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SCIENTIFIC TERRESTRIAL SERVICES

## TERRESTRIAL BIODIVERSITY ASSESSMENT

FOR THE PROPOSED MINING EXPANSION  
ACTIVITIES AT THE THARISA MINE,  
NORTH WEST PROVINCE.

### Part B: Floral Assessment

**Prepared for:** SLR Consulting (South Africa) Pty (Ltd)  
**Prepared by:** Scientific Terrestrial Services CC  
**Report author:** S. L. Daniels  
**Report reviewers:** C. Steyn (Pr.Sci.Nat)  
N. Cloete (Pr.Sci.Nat)  
**Report Reference:** STS 210061  
**Date:** June 2022



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## LIST OF ACRONYMS

AIP	Alien and Invasive Plants
ARC	Agricultural Research Council
BGIS	Biodiversity Geographic Information Systems
BODATSA	Botanical Database of Southern Africa
CBA	Critical Biodiversity Area
CR	Critically Endangered
CVBW	Channelled Valley Bottom Wetland
DFFE	Department of Forestry, Fisheries, and the Environment
DREAD	North West Department of Rural, Environmental and Agricultural Development
DMRE	Department of Mineral Resources and Energy
E-GIS	Environmental Geographical Information Systems
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMPr	Environmental Management Programme
EN	Endangered
ESA	Ecological Support Area
EW	Extinct in the Wild
GIS	Geographic Information System
GN	Government Notice
GPS	Global Positioning System
Ha	Hectare
IEM	Integrated Environmental Management
IUCN	International Union for the Conservation of Nature
LC	Least Concern
NBA	National Biodiversity Assessment (2018)
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
NEMBA	National Environmental Management Biodiversity Act, 2004 (Act No. 10 of 2004)
NFA	The National Forest Act, 1998 (Act No. 84 of 1998)
NL	Not Listed
NT	Near Threatened
NWBSP	North West Biodiversity Sector Plan
P	Protected
PES	Present Ecological State
POC	Probability of Occurrence
POSA	Plants of southern Africa
READ	(North West Department of) Rural, Agricultural, and Environmental Development
RDL	Red Data Listed
SACAD	South African Conservation Areas Database
SANBI	South African National Biodiversity Institute
SCC	Species of Conservation Concern
STS	Scientific Terrestrial Services CC
TNCO	Transvaal Nature Conservation Ordinance, 1983 (Ordinance No. 12 of 1983)
TOPS	Threatened or Protected Species (in terms of NEMBA)
UCVBW	Unchanneled Valley Bottom Wetland
VU	Vulnerable
WRD	Waste Rock Dump



## 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) and Skowno *et al.* (2019), 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</b> (as per the definition in NEMBA)	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 also includes diversity within species, between species, and of ecosystems.
<b>Biome - as per Mucina and Rutherford (2006); after Low and Rebelo (1998).</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>Corridor</b>	A dispersal route or a physical connection of suitable habitats linking previously unconnected regions.
<b>Development footprint</b> (as per the NEMA definition)	"in respect of land, means any evidence of its physical transformation as a result of the undertaking of any activity"
<b>Disturbance</b>	A temporal change, either regular or irregular (uncertain), in the environmental conditions that can trigger population fluctuations and secondary succession. Disturbance is an important driver of biological invasions.
<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</b>	Organisms in danger of extinction if causal factors continue to operate.
<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>Degradation</b>	The many human-caused processes that drive the decline or loss in biodiversity, ecosystem functions or ecosystem services in any terrestrial and associated aquatic ecosystems.
<b>Disturbance</b>	A temporal change, either regular or irregular (uncertain), in the environmental conditions that can trigger population fluctuations and secondary succession. Disturbance is an important driver of biological invasions.
<b>Driver (ecological)</b>	A driver is any natural or human-induced factor that directly or indirectly causes a change in ecosystem. A direct driver clearly influences ecosystem processes,

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



	where indirect driver influences ecosystem processes through altering one or more direct drivers.
<b>Ecological Condition</b>	<p>“ecological condition” means the extent to which the composition, structure and function of an area or biodiversity feature has been modified from a reference condition of “natural”.</p> <p>Various terminology can be used for precision of language:</p> <ul style="list-style-type: none"> <li>➤ <u>Fair ecological condition</u>: Areas that are moderately modified, semi-natural. An ecological condition class in which ecological function is maintained even though composition and structure have been compromised. Can apply to a site or an ecosystem.</li> <li>➤ <u>Good ecological condition</u>: Areas that are natural or near-natural. An ecological condition class in which composition, structure and function are still intact or largely intact. Can apply to a site or an ecosystem.</li> </ul> <p><u>Poor ecological condition</u>: Areas that are severely or irreversibly modified. An ecological condition class in which ecological function has been compromised in addition to structure and composition. Can apply to a site or an ecosystem.</p>
<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>Ground Truth</b>	To check the accuracy of (remotely sensed data) by means of in-situ observations.
<b>Habitat (as per the definition in NEMBA)</b>	A place where a species or ecological community naturally occurs.
<b>Habitat loss</b>	Conversion of natural habitat in an ecosystem to a land use or land cover class that results in irreversible change in the composition, structure and functional characteristics of the ecosystem concerned.
<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>Invasive species</b>	Alien species that sustain self-replacing populations over several life cycles, produce reproductive offspring, often in very large numbers at considerable distances from the parent and/or site of introduction, and have the potential to spread over long distances.
<b>Listed alien species</b>	All alien species that are regulated in South Africa under the National Environmental Management: Biodiversity Act, 2004 (Act No.10 of 2004), Alien and Invasive Species Regulations, 2020.
<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>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 (Red Data) and IUCN (International Union for the Conservation of Nature) listed threatened species as well as 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

## 1.1 Project Background

Scientific Terrestrial Services CC (STS) was appointed to conduct a Biodiversity Assessment as part of the Environmental Impact Assessment (EIA) phase in support of obtaining Environmental Authorisation (EA) for the proposed expansion of the Tharisa Mine, henceforth be referred to as the “**study area**” (Figure 1).

The study area is located in the North West province, within the Madibeng municipality, which is an administrative division of the Bojanala Platinum District Municipality. The study area is located approximately 20 km southeast of Rustenburg and approximately 2.5 km south of Marikana. The N4 is located approximately 1.4 km south of the study area and the R566 is located approximately 14 km west of the R556.

As part of its on-going mine planning, Tharisa has identified the need for additional waste rock storage on site. In this regard, Tharisa is making an application to the Department of Mineral Resources and Energy (DMRE) for an integrated EA and update of the mine’s current Environmental Management Programme (EMPr). The following activities are proposed:

1. Expansion of the existing and approved Far West WRD 1 by a footprint of 109 hectares (ha) – this expanded area is hereafter referred to as the “**West Above Ground Waste Rock Dump (WRD)**.” Portions of the West Above Ground WRD will be located on backfilled areas of the West Pit; and
2. Establishing a WRD above backfilled portions of the East pit – referred to as the “**East Above Ground WRD**”. The proposed East Above Ground WRD will cover an area of approximately 72 ha.

The purpose of this report is to define the floral ecology of the study area, to identify areas of increased Ecological Importance and Sensitivity (EIS), as well as the mapping of such areas, and to describe the Present Ecological State (PES) of the study area. The primary objective of the floral assessment is not to compile an exhaustive species list but rather to ensure that sufficient data are collected to describe all the vegetation communities present in the area of interest, to optimise the detection of species of conservation concern (SCC) and to assess habitat suitability for other potentially occurring SCC (SANBI, 2020).





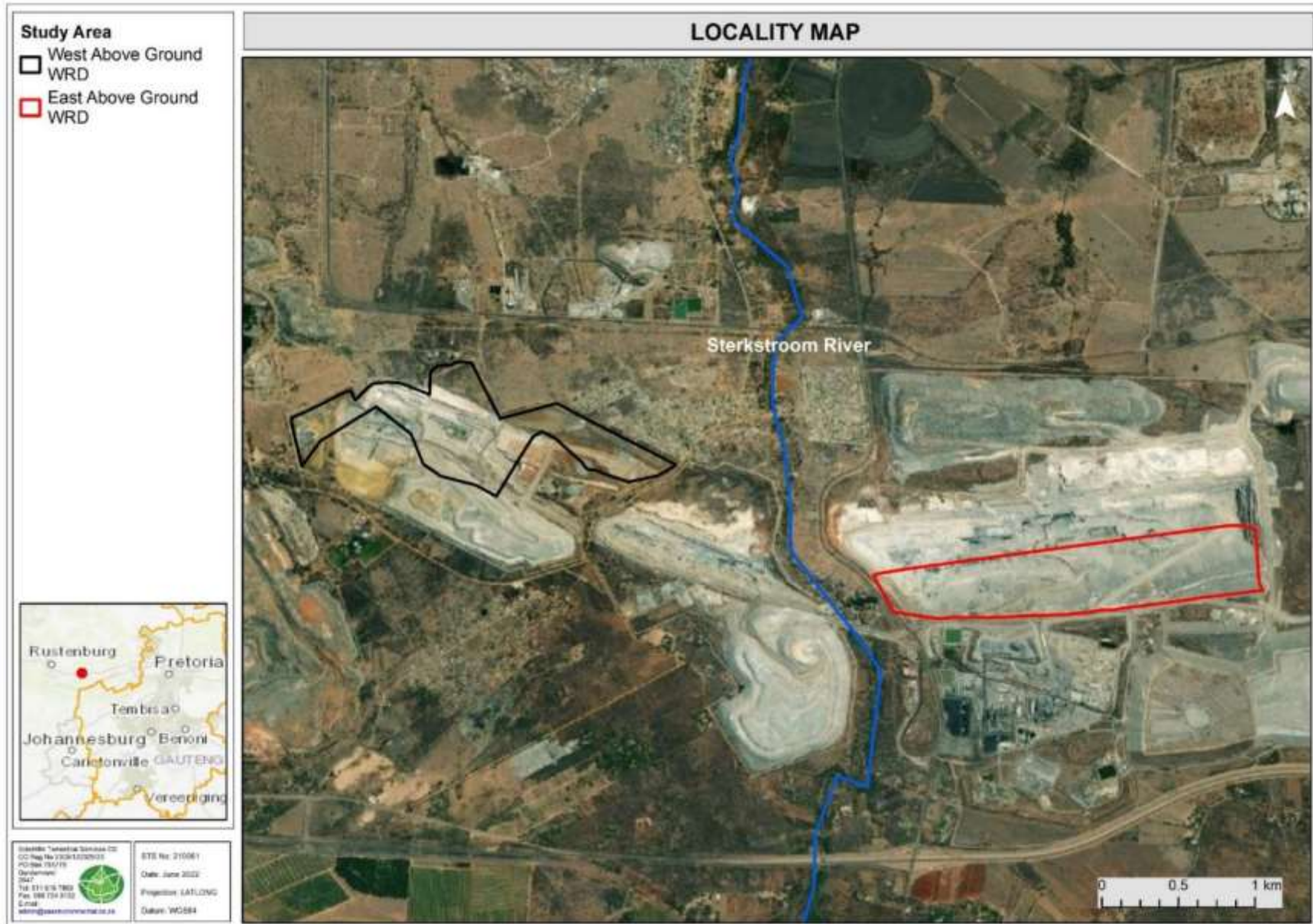


Figure 1: The locality of the study area and the proposed layout of the open cast pit overlaid on digital satellite imagery.



## 1.2 Scope of Work

Specific outcomes in terms of the report are as follows:

- To determine and describe habitat types, communities and the ecological state of the study area and to rank each habitat type based on conservation importance and ecological sensitivity;
- To provide inventories of floral species as encountered within the study area;
- To identify and consider all sensitive landscapes such as indigenous forests, rocky ridges, wetlands and/ or any other special features such as Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs);
- To conduct a Red Data Listed (RDL) floral species assessment as well as an assessment of other SCC, including the potential for such species to occur within the study area;
- To provide detailed information to guide the activities associated with the proposed development within the study area; and
- To ensure the ongoing functioning of the ecosystem in such a way as to support local and regional conservation requirements, to allow regional and national biodiversity targets to be met, and the provision of ecological services in the local area is sustained.

## 1.3 Assumptions and Limitations

The following assumptions and limitations are applicable to this report:

- The floral assessment was confined to the study area and does not include the neighbouring and adjacent properties. The entire study area and immediate surroundings were, however, included in the desktop analysis of which the results are presented in **Part A: Section 3**;
- With ecology being dynamic and complex, some aspects (some of which may be important) may have been overlooked. It is, however, expected that most floral communities have been accurately assessed and considered. Relevant online sources were further assessed to improve on the overall understanding of the study area's ecology;
- The data presented in this report are based on one site visit, undertaken on the 26<sup>th</sup> of April (autumn) and thus falls outside of the flowering season of several species within the region. A more comprehensive assessment would require that assessments take place in all seasons of the year. However, on-site data was augmented with all available desktop data. Together with project experience in the area, the overall degraded nature of the study area and its surroundings, and the use of background



information from studies previously conducted in the area (e.g., SAS 213199 (2013), and STS 210061, 2021), the findings of this assessment are considered an accurate reflection of the floral ecological characteristics of the study area for the purposes of informed decision-making processes; and

- An on-site visual investigation of the assessment areas was conducted to confirm the assumptions made during the consultation of the background maps and to determine whether the sensitivity of the terrestrial biodiversity associated with the assessment areas confirms the results of the online National Web-based Environmental Screening Tool, hereafter referred to as the “screening tool”.

## 2 ASSESSMENT APPROACH

### 2.1 General Approach

The vegetation surveys are based on the subjective sampling method which is a technique where the specialist chooses specific sample sites within the area of interest, based on their professional experience in the area and background research done prior to the site visit. This allows representative recordings of floral communities and optimal detection of SCC (refer to the methodology description in **Appendix A**).

