



SCIENTIFIC TERRESTRIAL SERVICES

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**BIODIVERSITY ASSESSMENT AS PART OF THE
ENVIRONMENTAL IMPACT ASSESSMENT (EIA) AND
AUTHORISATION PROCESS FOR THE PROPOSED
EXPANSION AND UPGRADE FOR ACTIVITIES
ASSOCIATED WITH THE BEESHOEK MINE, NEAR
POSTMASBURG, NORTHERN CAPE PROVINCE**

Prepared for

EnviroGistics (Pty) Ltd

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Section B: Floral Assessment

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SAS Environmental Group of Companies

DOCUMENT GUIDE

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

Theme-Specific Requirements as per Government Notice No. 320 Terrestrial Biodiversity Theme – Very High Sensitivity Rating as per Screening Tool Output		
No.	SPECIALIST ASSESSMENT AND MINIMUM REPORT CONTENT REQUIREMENTS	Section in report/Notes
2	Terrestrial Biodiversity Specialist Assessment	
2.1	The assessment must be prepared by a specialist registered with the South African Council for Natural Scientific Professionals (SACNASP) with expertise in the field of terrestrial biodiversity.	Part A – C: Cover Pages Part A: Appendix E
2.2	The assessment must be undertaken on the preferred site and within the proposed development footprint.	Part A: Section 1
2.3	The assessment must provide a baseline description of the site which includes, as a minimum, the following aspects:	
2.3.1	A description of the ecological drivers or processes of the system and how the proposed development will impact these;	Part B: Section 3 (flora) Part C: Section 3 (vertebrates)
2.3.2	Ecological functioning and ecological processes (e.g., fire, migration, pollination, etc.) that operate within the preferred site;	Part B: Section 3 (flora) Part C: Section 3 (vertebrates)
2.3.3	The ecological corridors that the proposed development would impede including migration and movement of flora and fauna;	Part A: Section 3 (desktop analysis) Part B: Section 3 (flora) Part C: Section 3 (vertebrates)
2.3.4	The description of any significant terrestrial landscape features (including rare or important flora-faunal associations, presence of Strategic Water Source Areas (SWSAs) or Freshwater Ecosystem Priority Area (FEPA) sub catchments;	Part A: Section 3 (desktop analysis) Part B: Section 3 (flora) Part C: Section 3 (vertebrates) <i>*For descriptions on the presence of FEPAs, please refer to the Freshwater Biodiversity Assessment (SAS 219099, 2021)</i>
2.3.5	A description of terrestrial biodiversity and ecosystems on the preferred site, including: <ul style="list-style-type: none"> a) main vegetation types; b) threatened ecosystems, including listed ecosystems as well as locally important habitat types identified; c) ecological connectivity, habitat fragmentation, ecological processes and fine scale habitats; and d) species, distribution, important habitats (e.g. feeding grounds, nesting sites, etc.) and movement patterns identified; 	Part A: Section 3 (desktop analysis) Part B: Section 3 (flora) Part C: Section 3 (vertebrates)
2.3.6	The assessment must identify any alternative development footprints within the preferred site which would be of a “low” sensitivity as identified by the screening tool and verified through the site sensitivity verification; and	Not Applicable.
2.3.7	The assessment must be based on the results of a site inspection undertaken on the preferred site and must identify:	
2.3.7.1	Terrestrial Critical Biodiversity Areas (CBAs), including: <ul style="list-style-type: none"> a) the reasons why an area has been identified as a CBA; b) an indication of whether or not the proposed development is consistent with maintaining the CBA in a natural or near natural state or in achieving the goal of rehabilitation; 	Part A: Section 3 (desktop analysis) Part B: Section 3 and 5.3.3



	<ul style="list-style-type: none"> c) <i>the impact on species composition and structure of vegetation with an indication of the extent of clearing activities in proportion to the remaining extent of the ecosystem type(s);</i> d) <i>the impact on ecosystem threat status;</i> e) <i>the impact on explicit subtypes in the vegetation;</i> f) <i>the impact on overall species and ecosystem diversity of the site; and</i> g) <i>the impact on any changes to threat status of populations of species of conservation concern in the CBA;</i> 	
2.3.7.2	<p>Terrestrial Ecological Support Areas (ESAs), including:</p> <ul style="list-style-type: none"> a) <i>the impact on the ecological processes that operate within or across the site;</i> b) <i>the extent the proposed development will impact on the functionality of the ESA; and</i> c) <i>loss of ecological connectivity (on site, and in relation to the broader landscape) due to the degradation and severing of ecological corridors or introducing barriers that impede migration and movement of flora and fauna;</i> 	
2.3.7.3	<p>Protected areas as defined by the National Environmental Management: Protected Areas Act, 2004 including-</p> <ul style="list-style-type: none"> a) <i>an opinion on whether the proposed development aligns with the objectives or purpose of the protected area and the zoning as per the protected area management plan;</i> 	<p>Part A: Section 3 (desktop analysis)</p> <p>However, not applicable as there are no protected areas within 10 km of the site.</p>
2.3.7.4	<p>Priority areas for protected area expansion, including-</p> <ul style="list-style-type: none"> a) <i>the way in which in which the proposed development will compromise or contribute to the expansion of the protected area network;</i> 	Part A: Section 3 (desktop analysis)
2.3.7.5	<p>SWSAs including:</p> <ul style="list-style-type: none"> a) <i>the impact(s) on the terrestrial habitat of a SWSA; and</i> b) <i>the impacts of the proposed development on the SWSA water quality and quantity (e.g. describing potential increased runoff leading to increased sediment load in water courses);</i> 	Not Applicable
2.3.7.6	<p>FEPA sub catchments, including-</p> <ul style="list-style-type: none"> a) <i>the impacts of the proposed development on habitat condition and species in the FEPA sub catchment;</i> 	<i>*For descriptions on the presence of FEPAs, please refer to the Freshwater Biodiversity Assessment (SAS 219099, 2021)</i>
2.3.7.7	<p>Indigenous forests, including:</p> <ul style="list-style-type: none"> a) <i>impact on the ecological integrity of the forest; and</i> b) <i>percentage of natural or near natural indigenous forest area lost and a statement on the implications in relation to the remaining areas.</i> 	Not Applicable
2.4	The findings of the assessment must be written up in a Terrestrial Biodiversity Specialist Assessment Report.	
	<p>Part B: Results of the Floral Assessment as well as conclusions on Terrestrial Biodiversity as it relates to vegetation communities.</p> <p>Part C: Results of the Vertebrate Assessment as well as conclusions on Terrestrial Biodiversity as it relates to faunal communities.</p> <p>Part D: Results of the Invertebrate Assessment as well as conclusions on Terrestrial Biodiversity as it relates to faunal communities.</p>	
3	Terrestrial Biodiversity Specialist Assessment Report	
3.1	The Terrestrial Biodiversity Specialist Assessment Report must contain, as a minimum, the following information:	
3.1.1	Contact details of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae;	Part A: Appendix E
3.1.2	A signed statement of independence by the specialist;	Part A: Appendix E
3.1.3	A statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;	Part B: Section 1.3 (flora) Part C: Section 1.3 (vertebrates)



3.1.4	A description of the methodology used to undertake the site verification and impact assessment and site inspection, including equipment and modelling used, where relevant;	Part A: Appendix C Part B: Section 2 (flora) Part B: Appendix A (flora) Part C: Section 2 (fauna) Part C: Appendix A (fauna)
3.1.5	A description of the assumptions made and any uncertainties or gaps in knowledge or data as well as a statement of the timing and intensity of site inspection observations;	Part B: Section 1.3 (flora) Part C: Section 1.3 (vertebrates)
3.1.6	A location of the areas not suitable for development, which are to be avoided during construction and operation (where relevant);	Part B: Section 4 (flora) Part C: Section 4 (vertebrates)
	Impact Assessment Requirements 3.1.7 Additional environmental impacts expected from the proposed development; 3.1.8 Any direct, indirect and cumulative impacts of the proposed development; 3.1.9 The degree to which impacts and risks can be mitigated; 3.1.10 The degree to which the impacts and risks can be reversed; 3.1.11 The degree to which the impacts and risks can cause loss of irreplaceable resources; 3.1.12 Proposed impact management actions and impact management outcomes proposed by the specialist for inclusion in the Environmental Management Programme (EMPr);	Part B: Section 5 (flora) Part C: Section 5 (vertebrates)
3.1.13	A motivation must be provided if there were development footprints identified as per paragraph 2.3.6 above that were identified as having a “low” terrestrial biodiversity sensitivity and that were not considered appropriate;	Not Applicable to this report
3.1.14	A substantiated statement, based on the findings of the specialist assessment, regarding the acceptability, or not, of the proposed development, if it should receive approval or not; and	Executive summary Part B: Section 6 (flora) Part C: Section 6 (vertebrates)
3.1.15	Any conditions to which this statement is subjected.	Part B: Section 5.4 (flora) Part C: Section 5.4 (vertebrates)
3.2	The findings of the Terrestrial Biodiversity Specialist Assessment must be incorporated into the Basic Assessment Report or the Environmental Impact Assessment Report, including the mitigation and monitoring measures as identified, which must be incorporated into the EMPr where relevant.	Not Applicable to this report. Responsibility of the EAP.
3.3	A signed copy of the assessment must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.	Not Applicable to this report



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LIST OF ACRONYMS

AIP	Alien and Invasive Plant
BODATSA	Botanical Database of Southern Africa
CBA	Critical Biodiversity Area
CR	Critically Endangered
DENC	Department of Environment and Nature Conservation
DFFE	Department of Forestry, Fisheries and the Environment
EAP	Environmental Assessment Practitioner
E-GIS	Environmental Geographical Information Systems
EIA	Environmental Impact Assessment
EN	Endangered
ESA	Ecological Support Area
EW	Extinct in the Wild
GIS	Geographic Information System
GPS	Global Positioning System
GWC	Griqualand West Centre
Ha	Hectares
IUCN	International Union for Conservation of Nature
MPRDA	Mineral and Petroleum Resources Development Act, 2002 [Act No. 28 of 2002]
NCNCA	Northern Cape Nature Conservation Act, 2009 [Act No. 9 of 2009]
NEMBA	National Environmental Management: Biodiversity Act, 2004 [Act No.10 of 2004]
NFA	National Forest Act, 1998 [Act No. 84 of 1998, as amended in September 2011]
OREX	Ore Export
QDS	Quarter Degree Square
RDL	Red Data Listed
SANBI	South African National Biodiversity Institute
SCC	Species of Conservation Concern
SRA	Surface Rights Area
STS	Scientific Terrestrial Services
TOPS	Threatened or Protected Species
VU	Vulnerable



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].

Alien species (syn. exotic species; non-native)	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.
Biodiversity priority areas	Features in the landscape or seascape that are important for conserving a representative sample of ecosystems and species, for maintaining ecological processes, or for the provision of ecosystem services. They include the following categories, most of which are identified based on systematic biodiversity planning principles and methods: protected areas, Critically Endangered and Endangered ecosystems, Critical Biodiversity Areas and Ecological Support Areas, Freshwater Ecosystem Priority Areas, high water yield areas, flagship free-flowing rivers, priority estuaries, focus areas for land-based protected area expansion, and focus areas for offshore protection. Marine ecosystem priority areas and coastal ecosystem priority areas have yet to be identified but will be included in future. The different categories are not mutually exclusive and, in some cases, overlap, often because a particular area or site is important for more than one reason. They should be complementary, with overlaps reinforcing the importance of an area.
Biological diversity or Biodiversity (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.
Biome - as per Mucina and Rutherford (2006); after Low and Rebelo (1998).	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).
Bioregion (as per the definition in NEMBA)	A geographic region which has in terms of section 40(1) been determined as a bioregion for the purposes of this Act;
Casual species	Those alien species that do not form self-replacing populations in the invaded region and whose persistence depends on repeated introductions of propagules (Richardson <i>et al.</i> 2000; Pyšek <i>et al.</i> 2004). The term is generally used for plants.
Critical Biodiversity Area (CBA)	A CBA is an area considered important for the survival of threatened species and includes valuable ecosystems such as wetlands, untransformed vegetation and ridges.
Corridor	A dispersal route or a physical connection of suitable habitats linking previously unconnected regions.
Critically Endangered (CR) (IUCN Red List category)	Applied to both species/taxa and ecosystems: 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. Critically Endangered 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. Critically endangered species are those considered to be at extremely high risk of extinction.
Degradation	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.
Disturbance	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.
Driver (ecological)	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, where



	indirect driver influences ecosystem processes through altering one or more direct drivers.
Endangered (EN) (Red List category)	Applied to both species/taxa and ecosystems: 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. Endangered ecosystem types are at a very high risk of collapse. Endangered species are those considered to be at very high risk of extinction.
Endemic species	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.
Ground-Truth	To check the accuracy of (remotely sensed data) by means of in-situ observations.
Habitat (as per the definition in NEMBA)	A place where a species or ecological community naturally occurs.
Indigenous vegetation (as per the definition in NEMA)	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.
Integrity (ecological)	The integrity of an ecosystem refers to its functional completeness, including its components (species) its patterns (distribution) and its processes.
Invasive species	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.
Listed alien species	All alien species that are regulated in South Africa under the National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004), Alien and Invasive Species Regulations, 2020.
Least Threatened	Least threatened ecosystems are still largely intact.
Native species (syn. indigenous species)	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).
Red Data Listed (RDL) species	According to the Red List of South African plants (http://redlist.sanbi.org/) 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.
Species of Conservation Concern (SCC)	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. These are species and subspecies that are important for South Africa's conservation decision-making processes.
Threatened ecosystem	An ecosystem that has been classified as Critically Endangered, Endangered or Vulnerable, 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 Biodiversity Act 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 NBA can be used as an interim list in planning and decision making. Also see Ecosystem threat status.
Threatened species	A species that has been classified as Critically Endangered, Endangered or Vulnerable, 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.
Vulnerable (VU) (Red List category)	Applied to both species/taxa and ecosystems: 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. An ecosystem type is Vulnerable when the best available evidence indicates that it meets any of the criteria A to E for VU and is then considered to be at a high risk of collapse.



1 INTRODUCTION

Scientific Terrestrial Services CC (STS) was appointed to conduct a Biodiversity Assessment and Impact Assessments as part of the Environmental Impact Assessment (EIA) and Authorisation process for the Consolidation, Upgrade and Expansion Activities at the Assmang (Pty) Ltd Beeshoek Iron Ore Mine, near Postmasburg, Northern Cape Province; henceforth referred to as the “Beeshoek Mine”. The proposed Consolidation, Upgrade and Expansion Activities will take place within the Beeshoek Mine’s Surface Rights Area (SRA) and entails five (5) projects (or listing activities) that will collectively be referred to as the “**focus area**” (refer to Section 1.1 below).

The Beeshoek Mine holds an existing Mining Right on the farms Beeshoek 448, and Olynfontein 475 and is situated within the Tsantsabane Local Municipality, and the ZF Mgcawu District Municipality. The Beeshoek Mine is further situated approximately 7 km west of the town of Postmasburg, and 70 km south of Kathu. The Beeshoek Mine is traversed by the R385 regional road, with the Ore Export (OREX) Railway Line traversing the Beeshoek Mine.

The purpose of this report is to define the floral ecology of the focus 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 focus area. The primary objective of this 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). An understanding of the location and extent of vegetation types of increased sensitivity, and the location of areas of increased importance for various species of SCC, will focus efforts for the identification and marking of SCC during detailed pre-construction walkdown efforts.



1.1 Project Description¹

Assmang (Pty) Ltd is the holder of the new order rights in terms of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA) in respect of high-grade hematite iron ore deposits at Beeshoek on the farms Beesthoek and Olynfontein. The mining method currently entails an opencast mining operation, which consists of five (5) active opencast pits (Village Opencast Pit, HF Opencast Pit, BF Opencast Pit, East Opencast Pit, and BN Opencast Pit). Although other opencast pits are dormant at this time, these are continuously assessed in terms of their economic value. The current resources of the Mine are approximately 87 million tonnes with a reserve of about 26 million tonnes.

The purpose of the Beeshoek Mine project is to give effect to the Regulation 23 MPRDA requirements for the optimisation of the Mining Right, as well as the implementation of the best practical environmental management measures for the operation and management of the WRDs. Further to this, the proposed Beeshoek Low-Grade Beneficiation Optimisation Project is to allow Beeshoek Mine to optimise the mining process and reduce mineral waste on site (in line with the National Waste Management Hierarchy), by implementing two additional Beneficiation Projects, namely a new WHIMS Plant to rework the existing slimes from the Slimes Dam and a new Jig Plant to rework the existing low-grade stockpile (Discard Dump).

The above-mentioned purpose of the Beeshoek Mine is split into five (5) projects (or listing activities). The five (5) projects will collectively be referred to as the “**focus area**”. See also Figures 1 - 4 for a depiction of the proposed five projects, with detailed descriptions of each provided in **Part A, Section 1.1**.

¹ Assmang (Pty) Ltd: Beeshoek Iron Ore Mine. FINAL Environmental Scoping Report in terms of National Environmental Management Act, 1998 and the National Environmental Management: Waste Act, 2008 for: Beeshoek Mine Optimisation Project. April 2021.
Report Reference - EnviroGistics Ref.: 21910. Departmental Ref.: 223MRC. Mining Right Ref: 223MRC
Report Author - Tanja Bekker. MSc. Environmental Management; Pr.Sci.Nat. EAPASA Reg No: 2019/306; SACNASP Reg No: 400198/09



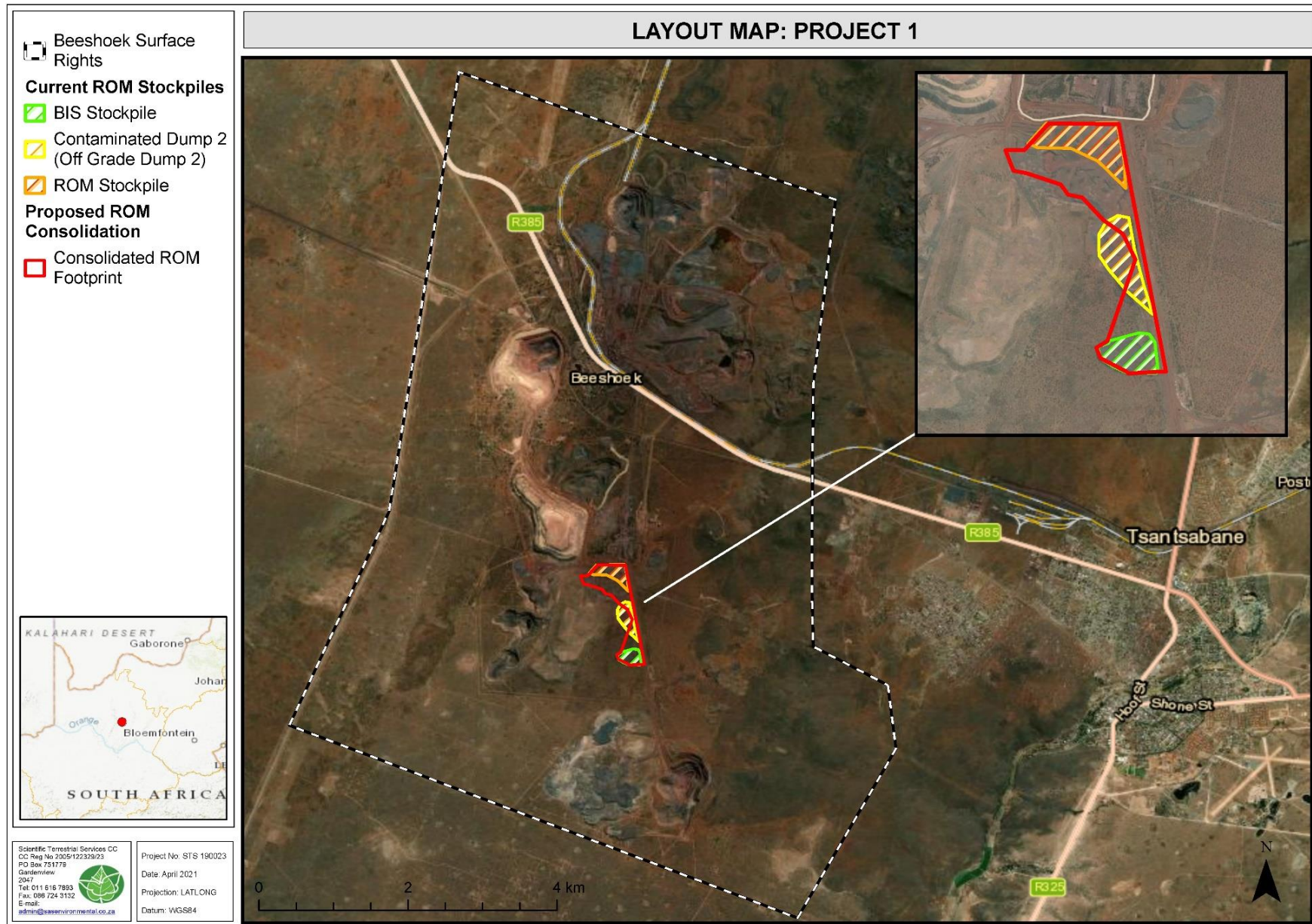


Figure 1: Layout map of Project 1 - Consolidation of Run of Mine (ROM) Stockpiles on South Mine.



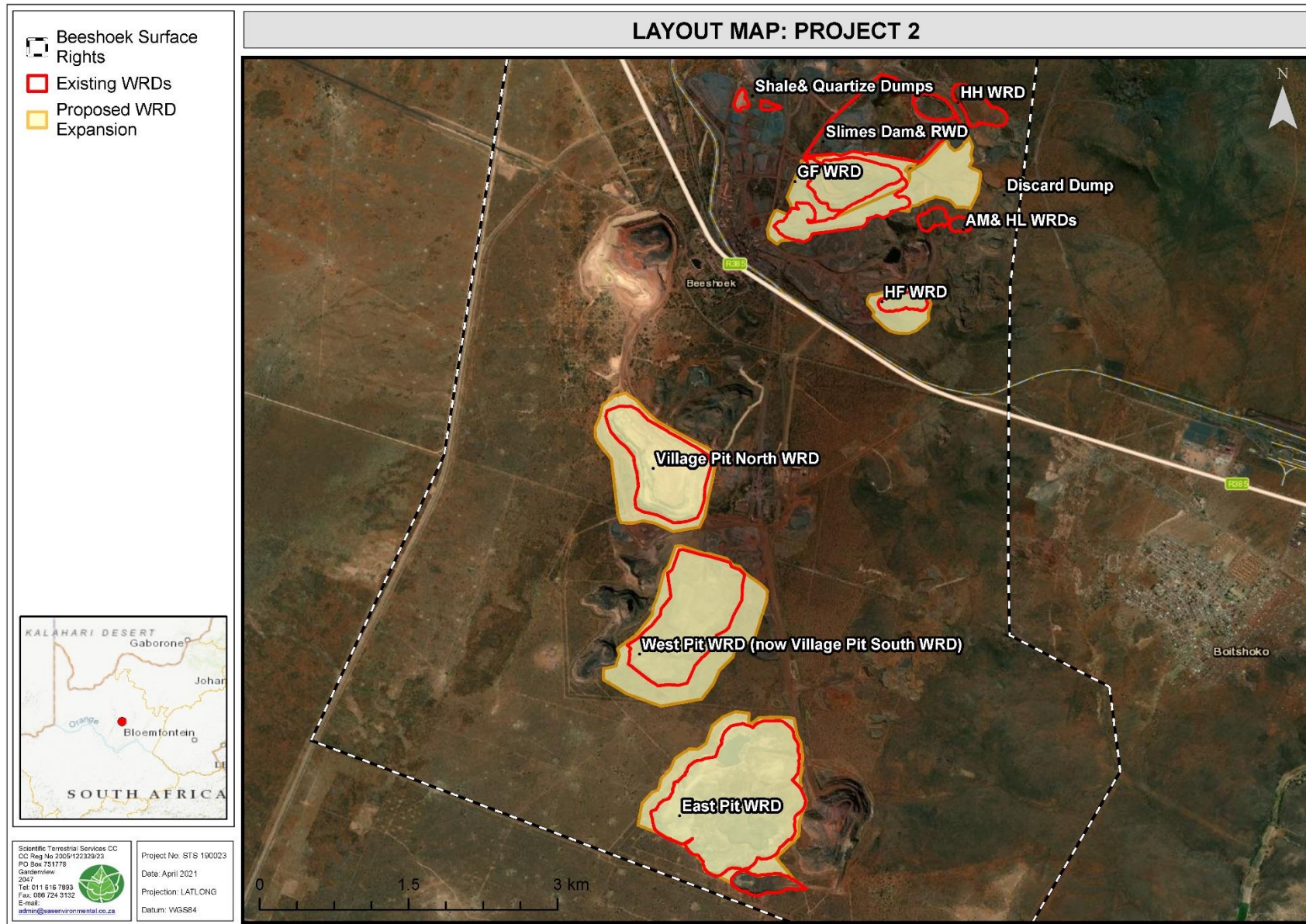


Figure 2: Layout map of Project 2 - Amendments to the design of existing Waste Rock Dumps in terms of the increase in heights, and allowance for final slope, which will result in extension of footprints.



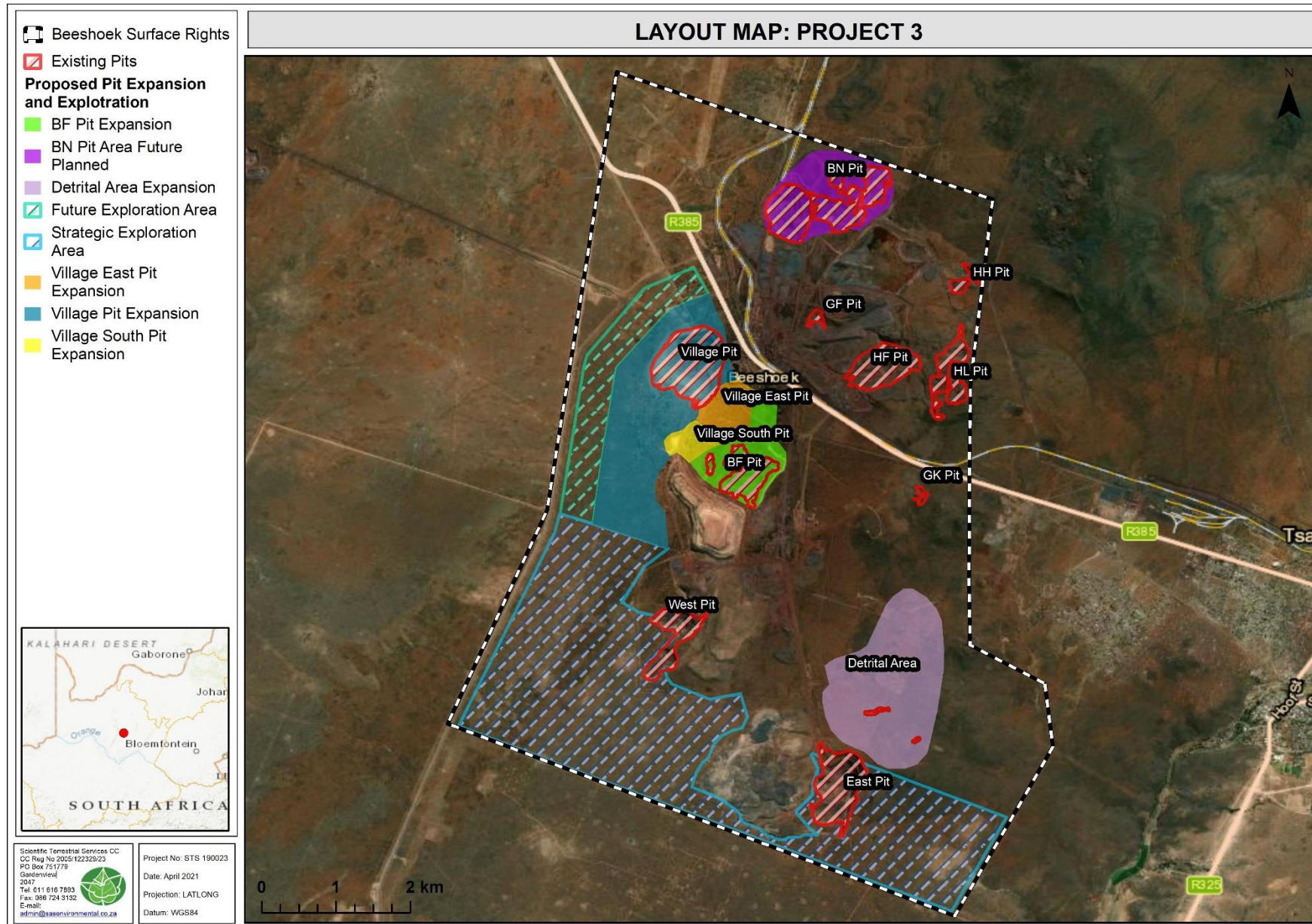


Figure 3: Layout map of Project 3 - Increase of Opencast footprint areas, as well as the undertaking of detrital mining.



