



**SCIENTIFIC TERRESTRIAL SERVICES**

# Terrestrial Biodiversity Assessment

FOR THE PROPOSED SOLAR PLANT FACILITY FOR  
BLACK ROCK MINE, NEAR HOTAZEL, NORTHERN CAPE  
PROVINCE.

## Part A: Background Information

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## EXECUTIVE SUMMARY

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Scientific Terrestrial Services (Pty) Ltd (STS) was appointed to conduct a terrestrial biodiversity assessment as part of the environmental authorisation process for the proposed Black Rock Solar Plant Facility, near Hotazel, Northern Cape Province. The Black Rock Solar Project consists of the Overhead Powerline (OHPL), Access Road, Proposed Substation and two solar project areas (i.e., western and eastern). Collectively the layout will be referred to as the “study area”.

The Surface Infrastructure includes the below list (Figure 3):

- OHPL investigation area.
- Access road.
- Western Solar Project Area.
- Eastern Solar Project Area.
- Proposed substation.

### Desktop research

The Black Rock Solar Project is situated within the Savanna Biome and the Eastern Kalahari Bushveld Bioregion and the Kalahari Duneveld Bioregion. Two vegetation types with a least concern conservation status are crossed by the proposed Black Rock Solar Project, namely the Kathu Bushveld (western and eastern section of the study area) and the Gordonia Duneveld (middle portion of the study area).

No significant protected or conservation features were identified for the Black Rock Solar Project. The Northern Cape Critical Biodiversity Areas (2016) database identified the middle portion of the study area to be an Ecological Support Area and the remaining extent to be Other Natural Areas.

The study area falls within the Gamagara corridor. The Gamagara corridor comprises the mining belt of the John Taolo Gaetsewe and Siyanda districts and runs from lime acres and Danielskuil to Hotazel in the north. The corridor focuses on the mining of iron and manganese.

### Floral and Faunal Ecology

Based on the results of the field investigations undertaken in end October – early November 2022, the following habitat units and sub-units were distinguished within the study area:

- **Thornveld Habitat:** Natural vegetation communities where species composition and vegetation structure have not deviated significantly from the reference states and only restricted disturbances were noted on site. The Thornveld Habitat unit includes two sub-units, namely:
  - Open Thornveld;
  - Semi-close Thornveld
- **Freshwater Habitat:** This habitat unit is associated with the Ga-Mogara river system over which the proposed powerline will traverse; and
- **Transformed Habitat:** This habitat encompasses the areas where vegetation clearance has taken place as part of excavation / construction activities or where areas currently form part of the Black Rock mine footprint.

During the site assessment, it was evident that the study area is still well utilised by faunal (albeit predominantly common) species. Smaller species such as reptiles, small mammals and invertebrates are more range restricted and are likely resident to the study area. More mobile species such as larger mammals are likely make use of the study area in conjunction with the surrounding natural areas. These species will have home / foraging ranges that will extend beyond the study area.

The outcome of the baseline assessment concluded that the Transformed Habitat Unit is of **low sensitivity** and the Ga-Mogara and Thornveld Habitat of **intermediate sensitivity**.

### Impact Summary

Most of the proposed activities will occur within the Open Thornveld; most of which can be attributed to the proposed footprint areas of the Solar PV panels. Considering biodiversity priority areas, no



threatened plants will be lost within these habitat units and is not regarded an ESA. As such, loss of these habitat units will result in negative impacts to floral communities (with residual impacts) but is not regarded as a significant impact and only local-scale loss of habitat is anticipated. Taking the current layout into account, avoidance of impacts to these habitat units is not possible. As such, mitigation of impacts should focus on minimisation through 1) adequate planning, 2) ensuring footprints remain within authorised areas, 3) edge effect management such as AIP and woody encroachment control, and 4) sound planning of stormwater management and erosion control. With mitigation measures adequately implemented, the planning and construction phase will yield to mostly low impact significance, with the exception of medium low impact significance associated with floral SCC, habitat diversity and connectivity associated with the solar PV facilities. For the operational phase, impact significance can only be reduced to a low and very-low significance.

Although the freshwater habitat is associated with an ESA, it is only the OHPL development that will affect this habitat. Direct impacts associated with the construction of the OHPL and positioning of the pylons will result in medium-low impacts should no mitigation measures be implemented. With the implementation of mitigation measures, such as the placement of the pylon positions outside of the 1:100-year floodline, delineated watercourse boundaries and the 32 m buffer zone will reduce the impact significance to very low.

Overall, impacts to the SCCs that are present on site, or that are anticipated to be present on site, will result in significant loss to population numbers if not mitigated and/or offset. Without mitigation implemented, the anticipated impact significance on floral SCC communities is anticipated to be medium-low (planning and construction phase for the Habitat associated with the OHPL. Medium high impact significance is expected for the Thornveld habitat associated with the solar development, due to the large number of protected trees found within this area.

With mitigation measures implemented, impact significance for the all habitat unites associated with the OHPL and the solar PV facilities can be reduced to low significance. The transformed habitat will remain as a very low impact significance with mitigation measures.

No threatened floral species of conservation concern (SCC) were recorded on site and their potential occurrence within study area is low, i.e., the habitat was not deemed suitable to support threatened floral species and this aligned with the outcome of the Screening Tool which produced a low sensitivity for the Plant Species Theme. The study area is, however, associated with habitat that supports provincially and nationally protected floral SCC. Overall, impacts to the SCCs that are present on site, or that are anticipated to be present on site, will result in significant loss to population numbers if not mitigated and/or offset.

The activities will impact on an ESA. This relates mostly to the Ga-Mogara Habitat Unit as it is recognised as an important ecological corridor by provincial conservation datasets. This aligned with the outcome of the Screening Tool which produced a very high sensitivity for the Terrestrial Biodiversity Theme (triggered by the presence of an ESA). It is recommended that the ESA, which is already fragmented and transformed in several sections, be avoided as far as possible, and measures taken to improve habitat integrity.

The proposed solar farm and OHPL will impact on faunal species and their habitat within the study area as a result of vegetation clearance activities, and the subsequent displacement of species from the disturbance footprints. In addition, the proposed activities will also impact upon habitat connectivity and faunal species movement patterns. The development of the solar farm will further likely have an impact on species as the loss of vegetation will result in the decrease of available food resources and space. Such will lead to increase competition amongst species, possibly leading to increased mortality rates until a balance in terms of species numbers and carrying capacity is achieved.

During the site assessment, a single SCC was observed, namely *Opisthophthalmus carinatus* (Robust Burrowing Scorpion). Several other SCC are considered to have an increased probability of occurrence (POC) for the study area. These species are at risk of possibly being run over/ hit by construction related machinery or as a result of huma / wildlife conflict (notably snakes, scorpions and spiders). Although these risks to faunal SCC are present, the observed and likely to occur SCC are not solely restricted to the habitats of the study area and can readily be observed in the natural areas surrounding the study area. The solar farm and OHPL therefore are unlikely to contribute to faunal SCC abundances and/or diversity decline in the region.



The most significant impacts to affect the floral and faunal habitat, species diversity, and SCC resulting from the proposed activities include, but are not limited to, the following:

- Clearance of habitat representative of the reference vegetation types;
- Fragmentation of floral and faunal habitat that will result in reduced movement of species and reduced dispersal opportunities for plant species;
- AIP proliferation and woody encroachment into natural vegetation, displacing indigenous flora and altering favourable habitat conditions for the establishment of indigenous species, which is of particular concern given that much of the surrounding areas are natural and intact, ecologically;
- Destruction, removal, or harvesting of floral and faunal SCC during construction and operational activities; and
- Potentially poorly implemented and monitored offsetting and/or rescue and relocation of SCC that will be affected by the proposed mining activities, leading to unmitigated impacts to, and loss of, SCC individuals.

It is the opinion of the ecologists that this study provides the relevant information required to implement Integrated Environmental Management (IEM) and to ensure that the best long-term use of the ecological resources in the study area will be made in support of the principle of sustainable development.

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## DOCUMENT GUIDE

The table below provides a guide to the reporting of biodiversity impacts as they relate to 1) Government Notice No. 320 Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on **Terrestrial Biodiversity** as published in Government Gazette 43110 dated 20 June 2020, and 2) Government Notice No. 1150 Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on **Terrestrial Plant and Animal Species** as published in Government Gazette 43855 dated 30 June 2020.

Theme-Specific Requirements as per Government Notice No. 320 Terrestrial Biodiversity Theme – Very High Sensitivity Rating as per Screening Tool Output		
No.	SPECIALIST ASSESSMENT AND MINIMUM REPORT CONTENT REQUIREMENTS	Section in report/Notes
2	<b>Terrestrial Biodiversity Specialist Assessment</b>	
2.1	The assessment must be prepared by a specialist registered with the South African Council for Natural Scientific Professionals (SACNASP) with expertise in the field of terrestrial biodiversity.	<b>Part A – C:</b> Cover Page <b>Part A:</b> Appendix E
2.2	The assessment must be undertaken on the preferred site and within the proposed development footprint.	<b>Part A:</b> Section 1
<b>2.3</b>	<b>The assessment must provide a baseline description of the site which includes, as a minimum, the following aspects:</b>	
2.3.1	A description of the ecological drivers or processes of the system and how the proposed development will impact these;	<b>Part B:</b> Section 3 (flora) <b>Part C:</b> Section 3 (fauna)
2.3.2	Ecological functioning and ecological processes (e.g., fire, migration, pollination, etc.) that operate within the preferred site;	<b>Part B:</b> Section 3 (flora) <b>Part C:</b> Section 3 (fauna)
2.3.3	The ecological corridors that the proposed development would impede including migration and movement of flora and fauna;	<b>Part A:</b> Section 3 (desktop analysis) <b>Part B:</b> Section 3 (flora) <b>Part C:</b> Section 3 (fauna)
2.3.4	The description of any significant terrestrial landscape features (including rare or important flora-faunal associations, presence of Strategic Water Source Areas (SWSAs) or Freshwater Ecosystem Priority Area (FEPA) sub catchments;	<b>Part A:</b> Section 3 (desktop analysis) <b>Part B:</b> Section 3 (flora) <b>Part C:</b> Section 3 (fauna)  <i>*For descriptions on the presence of FEPAs, please refer to the Freshwater Biodiversity Assessment (SAS 22 - 1173, 2022)</i>
2.3.5	A description of terrestrial biodiversity and ecosystems on the preferred site, including: <ul style="list-style-type: none"> <li>a) main vegetation types;</li> <li>b) threatened ecosystems, including listed ecosystems as well as locally important habitat types identified;</li> <li>c) ecological connectivity, habitat fragmentation, ecological processes, and fine scale habitats; and</li> <li>d) species, distribution, important habitats (e.g. feeding grounds, nesting sites, etc.) and movement patterns identified;</li> </ul>	<b>Part A:</b> Section 3 (desktop analysis) <b>Part B:</b> Section 3 (flora) <b>Part C:</b> Section 3 (fauna)
2.3.6	The assessment must identify any alternative development footprints within the preferred site which would be of a “low” sensitivity as identified by the screening tool and verified through the site sensitivity verification; and	<b>Part B:</b> Section 4 (flora) <b>Part C:</b> Section 4 (fauna)
<b>2.3.7</b>	<b>The assessment must be based on the results of a site inspection undertaken on the preferred site and must identify:</b>	
2.3.7.1	Terrestrial Critical Biodiversity Areas (CBAs), including: <ul style="list-style-type: none"> <li>a) <i>the reasons why an area has been identified as a CBA;</i></li> <li>b) <i>an indication of whether or not the proposed development is consistent with maintaining the CBA in a natural or near natural state or in achieving the goal of rehabilitation;</i></li> </ul>	<b>Part A:</b> Section 3 (desktop analysis) <b>Part B:</b> Section 3 <b>Part C:</b> Section 3



	<ul style="list-style-type: none"> <li>c) <i>the impact on species composition and structure of vegetation with an indication of the extent of clearing activities in proportion to the remaining extent of the ecosystem type(s);</i></li> <li>d) <i>the impact on ecosystem threat status;</i></li> <li>e) <i>the impact on explicit subtypes in the vegetation;</i></li> <li>f) <i>the impact on overall species and ecosystem diversity of the site; and</i></li> <li>g) <i>the impact on any changes to threat status of populations of species of conservation concern in the CBA;</i></li> </ul>	
2.3.7.2	<p>Terrestrial Ecological Support Areas (ESAs), including:</p> <ul style="list-style-type: none"> <li>a) <i>the impact on the ecological processes that operate within or across the site;</i></li> <li>b) <i>the extent the proposed development will impact on the functionality of the ESA; and</i></li> <li>c) <i>loss of ecological connectivity (on site, and in relation to the broader landscape) due to the degradation and severing of ecological corridors or introducing barriers that impede migration and movement of flora and fauna;</i></li> </ul>	
2.3.7.3	<p>Protected areas as defined by the National Environmental Management: Protected Areas Act, 2004 including-</p> <ul style="list-style-type: none"> <li>a) <i>an opinion on whether the proposed development aligns with the objectives or purpose of the protected area and the zoning as per the protected area management plan;</i></li> </ul>	<b>Part A:</b> Section 3 (desktop analysis). However, not applicable as no protected areas or areas of conservation concern are within 10 km of the proposed project
2.3.7.4	<p>Priority areas for protected area expansion, including-</p> <ul style="list-style-type: none"> <li>a) <i>the way in which in which the proposed development will compromise or contribute to the expansion of the protected area network;</i></li> </ul>	<b>Part A:</b> Section 3 (desktop analysis). Not applicable as no protected area expansion are within 10 km of the proposed project
2.3.7.5	<p>SWSAs including:</p> <ul style="list-style-type: none"> <li>a) <i>the impact(s) on the terrestrial habitat of a SWSA; and</i></li> <li>b) <i>the impacts of the proposed development on the SWSA water quality and quantity (e.g. describing potential increased runoff leading to increased sediment load in water courses);</i></li> </ul>	Not Applicable. No SWSAs within the focus area.
2.3.7.6	<p>FEPA sub catchments, including-</p> <ul style="list-style-type: none"> <li>a) <i>the impacts of the proposed development on habitat condition and species in the FEPA sub catchment;</i></li> </ul>	<i>*For descriptions on the presence of FEPAs, please refer to the Freshwater Biodiversity Assessment (SAS 22 – 1173, 2022)</i>
2.3.7.7	<p>Indigenous forests, including:</p> <ul style="list-style-type: none"> <li>a) <i>impact on the ecological integrity of the forest; and</i></li> <li>b) <i>percentage of natural or near natural indigenous forest area lost and a statement on the implications in relation to the remaining areas.</i></li> </ul>	Not Applicable. No indigenous forests within the focus area.
<b>2.4</b>	<b>The findings of the assessment must be written up in a Terrestrial Biodiversity Specialist Assessment Report.</b>	
	<p><b>Part B:</b> Results of the <b>Floral Assessment</b> as well as conclusions on Terrestrial Biodiversity as it relates to vegetation communities.</p> <p><b>Part C:</b> Results of the <b>Faunal Assessment</b> as well as conclusions on Terrestrial Biodiversity as it relates to faunal communities.</p>	
<b>3</b>	<b>Terrestrial Biodiversity Specialist Assessment Report</b>	
<b>3.1</b>	<b>The Terrestrial Biodiversity Specialist Assessment Report must contain, as a minimum, the following information:</b>	
3.1.1	Contact details of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae;	<b>Part A:</b> Appendix E
3.1.2	A signed statement of independence by the specialist;	<b>Part A:</b> Appendix E
3.1.3	A statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;	<b>Part B:</b> Section 1.2 (flora) <b>Part C:</b> Section 1.2 (fauna)
3.1.4	A description of the methodology used to undertake the site verification and impact assessment and site inspection, including equipment and modelling used, where relevant;	<b>Part A:</b> Appendix C <b>Part B:</b> Section 2 (flora) <b>Part B:</b> Appendix A (flora)



		<b>Part C:</b> Section 2 (fauna) <b>Part C:</b> Appendix A (fauna)
3.1.5	A description of the assumptions made and any uncertainties or gaps in knowledge or data as well as a statement of the timing and intensity of site inspection observations;	<b>Part B:</b> Section 1.2 (flora) <b>Part C:</b> Section 1.2 (fauna)
3.1.6	A location of the areas not suitable for development, which are to be avoided during construction and operation (where relevant);	<b>Part B:</b> Section 4 (flora) <b>Part C:</b> Section 4 (fauna)
	<b>Impact Assessment Requirements</b> 3.1.7 Additional environmental impacts expected from the proposed development; 3.1.8 Any direct, indirect and cumulative impacts of the proposed development; 3.1.9 The degree to which impacts and risks can be mitigated; 3.1.10 The degree to which the impacts and risks can be reversed; 3.1.11 The degree to which the impacts and risks can cause loss of irreplaceable resources; 3.1.12 Proposed impact management actions and impact management outcomes proposed by the specialist for inclusion in the Environmental Management Programme (EMPr);	<b>Part B:</b> Section 5 (flora) – Preliminary Scoping Phase Impact Assessment <b>Part C:</b> Section 5 (fauna) – Preliminary Scoping Phase Impact Assessment
3.1.13	A motivation must be provided if there were development footprints identified as per paragraph 2.3.6 above that were identified as having a “low” terrestrial biodiversity sensitivity and that were not considered appropriate;	<b>Not Applicable to this report</b>
3.1.14	A substantiated statement, based on the findings of the specialist assessment, regarding the acceptability, or not, of the proposed development, if it should receive approval or not; and	<b>Part A:</b> Executive summary <b>Part B:</b> Section 6 (flora) <b>Part C:</b> Section 6 (fauna)
3.1.15	Any conditions to which this statement is subjected.	<b>Part B:</b> Section 5 (flora) – Preliminary Scoping Phase statements only <b>Part C:</b> Section 5 (fauna) – Preliminary Scoping Phase statements only
3.2	The findings of the Terrestrial Biodiversity Specialist Assessment must be incorporated into the Basic Assessment Report or the Environmental Impact Assessment Report, including the mitigation and monitoring measures as identified, which must be incorporated into the EMPr where relevant.	This report is submitted to the EAP and applicant and will be appended to the EIA / EMP by the EAP in due course as part of the application process
3.3	A signed copy of the assessment must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.	