The below list includes the steps followed during the preparation for, and the conduction of, the field assessments:

- To guide the selection of appropriate sample sites, background data and digital satellite images were consulted before going to site, during which broad habitats, vegetation types and potentially sensitive sites were identified. The results of these analyses were then used to focus the fieldwork on specific areas of concern and to identify areas where targeted investigations were required (e.g., for SCC detection and within the study area);
- All relevant resources and datasets as presented by the 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/>), including the 2015 North West Biodiversity Sector Plan (NW BSP) and the online screening tool, were consulted to gain background information on the physical habitat and potential floral diversity associated with the assessment areas;
- Based on the broad habitat units delineated before going to site and the pre-identified points of interest, which is updated based on on-site observations and access



constraints, the selected sample areas were surveyed on foot, following subjective transects, to identify the occurrence of the dominant plant species and habitat diversities, but also to detect SCC<sup>2</sup> which tend to be sparsely distributed; and

- Photographs were taken of each vegetation community that is representative of typical vegetation structure of that community, as well as photos of all detected SCC (except for sensitive species as identified by the DFFE's screening tool<sup>3</sup>).

Additional information on the method of assessment is provided in **Appendix A** of this report.

## **2.2 Definitions, descriptions, and taxon nomenclature**

Scientific nomenclature for plant species in this report follows that of the SANBI's Red List of South African Plants Online, as it relates to the Botanical Database of Southern Africa (BODATSA). For alien species, the definitions of Richardson et al. (2011) are used. Vegetation structure is described as per Edwards (1983) (refer to Appendix A: Figure A1).

## **2.3 Sensitivity Mapping**

All the ecological features of the assessment areas were considered, and sensitive areas were assessed and delineated using a Global Positioning System (GPS). A Geographic Information System (GIS) was used to project these features onto satellite imagery. The sensitivity map should assist the Environmental Assessment Practitioner (EAP) / proponent as to the suitability of the proposed mining activities and other proposed development within the study area.

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<sup>2</sup> As part of the SCC assessment, the following classes were considered:

- **Threatened species.** In terms of Section 56(1) of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA), threatened species are Red Data Listed (RDL) species falling into the following categories of ecological status: Critically Endangered (CR), Endangered (EN), Vulnerable (VU) or Protected in terms of the NEMBA Threatened or Protected Species (TOPS) Regulations (General Notice (GN) R152 of 2007, as amended). Removal, translocation and/or destruction of these species require authorisation from the DFFE.
- **Protected Species.** Species that do not necessarily fall in the above categories of ecological status, but that are deemed important from a provincial biodiversity perspective, e.g., provincially protected for the North West Province (as per the Transvaal Nature Conservation Ordinance, 1983 (Ordinance No. 12 of 1983) (TNCO) for which restricted activities may not occur without permits from the relevant provincial authorities. The List of Protected Tree Species (GN No. 536) as published in the Government Gazette 41887 dated 7 September 2018 as it relates to the NFA was also considered for the SCC assessment.

<sup>3</sup> The identity of sensitive species **may not appear** in the final EIA report **nor any of the specialist reports** released into the public domain.



## 3 RESULTS OF FLORAL ASSESSMENT

### 3.1 *Broad-scale vegetation characteristics*

The study area is located within two vegetation types, namely the Marikana Thornveld in the west and the Moot Plains Bushveld in the east, i.e., the reference vegetation types. The Marikana Thornveld is listed as endangered (EN) in Mucina and Rutherford (2006) and in the updated 2018 Vegetation Map of South Africa, Lesotho, and Swaziland (SANBI, 2018a)), whereas the Moot Plains Bushveld is listed as vulnerable (VU) in Mucina and Rutherford (2006) but as least concern (LC) in the updated 2018 Vegetation Map of South Africa, Lesotho, and Swaziland (SANBI, 2018a)).

Mucina and Rutherford (2006) describe the Marikana Thornveld as having "...open *Vachellia karroo* woodland, occurring in valleys and slightly undulating plains, and some lowland hills. Shrubs are denser along drainage lines, on termitaria and rocky outcrops or in other habitat protected from fire". In contrast, Mucina and Rutherford (2006) describe the Moot Plains Bushveld as consisting of "...open to closed, low, often thorny savanna dominated by various species of *Vachellia* and *Senegalia* in the bottomlands and plains as well as woodlands of varying height and density on the lower hillsides. The herbaceous layer is dominated by grasses".

### 3.2 *Ground-truthed vegetation characteristics*

Overall, the habitat within the study area was characterised by transformed areas due to vegetation clearance<sup>4</sup> as part of mining expansions in which vegetation cover ranged from almost absent to low (Figure 2). Where vegetation was present, it was generally dominated by alien and invasive plant (AIP) species and/or native pioneer species that favour disturbed habitats. Given the level of transformation within the study area because of mining expansion, the presence of indigenous vegetation<sup>5</sup> was confirmed to be absent. The biodiversity of the study area was thus defined under one broad habitat unit as described below (Figure 3).

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<sup>4</sup> **Clearance of Indigenous Vegetation Explanatory Document. May 2017:** Clearance is referred to as "Ploughing of land, bulldozing of an area, eradication or removal of vegetation cover with chemicals, amongst others, constitutes clearance of vegetation, provided that this will result in the vegetation being eliminated, removed or eradicated."

<sup>5</sup> **The NEMA Listing Notice definition of indigenous vegetation:** "Indigenous vegetation: refers to vegetation consisting of indigenous plant species occurring naturally in an area, regardless of the level of alien infestation and where the topsoil has not been lawfully disturbed during the preceding 10 years."





**Figure 2:** Images illustrating the extent of transformation within the West Above Ground WRD (top image) and the East Above Ground WRD (bottom image). From the images, it is evident that vegetation is largely lacking, especially within the pits. Surrounding vegetation (i.e., around the pits) is lacking because of historic clearing and mining activities. Google imagery as of June 2022.

The habitat unit identified within the study area (and thus within the West Above Ground WRD and the East Above Ground WRD) was defined as **Transformed Habitat**. This habitat comprised approximately 165 ha and was associated with areas of 1) historic mining activities (i.e., in which low vegetation cover was identified and AIP and native pioneer species were recorded), 2) current mining activities (i.e., in the existing pits in which vegetation cover was largely absent), and 3) associated road and building infrastructure.

Within the surrounding areas there are Freshwater Features and areas of natural, vegetation. The Freshwater features that are present within the area surrounding the study area, namely an unchanneled valley bottom wetland (UCVBW; in the north of the West Above Ground WRD), a channelled valley bottom wetland (CVBW; in the north of the West Above Ground



WRD), and the Sterkstroom River (between the West and East Above Ground WRDs; Figure 3). These features are largely degraded and have been extensively modified by anthropogenic activities, e.g., historic, and current mining as well as historic agricultural activities. Despite this, the freshwater features, especially the CVBW and the Sterkstroom River provide connective corridors within the greater landscape (SAS 202238, 2022). The surrounding vegetated areas are largely degraded in nature (because of edge effects from mining activities, and historic mining and agriculture (SAS 213199 (2013)).



**Figure 3:** Image illustrating the freshwater features surrounding the study area. Freshwater Features include an UCVBW (light blue feature above the West Above Ground WRD, red polygon), a CVBW (cyan feature in the north of the West Above Ground WRD, yellow polygon), and the Sterkstroom River (dark blue feature between the West and East Above Ground WRDs).

For a breakdown of the floral communities, habitat characteristics and conservation sensitivities associated with the Transformed habitat unit, refer to Section 3.3. Figure 4 depicts the full extent and the zoomed extent of the study area and its associated Habitat Unit.

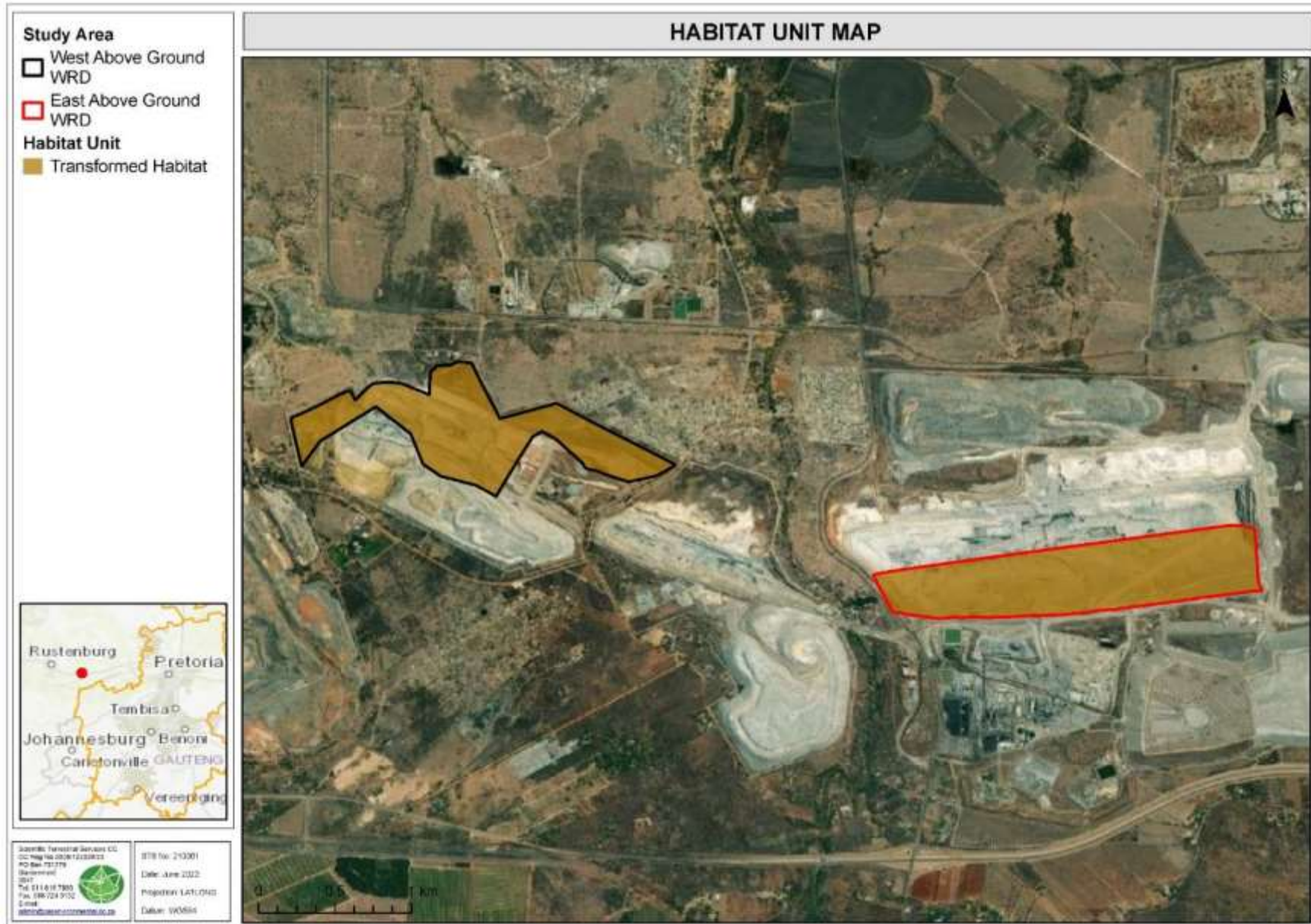



Figure 4: Conceptual illustration of the habitat unit associated with the study area.





### 3.3 Transformed Habitat

REFERENCE PHOTO/S	
	
<p>Representative pictures illustrating the Transformed Habitat Unit. Photograph (a) illustrates the typical mining landscape associated with the study area, (b) illustrates areas in which vegetation was absent, and (c) illustrates areas within the study area where vegetation was present, albeit in low densities and dominated by AIP and/or native pioneer species.</p>	
HABITAT OVERVIEW	SPECIES OVERVIEW
<p>The Transformed Habitat was the only habitat identified within the study area. The study area (including both the West Above Ground WRD and the East Above Ground WRD) are located within the active mining areas of the Tharisa Mine. As a result of their location within active mining areas, the associated vegetation associated has been significantly impacted, i.e., vegetation cover ranged from absent to low across the habitat unit. Typically, AIP species dominated in areas where vegetation was present. A low diversity of native species was recorded within the habitat; however, these species typically favour and can persist in disturbed environments.</p> <p>The Transformed Habitat is currently in a very poor ecological condition. Given the degree of mining activities and associated edge effects within the study area (i.e., the West Above Ground WRD and the East Above Ground WRD), the habitat is no longer considered to be representative of (1) either of the reference vegetation types (i.e., the Marikana Thornveld and/or the Moot Plains Bushveld), or (2) the threatened ecosystem (i.e., the Marikana Thornveld ecosystem).</p> <p><u>Vegetation structure:</u> The vegetation structure can be defined as <b>transformed in which no specific vegetation structure was evident</b>. Floral diversity was absent to very low throughout the habitat unit.</p>	<p>Compositional characteristics of the habitat unit:</p> <ul style="list-style-type: none"> <li>➤ <b>Dominant grass species</b> included <i>Aristida congesta</i> subsp. <i>congesta</i>, <i>Enneapogon cenchroides</i>, <i>Melinis repens</i>, and <i>Tragus racemosus</i>;</li> <li>➤ <b>Forb species</b> were poorly represented. Forbs that were recorded included <i>Commelina cf. erecta</i> and <i>Lagera decurrens</i>;</li> <li>➤ <b>The woody layer</b> was poorly represented, and only occasional woody individuals were recorded. Typical species recorded included <i>Gomphocarpus fruticosus</i>, <i>Searsia leptodictya</i>, and <i>Vachellia karroo</i>; and</li> <li>➤ <b>AIPs dominated</b> within the habitat. Typical species recorded included <i>Bidens plosa</i> (Not Listed, NL), <i>Conzya bonariensis</i> (NL), <i>Hibiscus trionum</i> (NL), <i>Melia azedarach</i> (NEMBA Category 1b), <i>Nicotiana glauca</i> (NEMBA Category 1b), <i>Pennisetum setaceum</i> (NEMBA Category 1b), <i>Tagetes minuta</i> (NL), and <i>Zinnia peruviana</i> (NL). Refer also to section 3.4.</li> </ul> <p>Refer to <b>Appendix C</b> for a list of species recorded within the habitat.</p>