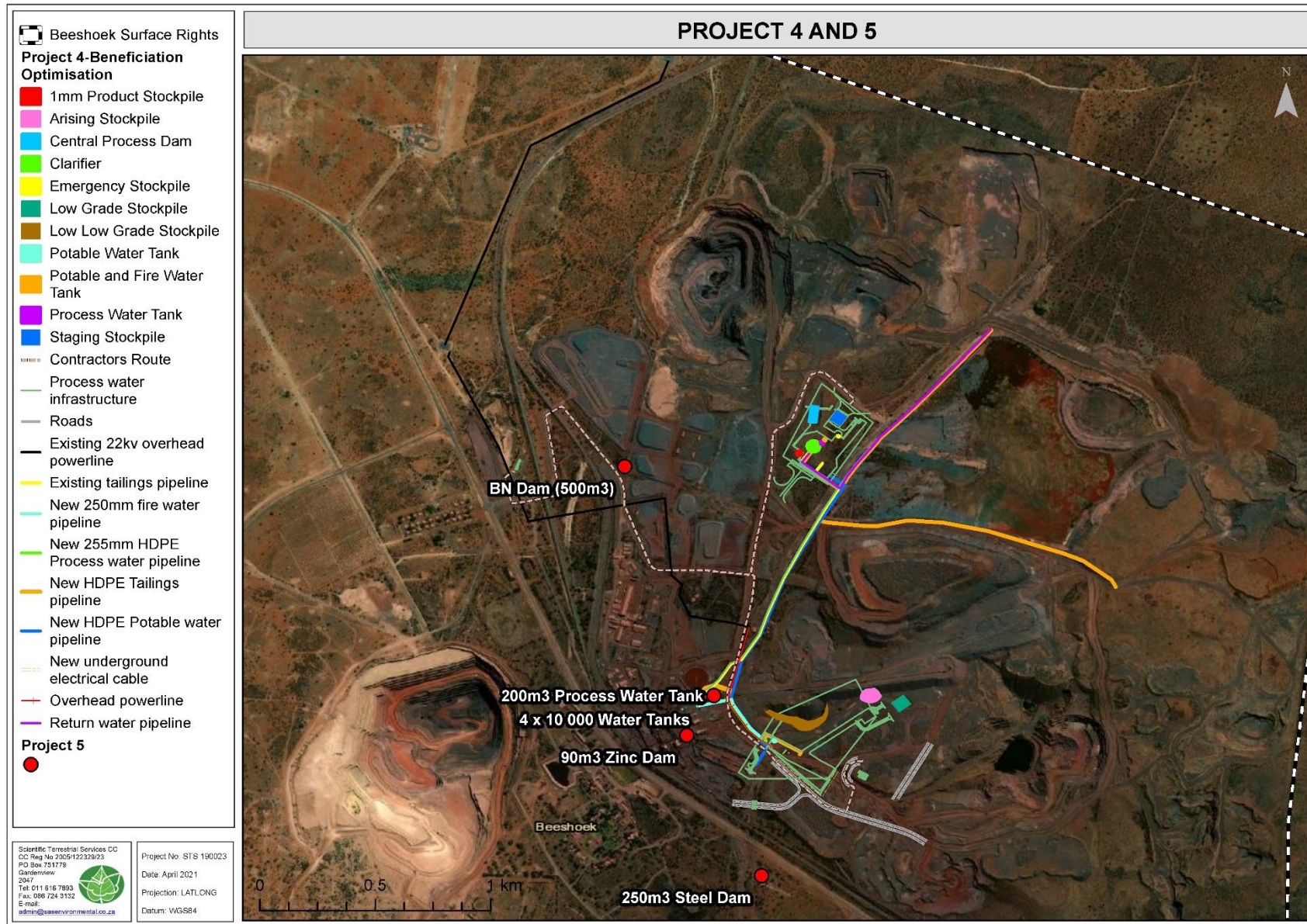


Figure 4: Layout map of Project 4 - Optimisation of Beneficiation and implementation of the Waste Management Hierarchy and of Project 5 - Water Management.



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 focus area and to rank each habitat type based on conservation importance and ecological sensitivity;
- To provide inventories of floral species as encountered within the focus 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 focus area;
- To provide detailed information to guide the activities associated with the proposed development within the focus 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 detailed floral assessment was confined to the Focus Area, however the Beeshoek Mine SRA under investigation as per Figure 1 in Part A, was included in the desktop analysis of which the results are presented in Part A: Section 3. Although habitat units have been described for the entire Beeshoek Mine SRA, areas outside of the assessed focus area (i.e., the footprint of the five proposed projects) were not assessed in detail and data were thus extrapolated for these areas. If changes are made to the footprint areas, these would need to be ground-truthed and mapping further refined;
- Sampling by its nature means that not all individuals are assessed and identified. With ecology being dynamic and complex, some aspects (some of which may be important) may have been overlooked. Three field assessments were undertaken across various seasons, namely 10-13 June 2019 (winter assessment), 22–24 January 2020 (summer assessment), and 1-5 March 2021 (early autumn) – although each seasonal assessment focused on different areas and did not necessarily incur a full assessment



of the previous areas. Each assessment did, however, aim to look at a portion of all the representative habitat units. A more comprehensive assessment would require that more than one assessment take place for the entire focus area and that these assessments occur across all seasons of the year. To account for seasonal limitations and frequency of assessments, on-site data were augmented with all available desktop data, together with project experience in the area; and

- Some floral SCC identities will not be made known in this report, although their potential to occur on site was assessed and reported on. As per the best practise guideline that accompanies the SANBI protocol and National Web-based Screening Tool, the name of the sensitive species may not appear in the final EIA report nor any of the specialist reports released into the public domain. It will be referred to as sensitive plants, and its threat status included, e.g., critically endangered sensitive plant.

Three field assessments were undertaken across various seasons, namely 10-13 June 2019 (winter assessment), 22–24 January 2020 (summer assessment), and 1-5 March 2021 (early autumn) 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.

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 direct footprint of the focus area);

- All relevant resources and datasets as presented by the South African National Biodiversity Institute's (SANBI's) Biodiversity Geographic Information Systems (BGIS) website (<http://bgis.sanbi.org>) and the Environmental Geographical Information Systems (E-GIS) website (<https://egis.environment.gov.za/>), including the Northern Cape CBA Map (2016), and the online National Web-based Environmental 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 which tend to be sparsely distributed. More details on this methodology are provided in **Appendix A**;
- 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**); 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.

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

2.2 Sensitivity Mapping

All the ecological features of the assessment areas were considered, and sensitive areas were assessed and projected onto satellite imagery. In addition, identified locations of protected species as encountered on site were marked by means of Global Positioning System (GPS). A Geographic Information System (GIS) was used to project these features onto satellite imagery and/or topographic maps. The sensitivity map should assist the Environmental Assessment Practitioner (EAP) / proponent as to the suitability of the focus area.



3 RESULTS OF THE FLORAL ASSESSMENT

3.1 Broad-scale vegetation characteristics

The Beeshoek Mine occurs in three vegetation types, namely the Kuruman Mountain Bushveld, the Kuruman Thornveld and the Postmasburg Thornveld, which were used as the reference states against which the ground-truthed vegetation communities were compared (Mucina and Rutherford, 2006). It is however known that the vegetation types for the region is poorly assessed and data somewhat outdated. As such, the vegetation communities are not anticipated to entirely be representative of these vegetation types.

3.2 Ground-truthed vegetation characteristics

Based on the results of the field investigation, five broad habitat units were distinguished for the focus area which was then used to extrapolated habitat units to the remaining extent of the Beeshoek Mine SRA.

The vegetation communities were grouped based on species compositions, but vegetation groupings also largely relied on the various soil forms found on site.

- **Calcrete Shrubland (± 1196 ha):** This habitat unit is located on shallow calcrete soils derived from the Coega/Knersvlakte soil forms. The vegetation mainly comprised shrubland with sparse grass cover. Species diversities were intermediate and trees generally of low diversity and abundance. Habitat integrity varied throughout this habitat unit, with some areas more encroached by indigenous woody species, and other areas characterised by largely intact vegetation;
- **Modified Habitat Unit:** This habitat unit includes areas where vegetation is significantly degraded or entirely absent as a result of mining-related activities. Two sub-units can be distinguished for this habitat unit, namely *Transformed Habitat* (± 2016 ha) and *Degraded Thornveld* (± 255 ha);
- **Moisture-driven Habitat:** This habitat unit is associated with cryptic wetlands, seasonal depressions, preferential flow paths and a recharge area. The Moisture-driven Habitat includes **watercourses** as delineated within the Freshwater Ecological Assessment (SAS 219099, 2021), but also includes **non-watercourse habitat** which is not considered true watercourse as defined in the National Water Act, 1998 (Act No. 36 of 1998) (NWA). Instead, these are low-lying areas where water will preferentially flow or accumulate during rain events, but the floral communities lack wetland indicator vegetation (e.g., vegetation within the centre of the Seasonal Depressions especially



differed from that of the Cryptic Wetlands). There is also an occurrence of different soil forms between the Watercourse and Non-watercourse habitat;

- **Open Thornveld Habitat Unit (± 686 ha):** Habitat restricted to the deeper red soils of the Vaalbos and Plooyburg soil forms. Vegetation included an almost continuous grass layer with large tree species such as *Vachellia erioloba* scattered throughout. Habitat integrity also varied throughout the site; and
- **Rupicolous Habitat Unit (± 812 ha):** This habitat unit includes areas with shallow red soils of the Mispah/Glenrosa soil forms, comprising darker iron-rich stones that either present as lower-lying areas with small pebbles or as prominent rock outcrops on hills. The vegetation communities were generally dominated by encroaching *Senegalia melifera* subsp. *detinens* but also included a higher species diversity when compared to the other habitat units within the Beeshoek Mine SRA.

For a breakdown of the floral communities, habitat characteristics and conservation sensitivities associated with the above-mentioned habitat units, refer to Section 3.2.1 – 3.2.5. Figures 5 (broad) and 6 (detailed) depict the full extent of the habitat units within the Beeshoek Mine. Figure 7 - 9 include the proposed layout.



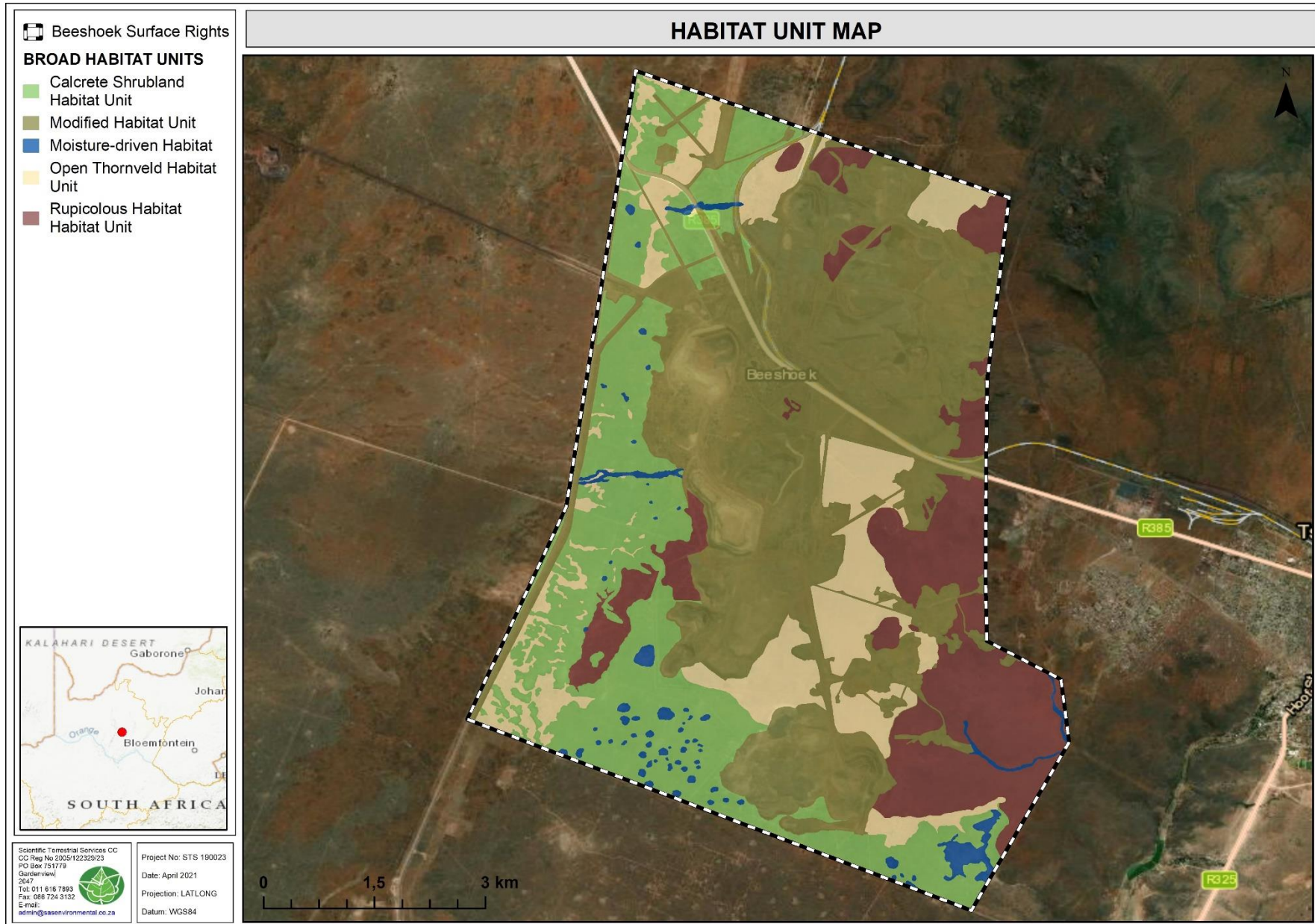


Figure 5: Conceptual illustration of the broad habitat units associated with the Beeshoek Mine.



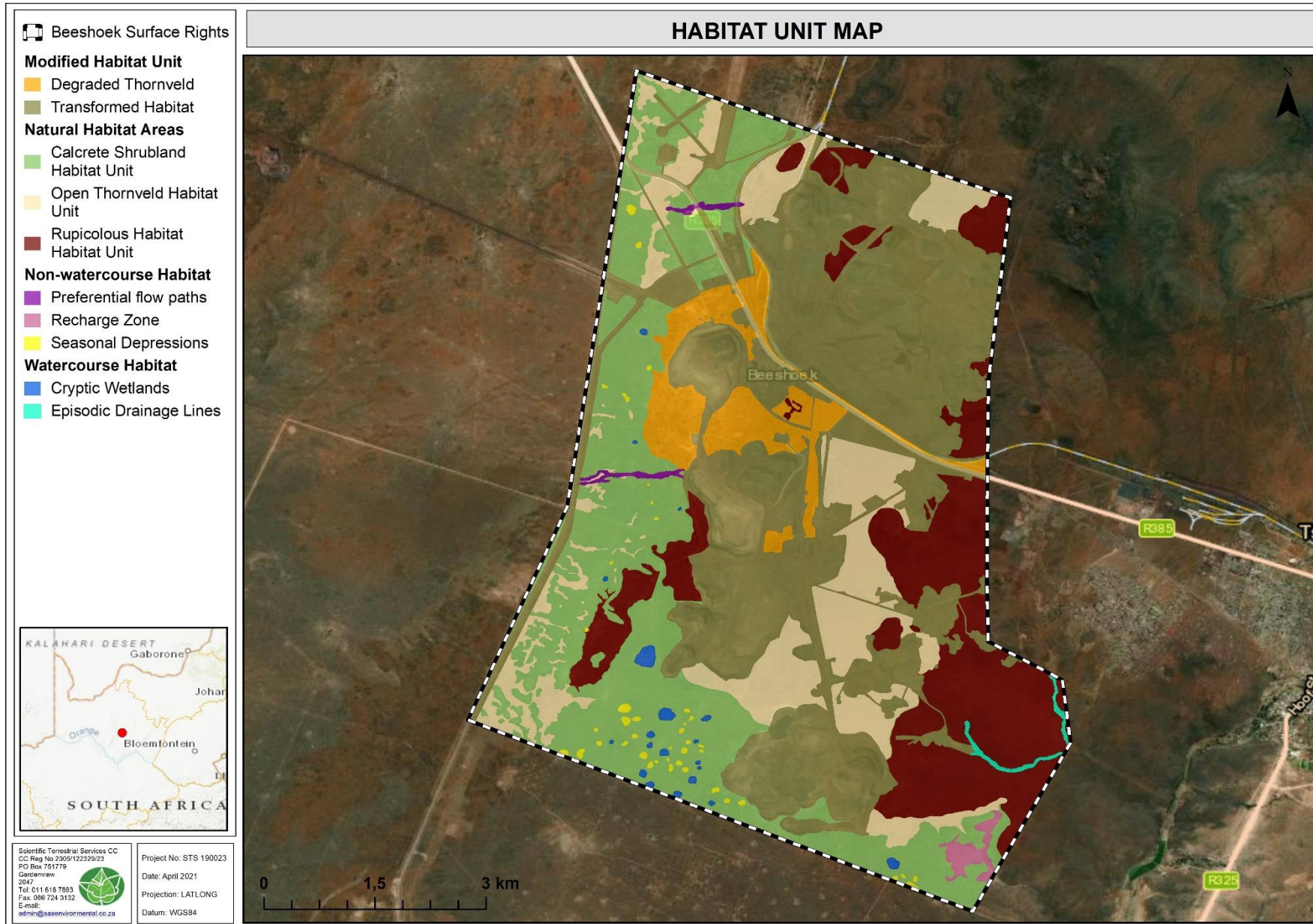


Figure 6: Breakdown of the subunits associated with the Beeshoek Mine.



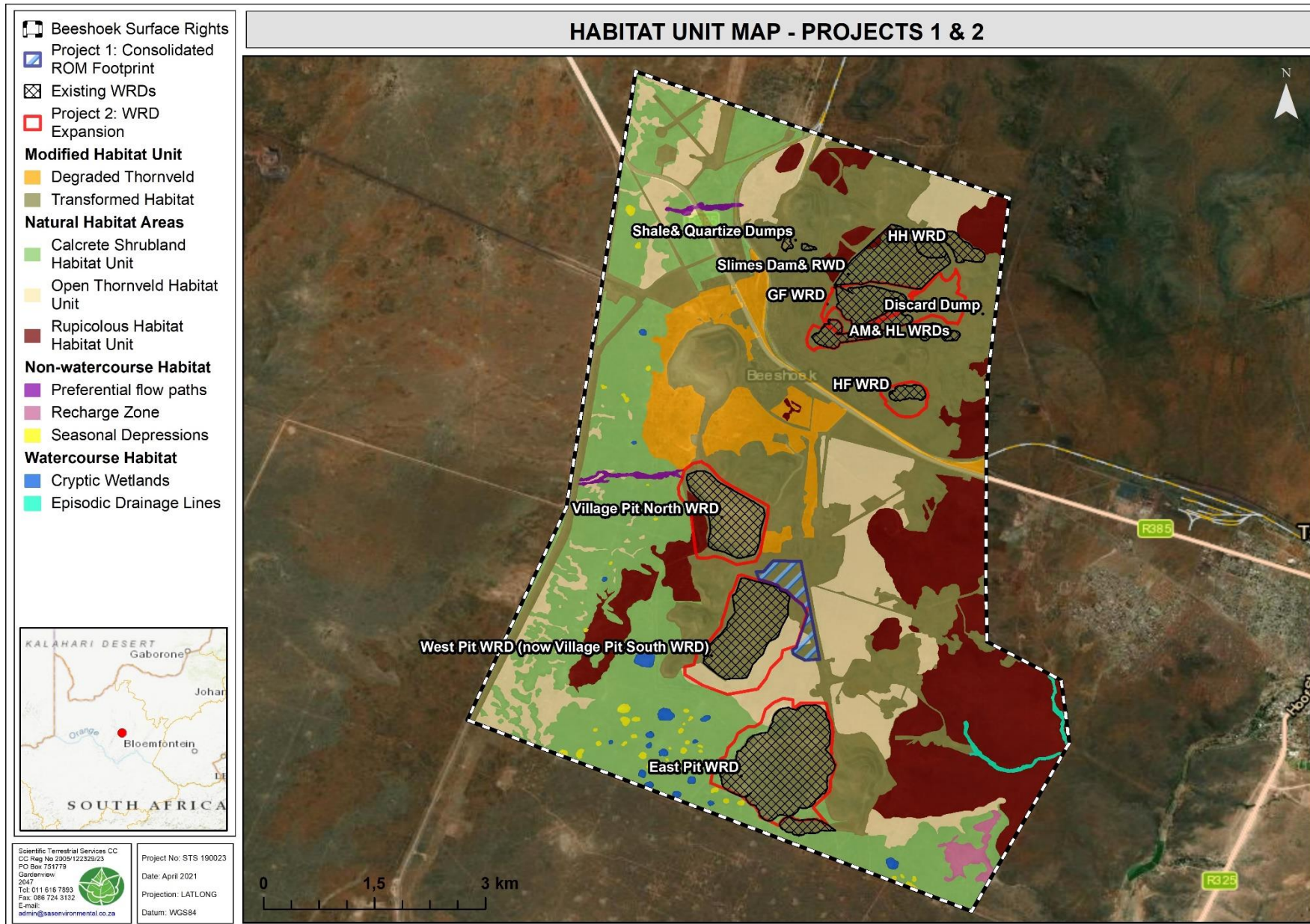


Figure 7: The proposed footprints of Project 1 and 2 superimposed onto the delineated habitat units.



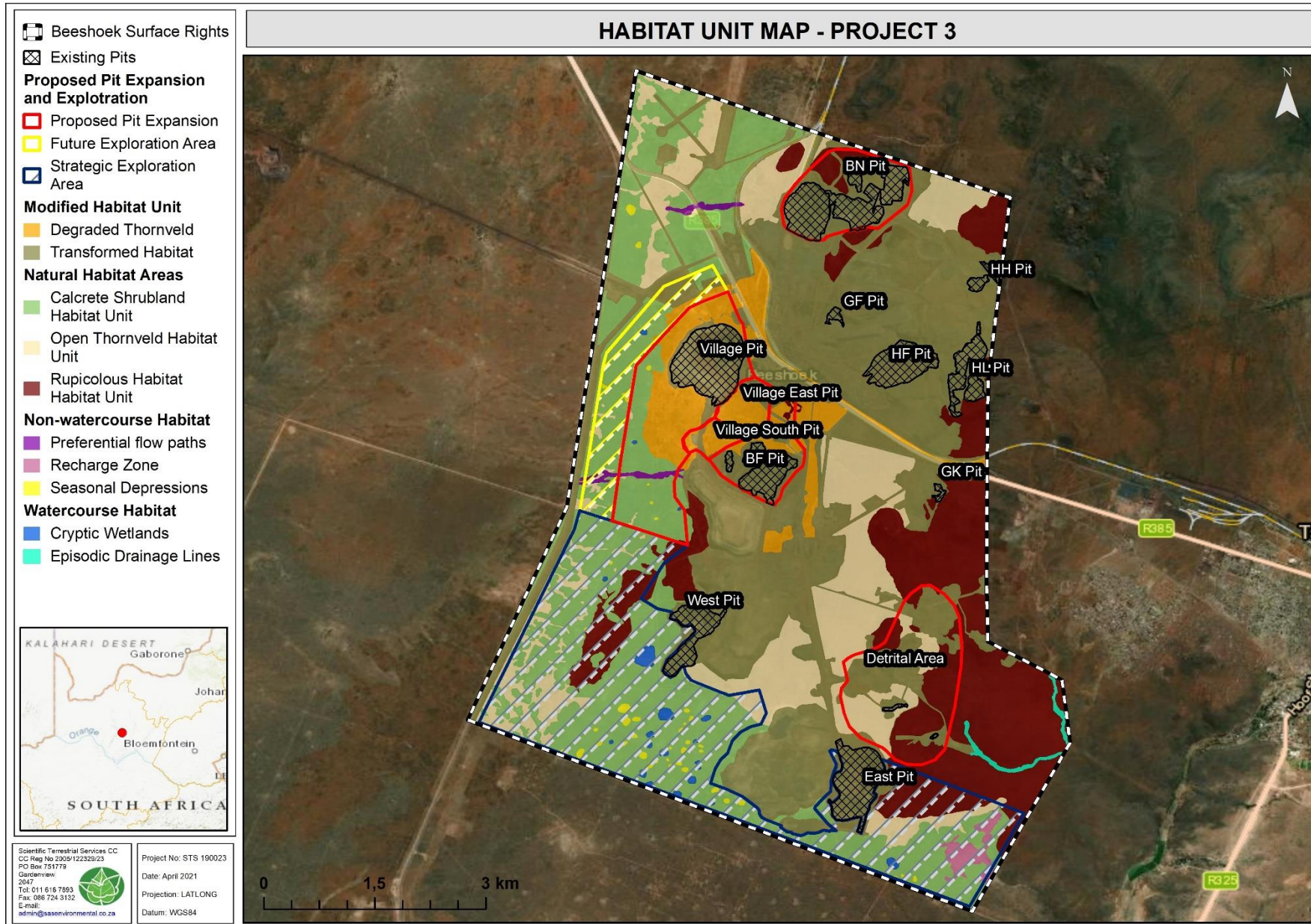


Figure 8: The proposed footprints of Project 3 superimposed onto the delineated habitat units.



