Aristida congesta subsp. *congesta*	Poaceae	Grass	Poor grazing potential, indicator of poor habitat, Increaser IIC	Least Concern (IUCN)	Tassel Three-awn (e), Katstertsteekgras (a)
Aristida diffusa Trin. subsp. *burkei* (Stapf) Melderis	Poaceae	Grass	Unpalatable, possible indicator of overgrazing	Least Concern (IUCN)	Iron Grass (e), Ystergras (a)
Aristida rhiniochloa Hochst.	Poaceae	Grass	Poor grazing value, often in disturbed areas, sandy soils	Least Concern (IUCN)	Rough Three-awn (e), Skurwesteekgras (a)
Asparagus species	Asparagaceae	Shrub	--	--	Wild Asparagus (e), Katbos (a)
***Balanites maughamii* Sprague**	**Balanitaceae**	**Tree**	**Potentially poisonous parts for fish, fruits are edible, traditional and medicinal uses**	**Least Concern (IUCN), Protected Tree (National Forest Act, 1998)**	**Greenthorn (e), Groendoring (a)**
Bidens pilosa L. *	Asteraceae	Herb	Edible parts	Naturalised exotic, Not evaluated	Black-jack (e), Knapsekêrel (a)

Species Name	Family	Growth Form	Status/ Uses	Conservation / Invasive Status	Common Name
Blepharis subvolubilis C.B.Clarke	Acanthaceae	Dwarf shrub	None	Least Concern (IUCN)	Eyelash flower (e)
Bolusanthus speciosus (Bolus) Harms	Fabaceae	Small tree	Roots used medicinally, traditional and practical uses	Least Concern (IUCN)	Elephant Wood (e), Tree Wisteria (e), Vanwykshout (a)
***Boscia albitrunca* (Burch.) Gilg & Gilg-Ben.**	**Capparaceae**	**Tree**	**Important fodder, traditional uses, traditional medicinal uses**	**Least Concern (IUCN), Protected Tree (National Forest Act, 1998)**	**Sheperd's Tree (e), Witgat (a), Matoppie (a), Mohlopi (ns)**
Boscia foetida Schinz subsp. *rehmanniana* (Pestal.) Toelken	Capparaceae	Small tree	Medicinal uses, browsing value	Least Concern (IUCN)	Bushveld Shepherd Tree (e), Stinkwitgat (a), Mopipi (ns)
Bothriochloa insculpta (A.Rich.) A.Camus	Poaceae	Grass	None	Least Concern (IUCN)	Pinhole Grass (e), Stippelgras (a)
Bulbostylis burchellii (Ficalho & Hiern) C.B.Clarke	Cyperaceae	Sedge	None	Least Concern (IUCN)	--
Carissa bispinosa (L.) Desf. ex Brenan	Apocynaceae	Shrub	Edible parts, medicinal uses	Least Concern (IUCN)	Forest num-num (e), Bosnoemnoem (a)
Catharanthus roseus (L.) G.Don *	Apocynaceae	Shrub	Traditional medicinal uses, originally from Madagascar	Declared invasive NEMBA Cat 1B	Madagascar periwinkle (e), Begraafplaasblom (a)
Cenchrus ciliaris L.	Poaceae	Grass	Palatable grazing species, Decreaser	Least Concern (IUCN)	Blue Buffalo Grass (e), Bloubuffelgras (a)
Cereus jamacuru (L.) Mill. *	Cactaceae	Succulent	Originally from South America, spines cause injuries, ornamental. Savanna and rocky ridges	Declared Invader - CARA (Category 1). NEMBA (Category 1B). Schedule 13 (Mpumalanga Nature Conservation Act 10 of 1998). Listed for Lesotho. GBIF listed	Queen of the night (e), Nagblom (a)
Chascanum species	Verbenaceae	Prostrate herb	--	--	--
Cissus cactiformis Gilg	Vitaceae	Climber	Traditional medicinal uses	Least Concern (IUCN)	Cactus vine (e)
Clematis hirsuta Perr. & Guill. var. *junodii* (Burtt Davy) W.T.Wang	Ranunculaceae	Climber	None	Least Concern (IUCN)	--
Cleome gynandra L.	Capparaceae	Herb	Edible parts	Least Concern (IUCN)	African Cabbage (e), Oorpeultjie (a)
Cleome species	Capparaceae	Herb	--	--	--
Combretum apiculatum Sond. subsp. *apiculatum*	Combretaceae	Tree	Traditional medicinal uses, seeds possibly poisonous but consumed by Brown-headed Parrots, leaves eaten by game, firewood	Least Concern (IUCN)	Red bushwillow (e), Rooibos (a), Mogoeleri (ss)
Combretum erythrophyllum (Burch.) Sond.	Combretaceae	Tree	Medicinal uses, ornamental in urban areas	Least Concern (IUCN)	River bushwillow (e), Vaderlandswilg (a)
Combretum hereroense Schinz	Combretaceae	Small tree	Firewood	Least Concern (IUCN)	Russet bushwillow (e), Kierieklapper (a)
Commelina africana	Commelinaceae	Herb	Medicinal properties	Least Concern (IUCN)	Yellow Wandering Jew (e), Geeleendagsblom (a)
Commelina erecta L.	Commelinaceae	Herb	None	Least Concern (IUCN)	--
Commiphora pyracanthoides Engl.	Burseraceae	Shrub	Edible parts, traditional uses	Least Concern (IUCN)	Common corkwood (e), Gewone kanniedood (a) Iminyela (z)
Croton gratissimus Burch. var. *gratissimus*	Euphorbiaceae	Tree	Medicinal uses, larval food for *Charaxes candiope candiope*	Least Concern (IUCN)	Lavender fever-berry (e), Laventelkoorsbessie (a)
Cucumis zeyheri Sond.	Cucurbitaceae	Prostrate herb	Edible parts	Least Concern (IUCN)	Wild Cucumber (e), Wildekomkommer (a)

Species Name	Family	Growth Form	Status/ Uses	Conservation / Invasive Status	Common Name
Cymbopogon validus (Stapf) Stapf ex Burtt Davy	Poaceae	Grass	Thatching & weaving, low grazing potential	Least Concern (IUCN)	Giant Turpentine Grass (e), Reuse Terpentyngras (a)
Cynanchum viminale (L.) Bassi subsp. *viminale*	Apocynaceae	Climber	Medicinal uses, potentially poisonous	Least Concern (IUCN)	Viny milkweed (e), Melktou (a)
Cynodon dactylon (L.) Pers.	Poaceae	Grass	Indicator of disturbed areas, grazing potential	Least Concern (IUCN)	Common Couch Grass (e), Gewone kweekgras (a)
Cyphostemma species	Vitaceae	Climber	--	--	--
Dactyloctenium giganteum Fisher & Schweick.	Poaceae	Grass	Palatable grazing	Least Concern (IUCN)	Giant Crowfoot (e), Reuse Hoenderspoor (a)
Dalechampia galpinii Pax	Euphorbiaceae	Climber	Traditional medicinal uses	Least Concern (IUCN)	Lowveld Wildhop (e)
Datura stramonium L. *	Solanaceae	Herb	Originally from Mexico, North America. Seed poisonous to animals and humans, medicinal uses	Declared Invader - CARA (Category 1), NEMBA (Category 1B), Schedule 13 (Mpumalanga Nature Conservation Act 10 of 1998). GBIF listed. Listed for Lesotho	Common thorn apple (e), Malpitte (a), Letjoi (s)
Dichanthium aristatum	Poaceae	Grass	Moderately palatable, indicator of heavy soils & degraded areas	Least Concern (IUCN)	Rainbow Vlei Grass (e), Reënboogvleigras (a)
Dichrostachys cinerea (L.) Wight & Arn. subsp. *africana* Brenan & Brummitt	Fabaceae	Small tree	Encroacher species, traditional medicinal uses, firewood, pods browsed extensively by game and stock	Least Concern (IUCN)	Small-leaved Sickle Bush (e), Kleinblaar-sekelbos (a), Ugagake (z)
Dicliptera* cf. *fruticosa	**Acanthaceae**	**Forb**	**--**	**Near Threatened (IUCN)**	**--**
Dicoma anomala Sond.	Asteraceae	Dwarf shrub	Medicinal uses	Least Concern (IUCN)	Maagbitterwortel (a)
Dicoma capensis	Asteraceae	Dwarf shrub	Medicinal uses	Least Concern (IUCN)	Koorsbossie (a)
Dicoma tomentosa Cass.	Asteraceae	Dwarf shrub	Often on overgrazed and trampled areas	Least Concern (IUCN)	Hairy Dicoma (e), Harige dicoma (a)
Digitaria eriantha Steud.	Poaceae	Grass	Weaving, palatable grazing grass, Decreaser	Least Concern (IUCN)	Finger grass (e), Finger gras (a)
Dombeya rotundifolia (Hochst.) Planch. var. *rotundifolia*	Malvaceae	Tree	Wood is used for traditional purposes, bark, roots and root is used medicinally	Least Concern (IUCN)	Wild Pear (e), Drolpeer (a)
Drimia elata Jacq.	Hyacinthaceae	Geophyte	Traditional uses, traditional medicinal uses	Least Concern (IUCN)	Satin Squill (e), Brandui (a)
Ehretia rigida (Thunb.) Druce subsp. *nervifolia* Retief & A.E.van Wyk	Ehretiaceae	Small tree	Roots are used medicinally	Least Concern (IUCN)	Puzzle Bush (e), Deurmekaarbos (a)
Elaeodendron transvaalensis (Burtt Davy) Codd	**Celastraceae**	**Small tree**	**Traditional and medicinal uses**	**Near Threatened (IUCN). Protected Tree (National Forest Act, 1998)**	**Bushveld Saffron (e), Bosveld-saffraan (a)**
Elephantorrhiza burkei Benth.	Fabaceae	Shrub	Traditional and medicinal uses	Least Concern (IUCN)	Broad-pod Elephant-root (e), Basboontjie (a)
Enneapogon cenchroides (Roem. & Schult.) C.E.Hubb.	Poaceae	Grass	Useful pioneer grass, moderately palatable	Least Concern (IUCN)	Nine-awned gras (e), Negenaaldgras (a)
Eragrostis capensis (Thunb.) Trin.	Poaceae	Grass	Moderate grazing potential	Least Concern (IUCN)	Heart-seed love grass (e), Hartjiesgras (a)
Eragrostis chloromelas Steud.	Poaceae	Grass	Edible parts, Increaser IIB	Least Concern (IUCN)	Curly leaf (e), Krulblaar (a)
Eragrostis lehmanniana Nees var. *lehmanniana*	Poaceae	Grass	Indicator of overgrazing, valuable grazing grass,	Least Concern (IUCN)	Lehman Love Grass (e), Lehmann-eragrostis (a), Knietjiesgras (a)
Eragrostis rigidior Pilg.	Poaceae	Grass	Important grazing grass in arid regions	Least Concern (IUCN)	Broad curly leaf (e), Breë Krulblaar (a)

Species Name	Family	Growth Form	Status/ Uses	Conservation / Invasive Status	Common Name
Eriosema species	Fabaceae	Dwarf shrub	--	--	--
Euclea natalensis A.DC. subsp. *angustifolia* F.White	Ebenaceae	Shrub	Traditional and medicinal uses, edible parts	Least Concern (IUCN)	Bushveld hairy guarri (e), Bosveld harige guarrie (a)
Euclea species	Ebenaceae	Shrub	--	--	--
Euclea undulata Thunb.	Ebenaceae	Small tree	Firewood, edible fruit, traditional medicinal uses	Least Concern (IUCN)	Common Guarri (e), Gewone ghwarrie (a)
***Eulophia petersii* (**Rchb.f.) Rchb.f.	Orchidaceae	Geophyte	None	Least Concern (IUCN). Protected Species LEMA Schedule 12	--
Euphorbia cf. *lydenburgensis* Schweick. & Letty	Euphorbiaceae	Succulent	None	Least Concern (IUCN)	Lydenburg Milkweed (e), Lydenburg Melkbos (a)
Euphorbia ingens E.Mey. ex Boiss.	Euphorbiaceae	Succulent	Latex is toxic and caustic, used medicinally and as a fish poison	Least Concern (IUCN)	Giant euphorbia (e), Naboom (a)
Euphorbia schinzii Pax	Euphorbiaceae	Succulent	None	Least Concern (IUCN)	--
Euphorbia species	Euphorbiaceae	Succulent	--	--	--
Fingerhuthia africana Lehm.	Poaceae	Grass	Moderate grazing potential, Decreaser	Least Concern (IUCN)	Thimble grass (e), Vingerhoedgras (a)
Flaveria bidentis (L.) Kuntze *	Asteraceae	Herb	None	Declared Invader - NEMBA (Category 1B. AIP, 2016).	Smelter's bush, Smelterbossie (a)
Gardenia volkensii K.Schum. subsp. *volkensii* var. *volkensii*	Rubiaceae	Tree	Fruit and root are used medicinally, traditional uses	Not evaluated (Least Concern)	Bushveld gardenia (e), Bosveldkatjiepiering (a)
Geigeria burkei Harv. subsp. *fruticulosa* Merxm.	Asteraceae	Dwarf shrub	Potentially poisonous	Least Concern (IUCN)	Vermeerbos (a)
Gossypium herbaceum subsp. *africanum*	Malvaceae	Herb	Traditional uses	Least Concern (IUCN)	Wild cotton (e), Wilde katoen (a)
Grewia bicolor Juss. var. *bicolor*	Malvaceae	Shrub	Medicinal uses, edible parts, highly variable	Least Concern (IUCN)	White-leaved Raisin (e), Witrosyntjie (a)
Grewia flava DC.	Malvaceae	Shrub	Edible parts, weaving, traditional uses, declared indicator of encroachment	Least Concern (IUCN)	Velvet Raisin (e), Fluweelrosyntjiebos (a)
Grewia flavescens Juss.	Malvaceae	Shrub	Edible parts, beer brewing	Least Concern (IUCN)	Bushman Raisin (e), Kruisbessie (a)
Grewia vernicosa Schinz	Malvaceae	Shrub	Generally on serpentine soils	Least Concern (IUCN)	Glossy Raisin (e), Glansrosyntjie (a)
Gymnosporia buxifolia (L.) Szyszyl.	Celastraceae	Small tree	Traditional uses, toxic parts, medicinal uses	Least Concern (IUCN)	Common spike-thorn (e), Gewone pendoring (a)
Gymnosporia polyacantha (Sond.) Marais	Celastraceae	Shrub	None	Least Concern (IUCN)	--
Helichrysum species	Asteraceae	Herb	None	--	--
Hermannia species	Malvaceae	Dwarf shrub	--	--	--
Heteropogon contortus (L.) Roem. & Schult.	Poaceae	Grass	Moderate grazing potential, irritant	Least Concern (IUCN)	Spear grass (e), Assegaaigras (a)
Hibiscus cannabinus L.	Malvaceae	Herb	None	Least Concern (IUCN)	Indian Hemp-leaved Hibiscus (e), Wildestokroos (a)
Hibiscus microcarpus Garcke	Malvaceae	Herb	None	Least Concern (IUCN)	Tiny Wild Hibiscus (e), Wilde klein Hibuscus (a)

Species Name	Family	Growth Form	Status/ Uses	Conservation / Invasive Status	Common Name
Holubia saccata Oliv.	Pedaliaceae	Herb	None	Least Concern (IUCN)	Sac Flower (e)
Hyparrhenia tamba (Steud.) Stapf	Poaceae	Grass	None	Least Concern (IUCN)	Berggras (a)
Hyperthelia dissoluta (Nees ex Steud.) Clayton	Poaceae	Grass	Thatching	Least Concern (IUCN)	Yellow Thatching Grass (e), Geeltamboekiegras (a)
Indigofera filipes Benth. ex Harv.	Fabaceae	Herb	None	Least Concern (IUCN)	--
Indigofera species	Fabaceae	Herb	--	--	--
Ipomoea species	Convolvulaceae	Prostrate herb	None	--	--
Jamesbrittenia aurantiaca	Scrophulariaceae	Herb	Colours & dyes	Least Concern (IUCN)	Cape Saffron (e), Saffraanbossie (a)
Jamesbrittenia burkeana (Benth.) Hilliard	Scrophulariaceae	Dwarf shrub	None	Least Concern (IUCN)	Bruinblommetjie (a)
Jasminum fluminense Vell. subsp. *fluminense*	Oleaceae	Climber	Along watercourses in dry country	Least Concern (IUCN)	Wild Jasmine (e), Wilde Jasmyn (a)
Justicia flava (Vahl) Vahl	Acanthaceae	Herb	None	Least Concern (IUCN)	Yellow Justicia (e), Geelgarnaalbos (a)
Kalanchoe luciae Raym.-Hamet subsp. *luciae*	Crassulaceae	Succulent	None	Least Concern (IUCN)	--
Kalanchoe paniculata Harv.	Crassulaceae	Succulent	None	Least Concern (IUCN)	Large Orange Kalanchoe (e), Hasieoor (a), Krimpsiektebossie (a)
Kalanchoe rotundifolia (Haw.) Haw.	Crassulaceae	Succulent	Medicinal uses, potentially poisonous	Least Concern (IUCN)	Nentakalanchoe (e), Nentabos (a)
Karomia speciosa (Hutch. & Corbishley) R.Fern.	Lamiaceae	Shrub	None	Least Concern (IUCN)	Southern Chinese-hats (e), Perssambreelblom (a)
Kirkia wilmsii Engl.	Kirkiaceae	Tree	Emergency water source	Least Concern (IUCN)	Mountain Kirkia (e), Bergsering (a)
Kleinia longiflora DC.	Asteraceae	Succulent	Traditional uses	Least Concern (IUCN)	Sjambokbos (a)
Kleinia stapeliiformis (E.Phillips) Stapf	Asteraceae	Succulent	Harvested for ornamental purposes	Least Concern (IUCN)	--
Kyphocarpa angustifolia (Moq.) Lopr.	Amaranthaceae	Herb	None	Least Concern (IUCN)	Silky Burweed (e)
Ledebouria species	Hyacinthaceae	Geophyte	--	--	--
Leonotis ocymifolia (Burm.f.) Iwarsson	Lamiaceae	Dwarf shrub	Medicinal uses, colours & dyes	Least Concern (IUCN)	Minaret Flower (e), Wildedagga (a)
Leucas species	Lamiaceae	Herb	--	--	--
Leucosphaera bainesii (Hook.f.) Gilg	Amaranthaceae	Dwarf Shrub	None	Least Concern (IUCN)	Perdebossie (a)
Melia azedarach L. *	Meliaceae	Tree	Originally from Asia, Australia. Poisonous seeds, ornamental	Declared Invader - CARA (Category 3), NEMBA (a. Category 1b b. Category 3 in urban areas). GBIF listed.	Seringa (e), Persian lilac (e), Gewone sering (a)
Momordica balsamina L.	Cucurbitaceae	Climber	Rigorous climber, edible parts, traditional medicinal uses	Least Concern (IUCN)	Balsam Pear (e), Laloentjie (a), Balsam Peer (a)
Morus alba L. *	Moraceae	Tree	Originally from northern China, edible parts	Declared Invader - NEMBA (Category 3). GBIF listed. CARA Category 3.	White mulberry (e) Moerbei (a)

