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Terrestrial Plant Species Assessment

prepared in accordance with the
*"Protocol for the Specialist Assessment and
minimum report content requirements for
environmental impacts on Terrestrial Plant
Species"*

Green Hydrogen and Ammonia Facility near Hendrina in Mpumalanga Province

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For: ENERTRAG SOUTH AFRICA

5 October 2022

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SPECIALIST DETAILS & DECLARATION

This report has been prepared in accordance with the protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial plant species, as promulgated in terms of Section 24 (5) of the National Environmental Management Act, 1998 (Act No. 107 of 1998), published in GN. No. 320 dated 20 March 2020. It has been prepared independently of influence or prejudice by any parties.

The details of Specialists are as follows:

Specialist	Qualification and accreditation
Dr David Hoare	PhD Botany SACNASP (Pr.Sc.Nat.)

Details of Author:

Dr David Hoare

PhD (Botany) – Nelson Mandela Metropolitan University, Port Elizabeth

Professional Natural Scientist, South African Council for Natural Scientific Professions, Reg. no. 400221/05 (Ecology, Botany)

Statement of independence:

I, David Hoare, as the appointed plant species specialist, hereby declare/affirm the correctness of the information provided in this compliance statement, and that I:

1. meet the general requirements to be independent and
2. have no business, financial, personal or other interest in the proposed development and that no circumstances have occurred that may have compromised my objectivity; and
3. am aware that a false declaration is an offence in terms of regulation 48 of the EIA Regulations (2014).



Dr David Hoare

5 October 2022

Date

TERMS OF REFERENCE

The specialist study is required to follow the published Protocols, provided in full below for the assessment of impacts on Terrestrial Biodiversity. Note that the Protocols require determination of the level of sensitivity, which then determines the level of assessment required, either a full assessment, or a Compliance Statement.

PROTOCOL FOR THE SPECIALIST ASSESSMENT AND MINIMUM REPORT CONTENT REQUIREMENTS FOR ENVIRONMENTAL IMPACTS ON TERRESTRIAL PLANT SPECIES

This site sensitivity assessment follows the requirements of The Environmental Impact Assessment Regulations, as promulgated in terms of Section 24 (5) of the National Environmental Management Act, 1998 (Act No. 107 of 1998), published in GN. No. 320 dated 20 March 2020.

General information

1.1 An applicant intending to undertake an activity identified in the scope of this protocol, on a site identified by the screening tool as being of "**very high**" or "**high**" sensitivity for terrestrial plant species, must submit a Terrestrial Plant Species Specialist Assessment Report.

1.2 An applicant intending to undertake an activity identified in the scope of this protocol, on a site identified by the screening tool as being of "**medium** sensitivity" for terrestrial plant species, must submit either a Terrestrial Plant Species Specialist Assessment Report or a Terrestrial Plant Species Compliance Statement, depending on the outcome of a site inspection undertaken in accordance with paragraph 4.

1.3 An applicant intending to undertake an activity identified in the scope of this protocol, on a site identified by the screening tool as being of "**low**" sensitivity for terrestrial plant species, must submit a Terrestrial Plant Species Compliance Statement.

1.4 Where the information gathered from the site sensitivity verification differs from the screening tool designation of "very high" or "high" for terrestrial plant species sensitivity on the screening tool, and it is found to be of a "low" sensitivity, then a Terrestrial Plant Species Compliance Statement must be submitted.

1.5 Where the information gathered from the site sensitivity verification differs from the screening tool designation of "low" terrestrial plant species sensitivity and it is found to be of a "very high" or "high" terrestrial plant species sensitivity, a Terrestrial Plant Species Specialist Assessment must be conducted.

1.6 If any part of the development falls within an area of confirmed "very high" or "high" sensitivity, the assessment and reporting requirements prescribed for the "very high" or "high" sensitivity, apply to the entire development footprint. Development footprint in the context of this protocol, means the area on which the proposed development will take place and includes the area that will be disturbed or impacted.

1.7 The Terrestrial Plant Species Specialist Assessment and the Terrestrial Plant Species Compliance Statement must be undertaken within the study area.

1.8 Where the nature of the activity is not expected to have an impact on species of conservation concern (SCC) beyond the boundary of the preferred site, the study area means the proposed development footprint within the preferred site.

1.9 Where the nature of the activity is expected to have an impact on SCC beyond boundary of the preferred site, the project areas of influence (PAOI) must be determined by the specialist in accordance with Species Environmental Assessment Guideline, and the study area must include the PAOI, as determined.

Terrestrial Plant Species Specialist Assessment

2.1 The assessment must be undertaken by a specialist registered with the South African Council for Natural Scientific Professions (SACNASP), within a field of practice relevant to the taxonomic groups ("taxa") for which the assessment is being undertaken.

2.2 The assessment must be undertaken within the study area.

2.3 The assessment must be undertaken in accordance with the Species Environmental Assessment Guideline and must:

2.3.1 Identify the SCC which were found, observed or are likely to occur within the study area;

2.3.2 provide evidence (photographs) of each SCC found or observed within the study area, which must be disseminated by the specialist to a recognized online database facility immediately after the site inspection has been performed (prior to preparing the report contemplated in paragraph 3);

2.3.3 identify the distribution, location, viability and detailed description of population size of the SCC identified within the study area;

2.3.4 identify the nature and the extent of the potential impact of the proposed development to the population of the SCC located within the study area;

2.3.5 determine the importance of the conservation of the population of the SCC identified within the study area, based on information available in national and international databases including the IUCN Red List of Threatened Species, Red List of South African Plants, and/or other relevant databases;

2.3.6 determine the potential impact of the proposed development on the habitat of the SCC located within the study area;

2.3.7 include a review of relevant literature on the population size of the SCC, the conservation interventions as well as any national or provincial species management plans for the SCC. This review must provide information on the need to conserve the SCC and indicate whether the development is compliant with the applicable species management plans and if not, a motivation for the deviation;

2.3.8 identify any dynamic ecological processes occurring within the broader landscape, that might be disrupted by the development and result in negative impact on the identified SCC, for example, fires in fire-prone systems;

2.3.9 identify any potential impact on ecological connectivity within the broader landscape, and resulting impacts on the identified SCC and its long term viability;

2.3.10 determine buffer distances as per the Species Environmental Assessment Guidelines used for the population of each SCC;

2.3.11 discuss the presence or likelihood of additional SCC including threatened species not identified by the screening tool, Data Deficient or Near Threatened Species, as well as any undescribed species; and

2.3.12 identify any alternative development footprints within the preferred development site which would be of “low” sensitivity” or “medium” sensitivity as identified by the screening tool and verified through the site sensitivity verification.

2.4 The findings of the assessment must be written up in a Terrestrial Plant Species Specialist Assessment Report.

Terrestrial Plant Species Specialist Assessment Report

3.1 This report must include as a minimum the following information:

3.1.1 contact details and relevant experience as well as the SACNASP registration number of the specialist preparing the assessment including a curriculum vitae;

3.1.2 a signed statement of independence by the specialist;

3.1.3 a statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;

3.1.4 a description of the methodology used to undertake the site sensitivity verification and impact assessment and site inspection, including equipment and modelling used where relevant;

3.1.5 a description of the assumptions made and any uncertainties or gaps in knowledge or data;

3.1.6 a description of the mean density of observations/number of samples sites per unit area of site inspection observations;

3.1.7 details of all SCC found or suspected to occur on site, ensuring sensitive species are appropriately reported;

3.1.8 the online database name, hyperlink and record accession numbers for disseminated evidence of SCC found within the study area;

3.1.9 the location of areas not suitable for development and to be avoided during construction where relevant;

3.1.10 a discussion on the cumulative impacts;

3.1.11 impact management actions and impact management outcomes proposed by the specialist for inclusion in the Environmental Management Programme (EMPr);

3.1.12 a reasoned opinion, based on the findings of the specialist assessment, regarding the acceptability or not, of the development related to the specific theme considered, and if the development should receive approval or not, related to the specific theme being considered, and any conditions to which the opinion is subjected if relevant; and

3.1.13 a motivation must be provided if there were any development footprints identified as per paragraph 2.3.12 above that were identified as having “low” or “medium” terrestrial plant species sensitivity and were not considered appropriate.

3.2 A signed copy of the assessment must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.

Terrestrial plant species compliance statement

Where the sensitivity in the Screening Report from the web-based Online Screening Tool has been confirmed to be LOW, a Plant Species Compliance Statement is required, either (1) for areas where no natural habitat remains, or (2) in natural areas where there is no suspected occurrence of SCC.

The compliance statement must be prepared by a SACNASP registered specialist under one of the two fields of practice (Botanical Science or Ecological Science).

The compliance statement must:

- be applicable within the study area
- confirm that the study area is of "low" sensitivity for terrestrial plant species; and
- indicate whether or not the proposed development will have any impact on SCC.

The compliance statement must contain, as a minimum, the following information:

- contact details of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae;
- a signed statement of independence by the specialist;
- a statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;
- a baseline profile description of biodiversity and ecosystems of the site;
- the methodology used to verify the sensitivities of the terrestrial biodiversity and plant species features on the site including the equipment and modelling used where relevant;
- in the case of a linear activity, confirmation from the terrestrial biodiversity specialist that, in their opinion, based on the mitigation and remedial measures proposed, the land can be returned to the current state within two years of completion of the construction phase;
- where required, proposed impact management outcomes or any monitoring requirements for inclusion in the EMP; and
- a description of the assumptions made as well as any uncertainties or gaps in knowledge or data; and
- any conditions to which this statement is subjected.

A signed copy of the compliance statement must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.

INTRODUCTION

Project Background

ENERTRAG South Africa (hereafter "ENERTRAG SA") is a subsidiary of the German-based ENERTRAG AG, a hydrogen and renewable energy developer founded in 1992. ENERTRAG AG has an established track-record of renewable energy projects around the world, comprising over 100 wind turbines with an installed capacity of over 760MW, and over 500 employees. Current Projects are in Germany, United Kingdom, France, Poland, Bulgaria and Belarus.

ENERTRAG SA was established in 2017, with the intention to investigate and develop renewable energy projects in South Africa. The transition from coal-based energy supply to renewables in the Country is inevitable, as coal resources are depleted, coal-based power stations reach the end of their economic life and considering international obligations and commitments to reduced emissions. The Project development area is blanketed with numerous coal prospecting and mining rights. Coal mining and energy derived from coal mining is the likely alternative to the Project. ENERTRAG SA are developing renewable energy projects to contribute to the Just Transition that promises to de-carbonise South Africa's energy sector and aims to:

- replace coal-based electricity with renewable electricity
- decarbonise different sectors of the economy through the replacement of fossil-based hydrogen and ammonia with green hydrogen and ammonia.

ENERTRAG SA proposes to develop the Hendrina Renewable Energy Complex, the complex comprises of five separate projects. The projects are:

- Hendrina North Wind Energy Facility (up to 200MW) over 3600ha;
- Hendrina South Wind Energy Facility (up to 200MW) over 2900ha;
- Hendrina North Grid Infrastructure (up to 275kV) - 15km;
- Hendrina South Grid Infrastructure (up to 275kV) - 16km;
- Green Hydrogen and Ammonia Facility (up to 25ha).

Each of these projects are being assessed, as part of the Complex development, and involve the undertaking of Listed Activities identified in the Environmental Impact Assessment (EIA) Regulations, 2014 (as amended) and as such require an Environmental Authorisation in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) before being undertaken.

This report pertains specifically to the **Green Hydrogen and Ammonia Facility** ("the Project").

This document is intended to provide a description of the proposed Project. The Project is being developed for private off-take by nearby mining and industrial operations. This project description is intended to provide sufficient project detail to facilitate effective Environmental Impact Assessment (EIA) for the proposed project in different specialist disciplines. If additional detail is required, please contact WSP.

Project description

The Project is located 17km west of Hendrina, in the Steve Tshwete Local Municipality, of the Nkangala District Municipality, Mpumalanga Province. Three alternative locations are being investigated for the development of the proposed Project:

Site Alternative 1 is located on Portion 3 of the Farm Dunbar 189IS, at the site of an old abandoned farmyard and has three powerline options from the associated Hendrina North and South Wind Energy Facilities ("WEF") as follows:

- Powerline option 1 is up to 2km in length, to the Hendrina North WEF substation Option 1 on Portion 1 of the Farm Dunbar 189IS;
- Powerline option 2 is up to 7km in length, to the Hendrina North WEF substation Option 2 on Portion 3 of the Farm Hartebeestkuil 185IS;
- Powerline option 3 is up to 1.5km in length, to the Hendrina South WEF substation on Portion 3 of the Farm Dunbar 189IS.

Site Alternative 1 has one option for water supply to the Site:

- Constructing a new pipeline (up to 16km) from the Komati Power Station

Site Alternative 2 is located on Portion 3 of the Farm Dunbar 189IS and Portion 18 of the Farm Weltevreden 193IS, adjacent to the proposed Hendrina South WEF substation and has three powerline options from the associated wind farms as follows:

- Powerline option 1 is up to 3km in length to the Hendrina North WEF Option 1 substation on Portion 1 of the Farm Dunbar 189IS;
- Powerline option 2 is up to 8km in length to the Hendrina North WEF substation Option 2 on Portion 3 of the Farm Hartebeestkuil 185IS;
- Powerline option 3 is up to 0.5km in length to the Hendrina South WEF substation on Portion 3 of the Farm Dunbar 189IS;

Site Alternative 2 has one option for water supply to the Site:

- Constructing a neCw pipeline (up to 17km) from the Komati Power Station

Site Alternative 3 is located on Portions 14 and 15 of the Farm Weltevreden 193IS and has three powerline options from the associated wind farms as follows:

- Powerline option 1 is up to 5km in length to the Hendrina North WEF Option 1 substation on Portion 1 of the Farm Dunbar 189IS;
- Powerline option 2 is up to 5km in length to the Hendrina North WEF substation Option 2 on Portion 3 of the Farm Hartebeestkuil 185IS;
- Powerline option 3 is up to 7km in length to the Hendrina South WEF substation on Portion 3 of the Farm Dunbar 189IS.

Site Alternative 3 has one option for water supply to the Site:

- Constructing a new pipeline (up to 19km) from the Komati Power Station.

The Project, and associated water pipeline and powerlines, is proposed to affect the following farm portions:

Parent Farm	Farm No	Portion No
Facility Alternative Site 1		
Dunbar	189IS	3
Facility Alternative Site 2		
Dunbar	189IS	3
Weltevreden	193IS	18
Facility Alternative Site 3		
Weltevreden	193IS	14
Weltevreden	193IS	15
Associated pipelines and powerlines may affect portions of the following land parcels:		
Bultfontein	187IS	1
Bultfontein	187IS	2
Bultfontein	187IS	3

Bultfontein	187IS	4
Bultfontein	187IS	6
Bultfontein	187IS	10
Bultfontein	187IS	14
Dunbar	189IS	0
Dunbar	189IS	1
Dunbar	189IS	2
Dunbar	189IS	4
Dunbar	189IS	5
Dunbar	189IS	6
Dunbar	189IS	7
Geluk	26IS	6
Geluk	26IS	7
Hartebeestkuil	185IS	3
Komati Power Station	56IS	0
Wilmansrust	47IS	1
Wilmansrust	47IS	3
Wilmansrust	47IS	9

Identified Theme Sensitivities

A sensitivity screening report from the DFFE Online Screening Tool was requested in the application category: Infrastructure | Localised infrastructure | Storage | Dangerous Goods | Chemicals for three options. The DFFE Screening Tool report for the area indicates the following ecological sensitivities:

Theme	Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
Plant Species Theme			X	

The sensitivity screening report is provided in Figure 1.

Plant Species theme

The plant species theme was highlighted as being of Medium sensitivity (for all three options) due to the potential presence of the following species:

Sensitivity	Feature(s)
Medium	Sensitive species 41
Medium	Sensitive species 691
Medium	Pachycarpus suaveolens

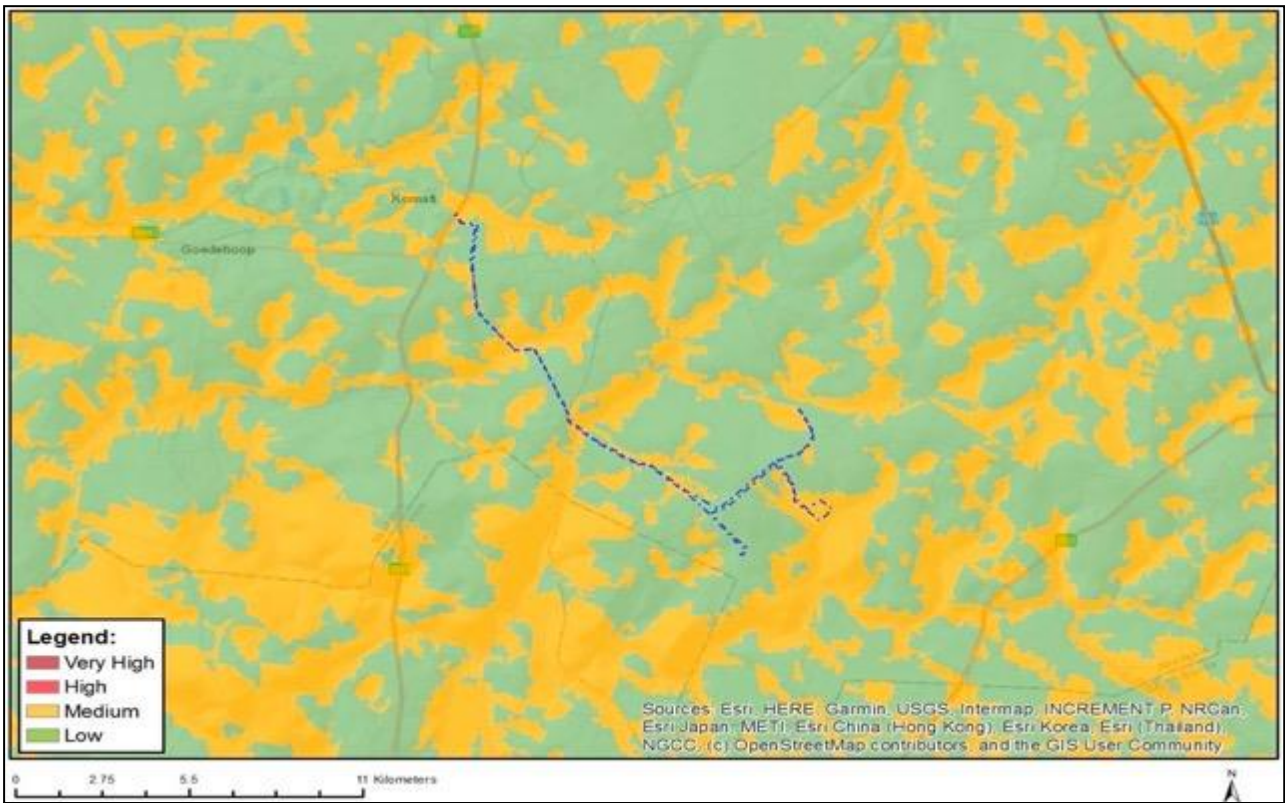


Figure 1: DFFE Screening Tool extract for plant species theme.