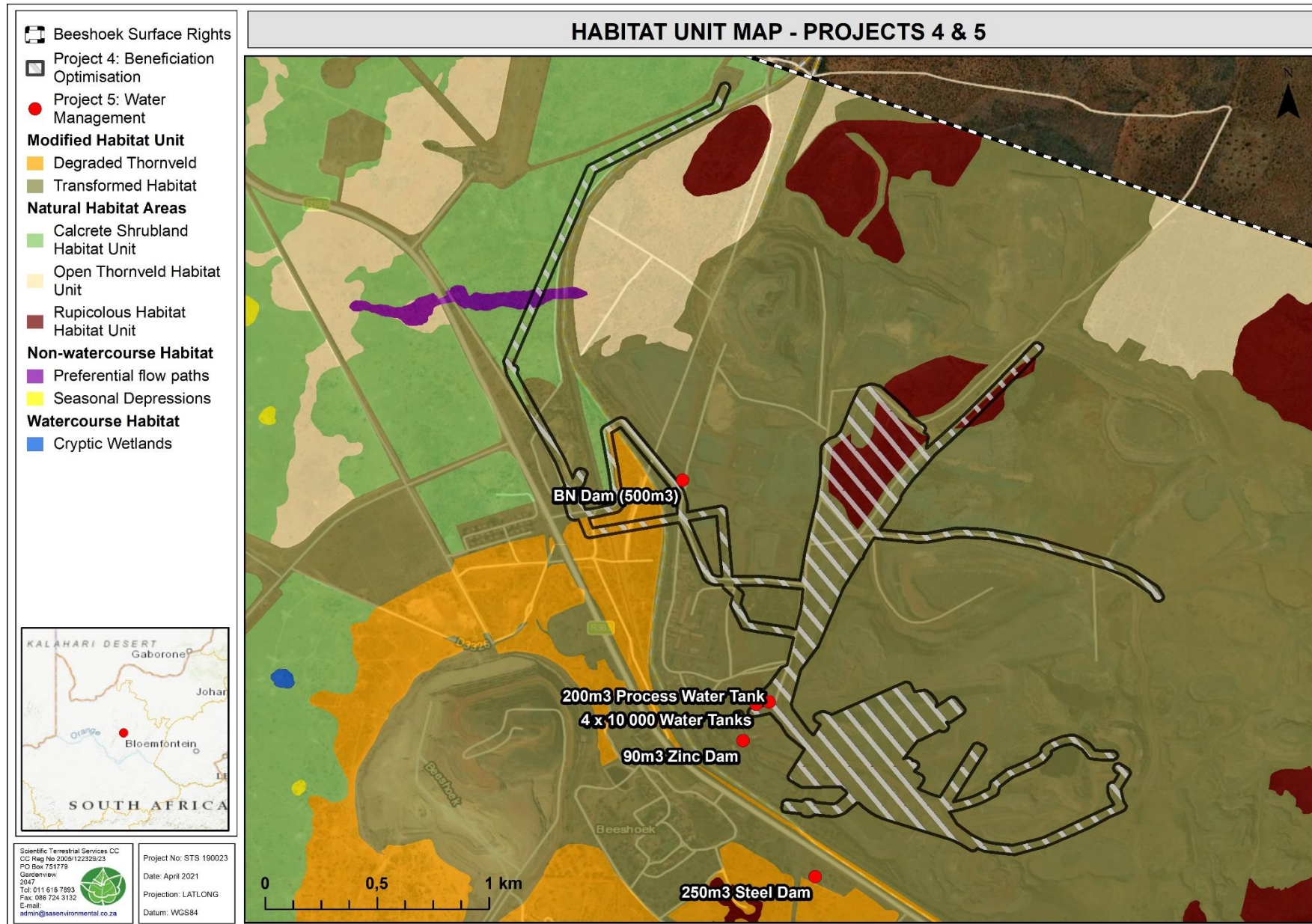



Figure 9: The proposed footprints of Project 4 and 5 superimposed onto the delineated habitat units.



3.2.1 Calcrete Shrubland Habitat Unit

REFERENCE PHOTOS	
	
<p>Shallow soils on calcrete outcrops (left) with vegetation dominated by dwarf shrubs. In areas of increased disturbances, there is encroachment by indigenous woody species (<i>Senegalia melifera</i> subsp. <i>detinens</i>).</p>	
HABITAT OVERVIEW	SPECIES OVERVIEW
<p>The Calcrete Shrubland habitat can be described as short, open shrubland where the woody component is dominated mainly by dwarf shrubs, with tall shrubs and/or small trees scattered in between. In areas where disturbances such as increased grazing pressures were more prominent, a notable increase in woody encroacher species such as <i>Senegalia melifera</i> subsp. <i>detinens</i> and <i>Rhigozum trichotomum</i> occurred.</p> <p>Habitat integrity ranges from moderately intact to moderately degraded. The results of edge effects from mining activities as well as grazing pressures have resulted in sub-optimal habitat conditions within encroached and/or trampled sections. The habitat is, however, still largely intact, and supports a variety of species.</p> <p>This Habitat Unit is considered representative of the reference Postmasburg Thornveld.</p>	<p>The vegetation communities within the Calcrete Shrubland were of intermediate to moderately high diversity, depending on the extent of woody encroachment and grazing pressures.</p> <p>The woody layer is well represented within this habitat unit and is characterised by sparsely occurring short trees / tall shrubs such as <i>Boscia albitrunca</i>, <i>Searsia tridactyla</i>, <i>Senegalia mellifera</i> subsp. <i>detinens</i> (encroaching in some areas) and <i>Tarchonanthus camphoratus</i>. Dwarf shrubs occur much more prominently throughout this habitat unit, comprising a range of species, namely <i>Aptosimum lineare</i>, <i>Eriocephalus</i> cf. <i>ericoides</i>, <i>Lasiosiphon polycephalus</i> (previously <i>Gnidia</i>), <i>Leucas capensis</i>, <i>Monechma incanum</i>, <i>Peliostomum leucorrhizum</i>, <i>Pentzia</i> cf. <i>calcareae</i>, <i>Roepera</i> (<i>Zygophyllum</i>) <i>pubescens</i>, and <i>Caroxylon dealatum</i>.</p> <p>Forbs were poorly represented which is characteristic of the reference state, namely the Postmasburg Thornveld. The graminoid layer was more diverse and comprised <i>Aristida adscensionis</i>, <i>Aristida diffusa</i> subsp. <i>burkei</i>, <i>Cymbopogon pospischilii</i>, <i>Enneapogon cenchroides</i>, <i>Enneapogon desvauxii</i> (abundant), <i>Eragrostis lehmanniana</i>, <i>Eragrostis obtusa</i>, <i>Fingerhuthia africana</i> and <i>Themeda triandra</i>.</p> <p>Refer to Appendix C for a list of species recorded within this habitat unit.</p>



SPECIES OF CONSERVATION CONCERN AND PRESENCE OF UNIQUE LANDSCAPES (CBAS, ESAS, PROTECTED AREAS, INDIGENOUS FOREST, ETC.)	
Presence of Unique Landscapes	<p>The Calcrete Shrubland is not associated with significant biodiversity or conservation features such as threatened ecosystems or Critical Biodiversity Areas (CBAs); however, the habitat unit seems to have a strong association with Cryptic Wetlands and Seasonal Depressions (pans) within the region. This association with pans aligns with sections of this habitat unit occurring within an Ecological Support Area (ESA), as per the Northern Cape CBA Map (2016).</p> <p>The Calcrete Shrubland is well represented in the broader region and also forms the largest habitat unit within the Beeshoek Mine. This habitat unit is representative of the Postmasburg Thornveld, an endemic vegetation type in South Africa, thus contributing to the uniqueness of this habitat unit within a national setting.</p>
Species of Conservation Concern	<p>No threatened floral SCC were recorded in this habitat unit during the 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), Vulnerable (VU) or Protected (P) categories of ecological status. Nor were any species listed in the NEMBA Threatened or Protected Species lists (TOPS, 2007) were identified in this habitat unit. The online National Environmental Screening Tool (or "Screening Tool") has identified one vulnerable plant species for the Beeshoek Mine with potential habitat within this habitat unit; however, more suitable habitat for this species is found in the Rupicolous Habitat Unit.</p> <p>The nationally protected tree, <i>Boscia albitrunca</i>, or Shepherd's tree, occurred in high abundances throughout this habitat unit. Most of the individuals were mature, reaching up to three metres in height. This species is protected under the National Forest Act, 1998 (Act No. 84 of 1998, as amended in September 2011) (NFA) with a least threatened conservation status. The NFA protected tree, <i>Vachellia erioloba</i>, or the Camel thorn, was recorded more along the edge of this habitat unit in areas where soils were deeper, however, some scattered individuals were recorded in this habitat unit.</p> <p>Numerous provincially protected species, i.e., those listed in Schedule 2 of the Northern Cape Nature Conservation Act, 2009 (Act No. 9 of 2009) (NCNCA), were recorded in the Calcrete Shrubland, with several additional species likely occurring within this habitat unit. Schedule 2 Protected Plants recorded in this habitat unit included the below:</p> <ul style="list-style-type: none"> • Species from the Aizoaceae family, <i>Mestoklema tuberosum</i>, <i>Ruschia cf. griquensis</i> and <i>Ruschia calcarea</i>; • Species from the protected Iridaceae family, namely <i>Babiana cf. bainesii</i>; • Numerous individuals from the protected genus <i>Boscia</i>, i.e., <i>Boscia albitrunca</i>; • Species of the protected family Oleaceae, namely <i>Olea europaea</i> subsp. <i>africana</i>; and • Species of <i>Oxalis cf. lawsonii</i>. <p>Permits from Department of Environment and Nature Conservation (DENC) and the Department of Forestry, Fisheries and the Environment (DFFE) should be obtained to remove, cut, or destroy the above-mentioned protected species before any vegetation clearing may take place. Refer to Appendix B for a list of species assessed as part of the SCC assessment.</p>

SOME REFERENCE PHOTOS OF FLORA WITHIN THIS HABITAT UNIT



From left to right: *Ruschia calcarea* (NCNCA Schedule 2 species), *Barleria rigidula* (abundant in this habitat), *Leucas capensis* (abundant in this habitat), *Roepera (Zygophyllum) pubescens* (abundant in this habitat)



CONCLUDING REMARKS


This habitat unit is of intermediate sensitivity and importance from a floral ecological and resource management perspective. Some sections in the northern extent of the Beeshoek SRA have been encroached by *Rhigozum trichotomum*, resulting in the habitat being homogenous and of moderately low importance from a floral ecological perspective. Approximately 133 ha of this habitat unit will be impacted by the proposed activities. Loss of this habitat unit within the Beeshoek SRA is thus of restricted extent and impact on floral ecology can be reduced and managed with mitigation measures implemented.

Key considerations:

- Considering that the Postmasburg Thornveld is an endemic vegetation type and the fact that there are several additional mining expansions planned in the region, further impact on the remaining extent of the currently least concern, but poorly protected, vegetation type may increase the threat status of the vegetation type. It will therefore be important to limit all activities within this habitat unit to what is absolutely necessary and where possible, it is recommended that encroachment of *Senegalia melifera* subsp. *detinens* and *Rhigozum trichotomum* be managed outside of all authorised footprint areas so to prevent further loss of habitat via indirect impacts.
- This habitat unit has been impacted by grazing pressure with woody encroachment evident in several sections. As a whole this habitat unit is still intact and supports an intermediate diversity of floral species. Several nationally and numerous provincially protected species were recorded in this habitat unit, although none were considered range restricted or threatened. If the proposed layout is authorised, it will be necessary to conduct a thorough walkdown of the footprint areas, including at least a 20 m buffer around the footprint area, where all protected floral species are marked for relocation to suitable habitat outside the direct footprint (for species that qualify for relocation). The protected species walkdown must be conducted during the flowering season of the species to ensure adequate detection and identification of the species. Good record-keeping will be necessary to record this process and to document all successes and failures associated with the relocation. These species require permit applications from the relevant governing authorities such as DFFE and DENC before they can be harmed or relocated or destroyed. It is also possible that these authorities may pose certain conditions for SCC removal, e.g., the DFFE has in the past recommended biodiversity offsetting for the loss of NFA protected trees within the Kathu area. Also refer to **Section 5.3.2** of this report.
- In terms of the National Web-based Environmental Screening Tool outcome, these areas align with the Medium Sensitivity assigned to the Plant Species Theme as the habitat is suitable for the triggered vulnerable plant species, though it is more likely that this species will be found in areas with more prominent outcropping in neighbouring habitat units. In terms of the Very High Sensitivity assigned to the Terrestrial Biodiversity Theme, only a small section of this habitat unit occurs in the triggered ESA. However, this habitat unit has a strong association with wetlands in the region. As such, loss of this habitat is unlikely to have a restricted impact, i.e., if this habitat is destroyed in areas where wetlands are present, there is potential for local to regional scale impacts on floral ecology.



3.2.2 Modified Habitat Unit

REFERENCE PHOTOS	
	
HABITAT OVERVIEW	SPECIES OVERVIEW
<p>This habitat unit excludes vegetation communities that are in any way representative of the reference state(s). The extent of transformation due to mining activities, or the fragmentation of habitat due to housing developments and mine expansion, has resulted in denuded veld.</p> <p>No clear vegetation structure can be linked to these areas as the natural vegetation structure has been altered or completely transformed. These areas are often associated with alien vegetation or a lack of floral heterogeneity.</p>	<p>This habitat was generally species-poor, if not entirely without floral species. Due to anthropogenic landscapes such as housing developments and the old golf course being part of this habitat unit, many of the species are alien.</p> <p>Refer to Appendix C for a list of species recorded within this Habitat Unit.</p>
SPECIES OF CONSERVATION CONCERN AND PRESENCE OF UNIQUE LANDSCAPES (CBAS, ESAS, PROTECTED AREAS, INDIGENOUS FOREST, ETC)	
<p>Presence of Unique Landscapes</p>	<p>None. Due to the extent of habitat modification, no significant areas remain that is considered important for floral ecology within the region. No unique landscapes important to flora was thus present. From a floral perspective, and in its current degraded state, this habitat unit is not important for species diversity or community structure.</p>
<p>Species of Conservation Concern</p>	<p>No threatened SCC are located within this habitat unit. Not are any anticipated to be present.</p> <p>Several isolated and scattered individuals of nationally (<i>Boscia albitrunca</i> and <i>Vachellia erioloba</i>) and provincially (<i>Boophone disticha</i>, <i>Babiana sp.</i>) protected floral species are present and would ideally necessitate a rescue and relocation initiative as far as is feasible. Permits from DENC and the DFFE should be obtained to remove, cut, or destroy the above-mentioned protected species before any vegetation clearing may take place.</p> <p>Refer to Appendix B for a list of species assessed as part of the SCC assessment.</p>



CONCLUDING REMARKS

This habitat unit is not considered important from a floral ecological importance and resource management perspective. Much of this habitat is already used for mining or housing development and as such largely falls outside of the proposed mining expansion. Projects 4 and 5 are, however, proposed to occur in this habitat unit which is highly unlikely to result in any significant impacts to floral ecology on a local or regional scale.

Key considerations:


- The habitat is severely degraded and no longer represents the original state(s), nor is it suitable to sustain viable populations of floral SCC. The infrastructure proposed within this habitat unit is unlikely to disrupt any significant ecological processes or impede any ecological corridors (from a purely floral perspective). No CBAs or ESAs are mapped within this habitat unit and thus no constraints on development are recognised.
- In terms of the National Web-based Environmental Screening Tool outcome, these areas match the Low Sensitivity assigned to the Plant Species Theme; however, it does not align with the Very High Sensitivity assigned to the Terrestrial Biodiversity Theme (due to habitat being significantly degraded and/or transformed).
- Due to the area already being exposed to disturbances and edge effect impacts from mining-related activities, this habitat unit is susceptible to Alien and Invasive Plant (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 AIP proliferation within the Beeshoek Mine. Several areas are also severely encroached. This encroachment, if not cleared, must be contained within degraded areas and prevented from increasing their extent within the remaining natural areas in the Beeshoek Mine.



3.2.3 Moisture-driven Habitat Unit

REFERENCE PHOTOS	
 <p style="text-align: center;">Cryptic wetlands (left and centre photo) with characteristic wet zones in the centre. Seasonal depressions (right photo) typically have continuous vegetation throughout without characteristic wetland indicator species.</p>	
HABITAT OVERVIEW	SPECIES OVERVIEW
<p>The Moisture-driven Habitat comprises a specialist group of vegetation that is adapted to living in saturated soils, however, this vegetation does not necessarily indicate the presence of a watercourse as defined in the National Water Act, 1998 (Act No. 36 of 1998) (NWA). The habitat is split between watercourse and non-watercourse habitat, where vegetation differed significantly between these two.</p> <p>The watercourse habitat includes:</p> <ul style="list-style-type: none"> • Cryptic Wetlands, i.e., pans considered to meet the classification as watercourses in the NWA (SAS 219099, 2021) with distinct vegetation communities considered to be key indicators of wetlands in arid regions. The pans/wetlands in arid regions differ from the more conventional wetlands in humid regions (which are continuously inundated systems with saturated soils) by only being inundated after sufficient rainfall (NRF, 2018). Throughout the study area numerous pans are present that meet the definition of Cryptic Wetlands. • An Episodic drainage line (unnamed tributary of the Groenwaterspruit) typically associated with a riparian zone (as per the NWA definition) formed by woody species within the channel or immediately adjacent to it. <p>The non-watercourse habitat is not defined as watercourses from an ecological perspective and include the seasonal depressions, preferential flow paths, anthropogenic drainage lines and a recharge zone.</p>	<p>Characteristic of the Cryptic Wetlands was the lining of trees around the outer edge. Trees considered to be indicator species of Cryptic Wetlands within the study area setting included <i>Ziziphus mucronata</i> and occasionally <i>Olea europaea</i> subsp. <i>africana</i> and less frequently <i>Vachellia erioloba</i>. <i>Tarchonanthus camphoratus</i> and <i>Senegalia melifera</i> subsp. <i>detinens</i> were typically abundant around the Cryptic wetlands but are not considered indicator species due to their abundance across the Beeshoek Mine. Characteristic grass species found along the outer edges of the Cryptic Wetlands included <i>Eragrostis echinochloidea</i> and <i>Eragrostis lehmanniana</i>, which always co-occurred with <i>Cullen tomentosum</i> (forb) and <i>Eragrostis bicolor</i> (grass) - typical wetland indicators occurring in the centre of the Cryptic Wetlands.</p> <p>Trees lined the Seasonal Depressions but mainly included <i>Tarchonanthus camphoratus</i> and <i>Senegalia melifera</i> subsp. <i>detinens</i> - <i>Ziziphus mucronata</i> often not present. The graminoid layer was less diverse and often lacked the presence of the Cryptic Wetlands indicator species, i.e., <i>Eragrostis bicolor</i>. Seasonal Depressions often comprised a grass layer where <i>Aristida congesta</i> subsp. <i>congesta</i> and <i>Enneapogon cenchroides</i> were dominant.</p> <p>The Preferential Flow Paths, anthropogenic drainage lines and recharge zone were sparsely lined with tree species, mainly comprising the terrestrial species from the surrounding habitat units. The graminoids mainly included <i>Aristida congesta</i> subsp. <i>congesta</i>, <i>Enneapogon desvauxii</i>, <i>Enneapogon cenchroides</i>, <i>Eragrostis trichophora</i> and <i>Eragrostis truncata</i> (dominant in the recharge zone).</p> <p>Refer to Appendix C for a list of species recorded within this habitat unit.</p>



SPECIES OF CONSERVATION CONCERN AND PRESENCE OF UNIQUE LANDSCAPES (CBAS, ESAS, PROTECTED AREAS, INDIGENOUS FOREST, ETC.)	
Presence of Unique Landscapes	<p>The watercourse habitat is significant from a biodiversity and conservation perspective. Important ecological corridors include the numerous Cryptic Wetlands and the Episodic Drainage Lines of the Groenwaterspruit – albeit more prominent during rainfall events. Many of these features are mapped within ESAs in the 2016 Northern Cape Critical Biodiversity Areas (NCDENC, 2016) dataset.</p> <p>From a floral perspective, the non-watercourse habitat (seasonal depressions, preferential flow paths, anthropogenic drainage line) is not considered to significantly contribute towards floral ecology within the Beeshoek Mine, nor within the greater region. Only the recharge zone may be important for recharge of a small tributary of the Groenwaterspruit as it is very likely that water from this area flows to the Groenwaterspruit and may thus contribute to the continued ecological functioning thereof (SAS 219099, 2021).</p>
Species of Conservation Concern	<p>No nationally threatened SCC (i.e., RDL plants), or TOPS listed plants in terms of NEMBA Section 56(1) were recorded in this habitat unit during the site assessment. The NFA protected tree, <i>Vachellia erioloba</i>, or the Camel thorn was present within this habitat unit. The <i>Vachellia erioloba</i> individuals were not abundant but did consist of mature individuals in a good condition. The Schedule 2 protected <i>Nerine laticoma</i> and <i>Olea europaea</i> subsp. <i>africana</i> were recorded within the Cryptic Wetlands.</p> <p>The Non-watercourse Habitat only included a small number of SCC which comprised of commonly occurring species such as <i>Boscia albitrunca</i> and <i>Boophone disticha</i>.</p> <p>Additional species potentially occurring within this habitat unit, which are known from the region and that are listed as Schedule 2 protected species (NCNCA), include <i>Bulbine abyssinica</i> and <i>Trachyandra saltii</i>.</p> <p>Permits from DENC and DFFE should be obtained to remove, cut or destroy the above-mentioned protected species before any vegetation clearing may take place. Refer to Appendix B for a list of species assessed as part of the SCC assessment.</p>
SOME REFERENCE PHOTOS OF FLORA WITHIN THIS HABITAT UNIT	
	
<p>From left to right: <i>Cullen tomentosum</i> (cryptic wetland indicator), <i>Eragrostis bocolor</i> (cryptic wetland indicator), <i>Eragrostis truncata</i> (abundant within the recharge zone. A species typically found in lime-rich soils but that is not a typical indicator of wetlands), <i>Sylvia</i> sp. (found in the seasonal and cryptic wetlands)</p>	



CONCLUDING REMARKS

This habitat unit is of Moderately High (watercourse habitat) to Moderately Low (non-watercourse habitat) sensitivity from a floral ecological and resource management perspective.

Habitat integrity varied between the Cryptic Wetlands, many of which have suffered impacts from grazing pressures. The Cryptic Wetlands and Episodic Drainage Lines comprise species that are protected either nationally or provincially and these features are important ecological corridors not only in the Beeshoek Mine but also in the larger region. Despite the lower species diversity when compared to other natural areas, these features remain important in the greater landscape. With the currently proposed activities, there will be minimal loss of Cryptic Wetlands and no loss of the Episodic Drainage Line.


The non-watercourse habitat (especially the Seasonal Depressions, Preferential Flow Paths and Anthropogenic Drainage Line) is deemed less important from a floral ecological perspective and these features are either species-poor or comprise a homogenous vegetation community, with a low probability of floral SCC occurring within them. The recharge zone, however, is potentially important from an overall ecological perspective (i.e., considering fauna and wetland ecology in the region as well), but from a pure floral perspective, no vegetation communities uniquely associated with wetland conditions were noted within this feature. As such, floristically the recharge zone is of less importance than the true watercourse habitat where more unique and habitat-restricted species were recorded.

Important recommendations:

- It is recommended that mining expansion be limited in the Cryptic Wetlands. Currently only two Cryptic Wetlands will be impacted by the proposed Village Pit Expansion. Most of the Cryptic Wetlands are located in the Strategic Exploration Area and exploration activities will need to ensure there is little to no impact on these systems. Impacts on floral communities associated with the Cryptic Wetlands will be unfavourable if not avoided during exploration activities, especially since these provide unique habitat within this semi-arid region and they serve as important ecological corridors - many of which are indicated as ESAs in the 2016 Northern Cape Critical Biodiversity Areas (NCDENC, 2016) dataset.
- To avoid the loss of potentially occurring floral SCC, the presence of such species should be confirmed before vegetation clearing commences. A thorough walkdown of the footprint areas should take place where all floral SCC are marked for rescue and relocation, or removal (where permit application would be required). This walkdown must take place during the growing season (ideally after adequate rains) when species identification will be more accurate, and many geophytes (e.g., *Babiana* species) will emerge from their winter dormancy. Marking, removing and/or translocating of tree species can occur during any time of the year seeing that these species are easily identifiable without flowers.
- For the non-watercourse habitat, none are mapped as ESAs in the 2016 Northern Cape CBA Map and no development constraints recognised for these features.
- In terms of the Screening Tool, the medium plant species theme is not supported for the triggered vulnerable plant species; however, the habitat is suitable for provincially protected floral species that are uniquely adapted to the seasonally, or periodically, soil-saturated conditions. The Very High Sensitivity in terms of the Terrestrial Sensitivity is supported due to the presence of naturally occurring watercourses.



3.2.4 Open Thornveld Habitat Unit

REFERENCE PHOTOS	
	
<p>Habitat typical of areas with deeper red soils.</p>	
HABITAT OVERVIEW	SPECIES OVERVIEW
<p>The Open Thornveld is characterised by areas with deeper red soils of the Vaalbos and Plooyburg soil forms. The habitat typically includes open thornveld with scattered <i>Vachellia erioloba</i> trees, as well as other <i>Senegalia</i> and <i>Vachellia</i> species. Several areas are, however, degraded due to mining edge effects and some grazing pressures, which has resulted in woody species such as <i>Senegalia melifera</i> subsp. <i>detinens</i> and <i>Rhigozum trichophora</i> encroaching into these areas.</p> <p>This habitat unit ranges from large stretches in the central section of the Beeshoek Mine where the vegetation is most representative of the Kuruman Thornveld vegetation type, to smaller, scattered pockets in the western section of the Mine.</p>	<p>The habitat unit is less species-rich than others within the Beeshoek Mine which is likely attributable to the unique habitat provided by the deeper red soils, as well as its very scattered distribution and often small extent within the Beeshoek Mine.</p> <p>Woody species are largely represented by thorn trees such as <i>Senegalia mellifera</i> subsp. <i>detinens</i>, <i>Vachellia erioloba</i>, <i>Vachellia hebeclada</i> subsp. <i>hebeclada</i>, <i>Vachellia tortilis</i> subsp. <i>heteracantha</i>, but also includes several other woody species that are well represented throughout the Beeshoek Mine such as <i>Eriocephalus</i> cf. <i>ericoides</i>, <i>Grewia flava</i>, <i>Lycium hirsutum</i>, <i>Tarchonanthus camphoratus</i> and <i>Ziziphus mucronata</i>. The grass layer was very prominent within this habitat unit, with grasses often much taller than within the surrounding habitat units. The more abundant graminoid species included <i>Enneapogon cenchroides</i>, <i>Eragristis trichophora</i>, <i>Stipagrostis uniplumis</i> and <i>Schmidtia kalahariensis</i>.</p> <p>Refer to Appendix C for a list of species recorded within this habitat unit.</p>
SPECIES OF CONSERVATION CONCERN AND PRESENCE OF UNIQUE LANDSCAPES (CBAS, ESAS, PROTECTED AREAS, INDIGENOUS FOREST, ETC.)	
<p>Presence of Unique Landscapes</p>	<p>This habitat unit largely occurs outside of any of the significant biodiversity and conservation features, although some small sections in the central regions of the Beeshoek Mine occur with an ESA. This habitat unit is not well-represented within the Beeshoek Mine, especially not sections where the vegetation communities remain fully intact.</p>
<p>Species of Conservation Concern</p>	<p>No nationally threatened SCC (i.e., RDL plants), in terms of NEMBA Section 56(1) were recorded in this habitat unit during the site assessment. Two NEMBA TOPS species, <i>Harpagophytum procumbens</i> and <i>Hoodia gordonii</i> (also a Schedule 1 NCNCA species) were recorded within the northern sections of this habitat unit. The deeper red soils provide ideal conditions for this species and it is anticipated that several more are present throughout this unit.</p> <p>The NFA protected tree, <i>Vachellia erioloba</i>, or the Camel thorn was present within this habitat unit – more prominent within this habitat unit than within others. The <i>Vachellia erioloba</i> individuals consisted of mature individuals in a healthy condition. <i>Boscia erioloba</i>, also an NFA protected tree, was present in low abundances within the open Thornveld Habitat Unit.</p>



Numerous provincially protected species, i.e., those listed in Schedule 1 and 2 of the NCNCA, were recorded in the Open Thornveld, with several additional species likely occurring within this habitat unit. Schedule 2 Protected Plants recorded in this habitat unit included the below:

- Species from the Aizoaceae family, *Mestoklema tuberosum*, *Ruschia cf. griquensis* and *Ruschia calcarea* (more in the mixed veld with some calcrete also present);
- Species from the protected Amaryllidaceae family, namely *Boophone disticha*;
- Scattered individuals from the protected genus *Boscia*, i.e., *Boscia albitrunca*;
- Species from the protected genus *Euphorbia*, namely *Euphorbia cf. duseimata*;
- Species of the protected family Apocynaceae, namely *Orbea* species;
- One individual was found from the specially protected *Hoodia gordonii*; and
- Species of *Oxalis cf. lawsonii*.

Permits from DENC and the DFFE should be obtained to remove, cut, or destroy the above-mentioned protected species before any vegetation clearing may take place.

Refer to **Appendix B** for a list of species assessed as part of the SCC assessment.