## LIST OF ACRONYMS

AIP	Alien and Invasive Plant
BGIS	Biodiversity Geographic Information Systems
BRM	Black Rock Mine
CARA	Conservation of Agricultural Resources Act, 1983 [Act No. 43 of 1983]
CBA	Critical Biodiversity Area
CR	Critically Endangered
DFFE	Department of Forestry, Fisheries and the Environment
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
E-GIS	Environmental Geographical Information Systems
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
EN	Endangered
ESA	Ecological Support Area
EW	Extinct in the Wild
FEPA	Freshwater Ecosystem Priority Areas
GIS	Geographic Information Systems
GN	Government Notice
GWC	Griqualand West Centre of Plant Endemism
Ha	Hectares
IBA	Important Bird and Biodiversity Area
IEM	Integrated Environmental Management
IUCN	International Union for Conservation of Nature
LC	Least Concern
MAP	Mean annual precipitation
MAPE	Mean Annual Potential Evaporation
MASMS	Mean Annual Soil Moisture Stress
MAT	Mean Annual Temperature
MFD	Mean Frost Days
MP	Moderately Protected
NBA	National Biodiversity Assessment
NCNCA	Northern Cape Nature Conservation Act, 2009 [Act No. 9 of 2009]
NCPSDF	Northern Cape Provincial Spatial Development Framework
NEMA	National Environmental Management Act, 1998 [Act No. 107 of 1998]
NEMBA	National Environmental Management: Biodiversity Act, 2004 [Act No. 10 of 2004]
NEMPAA	National Environmental Management: Protected Areas Act, 2003 [Act No. 57 of 2003]
NFA	National Forest Act, 1998 [Act No. 84 of 1998]
NPAES	National Protected Area Expansion Strategy
OHPL	Overhead Powerline
ONA	Other Natural Areas
PCD	Pollution Control Dam
PP	Poorly Protected
PV	Photovoltaics
QDS	Quarter Degree Squares
RDL	Red Data listed
ROM	Run of Mine
SABAP 2	South African Bird Atlas Project 2



<b>SACAD</b>	South African Conservation Areas Database
<b>SACNASP</b>	South African Council for Natural Scientific Professions
<b>SANBI</b>	South African National Biodiversity Institute
<b>SAPAD</b>	South African Protected Areas Database
<b>SCC</b>	Species of Conservation Concern
<b>STS</b>	Scientific Terrestrial Services [Pty] Ltd
<b>SWSA</b>	Strategic Water Source Areas
<b>VEGMAP</b>	Vegetation Map Project
<b>VU</b>	Vulnerable
<b>WSA</b>	Water Source Area



## GLOSSARY OF TERMS

Most definitions are based on terms and concepts elaborated by Richardson et al. (2011), Hui and Richardson (2017), Wilson et al. (2017), Skowno et al. (2019), and SANBI (2016), with consideration to their applicability in the South African context, especially South African legislation [notably the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004), and the associated Alien and Invasive Species Regulations, 2020].

<b>Alien species</b> (syn. Exotic species; non-native species)	A species that is present in a region outside its natural range due to human actions (intentional or accidental) that have enabled it to overcome biogeographic barriers.
<b>Biological diversity or Biodiversity (as per the definition in NEMBA)</b>	The variability among living organisms from all sources including, terrestrial, marine, and other aquatic ecosystems and the ecological complexes of which they are part and includes diversity within species, between species, and of ecosystems.
<b>Biodiversity priority areas</b>	<p>Features in the landscape or seascape that are important for conserving a representative sample of ecosystems and species, for maintaining ecological processes, or for the provision of ecosystem services. They include the following categories, most of which are identified based on systematic biodiversity planning principles and methods: Protected Areas, Critically Endangered and Endangered ecosystems, Critical Biodiversity Areas and Ecological Support Areas, Freshwater Ecosystem Priority Areas, high water yield areas, flagship free-flowing rivers, priority estuaries, Priority Areas for land-based protected area expansion, and Focus areas for offshore protection. Marine ecosystem priority areas and coastal ecosystem priority areas have yet to be identified but will be included in future.</p> <p>The different categories <i>are not mutually exclusive</i> and, in some cases, overlap, often because a particular area or site is important for more than one reason. They should be <i>complementary</i>, with overlaps <i>reinforcing the importance of an area</i>.</p>
<b>Biome – as per Mucina and Rutherford (2006)</b>	A broad ecological spatial unit representing major life zones of large natural areas – defined mainly by vegetation structure, climate, and major large-scale disturbance factors (such as fires).
<b>Bioregion (as per the definition in NEMBA)</b>	A geographic region which has in terms of section 40(1) been determined as a bioregion for the purposes of this Act.
<b>Critical Biodiversity Area (CBA)</b>	A CBA is an area considered important for the survival of threatened species and includes valuable ecosystems such as wetlands, untransformed vegetation, and ridges.
<b>Critically Endangered (CR) (IUCN<sup>1</sup> Red List category)</b>	<b>Applied to both species/taxa and ecosystems:</b> A species is CR when the best available evidence indicates that it meets at least one of the five IUCN criteria for CR, indicating that the species is facing an extremely high risk of extinction. CR ecosystem types are at an extremely high risk of collapse. Most of the ecosystem type has been severely or moderately modified from its natural state. The ecosystem type is likely to have lost much of its natural structure and functioning, and species associated with the ecosystem may have been lost. CR species are those considered to be at extremely high risk of extinction.
<b>Development footprint (as per the NEMA definition)</b>	“In respect of land, means any evidence of its physical transformation as a result of the undertaking of any activity”

<sup>1</sup> International Union for Conservation of Nature (IUCN)



<b>Ecological processes</b>	The functions and processes that operate to maintain and generate biodiversity. In order to include ecological processes in a biodiversity plan, their spatial components need to be identified and mapped.
<b>Ecological Support Area (ESA)</b>	An ESA provides connectivity and important ecological processes between CBAs and is therefore important in terms of habitat conservation.
<b>Ecoregion</b>	An ecoregion is a “recurring pattern of ecosystems associated with characteristic combinations of soil and landform that characterise that region.”
<b>Endangered (EN) (IUCN Red List category)</b>	<b>Applied to both species/taxa and ecosystems:</b> A species is EN when the best available evidence indicates that it meets at least one of the five IUCN criteria for EN, indicating that the species is facing a very high risk of extinction. EN ecosystem types are at a very high risk of collapse. EN species are those considered to be at very high risk of extinction.
<b>Endemic species</b>	Species that are only found within a pre-defined area. There can therefore be sub-continental (e.g., southern Africa), national (South Africa), provincial, regional, or even within a particular mountain range.
<b>Ground-truth</b>	Ground truth is a term used in various fields to refer to information provided by direct observation (i.e., empirical evidence) as opposed to information provided by inference.
<b>Habitat (As per the definition in NEMBA)</b>	A place where a species or ecological community naturally occurs.
<b>Important Bird and Biodiversity Area (IBA)</b>	The IBA Programme identifies and works to conserve a network of sites critical for the long-term survival of bird species that: are globally threatened, have a restricted range, are restricted to specific biomes/vegetation types or sites that have significant populations.
<b>Indigenous vegetation (As per the definition in NEMA)</b>	Vegetation occurring naturally within a defined area, regardless of the level of alien infestation and where the topsoil has not been lawfully disturbed during the preceding ten years.
<b>Integrity (ecological)</b>	The integrity of an ecosystem refers to its functional completeness, including its components (species) its patterns (distribution) and its processes.
<b>Least Threatened</b>	Least threatened ecosystems are still largely intact.
<b>Native species (syn. Indigenous species)</b>	Species that are found within their natural range where they have evolved without human intervention (intentional or accidental). Also includes species that have expanded their range as a result of human modification of the environment that does not directly impact dispersal (e.g., species are still native if they increase their range as a result of watered gardens but are alien if they increase their range as a result of spread along human-created corridors linking previously separate biogeographic regions).
<b>Near Threatened (according to IUCN)</b>	Close to being at high risk of extinction in the near future.
<b>Protected</b>	Species of high conservation value or national importance that require protection, according to TOPS 2007 and NEMBA.
<b>Red Data Listed (RDL) species</b>	According to the Red List of South African plants ( <a href="http://redlist.sanbi.org/">http://redlist.sanbi.org/</a> ) and the International Union for Conservation of Nature (IUCN), organisms that fall into the Extinct in the Wild (EW), Critically Endangered (CR), Endangered (EN), Vulnerable (VU) categories of ecological status.



<b>Species of Conservation Concern (SCC)</b>	The term SCC in the context of this report refers to all RDL and IUCN listed threatened species as well as provincially and nationally protected species of relevance to the project.
<b>Threatened ecosystem</b>	An ecosystem that has been classified as CR, EN or VU, based on an analysis of ecosystem threat status. A threatened ecosystem has lost or is losing vital aspects of its structure, function, or composition. The NEMBA allows the Minister of Environmental Affairs or a provincial MEC for Environmental Affairs to publish a list of threatened ecosystems. To date, threatened ecosystems have been listed only in the terrestrial environment. In cases where no list has yet been published by the Minister, such as for all aquatic ecosystems, the ecosystem threat status assessment in the National Biodiversity Assessment (NBA) can be used as an interim list in planning and decision making.
<b>Threatened species</b>	A species that has been classified as CR, EN or VU, based on a conservation assessment (Red List), using a standard set of criteria developed by the IUCN for determining the likelihood of a species becoming extinct. A threatened species faces a high risk of extinction in the near future.
<b>Vulnerable (VU) (Red List category)</b>	<b>Applied to both species/taxa and ecosystems:</b> A species is VU when the best available evidence indicates that it meets at least one of the five IUCN criteria for VU, indicating that the species is facing a high risk of extinction. An ecosystem type is VU when the best available evidence indicates that it meets any of the criteria A to E for VU and is then considered to be at a high risk of collapse.



# 1 INTRODUCTION

Scientific Terrestrial Services (Pty) Ltd (STS) was appointed to conduct a terrestrial biodiversity assessment as part of the environmental authorisation process for the proposed Black Rock Solar Plant Facility, near Hotazel, Northern Cape Province. The Black Rock Solar Project consists of the Overhead Powerline (OHPL), Access Road, Proposed Substation and two solar project areas (i.e., western and eastern). Collectively the layout will be referred to as the “**study area**”.

The study area is situated at Santoy, within the Gloria Mine Complex located approximately 6.25 km north of the town of Hotazel and 57 km north of Kathu. The R380 is situated approximately 1.2 km south of the study area which intersects with the R31 which is located at least 1.5 km to the south of the proposed OHPL area. The study area is located within the John Taolo Gaetsewe District Municipality, and the Joe Morolong Local Municipality. The land use of the area surrounding the study area includes other mining operations and livestock farming. The extent and location of the study area is illustrated in Figures 1 – 2.

The purpose of this report (Part A) is to define the biodiversity of the study area from a desktop conservation database perspective. It is the objective of this desktop assessment to provide detailed information to guide the fieldwork components (discussed in Parts B and C) to ensure that all relevant ecological aspects are considered prior to performing the field assessments. This report is not a standalone report and should be considered together with the outcome of the biodiversity assessments (Part B and C).



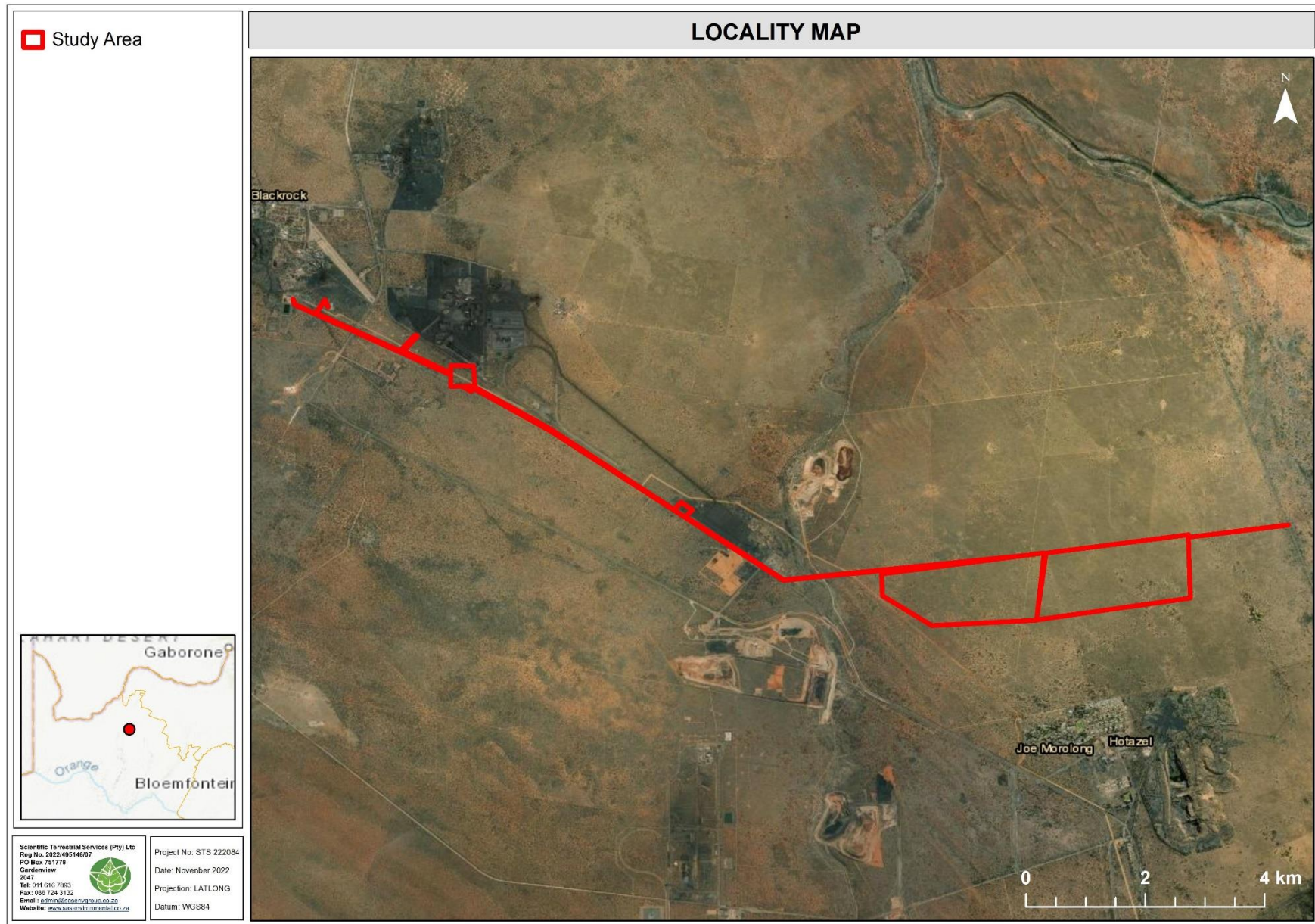


Figure 1: Digital Satellite image depicting the location of the study area in relation to surrounding areas.