Species Name	Family	Growth Form	Status/ Uses	Conservation / Invasive Status	Common Name
Nicotiana glauca Graham *	Solanaceae	Shrub	Originally from South America. Poisonous to livestock	Declared Invader - CARA 2002 (Category 1), NEMBA – (Category 1B). GBIF listed. CARA Category 1.	Wild Tobacco (e), Wildetabak (a), Koae (s)
Ocimum obovatum E.Mey. ex Benth. subsp. *obovatum*	Lamiaceae	Herb	None	Least Concern (IUCN)	Cat's Whiskers (e), Kat Baard (a)
Opuntia ficus-indica (L.) Mill. *	Cactaceae	Succulent	Originally from Mexico. Edible parts, medicinal uses. Cladodes poisonous when fed to cattle in large quantities, irritants	Declared Invader - NEMBA (Category 1B). CARA (Category 1). Invader Species, Schedule 13 (Mpumalanga Nature Conservation Act 10 of 1998). GBIF listed.	Sweet Prickley pear (e), Turksvy (a), Torofeiee (s)
Opuntia humifusa (Raf.) Raf. *	Cactaceae	Succulent	Originally from Central America (south-western United States and Mexico)	Declared Invader - CARA 2002 – Category 1 NEMBA – Category 1B	Eastern Prickly Pear (e), Devil's Tongue (e)
Opuntia leucotricha DC. *	Cactaceae	Succulent	Originally from Mexico	Declared Invader - CARA 2002 – Category 1 NEMBA – Category 1B	Aaron's Beard Pricly Pear (e)
Panicum maximum Jacq.	Poaceae	Grass	None	Least Concern (IUCN)	Buffalo Grass (e), Gewone Buffelsgras (a)
Peltophorum africanum Sond.	Caesalpiniaceae	Tree	Medicinal properties	Least Concern (IUCN)	Weeping wattle (e), Huilboom (a)
Pennisetum clandestinum Chiov. *	Poaceae	Grass	Originally from northeast Africa. Ornamental and for ground cover, fodder, styptic	Declared Invader - NEMBA (Category 1B in protected areas and wetlands in which it does not already occur).	Kikuyu Grass (e), Kikoejoegras (a) Mohloa-tshepe
Pergularia daemia (Forssk.) Chiov. subsp. *daemia*	Apocynaceae	Climber	Medicinal uses	Least Concern (IUCN)	Bobbejaankambro (a), Kgaba
Perotis patens Gand.	Poaceae	Grass	Indicator of poor management, Decreaser IIC	Least Concern (IUCN)	Cat's Tail (e), Katstertgras (a)
Phragmites mauritianus Kunth	Poaceae	Hydrophilic	None	Least Concern (IUCN)	Lowveld Reed (e), Laveldfluitjiesriet (a)
Phyllanthus species	Euphorbiaceae	Shrub	--	--	--
Polydora poskeana (Vatke & Hildebr.) H.Rob.sens.lat.	Asteraceae	Herb	Medicinal uses	Least Concern (IUCN)	Vernonia (a)
Populus x *canescens* (Aiton) Sm. *	Salicaceae	Tree	STI's, firewood, building material	Declared Invader - NEMBA (Category 2), CARA (Category 2). Originally from America, timber. GBIF listed.	Grey poplar (e), Gryspopulier (a), Populiri (s)
Pouzolzia mixta Solms	Urticaceae	Shrub	Traditional and traditional medicinal uses	Least Concern (IUCN)	Soap-nettle (e), Seepnetel (a)
Requienia sphaerosperma DC.	Fabaceae	Herb	None	Least Concern (IUCN)	--
Rhigozum brevispinosum Kuntze	Bignoniaceae	Shrub	None	Least Concern (IUCN)	Short-thorn pomegranate (e), Kortdoringgranaat (a)
Rhynchosia species	Fabaceae	Dwarf shrub	None	--	--
Rhynchosia totta (Thunb.) DC. var. *totta*	Fabaceae	Herb	Edible parts	Least Concern (IUCN)	Yellow Carpet Bean (e)
Ricinus communis L. var. *communis* *	Euphorbiaceae	Shrub	Poisonous parts	Declared Invader - NEMBA (Category 2))	Castor-oil plant (e), Kasterolie (a)
Salix babylonica L.	Salicaceae	Tree	Non-endemic	Naturalised exotic, Not evaluated	Weeping willow (e), Treurwilger (a)
Sansevieria hyacinthoides (L.) Druce	Liliaceae	Perennial herb	Traditional uses	Least Concern (IUCN)	Mother-in-law's Tongue (e), Skoonma se tong (a)

Species Name	Family	Growth Form	Status/ Uses	Conservation / Invasive Status	Common Name
Schizachyrium sanguineum (Retz.) Alston	Poaceae	Grass	Palatable grass, thatching, Increaser I	Least Concern (IUCN)	Red Atumn Grass (e), Rooiherfsgras (a)
Schkuhria pinnata (Lam.) Cabrera	Asteraceae	Herb	Medicinal uses, weed (S. America)	Naturalised exotic. Not Evaluated	Dwarf Marigold (e), Bitterbossie (a)
Schmidtia pappophoroides Steud.	Poaceae	Grass	Palatable grazing grass, Increaser	Least Concern (IUCN)	Sand Quick (e), Sandkweek (a)
***Sclerocarya birrea* (A.Rich.) Hochst. subsp. *caffra* (Sond.) Kokwaro**	**Anacardiaceae**	**Tree**	**Edible parts, traditional uses**	**Least Concern (IUCN). Protected Tree (National Forest Act, 1998)**	**Marula (e), Maroela (a)**
Searsia pentheri (Zahlbr.) Moffett	Anacardiaceae	Small tree	None	Least Concern (IUCN)	Crow Berry (e), Gewone Kraaibessie (a)
Searsia pyroides Burch. var. *pyroides*	Anacardiaceae	Small tree	Edible parts, medicinal uses	Least Concern (IUCN)	Common wild currant (e), Gewone taaibos (a)
Selaginella dregei (C.Presl) Hieron.	Selaginaceae	Fern	Medicinal uses	Least Concern (IUCN)	Resurrection Plant (e)
Senecio pleistocephalus S.Moore	Asteraceae	Climber	None	Least Concern (IUCN)	Golden Garland Vine (e)
Senegalia erubescens (Welw. ex Oliv.) Kyal. & Boatwr.	Fabaceae	Small tree	None, irritant. Often regarded as an encroacher species	Least Concern (IUCN)	Blue Thorn (e), Blouhaak (a), Moloto (tw)
Senegalia galpinii (Burtt Davy) Seigler & Ebinger	Fabaceae	Tree	Ornamental in gardens	Least Concern (IUCN)	Monkey Thorn (e), Apiesdoring (a)
Senegalia mellifera (Vahl) Seigler & Ebinger subsp. *detinens* (Burch.) Kyal. & Boatwr.	Fabaceae	Small tree	Declared indicator of encroachment, medicinal uses, poison source	Least Concern (IUCN)	Black Thorn (e), Swarthaak (a)
Senegalia nigrescens (Oliv.) P.J.H.Hurter	Fabaceae	Tree	Tannin rich bark, important browse for game, Host plant for larvae of *Charaxes phaeus*. Often regarded as an encroacher species	Least Concern (IUCN)	Knob thorn (e), Knoppiesdoring (a), Mokala (tw)
Senegalia senegal (L.) Britton var. *leiorhachis* (Brenan) Kyal. & Boatwr.	Fabaceae	Tree	None	Least Concern (IUCN)	Slender Three-hook Thorn (e), Slaploot (a), Muunga-thuda (v)
Senna didymobotrya (Fresen.) H.S.Irwin & Barneby *	Fabaceae	Herb	Ornamental, originally from tropical Africa	Declared Invader - CARA 2002 (Category 1). NEMBA (a. 1B in Eastern Cape, KwaZulu-Natal, Limpopo, Mpumalanga and Western Cape. b. Not listed elsewhere). CARA 2002	Peanut butter cassia (e), Grondboontjiebotterkassia (a)
Senna italica Mill. subsp. *arachoides* (Burch.) Lock	Fabaceae	Herb	Medicinal uses	Least Concern (IUCN)	Wild senna (e), Elandsertjie (a)
Sesamum triphyllum Welw. ex Asch. var. *triphyllum*	Pedaliaceae	Herb	Edible parts, essential oils	Least Concern (IUCN)	Wild sesame (e), Brandboontjie (a)
Sesbania bispinosa (Jacq.) W.Wight var. *bispinosa*	Fabaceae	Shrub	Exotic species, often in moist areas, marshes. Originally from India, China, Iran. Edible parts	Currently unlisted	Prickly Sesban
Sesbania punicea (Cav.) Benth. *	Fabaceae	Tree	Originally from S. America. Leaves, flowers, seeds poisonous	Declared Invader - NEMBA (Category 1B). CARA (Category 1).	Red Sesbania (e), Rooisesbania (a)
Setaria sphacelata (Schumach.) Stapf & C.E.Hubb. ex M.B.Moss var. *torta* (Stapf) Clayton	Poaceae	Grass	None	Least Concern (IUCN)	Small Creeping Foxtail (e), Kleinkuipmannagras (a)
Sida alba L.	Malvaceae	Herb	None	Least Concern (IUCN)	Spiny Sida (e), Stekeltaaiman (a)

Species Name	Family	Growth Form	Status/ Uses	Conservation / Invasive Status	Common Name
Sida cordifolia L.	Malvaceae	Herb	None	Least Concern (IUCN)	Flannel Weed (e), Hartblaartaaiman / Verdompsterk (a)
Sida species	Malvaceae	Herb	--	--	--
Smilax anceps Willd.	Smilacaceae	Climber	Medicinal uses, irritant	Least Concern (IUCN)	Thorny Rope (e), Doringtou (a)
Solanum elaeagnifolium Cav. *	Solanaceae	Dwarf shrub	Weed	Declared Invader - Category 1B (NEM:BA, 2004. AIP, 2014)	Silver-leaf bitter apple (e)
Sphenostylis angustifolia Sond.	Fabaceae	Prostrate herb	None	Least Concern (IUCN)	Wild sweetpea (e), Wilde-ertjie (a)
Sporobolus iocladosa (Trin.) Nees	Poaceae	Grass	Decreaser	Least Concern (IUCN)	Pan Dropseed (e), Panfynsaadgras (a)
Sporobolus pyramidalis P.Beauv.	Poaceae	Grass	Unpalatable, indicator of overgrazing, Decreaser IIC	Least Concern (IUCN)	Catstail Dropseed (e), Katstert-fynsaadgras (a)
***Stapelia gigantea* N.E.Br.**	**Apocynaceae**	**Succulent**	**Traditional medicinal uses**	**Least Concern (IUCN). Protected Species LEMA Schedule 12**	**Giant Carrion Flower (e), Reuseaasblom (a)**
Sterculia rogersii N.E.Br.	Sterculiaceae	Tree	Traditional uses, edible seeds	Least Concern (IUCN)	Star-chestnut (e), Sterkastaiing (a), Mukakate (v)
Stipagrostis hirtigluma (Steud.) De Winter subsp. *patula* (Hack.) De Winter	Poaceae	Grass	None	Least Concern (IUCN)	Blue Bushman Grass (e), Blouboesmangras (a)
Stylochaeton natalensis Schott	Araceae	Geophyte	Root and leaves used for traditional medicinal purposes	Least Concern (IUCN)	Bushveld Arum (e), Bosvelld Varkoor (a)
Tagetes minuta L.	Asteraceae	Herb	Originally from S. America. Essential oils, colours & dyes. Irritant	Not NEM:BA listed. GBIF listed.	Khaki Weed (e), Kakiebos (a), Lechuchutha (s)
Tecoma stans (L.) Juss. ex Kunth var. *stans* *	Bignoniaceae	Shrub	Ornamental	Declared Invader - CARA 2002 (Category 1). NEMBA (Category 1B)	Yellow elder (e), Geelklokkies (a)
Tephrosia species	Fabaceae	Herb	None	--	--
Terminalia prunioides M.A.Lawson	Combretaceae	Small tree	Traditional uses	Least Concern (IUCN)	Purple-pod Cluster-leaf (e), Sterkbas (a), Nshashantsawu (ts)
Tetradenia brevispicata (N.E.Br.) Codd	Lamiaceae	Dwarf shrub	None	Least Concern (IUCN)	Small-leaved Ginger-bush (e)
Themeda triandra Forssk.	Poaceae	Grass	Palatable grazing, Decreaser	Least Concern (IUCN)	Red grass (e), Rooigras (a)
Tragia dioica Sond.	Euphorbiaceae	Herb	None	Least Concern (IUCN)	Brandnetel (a)
Tribulus terrestris L.	Zygophyllaceae	Prostrate herb	Medicinal uses	Least Concern (IUCN)	Common Dubbeltjie (e), Gewone Dubbeltjie (a)
Tricholaena monachne (Trin.) Stapf & C.E.Hubb.	Poaceae	Grass	Moderate grazing potential, Increaser IIC	Least Concern (IUCN)	Blue-seed grass (e), Blousaadgras
Typha capensis (Rohrb.) N.E.Br.	Typhaceae	Hydrophilic	Edible parts, medicinal uses	Naturalised exotic. Cosmopolitan weed, Not evaluated	Bulrush (e), Papkuil (a)
Urochloa mosambicensis (Hack.) Dandy	Poaceae	Grass	Edible parts, palatable grazing grass	Least Concern (IUCN)	Bushveld signal grass (e), Bosveldbeesgras (a)
Vachellia exuvialis (I.Verd.) Kyal. & Boatwr.	Fabaceae	Small tree	None	Least Concern (IUCN)	Flaky Thorn (e), Skilferbas-doring (a)

Species Name	Family	Growth Form	Status/ Uses	Conservation / Invasive Status	Common Name
Vachellia grandicornuta (Gerstner) Seigler & Ebinger	Fabaceae	Small tree	Regarded as an encroacher species	Least Concern (IUCN)	Horned thorn (e), Horingdoring (a), Masaoka (tw)
Vachellia nilotica (L.) P.J.H.Hurter & Mabb. subsp. *kraussiana* (Benth.) Kyal. & Boatwr.	Fabaceae	Tree	Dyes and tans, traditional and medicinal uses	Least Concern (IUCN)	Scented-pod Thorn (e), Lekkerruikpeul (a)
Vachellia tortilis (Forssk.) Gallaso & Banfi subsp. *heteracantha* (Burch.) Kyal. & Boatwr.	Fabaceae	Tree	Medicinal uses (bark). Often regarded as an encroacher species	Least Concern (IUCN)	Curly-pod Acacia (e), Haak-en-steek (a), Isishoba (z)
Volkameria glabra (E.Mey.) Mabb. & Y.W.Yuan	Lamiaceae	Tree	Traditional and medicinal uses. Flowers attract birds and butterflies	Least Concern (IUCN)	Smooth Tinderwood (e), Bitterblaar (a)
Waltheria indica L.	Sterculiaceae	Herb	None	Least Concern (IUCN)	Meidebossie (a)
Xanthium strumarium L. *	Asteraceae	Dwarf shrub	None	Declared Invader - CARA 2002 (Category 1). Proposed legislation: NEMBA (Category 1B).	Large cocklebur (e), Kankerroos (a)
Ximenia caffra Sond. var. *caffra*	Olacaceae	Small tree	Edible parts	Least Concern (IUCN)	Large Sourplum (e), Grootsuurpruim (a)
Zinnia peruviana (L.) L.	Asteraceae	Perennial herb	Naturalised weed (South America)	Not Evaluated	Wildejakopregop (a)
Ziziphus mucronata Willd. subsp. *mucronata*	Rhamnaceae	Small tree	Edible parts, traditional medicinal uses, traditional uses	Least Concern (IUCN)	Buffalo-thorn (e), Blinkblaar-wag-'n-bietjie (a)

APPENDIX 2: IMAGE COLLAGE OF SELECTED PLANT SPECIES RECORDED FROM THE STUDY AREA AND IMMEDIATE SURROUNDS

Blepharis subvolubilis

Clematis brachiata

Xanthium strumarium

Aloe castanea

Gardenia volkensii

Aloe cf. *burgersfortensis*

Aloe marlothii

Boscia albitrunca

Cereus jamacuru

Drimia altissima

Hibiscus cannabinus

Karomia species

Cylindropuntia imbricata

Cynanchum viminale

Dicliptera species

Dicoma tomentosa

Euphorbia cf. *schinzii*

Euphorbia cf. *trigona*

Opuntia humifusa

Peponium caledonicum

Stapelia cf. *gettliffei*

Holubia saccata

Momordica balsamina

Opuntia leucotricha

Peponium caledonicum

Petalidium oblongifolium

Sansevieria hyacinthoides

Stapelia cf. *giganteum*

Sterculia rogersii

Sterculia rogersii

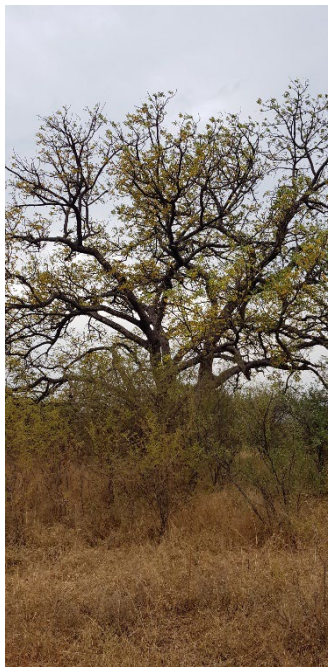
Senecio pleistocephalus

Tetradenia brevispicata

Triaspis glaucophylla

Vachellia exuvialis

Aristida cf. *rhiniochloa*



Sclerocarya birrea (Marula)

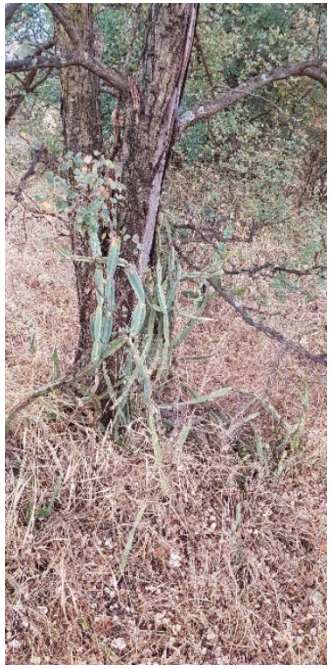
Agave sisalana

Aloe species

Cynanchum viminale

Adenia fruticosa (stem)

Adenia fruticosa (leaf)



Cissus cactiformis

Euphorbia cf. *lydenburgensis*

Kleinia stapeliiformis

Grewia bicolor

APPENDIX 3: LIST OF PROTECTED TREE SPECIES UNDER THE NATIONAL FOREST ACT, 1998 (ACT NO. 84 OF 1998)

Binomial name	*Common Name (English)*	*National Tree Number*
Adansonia digitata	Baobab	467
Afzelia quanzensis	Pod mahogany	207
Balanites maughamii* subsp. *maughamii	**Torchwood**	**251**
Barringtonia racemosa	Powder-puff tree	524
Boscia albitrunca	**Shepherd's tree**	**122**
Brachystegia spiciformis	Msasa	198.1
Breonadia salicina	Matumi	684
Bruguiera gymnorrhiza	Black mangrove	527
Cassipourea swaziensis	Swazi onionwood	531.1
Catha edulis	Bushman's tea	404
Ceriops tagal	Indian mangrove	525
Cleistanthus schlechteri var. *schlechteri*	False tamboti	320
Colubrina nicholsonii	Pondo weeping thorn	453.8
Combretum imberbe	Leadwood	539
Curtisia dentata	Assegai	570
Elaeodendron transvaalensis	Bushveld saffron	416
Erythrophysa transvaalensis	Bushveld red balloon	436.2
Euclea pseudebenus	Ebony guarri	598
Ficus trichopoda	Swamp fig	54
Leucadendron argenteum	Silver tree	77
Lumnitzera racemosa var. *racemosa*	Tonga mangrove	552
Lydenburgia abotti	Pondo bushman'sTea	407
Lydenburgia cassinoides	Sekhukhunibushman's tea	406
Mimusops caffra	Coastal red milkwood	583
Newtonia hildebrandtii var. *hildebrandtii*	Lebombo wattle	191
Ocotea bullata	Stinkwood	118
Ozoroa namaquensis	Gariep resin tree	373.2
Philenoptera violacea	Apple-leaf	238
Pittosporum viridiflorum	Cheesewood	139
Podocarpus elongates	Breede River yellowwood	15
Podocarpus falcatus	Outeniqua yellowwood	16
Podocarpus henkelii	Henkel's yellowwood	17
Podocarpus latifolius	Real yellowwood	18
Protea comptonii	Saddleback sugarbush	88
Protea curvata	Serpentine sugarbush	88.1
Prunus africana	Red stinkwood	147
Pterocarpus angolensis	Wild teak	236
Rhizophora mucronata	Red mangrove	526
Sclerocarya birrea* subsp. *caffra	**Marula**	**360**
Securidaca longepedunculata	Violet tree	303
Sideroxylon inerme subsp. *inerme*	White milkwood	579
Tephrosia pondoensis	Pondo poison pea	226.1
Vachellia (Acacia) erioloba	Camel thorn	168
Vachellia (Acacia) haematoxylon	Grey camel thorn	169
Warburgia salutaris	Pepper-bark tree	488
Widdringtonia cedarbergensis	Clanwilliam cedar	19
Widdringtonia schwarzii	Willowmore cedar	21

*Species indicated in **bold** were recorded from the development footprints during the site inspection period*

