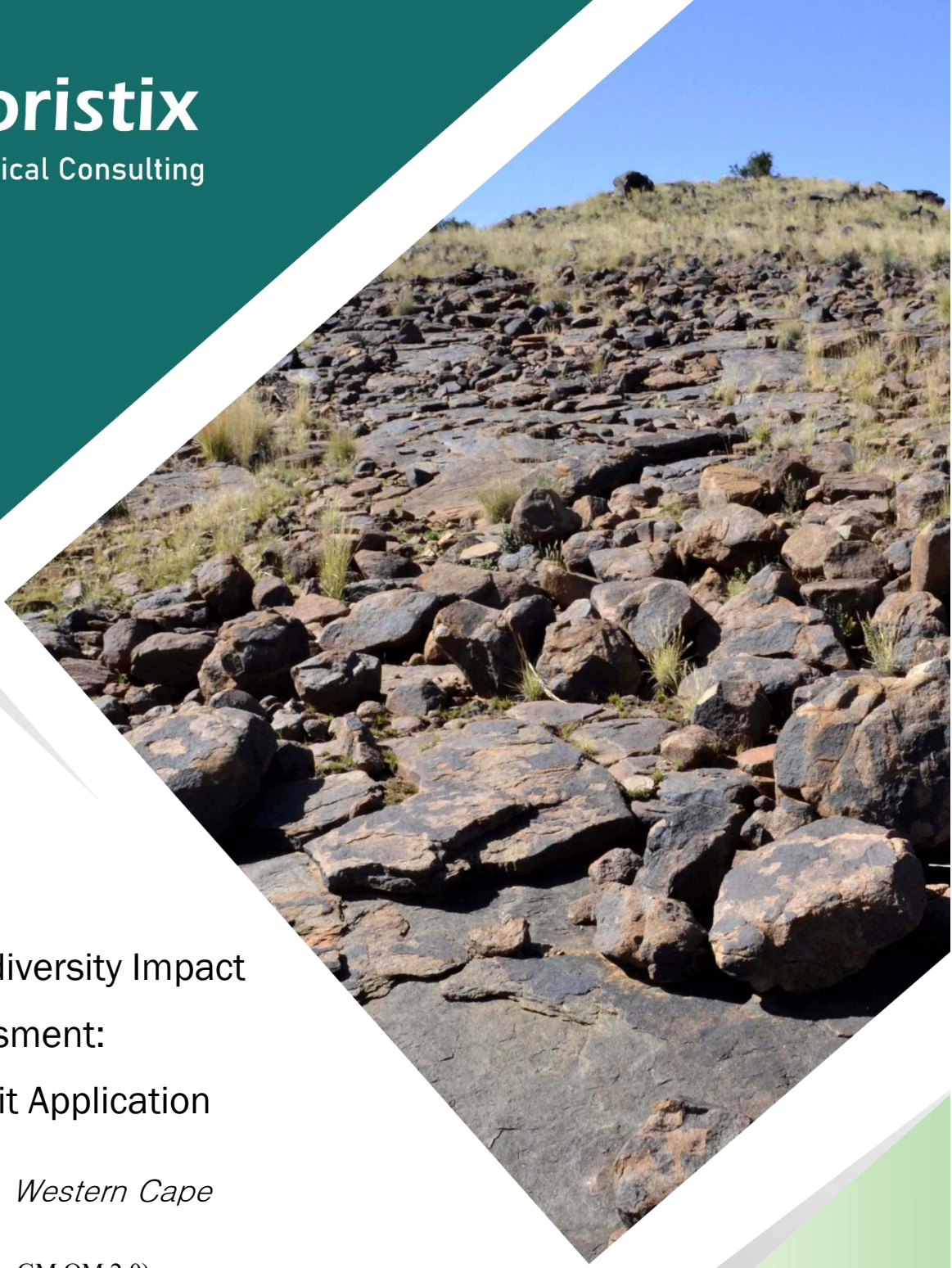
EcoFloristix

Specialist Botanical Consulting



Terrestrial Biodiversity Impact Assessment:

Mining Permit Application

Beaufort West, Western Cape

(Reference No.: GM.OM.2.0)

DATE
27 April 2023

PREPARED FOR

greenmined environmental

ecofloristix@gmail.com
keetjanhendrik@gmail.com
+27 71 451 4853

Acuity JRK (Pty) Ltd trading as
EcoFloristix Specialist Botanical Consulting

Internal Document Information

Report Title:	Terrestrial Biodiversity Impact Assessment: Mining Permit Application Beaufort West, Western Cape.
Date:	27 April 2023
Version:	2.0
Reference:	GM.OM.2.0
Author Details:	Dr. Jan-Hendrik Keet [BSc, BSc Hons, MSc (University of the Free State), PhD (Stellenbosch University)] Email: keetjanhendrik@gmail.com ecofloristix@gmail.com Contact: 071 451 4853
Client:	Greenmined Environmental (Pty) Ltd.
Suggested Citation:	Keet, J-H (2023) Flora and Vegetation Report. Mining Permit Application near Beaufort West, Western Cape. Report prepared for Greenmined Environmental (Pty) Ltd., GM.OM.2.0.

CONTENTS

i. List of Abbreviations

BODATSA:	Botanical Database of Southern Africa
CARA:	Conservation of Agricultural Resources Act (Act 43 of 1983)
CBA:	Critical Biodiversity Area
CITES:	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CR:	Critically Endangered (threat status)
DDD:	Data Deficient — Insufficient Information (threat status)
DDT:	Data Deficient — Taxonomically Problematic (threat status)
EA:	Environmental Authorization
ECO:	Environmental Control Officer
EIA:	Environmental Impact Assessment: EIA regulations promulgated under section 24(5) of NEMA and published in Government Notice R. 543 in Government Gazette 33306 of 18 June 2010
EMPr:	Environmental Management Programme
EN:	Endangered (threat status)
EO:	Environmental Officer
ESA:	Ecological Support Area
EW:	Extinct in the Wild (threat status)
EX:	Extinct (threat status)
FEPA:	Freshwater Ecosystem Priority Area
IAPs:	Invasive Alien Plant species
IUCN:	International Union for Conservation of Nature
LC:	Least Concern (threat status)
MP:	Moderately Protected (according to the National Biodiversity Assessment 2018 Ecosystem Protection Levels)
NE:	Not Evaluated (threat status)
NEM:BA A&IS:	NEM:BA Alien and Invasive Species Regulations, 2016
NEM:BA	National Environmental Management: Biodiversity Act (Act No. 10 of 2004)
NEMA:	National Environmental Management Act (Act 107 of 1998)
NFA:	National Forest Act 1998 (No. 84 of 1998)
NFEPA:	National Freshwater Ecosystem Priority Areas; identified to meet national freshwater conservation targets (CSIR, 2011)
NP:	Not Protected (according to the National Biodiversity Assessment 2018 Ecosystem Protection Levels)
NT:	Near Threatened (threat status)
NWA:	National Water Act 36 of 1998
ONA:	Other Natural Area

PA: Protected Area

PAOI: Project Area of Influence

POSA: Plants of southern Africa (online database)

PP: Poorly Protected (according to the National Biodiversity Assessment 2018 Ecosystem Protection Levels)

RE: Regionally Extinct (threat status)

REEA: SA Renewable Energy EIA Application Database (https://egis.environment.gov.za/)

RLE: Red List of Ecosystems for South Africa

SAIIAE: South African Inventory of Inland Aquatic Ecosystems

SANBI: South African National Biodiversity Institute

SCC: Species of Conservation Concern

VegMap: National Vegetation Map of Southern Africa, Lesotho, and Swaziland (as per Mucina and Rutherford, 2006, with subsequent updates, e.g., 2018)

VU: Vulnerable (threat status)

WP: Well Protected (according to the National Biodiversity Assessment 2018 Ecosystem Protection Levels)

ii. List of Figures

iii. List of Tables

iv. Specialist Information and Legal Requirements

The National Environmental Management Act, 1998 (Act No. 107 of 1998), together with the Environmental Impact Regulations 2014 (as amended) Requirements for Specialist Reports (Appendix 6, GN R326 EIA Regulations of 7 April 2017) and the Gazetted Specialist Assessment Protocol, require that a specialist report prepared in terms of these regulations must contain the following:

Requirements of Appendix 6	Sections in this Report
a) Details of i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report, including a curriculum vitae;	Section 11
b) A declaration that the specialist is independent in a form as may be specified by the competent authority;	Section v
c) An indication of the scope of, and the purpose for which, the report was prepared;	Section 2
i. an indication of the quality and age of base data used for the specialist report;	Section 3
ii. a description of existing impacts on the site, cumulative impacts of the proposed development, and levels of acceptable change;	Section 6 and 7
d) The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 4 (and 2.6)
e) A description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 3
f) Details of an assessment of the specifically identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 5.3.4
g) An identification of any areas to be avoided, including buffers;	Section 5.3.4
h) A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 5.3
i) A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 2.6
j) A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment or activities;	Section 6
k) Any mitigation measures for inclusion in the EMPr;	7
l) Any conditions for inclusion in the environmental authorisation;	7
m) Any monitoring requirements for inclusion in the EMPr or environmental authorisation;	7
n) A reasoned opinion- i. as to whether the proposed activity, activities or portions thereof should be authorised; (a) regarding the acceptability of the proposed activity or activities; and ii. if the opinion is that the proposed activity, activities, or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Section 7.2
o) A description of any consultation process that was undertaken during the course of preparing the specialist report;	N/A
p) A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	N/A
q) Any other information requested by the competent authority.	N/A
Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	N/A

v. Declaration of Consultant Independence

The consultant hereby declares that he:

- Is an independent specialist in this application;
- Regards the information contained in this report as it relates to specialist input/study to be true and correct at the time of publication;
- Do not, and will not, have any financial interest(s) in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA Environmental Impact Assessment Regulations, 2014, and any specific environmental management Act;
- Do not, and will not, have any vested interest(s) in the proceedings of the proposed activities;
- Have disclosed, to the applicant, EAP, and competent authority(-ies), any information that have, or may have, the potential to influence the decision of the competent authority(-ies) or the objectivity of any report, plan, or document required in terms of the NEMA Environmental Impact Assessment Regulations 2014, and any specific environmental management Act;
- Is fully aware of, and meet, the responsibilities in terms of the NEMA Environmental Impact Assessment Regulations 2014 (specifically in terms of regulation 13 of GN No. R. 326), and any specific environmental management Act, and that failure to comply with these requirements may result in disqualification;
- Have provided the competent authority(-ies) with access to all necessary information at his disposal at the time of publication regarding the application, whether such information is favourable to the applicant or not; and
- Are aware that a false declaration is an offense in terms of regulation 48 of GN No. R. 326.

REPORT AUTHOR:

Dr. Jan-Hendrik Keet Pr.Sci.Nat 121678 (Botanical Science)

Fields of Expertise: Botany; Biogeography; Terrestrial Biodiversity; Invasive Alien Plant Identification, Management and Monitoring; Biological Sciences; Experimental Design and Analysis; Geographic Information Systems.

BSc Chemistry with Physics and Biology; BSc (Hons) Botany; MSc Botany (Invasive Plant Species and Risk Assessment); PhD Botany (Invasive Plant Species and Impacts); GIS Intermediate (GISB1500S NQF Level 5); SAGIC Invasive Species Consultant.

April 2023

1. Executive Summary

A 5-ha mining footprint, specifically for the mining of dolerite, is proposed to be developed over an undisturbed area of the farm Farm Rhenosterkop nr 115, Beaufort West District, Western Cape Province. The applicant intends to win material from the area for at least 2 years with a possible extension of another 3 years.

The current layout of the study area, specifically the mining area, overlaps in part with a sensitive habitat that is rated as having a "High" Site Ecological Importance. The rest of the study area is rated as having a "Low" to "Very Low" Site Ecological Importance. The destructive nature of the proposed activities is expected to have a significant and high local negative impact as it will directly affect the habitat of various plant species, including protected plant species. The entire study area, as well as the surrounding region, is mostly pristine in nature, and 1) might prove to be useful in meeting future conservation targets if the respective vegetation types become threatened and/or listed in future, 2) supports various plant and animals species (including protected species, and potential SCC), and 3) supports various ecosystem processes and functions, thereby contributing to the integrity of the landscape.

However, the existence and importance of these habitats is not regarded as crucial, since the specific vegetation and plant community types found within the study area are also widely found beyond the study area and surrounds, and have large current national extents. No SCC were found within the study area, while three protected plant species were found, albeit in low abundances. The loss of these individuals from the study area does not pose a problem given the current extent of the specific vegetation and plant community types, and also given that the same species were found beyond the study area in regions that will not be affected by the proposed activities.

Finally, the mitigation measures described in this report can be implemented to achieve, on average, a medium to low residual impact. The findings of this report conclude that no fatal flaws are evident for the proposed project, and the proposed activities may be favourably considered, on the condition that all prescribed mitigation measures and supporting recommendations in this report are strictly implemented.

2. Introduction

2.1. General Information

This project, as well as all related areas/sites, will from here on interchangeably be referred to as either the "project" or the "study area" depending on the context, or the "study area and surrounds" to include a broader context. The terms "site" or "sites" may also be used to refer to a specific locality or localities. The term "project area of influence" (PAOI) may be used to refer to an area larger than the actual project boundaries given, which will specifically be influence by the proposed activities.

Greenmined Environmental (Pty) Ltd — hereafter referred to as "the client" — approached EcoFloristix Specialist Environmental Consulting to conduct a Terrestrial Biodiversity Impact Assessment for a mining permit application near Beaufort West in the Western Cape.

2.2. Terms of Reference (ToR)

The main aim of this assessment was to provide a professional opinion on botanical issues related to the proposed activities within the study area. Specifically, this assessment intends to provide the relevant information for guiding and mitigating the risk(s) associated with the proposed activities and their impacts on the local plant communities and associated ecosystems within the study area.

Briefly, the following activities were performed:

- A desktop assessment to identify relevant ecologically important geographical features (for example, unique habitats, Critical Biodiversity Areas (CBAs), and threatened ecosystems);
- A desktop assessment to compile a list of species that might occur in and around the study area, including Species of Conservation Concern [SCC] and protected plant species;
- A field survey to assess the species composition of the plant communities within and around the study area, as well as the presence of any SCC ;
- A delineation and mapping of the plant community and/or habitat types that occur within the study area, and a determination of their respective sensitivities;
- An identification of the potential impacts of the proposed activities on the plant communities of the study area, and an evaluation of the risks associated with these potential impacts; and
- A prescription of mitigation measures and recommendations for the identified risks.

2.3. Locality Details

The entire study area is located on the farm Rhenosterkop nr 115 about 30 km North of Beaufort West, and can be reached via the N1 toll road (Figure 1 and Figure 2). The entrance to the study area is located on the righthand side of the N1 when driving northbound.

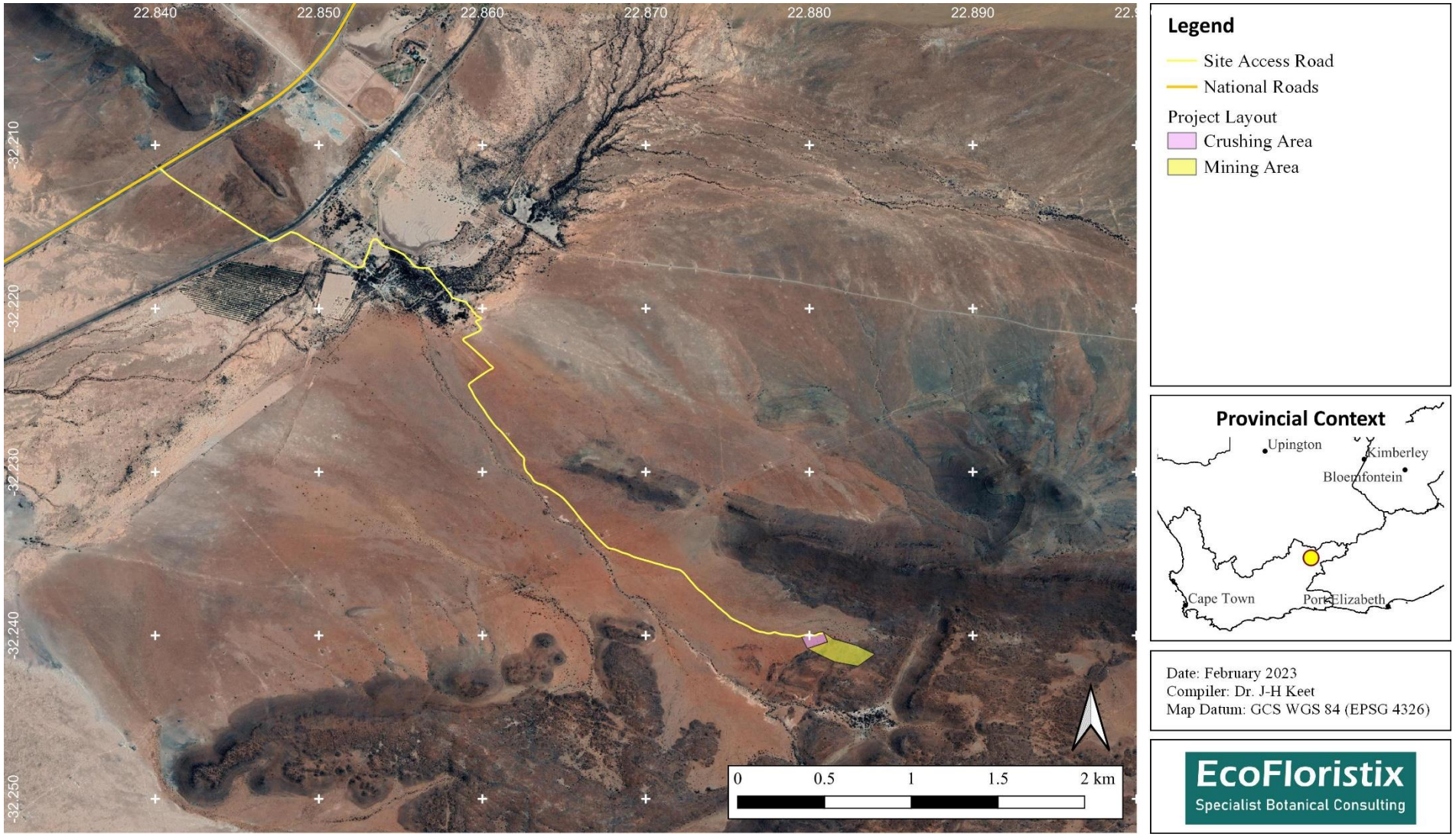


Figure 1: Locality of the study area, zoomed out to give a broad context. The inset map shows the main map extent (indicated with a yellow dot) within a provincial context, as well as the broader context of South Africa.

Figure 2: Overview of the proposed mining and crushing areas. The inset map shows the main map extent (indicated with a red arrow and yellow dot) within a provincial context, as well as the broader context of South Africa.

2.4. Proposed Activity and Details

Otter Mist Trading 1057 (Pty) Ltd — hereafter referred to as "the applicant" — applied for a mining permit for the mining of dolerite on the Farm Rhenosterkop nr 115, Beaufort West District, Western Cape Province.

The proposed mining footprint will be 5 ha and will be developed over an undisturbed area of the farm. The mining method will make use of drilling and blasting in order to loosen the hard rock. The material will then be loaded and hauled to a crushing plant where it will be screened to various sized stockpiles. The dolerite will be stockpiled until it is transported from the site using tipper trucks. All mining related activities will be contained within the approved mining permit boundaries.

The applicant intends to win material from the area for at least 2 years with a possible extension of another 3 years. The dolerite to be removed from the quarry will be used in local construction and building projects in the vicinity. The proposed quarry will therefore contribute to the upgrading/maintenance of road infrastructure and building contracts in and around the Beaufort West area.

The mining activities will consist of the following:

- Stripping and stockpiling of topsoil;
- Drilling;
- Blasting;
- Excavating;
- Crushing;
- Stockpiling and transporting;
- Sloping and landscaping upon closure of the site; and
- Replacing the topsoil and vegetation of the disturbed area.

The mining site will contain the following:

- Drilling equipment;
- Excavating equipment;
- Earth moving equipment;
- Static crushing and screening plants;
- Access Roads;
- Site Office (Containers);
- Site vehicles;
- Parking area for visitors and site vehicles;
- Vehicle service area;
- Wash bay;
- Workshop (Containers);
- Salvage Yard;
- Bunded diesel and oil storage facilities;
- Generator on bunded area;
- Ablution Facilities (Chemical Toilets);

- Weigh Bridge; and
- Demarcated general and hazardous waste area.

The proposed project will not require any additional electricity connections, as power will be supplied, when needed, by generators. All diesel storage will be below the threshold as mentioned in the EIA regulations of the National Environmental Management Act, 1998 (Act No 107 of 1998) as amended 2017.

Access to the proposed mining area will be via the N1, making use of the existing internal/haul roads to access the mining area. Haul roads will be extended as the open cast mining progresses and will be rehabilitated as part of the final reinstatement of the area. Trucks delivering the materials to the destinations will take the N1 national route.

The proposed access road intersects with more than 2 drainage lines which necessitates a water use application in terms of Section 21 of the NWA, 1998. Any water required for the implementation of the project will be bought and transported to the site.

The applicant only identified one alternative site for the proposed mining activity (as previously mentioned; see Figure 2 and Figure 3). This area is the only viable area due to the position of the dolerite reserve.

If applicable, project and/or technology alternatives will be considered in order to identify the best possible option that will accommodate the mining need, as well as have the least possible impact on the receiving environment.

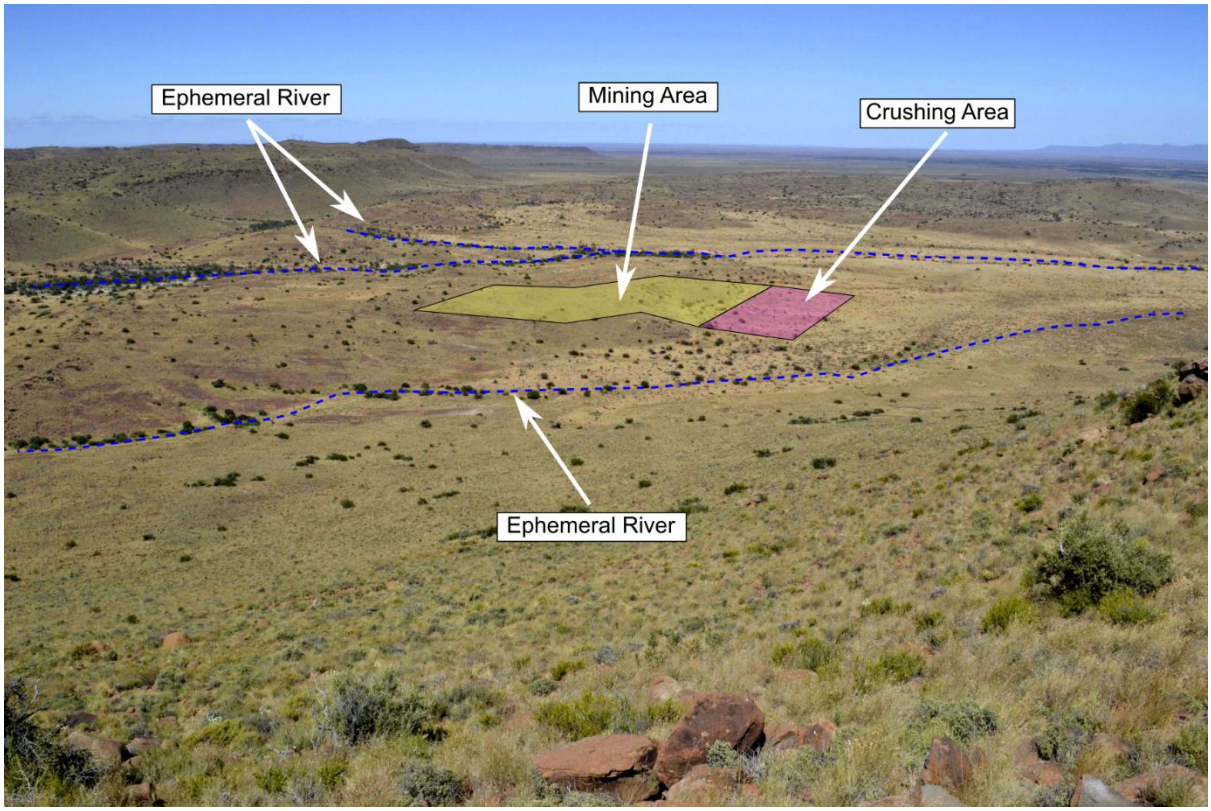


Figure 3: Landscape photo of the broader region surrounding the study area, together with the proposed areas in which the mining related activities will occur. The photo faces a south-westerly direction. Also shown are ephemeral streams/rivers that flow past the study area. Note: the areas indicated are only approximate are not intended to convey the precise localities of, or distances related to, the proposed mining areas and related activities, but instead to give a general idea of the study area and its surroundings. See Figure 2 for an accurate geographical layout.

2.5. Conditions of This Report

This report deals exclusively with the study area as defined in sections 2.1 and 2.3, and the impacts upon plant biodiversity and natural ecosystems in that area. Therefore, all relevant project information provided by the applicant and/or the client, as well as any other relevant Environmental Impact Assessment practitioner(s), to the biodiversity specialist(s) was assumed to be correct and valid at the time of its provision. This report is not liable to include and assess any alterations to the study area, as provided by the client, if such alterations occurred after the survey date(s).

All findings, recommendations, and conclusions provided in this report are based on the author's best scientific and professional knowledge at the time of compilation, as well as information available at the time of compilation. This report, whether in full or in part, may not be amended or extended in any way whatsoever without the prior written consent of the author. Any recommendations, statements, or conclusions drawn from, or based on, this report must clearly cite or make reference to this report, making sure to include the following reference: GM.OM.2.0. This

report must be included in its entirety whenever any recommendations, statements, or conclusions relating to this report form any part of another report.

2.6. General Assumptions and Potential Limitations

Temporal variation plays an important role in the structure and patterns of plant biodiversity, communities, and species occurrences. One site visit (or even multiple visits), or a single season's survey, might not fully catalogue plant species diversity in an area (for example, due to seasonal variation in vegetation and plant growth patterns).

Specifically, some annual, short-lived, ephemeral (plants surviving unfavourable conditions as seeds), geophytic (species with underground storage organs), or other cryptic species might not be observable/detectable. That is, many plant species are known to completely die back during certain times of the year, depending on respective life strategies. Thus, during these times such species remain unobservable/undetectable and survive only as dormant bulbs, corms, tubers, or rhizomes below the soil surface. Together with this, rare and threatened plant species are generally uncommon and/or localized, and can easily be overlooked. Even multiple site visits might fail to locate such species.

Furthermore, flowers and fruits are crucial for the complete and accurate identification of plant species, and any absence of such flowers and fruits might prevent the complete and accurate identification of such plant species. Flowering and fruiting times are species specific, and there are invariably always some plant species not flowering and/or fruiting during surveying. This not only impacts identifiability, but also detectability/visibility.

Finally, in practice it is almost always impossible to survey any area to its full extent, both physically and temporally. The total number of plant species recorded in any area is, therefore, almost always an underestimate of the potential number of species that could occur in such an area.

Considering all of the aforementioned, the possibility always exists that certain plant species might not be observable/detectable on site during the time of surveying, as a result of their potential annual, short-lived, dormant, cryptic, or ephemeral nature, or their rare and/or localized distributions on site, or the incomplete and inaccurate identification of plant species which lacked flowers and/or fruits and/or other characteristic features during surveying.

2.7. Key Legislative Requirements

The lists below provide legislation, policies, and guidelines that are applicable to the current project in terms of biodiversity and ecological support systems. Although these lists are extensive, they are not exhaustive, and other legislation, policies, and guidelines may also apply.

International Legislation:

- Convention on Biological Diversity (CBD, 1993)
- The Convention on Wetlands (RAMSAR Convention, 1971)
- The United Nations Framework Convention on Climate Change (UNFCC,1994)
- The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES 1973)
- The Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention, 1979)

National Legislation:

- Constitution of the Republic of South Africa (Act No. 108 of 1996)
- The National Environmental Management Act (NEMA) (Act No. 107 of 1998)
- The National Environmental Management: Protected Areas Act (Act No. 57 of 2003)
- The National Environmental Management: Biodiversity Act (NEM:BA) (Act No. 10 of 2004), Threatened or Protected Species Regulations
- Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998, GNR 320 of Government Gazette 43310 (March 2020)
- Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998, GNR 1150 of Government Gazette 43855 (October 2020)
- The National Environmental Management: Waste Act, 2008 (Act 59 of 2008)
- The Environment Conservation Act (Act No. 73 of 1989)
- National Protected Areas Expansion Strategy (NPAES)
- Natural Scientific Professions Act (Act No. 27 of 2003)
- National Biodiversity Framework (NBF, 2009)
- National Forest Act (Act No. 84 of 1998)

- National Veld and Forest Fire Act (101 of 1998)
- National Water Act (NWA) (Act No. 36 of 1998)
- National Spatial Biodiversity Assessment (NSBA)
- World Heritage Convention Act (Act No. 49 of 1999)
- Municipal Systems Act (Act No. 32 of 2000)
- Alien and Invasive Species Regulations and, Alien and Invasive Species Lists, published under NEM:BA (NEM:BA A&IS Regulations)
- South Africa's National Biodiversity Strategy and Action Plan (NBSAP)
- Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983) (CARA)
- Sustainable Utilisation of Agricultural Resources (Draft Legislation)
- White Paper on Biodiversity

Provincial Legislation:

- Draft Western Cape Biodiversity Bill, 2019
- Nature and Environmental Conservation Ordinance No. 19 of 1974
- Western Cape Nature Conservation Laws Amendment Act, No. 3, 2000
- Western Cape Biodiversity Sector Plan 2017

3. Assessment Approach and Methodology: Desktop Phase

This assessment was conducted according to the 2014 EIA Regulations, as amended on 7 April 2017, as well as according to the "*Guidelines for the implementation of the Terrestrial Fauna and Terrestrial Flora Species Protocols for environmental impact assessments in South Africa*" (South African National Biodiversity Institute, 2020).

A desktop assessment was undertaken using a suitable Geographic Information System (GIS; specifically QGIS version 3.20.0-Odense) and the latest available spatial datasets, as well as relevant online biodiversity databases and/or literature (these are listed where applicable). The aim of this was to develop digital cartographs and species lists. The subsections that now follow expand upon this desktop assessment.

3.1. Ecologically Important Landscape Features: Custom GIS Mapping

The GIS was used together with the latest Google Earth satellite imagery to delineate and map observable landscape features in the study area. Specifically, attention was given to homogenous units that could easily be recognized. Some examples of such features include drainage lines and rivers, plains and floodplains, hill- and mountain tops, and hill- and mountains slopes (if sufficiently large and distinct from surrounding features), as well as areas that have distinctly recognizable vegetation features, such as the presence/absence of large trees and/or shrubs, and vegetation patches of differing colours — these likely represent distinct plant community types. However, while satellite imagery is highly useful, it nevertheless suffers from several issues. This includes the generation of areas where image stitching has resulted in different colours for the same features, or imagery that might not have a high enough resolution, among other things. For this reason ground truthing is required to validate and refine the results of such desktop analyses.

3.2. Ecologically Important Landscape Features: Existing Data

Existing ecologically relevant data layers were incorporated into the GIS to establish how the proposed development might interact with any ecologically important entities. Emphasis was placed around the following spatial datasets:

3.2.1. Red List of Ecosystems for South Africa

The Red List of Ecosystems (RLE; http://bgis.sanbi.org/Projects/Detail/1233/) for South Africa is a dataset containing the historical/potential extent, as well as the remaining remnants, of each ecosystem type. This represents a revision of the "List of terrestrial ecosystems that are threatened or in need of protection" published in the government gazette in December 2011. Ecosystems are

categorised into one of four classes representing their risk of collapse, namely Critically Endangered (CR), Endangered (EN), Vulnerable (VU), or Least Concern (LC). The units of assessment for the RLE are the vegetation types of VegMap (see section 3.3.2).

3.2.2. National Biodiversity Assessment 2018

The National Biodiversity Assessment 2018 (NBA) (Skowno et al., 2019) assessed the state of South Africa's biodiversity based on the best available science to understand temporal trends, and informs policy and decision-making across a range of sectors. The NBA deals with three biodiversity components: 1) genetics, 2) species, and 3) ecosystems. The NBA also assesses biodiversity and ecosystems across terrestrial, freshwater, estuarine, and marine environments. The two headline indicators assessed in the NBA are:

- **Ecosystem Threat Status**: An indicator of ecosystem wellbeing. This concerns the amount of change regarding ecosystem structure, function, and/or composition, based on the proportion of the original extent of each ecosystem type still currently in good ecological condition. Specifically, ecosystem threat levels are categorised as Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT), or Least Concern (LC) (Figure 4).
- **Ecosystem Protection Level**: An indicator of how well ecosystems are adequately protected or under-protected. Specifically, ecosystems protection levels are categorised as Well Protected (WP), Moderately Protected (MP), Poorly Protected (PP), or Not Protected (NP), based on biodiversity targets for each ecosystem type included within one or more protected areas. So-called "under-protected ecosystems" include NP, PP, or MP ecosystem types.