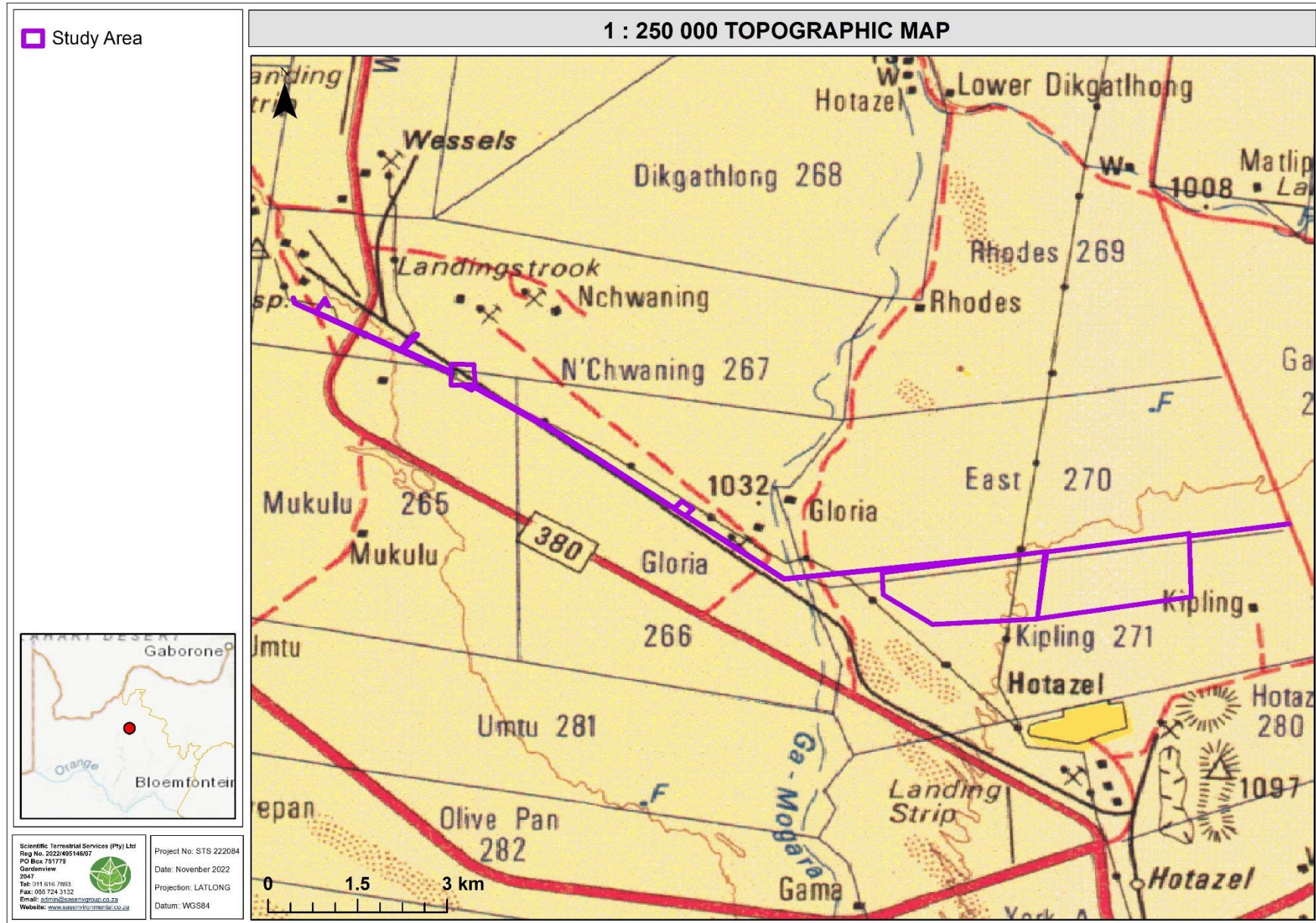


Figure 2: The study area depicted on a 1:250 000 topographical map in relation to the surrounding area.





## 1.1 Project Description

Assmang (Pty) Ltd mines manganese ore in the Black Rock area of the Kalahari, in the Northern Cape Province. The ore is mined from the Kalahari Manganese field. The Black Rock Mine (BRM) are approximately 60 km north-west of the town of Kuruman, near the town of Hotazel. Escience Associates (Pty) Ltd, referred to as EScience from here on, has been appointed to assist BRM with environmental permitting requirements for a proposed Solar Photovoltaics (PV) Facility, and associated infrastructure.

The proposed facility will provide power to BRM's operations, and will have a maximum generating capacity of 100 MW. The project will be built in phases with the first phase being 44 MW, which will include:

- A solar PV plant;
- Two substations and electrical distribution infrastructure; and
- Battery storage facilities.

Future phases will be scheduled as applicable after completion and commissioning of the first phase.

The proposed solar facility is to be located on the Remaining Extent of Farm Klipling 271 and will have a development footprint of approximately 450 ha in extent, with additional infrastructure for distributing the electricity to the BRM's operations. This infrastructure will tie in to BRM's existing infrastructure. BRM is the owner of all the properties on which the proposed project will occur. Although overhead distribution will span the Gamagara River, there will be no physical construction or activities within the flood plain of the river or a 32 m buffer measured from the edge of the river. The climate, relief, the size of the affected property, and the availability of land for the development, are favourable for the establishment of a solar facility.



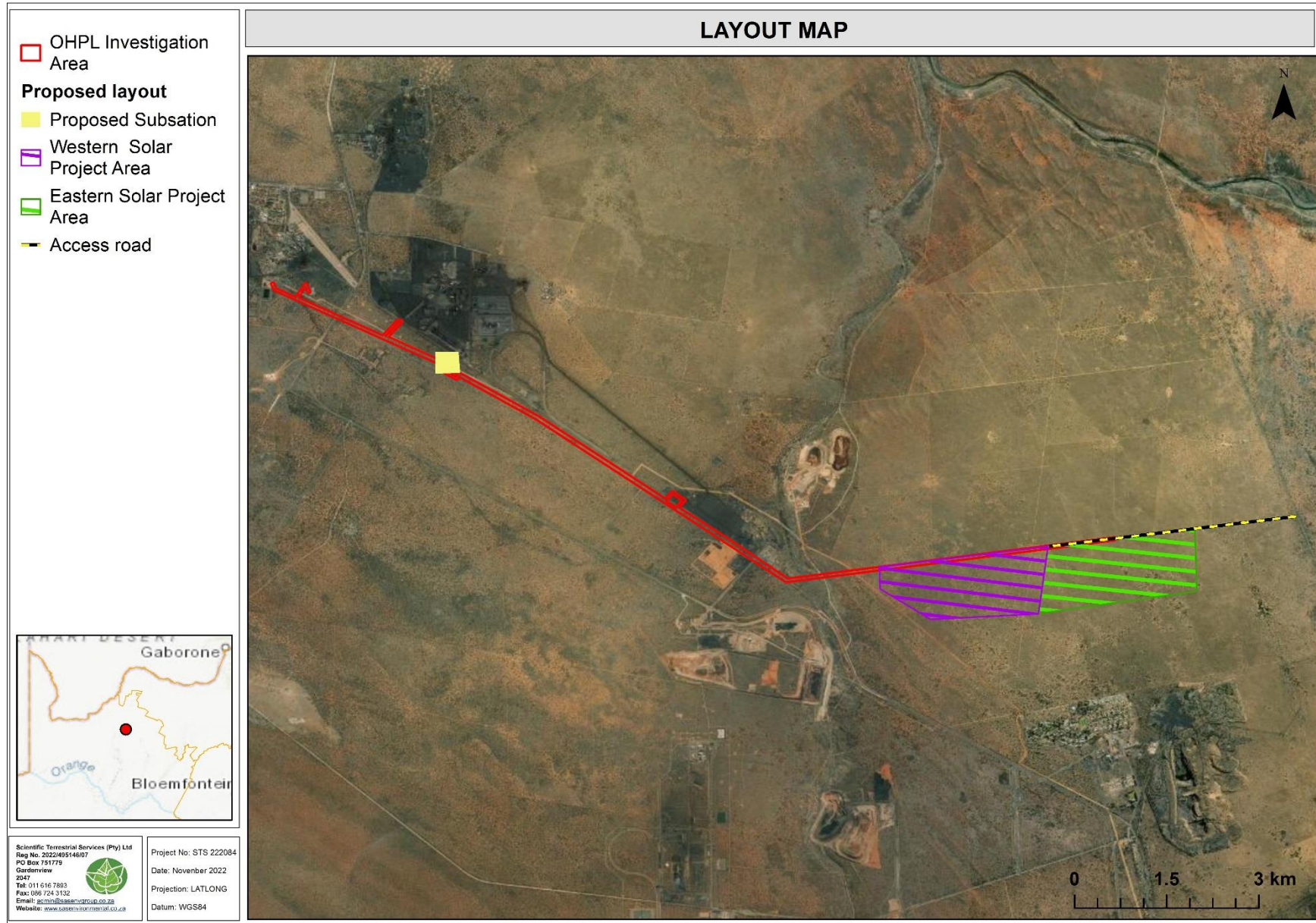


Figure 3: The layout in relation to the surrounding area.



## 1.2 Project Scope

Specific outcomes in terms of the Scoping Phase report are as follows:

- Compile a desktop assessment with all relevant information as presented by South African National Biodiversity Institute's (SANBI's) Biodiversity Geographic Information Systems (BGIS) website (<http://bgis.sanbi.org>) and the Environmental Geographical Information Systems (E-GIS) website (<https://egis.environment.gov.za/>). The desktop assessment aims to gain background information on the physical habitat and potential floral and faunal ecology associated with the study area;
- To state the indemnity and terms of use of this report (Appendix A) as well as to provide the details of the specialists who prepared the reports (Appendix E);
- To outline the legislative requirements that were considered for the assessment (Appendix B of this report); and
- To provide the methodologies followed relating to the impact assessment and development of the mitigation measures (Appendix C) that were applied in the floral and faunal assessments (Part B and Part C).

## 1.3 Assumptions and Limitations

The following assumptions and limitations are applicable to this report:

- The biodiversity desktop assessment is confined to the study area and does not include detailed results of the adjacent properties, although the sensitivity of surrounding areas has been included on the relevant maps;
- It is important to note that although all data sources used provide useful and often verifiable, high-quality data, the various databases used do not always provide an entirely accurate indication of the assessed area's actual site characteristics at the scale required to inform more intricate planning, e.g., at the scale needed for an EA. Nevertheless, this information is useful as background information to the study and is important in legislative contextualisation of risk and impact and was used as a guideline to inform the biodiversity assessment (refer also to Parts B and C), and to focus on areas and aspects of increased conservation importance. It must, however, be noted that site assessment of key areas may potentially contradict the information contained in the relevant databases, in which case the site verified, ground-truthed information must carry more weight in the decision-making process; and
- The full biodiversity assessment was undertaken in spring (31<sup>st</sup> to the 4<sup>th</sup> of November 2022). The field assessments aimed to determine the ecological status of the study



area and to “ground-truth” the results of the desktop assessment (as presented in Parts B and C).

## 1.4 Legislative Requirements

The following legislative requirements were considered during the assessment:

- The Constitution of the Republic of South Africa, 1996<sup>2</sup>;
- The Conservation of Agricultural Resource Act, 1983 (Act 43 of 1983) (CARA);
- The National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA);
- The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA);
  - Government Notice (GN) number 1002: National List of Ecosystems that are Threatened and Need Protection dated 9 December 2011, as it relates to the NEMBA;
  - GN number R.1020: Alien and Invasive Species Regulations, 2020, in Government Gazette 43735 dated September 2020 as it relates to the NEMBA;
  - GN number 1003: Legislation to come into force on the 1<sup>st</sup> of June 2022: Government Notice number 1003: Alien and Invasive Species Lists, 2020, in Government Gazette 43726 dated 18 September 2020, as it relates to the NEMBA; and
  - GN number 30568: Threatened or Protected Species (TOPS) list dated 14 December 2007, as it relates to the NEMBA.
- The National Forest Act, 1998 (Act No. 84 of 1998, amended) (NFA);
  - GN 1935: List of Protected Tree Species as published in the Government Gazette 46094 dated 25 March 2022, as it relates to the NFA;
- The National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003) (NEMPAA);
- Government Gazette 45421 dated 10 May 2019 as it relates to the Department of Forestry, Fisheries, and the Environment’s (DFFE) national environmental screening report required with an application for environmental authorisation as identified in regulation 16(1)(v) of EIA Regulations:
  - For the Terrestrial Biodiversity Theme: GN 320 Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental

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<sup>2</sup> Since 1996, the Constitution has been amended by seventeen amendments acts. The Constitution is formally entitled the ‘Constitution of the Republic of South Africa, 1996’. It was previously also numbered as if it were an Act of Parliament – Act No. 108 of 1996 – but since the passage of the Citation of Constitutional Laws Act, neither it nor the acts amending it are allocated act numbers.



Impacts on Terrestrial Biodiversity as published in Government Gazette 43110 dated 20 March 2020; and

- For Animal and Plant Species Themes: GN 1150 Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Plant and Animal Species as published in Government Gazette 43855 dated 30 October 2020;
- The Northern Cape Nature Conservation Act, 2009 (Act No. 9 of 2009) (NCNCA); and
- The Northern Cape Provincial Spatial Development Framework (NCPSDF) as developed 2011 to meet the requirements of the Northern Cape Planning and Development Act, 1998 (Act 7 of 1998) and the Municipal Systems Act, 2000 (Act 32 of 2000).

The details of each of the above, as they pertain to this study, are provided in Appendix B of this report.

## 2 ASSESSMENT APPROACH

Maps and digital satellite images were generated prior to the field assessment to determine broad habitats, vegetation types and potentially sensitive sites. Relevant databases and documentation that were considered during the desktop assessment of the focus area included <sup>3</sup>:

- National Protected Areas Expansion Strategy (NPAES) – 2018 database;
- The South African Conservation Areas Database, Quarter 2 (SACAD, 2022);
- The South African Protected Areas Database, Quarter 2 (SAPAD, 2022);
- Northern Cape Critical Biodiversity Areas (2016);
- The National Vegetation Map Project (VEGMAP), with the below vector dataset used for information on Biomes, Bioregions and Vegetation Type(s):
  - 2018 Final Vegetation Map of South Africa, Lesotho, and Swaziland (SANBI 2006–2018).
- National Red Listed Ecosystems 2021 (SANBI 2022.a and SANBI 2022.b);
- From the National Biodiversity Assessment (NBA, 2018) Terrestrial Assessment project (Skowno et al., 2019):

<sup>3</sup> Datasets obtained from:

- SANBI BGIS (2019). The South African National Biodiversity Institute - Biodiversity GIS (BGIS) [online]. URL: <http://bgis.sanbi.org> as retrieved in 2019; and
- Department of Environmental Affairs (DEA) Environmental Geographical Information Systems (E-GIS) website. URL: <https://egis.environment.gov.za/>



- 2018 Terrestrial ecosystem threat status and protection level – remaining extent (SANBI, 2018a); and
  - 2018 Terrestrial ecosystem threat status and protection level layer (SANBI, 2018b).
- The Important Bird and Biodiversity Areas (IBA) Programme and vector dataset (BirdLife South Africa, 2015; Marnewick et al., 2015a and 2015b), in conjunction with the South African Bird Atlas Project 2 (SABAP 2);
  - The International Union for Conservation of Nature (IUCN);
  - The National Web-Based Environmental Screening Tool (accessed 2022); and
  - From the 2017 Strategic Water Source Areas (SWSA) project:
    - 2017 SWSA Surface water (Water Research Commission, 2017).

The field assessment took place to determine the ecological status of the study area and to “ground-truth” the results of the desktop assessment. Results of the field assessment is presented in Parts B and C.



### 3 DESKTOP ASSESSMENT RESULTS

The below section provides the results of the desktop assessment and background research.

#### 3.1 Conservation Characteristics of the study area based on National and Provincial Datasets

The following section contains data accessed as part of the desktop assessment and are presented as a “dashboard” report below (Table 1). The dashboard report aims to present concise summaries of the data on as few pages as possible to allow for improved assimilation of results by the reader. Where required, further discussion and interpretation are provided.

**Table 1: Summary of the conservation characteristics for the study area (Quarter Degree Square (QDS) 2722BB).**

DETAILS OF THE STUDY AREA IN TERMS OF MUCINA & RUTHERFORD (2006) AND THE NATIONAL VEGETATION MAP PROJECT (SANBI, 2018A) - ORIGINAL EXTENT OF MAPPED VEGETATION TYPE			
<b>BIOME</b>	The study area is situated within the <b>Savanna Biome</b> .		
<b>BIOREGION</b>	The study area is located within the <b>Eastern Kalahari Bushveld Bioregion</b> and the <b>Kalahari Duneveld Bioregion</b> .		
<b>VEGETATION TYPES</b>	<b>Kathu Bushveld (SVk 12) –the western and eastern portions of the study area.</b>	<b>Gordonia Duneveld (SVkd1) – in the middle of the study area</b>	
<b>ALTITUDE (M)</b>	960 – 1 300	800 -1 200	
<b>CLIMATE</b>	Summer and autumn rainfall with very dry winters	Summer and autumn rainfall with very dry winters	
<b>CLIMATE</b>	<b>MAP (mm)</b>	300	182
	<b>MAT (°C)</b>	18.5	18.6
	<b>MFD (Days)</b>	27	21
	<b>MAPE (mm)</b>	2883	2912
	<b>MASMS (%)</b>	85	86
<b>DISTRIBUTION</b>	Northern Cape Province	Northern Cape Province	
<b>GEOLOGY AND SOILS</b>	Aeolian red sand and surface calcrete, deep (>1.2 m) sandy soils of Hutton and Clovelly soil forms. Land types of mainly Ah and Ae, with some Ag.	Aeolian sand underlain by superficial silcretes and calcretes of the Cenozoic Kalahari Group. Fixed parallel sand dunes, with Af land type almost exclusively.	
<b>CONSERVATION</b>	Least threatened. Target 16%. None conserved in statutory conservation areas. More than 1% already transformed, including the iron ore mining locality at Sishen, one of the biggest open-cast mines in the world. Erosion is very low.	Least threatened. Target 16%. Some 14% statutorily conserved in the Kgalagadi Transfrontier Park. Very little transformed. Generally low erosion, but some areas with spectacular destabilisation of normally vegetated dunes (through local overstocking) favoured by photographers. Erosion is normally very low.	