APPENDIX 4: LIMPOPO ENVIRONMENTAL MANAGEMENT ACT (ACT NO 7 OF 2003) CONSERVATION SCHEDULES FOR PLANT SPECIES

*Species indicated in **bold** were recorded from the development footprint during the site inspection period, or are regarded highly likely to persist on the site (apart from opportunistic or migratory purposes).*

Schedule 2	
Prohibited Aquatic Growth	
Common Name	*Scientific Name*
Azolla	*Azolla* spp
Kariba Weed	*Salvinia molesta*
Parrot's Feather	*Myriophyllum aquaticum*
Pond Weed	*Egeria densa*
Water Hyacinth	*Eichhornia crassipes*
Water Lettuce	*Pistia stratiotes*
Schedule 11	
Specially Protected Plants	
Common Name	*Scientific Name*
All cultivated seedlings of indigenous cycads	*Encephalartos* spp
Schedule 12 Trees and Shrubs	
Common Name	*Scientific Name*
The following *Adenia* species	*Adenia fruticosa simpliciflora*
Baobab	*Adansonia digitata*
Beech	*Faurea macnaughtonii*
Bitter False Thorn	*Albizia amara sericocephala*
The following *Boscia* species	*Boscia angustifolia* var. *corymbosa*
	Boscia foetida minima
Borassus Palm	*Borassus aethiopicum*
Brackenridgea	*Brackenridgea zanguebarica*
Capper Bush	*Capparis sepiaria* var. *subglabra*
The following Combretum species:	*Combretum collinum taborense*
	Combretum padoides
	Combretum petrophilum
	Combretum vendae
Forest Bastard Currant	*Allophylus ainifolius*
The following *Elephantorrhiza* species:	*Elephantorrhiza praetermissa*
The following *Grewia* species:	*Grewia rogersii*
The following *Hibiscus* species	*Hibiscus articulates*
	Hibiscus barnardii
	Hibiscus sabiensis
Large Cape Myrtle	*Myrsine pillansii*
Largeleaved Dragon Tree	*Dracaena hookerana*
Large-leaved Saucerberry	*Cordia africana*
The following *Maytenus* species:	*Maytenus oxycarpa*
	Maytenus pubescens
The following *Ochna* species	*Ochna glauca*
Pepperbark Tree	*Warburgia salutaris*
Pincushion	*Leucospermum saxosum*
The following *Rhus* species	*Rhus batophylla*
Sand ironplum	*Drypetes mossambicensis*
Salati Palm	*Borassus aethiopicum*
Stinkwood, Black	*Ocotea bullata*
Stinkwood, Transvaal	*Ocotea kenyensis*
Tamboti	*Spirostachys africana*
The following *Tarenna* species	*Tarenna zygoon*
Transvaal Red Balloon	*Erythrophysa transvaalensis*
Venda Beadstring	*Alchornea laxiflora*
Wild Banana	*Ensete ventricosum*
Wild Teak	*Pterocarpus angolensis*

Yellowwood, Outeniqua	*Podocarpus latifolius*
Yellowwood, Real	*Podocarpus falcatus*
Succulents	
All species of Aloes indigenous to the Province, **excluding** the following species:	
Common Name	***Scientific Name***
Aculeata	*Aloe aculeata*
Aloe, Catstail	*A. castanea*
Aloe, Krans	*A. arborescens*
Aloe, Mountain	*A. marlothii*
Ammophilla	*A. ammophilla*
Davyana	*A. davyana*
Fosteri	*A. fosteri*
Globuligemma	*A. globuligemma*
Grandidentata	*A. grandidentata*
Greatheadii	*A. greatheadii*
Lutescens	*A lutescens*
Mutans	*A. mutans*
Parvibracteata	*A. parvibracteata*
Transvaalensis	*A. transvaalensis*
Wickensii	*A. wickensii*
All species of *Brachystelma*	*Brachystelma* spp
All species of *Ceropegia*	*Ceropegia* spp
All species of *Duvalia*	*Duvalia* spp
The following *Euphorbia* species:	*Euphorbia barnardii,*
	E. divicola,
	E. grandialata,
	E. groenewaldii,
	E. louwii,
	E. restricta,
	E. rowlandii,
	E. tortirama
	E. waterbergensis
Ghaap	*Hoodia lugardii*
All species of Ghaap	*Tavaresia* spp
All species of *Huernia*	*Huernia* spp
All species of *Huerniopsis*	*Huerniopsis* spp
The following Impala Lilies	*Adenium multiflorum*
	A. olefolium
Kudu Lily	*Pachypodium saundersii*
All species of *Orbeanthus*	*Orbeanthus* spp
All species of *Orbeas*	*Orbea* spp
All species of *Orbeopsis*	*Orbeopsis* spp
All species of *Pachycymbiums*	*Pachycymbium* spp
All species of *Riocreuxias*	*Riocreuxia* spp
All species of *Stapeliads*	*Stapelia* spp
Stone Plant	*Lithops* leslieii
Other Plants	
The following *Agapanthus* species	*Agapanthus coddii, A. dyeri*
The following *Anacampseros* species	*Anacampseros bemenkampii* (now *A. rhodesica*)
All species of *Anomatheca*	*Anomatheca* spp
The following *Anthericum* species	*Anthericum cyperaceum*
The following Arum Lilies:	*Zantedeschia jucunda, Z.pentlandii, Z. rehmannii*
The following *Babiana* Species	*Babiana hypogea* var. *longituba*
Batesiana Gasteria	*Gasteria batesiana*
Blue Squill	*Scilla natalensis (Merwillea plumbea)*
Clivia	*Clivia caulescens*
The following *Cyathula* species	*Cyathula natalensis*
The following *Eragrostis* species	*Eragrostis arenicola*
The following *Eriosema* species	*Eriosema transvaalense*
The following *Eulophia* species	*Eulophia coddii*

	E. leachii
The following *Felicia* species	*Felicia fruticosa brevipendunculata*
The following *Festuca* species	*Festuca dracomontana*
All species of Fire Lily	*Cyrtanthus* spp
The following *Freylinia* species	*Freylinia tropica*
The following *Gladiolus* species	*Gladiolus macneilii*
The following *Habernaria* species	*Habernaria kraenzliniana*
The following *Heinsia* species	*Heinsia crinita*
The following *Hermstaedtia* species	*Hermstaedtia capitata*
The following *Hippocratea* species	*Hippocratea parvifolia*
The following *Hymenodictyon* species	*Hymenodictyon parvifolium parvifolium*
The following *Hyptis* species	*Hyptis spicigera*
The following *Inula* species	*Inula paniculata*
The following *Jasminum* species	*Jasminum abyssinbicum*
The following *Kalanchoe* species	*Kalanchoe crundallii*
	K. rogersii
The following *Kniphofia* species	*Kniphofia coralligemma*
	K. crassifolia
	K. rigidifolia
The following *Kotschya* species	*Kotschya thymodora*
The following *Melinus* species	*Melinus tenuissima*
The following *Mondia* species	*Mondia whitei*
The following *Monsonia* species	*Monsonia lanuginosa*
The following *Neobulosia* species	*Neobulosia tysonii*
The following *Nervillia* species	*Nervillia umbroza*
The following *Nymphaea* species	*Nymphaea lotus*
The following *Oberonia* species	*Oberonia distichia*
The following *Oreosyce* species	*Oreosyce africana*
Paint Brush	*Haemanthus montanus*
The following *Peristrophe* species	*Peristrophe cliffordii*
	P. gililandorum
	P. transvaalensis
The following *Phyllanthus* species	*Phyllanthus pinnatus*
The following *Pilea* species	*Pilea rivularis*
The following *Plinthus* species	*Plinthus rehmannii*
The following *Polycarpea* species	*Polycarpia eriantha* var. *effusa*
The following *Polystachya* species	*Polystachia albescens imbricata*
The following *Portulaca* species	*Portulaca foliosa*
	P. trianthemoides
The following *Rhyncosia* species	*Rhyncosia vendae*
Royal Paint Brush (Blood lily)	*Scadoxis puniceus*
The following *Sartidia* species	*Sartidia jucunda*
The following *Schizagyrium* species	*Schizagyrium brevifolium*
All species of South African Orchid	Family *Orchidaceae*
The following *Stadmania* species	*Stadmania oppositifolia*
The following *Streptocarpus* species	*Streptocarpus decipiens*
The following *Strophanthus* species	*Strophanthus luteolus*
The following *Sutera* species	*Sutera maerantha*
The following *Thorncroftia* species	*Thorncroftia media*
All species of Tree Ferns *Cyathea* species	*Cyathea* spp
All species of Tree Moss	*Porothamnium, Pilotrichella* and *Papillaria* spp
The following *Trilepisium* species	*Trilepisium madagascariensis*
The following *Tristachya* species	*Tristachya trifaria*
The following *Turbina* species	*Turbina shirensis*
The following *Watsonia* species	*Watsonia densiflora*
	W. transvaalensis
	W. wilmsii
Wild Ginger	*Burmannia madagascariensis*
Wild Ginger	*Siphonochilus aethiopicus*
The following *Xylopia* species	*Xylopia parviflora*

APPENDIX 5: DETERMINING THE SITE ECOLOGICAL IMPORTANCE

The Site Ecological Importance (SEI) is considered to be a function of the biodiversity importance (BI) of the receptor (e.g. species of conservation concern, the fauna species, plant community or habitat type) and its resilience to impacts (receptor resilience [RR]), determined as follows:

$$SEI = BI + RR$$

BI in turn is a function of conservation importance (CI) and the functional integrity (FI) of the receptor as follows:

$$BI = CI + FI$$

The guidelines (SANBI, 2022) define Conservation Importance as "*the importance of a site for supporting biodiversity features of conservation concern present, e.g. populations of IUCN threatened (CR, EN and VU) and Near Threatened species (NT), range-restricted species, globally significant populations of congregatory species, and areas of threatened ecosystem types, through predominantly natural processes*". The criteria for categorising CI are presented in Table 27.

Table 27: Criteria for determining Conservation Importance of a receptor (SANBI, 2022)

Conservation Importance	*Fulfilling Criteria*
Very High	Confirmed or highly likely occurrence of CR, EN, VU or Extremely Rare or Critically Rare species that have a global EOO of < 10 km^2
	Any area of natural habitat of a CR ecosystem type or large area (> 0.1 % of the total ecosystem type extent) of natural habitat of EN ecosystem type
	Globally significant populations of congregatory species (>10% of global population)
High	Confirmed or highly likely occurrence of CR, EN, VU species that have a global Extent of Occurrence of > 10 km^2. IUCN threatened species (CR, EN, VU) must be listed under any criterion other than A. If listed as threatened only under Criterion A, include if there are less than 10 locations or < 10 000 mature individuals remaining
	Small area (>0.01% but < 0.1 % of the total ecosystem type extent) of natural habitat of EN ecosystem type or large area (> 0.1 %) of natural habitat of VU ecosystem type
	Presence of rare (localised) species
	Globally significant populations of congregatory species (>1% but <10% of global population)
Medium	Confirmed or highly likely occurrence of populations of NT species, threatened species (CR, EN, VU) listed under A criterion only and which have more than 10 locations or more than 10 000 mature individuals
	Any area of natural habitat of threatened ecosystem type with status of VU
	Presence of range-restricted species
	> 50 % natural habitat with potential to support SCC
Low	No confirmed or highly likely populations of Species of Conservation Concern
	No confirmed or highly likely populations of range-restricted species
	< 50 % of natural habitat with limited potential to support SCC
Very Low	No confirmed and highly unlikely populations of SCC
	No confirmed and highly unlikely populations of range-restricted species
	No natural habitat remaining

The guidelines (SANBI, 2022) define Functional Integrity (FI) as "a measure of the ecological condition of the impact receptor as determined by its remaining intact and functional area, its connectivity to other natural areas and the degree of current persistent ecological impacts". Criteria for categorising FI are presented in Table 28.

Table 28: Criteria for Functional Integrity (FI)

Functional Integrity	*Fulfilling Criteria*
Very High	Very large (>100 ha) intact area for any conservation status of regional vegetation type or >5 ha for CR regional vegetation types
	High habitat connectivity serving as functional ecological corridors, limited road network between intact habitat patches
	No or minimal current ecological impacts with no signs of major past disturbance (e.g., ploughing)
High	Large (>20 ha but <100 ha) intact area for any conservation status of regional vegetation type or >10 ha for EN regional vegetation types
	Good habitat connectivity with potentially functional ecological corridors and a regularly used road network between intact habitat patches

Table 28: Criteria for Functional Integrity (FI)	
Functional Integrity	*Fulfilling Criteria*
	Only minor current ecological impacts (e.g., few livestock utilising area) with no signs of major past disturbance (e.g., ploughing) and good rehabilitation potential
Medium	Medium (>5 ha but <20 ha) semi-intact area for any conservation status of regional vegetation type or > 20 ha for VU regional vegetation types
	Only narrow corridors of good habitat connectivity or larger areas of poor habitat connectivity and a busy used road network between intact habitat patches
	Mostly minor current ecological impacts with some major impacts (e.g., established population of alien and invasive flora) and a few signs of minor past disturbance; moderate rehabilitation potential
Low	Small (>1 ha but <5 ha) area
	Almost no habitat connectivity but migrations still possible across some transformed or degraded natural habitat; a very busy used road network surrounds the area. Low rehabilitation potential
	Several minor and major current ecological impacts
Very Low	Very small (<1 ha) area
	No habitat connectivity except for flying species or flora with wind-dispersed seeds.
	Several major current ecological impacts

The Biological Integrity (BI) is derived from a simple matrix of CI and FI as follows (refer **Table 29**):

Table 29: Biodiversity Importance matrix						
Biodiversity Importance		*Conservation Importance*				
		Very High	**High**	**Medium**	**Low**	**Very Low**
Functional Integrity	Very High	Very High	Very High	High	Medium	Low
	High	Very High	High	Medium	Medium	Low
	Medium	High	Medium	Medium	Low	Very Low
	Low	Medium	Medium	Low	Low	Very Low
	Very Low	Medium	Low	Very Low	Very Low	Very Low

The guidelines (SANBI, 2022) define Receptor Resilience (RR) as "the intrinsic capacity of the receptor to resist major damage from disturbance and/or to recover to its current state with limited or no human intervention. The criteria for categorising RR are presented in **Table 30**.

Table 30: Criteria for Receptor Resilience (RR)	
Receptor Resilience	*Fulfilling Criteria*
Very High	Habitat that can recover rapidly (~ less than 5 years) to restore > 70 % of the current species composition and functionality of the receptor functionality, or species that have a very high likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a very high likelihood of returning to a site once the disturbance or impact has been removed
High	Habitat that can recover relatively quickly (~ 5-10 years) to restore > 70 % of the current species composition and functionality of the receptor functionality, or species that have a high likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a high likelihood of returning to a site once the disturbance or impact has been removed
Medium	Will recover slowly (~more than 10 years) to restore > 70 % of the current species composition and functionality of the receptor functionality, or species that have a moderate likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a moderate likelihood of returning to a site once the disturbance or impact has been removed
Low	Habitat that is unlikely to be able to recover fully after a relatively long period: > 15 years required to restore ~less than 50 % of the current species composition and functionality of the receptor functionality, or species that have a low likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a low likelihood of returning to a site once the disturbance or impact has been removed
Very Low	Habitat that is unable to recover from major impacts, or species that are unlikely to remain at a site even when a disturbance or impact is occurring, or species that are unlikely to return to a site once the disturbance or impact has been removed

Upon the successful determination of both BI and RR as described above, it is possible to evaluate Site Ecological Importance (SEI) from the final matrix as follows (refer **Table 30**).

Table 31: Site Ecological Importance matrix							
SEI		*Biodiversity Importance*					
		Very High	High	Medium	Low	Very Low
Receptor Resilience	Very Low	Very High	Very High	High	Medium	Low
	Low	Very High	Very High	High	Medium	Very Low
	Medium	Very High	High	Medium	Low	Very Low
	High	High	Medium	Low	Very Low	Very Low
	Very High	Medium	Low	Very Low	Very Low	Very Low

Table 32 provides the guidelines for interpreting Site Ecological Importance (SEI) of receptors in the context of the proposed development activities.

Table 32: Guidelines for interpreting Site Ecological Importance (SEI) of receptors in the context of the proposed development activities	
Site Ecological Importance	*Interpretation in relation to proposed development activities*
Very High	Avoidance mitigation - No destructive development activities should be considered. Offset mitigation not acceptable/not possible (i.e., last remaining populations of species, last remaining good condition patches of ecosystems/unique species assemblages). Destructive impacts for species/ecosystems where persistence target remains.
High	Avoidance mitigation wherever possible. Minimization mitigation – changes to project infrastructure design to limit the amount of habitat impacted; limited development activities of low impact acceptable. Offset mitigation may be required for high impact activities.
Medium	Minimization & restoration mitigation - development activities of medium impact acceptable followed by appropriate restoration activities
Low	Minimization & restoration mitigation - development activities of medium to high impact acceptable followed by appropriate restoration activities
Very Low	Minimization mitigation - development activities of medium to high impact acceptable and restoration activities may not be required

APPENDIX 6: IMPACT ASSESSMENT METHOD

To ensure standardisation of the Impact Assessment Process and the successful integration of specialist findings, a standard ratings approach is employed to ascertain the significance of anticipated and likely impacts on the receiving environment.

The potential environmental impacts associated with the project will be evaluated according to its nature, extent, duration, intensity, probability, and significance of the impacts, whereby:

Nature: A brief written statement of the environmental aspect being impacted upon by a particular action or activity;

Extent: Determines the spatial/ geographical scale over which the impact will be expressed. Typically, the severity and significance of an impact have different scales. This is often useful during the detailed assessment phase of a project in terms of further defining the determined significance or intensity of an impact. For example, high at a local scale, but low at a regional scale;

Duration: Indicates what the temporal scale of the impact will be;

Intensity: Defines the likelihood of an impact actually occurring; and

Cumulative: In relation to an activity, implies the impact of an activity that, in itself, may not be significant, but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area.