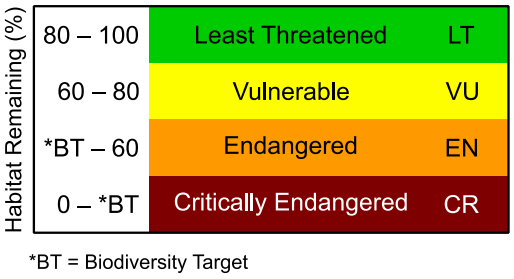


Figure 4: Ecosystem Threat Status categories (figure as originally depicted in Driver et al., 2005). The biodiversity target represents the minimum conservation requirement.

3.2.3. Protected Areas

- **South Africa Protected Areas Database** (SAPAD; DEA, 2020): SAPAD contains spatial conservation data for South Africa. It includes spatial and attribute information for formally

protected areas, as well as areas that are less formally protected. SAPAD, updated continually, forms the basis for the Register of Protected Areas (a legislative requirement under the National Environmental Management: Protected Areas Act, Act 57 of 2003).

- National Protected Areas Expansion Strategy (NPAES; SANBI, 2010): NPAES provides spatial information on areas that are suitable for terrestrial ecosystem protection. Areas were identified through a systematic biodiversity planning process. They present the best opportunities for meeting the ecosystem-specific protected area targets set in the NPAES and were designed with strong emphasis on climate change resilience and requirements for protecting freshwater ecosystems. NPAES focus areas are large, intact, and unfragmented, and are therefore highly important for biodiversity, climate resilience, and freshwater protection. Note that these areas are not necessarily future boundaries of protected areas — often times only a portion of a particular focus area would be required to meet protected area targets. Moreover, they are not a replacement for fine scale planning. Such planning might identify many different priority sites based on local requirements, constraints, and opportunities.

3.2.4. Hydrological Features: South African Inventory of Inland Aquatic Ecosystems

Rivers and wetlands provide numerous high-value provisional and regulatory ecosystem services, and are some of the most diverse South African aquatic ecosystems. South Africa is a water-stressed country, and its socio-economic development places enormous pressure on its water resources (Edwards, et al, 2018. Consequently, the management and monitoring of these systems is vital. As per the NBA (H van Deventer et al., 2018; Heidi Van Deventer et al., 2019), some of these ecosystems are among the most threatened and poorly protected South Africa.

The South African Inventory of Inland Aquatic Ecosystems (SAIIAE) is an inventory and collection of spatial data and supporting information that describes South Africa's inland aquatic ecosystems, and include rivers, wetlands, artificial water bodies, and freshwater species, among other things (H van Deventer et al., 2018).

The Ecosystem Threat Status (ETS) of river and wetland ecosystem types considers the extent to which each river ecosystem type has been altered from its natural condition. Ecosystem types are categorised as CR, EN, VU, or LT (Skowno et al., 2019; Heidi Van Deventer et al., 2019). So-called "threatened" ecosystem types include CR, EN, and VU.

3.2.5. Hydrological Features: National Freshwater Ecosystem Priority Area Status

South African river systems have been categorised, based on specific ecological criteria (i.e., ecosystem representation, water yield, connectivity, unique features, and threatened taxa), to better conserve aquatic ecosystems. Specifically, Freshwater Ecosystem Priority Areas (FEPAs) have emerged from this endeavour (Nel et al., 2011). FEPAs are intended to support conservation and are intended to guide the effective implementation of measures to achieve the National Environment Management Biodiversity Act's (NEM:BA) biodiversity goals.

3.2.6. Western Cape Biodiversity Spatial Plan

The Western Cape Biodiversity Spatial Plan (Pool-Stanvliet et al., 2017) classifies areas within the province based on its contribution to reach the conservation targets within the province. The C-Plan categorized various land used types according to their biodiversity and environmental importance as follows:

- **Critical Biodiversity Areas** (CBAs): areas that are required to meet biodiversity targets for species, ecosystems, or ecological processes and infrastructure. CBAs are of high biodiversity and ecological value and must be kept in a natural or near-natural state, with no further loss of habitat or species. Moreover, degraded areas should be rehabilitated to natural or near-natural conditions, and only low-impact, biodiversity-sensitive land uses are appropriate. Examples are areas required to meet biodiversity pattern (e.g. species, ecosystems) targets, Critically Endangered (CR) ecosystems, all areas required to meet ecological infrastructure targets, and critical corridors that maintain landscape connectivity. Two subtypes are distinguished:
    - CBA Irreplaceable (CBA 1): Areas that are critical for meeting biodiversity targets and thresholds, and which are required to ensure the persistence of viable species populations and ecosystem functionality.
    - CBA Optimal (CBA 2): Areas which represent the best localities, from a potentially larger selection of available planning units, that are optimally located to meet conservation targets, as well as other criteria.
- **Ecological Support Areas** (ESAs): the ecological functioning and sustainability of CBAs require support from additional areas, namely ESAs. Although ESAs are not essential for meeting biodiversity targets, they are nevertheless important for supporting PAs or CBAs. ESAs are often crucial for delivering ecosystem services. For terrestrial and aquatic environments, such areas are functional, but not necessarily pristine and natural. However, they are required to ensure the persistence and maintenance of biodiversity patterns and

ecological processes within CBAs, and also contribute significantly to the maintenance of ecological infrastructure. Two subtypes are distinguished:

- ESA 1: Areas that might still be functional, and could be natural, near-natural, or moderately degraded.
- ESA 2: Areas that are severely degraded or have no natural cover remaining and therefore require restoration.

- **Other Natural Areas** (ONAs): Some areas have not been identified as a priority in the current biodiversity spatial plan. However, they retain most of their natural character, and as such still perform many biodiversity and ecological infrastructure functions. Therefore, they are an important part of the natural ecosystem. It is desirable that ONAs, where possible, are managed or utilized such that minimizes habitat and species loss is minimized, and that ecosystem functionality through strategic landscape planning is ensured.
- **Severely Modified to No Natural Remaining** (NNR): These areas have been severely modified by human activity. They are no longer natural and do not contribute to biodiversity targets. However, these areas may still provide limited biodiversity and ecological infrastructure functions.
- **Protected Areas** (PAs): Areas that are formally protected by law in terms of the NEM:PAA. This includes gazetted private Nature Reserves and Protected Environments.

3.3. Botanical Assessment

The flora of the region was assessed both floristically (species identity) and compositionally (community assembly patterns).

3.3.1. Species Identities

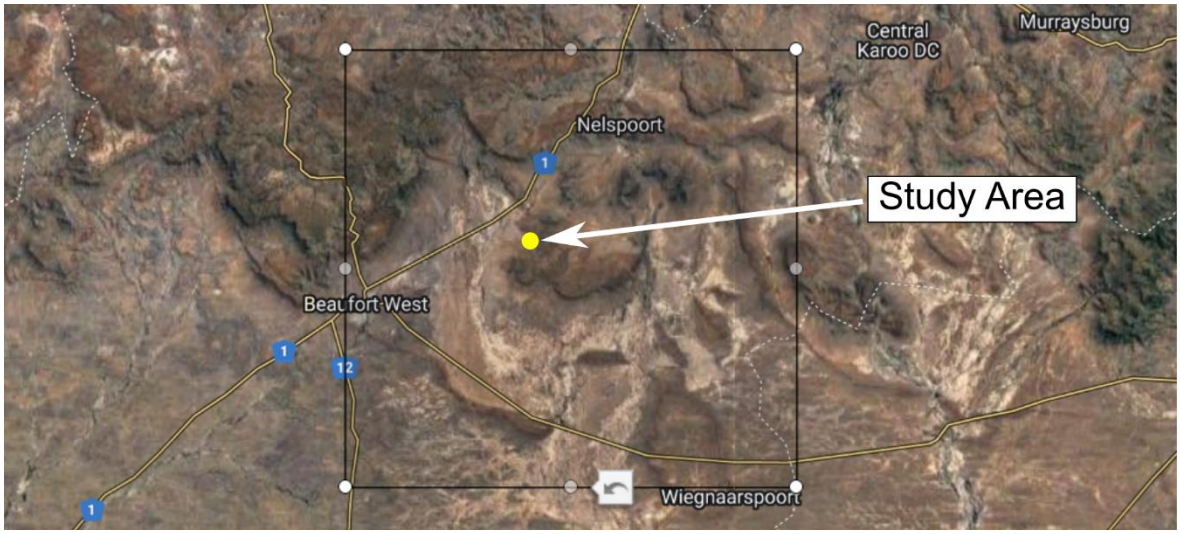


Figure 5: Locality of the study area, as well as the area (black rectangle) used to extract data from BODATSA/POSA. Extracted data was used to compile a list of plant species that may potentially occur within the study area, as well as the surrounding area, and to provide an indication of potential Species of Conservation Concern that may be found within this area.

Various reasons exist why the flora of a region cannot fully be assessed within a limited timeframe (specifically see section 2.6). Therefore, to develop a comprehensive list of plant species occurring within the broader regions, the following data sources were used to obtain historical distribution records:

- **Botanical Database of Southern Africa** (BODATSA; also often referred to as POSA [Plants of southern Africa]): this is an electronic database provided by the South African National Biodiversity Institute (SANBI) that provides herbarium records that have been collected in the region (http://posa.sanbi.org/). Records were specifically extracted from a very large area surrounding the actual study area (Figure 5).
- **The Red List of South African Plants** (Raimondo et al., 2009): this online database (http://redlist.sanbi.org/) provides the most current national status of South Africa's vascular plant species. This was used to assess SCC[1], which are taxa (in this case plant species) that have a significant conservation importance for preserving South Africa's high biological diversity. SCC have a high conservation importance in terms of preserving South

[1] Note that all South African plants have been assessed (i.e., assigned a red list category, or "redlisted") by the Red List of South African Plants. Therefore, using the terms "redlist" or "red list" specifically for Threatened or other conservation concern species is not accurate (even though it remains popular). The term "Species of Conservation Concern" (or SCC) is preferable, or "Threatened" where applicable.

Africa's high floristic diversity, and include threatened species, as well as "Extinct in the Wild" (EW), "Regionally Extinct" (RE), "Near Threatened" (NT), "Critically Rare", "Rare", "Declining", and "Data Deficient: Insufficient Information" (DDD) species (see Figure 6). Note that SANBI divides the IUCN category DD into "Data Deficient: Insufficient Information (DDD)", and "Data Deficient: Taxonomically Problematic (DDT)". When SCC occur in a study area, the proposed activities could impact them and result in significant biodiversity loss — the loss of SCC populations might either increase the extinction risk of the respective species, or might even contribute toward their extinction. As such, it is very important to note that a permit must be obtained from the relevant local authorities to destroy or relocate any SCC (or protected species).

- **iNaturalist**: this is a comprehensive online platform (https://www.inaturalist.org/) to which numerous citizen scientists contribute distribution records of biodiversity, mostly in the form of photos. Although many of the users are not professional botanists, various recognized botanical experts assist in accurate identification, and the platform is therefore an invaluable source of information regarding biodiversity.
- **National Web Based Environmental Screening Tool**: a geographically based, web-enabled application (https://screening.environment.gov.za/screeningtool/#/pages/welcome) which allows a proponent intending to submit an application for environmental authorisation in terms of the Environmental Impact Assessment (EIA) Regulations 2014, as amended, to screen their proposed site for any environmental sensitivity. Of specific interest for this report are the potential presences of so-called "sensitive plant species" in and around the study area.

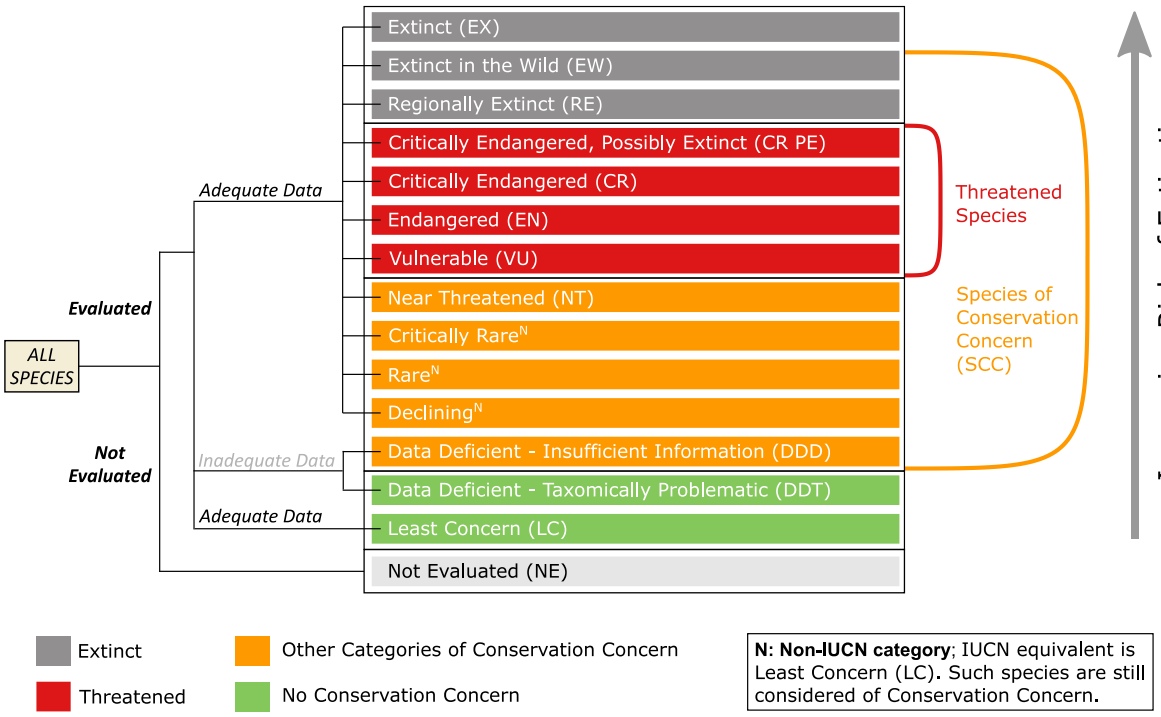


Figure 6: Red List categories used in this report as delineated according to SANBI's Red List of South African Plants (version 2020; http://redlist.sanbi.org/redcat.php).

The lists obtained from these databases were also used to identify protected plant species. Such species are protected by NEM:BA, as well as other provincial legislation (see section 2.7). No person may sell, buy, transport, destroy, or harvest a protected plant without a permit from the relevant authority.

Finally, the lists obtained from these databases were used to identify invasive alien plant species (IAPs) that are listed in the NEM:BA A&IS Regulations. IAPs can dominate, and even replace, native flora. Therefore, they have the ability to completely transform the structure, composition, and functioning of ecosystems. IAPs must be controlled, and preferably eradicated, by means of an eradication and monitoring program (see below for details).

3.3.1.a) NEM:BA Alien and Invasive Species Regulations

The NEM:BA A&IS Regulations is the most current legislation regarding IAPs. The list of Alien Invasive Species was published in August 2014 in terms of NEM:BA. The Alien and Invasive Species Regulations were published in the Government Gazette No. 44182, 24th of February 2021. The legislation requires the removal and/or control of Category 1a and 1b IAPs. In addition, unless authorised in terms of the National Water Act, no land user may allow Category 2 IAPs to occur within 30 meters of the 1:50 year flood line of a river, stream, spring, natural channel in which

water flows regularly or intermittently, lake, dam, or wetland. Category 3 IAPs are also prohibited from occurring close to a watercourse.

The NEM:BA A&IS Regulations categories are, briefly, as follows:

- Category 1a: Invasive species requiring compulsory control. All specimens must be removed and destroyed, and the species must be eradicated from the environment. No permits will be issued.
- Category 1b: Invasive species requiring compulsory control as part of an invasive species control program. All specimens must be removed and destroyed. Since these IAPs can have such a high invasive potential, infestations may qualify for a government sponsored invasive species management program. No permits will be issued.
- Category 2: Invasive species regulated by area. A demarcation permit is required to import, possess, grow, breed, move, sell, buy, or accept as a gift any Category 2 IAPs. No permits will be issued for Category 2 plants to exist in riparian zones.
- Category 3: Invasive species regulated by activity. An individual plant permit is required to undertake restricted activities such as importing, possessing, growing, breeding, moving, selling, buying, or accepting as a gift any Category 3 IAPs. No permits will be issued for Category 3 plants to exist in riparian zones.

According to the NEM:BA A&IS Regulations, any person in control of a Category 1b IAPs must immediately:

- Notify the competent authority in writing; and
- Take steps to manage the listed invasive species in compliance with:
    - Section 75 of NEM:BA;
    - The relevant invasive species management program developed in terms of regulation 4; and
- Any directive issued in terms of section 73(3) of NEM:BA.

3.3.2. Community Composition: Vegetation Types

The vegetation types (and their conservation statuses) of the study area, as well as the broader regions surrounding the study area, were determined using the South African National Vegetation Map, or simply "VegMap" (Dayaram et al., 2018; Mucina & Rutherford, 2006; South African National Biodiversity Institute, 2018) and the National List of Threatened Ecosystems (2011). The latest version of VegMap was consulted to check for any updates of the respective regions.

Although vegetation descriptions given in this report are as per VegMap 2006, these units were cross-validated with VegMap 2018 to ensure their extents remained the same.

4. Assessment Approach and Methodology: Fieldwork Phase

Briefly, the field surveys aimed to investigate the following on-site aspects:

- The occurrence of SCC and protected plant species;
- The specific vegetation types (identification, classification, and delineation); and
- The specific habitat/community types (classification and delineation).

4.1.1. Botanical Assessment Details

The botanical survey was conducted on 20 and 21 February 2023. This timeframe falls outside the optimum surveying period (which is generally accepted to be during spring and the beginning of summer; also see section 2.6 for assumptions and potential limitations). However, the region of study area received ample rainfall some time prior to the site visit, and the vegetation was therefore in a good condition for surveying.

Surveying was done within specifically targeted areas that were perceived as ecologically distinct and/or sensitive based on the results obtained from the desktop assessment of plant community types (sections 3.1 and 3.2). This was to optimize coverage and to perform a rapid, but efficient, vegetation and ecological assessment at each survey area.

The botanical assessment was conducted by surveying fixed-point plots of sufficient size within each community type, which were also supplemented with timed meanders (Goff et al., 1982) within the respective community types. The combination of single fixed-point plots, supplemented with timed random meanders, are highly efficient for conducting floristic analyses. This allows plant species coverages and SCC occurrences to be rapidly estimated, as well as the compilation of adequate plant species lists, thereby giving a prompt indication of botanical diversity. Other useful observations were also recorded within each community type, examples of which include ecological condition and current impacts (e.g., livestock grazing and degree of erosion), general vegetation density and physiognomic characteristics, habitat notes, and the presence of any sensitive features (e.g., wetlands and drainage lines) where applicable. Finally, any opportunistic observations were also made while surveying.

Various field guides and identification manuals were used for plant identification (Bromilow, 2010; Duncan et al., 2020; Fish et al., 2015; Henderson, 2020; Shearing & van Heerden, 2008; Van Oudtshoorn, 2012; Van Wyk et al., 2009), and are listed in section 9.

4.1.2. Sensitivities: Terrestrial Site Ecological Importance

The most current impact assessment methodology, namely the Site Ecological Importance (SEI), was followed here, as proposed by the *Guidelines for the implementation of the Terrestrial Fauna and Terrestrial Flora Species Protocols for environmental impact assessments in South Africa* (South African National Biodiversity Institute, 2020).

The different plant community types within the study area were delineated and identified based on field observations and satellite imagery (also see section 3.1). These plant community types were assigned Ecological Importance (EI) categories based on their ecological integrity, conservation value, functionality, ecosystem processes, and the presence/absence of SCC.

Specifically, Site Ecological Importance (SEI) is a function of two factors (Figure 7): 1) The Biodiversity Importance (BI) of the receptor (e.g., SCC, the vegetation/fauna community, or habitat type) and Receptor Resilience (RR; the resilience of the receptor to impacts). BI is in turn a function of Conservation Importance (CI; the importance of a site for supporting biodiversity features of conservation concern that are present) and the Functional Integrity (FI; the receptors' current ability to maintain its structure and functions, compared to its known or predicted state under ideal conditions) of the receptor.

BI and SEI are both calculated using respective risk matrices (Figure 8). BI, FI, and RR categories are all circumscribed by various criteria (see Table 1, Table 2, and Table 3). The various criteria per category may be applied in combination or in isolation. See Figure 8 for guidelines on interpreting the resulting SEI categories.

In this report, the SEI is evaluated here for each plant community type.

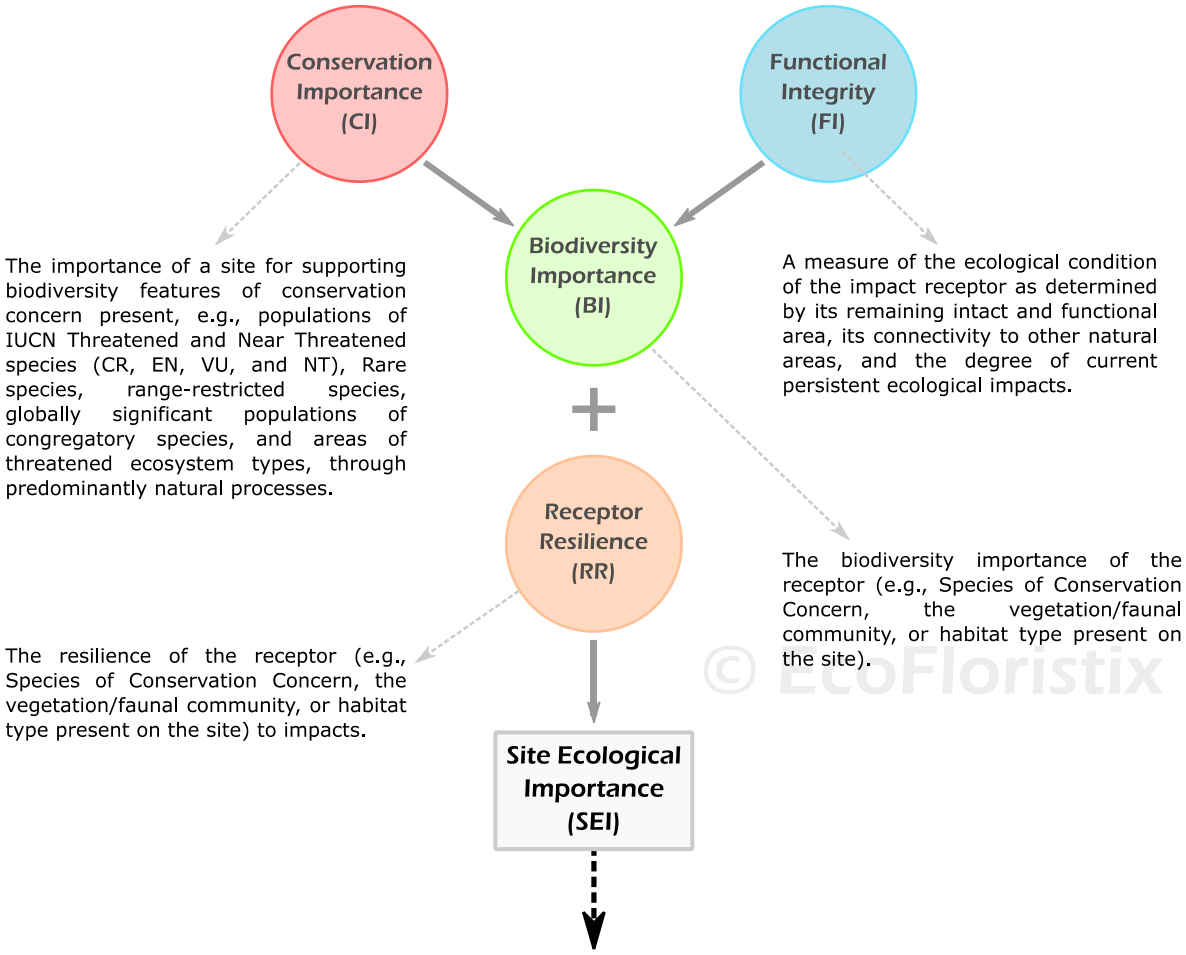
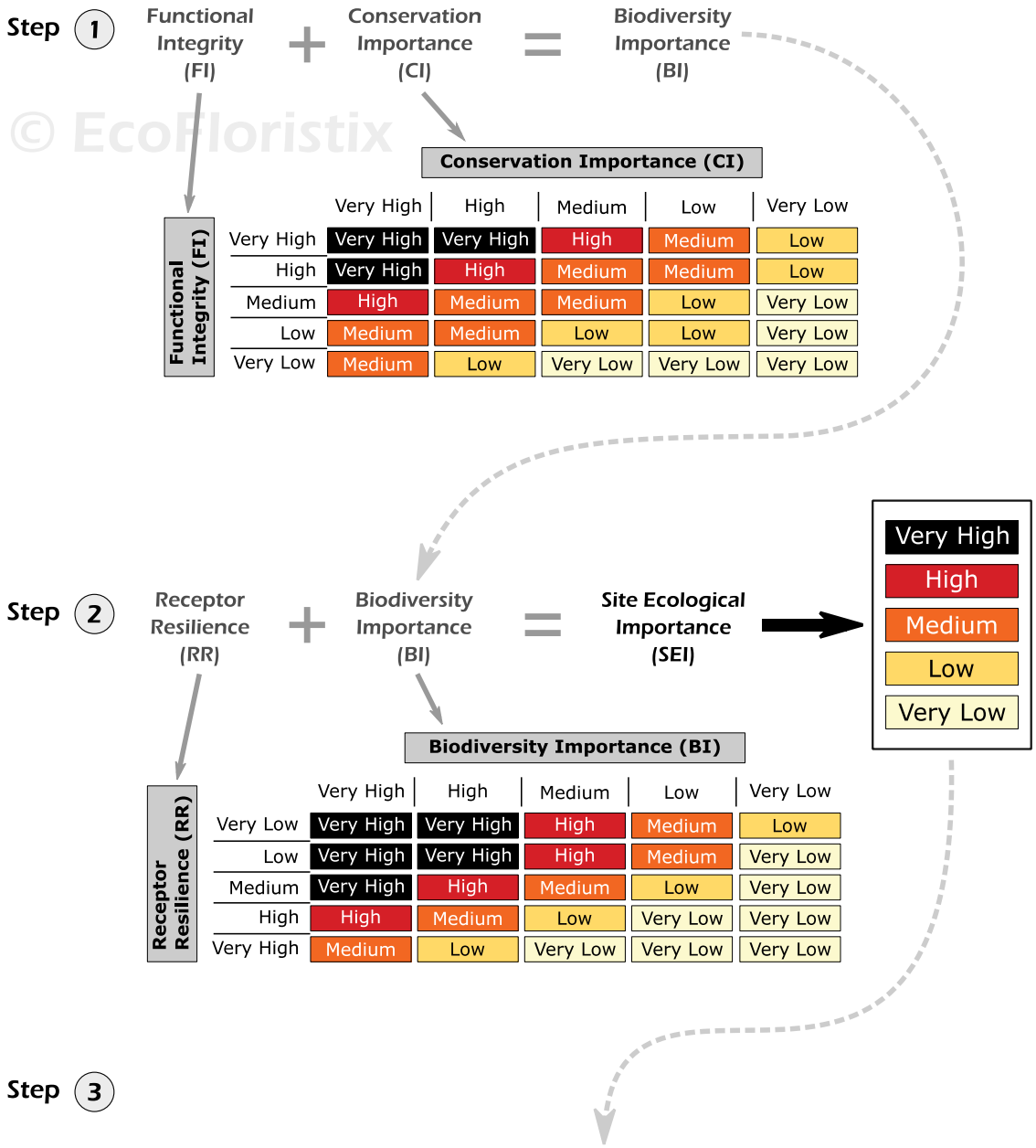


Figure 7: Details on the factors that contribute to the Site Ecological Importance value. Also see Figure 8.



SEI	Interpretation in Relation to Proposed Development Activities
Very High	Avoidance mitigation — no destructive development activities should be considered. Offset mitigation not acceptable/not possible (i.e., last remaining populations of species, last remaining good condition patches of ecosystems/unique species assemblages). Destructive impacts for species/ecosystems where persistence target remains.
High	Avoidance mitigation wherever possible. Minimisation mitigation — changes to project infrastructure design to limit the amount of habitat impacted, limited development activities of low impact acceptable. Offset mitigation may be required for high impact activities.
Medium	Minimisation and restoration mitigation — development activities of medium impact acceptable followed by appropriate restoration activities.
Low	Minimisation and restoration mitigation — development activities of medium to high impact acceptable followed by appropriate restoration activities.
Very Low	Minimisation mitigation — development activities of medium to high impact acceptable and restoration activities may not be required.

Figure 8: Calculations, scores, process, and guidelines for calculating and interpreting Site Ecological Importance categories (South African National Biodiversity Institute, 2020).

Table 1: Details regarding Conservation importance (CI) categories.

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

Table 2: Details regarding Functional Integrity (FI) categories.

Functional Integrity	Fulfilling criteria
Very high	• Very large (> 100 ha) intact area for any conservation status of ecosystem type or > 5 ha for CR ecosystem types. • High habitat connectivity serving as functional ecological corridors, limited road network between intact habitat patches. • No or minimal current negative ecological impacts with no signs of major past disturbance (e.g. ploughing).
High	• Large (> 20 ha but < 100 ha) intact area for any conservation status of ecosystem type or > 10 ha for EN ecosystem types. • Good habitat connectivity with potentially functional ecological corridors and a regularly used road network between intact habitat patches. • Only minor current negative ecological impacts (e.g. few livestock utilising area) with no signs of major past disturbance (e.g., ploughing) and good rehabilitation potential.
Medium	• Medium (> 5 ha but < 20 ha) semi-intact area for any conservation status of ecosystem type or > 20 ha for VU ecosystem types. • Only narrow corridors of good habitat connectivity or larger areas of poor habitat connectivity and a busy used road network between intact habitat patches. • Mostly minor current negative ecological impacts with some major impacts (e.g., established population of alien and invasive flora) and a few signs of minor past disturbance. Moderate rehabilitation potential.
Low	• Small (> 1 ha but < 5 ha) area. • Almost no habitat connectivity but migrations still possible across some modified or degraded natural habitat and a very busy used road network surrounds the area. Low rehabilitation potential. • Several minor and major current negative ecological impacts.
Very Low	• Very small (< 1 ha) area. • No habitat connectivity except for flying species or flora with wind-dispersed seeds. • Several major current negative ecological impacts.

Table 3: Details regarding Receptor Resilience (RR) categories.

Receptor Resilience	Fulfilling criteria
Very high	• Habitat that can recover rapidly (~ less than 5 years) to restore > 75% of the original species composition and functionality of the receptor functionality, or species that have a very high likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a very high likelihood of returning to a site once the disturbance or impact has been removed.
High	• Habitat that can recover relatively quickly (~ 5–10 years) to restore > 75% of the original species composition and functionality of the receptor functionality, or species that have a high likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a high likelihood of returning to a site once the disturbance or impact has been removed.
Medium	• Will recover slowly (~ more than 10 years) to restore > 75% of the original species composition and functionality of the receptor functionality, or species that have a moderate likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a moderate likelihood of returning to a site once the disturbance or impact has been removed.
Low	• Habitat that is unlikely to be able to recover fully after a relatively long period: > 15 years required to restore ~ less than 50% of the original species composition and functionality of the receptor functionality, or species that have a low likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a low likelihood of returning to a site once the disturbance or impact has been removed.
Very Low	• Habitat that is unable to recover from major impacts, or species that are unlikely to remain at a site even when a disturbance or impact is occurring, or species that are unlikely to return to a site once the disturbance or impact has been removed.

4.1.3. Impact Assessment Methodology

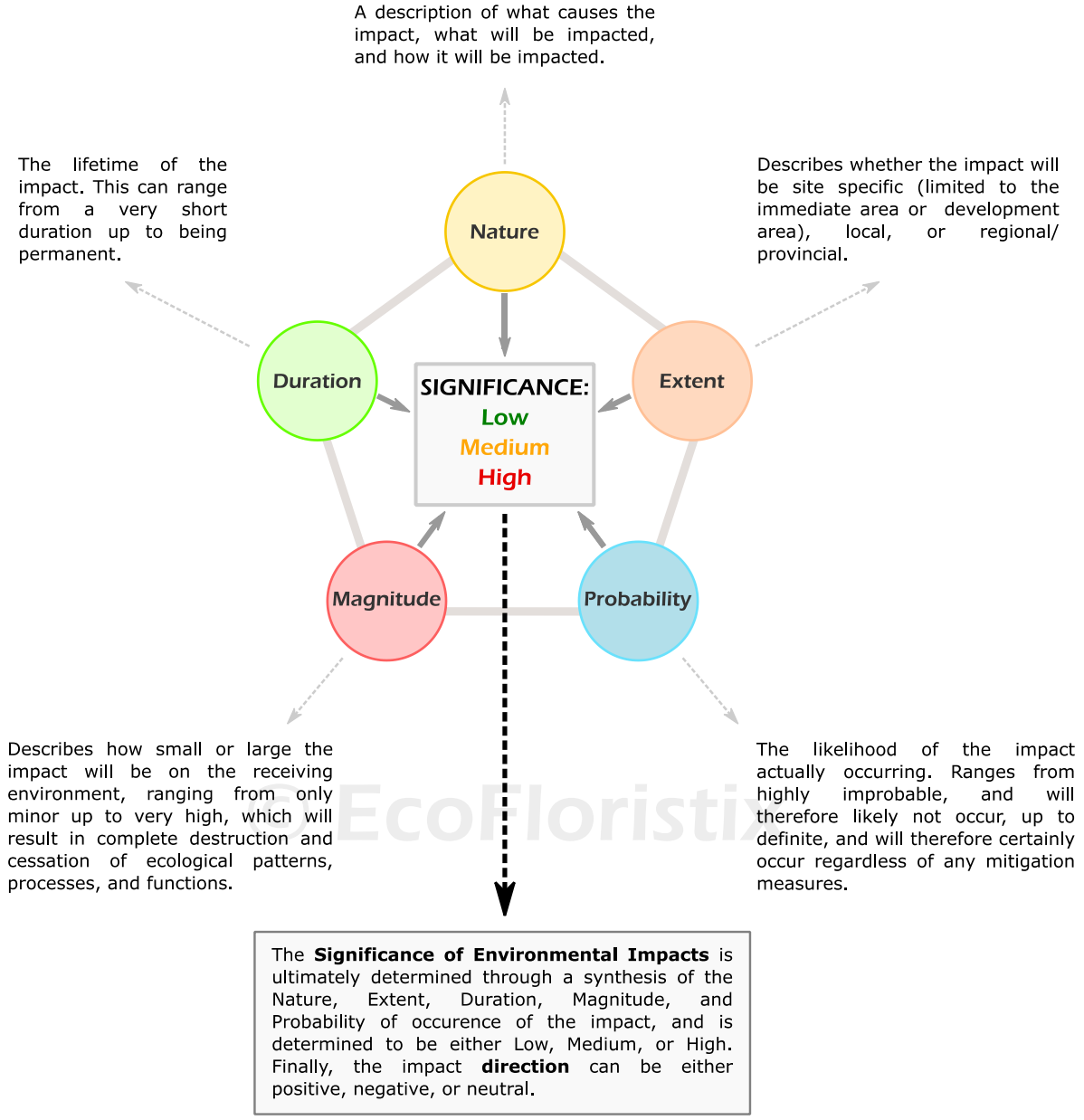


Figure 9: Details on the factors that contribute to the Significance of Environmental Impacts value. Also see Figure 10.