<p><b>VEGETATION AND LANDSCAPE FEATURES</b></p>	<p>Shrub layer generally most important with, for example, <i>Senegalia mellifera</i>, <i>Diospyros lycioides</i> and <i>Lycium hirsutum</i>. Grass layer is variable in cover.</p>	<p>Parallel dunes about 3–8 m above the plains. Open shrubland with ridges of grassland dominated by <i>Stipagrostis amabilis</i> on the dune crests and <i>Vachellia haematoxylon</i> on the dune slopes, also with <i>Senegalia mellifera</i> on lower slopes and <i>Rhigozum trichotomum</i> in the interdune strata.</p>	
<p><b>DETAILS OF THE STUDY AREA IN TERMS OF THE 2018 NATIONAL BIODIVERSITY ASSESSMENT - REMAINING EXTENT OF MAPPED VEGETATION TYPE</b></p>			
<p><b>NBA (2018): ECOSYSTEM PROTECTION LEVEL AND ECOSYSTEM THREAT STATUS</b></p> <p><b>FIGURE 4</b></p>	<p>The NBA indicates the perceived remaining extent of vegetation types. The study area is within the Kathu Bushveld (in the western and eastern sections of the study area) which is considered <b>Least Concerned (LC)</b> and <b>Poorly Protected (PP)</b> and the Gordonia Duneveld (in the middle on the study area) which is considered <b>LC</b> and <b>Moderately Protected (MP)</b>.</p> <p>The NBA is the primary tool for monitoring and reporting on the state of biodiversity in South Africa. Two headline indicators that are applied to both ecosystems and species are used in the NBA: <b>threat status</b> and <b>protection level</b>. Ecosystem threat status tells us about the degree to which ecosystems are still intact or alternatively losing vital aspects of their structure, function, and composition, on which their ability to provide ecosystem services ultimately depends. Ecosystem types are categorised as Critically Endangered (CR), Endangered (EN), Vulnerable (VU) or LC, based on the proportion of each ecosystem type that remains in good ecological condition relative to a series of thresholds. Ecosystem protection level tells us whether ecosystems are adequately protected or under-protected. Ecosystem types are categorised as not protected, poorly protected, moderately protected or well protected, based on the proportion of each ecosystem type that occurs within a protected area recognised in the NEMPAA.</p>		
<p><b>NATIONAL THREATENED ECOSYSTEMS ASSOCIATED WITH THE STUDY AREA (2011 AND PROPOSED 2021)</b></p>			
<p><b>RED LIST OF ECOSYSTEMS 2022</b></p>	<p>According to the Red List of Ecosystems (2022), the study area is not within any threatened ecosystem. but falls within LC ecosystems, namely the Kathu Bushveld and Gordonia Duneveld.</p> <p>The purpose of listing protected ecosystems is primarily to preserve witness sites of exceptionally high conservation value. The Revised National List of ecosystems that are Threatened or in need of Protection was developed between 2016 and 2020 incorporating the best information on terrestrial ecosystems extent and condition, pressures and drivers of change. The Revised National List of ecosystems that are Threatened or in need of Protection 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 458 terrestrial ecosystems types described in South Africa (Mucina and Rutherford 2006; with updates described in Dayaram et al., 2019).</p> <p><i>Note: The National list of threatened terrestrial ecosystems published in terms of the NEMBA in 2011 is no longer in affect. The Revised National List of Ecosystems that are Threatened and in Need of Protection (i.e., Red List of Ecosystems 2022) was published in the government gazette on November 18<sup>th</sup>, 2022, for public comment (Gazette Notice no. 2747) and came into effects on 18<sup>th</sup> November 2022.</i></p>		
<p><b>CONSERVATION DETAILS PERTAINING TO THE AREA OF INTEREST (VARIOUS DATABASES)</b></p>		<p><b>NATIONAL WEB BASED ENVIRONMENTAL SCREENING TOOL (accessed 2022)</b></p>	
<p><b>IMPORTANT BIRD AREAS (IBA) (2015)</b></p>	<p>The study area is not located within a 10 km radius of an IBA (IBA, 2015).</p>	<p>The screening tool is intended to allow for pre-screening of sensitivities in the landscape to be assessed within the EA process. This assists with implementing the mitigation hierarchy by allowing developers to adjust their proposed development footprint to avoid sensitive areas</p>	
<p><b>SAPAD (2022, Q2); SACAD (2022, Q2); NPAES (2018); AND SWSA (2017)</b></p>	<p>The various datasets associated with nationally protected areas (i.e., SAPAD and NPAES) do not indicate any</p>	<p><b>Animal Species Theme<sup>4</sup></b> <b>Figure 5</b></p>	<p>The Animal Species Theme for the study area was identified to be of <b>medium sensitivity</b>. However, most of the site was identified as <b>low sensitivity</b> areas with</p>

<sup>4</sup> Data Conservation status is from the Global Biodiversity Information Facility (GBIF) which provides free and open access to biodiversity data.





	protected areas or focus areas within 10 km of the study area.		only a portion of the most western section identified as medium faunal sensitivity. The trigger species identified by the Screening tool include <b>Aves-Aquila rapax</b> (Tawny Eagle; <b>EN</b> ).
	The various national conservation areas checked for the study area (i.e., SACAD, SWSA) did not indicate the study area to be within 10 km of any conservation areas. For the SWSA, only the surface water was checked for the terrestrial biodiversity assessment. Refer to the Freshwater compliance statement (SASg) for details on underground SWSA.	<b>Terrestrial Theme Figure 6</b>	For the Terrestrial Biodiversity Theme, the study area has an overall <b>very high sensitivity</b> due to the central section of the study area being classed as an ESA and the presence of a Freshwater Ecosystem Priority Areas (FEPA) Sub-catchment, present within the mid-section of the study area.
		<b>Plant Species Theme Figure 7</b>	The Plant Species Theme for the study area was identified to be of <b>low sensitivity</b> .

**NORTHERN CAPE PROVINCIAL SPATIAL DEVELOPMENT FRAMEWORK (NCPSDF, 2019) - FIGURE 8**

The NCPSDF is to function as an innovative strategy that will apply sustainability principles to all forms of land use management throughout the northern cape as well as to facilitate practical results, as it relates to the eradication of poverty and inequality and the protection of the integrity of the environment.

The study area occurs within the Gamagara corridor. The Gamagara corridor comprises the mining belt of the John Taolo Gaetsewe and Siyanda districts and runs from lime acres and Danielskuil to Hotazel in the north. The corridor focuses on the mining of iron and manganese.

**GRIQUALAND WEST CENTRE OF ENDEMISM (VAN STADEN ET AL., 2020) - FIGURE 9**

The study area occurs outside of the refined boundary of the Griqualand West Centre of Endemism (GWC) as updated by van Staden *et al.* (2020). More information regarding the Centres of Endemism can be found in Van Wyk & Smith (2001).

**NORTHERN CAPE CRITICAL BIODIVERSITY AREAS (2016) - FIGURE 10**

<b>Ecological Support Area (ESA)</b>	The central section of the study area is located within an <b>ESA</b> .  ESAs are areas which must retain their ecological processes to meet biodiversity targets for ecological processes that have not been met in CBAs or protected areas. Similarly, ESAs are required to meet biodiversity targets for representation of ecosystem types or species of special concern when it is not possible to meet them in CBAs. These areas support ecological functioning of protected areas or CBAs or a combination of these (SANBI, 2017).
<b>Other Natural Areas (ONA)</b>	The study area, particularly the western and eastern portions of the study area, are located within an area is classified as <b>ONAs</b> .  According to the Technical Guidelines for Critical Biodiversity Area (CBA) Maps document ONA consist of all those areas in good or fair ecological condition that fall outside the protected area network and have not been identified as CBAs or ESAs (SANBI, 2017).
<b>CBA Reasons Layer</b>	The Northern Cape CBAs (2016) database also includes the “reasons” layer, which is based on the planning units used in the spatial analysis and provides a list of biodiversity and ecological features found in each planning unit, which contribute to the biodiversity target (CBA Map Reason Metadata).  According to this Northern Cape CBA Reasons layer, the triggering feature for the ESA associated with the study area is the presence of the Gamagara River.

Areas Database; SAPAD = South African Protected Areas Database; IBA = Important Bird Area; MAP – Mean annual precipitation; MAT – Mean annual temperature; MAPE – Mean annual potential evaporation; MFD = Mean Frost Days; MASMS – Mean annual soil moisture stress (% of days when evaporative demand was more than double the soil moisture supply).



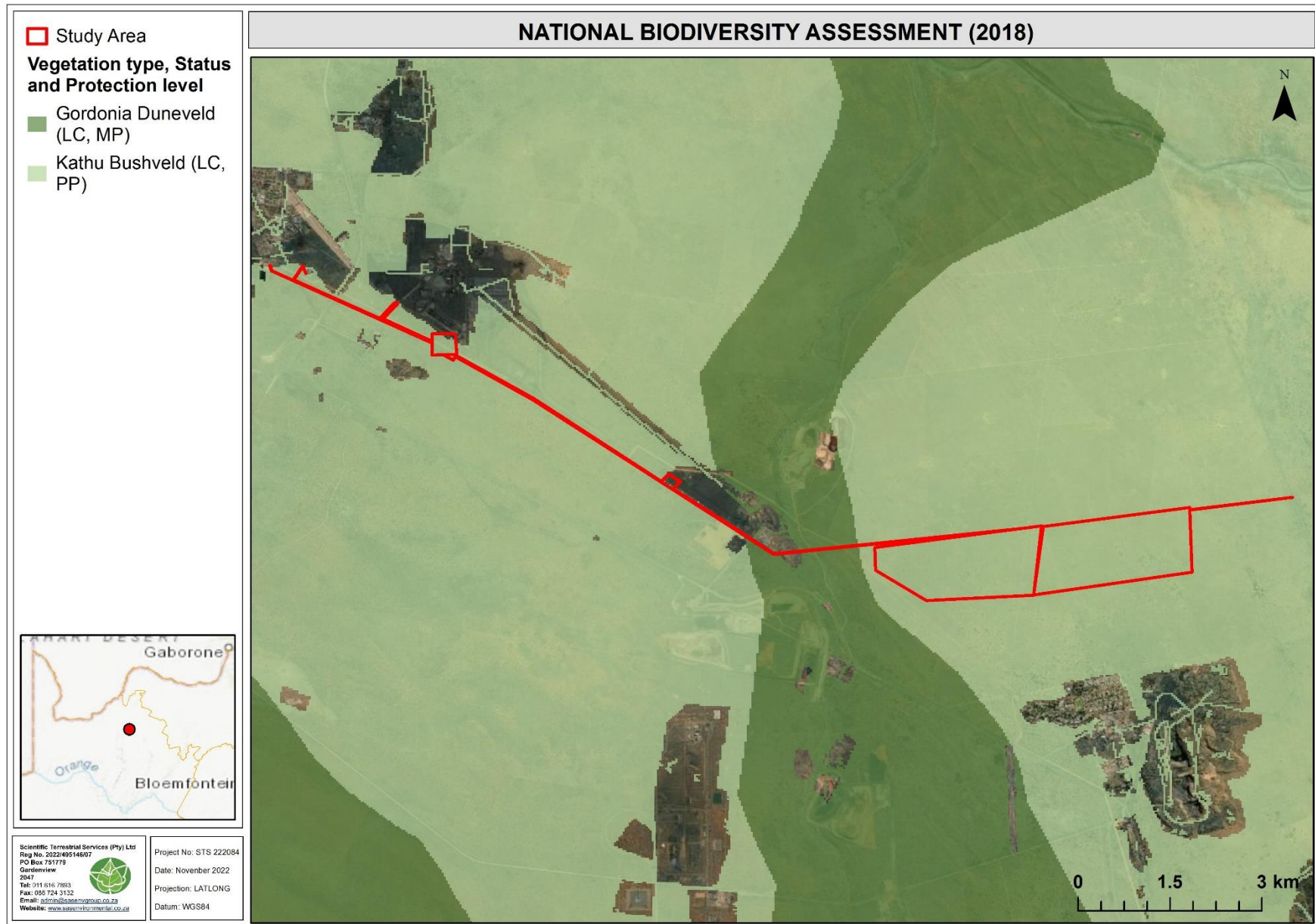


Figure 4: Vegetation types associated with the study area as identified by the National Biodiversity Assessment (NBA; 2018).



## Screening Report Map - Animal Species Theme

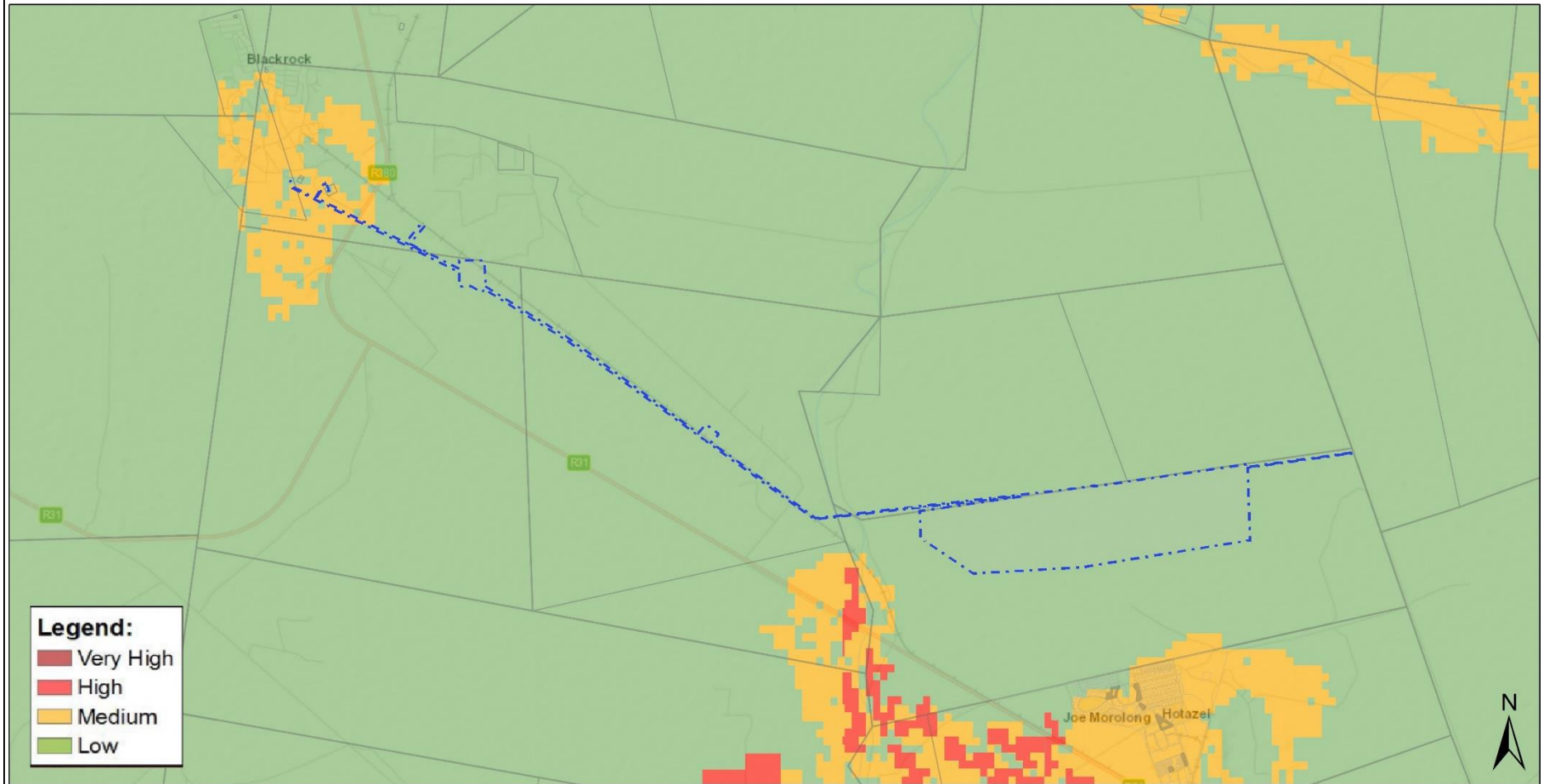


Figure 5: The Animal Species Theme outcome for the study area.