METHODOLOGY

The detailed methodology followed as well as the sources of data and information used as part of this assessment is described below.

Survey timing

The study commenced as a desktop-study followed by a site-specific field study on 3–7 February 2020. The site is within the Grassland biome with a peak rainfall season in summer, which occurs from October to March (Figure 2). There is, however, a delay between rainfall and vegetation growth, which means the peak growing season is from November to April, with most perennial species characteristic of the vegetation being easily identifiable from January to March. The timing of the survey was therefore ideal in terms of assessing the vegetation condition and flora composition of the site.

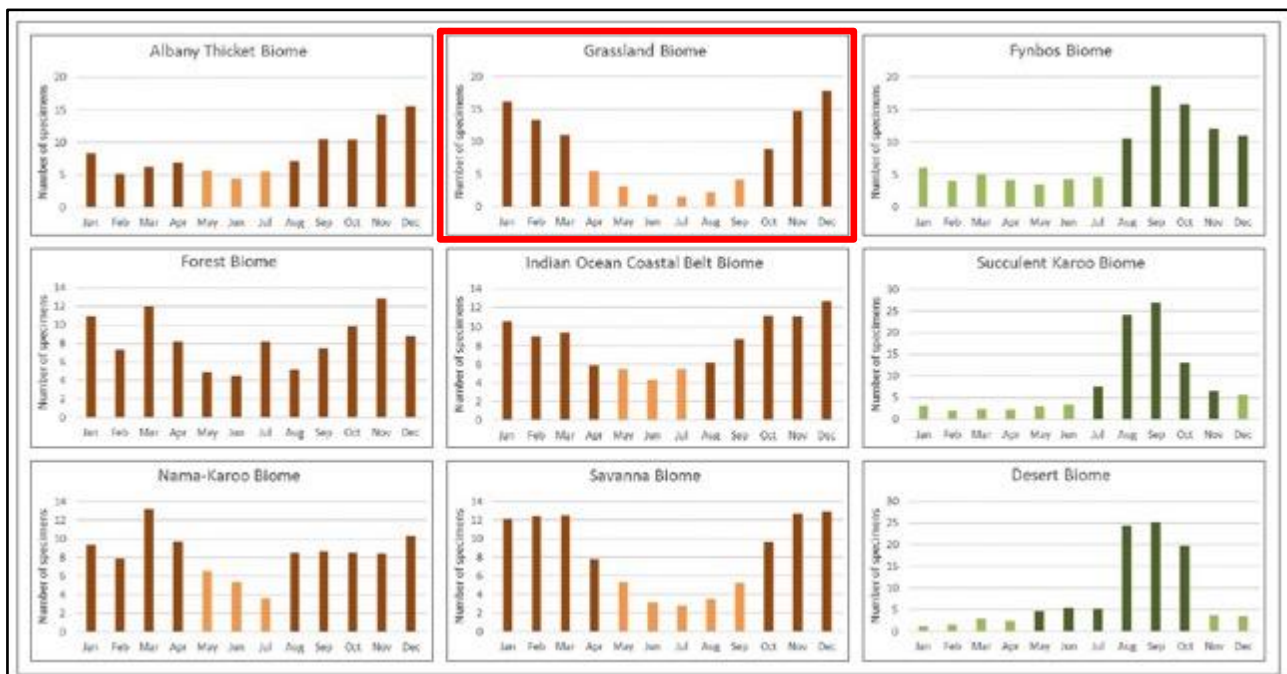


Figure 2: Recommended survey periods for different biomes (Species Environmental Assessment Guidelines).

Field survey approach

During the field survey, all major natural variation on site was assessed and select locations were traversed on foot. A hand-held Garmin GPSMap 64s was used to record a track within which observations were made.

Aerial imagery from Google Earth was used to identify and assess habitats on site. Patterns identified from satellite imagery were verified on the ground. During the field survey, particular attention was paid to ensuring that all habitat variability was covered physically on the ground during the search

for plant species. From this ground survey, as well as ad hoc observations on site, a checklist of plant species occurring on site was compiled.

Digital photographs were taken of all plant species that were seen on site. All plant species recorded were uploaded to the iNaturalist website.

Sources of information

- Broad vegetation types occurring on site were obtained from Mucina and Rutherford (2006), with updates according to the SANBI BGIS website (<http://bgis.sanbi.org>). The description of each vegetation type includes a list of plant species that may occur within the particular vegetation type.
- A list of plant species that could potentially occur in the general area was extracted from the database of the South African National biodiversity Institute (newposa.sanbi.org) for the quarter degree grids in which the site is located.
- The Red List plant species, as well as supplementary information on habitats and distribution, were obtained from the SANBI Threatened Species Programme (Red List of South African Plants, <http://redlist.sanbi.org>).
- Habitat information for each species was obtained from literature. The probability of finding any of these species was assessed by comparing the habitat requirements with habitats that occur on site. Species that have been recorded anywhere in proximity to the site (within 30 km), or could possibly occur there, were considered in the assessment.
- Regulations published for the National Forests Act (Act 84 of 1998) (NFA) as amended, provide a list of protected tree species for South Africa. The species on this list were assessed to determine which protected tree species have a geographical distribution that coincides with the study area and habitat requirements that may be met by available habitat in the study area. The distribution of species on this list were obtained from published sources (e.g. van Wyk & van Wyk 1997) and from the SANBI plants database website (<http://newposa.sanbi.org>) for quarter degree grids in which species have been previously recorded.

Limitations

The purpose of the fieldwork undertaken for this Project was to characterize the habitat of the study area, compile checklists from as diverse a variety of habitats as possible, and to map habitats within the entire collection of farms within which the Project is situated. The proposed project layout was provided during the EIA process; therefore no development footprint areas were assessed for the Project, only the general area in which the project is located. A final walk-through to survey conducted in Spring or early Summer is therefore recommended to check for potential species of conservation concern within footprints of the development.

DESCRIPTION OF STUDY AREA

Location

The Project is located 17km west of Hendrina, in the Steve Tshwete Local Municipality of the Nkangala District Municipality, Mpumalanga Province (Figure 3). It is located approximately halfway between Hendrina and Kriel and about 45 km south-east of eMalahleni. The Olifants River is located 2 km south of the site, Komati Power Station is north-west and there are scattered opencast and underground coal mines in the vicinity of the site.

Site conditions

The proposed infrastructure is within a grassland area with undulating topography. Much of the study area is currently or previously cultivated, the exception being wetland areas and areas of grassland with shallow soils that are not suitable for cultivation. Within the general area, there are various secondary roads leading from the main access roads, and several homestead complexes. There are groves of exotic trees scattered throughout the study area, but mostly clustered around homesteads and farm infrastructure, where they act as shelter and windbreaks. The vegetation in the study area is used primarily for livestock grazing and is affected to some degree by this use, but not to the extent that any severe degradation was noted on site. Except for cultivated areas and infrastructure, the

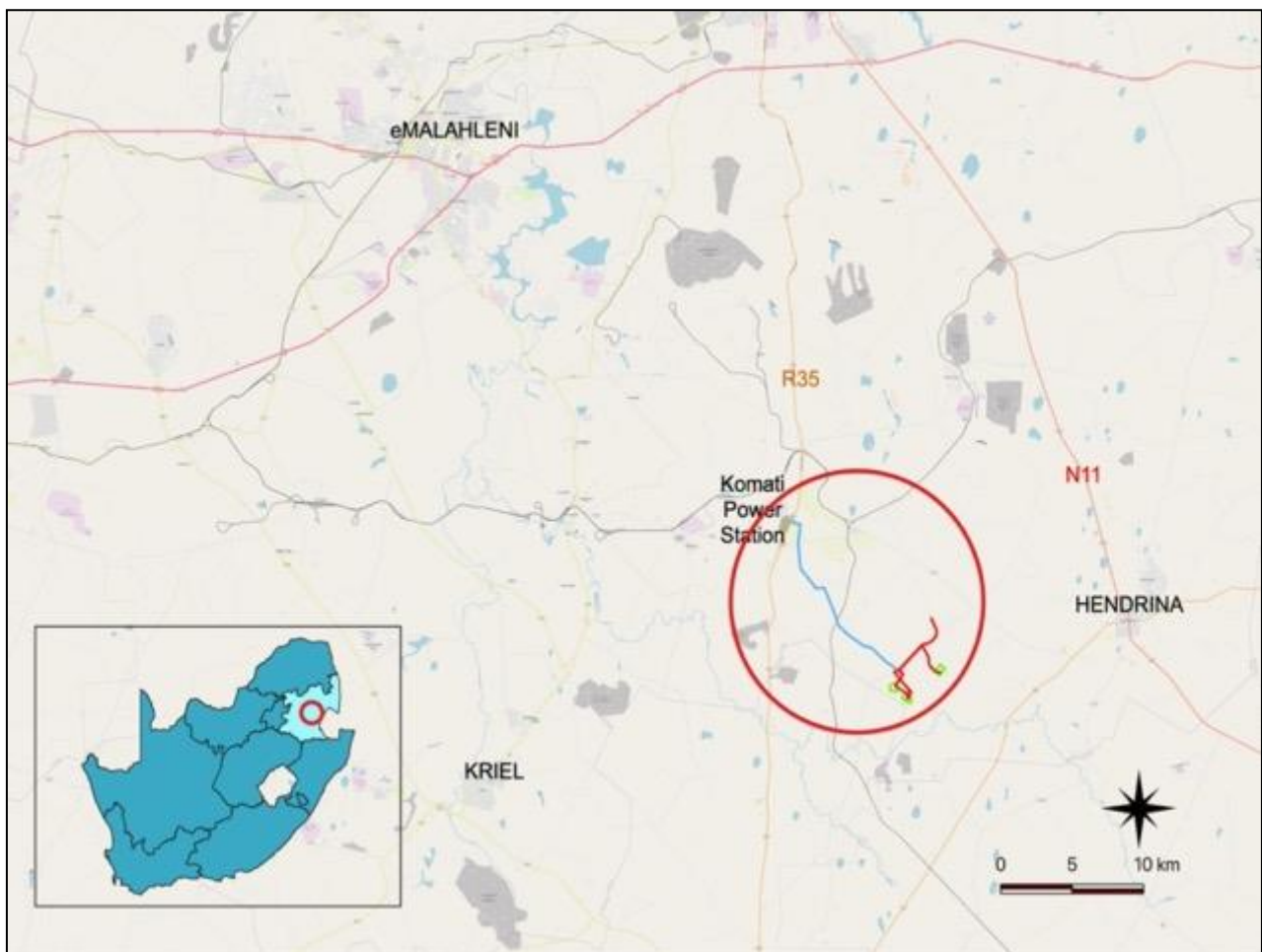


Figure 3: Location of the proposed infrastructure.

remaining vegetation and habitats in the study area appears to be what would be expected according to the natural relationship between the physical environment and the vegetation.

Topography and drainage

The study area is situated close to (within 2 km of) the floodplain of the Olifants River, as well as on the undulating plains and slopes north of the river. The site therefore includes moderately sloping topography in combination with undulating terrain.

The elevation on site varies from 1594 to 1692 m above sea level, an elevation difference of approximately 100 m across over 8 km. The highest point in the study area is along the powerline route between the infrastructure location options. The lowest point is in a drainage line close to Komati Power Station.

The general study area is drained by various drainage lines, and the Olifants River.

Regional vegetation patterns

There is one regional vegetation type occurring in the study area, namely Eastern Highveld Grassland (Figure 4). Eastern Highveld Grassland is described below, following Mucina & Rutherford, extracted from the SANBI BGIS website (<http://bgis.sanbi.org/vegmap>).

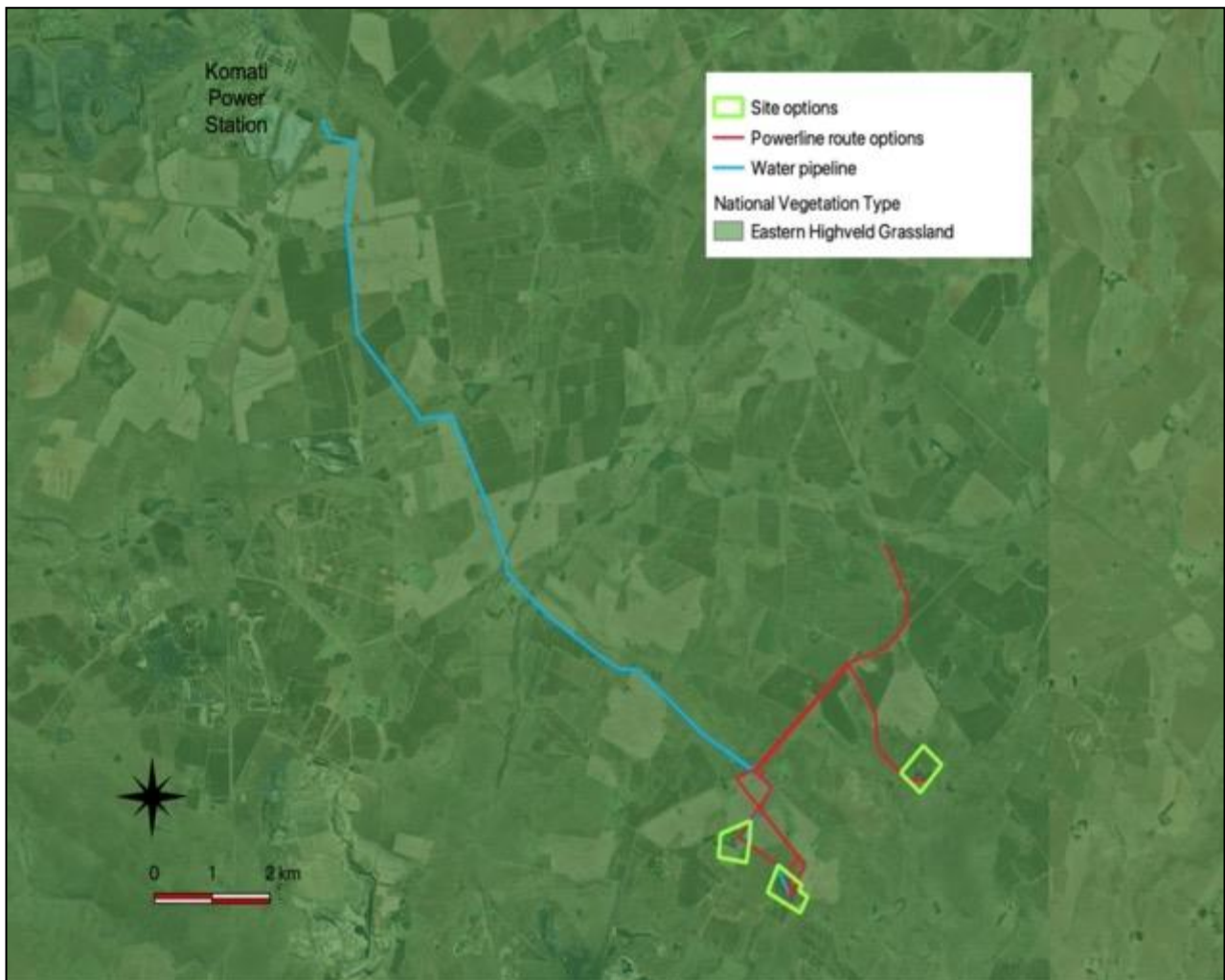


Figure 4: Regional vegetation types of the study area.

Eastern Highveld Grassland

Distribution

Found in Mpumalanga and Gauteng Provinces, on the plains between Belfast in the east and the eastern side of Johannesburg in the west and extending southwards to Bethal, Ermelo and west of Piet Retief. The vegetation type occurs at an altitude of between 1 520–1 780 m.

Vegetation & Landscape Features

The vegetation occurs on slightly to moderately undulating plains, including some low hills and pan depressions. The vegetation is short dense grassland dominated by the usual highveld grass composition (*Aristida*, *Digitaria*, *Eragrostis*, *Themeda*, *Tristachya*, etc.) with small, scattered rocky outcrops with wiry, sour grasses and some woody species (*Acacia caffra*, *Celtis africana*, *Diospyros lycioides* subsp. *lycioides*, *Parinari capensis*, *Protea caffra*, *P. welwitschii* and *Searsia magalismsontanum*).

Geology & Soils

Red to yellow sandy soils of the Ba and Bb land types found on shales and sandstones of the Madzaringwe Formation (Karoo Supergroup). Land types Bb (65%) and Ba (30%).

Climate

Strongly seasonal summer rainfall, with very dry winters. MAP 650–900 mm (overall average: 726 mm), MAP relatively uniform across most of this unit, but increases significantly in the extreme southeast. The coefficient of variation in MAP is 25% across most of the unit, but drops to 21% in the east and southeast. Incidence of frost from 13–42 days, but higher at higher elevations.

Important Taxa

Low Shrubs	<i>Anthospermum rigidum</i> subsp. <i>pumilum</i> , <i>Stoebe plumosa</i> .
Herbs	<i>Berkheya setifera</i> (d), <i>Haplocarpha scaposa</i> (d), <i>Justicia anagalloides</i> (d), <i>Pelargonium luridum</i> (d), <i>Acalypha angustata</i> , <i>Chamaecrista mimosoides</i> , <i>Dicoma anomala</i> , <i>Euryops gilfillanii</i> , <i>E. transvaalensis</i> subsp. <i>setilobus</i> , <i>Helichrysum aureonitens</i> , <i>H. caespititium</i> , <i>H. callicomum</i> , <i>H. oreophilum</i> , <i>H. rugulosum</i> , <i>Ipomoea crassipes</i> , <i>Pentanisia prunelloides</i> subsp. <i>latifolia</i> , <i>Selago densiflora</i> , <i>Senecio coronatus</i> , <i>Vernonia oligocephala</i> , <i>Wahlenbergia undulata</i> .
Geophytic Herbs	<i>Gladiolus crassifolius</i> , <i>Haemanthus humilis</i> subsp. <i>hirsutus</i> , <i>Hypoxis rigidula</i> var. <i>pilosissima</i> , <i>Ledebouria ovatifolia</i> .
Succulent Herbs	<i>Aloe ecklonis</i>
Graminoids	<i>Aristida aequiglumis</i> (d), <i>A. congesta</i> (d), <i>A. junciformis</i> subsp. <i>galpinii</i> (d), <i>Brachiaria serrata</i> (d), <i>Cynodon dactylon</i> (d), <i>Digitaria monodactyla</i> (d), <i>D. tricholaenoides</i> (d), <i>Elionurus muticus</i> (d), <i>Eragrostis chloromelas</i> (d), <i>E. curvula</i> (d), <i>E. plana</i> (d), <i>E. racemosa</i> (d), <i>E. sclerantha</i> (d), <i>Heteropogon contortus</i> (d), <i>Loudetia simplex</i> (d), <i>Microchloa caffra</i> (d), <i>Monocymbium ceresiiforme</i> (d), <i>Setaria sphacelata</i> (d), <i>Sporobolus africanus</i> (d), <i>S. pectinatus</i> (d), <i>Themeda triandra</i> (d), <i>Trachypogon spicatus</i> (d), <i>Tristachya leucothrix</i> (d), <i>T. rehmannii</i> (d), <i>Alloteropsis semialata</i> subsp. <i>eckloniana</i> , <i>Andropogon appendiculatus</i> , <i>A. schirensis</i> , <i>Bewisia biflora</i> , <i>Ctenium concinnum</i> , <i>Diheteropogon amplexans</i> , <i>Eragrostis capensis</i> , <i>E. gummiflua</i> , <i>E. patentissima</i> , <i>Harpochloa falx</i> , <i>Panicum natalense</i> , <i>Rendlia altera</i> , <i>Schizachyrium sanguineum</i> , <i>Setaria nigrirostris</i> , <i>Urelytrum agropyroides</i> .