SOME REFERENCE PHOTOS OF FLORA WITHIN THIS HABITAT UNIT



From left to right: *Orbea* sp. (NCNCA Schedule 2 protected plant), *Euphorbia* sp. (range-restricted species and NCNCA Schedule 2 protected plant), *Mestoklema tuberosum* (NCNCA Schedule 2 protected plant), *Vachellia erioloba* (NFA protected tree)

CONCLUDING REMARKS

This habitat unit is of intermediate sensitivity to moderately low sensitivity and importance from a floral ecological and resource management perspective. Mining expansions are largely excluded from the more intact sections of this habitat unit and hence will minimally impact on floral ecology associated with the areas of deeper red soils.

Key considerations:

- The greatest direct impact on this habitat unit will be from Pit and WRD expansion; however, this habitat unit has been fragmented (especially in the central section of the mine) and evidence of edge effect impacts are becoming more prominent. No ecological corridors are linked to this habitat unit, but it does provide unique habitat from a grazing perspective which in turn allow for the dispersal of floral species throughout the Beeshoek Mine. The Open Thornveld is also the only habitat unit where there is a prominent tree cover, as apposed to the dominant shrub cover in the remaining habitat units. It is recommended that the fragmented section of this habitat unit that is outside of authorised footprint areas be managed to prevent woody encroachment and AIP proliferation, especially in the areas not earmarked for future mining expansion. As far as is possible, fragmentation must be limited, and connectivity reinstated through the rehabilitation and management of areas where mining no longer occurs.
- Several nationally (NFA and TOPS) and provincially (Schedule 1 and 2) protected species were recorded in this habitat unit, some of which are considered range-restricted (e.g., *Euphorbia cf. duseimata*). If the proposed layout is authorised, it will be necessary to conduct a thorough walkdown of the footprint areas where all protected floral species are




marked for relocation to suitable habitat outside the direct footprint (where species qualify for translocation). It is also recommended that a plant nursery be instated on the mine property where floral SCC are temporarily relocated and further propagated to be used in rehabilitation activities later down the line. The protected species walkdown must be conducted during the flowering season of the species to ensure adequate detection and identification of the species. Good record-keeping will be necessary to record this process and to document all successes and failures associated with the relocation. These species require permit applications from the relevant governing authorities such as DFFE and DENC before they can be harmed or relocated or destroyed.

- In terms of the National Web-based Environmental Screening Tool outcome, these areas do not align with the Medium Sensitivity assigned to the Plant Species Theme as the habitat is not suitable for the triggered vulnerable plant species. In terms of the Very High Sensitivity assigned to the Terrestrial Biodiversity Theme, only a small section of this habitat unit minimally occurs in the triggered ESA of which largely fall outside of the proposed mine expansion and consolidation.
- Alien vegetation was noted to encroach into several sections of this habitat unit, especially species from the cacti family and several *Prosopis* species. It is recommended that an AIP plan be implemented for this habitat unit especially where mining activities might result in edge effect impacts on this unit.



3.2.5 Rupicolous Habitat Unit

REFERENCE PHOTOS	
 <p style="text-align: center;">Habitat typical of areas with shallow red soils.</p>	
HABITAT OVERVIEW	SPECIES OVERVIEW
<p>Vegetation structure of the Rupicolous Habitat can be described as short, closed shrubland with the habitat unit comprising two vegetation communities that are similar in species composition, but different in the biophysical environment – some sections include prominent outcrops, while others comprise smaller pebbles on flatter plains. One of the main defining characteristics of this unit is the shallow red soils on Mispah/Glenrosa soil forms, resulting in a similar species composition despite differences in the biophysical environment.</p> <p>In some regards this habitat unit reflects the species composition expected from the Kuruman Mountain Bushveld habitat unit; however, the vegetation structure does not. <i>Senegalia melifera</i> subsp. <i>detinens</i> is a prominent encroacher in this habitat unit and several areas are considered significantly degraded due to the extent of encroachment.</p>	<p>This habitat unit is more species-rich than most of the units within the study area, albeit greatly dominated by <i>Senegalia melifera</i> subsp. <i>detinens</i>. The woody, forb and graminoid layers are generally well developed, but occurs scattered due to the rocky nature of the environment. This habitat unit further harboured a higher diversity of succulent species than the remaining habitat units in the Beeshoek Mine.</p> <p>Vegetation communities largely comprise small trees such as <i>Boscia albitrunca</i>, <i>Searsia burchellii</i>, <i>Senegalia mellifera</i> subsp. <i>detinens</i> and <i>Ziziphus mucronata</i>, as well as shrubs such as, <i>Cadaba aphylla</i>, <i>Searsia tridactyla</i> and <i>Tarchonanthus camphoratus</i>. Dwarf shrubs with a karroid affinity occur scattered within this habitat unit, mainly including the species <i>Justicia divaricata</i>, <i>Pentzia incanum</i> and <i>Roepera (Zygophyllum) pubescens</i>.</p> <p>The habitat is ideal for succulent species, with <i>Anacampseros filamentosa</i> subsp. <i>tomentosa</i>, <i>Euphorbia</i> cf. <i>rhombifolia</i>, <i>Kleinia longiflora</i>, <i>Lycium cinereum</i>, <i>Pachypodium succulentum</i> and several alien <i>Opuntia</i> sp. often recorded within this habitat.</p> <p>Refer to Appendix C for a list of species recorded within this habitat unit.</p>
SPECIES OF CONSERVATION CONCERN AND PRESENCE OF UNIQUE LANDSCAPES (CBAS, ESAS, PROTECTED AREAS, INDIGENOUS FOREST, ETC.)	
Presence of Unique Landscapes	This habitat unit was once well-represented within the Beeshoek Mine area but has been extensively mined over the years. This habitat unit occurs within scattered sections of an ESA and provides unique habitat for a high diversity of floral species on site. Due to the uniquely different floral communities represented in this habitat unit, it is considered unique on a local scale.
Species of Conservation Concern	No threatened SCC (i.e., RDL plants), or TOPS listed plants, in terms of Section 56 of NEMBA, were recorded during the site assessment. The nationally protected tree, <i>Boscia albitrunca</i> , or Shepherd’s tree, occurred in moderate to high abundances throughout this habitat unit. The Screening Tool has identified one vulnerable



plant species for the Beeshoek Mine with potential habitat within this habitat unit. Although none were recorded during the site assessment, it is likely that they occur on site.

Numerous provincially protected species, i.e., those listed in Schedule 2 of the NCNCA, were recorded within this habitat unit and are listed below:

- Species from the Aizoaceae family, *Mestoklema tuberosum*, *Ruschia calcarea*) and *Tridentea* sp ;
- Species from the protected Asphodelaceae family, namely *Aloe grandidentata* and *Aloe hereroense*;
- Species from the protected Amaryllidaceae family, namely *Boophone disticha* and *Ammocharis cf. coranica*;
- Species in the protected genus *Anacampseros*, namely *Anacampseros filamentosa*;
- Scattered individuals from the protected genus *Boscia*, i.e., *Boscia albitrunca*;
- Numerous individuals from the protected Iridaceae family, especially *Babiana cf. bainesii* but also individuals of *Gladiolus permeabilis* subsp. *edulis*;
- Species from the protected genus *Euphorbia*, namely *Euphorbia cf. rhombifolia*;
- Species of the protected family Oleaceae, namely *Olea europaea* subsp. *africana*;
- The protected species *Nymania capensis*; and
- Species of *Oxalis cf. lawsonii*.

Permits from DENC and the DFFE should be obtained to remove, cut, or destroy the above-mentioned protected species before any vegetation clearing may take place.

Refer to Appendix B for a list of species assessed as part of the SCC assessment.

SOME REFERENCE PHOTOS OF FLORA WITHIN THIS HABITAT UNIT



From left to right: *Anacampseros filamentosa* subsp. *tomentosa* (restricted to this habitat unit and a NCNCA Schedule 2 protected plant), *Aloe hereroensis* var. *hereroensis* (NCNCA Schedule 2 protected plant), *Babiana* sp. (NCNCA Schedule 2 protected plant), *Gladiolus permeabilis* subsp. *edulis* (NCNCA Schedule 2 protected plant).

CONCLUDING REMARKS

This habitat unit is of moderately high sensitivity and importance (eastern sections) to moderately low (western sections) from a floral ecological and resource management perspective. Mining activities are largely excluded from this habitat unit and the impact will thus be locally restricted. The detrital area and BN Pit expansion will impact most on this habitat unit, especially on sections that are still intact, and which currently still have high species diversities.

Key considerations:

- This habitat unit is extensively encroached in most sections. As a whole this habitat unit is still intact despite the woody encroachment and it supports a high diversity of floral species within the woody, graminoid, succulent and forb components. Further loss of this habitat unit is not recommended as rehabilitation of these areas is highly unlikely to result in the pre-mined condition.



- Several nationally and provincially protected species were recorded in this habitat unit. If the proposed layout is authorised, it will be necessary to conduct a thorough walkdown of the footprint areas, including at least a 20 m buffer around the footprint area, where all protected floral species are marked for relocation to suitable habitat outside the direct footprint (as far as is feasible). The protected species walkdown must be conducted during the flowering season of the species to ensure adequate detection and identification of the species. Good record-keeping will be necessary to record this process and to document all successes and failures associated with the relocation. These species require permit applications from the relevant governing authorities such as DFFE and DENC before they can be harmed or relocated or destroyed.
- In terms of the National Web-based Environmental Screening Tool outcome, these areas do not align with the Medium Sensitivity assigned to the Plant Species Theme as the habitat is not suitable for the triggered vulnerable plant species. In terms of the Very High Sensitivity assigned to the Terrestrial Biodiversity Theme, several sections of this habitat unit occur in the triggered ESA of which a large section occurs in the proposed mine expansion and consolidation footprint.
- Alien vegetation was noted to encroach into several sections of this habitat unit, especially species from the cacti family. It is recommended that an AIP plan be implemented for this habitat unit especially where mining activities might result in edge effect impacts on this unit. Woody encroachment by *Senegalia melifera* subsp. *detinens* should be managed and further spread of this species should be prevented.



3.3 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 legislation². 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).

3.3.1 Legal Context

South Africa has released several Acts legislating 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

² 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 73³. 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.

3.3.2 Site Results

Of the AIPs recorded during the field assessment, 12 species are listed under NEMBA Category 1b and two under Category 2. The remaining species are not listed under NEMBA but species such as *Bidens bipinnata*, *Chenopodium album* and *Tagetes minuta* are considered problem plants having a negative impact on indigenous floral communities within disturbed and degraded areas. Refer to Table 1 below for more information on the AIPs recorded on site.

Alien vegetation were scattered throughout the Beeshoek Mine, but the most problematic species included a variety of cacti species mostly recorded within the Modified Habitat Unit and sections of the Open Thornveld and the Rupicolous Habitat Units. The cacti species are all listed as Category 1b invaders and consisted of *Austrocyllindropuntia cylindrica*, *Harrisia tortuosa*, *Opuntia ficus-indica*, *Opuntia imbricata*, *Opuntia microdasys*, *Tephrocactus articulatus* and *Trichocereus schickendantzii*.

Within the actively mined areas as well as rehabilitated areas the Category 1b grass *Pennisetum setaceum* was abundant (this is a well-known species known used for mine rehabilitation). To control *Pennisetum setaceum*, it will be necessary to take a phased approach where the species is slowly replaced with indigenous species. As such, an AIP management and control plan is recommended for the Beeshoek Mine.

³ 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.



Due to the extent of AIPs within the focus area, as well as the proximity to wetlands, it is highly recommended that an Alien and Invasive Species Control and Management Plan be set up and implemented to ensure further loss of indigenous floral communities do not occur.

Table 1: Alien and invasive alien species associated with the focus area.

Scientific name	Common Name	NEMBA Status	Calcrete Shrubland	Modified Habitat Unit	Open Thornveld Habitat Unit	Rupicolous Habitat Unit	Non-watercourse Habitat	Watercourse Habitat
WOODY SPECIES								
<i>Ailanthus altissima</i>	Tree-of-heaven	Category 1b		x				
<i>Grevillea robusta</i>	Australian silky oak	Category 3		x				
<i>Jacaranda mimosifolia</i>	Jacaranda	Not listed in the NC		x				
<i>Pinus sp.</i>	N/A	N/A		x				
<i>Prosopis glandulosa var. torreyana</i>	Honey mesquite	Category 3 in NC		x	x			x
<i>Schinus molle</i>	Peruvian pepper	Not Listed	x	x	x			
FORBS								
<i>*Alternanthera pungens</i>		Not Listed		x				
<i>*Argemone ochroleuca subsp. ochroleuca</i>	White-flowered Mexican poppy	Category 1b		x				
<i>*Bidens bipinnata</i>	Spanish needles, Blackjack	Not Listed		x	x			
<i>*Chenopodium album</i>	Goosefoot	Not Listed		x	x			x
<i>*Portulaca oleracea</i>	Common purslane, also known as Duckweed	Not Listed						x
<i>*Salsola kali</i>	Tumbleweed	Category 1b		x				
SUCCULENTS								
<i>*Austrocylindropuntia cylindrica</i>	Cane cactus	Category 1b		x				
<i>*Harrisia tortuosa</i>	Spiny snake cactus	Category 1b		x		x	x	
<i>*Opuntia ficus-indica</i>	Sweet prickly pear	Category 1b		x	x	x		
<i>*Opuntia imbricata</i>	Imbricate prickly pear	Category 1b		x				
<i>*Opuntia microdasys</i>	Yellow bunny-ears, Teddybear cactus	Category 1b		x	x			
<i>*Tephrocactus articulatus</i>	Pine cone cactus, Paperspine cholla	Category 1b		x				
<i>*Trichocereus schickendantzii</i>	Torch Cactus	Category 1b	x			x	x	
GRAMINOIDS								
<i>*Pennisetum setaceum</i>	Fountain grass	Category 1b		x	x			



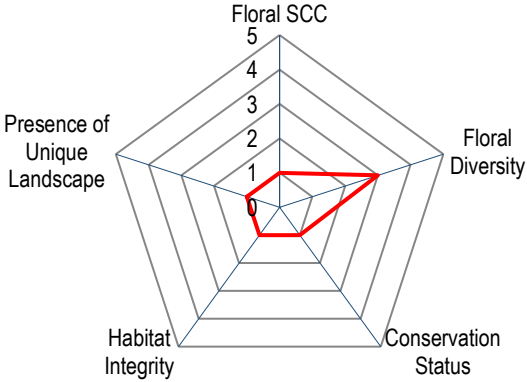
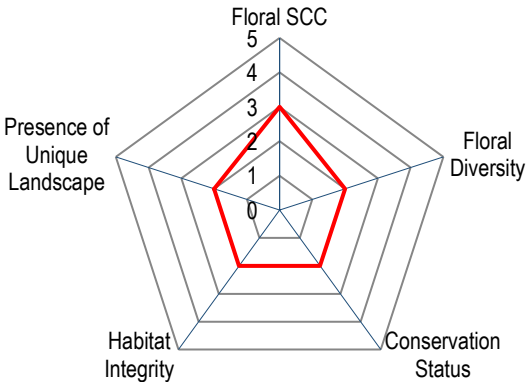
4 SENSITIVITY MAPPING

The National Web-Based Environmental Screening Tool identified the Beeshoek Mine to be in a **Low** and a **Medium Sensitivity** area for the Plant Species Theme and a **Very High Sensitivity** for the Terrestrial Biodiversity Theme. 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.

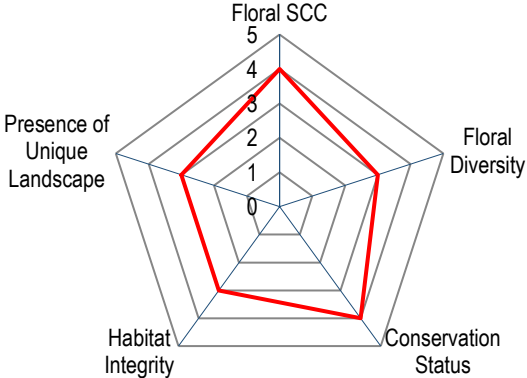
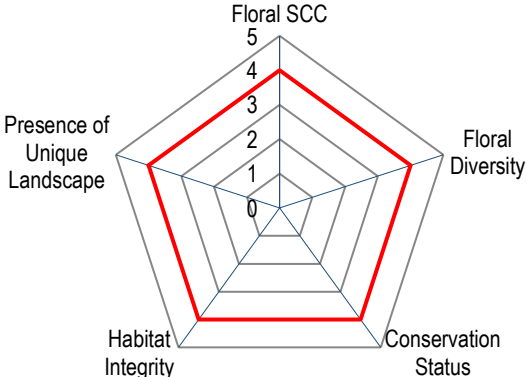
Figures 10 - 13 conceptually illustrate the areas considered to be of varying ecological sensitivity and how they will be impacted by the proposed infrastructure development. The areas are depicted according to their sensitivity in terms of the presence or potential for floral SCC, habitat integrity 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: #c8e6c9;">Low</p> 	<p>Optimise development potential.</p>	<p>Modified Habitat Unit (Transformed Habitat)</p>	<ul style="list-style-type: none"> - Indigenous floral diversity was low or absent. - Habitat not representative of the reference states. - Vegetation largely homogenous and / or AIP infestation is prominent and / or woody encroachment extensive. - Floral SCC are largely lacking, only scattered and isolated species remain. The potential for the habitat to support viable populations of SCC is deemed low.
<p style="text-align: center; background-color: #c8e6c9;">Moderately low</p> 	<p>Optimise development potential while improving biodiversity integrity of surrounding natural habitat and managing edge effects.</p>	<p>Calcrete Shrubland (heavily encroached sections)</p> <p>Modified Habitat Unit (Degraded Thornveld)</p> <p>Moisture-driven Habitat (Non-watercourse)</p> <p>Rupicolous Habitat (extensively encroached sections)</p> <p>Open Thornveld Habitat (heavily degraded sections)</p>	<ul style="list-style-type: none"> - Low floristic diversity and very fragmented. - No unique or significant biodiversity features present. - Floral SCC include isolated individuals with the extent of habitat degradation owing to low likelihood for viable SCC populations to occur.



Habitat Sensitivity	Conservation objective	Habitat Unit	Key habitat characteristics
<p style="text-align: center; background-color: #ffff00;">Intermediate</p> 	<p>Preserve and enhance biodiversity of the habitat unit and surrounds while optimizing development potential.</p>	<p>Calcrete Shrubland</p> <p>Rupicolous Habitat (moderately encroached sections)</p> <p>Open Thornveld Habitat</p>	<ul style="list-style-type: none"> - Habitat is intact and representative of the reference states, but some degradation has occurred due to mine edge effect impacts, grazing pressures and encroaching woody species. - The habitat is largely represented by indigenous species with several nationally (NFA and TOPS) and provincially (Schedule 1 and 2) protected floral species present. - No threatened species were recorded in this habitat; however, suitable habitat is present for species triggered by the Screening Tool.
<p style="text-align: center; background-color: #ff9900;">Moderately high</p> 	<p>Preserve and enhance the biodiversity of the habitat unit, limit development and disturbance.</p>	<p>Rupicolous Habitat (moderately encroached sections)</p> <p>Moisture-driven Habitat (watercourses)</p>	<ul style="list-style-type: none"> - Habitat either represented by high floral diversity or is of high conservation significance, especially the presence of watercourses within an arid region. - The habitat is considered unique from a floral composition perspective, in terms of the biophysical structure as well as the presence of ecological corridors. - Floral SCC did not include RDL species, but several nationally (NFA and TOPS) and provincially (Schedule 2) protected floral species present. - Suitable habitat is available for RDL species.



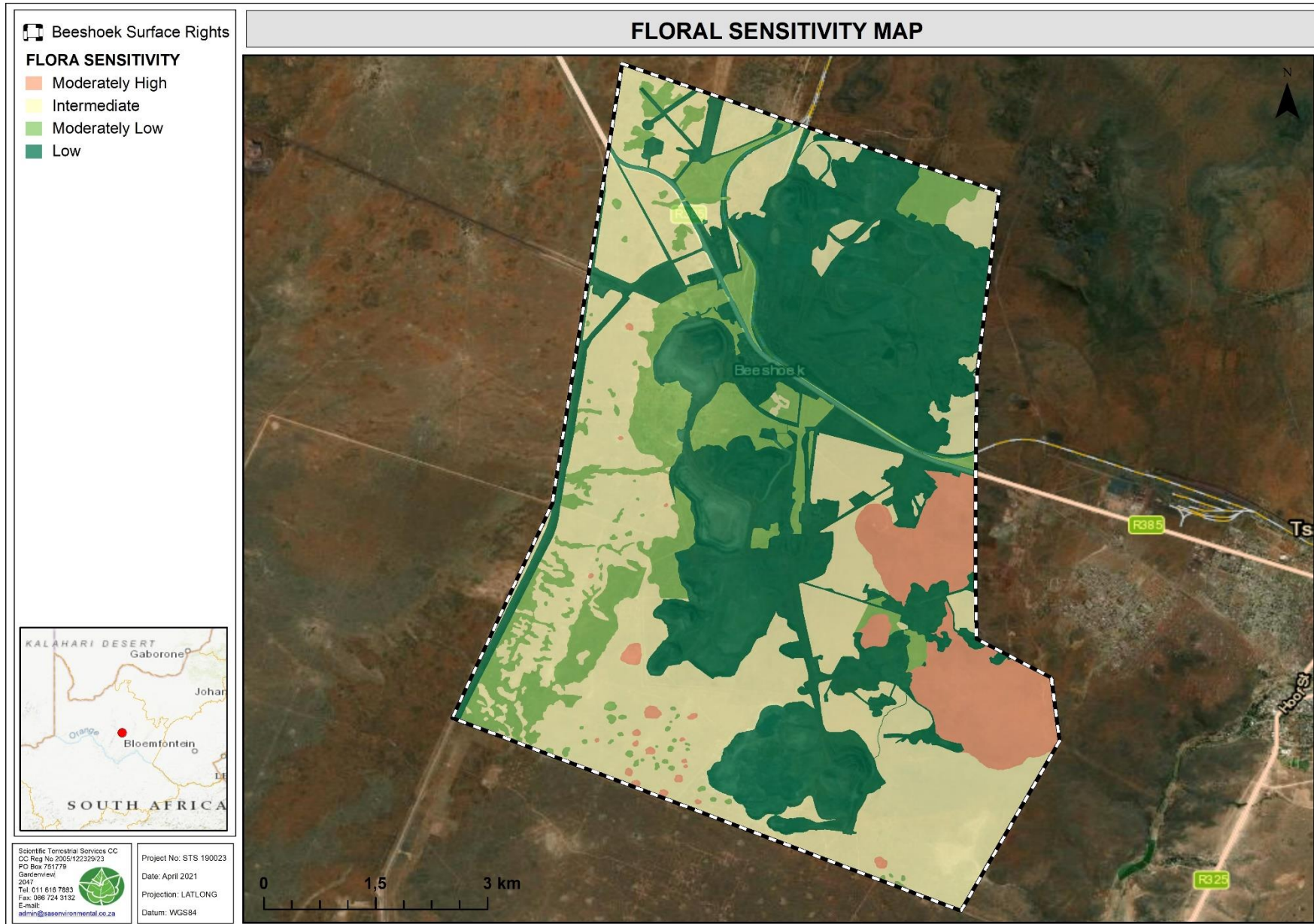


Figure 10: Sensitivity map for the Beeshoek Mine.



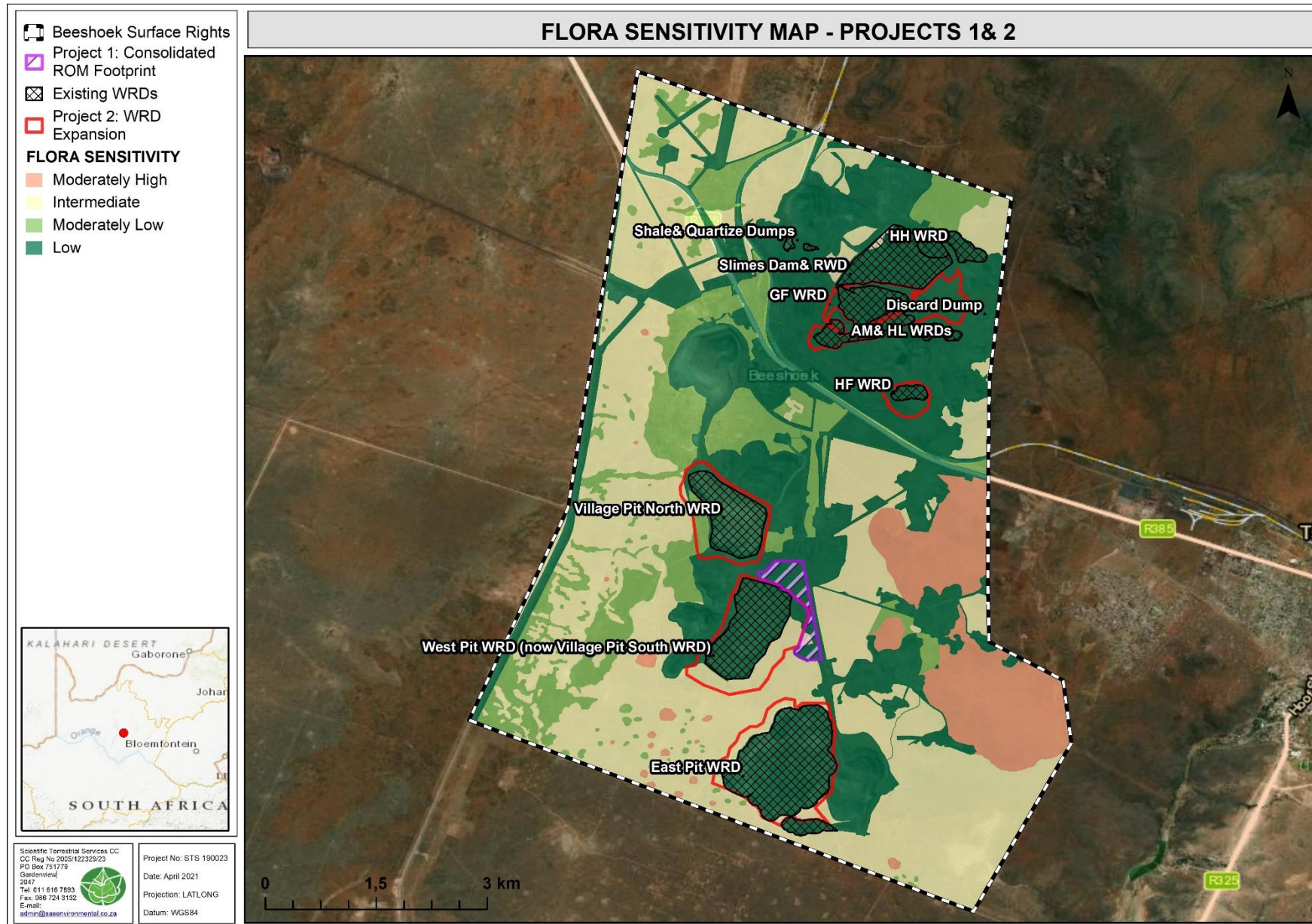


Figure 11: Sensitivity map for the Beeshoek Mine with the proposed Project 1 and 2 superimposed on the habitat sensitivities.