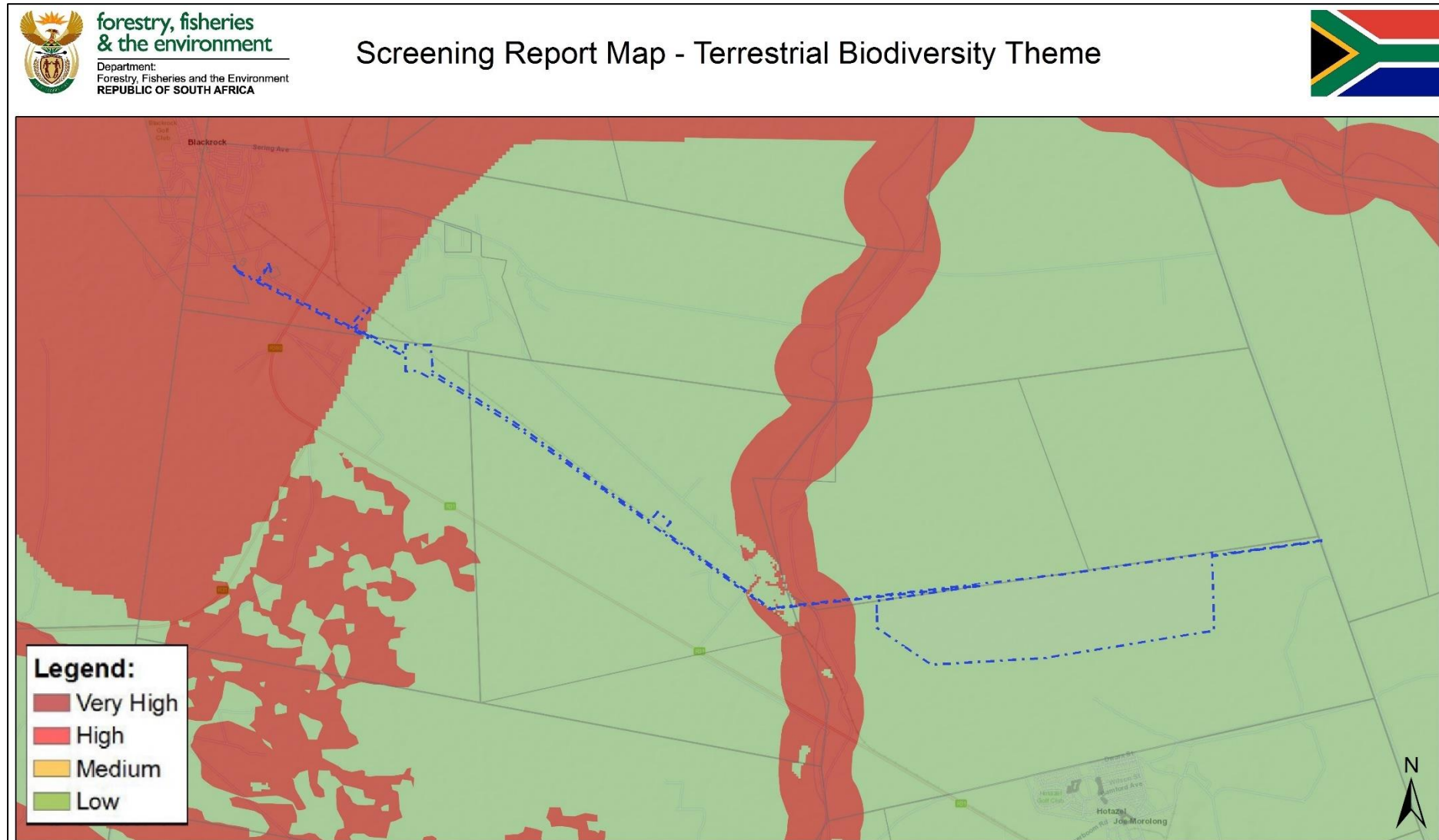


Figure 6: The Terrestrial Biodiversity Theme outcome for the study area.



### Screening Report Map - Plant Species Theme

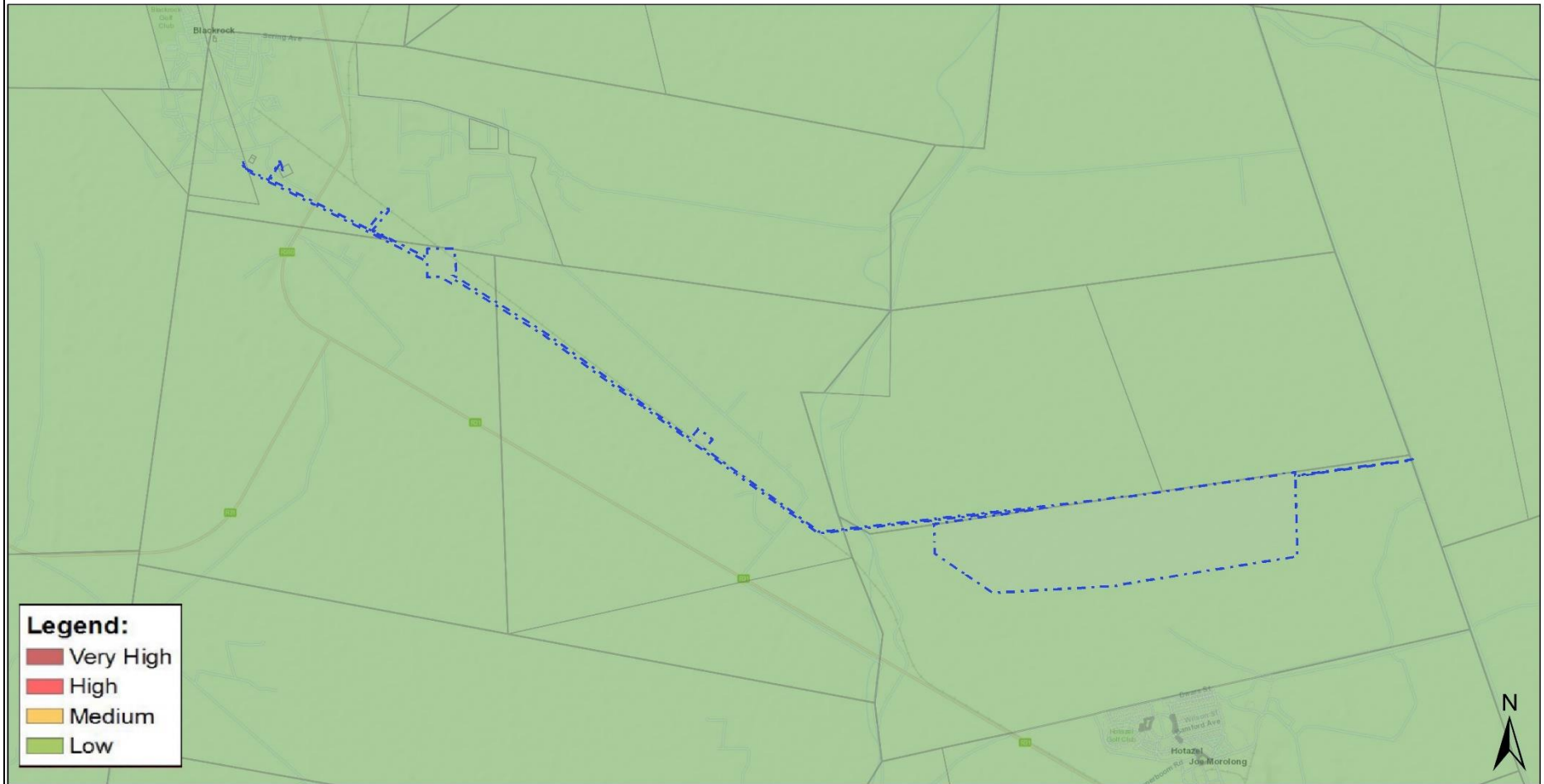


Figure 7: The Plant Species Theme outcome for the study area.



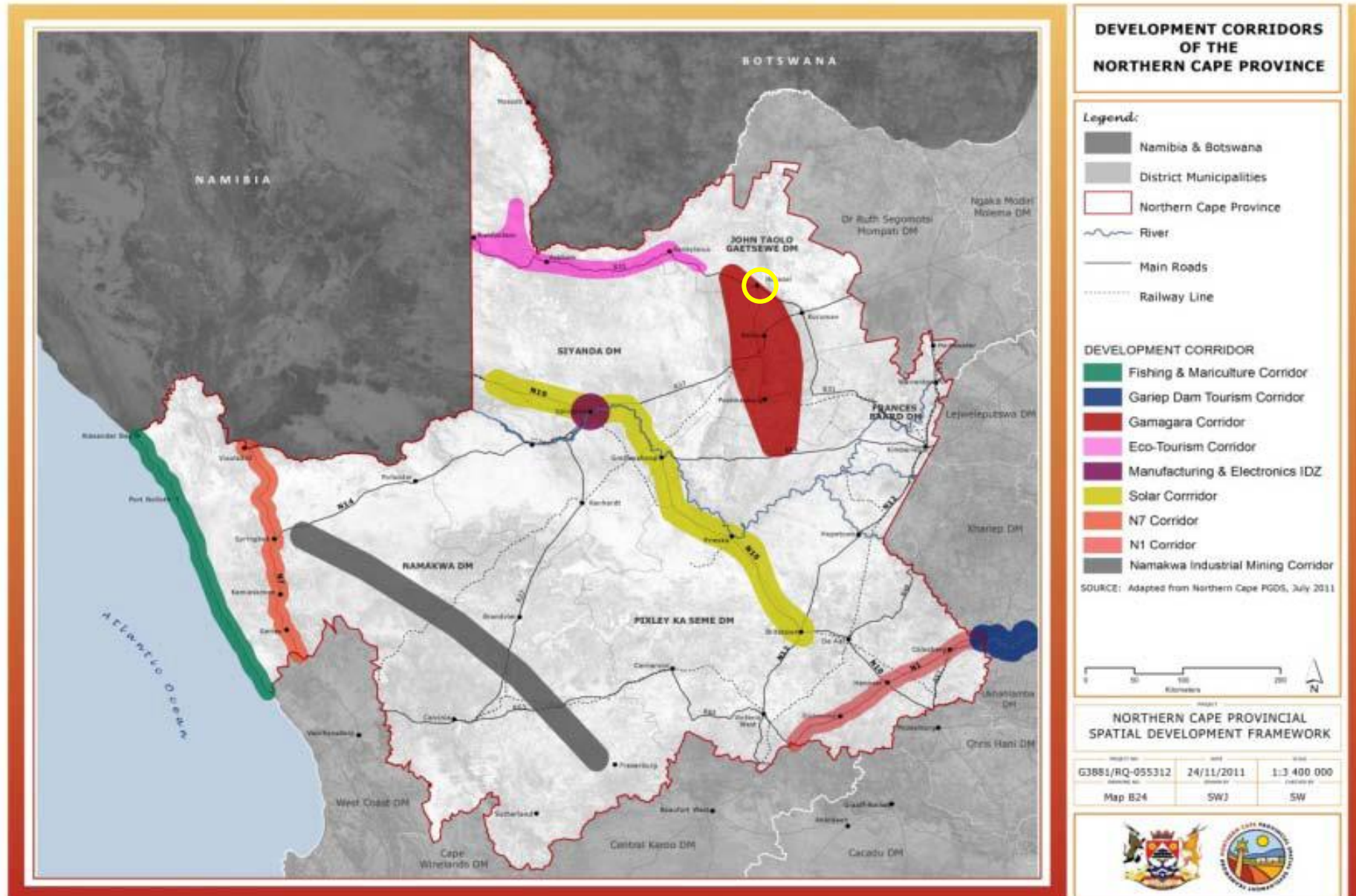


Figure 8: Development corridors of the Northern Cape Province: The estimated location of the study area is indicated by the yellow circle (NPSDF, 2012).



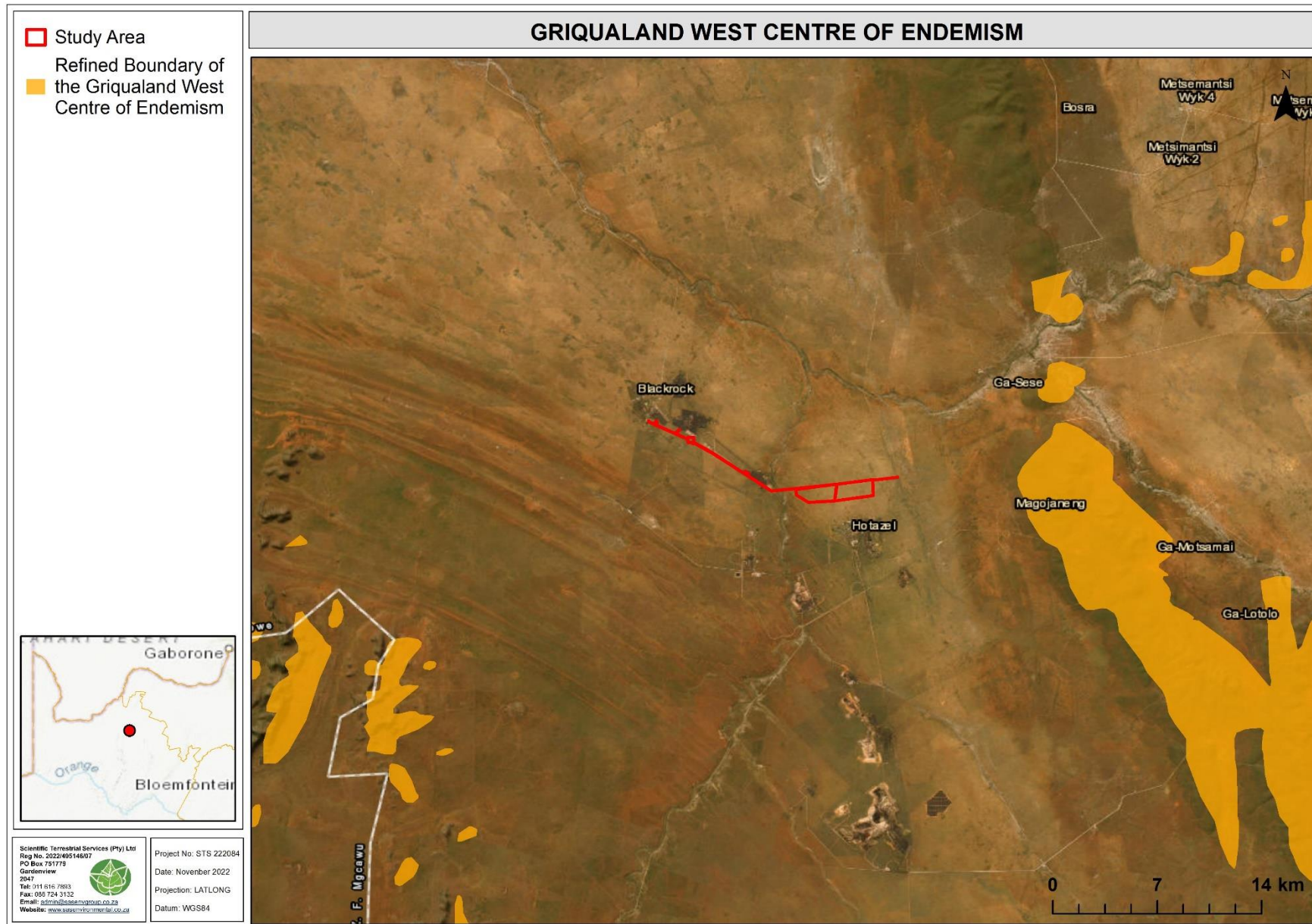


Figure 9: The study area in relation to the refined boundary of the GWC (van Staden *et al.*, 2020).