The Significance of Environmental Impacts was used to assess the impacts and risks associated with the proposed activities. It is a primarily function of 1) the present environmental aspects that are to be impacted on, 2) the probability of an impact occurring, and 3) the consequence of such an impact occurring before, and after, implementation of proposed mitigation measures. Specifically, the Significance of Environmental Impacts is assessed by its nature (descriptive), extent (scale), duration, magnitude (severity), probability (certainty), and direction (negative, neutral, or positive) (Figure 9), and is calculated using specific weightings as determined by the type of proposed

activities (Figure 10). Implicitly considered is the degree to which the impact can be reversed, may cause irreplaceable loss of resources, and/or can be mitigated.

The following project phases and impacts are usually assessed:

- Construction;
- Operation; and
- Decommissioning.

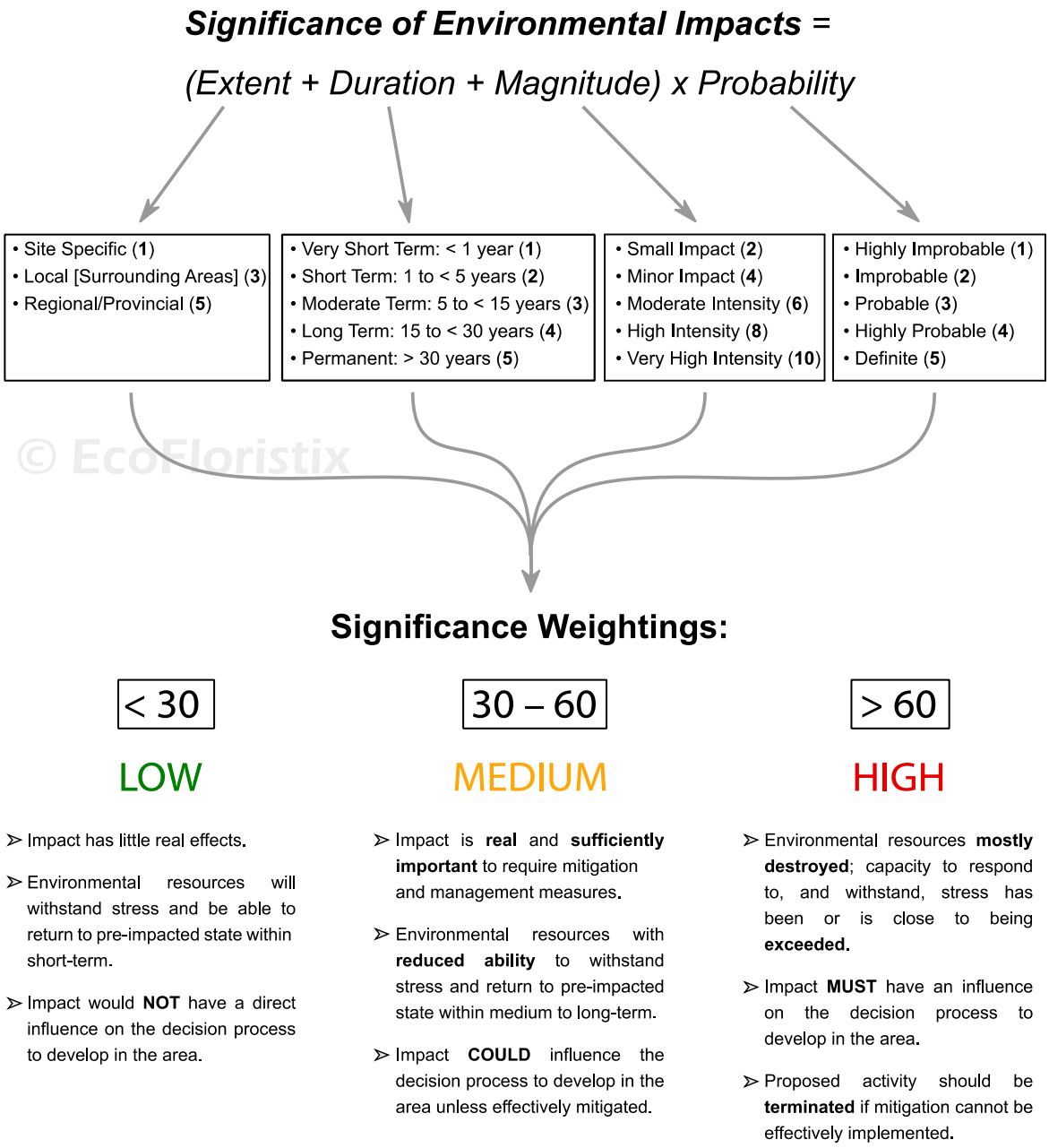


Figure 10: Weightings and steps for calculating Significance of Environmental Impacts value.

5. Results

5.1. Desktop Analyses: Ecologically Important Landscape Features

5.1.1. Ecosystem Threat Status

Figure 11: Ecosystem Threat Status, according to the National Biodiversity Assessment 2018, associated with study area.

According to the National Biodiversity Assessment 2018 spatial dataset the study area is located within an LC ecosystem (Figure 11; see section 3.2.1 for more details and notes on Ecosystem Threat Status categories). Therefore, the proposed activities will not have an impact on national Ecosystem Threat Status targets.

5.1.2. Ecosystem Protection Level

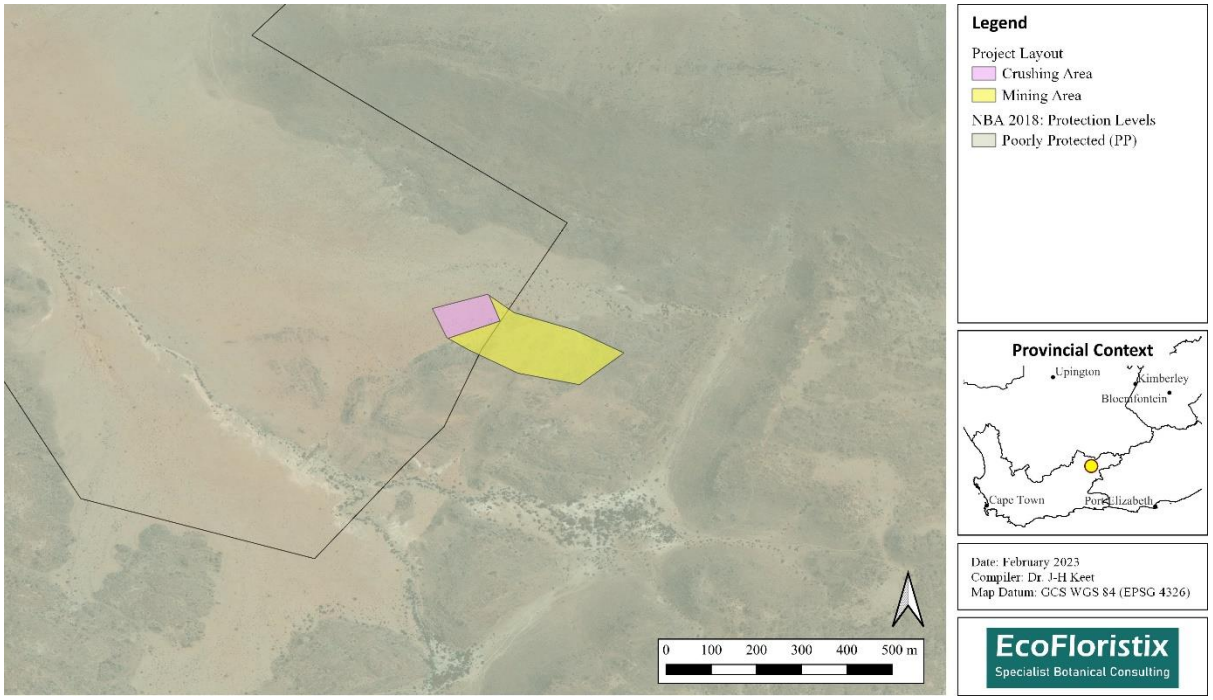


Figure 12: Ecosystem Protection Level, according to the National Biodiversity Assessment 2018, associated with study area.

According to the National Biodiversity Assessment 2018 spatial dataset the study area is located within a PP ecosystem (Figure 12; see section 3.2.1 for more details and notes on Ecosystem Protection Level categories). Fortunately, the current extent of the specific vegetation types remains large, and the proposed activities will likely not have an impact on national ecosystem protection levels and targets regarding the respective vegetation types.

5.1.3. Critical Biodiversity Areas and Ecological Support Areas

Figure 13: Locality of Critical Biodiversity Areas in the study area.

According to the Western Cape Biodiversity Spatial Plan dataset the study area is located within an ONA (Figure 13; see section 3.2.4 for more details and notes on CBA and ESA categories). Furthermore, the study area is surrounded by ESA1 (Central Karoo) areas to the north, south, and west. These coincide primarily with ephemeral streams/drainage lines. Three very small sections of ESA2 (Central Karoo) also occur near the study area (to the west and south), but these are likely artefacts of the algorithms that produced these areas since they all conform to ESA1 standards, and are the same plant community types that occur within these ESA1 areas.

5.1.4. National Protected Area Expansion Strategy

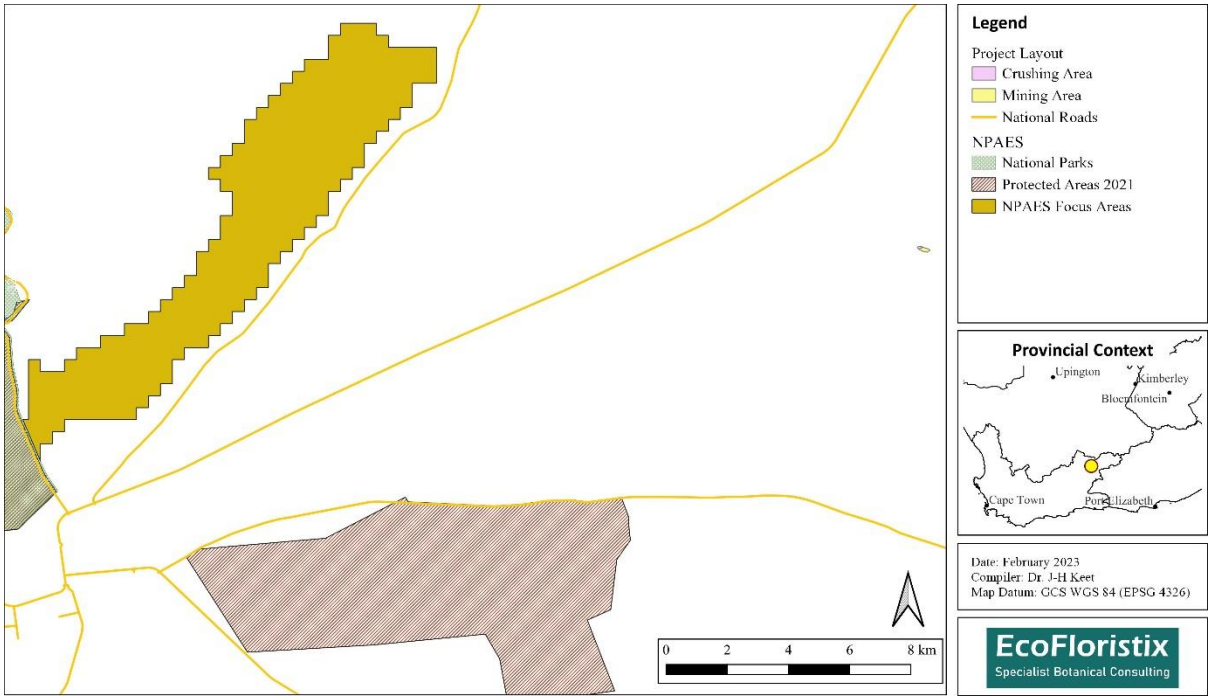


Figure 14: Study area locality in relation to designated areas of the National Protected Area Expansion Strategy.

The study area is not located within any NPAES Areas or any Formal-/Informal Protected Areas (Figure 14; see section 3.2.3 for more details and notes on the NPAES). The nearest NPAES Area (Upper Karoo) is located approximately 18 km west of the study area, while the nearest Formal Protected Area (Steenbokkie Private Nature Reserve) is located approximately 16 km southwest of the study area. The nearest Conservation Area (Karoo National Park) is located approximately 30 km southwest of the study area.

The proposed development will therefore not have an impact on NPAES area targets.

5.1.5. Hydrological Setting and National Freshwater Ecosystem Priority Areas

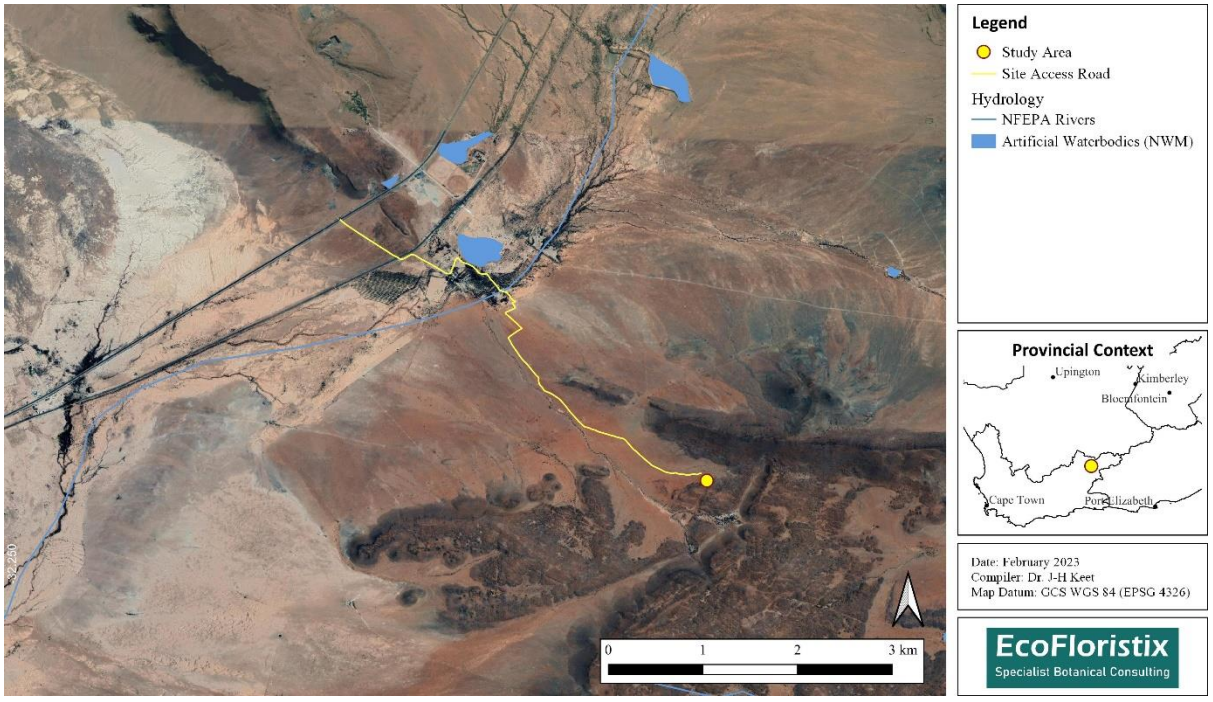


Figure 15: Ecosystem Threat Status, according to the South African Inventory of Inland Aquatic Ecosystems, of rivers and protection level of wetland ecosystems in the study area, as well as National Freshwater Ecosystem Priority Areas.

No threatened rivers systems, or wetlands, as determined by SAIIAE, occur near the study area (Figure 15; see section 3.2.4 for more details and notes on the SAIIAE). The site access road crosses a FEPA river (Platdoring). However, this is an existing access road with a concrete bridge at the crossing point, and as such does not pose a problem for the proposed activities.

5.1.6. Renewable Energy Projects

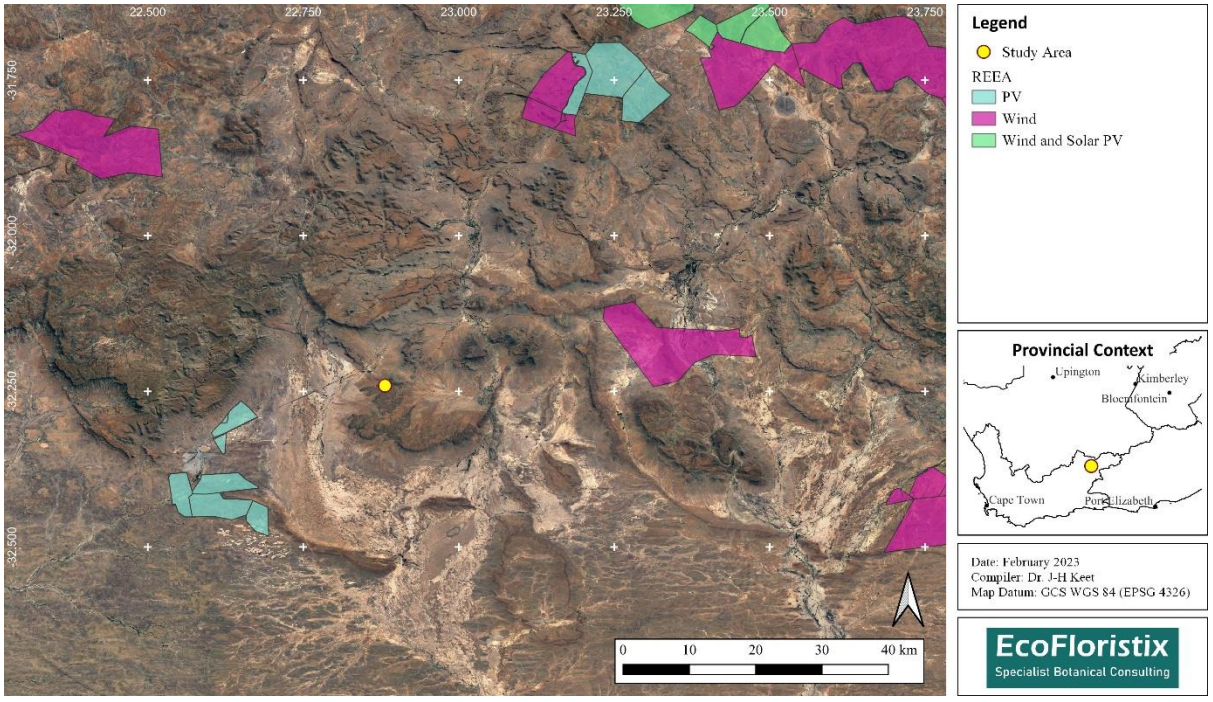


Figure 16: Renewable energy applications and projects, according to the SA Renewable Energy EIA Application Database (REEA), in the broader regions surrounding the study area.

A number of existing and planned applications for PV, wind, and solar PV developments occur in the broader regions surrounding the study area (Figure 16), according to the SA Renewable Energy EIA Application Database (REEA; data obtained from https://egis.environment.gov.za/ were accurate as per February 2023). The cumulative impact of all these projects will likely be moderate in conjunction with the destructive nature of the proposed activities of this project. The closest of these proposed facilities is 20 km to south west of study area.

5.2. Desktop Analyses: Botanical Assessment

5.2.1. Vegetation Types

According to VegMap, the entire study area overlaps with two vegetation types, namely Gamka Karoo (NKl 1) and Upper Karoo Hardeveld (NKu 2) (Figure 17 and Figure 18). Another vegetation type also occurs in the region of the study area, namely Karoo Riviere (AZi 6). All of these vegetation types are briefly described here.

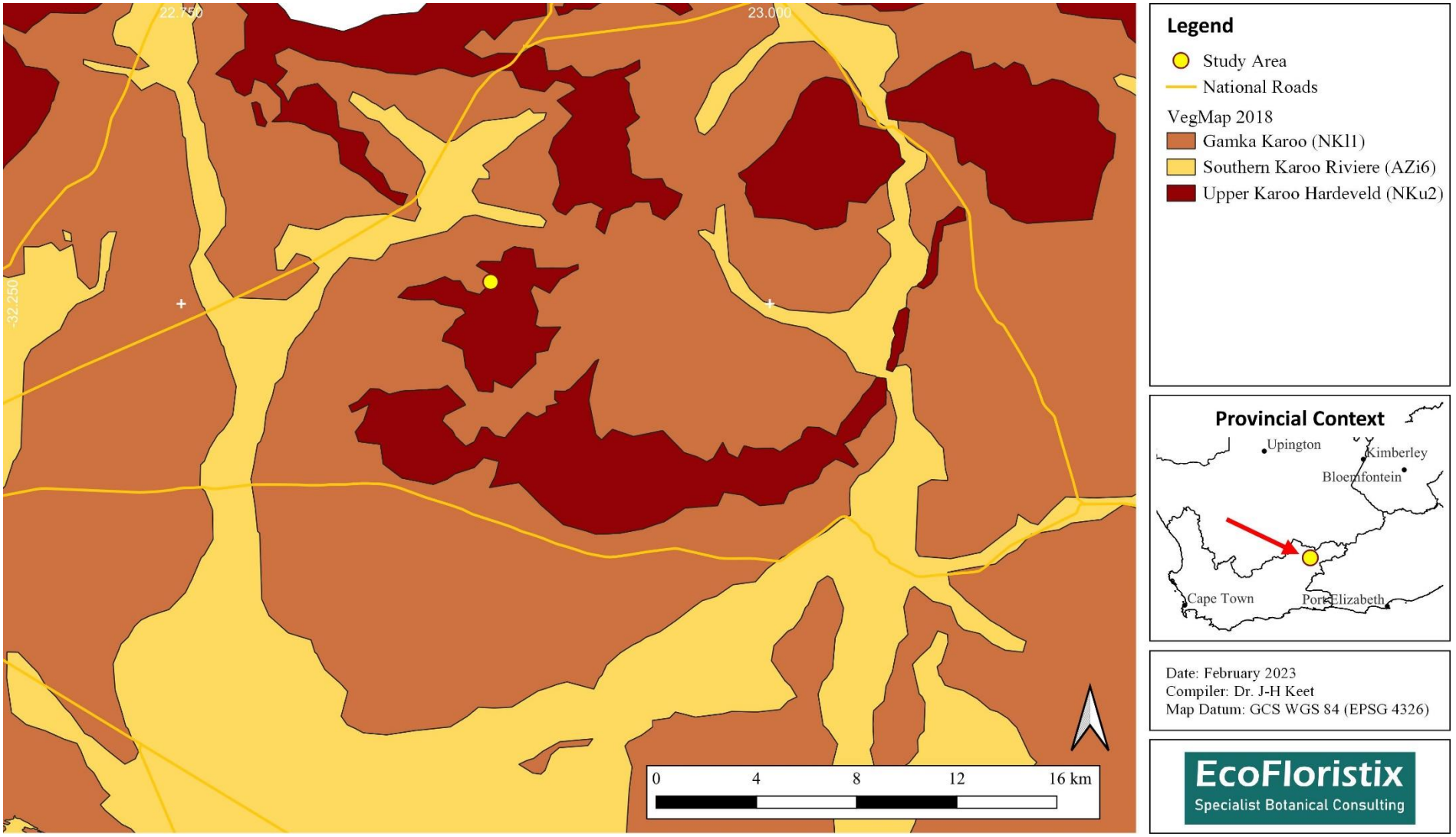


Figure 17: Vegetation types (according to VegMap 2018) for the study area, as well as the general region. This map is specifically zoomed out to show the broader extent of each vegetation type surrounding the study area.

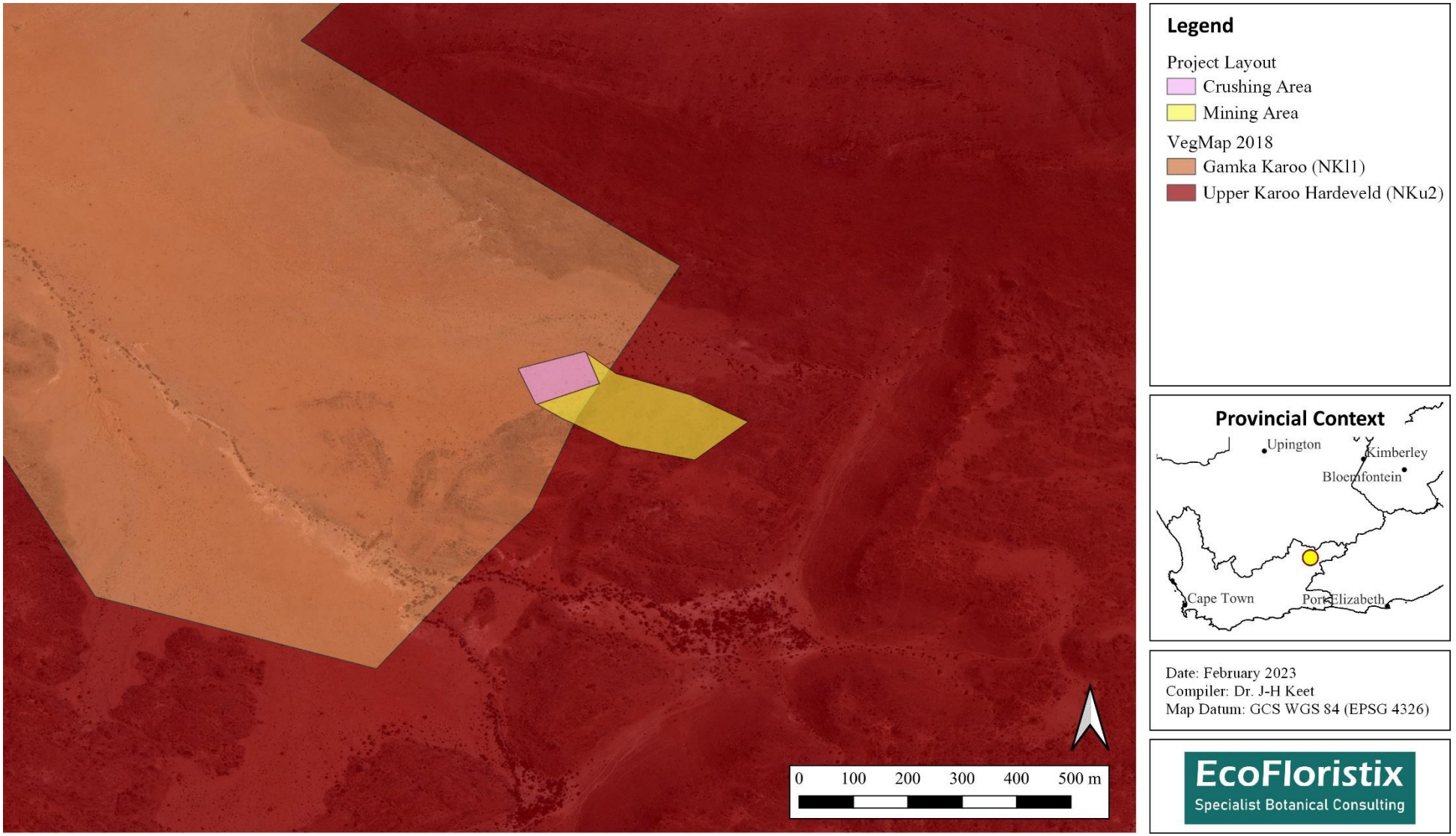


Figure 18: Study area specific vegetation types, according to VegMap 2018.

5.2.1.a) Gamka Karoo (NKl 1)

Occurs from approximately the edge of the Gamka basin catchment area in the west to about the Kariega River in the east, with an altitudinal range of 500 – 1 100 m. It is characterized by extremely irregular to slightly undulating plains covered with dwarf spiny shrubland dominated by Karoo dwarf shrubs with a rare occurrence of low trees. Dense stands of drought-resistant grasses cover broad sandy bottomlands, especially after abundant rains. It is one of the most arid units of the Nama-Karoo Biome, with rainfall mainly in autumn and summer. Strong north-westerly winds occur in winter.

Conservation: LC according to RLE. Target: 21%. About 2% statutorily conserved in the Karoo National Park and some in private reserves, such as Steenbokkie Private Nature Reserve (near Beaufort West). Only a small part has undergone transformation. The alien *Salsola kali* is a serious infestation problem locally. Erosion is moderate (78%), low (11%), and high (11%).

Table 4: Key species associated with Gamka Karoo (NKl 1).

IMPORTANT SPECIES	
Growth Form	**Key Species (d = "Dominant")**
Tall Shrubs	*Lycium cinereum (d), Rhigozum obovatum (d), Cadaba aphylla, Diospyros austro-africana, Ehretia rigida subsp. rigida, Lycium oxycarpum, Melianthus comosus, Rhus burchellii*
Tall Shrubs	*Lycium cinereum (d), L. oxycarpum (d), Rhigozum obovatum (d), Acacia karroo, Cadaba aphylla, Lycium schizocalyx, Rhus burchellii, Sisyndite spartea*
Low Shrubs	*Chrysocoma ciliata (d), Eriocephalus ericoides subsp. ericoides (d), E. spinescens (d), Felicia muricata (d), Galenia fruticosa (d), Limeum aethiopicum (d), Pentzia incana (d), Pteronia adenocarpa (d), Rosenia humilis (d), Aptosimum indivisum, Asparagus burchellii, Blepharis mitrata, Eriocephalus microphyllus var. pubescens, Felicia filifolia subsp. filifolia, F. muricata subsp. cinerascens, Galenia secunda, Garuleum bipinnatum, G. latifolium, Gomphocarpus filiformis, Helichrysum lucilioides, Hermannia desertorum, H. grandiflora, H. spinosa, Melolobium candicans, Microloma armatum, Monechma spartioides, Pentzia pinnatisecta, Plinthus karooicus, Polygala seminuda, Pteronia glauca, P. sordida, P. viscosa, Selago geniculata, Sericocoma avolans, Zygophyllum microcarpum, Z. microphyllum*
Succulent Shrubs	*Ruschia intricata (d), Aridaria noctiflora subsp. straminea, Crassula muscosa, Drosanthemum lique, Galenia sarcophylla, Kleinia longiflora, Ruschia spinosa, Salsola tuberculata, Sarcocaulon patersonii, Trichodiadema barbatum, Tripteris sinuata var. linearis*
Semiparasitic Shrub	*Thesium lineatum*

Herbs	*Gazania lichtensteinii (d), Chamaesyce inaequilatera, Dicoma capensis, Galenia glandulifera, Lepidium africanum subsp. africanum, L. desertorum, Lessertia pauciflora var. pauciflora, Leysera tenella, Osteospermum microphyllum, Sesamum capense, Tetragonia microptera, Tribulus terrestris, Ursinia nana*
Geophytic Herbs	*Drimia intricata, Moraea polystachya*
Graminoids	*Aristida congesta (d), A. diffusa (d), Fingerhuthia africana (d), Stipagrostis ciliata (d), S. obtusa (d), Aristida adscensionis, Cenchrus ciliaris, Digitaria argyrograpta, Enneapogon desvauxii, Enneapogon scaber, Eragrostis homomalla, E. lehmanniana, E. obtusa, Tragus berteronianus, T. koelerioides*
BIOGEOGRAPHICALLY IMPORTANT SPECIES	
Growth Form	**Key Species (d = "Dominant") (*Endemic to Great Karoo Basin)**
Succulent Shrubs	*Hereroa latipetala, H. odorata*, Pleiospilos compactus (southern and western limits of distribution), Rhinephyllum luteum, Stapelia engleriana**
Geophytic Herb	*Tritonia tugwelliae**
Low Shrub	*Felicia lasiocarpa**
Succulent Herbs	*Piaranthus comptus*, Tridentea parvipuncta subsp. parvipuncta**
Graminoid	*Oropetium capense (westernmost limit of distribution)*
ENDEMIC SPECIES	
Growth Form	**Key Species (d = "Dominant")**
Succulent Shrubs	*Chasmatophyllum stanleyi, Hereroa incurva, Hoodia dregei, Ruschia beaufortensis*
Low Shrubs	*Jamesbrittenia tenuifolia*
Herb	*Manulea karrooica*
Succulent Herb	*Piaranthus comptus*

5.2.1.b) Upper Karoo Hardeveld (NKu 2)

Distributed in the Northern, Western, and Eastern Cape Provinces, and with discrete areas of slopes and ridges, including dolerite dykes and sills, with an altitudinal range of 1 000 – 1 900 m. It is characterized by steep slopes of koppies, butts, mesas, and parts of the Great Escarpment covered with large boulders and stones supporting sparse dwarf Karoo scrub with drought-tolerant grasses. In the eastern part the climate is very close to that of Karoo Escarpment.