SPECIES OF CONSERVATION CONCERN AND PRESENCE OF UNIQUE LANDSCAPES (CBAs, ESAs, PROTECTED AREAS, INDIGENOUS FOREST, ETC)	
<b>Presence of Unique Landscapes</b>	<p>The Transformed Habitat is situated within i) a threatened ecosystem, namely the VU Marikana Thornveld ecosystem (gazetted - Government Notice (GN) 1002 of 2011), ii) the Magaliesburg Biosphere Reserve (South African Conservation Areas Database (SACAD), Q4_2021), iii) within CBA2<sup>6</sup>, ESA1<sup>7</sup> and ESA2<sup>8</sup> habitat (NWBSP), and iv) within areas of High and Moderate Biodiversity Importance (Mining and Biodiversity Guidelines, 2012)<sup>9</sup>.</p> <p>The classification of CBA2 areas within the Transformed Habitat was not supported following the field investigation because of the transformed state and significantly degraded ecological condition thereof. Furthermore, given the degree of degradation, lack of vegetation cover and habitat fragmentation, the presence of ESA habitat across the study area was also not confirmed. Given the aforementioned, the Transformed Habitat is also no longer considered to be representative of either the reference vegetation types or the Threatened Ecosystem in which it is located.</p> <p>Given the above, the very high sensitivity assigned by the National web-based screening tool to the study area was not confirmed.</p>
<b>Species of Conservation Concern</b>	<p>No threatened floral SCC were recorded on site during the April 2022 field assessment. In terms of Section 56 of the National Environmental Management: Biodiversity Act, 2004 (Act No.10 of 2004) (NEMBA), threatened species are Red Data Listed (RDL) species falling into the Critically Endangered (CR), Endangered (EN), VU or Protected (P) categories of ecological status. No suitable habitat to support RDL species was recorded on site.</p> <p>The screening tool indicated that the study area is in an area of <b>low sensitivity</b> from a Plant Species Theme perspective. As no RDL species were recorded within the study area and given that no suitable habitat to support RDL species was recorded within the study area, the low sensitivity assigned to the Plant Species Theme can be confirmed.</p>

<sup>6</sup> **CBA2** = areas characterised by ecosystems and species that are fully or largely intact and undisturbed in nature. These are biodiversity features that are approaching but have not passed their limits of acceptable change. These consist of areas with intermediate irreplaceability or some flexibility in terms of meeting biodiversity targets. There are options for loss of some components of biodiversity in these landscapes without compromising the ability to achieve biodiversity targets, although loss of these sites would require alternative sites to be added to the portfolio of CBAs. CBA2s should be maintained in a natural or near-natural state to maximise the retention of biodiversity pattern and ecological process. According to NWBSP (READ, 2015) these areas have been identified as CBA2 because they have been identified as i) part of an IBA, ii) they function as corridors in the landscape, and iii) because they function as critical corridor linkages for biodiversity.

<sup>7</sup> **ESA1** = ecosystems that are still in a natural, near-natural state or semi-natural state, and have not been previously developed. These ecosystems are moderately to significantly disturbed but are still able to maintain basic functionality within the landscape. Individual species or other biodiversity indicators may be severely disturbed or reduced. These are areas with low irreplaceability with respect to biodiversity pattern targets only. According to NWBSP (READ, 2015) these areas have been identified as ESA1 because they have been identified as part of an IBA.

<sup>8</sup> **ESA2** = ecosystems are not in a natural or near-natural state, and has been previously developed (e.g., ploughed). These ecosystems are significantly disturbed but still able to maintain some ecological functionality within the landscape. Individual species or other biodiversity indicators are severely disturbed or reduced and these are areas that have low irreplaceability with respect to biodiversity pattern targets only. These are areas with low irreplaceability with respect to biodiversity pattern targets only. These areas are required to maintain ecological processes especially landscape connectivity. According to NWBSP (READ, 2015) these areas have been identified as ESA2 because they have been identified as i) part of an IBA, and ii) because they function as critical corridor linkages for biodiversity.

<sup>9</sup> **Areas of High Biodiversity Importance:** Risk for mining: High risk for mining. Implications for mining: These areas are important for conserving biodiversity, for supporting or buffering other biodiversity priority areas, for maintaining important ecosystem services for communities or the country. An EIA should include an assessment of optimum, sustainable land use for a particular area and will determine the significance of the impact on spatial biodiversity. **Areas of Moderate Biodiversity Importance:** Risk for mining: Moderate risk for mining. Implications for mining: EIAs and their associated specialist studies should focus on confirming the presence and significance of these biodiversity features (e.g., threatened species) not included in the existing datasets, and on providing site-specific information to guide the application of the mitigation hierarchy.



The Transvaal Nature Conservation Ordinance, 1983 (Ordinance No. 12 of 1983) (TNCO) provides a list of Protected Plants (Schedule 11) and Specially Protected Species (Schedule 12) for the North West Province. These species were also considered as part of the SCC assessment for the study area because they are considered important provincially. However, no species as listed by the TNCO, nor any suitable habitat for such species, was recorded within the study area.

Additionally, protected species as per the National Forest Act, 1998 (Act No. 84 of 1998) (NFA) and the Threatened or Protected Species (TOPS) List as per the 2007 Regulations were included in the SCC assessment. However, no species as listed by the NFA or TOPS List, nor any suitable habitat for such species, was recorded within the study area.

A lack of suitable habitat for SCC is attributed to the significantly degraded nature of the Transformed Habitat. Although SCC are unlikely to be recorded within the study area, if in the case that such species are identified then appropriate measures should be followed: Permits from the North West Department of Rural, Environmental and Agricultural Development (DREAD) and authorisation from the DFFE should be obtained to remove, cut, or destroy any protected and/or threatened species (as indicated in Appendix B) before any vegetation clearing may take place.

Refer to **Appendix B** for the complete floral SCC assessment results.

#### REFERENCE PHOTOS OF FLORA WITHIN THIS HABITAT UNIT



Top, from left to right: *Pennisetum setaceum* (in flower; a NEMBA Category 1b species frequently recorded within the habitat, *Melinis repens* (in flower; a native grass species occasionally recorded), *Nicotiana glauca* (in flower; a NEMBA Category 1b woody species recorded within the Transformed Habitat), and *Tagetes minuta* (in flower; a problem plant species (i.e., an AIP that is NL) that was frequently recorded within the habitat).

#### CONCLUDING REMARKS

The Transformed Habitat is of low importance from a floral ecological and resource management perspective.

##### Key considerations:

- The reference vegetation type, as per Mucina & Rutherford (2006), included the **Marikana Thornveld** and the **Moot Plains Bushveld**. Furthermore, the study area was also located within the **VU Marikana Thornveld threatened ecosystem**. However, given the significantly degraded and altered nature of the Transformed Habitat, the habitat is no longer considered representative of 1) either the reference vegetation types, or 2) the threatened ecosystem.
- Overall, the Transformed Habitat did not provide suitable habitat to sustain viable populations of floral SCC (including provincial and nationally protected species). A lack of suitable habitat for SCC is attributed to the significantly degraded nature of the Transformed Habitat. Although SCC are unlikely to be recorded within the study area, if in the case that such species are identified then appropriate measures should be followed: Permits from the DREAD and authorisation from the DFFE should be obtained to remove, cut, or destroy any protected and/or threatened species (as indicated in Appendix B) before any vegetation clearing may take place.



- In terms of the screening tool outcome, the Transformed Habitat does match the sensitivity assigned to either the Terrestrial Biodiversity Theme or the Plant Species Theme. Given that no RDL species were recorded and that no suitable habitat for RDL species is available within the study area, the low sensitivity assigned by the screening tool to the Plant Species Theme was supported. In addition, as no CBA, ESA or threatened ecosystem habitat was identified within the study area, the very high sensitivity as assigned by the screening tool to the Terrestrial Biodiversity Theme was not supported.
- Due to the area already being exposed to disturbances (e.g., mining activities) and edge effect impacts (e.g., AIP proliferation), the Transformed Habitat is susceptible to continued and worsening AIP proliferation. Care must be taken to limit edge effects on the surrounding natural areas. Furthermore, it is recommended that an AIP species management plan be developed to manage the proliferation AIPs within the study area and thus limit the spread of such species to neighbouring areas.



### 3.4 Alien and Invasive Plant (AIP) Species

South Africa is home to an estimated 759 naturalised or invasive terrestrial plant species (Richardson et al., 2020), with 327 plant species, most of which are invasive, listed in national legislation<sup>10</sup>. Many introduced species are beneficial, e.g., almost all agriculture and forestry production are based on alien species, with alien species also widely used in industries such as horticulture. However, some of these species manage to “escape” from their original locations, spread and become invasive. Although only a small proportion of introduced species become invasive (~0.1–10%), those that do proceed to impact negatively on biodiversity and the services that South Africa’s diverse natural ecosystems provide (from ecotourism to harvesting food, cut flowers, and medicinal products) (van Wilgen and Wilson, 2018).

#### 3.4.1 Legal Context

South Africa has released several articles of legislation that are applicable to the control of alien species. Currently, invasive species are controlled by the National Environmental Management Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA) – Alien and Invasive Species Regulations, 2020, in Government Gazette 43735 dated 25 September 2020. AIPs defined in terms of NEMBA are assigned a category and listed within the NEMBA List of Alien and Invasive Species (2020) in accordance with Section 70(1)(a) of the NEMBA:

- **Category 1a** species are those targeted for urgent national eradication;
- **Category 1b** species must be controlled as part of a national management programme, and cannot be traded or otherwise allowed to spread;
- **Category 2** species are the same as category 1b species, except that permits can be issued for their usage (e.g., invasive tree species can still be used in commercial forestry, providing a permit is issued that specifies where they may be grown and that permit holders “*Unless otherwise specified in the Notice, any species listed as a Category 2 Listed Invasive Species that occurs outside the specified area contemplated in sub-regulation (1), must, for purposes of these regulations, be considered to be a Category 1b Listed Invasive Species and must be managed according to Regulation 3*”); and

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<sup>10</sup> Government Notice number 1003: Alien and Invasive Species Lists, 2020, in Government Gazette 43726 dated 18 September 2020, as it relates to the National Environmental Management Biodiversity Act, 2004 (Act No 10 of 2004).



- **Category 3** are listed invasive species that can be kept without permits, although they may not be traded or further propagated, and must be considered a Category 1b species if they occur in riparian zones.

Duty of care related to listed invasive species are referred to in NEMBA Section 73<sup>11</sup>. The motivation for this duty of care is both environmentally and economically driven. Management of alien species in South Africa is estimated to cost at least ZAR 2 billion (US\$142 million) each year - this being the amount currently spent by the national government's DFFE - i.e., the Working for Water programme (van Wilgen, 2020). Managing AIPs early on will reduce clearing costs in the long run.

### 3.4.2 Site Results

A total of 11 species were recorded within the Transformed Habitat of the study area. Of the 11 AIPs recorded during the field assessment, five species are listed under NEMBA Category 1b. The remaining six species are not listed under NEMBA. However, these species are problem plants<sup>12</sup> and are deemed to have a negative impact on indigenous floral communities within the study area. Refer to Table 1 below for more information on the AIPs recorded on site.

Due to the extent of AIPs within the study area, it is highly recommended that the existing Alien and Invasive Species Control and Management Plan for the mine be updated to include the new development areas. The Existing AIP control plan should be regularly updated to reflect the new AIP regulations<sup>13</sup> and AIP species lists<sup>14</sup> and implemented to ensure the further loss of indigenous floral communities do not occur.

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<sup>11</sup> Section 73(2): A person who is the owner of land on which a listed invasive species occurs must-

- a) notify any relevant competent authority, in writing, of the listed invasive species occurring on that land;
- b) take steps to control and eradicate the listed invasive species and to prevent it from spreading; and
- c) take all the required steps to prevent or minimise harm to biodiversity.

<sup>12</sup> A problem plant is any plant, shrub or tree which has a negative environmental impact in a particular locality and result in the subsequent loss of biodiversity, and (potential) excessive water consumption. These species, which can be native, have not been listed or classified as alien or invasive plants by the current South African. *The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA)*.

<sup>13</sup> GN number R.1020: Alien and Invasive Species Regulations, 2020, in Government Gazette 43735 dated September 2020 as it relates to the NEMBA.

<sup>14</sup> GN number 1003: Legislation to come into force on the 1st 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.



**Table 1: Dominant alien floral species identified within the Transformed Habitat during the field assessment with their invasive status as per NEMBA: Alien and Invasive Species Lists, GN R1003 of 2020.**

Scientific Name	Common Name	Origin	NEMBA Category or Problem Plant
<b>Woody Species</b>			
<i>Jacaranda mimosifolia</i>	Jacaranda	South America	1b
<i>Melia azedarach</i>	Syringa	India & Malaysia	1b
<i>Nicotiana glauca</i>	Tree tobacco	South America	1b
<i>Ricinus communis</i>	Castor oil plant	Mediterranean Basin, Eastern Africa, and India	1b
<b>Herbaceous Species</b>			
<i>Amaranthus hybridus</i>	Pigweed	North America	NL
<i>Bidens Pilosa</i>	Blackjack	Central & South America	NL
<i>Conzya bonariensis</i>	Flea bean	Central & South America	NL
<i>Hibiscus trionum</i>	Flower-of-an-hour	Mediterranean	NL
<i>Tagetes minuta</i>	Khaki Bos	South America	NL
<i>Zinnia peruviana</i>	Zinnia	Peru	NL
<b>Graminoid Species</b>			
<i>Pennisetum setaceum</i>	Fountain grass	East Africa	1b

## 4 SENSITIVITY MAPPING

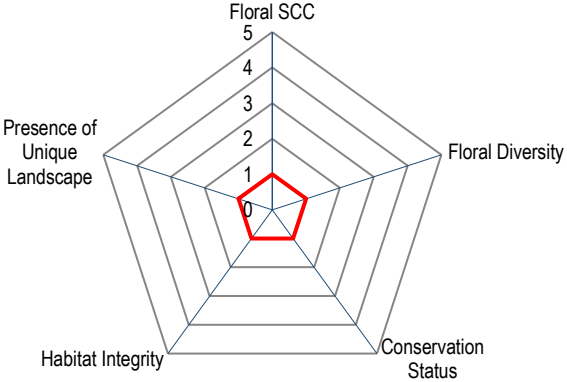
The screening tool identified the study area to be in a **low sensitivity** area for the Plant Species Theme. The Terrestrial Biodiversity Theme was identified as having a **very high sensitivity**. Based on the ground-truthed results of the site visit, Table 2 below presents the sensitivity of each identified habitat unit along with an associated conservation objective and implications for development.

