Boscia
ECOLOGICAL CONSULTING

ECOLOGICAL & WETLAND ASSESSMENT REPORT

Northern Spark 428 (Pty) Ltd

Brakfontein Diamond Prospecting Operation

Boscia
ECOLOGICAL CONSULTING

Address:
46 Marulani Lodge
755 Wapadrand Road
Wapadrand
0081

Tel: 082 992 1261
Email: BosciaEcology@gmail.com

Northern Spark 428 (Pty) Ltd

Remaining Extent of the Farm Brakfontein 276

Districts of Hopetown

Northern Cape Province

Ecological & Wetland Assessment Report in application for Environmental Authorisation related to a Diamond Prospecting Right

June 2023

EXECUTIVE SUMMARY

Northern Spark 428 Pty (Ltd) is proposing the prospecting of Diamonds on the Remaining Extent of the Farm Brakfontein 276, near Douglas in the District of Hopetown, Northern Cape Province. They have submitted a Prospecting Right application, which triggers the requirement to apply for Environmental Authorisation. For this, an ecological and wetland assessment is required to consider the impacts that the proposed activities might have on the ecosystems of the property, and therefore Boscia Ecological Consulting has been appointed by the applicant to conduct an assessment and provide an ecological and wetland assessment report. This report considers the impacts that the proposed activities might have on the ecological integrity of the property. It describes the characteristics of terrestrial, aquatic and wetland habitats in the proposed prospecting area, identifies the source of impacts from the prospecting operation and assesses these impacts, as well as the residual impacts after closure.

A desktop study and field investigations were performed to obtain ecological and biodiversity information for the proposed study area and three plant communities were identified on site. Two depressional wetlands are of very high sensitivity due to their vital ecological functionality and significance. The calcrete terraces are of high sensitivity, primarily because of the high number of the nationally protected tree (*Boscia albitrunca*) that occur here and the suitable habitat and overlapping distribution range for protected birds. The most profound impacts are expected to be related to the cumulative loss of natural terrestrial habitat on a landscape scale as well as the removal of the nationally protected tree, *Boscia albitrunca*. A number of provincially protected species also occur on site. Before any of these species are damaged or removed, permits need to be obtained from the Northern Cape Department of Environment and Nature Conservation and/or Department of Agriculture, Forestry and Fisheries, at least three months prior to any clearance of affected species.

The wetlands are sensitive and important for the maintenance of biodiversity in the form of unique habitats they provide for freshwater crustaceans. Even though rarely wet, these wetlands harbour egg banks of these specialised freshwater invertebrates in the dry sediment. Protecting the sediment in-situ is therefore vital. Before any direct activities can take place within a wetland, a water use licence needs to be obtained for Department of Water and Sanitation prior to such activities.

All things considered, authorisation for the proposed prospecting operation can be granted if the applicant commits to strictly adhere to effective avoidance, management, mitigation, and rehabilitation measures.

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1. INTRODUCTION

1.1. Background information

Northern Spark 428 Pty (Ltd) is proposing the prospecting of Diamonds on the Remaining Extent of the Farm Brakfontein 276 (from heron referred to as Brakfontein). The prospecting right area is located within the Hopetown District Municipality of the Northern Cape Province. It lies approximately 65 km south-west of the town Douglas, on a gravel road that turns of from the R357 leading to Prieska (Figure 1). The total extent of the prospecting right area is ± 2 145 ha.

Northern Spark has submitted a Prospecting Right application, which triggers the requirement for Environmental Authorisation. For this, an ecological and wetland assessment is required to consider the impacts that the proposed activities might have on the ecosystems of the property, and therefore Boscia Ecological Consulting has been appointed by the applicant to conduct an assessment and provide an ecological and wetland assessment report.

This assessment report describes the characteristics of terrestrial, aquatic and wetland habitats in the proposed prospecting area, identifies the biodiversity and species of conservation concern, identifies invasive and encroaching species and their distribution, indicates the source of impacts from the prospecting operation and assesses these impacts as well as the residual impacts after closure.

A variety of avoidance and mitigation measures associated with each identified impact are recommended to reduce the likely impact of the operation. Ecological responsibilities pertaining to relevant conservation legislation are also indicated. These should all be included in the EMPR.

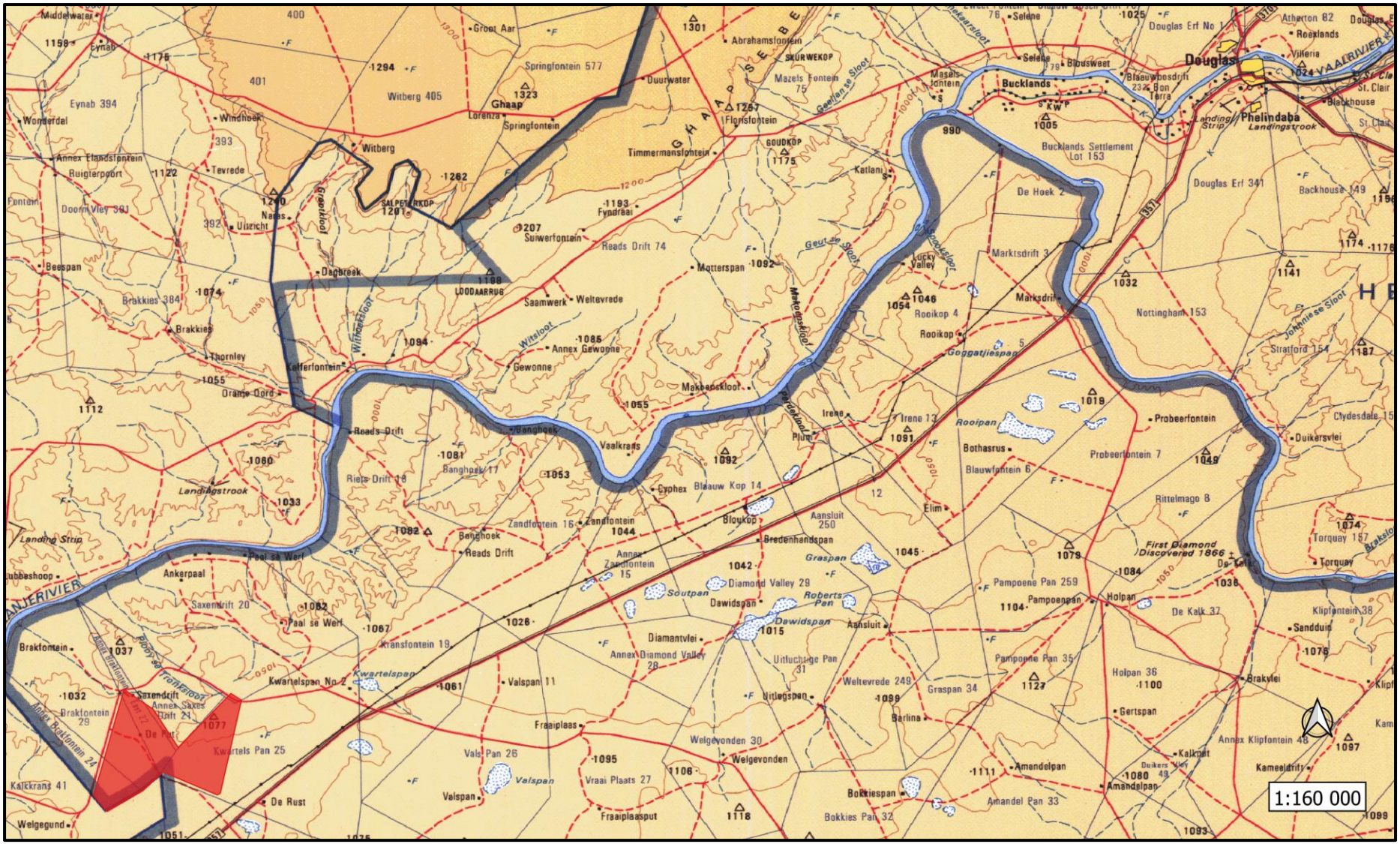


Figure 1. The location of the Brakfontein prospecting area is indicated in red.

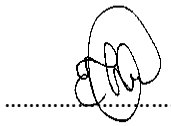
1.2. Scope of study

The specific terms of reference for the study include the following:

- conduct a desktop study and field investigation to identify and describe different ecological habitats (terrestrial, aquatic and wetland) and provide an inventory of biodiversity, i.e. communities/species/taxa and associated species of conservation concern within the environment that may be affected by the proposed activity;
- identify the relative ecological sensitivity of the project area;
- produce an assessment report that:
  - indicates identified habitats and fauna and flora species,
  - delineates and classifies wetlands,
  - indicates the ecological sensitivity of habitats and conservation values of species, including Wetland Health Assessment (PES), Wetland Ecological Importance and Sensitivity (EIS) and Wetland Functional Assessment (Eco-Services)
  - determines the potential impacts of the project on the ecological integrity,
  - provides mitigation measures and recommendations to limit project impacts,
  - indicates ecological responsibilities pertaining to relevant conservation legislation.

1.3. Details of the specialist consultant

Company Name	Boscia Ecological Consulting cc	**Registration No:**	2011/048041/23
Address	46 Marulani Lodge 755 Wapadrand Road Wapadrand 0081		
Contact Person	Dr Elizabeth (Betsie) Milne (Pr. Sci. Nat)		
Contact Details	Cell: 082 992 1261	Email: BosciaEcology@gmail.com	
Qualifications	Professional Natural Scientist - Ecological Science (Registration No: 131395) PhD Botany (Nelson Mandela Metropolitan University), Masters Environmental Management (University of the Free State), BTech Nature Conservation (Tshwane University of Technology)		

Declaration of independence	I, Elizabeth (Betsie) Milne, owner of Boscia Ecological Consulting, declare that I: • act as the independent specialist in this application; • regard the information contained in this report as it relates to my • specialist input/study to be true and correct; • do not have, and will not have any financial interest in the undertaking of the activity; other than the remuneration of work performed in terms of the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act; • have and will not have any vested interest in the activity proceedings; • have no, and will not engage in conflicting interest in the undertaking of the activities; • undertake to disclose to the component authority any material information that have or may have the potential to influence the decision of the competent authority, or the objectivity of any report, plan or document required in terms of the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act; • will provide the competent authority with access to all information at my disposal regarding the study.  ……

1.4. Description of the proposed activity

The prospecting operation is primarily based on alluvial diamond deposits that are restricted to the paleo terraces of the Orange River (Figure 2). The deposits will be sampled by means of pitting and trenching (including bulk sampling) using a phased approached. Approximately 100 pits (2 m x 3 m x 0.5 - 5 m each) and 30 trenches (100 m x 50 m x 0.5 - 5 m each) will be created for bulk sampling. This will be performed by means of an opencast method using heavy earthmoving machinery. Vegetated soil or overburden will be stripped, and the underlying gravels will be excavated, screened, and treated through a rotary plan plant before fed to a sorting plant for final recovery. The rough diamond product will then be removed for further beneficiation. No ore processing reagents are required or used in the treatment of the ore. An estimated total volume of 1 200 m^3 and 300 000 m^3 for pitting and trenching will be processed, respectively over 5 years. Prospecting activities will make use of existing roads where possible, but haul roads will also be created to access the prospecting areas. Supporting infrastructure include temporary office, workshop and ablution facilities with chemical toilets, storm water control berms, water tanks, fuel storage facility, wash bay, salvage yard, waste disposal site, a central processing plant and pipeline infrastructure.

Figure 2. The area on Brakfontein, where core prospecting activities are planned.

2. METHODOLOGY

2.1. Data collection

The study comprised a combination of field and desktop surveys for data collection on fauna and flora. The fieldwork component was conducted on 25 November 2022. Data for the desktop assessment was obtained from the quarter degree squares that include the study area (2923AC and 2923AD).

2.2. Flora

2.2.1. Field survey

For the field work component, satellite images were used to identify homogenous vegetation units within the proposed prospecting area. Representative sampling plots were allocated in these units and sampled with the aid of a GPS to characterise the species composition. The following quantitative data was collected:

- Species composition
- Species percentage cover
- Amount of bare soil and rock cover
- Presence of biotic and anthropogenic disturbances

Additional checklists of plant species were compiled during the surveys by traversing a linear route and recording species as they were encountered in each unit.