Habitats on site

The site is within an area of natural grassland but degraded (from heavily to light). The grassland contains species composition variation due to changes in topography, slope inclination, surface rockiness and the influence of water-flow and water retention in the landscape. A broad classification of the habitat units on site, which also reflects relatively uniform plant species compositional units, is as follows:

Natural habitats:

1. **Natural grassland** (open grassland on undulating plains – the condition is not indicated in the habitat map although there is a gradient from heavily grazed poor condition to moderate condition);
2. **Wetlands** (permanent and seasonal wetlands in drainage valleys, including channels, where they occur);

Transformed and degraded areas:

3. **Old lands** (secondary grasslands on previously cultivated areas);
4. **Exotic trees** (stands of exotic trees);
5. **Degraded areas** (disturbed areas with bare ground, weeds or waste ground).
6. **Current cultivation** (areas currently cultivated and fallow lands);
7. **Transformed** (areas such as roads and buildings where there is no vegetation).

A map of intact natural habitats within the study area and adjacent areas is provided in Figure 5.

Note that the mapping of any wetland-related habitats on site is based on vegetation characteristics and plant species composition and is not a wetland delineation according to the soil-based methodology required according to the National Water Act. For example, there are several facultative wetland species that occur in seasonal and temporary wetlands that do not occur in terrestrial grasslands (see description below for "Wetlands"). The habitats in which these wetland-related species occur are recognizable on aerial images and were mapped accordingly.

NATURAL VERSUS SECONDARY GRASSLAND	
Natural grassland	Areas of original vegetation in which the soil has not been mechanically disturbed, including areas that are in poor condition due to overgrazing, trampling, invasion by weeds or alien invasive species, inappropriate fire regimes , or any other factor that drives natural change in species composition or vegetation structure. The key factor is that the original plants continue to exist, often resprouting after defoliation from sub-surface stems or other storage organs.
Secondary grassland	Areas of vegetation where the original grassland vegetation has been lost through direct disturbance of the soil that results in physical removal of the original plants, the most common cause of which is ploughing, but could be other mechanical factors. The vegetation that develops is a result of recolonisation of the area through propagation.

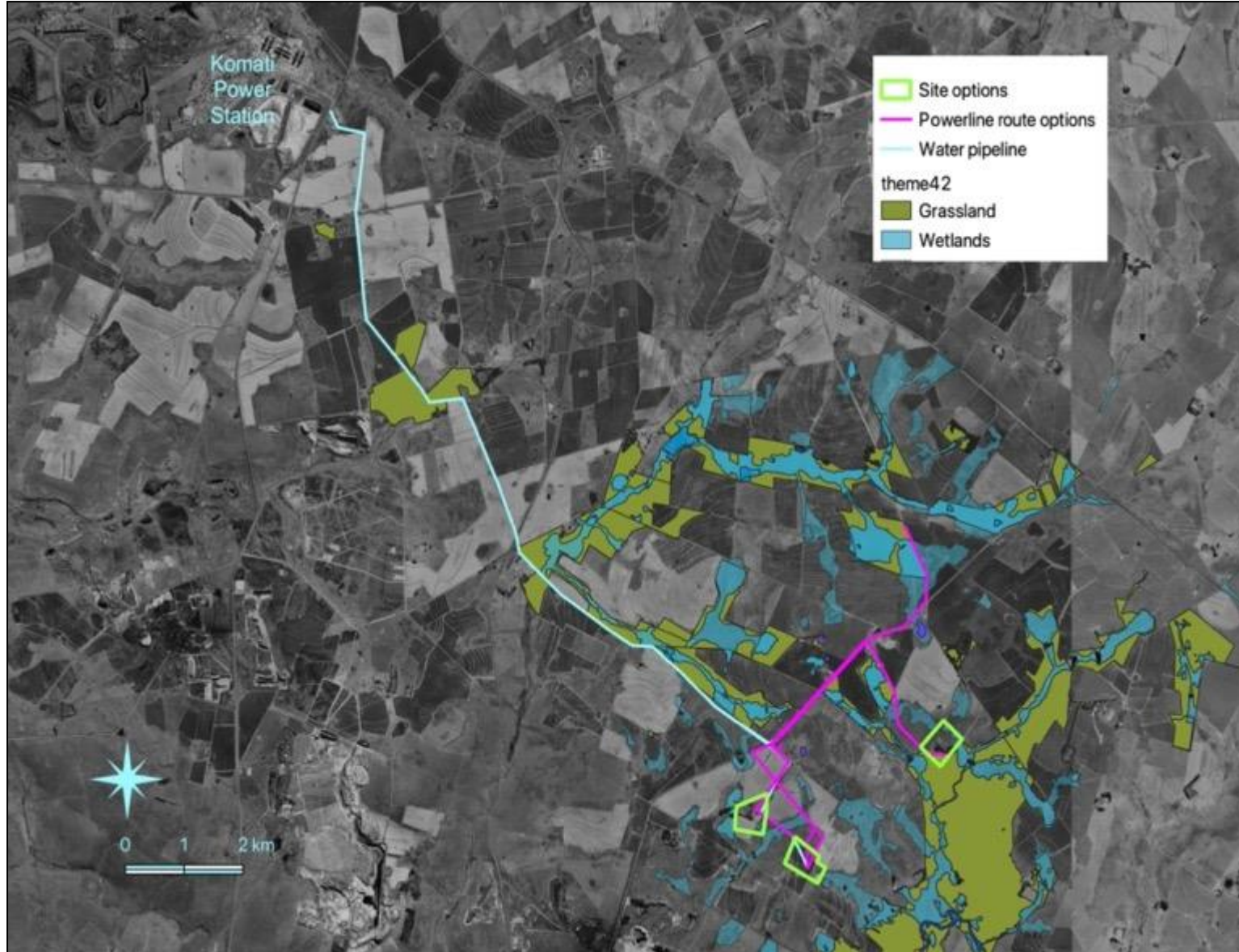


Figure 5: Main habitats of the study area.

Grassland

The natural vegetation of the study area is characterized by an open grassland on undulating hills and plains. It is generally a short to moderate height tussock grassland with closed canopy cover. The soil depth varies, as does the amount of surface rock cover. This was the most widespread vegetation community on site, occurring on all the relatively flat plains areas. These plains are also the area that has been most subject to cultivation.

The general floristic character of this vegetation on site is fairly uniform across wide areas, often dominated by the same suite of species, including the grasses: *Alloteropsis semialata*, *Aristida diffusa*, *Aristida junceiformis*, *Bewisia biflora*, *Brachiaria serrata*, *Diheteropogon amplexans*, *Elionurus muticus*, *Eragrostis capensis*, *Eragrostis chloromelas*, *Eragrostis plana*, *Eragrostis racemosa*, *Harporchloa falx*, *Heteropogon contortus*, *Microchloa caffra*, *Panicum natalense*, *Setaria sphacelata* var. *torta*, *Themeda triandra*, and *Tristachya leucothrix*, and the forbs: *Acalypha angustata*, *Anthospermum rigidum* subsp. *rigidum*, *Berkheya setifera*, *Chaetacanthus costatus*, *Commelina africana*, *Crabbea acaulis*, *Cucumis hirsutus*, *Cucumis zeyheri*, *Cyanotis speciosa*, *Gerbera viridifolia*, *Haplocarpha scaposa*, *Helichrysum rugulosum*, *Hemizygia pretoriae*, *Hermannia transvaalensis*, *Hibiscus aethiopicus*, *Hypoxis obtusa*, *Hypoxis rigidula*, *Indigofera comosa*, *Ipomoea ommaneyi*, *Justicia anagalloides*, *Kohautia amatymbica*, *Ledebouria ovatifolia*, *Monsonia attenuata*, *Nidorella hottentotta*, *Pentanisia angustifolia*, *Pollichia campestris*, *Scabiosa columbaria*, *Selago densiflora*, *Seriphium plumosum*, *Vernonia galpinii*, *Vernonia oligocephala*, and *Zornia milneana*. Overall diversity in this habitat is high and includes a full list of over 100 species. Local species richness is also high at 56 species per 400m² sampling area. This rivals the local richness of some of the most species-rich grasslands anywhere in the country.

Wetlands

There are various valley bottom wetlands in the study area. Valley bottom wetlands in this general area around Hendrina are generally dominated by a variety of grasses, sedges and herbaceous plants, including the graminoids, *Kyllinga erecta*, *Leersia hexandra*, *Agrostis lachnantha*, *Andropogon appendiculatus*, *Helictotrichon turgidulum*, *Scirpoides burkei*, *Cyperus teneristolon*, *Cyperus macranthus*, *Typha capensis*, *Agrostis erianthe*, *Hemarthria altissima*, *Panicum schinzii*, *Cyperus rigidifolius* and *Arundinella nepalensis*, the herbs, *Centella asiatica*, *Senecio polyodon*, *Senecio erubescens*, *Haplocarpha scaposa*, *Pelargonium luridum*, *Commelina africana*, *Lobelia flaccida*, *Monopsis decipiens*, and *Helichrysum aureonitens*. The species composition depends on the hydrological characteristics of the site, with a greater number of obligate wetland species occurring in more permanently damp areas, whereas dryer areas resemble more closely the terrestrial grassland in species composition.

The drainage areas are important habitat for animals, providing refuge and shelter, water, when it is available, palatable vegetation, when surrounding areas are in drought, and softer and deeper soils for burrowing animals. The habitat is also an important flood-attenuation component of the landscape, and a reservoir for soil water.

Habitat sensitivity

To determine ecological sensitivity in the study area, local and regional factors were considered. There are some habitats in the study area that have been described as sensitive, irrespective of regional assessments. This includes primarily the valley bottom wetlands. A detailed assessment of these areas is being undertaken by an aquatic specialist, and they are only considered here in terms of being important habitat for flora and fauna.

At a regional level, the Critical Biodiversity Area (CBA) map for Mpumalanga indicates various parts of the study area as being important for conservation. There are parts of the study area that fall within CBAs (Figure 6). Much of the remainder of the study area is heavily modified. The CBA map therefore corresponds with the distribution of remaining natural habitat on site.

In terms of other species of concern, including both plants and animals, the preferred habitat of each of these can be determined or has been described. They are, however, distributed amongst different habitats on site, which means that no single habitat is primarily important as habitat for species of concern.

A summary of sensitivities that occur on site and that may be vulnerable to damage from the proposed project are as follows:

1. CBA "Irreplaceable" areas: The Mpumalanga Biodiversity Sector Plan (MBSP) (Mpumalanga Parks and Tourism Agency 2014) shows areas on site within various conservation planning categories, including areas designated as "CBA: Irreplaceable". These are areas that are required to meet biodiversity targets (for biodiversity pattern and ecological process features), the implication being that there are no other areas that meet the biodiversity criteria for meeting these conservation planning objectives. The Provincial policy is that they should remain in a natural state. Where possible, impacts on these areas should be minimized.
2. Wetlands: These are described here only in terms of being a unique botanical habitat and not in the sense of a formal wetland delineation, which is normally assessed in a separate specialist study. The wetlands must be delineated according to "DWAF, 2003: A Practical Guideline Procedure for the Identification and Delineation of Wetlands and Riparian Zones". Restrictions in terms of infrastructure within these areas should be according to the National Water Act (Act 36 of 1998), except where the wetlands fall within a CBA "Irreplaceable" area, in which case they should be "No-Go" areas.
3. Listed ecosystems: Eastern Highveld Grassland and Eastern Temperate Freshwater Wetlands are both listed as Vulnerable in the National List of Ecosystems that are Threatened and need of protection (GN1002 of 2011). All remaining natural habitat on site falls within one of these two listed ecosystems.
4. Grasslands: Grassland vegetation, in a general sense has been identified as threatened nationally as a habitat type. Indications are that loss of any grassland habitat is permanent in an ecological and biodiversity sense, and it is not possible to restore grassland to a natural state after they have been disturbed. They should therefore be treated as sensitive, and all efforts made to minimize impacts on any area of grassland. If possible, the footprint of any proposed infrastructure should be kept to a minimum within any natural grasslands, especially those in a moderate to good condition.

Based on this information, a map of habitat sensitivity on site is provided in Figure 6. This shows main habitat sensitivity classes on site, as follows:

1. LOW for all transformed areas, including cultivated lands.
2. MEDIUM-LOW for secondary grasslands in previously cultivated areas.
3. MEDIUM for cultivated wetlands.
4. MEDIUM-HIGH for secondary wetlands in previously cultivated areas, as well as for all remaining natural areas on site.
5. HIGH for remaining natural habitat within "CBA: Irreplaceable" and "CBA: Optimal" areas.
6. VERY HIGH for intact natural wetlands.

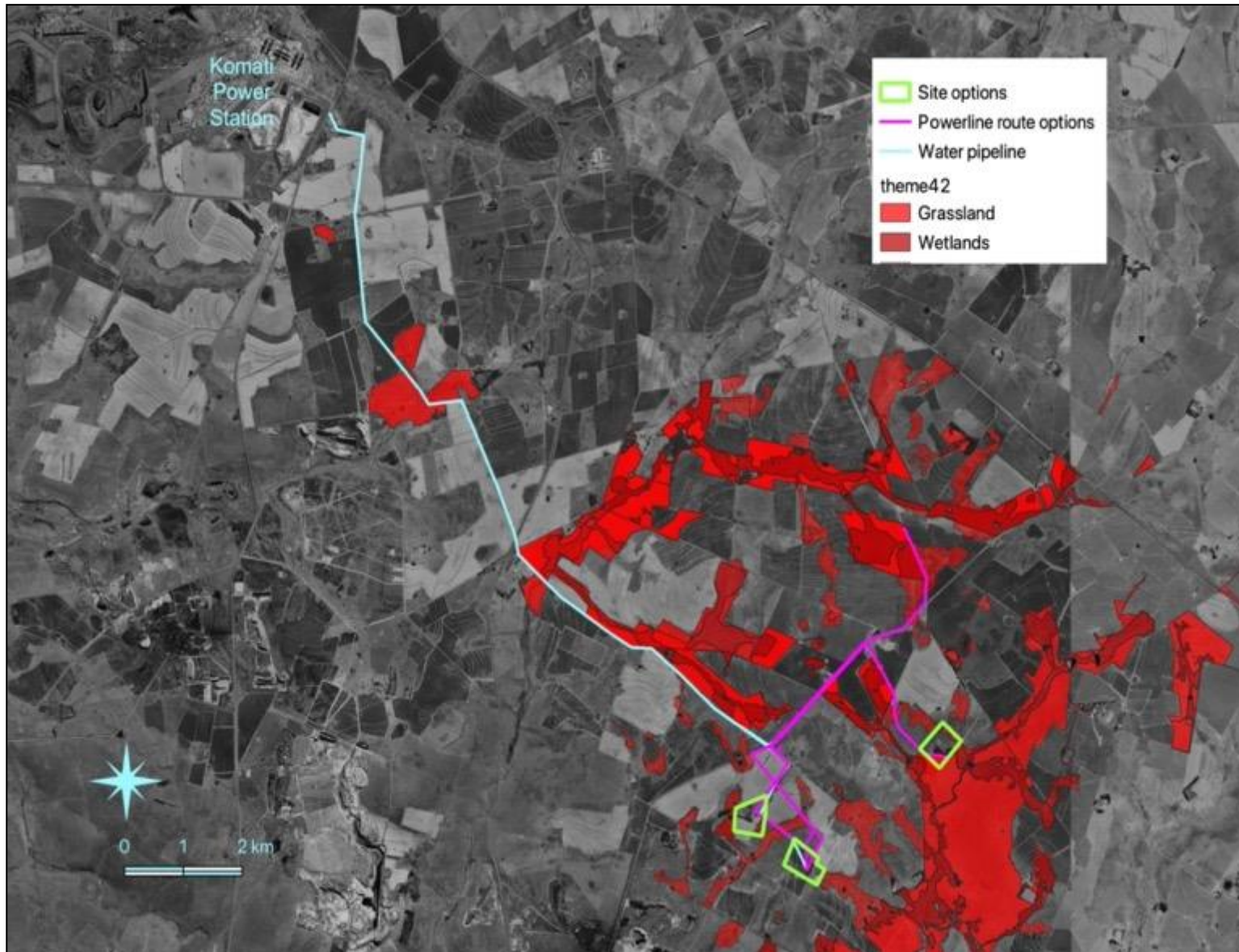


Figure 6: Habitat sensitivity of the study area, including CBAs.

Plant species flagged for the study area

According to the National Web-Based Environmental screening tool, three plant species have been flagged as of concern for the area the current project is in, listed below. A description of each species is provided.

Sensitive species 41

A common and widespread geophyte that is very similar to *Gladiolus crassifolius*, also a widespread and common species with a similar distribution. The main distribution area is Witbank to Lydenburg, and southwards to Piet Retief and Wakkerstroom. It occurs in wetlands or marshes in high altitude grassland that remain wet throughout the year or dry out for only a short period. This species is listed on the South African Red List with a national assessment of Vulnerable but is currently not recognized by the IUCN as it is regarded as a synonym of *G. crassifolius*. Whereas this species is confined more to wetland habitats, *G. crassifolius* has larger leaves, longer spikes and smaller flowers, and is found in drier, more stony habitats. It flowers from October to January but without flowers, the plant can be recognised as a *Gladiolus*. The closest historical record is approximately 30km from the study site. This species has a MODERATE chance of occurring on the site.