In terms of the screening tool outcome, the Transformed Habitat does match the sensitivity assigned to either the Terrestrial Biodiversity Theme or the Plant Species Theme. Given that no RDL species were recorded and that no suitable habitat for RDL species is available within the study area, the low sensitivity assigned by the screening tool to the Plant Species Theme was supported. In addition, as no CBA, ESA or threatened ecosystem habitat was identified within the study area, the very high sensitivity as assigned by the screening tool to the Terrestrial Biodiversity Theme was not supported.

Figure 5 conceptually illustrates the areas considered to be of varying ecological sensitivity and how they will be impacted by the proposed development. The areas are depicted according to their sensitivity in terms of the presence or potential for floral SCC, habitat integrity and levels of disturbance, threat status of the habitat type, the presence of unique landscapes and overall levels of diversity (compared to a reference type).



**Table 2: A summary of the sensitivity of each habitat unit and implications for development.**

Habitat Sensitivity	Conservation objective	Habitat Unit	Key habitat characteristics
<p style="text-align: center; background-color: #4CAF50; color: white; padding: 5px;">Low</p>  <p>The radar chart displays five metrics on a scale of 0 to 5. The current scores are: Floral SCC (5), Floral Diversity (3), Conservation Status (2), Habitat Integrity (2), and Presence of Unique Landscape (1). A red pentagon highlights the current scores.</p>	<p>Optimise development potential.</p>	<p><b>Transformed Habitat Unit</b></p>	<ul style="list-style-type: none"> <li>- Indigenous vegetation absent.</li> <li>- Vegetation density ranged from absent to low.</li> <li>- Habitat significantly transformed because of mining activities and mining edge effects.</li> <li>- AIP infestation is prominent.</li> <li>- Floral SCC are lacking and the potential for the habitat to support viable populations of SCC is deemed low.</li> <li>- Significant biodiversity features?</li> </ul>





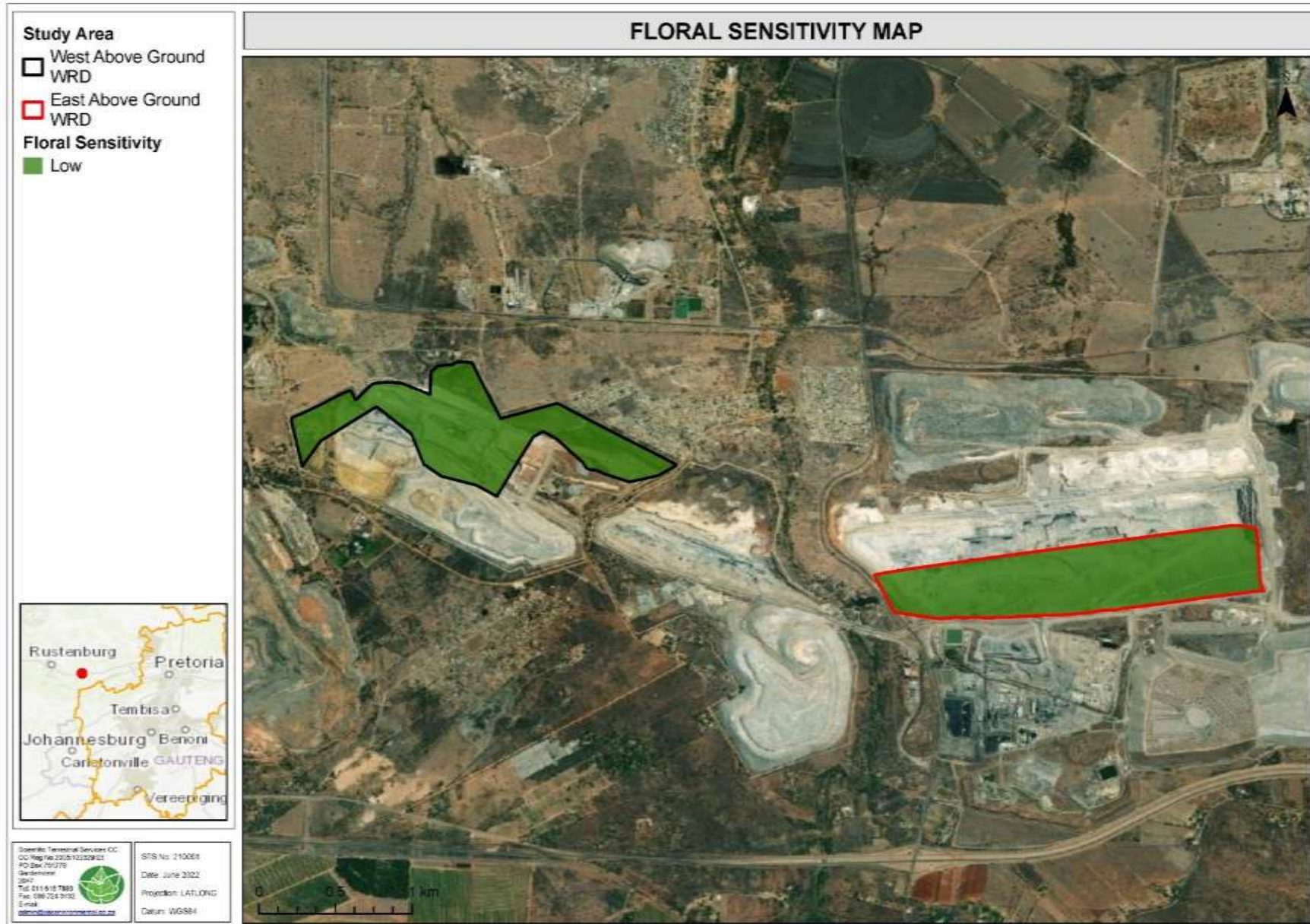


Figure 5: Conceptual illustration of the habitat sensitivity associated with study area as identified during the field assessment.



## 5 IMPACT ASSESSMENT

An impact discussion and assessment of all potential i) Mining Phase (i.e., Construction and Operational), and ii) Decommissioning & Rehabilitation Phase impacts are provided in Section 5.2 (Tables 4 – 7). All mitigatory measures required to minimise the perceived impacts are presented in Section 5.4 and Tables 8. The impact assessment (as provided by the proponent) was undertaken with reference to the perceived impacts prior to the implementation of mitigation measures and following the implementation of mitigation measures. The mitigated results of the impact assessment have been calculated on the premise that all mitigation measures as stipulated in this report are adhered to and implemented. Should such actions not be adhered to, it is highly likely that post-mitigation impact scores will increase.

The proposed activities associated with the Tharisa Mine expansion, that will take place within the study area, will include the following:

1. Extending a previously approved WRD – i.e., the West Above Ground WRD; and
2. Establishing a WRD above backfilled portions of the East and West pits – i.e., the East Above Ground WRD.

Freshwater features although not present within the study area are present within the surrounding area. As freshwater features are not located directly within the study area, the direct impacts of the proposed mining activity are not included in the impact assessment. However, the associated indirect impacts associated with the proposed mining development on these freshwater features are included in the impact assessment, specifically as impacts associated with the surrounding area.

### 5.1. Activities and Aspects

**Table 3: Activities and Aspects likely to impact on the floral resources of the study area.**

ACTIVITIES AND ASPECTS REGISTER	
Mining (i.e., Construction & Operational) Phase	
-	Not adhering to the average slope recommendations of 1V:3H.
-	<b>Impact:</b> Loss of floral habitat both within the study area and the surrounding areas. .
-	Site clearing and the removal of vegetation.
-	<b>Impact:</b> Loss of floral habitat, diversity, and the possible loss of floral SCC.
-	Proliferation of AIP species that colonise in areas of increased disturbances and that outcompete native species, including the further transformation of adjacent natural habitat.
-	<b>Impact:</b> Loss of favourable floral habitat outside of the direct development footprint, including a decrease in species diversity and a potential loss of floral SCC.
-	Additional pressure on floral habitat (in surrounding areas) by increased human movement associated with the proposed mining activities, including increased vehicular movement, contributing to: <ul style="list-style-type: none"> <li>• Overexploitation through the removal and/or collection of important or sensitive floral SCC beyond the direct footprint area;</li> </ul>



### ACTIVITIES AND ASPECTS REGISTER

<ul style="list-style-type: none"> <li>• Increased introduction and spread of AIPs; and</li> <li>• Increased risk of fire frequency.</li> </ul>	
- <b>Impact:</b> Loss of sensitive floral habitat and the potential loss of floral SCC.	
- Potentially poorly managed edge effects: <ul style="list-style-type: none"> <li>• Ineffective rehabilitation of compacted areas, bare soils, or eroded areas leading to the continual proliferation of AIP species in disturbed areas and subsequent spread to surrounding natural areas altering the floral habitat; and</li> <li>• Ineffective management of edge effects (e.g., AIP proliferation) that will impact surrounding freshwater habitats;</li> </ul>	
- <b>Impact:</b> Loss of floral habitat, diversity, and SCC within the direct footprint of the proposed development. Loss of surrounding floral diversity and floral SCC through the displacement of indigenous flora by AIP species - especially in response to disturbance in natural areas.	
- Dumping of excavated and construction material outside of designated areas, promoting the establishment of AIPs.	
- <b>Impact:</b> Loss of floral habitat, diversity, and SCC through displacement by AIPs.	
- Dust generated during mining activities accumulating on the surrounding floral individuals, altering the photosynthetic ability of plants <sup>15</sup> and potentially further decreasing optimal growing /re-establishing conditions.	
- <b>Impact:</b> Declines in plant functioning leading to loss of floral species and habitat for optimal growth.	
- Habitat fragmentation in the surrounding habitat because of mining activities.	
- <b>Impact:</b> Loss or alteration of floral habitat and species diversity.	
- Possible increased fire frequency during construction.	
- <b>Impact:</b> Loss or alteration of floral habitat and species diversity.	
- Risk of discharge and contamination from all operational facilities may pollute receiving environment with special mention of the salinisation of soils and nearby freshwater habitats (refer to Freshwater Assessment: SAS 202238 2022).	
- <b>Impact:</b> Leading to altered floral and aquatic habitat and loss of floral diversity.	
- On-going disturbance during the Mining Phase may lead to erosion and sedimentation of surrounding floral habitat.	
- <b>Impact:</b> Degradation of favourable habitat and limited potential for floral re-establishment leading to loss of floral habitat and diversity within the local area.	
- Seepage affecting soils and the groundwater regime.	
- <b>Impact:</b> Altered floral habitat and loss of floral diversity.	
Decommissioning & Rehabilitation Phase	
- Ineffective rehabilitation of exposed and impacted areas, increasing erosion risk and AIP proliferation within the surrounding areas.	
- <b>Impact:</b> Permanent loss of floral habitat, diversity and SCC, and a higher likelihood of edge effect impacts on adjacent and nearby natural vegetation.	
- Potential poor management and failure to monitor rehabilitation efforts, leading to: <ul style="list-style-type: none"> <li>• Landscapes left fragmented, resulting in reduced dispersal capabilities of floral species and an overall decrease in floral diversity;</li> <li>• Compacted soils limiting the re-establishment of natural vegetation;</li> <li>• Increased risk of erosion in areas left disturbed.</li> </ul>	
- <b>Impact:</b> Long-term (or permanent) loss of floral habitat, diversity, and SCC.	
- Disturbance of soils as part of demolition activities.	
- <b>Impact:</b> Loss of favourable growing conditions for floral communities.	
- On-going risk of contamination from mining facilities beyond closure.	
- <b>Impact:</b> Permanent impact on floral habitat.	
- On-going seepage and runoff may affect the groundwater regime and nearby freshwater features beyond closure.	
- <b>Impact:</b> Loss of floral habitat and associated species.	

<sup>15</sup> Sett, R. (2017). Responses in plants exposed to dust pollution. Horticulture International Journal, 1(2), 00010.



## 5.2 Floral Impact Assessment Results

The sections below provide the significance of perceived impacts arising from the proposed mining activities for the study area. The impact assessment is based on the layout provided by the proponent as illustrated in Figure 1.

### 5.2.1 IMPACT: Loss of Floral Habitat and Species Diversity.

The Transformed habitat is of low sensitivity. This habitat was significantly transformed and modified and was not considered to be representative of the reference vegetation type.

**Impacts associated with the Mining Phase:** this phase will result in the clearing of vegetation (albeit limited due to the lack of extensive vegetation cover within the habitat) for the proposed WRD development. Vegetation clearance will not impact indigenous vegetation (sensu NEMA Listing Notice). This may lead to the loss of floral species in these areas. Furthermore, the loss of favourable floral habitat and species diversity outside of the direct mining footprint may result during the Mining Phase if:

- i. AIPs are allowed to proliferate as a result of poorly managed disturbances and edge effects associated with the mining activities;
- ii. Dumping of mining material outside of designated areas occurs, promoting the establishment of AIPs which may lead to the loss of floral habitat and diversity through displacement of native species by AIPs;
- iii. Discharge and contamination from all operational facilities may pollute receiving environment with special mention of the salinisation of soils and nearby freshwater habitats (refer to Freshwater Assessment: SAS 202238 2022);
- iv. Dust generated during mining activities is allowed to accumulate on the surrounding floral individuals, altering the photosynthetic ability of plants<sup>16</sup> and potentially further decreasing optimal growing /re-establishing conditions; and
- v. Edge effects are poorly managed, including ineffective rehabilitation of compacted areas, bare soils, or eroded areas leading to the continual proliferation of AIP species in disturbed areas and subsequent spread to surrounding natural areas (may result in the alteration of floral habitat and/or the compaction of soils outside of the study area.

If mitigation measures as presented in Section 5.4 are implemented, then the significance ratings of the impacts can be reduced. The impact significance i) prior to mitigation measures is expected to be medium, and ii) post mitigation is expected to be low (Table 4).

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<sup>16</sup> Sett, R. (2017). Responses in plants exposed to dust pollution. Horticulture International Journal, 1(2), 00010.).