One of the richer floras of the Nama-Karoo Biome, this type also contains a substantial number of diagnostic species relative to the surrounding extensive flats (i.e. the Eastern, Northern, and Western Upper Karoo vegetation units). Examples are the widespread occurrence of *Asparagus mucronatus*, *A. striatus*, *Cissampelos capensis*, *Pachypodium succulentum*, *Rhigozum obovatum*

and *Cenchrus ciliaris* in this unit. Many of the endemic species listed are found along the Great Escarpment part of this vegetation type.

Conservation: LC according to RLE. Target: 21%. Only about 3% statutorily conserved in the Karoo National Park and Karoo Nature Reserve. Small percentage also protected in private reserves such as the Rupert Game Farm. Erosion is moderate (64%) and high (2%).

Table 5: Key species associated with Upper Karoo Hardeveld (NKu 2).

IMPORTANT SPECIES	
Growth Form	**Key Species (d = "Dominant")**
Tall Shrubs	*Lycium cinereum (d), Rhigozum obovatum (d), Cadaba aphylla, Diospyros austro-africana, Ehretia rigida subsp. rigida, Lycium oxycarpum, Melianthus comosus, Rhus burchellii*
Low Shrubs	*Chrysocoma ciliata (d), Eriocephalus ericoides subsp. ericoides (d), Euryops lateriflorus (d), Felicia muricata (d), Limeum aethiopicum (d), Pteronia glauca (d), Amphiglossa triflora, Aptosimum elongatum, A. spinescens, Asparagus mucronatus, A. retrofractus, A. striatus, A. suaveolens, Eriocephalus spinescens, Euryops annae, E. candollei, E. empetrifolium, E. nodosus, Felicia filifolia subsp. filifolia, Garuleum latifolium, Helichrysum lucilioides, H. zeyheri, Hermannia filifolia var. filifolia, H. multiflora, H. pulchella, H. vestita, Indigofera sessilifolia, Jamesbrittenia atropurpurea, Lessertia frutescens, Melolobium candicans, M. microphyllum, Microloma armatum, Monechma incanum, Nenax microphylla, Pegolettia retrofracta, Pelargonium abrotanifolium, P. ramosissimum, Pentzia globosa, P. spinescens, Plinthus karooicus, Polygala seminuda, Pteronia adenocarpa, P. sordida, Rosenia humilis, Selago albida, Solanum capense, Sutera halimifolia, Tetragonia arbuscula, Wahlenbergia tenella*
Succulent Shrubs	*Aloe broomii, Drosanthemum lique, Faucaria bosscheana, Kleinia longiflora, Pachypodium succulentum, Trichodiadema barbatum, Zygophyllum flexuosum*
Semiparasitic Shrub	*Thesium lineatum (d)*
Herbs	*Troglophyton capillaceum subsp. capillaceum, Dianthus caespitosus subsp. caespitosus, Gazania krebsiana, Lepidium africanum subsp. africanum, Leysera tenella, Pelargonium minimum, Sutera pinnatifida, Tribulus terrestris. Geophytic Herbs: Albuca setosa, Androcymbium albomarginatum, Asplenium cordatum, Boophone disticha, Cheilanthes bergiana, Drimia intricata, Oxalis depressa*
Graminoids	*Aristida adscensionis (d), A. congesta (d), A. diffusa (d), Cenchrus ciliaris (d), Enneapogon desvauxii (d), Eragrostis lehmanniana (d), E. obtusa (d), Sporobolus fimbriatus (d), Stipagrostis obtusa (d), Cynodon incompletus, Digitaria eriantha, Ehrharta calycina, Enneapogon scaber, E. scoparius, Eragrostis curvula, E. nindensis, E. procumbens, Fingerhuthia africana, Heteropogon contortus, Merxmuellera disticha, Stipagrostis ciliata, Themeda triandra, Tragus berteronianus, T. koelerioides*
ENDEMIC TAXA	

Succulent Shrubs	*Aloe chlorantha, Crassula barbata subsp. broomii, Delosperma robustum, Sceletium expansum, Stomatium suaveolens.*
Low Shrubs	*Cineraria polycephala, Euryops petraeus, Lotononis azureoides, Selago magnakarooica*
Tall Shrub	*Anisodontea malvastroides*
Herbs	*Cineraria arctotidea, Vellereophyton niveum*
Succulent Herbs	*Adromischus fallax, A. humilis*
Geophytic Herbs	*Gethyllis longistyla, Lachenalia aurioliae, Ornithogalum paucifolium subsp. karooparkense*

5.2.1.c) Karoo Riviere (AZi 6)

Distributed in the Western and Eastern Cape Provinces. This vegetation type is embedded within the Koedoesberge-Moordenaars Karoo, Prince Albert Succulent Karoo, Gamka Karoo, Eastern Lower Karoo, and southern parts of the Eastern Upper Karoo, as well as parts of the Albany Thicket Biome south of Cradock. It is characterized by narrow riverine flats supporting a complex of *Acacia karroo* or *Tamarix usneoides* thickets (up to 5 m tall), and fringed by tall *Salsola*-dominated shrubland (up to 1.5 m high). In sandy drainage lines *Stipagrostis namaquensis* may occasionally also dominate. Mesic thicket forms in the far eastern part of this region and may also contain *Leucosidea sericea*, *Rhamnus prinoides*, and *Ehrharta erecta*. The climate is subarid on the whole.

Conservation: LC according to RLE. Target 24%. Only about 1.5% statutorily conserved in the Karoo National Park, as well as in the Aberdeen, Bosberg, Commando Drift, Gamkapoort, and Karoo Nature Reserves, and in about 10 private reserves, mainly set up for game farming. Some 12% transformed for cultivation and building of dams, including Beaufort West, Beervlei, De Hoop, Floriskraal, Kommandodrift, Lake Arthur, Leeu-Gamka, Mentz, and Vanryneveldspas Dams. Frequent disturbance (floods, concentrated grazing pressure), and associated input of nutrients, increase the vulnerability of these habitats to invasion of alien woody species such as *Agave americana*, *Opuntia species*, *Prosopis* species, *Salix babylonica*, and *Schinus molle*, and forbs including *Atriplex eardleyae*, *A. lindleyi* subsp. *inflata*, *Cirsium vulgare*, *Salsola kali*, and *Schkuhria pinnata*.

Table 6: Key species associated with Karoo Riviere (AZi 6).

IMPORTANT SPECIES	
Riparian Thickets	
Growth Form	**Key Species (d = "Dominant")**
Small Trees	*Acacia karroo (d), Rhus lancea (d)*
Tall Shrubs	*Diospyros lycioides (d), Tamarix usneoides (d), Cadaba aphylla, Euclea undulata, Grewia robusta, Gymnosporia buxifolia, Melianthus comosus*
Low Shrub	*Asparagus striatus*
Succulent Shrubs	*Lycium cinereum (d), Amphiglossa callunoides, Lycium hirsutum, L. oxycarpum*
Rocky Slopes of River Canals	
Graminoid	*Stipagrostis namaquensis (d)*
Alluvial Shrublands & Herblands	
Low Shrubs	*Ballota africana, Bassia salsoloides, Carissa haematocarpa, Pentzia incana*
Succulent Shrubs	*Malephora uitenhagensis (d), Salsola aphylla (d), S. arborea (d), Drosanthemum lique, Salsola geminiflora, S. gemmifera*
Graminoids	*Cynodon incompletus (d), Cenchrus ciliaris, Cyperus marginatus*
Reed Beds	
Megagraminoid	*Phragmites australis (d)*
ENDEMIC SPECIES	
Alluvial Shrublands & Herblands	
Graminoid	*Isolepis expallescens*

5.2.2. Species of Conservation Concern and General Species Occurrences

Only SCC and protected plant species that might potentially occur in the study area and the broader surrounds, as predicted by online databases (see section 3.3.1), are listed in this section. The field survey(s) aimed to validate which of these species occur within the study area, and whether any additional species were present that may not yet have been recorded in official databases (see section 5.3.2). Also see section 2.7 for the key legislation that was used to assess SCC and protected plant species.

A total of 640 species have been recorded within the broader area (see section 10). Of this, the top three representative families were Asteraceae (123 spp.), Poaceae (71 spp.), and Aizoaceae (44 spp.).

This list included a total of 1 SCC (VU) and 50 protected species (Table 7; note that some of the Threatened/Rare species might also be protected; thus some overlap might occur between these numbers). Of specific note is *Audouinia esterhuyseniae* (VU). This is not a Nama Karoo species, but instead a rare montane resprouter known from two locations in the Hex River Mountains and Stettynsberg. It almost surely represents an error (either the locality data of the record was not accurately recorded in the field, or it was not accurately captured online). Therefore, this species does not present any concerns, since it will not occur in the study area or surrounds.

The initial screening report also revealed the potential presence of an additional two Medium Sensitive species, namely species 383 and 945 (for their protection, the identities of these species will not be made public).

Table 7: Species of Conservation Concern that have been recorded within the broader region surrounding the study area, as per the SANBI POSA online database.

Family	Species	IUCN	Protection Schedule
Bruniaceae	*Audouinia esterhuyseniae*	VU	4
Apocynaceae	*Stapelia engleriana*	DD	4
Santalaceae	*Thesium sonderianum*	DD	
Amaryllidaceae	*Gethyllis longistyla*	LC	4
Amaryllidaceae	*Gethyllis villosa*	LC	4
Amaryllidaceae	*Haemanthus humilis subsp. humilis*	LC	4
Anacampserotaceae	*Anacampseros albidiflora*	LC	4
Anacampserotaceae	*Anacampseros arachnoides*	LC	4
Apocynaceae	*Carissa bispinosa*	LC	4
Apocynaceae	*Ceropegia stapeliiformis subsp. stapeliiformis*	LC	4
Apocynaceae	*Duvalia maculata*	LC	4
Apocynaceae	*Gomphocarpus filiformis*	LC	4
Apocynaceae	*Gomphocarpus fruticosus subsp. fruticosus*	LC	4
Apocynaceae	*Gomphocarpus tomentosus subsp. tomentosus*	LC	4
Apocynaceae	*Huernia barbata subsp. barbata*	LC	4
Apocynaceae	*Huernia thuretii*	LC	4
Apocynaceae	*Microloma armatum var. armatum*	LC	4
Apocynaceae	*Piaranthus comptus*	LC	4
Apocynaceae	*Piaranthus geminatus subsp. geminatus*	LC	4
Apocynaceae	*Stapelia grandiflora var. grandiflora*	LC	4
Apocynaceae	*Stapelia olivacea*	LC	4
Apocynaceae	*Tridentea jucunda*	LC	4
Apocynaceae	*Xysmalobium gomphocarpoides var. gomphocarpoides*	LC	4
Apocynaceae	*Xysmalobium gomphocarpoides var. parvilobum*	LC	4
Asphodelaceae	*Aloe broomii var. broomii*	LC	4
Asphodelaceae	*Aloe claviflora*	LC	4
Asphodelaceae	*Aloe humilis*	LC	4
Asphodelaceae	*Haworthia semiviva*	LC	4
Hyacinthaceae	*Lachenalia aurioliae*	LC	4

Hyacinthaceae	*Veltheimia capensis*	LC	4
Iridaceae	*Gladiolus permeabilis subsp. permeabilis*	LC	4
Iridaceae	*Ixia marginifolia*	LC	4
Iridaceae	*Moraea cookii*	LC	4
Iridaceae	*Moraea crispa*	LC	4
Iridaceae	*Moraea polystachya*	LC	4
Iridaceae	*Moraea speciosa*	LC	4
Iridaceae	*Moraea unguiculata*	LC	4
Iridaceae	*Romulea atrandra var. esterhuyseniae*	LC	4
Iridaceae	*Romulea macowanii var. macowanii*	LC	4
Iridaceae	*Syringodea concolor*	LC	4
Iridaceae	*Tritonia florentiae*	LC	4
Iridaceae	*Tritonia laxifolia*	LC	4
Orchidaceae	*Eulophia hians var. hians*	LC	4
Orchidaceae	*Eulophia hians var. nutans*	LC	4
Orchidaceae	*Holothrix villosa var. villosa*	LC	4
Scrophulariaceae	*Diascia alonsooides*	LC	4
Scrophulariaceae	*Diascia capsularis*	LC	4
Asphodelaceae	*Haworthia marumiana var. marumiana*	NE	4
Anacampserotaceae	*Anacampseros filamentosa subsp. filamentosa*		4
Apocynaceae	*Ceropegia circinata*		4
Iridaceae	*Moraea ciliata subsp. ciliata*		4

5.2.3. Alien and Invasive Plant Species

A total of 33 alien plant species have been recorded within the extracted area, with 9 of them being listed invasive species within the NEM:BA A&IS Regulations, namely:

- *Atriplex nummularia* subsp. *nummularia* (Old man saltbush; Category 2)
- *Cylindropuntia imbricata* (Imbricate cactus, Imbricate prickly pear; Category 1b)
- *Cylindropuntia pallida* (Pink-flowered sheathed cholla; Category 1a)
- *Opuntia elata* (Orange tuna; Category 1b)
- *Opuntia ficus-indica* (Mission prickly pear, Sweet prickly pear; Category Multi)
- *Opuntia microdasys* (Yellow bunny-ears, Teddy- bear cactus; Category 1b)
- *Prosopis velutina* (Velvet mesquite; Category Multi)
- *Salsola kali (*Tumbleweed; Category 1b)
- *Tephrocactus articulatus* (Pine cone cactus, Paper- spine cholla; Category 1a)

The instances above where the phrase “Category Multi” is used indicates that the NEM:BA A&IS Regulations listing depends on a specific context, and certain exemptions might be applicable. With regards to the study area and surrounds, the following criteria are applicable:

- *Opuntia ficus-indica*: listed as Category 1b, unless:
    - Spineless cactus pear cultivars and selections are used.
    - (Note: the fruits, if used for human consumption, are not listed)
- *Prosopis velutina*: listed as Category 1b. However:
    - The pods may be used for fodder.

5.3. Study Area Assessment: Site Inspection

5.3.1. Plant Community Types

This section describes the different habitats and vegetation patterns, as expressed in plant community types, observed within the study area and the broader surrounds. As these are field-based observations, they are more reliable and applicable than the coarsely mapped results of VegMap, which does not yet adequately represent such finer details.

Given the small size of the study area, specifically in terms of the areas in which the proposed activities will occur, a larger area was selected to get a representative estimate of the plant communities of the study area and surrounds. Specifically, the plant community types were mapped within a 1 km radius of where the mining activities will occur. A total distance of ± 7 km was surveyed by vehicle, while a total distance of ± 14 km was surveyed on foot.

Four plant community types were found in and around the study area (Figure 19 and Figure 20; also see Table 8), namely:

- *Aristida congesta* - *Asparagus burchellii* (conforming to Gamka Karoo [NKl 1])
- *Aristida diffusa* - *Aristida congesta* (conforming to Upper Karoo Hardeveld [NKu 2])
- *Ruschia intricata* - *Aristida diffusa* (a subcommunity type of Upper Karoo Hardeveld [NKu 2])
- *Stipagrostis namaquana* - *Aristida diffusa* (conforming to Karoo Riviere [AZi 6])

The names of these plant community types are based the dominant plant species occurring in each type. These plant community types are discussed in more detail in the subsequent sections, and representative photos are given where applicable.

The following is brief overall summary (Table 8): a total of 87 plant species were found within the study area and surrounds, which consisted of 84 native, 0 threatened, 5 protected, 1 Western Cape endemic, 3 alien, and 1 NEM:BA listed invasive species. Furthermore, a total of 39 species were recorded within the study area and surrounds that were not recorded within online databases (e.g.,

POSA; see section 3.3.1), 3 of which are protected (*Anacampseros ustulata*, *Boophone disticha*, and *Strumaria tenella* subsp. *orientalis*), and 3 of which are alien species.

Table 8: Plant species summary statistics for the plant community types of the study area and broader surrounds (compare with Figure 19). "Unique" species were only found in the specific type in question, and not in the others. "Shared" species were shared with one or more of the other types. Note that overall total values might be less than the sum of all the respective values, since in many instances species were shared between the various types. SCC = Species of Conservation Concern; THREAT = Threatened species ("CR PE", "CR", "EN", or "VU"); WCE = Western Cape Endemic; NEM:BA = Species listed under NEM:BA Alien and Invasive Species Regulations; N/A = Not Applicable.

	Total	Shared	Unique	%Unique	SCC	THREAT	Protected	WCE	Native	Alien	NEM:BA
Community											
Aristida congesta - Asparagus burchellii	25	14	11	44	0	0	0	0	25	1	1
Aristida diffusa - Aristida congesta	41	16	25	61	0	0	2	0	41	0	0
Ruschia intricata - Aristida diffusa	21	9	12	57	0	0	3	1	21	0	0
Stipagrostis namaquana - Aristida diffusa	30	13	17	57	0	0	0	0	27	3	2
Overall Total											
	87	**N/A**	**N/A**	**N/A**	**0**	**0**	**5**	**1**	**84**	**3**	**2**

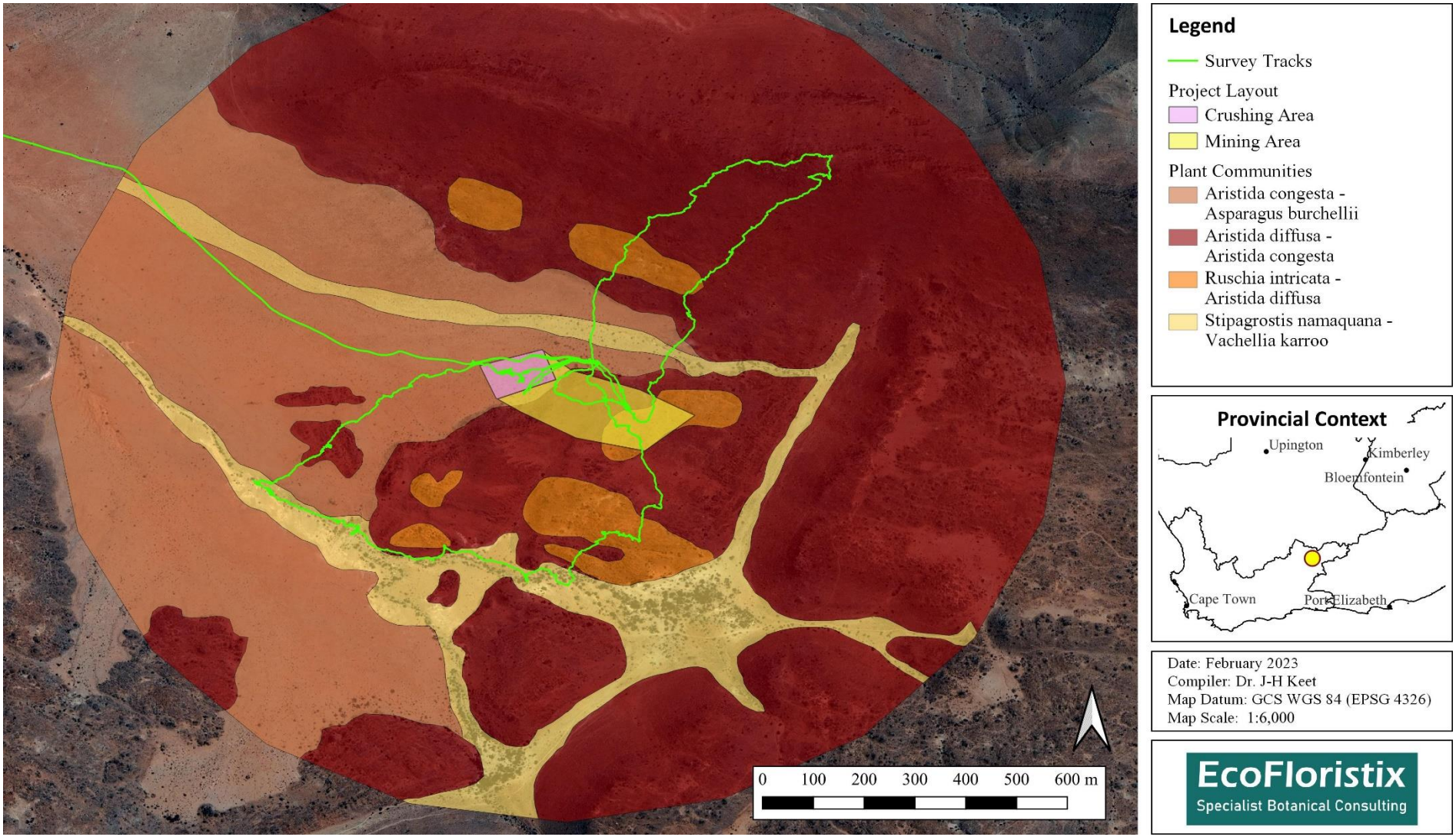


Figure 19: Plant communities that were observed in the study area and the broader surrounds. Four distinct plant communities were found.

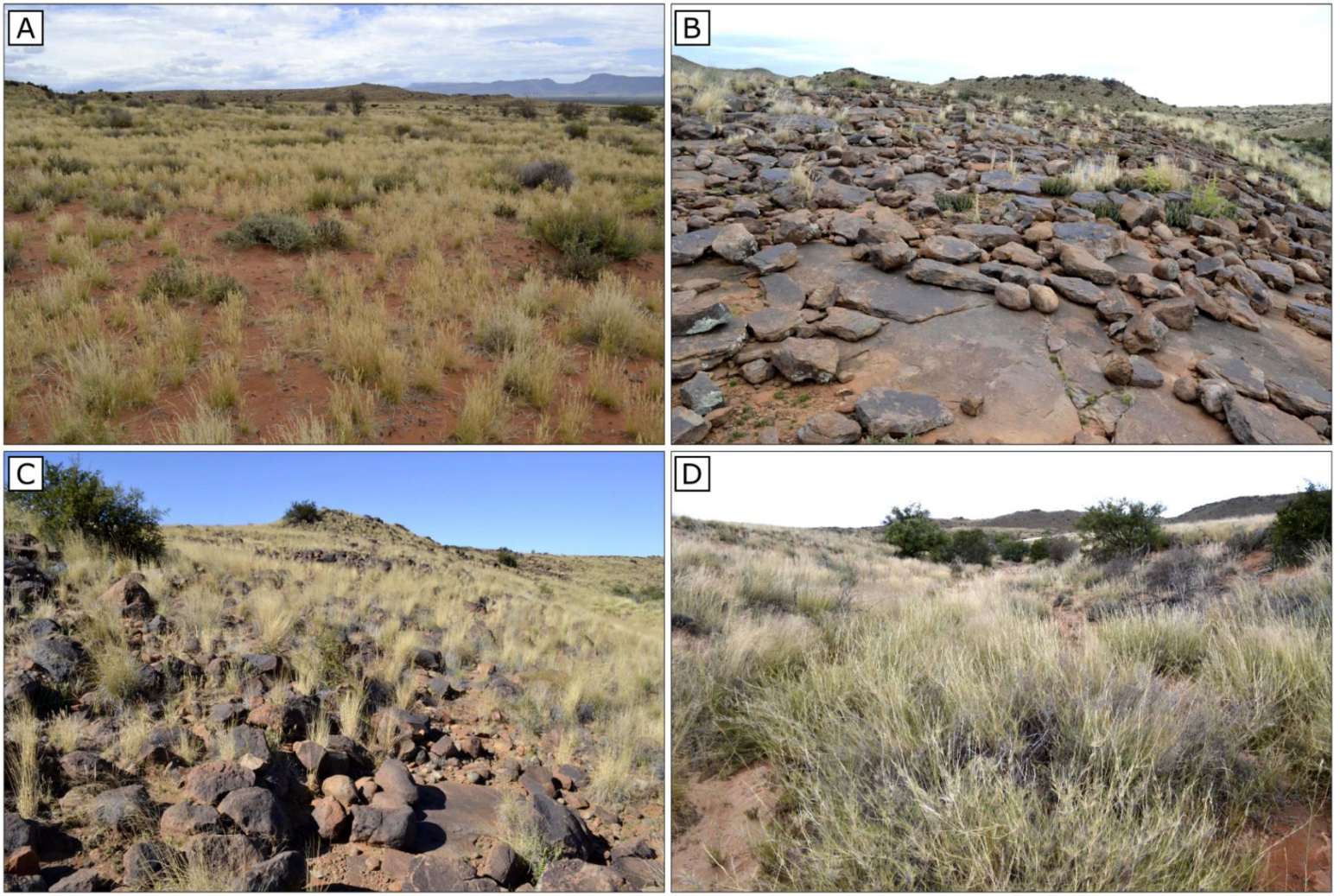


Figure 20: Four distinct plant community types were identified on site, namely A) *Aristida congesta - Asparagus burchellii* (low lying plains with deep sandy soils), B) *Ruschia intricata - Aristida diffusa* (dolerite sheets, with very shallow soils, on hill tops), C) *Aristida diffusa - Aristida congesta* (mix of large dolerite boulders and areas with deeper sands; mostly on hill slopes and parts of hill tops), and C) *Stipagrostis namaquana - Vachellia karroo* (in seasonal river- and streambeds).

5.3.1.a) Aristida congesta - Asparagus burchellii

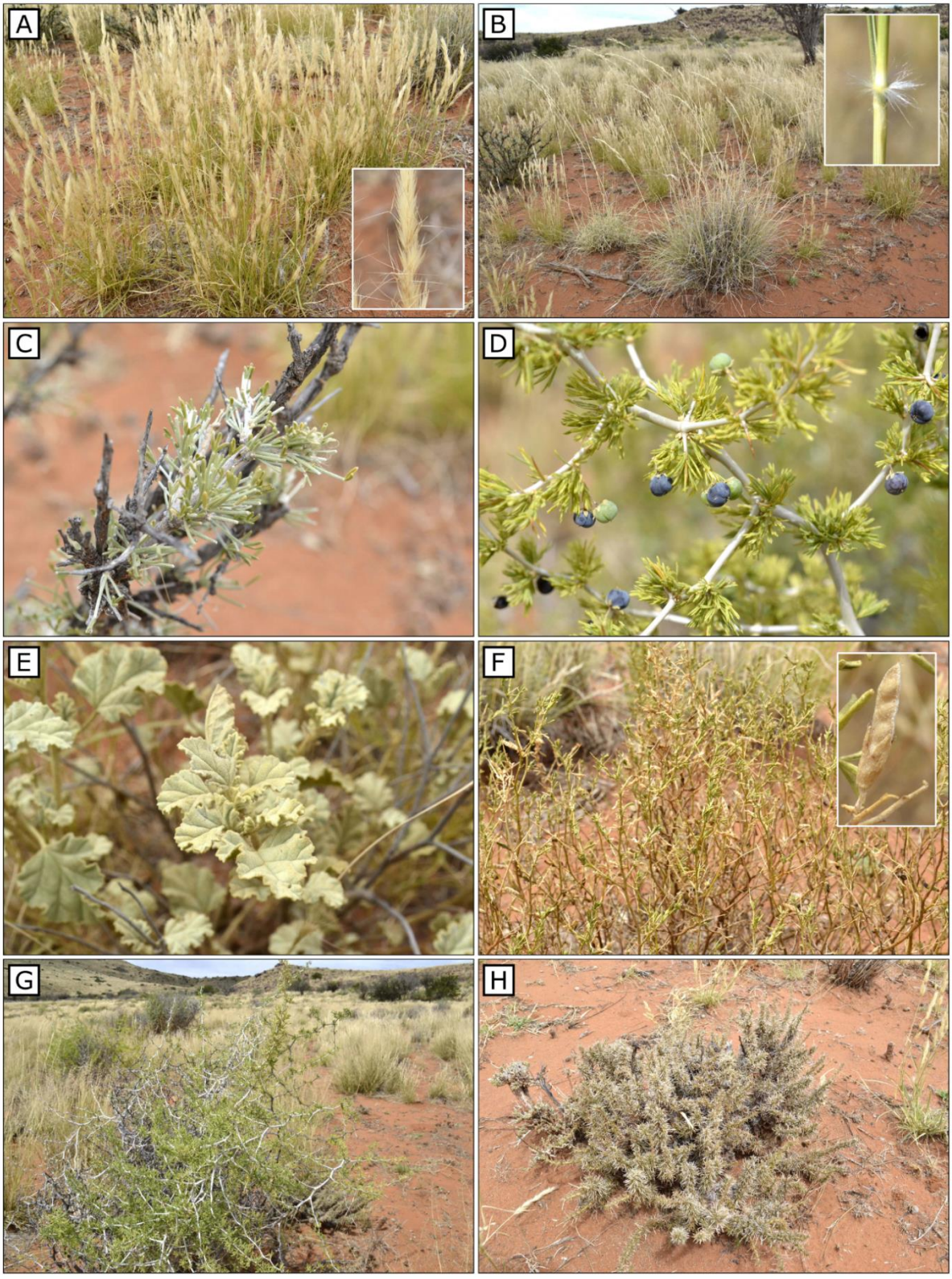


Figure 21: Some representative plant species that were found within the *Aristida congesta - Asparagus burchellii* plant community type. Species names: A) *Aristida congesta* subsp. *congesta*, B) *Stipagrostis ciliata* var. *capensis*, C) *Calobota spinescens*, D) *Asparagus burchellii*, E) *Hermannia vestita*, F) *Melolobium candicans*, G) *Asparagus retrofractus*, and H) *Aptosimum spinescens*.

Species Summary Statistics:

Total: 25

Shared:	14	SCC:	0	Native:	25
Unique:	11	Threatened:	0	Alien:	1
%Unique:	44	Protected:	0	NEM:BA:	1
		WCE:	0		

The *Aristida congesta* - *Asparagus burchellii* plant community type (Figure 21) conforms to the VegMap vegetation type Gamka Karoo (NKl 1). It is characterized by deep sandy soils, with a medium (about 50%) density of vegetation cover. It is relatively flat in topography, with a very gentle (< 5°) slope of a western aspect, specifically in this study area. The vegetation is mostly composed of the grasses *Aristida congesta* subsp. *congesta*, *Stipagrostis ciliata* var. *capensis*, *Cenchrus ciliaris*, *Eragrostis lehmanniana* var. *lehmanniana*, and *Stipagrostis obtusa*, with scattered small shrubs of *Asparagus burchellii*, *Calobota spinescens*, *Melolobium candicans*, *Aptosimum spinescens*, and *Pentzia globosa*. The succulent *Mesembryanthemum coriarium* also occurs on more disturbed patches, and some large shrubs of *Lycium ferocissimum* and *Vachellia karroo* are occasional. It was overall in a relatively pristine condition. Although sheep graze in the area, there were no signs of heavy overgrazing.