2.2.2. Desktop survey

For the desktop component, the South African National Vegetation Map (Mucina and Rutherford 2006) was used to obtain data on broad scale vegetation types. Further searches were undertaken specifically for Red List plant species within the current study area. Historical occurrences of Red List plant species were obtained from the SANBI: POSA database (Figure 3). The IUCN conservation status of plants in the species list was also extracted from the SANBI database and is based on the Threatened Species Programme (SANBI 2020).

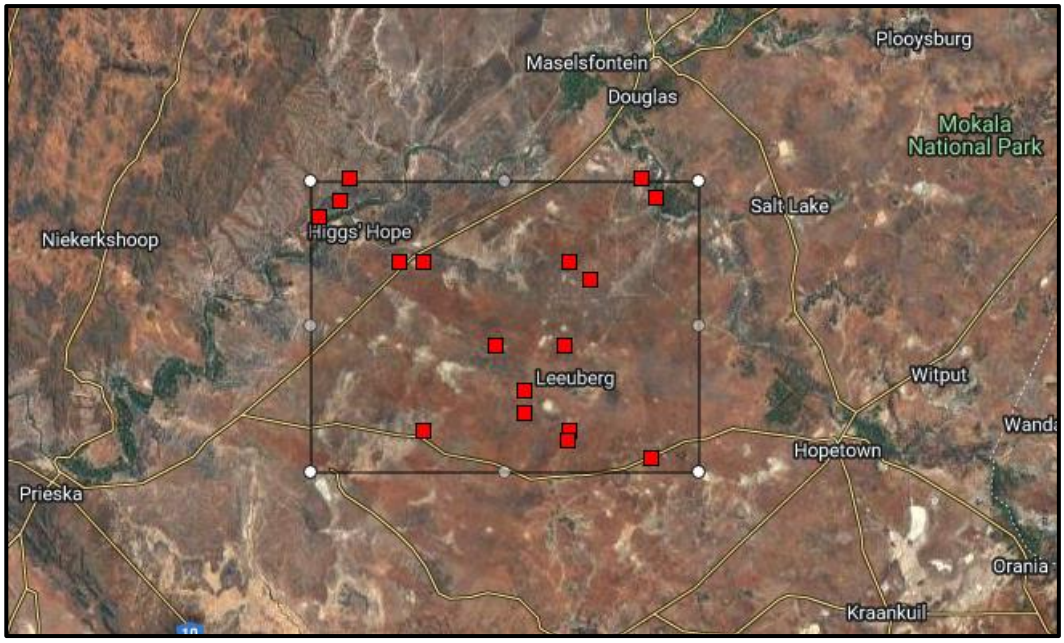


Figure 3. The extent of the map filter (large black square) applied on the POSA website to extract species information for the study area. The small red squares indicate historical data points.

2.3. Fauna

2.3.1. Field survey

The faunal field survey was conducted concurrent with the vegetation surveys. Habitats on site were assessed to compare with the habitat requirements of Red Data species. The presence of faunal species was determined using the following methods:

- Identification by visual observation,
- Identification of bird and mammal calls,
- Identification of signs (spoor, faeces, burrows, and nests).

2.3.2. Aquatic invertebrate cultures

To verify the presence of branchiopods, dry sediment was collected from the ephemeral pans on site. A hand spade was used to remove at least 1L of the top 5 cm at a minimum of three plots. Sub-samples were then inundated in containers for a minimum of 14 days in a temperature-controlled incubator with aeration, to simulate average habitat conditions for the region. All hatchlings were identified under the microscope to the lowest possible taxonomic rank. Water quality variables (pH and Electrical Conductivity (uS/cm)) were measured after three days of inundation using a handheld multi meter.

2.3.3. Desktop survey

A lists of mammals, reptiles, amphibians, birds, fish, and invertebrates, which are likely to occur in the study area, were obtained based on distribution records from the literature, including Friedmann and Daly (2004) and Stuart and Stuart (2015) for mammals, Alexander and Marais (2007) and Bates et al. (2014) for reptiles, Du Preez and Carruthers (2009) for amphibians, Gibbon (2006) for birds, Kleynhans (2007) for fish and Thirion (2007), Picker et al. (2004) and Griffiths et al. (2015) for invertebrates. A map of important bird areas (BirdLifeSA 2015) was also consulted.

Additional information on faunal distribution was extracted from the various databases hosted by the ADU web portal, http://adu.org.za, as well as from the Baboon Spider Atlas https://www.baboonspideratlas.co.za/, Freshwater Biodiversity Information System (FBIS) https://freshwaterbiodiversity.org/, and iNaturalist https://www.inaturalist.org/. The faunal species lists provided are based on species which are known to occur in the broad geographical area, as well as a preliminary assessment of the availability and quality of suitable habitat at the site.

The likelihood of Red Data species occurring on site has been determined using the distribution maps in the Red Data reference books (Friedmann and Daly 2004, Minter et al. 2004, Bates et al. 2014, Taylor et al. 2015, ADU 2016) and comparing their habitat preferences with the habitats described from the field survey. The conservation status of each species is also listed, based on the IUCN Red List Categories and Criteria (IUCN 2022) and/or the various regional and national red data books/lists for the respective taxa.

2.4. Wetland assessment procedures

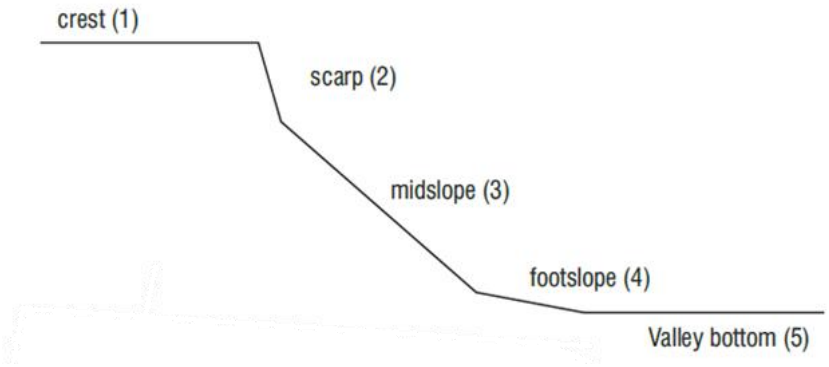
a) Wetland and riparian areas delineation

Wetlands and riparian areas were delineated according to methodology adapted from the delineation procedure as set out by Rountree et al. (2008). Even though the presence of all indicators included in this delineation procedure provides a logical, defensible, and technical basis for identifying an area as wetland or riparian area; these procedures were primarily developed for wetlands and riparian areas in mesic and humid regions.

The soil and vegetation descriptors outlined in these procedures do not fully accommodate those wetland and riparian areas found in more arid regions. Therefore, delineation of wetlands and riparian areas were performed by estimating their boundaries from satellite imagery and topographical maps, and then drawing it onto the site map, using clues such as topography, differences in colour, shading, texture, and elevation. These boundaries were then verified in the field. The field verification further considered topography, vegetation and alluvial soils or deposited material.

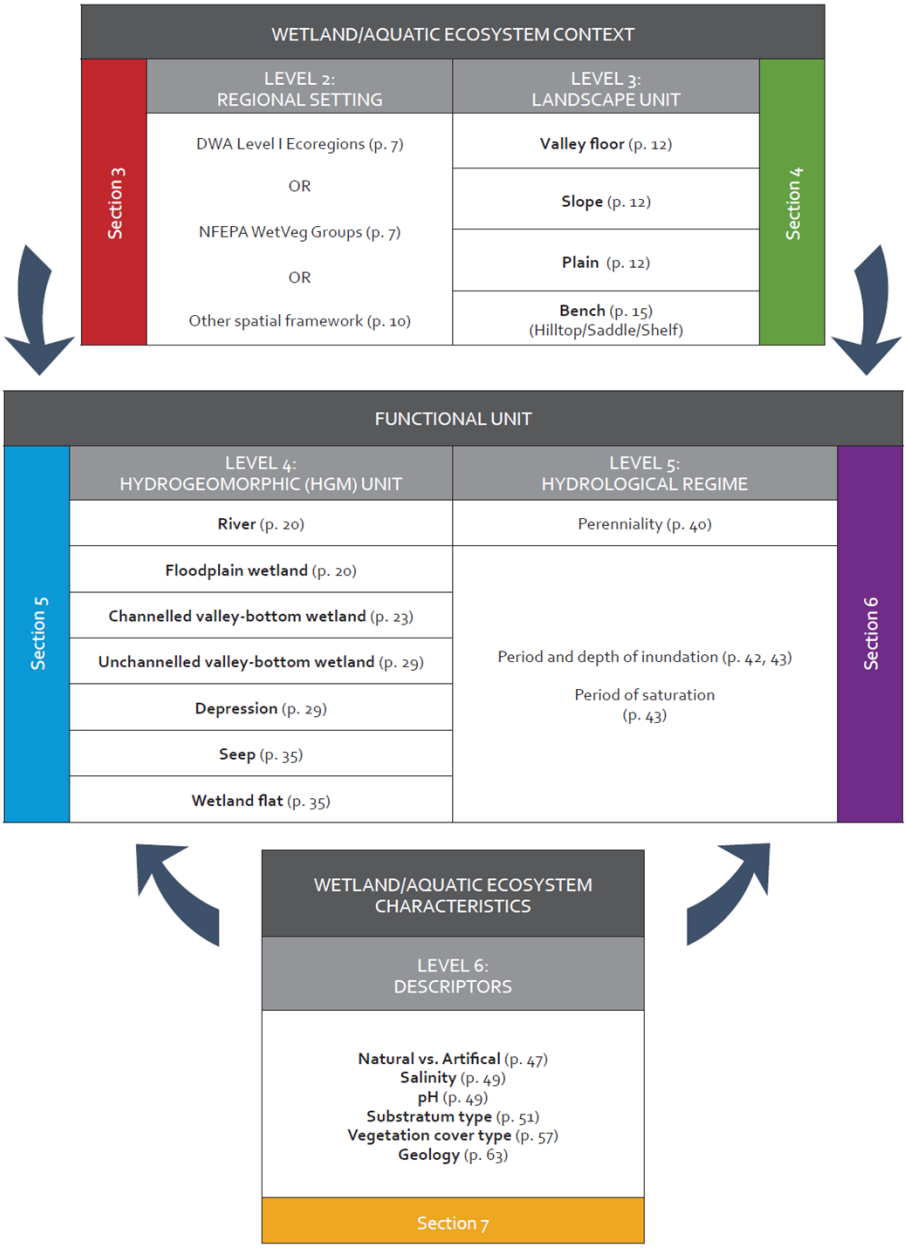
In terms of topography, terrain unit indicators were considered:

- **Terrain Unit Indicator** helps identifying those parts of the landscape where wetlands are most likely to occur. Typical terrain units are depicted below:



b) <u>Wetland Classification</u>

The wetlands were subsequently classified according to the classification procedure for inland systems (Level 2) developed by Ollis et al. (2013). The inland component of the Classification System has a tiered structure (see below diagram), which progresses from Regional Setting (Level 2) and Landscape Units (Level 3), to Hydrogeomorphic (HGM) Units at the finest spatial scale (Level 4). At Level 5, Inland Systems are distinguished from each other based on the hydrological regime and, in the case of open waterbodies, the inundation depth class. At Level 6, six 'descriptors' have been incorporated into the Classification System. These descriptors allow you to distinguish between aquatic ecosystems with different structural, chemical, and/or biological characteristics.