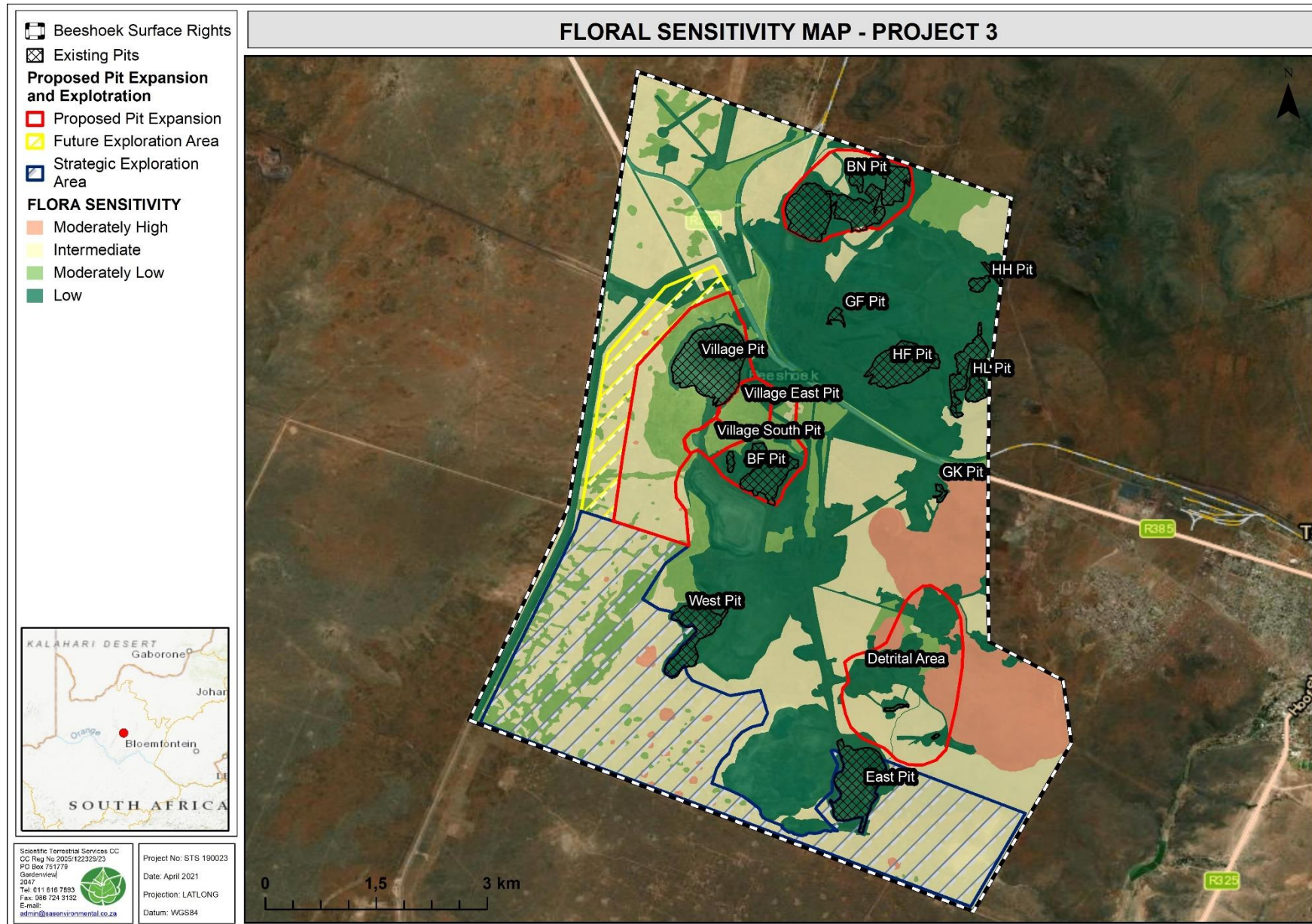


Figure 12: Sensitivity map for the Beeshoek Mine with the proposed Project 3 superimposed on the habitat sensitivities.



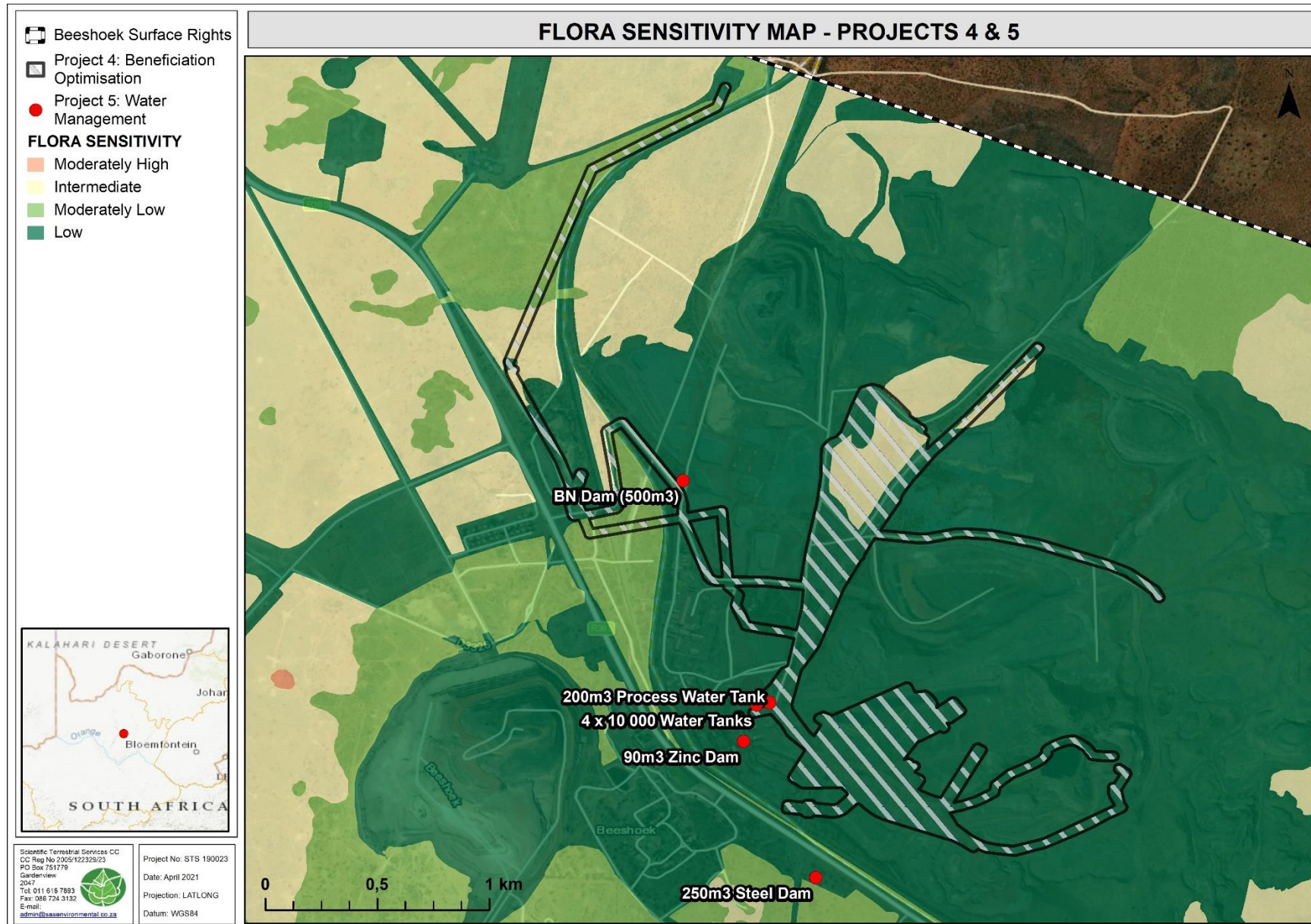


Figure 13: Sensitivity map for the Beeshoek Mine with the proposed Project 4 and 5 superimposed on the habitat sensitivities.



5 IMPACT ASSESSMENT

The sections below provide the significance of perceived impacts arising from the proposed Beeshoek Mine expansion and consolidation which is divided into five projects, collectively referred to as the focus area, namely:

- **Project 1:** Consolidation of Run of Mine (ROM) Stockpiles on South Mine.

- **Project 2:** Amendments to the design of existing Waste Rock Dumps (WRDs) in terms of the increase in heights, and allowance for final slope, which will result in extension of footprints.

- **Project 3:** Increase of Opencast footprint areas, as well as the undertaking of detrital mining for shallow iron ore reserves, including transportation routes (Haul roads).

- **Project 4:** Development of the Beneficiation Project which will comprise of a WHIMS Plant and Jig Plant at Beeshoek.

- **Project 5:** Water Management.

An impact discussion and assessment of all potential pre-construction, construction, operational and maintenance phase impacts are provided in Section 5.2. All mitigatory measures required to minimise the perceived impacts are presented in Section 5.4.



5.1 Activities and Aspect Register

The table below indicates the perceived risks to floral species associated with the activities pertaining to the proposed Beeshoek Mine expansion and Consolidation.

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

ACTIVITIES AND ASPECTS REGISTER	
Planning Phase	
-	Potential failure to conduct a walkdown of the footprint areas before construction activities where floral SCC are searched and marked for either rescue and relocation (only eligible species), for harvesting of propagules (where SCC cannot be relocated but can be propagated in a plant nursery to form part of rehabilitation activities later down the line), or to obtain numbers of SCC individuals that will be destroyed.
-	Impact: Unnecessary loss of floral SCC from the focus area with potential to impact on their population numbers and dynamics in the larger region.
-	Potential failure to relocate all floral SCC that are eligible for relocation to appropriate habitat outside the proposed mining footprint, or failure to harvest sufficient propagules of SCC to propagate for rehabilitation later down the line.
-	Impact: Loss of floral SCC from the focus area with potential to impact on their population numbers and dynamics in the larger region.
-	Potential failure to comply with national (NFA and TOPS) and provincial (NCNCA) legislation regarding permit applications for the removal, destruction, harvesting, or relocation of floral SCC within focus area.
-	Impact: Unnecessary or unlawful destruction/removal of floral SCC without input from the relevant conservation authorities, leading to a decline in the numbers of NEMBA TOPS plants, NCNCA -Protected plants and/or NFA-protected tree species within the focus area.
-	Potential inadequate liaison with the Department of Environment and Nature Conservation (DENC) and the Department of Forestry, Fisheries and the Environment (DFFE) with regards to floral SCC rescue and relocation permits;
-	Potential failure to prepare a Rescue and Relocation Plan for eligible floral SCC; and
-	Potential inadequate planning with regards to new site locations for floral SCC to be relocated.
-	Impact: Potential decline in the numbers of NEMBA TOPS plants, DENC -Protected plants and/or NFA-protected tree species within the focus areas, especially without guidance from the relevant regulating and conservation authorities.
-	Potential failure to demarcate sensitive habitat and floral SCC populations occurring outside of the direct project footprint as “No-Go” areas before construction commences.
-	Impact: Unnecessary clearing of vegetation and floral SCC. Overall increased in the decline of floral diversity and habitat.
-	Inconsiderate planning of infrastructure placement and design, leading to the loss of intact floral habitat, as well as unnecessary edge effect impacts on areas outside of the proposed mining footprint.
-	Impact: Degradation and modification of the receiving environment, loss of floral habitat.
-	Potential failure to design and implement an Alien and Invasive Plant (AIP) Management/Control plan before the commencement of mining activities, resulting in the spread of AIPs from the mining footprint to surrounding natural habitat (propagules “hitch-hike” with construction vehicles).
-	Impact: Spreads of AIPs, leading to potential loss of floral habitat and species diversity from surrounding natural habitat.
-	Potential failure to set up an Erosion Control Plan for sloped areas, as well as designing inadequate stormwater management measures that could lead to increased erosion and expansion of stockpiles and WRD footprints. Loss of a nutrient-rich topsoil layer and degradation of soil structure may also result.
-	Impact: Loss of floral habitat outside of the direct, authorised mining footprint.
Construction and Operational Phases	
-	Site preparation and clearing of vegetation.
-	Impact: Loss of sensitive floral habitat and the potential loss of additional floral SCC individuals due to loss of favourable habitat.
-	Potential failure to have relocated or harvested all floral SCC prior to the commencement of site clearing activities.
-	Impact: Loss of SCC individuals.
-	Potential failure to monitor the success of relocated floral SCC and propagation trials in plant nurseries from harvested propagules where SCC were not eligible for relocation.



ACTIVITIES AND ASPECTS REGISTER	
-	Impact: Loss of SCC individuals.
-	Proliferation of AIP species that colonise areas of increased disturbances and that outcompete native species, including the ongoing transformation of adjacent or nearby natural and more sensitive habitat.
-	Impact: Loss of favourable floral habitat outside of the direct mining footprint, including a decrease in floral diversity and loss of potentially occurring SCC.
-	Potential overexploitation through the removal and/or collection of important or sensitive floral SCC beyond the direct footprint area due to increased presence of workers on site.
-	Impact: Local to regional loss of floral SCC individuals.
-	Additional pressure on floral habitat by increased human movement associated with the proposed construction and operational activities, including increased vehicular movement, contributing to: <ul style="list-style-type: none"> • Overexploitation through the removal and/or collection of important or sensitive floral SCC beyond the direct footprint area; • Increased introduction and spread of AIPs; and • Increased risk of fire frequency.
-	Impact: Loss of sensitive floral habitat and the potential loss of floral SCC.
-	Potential failure to rehabilitate bare areas or disturbed sites as soon as they become available, potentially resulting in loss of viable soils, increased erosion risks and/or the proliferation of AIPs and increased bush encroachment.
-	Impact: Long-term loss of favourable habitat for the establishment of floral species. Loss of floral diversity and SCC.
-	Potentially poorly managed edge effects: <ul style="list-style-type: none"> • Potential ineffective rehabilitation of compacted areas, bare soils, or eroded areas leading to ongoing proliferation of AIP species in disturbed areas and subsequent spread to surrounding natural areas that then alter the floral habitat; • Ongoing intensification of bush encroachment resulting from increased disturbances or poor veld management; • Increased introduction and proliferation of alien plant species due to a lack of maintenance activities, or poorly implemented and monitored AIP Management programme, leading to ongoing displacement of natural vegetation outside of the footprint area; and • Potential fragmentation of sensitive habitat by transport vehicles not using designated roads.
-	Impact: Loss of floral habitat, diversity and potentially occurring SCC within and beyond the direct footprint of the proposed mining activities. Loss of surrounding floral diversity and floral SCC through the displacement of indigenous flora by AIP species and bush encroachers- especially in response to increased disturbances.
-	Dumping of excavated and construction material outside of designated areas, promoting the establishment of AIPs and/or an increase in encroaching woody species.
-	Impact: Loss of floral habitat, diversity and SCC through displacement by AIPs and indigenous encroachers such as <i>Senegalia melifera</i> subsp. <i>detinens</i> and <i>Rhigozum spp.</i>
-	Dust generated during construction and operational activities accumulating on the surrounding floral individuals, altering the photosynthetic ability of plants ⁴ and potentially further decreasing optimal growing /re-establishing conditions.
-	Impact: Declines in plant functioning leading to loss of floral species and habitat for optimal growth.
-	Possible increased fire frequency during construction.
-	Impact: Loss or alteration of floral habitat and species diversity.
-	Decreased ecoservice provision & decreased ability to support biodiversity by wetlands due to vegetation and soil disturbance.
-	Impact: Loss or alteration of Watercourse Habitat and associated species diversity.
-	On-going disturbance during operational phase may lead to erosion and sedimentation of surrounding floral habitat.
-	Impact: Degradation of favourable habitat and limited potential for floral re-establishment leading to loss of floral habitat and diversity within the local area.
Decommissioning & Rehabilitation Phases	
-	Potentially ineffective rehabilitation of Pits, WRDs, decommissioned mine infrastructure, and exposed and impacted areas leading to a shift in vegetation type;
-	Impact: Permanent loss of floral habitat, floral diversity and floral SCC due to loss of favourable habitat to reinstate floral SCC. Higher likelihood of edge effect impacts on adjacent and nearby natural vegetation of increased sensitivity.

⁴ Sett, R. (2017). Responses in plants exposed to dust pollution. Horticulture International Journal, 1(2), 00010.).



ACTIVITIES AND ASPECTS REGISTER	
<ul style="list-style-type: none"> - Likely inability to restore specialised habitats such as Cryptic Wetlands and Rupicolous Habitat. - Impact: Loss of species diversity and a permanent loss of habitat for a variety of potentially occurring endemics that are typically associated with these socialised habitat. 	
<ul style="list-style-type: none"> - Potential poor management and failure to monitor rehabilitation efforts, leading to: <ul style="list-style-type: none"> • Landscapes left fragmented, resulting in reduced dispersal capabilities of floral species and a decrease in floral diversity; • Compacted soils and increased AIP cover limiting the re-establishment of natural vegetation; and • Increased risk of erosion in areas left disturbed. - Impact: Long-term (or permanent) loss of floral habitat, diversity and SCC. 	
<ul style="list-style-type: none"> - Potentially poorly implemented and monitored AIP Management programme and bush encroachment management, leading to the reintroduction and proliferation of AIP species, or the intensification of bush encroachment within the area. - Impact: Permanent loss of surrounding natural floral habitat, diversity and SCC. 	
<ul style="list-style-type: none"> - Potential poor monitoring of relocated SCC and nursery specimens to be used for rehabilitation. - Impact: Loss of SCC from the Beeshoek Mine area and poorly reinstated and represented floral SCC within rehabilitated areas. 	

5.2 Floral Impact Assessment Results

The below table indicates the perceived risks to the floral ecology associated with all phases of the proposed development. The table also provides the findings of the impact assessment 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 impact tables are split across the various projects based on the type of impact that these projects will have on the receiving environment, e.g., Projects 1 and 2 were grouped and results of the impact assessment presented in Table 4. Project 3 was assessed on its own and results are presented in Table 5. Projects 4 and 5 were grouped and results presented in Table 6.

The impact assessment tables only include habitat units that are impacted by the proposed projects. As such, not all habitat units are listed or assessed as part of the various impact assessments. Where the impact on habitat, diversity or floral SCC will have the same outcome, certain habitat units were grouped.



Table 4: Impact on the floral habitat, diversity, and SCC from the proposed Project 1 and 2 activities.

Habitat Units	UNMANAGED								MANAGED							
	Probability of Impact	Sensitivity	Severity	Spatial Scale	Duration of Impact	Likelihood	Consequence	Significance	Probability of Impact	Sensitivity	Severity	Spatial Scale	Duration of Impact	Likelihood	Consequence	Significance
PLANNING PHASE																
Habitat and Diversity																
Calcrete Shrubland	3	3	3	2	3	6	8	48 Low	2	3	2	2	2	5	6	30 Low
Open Thornveld	3	3	3	2	3	6	8	48 Low	2	3	2	2	2	5	6	30 Low
Rupicolous Habitat	3	2	3	2	3	5	8	40 Low	1	2	2	2	2	3	6	18 Very low
Transformed Habitat	3	1	1	2	3	4	6	24 Very low	1	1	1	2	2	2	5	10 Very low
Species of Conservation Concern																
Calcrete Shrubland (<i>Boscia albitrunca</i> and <i>Vachellia erioloba</i>)	4	3	3	3	3	7	9	63 Medium-low	4	2	2	2	2	6	6	36 Low
Open Thornveld (<i>Boophone disticha</i> , <i>Boscia albitrunca</i> , <i>Orbea</i> sp., <i>Vachellia erioloba</i> , Potentially <i>Euphorbia</i> cf. <i>duseimata</i> and <i>Harpagophytum procumbens</i>)	4	3	3	3	3	7	9	63 Medium-low	4	2	2	2	2	6	6	36 Low
Rupicolous Habitat (Potentially <i>Boscia albitrunca</i>)	4	2	3	3	3	6	9	54 Medium-low	4	2	2	2	2	6	6	36 Low
Transformed Habitat	1	1	1	1	3	2	5	10 Very low	1	1	1	1	2	2	4	8 Very low
CONSTRUCTION AND OPERATIONAL PHASE																
Habitat and Diversity																
Calcrete Shrubland	5	3	2	2	4	8	8	64 Medium-low	4	3	2	1	4	7	7	49 Low
Open Thornveld	5	3	2	2	4	8	8	64 Medium-low	4	3	2	1	4	7	7	49 Low
Rupicolous Habitat	5	2	2	2	4	7	8	56 Medium-low	4	2	2	1	4	6	7	42 Low
Transformed Habitat	2	1	2	2	4	3	8	24 Very low	1	1	2	3	4	2	9	18 Very low



Habitat Units	UNMANAGED								MANAGED							
	Probability of Impact	Sensitivity	Severity	Spatial Scale	Duration of Impact	Likelihood	Consequence	Significance	Probability of Impact	Sensitivity	Severity	Spatial Scale	Duration of Impact	Likelihood	Consequence	Significance
Species of Conservation Concern																
Calcrete Shrubland (<i>Boscia albitrunca</i> and <i>Vachellia erioloba</i>)	3	3	2	3	4	6	9	54 Medium-low	2	3	2	1	4	5	7	35 Low
Open Thornveld (<i>Boophone disticha</i> , <i>Boscia albitrunca</i> , <i>Orbea sp.</i> , <i>Vachellia erioloba</i> , Potentially <i>Euphorbia cf. duseimata</i> and <i>Harpagophytum procumbens</i>)	3	3	2	3	4	6	9	54 Medium-low	2	3	2	1	4	5	7	35 Low
Rupicolous Habitat (Potentially <i>Boscia albitrunca</i>)	3	2	2	3	4	5	9	45 Low	2	2	1	1	4	4	6	24 Very low
Transformed Habitat	2	1	1	2	4	3	7	21 Very low	1	1	1	1	4	2	6	12 Very low
CLOSURE AND REHABILITATION PHASE																
Habitat and Diversity																
Natural Habitat Areas (Calcrete Shrubland, Open Thornveld, Rupicolous Habitat)	3	3	3	3	3	6	9	54 Medium-low	2	3	2	2	3	5	7	35 Low
Transformed Habitat	2	1	2	2	3	3	7	21 Very low	1	1	1	2	3	2	6	12 Very low
Species of Conservation Concern																
Applicable to all SCC	3	4	3	3	4	7	10	70 Medium-low	2	4	2	2	3	6	7	42 Low



Table 5: Impact on the floral habitat, diversity and SCC from the proposed Project 3 activities.

Habitat Units	UNMANAGED								MANAGED							
	Probability of Impact	Sensitivity	Severity	Spatial Scale	Duration of Impact	Likelihood	Consequence	Significance	Probability of Impact	Sensitivity	Severity	Spatial Scale	Duration of Impact	Likelihood	Consequence	Significance
PLANNING PHASE																
Habitat and Diversity																
Natural Habitat Areas (Calcrete Shrubland, Open Thornveld, Rupicolous Habitat)	3	4	3	3	3	7	9	63 Medium-low	1	4	2	2	2	5	6	30 Low
Watercourse Habitat (Cryptic Wetlands)	3	4	3	3	3	7	9	63 Medium-low	1	4	3	2	2	5	7	35 Low
Non-watercourse Habitat (Preferential flow paths, recharge zone and Seasonal Depressions)	2	2	2	2	3	4	7	28 Low	1	2	1	2	2	3	5	15 Very low
Modified Habitat (Transformed Areas and Degraded Thornveld)	2	2	2	2	2	4	6	24 Very low	1	2	1	1	2	3	4	12 Very low
Species of Conservation Concern																
Calcrete Shrubland <i>*Boscia albitrunca, Olea europaea subsp. africana, Ruschia calcarea, Vachellia erioloba</i>	5	3	3	3	5	8	11	88 Medium-high	4	3	2	2	3	7	7	49 Low
Open Thornveld <i>*Boopbone disticha, Boscia albitrunca, Oxalis sp., Vachellia erioloba</i> (potentially <i>Orbea</i> and <i>Euphorbea</i> species)	5	3	3	3	5	8	11	88 Medium-high	4	3	2	2	3	7	7	49 Low
Rupicolous Habitat <i>*Anacampseros filamentosa, Aloe hereroense, Aizoaceae, Ammocharis cf. coranica, Boscia albitrunca, Babiana bainesii, Euphorbia cf. rhombifolia, Gladiolus permeabilis subsp. edulis, Nymania capensis, Olea europaea subsp. africana, Vachellia erioloba</i>	4	4	3	3	5	8	11	88 Medium-high	4	4	2	3	3	8	8	64 Medium-low
Watercourse Habitat (Cryptic Wetlands) (<i>Nerine laticoma, Vachellia erioloba, Olea europaea subsp. africana</i>)	3	4	3	3	5	7	11	77 Medium-high	2	4	2	2	3	6	7	42 Low
Non-watercourse Habitat (Preferential flow paths, recharge zone and Seasonal Depressions) (<i>Vachellia erioloba</i> and <i>Nerine</i> sp.)	5	2	3	2	5	7	10	70 Medium-low	4	2	2	1	3	6	6	36 Low
Modified Habitat (Transformed Areas and Degraded Thornveld) (<i>Vachellia erioloba</i> and <i>Aloe grandicornuta</i>)	5	2	2	2	5	7	9	63 Medium-low	4	2	2	2	3	6	7	42 Low
CONSTRUCTION PHASE																
Habitat and Diversity																
Calcrete Shrubland	5	3	3	2	4	8	9	72 Medium-low	3	3	3	2	4	6	9	54 Medium-low



Habitat Units	UNMANAGED							MANAGED								
	Probability of Impact	Sensitivity	Severity	Spatial Scale	Duration of Impact	Likelihood	Consequence	Significance	Probability of Impact	Sensitivity	Severity	Spatial Scale	Duration of Impact	Likelihood	Consequence	Significance
Open Thornveld	5	3	3	2	4	8	9	72 Medium-low	3	3	2	2	4	6	8	48 Low
Rupicolous Habitat	5	4	3	2	4	9	9	81 Medium-high	3	4	2	2	4	7	8	56 Medium-low
Watercourse Habitat (Cryptic Wetlands)	5	4	2	2	4	9	8	72 Medium-low	3	4	2	2	4	7	8	56 Medium-low
Non-watercourse Habitat (Preferential flow paths, recharge zone and Seasonal Depressions)	5	2	2	2	4	7	8	56 Medium-low	3	2	1	1	4	5	6	30 Low
Modified Habitat (Transformed Areas and Degraded Thornveld)	5	2	2	2	4	7	8	56 Medium-low	2	2	1	1	4	4	6	24 Very low
Species of Conservation Concern																
Calcrete Shrubland (<i>Boscia albitrunca</i> , <i>Olea europaea</i> subsp. <i>africana</i> , <i>Ruschia calcarea</i> , <i>Vachellia erioloba</i>)	3	3	3	3	4	6	10	60 Medium-low	2	3	2	2	4	5	8	40 Low
Open Thornveld (<i>Boophone disticha</i> , <i>Boscia albitrunca</i> , <i>Hoodia gordonii</i> , <i>Oxalis</i> sp., <i>Vachellia erioloba</i> , and potentially <i>Orbea</i> and <i>Euphorbia</i> species)	3	3	3	3	4	6	10	60 Medium-low	2	3	2	2	4	5	8	40 Low
Rupicolous Habitat (<i>Anacampseros filamentosa</i> , <i>Aloe hereroense</i> , Aizoaceae, <i>Ammocharis cf. coranica</i> , <i>Boscia albitrunca</i> , <i>Babiana bainesii</i> , <i>Euphorbia cf. rhombifolia</i> , <i>Gladiolus permeabilis</i> subsp. <i>edulis</i> , <i>Nymanina capensis</i> , <i>Olea europaea</i> subsp. <i>africana</i> , <i>Vachellia erioloba</i>)	3	4	3	3	4	7	10	70 Medium-low	2	4	2	2	4	6	8	48 Low
Watercourse Habitat (Cryptic Wetlands) (<i>Nerine laticoma</i> , <i>Vachellia erioloba</i> , <i>Olea europaea</i> subsp. <i>africana</i>)	3	4	3	4	4	7	11	77 Medium-high	2	4	2	3	4	6	9	54 Medium-low
Non-watercourse Habitat (Preferential flow paths, recharge zone and Seasonal Depressions) (<i>Vachellia erioloba</i>)	2	2	2	2	4	4	8	32 Low	1	2	1	2	4	3	7	21 Very low
Modified Habitat (Transformed Areas and Degraded Thornveld) (<i>Vachellia erioloba</i> and <i>Aloe grandicornuta</i>)	2	2	2	2	4	4	8	32 Low	1	2	1	1	4	3	6	18 Very low
CLOSURE AND REHABILITATION PHASE																
Habitat and Diversity																
Natural Habitat Areas (Calcrete Shrubland, Open Thornveld, Rupicolous Habitat)	3	4	3	3	3	7	9	63 Medium-low	2	4	2	2	3	6	7	42 Low
Watercourse Habitat (Cryptic Wetlands)	3	4	3	3	3	7	9	63 Medium-low	2	4	2	2	3	6	7	42 Low
Non-watercourse Habitat (Preferential flow paths, recharge zone and Seasonal Depressions)	2	2	2	2	3	4	7	28 Low	1	2	1	1	3	3	5	15 Very low



Habitat Units	UNMANAGED								MANAGED							
	Probability of Impact	Sensitivity	Severity	Spatial Scale	Duration of Impact	Likelihood	Consequence	Significance	Probability of Impact	Sensitivity	Severity	Spatial Scale	Duration of Impact	Likelihood	Consequence	Significance
Modified Habitat (Transformed Areas and Degraded Thornveld)	2	2	2	2	3	4	7	28 Low	1	2	1	1	3	3	5	15 Very low
Species of Conservation Concern																
Applicable to all SCC	4	4	3	3	4	8	10	80 Medium-high	3	3	3	2	3	6	8	48 Low



Table 6: Impact on the faunal habitat, diversity and SCC from the proposed Project 4 and 5 activities.