Sensitive species 691

A widespread geophyte distributed in Free State, North West, Gauteng, and in Mpumalanga from Belfast and Ermelo to Wolmaransstad. It is found in wetlands in undulating grasslands. The species is currently listed as Vulnerable. It flowers from January to March but its peak flowering month is February. It could feasibly be found in wet areas on the site but is quite conspicuous in February when it flowers. The closest historical record is approximately 40km from the site. It has a MODERATE probability of occurring on the site.

Pachycarpus suaveolens

This is a rare plant, usually found as solitary individuals, although widespread due to the wind-dispersal mechanism of its seeds. It is conspicuous and showy when flowering in mid-summer, from December to February. The closest historical record of this species is about 30km from the site. It has a MODERATE probability of occurring on the site.

Additional listed plant species for the study area

The database search identified several additional plant species of conservation concern that could also occur on site that are not flagged in the Screening Tool output. These include the following:

Taxon	Red List status	Habitat and distribution	Flowering Time	Probability of occurrence
Alepidea cordifolia APIACEAE	Endangered (SA)	Widespread and extremely common across the eastern highveld of Mpumalanga, the eastern Free State, and north-western KwaZulu-Natal. It occurs along the north and north-eastern borders of Lesotho and is also found in Eswatini, on the Eastern Highlands of Zimbabwe and the Chimanimani Mountains of Mozambique. Forest margins, west and south facing mountain slopes and near drainage lines or islands within wetlands. Open grassland or on forest margins,	Summer, mostly February to March	MODERATE (within known overall distribution)

		often amongst rocks and/or along streams.		
Alepidea longeciliata APIACEAE	Endangered	Between Breyten, Lothair, Middelburg and Stoffberg. Recorded from 2 neighbouring grids. Eastern Highveld Grassland. Grassland, Karoo Sandstone, above 1600 m. Possibly associated with edges of pans.	Summer	MODERATE (within known overall distribution)
Aspidoglossum xanthosphaerum APOCYNACEAE	Vulnerable	Mpumalanga, Groenvlei and Ermelo. Closest known record is from Breyten and just to the west of Ermelo. Montane grassland, marshy sites, 1800 m.	Unknown	HIGH
Bowiea volubilis subsp. volubilis HYACINTHACEAE	Vulnerable (national)	Eastern Cape to Limpopo Province. Widespread elsewhere in southern and eastern Africa. Low and medium altitudes, usually along mountain ranges and in thickly vegetated river valleys, often under bush clumps and in boulder screes, sometimes found scrambling at the margins of karroid, succulent bush in the Eastern Cape. Occurs in bushy kloofs at the coast and inland in KwaZulu-Natal. In Gauteng, Mpumalanga and North West Province it is often found in open woodland or on steep rocky hills usually in well-shaded situations. Tolerates wet and dry conditions, growing predominantly in summer rainfall areas with an annual rainfall of 200-800 mm.		LOW (site within gap in distribution, habitat not suitable)
Eucomis pallidiflora subsp. polevansii HYACINTHACEAE	Near Threatened	Pilgrim's Rest and Lydenburg to Eswatini to southern Mpumalanga. Wetlands in grassland, often in standing water up to 300 mm deep. Recorded at Ermelo in similar habitat as that found on site.		HIGH
Gladiolus robertsoniae IRIDACEAE	Near Threatened	South-eastern Gauteng, northern Free State and south-western Mpumalanga. Moist highveld grasslands, found in wet, rocky sites, mostly dolerite outcrops, wedged in rock crevices.		HIGH
Khadia carolinensis AIZOACEAE	Vulnerable	Carolina and Belfast. Eastern Highveld Grassland, Lydenburg Montane Grassland, Rand Highveld Grassland. Well-drained, sandy loam soils among rocky outcrops, or at the edges		HIGH

		of sandstone sheets, Highveld Grassland, 1700 m.		
Kniphofia typhoides ASPHODELACEAE	Near Threatened	Gauteng, Limpopo, Mpumalanga, North West, Parys to Lydenburg to Paulpietersburg to Newcastle. Low lying wetlands and seasonally wet areas in climax Themeda triandra grasslands on heavy black clay soils, tends to disappear from degraded grasslands.		MODERATE (Habitat may not be suitable)
Merwillia plumbea HYACINTHACEAE	Near Threatened	Widespread in eastern half of South Africa. Also in Eswatini and Lesotho. Montane mistbelt and Ngongoni grassland, rocky areas on steep, well drained slopes. 300-2500 m.		HIGH

Protected species recorded in the study area

None of the tree species protected under the National Forests Act (Appendix 1) have been previously recorded in the area in which the site is located. None were found on site.

A catalogue of plant species found during the survey is provided in Appendix 2.

There are some species that may occur on site that are protected under the Mpumalanga Nature Conservation Act No. 10 of 1998 (Appendix 3). No species listed according to NEMBA (Appendix 4) were found on site.

It is a legal requirement to obtain a permit from the provincial authorities for the destruction of any of these species. A comprehensive walk-through survey of the final footprint is required to compile a complete list of these protected species with pictures.

POSSIBLE IMPACTS

Anticipated impacts

For all infrastructure components there is the possibility that individuals or populations of plant species of conservation concern may be lost due to construction impacts. Based on known information, and data collected on site, the probability of encountering species of conservation concern at any location is moderate to low. There are only small areas of habitat on site in which rare species are likely to be found.

The best mitigation to address uncertainty issues related to SCC is to do a walk-through survey of all final infrastructure positions to check for SCC, and to collect the necessary data for any flora permits that may be required.

Based on the field data and desktop assessment of SCC, the specific habitats, or locations where the risk is higher than anywhere else is within the wetlands and adjacent grasslands. Any areas with permanent moisture are potential habitat for one SCC.

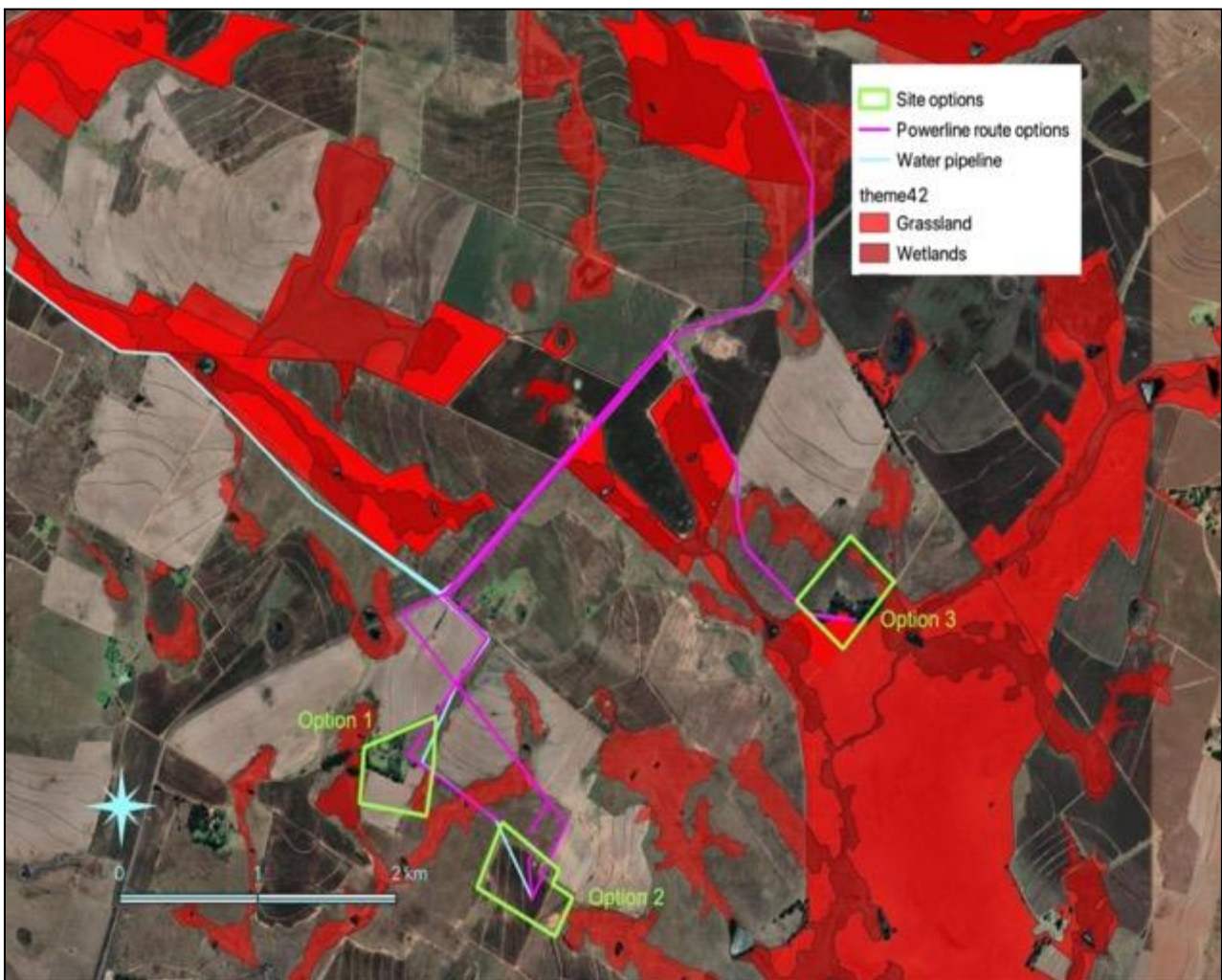


Figure 7: Plant location options in relation to sensitivities.

Proposed infrastructure in relation to sensitivities

Infrastructure locations relative to mapped Plant Theme sensitivities are shown in Figure 6 (all infrastructure) and Figure 7 (Hydrogen and Ammonia Plant locations).

Design Phase Impacts

No negative impacts occur during the Design Phase of the project since no physical construction activities take place. Nevertheless, measures taken during the Design Phase of the project can potentially have a significant positive effect on the nature, extent and intensity of impacts experienced during the Construction Phase. This is usually as a response to identified issues, leading to design modifications to avoid negative impacts.

Construction Phase Impacts

Direct impacts

Direct impacts include the following:

1. Loss of individuals of SCC due to clearing for construction.

Indirect impacts

None anticipated during the construction phase.

Operational Phase Impacts

Direct impacts

Possible direct impacts will include the following:

1. Sporadic disturbance to natural habitats due to unforeseen events during general operational activities and maintenance (e.g., fires, driving off-road) leading to loss of individuals of SCC.

Indirect impacts

These will include the following:

1. Establishment and spread of alien invasive plant species due to the presence of disturbance leading to loss of individuals of SCC.

Decommissioning Phase Impacts

Direct impacts

These will include the following:

1. Disturbance of natural vegetation due to the removal of infrastructure and need for working sites leading to possible loss of individuals of SCC.

Indirect impacts

These will occur due to renewed disturbance due to decommissioning activities, as follows:

1. Continued establishment and spread of alien invasive plant species due to the presence of migration corridors and disturbance vectors leading to possible loss of individuals of SCC.

Cumulative impacts

These include the following:

1. Cumulative impacts on individuals of SCC due to all project activities.

ASSESSMENT OF IMPACTS

A detailed assessment, as per the requirements the protocol for the specialist assessment and minimum report content requirements of environmental impacts on terrestrial plant species for activities requiring environmental authorisation, (20 March 2020), of the significance of all impacts during all phases of the project (Construction, Operation, Decommissioning and Cumulative) is provided below. This also includes all proposed mitigation measures and provides assessment before and after the implementation of proposed mitigation measures.

Construction Phase impacts

Loss of individuals of SCC due to clearing

There are three plant SCC flagged for the study area, all of which have a moderate probability of occurring in the types of habitats affected by the proposed project. There are an additional eight plant SCC that have moderate to high probability of occurring in the types of habitats affected by the proposed project. Any project component that causes direct loss of natural habitat has a probability of affecting individuals of SCC if present.

Impact 1		Loss of individuals of SCC	
Issue	Clearing of natural habitat for construction leading to direct loss of individuals of SCC		
Description of Impact			
Construction activities will require clearing of natural habitat, to be replaced by the infrastructure. This will result in permanent local loss of habitat and all individuals of species that make up that habitat.			
Type of Impact	Direct		
Nature of Impact	Negative		
Phases	Construction		
Criteria	Without Mitigation	With Mitigation	
Extent	3	1	
Duration	5	5	
Reversibility	5	5	
Magnitude (severity of impact)	3	1	
Probability	3	2	
Significance	48 (MODERATE)	24 (LOW)	
Mitigation actions			
The following measures are recommended:	1. Undertake a detailed walk-through survey of footprint areas that are within habitats where SCC are likely to occur. 2. Where significant populations of SCC are found, collect the data for any flora permits or micro-siting of infrastructure that may be required. 3. Compile a Plant Rescue Plan. 4. Undertake monitoring to evaluate whether further measures would be required to manage impacts.		
Monitoring			
The following monitoring is recommended:	As per management plans.		

Operational Phase impacts

Disturbance of vegetation due to general operational activities and maintenance leading to loss of SCC

During the operational phase of the project, there will be continuous activity on site, including normal operational activities, maintenance, and monitoring. There may also be minor additional construction. Rehabilitation of various sites, such as the construction camps, will also take place. These activities all have the potential to cause additional direct and/or indirect damage to natural habitat and vegetation that may possibly result in loss of individuals of SCC.

Impact 2		
Disturbance due to general operational activities and maintenance leading to loss of individuals of SCC		
Issue	Sporadic unforeseen disturbance to natural habitats e.g., accidental fires, driving off-road, dumping etc. during general operational activities and maintenance.	
Description of Impact		
Continued disturbance to natural habitats due to general operational activities and maintenance		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Operation	
Criteria	Without Mitigation	With Mitigation
Extent	3	1
Duration	5	5
Reversibility	5	5
Magnitude (severity of impact)	3	1
Probability	2	1
Significance	32 (MODERATE)	12 (VERY LOW)
Mitigation actions		
The following measures are recommended:	1. Protect natural habitat within project area of influence as sensitive. 2. Where undisturbed areas are to be affected by maintenance activities, undertake a detailed walk-through survey of footprint areas that are within habitats where SCC are likely to occur. 3. Additional measures as per impact 1	
Monitoring		
The following monitoring is recommended:	As per management plans	

Establishment and spread of alien invasive plant species due to the presence of disturbance leading to loss of individuals of SCC

The presence of disturbed surfaces on site creates ecological edges and corridors along which alien species can travel and become established. Where these become well-established, they alter ecological conditions leading to loss of vegetation and plant species within the affected areas. This may include plant SCC.

Impact 3	Establishment and spread of declared weeds and alien invader plants leading to loss of SCC
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Issue	Establishment and spread of declared weeds and alien invader plants leading to ecological changes that cause loss of local populations of plant species, including SCC	
Description of Impact		
Establishment and spread of declared weeds and alien invader plants		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Operation	
Criteria	Without Mitigation	With Mitigation
Extent	3	1
Duration	4	2
Reversibility	5	3
Magnitude (severity of impact)	3	1
Probability	3	2
Significance	45 (MODERATE)	14 (VERY LOW)
Mitigation actions		
The following measures are recommended:	<ol style="list-style-type: none"> 1. Prior to commencement of Operation, compile and implement an alien management plan, which highlights control priorities and areas and provides a programme for long-term control. 2. Undertake regular monitoring to detect alien invasions early so that they can be controlled. 3. Implement control measures. 	
Monitoring		
The following monitoring is recommended:	As per management plans	

Decommissioning Phase impacts

It is expected that the project will operate for a minimum of twenty to twenty-five years (a typical planned lifespan for a project of this nature). Decommissioning will probably require a series of steps resulting in the removal of equipment from the site and rehabilitation of footprint areas. It is possible that the site could be returned to a rural nature, but it is unlikely that natural vegetation would become established at disturbed locations on site for a very long time thereafter. The reality is that it is not possible to determine at this stage whether rehabilitation measures will be implemented or not or what the future for the site would be nor is it possible at this stage to determine what surrounding land pressures would be. These uncertainties make it difficult to undertake any assessment to determine possible impacts of decommissioning. It is recommended that a closure and rehabilitation plan be compiled near to the decommissioning stage but in advance of when decommissioning is planned, and that this would be required to be implemented prior to closure of the project. The closure and rehabilitation plan must follow the regulatory requirements at the time of decommissioning. Possible impacts are described below.

Disturbance of natural vegetation due to the removal of infrastructure and need for working sites leading to possible loss of individuals of SCC

During the decommissioning phase of the project, there will be a flurry of activity on site over a period, similar to during the construction phase, including dismantling and removal of equipment and rehabilitation. There may also be minor additional construction. Rehabilitation of various sites will also take place. These activities all have the potential to cause additional direct and/or indirect damage to natural habitat and vegetation that may possibly result in loss of individuals of SCC.

Impact 4			Loss and/or disturbance of indigenous natural vegetation during removal of infrastructure that may lead to loss of individuals of SCC
Issue	Disturbance of natural habitat during infrastructure removal that causes loss of local populations of plant species, including SCC		
Description of Impact			
Decommissioning activities may cause disturbance of natural habitat. This may result in permanent local loss of habitat			
Type of Impact	Direct		
Nature of Impact	Negative		
Phases	Decommissioning		
Criteria	Without Mitigation	With Mitigation	
Extent	3	1	
Duration	5	5	
Reversibility	5	5	
Magnitude (severity of impact)	3	1	
Probability	3	2	
Significance	48 (MODERATE)	24 (LOW)	
Mitigation actions			
The following measures are recommended:	1. Prior to decommissioning commencing, compile a Rehabilitation Plan in compliance with the regulatory requirements at the time of decommissioning. 2. Other mitigation, as per Impact 1.		
Monitoring			
The following monitoring is recommended:	As per management plans.		

Continued establishment and spread of alien invasive plant species due to the presence of migration corridors and disturbance vectors leading to possible loss of individuals of SCC

The presence of disturbed surfaces on site creates ecological edges and corridors along which alien species can travel and become established. Where these become well-established, they alter ecological conditions leading to loss of vegetation and plant species within the affected areas. This may include plant SCC.