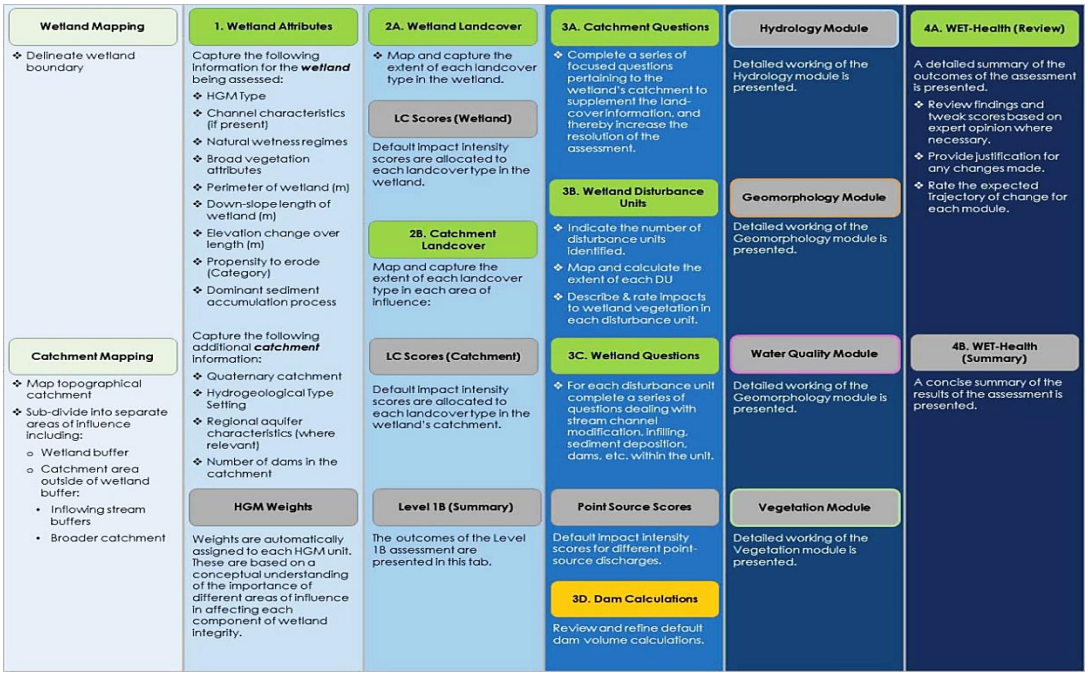


c) Wetland Health Assessment

A Present Ecological State (PES) assessment was conducted to establish baseline health for wetlands in the study area, based on WET-Health Version 2 (Macfarlane et al. 2020). The WET-Health tool is designed to assess the PES of a wetland by scoring the perceived deviation from a theoretical reference condition. The tool considers wetland PES to be a function of three core inter-related drivers, namely hydrology, geomorphology, and water quality. The biology of the wetland responds to changes in these drivers. The suite of tools developed for WET-Health Version 2 therefore assesses wetland PES based on four modules: (1) Hydrology, (2) Geomorphology, (3) Water quality, and (4) Vegetation:

Vegetation generally plays a central role in the biology of wetlands located in mesic and humid regions. However, in more arid environments, such as Brakfontein, wetlands are often naturally devoid of typical wetland vegetation, especially if wetlands are ephemeral. Wet-Health Version 2 recognises that their recommended method may not adequately cater for every situation, and expert review and refinement of impact scores is encouraged based on additional information and expert interpretation. This is accommodated in the Level 2 assessments by allowing the assessor to review and moderate scores with appropriate justification. Therefore, an adapted Wet-Health level 2 assessment was conducted to determine the PES of wetlands on Brakfontein.

A Level 2 approach is a rapid but robust field-based wetland PES assessment that includes a series of separate modules, brought together in an integrated assessment:



The WET-Health tool uses algorithms to produce impact intensity scores for each module, which are then combined in a standardised manner to produce an overall impact intensity score for the assessed wetland. These intensity scores correlate to an overall ecological category:

Ecological Category	Description	Impact score	PES Score (%)
A	Unmodified, natural.	0 – 0.9	91% - 100%
B	Largely natural with few modifications / in good health. A small change in natural habitats and biota may have taken place but the ecosystem functions are still predominantly unchanged.	1 – 1.9	81% - 90%
C	Moderately modified / fair condition. Loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged.	2 – 3.9	61% - 80%
D	Largely modified / poor condition. A large loss of natural habitat, biota and basic ecosystem functions has occurred.	4 – 5.9	41% - 60%
E	Seriously modified / very poor condition. The loss of natural habitat, biota and basic ecosystem functions is extensive.	6 – 7.9	21% - 40%
F	Critically modified / totally transformed. Modifications have reached a critical level and the lotic system has been modified completely with an almost complete loss of natural habitat and biota.	8 - 10	0 – 20%

Trajectory of Change classes and symbols used to describe the predicted nature of change in the state of a wetland from its present state given threats and vulnerability, are:

Trajectory class	Description	Symbol
Improve markedly	Likely to improve substantially over the next 5 years	↑↑
Improve	Likely to improve slightly over the next 5 years	↑
Remain stable	Likely to remain stable over the next 5 years	→
Deteriorate slightly	Likely to deteriorate slightly over the next 5 years	↓
Deteriorate markedly	Likely to deteriorate substantially	↓↓

d) Wetland Ecological Importance and Sensitivity

An Ecological Importance and Sensitivity (EIS) assessment was conducted by using methodology adapted from Duthie (1999). For this assessment procedure, a series of determinants are considered using a ranking scale of 0 to 4, i.e. Very high = 4; High = 3, Moderate = 2; Marginal/Low = 1; None = 0:

Determinant
PRIMARY DETERMINANTS
1. Rare & Endangered Species
2. Populations of Unique Species
3. Species/taxon Richness
4. Diversity of Habitat Types or Features
5 Migration route/breeding and feeding site for wetland species
6. Sensitivity to Changes in the Natural Hydrological Regime
7. Sensitivity to Water Quality Changes
8. Flood Storage, Energy Dissipation & Particulate/Element Removal
MODIFYING DETERMINANTS
9. Protected Status
10. Ecological Integrity

The median of the determinants is used to allocate an Ecological Management Class (EMC):

EIS Category	Mean range	EMC
Very high Wetlands that are considered ecologically important and sensitive on a national or even international level. The biodiversity of these wetlands is usually very sensitive to flow and habitat modifications.	> 3 and <= 4	A
High Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these wetlands may be sensitive to flow and habitat modifications.	> 2 and <= 3	B
Moderate Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these wetlands is not usually sensitive to flow and habitat modifications.	> 1 and <= 2	C
Low/marginal Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these wetlands is ubiquitous and not sensitive to flow and habitat modifications.	> 0 and <= 1	D

e) Wetland Functional Assessment

To evaluate the ecosystem services supplied by the wetlands of the study area, an assessment was conducted according to guidelines provided in WET-EcoServices (Version 2) (Kotze et al. 2020). This assessment examines and rates the following services according to their degree of importance and the degree to which the service is provided:

Ecosystem services supplied by wetlands	**Indirect benefits**	**Regulating and supporting benefits**	Flood attenuation		The spreading out and slowing down of floodwaters in the wetland, thereby reducing the severity of floods downstream
			Streamflow regulation		Sustaining streamflow during low flow periods
			Water quality enhancement benefits	Sediment trapping	The trapping and retention in the wetland of sediment carried by runoff waters
				Phosphate assimilation	Removal by the wetland of phosphates carried by runoff waters
				Nitrate assimilation	Removal by the wetland of nitrates carried by runoff waters
				Toxicant assimilation	Removal by the wetland of toxicants (e.g. metals, biocides and salts) carried by runoff waters
				Erosion control	Controlling of erosion at the wetland site, principally through the protection provided by vegetation
			Carbon storage		The trapping of carbon by the wetland, principally as soil organic matter
	Direct benefits	**Biodiversity maintenance**			Through the provision of habitat and maintenance of natural process by the wetland, a contribution is made to maintaining biodiversity
		Provisioning benefits	Provision of water for human use		The provision of water extracted directly from the wetland for domestic, agriculture or other purposes
			Provision of harvestable resources		The provision of natural resources from the wetland, including livestock grazing, craft plants, fish etc.
			Food for livestock		The provision of grazing for livestock
			Provision of cultivated foods		The provision of areas in the wetland favourable for the cultivation of foods
		Cultural benefits	Cultural and spiritual experience		Places of special cultural significance in the wetland, e.g. for baptisms or gathering of culturally significant plants
			Tourism and recreation		Sites of value for tourism and recreation in the wetland, often associated with scenic beauty and abundant birdlife
			Education and research		Sites of value in the wetland for education or research

Score	**< 0.5**	**0.5 – 1.2**	**1.3 – 2.0**	**2.1 – 2.8**	**> 2.8**
Rating of the likely extent to which a benefit is being supplied	Low	Moderately low	Intermediate	Moderately high	High

f) Determining the recommended buffer zone

A buffer is required by the NWA to be assigned to all watercourses that fall within an area earmarked for development, to reduce the impacts to aquatic resources and protect the range of goods and services that these resources provide to society. The buffer zones for wetlands on site were determined according to guidelines set out in Macfarlane and Bredin (2017), accompanied by their Site-Based Wetland Buffer Model.

2.5. Sensitivity mapping and assessment

An ecological sensitivity map of the site was produced by integrating the information collected on site with the available ecological and biodiversity information available in the literature and various spatial databases.

The sensitivity mapping entails delineating different habitat units identified on the satellite images and assigning likely sensitivity values to the units based on their ecological properties, conservation value and the potential presence of species of conservation concern, as well as their probability of being affected by proposed activities.

The sensitivity of the different units identified in the mapping procedure increased with probability and was rated according to the following scale:

Low: Areas of natural or transformed habitat with a low sensitivity where there is likely to be a negligible impact on ecological processes and biodiversity. Most types of activities can proceed within these areas with little ecological impact.

Medium: Areas of natural or previously transformed land where the impacts are likely to be largely local and the risk of secondary impact such as erosion low. Activities within these areas can proceed with relatively little ecological impact provided that appropriate mitigation measures are taken.

High: Areas of natural or transformed land where a high impact is anticipated due to the high biodiversity value, sensitivity or important ecological role of the area. These areas may contain or be important habitat for faunal species or provide important ecological services such as water flow regulation or forage provision. Activities within these areas are undesirable and should only proceed with caution as it may not be possible to mitigate all impacts appropriately.

Very High: Critical and unique habitats that serve as habitat for species of conservation concern or perform critical ecological roles. These areas are essentially no-go areas for activities and should be avoided as much as possible.

2.6. Impact assessment and mitigation

The criteria used to assess the significance of the impacts are shown in Table 1. The different project activities and associated infrastructure were identified and considered in order to identify and analyse the various possible impacts. The limits were defined in relation to project characteristics. Those for severity, extent, duration and probability are subjective, based on rule-of-thumb and experience.

Natural and existing mitigation measures were considered. These natural mitigation measures were defined as natural conditions, conditions inherent in the project design and existing management measures, which alleviate impacts.

The Consequence value of the impacts was calculated by using the following formula:

$$\underset{\text{(Severity + Spatial Scope + Duration)}}{\textit{CONSEQUENCE}} \; X \; \underset{\text{(Frequency of activity + Frequency of impact)}}{\textit{PROBABILITY}}$$

Consequence of impacts is defined as follows:

Very Low: Impact would be negligible. Almost no mitigation and/or remedial activity would be needed, and any minor steps which might be needed would be easy, cheap and simple.

Low: Impact would have little real effect. Mitigation and/or remedial activity would be either easily achieved or little would be required or both.

Low – Medium: Impact would be real but not substantial within the bounds of those which could occur. Mitigation and/or remedial activity would be both feasible and fairly easily possible.

Medium – High: Impact would be real and rather substantial within the bounds of those which could occur. Mitigation and/or remedial activity would be feasible, but not necessarily possible without difficulty.

High: Impacts of substantial order. Mitigation and/or remedial activity would be feasible but difficult, expensive, time consuming or some combination of these.

Very High: Of the highest order possible within the bounds of impacts which could occur. There would be no possible mitigation and/or remedial activity to offset the impact at the spatial or time scale for which was predicted.

Table 1. Criteria used to assess the significance of the impacts.

Weight	Severity	Spatial scope (Extent)	Duration
5	Disastrous	Trans boundary effects	Permanent
4	Catastrophic / major	National / Severe environmental damage	Residual
3	High/ Critical / Serious	Regional effect	Decommissioning
2	Medium / slightly harmful	Immediate surroundings / local / outside mine fence	Life of operation
1	Minimal/potentially harmful	Slight permit deviation / on-site	Short term / construction (6 months – 1 yrs)
0	Insignificant / non-harmful	Activity specific / No effect / Controlled	Immediate (0 – 6 months)

Weight number		**1**	**2**	**3**	**4**	**5**
Frequency						
Probability	**Frequency of impact**	Highly unlikely	Rare	Low likelihood	Probable / possible	Certain
		Practically impossible	Conceivable but very unlikely	Only remotely possible	Unusual but possible	Definite
	Frequency of activity	Annually or less	6 monthly / temporarily	Infrequent	Frequently	Life of operation

CONSEQUENCE
(Severity + Spatial Scope + Duration)

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

Colour code	**Significance rating**	**Value**	**Negative impact** Management strategy	**Positive Impact** Management strategy
	VERY HIGH	126 – 150	Improve current management	Maintain current management
	HIGH	101 – 125	Improve current management	Maintain current management
	MEDIUM – HIGH	76 – 100	Improve current management	Maintain current management
	LOW – MEDIUM	51 – 75	Improve current management	Maintain current management
	LOW	26 – 50	Improve current management	Maintain current management
	VERY LOW	1 – 25	Improve current management	Maintain current management

2.7. Assumptions and limitations

The study took place during early summer, which is not an optimal time of the year. The area received good rainfall during the previous season, but most grasses and annuals were still dormant during the time of the field survey and therefore the vegetation was not in a favourable state for the assessment. Furthermore, due to the brief duration of the survey and lack of seasonal coverage, the species lists reflected in this report cannot be regarded as fully representative. Ideally, a site should be visited during different seasons to ensure the variation in species presence and habitat conditions are captured. However, this is rarely possible due to time and cost constraints related to prospecting and mining right application processes. The survey was nevertheless conducted in a manner to ensure all representative communities were traversed, to include most of the common and important species present.