Table 33: Criteria and numerical for rating environmental impacts

Score	*Rating*	*Description*
Intensity (I) - defines the magnitude of the impact		
16	High	*Natural, cultural, and social functions and processes are altered to the extent that it permanently cease. Impact affects the continued viability of the systems/ components and the quality, use, integrity, and functionality of the systems/ components permanently ceases and are irreversibly impaired (system collapse). Rehabilitation and remediation is often impossible. If possible, rehabilitation and remediation is often unfeasible due to extremely high costs.* Impact may cause: • Loss of human life • Deterioration in human health • High impacts to ecosystems and environment resulting in: o Critical/ severe local scale (or larger) modification, degradation and/or collapse o Critical / severe local scale (or larger) modification, (reduction in level) of ecosystem services and/ or loss of ecosystem services
12	Moderately High	*Natural, cultural, and social functions and processes are altered to the extent that they are severely impaired and may temporarily cease. Impact affects the continued viability of the systems/ components and the quality, use, integrity, and functionality of the systems/ components are severely impaired and may temporarily cease. Rehabilitation and remediation will likely be at a high financial cost, but is often possible.* Impact may cause: • Loss of livelihoods • Individual economic loss • Moderately-high impacts to ecosystems and environment o Large local scale (or larger) modification, degradation and/ or collapse o Large local scale (or larger) modification (reduction in level) of ecosystem services and/ or loss of ecosystem services
8	Moderate	Affected environment is altered, but natural, cultural, and social functions and processes continue, albeit in a slightly modified way. Impact alters the quality, use and integrity of the systems/ components, but the systems/ components still continue to function, but in a moderately modified way (integrity and functionality impaired by major key processes/ drivers somewhat intact/ maintained) • Moderate impacts to ecosystems and environment: • Moderate local scale (or larger) ecosystem modification/ degradation and/ or collapse • Moderate local scale (or larger) modification (reduction in level) of ecosystem services and/ or loss of ecosystem services

Table 33: Criteria and numerical for rating environmental impacts		
Score	*Rating*	*Description*
4	Moderately Low	*Affected environment is altered, but natural, cultural, and social functions and processes continue albeit in a slightly modified way. Impact alters the quality, use and integrity of the systems/ components but the systems/ components still continue to function, although in a slightly modified way. Integrity, function, and major key processes/ drivers are slightly altered but are still intact/ maintained.* Moderate-low impacts to ecosystems and environment: • Small, but measurable local scale (or larger) ecosystem modification/ degradation • Small, but measurable local scale (or larger) modification (reduction in level) of ecosystem services and/ or loss of ecosystem services
1	Low	*Impact affects the environment in such a way that natural, cultural, and social functions and processes are not affected.* Negative change to onsite characteristics but with no impact on: • Human life • Human health • Local water resources, local ecosystem services and/ or key ecosystem controlling variables • Threatened habitat conservation/ representation • Threatened species survival

Table 34: Quantification of impact criteria		
Score	*Status*	*Description*
Extent (E) - Relates to the geographical/ spatial extent of the impact		
5	Global	The scale/ extent of the impact is global/ worldwide
4	National	The scale/ extent of the impact is applicable to the Republic of South Africa
3	Regional	Impact footprint includes the greater surrounding area within which the site is located (e.g. between 20 – 200 km radius of the site
2	Local	Impact footprint extends beyond the cadastral boundary of the site to include the areas adjacent and immediately surrounding the site (e.g. between a 0 – 20 km radius of the site)
1	Site	Impact footprint remains within the boundary of the site
Duration (D) - relates to the temporal scale/ duration of the impact		
5	Permanent	The impact will continue indefinitely and is irreversible
4	Long term	The impact and its effects will continue of a period in excess of 30 years. However, the impact is reversable with relevant and applicable mitigation and management actions
3	Medium term	The impact and its effects will last for 10 - 30 years. The impact is reversible with relevant and applicable mitigation and management actions
2	Medium-short term	The impact and its effects will continue or last for a period of a relatively long construction period and/ or a limited recovery time after this construction period, thereafter it will be entirely negated (3 - 10 years). The impact is fully reversible
1	Short term	The impact and its effects will only last for as long as the construction period and will either disappear with mitigation or will be mitigated through natural processes in a span shorter than the construction phase (0 - 3 years). The impact is fully reversible
Probability (P) - relates to the likelihood of the impact occurring		
1	Definite	More than 75 % change of occurrence. The impact is known to occur regularly under similar conditions and settings
0.75	Highly Probable	The impact has a 41 – 75 % change of occurring and thus is likely to occur. The impact is known to occur sporadically in similar conditions and settings
0.5	Possible	The impact has a 10 – 40 % change of occurring. This impact may/ could occur and is known to occur in low frequencies under similar conditions and settings
0.2	Unlikely	The possibility of the impact occurring is low with less than 10 % chance of occurring. The impact has not been known to occur under similar conditions and settings
0.1	Improbable	The possibility of the impact occurring is negligible and only under exceptional circumstances

Significance is determined through a synthesis of impact characteristics. Significance is also an indication of the importance of impacts in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The total number of points scored for each impact indicate the level of significance of the impact. Impact significance is calculated as the impact intensity, extent and duration against the probability, likelihood of the impact taking place, i.e.:

Impact significance - (impact intensity + impact extent + impact duration) x impact probability

Table 35: Impact significance categories		
Indicator	*Class*	*Description*
+ Positive	Any value	Any positive / beneficial 'impact', i.e. where no harm will occur due to the activity being undertaken
- Negative	Low	A low impact has no permanent impact of significance. Mitigation measures are feasible and are readily instituted as part of a standing design, construction, or operating procedure
	0 - 4.9	
	Moderately low	Mitigation is possible with additional design and construction inputs
	5 - 7.9	
	Moderate	The design of the site may be affected. Mitigation and possible remediation are needed during the construction and/ or operational phases. The effects of the impact may affect the broader environment
	8 - 12.9	
	Moderately high	Generally unacceptable unless offset/ compensated for by positive gains in other aspect of the environment that are of critically high importance (i.e. national or international importance only). Strict conditions and high levels of compliance and enforcement are required. The potential impact will affect a decision regarding the proposed activity and requires that the need and desirability of the project be clearly substantiated to justify the associated ecological risks
	13 - 17.9	
	High	Permanent and importance impacts likely to be a fatal flaw. Impacts should be avoided and limited opportunity for offset/ compensatory mitigation
	18 - 26	
Status		Denotes the perceived effect of the impact in the affected area
Positive (+)		Beneficial impact
Negative (-)		Deleterious or adverse impact
Neutral (/)		Impact is neither beneficial nor adverse
It is important to note that the status of an impact is assigned based on the *status quo* - i.e. should the project not proceed. Therefore, not all negative impacts are necessarily equally significant		

APPENDIX 8: CIRRICULUM VITAE

RIAAN A. J. ROBBESON (PR.SCI.NAT.)

Date of Birth: [redacted]
Nationality: South African
Address: [redacted]
Cellular Contact: [redacted]
Telephone Contact: [redacted]
Email: [redacted]

Consulting experience: 23 years
Name of Firm: Bathusi Environmental Consulting cc
Position: Member, Specialist Investigator (Ecology and Botany)
Years with BEC: 20 years
Profession: Environmental Scientist, Ecologist, Botanist

Education

DEGREE / DIPLOMA	FIELD	INSTITUTION
B.Sc.	Botany and Zoology (major subjects), Geography, Chemistry, Genetics	University of Pretoria (1987 – 1991)
B.Sc. (Hons)	Botany	University of Pretoria (1992)
M.Sc.	Plant Ecology	University of Pretoria (1994 – 1998)
Visual Basic Programming	Computer Programming and Basic Programme Development	Unischool (University of Pretoria), 1999

Affiliations

CLASS	PROFESSIONAL SOCIETY	YEAR OF REGISTRATION
Pr.Sci.Nat.	South African Council of Natural Scientific Professions (SACNASP) (Ecological Scientist & Botanical Scientist, Reg no: 400005/03)	2003
Cert.Sci.Nat.	South African Council of Natural Scientific Professions (SACNASP) (Zoological Scientist)	2021

Key Attributes

Riaan has always been a passionate ecologist. Since a young age his interest in ecology and his passion and understanding of the natural environment has guided him towards a lifelong commitment to a profession in the natural sciences. After obtaining his B.Sc. degree, with zoology and botany as major subjects in 1990, he committed to post-graduate studies, ultimately obtaining his Masters degree in Plant Ecology at the University of Pretoria in 1998, while working as a research assistant and team member of the National Grassland Biome Project between 1994 and 1998. His involvement in specialist environmental studies followed naturally after graduation in 1998, and he has since been passionately involved in numerous ecological studies with the main emphasis on botanical assessments as part of environmental applications.

Between 1997 and 1999 Riaan was a co-founder of EkoInfo cc and contributed to the general management and consulting responsibilities. In 1999 Riaan, as the sole member, established Bathusi Environmental Consulting cc with the objective of conducting ecological studies with a holistic approach and a strong emphasis of the inclusion of faunal disciplines. Towards this objective, the development of working relations with numerous other specialists was, and still remains, a major priority. Inter-disciplinary collaboration on numerous projects enabled Riaan to acquire a working knowledge of these disciplines, including invertebrates, mammals, herpetofauna and birds.

During his career that spans 20 years, Riaan has acquired extensive experience in the evaluation of the status and reaction of the natural environment to development, across the ecological spectrum of plants, animals, and biophysical attributes of the receiving environment. In addition to pure scientific investigations and ecological investigations, he has also successfully developed and implemented several biodiversity monitoring programmes on mining areas. In addition to a vast knowledge of the Grassland and Savanna Biomes, Riaan also utilises every possible opportunity to expand his knowledge of other biomes of southern Africa; he also

contributed to international projects in Botswana, Lesotho, and Mozambique. Riaan displays an enthusiastic, always willing and 'can do' approach to projects and is able to work either as part of a team environment, or in isolation.

Apart from being committed to his professional career, other personal interests of Riaan include wildlife and sports photography, birding (currently at 556 species), and a life-long passion for sport. He is the holder of five Comrades bronze medals between 2005 and 2010. He is also a frequent competitor in ultra-endurance mountain bike events across South Africa and socially plays golf and squash.

Relevant Computer Skills

⇒ MS Word
⇒ MS Excel
⇒ MS Access
⇒ GIS Arcview 3.2 (a)
⇒ Google Earth
⇒ Adobe Photoshop CS & Lightroom 2.6
⇒ Visual Basic Programming

Employment Record

POSITION	COMPANY	JOB DESCRIPTION	DURATION
Research Assistant	University of Pretoria	Botanical surveys, plant identifications, data capturing, data analysis, report compilation, phytosociological descriptions, Post graduate Masters Publications	1994 - 1998
Member	EkoInfo cc	Project acquisition, site investigations, data analysis, report compilation, GIS mapping, selected peer review for publications and specialist reports	1995 - 1999
Member	Bathusi Environmental Consulting	Project acquisition, project management, site investigations, data analysis, report compilation, GIS mapping, selected peer review for publications and specialist reports, financial administration	1999 - present

Experience & Project Contributions

The development of accurate and comprehensive biodiversity studies that forms an integral part of successful environmental applications for a wide range of clients represents a major focus of BEC. To achieve this objective Riaan is committed to effective acquisition of projects, involvement and management of other specialist investigators as well as the ecological integration and interpretation of biodiversity data and reports to present a holistic overview of the ecological receiving environment.

Riaan has contributed to more than 400 environmental projects and reports that include a range of specialist fields, including biodiversity impact assessments and scoping reports, biodiversity Fatal Flaw assessments, environmental audits, ecological screening assessments, botanical assessments, vegetation sampling, classification, description and mapping, the development and implementation of environmental monitoring programmes, Red Data flora assessments, invasive species management programmes, compilation of Environmental Management Programme Reports, etc.

The range of clients that are assisted by BEC include environmental companies, private developers, mining houses (gold, diamond, iron, coal, sand), parastatals, traditional coal-energy producers, alternative energy producers (coal-fired, UCG, solar), property developers, etc.

Languages

English: RWS - Excellent
Afrikaans: RWS – Excellent

Selected Reports and Projects

The following projects are presented as a brief selection of the contributions to more than 400 projects and reports between 1999 and 2019.

⇒ **Biodiversity Impact Assessments (EIAs):**

- Terrestrial Biodiversity (flora, fauna, avifauna) Impact Assessments of the proposed NEO 1 20MW Solar PV Plant that will be situated in the Mafeteng District of the Kingdom of Lesotho. 2018. For Royal HaskoningDHV. In collaboration with Pachnoda Consulting and Ecocheck Environmental Services.
- Terrestrial Biodiversity (flora, fauna, avifauna) Impact Assessments for the proposed Mutsho Power Project near Makhado, Limpopo Province. 2018. For Savannah Environmental. In collaboration with Pachnoda Consulting and Ecocheck Environmental Services.
- Biodiversity Impact Assessment and development of the biodiversity EMP for the proposed Kalkaar Solar Project in the Northern Cape Province. 2014. For SLR Consulting on behalf of SolarReserve, South Africa.
- Terrestrial biodiversity Impact Assessments of the proposed Tshivhaso Power Station near Lephalale in the Limpopo Province (Savanna Environmental). 2016. For Savannah Environmental. In collaboration with Pachnoda Consulting and Ecocheck Environmental Services.
- Terrestrial biodiversity Impact Assessments of the proposed expansion of the existing Kao Diamond Mine in the Kingdom of Lesotho (EIMS). 2016. For Savannah Environmental. For Environmental Impact Management Services (EIMS). In collaboration with Ecocheck Environmental Services.
- Biodiversity Impact Assessments of the Medupi Power Station near Lephalale in the Limpopo Province. 2006. For Royal HaskoningDHV, previously Bohlweki Environmental. In collaboration with Ecocheck Environmental Services.
- Impact Assessment for a proposed holiday destination in the Okavango Delta in the Republic of Botswana (@Land Landscape Architects). 1997. In collaboration with Ekotrust cc.
- Terrestrial Impact Assessment for a proposed hunting concession in the Okavango Delta in the Republic of Botswana (Ekotrust). 1997.
- Terrestrial Biodiversity Impact Assessment for the GOPE Diamond Mine in the Central Kalahari Game Reserve in the Republic of Botswana. 2008. For Marsh Vikela. In collaboration with Ecocheck Environmental Services.
- Botanical Assessments for the proposed expansion of a holiday destination in Mozambique (EkoInfo cc). 2005. In collaboration with EkoInfo cc and Ecocheck Environmental Services.
- Terrestrial biodiversity Impact Assessments of the proposed Steelpoort Pumped Storage Scheme. 2007. For Royal HaskoningDHV, previously Bohlweki Environmental. In collaboration with Ecocheck Environmental Services.

⇒ **Biodiversity Scoping Assessments:**

- Terrestrial Biodiversity (flora, fauna, avifauna) Scoping Assessments of the proposed NEO 1 20MW Solar PV Plant that will be situated in the Mafeteng District of the Kingdom of Lesotho. 2018. For Royal HaskoningDHV. In collaboration with Pachnoda Consulting and Ecocheck Environmental Services.
- Terrestrial Biodiversity (flora, fauna, avifauna) Scoping Assessments for the proposed Mutsho Power Project near Makhado, Limpopo Province. 2018. For Savannah Environmental. In collaboration with Pachnoda Consulting and Ecocheck Environmental Services.

⇒ **Biodiversity Screening Assessments:**

- Ecological Screening Assessments of 14 K-Routes for the Gauteng Province Department of Roads and Transport as part of the road expansion project. 2018. For Royal HaskoningDHV. In collaboration with Feathers Environmental Services.
- Terrestrial biodiversity screening assessment of the proposed Enviroblast Titanobel development in Gauteng Province. 2016. For Mills & Otten Environmental Consultants.
- Ecological Screening Assessment of the proposed Waterberg Heavy Haul railway project. 2015. For Royal HaskoningDHV

⇒ **Environmental Management Programme Reports (EMPR's):**

- Development of an Environmental Management Report for the Alkantpan Runway as part of the Copperton Wind Energy Project in the Northern Cape Province (fauna and avifauna). For Terramanzi Group. 2019. In collaboration with Pachnoda Consulting and Ecocheck Environmental Services.

- Development of Animal Conflict Resolution approach for the Alkantpan Runway as part of the Copperton Wind Energy Project in the Northern Cape Province (fauna and avifauna). For Terramanzi Group. 2019. In collaboration with Pachnoda Consulting and Ecocheck Environmental Services.
- Development of Biodiversity Action Programme report for the Matla Mine in the Mpumalanga Province. 2014. For Groundwater Consulting Services (GCS). In collaboration with Pachnoda Consulting and Ecocheck Environmental Services.
- Development of an Environmental Management Programme for the proposed Aspen Lakes residential development in Gauteng Province. 2014. For Mills & Otten Environmental Consultants.
- Development of Off-Site Mitigations recommendations for the proposed Majuba Power Station Ashing Expansion Project in the Mpumalanga Province. 2014. For Eskom. In collaboration with Ecocheck Environmental Services.
- Environmental Management Programme for the Vygeboom Power Line. 2019. For Royal HaskoningDHV (previously SSI).

⇒ Biological/ Biodiversity Monitoring Reports:

- Deployment of a biological monitoring programme to ascertain the breeding status of Grey-headed Gulls at the proposed Zenprop Skymall Property near O.R. Tambo International Airport in Gauteng Province. 2017. For Mills and Otten Environmental Consulting cc. In collaboration with Pachnoda Consulting.
- Development and deployment of a biennial faunal monitoring programme for the Letšeng Diamond Mine in the Kingdom of Lesotho (Letšeng Diamonds). Since 2015, ongoing. For Letšeng Diamonds. In collaboration with Pachnoda Consulting, Ecocheck Environmental Services and Enviro-Insight.
- Development and deployment of biodiversity monitoring programme at the Woestalleen Colliery properties in the Mpumalanga Province (Woestalleen Colliery, NuCoal). 1997 – 2008. In collaboration with EkoInfo cc.
- Floristic monitoring surveys within the Blesbokspruit river in the Gauteng Province to determine the effect of acid mine drainage. In collaboration with EkoInfo cc.
- Development and implementation of a biodiversity monitoring programme for the Ghaghoo Diamond Mine in Botswana. 2013. For VDDB Engineers, Marsh Vikela, Ghagoo Diamond Mine. In collaboration with Ecocheck Environmental Services.

⇒ Biodiversity Basic Assessment Reports:

- Terrestrial biodiversity Basic Assessment report for the proposed Etna – Trade powerline in the Gauteng Province (Eskom). 2016. In collaboration with Ecocheck Environmental Services.
- Ecological Basic Assessment of the proposed expansion of the Rietspruit Dam near Ventersdorp in the North-West Province. 2015. For Royal HaskoningDHV.

⇒ Species at Risk Assessments and Studies:

- Ecological status of the (Near Threatened) *Trachyandra erythrorrhiza* community in Esther Park from 2011 (ongoing) as part of compliance for the Bombela Concession Company. 2018. For Bombela Concession Company.
- Final walkdown and marking of protected tree species within the Thabametsi Power Project development footprint, the Medupi-Thabametsi 400 kV line, the Matimba-Thabametsi 400kV Line and the Thabametsi 33 kV line. 2018. For Savannah Environmental. In collaboration with Feathers Environmental Services and Ecocheck Environmental Services.
- Medicinal plants survey on a portion of the Farm Vlakfontein 30-IR in the Gauteng Province. 2017. For Mills & Otten Environmental Consultants.
- Final walkdown and marking of protected tree species within the Masa – Selomo 400 kV lines in the Limpopo Province. 2016. For Babcock International. In collaboration with Ecocheck Environmental Services.
- Search and rescue operation of medicinal plants at the proposed Vorna Valley development in Midrand, Gauteng Province. 2016. For Abland Developers.
- Protected species survey for the proposed water facility expansion at Giyani in the Limpopo Province. 2015. For EIMS.
- Red Data flora investigation for the proposed Irene Development within the Gauteng Province. 2004. For Mills & Otten Environmental Consultants.

⇒ Alien and Invasive Species Management Programmes:

- Development of a management plan for invasive fauna species at the Duvha Power Station in Gauteng Province. 2018. For Eskom. In collaboration with Ecocheck Environmental Services.
- Development of a management plan for alien and invasive plants at the Duvha Power Station in Mpumalanga Province. 2017. For Eskom.

- Development of a management plan for alien and invasive plants at the Majuba Power Station in Mpumalanga Province. 2017. For Eskom.
- Development of a management plan for alien and invasive plant at the Mercedes Benz (South Africa) Plant in Centurion, Gauteng Province. 2017. For Ingen Engineers.
- Survey of alien and invasive plant species for Exxaro Mining Properties in the Mpumalanga Province. 2018. For Ulwando.

⇒ Biodiversity Sensitivity Analysis:

- Sensitivity analysis for the proposed Mogale 1 (Doornbosch 308) development in Gauteng Province. 2016. For Greenergy.

⇒ Ecological Baseline Assessments and Descriptions:

- Baseline ecological assessment of the Mothae Diamond Mine in the Kingdom of Lesotho. 2017. For Sustain Consulting, Mothae Diamond Mine. In collaboration with Ecocheck Environmental Services.
- Baseline assessment of the proposed Tshwane Freight Terminal in the Gauteng Province. 2016
- Botanical assessments for the proposed Mmamabula Power Lines in the Republic of Botswana. 2006. For EkoInfo cc.
- Botanical surveys in the Tswalu Desert Reserve. 1997. For Ekotrust.
- Ecological Baseline Assessment of the proposed Golwe Development near Vhuri Vhuri in the Limpopo Province. 2007. For AgriDev Consultants. In collaboration with Ecocheck Environmental Services.

⇒ Biodiversity Risk Assessments:

- Risk assessment for the Sappi Enstra Mill in the Gauteng Province. 2016. For WSP Group.
- Assessment of potential damage to trees adjacent to ATC tower infrastructure in Lyttelton and Waterkloof in the Gauteng Province. 2015. For ATC.

⇒ Research, interpretation, analysis of aerial photographs and other:

- Sitting member of the Environmental Monitoring Committee (EMC) for Medupi Power Station (Eskom). 2007 – 2019. For Eskom (Medupi).
- Peer review of the biodiversity impact assessment report for the National Road 3: Keeversfontein to Warden expansion. 2014. For Cave Klapwijk & Associates.
- Development and deployment of provincial floristic surveys to correlate remote sensing vegetation degradation patterns in the Gauteng Province. 1999. For ISCW. In collaboration with EkoInfo cc.
- Development and deployment of provincial floristic surveys to correlate remote sensing vegetation degradation patterns in the Mpumalanga Province (ISCW). 1999. For ISCW. In collaboration with EkoInfo cc.
- Determination of the effect of uncontrolled fires in selected areas within the Sabi Sands Reserve as part of insurance claims. 2001. For Deneys Reitz Attorneys. In collaboration with EkoInfo cc.
- Determination of the impact of Quelea control actions in wetlands on the vegetation in selected wetland regions in the Free State Province. 2000. For ISCW. In collaboration with EkoInfo cc.
- Establishing wind and visual breaks through planting of trees at selected properties of Woestalleen Colliery in the Mpumalanga Province. 2002. For Woestalleen Colliery. In collaboration with EkoInfo cc.
- Ground truthing of landcover mapping procedures within the Gauteng Province. 2004. For SEF.
- Herpetological assessment of the proposed Moruladal Development in the Gauteng Province. 2004. For Mills & Otten Environmental Consultants.
- Assessment of Bushbabies at the proposed Wittkoppen Ext 112 in the Gauteng Province. 2004. For Mills & Otten Environmental Consultants. In collaboration with Ecocheck Environmental Services cc.
- Avifaunal surveys for the proposed H2 Power Plant Development near Bronkhorstspruit in the Mpumalanga Province. 2017. For Feathers Environmental Services.