Impact 5			Establishment and spread of declared weeds and alien invader plants leading to loss of SCC
Issue	Establishment and spread of declared weeds and alien invader plants leading to ecological changes that cause loss of local populations of plant species, including SCC		
Description of Impact			
Establishment and spread of declared weeds and alien invader plants			
Type of Impact	Indirect		
Nature of Impact	Negative		
Phases	Operation		
Criteria	Without Mitigation	With Mitigation	
Extent	3	1	

Duration	4	2
Reversibility	5	3
Magnitude (severity of impact)	3	1
Probability	3	2
Significance	45 (MODERATE)	14 (VERY LOW)
Mitigation actions		
The following measures are recommended:	1. Rehabilitate disturbed areas in accordance with the specifications of a Rehabilitation Plan. 2. Adhere to alien management plan, which highlights control priorities and areas and provides a programme for long-term control. 2. Undertake regular monitoring to detect alien invasions early so that they can be controlled. 3. Implement control measures.	
Monitoring		
The following monitoring is recommended:	As per management plans	

Cumulative impacts

Cumulative impacts on individuals of SCC

The terrestrial vegetation type in the broad study area is listed as Vulnerable and is impacted across its range by historical activities. Loss of habitat will occur for the project, which will be a small area in comparison to the total area of the vegetation type. However, the total loss of habitat due to several projects together will be greater than for any single project, so a cumulative effect will occur. The area lost in total will be very small compared to the total area of the vegetation type concerned. The cumulative effect will therefore be low for individuals of SCC within this vegetation type.

Impact 6			Cumulative impacts on individuals of SCC	
Issue	Clearing of natural habitat for construction			
Description of Impact				
Construction activities will require clearing of natural habitat, to be replaced by the infrastructure. This will result in permanent local loss of habitat, multiplied across multiple projects. Loss of habitat leads to loss of individuals of the species that occur within those habitats, including individuals of SCC.				
Type of Impact	Direct			
Nature of Impact	Negative			
Phases	Construction			
Criteria	Current project	Combination of projects		
Extent	3	3		
Duration	5	5		
Reversibility	5	5		
Magnitude (severity of impact)	3	3		
Probability	3	4		
Significance	48 (MODERATE)	64 (HIGH)		

Assessment of No-Go alternative

If the project does not proceed, then the current *status quo* will continue. This will involve continued use of the land for cultivation and livestock production, as well as the possibility of future mining. Historical aerial imagery shows that cultivation patterns have not changed much in recent history. This is probably because most areas that were viable for crop production were already cultivated in the early 1900s and that there is no benefit to cultivating any new areas, usually due to soil depth limitations. Within the project area, there is very little grassland remaining that has not been cultivated.

In terms of livestock production, the agricultural specialist report indicated that the long-term grazing capacity of the general area is high at 4.5 hectares per large stock unit (DAFF, 2018). Current stocking rates are much higher than this (around double). Therefore, the land is heavily overstocked, which is reflected in the condition of the grasslands on site. These are obviously overgrazed, and the site is on a long-term over-grazing trajectory. This implies that stocking rates, and therefore profitability, will need to be reduced to avert land degradation, putting financial strain on producers. An alternative income stream associated with financial benefits from hosting renewable energy projects is likely to improve the financial viability of any land manager, which in turn reduces the pressure to carry unsustainable stock numbers. This reduces pressure on the land, which reduces the likelihood of grazing-induced degradation.

In summary, the No-Go option will increase the rate of land degradation due to over-grazing, especially under adverse future climate scenarios, whereas there is a possibility of this effect being lessened in the case of the project promoting local economic diversity. There is also a moderate to high risk of loss of natural areas due to expansion of coal mining.

Summary of mitigation measures

The following mitigation measures are recommended to address known potential impacts:

- It is a legal requirement to obtain permits for specimens of protected species that will be lost due to construction of the project.
- A detailed pre-construction walk-through survey will be required during a summer to locate any individuals of protected plants, as well as for any populations of threatened plant species. This survey must cover the footprint of all approved infrastructure, including internal service roads and footprints of tower structures (final infrastructure layout). The best season is early to late Summer, but dependent on recent rainfall and vegetation growth.
- It is possible that some plants lost to the development can be rescued and planted in appropriate places in rehabilitation areas, but the description and appropriateness of such measures must be included in a Plant Rescue Plan. Any such measures will reduce the irreplaceable loss of resources as well as the cumulative effect. Note that Search and Rescue is only appropriate for some species and that a high mortality rate can be expected from individuals of species that are not appropriate to transplant.
- A Plant Rescue Plan must be compiled to be approved by the appropriate authorities.
- For any plants that are transplanted, annual monitoring should take place to assess survival. This should be undertaken for a period of three years after translocation and be undertaken by the ECO. The monitoring programme must be designed prior to translocation of plants and should include control sites (areas not disturbed by the project) to evaluate mortality relative to wild populations.
- No collecting or poaching of any plant species.
- Report any loss of protected species to conservation authorities as per permit requirements.
- Personnel to be educated about protection status of species, including distinguishing features, to be able to identify protected species.

Summary of monitoring recommendations

Specific monitoring recommendations should be provided in the Plant Rescue Plan, the Alien Invasive Management Plan, and the Rehabilitation Plan. The following are broad recommendations:

Rescued plants:

- The location of all transplanted rescued plants must be recorded, along with the identity of the plant.
- The health/vigour of each transplanted individual should be monitored annually for a minimum of three years.
- As a scientific control, an equal number of non-transplanted individuals of the same species, within similar habitats, should be monitored in the same way as the transplanted specimens. This will provide comparative data on the survival of wild populations relative to transplanted plants.

Threatened species

- If populations of threatened plant species are found to occur on site, annual monitoring of population health should take place. This should be appropriate to the species concerned.

CONCLUSIONS

Desktop information, field data collection and mapping from aerial imagery provides the following verifications of patterns for the plant species theme:

1. Most of the site consists of secondary and/ or degraded areas, including areas heavily invaded by alien invasive shrubs. Significant parts of the site therefore have very low sensitivity. Construction of project components is not problematic in these areas.
2. Where there is remaining natural habitat, this has characteristics of the regional vegetation type and is therefore representative of natural habitat in the general area, including the potential to support populations of plant SCC.
3. There are three plant species of conservation concern flagged by the screening tool that could possibly occur on site, as well as an additional eight species from historical records from SANBI databases. A targeted walk-through survey of footprint of construction areas is required to determine if any of these occur at any specific location or not. This survey can take place at the same time as the required walk-through surveys for permitting purposes, or it can be undertaken as a separate targeted survey. It is recommended that this is undertaken in Spring or early Summer if possible.
4. The project is supported if impacts on remaining natural areas on site and thus on plant SCC can be minimised, as suggested.
5. Alternative 1 and Alternative 2 are preferred over Alternative 3, simply because they affect almost no natural areas. They are therefore unlikely to affect any individuals of plant SCC. However, all options are feasible, on condition measures are taken to exclude the likelihood of individuals of plant SCC being affected.

Required pre-construction survey

For permitting purposes, the following flora survey is required prior to construction activities taking place:

1. Detailed floristic walk-through survey of all footprint areas in order to document composition, especially of protected species. This must be undertaken after an appropriate time-period after rainfall to allow emergence of any species of potential concern. The survey must also cover all footprint areas, including final road alignments. Renewable energy projects similar to the one assessed here tend to have high fluidity in terms of layout and technology, due to the current rapid evolution of the technology, which allows more efficient deployment of infrastructure. However, this means that “final” layouts regularly change. The walk-through survey:
 - a. Must assess the footprint that will be constructed – if this changes then the new footprint areas must be subject to a walk-through survey in full.
 - b. Must be undertaken in an appropriate flowering season.
 - c. Must be adequately resourced to ensure it is done properly.
 - d. Must be undertaken by a competent botanist.

REFERENCES:

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- VAN WYK, A.E. AND SMITH, G.F. (Eds) 2001. Regions of Floristic Endemism in Southern Africa: A review with emphasis on succulents, pp. 1-199. Umdaus Press, Pretoria.

APPENDICES:

Appendix 1: List of protected tree species (National Forests Act, 1998).

In terms of section 15(1) of the National Forests Act, 1998, no person may cut, disturb, damage or destroy any protected tree; or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree or any product derived from a protected tree, except under a licence or exemption granted by the Minister of Agriculture, Forestry and Fisheries. The list of Protected Tree Species under the National Forest Act, 1998 (Act No. 84 of 1998) is provided here. The most recent version of this list was published in the Government Gazette No. 41887 on 7 September 2018, designated as GN No. 536 of 2018, and contains 47 species distributed across South Africa.

Botanical name	English common names	Other common names Afrikaans (A), Sepedi (P), Sesotho (S), Setswana (T), Tshivenda (V), isiXhosa (X), isiZulu (Z), Xitsonga (XT)	National tree number
<i>Acacia erioloba</i>	Camel thorn	Kameeldoring (A)/Mogohlo (NS)/Mogoŋho (T)/	168
<i>Acacia haematoxylon</i>	Grey camel thorn	Vaalkameeldoring (A)/Mokholo (T)	169
<i>Adansonia digitata</i>	Baobab	Kremetart (A)/Seboi (NS)/Mowana (T)/Ximuwu (XT)	467
<i>Azelia quanzensis</i>	Pod mahogany	Peulmahonie (A)/Mutokota (V)/Inkehli (Z)	207
<i>Balanites</i> subsp. <i>maughamii</i>	Torchwood	Groendoring (A)/Ugobandlovu (Z)	251
<i>Barringtonia racemosa</i>	Powder-puff tree	Poeierkwasboom (A)/Iboqo (Z)	524
<i>Boscia albitrunca</i>	Shepherd's tree	Witgat (A)/Mohlōpi (NS)/Motlhōpi (T)/Muvhombwe (V)/Umgqomogqomo (X)/Umvithi (Z)	122
<i>Brachystegia spiciformis</i>	Msasa	Msasa (A)	198.1
<i>Breonadia salicina</i>	Matumi	Mingerhout (A)/Mohlome (NS)/Mutulume (V)/Umfomfo (Z)	684
<i>Bruguiera gymnorrhiza</i>	Black mangrove	Swartwortelboom (A)/isiKhangati (X)/IsiHlobane (Z)	527
<i>Cassipourea swaziensis</i>	Swazi onionwood	Swazi-ueihout (A)	531.1
<i>Catha edulis</i>	Bushman's tea	Boesmanstee (A)/Mohlatse (NS)/Igqwaka (X)/Umhlwazi (Z)	404
<i>Ceriops tagal</i>	Indian mangrove	Indiese wortelboom (A)/isinkaha (Z)	525
<i>Cleistanthus schlechteri</i> var. <i>schlechteri</i>	False tamboti	Bastertambotie (A)/Umzithi (Z)	320
<i>Colubrina nicholsonii</i>	Pondo weeping thorn	Pondo-treurdoring (A)	453.8

<i>Combretum imberbe</i>	Leadwood	Hardekool (A)/Mohwelere-tšhipi (NS)/Motswiri (T)/Impondondlovu (Z)	539
<i>Curtisia dentata</i>	Assegai	Assegai (A)/Umgxina (X)/Umagunda (Z)	570
<i>Elaeodendron transvaalensis</i>	Bushveld saffron	Bosveld-saffraan (A)/Monomane (T)/Ingwavuma (Z)	416
<i>Erythrophysa transvaalensis</i>	Bushveld red balloon	Bosveld-rooiklapperbos (A)/Mofalatsane (T)	436.2
<i>Euclea pseudebenus</i>	Ebony guarri	Ebbeboom-ghwarrie (A)	598
<i>Ficus trichopoda</i>	Swamp fig	Moerasvy (A)/Umvubu (Z)	54
<i>Leucadendron argenteum</i>	Silver tree	Silwerboom (A)	77
<i>Lumnitzera racemosa</i> var. <i>racemosa</i>	Tonga mangrove	Tonga-wortelboom (A)/isiKhahanesibomvu (Z)	552
<i>Lydenburgia abbottii</i>	Pondo bushman's tea	Pondo-boesmanstee (A)	407
<i>Lydenburgia cassinoides</i>	Sekhukhuni bushman's tea	Sekhukhuni-boesmanstee (A)	406
<i>Mimusops caffra</i>	Coastal red milkwood	Kusrooimelkhou (A)/Umthunzi (X)/Umkhakhayi (Z)	583
<i>Newtonia hildebrandtii</i> var. <i>hildebrandtii</i>	Lebombo wattle	Lebombo-wattel (A)/Umfomothi (Z)	191
<i>Ocotea bullata</i>	Stinkwood	Stinkhout (A)/Umhlungulu (X)/Umnukane (Z)	118
<i>Ozoroa namaquensis</i>	Gariep resin tree	Gariep-harpuisboom (A)	373.2
<i>Philenoptera violacea</i>	Apple-leaf	Appelblaar (A)/Mphata (NS)/Mohata (T)/isiHomohomo (Z)	238
<i>Pittosporum viridiflorum</i>	Cheesewood	Kasuur (A)/Kgalagangwe (NS)/Umkhwenkwe (X)/Umfusamvu (Z)	139
<i>Podocarpus elongatus</i>	Breede River yellowwood	Breeëriviergeelhout (A)	15
<i>Podocarpus falcatus</i> (<i>Afrocarpus falcatus</i>)	Outeniqua yellowwood	Outniekwageelhout (A)/Mogōbagōba (NS)/Umkhoba (X)/Umsonti (Z)	16
<i>Podocarpus henkelii</i>	Henkel's yellowwood	Henkel se geelhout (A)/Umsonti (X)/Umsonti (Z)	17
<i>Podocarpus latifolius</i>	Real yellowwood	Regte-geelhout (A)/Mogōbagōba (NS)/Umcheya (X)/Umkhoba (Z)	18
<i>Protea comptonii</i>	Saddleback sugarbush	Barberton-suikerbos (A)	88
<i>Protea curvata</i>	Serpentine sugarbush	Serpentynsuikerbos (A)	88.1
<i>Prunus africana</i>	Red stinkwood	Rooistinkhout (A)/Umkhakhase (X)/Umdomezulu (Z)	147
<i>Pterocarpus angolensis</i>	Wild teak	Kiaat (A)/Morōfo (NS)/Mokwa (T)/Mutondo (V)/Umvangazi (Z)	236
<i>Rhizophora mucronata</i>	Red mangrove	Rooiwortelboom (A)/isiKhangathi (X)/Umhlume (Z)	526
<i>Sclerocarya birrea</i> subsp. <i>caffra</i>	Marula	Maroela (A)/Morula (NS)/Morula (T)/Unganu (Z) /Nkanyi (XT)	360
<i>Securidaca longepedunculata</i>	Violet tree	Krinkhout (A)/Mmaba (T)	303

<i>Sideroxylon inerme</i> subsp. <i>inerme</i>	White milkwood	Witmelkhout (A)/Ximafana (X)/Umakhwelafingqane (Z)	579
<i>Tephrosia pondoensis</i>	Pondo poison pea	Pondo-gifertjie (A)	226.1
<i>Warburgia salutaris</i>	Pepper-bark tree	Peperbasboom (A)/Molaka (NS)/Mulanga (V)/isiBaha (Z)	488
<i>Widdringtonia cedarbergensis</i>	Clanwilliam cedar	Clanwilliamseder (A)	19
<i>Widdringtonia schwarzii</i>	Willowmore cedar	Baviaanskloofseder (A)	21
<i>Berchemia zeyheri</i> (RHAMNACEAE) LC	Red ivory Pink ivory	Rooi-ivoor (A) / Rooihout (A) / Monee (S) / umNeyi (SW) / umNini (Z, X) / Xiniyani (TS) / Moye (T) / Munia-niane (V)	450
<i>Diospyros mespiliformis</i> (EBENACEAE) LC	Jackal berry	Jakkalsbessie (A) / Musuma (V) / Muntoma (TS) / Mgula (TS)	606
<i>Schinziophyton rautanenii</i>	Manketti / Mongongo	Mankettiboom (A) / Monghongho (T) / Makongwa (T)	337
<i>Umtiza listeriana</i>	Umtiza	Umtiza (X) / Omtisa (A)	205

Appendix 2: Plant species recorded on site and nearby.

This list was compiled by extracting a list of species that have been recorded within a rectangular area that includes the study area as well as similar habitats in surrounding areas, as obtained from <http://newposa.sanbi.org/> accessed on 12 September 2021. It is probable that it includes some species that occur in habitats that do not occur on site. The list was supplemented from field observations, as well as observations from www.inaturalist.org, which are photographic observations verified by an online community.

The list is arranged by family in alphabetical order. Species listed in **green** are those that were found on site.

Acanthaceae

Blepharis innocua
Blepharis stainbankiae
Blepharis subvolubilis
Crabbea acaulis
Dyschoriste burchellii
Justicia anagalloides
Ruellia cordata
Thunbergia atriplicifolia
Thunbergia pondoensis

Achariaceae

Ceratiosicyos laevis
Kiggelaria africana

Agapanthaceae

Agapanthus inapertus. subsp. *intermedius*

Agavaceae

Chlorophytum comosum
Chlorophytum cooperi
Chlorophytum fasciculatum
Chlorophytum galpinii

Aizoaceae

Delosperma sutherlandii
Khadia carolinensis
Mossia intervallaris
Ruschia sp.