Official guideline documents and tools currently available to assess wetlands in South Africa were mainly developed for- and best applied to temperate wetlands of South Africa. The suite of methodologies available to date do not provide for a comprehensive and accurate assessment of our ephemeral wetlands. This is mainly because they are rarely wet and do not display typically descriptors used for wetland assessments in South Africa. These systems have also received little attention in terms of scientific research. Therefore, the nature of the wetland on site and the lack of fully applicable methodologies limits our ability to justify the impacts to- and sensitivity of these systems. Nevertheless, methodologies used for this assessment was adapted from the official guidelines, based on specialist knowledge and experience, to provide a comprehensive understanding of the wetlands and associated impacts related to prospecting.

3. DESCRIPTION OF THE AFFECTED ENVIRONMENT

3.1. Current and historic land use

The Brakfontein site is situated in a rural area, with major land uses in the region including mining and agriculture. According to AGIS, the land capability for the study site is primarily non-arable but is suitable for grazing. The agricultural region is demarcated for sheep farming, with the grazing capacity estimated at 32 Ha/LSU. Currently, the property is primarily used for grazing by livestock and wildlife. Existing infrastructure includes old homesteads, farm tracks and grazing camps (Figure 4).

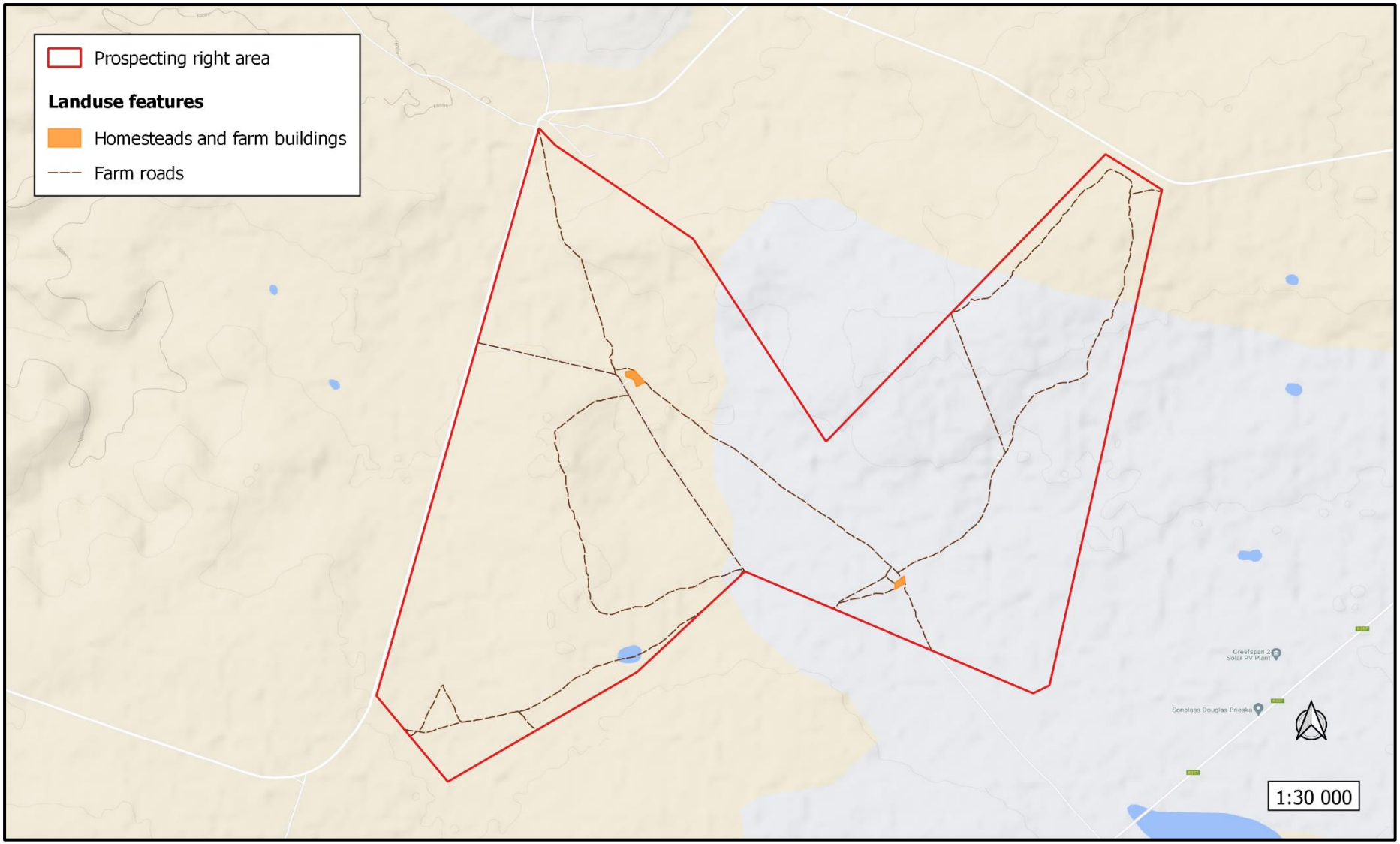


Figure 4. The existing land use features on the Brakfontein prospecting right area.

3.2. Geology, soils, and topography

According to the 1:250 000 Geological Map of 2922 Prieska (1995), the geological features on Brakfontein comprise Quaternary and Tertiary deposits (Figure 5). Calcrete is prominent in the north and south, while sand and sandy soil occur in the centre of the study area. The alluvial diamond deposits are expected to be associated with the calcrete (Figure 5).

The topography of the study area is characterised by level plains with some relief. Here, altitude ranges from 1 010 – 1 050 m above sea level. The terrain is indicated by a very gentle slope of <1 % across the study area. Landtypes found on Brakfontein include Ag136, Ag143 and Fc568 (Figure 6). The calcrete terraces, primarily represented by the Ag136 and Ag143 land type, are characterised by red-yellow apedal, freely drained soils, red, with high base status, and are shallow (< 300 mm deep). The centre of the property, depicted by the Fc568 landtype, comprise Glenrosa and/or Mispah forms, with lime generally present. Soils of the study area have high wind erosion- crusting- and compaction susceptibility. Water erosion susceptibility is also high, but due to the arid climate water erosion risks are low.

3.3. Vegetation

3.3.1. Broad-scale vegetation patterns

The study area falls within the Nama Karoo Biome (Mucina and Rutherford 2006). According to the vegetation map of Mucina and Rutherford (2012), the site is represented by one broad-scale vegetation units, i.e. Northern Upper Karoo (Figure 7). This vegetation map however does not reflect the true character of the site, because it has not been mapped at a very fine scale. Therefore, field-based classification of small-scale vegetation patterns are discussed in the next section.

Northern Upper Karoo is found in the Northern Cape and Free State at altitudes between 1 000 and 1 500 m. It is mainly restricted to the Northern regions of the Upper Karoo plateau from Prieska, Vosburg and Carnarvon in the west to Phillipstown, Petrusville and Petrusburg in the east. The topography is typically flat to gently sloping, with isolated hills in the Upper Karoo Hardeveld (in the south) and Vaalbos Rocky Shrubland (in the northeast). Numerous pans are interspersed in this unit. The vegetation occurs mainly as shrubland dominated by dwarf karoo shrubs, grasses and *Senegalia mellifera.* The geology and soil of this unit varies greatly.

Figure 5. The distribution of geological features in the study area.

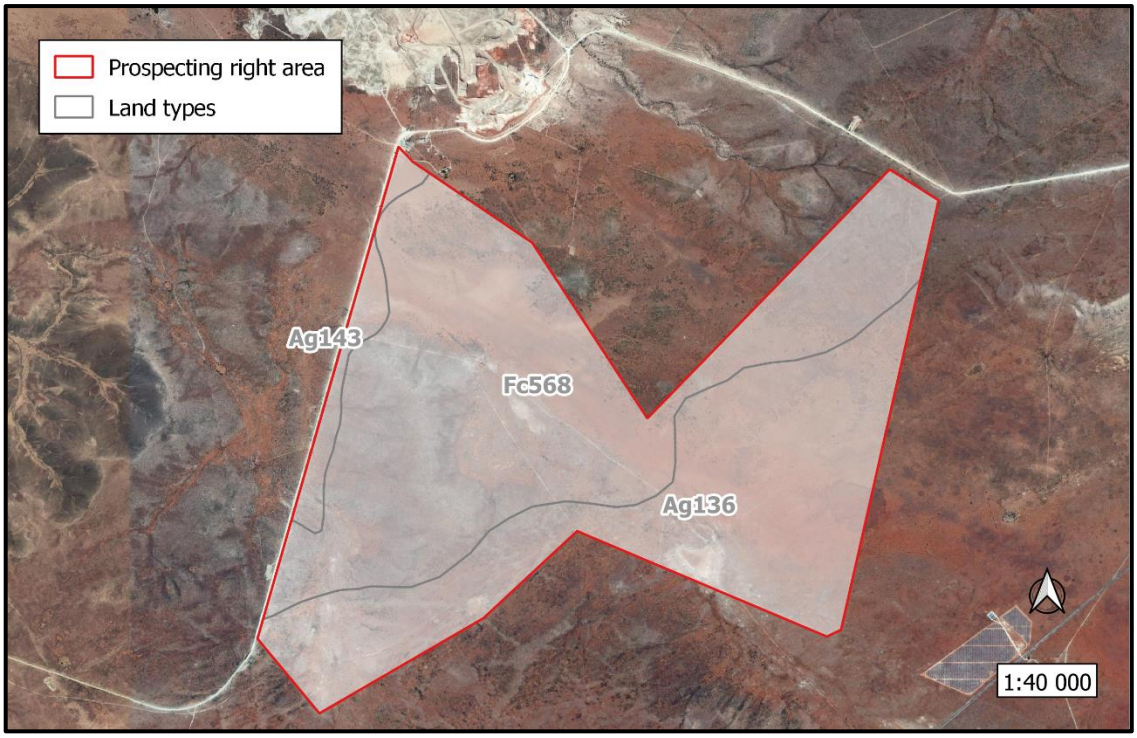


Figure 6. The distribution of land types in the study area.

Figure 7. The broad-scale vegetation units (Mucina and Rutherford 2012) present in the study area.

Geology includes shales of the Volksrust Formation, Dwyka Group Diamictite, Jurassic Karoo Dolerite sills and sheets, and calcretes of the Kalahari Group. Soils range from shallow to deep, red-yellow, apedal, freely drained to very shallow Glenrosa and Mispah forms. The most dominant landtypes are Ae, Ag and Fc. It is estimated that about 4% of the Northern Upper Karoo has been cleared for cultivation or transformed by building of dams; and human settlements are increasing in the north-eastern parts. Erosion is moderate, very low and low, while *Prosopis glandulosa*, considered among the top 12 agriculturally significant invasive alien plants in South Africa, are widely distributed in this unit. The unit is classified as being least threatened and it is not currently conserved within any formal conservation areas. Endemic plant species known from this unit include *Lithops hookeri, Stomatium pluridens, Atriplex spongiosa, Galenia exigua* and *Manulea deserticola*.

3.3.2. Fine-scale vegetation patterns

The proposed finer scale vegetation communities were delineated according to plant species correspondences and changes in soil structure. These can be divided into three distinct units (Figure 8) and are described below. A complete plant species list, including species historically recorded in the region, is presented in Appendix 1.

i) *Senegalia mellifera - Enneapogon desvauxii* open shrubland on calcrete

This plant community occupies most of the study area, where it is found on calcrete terraces in the north and south of the property (Figure 8). The vegetation is presented as shrubland with tall shrubs, scattered in a grassy matrix intermixed with dwarf shrubs (Figure 9). Rocky, calcareous soil covers 10 - 20% of the ground surface and biological soil crusts are prominent (Figure 9).