A total of 25 plant species (25 native and 1 alien) were recorded within this type. The alien species (*Prosopis glandulosa* var. *torreyana*) is a NEM:BA A&IS Regulations listed species. No SCC, protected, or provincial endemic species were found is type. The following native species were only recorded in this type (i.e., unique; however, it remains possible that some of them occur in some of other plant community types but were not observed):

- *Asparagus retrofractus*
- *Cissampelos capensis*
- *Dicoma capensis*
- *Galenia africana*
- *Ifloga glomerata*
- *Lycium ferocissimum*
- *Mesembryanthemum coriarium*
- *Solanum tomentosum*
- *Stipagrostis ciliata var. capensis*
- *Tribulus terrestris*
- *Viscum capense*

5.3.1.b) Aristida diffusa - Aristida congesta

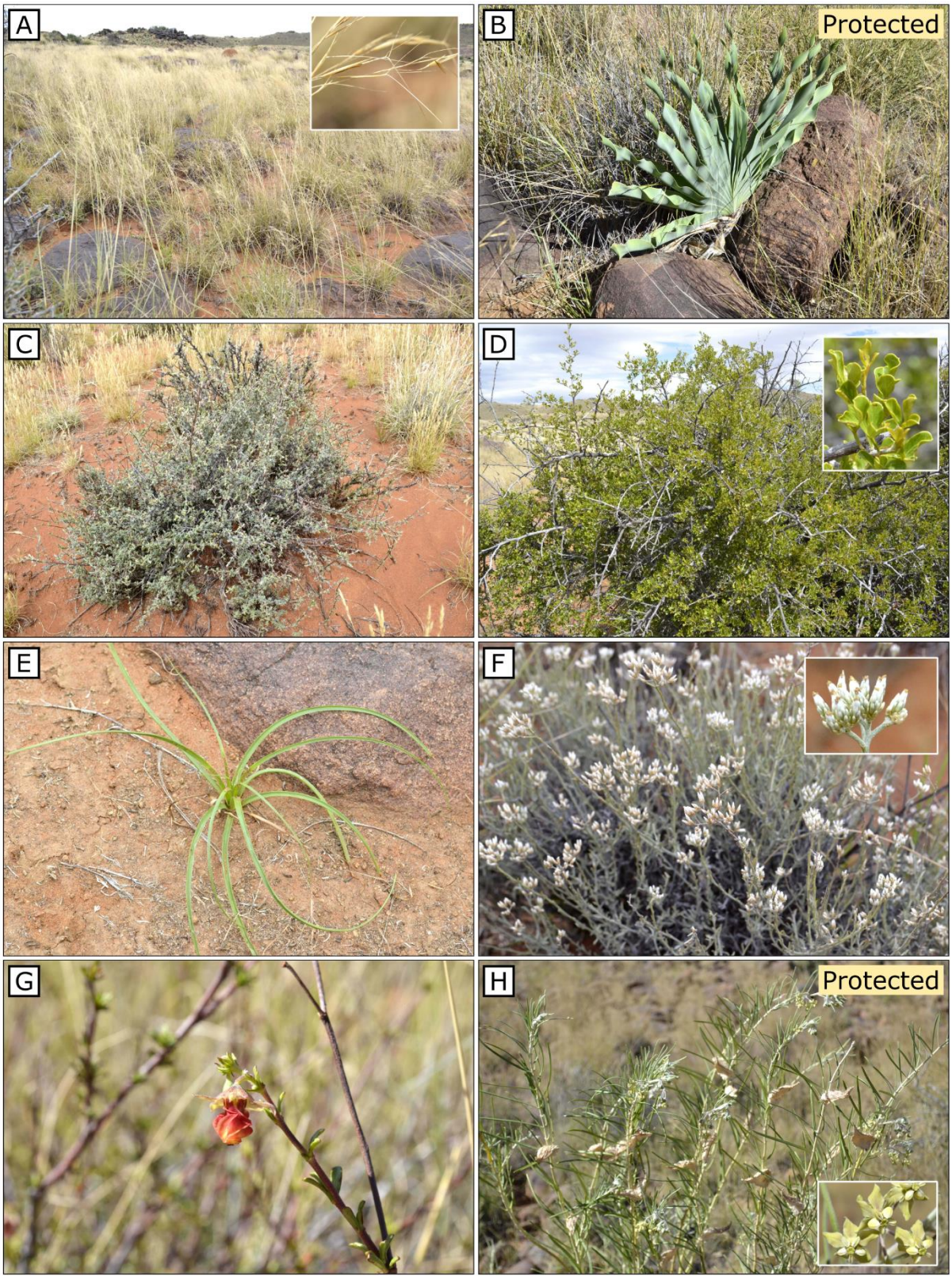


Figure 22: Some representative plant species that were found within the *Aristida diffusa - Aristida congesta* plant community type. Species names: A) *Aristida diffusa* subsp. *diffusa*, B) *Boophone disticha*, C) *Pteronia incana*, D) *Searsia burchellii*, E) *Cyperus usitatus*, F) *Helichrysum zeyheri*, G) *Hermannia flammula*, and H) *Gomphocarpus tomentosus* subsp. *tomentosus*.

Species Summary Statistics:

Total:	**41**				
Shared:	16	SCC:	0	Native:	41
Unique:	25	Threatened:	0	Alien:	0
%Unique:	61	Protected:	2	NEM:BA:	0
		WCE:	0		

The *Aristida diffusa* - *Aristida congesta* plant community type (Figure 22) conforms to the VegMap vegetation type Upper Karoo Hardeveld (NKu 2). It is characterized by hilly and rocky areas, with a medium (about 50%) density of vegetation cover. It has moderate to strong (5° – 25°C) slopes of various aspects, specifically in this study area, and is has numerous large dolerite boulders scattered all over. The vegetation is mostly composed of the grasses *Aristida diffusa* subsp. *diffusa*, *Heteropogon contortus*, *Oropetium capense*, and *Eragrostis lehmanniana* var. *lehmanniana*, with scattered small shrubs of *Aptosimum spinescens*, *Rhigozum obovatum*, *Ruschia intricata*, *Blepharis capensis*, *Grewia robusta*, and *Searsia burchellii*.

This plant community type was overall in a relatively pristine condition. Although sheep graze in the area, there were no signs of heavy overgrazing.

A total of 41 plant species (41 native and 0 alien) were recorded within this type. Two protected species (*Boophone disticha*, *Gomphocarpus tomentosus* subsp. *tomentosus*), were found in this type. The species *Gomphocarpus tomentosus* subsp. *tomentosus* is very widespread, and the destruction of these individuals do no present a problem to the proposed activities. The Western Cape Nature Conservation Laws Amendment Act, No. 3, 2000, legislated the protection of all species within the Asclepiadaceae family. However, this family has been subsumed within the Apocynaceae family, of which only species of *Pachypodium* are protected. This somewhat complicates matters; however, it is assumed that the now subfamily Asclepiadoideae (which is the same as the Asclepiadaceae) retains its protection status. Furthermore, only two individuals of *Boophone disticha* were found in the study area, and numerous individuals were found on the mountain to the north of the study area. These specimens are in a difficult to access area, and therefore will not be impacted on. As such, the loss of the two *Boophone disticha* individuals in the study area does not pose a problem.

The following native species were only recorded in this type (i.e., unique; however, it remains possible that some of them occur in some of other plant community types but were not observed):

- *Asparagus striatus*
- *Boophone disticha*

- *Chascanum pinnatifidum var. pinnatifidum*
- *Digitaria eriantha*
- *Enneapogon scoparius*
- *Eragrostis curvula*
- *Gomphocarpus tomentosus subsp. tomentosus*
- *Grewia robusta*
- *Helichrysum zeyheri*
- *Hermannia flammula*
- *Heteropogon contortus*
- *Indigofera setiflora*
- *Kleinia longiflora*
- *Melinis nerviglumis*
- *Pellaea calomelanos var. calomelanos*
- *Pentzia quinquefida*
- *Pollichia campestris*
- *Pteronia incana*
- *Rhigozum obovatum*
- *Selago albida*
- *Sericocoma avolans*
- *Themeda triandra*
- *Tragus koelerioides*
- *Trichodesma africanum*
- *Wahlenbergia nodosa*

5.3.1.c) Ruschia intricata - Aristida diffusa

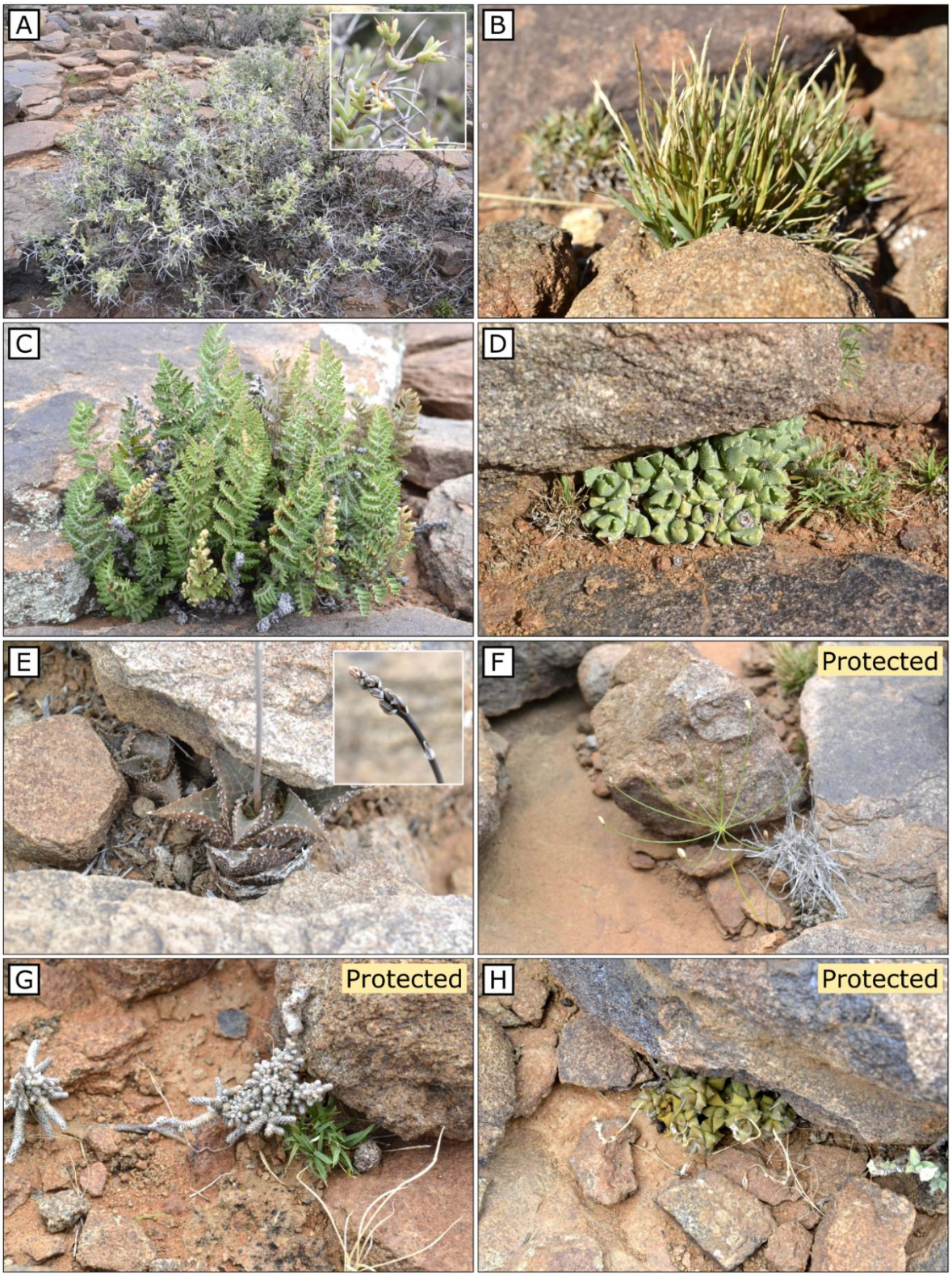


Figure 23: Some representative plant species that were found within the *Ruschia intricata - Aristida diffusa* plant community type. Species names: A) *Ruschia intricata*, B) *Oropetium capense*, C) *Cheilanthes eckloniana*, D) *Stomatium viride*, E) *Haworthiopsis tessellata* var. *tessellata*, F) *Strumaria tenella* subsp. *orientalis*, G) *Anacampseros ustulata*, and H) *Anacampseros albidiflora*.

Species Summary Statistics:

Total: 21

Shared:	9	SCC:	0	Native:	21
Unique:	12	Threatened:	0	Alien:	0
%Unique:	57	Protected:	3	NEM:BA:	0
		WCE:	1		

The *Ruschia intricata* - *Aristida diffusa* plant community type (Figure 23) shares aspects with the VegMap vegetation type Upper Karoo Hardeveld (NKu 2), and can be regarded as a subtype of Upper Karoo Hardeveld. It is characterized by large dolerite sheets with very shallow soils in which a range of succulents and other xerophytic plant species occur. As such it has a low (about 25%) density of vegetation cover. It has relatively flat to gentle (0° – 5°C) slopes of various aspects, specifically in this study area, and is has numerous large dolerite boulders scattered all over. It often occurs on hill and ridge tops. The vegetation is mostly composed of the succulents *Ruschia intricata*, *Anacampseros albidiflora*, *Anacampseros ustulata*, *Stomatium viride*, *Crassula muscosa*, and *Haworthiopsis tessellata* var. *tessellata*, with the graminoids *Aristida diffusa* subsp. *diffusa* and *Cyperus usitatus* also featuring prominently in some areas. The xerophytic fern *Cheilanthes eckloniana* grows in rock crevices, together with geophytic species such as *Strumaria tenella* subsp. *orientalis* and *Empodium*. *Pelargonium tragacanthoides* also features prominently in some areas.

This plant community type was overall in a relatively pristine condition. Although sheep graze in the area, there were no signs of heavy overgrazing.

A total of 21 plant species (21 native and 0 alien) were recorded within this type. Three protected species (*Anacampseros albidiflora*, *Anacampseros ustulata*, *Strumaria tenella* subsp. *orientalis*) were found in this type, together with the Western Cape Endemic *Stomatium viride*.

The following native species were only recorded in this type (i.e., unique; however, it remains possible that some of them occur in some of other plant community types but were not observed):

- *Anacampseros albidiflora*
- *Anacampseros ustulata*
- *Crassula corallina subsp. corallina*
- *Crassula muscosa*
- *Empodium*
- *Haworthiopsis tessellata var. tessellata*
- *Melica decumbens*
- *Pelargonium aridum*
- *Pelargonium tragacanthoides*
- *Stomatium viride*
- *Strumaria tenella subsp. orientalis*
- *Trichodiadema pomeridianum*

5.3.1.d) Stipagrostis namaquana - Vachellia karroo

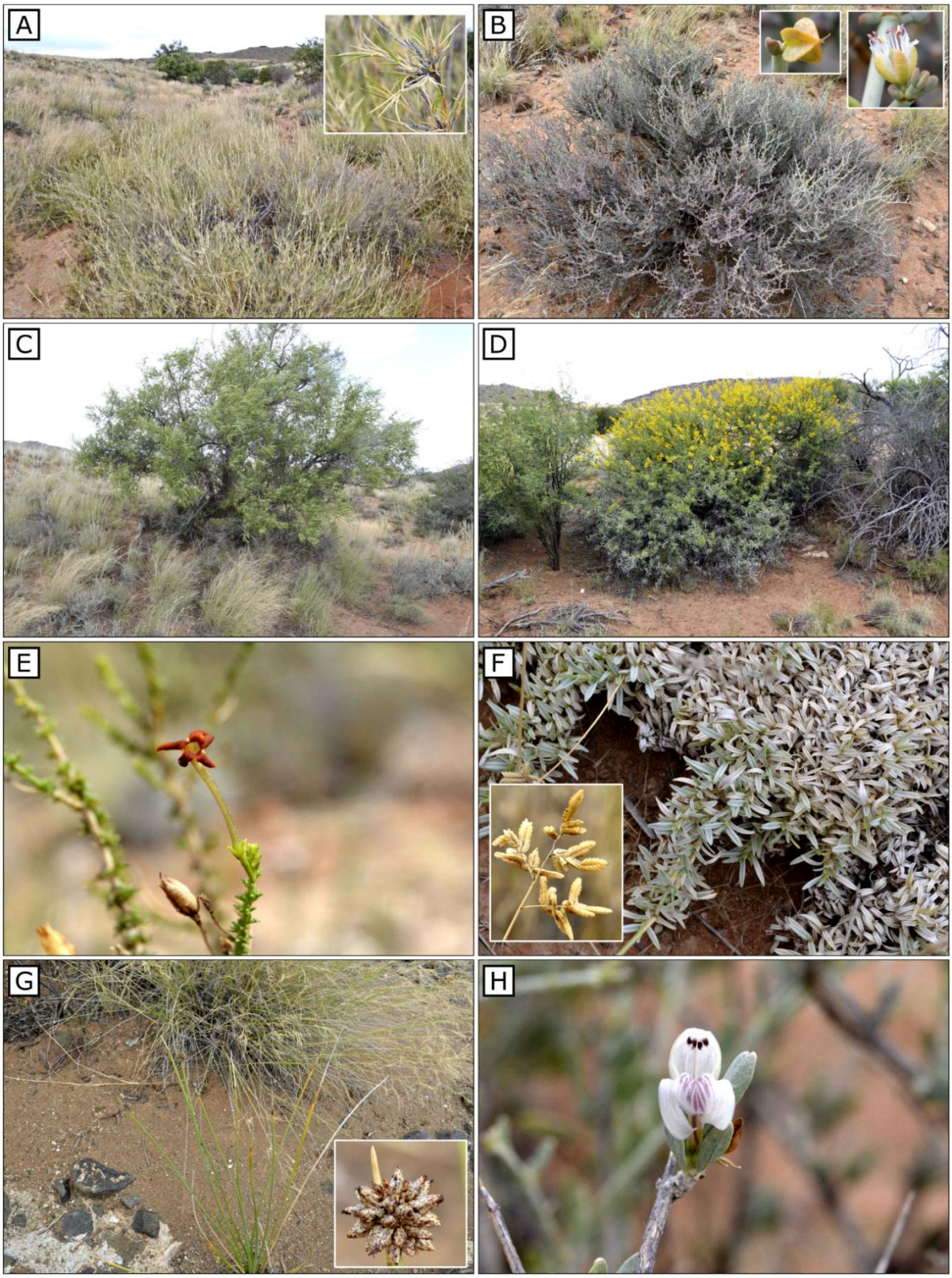


Figure 24: Some representative plant species that were found within the *Stipagrostis namaquana - Vachellia karroo* plant community type. Species names: A) *Stipagrostis namaquensis*, B) *Tetraena retrofracta*, C) *Searsia lancea*, D) *Vachellia karroo*, E) *Jamesbrittenia atropurpurea* subsp. *atropurpurea*, F) *Eragrostis bergiana*, G) *Afroscirpoides dioeca*, and H) *Justicia incana*.

Species Summary Statistics:

Total: 30

Shared:	13	SCC:	0	Native:	27
Unique:	17	Threatened:	0	Alien:	3
%Unique:	57	Protected:	0	NEM:BA:	2
		WCE:	0		

The *Stipagrostis namaquana* - *Vachellia karroo* plant community type (Figure 24) conforms to the VegMap vegetation type Karoo Riviere (AZi 6). It is characterized by ephemeral streams/drainage lines with sandy soils in which the grass a *Stipagrostis namaquana* tends to dominate. It has a low to medium (about 25% – 50%) density of vegetation cover. It has relatively gentle (~5°C) western aspect, specifically in this study area, with steep side slopes in some areas where riverbanks become prominent. *Vachellia karroo* tends to dominate on some of the slopes, together with scattered individuals of *Searsia lancea*. The vegetation is also composed of smaller shrubs such as *Asparagus burchellii*, *Calobota spinescens*, *Jamesbrittenia atropurpurea* subsp. *atropurpurea*, *Deverra denudata* subsp. *aphylla*, *Justicia incana*, *Tetraena retrofracta*. *Eragrostis bergiana* also features prominently in areas where underlying lime

This plant community type was mostly in a relatively pristine condition. However, the invasive species *Prosopis glandulosa* var. *torreyana* is problematic in certain areas.

A total of 30 plant species (27 native and 3 alien) were recorded within this type. No SCC, protected plant species, or provincial endemics were found in this type. Three alien species were found, of which two (*Prosopis glandulosa* var. *torreyana* and *Argemone ochroleuca*) were NEM:BA A&IS Regulations listed species.

The following native species were only recorded in this type (i.e., unique; however, it remains possible that some of them occur in some of other plant community types but were not observed):

- *Afroscirpoides dioeca*
- *Argemone ochroleuca*
- *Deverra denudata subsp. aphylla*
- *Dianthus micropetalus*
- *Diospyros lycioides subsp. lycioides*
- *Dysphania carinata*
- *Eragrostis bergiana*
- *Gazania krebsiana subsp. krebsiana*
- *Jamesbrittenia atropurpurea subsp. atropurpurea*
- *Justicia incana*
- *Kedrostis capensis*
- *Prosopis glandulosa var. torreyana*
- *Pteronia empetrifolia*
- *Searsia lancea*
- *Stipagrostis namaquensis*
- *Tetraena retrofracta*
- *Thesium hystrix*

5.3.2. Species of Conservation Concern

Ground truthing confirmed 5 protected plant species to be present within the study area (Table 9; also see Table 8 for more details on their occurrences within the respective plant community types). These were only protected species, and none of them were SCC. Three of these species (*Anacampseros ustulata*, *Boophone disticha*, and *Strumaria tenella* subsp. *orientalis*) were not present in the lists obtained from online databases during the desktop phase (see section 5.2.2).

Table 9: Plant Species of Conservation Concern recorded within the study area.

Family	Species	IUCN	Protection Schedule
Anacampserotaceae	*Anacampseros albidiflora*	LC	4
Anacampserotaceae	*Anacampseros ustulata*	LC	4
Amaryllidaceae	*Boophone disticha*	LC	4
Apocynaceae	*Gomphocarpus tomentosus subsp. tomentosus*	LC	4
Amaryllidaceae	*Strumaria tenella subsp. orientalis*	LC	4

5.3.3. Alien and Invasive Plant Species

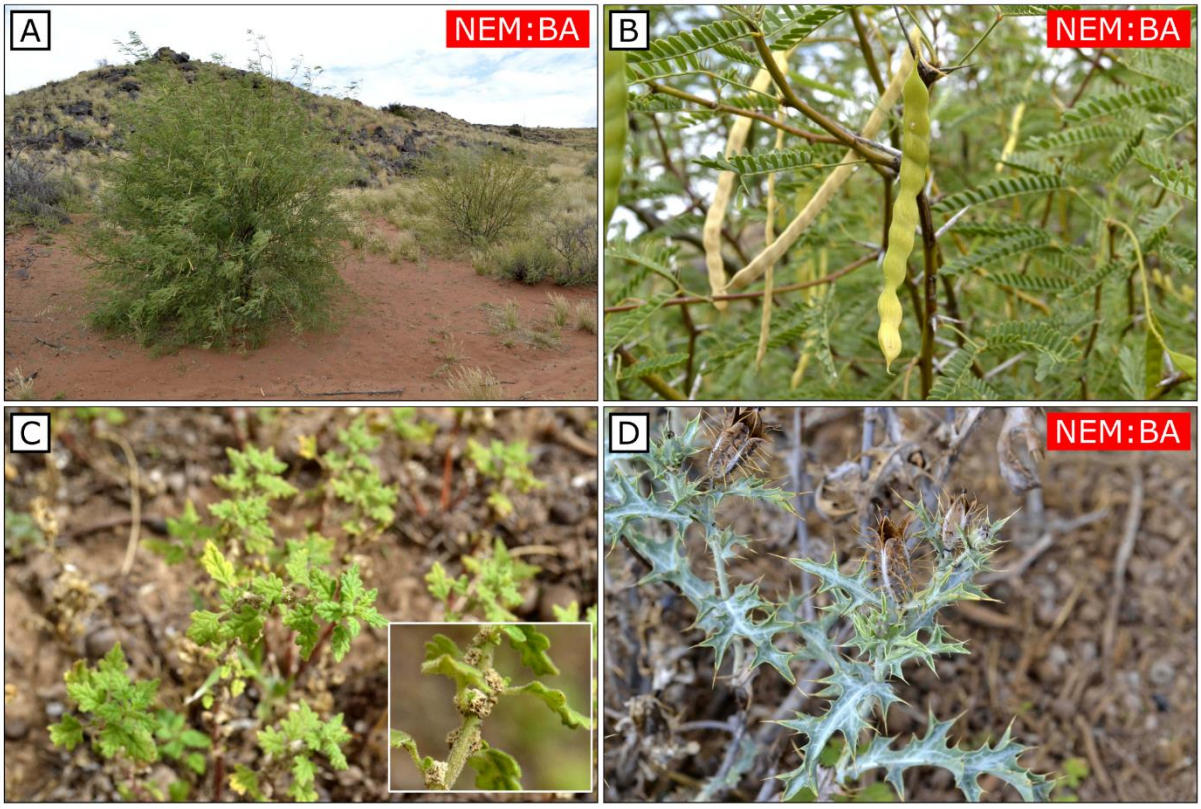


Figure 25: Alien plant species that were found within the study area. NEM:BA listed invasive species are indicated where applicable. A) *Prosopis glandulosa* var. *torreyana*, B) fruits of *Prosopis glandulosa* var. *torreyana*, C) *Dysphania carinata*, and D *Argemone ochroleuca*.

A total of 3 alien plant species were found within the study area, 2 of which (*Prosopis glandulosa* var. *torreyana* and *Argemone ochroleuca*) are NEM:BA A&IS Regulations listed invasive species (Figure 25). Specifically see section 3.3.1.a) for legal requirements pertaining to any NEM:BA A&IS Regulations listed species.

These species occurred within the *Aristida congesta* - *Asparagus burchellii* and *Stipagrostis namaquana* - *Vachellia karroo* plant community types. Only in the latter community does *Prosopis glandulosa* var. *torreyana* dominate to any degree. As such, none of the plant community types were dominated by alien species, and all of them were mostly free from alien species. Nevertheless, care should be taken to remove these species and to further prevent their spread.

5.3.4. Site Ecological Importance Assessment

The Relative Plant Species Theme Sensitivity for the study area was scored as "Medium", as indicated in the screening report (Figure 27). This is likely based on potential predicted presences of sensitive species in the area (see sections 3.3.1 and 5.2.2). No SCC were found on site, and as such the true Relative Plant Species Theme Sensitivity of the site can more likely be considered as "Low".

The Relative Biodiversity Theme Sensitivity for the study area was scored as "Low" (Figure 27). This is likely due to the study area occurring in an ONA, as well as being LC in terms of Ecosystem Threat Status, and not near any NPAES or NFEPA features (see section 5.1). A small area scored as "High" occurs to south of the study area, and is likely the result of a drainage area in that region. Field observations, together with the SEI assessment, indicated that most of the site indeed conforms to a "Low" to "Very Low" status (Table 10 and Figure 27). However, the following important things must be noted:

- Although the *Stipagrostis namaquana* - *Aristida diffusa* plant community type was scored as "Very Low" based on the SEI assessment, it should nevertheless be regarded as a No-Go area, except where disturbance is absolutely necessary. The reason is that this plant community type is a riverine community (i.e., mapped along drainage lines), and fulfils crucial ecological functions. This community may be disturbed only where absolutely necessary (e.g., when a crossing is required).
- Part of the study area — specifically the eastern part of the mining area — dissects a plant community type (*Ruschia intricata* - *Aristida diffusa*) assessed as having a "High" SEI. The loss of this small section will not significantly impact on this plant community type as a whole, since more of these communities also occur in the broader surrounds, and will not likely be impacted to any significant degree by the proposed activities. Moreover, the large

extent of Upper Karoo Hardeveld (NKu 2) that still exists (see 5.2.1.b) means that this plant community type (which can be regarded a subtype of NKu 2) still has a very broad distribution range and land coverage.

- The entire study area conforms at the very least to ESA1 status due to its predominantly pristine and undisturbed nature. As such, care must still be taken not to cause unnecessary disturbance where not warranted or permitted.

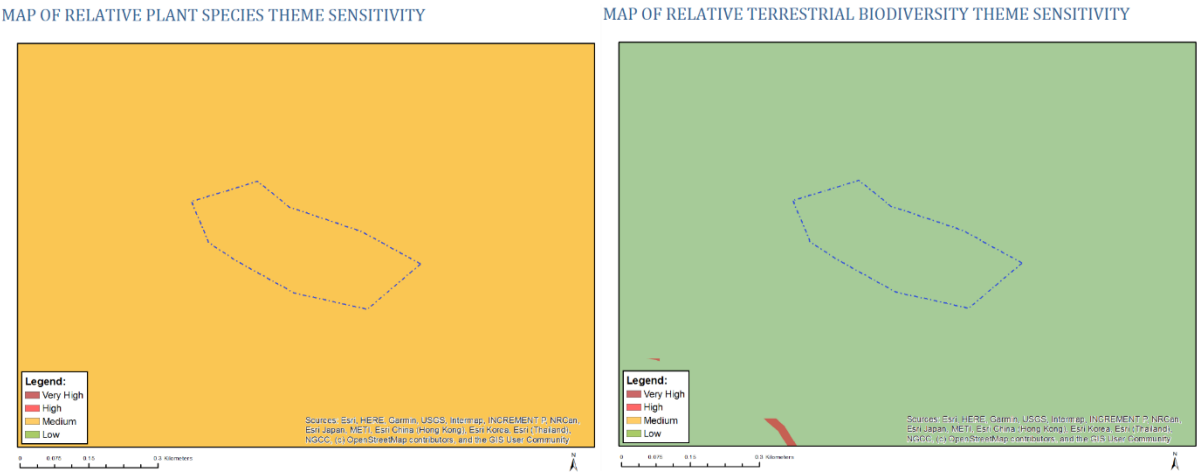


Figure 26: Relative plant species and terrestrial biodiversity theme sensitivities for the study area, as indicated by the National Web based Environmental Screening Tool.

Table 10: Evaluation of Site Ecological Importance (SEI) for the plant community types in the study area. BI = Biodiversity Importance.

Plant Community Type	Conservation Importance (CI)	Functional Integrity (FI)	Receptor Resilience (RR)	SEI
Aristida congesta - Asparagus burchellii	**Medium**: Although there are no SCC, > 50% of receptor contains natural habitat.	**High**: Large intact area for any conservation status of ecosystem type; good habitat connectivity with functional ecology; only minor current negative ecological impacts.	**Very High**: Habitat can recover rapidly, species (e.g., *Aristida* grass spp.) have a very high likelihood of remaining at a site even when a disturbance or impact is occurring, and very high likelihood of returning to a site once the disturbance or impact has been removed.	**Very Low (BI = Medium)**
Aristida diffusa - Aristida congesta	**Medium**: Although there are no SCC, > 50% of receptor contains natural habitat.	**High**: Large intact area for any conservation status of ecosystem type; good habitat connectivity with functional ecology; only minor current negative ecological impacts.	**Very High**: Habitat can recover rapidly, species (e.g., *Aristida* grass spp.) have a very high likelihood of remaining at a site even when a disturbance or impact is occurring, and very high likelihood of returning to a site once the disturbance or impact has been removed.	**Very Low (BI = Medium)**
Ruschia intricata - Aristida diffusa	**Medium**: Although there are no SCC, > 50% of receptor contains natural habitat.	**High**: Large intact area for any conservation status of ecosystem type; good habitat connectivity with functional ecology; only	**Medium**: will recover slowly (~ more than 10 years) to restore > 75% of the original species composition and functionality of the receptor functionality,	**High (BI = Medium)**

		minor current negative ecological impacts.	due to the numerous succulent species in this type; species have a moderate to low likelihood of returning to site once the disturbance or impact has been removed since crucial micro-habitats will be destroyed.	
Stipagrostis namaquana - Aristida diffusa	**Medium**: Although there are no SCC, > 50% of receptor contains natural habitat.	**Medium**: Mostly minor current negative ecological impacts with some major impacts (e.g., established population of alien and invasive flora)	**Very High**: Habitat can recover rapidly, species (e.g., *Stipagrostis* and *Aristida* grass spp.) have a very high likelihood of remaining at a site even when a disturbance or impact is occurring, and very high likelihood of returning to a site once the disturbance or impact has been removed.	**Low** **(BI = Medium)**

Figure 27: Site Ecological Importance for the study area (see Table 10 for more details).

6. Impact Risk Assessment

This section describes and summarizes the significance of perceived impacts on the terrestrial ecology of the study area and surrounds. Potential impacts were evaluated based on desktop and field assessment data to identify their relevance to the study area. The relevant impacts associated with the proposed activities were then subjected to the impact assessment methodology as described in section 4.1.3.

6.1. Biodiversity Risk Assessment

6.1.1. Present Impacts to Biodiversity

Anthropogenic activities and influences occur within the landscape, and very limited direct negative impacts to biodiversity were observed within the study area, including:

- Farm roads;
- Grazing and trampling of natural vegetation by livestock in certain areas (though the extent of this was never severe);
- IAPs; and
- Fences and associated maintenance.

6.1.2. Terrestrial Impacts

Habitat destruction, due to anthropogenic activities, displaces fauna and flora, and in some instances directly causes mortality. Specifically, habitat for wildlife is destroyed when land is cleared of vegetation for anthropogenic activities. This causes the loss of local breeding grounds, nesting sites, and wildlife movement corridors, such as rivers, streams and drainage lines, wooded areas, natural ridges, or other locally important features. The removal of natural vegetation not only reduces populations of individual plant species, as well as specific plant community types, but may also reduce the habitat available for animal species, thereby reducing animal populations and species compositions.

6.1.3. Loss of Irreplaceable Resources

- Mostly pristine natural vegetation will be lost.
- Microhabitats for specific plant community types (e.g., *Ruschia intricata - Aristida diffusa*) will be lost.
- Some parts of ESA1 will be impacted due to road crossings; however, these crossings and roads already exist.

6.1.4. Anticipated Impacts

Various impacts are anticipated for the proposed activities. These impacts are predicted and quantified in section 6.1.6, and their magnitude on the identified terrestrial biodiversity is assessed and evaluated (Table 11).

Table 11: Anticipated impacts on terrestrial biodiversity from the proposed activities in the study area and surrounds.