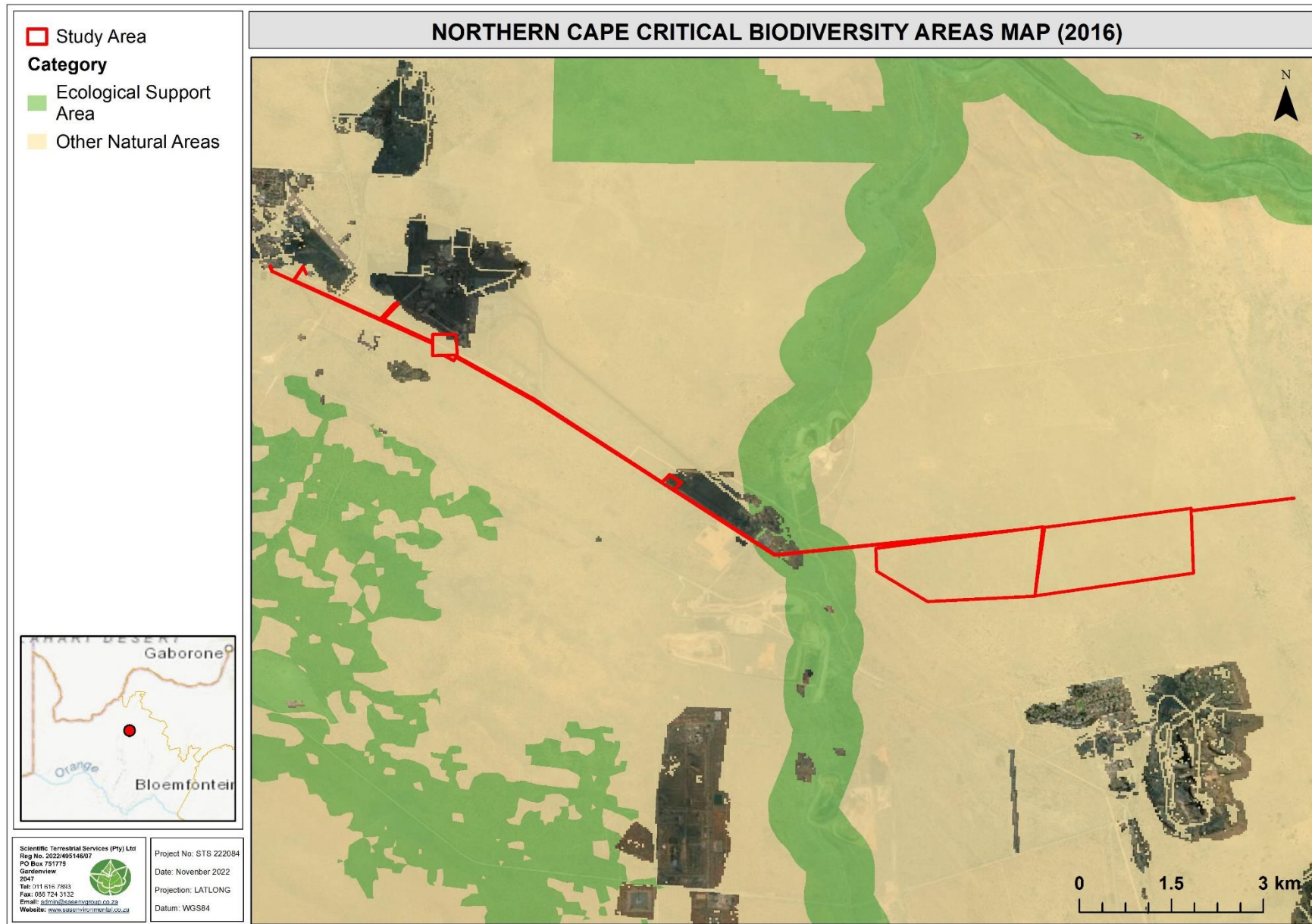


Figure 10: Importance of the study area in relation to the Northern Cape Critical Biodiversity Areas Database (2016).





## 4 STRUCTURE OF THE REPORT

**Part A** of this report served to introduce study area, as well as the general approach to the study. Part A also presents the results of general desktop information reviewed as part of the study, including the information generated by the relevant authorities as well as the context of the site in relation to the surrounding anthropogenic activities and ecological character. A descriptive project description is also included.

**Part B** presents the results of the floral field assessment, data analyses and discussion of the results. Part B then presents the results of the impact assessment, where the impacts on floral ecology and biodiversity are discussed.

**Part C** presents the results of the fauna field assessment. This section presents data analyses and a discussion of the results. Finally, this section then presents the results of the impact assessment where the impacts on vertebrate ecology and biodiversity are discussed.



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## **APPENDIX A: Indemnity and Terms of Use of this Report**

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## APPENDIX B: Legislative Requirements

### THE CONSTITUTION OF THE REPUBLIC OF SOUTH AFRICA, 1996

The environment and the health and well-being of people are safeguarded under the Constitution of the Republic of South Africa, 1996 by way of Section 24. Section 24(a) guarantees a right to an environment that is not harmful to human health or well-being and to environmental protection for the benefit of present and future generations. Section 24(b) directs the state to take reasonable legislative and other measures to prevent pollution, promote conservation, and secure the ecologically sustainable development and use of natural resources (including water and mineral resources) while promoting justifiable economic and social development. Section 27 guarantees every person the right of access to sufficient water, and the state is obliged to take reasonable legislative and other measures within its available resources to achieve the progressive realisation of this right. Section 27 is defined as a socio-economic right and not an environmental right. However, read with Section 24 it requires of the state to ensure that water is conserved and protected and that sufficient access to the resource is provided. Water regulation in South Africa places a great emphasis on protecting the resource and on providing access to water for everyone.

### THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 (ACT NO. 107 OF 1998) (NEMA)

The National Environmental Management Act, 1998 (Act No.107 of 1998) (NEMA) and the associated Environmental Impact Assessment (EIA) Regulations (GN R326 as amended in 2017 and well as listing notices 1, 2 and 3 (GN R327, R325 and R324 of 2017), state that prior to any development taking place which triggers any activity as listed within the abovementioned regulations, an environmental authorisation process needs to be followed and environmental authorisation obtained. This could follow either the Basic Assessment process or the Environmental Impact Assessment process depending on the nature of the activity and scale of the anticipated impacts

### THE NATIONAL ENVIRONMENTAL MANAGEMENT BIODIVERSITY ACT, 2004 (ACT NO. 10 OF 2004) (NEMBA)

The objectives of this act are (within the framework of NEMA) to provide for:

- The management and conservation of biological diversity within the Republic of South Africa and of the components of such diversity;
- The use of indigenous biological resources in a sustainable manner;
- The fair and equitable sharing among stakeholders of the benefits arising from bio prospecting involving indigenous biological resources;
- To give effect to ratify international agreements relating to biodiversity which are binding to the Republic;
- To provide for cooperative governance in biodiversity management and conservation; and
- To provide for a South African National Biodiversity Institute to assist in achieving the objectives of this Act.

This act alludes to the fact that management of biodiversity must take place to ensure that the biodiversity of the surrounding areas are not negatively impacted upon, by any activity being undertaken, in order to ensure the fair and equitable sharing among stakeholders of the benefits arising from indigenous biological resources.

Furthermore, a person should not carry out a restricted activity involving either:

- a) A specimen of a listed threatened or protected species;
- b) Specimens of an alien species; or
- c) A specimen of a listed invasive species without a permit.

### GOVERNMENT NOTICE NUMBER R.1020: ALIEN AND INVASIVE SPECIES REGULATIONS, 2020 (IN GOVERNMENT GAZETTE 43735), INCLUDING GOVERNMENT



## NOTICE NUMBER 1003: ALIEN AND INVASIVE SPECIES LISTS, 2020 (IN GOVERNMENT GAZETTE 43726) AS IT RELATES TO THE NEMBA

NEMBA is administered by the Department of Environmental Affairs and aims to provide for the management and conservation of South Africa's biodiversity within the framework of the NEMA. This act in terms of alien and invasive species aims to:

- Prevent the unauthorised introduction and spread of alien and invasive species to ecosystems and habitats where they do not naturally occur;
- Manage and control alien and invasive species, to prevent or minimize harm to the environment and biodiversity; and
- Eradicate alien species and invasive species from ecosystems and habitats where they cause harm such ecosystems or habitats.

Alien species are defined, in terms of the NEMBA as:

- (a) A species that is not an indigenous species; or
- (b) An indigenous species translocated or intended to be translocated to a place outside its natural distribution range in nature, but not an indigenous species that has extended its natural distribution range by natural means of migration or dispersal without human intervention.

Categories according to NEMBA (Alien and Invasive Species Regulations, 2020):

- **Category 1a:** Invasive species that require compulsory control;
- **Category 1b:** Invasive species that require control by means of an invasive species management programme;
- **Category 2:** Commercially used plants that must not be grown in demarcated areas, if there is a permit and that steps are taken to prevent their spread; and
- **Category 3:** Ornamentally used plants that must no longer be planted.

## THE CONSERVATION OF AGRICULTURAL RESOURCES ACT, 1983 (ACT NO. 43 OF 1983) (CARA)

Removal of the alien and weed species encountered in the application area must take place in order to comply with existing legislation (amendments to the regulations under the CARA, 1983 and Section 28 of the NEMA, 1998). Removal of AIP and weed species should take place throughout the construction and operation, phases in line with an approved AIP Management Plan.

## THE NATIONAL FOREST ACT, 1998 (ACT NO. 10 OF 1998) (NFA)

According to the department of Department of Forestry, Fisheries, and the Environment (DFFE) (previously the Department of Agriculture, Forestry and Fisheries (DAFF)) ©2019 website (<https://www.daff.gov.za/daffweb3/>):

“In terms of the National Forests Act of 1998 certain tree species (types of trees) can be identified and declared as protected. The Department of Water Affairs and Forestry followed an objective, scientific and participative process to arrive at the new list of protected tree species, enacted in 2004. All trees occurring in natural forests are also protected in terms of the Act. Protective actions take place within the framework of the Act as well as national policy and guidelines. Trees are protected for a variety of reasons, and some species require strict protection while others require control over harvesting and utilization.”

Applicable sections of the NFA pertaining to the proposed project include the below:

### **Section 12:**

Declaration of trees as protected

- 1) The Minister must declare-
  - a. a particular tree,
  - b. a particular group of trees,
  - c. a particular woodland; or
  - d. trees belonging to a particular species, to be a protected tree, group of trees, woodland, or species.
- 2) The Minister must make such a declaration only if he or she is of the opinion that the tree, group of trees, woodland or species is not already adequately protected in terms of other legislation.



- 3) In exercising a discretion in terms of this section, the Minister must consider the principles set out in section 3(3) of the NFA.

**Section 15(1):**

No person may cut, disturb, damage, or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree or any forest product derived from a protected tree, except under a licence granted by the Minister or in terms of an exemption from the provisions of this subsection published by the Minister in the Gazette.

Contravention of this declaration is regarded as a first category offence that may result in a person who is found guilty of being sentenced to a fine or imprisonment for a period up to three years, or both a fine and imprisonment.

**NATIONAL ENVIRONMENTAL MANAGEMENT: PROTECTED AREAS ACT, 2003 (ACT NO. 57 OF 2003) AS AMENDED<sup>5</sup> (NEMPAA)**

The objective of this act is to provide for the protection and conservation of ecologically viable areas representative of South Africa's biological biodiversity 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; for the continued existence, governance and functions of South African National Parks; and for matters in connection thereof.

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<sup>5</sup> Amendments to the NEMPAA:

- National Environmental Management: Protected Areas Amendment Act 31 of 2004 – Gazette No. 27274, No. 131. Commencement date: 1 November 2005 [Proc. No. R. 58, Gazette No. 28123]
- National Environment Laws Amendment Act 14 of 2009 – Gazette No. 32267, No. 617. Commencement date: 18 September 2009 [Proc. 65, Gazette No. 32580]
- National Environmental Management: Protected Areas Amendment Act 15 of 2009 – Gazette No. 32660, No. 748. Commencement date: 23 October 2009 – except for sections 1 and 8 [Proc. No. 69, Gazette No. 32660]
- Schedule 2 amended by Government Notice R236 in Government Gazette 36295 dated 27 March 2013. Commencement date: 1 April 2013 of sections 1 and 8 (relating to Schedule 2) of the National Environmental Management Protected Areas Amendment Act, 15 of 2009 [Proc. No. 7, Gazette No. 36296]
- National Environmental Management: Protected Areas Amendment Act 21 of 2014 - Government Notice 445 in Government Gazette 37710 dated 2 June 2014. Commencement date: 2 June 2014.
- Schedule 2 amendment by General Notice 2 of 2016 in Government Gazette 39728 dated 25 February 2016. Commencement date: 25 February 2016.



## **NORTHERN CAPE PROVINCIAL SPATIAL DEVELOPMENT FRAMEWORK (NCPSTDF, 2019)**

The Northern Cape Provincial Spatial Development Framework (NCPSTDF) was developed in 2011 to meet the requirements of the Northern Cape Planning and Development Act, 1998 (Act 7 of 1998) and the Municipal Systems Act, 2000 (Act 32 of 2000).

## **THE NORTHERN CAPE NATURE CONSERVATION ACT (ACT NO. 9 OF 2009) (NCNCA)**

The purpose of this Act is to provide for the sustainable utilisation of wild animals, aquatic biota and plants; to provide for the implementation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora; to provide for offences and penalties for contravention of the Act; to provide for the appointment of nature conservators to implement the provisions of the Act; to provide for the issuing of permits and other authorisations; and to provide for matters connected therewith.

Restricted activities involving specially protected plants:

49(1) No person June, without a permit –

- (a) Pick;
- (b) Import;
- (c) Export;
- (d) Transport;
- (e) Possess;
- (f) Cultivate; or
- (g) Trade in,

A specimen of a specially protected plant

Restricted activities involving protected plants

50 (1) Subject to the provision of section 52, no person June, without a permit –

- (a) Pick;
- (b) Import;
- (c) Export;
- (d) Transport;
- (e) Cultivate; or
- (f) Trade in,

A specimen of a protected plant.





## APPENDIX C: Impact Assessment Methodology

### *Ecological Impact Assessment Method*

In order for the Environmental Assessment Practitioner (EAP) to allow for sufficient consideration of all environmental impacts, impacts were assessed using a common, defensible method of assessing significance that will enable comparisons to be made between risks/impacts and will enable authorities, stakeholders and the applicant to understand the process and rationale upon which risks/impacts have been assessed. The method used for assessing risks/impacts is outlined in the sections below.

The first stage of risk/impact assessment is the identification of environmental activities, aspects and impacts. This is supported by the identification of receptors and resources, which allows for an understanding of the impact pathway and an assessment of the sensitivity to change. The definitions used in the impact assessment are presented below.

- An **activity** is a distinct process or task undertaken by an organisation for which a responsibility can be assigned. Activities also include facilities or infrastructure that is possessed by an organisation.
- An **environmental aspect** is an 'element of an organizations activities, products and services which can interact with the environment'<sup>6</sup>. The interaction of an aspect with the environment may result in an impact.
- **Environmental risks/impacts** are the consequences of these aspects on environmental resources or receptors of particular value or sensitivity, for example, disturbance due to noise and health effects due to poorer air quality. In the case where the impact is on human health or wellbeing, this should be stated. Similarly, where the receptor is not anthropogenic, then it should be stipulated what the receptor is.
- **Receptors** can comprise, but are not limited to, people or human-made systems, such as local residents, communities and social infrastructure, as well as components of the biophysical environment such as wetlands, flora and riverine systems.
- **Resources** include components of the biophysical environment.
- **Frequency of activity** refers to how often the proposed activity will take place.
- **Frequency of impact** refers to the frequency with which a stressor (aspect) will impact on the receptor.
- **Severity** refers to the degree of change to the receptor status in terms of the reversibility of the impact; sensitivity of receptor to stressor; duration of impact (increasing or decreasing with time); controversy potential and precedent setting; threat to environmental and health standards.
- **Spatial extent** refers to the geographical scale of the impact.
- **Duration** refers to the length of time over which the stressor will cause a change in the resource or receptor.

The significance of the impact is then assessed by rating each variable numerically according to the defined criteria. Refer to the Table B1. The purpose of the rating is to develop a clear understanding of influences and processes associated with each impact. The severity, spatial scope and duration of the impact together comprise the consequence of the impact and when summed can obtain a maximum value of 15. The frequency of the activity and the frequency of the impact together comprise the likelihood of the impact occurring and can obtain a maximum value of 10. The values for likelihood and consequence of the impact are then read off a significance-rating matrix and are used to determine the level of mitigation that may be necessary<sup>7</sup>.

The assessment of significance is undertaken twice. Initial significance is based on only natural and existing mitigation measures (including built-in engineering designs). The subsequent assessment takes into account the recommended management measures required to mitigate the impacts. Measures such as demolishing infrastructure, and reinstatement and rehabilitation of land, are considered post-mitigation.

<sup>6</sup> The definition has been aligned with that used in the ISO 14001 Standard.

<sup>7</sup> Some risks/impacts that have low significance will however still require mitigation.



The model outcome of the impacts was then assessed in terms of impact certainty and consideration of available information. The Precautionary Principle is applied in line with South Africa's National Environmental Management Act, 1998 (Act No. 107 of 1998) in instances of uncertainty or lack of information, by increasing assigned ratings or adjusting final model outcomes. In certain instances, where a variable or outcome requires rational adjustment due to model limitations, the model outcomes have been adjusted.