Senegalia mellifera dominates the tall shrub layer, but *Boscia albitrunca* is also common. Other tall and medium-sized shrubs include *Phaeoptilum spinosum*, *Cadaba aphylla, Kleinia longiflora, Rhigozum trichotomum* and *Prosopis velutina*. The dwarf shrub layer is more diverse and is dominated by *Roepera lichtensteiniana*, *Pentzia incana*, *P. calcarea*, *Aptosimum albomarginatum* and *Pteronia mucronata*, but *Aizoon asbestinum, Melhania rehmannii, Thesium lineatum, Sericocoma avolans, Fagonia minutistipula, Aptosimum spinescens, Pegolettia retrofracta, Felicia fascicularis, Rosenia humilis, Pentzia globosa, Justicia incana* and *Plinthus karooicus* are also widespread.

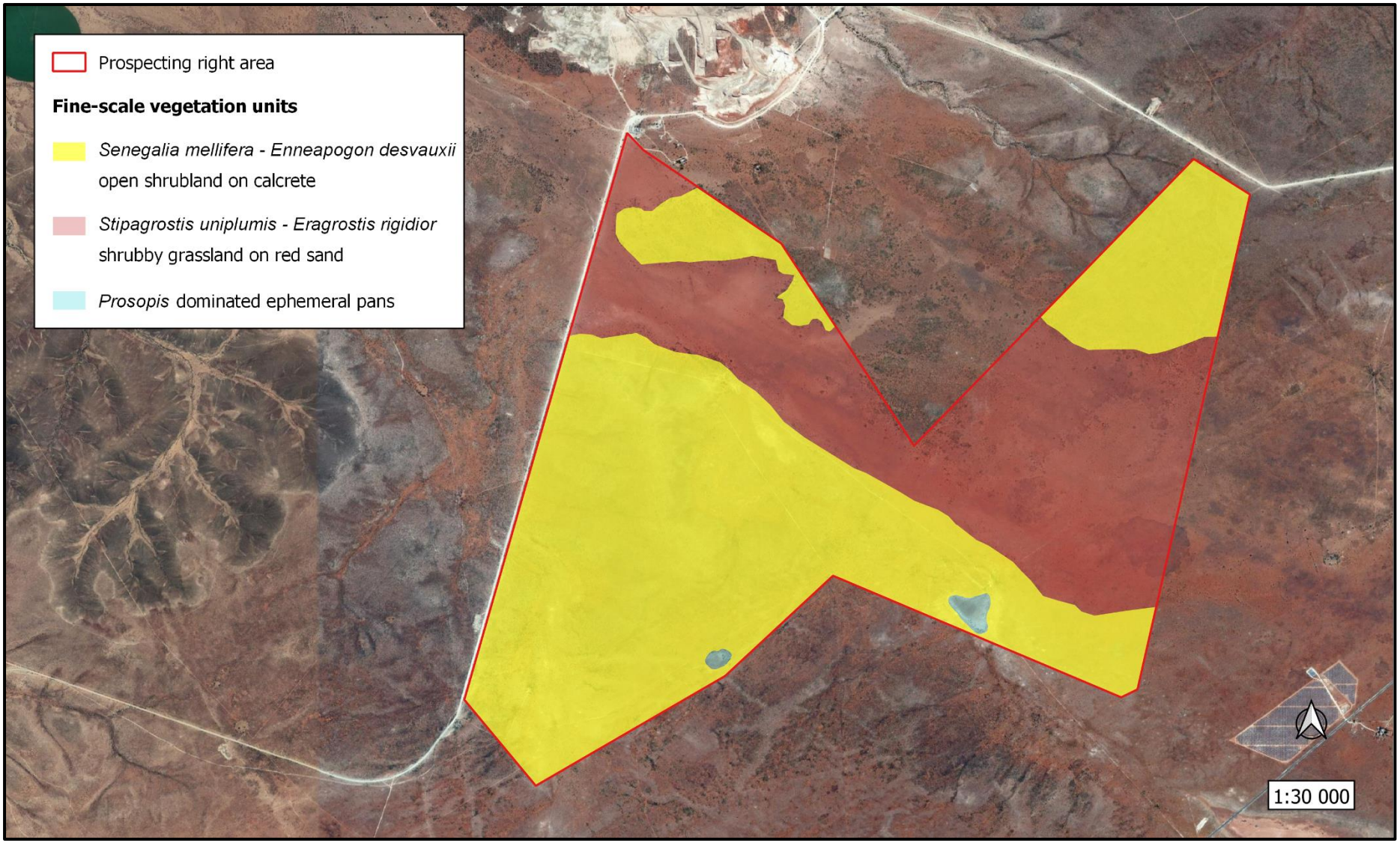


Figure 8. The distribution of fine-scale plant communities in the study area.

The grass layer is predominantly short and dominated by *Enneapogon desvauxii*, but *Aristida junciformis* forms dense patches in places. Other common grasses include *Eragrostis nindensis, E. echinochloidea, Stipagrostis ciliata, Fingerhuthia africana.*

Herbs include *Tribulus zeyheri* subsp. *zeyheri*, *Limeum aethiopicum, Geigeria ornativa*, *Lotononis laxa, Helichrysum argyrosphaerum* and the invasive *Argemone ochroleuca.*

Figure 9. The calcrete terraces are occupied by a shubland community with a tall shrub layer, growing among a grassy matrix intermixed with low shrubs (top). The shallow calcareous soil is covered with biological soil crusts (bottom).

ii) *Stipagrostis uniplumis - Eragrostis rigidior* shrubby grassland on red sand

This plant community is restricted to the sandy substrate in the centre of the study area (Figure 8). The vegetation occurs on shallow sand, which constitutes approximately 10 – 20% of the ground cover. Biological soil crusts are common (Figure 10). The vegetation is presented as a shrubby grassland where a dominant grass layer is intermixed with low shrubs, while tall shrubs are very sparsely scattered (Figure 10).

The grass layer is dominated by *Stipagrostis uniplumis*, with *Eragrostis rigidior* also being common. Other grasses include *Aristida congesta* subsp. *congesta, Eragrostis lehmanniana, Enneapogon desvauxii,* and *Stipagrostis ciliata.*

The low shrub component is diverse, with *Aptosimum albomarginatum, Justicia incana* and *Pegolettia retrofracta* dominating. Other common species include *Plinthus karooicus, Aptosimum marlothii, A. spinescens, Thesium hystrix, Lycium pilifolium, Pentzia calcarea, Asparagus suaveolens, Helichrysum lucilioides, Pteronia mucronata, Ruschia spinosa* and *Melolobium microphyllum.* Sparsely scattered tall shrubs include *Asparagus retrofractus, Lycium bosciifolium, Senegalia mellifera, Prosopis velutina* and *Rhigozum trichotomum*.

The herb layer is well developed and include *Hermannia erodioides, Senna italica, Indigofera alternans, Geigeria ornativa, Helichrysum argyrosphaerum, Sericorema remotiflora, Gazania krebsiana* subsp*. arctotoides* and the bulb *Moraea simulans*.

Figure 10. The vegetation community on sand includes a dominant grass layer intermixed with low shrubs, with tall shrubs sparsely scattered throughout (left). Biological soil crusts are common (right).

iii) *Prosopis* dominated ephemeral pans

The two ephemeral pans occur along the southern boundary of the study area (Figure 8). Their plant communities differ substantially, but both pans have been significantly infested by *Prosopis velutina* (Figure 11). The pan in the west is presented as grassland, with bare ground constituting approximately 10% of the ground cover (Figure 11) Here, *Aristida congesta* subsp. *congesta* dominate, but *Eragrostis echinochloidea, E. bicolor, E. obtusa* and *Panicum coloratum* are also common. Herbs include *Lotononis laxa, Osteospermum muricatum, Boerhavia diffusa, Heliotropium ciliatum* and *Selago densiflora*. Low shrubs from the surrounding shrubland matrix, such as *Pentzia globosa Aptosimum albomarginatum,* have encroached the pan. The pan in the east is presented as shrubland with very low diversity and bare ground constituting approximately 70% of the ground cover (Figure 11). Apart from *Prosopis*, *Atriplex nummularia* dominates this community, with *Mesembryanthemum coriarium* scattered sparsely across the pan.

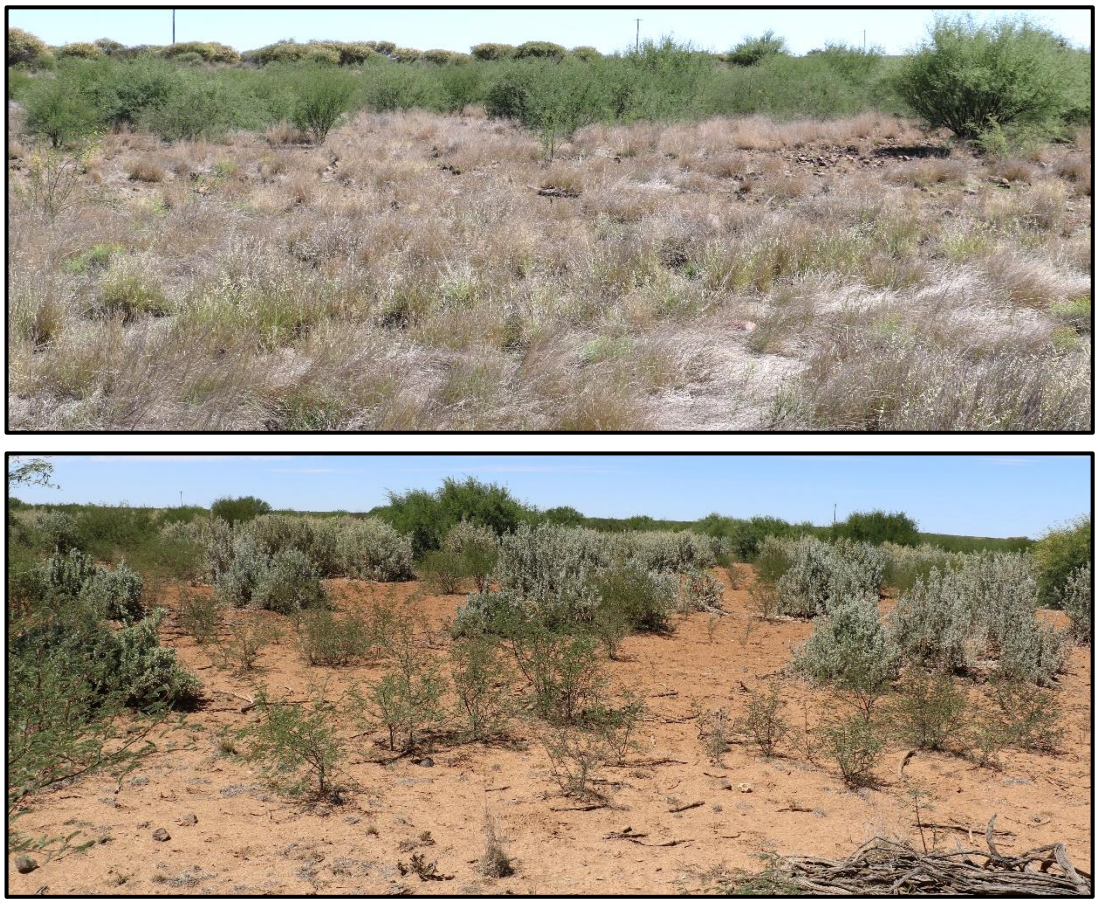


Figure 11. The plant composition of the two pans on Brakfontein differ substantially although both have been significantly infested by *Prosopis velutina*. The pan in the west is primarily represented by grassland (top), while the pan in the east is represented by shrubland (bottom).

3.3.3. Population of sensitive, threatened and protected plant species

The SANBI Red List provides information on the national conservation status of South Africa's indigenous plants, while the National Forests Act (No. 84 of 1998) (NFA) and the Northern Cape Nature Conservation Act (Act No. 9 of 2009) (NCNCA) restricts activities regarding sensitive plant species. Section 15 of the NFA prevents any person to cut, disturb, damage, destroy or remove any protected tree; or collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a licence granted by the Minister. Section 49 (1) and 50 (1) of the NCNCA states that no person may, without a permit pick, transport, possess, or trade in a specimen of a specially protected (Schedule 1) or protected (Schedule 2) plants. Furthermore, Section 51(2) states that no person may, without a permit, pick an indigenous plant (Schedule 3) in such manner that it constitutes large-scale harvesting.