Main Impact	Proposed Project Activities Causing Impact	Secondary Impacts Anticipated
1. Destruction, fragmentation, and/or degradation of plant community types, habitats, and ecosystems	Vegetation clearing	Displacement/loss of flora and fauna (including possible SCC and protected plant species)
	Access roads and servitudes	Increased potential for soil erosion; edge effects might impact on flora
	Elevated soil dust levels	Habitat alteration due to altered species and plant community compositions, resulting in potential habitat fragmentation
	Dumping of waste products	Increased potential for establishment of IAPs; altered plant community types
	Fire (e.g., from cooking fires or cigarettes)	Erosion and vegetation destruction
2. Spread and/or establishment of alien and/or invasive species	Vegetation clearing	Habitat loss for native flora and fauna (including SCC and/or protected plant species)
	Vehicles potentially spreading propagules	Spreading of potentially dangerous diseases due to invasive and pest species; altered plant community types due to highly competitive abilities of IAPs
	Unsanitary conditions surrounding infrastructure promoting the establishment of alien and/or invasive rodents, and/or other vermin	Alteration of faunal assemblages due to habitat modification; altered plant community types due to vermin
3. Direct mortality of fauna	Vegetation clearing	Loss of habitat; loss of ecosystem services
	Roadkill due to vehicle collision	Altered plant community types due to altered faunal assemblages
	Pollution of water resources due to dust effects, chemical spills, etc.	Increase in rodent populations and associated disease risk
	Intentional killing of fauna for food (hunting)	Altered plant community types due to altered faunal assemblages
4. Reduced dispersal/migration of fauna	Loss of landscape used as corridor	Loss of ecosystem services
	Compacted roads	
	Vegetation clearing	Reduced plant seed dispersal
5. Environmental pollution and degradation due to water runoff, spills from vehicles, and erosion	Chemical (organic/inorganic) spills	Pollution in watercourses and the surrounding environment; altered plant community types
	Erosion	Faunal mortality (direct and indirectly); groundwater pollution; loss of ecosystem services; altered plant community types and potential loss of SCC and/or protected plant species
6. Disruption/alteration of ecological life cycles (breeding, migration, feeding) due to noise, dust, and/or light pollution.	Operation of machinery (large earth moving machinery; vehicles)	Disruption/alteration of ecological life cycles due to noise; loss of ecosystem services
	Project activities that can cause disruption/alteration of ecological life cycles due to dust	Secondary impacts associated with disruption/alteration of ecological life cycles due to dust
	Vehicles	Loss of ecosystem services
7. Staff and others interacting directly with fauna or flora (both of which potentially dangerous), or poaching them.	All unregulated/supervised activities outdoors	Loss of SCCs and/or protected plant species; altered plant community types

6.1.5. Unplanned Events

Unplanned events may potentially occur in any project. The potential impacts resulting from such events require management. An unplanned event assessment, specifically from a terrestrial ecology perspective, is therefore also presented here (Table 12). However, it is important to note that other potential unplanned events may also occur, which have not been described here. Such events must therefore be recorded and managed throughout all phases of the project.

Table 12: Unplanned events, together with their potential impacts, on terrestrial biodiversity from the proposed activities in the study area and surrounds

Event	Potential Impact	Mitigation
Spills into the surrounding environment	Contamination of habitat and water resources associated with a spillage. Altered plant community types due to altered environment, with subsequent alterations in faunal assemblages.	A spill response kit must be available at all times. Incidents must be reported, and if necessary, a biodiversity specialist must investigate the extent of the impact and provide rehabilitation recommendations.
Fire	Uncontrolled/unmanaged fire that spreads to the surrounding natural areas (only a problem associated with fire-prone vegetation, or areas that have accumulated a sufficient fuel load).	An appropriate and adequate fire management plan must be created and implemented if needed. Appropriate fire-fighting equipment must be on site at all times, and staff must be adequately trained in their usage.
Erosion caused by surface water runoff	Erosion on the sides of roads (or across roads where the topography enables this); altered native plant community types associated with large scale erosion; increased risk of alien and/or invasive species.	A storm water management plan must be compiled and implemented if needed. Any signs of erosion must immediately be addressed.

6.1.6. Identification and Assessment of Additional Potential Impacts

The assessment of impact significance considers both pre- and post-mitigation scenarios. Moreover, it usually considers these scenarios for all the phases during the project lifecycle, namely

- Construction: The construction phase refers to the period of construction when all proposed features of the project are constructed. It usually has the largest direct biodiversity impact.
- Operational: The operational phase refers to the period when the construction phase has been completed, and the proposed activities of the project commences.
- Decommissioning: The phase where regular daily activities have ceased, and the project has ended.

6.1.6.a) Construction Phase

The main anticipated impacts are given below, and the impact ratings at the end:

- Vegetation clearing will lead to the loss of pristine vegetation and result in a loss of specific nationally listed vegetation types and local plant community types, loss of local plant species and consequent genetic diversity, loss of potentially occurring SCC and protected plant species, loss of habitats for fauna and subsequent potential loss of faunal species and communities, loss of ecosystem functionality and integrity (i.e., increase in habitat fragmentation and increased edge effects), potential proliferation of alien and invasive plant species. On a cumulative basis, if numerous other developments occur in the future, the loss of these vegetation communities and habitats may potentially cause a change in the conservation status of the affected vegetation types, as well as their abilities and associated features to fulfil their ecological functions.
- A human presence on, and potential uncontrolled access to, the site may result in negative impacts on fauna and flora through poaching of fauna and/or uncontrolled collection of plants, or other reckless activities that might impact upon them.
- Soil compaction and/or increased erosion risk would occur due to the loss of vegetation cover and/or soil disturbance. This may potentially impact the downstream watercourses and aquatic habitats. These potential impacts may result in a reduction in the buffering capacities of the landscape during extreme weather events. Large-scale uncontrolled erosion might also further impact on plant community types and habits that are not directly in the PAOI.
- IAPs may establish and proliferate in certain areas due to excessive disturbance to vegetation. IAPs propagules might specifically be introduced to the study area by machinery (trucks, personnel vehicles, other heavy machinery, etc.) traversing through areas — that is, IAPs propagules might enter the study area as stowaways — or they may already be present in the study area and surrounds.
- The presence and operation of mining vehicles and machinery in the study area will create a physical impact, and will generate noise, potential pollution, and other forms of disturbances.
- Displacement of faunal communities due to vegetation and habitat loss, and direct mortalities and disturbance (e.g., road collisions, noise, dust, vibration).
- Chemical pollution associated with various materials used (e.g., dust suppressants, accidental spills, etc.).

Construction Phase	
Potential impacts on plant communities, and SCC and/or protected plant species.	
Summary of Impact	Vegetation clearing will impact on vegetation, and potential SCC and protected plant species. Impacts will occur due to the construction activities. This impact is most likely and significant impact and will lead to direct loss of vegetation.

	The most likely consequences include: • local loss of habitat (to an extent as a natural ground covering will be maintained where possible) • local disturbance to processes maintaining local biodiversity and ecosystem goods and services • a potential loss of a few protected species.	
	Pre-Mitigation Impact Rating	**Post-Mitigation Impact Rating**
Extent	Site Specific (1)	Site Specific (1)
Duration	Long Term (4)	Moderate Term (3)
Magnitude	High (8)	Moderate (6)
Probability	Definite (5)	Probable (3)
Significance	**High (65)**	**Medium (30)**
Direction	Negative	Negative
Reversibility	Low	Low
Is Mitigation Possible?	Yes, reasonable mitigation will result in altered, but functional, vegetation with high restoration potential in most areas. The plant community type that will be the most affected is the *Ruschia intricata - Aristida diffusa* type since it is characterized by unique microhabitat conditions, specifically large dolerite sheets with very shallow overlying soils. While it might prove very difficult to replicate these exact microhabitat conditions, it is highly probable that this type might be successfully rehabilitated to its closely related counterpart, namely the *Aristida diffusa - Aristida congesta* type. This is because the *Ruschia intricata - Aristida diffusa* type can be regarded as a subtype of the former, and manifests in the areas where soils become much more shallow than usual. Thus, while the rehabilitation and restoration potential is low for the *Ruschia intricata - Aristida diffusa* type, it is indeed moderate to high for the *Aristida diffusa - Aristida congesta* type. In this sense, the loss of one plant community type can be mitigated by a gain in another type. The impacts on the *Aristida congesta - Asparagus burchellii* type are not as high as the aforementioned, since no actual mining will occur in it. Thus, it has a high rehabilitation potential. Finally, the majority of the protected plant species found on site are easy to relocate and will likely have a high success rate if the advised relocation guidelines are followed. Only one species, namely *Gomphocarpus tomentosus* subsp. *tomentosus*, might prove difficult to relocate, but only if individuals have deep root systems that are difficult to remove without significant damage. If the appropriate relocation measures are implemented, then a good success rate might be achieved.	
Impacts on faunal communities.		
Summary of Impact	Increased noise, pollution, and disturbance levels, and an on-site human presence will be detrimental to fauna. Sensitive and shy fauna will be displaced due to the human activities, while slow-moving species might not be able to avoid the construction activities and might be killed. Some impact on fauna is highly likely to occur during construction.	
	Pre-Mitigation Impact Rating	**Post-Mitigation Impact Rating**
Extent	Site Specific (1)	Site Specific (1)
Duration	Moderate Term (3)	Moderate Term (3)
Magnitude	Minor (4)	Minor (4)
Probability	Definite (5)	Probable (3)
Significance	**Medium (40)**	**Low (24)**
Direction	Negative	Negative
Reversibility	Moderate	High
Is Mitigation Possible?	Yes, to a large extent.	
Soil erosion and associated degradation of ecosystems.		
Summary of Impact	Construction activities cause soil disturbance at the site and will render the area vulnerable to erosion. Erosion is one a large risk factor associated with the development and it is therefore critically	

	important that proper erosion control measures are implemented and maintained over the project lifecycle.	
	Pre-Mitigation Impact Rating	**Post Mitigation Impact Rating**
Extent	Local (3)	Site Specific (1)
Duration	Long Term (4)	Moderate Term (3)
Magnitude	Moderate (6)	Minor (4)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (52)**	**Low (24)**
Direction	Negative	Negative
Reversibility	Moderate	High
Is Mitigation Possible?	Yes, to a large extent.	
Spread and/or establishment of alien and/or invasive species.		
Summary of Impact	Increased alien plant invasion is a large risk factor associated with this development. The disturbed and bare ground that is likely to be present during and after construction will increase site's vulnerability to alien plant invasion for a long time if not managed. Furthermore, the National Environmental Management Biodiversity Act (Act No. 10 of 2004), as well as the Conservation of Agricultural Resources Act, (Act No. 43 of 1983) requires that listed alien species are controlled in accordance with the Act.	
	Pre-Mitigation Impact Rating	**Post Mitigation Impact Rating**
Extent	Local (3)	Site Specific (1)
Duration	Long Term (4)	Moderate Term (3)
Magnitude	Moderate (6)	Minor (4)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (52)**	**Low (24)**
Direction	Negative	Negative
Reversibility	Moderate	High
Is Mitigation Possible?	Yes, to a large extent.	
Chemical pollution associated with various materials, if used.		
Summary of Impact	The presence and operation of mining vehicles and machinery, as well as various other materials, might generate pollution, whether from intentional use (for example, dust suppressants) or from accidents (for example, accidental fuel spills). This can impact ecosystem structure, and function, and composition.	
	Pre-Mitigation Impact Rating	**Post Mitigation Impact Rating**
Extent	Local (3)	Site Specific (1)
Duration	Moderate Term (3)	Short Term (2)
Magnitude	Moderate (6)	Minor (4)
Probability	Probable (3)	Improbable (2)
Significance	Medium (36)	Low (14)
Direction	Negative	Negative
Reversibility	Moderate	High
Is Mitigation Possible?	Yes, to a large extent.	

6.1.6.b) Operational Phase

The main anticipated impacts include:

- Further introduction, establishment, and potential spread of IAPs.
- The deterioration of surrounding plant communities and habitats due to dust and edge effect impacts. Dust reduces plant photosynthesis and leads to veld degradation/retrogression.
- Continued fragmentation, and subsequent degradation, of habitats and ecosystems. This will result in a continued loss of plant communities, with a consequent impact on the potential occurrence of SCC and protected plant species.
- Maintenance and mining vehicles that are continually moving causes sensory disturbances to fauna and affects their lifecycles and movement. This might cause ongoing displacement and direct mortalities of faunal communities (similar to construction phase impacts).
- The use of various chemical and other materials in daily activities might lead to the pollution of water sources and the general environment, and ultimately death of fauna and flora.

Operational Phase		
Potential impacts on plant communities, and SCC and/or protected plant species.		
Summary of Impact	Continued fragmentation and degradation of habitats and ecosystems might result from operational activities, which will continue to impact plant communities, including and potential SCC and protected plant species. The most likely consequences include: • continued local loss of habitat • local disturbance to processes maintaining local biodiversity and ecosystem goods and services • a potential loss of species and genetic diversity.	
	Pre-Mitigation Impact Rating	**Post-Mitigation Impact Rating**
Extent	Site Specific (1)	Site Specific (1)
Duration	Moderate Term (3)	Moderate Term (3)
Magnitude	Moderate (6)	Minor (4)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (40)**	**Low (24)**
Direction	Negative	Negative
Reversibility	Low	Low
Is Mitigation Possible?	Yes, reasonable mitigation will result in altered, but functional, vegetation with high restoration potential in most areas.	
Impacts on faunal communities.		
Summary of Impact	An on-site human presence will continue to contribute to the displacement of, and direct mortalities of, faunal communities due to disturbances (road collisions, noise, pollution, and disturbance).	
	Pre-Mitigation Impact Rating	**Post-Mitigation Impact Rating**
Extent	Local (3)	Site Specific (1)
Duration	Moderate Term (3)	Moderate Term (3)

Magnitude	Moderate (6)	Minor (4)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (48)**	**Low (24)**
Direction	Negative	Negative
Reversibility	Moderate	High
Is Mitigation Possible?	Yes, to a large extent.	
Soil erosion and associated degradation of ecosystems.		
Summary of Impact	Daily operational activities will continue to pose a risk of soil disturbance at the site. It will remain critically important that proper erosion control measures are implemented and maintained over the project lifecycle.	
	Pre-Mitigation Impact Rating	**Post Mitigation Impact Rating**
Extent	Local (3)	Site Specific (1)
Duration	Moderate Term (3)	Moderate Term (3)
Magnitude	Moderate (6)	Minor (4)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (48)**	**Low (24)**
Direction	Negative	Negative
Reversibility	Moderate	High
Is Mitigation Possible?	Yes, to a large extent.	
Spread and/or establishment of alien and/or invasive species.		
Summary of Impact	Daily operational activities will continue to pose a risk of alien plant invasion due to continuous disturbance. It will remain critically important that any listed alien species found during the operational phase be controlled in accordance with NEM:BA.	
	Pre-Mitigation Impact Rating	**Post Mitigation Impact Rating**
Extent	Local (3)	Site Specific (1)
Duration	Moderate Term (3)	Moderate Term (3)
Magnitude	Moderate (6)	Minor (4)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (48)**	**Low (24)**
Direction	Negative	Negative
Reversibility	Moderate	High
Is Mitigation Possible?	Yes, to a large extent.	
Chemical pollution associated with various materials, if used.		
Summary of Impact	The continuous presence and operation of mining vehicles and machinery, as well as the use of various other materials, will continue pose a risk of pollution, whether from intentional use (for example, dust suppressants) or from accidents (for example, accidental fuel spills).	
	Pre-Mitigation Impact Rating	**Post Mitigation Impact Rating**
Extent	Site Specific (1)	Site Specific (1)
Duration	Moderate Term (3)	Moderate Term (3)
Magnitude	Moderate (6)	Minor (4)
Probability	Highly Probable (4)	Probable (3)
Significance	Medium (40)	Low (24)
Direction	Negative	Negative

Reversibility	Moderate	High
Is Mitigation Possible?	Yes, to a large extent.	

6.1.7. Cumulative Impacts

Cumulative impacts are assessed based on the extent of the currently proposed project, other developments in the area (whether similar or different), and general habitat loss, transformation, and/or fragmentation resulting from other activities in the area. In areas where future developments will continue to compound the impacts in an area or region, the cumulative effects of the development is assessed.

This section describes the potential cumulative impacts of the project. Localized cumulative impacts include the cumulative effects from other operations that may potentially cause additive effects on the environment. Long-term cumulative impacts can lead to the loss of endemic species and SCC, loss of protected plant species, loss of local plant community types, habitats, and vegetation types, and even degradation of well conserved areas, among other things.

Cumulative Impacts		
Reduced ability to meet conservation obligations and targets.		
Summary of Impact	Habitat destruction and fragmentation can potentially disrupt the connectivity of the landscape for fauna and flora, and impair their ability to respond to environmental fluctuations. It can also lead to the loss of local plant community types, SCC, and protected plant species. The loss of unprotected vegetation types on a cumulative basis from the broader area negatively impacts provincial and national conservation targets. The study area does not contain any SCC, and will not impact on national SCC listings. Only a few protected plant species occur in the study area, and they occur in small numbers. Thus, the cumulative impacts on these protected plant species will be very small. The study area does not occur in a CBA or ESA, and will thus not impact such targets. The study area is in a LC ecosystem, and will not affect RLE targets. It is unlikely that the proposed development will impact on downstream water resources due to the small size of the development and distance from freshwater resources. With effective mitigation, including erosion control, stormwater management, and mine rehabilitation, the natural vegetation of the surrounds will be maintained and subsequently will not cause major impacts on surrounding areas.	
	Overall impact considered in isolation	**Overall impact together with other activities in the area**
Extent	Site Specific (1)	Local (3)
Duration	Moderate Term (3)	Long Term (4)
Magnitude	Minor (4)	Moderate (6)
Probability	Highly Probable (4)	Highly Probable (4)
Significance	**Medium (32)**	**Medium (52)**
Direction	Negative	Negative
Reversibility	Low	Low

Is Mitigation Possible?	Yes, reasonable mitigation will result in altered, but functional, vegetation with high restoration potential in most areas.	
Impacts on broad-scale ecological processes.		
Summary of Impact	Transformation of intact habitats could potentially compromise ecological processes, as well as ecological functioning of important habitats, and would contribute to the fragmentation of the landscape and potentially disrupt the connectivity of the landscape for fauna and flora, and impair their ability to respond to environmental fluctuations.	
	Overall impact considered in isolation	**Overall impact together with other activities in the area**
Extent	Site Specific (1)	Local (3)
Duration	Moderate Term (3)	Moderate Term (3)
Magnitude	Minor (4)	Moderate (6)
Probability	Probable (3)	Probable (3)
Significance	**Low (24)**	**Medium (36)**
Direction	Negative	Negative
Reversibility	Moderate	High
Is Mitigation Possible?	Yes, to a large extent.	

7. Mitigation Measures and Biodiversity Management Plan

7.1. Mitigation Measures

Site-Establishment and Operational Phases	
Impact	**Mitigation**
Potential impacts on plant communities, and SCC and/or protected plant species.	A pre-construction walk-through of the final mining footprint should be conducted in the flowering season by a suitably qualified botanist for SCC or protected plant species that will be affected (also to comply with provincial permit conditions), and to develop a more comprehensive plant species list of the area. For threatened species that may not be destroyed, it is recommended that professional search and rescue service providers be used to remove such plants and to use them either for later rehabilitation work or other conservation projects. Any individual of an SCC or protected plant species present on site requires a relocation or destruction permit (from CapeNature) to remove or destroy such an individual. High visibility flags must be placed near any threatened/protected plants in order to avoid any damage or destruction to them. If left undisturbed, the sensitivity and importance of these species must be part of the environmental awareness program. When infrastructure, development areas or routes intersect with protected plants, and which cannot be avoided, such plants should be removed from the soil and relocated/re-planted in similar habitats where they should be able to resprout and flourish again. All SCC and protected plant species should be relocated, and as many other geophytic species as possible. Permits must be kept on-site and in the possession of the flora search and rescue team at all times. A pre-construction environmental induction must be provided for all staff to ensure compliance with basic environmental principles. This includes awareness of no littering, appropriate handling of pollution and chemical spills, avoiding fire hazards, minimising wildlife interactions, and remaining within demarcated construction areas. Contractor's EO must provide supervision and oversight of vegetation clearing activities and other activities which may cause damage to the environment, especially at the initiation of the project, when the majority of vegetation clearing is taking place. Blanket clearing of vegetation must be limited to the proposed footprint and associated infrastructure. No clearing outside of the minimum required footprint to take place. Clearing of vegetation should be minimized and avoided where possible. Areas of indigenous vegetation, even secondary communities outside of the direct project footprint, should under no circumstances be fragmented or disturbed further. No plant species, whether native or exotic, should be brought into, ore removed from, the project area, to prevent the spread of exotic or invasive species or the illegal collection of plants. Topsoil must be stripped and stockpiled separately during site preparation and replaced over disturbed areas on completion. Ensure that laydown areas, construction camps, and other temporary use areas are located in areas of low sensitivity and are properly fenced or demarcated as appropriately and practically possible. Materials may not be stored for extended periods of time and must be removed from the project area once the construction phase has been concluded. No permanent construction phase structures should be permitted. Construction buildings should preferably be prefabricated or constructed of re-usable/recyclable materials. No storage of vehicles or equipment will be allowed outside of the designated project areas.

	All vehicles must remain on demarcated roads and no unnecessary driving in the veld outside these areas are allowed. Regular dust suppression should occur during operation. No plants may be translocated or otherwise uprooted or disturbed for rehabilitation or other purposes without express permission from the Contractor's EO or without the relevant permits. No fires must be allowed on-site. A fire management plan needs to be complied and implemented to restrict the impact fire might have on the surrounding areas. Areas that are denuded during construction must be re-vegetated with indigenous vegetation to prevent erosion. This will also reduce the likelihood of encroachment by IAPs. Livestock must always be kept out of the project area, especially in areas that have been recently re-vegetated. After the operation, rehabilitate an acceptable vegetation layer according to rehabilitation recommendations as provided within a site-specific Rehabilitation Plan compiled by a suitably qualified botanist. Revegetation should occur naturally where topsoils were not severely altered. A hydrocarbon spill management plan must be implemented. The Contractor shall be in possession of an emergency spill kit that must always be complete and available on site. Drip trays or any form of oil absorbent material must be placed underneath vehicles/machinery and equipment when not in use. No servicing of equipment on site unless necessary. Contaminated soils shall be treated in situ or removed and be placed in containers. Appropriately contain any spills in such a way as to prevent them leaking and entering the environment. All vehicles and equipment must be maintained, and all re-fuelling and servicing of equipment is to take place in demarcated areas outside of the project area.
Impacts on faunal communities.	Site access should be controlled and no unauthorised persons should be allowed onto the site. Any fauna directly threatened by the associated activities should be removed to a safe location by a suitably qualified person. The collection/trapping, hunting, or poisoning of any animals at the site is strictly forbidden. Signs must be put up to enforce this. Personnel should not be allowed to wander off demarcated areas. Fires must not be allowed on site. All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel, and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill. All construction and maintenance motor vehicle operators should undergo an environmental induction that includes instruction on the need to comply with speed limits, to respect all forms of wildlife. All vehicles should adhere to a low speed limit (30 km/h) to avoid collisions with susceptible species. Construction vehicles must be limited to a minimal footprint on site (no movement outside of the earmarked footprint). Schedule activities and operations during least sensitive periods, to avoid migration, nesting, and breeding seasons. Ensure that cables and connections are insulated successfully to reduce electrocution risk. Use environmentally friendly chemical products.
Soil erosion and associated	Minimize the number of disturbed areas; only disturb the absolute minimum number of areas required for the project. All other areas should be left undisturbed.

degradation of ecosystems.	Any signs of erosion resulting from the project activities must be rectified immediately and monitored thereafter to ensure that they do not re-occur. Mining within steep slopes will need to ensure that adequate slope protection is provided. All denuded areas resulting from the development should be re-vegetated, post-operation, with locally occurring native plant species to bind the soil and limit erosion potential. Roads and other disturbed areas within the study area should be regularly monitored for erosion problems, and problem areas should receive follow-up monitoring to assess remediation success. Speed limits must be put in place to reduce erosion. Reduce dust generated by the project activities, especially earth moving machinery, through wetting the soil surface and erecting signs to enforce the speed limit, as well as creating speed bumps enforce slower speeds. Existing access routes and walking paths must be made use of wherever possible. Silt/sediment traps/barriers should be used where there is a danger of topsoil or material stockpiles eroding and entering downstream drainage lines and other sensitive areas. These sediment/silt barriers should be regularly maintained and cleared so as to ensure effective drainage of the areas Topsoil should be removed and stored separately from subsoil. Topsoil should be reapplied where appropriate as soon as possible in order to encourage and facilitate rapid regeneration of the natural vegetation on cleared areas. Stockpiles must be protected from erosion, stored on flat areas where possible, and be surrounded by appropriate berms. Any erosion points created during construction should be filled and stabilized immediately. Practical phased development and vegetation clearing should be practiced so that cleared areas are not left un-vegetated and vulnerable to erosion for extended periods of time. Construction of gabions and other stabilisation features must be undertaken to prevent erosion, where deemed necessary. A stormwater management plan must be compiled and implemented. Soil should be stabilized in the period when it is disturbed until revegetation can take place. This can be done either temporarily or permanently, and can include methods such as using layers of either sterile mulch (that will not drastically alter soil conditions), blankets, wood binders, geo-textiles, artificial turf blankets, mats, or fibre rolls, depending on availability and how appropriate the measures are for the project. Runoff water on exposed areas should be controlled, for example with use of sediment traps, articulated concrete blocks, riprap, or geotextiles. Site entrances should be stabilized so that sediments are not carried away by the movement of construction vehicles to and from the site. Stabilized construction entrances can be made, for example, by making use of crushed stone. Care should be taken to remove all foreign debris from the site upon termination of the activities.
Spread and/or establishment of alien and/or invasive species.	All IAPs must be removed from the site as per NEM:BA requirements. A pest control plan must be implemented. Regular monitoring for alien plants at the site should occur and could be conducted simultaneously with erosion monitoring. When alien plants are detected, these should be controlled and cleared using the recommended control measures for each species to ensure that the problem is not exacerbated or does not re-occur and increase to problematic levels. Clearing methods should aim to keep disturbance to a minimum and must be undertaken in accordance with relevant guidelines. No planting or importing of any alien species to the site for landscaping, rehabilitation, or any other purpose should be allowed.

	The construction footprint area should be kept to a minimum. The footprint area must be clearly demarcated to avoid unnecessary disturbances to adjacent areas. Footprint of the roads must be within prescribed widths. Waste management must be a priority and all waste must be collected and stored adequately. It is recommended that all waste be removed from site on a weekly basis to prevent rodents and other pests entering the site.
Waste Management and Chemical pollution associated with various materials, if used.	Waste management must be a priority and all waste must be collected and stored effectively. Litter, spills, fuels, chemicals, and human waste in and around the study area must be removed. A minimum of one toilet must be provided per 10 persons. Portable toilets must be pumped dry to ensure the system does not degrade over time and spill into the surrounding area. The Contractor should supply sealable and properly marked domestic waste collection bins and all solid waste collected shall be disposed of at a licensed disposal facility. Where a registered disposal facility is not available close to the project area, the Contractor shall provide a method statement with regard to waste management. Under no circumstances may domestic waste be burned on site. Refuse bins will be emptied and secured Temporary storage of domestic waste shall be in covered waste skips. The maximum domestic waste storage period will be 10 days.
Cumulative Impacts	
Impact	**Mitigation**
Reduced ability to meet conservation obligations and targets.	The activity footprints of various proposed mining locations in the area must be kept to a minimum and natural vegetation should be encouraged to return during the decommissioning phase. Reduce the footprint of mining areas within sensitive habitat types as much as possible. Any signs of erosion resulting from the project activities must be rectified immediately and monitored thereafter to ensure that they do not re-occur. All denuded areas resulting from the development should be re-vegetated, post-operation, with locally occurring native species, to bind the soil and limit erosion potential. Roads and other disturbed areas within the study area should be regularly monitored for erosion problems, and problem areas should receive follow-up monitoring to assess the success of the remediation. Silt/sediment traps/barriers should be used where there is a danger of topsoil or material stockpiles eroding and entering downstream drainage lines and other sensitive areas. These sediment/silt barriers should be regularly maintained and cleared so as to ensure effective drainage of the areas Practical phased development and vegetation clearing should be practiced so that cleared areas are not left un-vegetated and vulnerable to erosion for extended periods of time. A suitable weed management strategy to be implemented in the construction and operation phases. Regular monitoring for alien plants at the site should occur and could be conducted simultaneously with erosion monitoring. When alien plants are detected, these should be controlled and cleared using the recommended control measures for each species to ensure that the problem is not exacerbated or does not re-occur and increase to problematic levels.

Impacts on broad-scale ecological processes.	The footprints of the individual mining areas should be kept to a minimum and natural vegetation should be encouraged to return to disturbed areas post-operational phase. Reduce the footprint of mining areas within sensitive habitat types as much as possible.

7.2. Species Specific Search and Rescue Procedures

SCC and protected plant species that are listed in schedules 3 and 4 of the Western Cape Nature Conservation Laws Amendment Act, 2000 (Act No. 3 of 2000) may not be picked or removed without the relevant permit from CapeNature. Moreover, it is highly recommended that such species be relocated, via suitable Search and Rescue Procedures, in order to avoid their destruction.

Plant Search and Rescue Procedures might not be successful for various reasons (for example, a lack of suitable receiving habitats and species-specific biological traits that complicate relocation, such as very deep root systems). However, a good amount of success can be achieved by implementing specific measures. It is therefore crucial that the following steps are taken to optimize the success of such procedures:

- Individuals should be removed from their current environments with the least possible amount of damage, giving special attention to protecting their root systems.
- Individuals should be stored and relocated according to their own unique requirements (for example, herbaceous species should be kept moist, succulents should be kept dry and not allowed to rot, geophytes should be kept dry and not allowed to rot, etc.; see section 7.2.1 for more details).
- Individuals must be relocated and transplanted into suitable habitats. Ideally, these habitats should be equivalent to the original environment — that is, the receiving areas should be of the same plant community type from which the individuals originated, or at least as close to it as possible. These requirements are species dependent, since different species might originate from different plant community types, and these requirements must therefore be adapted where necessary for each species. VegMap may be used as a guideline for relocation requirements; however, since much of it is coarsely mapped, it does not incorporate the often-unique microhabitat conditions where many species grow, and it is therefore highly recommended that plant community types (based on a fine-scale vegetation assessment, as presented in this report) are used instead.
- Individuals must ideally be relocated at the start of, or just prior to, the growing season in order to give them the best chance of establishing. If this is not possible, individuals must be kept in cultivation, taking care to implement suitable cultivation measures on a species-specific or functional type basis. Notable exceptions to this are many geophytic species which are able to survive the dormant season without the need for active cultivation measure.

- Additional measures may be implemented to aid establishment if the above condition is difficult to satisfy (i.e., relocation at the onset of the growing season), for example intermittent watering of relocated individuals.

7.2.1. General Plant Relocation Methods

The following general plant relocation methods are recommended for each functional plant group type:

Geophytes (species that have underground storage organs such as bulbs, rhizomes, tubers, and corms):

- Dedicated plant Search and Rescue staff should be present with topsoil removal and should gently rake through the soil for any SCC or protected plant species.
- Small geophytes should carefully be removed from the soil; a very coarse sieve may be used to separate out fine soil particles to maximize the chances of locating these geophytes.
- Large geophytes can be removed on the spot without having to remove a large area of topsoil. Such bulbs are often deep seated, and care should be taken to dig deep enough to remove the individual with its entire root system. Care should also be taken not to damage the bulb itself, which can become infected if damaged, and especially the basal plate, since damage to it might prove fatal.
- Geophytes should be stored in brown paper bags in a protected, dark, well-aerated, and dry environment until replanting. Large geophytes might be stored in perforated plastic crates, provided that ample aeration exists and that the individuals are not exposed to conditions that might cause them to rot.

Dwarf shrubs and forbs:

- Many shrub and forb species have deep root systems and it is imperative that these root systems are removed as intact as possible. Special care should be taken to avoid damage to taproots where present.
- Individuals should be bagged as soon as possible after removal, taking care to keep their root systems moist. Such individuals should then be kept in cultivation until they can be relocated into the wild. This might require special storage and care, such as at a local nursery or reserve. Note that staff may have to be appointed to tend to such plants until they can be planted out.

- Note that the success of relocating shrubs and forbs might not be high, especially when they have very deep root systems, which are often damaged during removal. The aftercare of such specimens is thus crucial.

Succulents:

- Fortunately, the majority of succulents are well suited to relocation efforts. Moreover, succulents that grow in shallow soils are usually easy to remove since they generally have shallow root systems. Although most succulents are hardy and resistant to root damage, care should nevertheless still be taken to minimize damage when removing their root systems.
- It is crucial that individuals are kept dry when removed from their environment and not allowed to rot. If the individuals will be kept for long periods until relocation, they should be planted in containers that have very well drained soils (a general succulent mix will likely suffice). Care should be taken not to overwater succulents. Exceptions will apply for certain aquatic succulents.

7.2.2. Species-Specific Relocation Methods

The following species-specific relocation methods should be considered:

- *Anacampseros albidiflora* and *A. ustulata*
    - These are tiny succulent species and will likely relocate well, since they do not have large and extensive root systems. They must be relocated to an equivalent plant community type (specifically the *Ruschia intricata* - *Aristida diffusa* type) which is characterised by very shallow dolerite soils overlying dolerite sheet rock. Seeing that these species are tiny and might have limited reserves, they should be transplanted into containers with shallow and well-draining soils if they will be stored for a long period until they can be relocated.
    - Apply the additional relocation guidelines for succulents as in section 7.2.1.
- *Boophone disticha* and *Strumaria tenella* subsp. *orientalis*
    - These are geophytic species and will likely relocate well. They must be relocated to an equivalent plant community type (specifically the *Aristida diffusa* - *Aristida congesta* type for *Boophone disticha* and the *Ruschia intricata* - *Aristida diffusa* type for *Strumaria tenella* subsp. *orientalis*).
    - Both species can likely be stored well for a long period of time, without having to plant them in containers, if they are removed during the dormant season.
    - Apply the additional relocation guidelines for geophytes as in section 7.2.1.