**Table 4: Assessment of impact for the Mining Phase: Loss of habitat and species diversity in the Transformed Habitat.**

Issue: loss of floral habitat and diversity		
Phases: Mining Phase		
Criteria	Without Mitigation	With Mitigation
Intensity	Moderate (M)	Minor (L)
Duration	Medium-term (M)	Short-term (L)
Extent	Whole site (L)	Whole site (L)
Consequence	Medium (M)	Low (L)
Probability	Definite (VH)	Definite (VH)
Significance	<b>Medium (M)</b>	<b>Low (L)</b>
<b>Nature of cumulative impacts</b>		
	The proposed project could further impact on the floral habitat and diversity through edge effect impacts, including AIP proliferation) – this is relevant to all surrounding areas (including surrounding freshwater features).	
<b>Degree to which impact can be reversed</b>		
	Moderate. The impact can be somewhat reversed once the Mining Phase is completed, and management measures are put in place and adhered to.	
<b>Degree to which impact may cause irreplaceable loss of resources</b>		
	Low-moderate.	
<b>Residual impacts</b>		
	Residual impacts are anticipated to be low. Potential residual impacts include: <ul style="list-style-type: none"> <li>- Permanent loss of and altered floral species diversity because of poorly managed edge effects (such as further AIP proliferation).</li> </ul>	



**Impacts associated with the Decommissioning & Rehabilitation Phase:** The proposed mining activities may have a notably decreased impact during this phase. This is because no further vegetation clearing, or construction is anticipated to take place. However, ongoing, or permanent loss of floral habitat and diversity is anticipated during the Decommissioning and Rehabilitation Phase if:

- i. Poorly implemented and monitored AIP Management and/or control programmes are in place which may lead to ongoing displacement of natural vegetation outside of the footprint area;
- ii. Disturbance of soils as part of demolition activities which may lead to the loss of favourable growing conditions for floral communities in the study area and surrounding areas;
- iii. Continued contamination from mining facilities beyond closure if not decommissioned effectively; and
- iv. Poorly implemented management and failure to appropriately implement and monitor rehabilitation efforts may lead to: landscapes left fragmented, resulting in reduced dispersal capabilities of floral species and a decrease in floral diversity, increases in compacted soils and increased AIP cover limiting the re-establishment of natural vegetation and an increased risk of erosion in areas left disturbed.

If mitigation measures as presented in Section 5.4 are implemented, then the significance ratings of the impacts can be reduced. The impact significance i) prior to mitigation measures is expected to be medium, and ii) post mitigation is expected to be very low (Table 5).

**Table 5: Assessment of impact for the Decommissioning & Rehabilitation Phase: Loss of habitat and species diversity in the Transformed Habitat.**

Issue: loss of floral habitat and diversity		
Phases: Decommissioning & Rehabilitation Phase		
Criteria	Without Mitigation	With Mitigation
Intensity	Moderate (M)	Minor change (L)
Duration	Long-term (H)	Short-term (L)
Extent	Beyond the site boundary (M)	Whole site (L)
Consequence	Medium (M)	Very low (VL)
Probability	Probable (H)	Possible (M)
Significance	<b>Medium (M)</b>	<b>Very Low (VL)</b>
<b>Nature of cumulative impacts</b>	The proposed project could further impact on the floral habitat and diversity through edge effect impacts, including AIP proliferation – this is relevant to all surrounding areas (including surrounding freshwater features).	



Issue: loss of floral habitat and diversity	
Degree to which impact can be reversed	Impact can be partially reversed during the decommissioning phase if management measures are put in place and strictly adhered to.
Degree to which impact may cause irreplaceable loss of resources	Very low
Residual impacts	Residual impacts are anticipated to be low. Potential residual impacts include: <ul style="list-style-type: none"> <li>- Permanent loss of and altered floral species diversity;</li> <li>- Edge effects such as further habitat fragmentation and AIP proliferation.</li> </ul>

### 5.2.2 IMPACT: Loss of Floral SCC

No floral SCC were observed at the time of assessment, and suitable habitat to support SCC was completely lacking within the study area (attributed to the level of transformation and location of the study area within an active mining area).

It is recommended that, in the unlikely event that any SCC be identified within the study area (particularly during the Mining Phase), that such species be marked by means of a GPS. All floral SCC (be it nationally or provincially protected species) that are marked should be investigated for potential relocation to suitable habitat outside the direct footprint (as far as is feasible). Good record-keeping will be necessary to record this process and to document all successes and failures associated with the relocation. Rescue and relocation of SCC should be done by a suitably qualified specialist and either relocated (if feasible) to suitable habitat outside of the development footprint or moved to registered nurseries such as the Agricultural Research Council (ARC) or the SANBI. Permits from the North West DREAD and the DFFE should be obtained to remove, cut, or destroy the above-mentioned protected species before any vegetation clearing may take place.

**Impacts associated with the Mining Phase:** The Mining Phase (prior to the implementation of mitigation measures) will result in the clearing of (albeit limited due to the lack of extensive vegetation cover within the habitat) for the proposed WRD development. Although this will lead to the loss of floral habitat, the loss of floral SCC is deemed low and suitable habitat to support SCC was absent. The Mining Phase may further be associated with the following impacts on floral SCC (prior to the implementation of mitigation measures):

- i. over exploitation through the removal and/or collection of SCC beyond the direct footprint which will result in the loss of SCC abundance and diversity;
  - ii. additional pressures associated with increased human presence within the study area resulting in an increase in the potential spread of AIP species which could result in the loss of SCC individuals and associated habitat (especially outside of the study area);
- and



- iii. poorly managed edge effects (including ineffective rehabilitation of bare areas and the subsequent spread of AIP species into surrounding areas which may result in the degradation of habitat and SCC individuals.

If mitigation measures as presented in Section 5.4 are implemented, then the significance ratings of the impacts can be reduced. The significance i) prior to mitigation measures is expected to be low, and ii) post mitigation the significance is expected to be very low (Table 6).

**Table 6: Assessment of impact for the Mining Phase: Loss of Floral SCC within the Transformed Habitat.**

Issue: loss of floral SCC habitat and diversity		
Phases: Mining Phase		
Criteria	Without Mitigation	With Mitigation
Intensity	Moderate (M)	Minor (L)
Duration	Medium-term (M)	Short-term (L)
Extent	Beyond the site boundary (M)	Whole site (L)
Consequence	Medium (M)	Low (L)
Probability	Possible (M)	Conceivable (L)
Significance	<b>Low (L)</b>	<b>Very low (VL)</b>
<b>Nature of cumulative impacts</b>		
The proposed project could further impact on the floral habitat and diversity as well as floral SCC through fragmentation of habitat of increased biodiversity importance and sensitivity.		
<b>Degree to which impact can be reversed</b>		
Moderate - high.		
<b>Degree to which impact may cause irreplaceable loss of resources</b>		
Low.		
<b>Residual impacts</b>		
Potential residual impacts include: - The ongoing loss of SCC/protected floral species and suitable habitat for such species in the surrounding areas due to unmanaged edge effects (e.g., AIP proliferation).		

**Impacts associated with the Decommissioning & Rehabilitation Phase:** this phase of the proposed development should have no impacts to the receiving environment for SCC provided that all mitigation measures are in place and that edge effects are suitably managed. Poorly managed edge effects such as potentially poorly implemented and monitored AIP Management programmes can lead to the reintroduction and proliferation of AIP species within the area which can lead to the permanent loss of SCC and associated surrounding natural floral habitat (SAS 213199 (2013)). Furthermore, ineffective monitoring of relocated SCC can





result in the loss of SCC from the focus area and poorly reinstated and represented floral SCC within rehabilitated sites.

If mitigation measures as presented in Section 5.4 are implemented, then the significance ratings of the impacts can be reduced. The significance i) prior to mitigation measures is expected to be very low, and ii) post mitigation the significance is expected to be insignificant (Table 7).

**Table 7: Assessment of impact for the Decommissioning & Rehabilitation Phase for the Loss of Floral SCC within the Transformed Habitat.**

Issue: loss of floral SCC habitat and diversity		
Phases: Decommissioning & Rehabilitation Phase		
Criteria	Without Mitigation	With Mitigation
Intensity	Minor (L)	Minor (L)
Duration	Short-term (L)	Short-term (L)
Extent	Whole site (L)	A part of the site (VL)
Consequence	Low (L)	Very low (VL)
Probability	Conceivable (L)	Conceivable (L)
Significance	<b>Very low (VL)</b>	<b>Insignificant (VL)</b>
<b>Nature of cumulative impacts</b>	The proposed project could further impact on the floral habitat and diversity as well as floral SCC through edge effects (e.g., AIP proliferation).	
<b>Degree to which impact can be reversed</b>	Moderate - high.	
<b>Degree to which impact may cause irreplaceable loss of resources</b>	Low-moderate	
<b>Residual impacts</b>	Potential residual impacts include: - The loss of suitable habitat for floral species.	

### 5.3. Impact Discussion

The impact assessment was undertaken on all aspects of floral ecology deemed likely to be affected by the proposed mining activities.

Prior to mitigation measures the i) Mining (i.e., Construction and Operational) Phase and ii) Decommissioning & Rehabilitation Phase scored an impact significance as follows:

- Mining Phase: this phase scored an impact significance ranging between medium (prior to mitigation implementation) and very low (with mitigation implemented); and
- Decommissioning & Rehabilitation Phase: this phase scored an impact significance ranging between low (prior to mitigation implementation) and insignificant (with mitigation implemented).



### 5.3.1. Impact on Floral Habitat and Diversity

The proposed mining activities will result in the minimal clearance of vegetation within habitat that is deemed to be of a low floral sensitivity.

Low to very significance impacts are anticipated for the **Transformed Habitat Unit** due to the transformed nature of this habitat. Overall, this habitat supported a low diversity of floral species. Given that the floral communities within this habitat unit have shifted significantly away from the reference vegetation type a significant loss of floral communities is not anticipated.

Negative impacts likely to be associated with the floral ecology within and around the study area include, but are not limited to, the following:

- Mining footprint creep and placement of infrastructure within natural habitat outside of the authorised footprint, including surrounding freshwater features; and
- AIP proliferation and erosion in disturbed areas.

### 5.3.2. Impacts on Floral SCC

No floral SCC were observed at the time of assessment, and suitable habitat to support SCC was completely lacking within the study area (attributed to the level of transformation and location of the study area within an active mining area).

### 5.3.3. Impact on CBAs, ESAs, Threatened Vegetation and Protected Areas

National databases indicate that the study area is located within (1) CBA2, ESA1, and ESA2 habitat (as per the NWBSP), and (2) a threatened habitat (namely the VU Marikana Thornveld). However, the site assessment included that these biodiversity features have been degraded (attributed to the significantly transformed and modified habitat present within the study area) and the CBA ad ESAs are therefore no longer contributing toward reaching biodiversity targets, and representative features of the threatened ecosystem in not retained in the habitats on site. As such, no impacts to CBA2, ESA1, ESA2, and threatened ecosystem habitat within the study area are anticipated (and thus are not assessed in the impact tables above) as the study area in located within existing transformed habitat.

### 5.3.4. Probable Residual Impacts

Even with extensive mitigation, residual impacts on the receiving floral ecological environment are deemed likely. The following points highlight the key latent impacts that have been identified:



- Destruction of floral habitat (including CBA2 (i.e., Sterkstroom River);
- Permanent loss of and altered floral species diversity outside of the footprint area, including loss of favourable habitat for SCC; and
- Edge effects such as further habitat fragmentation and AIP proliferation in adjacent natural vegetation.

### 5.2.5. Cumulative Impacts

The proposed mining activities could further impact on the floral habitat and diversity as well as floral SCC in the surrounding area through fragmentation of habitat.

AIPs are reported to be one of the greatest threats to biodiversity and are closely associated with disturbance, being able to colonise disturbed areas rapidly. Several sections of the study area are already associated with AIP proliferation and, if not controlled, or if disturbed areas are not sufficiently rehabilitated, these species can continue to spread across the landscape, resulting in a cumulative loss of indigenous floral species and potential permanent displacement of SCC (especially relevant to the Sterkstroom River). If no AIP Management plan gets implemented for the proposed development (or the current AIP Management plan is not updated to reflect the current AIP proliferation within the study area), such species will spread to adjacent natural areas.

## 5.4. Integrated Impact Mitigation

The table below (Table 8) highlights the key, general integrated mitigation measures that are applicable to the proposed mining activities in order to suitably manage and mitigate the ecological impacts that are associated with all phases of the proposed development. Provided that all management and mitigation measures are implemented, as stipulated in this report, the overall risk to floral and faunal diversity, habitat and SCC can be mitigated and minimised.

**Table 8: A summary of the mitigatory requirements for floral resources.**

<b>Project phase</b>	Mining Phase (i.e., the construction and maintenance phase)
<b>Impact Summary</b>	Loss of floral habitat, species, and SCC
<b>Proposed mitigation and management measures:</b>	
<b>Development footprint</b>	
<ul style="list-style-type: none"> <li>• Minimise loss of vegetation where possible through adequate planning and, where necessary, by incorporating the sensitivity of the biodiversity report as well as any other specialist studies;</li> <li>• The construction footprint must be kept as small as possible in order to minimise impact on the surrounding environment (edge effect management);</li> <li>• Removal of vegetation must be restricted to the approved development footprint.</li> <li>• Vehicles should be restricted to travelling only on designated roadways to limit the ecological footprint of the mining activities. Additional road construction should be limited to what is absolutely necessary, and the footprint thereof kept to a minimal;</li> <li>• No collection of indigenous floral species must be allowed by construction personnel;</li> <li>• Care should be taken during the construction of the proposed infrastructure development to limit edge effects to surrounding natural habitat. This can be achieved by:</li> <li>• Ensuring continued demarcation all footprint areas during mining activities;</li> </ul>	