**Table C1: Criteria for assessing significance of impacts.**

**LIKELIHOOD DESCRIPTORS**

<b>Probability of impact</b>	<b>RATING</b>
Highly unlikely	1
Possible	2
Likely	3
Highly likely	4
Definite	5
<b>Sensitivity of receiving environment</b>	<b>RATING</b>
Ecology not sensitive/important	1
Ecology with limited sensitivity/importance	2
Ecology moderately sensitive/ /important	3
Ecology highly sensitive /important	4
Ecology critically sensitive /important	5

**CONSEQUENCE DESCRIPTORS**

<b>Severity of impact</b>	<b>RATING</b>
Insignificant / ecosystem structure and function unchanged	1
Small / ecosystem structure and function largely unchanged	2
Significant / ecosystem structure and function moderately altered	3
Great / harmful/ ecosystem structure and function largely altered	4
Disastrous / ecosystem structure and function seriously to critically altered	5
<b>Spatial scope of impact</b>	<b>RATING</b>
Activity specific/ < 5 ha impacted / Linear developments affected < 100m	1
Development specific/ within the site boundary / < 100ha impacted / Linear developments affected < 100m	2
Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear developments affected < 1000m	3
Regional within 5 km of the site boundary / < 2000ha impacted / Linear developments affected < 3000m	4
Entire habitat unit / Entire system/ > 2000ha impacted / Linear developments affected > 3000m	5
<b>Duration of impact</b>	<b>RATING</b>
One day to one month	1
One month to one year	2
One year to five years	3
Life of operation or less than 20 years	4
Permanent	5



**Table C2: Significance Rating Matrix.**

LIKELIHOOD (Frequency of activity + Frequency of impact)	CONSEQUENCE (Severity + Spatial Scope + Duration)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	
3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	
4	8	12	16	20	24	28	32	36	40	44	48	52	56	60	
5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	
6	12	18	24	30	36	42	48	54	60	66	72	78	84	90	
7	14	21	28	35	42	49	56	63	70	77	84	91	98	105	
8	16	24	32	40	48	56	64	72	80	88	96	104	112	120	
9	18	27	36	45	54	63	72	81	90	99	108	117	126	135	
10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	

**Table C3: Positive/Negative Mitigation Ratings.**

Significance Rating	Value	Negative Impact Management Recommendation	Positive Impact Management Recommendation
Very high	126-150	Critically consider the viability of proposed projects Improve current management of existing projects significantly and immediately	Maintain current management
High	101-125	Comprehensively consider the viability of proposed projects Improve current management of existing projects significantly	Maintain current management
Medium-high	76-100	Consider the viability of proposed projects Improve current management of existing projects	Maintain current management
Medium-low	51-75	Actively seek mechanisms to minimise impacts in line with the mitigation hierarchy	Maintain current management and/or proposed project criteria and strive for continuous improvement
Low	26-50	Where deemed necessary seek mechanisms to minimise impacts in line with the mitigation hierarchy	Maintain current management and/or proposed project criteria and strive for continuous improvement
Very low	1-25	Maintain current management and/or proposed project criteria and strive for continuous improvement	Maintain current management and/or proposed project criteria and strive for continuous improvement

The following points were considered when undertaking the assessment:

- Risks and impacts were analysed in the context of the *project's area of influence* encompassing:
  - Primary project site and related facilities that the proponent and their contractors develops or controls;
  - Areas potentially impacted by cumulative impacts for any existing project or condition and other project-related developments; and
  - Areas potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at a different location.
- Risks/Impacts were assessed for all stages of the project cycle including:
  - Pre-construction;
  - Construction;
  - Operation;
  - Closure and decommissioning.
- If applicable, transboundary or global effects were assessed.
- Individuals or groups who may be differentially or disproportionately affected by the project because of their *disadvantaged* or *vulnerable* status were assessed.



- Particular attention was paid to describing any residual impacts that will occur after rehabilitation.

## **Mitigation measure development**

According to the DEA *et al.*, (2013) “Rich biodiversity underpins the diverse ecosystems that deliver ecosystem services that are of benefit to people, including the provision of basic services and goods such as clean air, water, food, medicine and fibre; as well as more complex services that regulate and mitigate our climate, protect people and other life forms from natural disaster and provide people with a rich heritage of nature-based cultural traditions. Intact ecological infrastructure contributes significant savings through, for example, the regulation of natural hazards such as storm surges and flooding which is attenuated by wetlands”.

According to the DEA *et al.* (2013) Ecosystem services can be divided into 4 main categories:

- Provisioning services are the harvestable goods or products obtained from ecosystems such as food, timber, fibre, medicine, and freshwater;
- Cultural services are the non-material benefits such as heritage landscapes and seascapes, recreation, ecotourism, spiritual values and aesthetic enjoyment;
- Regulating services are the benefits obtained from an ecosystem’s control of natural processes, such as climate, disease, erosion, water flows, and pollination, as well as protection from natural hazards; and
- Supporting services are the natural processes such as nutrient cycling, soil formation and primary production that maintain the other services.

Loss of biodiversity puts aspects of the economy, wellbeing and quality of life at risk, and reduces socio-economic options for future generations. This is of particular concern for the poor in rural areas who have limited assets and are more dependent on common property resources for their livelihoods. The importance of maintaining biodiversity and intact ecosystems for ensuring on-going provision of ecosystem services, and the consequences of ecosystem change for human well-being, were detailed in a global assessment entitled the Millennium Ecosystem Assessment (MEA, 2005), which established a scientific basis for the need for action to enhance management and conservation of biodiversity.

Sustainable development is enshrined in South Africa’s Constitution and laws. The need to sustain biodiversity is directly or indirectly referred to in a number of Acts, not least the National Environmental Management: Biodiversity Act, 2004 (No. 10 of 2004) (hereafter referred to as the Biodiversity Act) and is fundamental to the notion of sustainable development. In addition, International guidelines and commitments as well as national policies and strategies are important in creating a shared vision for sustainable development in South Africa (DEA *et al.*, 2013).

Pressures on biodiversity are numerous and increasing. According to the DEA *et al.*, (2013) Loss of natural habitat is the single biggest cause of biodiversity loss in South Africa and much of the world. The most severe transformation of habitat arises from the direct conversion of natural habitat for human requirements, including<sup>8</sup>:

- Cultivation and grazing activities;
- Rural and urban development;
- Industrial and mining activities, and
- Infrastructure development.

Impacts on biodiversity can largely take place in four ways (DEA *et al.*, 2013):

- **Direct impacts:** are impacts directly related to the project including project aspects such as site clearing, water abstraction and discharge of water from riverine resources;
- **Indirect impacts:** are impacts associated with a project that may occur within the zone of influence in a project such as surrounding terrestrial areas and downstream areas on water courses;
- **Induced impacts:** are impacts directly attributable to the project but are expected to occur due to the activities of the project. Factors included here are urban sprawl and the development of associated industries; and

<sup>8</sup> Limpopo Province Environment Outlook. A Report on the State of the Environment, 2002. Chapter 4.



- **Cumulative impacts:** can be defined as the sum of the impact of a project as well as the impacts from past, existing and reasonably foreseeable future projects that would affect the same biodiversity resources. Examples include numerous mining operations within the same drainage catchment or numerous residential developments within the same habitat for faunal or floral species.

Given the limited resources available for biodiversity management and conservation, as well as the need for development, efforts to conserve biodiversity need to be strategic, focused and supportive of sustainable development. This is a fundamental principle underpinning South Africa's approach to the management and conservation of its biodiversity and has resulted the definition of a clear mitigation strategy for biodiversity impacts.

'Mitigation' is a broad term that covers all components of the 'mitigation hierarchy' defined hereunder. It involves selecting and implementing measures – amongst others – to conserve biodiversity and to protect the users of biodiversity and other affected stakeholders from potentially adverse impacts as a result of mining or any other land use. The aim is to prevent adverse impacts from occurring or, where this is unavoidable, to limit their significance to an acceptable level. Offsetting of impacts is considered to be the last option in the mitigation hierarchy for any project.

The mitigation hierarchy in general consists of the following in order of which impacts should be mitigated (DEA *et al.*, 2013):

- **Avoid/prevent impact:** can be done through utilising alternative sites, technology and scale of projects to prevent impacts. In some cases, if impacts are expected to be too high the “no project” option should also be considered, especially where it is expected that the lower levels of mitigation will not be adequate to limit environmental damage and eco-service provision to suitable levels;
- **Minimise impact:** can be done through utilisation of alternatives that will ensure that impacts on biodiversity and ecoservices provision are reduced. Impact minimisation is considered an essential part of any development project;
- **Rehabilitate impact:** is applicable to areas where impact avoidance and minimisation are unavoidable where an attempt to re-instate impacted areas and return them to conditions which are ecologically similar to the pre-project condition or an agreed post project land use, for example arable land. Rehabilitation can however not be considered as the primary mitigation tool as even with significant resources and effort rehabilitation usually does not lead to adequate replication of the diversity and complexity of the natural system. Rehabilitation often only restores ecological function to some degree to avoid ongoing negative impacts and to minimise aesthetic damage to the setting of a project. Practical rehabilitation should consist of the following phases in best practice:
  - **Structural rehabilitation** which includes physical rehabilitation of areas by means of earthworks, potential stabilisation of areas as well as any other activities required to develop a long terms sustainable ecological structure;
  - **Functional rehabilitation** which focuses on ensuring that the ecological functionality of the ecological resources on the BRM supports the intended post closure land use. In this regard special mention is made of the need to ensure the continued functioning and integrity of wetland and riverine areas throughout and after the rehabilitation phase;
  - **Biodiversity reinstatement** which focuses on ensuring that a reasonable level of biodiversity is re-instated to a level that supports the local post closure land uses. In this regard special mention is made of re-instating vegetation to levels which will allow the natural climax vegetation community or community suitable for supporting the intended post closure land use; and
  - **Species reinstatement** which focuses on the re-introduction of any ecologically important species which may be important for socio-cultural reasons, ecosystem functioning reasons and for conservation reasons. Species re-instatement need only occur if deemed necessary.
- **Offset impact:** refers to compensating for residual or unavoidable negative impacts on biodiversity. Offsetting should take place to address any impacts deemed to be unacceptable which cannot be mitigated through the other mechanisms in the mitigation hierarchy. The objective of biodiversity offsets should be to ensure no net loss of biodiversity. Biodiversity



offsets can be considered to be a last resort to compensate for residual negative impacts on biodiversity.

The significance of residual impacts should be identified on a regional as well as national scale when considering biodiversity conservation initiatives. If the residual impacts lead to irreversible loss or irreplaceable biodiversity the residual impacts should be considered to be of *very high significance* and when residual impacts are considered to be of *very high significance*, offset initiatives are not considered an appropriate way to deal with the magnitude and/or significance of the biodiversity loss. In the case of residual impacts determined to have *medium to high significance*, an offset initiative may be investigated. If the residual biodiversity impacts are considered of low significance no biodiversity offset is required.<sup>9</sup>

In light of the above discussion the following points present the key concepts considered in the development of mitigation measures for the proposed project.

- Mitigation and performance improvement measures and actions that address the risks and impacts<sup>10</sup> are identified and described in as much detail as possible.
- Measures and actions to address negative impacts will favour avoidance and prevention over minimisation, mitigation or compensation where possible.
- Desired outcomes are defined and have been developed in such a way as to be measurable events with performance indicators, targets and acceptable criteria that can be tracked over defined periods, with estimates of the resources (including human resource and training requirements) and responsibilities for implementation wherever possible.

## **Recommendations**

Recommendations were developed to address and mitigate impacts associated with the proposed projects. These recommendations also include general management measures which apply to the proposed projects as a whole. Mitigation measures have been developed to address issues in all phases throughout the life of the projects from planning, through to construction and operation.

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<sup>9</sup> Provincial Guideline on Biodiversity Offsets, Western Cape, 2007.

<sup>10</sup> Mitigation measures should address both positive and negative impacts



## APPENDIX D: Vegetation Types

### Kathu Bushveld (SVk 12)



Kathu Bushveld (SVk 12): Open savanna dominated by *Vachellia erioloba*, *Senegalia melifera* and *Grewia flava* with low cover of *Stipagrostis ciliata* against the red sand east of Oupos, in the Kuruman District north of Kathu. Image taken from Mucina and Rutherford (2006), Figure 9.82 (page 522). ©M.C. Rutherford.

Table D1: Dominant & typical floristic species of the Kathu Bushveld (Mucina & Rutherford, 2006)

GROUP	SPECIES
<b>Woody Species</b>	
Tall tree	<i>Vachellia erioloba</i> (d).
Small trees	<i>Senegalia mellifera</i> subsp. <i>detinens</i> (d), <i>Boscia albitrunca</i> (d), <i>Terminalia sericea</i> .
Tall shrubs	<i>Diospyros lycioides</i> subsp. <i>lycioides</i> (d), <i>Dichrostachys cinerea</i> , <i>Grewia flava</i> , <i>Gymnosporia buxifolia</i> , <i>Rhigozum brevispinosum</i> .
Low shrubs	<i>Aptosimum decumbens</i> , <i>Grewia retinervis</i> , <i>Nolletia arenosa</i> , <i>Sida cordifolia</i> , <i>Tragia dioica</i> .
<b>Herbaceous species</b>	
Herbs	<i>Acrotome inflata</i> , <i>Erlangea misera</i> , <i>Gisekia africana</i> , <i>Heliotropium ciliatum</i> , <i>Hermbstaedtia fleckii</i> , <i>H. odorata</i> , <i>Limeum fenestratum</i> , <i>L. viscosum</i> , <i>Lotononis platycarpa</i> , <i>Senna italica</i> subsp. <i>arachoides</i> , <i>Tribulus terrestris</i> .
<b>Graminoids</b>	
Grasses	<i>Aristida meridionalis</i> (d), <i>Brachiaria nigropedata</i> (d), <i>Centropodia glauca</i> (d), <i>Eragrostis lehmanniana</i> (d), <i>Schmidtia pappophoroides</i> (d), <i>Stipagrostis ciliata</i> (d), <i>Aristida congesta</i> , <i>Eragrostis biflora</i> , <i>E. chloromelas</i> , <i>E. heteromera</i> , <i>E. pallens</i> , <i>Melinis repens</i> , <i>Schmidtia kalahariensis</i> , <i>Stipagrostis uniplumis</i> , <i>Tragus berteronianus</i> .
<b>BIOGEOGRAPHICALLY IMPORTANT TAXA (KALAHARI ENDEMICS)</b>	
<b>Woody Species</b>	
Small trees	<i>Vachellia luederitzii</i> var. <i>luederitzii</i> .
<b>Herbaceous species</b>	
Herbs	<i>Neuradopsis bechuanensis</i> .
<b>Graminoids</b>	
Grasses	<i>Anthephora argentea</i> , <i>Megaloptachne albescens</i> , <i>Panicum kalaharensense</i> .

\*(d) – Dominant species for the vegetation type



### Gordonia Duneveld (SVkd 1)



**Gordonia Duneveld (SVkd 1):** Sparse dune shrubland with *Vachellia haematoxylon* (the silver bush on the slopes) and *Stipagrostis amabilis* (the grass on the dune ridge) in the valley of the Auob River in the Kgalagadi Transfrontier Park. Image taken from Mucina and Rutherford (2006), Figure 9.86 (page 525). ©D. Mucina.

**Table D2: Dominant & typical floristic species of the Gordonia Duneveld (Mucina & Rutherford, 2006)**

GROUP	SPECIES
<b>Woody Species</b>	
Small trees	<i>Senegalila mellifera</i> subsp. <i>detinens</i> (d).
Tall shrubs	<i>Grewia flava</i> (d), <i>Rhigozum trichotomum</i> (d).
Low shrubs	<i>Aptosimum albomarginatum</i> , <i>Monechma incanum</i> , <i>Requienia sphaerosperma</i> .
Succulent shrubs	<i>Lycium bosciifolium</i> , <i>L. pumilum</i> , <i>Talinum cafrum</i> .
<b>Herbaceous species</b>	
Herbs	<i>Hermestaedtia fleckii</i> (d), <i>Acanthosicyos naudinianus</i> , <i>Hermannia tomentosa</i> , <i>Limeum arenicolum</i> , <i>L. argute-carinatum</i> , <i>Oxygonum dregeanum</i> subsp. <i>canescens</i> var. <i>canescens</i> , <i>Sericorema remotiflora</i> , <i>Sesamum triphyllum</i> , <i>Tribulus zeyheri</i> .
<b>Graminoids</b>	
Grasses	<i>Schmidtia kalahariensis</i> (d), <i>Brachiaria glomerata</i> , <i>Bulbostylis hispidula</i> , <i>Centropodia glauca</i> , <i>Eragrostis lehmanniana</i> , <i>Stipagrostis ciliata</i> , <i>S. obtusa</i> , <i>S. uniplumis</i> .
<b>BIOGEOGRAPHICALLY IMPORTANT TAXA (KALAHARI ENDEMICS)</b>	
<b>Woody Species</b>	
Tall shrub	<i>Vachellia haematoxylon</i> (d).
<b>Herbaceous species</b>	
Herbs	<i>Helichrysum arenicola</i> , <i>Kohautia ramosissima</i> , <i>Neuradopsis austro-africana</i> .
<b>Graminoids</b>	
Grasses	<i>Stipagrostis amabilis</i> (d), <i>Anthephora argentea</i> , <i>Megaloprotachne albescens</i> .