- *Gomphocarpus tomentosus* subsp. *tomentosus*
    - This is a dwarf shrub species and will likely relocate moderately well if the specific individuals in question have shallow root systems (individuals with deeper root systems might prove problematic if their root systems cannot be entirely removed without causing damage). Individuals must be relocated to an equivalent plant community type (this can be either the *Aristida congesta* - *Asparagus burchellii* or *Aristida diffusa* - *Aristida congesta* types).
    - It will be imperative to store individuals in plant bags, and to apply the necessary cultivation practices, until they can be planted out.
    - Apply the additional relocation guidelines for dwarf shrubs and forbs as in section 7.2.1.

8. Conclusion and Impact Statement

8.1. Conclusion

A comprehensive desktop study, together field survey results, suggest a high confidence in the information provided. The surveys ensured that a suitable coverage was obtained for the assessment areas, and the relevant plant community types were assessed to obtain a general species overview, while the major current impacts were observed.

The conservation status of the study area is classified as “Least Concern”, although its protection level is regarded as “Poorly Protected”. The study area does not overlap with any CBA, ESA, NPAES, or NFEPA features. The current layout of the study area overlaps in part within sensitive habitats, classified as having a “High” SEI. The rest of the study area and surrounds is classified as having a “Low” and “Very Low” SEI. The specific plant community type that has a “High” SEI rating also occurs in a few areas surrounding the study area, and these patches will not likely be influence by the proposed activities. As such, a small loss of this plant community type is acceptable, as long as the other patches of this community in the surrounding areas are not disturbed. Nevertheless, considering the pristine nature of the study area and surrounds, care should be taken regarding the impacts upon it, and it must be kept in mind that this area still:

- Might prove to be useful in meeting future conservation targets if the respective vegetation types become threatened and/or listed in future.
- Supports various plant and animals species (including protected species, and potential SCC).

- Supports various ecosystem processes and functions, thereby contributing to the integrity of the landscape.

Given the above, it is highly unlikely that this development will have an impact on ecosystem status or nationally listed vegetation types due to the limited extent of the mine, as well as the large extent of natural vegetation surrounding the mining area. Furthermore, this mine will not have a significant impact on the services and functions provided by the surrounding natural habitats, and development within this area is regarded as acceptable, provided that the mitigation measures given in this report is closely followed.

In terms of local plant species levels, the site is not exceptional rich in species and therefore not highly sensitive in this regard. Moreover, no SCC or range restricted species are present within the study area. The extensive nature of the study area vegetation and plant community types within the wider landscape means that all species within the study area will highly likely also be found in the surrounding areas. Thus, given that the majority of impacts associated with the proposed activities are likely to be local in nature and not of wider significance, loss of particular species within the study area will not be problematic.

Five provincially protected species were found in the study area (but only in low numbers), as well in the surrounding areas. None of them are SCC and their loss from the study area will not be significant and will not compromise the viability of the local populations of these species.

In terms of the likely botanical impacts associated with the mine, impacts on vegetation during the construction and operational phases are likely to be relatively high (medium after mitigation), and are somewhat difficult to mitigate given the destructive nature of the proposed activities. However, given the large extent of the affected vegetation and plant community types, and given the small footprint of the mining area, the impact on the vegetation is likely to be of locally high intensity but not broadly significant. Potential cumulative impacts are also furthermore regarded limited and of low to moderate significance.

The proposed study area is well positioned to mostly avoid highly sensitive receptors and the proposed activities will not severely compromise the survival and continued persistence any specific plant or animal species within the study area and surrounds if mitigation measures are fully implemented.

The mitigations, management, and associated monitoring regarding all the impacts identified in this report are the most important factors of this project and must be considered by the issuing authority.

8.2. Impact Statement

The main expected impacts of the proposed activities include:

- habitat loss, fragmentation, and degradation;
- loss of sensitive plant community types;
- increased alien plant invasion;
- species disturbance and displacement caused during the construction and operational phases; and
- direct mortality during the construction and operational phases.

The mitigation measures described in this report can be implemented to achieve, on average a medium to low residual impact (Table 13).

Table 13: Summary of anticipated impacts associated with the proposed activities in the study area and surrounds.

REGULAR IMPACTS		
Construction Phase		
	Pre-Mitigation Impact Rating	**Post-Mitigation Impact Rating**
Potential impacts on plant communities, and SCC and/or protected plant species.	High (65)	Medium (30)
Impacts on faunal communities.	Medium (40)	Low (24)
Soil erosion and associated degradation of ecosystems.	Medium (52)	Low (24)
Spread and/or establishment of alien and/or invasive species.	Medium (52)	Low (24)
Chemical pollution associated with various materials, if used.	Medium (36)	Low (14)
Operational Phase		
	Pre-Mitigation Impact Rating	**Post-Mitigation Impact Rating**
Potential impacts on plant communities, and SCC and/or protected plant species.	Medium (40)	Low (24)
Impacts on faunal communities.	Medium (48)	Low (24)
Soil erosion and associated degradation of ecosystems.	Medium (48)	Low (24)
Spread and/or establishment of alien and/or invasive species.	Medium (48)	Low (24)
Chemical pollution associated with various materials, if used.	Medium (40)	Low (24)
CUMULATIVE IMPACTS		
	Overall impact considered in isolation	**Overall impact together with other activities in the area**
Reduced ability to meet conservation obligations and targets.	Medium (32)	Medium (52)
Impacts on broad-scale ecological processes.	Low (24)	Medium (36)

Considering all the findings of this report, no fatal flaws are evident for the proposed project, and development in the study area is considered acceptable. It is the opinion of the specialist that the proposed activities may be favourably considered, on the condition that all prescribed mitigation measures and supporting recommendations are strictly implemented.

9. References

Bromilow, C. (2010). *Problem Plants and Alien Weeds of South Africa* (3rd ed). Briza Publications.

Dayaram, A., Harris, L., Grobler, B. A., van der Merwe, S., Rebelo, A. G., Powrie, L. W., Vlok, J. H. J., Desmet, P., Qabaqaba, M., Hlahane, K. M., & Skowno, A. L. (2018). Vegetation Map of South Africa, Lesotho and Swaziland 2018: A description of changes since 2006. *Bothalia*, *49*(1), a2452. https://doi.org/10.4102/ abc.v49i1.2452

Driver, A., Maze, K., Rouget, M., Lombard, A. T., Nel, J., Turpie, J. K., Cowling, R. M., Desmet, P., Goodman, P., Harris, J., Jonas, Z., Reyers, B., Sink, K., & Strauss, T. (2005). *National Spatial Biodiversity Assessment 2004: Priorities for Biodiversity Conservation in South Africa. Strelitzia 17.* South African National Biodiversity Institute.

Duncan, G., Jeppe, B., & Voigt, L. (2020). *Field guide to the Amaryllis family of southern Africa and surrounding territories*. Galley Press.

Fish, L., Mashau, A. C., Moeaha, M. J., & Nembudani, M. T. (2015). *Identification guide to southern African Grasses: An identification manual with keys, descriptions and distributions, Strelitzia 36*. South African National Biodiversity Institute.

Goff, F. G., Dawson, G. A., & Rochow, J. J. (1982). Site examination for threatened and endangered plant species. *Environmental Management*, *6*(4), 307–316. https://doi.org/10.1007/BF01875062

Henderson, L. (2020). *Invasive Alien Plants in South Africa. PPRI Handbook No 21.* Department of Environment, Forestry and Fisheries of South Africa.

Mucina, L., & Rutherford, M. C. (Reds). (2006). *The vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19.* South African National Biodiversity Institute.

Nel, J., Maherry, A. M., Peterson, C. P., Roux, D. J., Driver, A., Hill, L., van Deventer, H., Funke, N., Swartz, E. R., Smith-Adao, L. B., Mbona, N., Downsborough, L., & Nienaber, S. (2011). *Technical Report for the National Freshwater Ecosystem Priority Areas project. WRC Report No. 1801/2/11.*

Pool-Stanvliet, R., Duffell-Canham, A., Pence, G., & Smart, R. (2017). *Western Cape*

Biodiversity Spatial Plan Handbook. CapeNature. http://bgis.sanbi.org/Projects/Detail/194

Raimondo, D., von Staden, L., Foden, W., Victor, J. E., Helme, N., Turner, R. C., Kamundi, D. A., & Manyama, P. A. (2009). *Red List of South African plants 2009. Strelitzia 25.* South African National Biodiversity Institute.

Shearing, D., & van Heerden, K. (2008). *Karoo: South African Wild Flower Guide 6*. Botanical Society of South Africa.

Skowno, A. L., Poole, C. J., Raimondo, D., Sink, K., van Deventer, H., van Niekerk, L., Harris, L. R., Smith-Adao, L. B., Tolley, K. A., Zengeya, T. A., Foden, W., Midgley, G. F., & Driver, A. (2019). *National Biodiversity Assessment 2018: The status of South Africa's ecosystems and biodiversity. Synthesis Report. South African National Biodiversity Institute, an entity of the Department of Environment, Forestry and Fisheries.*

South African National Biodiversity Institute. (2018). *The Vegetation Map of South Africa, Lesotho and Swaziland, Mucina, L., Rutherford, M.C. and Powrie, L.W. (Editors), Version 2018*. http://bgis.sanbi.org/Projects/Detail/186

South African National Biodiversity Institute. (2020). *Species Environmental Assessment Guideline. Guidelines for the implementation of the Terrestrial Fauna and Terrestrial Flora Species Protocols for environmental impact assessments in South Africa* (Number 3.1). South African National Biodiversity Institute.

van Deventer, H, Smith-Adao, L., Mbona, N., Peterson, C., Skowno, A. L., Collins, N. B., Grenfell, M., Job, N., Lotter, M., Ollis, D., Scherman, P., Sieben, E., & Snaddon, K. (2018). *South African National Biodiversity Assessment 2018: Technical Report. Volume 2a: South African Inventory of Inland Aquatic Ecosystems (SAIIAE)* (Vol 3, Number October). http://hdl.handle.net/20.500.12143/5847.

Van Deventer, Heidi, Smith-Adao, L., Collins, N., Grenfell, M., Grundling, A., Grundling, P.-L., Impson, D., Job, N., Lotter, M., Ollis, D., Peterson, C., Scherman, P., Sieben, E., Snaddon, K., Tererai, F., & van der Colff, D. (2019). *South African National Biodiversity Assessment 2018: Technical Report. Volume 2b: Inland Aquatic (Freshwater) Realm: Vol CSIR repor*. http://hdl.handle.net/20.500.12143/6230

Van Oudtshoorn, F. (2012). *Gids tot Grasse van suider-Afrika* (3rd ed). Briza Publications.

Van Wyk, B.-E., Van Oudtshoorn, B., & Gericke, N. (2009). *Medicinal Plants of South Africa*. Briza Publications.

10. Appendix 1: Plant Species List

The species list presented here is a combination of online (e.g., POSA database) and study area survey data. Descriptions of colours and symbols are given below:

Species in **bold**:	Species that were found in the study area.
Species marked with "*":	Protected species.
Species marked with "†":	Species of Conservation Concern.
Species highlighted in blue:	Alien species.
Species marked with NEM:BA:	Alien species listed in the NEM:BA A&IS Regulations.
Species marked with WCE:	Western Cape Endemic.
Small letters in []:	Vegetation/plant community type in which the species was found:

- a: *Aristida congesta - Asparagus burchellii*
- b: *Aristida diffusa - Aristida congesta*
- c: *Ruschia intricata - Aristida diffusa*
- d: *Stipagrostis namaquana - Vachellia karroo*

Family	*Species*	IUCN	Family	*Species*	IUCN	Family	*Species*	IUCN
Crassulaceae	*Adromischus humilis*	LC	Euphorbiaceae	*Euphorbia rhombifolia*	LC	Scrophulariaceae	*Nemesia sp.*	
Cyperaceae	***Afroscirpoides dioeca*** **[d]**	**LC**	Euphorbiaceae	*Euphorbia sp.*		Rubiaceae	*Nenax microphylla*	LC
Poaceae	*Agrostis lachnantha var. lachnantha*	LC	Euphorbiaceae	*Euphorbia spartaria*	LC	Apiaceae	*Notobubon laevigatum*	LC
Aizoaceae	*Aizoon glinoides*	LC	Euphorbiaceae	*Euphorbia stellispina*	LC	Asteraceae	*Oedera glandulosa*	
Aizoaceae	*Aizoon rigidum*	LC	Euphorbiaceae	*Euphorbia stolonifera*	LC	Asteraceae	*Oedera humilis*	
Hyacinthaceae	*Albuca exuviata*	LC	Asteraceae	*Euryops anthemoides subsp. anthemoides*	LC	Asteraceae	*Oedera oppositifolia*	
Hyacinthaceae	*Albuca namaquensis*	LC	Asteraceae	*Euryops cuneatus*	LC	Asteraceae	*Oedera spinescens*	
Hyacinthaceae	*Albuca setosa*	LC	Asteraceae	*Euryops empetrifolius*	LC	Ophioglossaceae	*Ophioglossum polyphyllum var. polyphyllum*	LC
Hyacinthaceae	*Albuca unifolia*	LC	Asteraceae	*Euryops imbricatus*	LC	Cactaceae	*Opuntia elata* (NEM:BA)	
Asphodelaceae	**Aloe broomii var. broomii*	LC	Asteraceae	*Euryops lateriflorus*	LC	Cactaceae	*Opuntia ficus-indica* (NEM:BA)	NE
Asphodelaceae	**Aloe claviflora*	LC	Asteraceae	*Euryops oligoglossus subsp. oligoglossus*	LC	Cactaceae	*Opuntia microdasys* (NEM:BA)	NE
Asphodelaceae	**Aloe humilis*	LC	Asteraceae	*Euryops subcarnosus subsp. vulgaris*	LC	Hyacinthaceae	*Ornithogalum comptonii*	LC
Aizoaceae	*Aloinopsis rosulata*	LC	Asteraceae	*Euryops trifidus*	LC	Hyacinthaceae	*Ornithogalum flexuosum*	LC
Lythraceae	*Ammannia anagalloides*		Asteraceae	*Felicia fascicularis*	LC	Hyacinthaceae	*Ornithogalum hispidum subsp. hispidum*	LC
Anacampserotaceae	****Anacampseros albidiflora*** **[c]**	**LC**	Asteraceae	*Felicia filifolia subsp. bodkinii*	LC	Colchicaceae	*Ornithoglossum vulgare*	LC
Anacampserotaceae	**Anacampseros arachnoides*	LC	Asteraceae	*Felicia filifolia subsp. filifolia*	LC	**Poaceae**	***Oropetium capense*** **[bc]**	**LC**
Anacampserotaceae	**Anacampseros filamentosa subsp. filamentosa*		Asteraceae	*Felicia hirsuta*	LC	Asteraceae	*Osteospermum calendulaceum*	LC
Anacampserotaceae	****Anacampseros ustulata*** **[c]**	**LC**	Asteraceae	*Felicia hyssopifolia subsp. polyphylla*	LC	Asteraceae	*Osteospermum microphyllum*	LC

Boraginaceae	*Anchusa riparia*	LC	Asteraceae	*Felicia muricata subsp. muricata*	LC	Asteraceae	*Osteospermum muricatum subsp. muricatum*	LC
Malvaceae	*Anisodontea anomala*	LC	Asteraceae	*Felicia namaquana*	LC	Asteraceae	*Osteospermum scariosum var. integrifolium*	NE
Malvaceae	*Anisodontea malvastroides*	LC	Asteraceae	*Felicia ovata*	LC	Asteraceae	*Osteospermum scariosum var. scariosum*	NE
Malvaceae	*Anisodontea triloba*	LC	Asteraceae	*Felicia sp.*		Asteraceae	*Osteospermum sinuatum var. sinuatum*	LC
Rubiaceae	*Anthospermum dregei subsp. dregei*	LC	Poaceae	*Festuca scabra*	LC	Asteraceae	*Othonna eriocarpa*	LC
Rubiaceae	*Anthospermum rigidum subsp. rigidum*	LC	Poaceae	*Fingerhuthia africana*	LC	Asteraceae	*Othonna furcata*	LC
Rubiaceae	*Anthospermum sp.*		Poaceae	*Fingerhuthia sesleriiformis*	LC	Asteraceae	*Othonna pavonia*	LC
Rubiaceae	*Anthospermum spathulatum subsp. spathulatum*	LC	Urticaceae	*Forsskaolea candida*	LC	Asteraceae	*Othonna sp.*	
Aizoaceae	*Antimima sp.*		Frankeniaceae	*Frankenia pulverulenta*	LC	Oxalidaceae	*Oxalis pes-caprae var. pes-caprae*	LC
Scrophulariaceae	*Aptosimum indivisum*	LC	Cyperaceae	*Fuirena coerulescens*	LC	Oxalidaceae	*Oxalis psilopoda*	LC
Scrophulariaceae	*Aptosimum marlothii*	LC	**Aizoaceae**	***Galenia africana*** [a]	**LC**	Oxalidaceae	*Oxalis smithiana*	LC
Scrophulariaceae	*Aptosimum procumbens*	LC	Aizoaceae	*Galenia glandulifera*	LC	Poaceae	*Panicum maximum*	LC
Scrophulariaceae	***Aptosimum spinescens*** [ab]	**LC**	Aizoaceae	*Galenia papulosa*	LC	Thymelaeaceae	*Passerina corymbosa*	LC
Asteraceae	*Arctotis arctotoides*	LC	Aizoaceae	*Galenia procumbens*	LC	Asteraceae	*Pegolettia retrofracta*	LC
Asteraceae	*Arctotis dregei*	LC	Aizoaceae	*Galenia sarcophylla*	LC	Geraniaceae	*Pelargonium abrotanifolium*	LC
Asteraceae	*Arctotis leiocarpa*	LC	Rubiaceae	*Galium capense subsp. capense*	LC	**Geraniaceae**	***Pelargonium aridum*** [c]	**LC**
Asteraceae	*Arctotis microcephala*	LC	Rubiaceae	*Galium capense subsp. garipense*	LC	Geraniaceae	*Pelargonium glutinosum*	LC
Asteraceae	*Arctotis subacaulis*	LC	Rubiaceae	*Galium tomentosum*	LC	Geraniaceae	*Pelargonium griseum*	LC
Asteraceae	*Arctotis venusta*	LC	Asteraceae	*Garuleum bipinnatum*	LC	Geraniaceae	*Pelargonium grossularioides*	LC
Papaveraceae	***Argemone ochroleuca subsp. ochroleuca*** [d]	**NE**	Asphodelaceae	*Gasteria disticha var. disticha*		Geraniaceae	*Pelargonium laxum subsp. karooicum*	
Fabaceae	*Argyrolobium argenteum*	LC	Asphodelaceae	*Gasteria disticha var. robusta*		Geraniaceae	*Pelargonium laxum subsp. laxum*	LC
Fabaceae	*Argyrolobium sp.*		Asphodelaceae	*Gasteria sp.*		Geraniaceae	*Pelargonium malacoides*	
Poaceae	*Aristida adscensionis*	LC	Asteraceae	*Gazania ciliaris*	LC	Geraniaceae	*Pelargonium multicaule subsp. multicaule*	LC
Poaceae	***Aristida congesta subsp. congesta*** [abc]	**LC**	Asteraceae	*Gazania heterochaeta*	LC	Geraniaceae	*Pelargonium ramosissimum*	LC
Poaceae	*Aristida diffusa subsp. burkei*	LC	Asteraceae	*Gazania krebsiana*		Geraniaceae	*Pelargonium ribifolium*	LC
Poaceae	***Aristida diffusa subsp. diffusa*** [bcd]	**LC**	Asteraceae	*Gazania krebsiana subsp. arctotoides*	LC	Geraniaceae	*Pelargonium senecioides*	LC
Poaceae	*Aristida engleri var. engleri*	LC	**Asteraceae**	***Gazania krebsiana subsp. krebsiana*** [d]	**LC**	Geraniaceae	*Pelargonium sessiliflorum*	
Poaceae	*Aristida junciformis subsp. junciformis*	LC	Asteraceae	*Gazania krebsiana subsp. serrulata*	LC	Geraniaceae	*Pelargonium sidoides*	LC
Poaceae	*Aristida sp.*		Asteraceae	*Gazania lichtensteinii*	LC	Geraniaceae	*Pelargonium tetragonum*	LC
Asparagaceae	*Asparagus aethiopicus*	LC	Asteraceae	*Gazania sp.*		**Geraniaceae**	***Pelargonium tragacanthoides*** [c]	**LC**
Asparagaceae	***Asparagus burchellii*** [abcd]	**LC**	Asteraceae	*Geigeria filifolia*	LC	Scrophulariaceae	*Peliostomum leucorrhizum*	LC
Asparagaceae	*Asparagus capensis var. capensis*	LC	Asteraceae	*Geigeria ornativa subsp. ornativa*	LC	**Pteridaceae**	***Pellaea calomelanos var. calomelanos*** [b]	**LC**
Asparagaceae	*Asparagus exuvialis*	LC	Geraniaceae	*Geranium dregei*	LC	Poaceae	*Pentameris airoides subsp. jugorum*	LC
Asparagaceae	*Asparagus laricinus*	LC	Geraniaceae	*Geranium harveyi*	LC	Asteraceae	*Pentzia calcarea*	LC
Asparagaceae	*Asparagus lignosus*	LC	Asteraceae	*Gerbera piloselloides*	LC	**Asteraceae**	***Pentzia globosa*** [ad]	**LC**
Asparagaceae	*Asparagus mucronatus*	LC	Amaryllidaceae	**Gethyllis longistyla*	LC	Asteraceae	*Pentzia incana*	LC
Asparagaceae	***Asparagus retrofractus*** [a]	**LC**	Amaryllidaceae	**Gethyllis villosa*	LC	Asteraceae	*Pentzia lanata*	LC

Asparagaceae	*Asparagus sp.*		Gisekiaceae	*Gisekia pharnaceoides var. pharnaceoides*	LC	Asteraceae	*Pentzia punctata*	LC
Asparagaceae	***Asparagus striatus*** [b]	**LC**	Iridaceae	**Gladiolus permeabilis subsp. permeabilis*	LC	**Asteraceae**	***Pentzia quinquefida*** [b]	**LC**
Asparagaceae	*Asparagus suaveolens*	LC	Asteraceae	*Gnaphalium capense*	LC	Polygonaceae	*Persicaria lapathifolia*	
Aspleniaceae	*Asplenium adiantum-nigrum var. adiantum-nigrum*	LC	Thymelaeaceae	*Gnidia meyeri*	LC	Poaceae	*Phalaris minor*	NE
Aspleniaceae	*Asplenium cordatum*	LC	Apocynaceae	**Gomphocarpus filiformis*	LC	Poaceae	*Phragmites australis*	LC
Aspleniaceae	*Asplenium trichomanes subsp. quadrivalens*	LC	Apocynaceae	**Gomphocarpus fruticosus subsp. fruticosus*	LC	Rhamnaceae	*Phylica purpurea*	
Asphodelaceae	*Astroloba foliolosa*	LC	**Apocynaceae**	****Gomphocarpus tomentosus subsp. tomentosus*** [b]	**LC**	Asteraceae	*Phymaspermum parvifolium*	LC
Asteraceae	*Athanasia microcephala*	LC	Asteraceae	*Gorteria alienata*		Asteraceae	*Phymaspermum thymelaeoides*	
Amaranthaceae	*Atriplex lindleyi subsp. inflata*		**Malvaceae**	***Grewia robusta*** [b]	**LC**	Apocynaceae	**Piaranthus comptus*	LC
Amaranthaceae	*Atriplex nummularia subsp. nummularia* (NEM:BA)		Achariaceae	*Guthriea capensis*	LC	Apocynaceae	**Piaranthus geminatus subsp. geminatus*	LC
Amaranthaceae	*Atriplex semibaccata*		**Celastraceae**	***Gymnosporia buxifolia*** [bd]	**LC**	Aizoaceae	*Plinthus karooicus*	LC
Bruniaceae	*†*Audouinia esterhuyseniae*	VU	Amaryllidaceae	**Haemanthus humilis subsp. humilis*	LC	**Caryophyllaceae**	***Pollichia campestris*** [b]	**LC**
Acanthaceae	*Barleria stimulans*	LC	Asphodelaceae	**Haworthia marumiana var. marumiana*	NE	Polygalaceae	*Polygala ephedroides*	LC
Asteraceae	*Berkheya carlinifolia*		Asphodelaceae	**Haworthia semiviva*	LC	Polygalaceae	*Polygala leptophylla var. leptophylla*	LC
Asteraceae	*Berkheya glabrata*	LC	Asphodelaceae	*Haworthiopsis fasciata*		Polygalaceae	*Polygala sp.*	
Apiaceae	*Berula thunbergii*	LC	Asphodelaceae	*Haworthiopsis nigra var. diversifolia*		Poaceae	*Polypogon monspeliensis*	NE
Acanthaceae	***Blepharis capensis*** [bd]	**LC**	Asphodelaceae	*Haworthiopsis nigra var. nigra*		Poaceae	*Polypogon sp.*	
Acanthaceae	*Blepharis mitrata*	LC	Asphodelaceae	*Haworthiopsis tessellata*		Poaceae	*Polypogon viridis*	NE
Nyctaginaceae	*Boerhavia cordobensis*		**Asphodelaceae**	***Haworthiopsis tessellata var. tessellata*** [c]	**LC**	Salicaceae	*Populus nigra var. italica*	
Amaryllidaceae	****Boophone disticha*** [b]	**LC**	Asphodelaceae	*Haworthiopsis tessellata var. tessellata* [c]		Fabaceae	*Prosopis chilensis*	NE
Poaceae	*Bromus catharticus*	NE	Scrophulariaceae	*Hebenstretia parviflora*	LC	Fabaceae	*Prosopis glandulosa var. glandulosa*	NE
Scrophulariaceae	*Buddleja glomerata*	LC	Scrophulariaceae	*Hebenstretia robusta*	LC	**Fabaceae**	***Prosopis glandulosa var. torreyana*** (NEM:BA)[d]	**NE**
Scrophulariaceae	*Buddleja salviifolia*	LC	Scrophulariaceae	*Hebenstretia sp.*		Fabaceae	*Prosopis velutina* (NEM:BA)	NE
Asphodelaceae	*Bulbine abyssinica*	LC	Asteraceae	*Helichrysum asperum var. appressifolium*	LC	Asteraceae	*Pseudognaphalium luteoalbum*	LC
Asphodelaceae	*Bulbine frutescens*	LC	Asteraceae	*Helichrysum caespititium*	LC	Asteraceae	*Pseudognaphalium undulatum*	LC
Asphodelaceae	*Bulbine lagopus*	LC	Asteraceae	*Helichrysum dregeanum*	LC	Cyperaceae	*Pseudoschoenus inanis*	LC
Asphodelaceae	*Bulbine narcissifolia*	LC	Asteraceae	*Helichrysum hamulosum*	LC	Asteraceae	*Pteronia adenocarpa*	LC
Asphodelaceae	*Bulbine sp.*		Asteraceae	*Helichrysum lineare*	LC	Asteraceae	*Pteronia bolusii*	LC
Asphodelaceae	*Bulbine triebneri*	LC	Asteraceae	*Helichrysum lucilioides*	LC	**Asteraceae**	***Pteronia empetrifolia*** [d]	**LC**
Cyperaceae	*Bulbostylis humilis*	LC	Asteraceae	*Helichrysum pumilio subsp. pumilio*	LC	Asteraceae	*Pteronia hutchinsoniana*	LC
Capparaceae	*Cadaba aphylla*	LC	Asteraceae	*Helichrysum rugulosum*	LC	**Asteraceae**	***Pteronia incana*** [b]	**LC**
Fabaceae	***Calobota spinescens*** [ad]	**LC**	Asteraceae	*Helichrysum scitulum*	LC	Asteraceae	*Pteronia membranacea*	LC
Poaceae	*Capeochloa arundinacea*	LC	Asteraceae	*Helichrysum sp.*		Asteraceae	*Pteronia stoehelinoides*	LC
Asteraceae	*Caputia tomentosa*	LC	Asteraceae	*Helichrysum trilineatum*	LC	Asteraceae	*Pteronia viscosa*	LC

Apocynaceae	*Carissa bispinosa*	LC	**Asteraceae**	***Helichrysum zeyheri*** [b]	**LC**	Malvaceae	*Radyera urens*	LC
Poaceae	***Cenchrus ciliaris*** [ad]	**LC**	Brassicaceae	*Heliophila carnosa*	LC	Ranunculaceae	*Ranunculus multifidus*	LC
Poaceae	*Cenchrus setaceus*	NE	Brassicaceae	*Heliophila crithmifolia*	LC	Ranunculaceae	*Ranunculus trichophyllus*	LC
Poaceae	*Cenchrus sphacelatus*	LC	Brassicaceae	*Heliophila minima*	LC	Asteraceae	*Relhania sp.*	
Caryophyllaceae	*Cerastium capense*	LC	Brassicaceae	*Heliophila suavissima*	LC	Rhamnaceae	*Rhamnus prinoides*	LC
Apocynaceae	*Ceropegia circinata*		Malvaceae	*Hermannia althaeifolia*	LC	**Bignoniaceae**	***Rhigozum obovatum*** [b]	**LC**
Apocynaceae	*Ceropegia stapeliiformis subsp. stapeliiformis*	LC	Malvaceae	*Hermannia burkei*	LC	Bignoniaceae	*Rhigozum trichotomum*	LC
Scrophulariaceae	*Chaenostoma halimifolium*	LC	Malvaceae	*Hermannia cernua*	LC	Zygophyllaceae	*Roepera incrustata*	
Scrophulariaceae	*Chaenostoma macrosiphon*	LC	Malvaceae	*Hermannia coccocarpa*	LC	Zygophyllaceae	*Roepera lichtensteiniana*	
Scrophulariaceae	*Chaenostoma pauciflorum*	LC	Malvaceae	*Hermannia comosa*	LC	Iridaceae	*Romulea atrandra var. esterhuyseniae*	LC
Scrophulariaceae	*Chaenostoma rotundifolium*	LC	Malvaceae	*Hermannia cuneifolia var. cuneifolia*	LC	Iridaceae	*Romulea macowanii var. macowanii*	LC
Scrophulariaceae	*Chaenostoma sp.*		Malvaceae	*Hermannia cuneifolia var. glabrescens*	LC	Rosaceae	*Rubus ludwigii subsp. ludwigii*	LC
Verbenaceae	***Chascanum pinnatifidum var. pinnatifidum*** [b]	**LC**	Malvaceae	*Hermannia desertorum*	LC	**Aizoaceae**	***Ruschia intricata*** [bc]	**LC**
Verbenaceae	*Chascanum pumilum*	LC	Malvaceae	*Hermannia filifolia var. grandicalyx*	NE	Aizoaceae	*Ruschia sp.*	
Aizoaceae	*Chasmatophyllum musculinum*	LC	**Malvaceae**	***Hermannia flammula*** [b]	**LC**	Aizoaceae	*Ruschia spinosa*	LC
Pteridaceae	***Cheilanthes eckloniana*** [bc]	**LC**	Malvaceae	*Hermannia grandiflora*	LC	Amaranthaceae	*Salsola aphylla*	LC
Pteridaceae	*Cheilanthes hirta var. brevipilosa forma laxa*		Malvaceae	*Hermannia pulchella*	LC	Amaranthaceae	*Salsola atrata*	LC
Pteridaceae	*Cheilanthes hirta var. hirta*	LC	Malvaceae	*Hermannia spinosa*	LC	Amaranthaceae	*Salsola dealata*	LC
Pteridaceae	*Cheilanthes induta*	LC	Malvaceae	*Hermannia stricta*	LC	Amaranthaceae	*Salsola kali* (NEM:BA)	
Gentianaceae	*Chironia palustris subsp. palustris*	LC	**Malvaceae**	***Hermannia vestita*** [abcd]	**LC**	Amaranthaceae	*Salsola minutifolia*	LC
Poaceae	*Chloris virgata*	LC	Asteraceae	*Hertia ciliata*	LC	Amaranthaceae	*Salsola rabieana*	LC
Asteraceae	***Chrysocoma ciliata*** [ad]	**LC**	Apiaceae	*Heteromorpha arborescens var. arborescens*	LC	Amaranthaceae	*Salsola seminuda*	LC
Asteraceae	*Chrysocoma sp.*		**Poaceae**	***Heteropogon contortus*** [b]	**LC**	Lamiaceae	*Salvia disermas*	LC
Asteraceae	*Cineraria aspera*	LC	Malvaceae	*Hibiscus pusillus*	LC	Lamiaceae	*Salvia stenophylla*	
Asteraceae	*Cineraria mollis*	LC	Malvaceae	*Hibiscus trionum*		Lamiaceae	*Salvia verbenaca*	LC
Menispermaceae	***Cissampelos capensis*** [a]	**LC**	Orchidaceae	*Holothrix villosa var. villosa*	LC	Dipsacaceae	*Scabiosa columbaria*	LC
Ranunculaceae	*Clematis brachiata*	LC	Poaceae	*Hordeum murinum subsp. glaucum*	NE	Poaceae	*Schismus barbatus*	LC
Rosaceae	*Cliffortia crenata*	LC	Poaceae	*Hordeum murinum subsp. leporinum*	NE	Aizoaceae	*Schlechteranthus spinescens*	
Peraceae	*Clutia sp.*		Apocynaceae	*Huernia barbata subsp. barbata*	LC	Cyperaceae	*Schoenoxiphium sp.*	
Peraceae	*Clutia thunbergii*	LC	Apocynaceae	*Huernia thuretii*	LC	Caryophyllaceae	*Scleranthus sp.*	
Colchicaceae	*Colchicum melanthioides*		Poaceae	*Hyparrhenia hirta*	LC	**Anacardiaceae**	***Searsia burchellii*** [ab]	**LC**
Colchicaceae	*Colchicum melanthioides subsp. transvaalense*	LC	**Asteraceae**	***Ifloga glomerata*** [a]	**LC**	**Anacardiaceae**	***Searsia lancea*** [d]	**LC**
Colchicaceae	*Colchicum striatum*	LC	Fabaceae	*Indigastrum niveum*		Anacardiaceae	*Searsia pallens*	LC
Convolvulaceae	*Convolvulus sagittatus*	LC	Fabaceae	*Indigofera alternans*		Anacardiaceae	*Searsia pyroides var. pyroides*	LC
Asteraceae	*Conyza scabrida*		Fabaceae	*Indigofera alternans var. alternans*	LC	Anacardiaceae	*Searsia undulata*	LC
Asteraceae	*Cotula microglossa*	LC	Fabaceae	*Indigofera heterophylla*	LC	Gentianaceae	*Sebaea sp.*	
Crassulaceae	*Cotyledon cuneata*	LC	Fabaceae	*Indigofera meyeriana*	LC	**Scrophulariaceae**	***Selago albida*** [b]	**LC**
Crassulaceae	*Cotyledon orbiculata var. oblonga*	LC	Fabaceae	*Indigofera sessilifolia*	LC	Scrophulariaceae	*Selago centralis*	LC
Crassulaceae	*Cotyledon orbiculata var. orbiculata*	LC	**Fabaceae**	***Indigofera setiflora*** [b]	**LC**	Scrophulariaceae	*Selago magnakarooica*	LC