Habitat Units	UNMANAGED								MANAGED							
	Probability of Impact	Sensitivity	Severity	Spatial Scale	Duration of Impact	Likelihood	Consequence	Significance	Probability of Impact	Sensitivity	Severity	Spatial Scale	Duration of Impact	Likelihood	Consequence	Significance
PLANNING PHASE																
Habitat and Diversity																
Natural Habitat Areas (Calcrete Shrubland, Rupicolous Habitat)	3	3	3	2	2	6	7	42 Low	3	3	2	2	2	6	6	36 Low
Non-watercourse Habitat (Preferential flow path)	3	2	2	2	2	5	6	30 Low	2	2	1	1	2	4	4	16 Very low
Modified Habitat (Transformed Areas and Degraded Thornveld)	2	2	1	2	2	4	5	20 Very low	1	2	1	1	2	3	4	12 Very low
Species of Conservation Concern																
Calcrete Shrubland *Aizoaceae, Boscia albitrunca, Vachellia erioloba	3	3	2	2	2	6	6	36 Low	2	3	2	2	2	5	6	30 Low
Rupicolous Habitat *Boscia albitrunca	3	3	2	2	2	6	6	36 Low	2	3	2	2	2	5	6	30 Low
Non-watercourse Habitat (Preferential flow path)	2	2	2	2	2	4	6	24 Very low	1	2	1	1	2	3	4	12 Very low
CONSTRUCTION PHASE																
Habitat and Diversity																
Calcrete Shrubland	4	2	2	2	4	6	8	48 Low	2	3	1	2	4	5	7	35 Low
Rupicolous Habitat	4	3	2	2	4	7	8	56 Medium-low	2	3	1	1	4	5	6	30 Low
Non-watercourse Habitat (Preferential flow path)	4	2	2	2	4	6	8	48 Low	2	2	1	1	4	4	6	24 Very low
Modified Habitat (Transformed Areas and Degraded Thornveld)	3	2	1	2	4	5	7	35 Low	2	2	1	1	4	4	6	24 Very low
Species of Conservation Concern																
Calcrete Shrubland *Aizoaceae, Boscia albitrunca, Vachellia erioloba	4	3	3	2	4	7	9	63 Medium-low	2	3	2	2	4	5	8	40 Low
Rupicolous Habitat *Boscia albitrunca	4	3	2	2	4	7	8	56 Medium-low	2	3	2	1	4	5	7	35 Low
Non-watercourse Habitat (Preferential flow path)	2	2	2	2	4	4	8	32 Low	1	2	1	1	4	3	6	18 Very low



Habitat Units	UNMANAGED								MANAGED							
	Probability of Impact	Sensitivity	Severity	Spatial Scale	Duration of Impact	Likelihood	Consequence	Significance	Probability of Impact	Sensitivity	Severity	Spatial Scale	Duration of Impact	Likelihood	Consequence	Significance
Modified Habitat (Transformed Areas and Degraded Thornveld)	2	2	2	2	4	4	8	32 Low	1	2	1	1	4	3	6	18 Very low
CLOSURE AND REHABILITATION PHASE																
Habitat and Diversity																
Calcrete Shrubland	3	3	3	2	3	6	8	48 Low	2	3	2	2	3	5	7	35 Low
Rupicolous Habitat	3	3	3	2	3	6	8	48 Low	2	3	1	1	3	5	5	25 Very low
Non-watercourse Habitat (Preferential flow path)	2	2	2	2	3	4	7	28 Low	1	2	1	1	3	3	5	15 Very low
Modified Habitat (Transformed Areas and Degraded Thornveld)	2	2	2	2	3	4	7	28 Low	1	2	1	1	3	3	5	15 Very low
Species of Conservation Concern																
Applicable to all SCC	3	3	3	2	3	6	8	48 Low	1	3	2	2	2	4	6	24 Very low



5.3 Impact Discussion

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

Separately, the five projects will vary considerably in the significance of the impact ratings on floral ecology associated with the Beeshoek Mine. Collectively, the impacts are anticipated to be greater (in extent) for the Rupicolous Habitat, Calcrete Shrubland, Degraded Thornveld, and Open Thornveld. Most of the proposed activities is, however, restricted to the Transformed Habitat Unit and will thus not significantly impact on habitat within the Beeshoek Mine Area. Refer to Table 7 for a breakdown of the anticipated impacts from the proposed Projects 1 – 5.

Table 7: Habitat Unit impact summary.

	Calcrete Shrubland	Cryptic Wetlands	Degraded Thornveld	Episodic Drainage Line	Open Thornveld	Preferential flow paths	Recharge Zone	Rupicolous Habitat	Seasonal Depressions	Transformed Habitat
Extent (ha) of Habitat Unit within the Beeshoek SRA	1196	17	255	8	686	14	25	812	15	2016
Total Extent (ha) of Habitat Unit Impacted by proposed Projects 1 - 5	133	0	157	0	107	4	0	131	1	948
Percentage (%) of each habitat unit impacted within the Beeshoek SRA	11%	2%	62%	0	16%	30%	0	16%	4%	47%

For floral habitat and diversity, the construction and operational phases (or mining phase) will have the greatest impacts. Impacts on protected floral species will be higher during the *planning phase* during which SCC should be relocated and/or propagules harvested for propagation in plant nurseries. Relocation of most of the geophyte and succulent SCC on site will likely be successful, with woody species more likely to require harvesting of propagules to propagate in a plant nursery. Avoidance of impacts on SCC population genetics and dynamics will, however, not be entirely possible. Impacts during the construction and operational phase can be reduced to lower impact significance on floral SCC given that sufficient monitoring of relocated and harvested specimens is implemented. During closure and rehabilitation, the significance of impacts on floral SCC will be limited in its potential to be reduced for some species, as it is unlikely that the favourable, pre-mined habitat can be achieved with rehabilitation for certain habitat types (e.g., Rupicolous Habitat Unit). Habitat generalists will more easily be reinstated during rehabilitation regardless of the success of achieving the pre-mined condition.



5.3.1 Impact on Floral Habitat and Diversity

The data gathered during the site visit indicate that the Modified Habitat Unit is of **Low and Moderately Low Sensitivity**, the Calcrete Shrubland is of **Intermediate and Moderately Low Sensitivity**, the Watercourses (Cryptic Wetlands and Episodic Drainage lines) of **Moderately High Sensitivity**, the Non-watercourses (Preferential Flow Paths, Seasonal Depressions and Recharge zone) of **Moderately Low Sensitivity**, the Open Thornveld varied between **Intermediate and Moderately Low Sensitivities**, and the Rupicolous Habitat varied between **Moderately Low and Moderately High Sensitivities**. The proposed Beeshoek Mine activities will impact on these habitat units to varying degrees and is discussed in more detail below.

5.3.1.1 Impacts from Project 1 and 2 (Consolidation of ROM Stockpiles on South Mine and amendments to the design of existing WRDs)

The activities related to Projects 1 and 2 are limited in extent and will in many instances impact on habitat that is already degraded (due to edge effect from current mining activities, or their fragmentation from larger, intact habitat). There will, however, be loss of floral habitat from especially the Calcrete Shrubland (Village Pit North Waste Rock Dump and East Pit Waste Rock Dump) and Open Thornveld (Village Pit South Waste Rock Dump and East Pit Waste Rock Dump), which will result in localised impact on floral diversity and habitat given that mitigation measures are sufficiently implemented. The below table summarises the extent of habitat that will be impacted by the proposed Projects 1 and 2 in relation to the habitat that will be lost resulting from all proposed activities (Project 1 – 5), including those not discussed within this report (Railway Line Link Project: STS 200066, 2021).

Table 8: Approximate extent of habitat impacted by the proposed Projects 1 and 2, including percentage of habitat lost in relation to total habitat that will be lost to additionally proposed activities.

HABITAT UNIT	Calcrete Shrubland	Cryptic Wetlands	Degraded Thornveld	Episodic Drainage Line	Open Thornveld	Preferential flow paths	Recharge Zone	Rupicolous Habitat	Seasonal Depressions	Transformed Habitat
Total Extent (ha) of Habitat Unit Impacted by proposed Projects 1 - 5	133	-	157	-	107	4	-	131	1	948
Extent (ha) of Habitat Unit Impacted by proposed Railway Line Link Project	10	-	26	-	5	1	-	-	-	30
Total Extent (ha) of Habitat Unit Impacted by all proposed activities (Projects 1 - 5 & Railway Line Link)	143	-	183	-	112	5	-	131	1	978



HABITAT UNIT	Calcrete Shrubland	Cryptic Wetlands	Degraded Thornveld	Episodic Drainage Line	Open Thornveld	Preferential flow paths	Recharge Zone	Rupicolous Habitat	Seasonal Depressions	Transformed Habitat
Extent (ha) of Habitat Unit Impacted by proposed Projects 1 and 2	21	-	-	-	47	-	-	13	-	485
Percentage of total habitat unit lost resulting from Projects 1 and 2 (in relation to habitat lost from additional activities proposed for the Beeshoek Mine)	15%	-	-	-	42%	-	-	10%	-	50%

Prior to mitigation measures implemented, impact significance on floral habitat and diversity varies between **Medium-Low and Low** for all the natural areas being impacted, to **Very low** where habitat is already transformed or degraded. With mitigation measures implemented, the direct and indirect impacts on the floral habitat and diversity can mostly be reduced to **Low** for all the natural areas being impacted, with impact significance remaining **Very Low** for the Transformed Habitat Unit.

To guarantee impacts remain localised, it must be ensured that planned and authorised footprints do not increase as mining activities continue. Edge effects from mining activities and AIP proliferation must be strictly managed.

5.3.1.2 Impacts from Project 3 (Pit expansions)

The activities associated with Project 3 will result in greater loss of natural habitat areas when compared to the other proposed projects. The Calcrete Shrubland, Open Thornveld Habitat, and the Rupicolous Habitat Units will be directly impacted. The extent of habitat lost will result in declines in floral diversity and habitat within the Beeshoek Mine area; however, impacts are likely to only be of local extent for the current Beeshoek Mine Optimisation Project (projects 1 – 5). If future expansions will occur, these habitat types will be threatened on a larger scale, especially if the closure and rehabilitation phases of the project cannot achieve the pre-mined state. The below table summarises the extent of habitat that will be impacted by the proposed Project 3 in relation to the habitat that will be lost resulting from all proposed activities (Project 1 – 5), including those not discussed within this report (Railway Line Link Project: STS 200066, 2021).



Table 9: Approximate extent of habitat impacted by the proposed Project 3, including percentage of habitat lost in relation to total habitat that will be lost to additionally proposed activities.

HABITAT UNIT	Calcrete Shrubland	Cryptic Wetlands	Degraded Thornveld	Episodic Drainage Line	Open Thornveld	Preferential flow paths	Recharge Zone	Rupicolous Habitat	Seasonal Depressions	Transformed Habitat
Total Extent (ha) of Habitat Unit Impacted by proposed Projects 1 - 5	133	-	157	-	107	4	-	131	1	948
Extent (ha) of Habitat Unit Impacted by proposed Railway Line Link Project	10	-	26	-	5	1	-	-	-	30
Total Extent (ha) of Habitat Unit Impacted by all proposed activities (Projects 1 - 5 & Railway Line Link)	143	-	183	-	112	5	-	131	1	978
Extent (ha) of Habitat Unit Impacted by proposed Project 3	106	-	155	-	59	4	-	107	0,5	376
Percentage of total habitat unit lost resulting from Project 3 (in relation to habitat lost from additional activities proposed for the Beeshoek Mine)	74%	-	-	-	53%	-	-	82%	-	38%

Prior to mitigation measures implemented, impact significance on floral habitat and diversity varies between **Medium-high** (Rupicolous Habitat) and **Medium-low** (Calcrete Shrubland, Open Thornveld and Cryptic Wetlands) for all the natural areas being impacted, to **Low** and **Very low** in areas where habitat is already transformed or degraded (Modified Habitat and non-watercourse habitat). With mitigation measures implemented, the direct and indirect impacts on the floral habitat and diversity can mostly be reduced to **Very low** for the Non-watercourses and Modified Habitat, with impact significance lowered to a potential **Moderately-low** and **Low** for the Cryptic Wetlands, Rupicolous Habitat, Calcrete Shrubland and Open Thornveld.

Loss of natural habitat areas such as the Calcrete Shrublands, Open Thornveld and Rupicolous Habitat will be unfavourable and will result in local loss of floral habitat and diversity. These habitat units are representative of their reference states, albeit somewhat modified due to current and historic disturbances. Considering that the Postmasburg Thornveld, Kuruman Thornveld and Kuruman Mountain Bushveld are endemic vegetation types (Skowno et al, 2019) and the fact that there are several additional mining expansions planned in the region, further impact on the remaining extent of the currently least concern, but poorly protected, vegetation types could increase their threat status. Loss of Cryptic Wetlands are restricted to two pans impacted by the Village Pit Expansion; thus, the impact will be restricted to a local scale. However, as far as possible, no additional Cryptic Wetlands



should be impacted as these are significant biodiversity features for which impacts cannot be fully mitigated or restricted to the local scale.

5.3.1.3 Impacts from Projects 4 and 5 (Beneficiation Project and Water Management):

The activities associated with Projects 4 and 5 are limited in extent and will mostly impact on habitat that is already degraded and transformed. There will be loss of some floral habitat within the Rupicolous Habitat (Beneficiation Optimisation infrastructure), which will result in small and localised impacts on floral diversity and habitat given that mitigation measures are sufficiently implemented. The below table summarises the extent of habitat that will be impacted by the proposed Projects 4 and 5 in relation to the habitat that will be lost resulting from all proposed activities (Project 1 – 5), including those not discussed within this report (Railway Line Link Project: STS 200066, 2021).

Table 10: Approximate extent of habitat impacted by the proposed Projects 4 and 5, including percentage of habitat lost in relation to total habitat that will be lost to additionally proposed activities.

HABITAT UNIT	Calcrete Shrubland	Cryptic Wetlands	Degraded Thornveld	Episodic Drainage Line	Open Thornveld	Preferential flow paths	Recharge Zone	Rupicolous Habitat	Seasonal Depressions	Transformed Habitat
Total Extent (ha) of Habitat Unit Impacted by proposed Projects 1 - 5	133	-	157	-	107	4	-	131	1	948
Extent (ha) of Habitat Unit Impacted by proposed Railway Line Link Project	10	-	26	-	5	1	-	-	-	30
Total Extent (ha) of Habitat Unit Impacted by all proposed activities (Projects 1 - 5 & Railway Line Link)	143	-	183	-	112	5	-	131	1	978
Extent (ha) of Habitat Unit Impacted by proposed Projects 4 and 5	6	-	2	-	0,3	-	-	12	0,5	86
Percentage of total habitat unit lost resulting from Projects 4 and 5 (in relation to habitat lost from additional activities proposed for the Beeshoek Mine)	4%	-	1%	-	0	-	-	9%	50%	9%

Prior to mitigation measures implemented, impact significance on floral habitat and diversity varies between Medium-**low** to **Very low**. With mitigation measures implemented, the direct and indirect impacts on the floral habitat and diversity can mostly be reduced to **Low** and **Very low** impact significance.

With mitigation measures adhered to, the proposed activities associated with Projects 4 and 5 are not anticipated to have significant or residual impacts on the floral communities within the Beeshoek Mine.



Most significant impacts to affect the floral habitat integrity and species diversity within the Beeshoek Mine include, but are not limited to, the following:

- Mining activities within sensitive habitat such as Cryptic Wetlands, species-rich Rupicolous Habitat, large stretches of untransformed Calcrete Shrubland;
- Continued expansion resulting in increasingly fragmented habitat;
- Increase risk of erosion and poor stormwater management - resulting in loss of soils, the down-slope sedimentation of habitat and the consequent loss of habitat beyond the planned footprint;
- AIP proliferation and woody encroachment into natural vegetation, displacing indigenous flora and altering favourable habitat conditions for the establishment of indigenous species;
- Rehabilitation efforts are likely to result in sub-optimal recovery of pre-mining conditions, resulting in residual impacts to floral communities; and
- Increased human populations in the surrounding area leading to greater pressure on natural floral habitat both within the Beeshoek Mine and the surroundings.

5.3.2 Impacts on Floral SCC

The Beeshoek Mine and many sections of the focus area are associated with floral SCC which will directly be impacted on by the proposed mining activities. The SCC recorded on site include species protected under the NCNCA (Schedule 1 and 2) and the NFA, which are species not threatened in terms of NEMBA Section 56. The habitat associated with the Calcrete Shrubland and Rupicolous Habitat provide favourable conditions for threatened species to occur and their potential occurrence within the focus area cannot be excluded.

Within the focus area, the habitat units with the highest abundance and diversity of floral SCC included the Rupicolous Habitat (most diverse) and the Calcrete Shrubland and Open Thornveld (more abundant). The remaining habitat units were either too degraded to host a good representation of floral SCC or comprised specialised habitat (Cryptic Wetlands) where SCC will Likely only be detected with ongoing seasonal surveys. The below table provides an indication of the abundance of SCC associated with each habitat unit in which project activities will take place.

Table 11: Floral SCC summary per habitat unit.

HABITAT UNIT	Impacts on protected SCC	Total Extent (ha) of Habitat Unit Impacted by proposed Projects 1 - 5
Calcrete Shrubland	High abundance of protected SCC	133
Cryptic Wetlands	Low abundance and diversity of protected SCC	0
Degraded Thornveld	Moderate abundance of protected SCC	157



HABITAT UNIT	Impacts on protected SCC	Total Extent (ha) of Habitat Unit Impacted by proposed Projects 1 - 5
Episodic Drainage Line	Moderately low association with protected SCC	0
Open Thornveld	High abundance of protected SCC	107
Preferential flow paths	Low association with protected SCC	4
Recharge Zone	Moderately low association with protected SCC	0
Rupicolous Habitat	High abundance and diversity of protected SCC	131
Seasonal Depressions	Low association with protected SCC	1
Transformed Habitat	Low association with protected SCC	948

Impact on floral SCC varies significantly between the habitat units. Without mitigation implemented, the anticipated impact significance on floral SCC communities is between **Medium-low** and **Medium-High** for the SCC occurring within the natural habitat areas. The pre-mitigation impacts on floral SCC for the Degraded and Transformed Habitat Unit and Non-watercourse habitat is anticipated to vary from **Medium-low to Low**. With mitigation measures implemented, the impact significance can be reduced **Medium-low and Very low** levels.

Mining activities associated with Project 2 and especially Project 3 are anticipated to have an unfavourable impact on floral SCC. Projects 1, 4 and 5 will minimally impact on floral SCC. Schedule 1 and 2 Protected Species require permits from the DENC before vegetation clearing can commence, with TOPS and NFA protected species requiring permits and authorisation from DFFE. Species of geophytes and succulents are good candidates for rescue and relocation, and it is recommended that where these species will be cleared as part of site preparation activities or maintenance activities, they rather be relocated to suitable, similar habitat outside of the proposed footprint area. For woody species that require more effort to relocate and for which relocation success is often low, it is recommended that propagules be harvested prior to clearing. These propagules can be propagated in a plant nursery for use in rehabilitation activities later down the line.

Due to the potential for threatened plant species (RDL plants as per NEMBA Section 56) to occur within the proposed project footprint, it is recommended that a walkdown of the site take place prior to vegetation clearance activities. The walkdown should take place in the optimal season for detecting the threatened species, i.e., typically between November and March, as well as winter months for some species. According to SANBI's Red List of South African Plants website, *ex situ* ('search and rescue') options for RDL plants is strongly discouraged. As such, the best mitigation to limit impacts on these species is avoidance. However, if the proposed activities are authorised, and RDL plants will be impacted, compensating for the loss of SCC must occur. All RDL plant species that will be lost due to clearing of vegetation must be replaced either during rehabilitation initiatives or through translocation to suitable habitat



surrounding the disturbance footprint. SCC lost due to the proposed activities must be replaced following the guideline for biodiversity offsets proposed in the draft National Biodiversity Guidelines (GN 276 of 2017), e.g., for species with a vulnerable threat status: replace species at a ratio of 1:5.

Activities which are likely to negatively affect the flora of conservation concern within and around the focus area include, but are not limited to, the following:

- Placement of mining infrastructure within floral SCC habitat;
- Destruction, removal or harvesting of floral SCC during construction and operational activities; and
- Potentially poorly implemented and monitored rescue and relocation of SCC that will be affected by the proposed projects, leading to unsuccessful rescue efforts and loss of SCC individuals.

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

The proposed development will not impact on CBAs or threatened ecosystems. The development will, however, impact on ESAs (Cryptic Wetlands and Rupicolous Habitat). These ESAs are important features in the greater landscape and provide unique conditions for flora adapted to soils with higher moisture content during rain periods. The mountainous Rupicolous Habitat further provide important movement corridors for both floral and faunal species.

5.3.4 Probable Latent Impacts

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

- Permanent loss of niche floral habitat (Rupicolous Habitat and Cryptic Wetlands);
- Permanent loss of and altered floral species diversity;
- Edge effects such as habitat fragmentation, AIP proliferation and bush encroachment;
- The ongoing loss of SCC/protected floral species and suitable habitat for such species; and
- Disturbed areas not rehabilitated to an ecologically functioning state, e.g., the currently rehabilitated areas are only vegetated with the alien grass *Pennisetum setaceum*, (Fountain grass, category 1b invader) resulting in landscapes with low biodiversity and ecological potential. If this rehabilitation practice continues, it will result in significant



loss of floral habitat, species diversity, large stretches of endemic vegetation types, and SCC/protected floral species.

5.3.5 Cumulative Impacts

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.

AIP spread can potentially become severe if AIPs are not monitored, especially along linear developments that typically serve as a corridor for spread of AIPs. These species can spread to adjacent natural areas, thus impacting on the indigenous biodiversity of the region. If the current rehabilitation practice is pursued, i.e., revegetating with *Pennisetum setaceum* (see below image), then there will be potential for this species to displace native floral communities in adjacent, natural vegetation communities over time.



Figure 14: Snapshot of the rehabilitation site north of the R385. Revegetating with *Pennisetum setaceum* has resulted in low floristic and faunal diversity. The landscape is not considered ecologically functioning.

Ongoing mining expansion within the area surrounding Postmasburg will contribute to regional scale loss of the endemic vegetation types associated with the Beeshoek mine (Kuruman Mountain Bushveld, Kuruman Thornveld and the Postmasburg Thornveld). The location of the mine within the Griqualand West Centre (GWC) further points to the potential for loss of endemic floral species due to mining expansion in the area.

5.4 Integrated Impact Mitigation

The table below highlights the key, general integrated mitigation measures that are applicable to the proposed development 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 diversity, habitat and SCC can be mitigated and minimised.

Table 12: A summary of the mitigatory requirements for floral resources.

Project phase	Planning Phase
Impact Summary	Loss of floral habitat, species and SCC
Proposed mitigation and management measures:	
Floral Habitat and Diversity	
<ul style="list-style-type: none"> - Minimise loss of indigenous vegetation where possible through adequate planning and, where necessary, by incorporating the sensitivity of the biodiversity report as well as other specialist studies; - It must be ensured that, as far as possible, all proposed infrastructure, including temporary infrastructure, is placed outside of sensitive habitat units; - Access roads should be kept to existing roads, as far as possible, so as to reduce fragmentation of natural habitat outside of the authorised footprint; - It is recommended that prior to the commencement of construction activities that the entire construction servitude be fenced off and clearly demarcated - Prior to the commencement of construction activities, an AIP Management/Control Plan should be compiled for implementation: <ul style="list-style-type: none"> • Removal of alien invasive species should preferably commence during the pre-construction phase and continue throughout the construction and operational phases. AIPs should be cleared within the focus area before any vegetation clearing activities commence, thereby ensuring that no AIP propagules are spread with construction rubble, or soils contaminated with AIP seeds during the construction phase; and • An AIP Management/Control Plan should be implemented by a qualified professional. No uncertified chemical control of AIPs to occur within the watercourses. 	
Floral SCC	
<ul style="list-style-type: none"> - Floral SCC recorded within the proposed mining footprint included species protected under the NFA and the NEMBA TOPS regulations, as well as species protected under Schedule 1 and 2 of the NCNCA. A walkdown of the footprint area is required before construction activities commence, where all anticipated floral SCC/protected species are searched for relocation and/or destruction so that all necessary permits can be obtained from the DENC and DFFE; - For NFA protected tree species, attempting to relocate mature individuals are often too expensive and/or result in unsuccessful re-establishment due to unavoidable damage to their root systems during their excavation. Where possible, seedlings of affected tree species should be targeted for relocation, and seeds must be harvested prior to vegetation clearance to use in rehabilitation activities. It is important that seedlings and seeds be harvested within a close proximity of an area to be impacted, so as to prevent alteration of population genetics; - Geophytes and succulents are good candidates for rescue and relocation, and these should be targeted for such initiatives. Where possible, propagules of such species must also be harvested and propagated in a plant nursery to use in rehabilitation activities during the closure and rehabilitation phase of the project; and - A rescue and relocation plan must be drafted and approved by the relevant authorities for all floral SCC that will potentially be impacted by the proposed mining activities. The Rescue and Relocation Plan must be used in conjunction with an approved Rehabilitation Plan for the Beeshoek Mine to ensure successful translocation and/or reinstatement of floral SCC and habitat for such species. 	
Project phase	Construction and Operational Phases
Impact Summary	Loss of floral habitat, species and SCC
Proposed mitigation and management measures:	
Development footprint	
<ul style="list-style-type: none"> - The disturbance footprint must be kept as small as possible in order to minimise impact on the surrounding environment (edge effect management); - All areas of increased ecological sensitivity beyond the approved footprint must be designated as No-Go areas and be off-limits to all unauthorised construction vehicles and personnel; - Removal of vegetation must be restricted to what is absolutely necessary and should remain within the approved footprint; - No additional habitat is to be disturbed during the operational phase of the project outside of the demarcated approved footprints (being applied for). Biweekly (recommended) to monthly (minimum requirement) monitoring and recording of the footprint areas must be done by the Environmental Control 	



- Officer (ECO) and photographic records kept – special attention should also be paid to potential increase and spread of alien vegetation and bush encroachment;
- Vehicles should be restricted to travelling only on designated roadways to limit the ecological footprint of the construction activities. Additional road construction should be limited to what is absolutely necessary, and the footprint thereof kept to a minimal;
 - No collection of indigenous floral species must be allowed by construction personnel, especially with regards to floral SCC;
 - No dumping of litter, rubble or cleared vegetation on site must be allowed. Infrastructure and rubble removed as a result of the construction 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 phase for all construction rubble and general waste. Vegetation cuttings must be carefully collected and disposed of at a separate waste facility;
 - If any spills occur, they should be cleaned up immediately 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; and
 - Upon completion of construction activities, it must be ensured that no bare areas remain, and that indigenous species be used to revegetate the disturbed area.