⇒ Green Certification

- Ecological Green Building Certification for the proposed Woodmead Development in Gauteng Province. 2018. For Mills & Otten Environmental Consultants.

⇒ GIS and related

- Mapping and GIS digitising of maps for the National VEGMAP project. 2000. For Ecotrust.

LUKAS J. NIEMAND (PR.SCI.NAT.)

Name:	LUKAS JURIE NIEMAND
Company:	Pachnoda Consulting cc (Director)
Date of Birth:	[redacted]
Nationality:	South African
Languages:	English and Afrikaans

EDUCATIONAL QUALIFICATIONS

1992	Hoërskool Hartbeespoort, Hartbeespoort - Senior Certificate.
1996	University of Pretoria, Pretoria - B.Sc. (Zoology and Entomology).
1997	University of Pretoria, Pretoria - B.Sc. (Hons) (Entomology).
2001	University of Pretoria, Pretoria - M.Sc. (Restoration Ecology/Zoology).

MEMBERSHIP IN PROFESSIONAL SOCIETY

⇒ Professional Natural Scientist (Pr. Sci. Nat.) (Reg. no. [redacted] Ecology & Zoology)
⇒ BirdLife South Africa [redacted]
⇒ Hartbeespoort Natural Heritage Society

COMPANY E1PERIENCE

Pachnoda Consulting CC is a small enterprise based in Pretoria, South Africa providing specialised consulting services and products in the terrestrial ecological milieu for mining companies, environmental consultants, developers, and other industry related institutions throughout Africa and abroad.

Pachnoda Consulting envisions a holistic approach to ensure the sustainable development and preservation of natural resources based on accepted scientific methods. Since its establishment in 2007, it has produced several ecological assessments, including botanical and faunal surveys spanning all nine provinces in South Africa and a number of African countries. It provides a broad range of quality services that specialises in ornithology (avifauna), entomology (invertebrates) and general zoology. In addition, it values a long-standing relationship with various non-governmental and tertiary institutions notably the University of Pretoria, Endangered Wildlife Trust, the Agricultural Research Council and the South African Biodiversity Institute.

CORE SERVICES

⇒ Objective and quantified ecological assessments (a holistic eco-system approach based on approved scientific methods) in accordance with International Best Practice (e.g. International Finance Corporation's Performance Standards & Millennium Challenge Corporation's Guidelines)
⇒ Ecological due diligence and risk assessments;
⇒ Taxon-specific surveys in the botanical, mammalian, avifaunal and invertebrate fields;
⇒ Bird impact studies for power lines and renewable energy plants;
⇒ Biodiversity action plans; and
⇒ Mapping and modelling of species distributions and ecological sensitivities.

MEMBER

Lukas Niemand is director and founding member of Pachnoda Consulting. He has been involved in the discipline of consultant ecologist since 2000, and his core services include ecological studies with emphasis on ornithological (the study of birds), faunal and entomological (the study of invertebrates) assessments.

He has travelled extensively to many remote places as far afield as Marion Island, and has worked on numerous international projects pertaining to the African continent (South Africa, Lesotho, Mozambique, Burundi, Congo-Brazzaville, Liberia, Zambia, Tanzania, Guinea and Ethiopia). He worked on projects earmarked for the urban and mining sector and has been involved in linear projects, monitoring programmes, biodiversity action plans as well as specific investigations regarding species with rare/elusive life-history traits (e.g. threatened species).

He is also registered with the panel of the Birds and Renewable Energy division of BirdLife South Africa.

PROJECTS

A Work conducted in South Africa

1 General Ecological Assessments (Fauna, Flora and Red Data Scans, including both functional and compositional aspects) for urban, residential, recreational and light industrial developments:

⇒ Belvedere Trust, Proposed retirement village on Amorosa Agricultural Holdings, Roodepoort, Gauteng (2004);
⇒ City of Joburg Property Development Company, Proposed upgrade and development of the Orlando Dam Intersection, Soweto, Gauteng (2004);
⇒ PDNA, Proposed NASREC development, Johannesburg, Gauteng (2004);
⇒ 17 Shaft Conference and Education Centre, Proposed establishment of the Veteran's Heritage Education Centre, Crown Mines, Gauteng (2004);
⇒ GAUTRANS, Proposed re-alignment of Road D781 and construction of a road bridge over the Rietvleispruit, Kempton Park, Gauteng (2004);
⇒ Mr. N. Lang, Ecological Opinion on the proposed establishment of a township, Muldersdrift, Gauteng (2004);
⇒ AGES, Proposed Equestrian Centre, Leeufontein 299 IR, Gauteng (2004);
⇒ PDNA, Proposed new bridge and re-alignment of a portion of provincial road P101-2 (R51), Laversburg, Gauteng (2004);
⇒ Blenneerville Investment (Pty) Ltd, Proposed construction of a residential and commercial development on of Paradiso Estate, Tweefontein 372 JR, Gauteng (2004);
⇒ Les Roches (Pty) Ltd, Proposed zoning of holdings 1, 2 & 3 of Hyde Park Agricultural Holdings, Gauteng (2004);
⇒ Celebration North Riding (Pty) Ltd, Proposed mixed land-use development, North Riding, Gauteng (2005);
⇒ Wilderness Safaris, Proposed upgrade of the Manzengwenya Dive Camp, Greater St. Lucia Wetlands Park, KwaZulu-Natal (2005);
⇒ Wilderness Safaris, Proposed upgrade of the Rocktail Bay Camp, Greater St. Lucia Wetlands Park, KwaZulu-Natal (2005);
⇒ GAEA Projects, Corridor Assessment for the proposed Sibaya Precinct, KwaZulu-Natal (2005);
⇒ Computer Domain Holdings (Pty) Ltd, Red Data Floral Scan on portion 3 of the farm Elandshoek, portions 12 & 27 of the farm Groot Suikerboschkop, and portions 5 & 10 of the farm Palmietfontein, Dullstroom (2005);
⇒ Zong's Property Investments, Proposed establishment of a residential development on a portion of Pomona Estates Agricultural Holdings, Pomona, Gauteng (2005);
⇒ GJ van Zyl Trust, Proposed development of a resort on the Farm Witpoort 216 JS, Mpumalanga (2005);
⇒ Mr. Howard Walker, Proposed subdivision of the Farm Lunsklip 105 JT, and the Farm Morgenzon 122 JT, for the establishment of a private resort, Dullstroom, Mpumalanga (2005);
⇒ Lavender Manor cc, Proposed establishment of a retail, commercial and Lavender Manor Township on part of farm Rietfontein 189 IQ, Muldersdrift, Gauteng (2005);
⇒ Geo Pollution Technologies, Proposed establishment of a residential development: Noordwyk Ext 65 & 80 on Erand Agricultural Holdings, Midrand, Gauteng (2005);
⇒ Mr. A. Le Roux, Proposed Cradle View Country Estate, Muldersdrift, Gauteng (2006);
⇒ Viking Bay Development Company (Pty) Ltd, Proposed Viking Bay freshwater marina and hotel development, Vaal Dam, Gauteng (2006);
⇒ Land for Africa (Pty) Ltd, Ecological Opinion for the proposed establishment of a residential township on holding 122 Erand Agricultural Holding Extension 1, Halfway House, Midrand, Gauteng (2006);
⇒ Brickot Developments cc, Ecological opinion for the proposed Bethal Retirement Village on the remainder of portion 3 of the farm Mooifontein 108 IS, Bethal, Mpumalanga (2006);
⇒ Brawild (Pty) Ltd, Red Data Scan for the proposed Annlin Ex 117, Pretoria, Gauteng (2006);
⇒ Mbombela Local Municipality, Ecological Opinion for the proposed extension of the Lowveld Botanical Gardens, Nelspruit, Mpumalanga (2006);
⇒ Aurecon, Desktop biodiversity assessment and wetland scan: upgrade of the River View waste water treatment works, eMalahleni, Mpumalanga province. Report compiled in association with Imperata Consulting (2009);
⇒ Teurlings Environmental, Ecological evaluation for rectification as per Section 24G of NEMA on Portion 437 of the Farm Zwavelpoort 373 JR, Bronberg area, Gauteng (2017);
⇒ Kyllinga Consulting/ AdiEnvironmental - Ecological Assessment (with emphasis on terrestrial fauna) for the proposed Rockdale development, Middelburg, Mpumalanga (2017);
⇒ Envirolution Consulting, Ecological evaluation for the proposed V& S Asphalt Plant at Putfontein, Gauteng (2018);
⇒ Batho Earth - An ecological evaluation (fauna & flora) on Portion 24 of Erf 2440 in Newcastle, KwaZulu-Natal (2018);
⇒ De Castro & Brits Ecological Consultants/ Bucandi Environmental - Matopie Ecological Assessment as part of the Section 24G rectification process for unauthorised construction activities on Portion 27 of the Farm Kloppersbos 128 JR, Dinokeng, Gauteng Province (2018);
⇒ Knight Piésold/ Afri-Active Mechanical & Electrical - Ecological and Avifaunal assessment for the Lanark PV Solar Facility near Dendron (Mogwadi), Limpopo Province (2018);
⇒ Teurlings Environmental, Ecological Evaluation for Plot 82 on the Farm Klipkop (Del la Mas), Bronberg Area, Gauteng (2018);
⇒ De Castro & Brits Ecological Consultants/ Bucandi Environmental - Terrestrial Ecological Assessment for the expansion of the Hesters Rust Quarry near Welkom, Free State Province (2019);
⇒ Exigent Environmental - Ecological Evaluation (with emphasis on vegetation) on Portions 77, 169 and RE 76 of the Farm Zandfontein 317 JR, Andeon, Gauteng (2018);
⇒ SRK Consulting, Terrestrial ecological assessment for the proposed development of the Sandton field and Study Centre, Sandton, Gauteng (2018);
⇒ Teurlings Environmental, Ecological Management and Rehabilitation (including alien plant management plan) for rectification as per Section 24G of NEMA on Portion 437 of the Farm Zwavelpoort 373 JR, Bronberg area, Gauteng (2019);

- ⇒ Batho Earth, Ecological evaluation for the Mahlakwane Trick Stop at Steelpoort, Limpopo Province (2019);
- ⇒ EkoInfo/NGT Holdings, Vertebrate faunal assessment for the proposed Madimatle Cave recreation plan near Thabazimbi, Limpopo Province (2019);
- ⇒ De Castro & Brits Ecological Consultants/ Bucandi Environmental - Ecological Assessment for the Hubner Hog development on Portion 224 of the Farm Honingnestkrans 269 JR, Dinokeng, Gauteng Province (2019);
- ⇒ NuLeaf Planning & Environmental, Ecological evaluation for the Tuna park open space project, Nigel, Gauteng (2019);
- ⇒ Kyllinga Consulting, Fauna assessment for the proposed residential development on Portion 58 of the Farm Zwavelpoort 373 JR , Bronberg area, Gauteng (2019);
- ⇒ Envirolution Consulting, Ecological evaluation for a Tyre recycling plant on Portion 156 of Farm Zandspruit 191 IQ, Gauteng (2020);
- ⇒ Adienvironmental/Kyllinga consulting, Ecological assessment for the proposed light industrial development on Portion 58 of the Farm Vaalbank 289 JS, Middelburg, Mpumalanga (2020).

2 Mining and Industrial related projects (ecological assessments):

- ⇒ Lonmin Platinum (Western Platinum Limited), Ecological Assessment for the proposed MK3 Shaft Complex on the farm Wonderkop 400 JQ, Rustenburg, North West Province (2004);
- ⇒ Impala Platinum Limited, Ecological Assessment for prospecting SEMPs on the farms Buffelshoek 386 KT, Kalkfontein 367 KT, Spitskop 333 KT, Steelpoortpark 366 Kt and Tweefontein 360 KT and Hackney 116 KT (all Sekhukhuneland), Mpumalanga and Limpopo Province (2004);
- ⇒ Transnet Limited, Terrestrial Faunal Ecological Opinion: Phase 1B expansion of the Sishen-Saldanha Iron ore export corridor, Saldanha Bay, Western Cape (2005);
- ⇒ Trans-Caledon Tunnel Authority (TCTA), Ecological Assessment for borrow pit SEMPs on the TCTA pipeline, Vaal Marina to Secunda (2005);
- ⇒ Boynton Platinum (Pty) Ltd, Ecological Assessment for the proposed establishment of platinum mines on the farms Tuschenkomst 135 JP, Witkleifontein 136 JP and Ruighoek 169 JP, North West Province (2005);
- ⇒ Impala Platinum Holdings, Ecological Assessment for prospecting SEMPs on the Impala Platinum Bafokeng Mining Complex, North West Province (2005);
- ⇒ Ceramic Industries Limited, Ecological Assessment of the Rietspruit Clay Quarries, Vanderbijlpark, Gauteng (2005);
- ⇒ Ekurhuleni Metropolitan Municipality, Ecological Assessment Report for the proposed GLB Landfill Site on the farm Zesfontein 27 IR, Benoni, Gauteng (peer reviewed, 2006);
- ⇒ Ceramic Industries Limited, Ecological Assessment of the Leeukuil Clay Quarries, Vanderbijlpark, Gauteng (2006);
- ⇒ Council for Geoscience, Habitat sensitivity assessment scoping report for Bon Accord quarry on a portion of the farm de Onderstepoort 300-JR, Tshwane, Gauteng (2007);
- ⇒ Natural Scientific Services cc, Botanical survey for the SASOL Mafutha coal project near Lephalale, Limpopo Province, RSA (2008);
- ⇒ SRK Consulting, Ecological assessment on Vlakfontein area, NW of Ogies, Mpumalanga. Report compiled in association with EkoInfo (2009);
- ⇒ Fraser Alexander, Biodiversity action plan for Lonmin Limpopo & Platinum, North West & Limpopo Province, RSA (2008-2009);
- ⇒ Envirolution Consulting (Pty) Ltd., Ecological screening report and site selection process for an Eskom general landfill and hazardous waste storage facility near Lephalale, Limpopo Province, RSA (2009);
- ⇒ Envirolution Consulting (Pty) Ltd., Ecological assessment for the proposed construction of an Eskom general landfill and hazardous waste storage facility at the Matimba Power Station, Limpopo Province, RSA (2009);
- ⇒ Shangoni/Vergenoeg Mining Company, Ecological assessment for the proposed construction of a slurry pipeline and waste rock dump at the Vergenoeg Mine, Gauteng (2011);
- ⇒ ENVASS, An ecological evaluation (vertebrate & avifaunal component) for the proposed alternative energy plant on Portion 3, 4 & 5 of the Farm Groenwater 453, Northern cape (2012); and
- ⇒ ENVASS, Ecological evaluation (vertebrate & avifaunal component) for the proposed alternative energy plant on !xun & khwe, Northern cape (2012).
- ⇒ Mulilo & CSIR, Ecological evaluation (vertebrate & avifaunal component) for seven proposed PV plants near Kenhardt, Northern Cape (2016);
- ⇒ Shangoni & Aquila Resources (Vegetation, vertebrate & avifaunal component) for the mining of Iron Ore at Meletse Mountain near Thabazimbi, including the compilation of a habitat occurrence model for a threatened fern species (*Cheilanthes deltoidea silicicola*) and an offset strategy (2016);
- ⇒ De Castro and Brits/Clearstream Environmental, Terrestrial ecological assessment for the Impumelelo Mine (SASOL) expansion areas between Secunda and Greylingstad, Mpumalanga (2016);
- ⇒ EkoInfo/AngloCoal - Biodiversity assessment (vertebrates and invertebrates) for Kriel Coal Mine Lease Area (18 000ha), Kriel, Mpumalanga (2017);
- ⇒ De Castro & Brits Ecological Consultants/ Cleanstream Environmental, Bio-monitoring survey for Exxaro Glisa coal mine: Vertebrate Wetland Fauna Assessment, Belfast, Mpumalanga (2018).
- ⇒ De Castro & Brits Ecological Consultants/ Cleanstream Environmental - Ecological follow-up survey of the Stuart Colliery with emphasis on surface infrastructure, Delmas, Mpumalanga (2018);
- ⇒ EkoInfo/Ethical Exchange - Biodiversity assessment (with inputs related to fauna) for the application of a prospecting permit at the Boschpoort Granite Mine, North-West Province (2019);
- ⇒ EkoInfo/Seriti - Biodiversity baseline assessment (vertebrates and invertebrates) for the Kriel Colliery's post mined and rehabilitated areas, Kriel, Mpumalanga (2019);

⇒ De Castro & Brits Ecological Consultants, Vertebrate Fauna Assessment for Glencore's Wonderfontein Mine complex Mineral Rights Area, Wonderfontein, Mpumalanga (2019);
⇒ Bathusi Environmental/ENVASS, Terrestrial fauna and avifaunal survey and impact assessment for the mining of heavy mineral sands at areas known as Die Kom and Grouwduin se Kop, near Koekenaap, Western Cape (2019);
⇒ De Castro & Brits Ecological Consultants/ Cleanstream Environmental, Bio-monitoring survey for Exxaro Glisa coal mine: Vertebrate Wetland Fauna Assessment, Belfast, Mpumalanga (2020);
⇒ De Castro & Brits Ecological Consultants/Cleanstream Environmental, Vertebrate Fauna Assessment on 376.5ha of Kriel Colliery Pit F, Kriel, Mpumalanga (2020).