- No construction rubble or cleared AIP species are to be disposed of outside of demarcated areas, and should be taken to a registered waste disposal facility or low sensitivity areas allocated specifically for waste dumping;
- All soils compacted as a result of mining activities should be ripped and profiled and reseeded once these areas become available for rehabilitation;
- Manage the spread of AIP species, which may affect remaining natural habitat within surrounding areas (especially nearby freshwater features). Specific mention in this regard is made to Category 1b species identified within the development footprint areas (refer to section 3.4 of this report); and
- No dumping of litter, rubble or cleared vegetation on site should be allowed. Infrastructure and rubble removed because of mining activities should be disposed of at an appropriate registered dump site away from the development footprint. No temporary dump sites should be allowed in areas with natural vegetation. Waste disposal containers and bins should be provided during the construction and maintenance phase for all construction rubble and general waste. Vegetation cuttings must be carefully collected and disposed of at a separate waste facility or demarcated low sensitivity site.
- If any spills occur, they should be immediately cleaned up to avoid soil contamination that can hinder floral rehabilitation later down the line. Spill kits should be kept on-site within workshops. In the event of a breakdown, maintenance of vehicles must take place with care, and the recollection of spillage should be practised, preventing the ingress of hydrocarbons into the topsoil;
- Suppress dust to mitigate the impact of dust on flora within a close proximity of construction activities (Sett 2017) – any chemicals used for this purpose must not be permitted to enter the Freshwater habitats; and
- Upon completion of mining activities, it must be ensured that no bare areas remain, and that indigenous species be used to revegetate the disturbed area.
- Ensure sound geotechnical design and carefully plan future WRD utilization and closure;
- Slope monitoring should be carried out regularly to manage the slope angle and height with variation in material properties.
- Ensure that the slope ratio is not excessively steep which may induce slope failure or implement mechanisms to improve slope stability where necessary.
- Ensure that where berms and/or cut of trenches are developed and appropriately sized around the WRDs they are sufficient in design to capture any sediment and water runoff and stop such spreading into the surrounding soils in line with the requirements of Regulation GN704 of 2016;
- The drains and associated clean and dirty water separation structures must be maintained in good working order.
- Regular monitoring should be undertaken to assess the footprint area of the WRD and to measure the degree of sedimentation and soil disturbance in order to allow for adaptive management;
- Where high levels of sediment are collecting at the base of the various WRDs, these areas should be revegetated to stabilise these sections to minimise further dispersion of sediment into the surrounding soils during high rainfall events. Should this not be feasible, this material should be collected, transported, and stored in a suitable waste facility where it cannot be transported further through erosive agents. The remaining bare soil areas are then to be revegetated accordingly;
- Any areas where there is increased risk that water runoff and sediment will enter into any freshwater systems, appropriate drainage infrastructure must be developed to minimise this risk; and
- An alien plant control plan must be implemented, and all alien plants controlled, with focus on the bases of the WRDs within 50 m of the toe of each WRD. All alien plants in the freshwater systems must be controlled in line with relevant legislation to minimise further dispersal of alien plant propagules. The relevant legislation is listed below:
  - The Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) (CARA)
  - The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA);
  - Government Notice (GN) number R.1020: Alien and Invasive Species Regulations, 2020, in Government Gazette 43735 dated 25 September 2020 as it relates to the NEMBA; and
  - GN number 1003: Alien and Invasive Species Lists, 2020, in Government Gazette 43726 dated 18 September 2020, as it relates to the NEMBA.

#### **Alien Vegetation**

- Prior to the commencement of the proposed mining activities, the current AIP Management/Control Plan should be updated by a qualified specialist and subsequently implemented:
- Removal of AIPs should occur regularly throughout the mining phase and continue throughout the i) Mining Phase, and ii) the Decommissioning & Rehabilitation Phase;
- The existing AIP Management/Control Plan should be regularly updated (and implemented) by a qualified professional. No use of uncertified chemicals may be used for chemical control of AIPs. Only trained personnel are to use chemical and mechanical control methods of AIPs. Chemical control may not be used near freshwater features (e.g., within the surrounding areas of the mining area).
- Edge effects arising from the proposed mining activities, such as erosion and AIP proliferation, which may affect adjacent natural areas, need to be strictly managed. Specific mention in this regard is made of Category 1b AIP species (as listed in the NEMBA Alien species lists, 2020), in line with the NEMBA



<p>Alien and Invasive Species Regulations (2020) (section 3.4 of this report). Ongoing monitoring and clearing/control should take place throughout the i) Mining and ii) Decommissioning &amp; Rehabilitation Phases of the proposed mining activities; and</p> <ul style="list-style-type: none"> <li>• Alien vegetation that is removed must not be allowed to lay on unprotected ground as seeds might disperse upon it. All cleared plant material to be disposed of at a licensed waste facility which complies with legal standards or an area demarcated specifically for cleared vegetation and waste.</li> </ul>	
<p><b>Fire</b></p> <ul style="list-style-type: none"> <li>• No illicit fires must be allowed during the construction of the proposed development.</li> </ul>	
<b>Project phase</b>	Decommissioning & Rehabilitation Phase
<b>Impact Summary</b>	Loss of floral habitat, species, and SCC
<p><b>Proposed mitigation and management measures:</b></p>	
<p><b>Development footprint</b></p> <ul style="list-style-type: none"> <li>• No additional habitat is to be disturbed during the Decommissioning &amp; Rehabilitation Phase of the development;</li> <li>• No vehicles are allowed to indiscriminately drive through sensitive habitat and natural areas; and</li> <li>• No dumping of litter must be allowed on-site.</li> </ul>	
<p><b>Alien Vegetation</b></p> <ul style="list-style-type: none"> <li>• Edge effects, such as erosion and alien plant species proliferation, which may affect adjacent natural areas, need to be strictly managed;</li> <li>• Ongoing alien and invasive plant monitoring and clearing/control should take place throughout the Decommissioning &amp; Rehabilitation Phase, and the project perimeters should be regularly checked for AIP establishment to prevent spread into surrounding natural areas;</li> <li>• Alien vegetation that is removed must not be allowed to lay on unprotected ground as seeds might disperse upon it. All cleared plant material to be disposed of at a licensed waste facility, which complies with legal standards; and</li> <li>• Floral monitoring should be done annually during rehabilitation activities.</li> </ul>	
<p><b>Rehabilitation</b></p> <ul style="list-style-type: none"> <li>• All infrastructure footprints that will be decommissioned should be concurrently rehabilitated in accordance with a rehabilitation plan compiled by a suitable specialist;</li> <li>• All soils compacted because of mining activities falling outside of the project area should be ripped and profiled. Special attention should be paid to alien and invasive control within these areas;</li> <li>• Any natural areas beyond the direct footprint, which have been affected by the construction activities, must be rehabilitated using indigenous species;</li> <li>• All rehabilitated areas should be rehabilitated to a point where natural processes will allow the ecological functioning and biodiversity of the area to be re-instated as per the post-closure land-use objective; and</li> <li>• Rehabilitation efforts must be implemented for a period of at least five years after decommissioning. A mix of indigenous grass seeds can be used during rehabilitation activities.</li> </ul>	

## 6 CONCLUSION

STS was appointed to conduct a Biodiversity Assessment as part of the EIA phase in support of obtaining EA for the proposed expansion of the Tharisa Mine WRDs. The proposed activities associated with the Tharisa Mine expansion, that will take place within the study area, will include the following:

1. Extending a previously approved WRD – referred to as the “West Above Ground WRD”; and
2. Establishing a WRD above backfilled portions of the East and West pits – referred to as the “East Above Ground WRD”.

During the field assessment, one habitat unit was identified within the study area, namely Transformed Habitat. The sensitivity of this habitat, from a floral perspective, was of a **low sensitivity**.



No SANBI RDL species or any other nationally (e.g., species under the NFA or TOPS List) or provincially protected species (e.g., species listed under the TNCO) were observed during the field assessment. Furthermore, no suitable habitat to support populations thereof was identified within the study area. A lack of suitable habitat for SCC is attributed to the significantly degraded nature of the Transformed Habitat.

Following the biodiversity assessment within the study area, the impacts associated with the proposed development activities were determined. Prior to mitigation measures the i) Mining (i.e., Construction and Operational) Phase and iii) Decommissioning & Rehabilitation Phase scored an impact significance as follows:

- Mining Phase: this phase scored an impact significance ranging between medium and very low; and
- Decommissioning & Rehabilitation Phase: this phase scored an impact significance ranging between medium and insignificant.

With mitigation measure implemented, the direct and indirect impacts on the floral ecology for the study area may be reduced to very low or insignificant for all phases associated with the proposed mining activities. As part of the rehabilitation actions, disturbed areas not within the development footprint must be rehabilitated appropriately and AIP establishment controlled within such areas.

The study area is located within areas of conservation significance, including a CBA2, ESA1, ESA2 and the remaining extent of the VU Marikana Thornveld threatened ecosystem (of national importance). The impact of the proposed mining activities on these areas within the study area (i.e., immediate local area) are not anticipated to be determinantal as the areas in which the proposed WRDs are located are within existing transformed habitat.

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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## APPENDIX A: Floral Method of Assessment

### *Floral Species of Conservational Concern Assessment*

Prior to the site visit, a record of floral SCC and their habitat requirements was developed for the study area, which includes consulting the National Web-based Environmental Screening Tool. Because not all SCC have been included in the Screening Tool layers (e.g. NT and DD taxa), it remains important for the specialist to be on the lookout for additional SCC. For this study, two primary sources were consulted and are described below.

#### The National Web-Based Environmental Screening Tool

The Screening Tool was accessed to obtain a list of potentially occurring species of conservation concern for the study area. Each of the themes in the Screening Tool consists of theme-specific spatial datasets which have been assigned a sensitivity level namely, “*low*”, “*medium*”, “*high*” and “*very high*” sensitivity. The four levels of sensitivity are derived and identified in different ways, e.g., for **confirmed** areas of occupied habitat for SCC a Very High and High Sensitivity is assigned and for areas of suitable habitat where SCC may occur based on spatial models only, a Medium Sensitivity is assigned. The different sensitivity ratings pertaining to the Plant [and Animal] Protocols are described below<sup>17</sup>:

- **Very High:** Habitat for species that are endemic to South Africa, where all the known occurrences of that species are within an area of 10 km<sup>2</sup> are considered Critical Habitat, as all remaining habitat is irreplaceable. Typically, these include species that qualify under Critically Endangered (CR), Endangered (EN), or Vulnerable (VU) D criteria of the IUCN or species listed as Critically/ Extremely Rare under South Africa’s National Red List Criteria. For each species reliant on a Critical Habitat, all remaining suitable habitat has been manually mapped at a fine scale.
- **High:** Recent occurrence records for all threatened (CR, EN, VU) and/or rare endemic species are included in the high sensitivity level. Spatial polygons of suitable habitat have been produced for each species by intersecting recently collected occurrence records (those collected since the year 2000) that have a spatial confidence level of less than 250 m with segments of remaining natural habitat.
- **Medium:** Model-derived suitable habitat areas for threatened and/or rare species are included in the medium sensitivity level. Two types of spatial models have been included. The first is a simple rule-based habitat suitability model where habitat attributes such as vegetation type and altitude are selected for all areas where a species has been recorded to occur. The second is a species distribution model which uses species occurrence records combined with multiple environmental variables to quantify and predict areas of suitable habitat. The models provide a probability-based distribution indicating a continuous range of habitat suitability across areas that have not been previously surveyed. A probability threshold of 75% for suitable habitat has been used to convert the modelled probability surface and reduce it into a single spatial area which defines areas that fall within the medium sensitivity level.
- **Low:** Areas where no SCC are known or expected to occur.

#### BRAHMS Online Website

The Botanical Database of Southern Africa (BODATSA) is accessed to obtain plant names and floristic details (<http://posa.sanbi.org/>) for species of conservation concern within a selected boundary;

<sup>17</sup> More details on the use of the Screening Tool for Species of Conservation Concern can be found in the below resources:

- South African National Biodiversity Institute (SANBI). 2020. Draft Species Environmental Assessment Guideline. Guidelines for the implementation of the Terrestrial Flora (3c) & Terrestrial Fauna (3d) Species Protocols for environmental impact assessments in South Africa. South African National Biodiversity Institute, Pretoria. Version 1.0.
- The National Web based Environmental Screening Tool website: <https://screening.environment.gov.za/screeningtool/#/pages/welcome>



- This website provides access to South African plant names (taxa), specimens (herbarium sheets) and observations of plants made in the field (botanical records). Data is obtained from the BODATSA, which contains records from the National Herbarium in Pretoria (PRE), the Compton Herbarium in Cape Town (NBG & SAM) and the KwaZulu-Natal Herbarium in Durban (NH).
- Information on habitat requirements etc. is obtained from the SANBI Red List of South African Plants website (<http://redlist.sanbi.org/>).
- Typically, data is extracted for the Quarter Degree Square in which the study area is situated but where it is deemed appropriate, a larger area can be included.

### NEMBA TOPS Species

The Threatened or Protected Species (TOPS) Regulations (GN 30568 of 2007) under Section 56(1) of the National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004) (NEMBA), were taken into consideration for the North West Province.

### Provincially Protected Species

The Transvaal Nature Conservation Ordinance, 1983 (Ordinance No. 12 of 1983) (TNCO) provides a list of provincially protected plants under Schedule 11 (Protected Plants) and Schedule 12 (Specially Protected Species). These species formed part of the SCC assessment. The list is available online at the following link: <https://cer.org.za/wp-content/uploads/2017/01/North-West-Biodiversity-Management-Act.pdf>

### Nationally Protected Tree species

The National Forest Act, 1998 (Act No. 84 of 1998) provides a list of nationally protected tree species. The act serves to promote the sustainable use of forests and/or trees for environmental, economic, educational, recreational, cultural, health, and spiritual purposes. Protected tree species whose ranges have the potential to be located within the study area were thus included in the SCC assessment.

Throughout the floral assessment, special attention was paid to the identification of any of these SCC as well as the identification of suitable habitat that could potentially support these species.

The Probability of Occurrence (POC) for each floral SCC is described:

- **“Confirmed”**: if observed during the survey;
- **“High”**: if within the species’ known distribution range and suitable habitat is available;
- **“Medium”**: if either within the known distribution range of the species or if suitable habitat is present; or
- **“Low”**: if the habitat is not suitable and falls outside the distribution range of the species.

Low POC	Medium POC	High POC	Confirmed
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The accuracy of the POC is based on the available knowledge about the species in question, with many of the species lacking in-depth habitat research.



## Floral Habitat Sensitivity

The floral habitat sensitivity of each habitat unit was determined by calculating the mean of five different parameters which influence floral communities and provide an indication of the overall floristic ecological integrity, importance and sensitivity of the habitat unit. Each of the following parameters are subjectively rated on a scale of 1 to 5 (1 = lowest and 5 = highest):

- **Floral SCC:** The confirmed presence or potential for floral SCC or any other significant species, such as endemics, to occur within the habitat unit;
- **Unique Landscapes:** The presence of unique landscapes or the presence of an ecologically intact habitat unit in a transformed region;
- **Conservation Status:** The conservation status of the ecosystem or vegetation type in which the habitat unit is situated based on local, regional and national databases. Whether the habitat is representative of a Critical Biodiversity Area or forms part of an Ecological Support Area is also taken into consideration;
- **Floral Diversity:** The recorded floral diversity compared to a suitable reference condition such as surrounding natural areas or available floristic databases; and
- **Habitat Integrity:** The degree to which the habitat unit is transformed based on observed disturbances which may affect habitat integrity.