Most species of the region are classified as least concern; a category which includes widespread and abundant taxa (Table 2). However, two species are listed under the National Environmental: Biodiversity Act (Act No. 10 of 2004) (NEMBA). *Acanthopsis hoffmannseggiana* (**Data Deficient – Taxonomically Problematic (DDT)**) is a widespread and variable species that possibly contains several taxa, some of which may be of conservation concern and more study is needed to find reliable distinguishing characters to separate individual taxa. It was not recorded in the study area but are generally common on the calcrete plateaus and tillite ridge slopes of the region. *Salsola smithii* is also listed as **DDT**. The entire *Salsola* genus needs taxonomic revision because its species are poorly defined and difficult to separate. Therefore, based on currently available data, the risk of extinction of this species cannot be assessed. It was also not recorded during the field survey.

Table 2. Plant species from the region that are of conservation concern. Those recorded in the study area are indicate with *.

FAMILY	Scientific name	Status	NFA	NCNCA
ACANTHACEAE	***Acanthopsis hoffmannseggiana***	**DDT**		
AIZOACEAE	*Mesembryanthemum coriarium**			**S2**
AIZOACEAE	*Ruschia spinosa**			**S2**
AMARANTHACEAE	***Salsola smithii***	**DDT**		
APOCYNACEAE	*Microloma armatum* var. *armatum*			**S2**
BRASSICACEAE	*Boscia albitrunca**		**X**	**S2**
IRIDACEAE	*Moraea simulans**			**S2**

Species protected in terms of the National Forests (NFA) Act No 84 of 1998 include *Boscia albitrunca* (Table 2 and Figure 12), which was restricted to the shrubland on calcrete. Here, it was found at low densities of approximately one individual per hectare, primarily as adults, i.e., stunted shrubs (80 cm - 1 m (h) x 2 m (d)), taller shrubs (1 - 2 m (h) x 2 m (d)), younger trees (1 - 2 m (h) x 1 m (d)) and very large old trees up to 3 m (h) x 6 m (d).

Protected species in terms of Schedule 1 and 2 of the Northern Cape Nature Conservation (NCNCA) Act No. 9 of 2009 are listed in Table 2. No species specially protected under Schedule 1 were recorded during the field survey. Those protected under Schedule 2 include all Aizoaceae species previously included in the family Mesembryanthemaceae, all species included in the family Apocynaceae and Iridaceae, as well as *Boscia albitrunca*. *Microloma armatum* var. *armatum* is known from the region but was not recorded on site. *Ruschia spinosa* and *Moraea simulans* were both restricted to the shrubby grassland on red sand, while *Mesembryanthemum coriarium* was restricted to the ephemeral pan in the east.

Although not formally regulated, biological soil crusts were associated with the calcareous soils of the shrubland and open grassland on red sand (Figure 9 and Figure 10). These are very sensitive microhabitats and an integral component of arid environments. These crusts are thin layers of living material formed in the uppermost millimetres of soil where soil particles are aggregated by a community of highly specialized organisms, including cyanobacteria and other bacteria, microfungi, algae, lichens, and mosses. The crust is crucial for soil stabilization, water retention, and soil fertility and is recognized as having a major influence on global ecosystems (Belnap and Weber 2013). After disturbance, biological soil crusts may take 250 to 1 000 years in arid regions to recover.

3.3.4. Weeds and invader plant species

Weeds and invasive species are controlled in terms of the National Environmental Management: Biodiversity (NEMBA) Act 10 of 2004, the Conservation of Agricultural Resources (CARA) Act 43 of 1993, as well as the NCNCA (Schedule 6). These are species that do not naturally occur in a given area and exhibit tendencies to invade that area, and others; at the cost of locally indigenous species. To govern the control of such species, NEMBA and CARA have divided weeds and invader species into categories (see Table 3). All declared weeds and invasive species recorded in the study region are listed in Table 4, along with their categories according to CARA, NEMBA and NCNCA.

Figure 12. The different growth forms of the protected tree *Boscia albitrunca* found in the study area.

Table 3. The categorisation of weeds and invader plant species, according to NEMBA and CARA.

NEMBA		CARA	
1a	Listed invasive species that must be combatted or eradicated.	**1**	Plant species that must be removed and destroyed immediately. These plants serve no economic purpose and possess characteristics that are harmful to humans, animals and the environment.
1b	Listed invasive species that must be controlled.	**2**	Plant species that may be grown under controlled conditions. These plants have certain useful qualities and are allowed in demarcated areas. In other areas they must be eradicated and controlled.
2	Listed invasive species that require a permit to carry out a restricted activity within an area.	**3**	Plant species that may no longer be planted. These are alien plants that have escaped from, or are growing in gardens and are proven to be invaders. No further planting is allowed. Existing plants may remain (except those within the flood line, 30 m from a watercourse, or in a wetland) and must be prevented from spreading.
3	Listed invasive species that are subject to exemptions and prohibitions		

Table 4. A list of declared weeds and invasive species recorded in the study region.

Scientific name	Common name	CARA	NEMBA	NCNCA
Argemone ochroleuca	White-flowered Mexican poppy	1	1b	S6
Atriplex nummularia	Old man saltbush	2	2	S6
Cylindropuntia fulgida var. fulgida	Chain-fruit cholla		1b	
Prosopis velutina	Velvet mesquite	2	3	S6

3.3.5. Indicators of bush encroachment

Bush encroacher species are controlled in terms of Regulation 16 of CARA; where land users of an area in which natural vegetation occurs and that contains communities of encroacher indicator plants are required to follow sound practices to prevent the deterioration of natural resources and to combat bush encroachment where it occurs. Declared indicators of bush encroachment in the Northern Cape, recorded in the study area, are listed in Table 5.

Table 5. A list of declared indicators of bush encroachment in the Northern Cape, which were recorded in the study area.

Scientific name	Common name
Rhigozum trichotomum	Three-thorn rhigozum
Senegalia mellifera	Black thorn

3.4. Faunal communities

According to Section 3(a) and 4(a) of the Northern Cape Nature Conservation (NCNCA) Act No. 9 of 2009, no person may, without a permit by any means hunt, kill, poison, capture, disturb, or injure any protected (Schedule 2) or specially protected (Schedule 1) wild animals. Furthermore, Section 12 (1) of NCNCA states that no person may, on a land of which he or she is not the owner, hunt a wild animal without the written permission from the landowner. According to the act "wild animal" means a live vertebrate or invertebrate animal, and the egg or spawn of such animal.

The landscape features on the Brakfontein site provide several habitat opportunities to faunal communities. Wild animals likely to be found in the study area are discussed in their respective faunal groups below.

3.4.1. Mammals

As many as 54 terrestrial mammals and nine bat species have been recorded in the region (see Appendix 2). Species that were encountered during the site visit include Gemsbok, Springbok, Greater Kudu, Steenbok and Yellow Mongoose. Signs of activities from fossorial mammal species were also observed (Figure 13).

Seven listed terrestrial mammal species and two listed bat species potentially occur in the area (Table 6). Virtually all mammals of the study area are protected; either according to Schedule 1, 2 or 3 of NCNCA (see Appendix 2). Those that are specially protected are also indicated in Table 6.

Figure 13. Evidence of fossorial mammal activity recorded during the field visit.

Table 6. A list of mammal species that are likely to be found in the study area, which are of conservation concern in terms of the international (IUCN) Red List and the 2016 Mammal Red List of South Africa Lesotho and Swaziland (EWT 2016). Their respective NCNCA schedule numbers are indicated in superscript.

Scientific name	Common name	IUCN Status	EWT 2016
[2]*Eidolon helvum*	African Straw-coloured Fruit-bat	NT	
[2]*Rhinolophus denti*	Dent's Horseshoe Bat		NT
[1]*Orycteropus afer*	Aardvark		
[1]*Smutsia temminckii*	Temminck's Ground Pangolin	VU	VU
[2]*Parotomys littledalei*	Littledale's Whistling Rat		NT
[1]*Atelerix frontalis*	South African Hedgehog		NT
[1]*Proteles cristatus*	Aardwolf		
[1]*Felis silvestris cafra*	African Wild Cat		
[1]*Felis nigripes*	Black-footed cat	VU	VU
[1]*Vulpes chama*	Cape Fox		
[1]*Hyaena brunnea*	Brown Hyena	NT	NT
[1]*Otocyon megalotis*	Bat-eared Fox		
[2]*Aonyx capensis*	Cape Clawless Otter	NT	NT
[1]*Poecilogale albinucha*	African Striped Weasel		NT
[1]*Ictonyx striatus*	Striped Polecat		
[1]*Mellivora capensis*	Honey Badger		

Honey Badger, Aardwolf, African Wild Cat, Cape Fox, Bat-eared Fox and Striped Polecat have a high chance of occurring across the site, given their wide habitat tolerances. Aardvark, Ground Pangolin and African striped Weasel have a high potential of occurring in the shrubby grassland on sand. Pangolins, however, are seldomly encountered due to their inconspicuous nature. Similarly, the South African Hedgehog also has a high chance of occurring on site based on their association with open, arid habitat.

Black-footed Cat prefers arid habitat, but their conspicuous nature might cause them to avoid the study area due to ongoing prospecting activities. It therefore has a moderate potential to occur on site.

The African Straw-coloured Fruit-bat requires fruit trees and is not expected to occur on site. Similarly, Dent's Horseshoe Bat also has a low chance to be found on site due to their preference for savanna habitats. The Brown Hyaena has a low potential to be found on site mainly since farm fences are restricting their occurrences across their natural distribution range. The Littledale's whistling rat is also not expected to occur on site based on their restricted distribution. The Cape Clawless Otter is restricted to river habitats and is therefore not expected to be found on site.

Apart from these special species of conservation concern, problem animals (Schedule 4 of the NCNCA) with a high likelihood to occur on site include Black-backed Jackal, Caracal and Vervet Monkey.

3.4.2. Reptiles

The Brakfontein prospecting area lies within the distribution range of at least 36 reptile species (see Appendix 2). No listed species are known to occur in the area, but most reptiles of the study area are protected either according to Schedule 1 or 2 of NCNCA (Appendix 2). Specially protected species include *Karusasaurus polyzonus* (Southern Karusa Lizard) and *Chamaeleo dilepis dilepis* (Common Flap-neck Chameleon). The Karusa Lizard is a rock-dwelling species inhabiting rocky outcrops and is not expected to occur on site. The Common Flap-neck Chameleon is typically found high up in bushes or trees and is expected to potentially occur across the site (Figure 14).

Southern Karusa Lizard

Common Banded Gecko

Aurora Snake

Greater Dwarf Tortoise

Common Flap-neck Chameleon

Marsh Terrapin

Western Ground Agama

Figure 14. Reptile species of special importance that are expected to occur in the study area (top). The Agama was frequently encountered during the field survey and the Marsh Terrapin is expected to occur in the pans (bottom).

South African endemics include *Pachydactylus mariquensis* (Common Banded Gecko), *Lamprophis aurora* (Aurora Snake) and *Homopus femoralis* (Greater Dwarf Tortoise). The Common Banded Gecko prefers sandy soil and sparse vegetation in a variety of habitats such as sandy plains and dry riverbeds. The Aurora Snake is often found near streams and under rocks and old termitaria, while the Greater Dwarf Tortoise occurs in rocky areas with dense vegetation where they take shelter among rocks or under plants. Images of these reptile species of special importance are shown in Figure 14.

The Western Ground Agama, a common species of Least Concern, was frequently encountered during the field survey (Figure 14). The remaining common reptile species of the region are expected to occur in the terrestrial habitats on site, while the Marsh Terrapin is expected to be associated with the ephemeral pans (Figure 14). It survives drought by burrowing into moist soil and then emerges after good rains.

3.4.3. Amphibians

Fourteen amphibian species are known from the region (Appendix 2). The ephemeral pans represent suitable habitat for breeding during wet periods. Those frog species that are fairly independent of water (i.e. Bushveld Rain Frog, Boettger's Caco) are expected to take refuge under rocks and logs, soil cracks, sandy substrates, leaf litter and abandoned mounds of termites.