3 Avifaunal and Invertebrate Assessments:

⇒ Lavender Manor cc, Red Data Bird Assessment for the proposed establishment of a retail, commercial and Lavender Manor Township on part of the farm Rietfontein 189 IQ, Muldersdrift, Gauteng (2004);
⇒ Helga Schneider & Associates, Avifaunal & Invertebrate Red Data Assessment for the proposed rezoning & subdivision on Erf 6486 Orange Farm Ext 2, Johannesburg, Gauteng (2005);
⇒ TOWNDEV, Avifaunal and Arachnid Assessment for the proposed subdivision of Grootfontein 349 JR, Rievlei Dam, Gauteng (2006);
⇒ Prof. Van Rensburg, Red Data Invertebrate Scan for the proposed Rietvalleirand Extension 59, Gauteng (2006);
⇒ Group Five Property Development, Invertebrate Assessment for the proposed Buccleuch Ex 1, Gauteng (2006);
⇒ Zong's Property Investments, Avifaunal and Metisella meninx assessment for the establishment of a residential development on a portion of Pomona Estates Agricultural Holdings, Pomona, Gauteng (2006);
⇒ Waterval Islamic Institute, Avifaunal and Invertebrate Assessment for the proposed Northern Golf Course Development, Midrand, Gauteng (2006);
⇒ Ekurhuleni Metropolitan Municipality, Avifaunal & Invertebrate Red Data Assessment for the proposed low-cost housing development on Olifantsfontein 410 JR, Gauteng (2006);
⇒ City of Tshwane Metropolitan Municipality, Invertebrate Red Data Scan for the proposed flood remediation and river upgrade at Soshanguve, Gauteng (2006);
⇒ AGES, Invertebrate assessment for the proposed mining activities on the farm Thorncliffe 374 KT, 1strata Eastern Mines, Mpumalanga (2007)
⇒ AGES, Mammal and invertebrate assessment for the proposed Kalplats project, Stella, North West Province (2007)
⇒ Exigent Engineering Consultants, Invertebrate assessment for the proposed Derdepoort 1 11, Derdepoort, Gauteng (2007);
⇒ Exigent Engineering Consultants, Invertebrate and Avifaunal scan for the proposed Cutty Sark hotel extension, Scottburgh, Kwazulu-Natal (2007);
⇒ Strategic Environmental Focus, African Grass Owl assessment on the proposed Cradle View country estate on portion 60 of the farm Driefontein 179 IQ, Muldersdrift, Gauteng (2007);
⇒ GEOLAB, Ecological assessment for the West Rand Gold Operations (WERGO) Witfontein tailings disposal facility, Mintails, Gauteng, RSA (2008);
⇒ Coastal Environmental Services, Avifaunal Assessment for the proposed mining of heavy minerals at Port Durnford (Exxaro KZN-Sands), KwaZulu-Natal (2008);
⇒ SRK & Natural Scientific Services cc, A feasibility study for the mining of coal north of the Limpopo Province. Avifaunal & invertebrate assessment, Rio Tinto Exploration, Limpopo Province, RSA (2009);
⇒ Eskom/Baagi Environmental, An environmental management plan (avifaunal & faunal component) for the proposed Dinaledi - Spitskop 400 kV transmission line, North West Province (2010);
⇒ Eskom/Baagi Environmental, An avifaunal impact report for the proposed 400 kV Ariadne-Venus transmission line between Estcourt and Pietermaritzburg, KwaZulu-Natal (2010);
⇒ Eskom/Baagi Environmental, An avifaunal impact assessment report for a 275 kV power line between the substations of Glockner and Kookfontein, Vanderbijlpark, Gauteng (2010);
⇒ Groundwater Consulting Services (Pty) Ltd/EkoInfo, An invertebrate and avifaunal specialist report for the proposed expansion of Exxaro's Glisa coal mine, Belfast, Mpumalanga (2010);
⇒ Eskom/Baagi Environmental, An environmental management plan (avifauna component) for the proposed 400 kV Medupi-Massa transmission lines, Limpopo Province (2011);
⇒ Eskom/Baagi Environmental, An avifaunal and fauna impact assessment report for the proposed 400 kV Arnott-Gumeni transmission line, Mpumalanga Province (2012);
⇒ Eskom/Baagi Environmental, An environmental management plan (avifaunal component) for the proposed 400 kV Ngwedi transmission line and substation, North West Province (2012);
⇒ Exxaro/EkoInfo, An avifaunal and invertebrate assessment (as part of a Biodiversity Assessment and action plan) for the Gravelotte MagVanTi Mining Area, Limpopo Province (2012);
⇒ Groundwater Consulting Services (Pty) Ltd/EkoInfo, An invertebrate and avifaunal specialist report for the proposed Paardeplaats coal mine area, Belfast, Mpumalanga (2012);
⇒ Groundwater Consulting Services (Pty) Ltd/EkoInfo, An invertebrate and avifaunal specialist report for the proposed Leeuwpan coal mine area, Belfast, Mpumalanga (2013);
⇒ Eskom/Baagi Environmental, An environmental management plan (avifaunal component) for the proposed Medupi - Borutho 400 kV transmission line, Limpopo Province (2012);
⇒ Eskom/Baagi Environmental, An environmental management plan (avifaunal component) for the proposed Gromis - Oranjemund 400 kV transmission line, Northern Cape (2013);
⇒ Eskom/Baagi Environmental, An environmental management plan (avifaunal component) for the proposed Ariadne - Eros 400 kV transmission line, KwaZulu-Natal (2014);

- ⇒ Eskom/Baagi Environmental, An avifaunal and fauna impact assessment report for the proposed 400 kV Nzhelele - Triangle Project, Musina, Limpopo Province (2014);
- ⇒ Exxaro/EkoInfo, An avifauna and invertebrate investigation for the proposed Zonderwater Coal Project, Lephalale, Limpopo Province (2014);
- ⇒ Eskom/Baagi Environmental, An environmental management plan (avifaunal component) for the proposed Everest - Merapi 400 kV transmission line, Free State Province (2015);
- ⇒ Malelane Safari Resort Investments, An avifaunal investigation for the proposed safari lodge near Malelane Gate, Kruger National Park (2015);
- ⇒ Exigent, An avifaunal investigation for the proposed Zamokuhle Development within the Pongola Game Reserve, Mkuzi, KwaZulu-Natal (2016);
- ⇒ Bathusi Environmental/ Savannah Environmental, Avifaunal baseline survey and impact assessment as part of a terrestrial biodiversity impact assessment for the proposed Tshivhaso Coal-fired power plant near Lephalale, Limpopo Province (2016);
- ⇒ Eskom/Baagi, Avifauna and fauna assessment for the proposed Mahikeng main transmission substation and 400kV Pluto to Mahikeng powerline within the Merafong City Local Municipality of Gauteng Province and the Ditsobotla, JB Marks and Mafikeng Local Munisipalities of the North West Province (2018);
- ⇒ Bathusi Environmental/ Savannah Environmental, Avifaunal baseline survey and impact assessment as part of a terrestrial biodiversity impact assessment for the proposed Mutsho power project near Makhado, Limpopo Province (2018);
- ⇒ Savannah Environmental/ ABO Wind Lichtenburg 1 PV - Avifaunal baseline Assessment for the 100MW Lichtenburg 1 PV Solar Facility, Lichtenburg, North-West Province (2018);
- ⇒ Savannah Environmental/ ABO Wind Lichtenburg 2 PV - Avifaunal baseline Assessment for the 100MW Lichtenburg 2 PV Solar Facility, Lichtenburg, North-West Province (2018);
- ⇒ Savannah Environmental/ ABO Wind Lichtenburg 3 PV - Avifaunal baseline Assessment for the 100MW Lichtenburg 3 PV Solar Facility, Lichtenburg, North-West Province (2018);
- ⇒ Bathusi Environmental/ Mills & Otten - African Grass-Owl (*Tyto capensis*) and general bird assessment on the Remainder Portion 332 of the Farm Knopjeslaagte 385 JR, Gauteng (2018);
- ⇒ Nyengere Solutions/ Waterberg Joint Venture - Avifauna, Invertebrate and Bat benchmark surveys for the proposed Waterberg mining project (dry season), Makgabeng, Central Limpopo Province (2018);
- ⇒ Knight Piésold/ Afri-Active Mechanical & Electrical - Avifaunal baseline assessment for the Lanark PV Solar Facility near Dendron (Mogwadi), Limpopo Province (2018);
- ⇒ Nyengere Solutions/ Waterberg Joint Venture - Avifauna, Invertebrate and Bat benchmark surveys for the proposed Waterberg mining project (wet season), Makgabeng, Central Limpopo Province (2019);
- ⇒ Eskom/Bathusi Environmental, environmental management plan; Avifaunal Component for the dismantling of the Grootpan-Brakfontein double circuit powerline near Ogies, Mpumalanga (2019);
- ⇒ Bathusi Environment/Terramanzi, Conflict resolution actions for the proposed Alkantpan Airstrip on a Portion of the Farm Smous Pan 105: Avifaunal Component, Copperton, Northern Cape (2019);
- ⇒ Eskom/EkoInfo, Avifaunal and general terrestrial fauna assessment for a 400kV powerline as required for the East Coast Gas Project, Richards Bay, KwaZulu-Natal (2019).

4 Other Assessments: Facilitation, project management and conduction of environmental scoping exercises, Environmental Impact Assessments, Environmental Management Plans, Feasibility Reports, for a range of projects and issues such as:

- ⇒ Planning and facilitation of environmental awareness workshops (Winterveltd Workshops for the Department of Environmental Affairs and Tourism);
- ⇒ Compilation and evaluation of EIA reports and Environmental Management Plans (EMPs) for both the private and public sector (e.g. Scoping Report for the relocation of oxidation ponds for the Moqhaka Local Municipality and the installation of an underground additive tank for Sasol Oil (Pty) Ltd).
- ⇒ Urban Renewal Projects: Bekkersdal Urban Renewal Project and the Greater Evaton Urban Renewal Project for the Gauteng Department of Housing.
- ⇒ Douglas Collieries (Inkwe Collieries), Biodiversity Assessment and database compilation of the Douglas Collieries (2005);
- ⇒ Orion Group, Ecological Sensitivity Map for the proposed golf course and related facilities, Mont-Aux-Sources (2005);
- ⇒ Johannesburg Roads Agency, Alien Eradication and Rehabilitation Programme for the proposed upgrade of 14th Avenue, Randburg, Gauteng (2006);
- ⇒ City of Joburg Property Development Company, Ecological Management Plan for the Orlando Dam intersection, Soweto, Gauteng (2006);
- ⇒ GJ van Zyl Trust, Alien Eradication Programme for the proposed development of a resort on the Farm Witpoort 216 JS, Mpumalanga (2006);
- ⇒ GJ van Zyl Trust, Fire Management Plan for the proposed development of a resort on the Farm Witpoort 216 JS, Mpumalanga (2006); and
- ⇒ Khutala Collieries (Inkwe Collieries), Biodiversity Assessment and database compilation (2006)

5 Linear Assessments:

- ⇒ Trans-Caledon Tunnel Authority (TCTA), Proposed Vaal River Eastern Subsytem Augmentation (VRESAP) pipeline from Vaal Marina to Secunda (2005);
- ⇒ PBA International (in association with Bathusi EC), Ecological Scoping Report for the proposed Eskom Delta-Epsilon 765 kV Transmission lines (2007);

- ⇒ Bohlweki Environmental (in association with Bathusi EC), Ecological Scoping Report for the proposed Eskom Malelane-Boulders 132 kV Distribution line (2007);
- ⇒ Bohlweki Environmental (in association with Bathusi EC), Ecological Scoping Report for the proposed Eskom Marathon-Delta 132 kV Distribution line (2007);
- ⇒ Strategic Environmental Focus, Avifaunal EIA Report for the proposed Eskom Hendrina-Prairie-Marathon 400 kV Transmission line, Mpumalanga (2007);
- ⇒ Natural Scientific Services cc, Botanical survey for the proposed upgrade of the Transnet railway line between Hotazel, Northern Cape and the Port of Ngqura, Eastern Cape, RSA (2008);
- ⇒ Envirolution Consulting (Pty) Ltd, Ecological Report for the proposed Eskom Apollo-Lepini 400kV transmission line (2009);
- ⇒ Arcus Gibb, An ecological investigation for the Tumelo 132 kV distribution line and power line near Kagiso, Gauteng (2010);
- ⇒ AECOM, Fauna assessment for the proposed upgrade of the Moloto Road through Gauteng, Mpumalanga and Limpopo Provinces (2016);
- ⇒ Envirolution consulting, Terrestrial ecological assessment and rehabilitation plan for the proposed Meyersdal pipeline located within the Meyersdal Nature Estate, Alberton, Gauteng (2017);
- ⇒ Envirolution consulting, Terrestrial ecological assessment for the Witpoortjie distribution line, Witpoortjie, Gauteng (2017);
- ⇒ Envirolution consulting, Terrestrial ecological assessment and rehabilitation plan for a sewer pipeline at the Pomona Spruit system, Kempton Park, Gauteng (2017);
- ⇒ Shangoni Management Services/ Ekurhuleni Metropolitan Municipality - Ecological Evaluation for the upgrade of the Serengeti Sewer Pump Station and rising main, Ekurhuleni Metropolitan Municipality, Pomona, Gauteng (2018);
- ⇒ AdiEnvironmental/Kyllinga Consulting, Ecological Assessment for the Empuluzi - Methula Phase 1 bulk water supply scheme, Mpuluzi, Mpumalanga (2018);
- ⇒ SRK Consulting, Ecological Evaluation for the proposed Baviaanspoort pipeline, northern Pretoria, Gauteng (2019).

B Work conducted in other African countries:

- ⇒ Rural Maintenance, Invertebrate study for four mini-hydroelectric generation plants, Northern Malawi, Africa (2010);
- ⇒ Impacto, An avifaunal study (Phase 1) for the proposed Mpanda Nkwua Dam in the Zambezi River, Mozambique, Tete Province (2010);
- ⇒ Conseil Régional des Pays de la Loire, An avifaunal investigation of the Rusizi and Ruvubu National Parks (Burundi), and the feasibility of establishing an avi-tourism network with specific emphasis on the protection of important flyways used by Palearctic birds - of - prey (2010);
- ⇒ Impacto, An avifaunal study (Phase 2) for the proposed Mpanda Nkwua Dam in the Zambezi River, Mozambique, Tete Province (2011);
- ⇒ Rural Maintenance, Invertebrate scan for the expansion of coal mining activities at Kayelekera, Northern Malawi, Africa (2011);
- ⇒ Rural Maintenance, Invertebrate study for a mini-hydroelectric plant at the Chisanga Falls, Nyika National Park, Malawi (2011);
- ⇒ Impacto/ERM/Enviro-Insight, Avifaunal investigation for the proposed Ncondezi Coal Mine, Tete Province, Mozambique (2011);
- ⇒ Enviro-Insight, Avifaunal investigation for the Riversdale Coal Mine complex, Tete Province, Monzambique (2011);
- ⇒ Anadarko Petroleum/ERM/Enviro-Insight, Avifaunal investigation for the proposed Anadarko Mozambique Area 1 Liquefied Natural Gas plant in northern Mozambique, Cabo Delgado Province, Mozambique (2012);
- ⇒ Coffey Environments/EkoInfo, Avifaunal investigation for the mining of iron ore by Baobab Resources, Tete Province, Mozambique (a scoping-level assessment); and
- ⇒ SRK/Flora, Fauna and Man Ecological Services, An avifaunal and invertebrate assessment for the establishment of a potash mine at Konkoati, Republic of the Congo (2012);
- ⇒ China Union/ERM/Enviro-Insight, Avifaunal investigation for the proposed mining of iron ore in Bong County, Liberia (2012);
- ⇒ SRK/Flora, Fauna and Man Ecological Services, An invertebrate assessment for the mining of iron ore by DMC Congo Mining/Exxaro at Mayoko, Republic of the Congo (2012);
- ⇒ Western Cluster/ERM/Enviro-Insight, Avifaunal investigation for the proposed mining of iron ore at Bomi Hills, ,Bomi County, Liberia (2013);
- ⇒ SRK/Flora, Fauna and Man Ecological Services, An invertebrate assessment for the establishment of an ecological offset for the DMC Congo Mining/Exxaro Iron Ore Mine at Mayoko, Republic of the Congo (2013);
- ⇒ Western Cluster/ERM/Enviro-Insight, Avifaunal investigation for the proposed mining of iron ore at Bea Mountain, Grand Cape Mount County, Liberia (2013);
- ⇒ Western Cluster/ERM/Enviro-Insight, Avifaunal investigation for the proposed mining of iron ore at Mano River, Grand Cape Mount County, Liberia (2013);
- ⇒ Anadarko Petroleum/ERM/Enviro-Insight, DUAT Area Terrestrial Ecology Baseline Augmentation: Avifaunal Component with emphasis on determining important flyways for emblematic non-passerine birds where the potential risk of avian collisions to approaching aircraft is eminent during the establishment of an airstrip, Cabo Delgado Province, Mozambique (2012);
- ⇒ Anadarko Petroleum/ERM/Enviro-Insight, Regional Terrestrial Baseline Report, Avifaunal Component for the Mozambique Gas development with emphasis on critical habitat as per the IFC PS6, Cabo Delgado Province, Mozambique (2012);
- ⇒ WSP/Flora, Fauna and Man Ecological Services, An invertebrate assessment for the establishment of a phosphate mine, Hinda Phosphate Project, Republic of the Congo (2014);
- ⇒ De Beers/Bathusi Environmental, An avifaunal monitoring report for the Letseng Diamond Mine, Lesotho (2015);
- ⇒ ASCOM Mining/ Flora, Fauna and Man Ecological Services, An Invertebrate and Avifaunal survey for the proposed mining of gold in western Ethiopia, Ethiopia (2015);
- ⇒ Western Power/Ecotone - A faunal investigation for the proposed development of a hydro-powered generation plant at Sioma, western Zambia (2015);

- ⇒ Aureus Mine/Enviro-Insight, An avifaunal investigation for the proposed mining of gold at the New Liberty Gold Mine, Liberia (2015 - 2016);
- ⇒ SRK/ Flora, Fauna and Man Ecological Services, An invertebrate and avifaunal screen for the proposed mining of phosphate substances at Dougou, part of a mining license extension of the Kola Project, Republic Of Congo (2016);
- ⇒ De Beers/Bathusi Environmental, An avifaunal monitoring report (second monitoring session) for the Letseng Diamond Mine, Lesotho (2017);
- ⇒ Western Power/Ecotone - A follow-up wet season faunal investigation for the proposed revised infrastructure for the development of a hydro-powered generation plant at Sioma, western Zambia (2018);
- ⇒ ASCOM Mining/ Flora, Fauna and Man Ecological Services, An Invertebrate and Avifaunal dry season survey for the proposed mining of gold in western Ethiopia, Ethiopia (2018);
- ⇒ SRK/ The Biodiversity Company, An Avifaunal dry season survey for the proposed mining of gold at Siguiri, Guinea, (2018);
- ⇒ Enviro-Insight/ERM, Critical Habitat Review and assessment of threatened Orthoptera taxa as per IFC PS6 at Pugu Hills and Ruvu forest Reserves along the proposed Yapi Merkezi railway line, near Dar-es-Salaam, Tanzania (2019);
- ⇒ De Beers/Bathusi Environmental, An avifaunal monitoring report (third monitoring session) for the Letseng Diamond Mine, Lesotho (2019);

C Additional Experience:

- ⇒ Monitoring and evaluation of the rehabilitation programme for the mining company Richards Bay Minerals (RBM) with special reference to vegetation, bird, small mammal and millipede assemblages.
- ⇒ Other responsibilities include assessment of the ecological standard operating procedures (SOP) according to RBM's environmental management programme in compliance with ISO 14001 environmental standards accreditation process.
- ⇒ Participated in the annual relief programme on the S.A Agulhas voyage to Subantarctic Marion Island (Prins Edward group). Took part in the research to estimate the population dynamics and demography of the alien house mouse (Mus musculus) on the island (under supervision of the University of Pretoria).
- ⇒ Participated in the preparation of a conservation management plan for a game and trout farm in conjunction with Mpumalanga Parks Board (in charge of the bird section) for the farm Nu-Scotland Bavaria.
- ⇒ Lead a successful professional bird tour (party of 12) to the Eastern Zimbabwean highlands and adjacent Mashonaland Plato (10 days).
- ⇒ Lead a successful professional bird tour (party of 9) to the Cape Peninsula, Karoo and West Coast (10 days).
- ⇒ Lead a successful professional bird tour (party of 12) to the Swaziland and Northern Zululand (10 days).
- ⇒ Lead a successful professional bird tour (party of 15) to the Namibia (10 days).
- ⇒ Lead a successful professional bird tour (party of 14) to the Eastern Drakensberg and Lesotho (10 days).

EMPLOYMENT HISTORY:

March 2007 – Current: of Director of Pachnoda Consulting cc
2004- January 2007: Strategic Environmental Focus (Pty) - Terrestrial Ecologist
2003 – 2004: Enviro-Afrik (Pty) Ltd– Environmental Consultant
2001 – 2003: University of Pretoria - Research Assistant

PUBLICATIONS:

- ⇒ McEWAN, K.L., ALE1ANDER, G.J., NIEMAND, L.J. & BREDIN, I.P. 2007. The effect of land transformation on diversity and abundance of reptiles. Paper presented at the 50th Anniversary Conference of the Zoological Society of Southern Africa.
- ⇒ NIEMAND, L. 1997. Distribution and consumption of a rust fungus *Ravenelia macowaniana* by micro-lepidopteran larvae across an urban gradient: spatial autocorrelation and impact assessment. Hons publication, University of Pretoria, Pretoria
- ⇒ NIEMAND, L. 2001. The contribution of the bird community of the regenerating coastal dunes at Richards Bay to regional diversity. MSc Thesis, University of Pretoria, Pretoria.
- ⇒ VAN AARDE, R.J., WASSENAAR, T.D., NIEMAND, L., KNOWLES, T., FERREIRA, S. 2004. Coastal dune forest rehabilitation: a case study on small mammal and bird assemblages in northern KwaZulu-Natal, South Africa. In: Martínez, M.L. & Psuty, N. (Eds.) *Coastal sand dunes: Ecology and Restoration*. Springer-Verlag, Heidelberg.
- ⇒ VAN AARDE, R., DELPORT, J. & NIEMAND, L. 1999. Of frogs and men. *Mechanical Technology,* June: 32-33.
- ⇒ VAN AARDE, R., DELPORT, J. & NIEMAND, L. 1999. Gone Frogging. *Getaway,* January: 80-83.