Each of these values contribute equally to the mean score, which determines the floral habitat sensitivity class in which each habitat unit falls. A conservation and land-use objective is also assigned to each sensitivity class which aims to guide the responsible and sustainable utilization of the habitat unit in question. In order to present the results use is made of spider diagrams to depict the significance of each aspect of floral ecology for each vegetation type. The different classes and land-use objectives are presented in the table below:

**Table A1: Floral habitat sensitivity rankings and associated land-use objectives.**

Score	Rating significance	Conservation objective
1 < 1.5	Low	Optimise development potential.
≥ 1.5 < 2.5	Moderately low	Optimise development potential while improving biodiversity integrity of surrounding natural habitat and managing edge effects.
≥ 2.5 < 3.5	Intermediate	Preserve and enhance biodiversity of the habitat unit and surrounds while optimising development potential.
≥ 3.5 < 4.5	Moderately high	Preserve and enhance the biodiversity of the habitat unit, limit development and disturbance.
≥ 4.5 ≤ 5.0	High	Preserve and enhance the biodiversity of the habitat unit, no-go alternative must be considered.



## **Vegetation Surveys**

When planning the timing of a floristic survey, it is important to remember that the primary objective is not an exhaustive species list but rather to ensure that sufficient data are collected to describe all the vegetation communities present in the area of interest, to optimise the detection of SCC and to assess habitat suitability for other potentially occurring SCC (SANBI, 2020).

The vegetation survey incorporates the subjective (or stratified) sampling method. Subjective sampling is a sampling technique in which the specialist relies on his or her own professional experience when choosing sample sites within the study area. This allows representative recordings of floral communities and optimal detection of SCC. Subjective sampling is used to consider different areas (or habitat units) which are identified within the main body of a habitat/study area.

One of the problems with random sampling, another popular sampling method, is that random samples may not cover all areas of a study area equally and thus increase the potential to miss floral SCC. Random sampling methods also tend to require more time in the field to locate the amount of SCC that can be detected using subjective sampling methods - In the context of an EIA where time constraints are often restrictive, priority needs to be given to collecting data in the shortest time possible without compromising the efficiency of locating SCC (SANBI, 2020).

Vegetation structure has been described following the guideline in Edwards (1983). Refer to Figure A1 below:



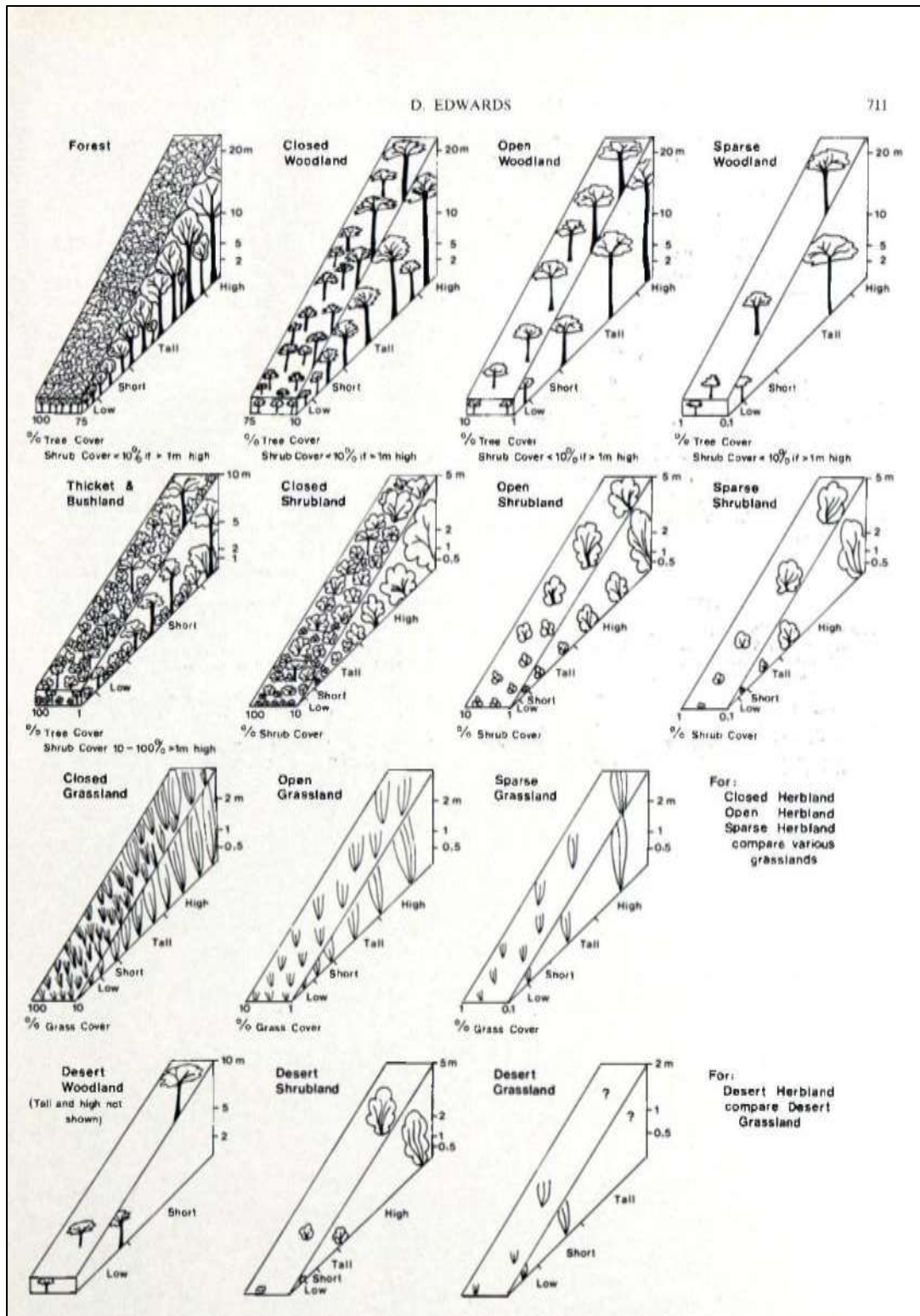


Figure A1: Diagrammatic representation of structural groups and formation classes. Only dominant growth forms are shown.



## APPENDIX B: Floral SCC

South Africa uses the internationally endorsed IUCN Red List Categories and Criteria in the Red List of South African plants. This scientific system is designed to measure species' risk of extinction. The purpose of this system is to highlight those species that are most urgently in need of conservation action. For the POC assessment, a list of Red Data Listed (RDL) species previously recorded within the 10 km of the study area was pulled from the Botanical Database of Southern Africa (BODATSA) (<http://posa.sanbi.org/>). This list was further cross-checked with the NEMA TOPS flora) to identify provincially protected species previously recorded for the area.

### Definitions of the national Red List categories

Categories marked with <sup>N</sup> are non-IUCN, national Red List categories for species not in danger of extinction but considered of conservation concern. The IUCN equivalent of these categories is Least Concern (LC).

- **Extinct (EX)** A species is Extinct when there is no reasonable doubt that the last individual has died. Species should be classified as Extinct only once exhaustive surveys throughout the species' known range have failed to record an individual.
- **Extinct in the Wild (EW)** A species is Extinct in the Wild when it is known to survive only in cultivation or as a naturalized population (or populations) well outside the past range.
- **Regionally Extinct (RE)** A species is Regionally Extinct when it is extinct within the region assessed (in this case South Africa), but wild populations can still be found in areas outside the region.
- **Critically Endangered, Possibly Extinct (CR PE)** Possibly Extinct is a special tag associated with the category Critically Endangered, indicating species that are highly likely to be extinct, but the exhaustive surveys required for classifying the species as Extinct has not yet been completed. A small chance remains that such species may still be rediscovered.
- **Critically Endangered (CR)** A species is Critically Endangered when the best available evidence indicates that it meets at least one of the five IUCN criteria for Critically Endangered, indicating that the species is facing an extremely high risk of extinction.
- **Endangered (EN)** A species is Endangered when the best available evidence indicates that it meets at least one of the five IUCN criteria for Endangered, indicating that the species is facing a very high risk of extinction.
- **Vulnerable (VU)** A species is Vulnerable when the best available evidence indicates that it meets at least one of the five IUCN criteria for Vulnerable, indicating that the species is facing a high risk of extinction.
- **Near Threatened (NT)** A species is Near Threatened when available evidence indicates that it nearly meets any of the IUCN criteria for Vulnerable and is therefore likely to become at risk of extinction in the near future.
- <sup>N</sup>**Critically Rare** A species is Critically Rare when it is known to occur at a single site but is not exposed to any direct or plausible potential threat and does not otherwise qualify for a category of threat according to one of the five IUCN criteria.
- <sup>N</sup>**Rare** A species is Rare when it meets at least one of four South African criteria for rarity but is not exposed to any direct or plausible potential threat and does not qualify for a category of threat according to one of the five IUCN criteria. The four criteria are as follows:
  - Restricted range: Extent of Occurrence (EOO) <500 km<sup>2</sup>, OR
  - Habitat specialist: Species is restricted to a specialized microhabitat so that it has a very small Area of Occupancy (AOO), typically smaller than 20 km<sup>2</sup>, OR
  - Low densities of individuals: Species always occurs as single individuals or very small subpopulations (typically fewer than 50 mature individuals) scattered over a wide area, OR
  - Small global population: Less than 10 000 mature individuals.
- **Least Concern** A species is Least Concern when it has been evaluated against the IUCN criteria and does not qualify for any of the above categories. Species classified as Least Concern are considered at low risk of extinction. Widespread and abundant species are typically classified in this category.



- **Data Deficient - Insufficient Information (DDD)** A species is DDD when there is inadequate information to make an assessment of its risk of extinction, but the species is well defined. Listing of species in this category indicates that more information is required, and that future research could show that a threatened classification is appropriate.
- **Data Deficient - Taxonomically Problematic (DDT)** A species is DDT when taxonomic problems hinder the distribution range and habitat from being well defined, so that an assessment of risk of extinction is not possible.
- **Not Evaluated (NE)** A species is Not Evaluated when it has not been evaluated against the criteria. The national Red List of South African plants is a comprehensive assessment of all South African indigenous plants, and therefore all species are assessed and given a national Red List status. However, some species included in [Plants of southern Africa: an online checklist](#) are species that do not qualify for national listing because they are naturalized exotics, hybrids (natural or cultivated), or synonyms. These species are given the status Not Evaluated and the reasons why they have not been assessed are included in the assessment justification.

The below tables present the results of the POC assessment.

## Nationally Protected Flora

**Table B1: Red Data List (RDL) species (as obtained from Plants of Southern Africa (POSA)) for the study area.**

Species	National status	Habitat	POC
<i>Adromischus umbraticola</i>	NT	<b>Range:</b> Potchefstroom and Zeerust to Cullinan. <b>Major habitats:</b> Savanna. <b>Description:</b> South-facing rock crevices on ridges, restricted to Gold Reef Mountain Bushveld in the northern parts of its range, and Andesite Mountain Bushveld in the south. <b>Population trend:</b> Decreasing.	Low
<i>Myrothamnus flabellifolius</i>	DDT	<b>Range:</b> Gauteng, KwaZulu-Natal, Limpopo, Mpumalanga, North West. <b>Major habitats:</b> Terrestrial. <b>Description:</b> It usually forms large stands in shallow soil on sunny rocky hills or along cracks and crevices in rocks. <b>Population trend:</b> NA	Low
<i>Stenostelma umbelluliferum</i>	NT	<b>Range:</b> Pretoria North and adjacent areas in North West Province. <b>Major habitats:</b> Savanna. <b>Description:</b> Deep black turf in open woodland mainly in the vicinity of drainage lines. <b>Population trend:</b> Decreasing.	Low

**Table B2: Protected Tree species as per the National Forest Act, 1998 (Act No. 84 of 1998) (NFA) that have distributions overlapping with the study area.**

Species	National status	Habitat	POC
<i>Boscia alubitrucha</i>	LC	<b>Range:</b> Free State, Gauteng, KwaZulu-Natal, Limpopo, Mpumalanga, Northern Cape, North West Not endemic to South Africa. <b>Major habitats:</b> Savanna. <b>Description:</b> This species is found in the drier parts of southern Africa, in areas of low rainfall.	Low
<i>Erythrophysa transvaalensis</i>	LC	<b>Range:</b> North-western Limpopo Province to Rustenburg, also extending to Botswana and Zimbabwe. <b>Major habitats:</b> Savanna. <b>Description:</b> Rocky hillsides and stony koppies.	Low





		<b>Population trend:</b> Stable.	
<i>Pittosporum viridiflorum</i>	LC	<b>Range:</b> Eastern Cape, Free State, Gauteng, KwaZulu-Natal, Limpopo, Mpumalanga, North West, Western Cape. Not endemic to South Africa. <b>Major habitats:</b> Forest. <b>Description:</b> Grows in tall forest and in scrub on the forest margin, kloofs and on stream banks.	Low
<i>Podocarpus henkelii</i>	LC	<b>Range:</b> Southern Drakensberg to Gauteng. <b>Major habitats:</b> Forest. <b>Description:</b> It is most abundant in moist inland forest, locally common in montane forest of the Northern KwaZulu-Natal Drakensberg. <b>Population Trend:</b> Stable.	Low
<i>Prunus africana</i>	VU	<b>Range:</b> Widespread in Africa from the southern Cape, through KwaZulu-Natal, Swaziland and northwards into Zimbabwe and central Africa and the islands of Madagascar and Comoros. <b>Major habitats:</b> Eastern Valley Bushveld, Gold Reef Mountain Bushveld, Ohrigstad Mountain Bushveld, Pong Dolomite Mountain Bushveld, Mamabolo Mountain Bushveld, Soutpansberg Mountain Bushveld, Northern Coastal Forest, Scarp Forest, Northern Mistbelt Forest, Southern Mistbelt Forest, Northern Afrotropical Forest. <b>Description:</b> Evergreen forests near the coast, inland mistbelt forests and afro-montane forests up to 2100 m. <b>Population trend:</b> Decreasing.	Low
<i>Sclerocarya birrea</i> subsp. <i>caffra</i>	LC	<b>Range:</b> Gauteng, KwaZulu-Natal, Limpopo, Mpumalanga, North West. Not endemic to South Africa. <b>Major habitats:</b> Woodland. <b>Description:</b> In South Africa it is more dominant in the Baphalaborwa area in Limpopo. It occurs naturally in various types of woodland, on sandy soil or occasionally sandy loam.	Low
<i>Securidaca longepedunculata</i> var. <i>longepedunculata</i>		<b>Range:</b> Gauteng, Limpopo, North West. <b>Description:</b> It occurs in the North-West and Limpopo provinces of South Africa, in Mozambique and is widely distributed in tropical Africa. The violet tree is found in woodland and arid savanna soils. <b>Population trend:</b> Unknown.	Low
<i>Vachellia erioloba</i>	LC	<b>Range:</b> Widespread in the arid northern provinces of South Africa, also Namibia, Botswana, Zimbabwe, southern Angola, and south-western Zambia. Not endemic to South Africa. <b>Major habitats:</b> Widespread. <b>Description:</b> Savanna, semi-desert, and desert areas with deep, sandy soils and along drainage lines in very arid areas, sometimes in rocky outcrops. <b>Population Trend:</b> Decreasing.	Low