\*(d) – Dominant species for the vegetation type





## APPENDIX E: Details, Expertise And Curriculum Vitae of Specialists

### 1. (a) (i) Details of the specialist who prepared the report

Charne Gouws	MSc Plant Science (University of Pretoria)
Chris Hooton	BTech Nature Conservation (Tshwane University of Technology)
Christien Steyn	MSc Plant Science (University of Pretoria)
Nelanie Cloete	MSc Botany and Environmental Management (University of Johannesburg)
Stephen van Staden	MSc Environmental Management (University of Johannesburg)

### 1. (A). (ii) The expertise of that specialist to compile a specialist report including a curriculum vitae

Company of Specialist:	Scientific Terrestrial Services		
Postal address:	PO. Box 751779, Gardenview		
Postal code:	2047	Fax:	086 724 3132
Telephone:	011 616 7893		
Name / Contact person:	Charne Gouws		
E-mail:	<a href="mailto:charne@sasenvgroup.co.za">charne@sasenvgroup.co.za</a>		
Qualifications	MSc (Plant Science) (University of Pretoria) BSc (Hons) Plant Science (University of Pretoria) BSc (Environmental Sciences) (University of Pretoria)		
Registration / Associations	SANAP (South African National Antarctic Programme) Golden Key Honorary Society		
Name / Contact person:	Chris Hooton		
E-mail:	<a href="mailto:chris@sasenvgroup.co.za">chris@sasenvgroup.co.za</a>		
Qualifications	BTech Nature Conservation (Tshwane University of Technology) National Diploma Nature Conservation (Tshwane University of Technology)		
Name	Christien Steyn		
E-mail:	<a href="mailto:christien@sasenvgroup.co.za">christien@sasenvgroup.co.za</a>		
Qualifications	MSc (Plant Science) (University of Pretoria) BSc (Hons) Plant Science (University of Pretoria) BSc (Environmental Sciences) (University of Pretoria)		
Registration / Associations	Professional member of the South African Council for Natural Scientific Professions (SACNASP – Reg No. 127823/21) Member of the Botanical Society of South Africa (BotSoc) Member of the Grassland Society of South Africa (GSSA) Member of the Land Rehabilitation Society of Southern Africa (LARSSA) Member of the South African Association of Botanists (SAAB) Member of the Southern African Wildlife Management Association (SAWMA)		
Name / Contact person:	Nelanie Cloete		
E-mail:	<a href="mailto:nelanie@sasenvgroup.co.za">nelanie@sasenvgroup.co.za</a>		
Qualifications	MSc Environmental Management (University of Johannesburg) MSc Botany (University of Johannesburg) BSc (Hons) Botany (University of Johannesburg) BSc (Botany and Zoology) (Rand Afrikaans University)		
Registration / Associations	Certificate – Department of Environmental Science in Legal context of Environmental Management, Compliance and Enforcement (UNISA) Introduction to Project Management - Online course by the University of Adelaide Integrated Water Resource Management, the National Water Act, and Water Use Authorisations, focusing on WULAs and IWWMPs Environmental legal compliance, Monitoring and Auditing		
Name / Contact person:	Stephen van Staden		
E-mail:	<a href="mailto:stephen@sasenvgroup.co.za">stephen@sasenvgroup.co.za</a>		



Qualifications	MSc (Environmental Management) (University of Johannesburg) BSc (Hons) Zoology (Aquatic Ecology) (University of Johannesburg) BSc (Zoology, Geography and Environmental Management) (University of Johannesburg)
Registration / Associations	Registered Professional Scientist at South African Council for Natural Scientific Professions (SACNASP) Accredited River Health Practitioner by the South African River Health Program (RHP) Member of the South African Soil Surveyors Association (SASSO) Member of the Gauteng Wetland Forum Member of the Gauteng Wetland Forum Member of International Association of Impact Assessors (IAIA) South Africa; Member of the Land Rehabilitation Society of South Africa (LaRSSA)

**1. (b) a declaration that the specialist is independent in a form as may be specified by the competent authority**

I, Charne Gouws, declare that -

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



-----  
Signature of the Specialist

I, Christopher Hooton, declare that -

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





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Specialist Signature

I, Christien Steyn, declare that -

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



-----  
Signature of the Specialist

I, Nelanie Cloete, declare that -

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



-----  
Signature of the Specialist

I, Stephen van Staden, declare that -

- I act as the **independent specialist** (reviewer) in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;



- I have expertise in conducting the specialist report relevant to this application, including knowledge of the relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct



-----  
Signature of the Specialist





## SAS ENVIRONMENTAL GROUP OF COMPANIES – SPECIALIST CONSULTANT INFORMATION

### CURRICULUM VITAE OF CHARNE GOUWS

#### PERSONAL DETAILS

Position in Company	Floral Ecologist
Joined SAS Environmental Group of Companies	2022

#### MEMBERSHIP IN PROFESSIONAL SOCIETIES

SANAP (South African National Antarctic Programme)  
Golden Key Honorary Society

#### EDUCATION

##### Qualifications

MSc Plant Science (University of Pretoria)	2021
BSc (Hons) Plant Science (Invasion Biology) (University of Pretoria)	2018
BSc Environmental Science (University of Pretoria)	2017

##### Short courses and Training

- Advanced Grass Identification Course (2019)
- CREW Tree Identification Course (2019)
- ISO 140001 Environmental Management Course (2020)
- Ecological Practices and Theory Short Course (2020)

#### AREAS OF WORK EXPERIENCE

**South Africa** – Gauteng, Mpumalanga, Limpopo, KwaZulu-Natal, Northern Cape, North West and Eastern Cape

#### KEY SPECIALIST DISCIPLINES

##### Biodiversity Assessments

- Floral Assessments
- Desktop Studies, Mapping and Background Information Research
- Floral Marking
- Alien Management Plans





## SAS ENVIRONMENTAL GROUP OF COMPANIES – SPECIALIST CONSULTANT INFORMATION

### CURRICULUM VITAE OF CHRISTOPHER HOOTON

#### PERSONAL DETAILS

Position in Company	Senior Scientist, Member Biodiversity Specialist
Joined SAS Environmental Group of Companies	2013

#### EDUCATION

##### Qualifications

BTech Nature Conservation (Tshwane University of Technology)	2013
National Diploma Nature Conservation (Tshwane University of Technology)	2008

#### AREAS OF WORK EXPERIENCE

**South Africa** – Gauteng, Mpumalanga, North West, Limpopo, KwaZulu-Natal, Eastern Cape, Western Cape, Northern Cape, Free State

**Africa** - Zimbabwe, Sierra Leone, Zambia

#### KEY SPECIALIST DISCIPLINES

##### Biodiversity Assessments

- Floral Assessments
- Faunal Assessments
- Biodiversity Actions Plan (BAP)
- Biodiversity Management Plan (BMP)
- Alien and Invasive Control Plan (AICP)
- Ecological Scan
- Protected Tree and Floral Marking and Reporting
- Biodiversity Offset Plan

##### Freshwater Assessments

- Freshwater Verification Assessment
- Freshwater (wetland / riparian) Delineation and Assessment
- Freshwater Eco Service and Status Determination
- Rehabilitation Assessment / Planning





## SAS ENVIRONMENTAL GROUP OF COMPANIES – SPECIALIST CONSULTANT INFORMATION

### CURRICULUM VITAE OF CHRISTIEN STEYN

#### PERSONAL DETAILS

Position in Company	Floral Ecologist
Joined SAS Environmental Group of Companies	2018

#### MEMBERSHIP IN PROFESSIONAL SOCIETIES

Professional member of the South African Council for Natural Scientific Professions (SACNASP – Reg No. 127823/21)

Member of the Botanical Society of South Africa (BotSoc)

Member of the Grassland Society of South Africa (GSSA)

Member of the Land Rehabilitation Society of Southern Africa (LARSSA)

Member of the South African Association of Botanists (SAAB)

Member of the South African Wildlife Management Association (SAWMA)

#### EDUCATION

##### Qualifications

MSc Plant Science (University of Pretoria)	2017
BSc (Hons) Plant Science (Invasion Biology) (University of Pretoria)	2014
BSc Environmental Science (University of Pretoria)	2013

##### Short courses and Training

- BotSoc Branch: Species Environmental Assessment Guidelines Course (2022).
- Advanced Grass Identification Course (2021).
- Practical Plant Identification, including Herbarium Usage and Protocols.
- Vegetation Classification and Mapping: Use of Geographic Information System for understanding vegetation pattern and biodiversity conservation.
- Introduction to Statistics for Biologists: Applications of plant ecology principles in plant conservation, i.e., species distribution modelling, alien plant invasions, conservation planning.
- International Plant Functional Trait Course: Hands-on, field-based exploration of plant functional traits, along with experience in the usage of plant traits data in climate-change research and ecosystem ecology. <https://www.uib.no/en/rg/EECRG/97477/plant-functional-traits-course-2>

#### AREAS OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, North West, Limpopo, KwaZulu-Natal, Northern Cape, Free State

#### KEY SPECIALIST DISCIPLINES

##### Biodiversity Assessments

- Terrestrial Ecological and Biodiversity Scoping Assessments
- Terrestrial Ecological and Biodiversity Screening Assessments
- Floral Assessments
- Input into Terrestrial Rehabilitation Plan design with the focus on the re-establishment of vegetation
- Floral Rescue and Relocation Plans
- Alien and Invasive Plant Control and Management Plans (AIPCPs)
- Alien and Invasive Plant Identification and awareness training
- Terrestrial Monitoring
- Protected Tree and Floral Marking and Reporting
- Desktop Studies, Mapping and Background Information Research





## SAS ENVIRONMENTAL GROUP OF COMPANIES – SPECIALIST CONSULTANT INFORMATION

### CURRICULUM VITAE OF NELANIE CLOETE

#### PERSONAL DETAILS

Position in Company	Senior Scientist, Member Water Resource and Botanical Discipline Lead
Joined SAS Environmental Group of Companies	2011

#### MEMBERSHIP IN PROFESSIONAL SOCIETIES

Professional member of the South African Council for Natural Scientific Professions (SACNASP – Reg No. 400503/14)  
 Member of the South African Association of Botanists (SAAB)  
 Member of the International Affiliation for Impact Assessments (IAIAsa) South Africa group  
 Member of the Grassland Society of South Africa (GSSA)  
 Member of the Botanical Society of South Africa (BotSoc)  
 Member of the Gauteng Wetland Forum (GWF)  
 Member of the South African Wetland Society (SAWS)

#### EDUCATION

##### Qualifications

MSc Environmental Management (University of Johannesburg)	2013
MSc Botany (University of Johannesburg)	2007
BSc (Hons) Botany (University of Johannesburg)	2005
BSc (Botany and Zoology) (Rand Afrikaans University)	2004

##### Short Courses

Certificate – Department of Environmental Science in Legal context of Environmental Management, Compliance and Enforcement (UNISA)	2009
Introduction to Project Management - Online course by the University of Adelaide	2016
Integrated Water Resource Management, the National Water Act, and Water Use Authorisations, focusing on WULAs and IWWMPs	2017
Environmental legal compliance, Monitoring and Auditing	2021

#### AREAS OF WORK EXPERIENCE

**South Africa** – Gauteng, Mpumalanga, North West, Limpopo, KwaZulu-Natal, Northern Cape, Eastern Cape, Free State  
**Africa** - Democratic Republic of the Congo (DRC)

#### KEY SPECIALIST DISCIPLINES

##### Biodiversity Assessments

- Floral Assessments
- Biodiversity Actions Plan (BAP) & Biodiversity Management Plan (BMP)
- Alien and Invasive Control Plan (AICP)
- Ecological Scan
- Terrestrial Monitoring
- Protected Tree and Floral Marking and Reporting
- Biodiversity Offset Plan

##### Freshwater Assessments

- Desktop Freshwater Delineation
- Freshwater Verification Assessment
- Freshwater (wetland / riparian) Delineation and Assessment
- Freshwater Eco Service and Status Determination
- Rehabilitation Assessment / Planning
- Plant species and Landscape Plan

##### Legislative Requirements, Processes and Assessments

- Water Use Applications (Water Use Licence Applications / General Authorisations)
- Environmental and Water Use Audits
- Freshwater Resource Management and Monitoring as part of EMPR and WUL conditions
- Environmental Control Officer monitoring







## SAS ENVIRONMENTAL GROUP OF COMPANIES – SPECIALIST CONSULTANT INFORMATION

### CURRICULUM VITAE OF **STEPHEN VAN STADEN**

#### PERSONAL DETAILS

Position in Company	Group CEO, Water Resource Discipline Lead, Managing Member, Ecologist, Aquatic Ecologist
Joined SAS Environmental Group of Companies	2003 (year of establishment)

#### MEMBERSHIP IN PROFESSIONAL SOCIETIES

Registered Professional Scientist at South African Council for Natural Scientific Professions (SACNASP)  
Accredited River Health Practitioner by the South African River Health Program (RHP)  
Member of the South African Soil Surveyors Association (SASSO) Member of the Gauteng Wetland Forum  
Member of the Gauteng Wetland Forum  
Member of International Association of Impact Assessors (IAIA) South Africa;  
Member of the Land Rehabilitation Society of South Africa (LaRSSA)

#### EDUCATION

##### Qualifications

MSc Environmental Management (University of Johannesburg)	2003
BSc (Hons) Zoology (Aquatic Ecology) (University of Johannesburg)	2001
BSc (Zoology, Geography and Environmental Management) (University of Johannesburg)	2000

##### Short Courses

Integrated Water Resource Management, the National Water Act, and Water Use Authorisations, focusing on WULAs and IWWMPs	2017
Tools for Wetland Assessment (Rhodes University)	2017
Legal liability training course (Legricon Pty Ltd)	2018
Hazard identification and risk assessment training course (Legricon Pty Ltd)	2018
Wetland Management: Introduction and Delineation (WLID1502S) (University of the Free State)	2018
Hydropedology and Wetland Functioning (TerraSoil Science and Water Business Academy)	2018

#### AREAS OF WORK EXPERIENCE

**South Africa** – All Provinces

**Southern Africa** – Lesotho, Botswana, Mozambique, Zimbabwe Zambia

**Eastern Africa** – Tanzania Mauritius

**West Africa** – Ghana, Liberia, Angola, Guinea Bissau, Nigeria, Sierra Leona

**Central Africa** – Democratic Republic of the Congo

#### DEVELOPMENT SECTORS OF EXPERIENCE

1. Mining: Coal, chrome, Platinum Group Metals (PGMs), mineral sands, gold, phosphate, river sand, clay, fluorspar
2. Linear developments (energy transmission, telecommunication, pipelines, roads)
3. Minerals beneficiation
4. Renewable energy (Hydro, wind and solar)
5. Commercial development
6. Residential development
7. Agriculture
8. Industrial/chemical

#### KEY SPECIALIST DISCIPLINES

##### Legislative Requirements, Processes and Assessments

- Water Use Applications (Water Use Licence Applications / General Authorisations)
- Environmental and Water Use Audits
- Freshwater Resource Management and Monitoring as part of EMPR and WUL conditions

##### Freshwater Assessments

- Freshwater (wetland / riparian) Delineation and Assessment
- Freshwater Eco Service and Status Determination
- Rehabilitation Assessment / Planning



- Maintenance and Management Plans
- Plant Species and Landscape Plans
- Freshwater Offset Plans
- Hydropedological Assessment
- Pit Closure Analysis
- Aquatic Ecological Assessment and Water Quality Studies**
- Habitat Assessment Indices (IHAS, HRC, IHIA & RHAM)
- Aquatic Macro-Invertebrates (SASS5 & MIRAI)
- Fish Assemblage Integrity Index (FRAI)
- Fish Health Assessments
- Riparian Vegetation Integrity (VEGRAI)
- Toxicological Analysis
- Water quality Monitoring
- Screening Test
- Riverine Rehabilitation Plans
- Biodiversity Assessments**
- Floral Assessments
- Biodiversity Actions Plan (BAP)
- Biodiversity Management Plan (BMP)
- Alien and Invasive Control Plan (AICP)
- Ecological Scan
- Terrestrial Monitoring
- Biodiversity Offset Plan
- Soil and Land Capability Assessment**
- Soil and Land Capability Assessment
- Hydropedological Assessment
- Visual Impact Assessment**
- Visual Baseline and Impact Assessments
- Visual Impact Peer Review Assessments