PRESENTATIONS, CONFERENCES & PUBLIC AWARENESS

- ⇒ Co-presenter at the Wetland Training Course (30 July – 3 August 2007) entitled: "Wetland-associated fauna". University of Pretoria, Pretoria.
- ⇒ Co-presenter and lecturer of the pre-conference training course (entitled "Can rehabilitation contribute towards biodiversity?") at the 3rd Annual LaRSSA (Land Rehabilitation Society of Southern Africa) Conference (8-11 September 2015), Glenburn Lodge, Muldersdrift, Gauteng.
- ⇒ Technical advisor to the Go/Weg magazine in response to bird and ecological related queries from the public/readers.

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Education:
Waterkloof High School, Pretoria: Matriculated: 1992
University of Pretoria, Pretoria: B.Sc. (Zoology and Entomology): 1995
University of Pretoria, Pretoria: B.Sc. (Hons.)(Entomology): 1996
University of Pretoria, Pretoria: M.Sc. (Grassland Conservation Ecology): 2004

Membership of Professional Associations:
Ecological and Zoological Scientist with the South African Council for Natural Scientific Professions (400204/05)

Other Training:
Bats and Wind Energy Course – Endangered Wildlife Trust: 2013

Countries of Work Experience:
South Africa, Mozambique, Botswana, Namibia and Lesotho

Languages: English and Afrikaans

Employment Record:

From: Jan 2001 to October 2001
Employer: Mala-Mala Private Game Reserve
Position Held: Game Ranger
Summary: Responsible for hosting international guests during their stay at the Game Reserve

From: Jan 2002 to 2018
Employer: Ecocheck
Position Held: Principal biodiversity specialist
Summary: As Director of Ecocheck, responsible for the management of a small business and reporting on all projects – specifically faunal biodiversity assessments for the purposes of EIA's, EMPR's, EMP's, SEA's and biodiversity risk assessments.

11. Work undertaken 2010 - present	
Name of assignment or project: Year: Location: Client: Main Project Features: Positions held: Activities performed:	Overvaal Tunnel Project 2015 Mpumalanga: Piet Retief Transnet Construction of a new railway tunnel Faunal specialist Field assessment and reporting on the faunal of the area proposed for the new railway tunnel for EIA and EMP purposes
Name of assignment or project: Year: Location: Client: Main Project Features: Positions held: Activities performed:	Vaalbult Coal Mine 2012 - ongoing Mpumalanga: Carolina EkoInfo Development and operation of a new opencast coal mine Faunal specialist Field assessment and reporting on the faunal of the area proposed for the new coal mine for EIA and EMP purposes
Name of assignment or project: Year: Location: Client: Main Project Features: Positions held: Activities performed:	Ferrum – Nieuwehoop 400 kV transmission power line 2014 - ongoing Northern Cape: Kathu to Kenhardt Eskom Strengthening the Sishen – Saldanha railway Walkdown coordinator and EMP compiler Liaised with landowners, coordinated the biodiversity and heritage walkdown and compiled the Construction EMP and Operation EMP
Name of assignment or project: Year:	Arriesfontein transmission power line 2014

Location:	Northern Cape
Client:	Eskom
Main Project Features:	Connecting the Arriesfontein Solar Power Plant to the national grid
Positions held:	Faunal specialist
Activities performed:	Walkdown of the proposed Arriesfontein transmission power line and compiling the faunal section of the EMP
Name of assignment or project:	The Reeds residential development
Year:	2014
Location:	Gauteng: Pretoria
Client:	BEC
Main Project Features:	Developing a mixed residential development in suburban Pretoria
Positions held:	Faunal specialist
Activities performed:	Field assessment and reporting on the fauna of the area proposed for the development for EIA purposes
Name of assignment or project:	Apollo Esselen transmission power line
Year:	2014
Location:	Gauteng: Pretoria
Client:	Eskom
Main Project Features:	Construction and operation of a transmission power line
Positions held:	Faunal specialist
Activities performed:	Field assessment and reporting on the fauna of the area proposed for the construction of the power line for EIA purposes
Name of assignment or project:	Doorpoort Exts. 44-46 residential development
Year:	2014
Location:	Gauteng: Pretoria
Client:	Seaton Thomson & Associated
Main Project Features:	Developing a new residential area in Doornpoort, Pretoria
Positions held:	Faunal specialist
Activities performed:	Finalizing the faunal assessment for the area proposed for the development with specific reference to red data animals
Name of assignment or project:	Gaghoo diamond mine
Year:	2008-2013
Location:	Botswana: Central Kalahari Game Reserve
Client:	Marsh Vikela
Main Project Features:	Development and operation of an underground diamond mine
Positions held:	Faunal specialist
Activities performed:	Field assessments and reporting for scoping, EIA, EMP and environmental monitoring purposes
Name of assignment or project:	Elders Coal Mine
Year:	2013
Location:	Mpumalanga: Bethal
Client:	Anglo Coal
Main Project Features:	Expansion of the Elders opencast coal mine
Positions held:	Invertebrate specialist
Activities performed:	Field assessment and reporting on the invertebrates of the greenfield areas proposed for the expansion of the Elders coal mine
Name of assignment or project:	Proteadal Mogale City
Year:	2013
Location:	Gauteng: Mogale City
Client:	Mogale City
Main Project Features:	Development of a new mixed residential area in Mogale City
Positions held:	Invertebrate specialist
Activities performed:	Field assessment and EIA reporting on the invertebrates of the area proposed for the new development
Name of assignment or project:	Frankfort Mining Project
Year:	2013
Location:	Free State: Frankfort
Client:	BEC
Main Project Features:	Development of a new opencast mine at Frankfort
Positions held:	Faunal specialist
Activities performed:	Field assessment and reporting on the fauna of the area proposed for the new mine
Name of assignment or project:	Witkop Mining Project
Year:	2013
Location:	Free State: Witkop
Client:	BEC

Main Project Features: Positions held: Activities performed:	Development of a new opencast mine at Witkop Faunal specialist Field assessment and reporting on the fauna of the area proposed for the new mine
Name of assignment or project: Year: Location: Client: Main Project Features: Positions held: Activities performed:	Kalkaar Solar Power Plant 2013 Northern Cape: Kalkaar BEC Construction and operation of a new photo voltaic power plant Faunal specialist Field assessment and reporting on the fauna of the area proposed for the new power plant for EIA and EMP purposes
Name of assignment or project: Year: Location: Client: Main Project Features: Positions held: Activities performed:	Retile Uranium Mine 2013 Namibia: Namib desert, Swakopmund region Reptile Mining Development of a new uranium mine near Swakopmund Invertebrate specialist: field assistant Field assessment on the invertebrates of the area proposed for the new uranium mine in the Namib desert
Name of assignment or project: Year: Location: Client: Main Project Features: Positions held: Activities performed:	Tete Iron Mine 2012 Mozambique: Tete region Coffee International Development of a new iron mine near Tete Invertebrate specialist Initial field assessment and reporting on the invertebrates of the area proposed for the new iron mine
Name of assignment or project: Year: Location: Client: Main Project Features: Positions held: Activities performed:	Ingula Pumped Storage Scheme 2012-2013 Free State and KwaZulu-Natal: van Reenen region Eskom Construction and operation of pumped storage for power generation Invertebrate specialist Compiling and implementing an environmental monitoring programme for the invertebrates of the Ingula area
Name of assignment or project: Year: Location: Client: Main Project Features: Positions held: Activities performed:	Nuclear 1 Power Station 2012-2014 Western Cape and Eastern Cape Eskom Development of the new proposed Nuclear 1 power station Invertebrate specialist Field assessments and reporting on the invertebrates of the three alternative sites proposed for Nuclear 1 on the coast of South Africa
Name of assignment or project: Year: Location: Client: Main Project Features: Positions held: Activities performed:	Randpark Golf Club Development 2012 Gauteng: Randpark Randpark Golf Club Development of residential units within the Randpark Golf Club area Faunal specialist Field assessment and reporting on the fauna with specific reference to red data animals within the Randpark Golf club area
Name of assignment or project: Year: Location: Client: Main Project Features: Positions held: Activities performed:	Steynol Coal Mine 2012 Gauteng BEC Development of a new opencast coal mine in Gauteng Faunal specialist Field assessment and reporting on the fauna of the area proposed for the new coal mine
Name of assignment or project: Year: Location: Client: Main Project Features: Positions held: Activities performed:	Groenpunt Water Treatment Facility Expansion 2012 Free State: Vaal Dam area Department of Correctional Services Expansion of the existing Groenpunt water treatment facility Faunal specialist

	Field investigation and reporting on the fauna of the area proposed for the expansion of the Groenpunt water treatment facility
Name of assignment or project: Year: Location: Client: Main Project Features: Positions held: Activities performed:	Lospersfontein Water Treatment Facility Expansion 2012 Gauteng Department of Correctional Services Expansion of the existing Lospersfontein water treatment facility Faunal specialist Field investigation and reporting on the fauna of the area proposed for the expansion of the Lospersfontein water treatment facility
Name of assignment or project: Year: Location: Client: Main Project Features: Positions held: Activities performed:	Rooipunt Solar Power Plant 2012 Northern Cape: Rooipunt BEC Development of a new photo voltaic power plant Faunal specialist Field investigation and reporting on the fauna of the area proposed for the new photo voltaic power plant at Rooipunt
Name of assignment or project: Year: Location: Client: Main Project Features: Positions held: Activities performed:	Jacomynspan Mine 2012 Northern Cape: Putsonderwater region BEC Development of the new mine at Jacomynspan Faunal specialist Field investigation and reporting on the fauna of the area proposed for the new mine at Jacomynspan
Name of assignment or project: Year: Location: Client: Main Project Features: Positions held: Activities performed:	Two Rivers Platinum Mine Expansion 2012 Mpumalanga: Steelpoort region Two Rivers Platinum Mine Expansion of the existing Two Rivers Platinum mine Faunal specialist Field investigation and reporting on the fauna of the areas proposed for the expansion of the Two Rivers Platinum mine
Name of assignment or project: Year: Location: Client: Main Project Features: Positions held: Activities performed:	Grootegeluk Coal Mine IPP Baseload Project 2012 Limpopo Province: Ellisras region Exxaro Construction and operation of the IPP baseload station at Grootegeluk Faunal specialist Field investigation and reporting on the fauna of the area proposed for the IPP baseload station for the Grootegeluk coal mine
Name of assignment or project: Year: Location: Client: Main Project Features: Positions held: Activities performed:	Gravelotte Iron Mine 2012 Limpopo Province: Gravelotte region Exxaro Development of a new iron mine in the Gravelotte region Ecological field assistant Assisting with the ecological assessment of the area
Name of assignment or project: Year: Location: Client: Main Project Features: Positions held: Activities performed:	Matimba Power Station Ashing Facility Expansion 2012 Limpopo Province: Ellisras region Eskom Expansion of the current ashing facility at Matimba Power Station Faunal specialist Field investigations and reporting on the fauna of the two alternative areas proposed for the expansion of the ashing facility of Matimba
Name of assignment or project: Year: Location: Client: Main Project Features: Positions held: Activities performed:	Tutuka Power Station Ashing Facility Expansion 2012 Mpumalanga Eskom Expansion of the current ashing facility at Tutuka Power Station Faunal specialist Field investigations and reporting on the fauna of the area proposed for the expansion of the ashing facility of Tutuka power station

Name of assignment or project: Year: Location: Client: Main Project Features: Positions held: Activities performed:	Schoongezicht Coal Mine 2012 Mpumalanga BEC Development of a new opencast coal mine at Schoongezicht Faunal specialist Field investigations and reporting on the fauna of the area proposed for the new opencast coal mine
Name of assignment or project: Year: Location: Client: Main Project Features: Positions held: Activities performed:	Inyanda Coal Mine 2012 Mpumalanga BEC Development of a new opencast coal mine at Inyanda Faunal specialist Field investigations and reporting on the fauna of the area proposed for the new opencast coal mine
Name of assignment or project: Year: Location: Client: Main Project Features: Positions held: Activities performed:	Schurvekop Coal Mine 2012 Mpumalanga BEC Development of a new opencast coal mine at Schurvekop Faunal specialist Field investigations and reporting on the fauna of the area proposed for the new opencast coal mine
Name of assignment or project: Year: Location: Client: Main Project Features: Positions held: Activities performed:	Kangra Maquasa Coal Mine 2012 Mpumalanga BEC Development of a new opencast coal mine at Kangra Maquasa Faunal specialist Field investigations and reporting on the fauna of the area proposed for the new opencast coal mine
Name of assignment or project: Year: Location: Client: Main Project Features: Positions held: Activities performed:	Letseng Diamond Mine Expansion 2011 Lesotho: Letseng Letseng Diamond Mine Expansion of the existing Letseng diamond mine Faunal specialist Field investigations and reporting on the fauna of the areas proposed for the expansion of the Letseng Diamond Mine
Name of assignment or project: Year: Location: Client: Main Project Features: Positions held: Activities performed:	Momentus Solar Energy Plant 2011 North West Province BEC Development of a new solar energy plant Faunal specialist Field investigations and reporting on the fauna of the areas proposed for the new solar energy plant
Name of assignment or project: Year: Location: Client: Main Project Features: Positions held: Activities performed:	Eloff Coal Mine 2011 Mpumalanga: Eloff BEC Development of a new opencast coal mine near Eloff Faunal specialist Field investigations and reporting on the fauna of the areas proposed for the new opencast coal mine near Eloff
Name of assignment or project: Year: Location: Client: Main Project Features: Positions held: Activities performed:	Matla Coal Mine Expansion 2011 Mpumalanga: Delmas district Matla Coal Expansion of the existing Matla coal mine Faunal specialist Field investigations and reporting on the fauna of the areas proposed for the expansion of the Matla Coal Mine
Name of assignment or project:	Hendrina Power Station Ashing Facility Expansion

Year: Location: Client: Main Project Features: Positions held: Activities performed:	2011 Mpumalanga: Hendrina Eskom Expansion of the current ashing facility at Hendrina Power Station Faunal specialist Field investigations and reporting on the fauna of the area proposed for the expansion of the ashing facility of Hendrina power station
Name of assignment or project: Year: Location: Client: Main Project Features: Positions held: Activities performed:	Mphanda Nkuwa Dam 2010 Mozambique: between Tete and Cahora Bassa Dam, Zambezi River Impacto Development of a new dam in the Zambezi River for power generation Invertebrate specialist Field investigations and reporting on the invertebrates of the areas to be inundated during the construction of the Mphanda Nkuwa dam
Name of assignment or project: Year: Location: Client: Main Project Features: Positions held: Activities performed:	Ariadne-Venus Transmission Power Lines 2010 KwaZulu-Natal Eskom Construction and operation of a transmission power line Invertebrate specialist Field assessment and reporting on the invertebrates of the area proposed for the construction of the power line for EIA purposes
Name of assignment or project: Year: Location: Client: Main Project Features: Positions held: Activities performed:	Naledi Landfill Site 2010 North West Province BEC Development of a new landfill site Faunal specialist Field investigations and reporting on the fauna of the area proposed for the new landfill site at Naledi
Name of assignment or project: Year: Location: Client: Main Project Features: Positions held: Activities performed:	Aggeneis-Paulputs Transmission Power Lines 2010 Northern Cape: Aggeneis Eskom Construction and operation of a transmission power line Faunal specialist Field assessment and reporting on the fauna of the area proposed for the construction of the power line for EIA purposes
Name of assignment or project: Year: Location: Client: Main Project Features: Positions held: Activities performed:	Medupi-Spitskop Protected Trees 2010 Limpopo Province: Ellisras region Eskom Construction and operation of a transmission power line Ecologist Assessing the presence of protected trees within the power line servitude
Name of assignment or project: Year: Location: Client: Main Project Features: Positions held: Activities performed:	Mokopane Power Line Integration Project 2010 Limpopo Province: Mokopane Eskom Construction and operation of transmission power lines Faunal specialist Field assessment and reporting on the fauna of the areas proposed for the construction of the power lines for EIA purposes
Name of assignment or project: Year: Location: Client: Main Project Features: Positions held: Activities performed:	Medupi Power Station Conveyor 2010 Limpopo Province: Ellisras district Eskom Construction and operation of a conveyor for the Medupi power station Faunal specialists Field assessment and reporting on the fauna of the areas proposed for the construction of the conveyor for EIA purposes
Name of assignment or project: Year: Location:	Majuba Underground Gasification Project 2010 Mpumalanga: Majuba

Client: Main Project Features: Positions held: Activities performed:	Eskom Development of a underground gasification area for power generation Faunal specialist Field assessment and reporting on the fauna of the areas proposed for the development of the underground gasification area for EIA purposes
Name of assignment or project: Year: Location: Client: Main Project Features: Positions held: Activities performed:	Forzando Coal Mine 2010 Mpumalanga BEC Development of a new opencast coal mine Faunal specialist Field assessment and reporting on the fauna of the areas proposed for the development of the new opencast coal mine
Name of assignment or project: Year: Location: Client: Main Project Features: Positions held: Activities performed:	Delta-Epsilom Transmission Power Lines 2010 Limpopo Province Eskom Construction and operation of transmission power lines Faunal specialist Field assessment and reporting on the fauna of the areas proposed for the construction of the power lines for EIA purposes
Name of assignment or project: Year: Location: Client: Main Project Features: Positions held: Activities performed:	Matla-Jupiter Transmission Power Lines 2010 Mpumalanga Eskom Construction and operation of transmission power lines Faunal specialist Field assessment and reporting on the fauna of the areas proposed for the construction of the power lines for EIA purposes
Name of assignment or project: Year: Location: Client: Main Project Features: Positions held: Activities performed:	Hilltop Rest Power Lines 2010 Mpumalanga Eskom Construction and operation of transmission power lines Faunal specialist Field assessment and reporting on the fauna of the areas proposed for the construction of the power lines for EIA purposes

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CONDITIONS, LIMITATIONS AND ASSUMPTIONS

⇒ Findings, results, observations, conclusions and recommendations presented in this report are based on the authors' best scientific and professional knowledge as well as the interpretation of information available to them at the time of compiling this report.

⇒ Due care and diligence was exercised by the authors in rendering services, preparing this document and executing responsibilities as specialist consultants.

⇒ It is assumed that third party information (obtained from government, academic/research institution, non-governmental organisations) is accurate and true.

⇒ Even though care is taken to ensure the accuracy of surveys, data analysis and other aspects of this report, it should be noted that ecological/ biodiversity studies, notably for EIA purposes, are limited in time, budget and scope. It is not the purpose of this report to present exhaustively detailed information. Decisions and discussions are therefore, and to some extent, based on reasonable and informed decisions and assumptions that are extracted from *bona fide* information sources and from deductive reasoning (Precautionary Principle).

⇒ In order to obtain a comprehensive understanding of the dynamics of terrestrial ecological and diversity patterns, with particular reference to endemic, rare, or threatened species in any area, biodiversity assessments should always consider investigations at different time scales (across seasons/years) and through replication. However, such long-term studies are generally not part of the terms of reference for EIA assessments.

⇒ Results presented in this report are based on a snapshot investigation of the study area and not on detailed and long-term investigations of all environmental attributes and the varying degrees of biological diversity that may be present in the study area. Specifically, no discipline-specific, long-term survey methods were used in the collation of data from the site. Although as much as possible data was obtained from opportunistic observations during the brief survey period, these surveys are customarily limited by budgetary and time constraints – results presented in this report need to be interpreted with these limitations in mind.

⇒ Background information that were used to inform and augment the assessment was limited to data and GIS coverage available for the project site on a relevant scale. A paucity of site-specific data is typical of these data sources and should be accepted as a norm.

⇒ Notably, rare and endemic species normally do not occur in great densities and, because of customary limitations in the search and identification of Red Listed species, the detailed investigation of these species was not possible. Results are ultimately based on estimations and specialist interpretation of imperfect data.

⇒ It is emphasised that information, as presented in this document, only have bearing on the sites as indicated on accompanying maps. This information cannot be applied to any other area, however similar in appearance or any other aspect, without proper investigation.

⇒ Additional or supplementary information may become known during a later stage of the process or development. The authors therefore reserve the right to modify aspects of the report, including findings and recommendations,

should new information become available from ongoing research or additional work performed in the immediate region of this specific area, or any forthcoming information pertaining to this investigation after the submission of this report.

⇒ The respective companies and specialists therefore do not accept any liability for conclusions, suggestions, limitations and recommendations made in good faith, based on available information, or based on data that was obtained from surveys of a brief nature.

⇒ This report should always be considered in its entirety. Reading and representing portions of the report in isolation could lead to incorrect conclusions and assumptions. In case of any uncertainty, the authors should be contacted to clarify any viewpoints, recommendations and/ or results.