**Table B3: Protected Plants as per the NEMBA TOPS List for South Africa<sup>18</sup> for the North West Province.**

Scientific Name	Threat Status	Details	POC
<i>Aloe peglerae</i>	EN	<b>Range:</b> Gauteng, North West. <b>Major habitats:</b> Gold Reef Mountain Bushveld, Waterberg-Magaliesberg Summit Sourveld, Rand Highveld Grassland. <b>Description:</b> Grassland, in shallow, gravely quartzitic soils on rocky, north-facing slopes or summits of ridges. <b>Population trend:</b> Decreasing	Low
<i>Drimia sanguinea</i>	P	<b>Range:</b> Free State, Gauteng, Limpopo, Mpumalanga, Northern Cape, North West. <b>Major habitats:</b> Savanna. <b>Description:</b> Open veld and scrubby woodland in a variety of soil types. <b>Population trend:</b> Decreasing.	Low
<i>Euphorbia knobellii</i>	EN	<b>Range:</b> North West. <b>Major habitats:</b> Dwarsberg-Swartruggens Mountain Bushveld. <b>Description:</b> Woodland and thornveld, wedged among large rocks on the slopes of quartzitic ridges, 1000-1200 m. <b>Population trend:</b> Decreasing.	Low
<i>Euphorbia perangusta</i>	P	<b>Range:</b> North West. <b>Major habitats:</b> Dwaalboom Thornveld. <b>Description:</b> Woodland and thornveld, wedged among large rocks on the slopes of quartzitic ridges, 1000-1200 m. <b>Population trend:</b> unknown.	Low
<i>Harpagophytum procumbens</i>	P	<b>Range:</b> Free State, Limpopo, Northern Cape, North West. <b>Major Habitats:</b> Nama Karoo, Savanna. <b>Description:</b> Well drained sandy habitats in open savanna and woodlands. <b>Population trend:</b> Stable.	Low
<i>Pelargonium sidoides</i>	P	<b>Range:</b> Uniondale in the Western Cape eastwards throughout the Eastern Cape, Lesotho and the Free State as far north as Lichtenburg in North West Province and the Lydenburg district in Mpumalanga. <b>Major habitats:</b> Albany Thicket, Fynbos, Grassland, Nama Karoo, Succulent Karoo. <b>Description:</b> Usually in short grassland, sometimes with occasional shrubs or trees, often in stony soils varying from clay-loam, shale or basalt. <b>Population trend:</b> Decreasing.	Low
<i>Prunus africana</i>	VU	<b>Range:</b> Widespread in Africa from the southern Cape, through KwaZulu-Natal, Swaziland and northwards into Zimbabwe and central Africa and the islands of Madagascar and Comoros. <b>Major habitats:</b> Scarp Forest, Northern Mistbelt Forest, Southern Mistbelt Forest, Northern Afrotemperate Forest. <b>Description:</b> Evergreen forests near the coast,	Low

<sup>18</sup> National Environmental Management: Biodiversity Act 10 of 2004 - Threatened or Protected Species Regulations, 2007. Government Notice R152 in Government Gazette 29657 dated 23 February 2007. Commencement date: 1 July 2007 [GN R150, Gazette no. 29657], as amended.



		inland mistbelt forests and afro-montane forests up to 2100 m. <b>Population trend:</b> Decreasing.	
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\*EN = Endangered; P = Protected; VU = Vulnerable.

## Provincially Protected Flora

**Table B4: Protected Plants as per the Transvaal Nature Conservation Ordinance, 1983 (Ordinance No. 12 of 1983) (TNCO) which provides a list of Protected Plants (Schedule 11) and Specially Protected Species (Schedule 12).**

Schedule 11 (Protected Plant Species)		
Common Name	Scientific Name	POC
All species of tree moss	<i>Porothamnium, Pilotrichella and Papillaria</i> spp.	Low
All species of true ferns excluding the bracken fern	Class Filicinae excluding <i>Pteridium aquilinum</i> Ferns recorded on site: <i>Pellaea calomelanos</i>	Low
All plants of cycads not occurring in Transvaal	All plants of the genus <i>Encephalartos</i> not occurring and the seedlings of the species of cycads in Transvaal and the seedlings of the species referred to in Schedule 12 (a) of <i>Encephalartos</i> referred to in Schedule 12 (a)	Low
All species of yellow wood	<i>Podocarpus</i> spp.	Low
All species of wild cypress	<i>Widdringtonia</i> spp.	Low
Borassus palm	<i>Borassus aethiopicum</i>	Low
All species of arum lilies	<i>Zantedeschia</i> spp.	Low
All species of flame lilies	<i>Gloriosa</i> spp.	Low
All species of Christmas bells	<i>Littonia</i> spp.	Low
All species of red-hot poker	<i>Kniphofia</i> spp.	Low
All species of aloes excluding (a) All species not occurring in the Transvaal; (b) the following species: <i>Aculeata, Ammophilla, Arborescens, Barbertoniae, Castanea, Davyana, Globuligemma, Grandidentata, Grandidentata, Lutescens, Marlothii, Mutans, Parvibracteata, Transvaalensis and Wickensii</i>	All species of <i>Aloes</i> excluding (a) All species not occurring in the Transvaal; (b) the following species: <i>A. aculeata, A. ammophilla, A. arborescens, A. barbertoniae, A. castanea, A. davyana, A. globuligemma, A. grandidentata, A. lutescens, A. marlothii, A. mutans, A. parvibracteata, A. transvaalensis, and A. wickensii</i>	Low
All species of agapanthus	<i>Agapanthus</i> spp.	Low
blue squill	<i>Schilla natalensis</i>	Low
All species of pineapple flower	<i>Eucomis</i> spp.	Low
All species of galtonia	<i>Galtonia</i> spp.	Low
All species of dracaena	<i>Dracaena</i> spp.	Low
All species of paint brush	<i>Haemanthus</i> spp.	Low
All species of paint brush	<i>Scadoxis</i> spp.	High
All species of clivia	<i>Clivia</i> spp.	Low
All species of nerine	<i>Nerine</i> spp.	Low
Pink brunsvigia	<i>Brunsvigia radulosa</i>	Low
All species of crinum	<i>Crinum</i> spp.	Low
Ground lily	<i>Ammocharis coramica</i>	Low
All species of fire lily	<i>Cyrtanthus</i> spp.	Low
All species of elephant's foot	<i>Dioscorea</i> spp.	Low



Schedule 11 (Protected Plant Species)		
Common Name	Scientific Name	POC
All species of irises	<i>Dietes</i> spp.	Low
River lily	<i>Schizostylis coccinea</i>	Low
All species of hairbells	<i>Dierama</i> spp.	Low
All species of babiana	<i>Babiana</i> spp.	Low
All species of gladioli	<i>Gladiolus</i> spp.	Low
All species of laparousia	<i>Lapeirousia</i> spp.	Low
All species of watsonias	<i>Watsonia</i> spp.	Low
Wild banana	<i>Ensete ventricosum</i>	Low
Transvaal strelitzia	<i>Strelitzia caudata</i>	Low
Wild ginger	<i>Kaempferia aethiopica</i>	Low
Wild ginger	<i>Burmannia madagascariensis</i>	Low
All species of orchids excluding those species not occurring in Transvaal occurring in Transvaal	Orchidaceae spp. excluding those species not occurring in Transvaal occurring in Transvaal	Low
All species of proteas excluding those species not occurring in Transvaal occurring in Transvaal	<i>Protea</i> spp. excluding those species not occurring in Transvaal occurring in Transvaal	Low
Pincushion	<i>Leucospermum gerrardii</i>	Low
Pincushion	<i>Leucospermum saxosum</i>	Low
Stone plant	<i>Frithia pulchra</i>	Low
Stone plant	<i>Lithops lesliei</i>	Low
Schreber's waterlily	<i>Brasenia schreberi</i>	Low
All species of waterlilies	<i>Nymphaea</i> spp.	Low
Wonderplant	<i>Tinospora fragosum</i>	Low
Black stinkwood	<i>Ocotea bullata</i>	Low
Stinkwood	<i>Ocotea kenyensis</i>	Low
Kiaat	<i>Pterocarpus angolensis</i>	Low
Tamboti	<i>Spirostachys africana</i>	Low
The following euphorbias: Barnardii, Clivicola, Grandialata, Groenewaldii, Knobelii, Perangusta, Restricta, Rowlandii, Tortirama and Waterbergensis	The following species of the Genus <i>Euphorbia</i> : <i>E. barnardii</i> , <i>E. clivicola</i> , <i>E. grandialata</i> , <i>E. groenewaldii</i> , <i>E. knobellii</i> , <i>E. perangusta</i> , <i>E. restricta</i> , <i>E. rowlandii</i> , <i>E. tortirama</i> , and <i>E. waterbergensis</i>	Low
Baobab	<i>Adansonia digitata</i>	Low
All species of begonias	<i>Begonia</i> spp.	Low
All species of cabbage trees	<i>Cussonia</i> spp.	Low
The following species of ericas (heaths): Alopecurus, Cerinthoides and Oatesii	The following species of the genus <i>Erica</i> : <i>E. alopecurus</i> , <i>E. cerinthoides</i> and <i>E. oatesii</i>	Low
Big leaf fever tree	<i>Anthocleista grandiflora</i>	Low
The following species of impala lilies: Obesum, Oleifolium and Swazicum	the following species of the genus <i>Adenium</i> : <i>A. obesum</i> , <i>A. oleifolium</i> and <i>A. swazicum</i>	Low
Kudu lily	<i>Pachypodium saundersii</i>	Low
All species of <i>Brachystelma</i>	<i>Brachystelma</i> spp.	Low
All species of <i>Ceropegia</i>	<i>Ceropegia</i> spp.	Low
All species of <i>Riocreuxias</i>	<i>Riocreuxia</i> spp.	Low
All species of Ghaap	<i>Tavaresia</i> spp.	Low



<b>Schedule 11 (Protected Plant Species)</b>		
<b>Common Name</b>	<b>Scientific Name</b>	<b>POC</b>
All species of <i>Huerniopsis</i> and <i>Heurnia</i>	<i>Huerniopsis</i> and <i>Huernia</i> spp.	Low
All species of <i>Duvalia</i>	<i>Duvalia</i> spp.	Low
All species of stapeliads	<i>Stapelia</i> spp.	Low
Stapeliad	<i>Hoodia lugardii</i>	Low
All species of <i>Orbeanthus</i>	<i>Orbeanthus</i> spp.	Low
All species of <i>Orbeas</i>	<i>Orbea</i> spp.	Low
All species of <i>Pachycymbiums</i>	<i>Pachycymbium</i> spp.	Low
All species of <i>Orbeopsis</i>	<i>Orbeopsis</i> spp.	Low
All species of Primulas	<i>Streptocarpus</i> spp.	Low
<b>Schedule 12 (Specially Protected Plant Species)</b>		
In this schedule "seedling" means a cultivated plant of which the diameter of the trunk or bulb, either above or below the ground, does not exceed 150 mm.		
(a) All plants, excluding seedlings, of the following cycads of the Genus <i>Encephalartos</i> :		
Dolomiticus	<i>E. dolomiticus</i>	Low
Dyer	<i>E. dyerianus</i>	Low
Middelburg	<i>E. middelburgensis</i>	Low
Eugene marais	<i>E. eugene</i>	Low
Maraisii heenan	<i>E. heenanu</i>	Low
Inopinus	<i>E. inopinus</i>	Low
Laevifolius	<i>E. laevifolius</i>	Low
Lanatus	<i>E. lanatus</i>	Low
Lebombo	<i>E. lebomboensis</i>	Low
Ngoyanus	<i>E. ngoyanus</i>	Low
Paucidentatus	<i>E. paucidentatus</i>	Low
Modjadje	<i>E. transvenosus</i>	Low
Villosus	<i>E. villosus</i>	Low
(b) All plants of the following cycad <i>Encephalartos</i> species:		
Cupidus	<i>E. cupidus</i>	Low
Humilus	<i>E. humilus</i>	Low



## APPENDIX C: Floral Species List

**Table C1: Dominant floral species encountered during the field assessment. Alien species identified during the field assessment are indicated with an asterisk (\*).**

Scientific Name		
Woody Species	Herbaceous Species	Graminoid Speices
* <i>Jacaranda mimosifolia</i>	* <i>Amaranthus Spp.</i>	* <i>Pennisetum setaceum</i>
* <i>Melia azedarach</i>	* <i>Bidens Pilosa</i>	<i>Aristida Congesta subsp. Congesta</i>
* <i>Nicotiana glauca</i>	* <i>Conzya bonariensis</i>	<i>Cymbopogon caecius</i>
<i>Asparagus larinus</i>	* <i>Hibiscus trionum</i>	<i>Enneapogon cenchroides</i>
<i>Dichrostachys cinerea</i>	* <i>Ricinus communis</i>	<i>Heteropogon contortus</i>
<i>Euclea crispa</i>	* <i>Tagetes minuta</i>	<i>Melinis repens</i>
<i>Gomphocarpus fruticosus</i>	* <i>Zinnia peruvianna</i>	<i>Tragus berteronianus</i>
<i>Searsia leptodictya</i>	<i>Commelina cf. erecta</i>	
<i>Vachellia karroo</i>	<i>Laggera decurrens</i>	