Alliaceae

Tulbaghia acutiloba
Tulbaghia cernua
Tulbaghia leucantha
Tulbaghia ludwigiana

Amaranthaceae

Amaranthus hybridus subsp. *cruentus*; Naturalised
Amaranthus hybridus subsp. *hybridus* var. *hybridus*; Naturalised
Amaranthus thunbergii
Chenopodium album; Naturalised

Cyathula cylindrica var. *cylindrica*
Cyathula uncinulata
Gomphrena celosioides; Naturalised
Guilleminea densa; Naturalised; Invasive

Amaryllidaceae

Boophone disticha
Brunsvigia natalensis
Brunsvigia radulosa
Crinum bulbispermum (Protected)
Cyrtanthus breviflorus (Protected)
Cyrtanthus stenanthus var. *major* (Protected)
Cyrtanthus tuckii var. *transvaalensis* (Protected)
Cyrtanthus tuckii var. *tuckii* (Protected)
Haemanthus humilis subsp. *Hirsutus* (Protected)
Haemanthus montanus (Protected)
Nerine angustifolia
Nerine gracilis
Nerine krigei
Nerine rehmannii
Scadoxus puniceus (Protected)

Anacardiaceae

Ozoroa engleri
Searsia dentata
Searsia discolor
Searsia magalismontana subsp. *magalismontana*
Searsia rigida var. *rigida*
Searsia tumulicola var. *tumulicola*

Apiaceae

Afrosciadium magalismontanum
Alepidea peduncularis
Centella asiatica
Heteromorpha arborescens var. *abyssinica*

Apocynaceae

Anisotoma pedunculata
Asclepias albens
Asclepias aurea
Asclepias brevicuspis
Asclepias crassinervis
Asclepias cucullata subsp. *cucullata*
Asclepias cultriformis
Asclepias eminens
Asclepias fulva
Asclepias gibba var. *gibba*
Asclepias gibba var. *media*
Asclepias macropus
Asclepias multicaulis
Asclepias stellifera
Aspidoglossum araneiferum
Aspidoglossum biflorum
Aspidoglossum glanduliferum
Aspidoglossum lamellatum
Aspidoglossum ovalifolium

Aspidoglossum xanthosphaerum
Brachystelma foetidum (Protected)
Brachystelma pygmaeum subsp. *pygmaeum* (Protected)
Cordylogyne globosa
Gomphocarpus fruticosus
Gomphocarpus rivularis
Miraglossum pulchellum
Pachycarpus campanulatus var. *sutherlandii*
Pachycarpus grandiflorus subsp. *grandiflorus*
Pachycarpus macrochilus
Pachycarpus plicatus
Pachycarpus scaber
Pachycarpus suaveolens
Parapodium costatum
Raphionacme hirsuta
Riocreuxia picta
Riocreuxia polyantha
Schizoglossum atropurpureum atropurpureum
Schizoglossum nitidum. Indigenous
Schizoglossum peglerae
Sisyranthus huttoniae
Sisyranthus imberbis
Stenostelma periglossoides
Woodia sp.
Xysmalobium asperum
Xysmalobium parviflorum
Xysmalobium stockenstromense
Xysmalobium undulatum var. *undulatum*

Aponogetonaceae

Aponogeton junceus

Araceae

Zantedeschia albomaculata subsp. *Macrocarpa* (Protected)
Zantedeschia rehmannii (Protected)

Asparagaceae

Asparagus bechuanicus
Asparagus cooperi
Asparagus devenishii
Asparagus fractiflexus
Asparagus laricinus
Asparagus ramosissimus
Asparagus virgatus

Asphodelaceae

Aloe bergeriana (Protected)
Aloe boylei (Protected)
Aloe davyana (Protected)
Aloe ecklonis (Protected)
Aloe graciliflora (Protected)
Aloe hlangapies (Protected)
Aloe jeppeae (Protected)
Aloe maculata subsp. *maculata* (Protected)
Bulbine abyssinica
Bulbine capitata

Kniphofia albescens (Protected)
Kniphofia porphyrantha (Protected)
Kniphofia typhoides (Protected)
Trachyandra asperata var. *carolinensis*
Trachyandra asperata var. *macowanii*
Trachyandra asperata var. *nataglencoensis*
Trachyandra asperata var. *swaziensis*
Trachyandra gerrardii
Trachyandra saltii var. *saltii*

Aspleniaceae

Asplenium aethiopicum
Asplenium capense

Asteraceae

Adenanthellum osmitoides
Afroaster hispidus
Afroaster serrulatus
Artemisia afra
Athrixia elata
Berkheya echinacea subsp. *echinacea*
Berkheya insignis
Berkheya pinnatifida subsp. *ingrata*
Berkheya radula
Berkheya setifera
Berkheya speciosa subsp. *lanceolata*
Berkheya zeyheri subsp. *zeyheri*
Bidens pilosa; Naturalised
Callilepis salicifolia
Campuloclinium macrocephalum; Naturalised; Invasive
Cineraria lyratiformis
Cirsium vulgare; Naturalised; Invasive, NEMBA Category 1b
Conyza gouanii
Conyza pinnata
Conyza podocephala
Cosmos bipinnatus; Naturalised
Cotula anthemoides
Denekia capensis
Dichrocephala integrifolia subsp. *integrifolia*
Dicoma anomala
Didelta carnos var. *carnos*
Dimorphotheca caulescens
Dimorphotheca jucunda E
Dimorphotheca spectabilis
Dimorphotheca zeyheri
Erigeron bonariensis; Naturalised; Invasive
Erigeron canadensis; Naturalised; Invasive
Euryops gilfillanii
Euryops laxus
Euryops transvaalensis subsp. *setilobus*
Felicia filifolia subsp. *filifolia*
Felicia muricata subsp. *muricata*
Felicia muricata subsp. *strictifolia*
Gamochoeta antillana; Naturalised; Invasive
Gamochoeta pensylvanica; Naturalised
Gazania krebsiana subsp. *serrulata*

Geigeria aspera var. *aspera*
Geigeria burkei subsp. *burkei* var. *burkei*
Geigeria burkei subsp. *burkei* var. *intermedia*
Geigeria burkei subsp. *valida*
Geigeria filifolia
Gerbera ambigua
Gerbera natalensis
Gerbera piloselloides
Gerbera viridifolia
Gnaphalium filagopsis
Haplocarpha scaposa
Helichrysum adenocarpum subsp. *adenocarpum*
Helichrysum albilanatum
Helichrysum aureonitens
Helichrysum aureum var. *monocephalum*
Helichrysum caespititium
Helichrysum callicomum
Helichrysum cephaloideum
Helichrysum griseum
Helichrysum miconiifolium
Helichrysum molestum
Helichrysum mundtii
Helichrysum nudifolium var. *nudifolium*
Helichrysum nudifolium var. *pilosellum*
Helichrysum opacum
Helichrysum oreophilum
Helichrysum rugulosum
Helichrysum splendidum
Helichrysum subglomeratum
Hilliardiella aristata
Hilliardiella elaeagnoides
Hilliardiella hirsuta
Hilliardiella nudicaulis
Hypochaeris radicata; Naturalised
Lactuca inermis
Lasiospermum pedunculare
Lopholaena segmentata
Macledium zeyheri subsp. *zeyheri*
Nidorella anomala
Nidorella auriculata
Nidorella resedifolia subsp. *resedifolia*
Osteospermum moniliferum subsp. *canescens*
Osteospermum scariosum var. *scariosum*
Othonna natalensis
Parapolydora fastigiata
Polydora angustifolia
Pseudognaphalium luteoalbum cryptogenic
Pseudognaphalium oligandrum
Pseudopegolettia tenella
Pulicaria scabra
Schistostephium crataegifolium
Schkuhria pinnata; Naturalised
Senecio affinis
Senecio albanensis var. *albanensis*
Senecio bupleuroides
Senecio coronatus

Senecio erubescens var. *erubescens*
Senecio harveianus
Senecio hieracioides
Senecio isatideus
Senecio laevigatus var. *integrifolius*
Senecio laevigatus var. *laevigatus*
Senecio latifolius
Senecio madagascariensis
Senecio othonniflorus
Senecio oxyriifolius subsp. *oxyriifolius*
Senecio pentactinus
Senecio polyodon
Senecio rhomboideus
Senecio scitus
Senecio speciosus
Senecio subcoriaceus
Senecio venosus
Seriphium plumosum
Sonchus asper subsp. *asper*; Naturalised; Invasive
Sonchus nanus
Sonchus oleraceus; Naturalised; Invasive
Tagetes minuta; Naturalised; Invasive
Tolpis capensis
Ursinia montana subsp. *montana*
Ursinia nana subsp. *leptophylla*
Ursinia nana subsp. *nana*
Ursinia paleacea
Ursinia tenuiloba

Bartramiaceae

Philonotis falcata
Philonotis hastata

Begoniaceae

Begonia sutherlandii subsp. *sutherlandii*

Blechnaceae

Blechnum attenuatum
Blechnum australe subsp. *australe*

Boraginaceae

Cynoglossum austroafricanum
Cynoglossum hispidum
Cynoglossum lanceolatum
Lithospermum cinereum
Myosotis graminifolia
Myosotis sylvatica; Naturalised

Brassicaceae

Erucastrum austroafricanum
Heliophila carnosia
Lepidium schinzii
Lepidium transvaalense
Nasturtium officinale; Naturalised; Invasive
Rorippa fluviatilis var. *fluviatilis*
Rorippa nudiuscula

Sisymbrium turczaninowii
Turritis glabra; Naturalised

Bruchiaceae

Cladophascum gymnomitrioides

Bryaceae

Anomobryum julaceum
Bryum apiculatum
Bryum argenteum
Bryum cellulare
Bryum dichotomum

Cactaceae

Opuntia ficus-indica; Naturalised; Invasive, NEMBA Category 1b

Campanulaceae

Wahlenbergia undulata
Wahlenbergia virgata

Caryophyllaceae

Cerastium arabidis
Cerastium capense
Dianthus transvaalensis
Dianthus sp.
Herniaria erckertii subsp. *erckertii*
Pollichia campestris
Silene burchellii subsp. *modesta*
Silene burchellii subsp. *pilosellifolia*
Silene undulata
Spergularia media; Naturalised

Celastraceae

Gymnosporia buxifolia
Maytenus undata

Cleomaceae

Cleome monophylla

Colchicaceae

Colchicum longipes
Colchicum striatum
Gloriosa modesta

Commelinaceae

Commelina africana var. *africana*
Commelina africana var. *krebsiana*
Commelina africana var. *lancispatha*
Commelina benghalensis
Commelina subulata
Cyanotis speciosa

Convolvulaceae

Convolvulus arvensis; Naturalised; Invasive
Convolvulus natalensis
Convolvulus sagittatus

Convolvulus thunbergii
Falkia oblonga
Ipomoea bathycolpos
Ipomoea crassipes var. *crassipes*
Ipomoea oblongata
Ipomoea ommanneyi
Ipomoea simplex
Merremia verecunda
Xenostegia tridentata subsp. *angustifolia*

Crassulaceae

Crassula alba var. *alba*
Crassula barbata subsp. *barbata*
Crassula capitella subsp. *nodulosa*
Crassula compacta
Crassula lanceolata subsp. *transvaalensis*
Crassula natans var. *minus*
Crassula natans var. *natans*
Crassula setulosa var. *setulosa* forma *setulosa*
Crassula tuberella
Crassula vaginata subsp. *vaginata*

Cucurbitaceae

Coccinia adoensis
Cucumis anguria var. *longaculeatus*
Cucumis hirsutus
Cucumis myriocarpus subsp. *myriocarpus*
Cucumis zeyheri

Cyperaceae

Ascolepis capensis
Bulbostylis densa subsp. *afromontana*
Bulbostylis humilis
Bulbostylis oritrephes
Bulbostylis schoenoides
Bulbostylis scleropus
Carex ludwigii
Carex rhodesiaca
Cyperus congestus
Cyperus denudatus
Cyperus difformis
Cyperus esculentus var. *esculentus*
Cyperus fastigiatus
Cyperus laevigatus
Cyperus longus var. *longus*
Cyperus longus var. *tenuiflorus*
Cyperus margaritaceus var. *margaritaceus*
Cyperus marginatus
Cyperus obtusiflorus var. *flavissimus*
Cyperus parvinux
Cyperus rigidifolius
Cyperus rupestris var. *rupestris*
Cyperus schlechteri
Cyperus sphaerospermus
Cyperus squarrosus
Cyperus uitenhagensis

Cyperus teneristolon
Cyperus usitatus
Dracoscirpoides surculosa
Eleocharis dregeana
Eleocharis limosa
Fimbristylis complanata
Fuirena coerulescens
Isolepis cernua var. *cernua*
Isolepis costata
Isolepis fluitans var. *fluitans*
Isolepis sepulcralis
Isolepis setacea
Kyllinga alata
Kyllinga erecta var. *erecta*
Kyllinga pulchella
Lipocarpha nana
Lipocarpha rehmannii
Pycnus betschuanus
Pycnus chrysanthus
Pycnus cooperi
Pycnus macranthus
Pycnus nitidus
Pycnus pumilus
Pycnus rehmannianus
Rhynchospora brownii
Schoenoplectus corymbosus
Schoenoplectus decipiens
Schoenoplectus muriculatus
Schoenoplectus tabernaemontani; Naturalised
Schoenoxiphium sp.
Scirpoides burkei

Dioscoreaceae

Dioscorea dregeana

Dipsacaceae

Scabiosa columbaria

Droseraceae

Drosera burkeana

Dryopteridaceae

Dryopteris athamantica

Ebenaceae

Diospyros austro-africana var. *microphylla*

Diospyros lycioides subsp. *guerkei*

Euclea sp.

Ericaceae

Erica alopecurus var. *alopecurus*

Erica cerinthoides var. *cerinthoides*

Erica drakensbergensis

Erica oatesii

Eriocaulaceae

Eriocaulon abyssinicum
Eriocaulon sonderianum

Euphorbiaceae

Acalypha angustata

Acalypha caperonioides var. *caperonioides*
Acalypha wilmsii
Euphorbia gueinzii
Euphorbia inaequilatera
Euphorbia natalensis
Euphorbia striata

Exornothecaceae (Liverworts)

Exornotheca holstii

Fabaceae

Acacia dealbata; Naturalised; Invasive
Aeschynomene rehmannii var. *leptobotrya*
Aeschynomene rehmannii var. *rehmannii*
Alysicarpus zeyheri
Argyrolobium harveyanum
Argyrolobium humile
Argyrolobium lotoides
Argyrolobium pauciflorum
Argyrolobium rupestre subsp. *rupestre*
Argyrolobium speciosum
Argyrolobium transvaalense
Argyrolobium tuberosum
Aspalathus callosa Indigenous
Chamaecrista capensis var. *capensis*
Chamaecrista capensis var. *flavescens*
Chamaecrista comosa
Crotalaria distans subsp. *distans*
Crotalaria eremicola subsp. *eremicola*
Crotalaria globifera
Crotalaria magaliesbergensis
Crotalaria sphaerocarpa subsp. *sphaerocarpa*
Dichilus strictus
Dolichos angustifolius
Dolichos falciformis
Elephantorrhiza elephantina
Elephantorrhiza praetermissa
Eriosema cordatum
Eriosema kraussianum
Eriosema salignum
Eriosema simulans
Erythrina zeyheri
Indigastrum fastigiatum
Indigofera buchananii
Indigofera comosa
Indigofera dimidiata
Indigofera dregeana
Indigofera evansiana
Indigofera frondosa
Indigofera hedyantha
Indigofera hilaris var. *hilaris*

Indigofera longibarbata
Indigofera melanadenia
Indigofera placida
Indigofera rostrata
Indigofera sanguinea
Indigofera tristoides
Lablab purpureus subsp. *uncinatus*
Leobordea adpressa subsp. *adpressa*
Leobordea eriantha
Leobordea foliosa
Lespedeza cuneata; Naturalised
Lessertia frutescens subsp. *microphylla*
Listia heterophylla
Lotus discolor subsp. *discolor*
Medicago laciniata var. *laciniata*; Naturalised
Melolobium alpinum
Melolobium calycinum
Melolobium microphyllum
Melolobium obcordatum
Melolobium wilmsii
Mucuna coriacea Baker
Pearsonia cajanifolia subsp. *cryptantha*
Pearsonia sessilifolia subsp. *filifolia*
Pearsonia sessilifolia subsp. *sessilifolia*
Rhynchosia adenodes
Rhynchosia nervosa var. *nervosa*
Rhynchosia pauciflora
Rhynchosia pedunculata
Rhynchosia reptabunda
Rhynchosia totta var. *totta*
Tephrosia capensis var. *acutifolia*
Tephrosia capensis var. *capensis*
Tephrosia natalensis subsp. *natalensis*
Tephrosia semiglabra
Trifolium africanum var. *africanum*
Trifolium africanum var. *lydenburgense*
Vigna luteola var. *luteola*
Vigna oblongifolia var. *oblongifolia*
Vigna unguiculata subsp. *unguiculata* var. *unguiculata*
Zornia capensis subsp. *capensis*
Zornia linearis
Zornia milneana

Fagaceae

Quercus robur; Naturalised

Gentianaceae

Chironia krebsii
Chironia palustris subsp. *transvaalensis*
Chironia purpurascens subsp. *humilis*
Exochaenium grande
Sebaea leiostyla
Sebaea repens
Sebaea sedoides var. *sedoides*

Geraniaceae

Geranium multifectum
Geranium robustum
Geranium wakkerstroomianum
Monsonia angustifolia
Monsonia attenuata
Monsonia brevirostrata
Pelargonium alchemilloides
Pelargonium luridum
Pelargonium minimum
Pelargonium pseudofumarioides
Pelargonium sidoides

Gesneriaceae

Streptocarpus dunnii
Streptocarpus galpinii
Streptocarpus pentherianus

Haloragaceae

Laurembergia repens subsp. *brachypoda*

Hyacinthaceae

Albuca baurii
Albuca setosa
Albuca shawii
Albuca virens subsp. *virens*
Dipcadi brevifolium
Dipcadi marlothii
Dipcadi viride
Drimia calcarata
Drimia depressa
Drimia elata
Drimia multisetosa
Drimia pauciflora
Drimia sphaerocephala
Eucomis autumnalis subsp. *clavata* (Protected)
Eucomis montana (Protected)
Eucomis pallidiflora subsp. *pallidiflora* (Protected)
Ledebouria cooperi
Ledebouria humifusa
Ledebouria leptophylla
Ledebouria marginata
Ledebouria ovatifolia
Ledebouria revoluta
Merwillia plumbea
Ornithogalum candicans
Ornithogalum capillare
Ornithogalum esterhuyseniae
Ornithogalum flexuosum
Ornithogalum juncifolium var. *juncifolium*
Schizocarpus nervosus

Hydrocharitaceae

Lagarosiphon muscoides

Hypericaceae

Hypericum aethiopicum subsp. *sonderi*

Hypericum lalandii

Hypoxidaceae

Empodium elongatum

Hypoxis acuminata

Hypoxis argentea var. *argentea*

Hypoxis filiformis

Hypoxis hemerocallidea

Hypoxis iridifolia

Hypoxis multiceps

Hypoxis obtusa

Hypoxis rigidula var. *rigidula*

Iridaceae

Aristea torulosa

Babiana bainesii

Crocsmia paniculata

Dierama insigne

Dierama mossii

Dierama tyrium

Gladiolus crassifolius (Protected)

Gladiolus dalenii subsp. *dalenii* (Protected)

Gladiolus ecklonii (Protected)

Gladiolus elliotii (Protected)

Gladiolus longicollis subsp. *platypetalus* (Protected)

Gladiolus paludosus (Protected)

Gladiolus papilio (Protected)

Gladiolus robertsoniae (Protected)

Gladiolus sericeovillosus subsp. *calvatus* (Protected)

Gladiolus sericeovillosus subsp. *sericeovillosus* (Protected)

Gladiolus vinosomaculatus (Protected)

Gladiolus woodii (Protected)

Hesperantha coccinea

Hesperantha longicollis

Hesperantha rupestris

Moraea elliotii

Moraea filicaulis

Moraea pallida

Moraea pubiflora

Watsonia bella (Protected)

Watsonia pulchra (Protected)

Juncaceae

Juncus dregeanus subsp. *dregeanus*

Juncus exsertus

Juncus oxycarpus

Juncus punctorius

Lamiaceae

Acrotome hispida

Acrotome inflata

Aeollanthus buchnerianus

Ajuga ophrydis

Leonotis ocymifolia var. *raineriana*

Mentha aquatica

Ocimum obovatum subsp. *obovatum* var. *obovatum*

Platostoma rotundifolium
Pycnostachys reticulata
Rothea hirsuta
Salvia aurita var. *galpinii*
Salvia repens var. *repens*
Salvia runcinata
Stachys hyssopoides
Stachys kuntzei
Stachys natalensis var. *natalensis*
Stachys nigricans
Syncolostemon albiflorus
Syncolostemon concinnus
Syncolostemon pretoriae
Teucrium trifidum