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ACRONYMS & ABBREVIATIONS

Table 36: Acronyms and abbreviations in the report	
ADU	Animal Demography Unit, Department of Biological Sciences, University of the Western Cape
BEC	Bathusi Environmental Consulting cc
CBD	Convention on Biological Diversity
CITES	Convention of International Trade in Endangered Species
CR	Critically Endangered
DD	Data Deficient
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EN	Endangered
End	Endemic Species
GIS	Geographic Information Systems
GPS	Global Positioning System (handheld device)
IBA	Important Bird Area
IUCN	International Union for Conservation of Nature
LC	Least Concern
mmasl	Mean Meters Above Sea Level, or m.
NEnd	Near Endemic Species
NT	Near Threatened
Pr.Sci.Nat	Professional Natural Scientist (registered at SACNASP)
SABAP	South African Bird Atlas Project
SACNASP	South African Council for Natural Scientific Professions
SANBI	South African National Biodiversity Institute
SCC	Species of Conservation Concern
SSC	Species of Special Concern
VU	Vulnerable

GLOSSARY OF TERMS

Table 37: Glossary of terms for the report	
Abundance	The quantity, number or amount of a species present in a particular area or sample
Ad hoc	Random, non-sequential, opportunistic observations
Altitude	Expressed as mean meters above sea level (mmasl), or meter (m)
Amphibian	Cold-blooded vertebrate animal of a class that comprises the frogs, toads, newts, salamanders and caecilians
Antelope	Swift running, deer-like ruminant with smooth hair and upward-pointing horns
Anthropogenic	Human induced
Austral	Southern hemisphere
Avifauna	Birds
Biodiversity	Diversity among and within plant and animal species in an environment

Carnivore	Flesh eating animal
Commute	Travel between destinations, normally on a daily basis
Composition	Constituents (animals or plants) of a sample, or area
Conspecific	Animals or plants belonging to the same species
Data Deficient	Species has been categorized (UICN) as offering insufficient information for a proper assessment of conservation status to be made
Density	Number of individuals in a given area
Disjunct	Disjoined or distinct from one another
Diversity	Number of species in a given area
Dominance	The predominance (abundance, numbers) of one or more species in a plant or animal community
Dwarf shrub	A plant that bears hibernating buds on persistent shoots near the ground, usually woody plants with perennating buds borne close to the ground, usually less than 25 centimetres above soil surface
Ecology	The branch of biology that deals with the relations of organisms to one another and to their physical surroundings
Endemic	Restricted to a certain geographic area
Granivore	Animals that eat seeds as the main part of their diet
Herbaceous	Vascular plants that have no persistent woody stems above ground
Herbivorous	Animals that eat plants
Herpetofauna	Amphibians and Reptiles
Hibernate	An animal or plant that spends the winter in a dormant state
Insectivorous	Animals that feed on insects as the main part of their diet
Invertebrate	An animal lacking a backbone, such as an arthropod, mollusc, annelid, coelenterate, etc
Lepidoptera	Butterflies
Mesic	An environment or habitat) containing a moderate amount of moisture
Mammal	A warm-blooded vertebrate animal of a class that is distinguished by the possession of hair or fur, females that secrete milk for the nourishment of the young and (typically) the birth of live young
Nocturnal (animal)	Animals that are active during night periods
Omnivorous	Animals that feed on a variety of foot of both animal and plant origin
Passerine	Relating to or denoting birds of a large order distinguished by having feet that are adapted for perching, including all songbirds
Predator	Animals that naturally preys on other animals, species
Primate	Animals characterized by large brains relative to other mammals, as well as an increased reliance on stereoscopic vision at the expense of smell, the dominant sensory system in most mammals
Putative species	Species that are assumed to exist, or reputed to have existed
Rainfall	Expressed as millimetre (mm)
Red Data	A taxon included in the UICN list of threatened species
Reptile	Tetrapod animals in the class Reptilia, comprising today's turtles, crocodilians, snakes, amphisbaenians, lizards, etc
Rodent	Gnawing mammal of an order that includes rats, mice, squirrels, hamsters, porcupines and their relatives, distinguished by strong constantly growing incisors and no canine teeth. They constitute the largest order of mammals
Scavenger	An animal that feeds on carrion, dead plant material, or refuse materials
Subterranean	Existing, living under the earth's surface
Territorial	The sociographical area that an animal of a particular species consistently defends against conspecifics (or, occasionally, animals of other species). Animals that defend territories in this way are referred to as territorial. Territoriality is only shown by a minority of species.
Temperature	Expressed as Degrees Celsius (°C)
Threatened	Species (including animals, plants, fungi, etc.) which are vulnerable to endangerment in the near future. Species that are threatened are sometimes characterised by the population dynamics measure of critical dispensation, a mathematical measure of biomass related to population growth rate

REFERENCES

ADU-UCT. 2017. *Animal Demography Unit Virtual Museum*. Available at: vmus.adu.org.za.

AGIS, 2007. Agricultural Geo-Referenced Information System, accessed from www.agis.agric.za on 2010.

BATES, M.F, BRANCH, W.R., BAUER, A.M., BURGER, M., MARAIS, J., ALEXANDER, G.J. & DE VILLIERS, M.S. (eds). 2014. Atlas and Red List of the Reptiles of South Africa, Lesotho, and Swaziland. *Suricata 1*. South African National Biodiversity Institute, Pretoria.

BAUER, H., PACKER, C., FUNSTON, P.F., HENSCHEL, P. & NOWELL, K. 2016. *Panthera leo*. The IUCN Red List of Threatened Species 2016: e.T15951A115130419. http://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T15951A107265605.en

BAZELET, C. & NASKRECKI, P. 2014. *Aroegas fuscus*. The IUCN Red List of Threatened Species 2014: e.T20639359A56180116. http://dx.doi.org/10.2305/IUCN.UK.2014-1.RLTS.T20639359A56180116.en

BIRDLIFE INTERNATIONAL. 2020. *Sagittarius serpentarius*. The IUCN Red List of Threatened Species 2020: e.T22696221A173647556. https://dx.doi.org/10.2305/IUCN.UK.2020-3.RLTS.T22696221A173647556.en

BIRDLIFE SOUTH AFRICA. 2018. *BirdLife South Africa Checklist of Birds in South Africa*, 2018.

BUCKLAND, S.T., ANDERSON, D.R., BURNHAM, K.P., LAAKE, J.L. 1993. *Distance Sampling: Estimating abundance of biological populations*. Chapman and Hall, London.

CHILD, M.F., RO1BURGH, L., DO LINH SAN, E., RAIMONDO, D. & DAVIES-MOSTERT, H.T. (eds) 2016. *The Red List of Mammals of South Africa, Swaziland and Lesotho*. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.

CLARKE, K.R. & WARWICK, R.M. 1994. *Changes in marine communities: An approach to statistical analysis and interpretation*. Natural Environmental Research Council, United Kingdom.

COHEN L, TAYLOR P, JACOBS D, KEARNEY T, MACEWAN K, MONADJEM A, RICHARDS LR, SCHOEMAN C, SETHUSA T. 2016. A *conservation assessment of Rhinolophus cohenae*. In Child MF, Roxburgh L, Do Linh San E, Raimondo D, Davies-Mostert HT, editors. The Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.

COLWELL, R.K. 2013. ESTIMATES: STATISTICAL ESTIMATION OF SPECIES RICHNESS AND SHARED SPECIES FROM SAMPLES. VERSION 9. USER'S GUIDE AND APPLICATION PUBLISHED AT: HTTP://PURL.OCLC.ORG/ESTIMATES.

CONVENTION ON BIOLOGICAL DIVERSITY. Signed 1993 and ratified 2 November 1995.

DAVIES-MOSTERT HT, PAGE-NICHOLSON S, MARNEWECK DG, MARNEWICK K, CILLIERS D, WHITTINGTON-JONES B, KILLIAN H, MILLS MGL, PARKER D, POWER J, REHSE T, CHILD MF. 2016. *A conservation assessment of Lycaon pictus*. In Child MF, Roxburgh L, Do Linh San E, Raimondo D, Davies-Mostert HT, editors. The Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.

DEL HOYO, J., ELLIOTT, A. & CHRISTIE, D.A. eds. 1992-2011. *Handbook of the Birds of the World.* Vol 1-16. Lynx Edicions, Barcelona.

DEPARTMENT OF ENVIRONMENTAL AFFAIRS AND TOURISM. 2001. Environmental Potential Atlas. DEAT, Pretoria.

ENDANGERED WILDLIFE TRUST. 2002. The Biodiversity of South Africa 2002. Indicators, Trends and Human Impacts. Struik Publishers, Cape Town.

FISHPOOL, L.D.C. 1997. *Important Bird Areas in Africa: IBA criteria: categories, species lists and population thresholds*. BirdLife International, Cambridge.

FRIEDMANN,Y. & DALY, B. 2004. *Red Data Book of the Mammals of South Africa: A Conservation Assessment*. CBSG South Africa, Conservation Breeding Specialist Group (SSC/IUCN), Endangered Wildlife Trust, South Africa.

GILL, F, D Donsker, & P Rasmussen (Eds). 2021. IOC World Bird List (v 11.1). Doi 10.14344/IOC.ML.10.2. http://www.worldbirdnames.org/

GOBUSH, K.S., EDWARDS, C.T.T, BALFOUR, D., WITTEMYER, G., MAISELS, F. & TAYLOR, R.D. 2021. *Loxodonta africana*. The IUCN Red List of Threatened Species 2021: e.T181008073A181022663. https://dx.doi.org/10.2305/IUCN.UK.2021-1.RLTS.T181008073A181022663.en

GOVERNMENT GAZETTE [of the Republic of South Africa]. 2001. Amendments to the Conservation of Agricultural Resources Act, 1983 (Act No.43 of 1983). Government Gazette, 429 (22166) of 30 March 2001. Department of Agriculture, Republic of South Africa.

HARDAKER, T. 2019. *Southern African Bird List* - Version 09 - 06 July 2019.

HARDAKER, T. 2020. *Southern African Bird List* - Version 10.

HARRISON, J.A., ALLAN, D.G., UNDERHILL, L.G., HERREMANS, M., TREE, A.J., PARKER, V. & BROWN, C.J. (eds.). 1997. *The Atlas of Southern African Birds. Vol. 1 & 2*. BirdLife South Africa, Johannesburg.

HOCKEY, P.A.R., DEAN, W.R.J. & RYAN, P.G. (eds.) 2005. *Roberts – Birds of Southern Africa*, VIIth ed. The Trustees of the John Voelker Bird Book Fund, Cape Town.

HOFFMAN T. & ASHWELL A. 2001. Nature Divided: Land degradation in South Africa. University of Cape Town Press, Cape Town

INTERNATIONAL UNION FOR CONSERVATION OF NATURE. 2020. http://www.iucnredlist.org/

ISBERG, S., COMBRINK, X., LIPPAI, C. & BALAGUERA-REINA, S.A. 2019. *Crocodylus niloticus*. *The IUCN Red List of Threatened Species* 2019: e.T45433088A3010181. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T45433088A3010181.en. Downloaded on 10 October 2021.

IUCN Red List of Threatened Species. Version 2019.1. http://www.iucnredlist.org/.

JACQUES, H., REED-SMITH, J. & SOMERS, M.J. 2015. *Aonyx capensis*. The IUCN Red List of Threatened Species. Version 2015.2. http://www.iucnredlist.org/.

KNOBEL, J. 1999. The magnificent natural heritage of South Africa. Sunbird Publishing, South Africa.

KRUSKAL, J.B. & WISH, M. 1978. *Multidimensional Scaling*. Sage Publications, London.

MAGURRAN, A.E. 1988. *Ecological diversity and its measurement*. Croom Helm, London

MARNEWICK, M.D., RETIEF, E.F., THERON, N.T., WRIGHT, D.R. AND ANDERSON, T.A. 2015. *Important Bird and Biodiversity Areas of South Africa*. Johannesburg: BirdLife South Africa.

MEASEY, G.L. (ed). 2010. Ensuring a future for South Africa's frogs: a strategy for conservation research on South African amphibians. *SANBI Biodiversity Series* 19, National Biodiversity Institute, Pretoria.

MECENERO, S, BALL, J.B., EDGE, D.A., HAMER, M.L., HENNING, G.A., KRÜGER, M., PRINGLE, E.L., TERBLANCHE, R.F. & WILLIAMS, M.C. (eds.) 2013. *Conservation assessment of butterflies of South Africa, Lesotho and Swaziland: Red list and atlas*. Saftronics (Pty) Ltd., Johannesburg & Animal Demography Unit, Cape Town.

MILLER S, RIGGIO J, FUNSTON P, POWER RJ, WILLIAMS V, CHILD MF. 2016. *A conservation assessment of Panthera leo*. In Child MF, Roxburgh L, Do Linh San E, Raimondo D, Davies-Mostert HT, editors. The Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.

MINTER, L.R., BURGER, M., HARRISON, J.A., BRAACK, H.H., BISHOP, P.J. & KLOEPFER, D. 2004. *Atlas and Red data Book of the Frogs of South Africa, Lesotho and Swaziland*. SI/MAB Series #9. Smithsonian Institution, Washington, D.C.

MORENO, C. E. & HALFTER, G. 2000. Assessing the completeness of bat biodiversity inventories using species accumulation curves. *Journal of Applied Ecology* 37, 149– 158.

MPUMALANGA TOURISM AND PARKS AGENCY. MBSP Terrestrial Assessment 2014 [Vector] 2014. Available from the Biodiversity GIS website, downloaded on 02 July 2020

MUCINA, L. & RUTHERFORD, M.C. (eds.). 2006. The vegetation of South Africa, Lesotho and Swaziland. *Strelitzia 19*. South African National Biodiversity Institute, Pretoria.

NASKRECKI, P. 1996. Systematics of the southern African Meconematinae (Orthoptera: Tettigoniidae). *African Journal of Zoology* 110(2): 159-193.

NATIONAENVIRONMENTAL MANAGEMENT BIODIVERSITY ACT, 2004 (Act No. 10 of 2004).

PIETERSEN D, JANSEN R, SWART J, KOTZE A. 2016. *A conservation assessment of Smutsia temminckii*. In Child MF, Roxburgh L, Do Linh San E, Raimondo D, Davies-Mostert HT, editors. The Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.

SELIER SAJ, HENLEY M, PRETORIUS Y, GARAI M. 2016. A conservation assessment of *Loxodonta africana*. In Child MF, Roxburgh L, Do Linh San E, Raimondo D, Davies-Mostert HT, editors. The Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.

SKINNER, J.D. & CHIMIMBA, C.T. (Revisers). 2005. *Mammals of the Southern African Subregion*. Cambridge University Press, London.

STUART, C. & STUART, M. 2015. *Stuart's Field Guide To Mammals Of Southern Africa, including Angola, Zambia and Malawi*. Struik Nature, Cape Town.

SUTHERLAND, W.J. (ed.). 2006. Ecological Census Techniques, 2nd ed. Cambridge University Press, UK.

TARBOTON, W.R & ALLEN, D.G. 1984. The status and the conservation of birds of prey in the Transvaal. *Transvaal Mus. Monograph* 3.

TAYLOR A, AVENANT N, SCHULZE E, VILJOEN P, CHILD MF. 2016a. *A conservation assessment of Redunca fulvorufula fulvorufula*. In Child MF, Roxburgh L, Do Linh San E, Raimondo D, Davies-Mostert HT, editors. The Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.

TAYLOR PJ, BAXTER R, POWER RJ, MONADJEM A, CHILD MF. 2016b. A conservation assessment of *Crocidura maquassiensis*. In Child MF, Roxburgh L, Do Linh San E, Raimondo D, Davies-Mostert HT, editors. The Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.

TAYLOR, M.R., PEACOCK, F. & WANLESS, R. (eds.). 2015. *The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland*. BirdLife South Africa, Johannesburg.

TAYLOR, P. 1998. *The smaller mammals of KwaZulu-Natal*. University of Natal Press, Pietermaritzburg.

THREATENED SPECIES PROGRAMME (TSP). 2007. *Interim Red Data List of South African Plant Species*. Produced in collaboration with the National Botanical Institute (NBI), NORAD and the Department of Environmental Affairs and Tourism (DEAT).

UNEP. 2002. Global Environment Outlook –3: Past, present, and future perspectives. United Nations Environment Programme, Earthscan Publications Ltd, London.

VAN RIET, W., P. CLAASSEN, J. VAN RENSBURG, T. VILJOEN & L. DU PLESSIS. 1997. *Environmental Potential Atlas for South Africa*. J.L. van Schaik, Pretoria.

VAN WILGEN B.W. & VAN WYK E. 1999. Invading alien plants in South Africa: impacts and solutions. In: People and rangelands building the future.

VAN WYK B. & GERICKE N. 2000. People's Plants. Briza Publications, Pretoria.

VISSER D.J.L. (1984). The Geology of the Republics of South Africa, Transkei, Bophutatswana, Venda and Ciskei and the Kingdoms of Lesotho and Swaziland. Fourth Edition. Department of Mineral and Energy Affairs. Republic of South Africa.

WATSON, D.M. 2003. The 'standardized search': An improved way to conduct bird surveys. *Austral Ecology* 28: 515-525.

WIESEL, I., MAUDE, G., SCOTT, D. & MILLS, G. 2008. *Hyaena brunnea*. In: IUCN 2010. IUCN Red List of Threatened Species. Version 2010.4. http://www.iucnredlist.org/.

WILSON, D.E. & MITTERMEIER, R.A. eds 2009. *Handbook of the mammals of the world. Vol 1. Carnivores*. Lynx Editions, Barcelona.

WOOD, J., Low, A.B., Donaldson, J.S., & Rebelo, A.G. 1994. *Threats to plant species through urbanisation and habitat fragmentation in the Cape Metropolitan Area, South Africa*. In: Huntley, B.J. (Ed.) Botanical Diversity in Southern Africa. National Botanical Institute, Pretoria.

WOODHALL, S. 2005. *Field guide to the butterflies of South Africa*. Struik Publishers, Cape Town.

WYNBERG R. 2002. A decade of biodiversity conservation and use in South Africa: tracking progress from the Rio Earth Summit to the Johannesburg World Summit on Sustainable Development. South African Journal of Science 98: 233-243.

List of field guides and information sources:

- ⇒ A field guide to wild flowers of KwaZulu-Natal and the Eastern Region (Pooley, 2005)
- ⇒ A guide to grasses of southern Africa (van Oudtshoorn, 2012)
- ⇒ Alien weeds and invasive plants. A complete guide to declared weeds and invaders in South Africa (Henderson, 2001)
- ⇒ BRAHM (Botanical Research and Herbarium Management System (newposa.sanbi.org, accessed 2020/12/28)
- ⇒ Field guide to the Orchids of northern South Africa and Swaziland (McMurtry, et. al., 2008)
- ⇒ Field guide to trees of southern Africa (van Wyk and van Wyk, 2013)
- ⇒ Field guide to Wild Flowers of the Highveld (van Wyk & Malan, 1998)
- ⇒ Guide to Aloes of South Africa (van Wyk & Smith, 1996)
- ⇒ Guide to trees introduced in southern Africa (Glen & van Wyk, 1997)
- ⇒ Medicinal Plants of South Africa (van Wyk, Oudtshoorn & Gericke, 2009)
- ⇒ People's Plants (van Wyk & Gericke, 2000)
- ⇒ Poisonous plants of South Africa (van Wyk, van Heerden, van Oudtshoorn, 2005)
- ⇒ Probleem Plante van Suid Afrika (Bromilow, 1996)
- ⇒ Problem plants and alien weeds of South Africa (Bromilow, 2010)
- ⇒ Red Data List of southern African Plants (Hillton-Taylor, 1995)
- ⇒ South Africa's National Listed Invasive Species (www.invasives.org)
- ⇒ Succulents of southern Africa (Frandsen, 2017)
- ⇒ The Vegetation of South Africa, Lesotho, and Swaziland (Mucina & Rutherford, 2006)
- ⇒ Trees and shrubs of Mpumalanga and Kruger National Park (Schmidt, Lotter & McClellan, 2002)
- ⇒ Wild flowers of Northern South Africa (Fabian & Germishuizen, 1997)
- ⇒ Wild flowers of the Limpopo Valley (van der Walt, 2009)
- ⇒ www.sabap2.birdmap.africa

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⇒ Protected and Red Data Species studies;
⇒ Biodiversity walkdowns and marking of protected species;
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