Edge effect Management

- To limit edge effect impacts to the surrounding natural habitat, the below guidelines must be followed:
 - Demarcating all footprint areas during construction activities;
 - No construction rubble to be disposed of outside of demarcated areas, and should be taken to a registered waste disposal facility;
 - All soils compacted as a result of construction activities should be ripped, profiled and reseeded;
 - Suppress dust to mitigate the impact of dust on flora within a close proximity of construction activities;
 - Minimise the risk of erosion by limiting the extent of disturbed vegetation and exposed soil; and
 - Manage the spread of AIP species and bush encroachers, which may affect remaining natural habitat within surrounding areas.
- Ongoing alien and invasive plant monitoring and clearing/control should take place throughout all phases of the project activities. The project perimeters should regularly be checked for AIP proliferation to prevent spread into surrounding natural areas; and
- Management of AIPs during the construction-phase and operational-phase activities must be focused on limiting their introduction and preventing their spread. For example, roadsides should be monitored, as they serve as common corridors along which AIP species are introduced and dispersed, and disturbed areas should regularly be monitored for AIP recruitment until successfully rehabilitated.

Floral SCC

- Any unauthorised collection of floral material is to be prohibited;
- Monitoring of any rescued and relocated floral SCC should commence during the construction phase and continue until it is evident that relocated species have successfully established;
- Harvesting of protected floral species by construction and operational personnel should be strictly prohibited; and
- Edge effect control needs to be implemented to prevent further degradation and potential loss of floral SCC outside of the proposed development footprint area.

Fire

- No illicit fires must be allowed during the operational phases of the proposed Borrow Pit project; and
- Fire breaks should be maintained during the construction and operational phases.

Dust

- An effective dust management plan must be designed and implemented to mitigate the impact of dust on flora throughout the construction phase;
- Dust pollution have been associated with poor photosynthetic functionality in plants⁵. There is evidence of dust pollution leading to a reduction in chlorophyll, including chlorophyll degradation and reduced

⁵ Sett, R. (2017). Responses in plants exposed to dust pollution. Horticulture International Journal, 1(2), 00010.).



photosynthetic activity^{6 7}, resulting from dust deposition on leaf surfaces. Dust deposition also result in stomata clogging⁸, which causes a decreased rate of carbon dioxide exchange, carbon assimilation, transpiration, and therefore decreased net photosynthesis.

Rehabilitation

- Rehabilitation of natural vegetation should proceed in accordance with the rehabilitation plan – concurrent rehabilitation is recommended. This rehabilitation plan should consider all phases of the project indicating rehabilitation actions to be undertaken during and once construction has been completed, ongoing rehabilitation during the operational phase of the project as well as rehabilitation actions to be undertaken after operations have ceased;
- Appropriate shaping of disturbed areas is essential. To promote successful establishment of vegetation, the slopes must not be steeper than 1(V):5(H) or 1(V):3(H) (depending on engineering input and recommendations). New slopes should resemble/mimic the natural topography of the surrounding area. Where slopes are left steeper than what is recommended for whatever reason, additional measures will be required to prevent soil erosion and to appropriately manage stormwater;
- Any natural areas beyond the direct footprint, which have been affected by the construction or operational activities, must be rehabilitated using indigenous species;
- Floral monitoring should be done annually during operational activities. Please also refer to the monitoring guidelines in section 5.5;
- Rehabilitation must be implemented concurrently as per the rehabilitation plan, and disturbed areas must be rehabilitated as soon as such areas become available. This will not only reduce the total disturbance footprint but will also reduce the overall rehabilitation effort and costs associated with it; and
- All soils compacted because of construction 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.

Project phase	Closure & Rehabilitation Phase
Impact Summary	Loss of floral habitat, species and SCC

Proposed mitigation and management measures:

Rehabilitation

- All infrastructure and footprint areas should be rehabilitated in accordance with the rehabilitation plan;
- 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;
- The post-closure rehabilitation land use must be determined and agreed upon for the rehabilitation plan to be drafted. It is recommended that the port-closure land use be to natural vegetation that represents, as far as possible, the pre-mined vegetation communities, with ecological function prioritised. The rehabilitated areas must be able to sustain floral SCC, especially if such species are relocated into rehabilitated sites;
- Edge effects such as erosion and AIP proliferation, which may affect adjacent or sensitive habitat, need to be strictly managed adjacent to the footprint areas and as part of the rehabilitation phase;
- Ongoing alien and invasive vegetation and bush encroachment monitoring and control should take place throughout the rehabilitation phase of the project; and
- Monitoring of rescued and relocated floral SCC should continue during the Closure & Rehabilitation Phase until it is evident that the species have successfully established. Where possible, these species should be reintroduced into rehabilitation sites.

⁶ Gunamani T, Gurusamy R, Swamynathan K. Effect of dust pollution on the dermal appendages and anatomy of leaves in some herbaceous plants. J Swamy Boli Club. 1991;8(3-4):79-85.

⁷ Naik DP, Ushamani, Somasekhar RK. Reduction in protein and chlorophyll contents in some plant species due to some stone quarrying activity. Environ Polln Cont J. 2005;8:42-44.

⁸ Vijaywargiya A, Pandey GP. Effect of cement dust on soybean, Glycine max (L) merr. And Maize, Zea mays Linn. Inflorescence study. Geobios. 2003;30:209-212.



5.5 Floral Monitoring

A floral monitoring plan must be designed and implemented throughout all phases of the proposed mining project, should it be approved. The following points aim to guide the design of the monitoring plan, and it must be noted that the monitoring plan must be continually updated and refined for site-specific requirements:

- Permanent monitoring plots must be established within (target area) and surrounding (reference area) all rehabilitated areas. These plots must be designed to accurately monitor the following parameters:
 - Species diversity and species abundance;
 - Recruitment of indigenous species and of alien and invasive species, including alien vs Indigenous plant ratios;
 - Erosion levels and the efficacy of erosion control measures; and
 - Vegetation community structure including species composition and diversity which should be compared to pre-development conditions and work towards the post-closure objective.
- Monitoring of all the natural areas and relocated SCC should continue throughout the operational phase to ensure these systems are not adversely affected by associated activities;
- The rehabilitation plan must be continuously updated (i.e., adaptive management) in accordance with the monitoring results to ensure that optimal rehabilitation measures are employed. Adaptive management is an integral part of any rehabilitation plan as it assesses monitoring results to allow rehabilitation measures to be revisited and to be adapted accordingly;
- Results of the monitoring activities must be considered during all phases of the proposed project and action must be taken to mitigate impacts as soon as negative effects from mining activities become apparent; and
- The method of monitoring must be designed to be subjective and repeatable to ensure consistent results.

5.6 Impact Statement on planned Exploration

The Beeshoek Mine has provided a 5-year exploration plan (Figure 15) of drill sites / borehole placement for which STS was requested to provide an impact statement.

The proposed 5-year plan mostly falls within the Calcrete Shrubland and Modified Habitat, with smaller sections of Rupicolous Habitat, Cryptic Wetlands, Seasonal Depressions and Open Thornveld also targeted for exploration. The exploration activities will result in loss of



habitat but with a restricted, localised impact that can be rehabilitated. The current 5-year plan has aimed to avoid Cryptic Wetlands as far as possible which will ensure specialised habitat remain intact and functional.

There are five key ecological impacts on the receiving environment that are anticipated to occur based on the 5-year exploration plan, namely:

1. Loss of vegetation and floral SCC within the impacted sites;
2. In response to the disturbance caused by the exploration drilling, there will be an increased risk of proliferation of alien vegetation due, and/or increased risk in the encroachment response of certain native woody species such as *Senegalia melifera* subsp. *detinens* and *Rhigozum trichotomum*;
3. Increased sedimentation of the Cryptic Wetlands as a result of disturbances to the soils, including soil compaction, leading to increased erosion;
4. Fragmentation of habitat in the event that the disturbed areas are not rehabilitated or temporary roads are constructed for exploration vehicles to get to and from the drill sites; and
5. Potential contamination of soils.

Recommendations, in addition to the “good housekeeping practices”, required to minimise the impact on the floral ecology of the area, should the exploration drilling proceed, are provided below:

Planning and layout

- Limit the footprint area of the construction activity (including the placement of temporary infrastructure) to what is absolutely essential in order to minimise the loss of vegetation, compaction of soils, erosion and consequent increase of surface water runoff potential;
- The footprint areas of all surface infrastructure (e.g., truck parking area, low grade stockpiles etc.) must remain as small as possible within the parameters of operational and engineering requirements. It is strongly recommended that during the planning phase, layout and positioning of infrastructure and boreholes take into consideration the locality of protected plant species as the removal of, or any damage to, these species will require permit applications;
- As far as possible, all drilling activities (including any creation of soil or vegetation stockpiles and any temporary structures as part of the drilling rig) must remain in well-planned, demarcated areas so to minimise the footprint area;



- All drilling activities must be strictly managed in a responsible manner in line with the mitigation hierarchy; and
- Access to the drilling sites for the transport of the drilling equipment and samples should make use of existing roads as far as possible. In this regard, the removal of protected floral species should be avoided.

Habitat management

- Ensure that all spills are immediately cleaned up;
- No dumping of waste should take place within the natural habitat areas. If any spills occur, they should be immediately cleaned up;
- All material and waste must be removed from site upon the completion of construction;
- An alien vegetation control program should be implemented. Alien floral invasion is expected within any disturbed areas, and therefore regular monitoring and control of alien invasive vegetation should take place in accordance with the EMPr;
- Edge effects must be monitored and managed;
- All areas affected by topsoil stockpiling (from sump excavation) or vegetation stockpiling (vegetation clearance) during the operational phase of the drilling activities should be rehabilitated; and
- Upon completion of drilling activities all access roads which are no longer required should be rehabilitated, and all drilling equipment should be removed. Compacted soils should be ripped and revegetated with indigenous vegetation to prevent erosion, sheet runoff, and to discourage the establishment of AIPs after the operational phase.

Given the above, as long as the exploration activities avoid sensitive habitat associated with the Cryptic Wetlands and that areas are rehabilitated post-drilling, the impact on floral ecology may remain minimal. It will, however, be important to ensure that no provincially or nationally protected floral species are affected by exploration activities without permit application from the relevant authorities (DENC and/or DFFE). Avoiding unnecessary loss of vegetation must be prioritised and the areas that are disturbed by exploration activities must be rehabilitated and edge effect impacts prevented.



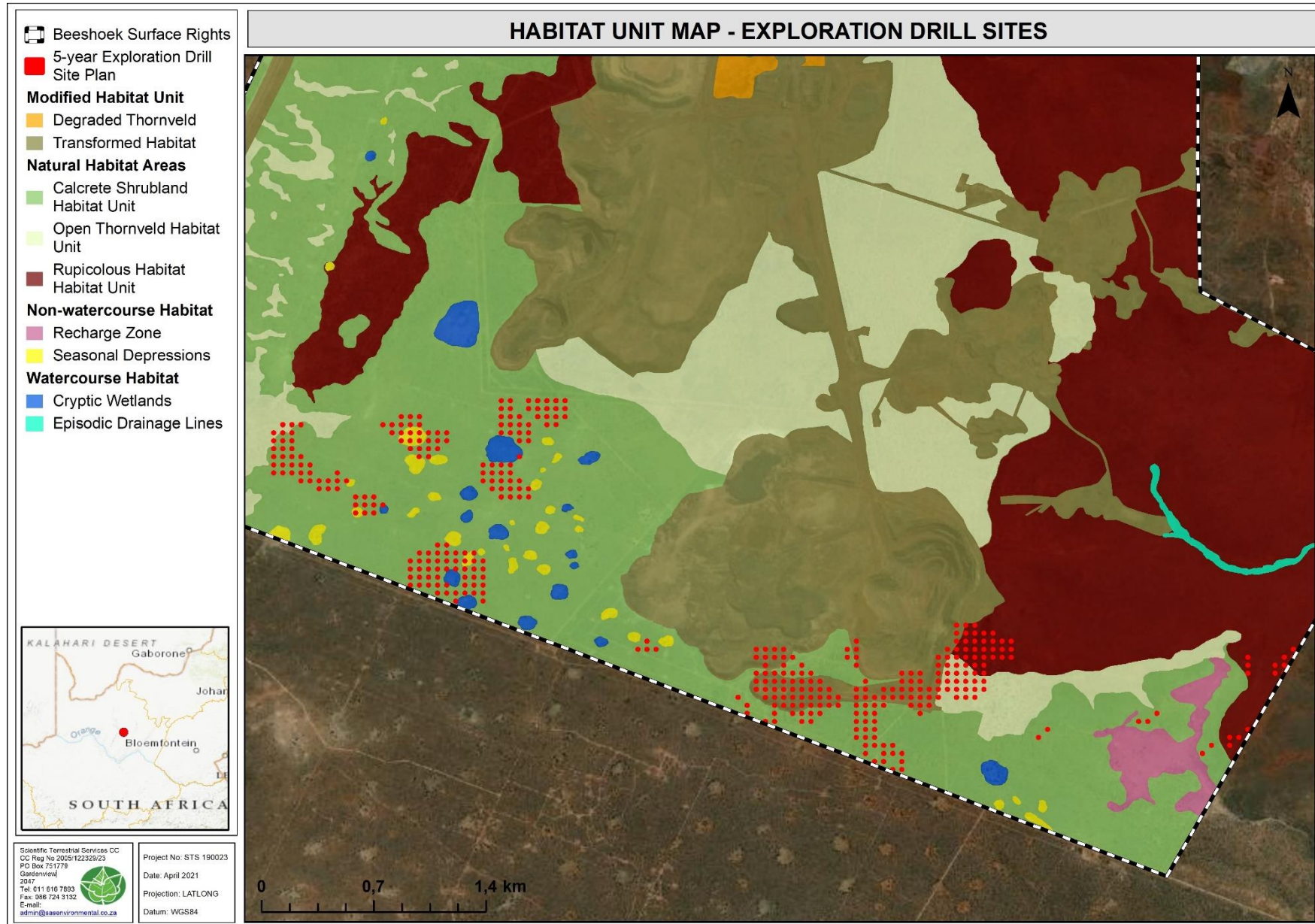


Figure 15: Beeshoek Mine 5-year exploration plan.



6 CONCLUSION

STS was appointed to conduct a Biodiversity Assessment and Impact Assessments as part of the EIA and Authorisation process for the Consolidation, Upgrade and Expansion Activities at the Assmang (Pty) Ltd Beeshoek Iron Ore Mine, near Postmasburg, Northern Cape Province. The proposed Consolidation, Upgrade and Expansion Activities will take place within the Beeshoek Mine's SRA, which is split into five (5) projects (or listing activities). The five (5) projects will collectively be referred to as the “**focus area**” and include the below:

- **Project 1:** Consolidation of Run of Mine (ROM) Stockpiles on South Mine.
- **Project 2:** Amendments to the design of existing Waste Rock Dumps (WRDs) in terms of the increase in heights, and allowance for final slope, which will result in extension of footprints.
- **Project 3:** Increase of Opencast footprint areas, as well as the undertaking of detrital mining for shallow iron ore reserves, including transportation routes (Haul roads).
- **Project 4:** Development of the Beneficiation Project which will comprise of a WHIMS Plant and Jig Plant at Beeshoek.

Habitat and species summaries:

Based on the results of the field investigation that was undertaken across various seasons, namely 10-13 June 2019 (winter assessment), 22–24 January 2020 (summer assessment), and 1-5 March 2021 (early autumn), five broad habitat units were distinguished for the Beeshoek Mine:

- **Calcrete Shrubland:** This habitat unit is located on shallow calcrete soils derived from the Coega/Knersvlakte soil forms. The vegetation mainly comprised shrubland with sparse grass cover. Species diversities were intermediate and trees generally of low diversity and abundance. Habitat integrity varied throughout this habitat unit, with some areas more encroached by indigenous woody species, and other areas characterised by largely intact vegetation;
- **Modified Habitat Unit:** This habitat unit includes areas where vegetation is significantly degraded or entirely absent as a result of mining-related activities. Two sub-units can be distinguished for this habitat unit, namely *Transformed Habitat* and *Degraded Thornveld*;
- **Moisture-driven Habitat:** This habitat unit is associated with cryptic wetlands, seasonal depressions, preferential flow paths and a recharge area. The Moisture-driven Habitat includes **watercourses** as delineated within the Freshwater Ecological



Assessment (SAS 219099, 2021), but also includes **non-watercourse habitat** which is not considered true watercourse as defined in the National Water Act, 1998 (Act No. 36 of 1998) (NWA). Instead, these are low-lying areas where water will preferentially move during rain events, but the floral communities lack wetland indicator vegetation (e.g., vegetation within the centre of the Seasonal Depressions especially differed from that of the Cryptic Wetlands). There is also an occurrence of different soil forms between the Watercourse and Non-watercourse habitat;

- **Open Thornveld Habitat Unit:** Habitat restricted to the deeper red soils of the Vaalbos and Plooyburg soil forms. Vegetation included an almost continuous grass layer with large tree species such as *Vachellia erioloba* scattered throughout. Habitat integrity also varied throughout the site; and
- **Rupicolous Habitat Unit:** This habitat unit includes areas with shallow red soils of the Mispah/Glenrosa soil forms, comprising darker iron-rich stones that either present as lower-lying areas with small pebbles or as prominent rock outcrops on hills. The vegetation communities were generally dominated by encroaching *Senegalia melifera* subsp. *detinens* but also included a higher species diversity when compared to the other habitat units within the Beeshoek Mine SRA.

Based on conservation significance, presence of SCC and the level of habitat degradation, the floral sensitivity of the habitat units indicate that the Modified Habitat Unit is of **Low and Moderately Low Sensitivity**, the Calcrete Shrubland is of **Intermediate and Moderately Low Sensitivity**, the Watercourses (Cryptic Wetlands and Episodic Drainage lines) of **Moderately High Sensitivity**, the Non-watercourses (Preferential Flow Paths, Seasonal Depressions and Recharge zone) of **Moderately Low Sensitivity**, the Open Thornveld varied between **Intermediate and Moderately Low Sensitivities**, and the Rupicolous Habitat varied between **Moderately Low and Moderately High Sensitivities**. The proposed Beeshoek Mine activities will impact on these habitat units to varying degrees. Floral SCC recorded within the focus area included species protected under the NFA, NEMBA TOPS regulations, and Schedule 1 and 2 protected species of the NCNCA.

Impact summary:

Separately, the five projects will vary considerably in the significance of the impact ratings on floral ecology associated with the Beeshoek Mine. Collectively, the impacts are anticipated to be significant on both floral habitat and diversity, as well as on floral SCC.

For floral habitat and diversity, the construction and operational phases (or mining phase) will have the greatest impacts, with the closure and rehabilitation phase unlikely to reinstate the



pre-mined floral communities and habitat, thus having limited ability to reduce impacts on floral ecology in the long-term.

Impacts on protected floral species will be higher during the *planning phase* during which SCC should be relocated and/or propagules harvested for propagation in plant nurseries. Relocation of most of the geophyte and succulent SCC on site will likely be successful, with woody species more likely to require harvesting of propagules to propagate in a plant nursery. Avoidance of impacts on SCC population genetics and dynamics will, however, not be entirely possible. Impacts during the construction and operational phase can be reduced to lower impact significance on floral SCC given that sufficient monitoring of relocated and harvested specimens is implemented. During closure and rehabilitation, the significance of impact on floral SCC will be limited in its potential to be reduced as it is unlikely that the favourable, pre-mined habitat can be achieved with rehabilitation.

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 Borrow Pits 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 focus 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 focus 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 below⁹:

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

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;

- 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

⁹ 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>



the Botanical Database of Southern Africa (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 (QDS) in which the focus area is situated but where it is deemed appropriate, a larger area can be included.

NEMBA TOPS Species

The National Environmental Management: Biodiversity Act, 2004 (Act No.10 of 2004) (NEMBA) Threatened or Protected Species (TOPS) list (Government Gazette [GN] 29657, as amended in GN R1187 in Government Gazette 30568 of 2007 and again in GN 627 in Government Gazette 43386 of 2020) were taken into consideration.

Specially Protected and Protected Species

The Northern Cape Nature Conservation Act, 2009 (Act No. 9 of 2009) (NCNCA), provides a list of Specially Protected Species (Schedule 1) (Section 49(1) of the NCNCA) and Protected Species (Schedule 2) (Section 50(1) of the NCNCA) for the Northern Cape Province. These species formed part of 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. 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 optimizing 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 focus 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/focus area.

One of the problems with random sampling, another popular sampling method, is that random samples may not cover all areas of a focus 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:



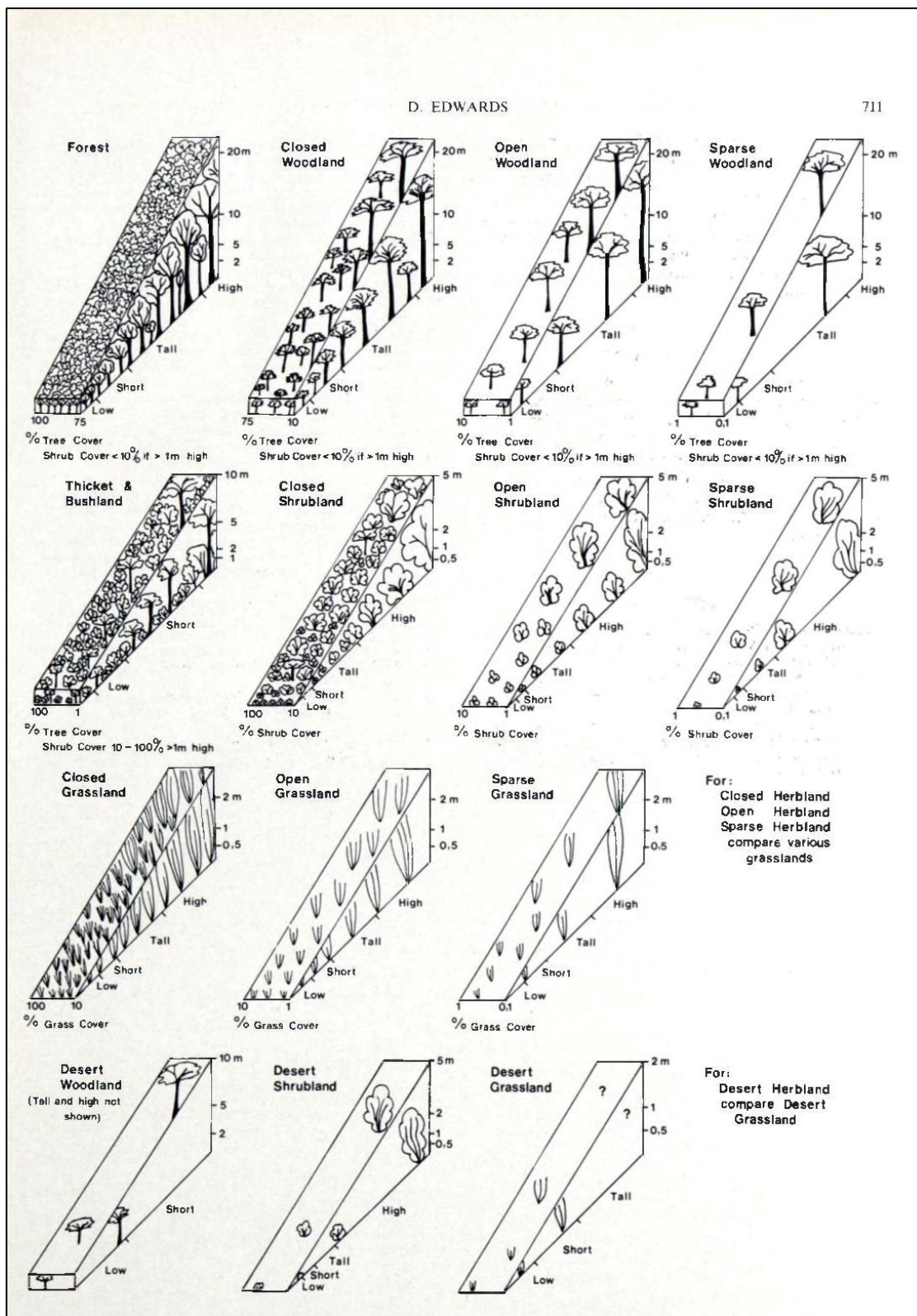


Figure A1: Diagrammatic representation of structural groups and formation classes. Only dominant growth forms are shown.



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. Due to its strong focus on determining risk of extinction, the IUCN system does not highlight species that are at low risk of extinction but may nonetheless be of high conservation importance. Because the Red List of South African plants is used widely in South African conservation practices such as systematic conservation planning or protected area expansion, we use an amended system of categories designed to highlight those species that are at low risk of extinction but of conservation concern.

Definitions of the national Red List categories

Categories marked with ^N 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.
- ^N**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.
- ^N**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 km², 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 km², 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.

POC for RDL Floral SCC obtained from BODATSA and the Online National Environmental Screening Tool

Table B1: Red Data Listed (RDL) plant species recorded in the QDS' 2822BB, 2823AA, 2822BD and 2823AC (Figure B1). Species list obtained from the new Plants of southern Africa (new POSA) online catalogue, or BODATSA. Additional species were obtained from the National Web Based Screening Tool. Information on species distributions and conservation status were derived from the Red List of South African Plants website (<http://redlist.sanbi.org/index.php>).

Scientific Name	IUCN	Habitat description	POC
Sensitive species 249	VU	South African endemic Range: Northern Cape - Postmasburg Major habitats: Kuruman Thornveld Description: Among pebbles in shallow soil	Medium
<i>Aloidendron dichotomum</i>	VU	Range: From Nieuwoudtville east to Olifantsfontein and northwards to the Brandberg in Namibia. Major habitats: Richtersveld Mountain Shrubland, Namaqualand Shale Shrubland, Namaqualand Klipkoppe Shrubland, Northern Knersvlakte Vygieveld, Bushmanland Arid Grassland, Blouputs Karroid Thornveld, Lower Gariep Broken Veld, Kahams Mountain Desert, Eastern Gariep Rocky Desert, Upper Gariep Alluvial Vegetation. Description: On north-facing rocky slopes (particularly dolomite) in the south of its range. Any slopes and sandy flats in the central and northern parts of range.	Low



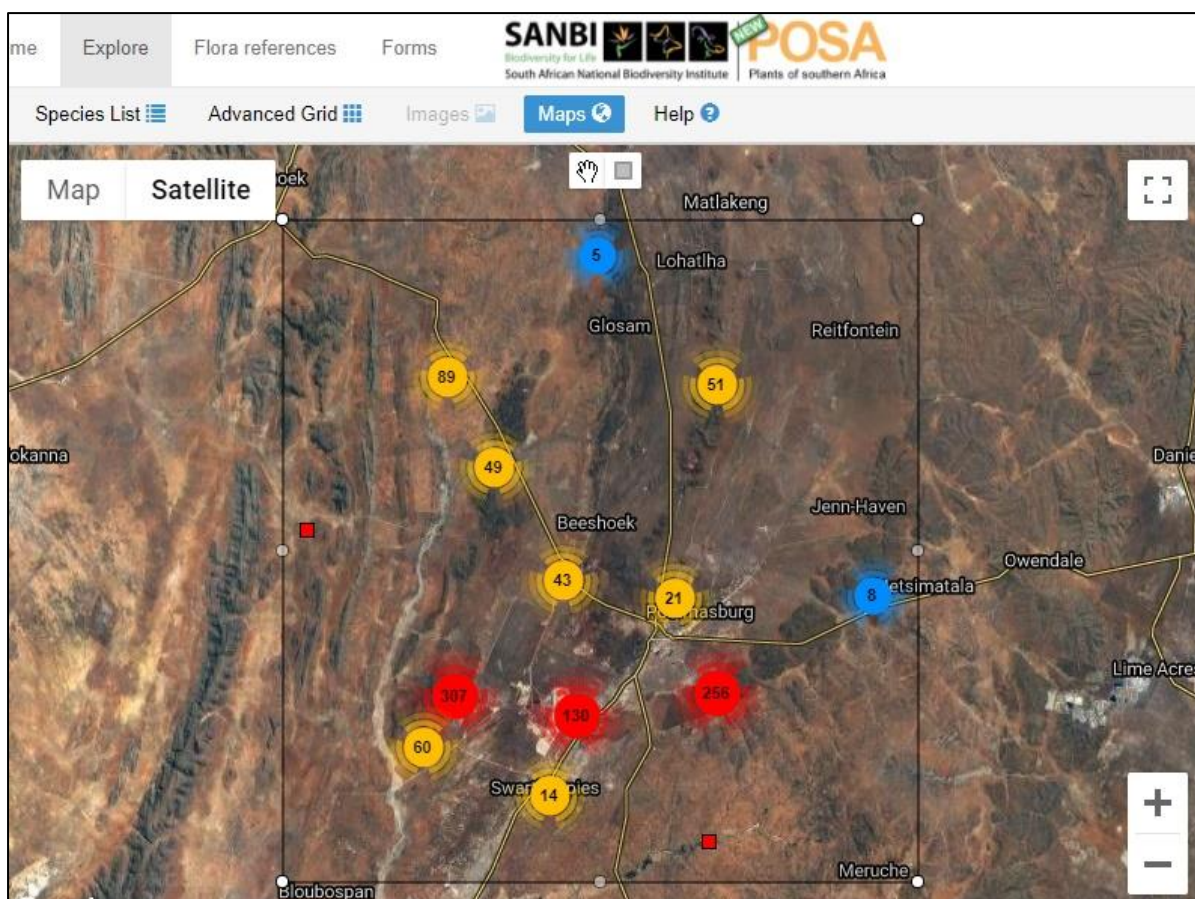


Figure B1: BODATSA / Plants of Southern Africa database search for SCC within the QDS' 2822BB, 2823AA, 2822BD and 2823AC.