Lentibulariaceae

Utricularia prehensilis

Limeaceae

Limeum sulcatum var. *sulcatum*

Linaceae

Linum thunbergii

Linderniaceae

Linderniella nana

Lobeliaceae

Cyphia elata
Lobelia erinus
Lobelia flaccida subsp. *flaccida*
Lobelia sonderiana
Monopsis decipiens

Lythraceae

Nesaea sagittifolia var. *sagittifolia*
Nesaea schinzii

Malvaceae

Grewia flava
Grewia occidentalis var. *occidentalis*
Hermannia cordata
Hermannia cristata
Hermannia depressa
Hermannia transvaalensis
Hibiscus aethiopicus var. *ovatus*
Hibiscus microcarpus
Hibiscus trionum; Naturalised
Malva parviflora var. *parviflora*; Naturalised
Pavonia columella
Sida chrysantha
Sida rhombifolia subsp. *rhombifolia*

Melianthaceae

Melianthus dregeanus subsp. *insignis*

Menispermaceae

Stephania abyssinica var. *tomentella*

Menyanthaceae

Nymphoides thunbergiana

Molluginaceae

Psammotropha myriantha

Myrsinaceae

Rapanea melanophloeos

Myrtaceae

Eucalyptus camaldulensis; Naturalised; Invasive, NEMBA Category 1b in riparian areas

Ochnaceae

Ochna natalitia

Onagraceae

Epilobium capense

Ludwigia palustris; Naturalised

Oenothera stricta subsp. *stricta*; Naturalised; Invasive

Oenothera tetraptera; Naturalised; Invasive

Orchidaceae

Brachycorythis ovata subsp. *ovata* (Protected)

Brachycorythis pubescens (Protected)

Brownleea parviflora (Protected)

Disa aconitoides subsp. *aconitoides* (Protected)

Disa cooperi (Protected)

Disa nervosa (Protected)

Disa patula var. *transvaalensis* (Protected)

Disa stachyoides (Protected)

Disa versicolor (Protected)

Disperis cooperi (Protected)

Disperis fanniniae (Protected)

Eulophia cooperi (Protected)

Eulophia hians var. *hians* (Protected)

Eulophia hians var. *inaequalis* (Protected)

Eulophia hians var. *nutans* (Protected)

Eulophia ovalis var. *bainesii* (Protected)

Eulophia ovalis var. *ovalis* (Protected)

Eulophia parvilabris (Protected)

Habenaria barbertoni (Protected)

Habenaria clavata (Protected)

Habenaria dives (Protected)

Habenaria epipactidea (Protected)

Habenaria falcicornis subsp. *caffra* (Protected)

Habenaria lithophila (Protected)

Neobolusia tysonii (Protected)

Orthochilus foliosus (Protected)

Orthochilus leontoglossus (Protected)

Orthochilus vinosus (Protected)

Orthochilus welwitschii (Protected)

Pterygodium nigrescens (Protected)

Satyrium hallackii subsp. *ocellatum* (Protected)

Satyrium longicauda var. *longicauda* (Protected)
Satyrium neglectum subsp. *neglectum* var. *neglectum* (Protected)
Satyrium parviflorum (Protected)
Satyrium trinerve (Protected)
Schizochilus zeyheri (Protected)

Orobanchaceae

Alectra capensis
Buchnera reducta
Cycnium adonense
Cycnium tubulosum subsp. *tubulosum*
Harveya speciosa
Melasma scabrum var. *scabrum*
Sopubia cana var. *cana*
Sopubia simplex
Striga asiatica
Striga bilabiata subsp. *bilabiata*
Striga elegans
Striga gesnerioides

Orthotrichaceae

Orthotrichum diaphanum

Oxalidaceae

Oxalis convexula
Oxalis corniculata; Naturalised; Invasive
Oxalis obliquifolia
Oxalis smithiana

Papaveraceae

Argemone ochroleuca; Naturalised; Invasive, NEMBA Category 1b
Papaver aculeatum

Peraceae

Clutia hirsuta var. *hirsuta*
Clutia monticola var. *monticola*
Clutia natalensis
Clutia virgata

Phrymaceae

Mimulus gracilis

Phyllanthaceae

Phyllanthus glaucophyllus

Phytolaccaceae

Phytolacca octandra; Naturalized; Invasive

Plantaginaceae

Linaria vulgaris; Naturalised; Invasive
Plantago lanceolata
Veronica anagallis-aquatica

Poaceae

Agrostis continuata
Agrostis eriantha var. *eriantha*

Agrostis gigantea; Naturalised
Agrostis lachnantha var. *lachnantha*
Alloteropsis semialata subsp. *eckloniana*
Alloteropsis semialata subsp. *semialata*
Andropogon appendiculatus
Andropogon eucomus
Andropogon lacunosus
Andropogon schirensis
Anthoxanthum odoratum var. *odoratum*; Naturalised
Aristida adscensionis
Aristida bipartita
Aristida canescens subsp. *canescens*
Aristida congesta subsp. *barbicollis*
Aristida congesta subsp. *congesta*
Aristida diffusa subsp. *burkei*
Aristida junciformis subsp. *junciformis*
Aristida recta
Aristida scabrivalvis subsp. *scabrivalvis*
Aristida vestita
Arundinella nepalensis
Avena sativa; Naturalised; Invasive
Bothriochloa insculpta
Brachiaria eruciformis
Brachiaria humidicola
Brachiaria serrata
Briza minor; Naturalised; Invasive
Bromus catharticus; Naturalised; Invasive
Bromus leptoclados
Calamagrostis epigejos var. *capensis*
Catalepis gracilis
Chloris virgata
Ctenium concinnum
Cymbopogon caesius
Cymbopogon dieterlenii
Cymbopogon pospischilii
Cynodon dactylon
Cynodon hirsutus
Cynodon transvaalensis
Dactylis glomerata; Naturalised; Invasive
Digitaria ciliaris; Naturalised
Digitaria diagonalis var. *diagonalis*
Digitaria diversinervis
Digitaria eriantha
Digitaria flaccida
Digitaria sanguinalis; Naturalised
Digitaria ternata
Digitaria tricholaenoides
Diheteropogon amplexens var. *amplexens*
Echinochloa crus-galli
Ehrharta erecta var. *natalensis*
Eleusine coracana subsp. *africana*
Elionurus muticus
Enneapogon scoparius
Eragrostis caesia
Eragrostis capensis
Eragrostis chloromelas

Eragrostis cilianensis
Eragrostis curvula
Eragrostis gummiflua
Eragrostis lappula
Eragrostis lehmanniana var. *chaunantha*
Eragrostis lehmanniana var. *lehmanniana*
Eragrostis mexicana subsp. *virescens*; Naturalised
Eragrostis obtusa
Eragrostis patentissima
Eragrostis plana
Eragrostis planiculmis
Eragrostis racemosa
Eragrostis remotiflora
Eragrostis sclerantha subsp. *sclerantha*
Eragrostis tef; Naturalised
Eriochrysis brachypogon
Festuca caprina
Festuca scabra
Fingerhuthia africana
Fingerhuthia sesleriiformis
Harpochloa falx
Helictotrichon turgidulum
Hemarthria altissima
Heteropogon contortus
Holcus lanatus; Naturalised; Invasive
Hyparrhenia anamesa
Hyparrhenia dregeana
Hyparrhenia hirta
Imperata cylindrica
Koeleria capensis
Leersia hexandra
Lolium multiflorum; Naturalised; Invasive
Lolium temulentum; Naturalised; Invasive
Lophacme digitata
Loudetia densispica
Loudetia simplex
Melinis nerviglumis
Microchloa caffra
Monocymbium cerasiiforme
Panicum ecklonii
Panicum natalense
Panicum schinzii
Paspalum dilatatum; Naturalised; Invasive
Paspalum distichum; Naturalised; Invasive
Paspalum urvillei; Naturalised; Invasive
Pennisetum clandestinum; Naturalized; Invasive
Pennisetum macrourum
Pennisetum sphacelatum
Pennisetum thunbergii
Pennisetum unisetum
Perotis sp.
Phalaris arundinacea; Naturalised
Phalaris canariensis; Naturalised
Phalaris minor; Naturalised
Poa annua; Naturalised
Poa binata

Pogonarthria squarrosa
Rendlia altera
Sacciolepis chevalieri
Sacciolepis typhura
Schizachyrium sanguineum
Setaria incrassata
Setaria nigrirostris
Setaria pumila
Setaria sphacelata var. *sphacelata*
Setaria sphacelata var. *torta*
Sorghum bicolor subsp. *arundinaceum*
Sporobolus albicans
Sporobolus centrifugus
Sporobolus discosporus
Sporobolus fimbriatus
Stiburus alopecuroides
Stiburus conrathii
Themeda triandra
Trachypogon spicatus
Tragus berteronianus
Tragus racemosus
Triraphis andropogonoides
Tristachya leucothrix
Tristachya rehmannii
Urochloa panicoides

Polygalaceae

Polygala africana
Polygala albida subsp. *albida*
Polygala gerrardii
Polygala gracilentata
Polygala hottentotta
Polygala krumanina
Polygala ohlendoriana
Polygala transvaalensis
Polygala transvaalensis subsp. *transvaalensis*
Polygala uncinata
Polygala virgata var. *decora*

Polygonaceae

Oxygonum dregeanum subsp. *canescens* var. *canescens*
Oxygonum dregeanum subsp. *swazicum*
Persicaria amphibia; Naturalised
Persicaria decipiens
Persicaria hystricula
Persicaria lapathifolia; Naturalised; Invasive
Persicaria madagascariensis
Rumex acetosella subsp. *angiocarpus*; Naturalised; Invasive, NEMBA Category 1b
Rumex crispus; Naturalised; Invasive
Rumex lanceolatus
Rumex sagittatus
Rumex woodii

Pontederiaceae

Pontederia cordata; Naturalised

Portulacaceae

Portulaca oleracea; Naturalised

Pottiaceae

Didymodon tophaceus

Trichostomum brachydontium

Proteaceae

Protea roupelliae subsp. *roupelliae* (Protected)

Pteridaceae

Cheilanthes eckloniana

Cheilanthes hirta var. *brevipilosa*

Cheilanthes hirta var. *hirta*

Cheilanthes hirta var. *nemorosa*

Cheilanthes multifida subsp. *lacerata*

Cheilanthes quadripinnata

Cheilanthes viridis var. *viridis*

Pellaea calomelanos var. *calomelanos*

Pityrogramma argentea

Ranunculaceae

Clematis brachiata

Peltocalathos baurii

Ranunculus dregei

Ranunculus multifidus

Ranunculus trichophyllus

Rhamnaceae

Ziziphus zeyheriana

Rosaceae

Agrimonia procera; Naturalised; Invasive

Alchemilla capensis

Alchemilla woodii

Rubus ludwigii subsp. *ludwigii*

Sanguisorba minor subsp. *muricata*; Naturalised

Rubiaceae

Anthospermum herbaceum

Anthospermum rigidum subsp. *rigidum*

Canthium inerme

Cephalanthus natalensis

Galium capense subsp. *capense*

Galium capense subsp. *garipense* var. *garipense*

Kohautia amatymbica

Kohautia caespitosa subsp. *brachyloba*

Pachystigma pygmaeum

Pachystigma thamnus

Pentanisia angustifolia

Pentanisia prunelloides subsp. *prunelloides*

Pentanisia prunelloides subsp. *latifolia*

Richardia brasiliensis; Naturalised

Spermacoce natalensis

Ruscaceae

Eriospermum cooperi var. *cooperi*
Eriospermum corymbosum
Eriospermum flagelliforme
Eriospermum porphyrium
Eriospermum porphyrovalve

Rutaceae

Ruta graveolens; Naturalised

Salicaceae

Salix babylonica var. *babylonica*; Naturalised

Santalaceae

Thesium asterias
Thesium costatum var. *costatum*
Thesium costatum var. *juniperinum*
Thesium goetzeanum
Thesium pallidum
Thesium scirpioides

Scrophulariaceae

Chaenostoma neglectum
Chaenostoma patrioticum
Diclis rotundifolia
Gomphostigma virgatum
Hebenstretia angolensis
Hebenstretia comosa Indigenous
Hebenstretia oatesii subsp. *oatesii*
Hebenstretia rehmannii
Jamesbrittenia aurantiaca
Jamesbrittenia montana
Jamesbrittenia stricta
Limosella longiflora
Limosella maior
Manulea bellidifolia
Manulea rhodantha subsp. *aurantiaca*
Melanospermum rupestre
Melanospermum transvaalense
Nemesia fruticans
Selago capitellata
Selago densiflora
Selago galpinii
Teedia lucida
Tetraselago longituba
Zaluzianskya elongata
Zaluzianskya rubrostellata
Zaluzianskya spathacea

Solanaceae

Cestrum parqui; Naturalised; Invasive
Datura stramonium; Naturalised; Invasive, NEMBA Category 1b
Physalis angulata; Naturalised; Invasive
Solanum aculeatissimum; Naturalised
Solanum campylacanthum
Solanum capense
Solanum elaeagnifolium; Naturalised; Invasive, NEMBA Category 1b

Solanum humile
Solanum lichtensteinii
Solanum panduriforme
Solanum retroflexum
Solanum sisymbriifolium; Naturalised; Invasive, NEMBA Category 1b

Thymelaeaceae

Gnidia fastigiata
Gnidia gymnostachya
Gnidia nodiflora
Lasiosiphon burchellii
Lasiosiphon caffer
Lasiosiphon kraussianus
Lasiosiphon microcephalus

Typhaceae

Typha capensis

Valerianaceae

Valeriana capensis var. *capensis*

Verbenaceae

Chascanum latifolium var. *transvaalense*
Lantana rugosa
Verbena bonariensis; Naturalised; Invasive, NEMBA Category 1b
Verbena rigida; Naturalised; Invasive

Vitaceae

Cissus diversilobata

Xyridaceae

Xyris capensis
Xyris gerrardii

Zygophyllaceae

Tribulus terrestris

Appendix 3: Flora protected under the Mpumalanga Nature Conservation Act No. 10 of 1998.

SCHEDULE 11: PROTECTED PLANT SPECIES (SECTION 69 (1) (a))

Common name	Scientific name
All species of tree ferns, excluding the bracken fern	All species of the Genus: <i>Cyathea capensis</i> and <i>Cyathea dregei</i>
All species of cycads in Republic of South Africa and the seedlings of the species of cycads referred to in Schedule 12	All species of the family <i>Zamiaceae</i> occurring in the Republic of South Africa and the seedlings of the species of <i>Encephalartos</i> referred to in Schedule 12
All species of yellow wood	<i>Podocarpus</i> spp.
All species of arum lilies	<i>Zantedeschia</i> spp.
"volstruiskos"	<i>Schizobasis intricata</i>
"knolklimop"	<i>Bowiea volubilis</i>
All species of red-hot pokers	<i>Kniphofia</i> spp.
All species of aloes, excluding: (a) all species not occurring in Mpumalanga and (b) the following species: all species of haworthias all species of agapanthus all species of squill	<i>Aloe</i> spp., excluding: (a) all species not occurring in Mpumalanga and (b) the following species: <i>Haworthia</i> spp. <i>Agapanthus</i> spp. <i>Scilla</i> spp.
All species of pineapple flower	<i>Eucomis</i> spp.
All species of dracaena	<i>Dracaena</i> spp.
All species of paintbrush	<i>Haemanthus</i> spp. and <i>Scadoxus</i> spp.
Cape poison bulb	<i>Boophone disticha</i>
All species of clivia	<i>Clivia</i> spp.
All species of brunsvigia	<i>Brunsvigia</i> spp.
All species of crinum	<i>Crinum</i> spp.
Ground lily	<i>Ammocharis coranica</i>
All species of fire lily	<i>Cyrtanthus</i> spp.
All species of elephantsfoot	<i>Dioscorea</i> spp.
River lily	<i>Hesperantha coccinea</i>
All species of gladioli	<i>Gladiolus</i> spp.
All species of watsonia	<i>Watsonia</i> spp.
Wild ginger	<i>Siphonochilus aethiopicus</i>
All species of orchids	All species of the family <i>Orchidaceae</i>
All species of the family proteaceae	All species of the family <i>Proteaceae</i>
All species of black stinkwood	<i>Ocotea</i> spp.
kiaat	<i>Pterocarpus angolensis</i>
tamboti	<i>Spirostachys africana</i>
The following species of euphorbias: <i>Euphorbia bernardii</i> and <i>Euphorbia grandialata</i>	The following species of euphorbias: <i>Euphorbia bernardii</i> and <i>Euphorbia grandialata</i>
Common bersama	<i>Bersama tysoniana</i>
Red ivory	<i>Berchemia zeyheri</i>
Pepperbark tree	<i>Warburgia salutaris</i>
All species of ardenia	<i>Adenia</i> spp.
Bastard onion wood	<i>Cassipourea gerrardii</i>
Assegai tree	<i>Curtisia dentata</i>
All species of olive trees	All species of the Genus <i>Olea</i>
All species of impala lilies	All species of the Genus <i>Adenium</i>

Kudu lily	Pachypodium saundersii
All species of brachystelma	Brachystelma spp.
All species of ceropegia	Ceropegia spp.
All species of huerniopsis and huernia	Huerniopsis and Huernia spp.
All species of duvalia	Duvalia spp.
All species of stapeliads	Stapelia spp.
All species of orbeanthus	Orbeanthus spp.
All species of orbeas	Orbea spp.
All species of orbeopsis	Orbeopsis spp.

SCHEDULE 12: SPECIALLY PROTECTED PLANT SPECIES (SECTION 69 (1) (b))

In this schedule "seedling" means a plant of which the diameter of the trunk or bulb, either above or below the ground, does not exceed 150 mm.