Crassulaceae	*Cotyledon papillaris*	LC	Cyperaceae	*Isolepis angelica*	LC	Scrophulariaceae	*Selago saxatilis*	LC
Crassulaceae	*Cotyledon sp.*		Cyperaceae	*Isolepis cernua var. cernua*	LC	Scrophulariaceae	*Selago sp.*	
Crassulaceae	*Crassula barbata subsp. barbata*	LC	Cyperaceae	*Isolepis setacea*	LC	Asteraceae	*Senecio achilleifolius*	LC
Crassulaceae	*Crassula capitella subsp. thyrsiflora*	LC	Iridaceae	**Ixia marginifolia*	LC	Asteraceae	*Senecio angustifolius*	LC
Crassulaceae	***Crassula corallina subsp. corallina*** [c]	**LC**	Scrophulariaceae	*Jamesbrittenia atropurpurea*		Asteraceae	*Senecio asperulus*	LC
Crassulaceae	*Crassula expansa subsp. expansa*	LC	**Scrophulariaceae**	***Jamesbrittenia atropurpurea subsp. atropurpurea*** [d]	**LC**	Asteraceae	*Senecio burchellii*	LC
Crassulaceae	*Crassula montana subsp. quadrangularis*	LC	Scrophulariaceae	*Jamesbrittenia sp.*		Asteraceae	*Senecio cordifolius*	LC
Crassulaceae	***Crassula muscosa*** [c]	**LC**	Scrophulariaceae	*Jamesbrittenia tysonii*	LC	Asteraceae	*Senecio cotyledonis*	LC
Crassulaceae	*Crassula muscosa var. muscosa*	NE	Juncaceae	*Juncus acutus subsp. leopoldii*	LC	Asteraceae	*Senecio hastatus*	LC
Crassulaceae	*Crassula natans*		Juncaceae	*Juncus exsertus*	LC	Asteraceae	*Senecio inaequidens*	LC
Crassulaceae	*Crassula pubescens subsp. pubescens*	LC	Juncaceae	*Juncus inflexus*	LC	Asteraceae	*Senecio muirii*	LC
Crassulaceae	*Crassula rupestris subsp. rupestris*	LC	Juncaceae	*Juncus scabriusculus*	LC	Asteraceae	*Senecio pinnulatus*	LC
Crassulaceae	*Crassula socialis*	LC	**Acanthaceae**	***Justicia incana*** [d]	**LC**	**Amaranthaceae**	***Sericocoma avolans*** [b]	**LC**
Crassulaceae	*Crassula tetragona subsp. tetragona*	LC	Acanthaceae	*Justicia incana* [d]		Poaceae	*Setaria sphacelata var. torta*	LC
Crassulaceae	*Crassula tomentosa var. tomentosa*	LC	Acanthaceae	*Justicia spartioides*		Poaceae	*Setaria verticillata*	LC
Scrophulariaceae	*Cromidon decumbens*	LC	**Cucurbitaceae**	***Kedrostis capensis*** [d]	**LC**	Caryophyllaceae	*Silene burchellii subsp. modesta*	LC
Cucurbitaceae	*Cucumis africanus*	LC	Kewaceae	*Kewa salsoloides*	LC	Caryophyllaceae	*Silene burchellii subsp. pilosellifolia*	
Cucurbitaceae	*Cucumis zeyheri*	LC	Achariaceae	*Kiggelaria africana*	LC	Caryophyllaceae	*Silene undulata*	
Asteraceae	*Curio articulatus*	LC	**Asteraceae**	***Kleinia longiflora*** [b]	**LC**	Solanaceae	*Solanum capense*	LC
Asteraceae	*Curio radicans*	LC	Hyacinthaceae	**Lachenalia aurioliae*	LC	Solanaceae	*Solanum retroflexum*	LC
Asteraceae	*Cuspidia cernua subsp. annua*	LC	Santalaceae	*Lacomucinaea lineata*		Solanaceae	*Solanum tomentosum* [a]	
Araliaceae	*Cussonia paniculata subsp. paniculata*	LC	Asteraceae	*Lactuca inermis*	LC	**Solanaceae**	***Solanum tomentosum*** [a]	**LC**
Cactaceae	*Cylindropuntia fulgida*		Verbenaceae	*Lantana rugosa*	LC	Asteraceae	*Sonchus dregeanus*	LC
Cactaceae	*Cylindropuntia imbricata* (NEM:BA)		Thymelaeaceae	*Lasiosiphon deserticola*	LC	Poaceae	*Sporobolus fimbriatus*	LC
Cactaceae	*Cylindropuntia pallida* (NEM:BA)		Thymelaeaceae	*Lasiosiphon polycephalus*	LC	Poaceae	*Sporobolus ioclados*	LC
Poaceae	*Cymbopogon dieterlenii*	LC	Thymelaeaceae	*Lasiosiphon sp.*		Poaceae	*Sporobolus tenellus*	LC
Poaceae	*Cymbopogon prolixus*	LC	Lamiaceae	*Leonotis ocymifolia*	LC	Lamiaceae	*Stachys cuneata*	LC
Poaceae	*Cynodon dactylon*	LC	Poaceae	*Leptochloa fusca*	LC	Lamiaceae	*Stachys dregeana*	LC
Poaceae	*Cynodon incompletus*	LC	Fabaceae	*Lessertia annularis*	LC	Lamiaceae	*Stachys linearis*	LC
Cyperaceae	***Cyperus*** [bc]		Fabaceae	*Lessertia frutescens subsp. frutescens*	LC	Lamiaceae	*Stachys rugosa*	LC
Cyperaceae	*Cyperus longus var. tenuiflorus*	NE	Fabaceae	*Lessertia frutescens subsp. microphylla*	LC	Apocynaceae	*†*Stapelia engleriana*	DD
Cyperaceae	*Cyperus marginatus*	LC	Fabaceae	*Lessertia inflata*	LC	Apocynaceae	**Stapelia grandiflora var. grandiflora*	LC
Cyperaceae	*Cyperus textilis*	LC	Fabaceae	*Lessertia pauciflora*		Apocynaceae	**Stapelia olivacea*	LC
Cyperaceae	***Cyperus usitatus*** [bc]	**LC**	Asteraceae	*Leysera gnaphalodes*	LC	**Poaceae**	***Stipagrostis ciliata var. capensis*** [a]	**LC**
Aizoaceae	*Delosperma sp.*		Asteraceae	*Leysera tenella*	LC	**Poaceae**	***Stipagrostis namaquensis*** [d]	**LC**
Apiaceae	***Deverra denudata subsp. aphylla*** [d]	**LC**	Limeaceae	*Limeum aethiopicum var. aethiopicum*	NE	**Poaceae**	***Stipagrostis obtusa*** [ad]	**LC**
Caryophyllaceae	***Dianthus micropetalus*** [d]	**LC**	Scrophulariaceae	*Limosella grandiflora*	LC	Poaceae	*Stipagrostis uniplumis var. uniplumis*	LC
Caryophyllaceae	*Dianthus thunbergii forma thunbergii*	NE	Scrophulariaceae	*Limosella vesiculosa*	LC	Aizoaceae	*Stomatium sp.*	
Scrophulariaceae	**Diascia alonsooides*	LC	Boraginaceae	*Lithospermum scabrum*	LC	**Aizoaceae**	***Stomatium viride*** (WCE)[c]	**LC**
Scrophulariaceae	**Diascia capsularis*	LC	Lobeliaceae	*Lobelia dregeana*	LC	**Amaryllidaceae**	****Strumaria tenella subsp. orientalis*** [c]	**LC**

Asteraceae	*Dicerothamnus rhinocerotis*		Lobeliaceae	*Lobelia sp.*		Iridaceae	**Syringodea concolor*	LC
Fabaceae	*Dichilus gracilis*	LC	Lobeliaceae	*Lobelia thermalis*	LC	Talinaceae	*Talinum caffrum*	LC
Asteraceae	***Dicoma capensis*** [a]	**LC**	Boraginaceae	*Lobostemon stachydeus*	LC	Asteraceae	*Taraxacum officinale*	
Asteraceae	*Dicoma picta*	LC	Fabaceae	*Lotononis azureoides*	LC	Asteraceae	*Tarchonanthus minor*	LC
Poaceae	*Digitaria argyrograpta*	LC	Fabaceae	*Lotononis caerulescens*	LC	Poaceae	*Tenaxia disticha*	
Poaceae	***Digitaria eriantha*** [b]	**LC**	Fabaceae	*Lotononis fruticoides*	LC	Cactaceae	*Tephrocactus articulatus* (NEM:BA)	
Asteraceae	*Dimorphotheca cuneata*	LC	Fabaceae	*Lotononis tenella*	LC	Zygophyllaceae	*Tetraena chrysopteros*	
Asteraceae	*Dimorphotheca sp.*		Solanaceae	*Lycium cinereum*	LC	Zygophyllaceae	*Tetraena microcarpa*	
Ebenaceae	*Diospyros austroafricana var. austroafricana*	LC	**Solanaceae**	***Lycium ferocissimum*** [a]	**LC**	**Zygophyllaceae**	***Tetraena retrofracta*** [d]	**LC**
Ebenaceae	*Diospyros austroafricana var. microphylla*	LC	Solanaceae	*Lycium hirsutum*	LC	Aizoaceae	*Tetragonia arbuscula*	LC
Ebenaceae	***Diospyros lycioides subsp. lycioides*** [d]	**LC**	Solanaceae	*Lycium horridum*	LC	Aizoaceae	*Tetragonia spicata*	LC
Hyacinthaceae	*Dipcadi viride*	LC	Solanaceae	*Lycium pumilum*	LC	Lamiaceae	*Teucrium africanum*	LC
Hyacinthaceae	*Drimia intricata*	LC	Solanaceae	*Lycium schizocalyx*	LC	Lamiaceae	*Teucrium trifidum*	LC
Hyacinthaceae	*Drimia sp.*		Aizoaceae	*Malephora thunbergii*	LC	**Poaceae**	***Themeda triandra*** [b]	**LC**
Aizoaceae	*Drosanthemum hispidum*	LC	Malvaceae	*Malva pusilla*		**Santalaceae**	***Thesium hystrix*** [d]	**LC**
Aizoaceae	*Drosanthemum lique*	LC	Asteraceae	*Mantisalca salmantica*		Santalaceae	*†Thesium sonderianum*	DD
Aizoaceae	*Drosanthemum sp.*		Marsileaceae	*Marsilea burchellii*	LC	Pottiaceae	*Tortula atrovirens*	
Aizoaceae	*Drosanthemum vespertinum*	LC	Hyacinthaceae	*Massonia echinata*	LC	Asphodelaceae	*Trachyandra acocksii*	LC
Apocynaceae	**Duvalia maculata*	LC	Fabaceae	*Medicago laciniata var. laciniata*	NE	Asphodelaceae	*Trachyandra jacquiniana*	LC
Amaranthaceae	***Dysphania carinata*** [d]	**NE**	Melianthaceae	*Melianthus comosus*	LC	**Poaceae**	***Tragus koelerioides*** [b]	**LC**
Amaranthaceae	*Dysphania schraderiana*		**Poaceae**	***Melica decumbens*** [c]	**LC**	Poaceae	*Tragus racemosus*	LC
Boraginaceae	*Ehretia rigida subsp. rigida*	LC	Poaceae	*Melica racemosa*	LC	Aizoaceae	*Trianthema parvifolia var. parvifolia*	LC
Poaceae	*Ehrharta calycina*	LC	**Poaceae**	***Melinis nerviglumis*** [b]	**LC**	Poaceae	*Tribolium purpureum*	LC
Poaceae	*Ehrharta erecta var. erecta*	LC	Poaceae	*Melinis repens subsp. grandiflora*	LC	**Zygophyllaceae**	***Tribulus terrestris*** [a]	**LC**
Poaceae	*Ehrharta erecta var. natalensis*	LC	Poaceae	*Melinis repens subsp. repens*	LC	**Boraginaceae**	***Trichodesma africanum*** [b]	**LC**
Hypoxidaceae	***Empodium*** [c]		**Fabaceae**	***Melolobium candicans*** [abd]	**LC**	Aizoaceae	*Trichodiadema barbatum*	LC
Hypoxidaceae	*Empodium flexile*	LC	Fabaceae	*Melolobium canescens*	LC	Aizoaceae	*Trichodiadema intonsum*	LC
Hypoxidaceae	*Empodium gloriosum*	LC	Fabaceae	*Melolobium microphyllum*	LC	**Aizoaceae**	***Trichodiadema pomeridianum*** [c]	**LC**
Poaceae	*Enneapogon desvauxii*	LC	Fabaceae	*Melolobium sp.*		Aizoaceae	*Trichodiadema setuliferum*	LC
Poaceae	*Enneapogon scaber*	LC	Lamiaceae	*Mentha longifolia subsp. capensis*	LC	Aizoaceae	*Trichodiadema sp.*	
Poaceae	***Enneapogon scoparius*** [b]	**LC**	Aizoaceae	*Mesembryanthemum articulatum*		Apocynaceae	**Tridentea jucunda*	LC
Poaceae	***Eragrostis bergiana*** [d]	**LC**	Aizoaceae	*Mesembryanthemum coriarium* [a]		Poaceae	*Trisetopsis hirtula*	
Poaceae	*Eragrostis bicolor*	LC	**Aizoaceae**	***Mesembryanthemum coriarium*** [a]	**LC**	Iridaceae	**Tritonia florentiae*	LC
Poaceae	*Eragrostis chloromelas*	LC	Aizoaceae	*Mesembryanthemum crystallinum*	LC	Iridaceae	**Tritonia laxifolia*	LC
Poaceae	*Eragrostis cilianensis*	LC	Aizoaceae	*Mesembryanthemum emarcidum*		Asteraceae	*Troglophyton capillaceum subsp. capillaceum*	LC
Poaceae	***Eragrostis curvula*** [b]	**LC**	Aizoaceae	*Mesembryanthemum excavatum*	LC	Crassulaceae	*Tylecodon reticulatus subsp. reticulatus*	LC
Poaceae	*Eragrostis homomalla*	LC	Aizoaceae	*Mesembryanthemum geniculiflorum*		Crassulaceae	*Tylecodon wallichii subsp. wallichii*	LC
Poaceae	***Eragrostis lehmanniana var. lehmanniana*** [abd]	**LC**	Aizoaceae	*Mesembryanthemum grossum*		Typhaceae	*Typha capensis*	LC
Poaceae	*Eragrostis obtusa*	LC	Aizoaceae	*Mesembryanthemum guerichianum*	LC	Poaceae	*Urochloa panicoides*	LC

Poaceae	*Eragrostis procumbens*	LC	Aizoaceae	*Mesembryanthemum inachabense*	LC	Asteraceae	*Ursinia nana subsp. nana*	LC
Asteraceae	*Eriocephalus africanus var. paniculatus*	LC	Aizoaceae	*Mesembryanthemum noctiflorum subsp. noctiflorum*		Urticaceae	*Urtica dioica*	
Asteraceae	*Eriocephalus ericoides subsp. ericoides*	LC	Aizoaceae	*Mesembryanthemum noctiflorum subsp. stramineum*		Urticaceae	*Urtica lobulata*	LC
Asteraceae	*Eriocephalus eximius*	LC	Aizoaceae	*Mesembryanthemum stenandrum*	LC	Urticaceae	*Urtica urens*	
Asteraceae	*Eriocephalus microcephalus*	LC	Aizoaceae	*Mesembryanthemum tetragonum*		**Fabaceae**	***Vachellia karroo*** [ad]	**LC**
Asteraceae	***Eriocephalus pauperrimus*** [ab]	**LC**	Aizoaceae	*Mestoklema arboriforme*	LC	Hyacinthaceae	**Veltheimia capensis*	LC
Asteraceae	*Eriocephalus spinescens*	LC	Aizoaceae	*Mestoklema tuberosum*	LC	Plantaginaceae	*Veronica anagallis-aquatica*	LC
Asteraceae	*Eriocephalus tenuifolius*	LC	Apocynaceae	**Microloma armatum var. armatum*	LC	**Santalaceae**	***Viscum capense*** [a]	**LC**
Geraniaceae	*Erodium cicutarium*		Geraniaceae	*Monsonia salmoniflora*	LC	Santalaceae	*Viscum continuum*	LC
Orchidaceae	**Eulophia hians var. hians*	LC	Loranthaceae	*Moquiniella rubra*	LC	Santalaceae	*Viscum rotundifolium*	LC
Orchidaceae	**Eulophia hians var. nutans*	LC	Iridaceae	**Moraea ciliata subsp. ciliata*		Campanulaceae	*Wahlenbergia cernua*	LC
Asteraceae	*Eumorphia corymbosa*	LC	Iridaceae	**Moraea cookii*	LC	**Campanulaceae**	***Wahlenbergia nodosa*** [b]	**LC**
Euphorbiaceae	*Euphorbia braunsii*	LC	Iridaceae	**Moraea crispa*	LC	Campanulaceae	*Wahlenbergia sp.*	
Euphorbiaceae	*Euphorbia clavarioides*	LC	Iridaceae	**Moraea polystachya*	LC	Campanulaceae	*Wahlenbergia tenella var. tenella*	LC
Euphorbiaceae	*Euphorbia decepta*	LC	Iridaceae	**Moraea speciosa*	LC	Campanulaceae	*Wahlenbergia undulata*	LC
Euphorbiaceae	*Euphorbia hypogaea*	LC	Iridaceae	**Moraea unguiculata*	LC	Apocynaceae	**Xysmalobium gomphocarpoides var. gomphocarpoides*	LC
Euphorbiaceae	*Euphorbia inaequilatera*	LC	Polygalaceae	*Muraltia macrocarpa*	LC	Apocynaceae	**Xysmalobium gomphocarpoides var. parvilobum*	LC
Euphorbiaceae	*Euphorbia mauritanica*	LC	Scrophulariaceae	*Nemesia cynanchifolia*	LC	Scrophulariaceae	*Zaluzianskya venusta*	LC
Euphorbiaceae	*Euphorbia patula subsp. patula*		Scrophulariaceae	*Nemesia fruticans*	LC			
Euphorbiaceae	*Euphorbia pillansii*	LC	Scrophulariaceae	*Nemesia linearis*	LC			

11. Appendix 2: Abbreviated Curriculum Vitae of the Specialist

Personal Details:

- Name: Dr. Jan-Hendrik Keet
- Address: Somerset West, Western Cape, 7130
- Cell: 071 451 4853
- Email: keetjanhendrik@gmail.com
- Date of Birth: 07 November 1988

Expertise and Experience:

- Current: Freelance Academic/Technical Editor, Proof-reader, and Dissertation Specialist
- Current: Botanical Specialist
- Previous: Post-Doctoral Researcher – DST NRF Centre of Excellence for Invasion Biology (Department of Botany and Zoology), Stellenbosch University
- Specialization: Botany, Ecology, Geography, Invasive Plant Species, and Invasion Biology
- Years of experience: > 10 years
- Published in various, high-impact, national and international scientific journals

Skills and Competencies:

- Invasive Species Biology (PhD in Botany [Stellenbosch University] with a focus on Invasive Alien Plant Species and their environmental impacts)
- Plant Biogeography and Ecology
- Plant Identification and Taxonomy
- Vegetation Surveys and Mapping
- Biological Sciences
- Soil Microbiomes, Function, and Chemistry
- Geographic Information Systems (*GISB1500S, NQF level 5*)
- Research Data Management and Data Visualization
- Statistical Computing Methods (*R Statistical Computing Expert*)
- Experimental Design and Analysis

Global Scientific Influence:

- Research Interest Score 338.7
- Citations 389
- Scopus h-index 8
- Google Scholar h-index 10
- Google Scholar i10-index 11

Tertiary Education:

- 2015 – 2019: Stellenbosch University, Stellenbosch, South Africa. Doctor of Philosophy (Botany)

- 2013 – 2014: University of the Free State, Bloemfontein, South Africa. Magister Scientiae (Botany)
- 2012: University of the Free State, Bloemfontein, South Africa. Bachelor of Science Honours (Botany) - cum laude
- 2009 – 2011: University of the Free State, Bloemfontein, South Africa. Bachelor of Science (Chemistry with Physics and Biology) - *cum laude*

Employment History:

- 2015 – present: Botanical Specialist
- 2021 – present: Freelance Academic/Technical Editor, Proof-reader, and Dissertation Specialist
- 2019 – 2021: Post-Doctoral Researcher – Centre for Invasion Biology (Department of Botany and Zoology), Stellenbosch University
- 2011: Part-time demonstrator. Department of Plant Sciences, University of the Free State, Bloemfontein, South Africa
- 2010: Part-time lab assistant. Department of Chemistry, University of the Free State, Bloemfontein, South Africa
- 2007 – 2009: Shop Manager. Christian Tees, Brandwag Centre, Bloemfontein

Memberships, Certifications and Short Courses:

- SACNASP: Professional Natural Scientist (No.: 121678)
- The International Association for Vegetation Science (Membership No.: 1326737)
- SAGIC Invasive Species Consultant (Cape Town, South Africa), March 2016
- GIS Intermediate (NQF level 5): Hydrological modelling and terrain analysis using digital elevation models (University of the Free State, South Africa), 2014
- Project Management (Stellenbosch University), 2023
- Good Laboratory Practice seminar presented by Merck Millipore South Africa, 2012
- Laboratory Safety seminar presented by Merck Millipore South Africa, 2012
- Golden Key International Honour Society (Membership No.: 7564025)

Peer-reviewed Scientific Publications and Book Chapters:

- **Keet J-H**, Ellis AG, Hui C, Le Roux (in prep) Responses of soil bacterial communities to invasive Australian *Acacia* species over large spatial scales. In: Richardson DM & Le Roux JJ (Eds.) *Wattles: Australian acacias around the world*, *CAB International*.
- **Keet J-H**, Datta A, Foxcroft LC, Kumschick S, Wilson JRU, Nichols GR, Richardson DM (2022) Assessing the level of compliance with alien plant regulations in a large African protected area. *Biological Invasions* 24: 3831 – 3844, https://doi.org/10.1007/s10530-022-02883-7.
- Warrington S, Ellis AG, **Keet J-H**, Le Roux JJ (2022) How does familiarity in rhizobial interactions impact the performance of invasive and native legumes? *Neobiota* 72: 129 – 156, https://neobiota.pensoft.net/article/79620/.
- **Keet J-H** & Richardson, DM (2022) A rapid survey of naturalized and invasive eucalypt species in southwestern Limpopo, South Africa. *South African Journal of Botany* 144: 339 – 346, https://doi.org/10.1016/j.sajb.2021.09.008.
- Novoa A, Foxcroft LC, **Keet J-H**, Pyšek P, Le Roux JJ (2021) The invasive cactus *Opuntia stricta* creates fertility islands in African savannas and benefits from those

created by native trees. Scientific Reports 11: 20748, https://www.nature.com/articles/s41598-021-99857-x.

- **Keet J-H**, Ellis AG, Hui C, Novoa A, Le Roux JJ (2021) Impacts of invasive Australian acacias on soil bacterial community composition, microbial enzymatic activities, and nutrient availability in fynbos soils. *Microbial Ecology* 82: 704 – 721, http://dx.doi.org/10.1007/s00248-021-01683-1.
- **Keet J-H**, Robertson MP, Richardson DM (2020) *Alnus glutinosa* (Betulaceae) in South Africa: invasive potential and management options. *South African Journal of Botany* 135: 280 – 293, https://doi.org/10.1016/j.sajb.2020.09.009.
- Wilson JRU, Datta A, Hirsch H, **Keet J-H**, Mbobo T, Nkuna KV, Nsikani MM, Pyšek P, Richardson DM, Zengeya TA, Kumschick S (2020) Is invasion science moving towards agreed standards? The influence of selected frameworks. *NeoBiota*, 62: 569 – 590, https://doi.org/10.3897/neobiota.62.53243.
- Novoa A, **Keet J-H**, Lechuga-Lago Y, Pyšek P, Le Roux JJ (2020) Urbanization and *Carpobrotus edulis* invasion alter the diversity and composition of soil bacterial communities in coastal areas. FEMS Microbiology Ecology 96(7): fiaa106, https://doi.org/10.1093/femsec/fiaa106.
- Le Roux JJ, Leishman MR, Cinantya AP, Gufu GD, Hirsch H, **Keet J-H**, Manea A, Saul W-C, Tabassum S, Warrington S, Yannelli FA, Ossola A (2020) Plant biodiversity in the face of global change. *Current Biology* 30: R371 – R392, https://doi.org/10.1016/j.cub.2020.02.066.
- Hirsch H, Allsopp MH, Canavan S, Cheek M, Geerts S, Geldenhuys CJ, Harding G, Hurley BP, Jones W, **Keet J-H**, Klein H, Ruwanza S, van Wilgen BW, Wingfield MJ, Richardson DM (2019) *Eucalyptus camaldulensis* in South Africa – past, present, future. *Transactions of the Royal Society of South Africa* 75(1): 1 – 22, https://doi.org/10.1080/0035919X.2019.1669732.
- Le Roux JJ, Hui C, Castillo ML, Iriondo, JM, **Keet J-H**, Khapugin, AA, Médail F, Rejmánek M, Theron G, Yannelli FA, Hirsch H (2019) Recent anthropogenic plant extinctions differ in biodiversity hotspots and coldspots. *Current Biology* 29(17): 2912 – 2918, https://doi.org/10.1016/j.cub.2019.07.063.
- **Keet J-H**, Ellis AG, Hui C, Le Roux JJ (2019) Strong spatial and temporal turnover of soil bacterial communities in South Africa's hyperdiverse fynbos biome. *Soil Biology and Biochemistry* 136: 107541, https://doi.org/10.1016/j.soilbio.2019.107541.
- Le Roux JJ, Ellis AG, Van Zyl L-M, Hosking ND, **Keet J-H**, Yannelli F (2018) Importance of soil legacy effects and successful mutualistic interactions during Australian acacia invasions in nutrient-poor environments. *Journal of Ecology* 106(5): 2071 – 2081, https://doi.org/10.1111/1365-2745.1296.
- **Keet J-H**, Ellis AG, Hui C, Le Roux JJ (2017) Legume–rhizobium symbiotic promiscuity and effectiveness do not affect plant invasiveness. *Annals of Botany* 119(8): 1319 – 1331, https://doi.org/10.1093/aob/mcx028.
- Le Roux JJ, **Keet J-H**, Mutiti B, Ellis AG (2017) Cultivation may not dramatically alter rhizobial community diversity or structure associated with rooibos tea (*Aspalathus linearis* Burm.f.) in South Africa. *South African Journal of Botany* 110: 87-96, https://doi.org/10.1016/j.sajb.2017.01.014.
- Le Roux JJ, Hui C, **Keet J-H**, Ellis AG (2017) Co-introduction vs ecological fitting as pathways to the establishment of effective mutualisms during biological invasions. *New Phytologist* 215(4): 1354 – 1360, https://doi.org/10.1111/nph.14593.

- Nsikani M, Novoa A, Van Wilgen B, **Keet J-H**, Gaertner M (2017) *Acacia saligna*'s soil legacy effects persist up to ten years after clearing: Implications for ecological restoration. *Austral Ecology* 42(8): 880 – 889, https://doi.org/10.1111/aec.12515.
- Keet J-H, Cindi D, Du Preez PJ (2016) Assessing the invasiveness of *Berberis aristata* and *B. julianae* (Berberidaceae) in South Africa: management options and legal recommendations. *South African Journal of Botany* 105: 288 – 298, https://doi.org/10.1016/j.sajb.2016.04.012.

Conferences:

- 46th South African Association of Botanists conference (Qwa-Qwa, South Africa), January 2020, ***Alnus glutinosa* (L.) Gaertn. [Black Alder]: *an emerging invader in South Africa***
- International Association for Food Protection (IAFP; Louisville, Kentucky, USA), July 2019.
- Ecological Society of America Conference, (New Orleans, Louisiana, USA), August 2018 **Invasive legumes dramatically impact soil bacterial community structures but not function**
- Legumes for Life Workshop (Stellenbosch, South Africa), May 2018 **Legume-rhizobium symbiotic promiscuity and effectiveness do not affect plant invasiveness**
- Fynbos Forum Conference (Swellendam, South Africa), July 2017 **Assessing the impacts of invasive legumes on soil conditions and microbial community composition in a biodiversity hotspot**
- 43rd South African Association of Botanists Conference (Cape Town, South Africa), January 2017, **Legume-rhizobium symbiotic promiscuity and effectiveness do not affect plant invasiveness** *Best PhD presentation*
- 43rd Annual Research Symposium on the Management of Biological Invasions Conference (Worcester, South Africa), May 2016, **Legume-rhizobium symbiotic promiscuity does not determine plant invasiveness**
- Evolutionary dynamics of tree invasions: drivers, dimensions, and implications for management (Stellenbosch, South Africa), November 2015
- Neobiota: 8th International Conference on Biological Invasions (Antalya, Turkey), November 2014, **Assessing the threat and potential for management of Berberis spp. (Berberidaceae) in South Africa**
- 42nd Annual Symposium on the Management of Invasive Alien Plants (Karridene Beach Hotel, Durban, South Africa)
- XXth Association for the Taxonomic Study of the Flora of Tropical Africa International Conference (Stellenbosch, South Africa), January 2014
- 41st Annual Symposium on the Management of Invasive Alien Plants (Cape St. Francis, South Africa), May 2013

EIAs and other surveys:

- In collaboration with Nkurenkuru Ecology and Biodiversity, 2022. Full Botanical Assessment for the proposed development of wind energy facilities south of Bethal, Mpumalanga Province.
- In collaboration with Nkurenkuru Ecology and Biodiversity, 2021. Application (Expansion of mining footprint), and Final Basic Assessment and Environmental

Management Plan for the proposed sand mine expansion on Portion 4 of the Farm Zandberg Fontein 97, Western Cape Province.

- In collaboration with Nkurenkuru Ecology and Biodiversity, 2021. Proposed development of wind energy facilities on the farms Brussels, Driepoort (664-1 and 664-2), Kameelfontein, Lisbon, Nazareth, and Zwartkrans, near Vryburg, Northwest Province.
- In collaboration with Nkurenkuru Ecology and Biodiversity, 2021. Botanical Study and Assessment: Proposed development of wind energy facilities on the farm Kluitjieskraal, Loeriesfontein, Northern Cape Province.
- In collaboration with Nkurenkuru Ecology and Biodiversity, 2021. Botanical Study and Assessment: Proposed development of an access road to the authorised Sutherland 1 and Rietrug wind energy facilities near Sutherland.
- Specialist Botanical Assessment Report: Assessment of Damage and Rehabilitation Costs for Unauthorised Driving of a 4x4 Vehicle in the Big Bay Open Space System, Cape Town. Prepared for Hannes, Pretorius, Bock & Bryant Attorneys.
- In collaboration with Nkurenkuru Ecology and Biodiversity, 2019. Mining Permit, Final Basic Assessment & Environmental Management Plan for the proposed mining of Sillimanite, Aggregate and Stone Gravel on the Farm Koenabib 43, Northern Cape Province. Botanical Study and Assessment Report. Unpublished report prepared by Nkurenkuru Ecology and Biodiversity for GreenMined Environmental. Version 1.0, 30 January 2020
- In collaboration with Nkurenkuru Ecology and Biodiversity, 2019. Mining Permit, Final Basic Assessment & Environmental Management Plan for the proposed mining of Sillimanite on the Farm Wortel 42, Northern Cape Province. Botanical Study and Assessment Report. Unpublished report prepared by Nkurenkuru Ecology and Biodiversity for GreenMined Environmental. Version 1.0, 30 January 2020
- Specialist Invasive Alien Plant Species Report: Prepared for: Mpact Corrugated, Kuils River (Western Cape), July 2019
- Proposed Township development, Country view, Gauteng: Biodiversity Impact Assessment (Flora) – Specialist Report prepared for Zone Land Solutions (PTY) Ltd, July 2015
- Colenso Anthracite Coal Mining and Power Station Project: Biodiversity Impact Assessment (Flora) – Specialist Report prepared for Zone Land Solutions (PTY) Ltd, July 2015