NEMBA TOPS List for South Africa¹⁰

Table B3: TOPS list for South Africa – plant species.

Scientific Name	Common Name	POC	Provincial Distribution	Status
<i>Adenia wilmsii</i>	No common name	Low	Provincial distribution: Mpumalanga Range: Lydenburg to Waterval Boven Description: Dolerite outcrops or red loam soil, in open woodland, 1300-1500 m.	EN; P
<i>Adenium swazicum</i>	Swaziland Impala Lily	Low	Range: Kruger National Park to Swaziland along the Lebombo Mountains and adjacent areas in south-western Mozambique.	VU
<i>Adenium swazicum</i>	Swaziland Impala Lily	Low	Provincial distribution: Mpumalanga	VU
<i>Aloe albida</i>	Grass Aloe	Low	Provincial distribution: Mpumalanga Range: Aloe albida has a restricted range in the mountains south of Barberton, Mpumalanga, extending to Malolotja in north-western Swaziland.	NT
<i>Aloe pillansii</i> (now <i>Aloidendron pillansii</i>)	False Quiver Tree	Low	Provincial distribution: Northern Cape Range: Richtersveld and southern Namibia.	EN

¹⁰ 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 June 2007 [GN R150, Gazette no. 29657], as amended.



Scientific Name	Common Name	POC	Provincial Distribution	Status
<i>Aloe simii</i>	No common name	Low	Provincial distribution: Mpumalanga Range: This species is endemic to a small area in the transition area between the Mpumalanga Lowveld and Escarpment, where it occurs from Sabie southwards to White River and around Nelspruit. Description: It occurs along drainage lines and in wetlands in open woodland and grassland, 600-1100 m.	EN; P
<i>Clivia mirabilis</i>	"Oorlogskloof" Bush Lily	Low	Provincial distribution: Northern Cape, Western Cape Range: Nieuwoudtville.	VU; P
<i>Diaphananthe millarii</i>	Tree Orchid	Low	Provincial distribution: Eastern Cape, KwaZulu-Natal Range: East London and Durban.	VU
<i>Disa macrostachya</i>	No common name	Low	Provincial distribution: Northern Cape Range: Namaqualand, Kamiesberg.	EN; P
<i>Disa nubigena</i>	No common name	Low	Provincial distribution: Western Cape	Rare; P
<i>Disa physodes</i>	No common name	Low	Provincial distribution: Western Cape	CR; P
<i>Disa procera</i>	No common name	Low	Provincial distribution: Western Cape	EN; P
<i>Disa sabulosa</i>	No common name	Low	Provincial distribution: Western Cape	EN; P
<i>Encephalartos aemulans</i>	Ngotsho Cycad	Low	Provincial distribution: KwaZulu-Natal	CR
<i>Encephalartos altensteinii</i>	Bread Palm	Low	Provincial distribution: Eastern Cape, KwaZulu-Natal	VU; P
<i>Encephalartos arenarius</i>	Dune Cycad	Low	Provincial distribution: Eastern Cape	EN
<i>Encephalartos brevifoliolatus</i>	Escarpment Cycad	Low	Provincial distribution: Limpopo	EW
<i>Encephalartos caffer</i>	Breadfruit Tree	Low	Provincial distribution: Eastern Cape, KwaZulu-Natal	NT; P
<i>Encephalartos cerinus</i>	Waxen Cycad	Low	Provincial distribution: KwaZulu-Natal	CR
<i>Encephalartos cupidus</i>	Blyde River Cycad	Low	Provincial distribution: Limpopo, Mpumalanga Description: Grassland, on steep, rocky slopes or cliffs and sometimes near seepage areas bordering gallery forests.	CR
<i>Encephalartos dolomiticus</i>	Wolkberg Cycad	Low	Provincial distribution: Limpopo	CR
<i>Encephalartos dyerianus</i>	Lowveld Cycad	Low	Provincial distribution: Limpopo	CR; P
<i>Encephalartos eugene-maraisii</i>	Waterberg Cycad	Low	Provincial distribution: Limpopo	EN
<i>Encephalartos friderici-guilielmi</i>	No common name	Low	Provincial distribution: Eastern Cape, KwaZulu-Natal	NT; P
<i>Encephalartos ghellinckii</i>	No common name	Low	Provincial distribution: Eastern Cape, KwaZulu-Natal	VU; P
<i>Encephalartos heenanii</i>	Woolly Cycad	Low	Provincial distribution: Mpumalanga Description: Open areas of montane grasslands amidst scarp forest in deep valleys and ravines.	CR
<i>Encephalartos hirsutus</i>	Venda Cycad	Low	Provincial distribution: Limpopo	CR
<i>Encephalartos horridus</i>	Eastern Cape Blue Cycad	Low	Provincial distribution: Eastern Cape	EN
<i>Encephalartos humilis</i>	No common name	Low	Provincial distribution: Mpumalanga Description: Montane and mistbelt grassland, rocky sandstone slopes.	VU; P
<i>Encephalartos inopinus</i>	Lydenburg Cycad	Low	Provincial distribution: Limpopo	CR
<i>Encephalartos laevifolius</i>	Kaapsehoop Cycad	Low	Provincial distribution: Eastern Cape, KwaZulu-Natal, Limpopo, Mpumalanga Description: Steep, rocky slopes in mistbelt grassland, 1300-1500 m.	CR
<i>Encephalartos lanatus</i>	No common name	Low	Provincial distribution: Gauteng and western Mpumalanga Description: Sheltered, wooded ravines in sandstone ridges, 1200-1500 m.	NT; P
<i>Encephalartos latifrons</i>	Albany Cycad	Low	Provincial distribution: Eastern Cape	CR



Scientific Name	Common Name	POC	Provincial Distribution	Status
<i>Encephalartos leboomboensis</i>	Lebombo Cycad	Low	Provincial distribution: KwaZulu-Natal, Mpumalanga Description: Cliffs and rocky ravines in savanna and grassland.	EN
<i>Encephalartos lehmannii</i>	No common name	Low	Provincial distribution: Eastern Cape	NT; P
<i>Encephalartos longifolius</i>	No common name	Low	Provincial distribution: Eastern Cape	NT; P
<i>Encephalartos middelburgensis</i>	Middelburg Cycad	Low	Provincial distribution: Gauteng, Mpumalanga Description: Open grasslands and in sheltered valleys.	CR
<i>Encephalartos msinganus</i>	Msinga, Cycad	Low	Provincial distribution: KwaZulu-Natal	CR
<i>Encephalartos natalensis</i>	Natal Giant Cycad	Low	Provincial distribution: Eastern Cape, KwaZulu-Natal	NT; P
<i>Encephalartos ngoyanus</i>	Ngoye Dwarf Cycad	Low	Provincial distribution: KwaZulu-Natal	VU
<i>Encephalartos nubimontanus</i>	Blue Cycad	Low	Provincial distribution: Limpopo	EW
<i>Encephalartos paucidentatus</i>	No common name	Low	Provincial distribution: Mpumalanga Description: Forest, occurs on steep rocky slopes and alongside streams in deep gorges.	VU; P
<i>Encephalartos princeps</i>	No common name	Low	Provincial distribution: Eastern Cape	VU; P
<i>Encephalartos senticosus</i>	No common name	Low	Provincial distribution: KwaZulu-Natal	VU; P
<i>Encephalartos transvenosus</i>	Modjadje Cycad	Low	Provincial distribution: Limpopo	LC; P
<i>Encephalartos trispinosus</i>	No common name	Low	Provincial distribution: Eastern Cape	VU; P
<i>Encephalartos woodii</i>	Wood's Cycad	Low	Provincial distribution: KwaZulu-Natal	EW
<i>Euphorbia clivicola</i>	No common name	Low	Provincial distribution: Limpopo	CR; P
<i>Euphorbia meloformis</i>	No common name	Low	Provincial distribution: Eastern Cape	NT; P
<i>Euphorbia obesa</i>	No common name	Low	Provincial distribution: Eastern Cape	EN; P
<i>Harpagophytum procumbens</i>	Devil's Claw	Confirmed	Provincial distribution: Free State, Limpopo, Northern Cape, North West Description: Well drained sandy habitats in open savanna and woodlands	LC; P
<i>Harpagophytum zeyherii</i>	Devil's Claw	Low	Provincial distribution: Gauteng, Limpopo, Mpumalanga, North West	LC; P
<i>Hoodia currorii</i>	Ghaap	Low	Provincial distribution: Limpopo	P
<i>Hoodia gordonii</i>	Ghaap	Confirmed	Provincial distribution: Free State, Northern Cape, Western Cape Description: Occurs in a wide variety of arid habitats from coastal to mountainous, also on gentle to steep shale ridges, found from dry, rocky places to sandy spots in riverbeds.	DDD; P
<i>Jubaeopsis caffra</i>	Pondoland Coconut	Low	Provincial distribution: Eastern Cape	EN
<i>Merwillia plumbea</i>	Blue Squill	Low	Provincial distribution: KwaZulu-Natal, Mpumalanga Major habitats: Grassland Description: Montane mistbelt and Ngongoni grassland, rocky areas on steep, well drained slopes. 300-2500 m.	NT
<i>Newtonia hildebrandtii</i> var. <i>hildebrandtii</i>	Lebombo Wattle	Low	Provincial distribution: KwaZulu-Natal	Now LC
<i>Protea odorata</i>	Swartland Sugarbush	Low	Provincial distribution: Western Cape	CR; P
<i>Siphonochilus aethiopicus</i>	Wild Ginger	Low	Provincial distribution: KwaZulu-Natal, Limpopo, Mpumalanga Range: Sporadically from the Letaba catchment in the Limpopo Lowveld to Swaziland. Extinct in KwaZulu-Natal. Widespread elsewhere in Africa. Description: Tall open or closed woodland, wooded grassland or bushveld.	CR
<i>Stangeria eriopus</i>	No common name	Low	Provincial distribution: Eastern Cape, KwaZulu-Natal	VU; P



Scientific Name	Common Name	POC	Provincial Distribution	Status
<i>Warburgia salutaris</i>	Pepper-bark Tree	Low	Provincial distribution: KwaZulu-Natal, Limpopo, Mpumalanga Range: North-eastern KwaZulu-Natal, Mpumalanga and Limpopo Province. Also occurs in Swaziland, Mozambique and Zimbabwe and Malawi. Description: Variable, including coastal, riverine, dune and montane forest as well as open woodland and thickets.	EN
<i>Zantedeschia jucunda</i>	Yellow Arum Lilly	Low	Provincial distribution: Limpopo	VU

CR = Critically Endangered, DDD = Data Deficient - Insufficient Information; EN = Endangered, EW = Extinct in the Wild, NT = Near Threatened, VU = Vulnerable, P = Protected, POC = Probability of Occurrence.

NFA Protected Trees

Table F4: Protected trees as defined by The National Forest Act, 1998, (Act No. 84 of 1998) (NFA) for the QDS 2527AA. Additional information on species threat status as defined in The Red List of South African Plants (<http://redlist.sanbi.org/index.php>) is presented.

Family	Scientific Name	IUCN	Growth form	POC
Brassicaceae	<i>Boscia albitrunca</i>	LC	Tree	Confirmed
Fabaceae	<i>Vachellia erioloba</i>	LC	Tree	Confirmed
Fabaceae	<i>Vachellia haematoxylon</i>	LC	Tree	Low



APPENDIX C: Floral Species List

Table C1: Dominant woody plant species encountered in the Beeshoek Mine and especially within the focus area during the field assessment. Alien species are indicated with an asterisk (*) and protected species are emboldened. "XX" refers to species that were particularly common or abundant.

Scientific name	Calcrete Shrubland	Modified Habitat Unit	Open Thornveld Habitat Unit	Rupicolous Habitat Unit	Non-watercourse Habitat	Watercourse Habitat
* <i>Ailanthus altissima</i>		x				
* <i>Grevillea robusta</i>		x				
* <i>Jacaranda mimosifolia</i>		x				
* <i>Pinus sp.</i>		x				
* <i>Prosopis glandulosa var. torreyana</i>		xx	x			x
* <i>Schinus molle</i>	x	x	x			
<i>Amphiglossa tecta</i>	x					
<i>Aptosimum albomarginatum</i>	x		x			
<i>Aptosimum indivisum</i>				x	x	
<i>Aptosimum lineare</i>	x					
<i>Aptosimum marlothii</i>	x mixed veld	x	x			
<i>Aptosimum spinescens</i>	x					
<i>Asparagus laricinus</i>	x	x	x			
<i>Asparagus nelsii</i>	x	x	x	x		
<i>Barleria rigida</i>	x		x	x		
<i>Blepharis sp.</i>		x				
<i>Boscia albitrunca</i> (NFA; Schedule 2 Protected Genus (Boscia))	xx	x	x	xx		
<i>Cadaba aphylla</i>	x	x	x	x		
<i>Caroxylon dealatum</i>	x		x			
<i>Chrysocoma obtusata</i>	x	x	x	x		x
<i>Croton gratissimus</i>				x		
<i>Diospyros lycioides subsp. lycioides</i>	x	x			x	x
<i>Ehretia rigida subsp. rigida</i>	x		x			
<i>Eriocephalus cf. ericoides</i> (medicinal)	x		xx	x	x	
<i>Euclea undulata</i>				x		
<i>Euryops sp.</i>		x		x		
<i>Felicia cf. fascicularis</i>	x	x	x	x		
<i>Glossochilus burchellii</i>			x	x		
<i>Grewia flava</i>	x		x	x	x	
<i>Gymnosporia buxifolia</i> (Schedule 2 - Protected genus (Gymnosporia))	x		x			
<i>Hermannia burchellii</i>			x	x		
<i>Hermannia stricta</i>	x					
<i>Indigofera charlieriana</i>			x		x	



Scientific name	Calcrete Shrubland	Modified Habitat Unit	Open Thornveld Habitat Unit	Rupicolous Habitat Unit	Non-watercourse Habitat	Watercourse Habitat
Jamesbrittenia tysonii (Schedule 2 - Protected genus (Jamesbrittenia))		x		x		
<i>Justicia divaricata (Monechma divaricatum)</i>	x	x	x	x		x
<i>Lacomucinaea lineata</i>				x		
<i>Lantana rugosa</i>				x		
<i>Lasiosiphon polycephalus (previously Gnidia)</i>	x		x			
<i>Leucas capensis</i>	x			xx		
<i>Lycium hirsutum</i>			x	x	x	
<i>Monechma incanum</i>	x		x	x		
Nymanina capensis (Schedule 2 - Protected species)				x		
<i>Oedera humilis</i>	x					
<i>Olea europaea</i> subsp. <i>africana</i> (Schedule 2 Protected Family (Oleaceae))	x			x		
<i>Pegolettia retrofracta</i>	x					
<i>Peliostomum leucorrhizum</i>	x			x		
<i>Pentzia cf. calcarea</i>	x		x			x
<i>Pteronia undulata</i>				x		
<i>Ptychobium biflorum</i>				x		
<i>Rhigozum obovatum</i>				x		
<i>Rhigozum trichotomum</i>	x	x	x	x		
<i>Roepera (Zygophyllum) pubescens</i>	x		x	x		
<i>Searsia burchellii</i>				x		
<i>Searsia lancea</i>		x				
<i>Searsia leptodictya</i>		x	x			x
<i>Searsia tridactyla</i>	x		x	x	x	
<i>Senegalia mellifera</i> subsp. <i>detinens</i>	x	x	x	xx	x	
<i>Senna italica</i>			x	x		x
<i>Solanum tomentosum</i>			x			
<i>Tapinanthus oleifolius</i>	x	x	x	x		
<i>Tarchonanthus camphoratus</i>	x	x	x	x	x	x
<i>Vachellia erioloba</i> (NFA)	x	x	xx	x only the lower slopes	x	x
<i>Vachellia hebeclada</i> subsp. <i>hebeclada</i>	x	x	x			
<i>Vachellia tortilis</i> subsp. <i>heteracantha</i>	x		x			
<i>Vangueria infausta</i>				x		
<i>Waltheria indica</i>				x		
<i>Ziziphus mucronata</i>	x	x	x	x		x



Table C2: Dominant forb species encountered in the Beeshoek Mine and especially within the focus area during the field assessment. Alien species are indicated with an asterisk (*) and protected species are emboldened. "XX" refers to species that were particularly common or abundant.

Scientific name	Calcrete Shrubland	Modified Habitat Unit	Open Thornveld Habitat Unit	Rupicolous Habitat Unit	Non-watercourse Habitat	Watercourse Habitat
* <i>Alternanthera pungens</i>		x				
* <i>Argemone ochroleuca subsp. ochroleuca</i>		x				
* <i>Bidens bipinnata</i>		x	x			
* <i>Chenopodium album</i>		x	x			x
* <i>Portulaca oleracea</i>						xx
* <i>Salsola kali</i>		x				
* <i>Schkurhia pinnata</i>		x	x		x	x
* <i>Solanum elaeagnifolium</i>	x (not much)					
* <i>Tagetes minuta</i>		x	x			
* <i>Taraxacum officinale</i>		x				
<i>Abutilon austro-africanum</i>	x				x	
<i>Ammocharis cf. coranica</i> (Schedule 2 - Protected family (Amaryllidaceae))			x	x		
<i>Arctotis leiocarpa</i>		x	x			
<i>Babiana bainesii</i> (Schedule 2 - Protected family (Iridaceae))			x	xx		
<i>Barleria lichtensteiniana</i>				x		
<i>Blepharis furcata</i>				x		
<i>Boophone disticha</i> (Schedule 2 - Protected family (Amaryllidaceae))	x		x	x		x floodplain
<i>Cleome angustifolia</i>	x					
<i>Cleome rubella</i>			x	x		
<i>Coccinia sessilifolia</i>	x	x		x		
<i>Commelina africana</i>				x		
<i>Cucumis africanus</i>			x			
<i>Cullen tomentosum</i>						x
<i>Dicoma anomala</i>	x			x		
<i>Dicoma capensis</i>	x					
<i>Dipcadi cf. bakerianum</i>	x	x	x			
<i>Dysphania pumilio</i>	x	x				
<i>Eriospermum cf. porphyrium</i>	x	x	x			
<i>Gazania krebsiana subsp. serrulata</i>			x			
<i>Geigeria filifolia</i>	x		x			
<i>Geigeria ornativa</i>	x	x	x			x
<i>Gisekia africana var. africana</i>				x		
<i>Gladiolus permeabilis subsp. edulis</i> (Schedule 2 - Protected family (Iridaceae))				x		
<i>Harpagophytum procumbens</i> (NEMBA TOPS)						
<i>Haemanthus sp.</i> (Schedule 2 - Protected family (Amaryllidaceae))				x		
<i>Helichrysum argyrosphaerum</i>	x					
<i>Helichrysum sp</i>		x		x		
<i>Heliophila minima</i>			x	x		
<i>Heliotropium cf. steudneri</i>		x	x			
<i>Hermannia comosa</i>	x		x	x		x
<i>Hermannia depressa</i>	x					x
<i>Hermannia linearifolia</i>	x					
<i>Hermbstaedtia fleckii</i>	x		x	x		
<i>Hirpicium echinus</i>		x	x			



<i>Indigofera alternans</i>				X			X
<i>Indigofera daleoides</i>	X	X					
<i>Indigofera heterotricha</i>					X		
<i>Kohautia cynanchica</i>	X				X		X
<i>Kyphocarpa angustifolia</i>	XX		X	X			
<i>Lacomucinaea lineata</i> (previously <i>Thesium lineatum</i>)	X				X		
<i>Ledebouria</i> sp.	X	X	X	X			
<i>Lepidium</i> cf. <i>englerianum</i>							X
<i>Limeum argute-carinatum</i>	X						
<i>Limeum</i> cf. <i>aethiopicum</i>	X		X	X			X
<i>Microloma armatum</i>	X	X	X				
<i>Mollugo cerviana</i>			X	X			X
<i>Ornithoglossum vulgare</i>				X			
<i>Oxalis semiloba</i> subsp. <i>semiloba</i> (Schedule 2 - Protected genus (<i>Oxalis</i>))			X	X			X
<i>Pelargonium</i> sp.							X
<i>Pellaea calomelanos</i>				X			
<i>Phyllanthus parvulus</i>				X			
<i>Ptychobium biflorum</i> subsp. <i>biflorum</i>				X			
<i>Rhynchosia totta</i> var <i>totta</i>				X			
<i>Salvia</i> sp.							X
<i>Sansevieria aethiopica</i>			X	X			
<i>Sansevieria pearsonii</i>				X			
<i>Seddera capensis</i>				X			
<i>Selago densiflora</i>				X			X
<i>Senecio cardaminifolius</i>			X				
<i>Senecio inaequidens</i>		X					
<i>Sesamum triphyllum</i>	X					X	
<i>Sida ovata</i>				X			
<i>Trianthema parvifolia</i>	XX						
<i>Tribulus zeyheri</i> subsp. <i>zeyheri</i>	X	X				X	
<i>Vahlia capensis</i>							X

Table C3: Dominant succulent plant species encountered in the Beeshoek Mine and especially within the focus area during the field assessment. Alien species are indicated with an asterisk (*) and protected species are emboldened. "XX" refers to species that were particularly common or abundant.

Scientific name	Calcrete Shrubland	Modified Habitat Unit	Open Thornveld Habitat Unit	Rupicolous Habitat Unit	Non-watercourse Habitat	Watercourse Habitat
* <i>Austrocylindropuntia cylindrica</i>		XX				
* <i>Harrisia tortuosa</i>		X		X	X	
* <i>Opuntia ficus-indica</i>		X	X	X		
* <i>Opuntia imbricata</i>		X				
* <i>Opuntia microdasys</i>		X	X			
* <i>Tephrocactus articulatus</i>		X				
* <i>Trichocereus schickendantzii</i>	X			X	X	
<i>Aloe grandidentata</i> (Schedule 2 Protected family (Asphodelaceae))		X		XX		
<i>Aloe hereroensis</i> var. <i>hereroensis</i> (Schedule 2 Protected family (Asphodelaceae))				XX		
<i>Anacampseros filamentosa</i> subsp. <i>tomentosa</i> (Schedule 2 Protected Genus (<i>Anacampseros</i> spp.))				XX		
<i>Euphorbia</i> cf. <i>duseimata</i> (Schedule 2 Protected Genus (<i>Euphorbia</i>))			X			
<i>Euphorbia</i> cf. <i>rhombifolia</i> (Schedule 2 Protected Genus (<i>Euphorbia</i>))				X		
<i>Hertia pallens</i>	X	X		X		
<i>Kleinia longiflora</i>			X	X		



Scientific name	Calcrete Shrubland	Modified Habitat Unit	Open Thornveld Habitat Unit	Rupicolous Habitat Unit	Non-watercourse Habitat	Watercourse Habitat
<i>Lycium cinereum</i>	x	x	x	x		
<i>Mestoklema tuberosum</i> (Schedule 2 Protected family (Aizoaceae))	x		x	x		
<i>Orbea</i> sp. (Schedule 2 Protected family (Apocynaceae))			x			
<i>Pachypodium succulentum</i> (Schedule 2 Protected family (Apocynaceae))				x		
<i>Ruschia calcarea</i> (Schedule 2 Protected family (Aizoaceae))				x		
<i>Ruschia</i> cf. <i>griquensis</i> (Schedule 2 Protected family (Aizoaceae))	x		x			
<i>Tridentea</i> sp. (Schedule 2 Protected family (Aizoaceae))	x	x				
<i>Viscum rotundifolium</i>	x		x	x		

Table C4: Dominant graminoid species encountered in the Beeshoek Mine and especially within the focus area during the field assessment. Alien species are indicated with an asterisk (*) and protected species are emboldened. "XX" refers to species that were particularly common or abundant.

Scientific name	Calcrete Shrubland	Modified Habitat Unit	Open Thornveld Habitat Unit	Rupicolous Habitat Unit	Non-watercourse Habitat	Watercourse Habitat
* <i>Pennisetum setaceum</i>		x	x			
<i>Andropogon chinensis</i>		x				
<i>Aristida adscensionis</i>	x	x		x	x	x
<i>Aristida congesta</i> subsp. <i>congesta</i>		x	x	x	x	x
<i>Aristida diffusa</i>	x			x		
<i>Brachiaria marlothii</i>		x				
<i>Brachiaria nigropedata</i>		x	x	x		
<i>Brachiaria serrata</i>						x
<i>Bulbostylis burchellii</i>				x		
<i>Cenchrus ciliaris</i>	x	x	x	x	x	x
<i>Centropodia glauca</i>		x	x			
<i>Chloris virgata</i>					x	x
<i>Cymbopogon pospischilii</i>				x	x	
<i>Cynodon dactylon</i>		x				x
<i>Cyperus</i> sp.					x	x
<i>Digitaria eriantha</i> subsp. <i>eriantha</i>				x		
<i>Diheteropogon amplexens</i>				x		
<i>Enneapogon cenchroides</i>	x		xx	x	x	x
<i>Enneapogon desvauxii</i>	xx	xx		x	x	x
<i>Enneapogon scoparius</i>	x		x	x		
<i>Eragrostis annulata</i>			x	x		
<i>Eragrostis bicolor</i>						x
<i>Eragrostis</i> cf. <i>echinochloidea</i> × <i>obtusa</i>	x					
<i>Eragrostis echinochloidea</i>						x
<i>Eragrostis lehmanniana</i>	x		x	x	x	x
<i>Eragrostis nindensis</i>				x		
<i>Eragrostis obtusa</i>	x		x		x	
<i>Eragrostis pallens</i>			x			
<i>Eragrostis porosa</i>				x		x
<i>Eragrostis rotifer</i>						x



Scientific name	Calcrete Shrubland	Modified Habitat Unit	Open Thornveld Habitat Unit	Rupicolous Habitat Unit	Non-watercourse Habitat	Watercourse Habitat
<i>Eragrostis sp.</i>	x		x			
<i>Eragrostis trichophora</i>	x	x	x		x	
<i>Eragrostis truncata</i>	x				xx	
<i>Eragrostis x pseudo-obtusa</i>	x			x	x	
<i>Fingerhuthia africana</i>	x		x	x	x	
<i>Heteropogon contortus</i>		x		x		
<i>Melinis repens</i>		x	x	x		
<i>Oropetium capense</i>	x					
<i>Panicum coloratum</i>				x		
<i>Phragmites australis</i>		x				
<i>Pogonarthria squarrosa</i>			x			
<i>Schmidtia kalahariensis</i>	x		x	x		
<i>Schmidtia pappophoroides</i>		x	x	x		x
<i>Setaria verticillata</i>	x (under eath trees)	x			x	
<i>Sporobolus fimbriatus</i>	x					
<i>Stipagrostis obtusa</i>	xx			x		
<i>Stipagrostis uniplumis</i>		x	xx	x	x	
<i>Themeda triandra</i>	x					
<i>Tragus racemosus</i>			x			x
<i>Urochloa panicoides</i>						x