Common name	Scientific name
All plants, excluding seedlings, of the following species of cycads: dolomiticus, dyer, middelburg, eugene marais, heenan, inopinus, laevifolius, lanatus, lebombo, ngoyanus, paucidentatus, modjadje and villosus	All plants, excluding seedlings, of the following species of the Genus Encephalartos: E. dolomiticus, E. dyerianus, E. middelburgensis, E. eugene maraisii, E. heenanii, E. inopinus, E. laevifolius, E. lanatus, E. lebomboensis, E. ngoyanus, E. paucidentatus, E. transvenosus and E. villosus and any species derived from the above species
All plants of the following species of cycads: cupidus and humilus	All plants of the following species of the Genus Encephalartos: E. cupidus and E. humilus
All species of cycads in their natural habitat	All plants of the Genus Encephalartos in their natural habitat

Appendix 4: Flora protected under the National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004)

(as updated in R. 1187, 14 December 2007)

CRITICALLY ENDANGERED SPECIES

Flora

Adenium swazicum
Aloe pillansii
Diaphananthe millarii
Dioscorea ebutsniorum
Encephalartos aemulans
Encephalartos brevifoliolatus
Encephalartos cerinus
Encephalartos dolomiticus
Encephalartos heenanii
Encephalartos hirsutus
Encephalartos inopinus
Encephalartos latifrons
Encephalartos middelburgensis
Encephalartos nubimontanus
Encephalartos woodii

ENDANGERED SPECIES

Flora

Angraecum africae
Encephalartos arenarius
Encephalartos cupidus
Encephalartos horridus
Encephalartos laevifolius
Encephalartos lebomboensis
Encephalartos msinganus
Jubaeopsis caffra
Siphonochilus aethiopicus
Warburgia salutaris
Newtonia hilderbrandi

VULNERABLE SPECIES

Flora

Aloe albida
Encephalartos cycadifolius
Encephalartos Eugene-maraisii
Encephalartos ngovanus
Merwillia plumbea
Zantedeschia jucunda

PROTECTED SPECIES

Flora

Adenia wilmsii
Aloe simii
Clivia mirabilis
Disa macrostachya
Disa nubigena
Disa physodes
Disa procera
Disa sabulosa

Encephalartos altensteinii
Encephalartos caffer
Encephalartos dyerianus
Encephalartos frederici-guilielmi
Encephalartos ghellinckii
Encephalartos humilis
Encephalartos lanatus
Encephalartos lehmannii
Encephalartos longifolius
Encephalartos natalensis
Encephalartos paucidentatus
Encephalartos princeps
Encephalartos senticosus
Encephalartos transvenosus
Encephalartos trispinosus
Encephalartos umbeluziensis
Encephalartos villosus
Euphorbia clivicola
Euphorbia meloformis
Euphorbia obesa
Harpagophytum procumbens
Harpagophytum zeyherii
Hoodia gordonii
Hoodia currorii
Protea odorata
Stangeria eriopus

Appendix 5: Curriculum vitae: Dr David Hoare

Education

Matric - Graeme College, Grahamstown, 1984

BSc (majors: Botany, Zoology) - Rhodes University, 1991-1993

BSc (Hons) (Botany) - Rhodes University, 1994 with distinction

MSc (Botany) - University of Pretoria, 1995-1997 with distinction

PhD (Botany) – Nelson Mandela Metropolitan University, Port Elizabeth

Main areas of specialisation

- Vegetation ecology, primarily in grasslands, thicket, coastal systems, wetlands.
- Plant biodiversity and threatened plant species specialist.
- Alien plant identification and control / management plans.
- Remote sensing, analysis and mapping of vegetation.
- Specialist consultant for environmental management projects.

Membership

Professional Natural Scientist, South African Council for Natural Scientific Professions, 16 August 2005
– present. Reg. no. 400221/05 (Ecology, Botany)

Member, International Association of Vegetation Scientists (IAVS)

Member, Ecological Society of America (ESA)

Member, International Association for Impact Assessment (IAIA)

Member, Herpetological Association of Africa (HAA)

Employment history

1 December 2004 – present, Director, David Hoare Consulting (Pty) Ltd. Consultant, specialist consultant contracted to various companies and organisations.

1 January 2009 – 30 June 2009, Lecturer, University of Pretoria, Botany Dept.

1 January 2013 – 30 June 2013, Lecturer, University of Pretoria, Botany Dept.

1 February 1998 – 30 November 2004, Researcher, Agricultural Research Council, Range and Forage Institute, Private Bag X05, Lynn East, 0039. Duties: project management, general vegetation ecology, remote sensing image processing.

Experience as consultant

Ecological consultant since 1995. Author of over 800 specialist ecological consulting reports. Wide experience in ecological studies within grassland, savanna and fynbos, as well as riparian, coastal and wetland vegetation.

Publication record:**Refereed scientific articles (in chronological order):****Journal articles:**

- HOARE, D.B.** & BREDENKAMP, G.J. 1999. Grassland communities of the Amatola / Winterberg mountain region of the Eastern Cape, South Africa. *South African Journal of Botany* 64: 44-61.
- HOARE, D.B.**, VICTOR, J.E., LUBKE, R.A. & MUCINA, L., 2000. Vegetation of the coastal fynbos and rocky headlands south of George, South Africa. *Bothalia* 30: 87-96.
- VICTOR, J.E., **HOARE, D.B.** & LUBKE, R.A., 2000. Checklist of plant species of the coastal fynbos and rocky headlands south of George, South Africa. *Bothalia* 30: 97-101.
- MUCINA, L, BREDENKAMP, G.J., **HOARE, D.B** & MCDONALD, D.J. 2000. A National Vegetation Database for South Africa *South African Journal of Science* 96: 1-2.
- HOARE, D.B.** & BREDENKAMP, G.J. 2001. Syntaxonomy and environmental gradients of the grasslands of the Stormberg / Drakensberg mountain region of the Eastern Cape, South Africa.. *South African Journal of Botany* 67: 595 – 608.
- LUBKE, R.A., **HOARE, D.B.**, VICTOR, J.E. & KETELAAR, R. 2003. The vegetation of the habitat of the Brenton blue butterfly, *Orachrysops niobe* (Trimen), in the Western Cape, South Africa. *South African Journal of Science* 99: 201–206.
- HOARE, D.B** & FROST, P. 2004. Phenological classification of natural vegetation in southern Africa using AVHRR vegetation index data. *Applied Vegetation Science* 7: 19-28.
- FOX, S.C., HOFFMANN, M.T. and HOARE, D. 2005. The phenological pattern of vegetation in Namaqualand, South Africa and its climatic correlates using NOAA-AVHRR NDVI data. *South African Geographic Journal*, 87: 85–94.
- Pfab, M.F., Compaan, P.C., Whittington-Jones, C.A., Engelbrecht, I., Dumalisile, L., Mills, L., West, S.D., Muller, P., Masterson, G.P.R., Nevhutalu, L.S., Holness, S.D., **Hoare, D.B.** 2017. The Gauteng Conservation Plan: Planning for biodiversity in a rapidly urbanising province. *Bothalia*, Vol. 47:1. a2182. <https://doi.org/10.4102/abc.v47i1.2182>.

Book chapters and conference proceedings:

- HOARE, D.B.** 2002. Biodiversity and performance of grassland ecosystems in communal and commercial farming systems in South Africa. Proceedings of the FAO's Biodiversity and Ecosystem Approach in Agriculture, Forestry and Fisheries Event: 12–13 October, 2002. Food and Agriculture Organisation of the United Nations, Viale delle Terme di Caracalla, Rome, Italy. pp. 10 - 27.
- STEENKAMP, Y., VAN WYK, A.E., VICTOR, J.E., **HOARE, D.B.**, DOLD, A.P., SMITH, G.F. & COWLING, R.M. 2005. Maputaland-Pondoland-Albany Hotspot. In: Mittermeier, R.A., Gil, P.R., Hoffmann, M., Pilgrim, J., Brooks, T., Mittermeier, C.G., Lamoreux, J. & Fonseca, G.A.B. da (eds.) *Hotspots revisited*. CEMEX, pp.218–229. ISBN 968-6397-77-9
- STEENKAMP, Y., VAN WYK, A.E., VICTOR, J.E., **HOARE, D.B.**, DOLD, A.P., SMITH, G.F. & COWLING, R.M. 2005. Maputaland-Pondoland-Albany Hotspot. <http://www.biodiversityhotspots.org/xp/hotspots/maputaland/>.
- HOARE, D.B.**, MUCINA, L., RUTHERFORD, M.C., VLOK, J., EUSTON-BROWN, D., PALMER, A.R., POWRIE, L.W., LECHMERE-OERTEL, R.G., PROCHES, S.M., DOLD, T. and WARD, R.A. *Albany Thickets*. in Mucina, L. and Rutherford, M.C. (eds.) 2006. The vegetation of South Africa, Lesotho and Swaziland. *Strelitzia* 19, South African National Biodiversity Institute, Pretoria.
- MUCINA, L., **HOARE, D.B.**, LÖTTER, M.C., DU PREEZ, P.J., RUTHERFORD, M.C., SCOTT-SHAW, C.R., BREDENKAMP, G.J., POWRIE, L.W., SCOTT, L., CAMP, K.G.T., CILLIERS, S.S., BEZUIDENHOUT, H., MOSTERT, T.H., SIEBERT, S.J., WINTER, P.J.D., BURROWS, J.E., DOBSON, L., WARD, R.A., STALMANS, M., OLIVER, E.G.H., SIEBERT, F., SCHMIDT, E., KOBISI, K., KOSE, L. 2006. *Grassland Biome*. In: Mucina, L. & Rutherford, M.C. (eds.) The vegetation of South Africa, Lesotho and Swaziland. *Strelitzia* 19. South African National Biodiversity Institute, Pretoria.
- RUTHERFORD, M.C., MUCINA, L., LÖTTER, M.C., BREDENKAMP, G.J., SMIT, J.H.L., SCOTT-SHAW, C.R., **HOARE, D.B.**, GOODMAN, P.S., BEZUIDENHOUT, H., SCOTT, L. & ELLIS, F., POWRIE, L.W., SIEBERT, F., MOSTERT, T.H., HENNING, B.J., VENTER, C.E., CAMP, K.G.T., SIEBERT, S.J., MATTHEWS, W.S., BURROWS, J.E., DOBSON, L., VAN ROOYEN, N., SCHMIDT, E., WINTER, P.J.D., DU PREEZ, P.J., WARD, R.A., WILLIAMSON, S. and HURTER, P.J.H. 2006. *Savanna Biome*. In: Mucina, L. &

- Rutherford, M.C. (eds.) The vegetation of South Africa, Lesotho and Swaziland. *Strelitzia* 19. South African National Biodiversity Institute, Pretoria.
- MUCINA, L., RUTHERFORD, M.C., PALMER, A.R., MILTON, S.J., SCOTT, L., VAN DER MERWE, B., **HOARE, D.B.**, BEZUIDENHOUT, H., VLOK, J.H.J., EUSTON-BROWN, D.I.W., POWRIE, L.W. & DOLD, A.P. 2006. *Nama-Karoo Biome*. In: Mucina, L. & Rutherford, M.C. (eds.) The vegetation of South Africa, Lesotho and Swaziland. *Strelitzia* 19. South African National Biodiversity Institute, Pretoria.
- MUCINA, L., SCOTT-SHAW, C.R., RUTHERFORD, M.C., CAMP, K.G.T., MATTHEWS, W.S., POWRIE, L.W. and **HOARE, D.B.** 2006. *Indian Ocean Coastal Belt*. In: Mucina, L. & Rutherford, M.C. (eds.) The vegetation of South Africa, Lesotho and Swaziland. *Strelitzia* 19. South African National Biodiversity Institute, Pretoria.

Conference Presentations:

- HOARE, D.B. & LUBKE, R.A. *Management effects on diversity at Goukamma Nature Reserve, Southern Cape*; Paper presentation, Fynbos Forum, Bienne Donne, July 1994
- HOARE, D.B., VICTOR, J.E. & LUBKE, R.A. *Description of the coastal fynbos south of George, southern Cape*; Paper presentation, Fynbos Forum, Bienne Donne, July 1994
- HOARE, D.B. & LUBKE, R.A. *Management effects on fynbos diversity at Goukamma Nature Reserve, Southern Cape*; Paper presentation, South African Association of Botanists Annual Congress, Bloemfontein, January 1995
- HOARE, D.B. & BOTHA, C.E.J. *Anatomy and ecophysiology of the dunegrass Ehrharta villosa var. maxima*; Poster presentation, South African Association of Botanists Annual Congress, Bloemfontein, January 1995
- HOARE, D.B., PALMER, A.R. & BREDENKAMP, G.J. 1996. *Modelling grassland community distributions in the Eastern Cape using annual rainfall and elevation*; Poster presentation, South African Association of Botanists Annual Congress, Stellenbosch, January 1996
- HOARE, D.B. *Modelling vegetation on a past climate as a test for palaeontological hypotheses on vegetation distributions*; Paper presentation, Randse Afrikaanse Universiteit postgraduate symposium, 1997
- HOARE, D.B., VICTOR, J.E. & BREDENKAMP, G.J. *Historical and ecological links between grassy fynbos and afro-montane fynbos in the Eastern Cape*; Paper presentation, South African Association of Botanists Annual Congress, Cape Town, January 1998
- LUBKE, R.A., HOARE, D.B., VICTOR, J.E. & KETELAAR, R. *The habitat of the Brenton Blue Butterfly*. Paper presentation, South African Association of Botanists Annual Congress, Cape Town, January 1998
- HOARE, D.B. & PANAGOS, M.D. *Satellite stratification of vegetation – structure or floristic composition?* Poster presentation at the 34th Annual Congress of the Grassland Society of South Africa, Warmbaths, 1-4 February 1999.
- HOARE, D.B. & WESSELS, K. *Conservation status and threats to grasslands of the northern regions of South Africa*, Poster presentation at the South African Association of Botanists Annual Congress, Potchefstroom, January 2000.
- HOARE, D.B. *Phenological dynamics of Eastern Cape vegetation*. Oral paper presentation at the South African Association of Botanists Annual Congress, Grahamstown, January 2002.
- HOARE, D.B., MUCINA, L., VAN DER MERWE, J.P.H. & PALMER, A.R. *Classification and digital mapping of grasslands of the Eastern Cape* Poster presentation at the South African Association of Botanists Annual Congress, Grahamstown, January 2002.
- HOARE, D.B. *Deriving phenological variables for Eastern Cape vegetation using satellite data* Poster presentation at the South African Association of Botanists Annual Congress, Grahamstown, January 2002.
- MUCINA, L., RUTHERFORD, M.C., HOARE, D.B. & POWRIE, L.W. 2003. *VegMap: The new vegetation map of South Africa, Lesotho and Swaziland*. In: Pedrotti, F. (ed.) *Abstracts: Water Resources and Vegetation, 46th Symposium of the International Association for Vegetation Science*, June 8 to 14 – Napoli, Italy.
- HOARE, D.B. 2003. *Species diversity patterns in moist temperate grasslands of South Africa*. *Proceedings of the VIIth International Rangeland Congress*, 26 July – 1 August 2003, Durban South Africa. *African Journal of Range and Forage Science*. 20: 84.

Unpublished technical reports:

- PALMER, A.R., HOARE, D.B. & HINTSA, M.D., 1999. Using satellite imagery to map veld condition in Mpumalanga: A preliminary report. Report to the National Department of Agriculture (Directorate Resource Conservation). ARC Range and Forage Institute, Grahamstown.
- HOARE, D.B. 1999. The classification and mapping of the savanna biome of South Africa: methodology for mapping the vegetation communities of the South African savanna at a scale of 1:250 000. Report to the National Department of Agriculture (Directorate Resource Conservation). ARC Range and Forage Institute, Pretoria.
- HOARE, D.B. 1999. The classification and mapping of the savanna biome of South Africa: size and coverage of field data that exists on the database of vegetation data for South African savanna. Report to the National Department of Agriculture (Directorate Resource Conservation). ARC Range and Forage Institute, Pretoria.
- THOMPSON, M.W., VAN DEN BERG, H.M., NEWBY, T.S. & HOARE, D.B. 2001. Guideline procedures for national land-cover mapping and change monitoring. Report no. ENV/P/C 2001-006 produced for Department of Water Affairs and Forestry, National Department of Agriculture and Department of Environment Affairs and Tourism. Copyright: Council for Scientific and Industrial Research (CSIR) and Agricultural Research Council (ARC).
- HOARE, D.B. 2003. Natural resource survey of node O R Tambo, using remote sensing techniques, Unpublished report and database of field data for ARC Institute for Soil, Climate & Water, ARC Range and Forage Institute, Grahamstown.
- HOARE, D.B. 2003. Short-term changes in vegetation of Suikerbosrand Nature Reserve, South Africa, on the basis of resampled vegetation sites. Gauteng Department of Agriculture, Conservation, Environment and Land Affairs, Conservation Division.
- BRITTON, D., SILBERBAUER, L., ROBERTSON, H., LUBKE, R., HOARE, D., VICTOR, J., EDGE, D. & BALL, J. 1997. The Life-history, ecology and conservation of the Brenton Blue Butterfly (*Orachrysops niobe*) (Trimen) (*Lycaenidea*) at Brenton-on-Sea. Unpublished report for the Endangered Wildlife Trust of Southern Africa, Johannesburg. 38pp.
- HOARE, D.B., VICTOR, J.E. & MARNEWIC, G. 2005. Vegetation and flora of the wetlands of Nylsvley River catchment as component of a project to develop a framework for the sustainable management of wetlands in Limpopo Province.

Consulting reports:

Total of over 800 specialist consulting reports for various environmental projects from 1995 – present.

Workshops / symposia attended:

- International Association for Impact Assessment Annual Congress, Durban, 16 – 19 May 2018.
- Workshop on remote sensing of rangelands presented by Paul Tueller, University of Nevada Reno, USA, VIIth International Rangeland Congress, 26 July – 1 August 2003, Durban South Africa.
- VIIth International Rangeland Congress, 26 July – 1 August 2003, Durban South Africa.
- BioMap workshop, Stellenbosch, March 2002 to develop strategies for studying vegetation dynamics of Namaqualand using remote sensing techniques
- South African Association of Botanists Annual Congress, Grahamstown, January 2002.
- 28th International Symposium on Remote Sensing of Environment, Somerset West, 27-31 March 2000.
- Workshop on Vegetation Structural Characterisation: Tree Cover, Height and Biomass, 28th International Symposium on Remote Sensing of Environment, Strand, 26 March 2000.
- South African Association of Botanists Annual Congress, Potchefstroom, January 2000
- National Botanical Institute Vegmap Workshop, Kirstenbosch, Cape Town, 30 September-1 October 1999.
- Sustainable Land Management – Guidelines for Impact Monitoring, Orientation Workshop: Sharing Impact Monitoring Experience, Zithabiseni, 27-29 September 1999.
- WWF Macro Economic Reforms and Sustainable Development in Southern Africa, Environmental Economic Training Workshop, development Bank, Midrand, 13-14 September 1999.
- 34th Annual Congress of the Grassland Society of South Africa, Warmbaths, 1-4 February 1999
- Expert Workshop on National Indicators of Environmental Sustainable Development, Dept. of Environmental Affairs and Tourism, Roodevallei Country Lodge, Roodeplaat Dam, Pretoria, 20-21 October 1998.

South African Association of Botanists Annual Congress, Cape Town, January 1998
Randse Afrikaanse Universiteit postgraduate symposium, 1997.
South African Association of Botanists Annual Congress, Bloemfontein, January 1995.