The Giant Bull Frog (*Pyxicephalus adspersus,* Figure 15) is listed as Near Threatened in the Southern African Frog Atlas and is protected according to Schedule 1 of the NCNCA. They prefer seasonal shallow grassy pans, vleis and other rain-filled depressions in open flat areas of grassland or savanna, but mainly remain buried up to 1 m underground until conditions become favourable. The site lies within the known distribution of this species and the ephemeral pans provide ideal habitat for it on site, especially the pan in the west.

All other amphibians of the study area are protected according to Schedule 2 of NCNCA (see Appendix 2). Raucous Toad (*Amietophrynus rangeri*) and Southern Pygmy Toad (*Poyntonophrynus vertebralis*) (Figure 15) are endemic to South Africa and occur in a variety of terrestrial habitats for most of the time. However, they use temporary waterbodies containing rainwater to breed, including pans, pools, roadside ditches, farm dams and even quarries.

Figure 15. The Giant Bull Frog's distribution range overlaps with that of the study area and is likely to occur in the ephemeral pan in the west (left), while the South African endemics, i.e., Raucous Toad (middle) and Southern Pygmy Toad (right) could potentially occur in the terrestrial habitats, before migrating to temporary pools for breeding in the rainy season.

3.4.4. Avifauna

The study site does not fall within or near (< 100 km) any of the Important Bird Areas (IBA) defined by Birdlife South Africa. A total number of 261 bird species have been recorded from the region (see Appendix 2), of which as many as 25 are listed and classified as Vulnerable, Near Threatened, Endangered or Critically Endangered (Table 7). Furthermore, all birds are protected either according to Schedule 1, 2 or 3 of NCNCA (Appendix 2). Those that are specially protected (Schedule 1) are also listed in Table 7. Plants, from grass tufts to shrubs and trees provide important micro-habitats to birds in the terrestrial habitats, while ephemeral pans further increase habitat opportunities to water birds during the rainy season. Therefore, the study area is expected to host a diverse avifauna community.

Many of the species of conservation concern are expected to occur on site either by occasionally passing over, foraging, or nesting. The most common bird species of conservation concern expected to occur in the terrestrial habitats on site include Kori Bustard (Near Threatened), Ludwig's Bustard (Endangered), Secretarybird (Vulnerable) and Tawny Eagle (Endangered) (Figure 16). Pale Chanting Goshawk (NCNCA: Schedule 1) was encountered in the shrubland on calcrete (Figure 16). None of the ephemeral pans were inundated during the field survey, but they could potentially attract protected water birds, such as Curley Sandpiper, Black-winged Pratincole, Marabou Stork, Maccoa Duck, Lesser Flamingo, Greater Flamingo and Greater Painted-snipe during wet seasons, of which all are Near Threatened. Images of these bird species are shown in Figure 16.

Table 7. Bird of conservation concern that are likely to occur on site. Species are indicated in terms of the IUCN, SA Red Data Book and Schedule 1 of the NCNCA.

Scientific name	Common name	IUCN	SA RDB	NCNCA
Accipiter badius	Shikra			X
Anthropoides paradisea	Blue Crane	VU	NT	
Aquila rapax	Tawny Eagle	VU	EN	X
Aquila verreauxii	Verreaux's Eagle		VU	X
Ardeotis kori	Kori Bustard	NT	NT	
Bubo africanus	Spotted Eagle-Owl			X
Bubo lacteus	Verreaux's Eagle-Owl			X
Buteo rufofuscus	Jackal Buzzard			X
Buteo vulpinus	Steppe Buzzard			X
Calidris ferruginea	Curlew Sandpiper	NT		X
Caprimulgus europaeus	European Nightjar			X
Caprimulgus rufigena	Rufous-cheeked Nightjar			X
Caprimulgus tristigma	Freckled Nightjar			X
Charadrius pallidus	Chestnut-banded Plover	NT	NT	X
Ciconia abdimii	Abdim's Stork		NT	
Ciconia nigra	Black Stork		VU	X
Circaetus pectoralis	Black-chested Snake-Eagle			X
Circus maurus	Black Harrier	EN		X
Circus pygargus	Montagu's Harrier			X
Circus ranivorus	African Marsh-Harrier		EN	X
Coracias garrulus	European Roller		NT	
Cursorius rufus	Burchell's Courser		VU	
Elanus caeruleus	Black-shouldered Kite			X
Falco biarmicus	Lanner Falcon		VU	X
Falco naumanni	Lesser Kestrel			X
Falco peregrinus	Peregrine Falcon			X
Falco rupicolis	Rock Kestrel			X
Falco rupicoloides	Greater Kestrel			X
Glareola nordmanni	Black-winged Pratincole	NT	NT	X
Glaucidium perlatum	Pearl-spotted Owlet			X
Gyps africanus	White-backed Vulture	CR	CR	X
Gyps coprotheres	Cape Vulture	VU	EN	X
Haliaeetus vocifer	African Fish-Eagle			X
Hieraaetus pennatus	Booted Eagle			X
Leptoptilos crumeniferus	Marabou Stork		NT	X
Melierax canorus	Southern Pale Chanting Goshawk			X
Melierax gabar	Gabar Goshawk			X
Milvus migrans	Black Kite			X
Neotis ludwigii	Ludwig's Bustard	EN	EN	X
Oxyura maccoa	Maccoa Duck	VU	NT	
Phoenicopterus minor	Lesser Flamingo	NT	NT	X
Phoenicopterus ruber	Greater Flamingo		NT	X
Polemaetus bellicosus	Martial Eagle	EN	EN	X
Polihierax semitorquatus	Pygmy Falcon			X
Polyboroides typus	African Harrier-Hawk			X
Ptilopsus granti	Southern White-faced Scops-Owl			X
Rostratula benghalensis	Greater Painted-snipe		NT	X
Sagittarius serpentarius	Secretarybird	EN	VU	X
Torgos tracheliotus	Lappet-faced Vulture	EN	EN	X
Tyto alba	Barn Owl			X

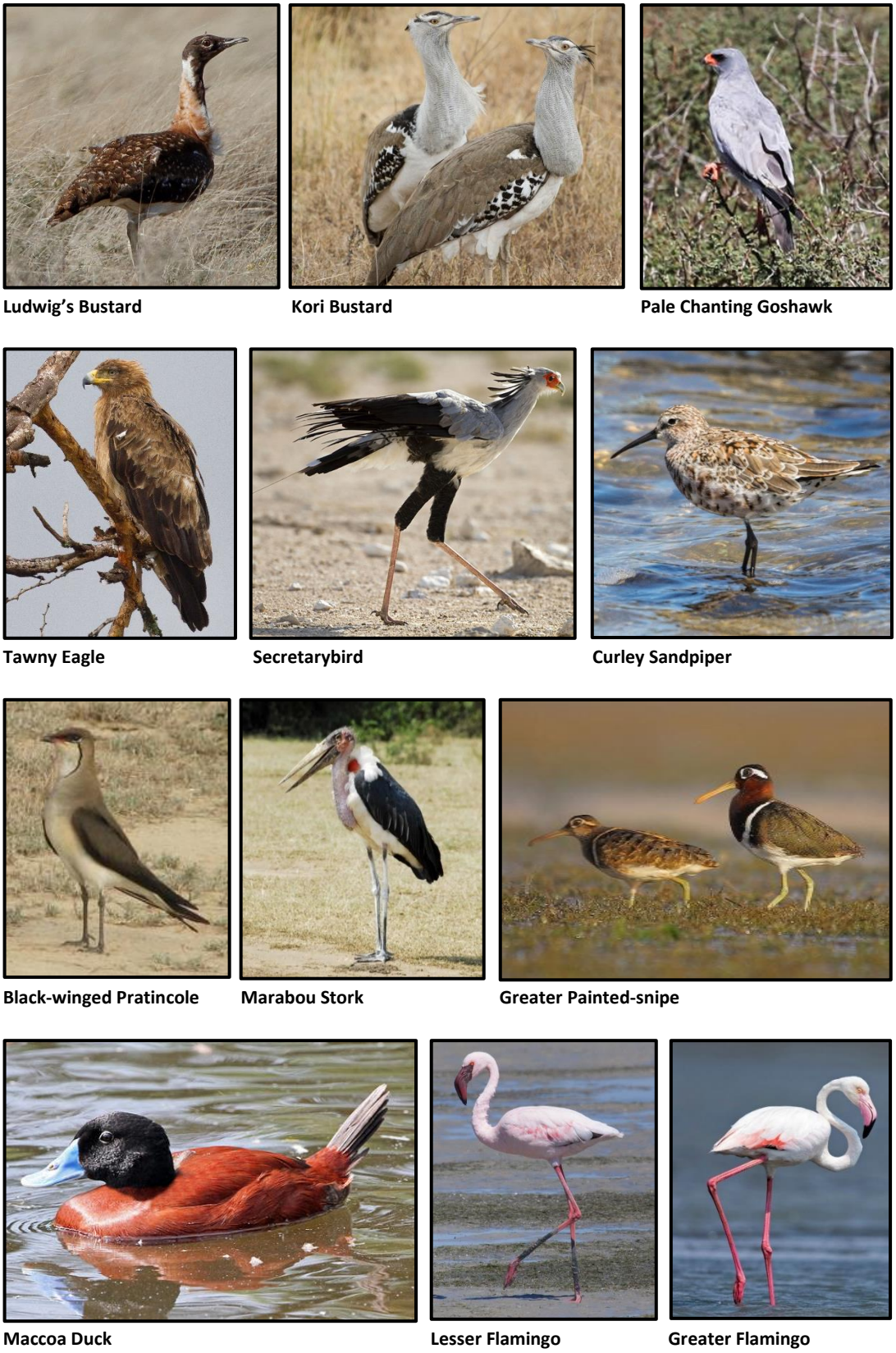


Figure 16. Bird species of conservation concern that are expected to occur in the study area.

3.4.5. Fish

In addition to those regulations in the NCNCA pertaining to wild animals, Section 32 and 33 of the NCNCA states that no person may, without a permit angle and not immediately release, catch, import, export, transport, keep, possess, breed, or trade in a specimen of a specially protected (Schedule 1) or protected (Schedule 2) fish. No fish are expected to occur in the ephemeral pans, even when filled, mainly due to their ephemerality. Therefore, no fish species are expected to occur on site.

3.4.6. Invertebrates

Invertebrates dominate inland habitats and play a significant role in the overall function of the ecosystem (Kremen et al. 1993, Weisser and Siemann 2004). In general, they are widely distributed and extremely diverse, which makes it almost impossible to list all species that may possibly occur on site without a dedicated study. Invertebrates have also not been surveyed as comprehensively as plants and mammals and therefore current available data on their distribution is much scarcer. Nevertheless, key morphospecies and species of conservation concern are discussed here, as well as the major habitats which delimit possible invertebrate communities on site.

Eight invertebrate species of the Northern Cape appear on the IUCN Red Data list of threatened species and are listed in Table 8. However, none of these species' distribution ranges overlap with that of the study area. In addition, those species that are specially protected according to Schedule 1 of the NCNCA include all Velvet Worms as well as some Baboon Spider species, Stag Beetles and the Flightless Dung Beetle (Table 8). Of these, Common Baboon Spiders (*Harpactira* sp.) have been recorded from the region (Figure 17).

All Rock- Creeping- and Burrowing Scorpions are protected according to Schedule 2 of the NCNCA, along with several beetles, butterflies and moths (Table 8). Of these, Burrowing and Rock Scorpions as well as some Gossamer-winged Butterflies, Skippers, Brush-footed Butterflies and Satyrs have the highest likelihood to be found on site.

All other invertebrates from the class Insecta and Arachnida are protected according to Schedule 3 of the NCNCA.

Table 8. Invertebrate species found in the Northern Cape that are of conservation concern.

CLASS	ORDER	Scientific Name	Common name	Status
ARACHNIDA	MYGALOMORPHAE	*Ceratogyrus* spp.	Horned Baboon Spiders	S1
		Harpactira spp.	Common Baboon Spiders	S1
		Pterinochilus spp.	Goldenbrown Baboon Spiders	S1
	SCORPIONES	*Hadogenes* spp.	All Rock Scorpions	S2
		Opistacanthus spp.	All Creeping Scorpions	S2
		Opistophthalmus spp.	All Burrowing Scorpions	S2
INSECTA	COLEOPTERA	*Circellium bacchus*	Flightless Dung Beetle	S1
		Colophon spp.	All Stag Beetles	S1
		Dromica spp.	Tiger Beetles (all species)	S2
		Graphipterus assimilis	Velvet Ground Beetle	S2
		Ichnestoma spp.	All Fruit Chafer Beetles	S2
		Manticora spp.	All Monster Tiger Beetles	S2
		Megacephala asperata	Tiger Beetle	S2
		Megacephala regalis	Tiger Beetle	S2
		Nigidius auriculatus	Stag Beetle	S2
		Oonotus adspersus	Stag Beetle	S2
		Oonotus interioris	Stag Beetle	S2
		Oonotus rex	Stag Beetle	S2
		Oonotus sericeus	Stag Beetle	S2
		Platychile pallida	Tiger Beetle	S2
		Prosopocoilus petitclerci	Stag Beetle	S2
		Prothyma guttipennis	Tiger Beetle	S2
	LEPIDOPTERA	*Lepidochrysops penningtoni*	Pennington's Blue	**DD**
		Lycaenidae	All Gossamer-winged Butterflies	S2
		Hepialidae	All Swift Moths	S2
		Hesperiidae	All Skippers	S2
		Nymphalidae	All Brush-footed Butterflies	S2
		Satyridae	All Satyrs	S2
	ORTHOPTERA	*Africariola longicauda*	Richtersveld Katydid	**VU**
		Alfredectes browni	Brown's Shieldback	**DD**
		Brinckiella serricauda	Serrated Winter Katydid	**DD**
		Brinckiella arboricola	Tree Winter Katydid	**EN**
		Brinckiella aptera	Mute Winter Katydid	**VU**
		Brinckiella karooensis	Karoo Winter Katydid	**VU**
		Brinckiella mauerbergerorum	Mauerberger's Winter Katydid	**VU**
ONYCHOPHORA			All Velvet worms	S1

Two major habitats delimit possible invertebrate communities in the study area:

i. **Terrestrial vegetation classified as Karoo for insect preference (Picker et al. 2004)**

Species All the terrestrial vegetation communities on site fall within this habitat and represent unique species assemblages, with an above-average representation of beetles, grasshoppers, flies, wasps, and lacewings. The protected spiders, butterflies and scorpions discussed above would also be associated with this habitat. Termitaria, most likely belonging to *Trinervitermes trinervoides*, as well as Community Nest Spiders (*Stegodyphus* sp.), Brown-veined White (*Belenois aurota*), and Cicadas were recorded during the field survey (Figure 17).

ii. **Ephemeral pans**

Ephemeral pans in the region are known to host specialist crustaceans which are specifically adapted to ephemerality. None of the pans on site had water during the field survey and therefore could not be sampled for live aquatic specimens. However, *Branchipodopsis* sp. (Anostraca, fairy shrimp), *Daphnia* sp. (Cladocera, water fleas), CHYDORIDA sp. (Cladocera, water fleas), and Ostracoda hatched from sediment collected from the Pan in the west (Figure 18). Ostracods also hatched from the pan in the east, while Anostraca and Notostraca eggs were found in the sediment, but no other hatchlings emerged during the hatching trials. Their eggs lie dormant in the soil until the pans are inundated. They then hatch and mature rapidly to produce eggs that accumulate in the top few centimetres of the sediment. These eggs are heat and drought resistant and ensure the continued existence of species in a habitat. The egg banks are essentially the vault that contains the biodiversity of the aquatic habitat during times of drought. Any disturbances to the soil will expose the eggs to erosion and crushing, which will result in species losses and possible extinction. Within a few days after the pans are inundated the crustaceans eggs will hatch. This usually attracts several wetland birds to forage on the crustaceans as their main food source. Therefore, the crustaceans are essential components in the food web. These pans also act as important breeding and feeding links to birds in terms of connectivity, by providing stepping-stone corridors in an arid landscape. The disturbance or destruction of these pans will not only impact the specialised pan invertebrate communities locally but will also have a regional and landscape-level effect.

***Harpactira* sp. (Schedule 1)**

Cicadida sp.

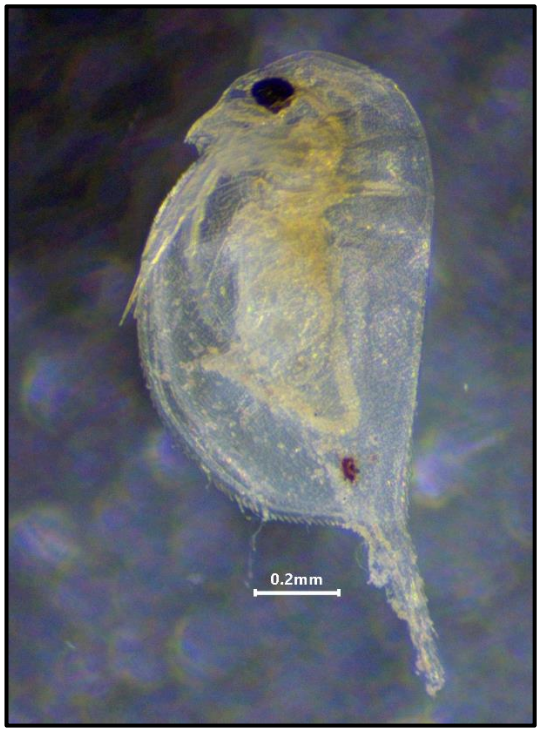
Pieridae (Brown-veined White)

***Trinervitermes* mounds**

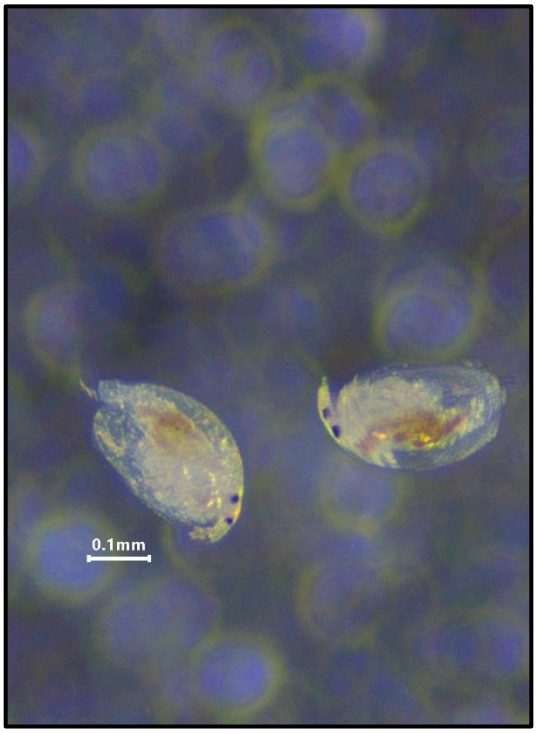
Stegodyphus sp. (Community Nest Spiders)

Figure 17. Terrestrial invertebrates that have been recorded in the study area.

***Branchipodopsis* sp. (Anostraca: Fairy shrimp)**



***Daphnia* sp. (Cladocera: Water flea)**



CHYDORIDAE sp. (Cladocera: Water flea)

Ostracoda (Seed shrimp)

Sediment (Egg bank)

Figure 18. Crustacean taxa that hatched from sediment collected in the Brakfontein depressional wetlands. Their egg banks are found in the first few centimetres of the soil.

3.5. Water resources

The National Water Act (36 of 1998) (NWA) provides a framework to protect water resources. According to this Act, a water resource includes a watercourse, surface water, estuary, or aquifer; whereas a water course includes:

a) a river or spring,
b) a natural channel in which water flows regularly or intermittently,
c) a wetland, lake or dam into which, or from which, water flows, and
d) any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse.

Any reference to a watercourse includes its bed and banks and a water resource does not only include the water within the system, but also the entire water cycle; i.e. evaporation, precipitation, the habitats and processes. The purpose of this Act (Section 2) is to ensure that the nation's water resources are protected, used, developed, conserved, managed and controlled in ways which take into account amongst other factors - (g) protecting aquatic and associated ecosystems and their biological diversity and (h) reducing and preventing pollution and degradation of water resources. No activity may take place within a watercourse unless authorised by the Department of Water and Sanitation (DWS). Any area within a wetland or riparian zone is therefore excluded from development unless authorisation is obtained from the DWS in terms of Section 21 (c) and (i).

3.5.1. Water resources setting

The Brakfontein study area falls within the Boegoeberg quaternary catchment D71C of the Lower Orange Water Management Area (Figure 19). This quaternary catchment has been allocated a Present Ecological State (PES) of 'Moderately Modified' (C) by Smook et al. (2002), and information regarding its mean annual rainfall, evaporation potential and runoff is provided in Table 9.

Table 9. Catchment characteristics for the Boegoeberg quaternary catchments (Smook et al. 2002).

Quaternary catchment	Catchment Area (km^2)	Mean Annual Rainfall (mm)	Mean Annual Evaporation (mm)	Mean Annual Runoff (10^6 m^3)
D71C	1 592	250	2 350	4.75

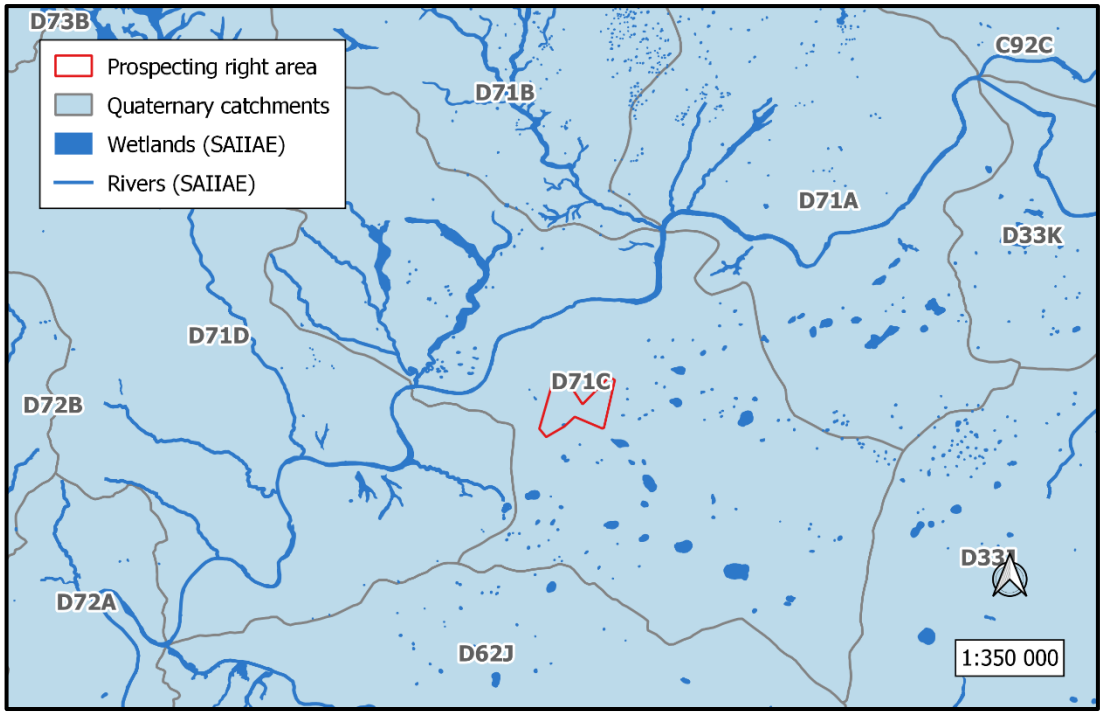


Figure 19. The locality of the proposed prospecting area in relation to the quaternary catchments of the Lower Orange Water Management Area.

According to The South African Inventory of Inland Aquatic Ecosystems (SAIIAE), Brakfontein falls within the Upper Karoo Bioregion, where 1.9 % (236 551 ha) of the land area is covered by inland wetlands, including depressions, floodplains, seeps and valley-bottom wetland types (Van Deventer et al. 2019). Their spatial extent according to their present ecological status is depicted in Table 10. Most of these wetlands have been moderately to severely modified.

According to the SAIIAE, one ephemeral pan occurs on Brakfontein (Figure 20), which has been classified as being in a natural or near-natural condition.

Table 10. Percentage of inland wetland spatial extent according to the present ecological status per wetland type of the Upper Karoo Bioregion.

Wetland type	Total Extent (%)	% Natural or near-natural (A/B)	% Moderately modified (C)	% Heavily to severely/ critically modified (D/E/F)
Depression	27.9	49	10.6	40.4
Floodplain	27.5	0.4	1.7	98
Seep	2.8	11.9	76.2	11.9
Valley-bottom	41.8	5.5	35.1	59.4

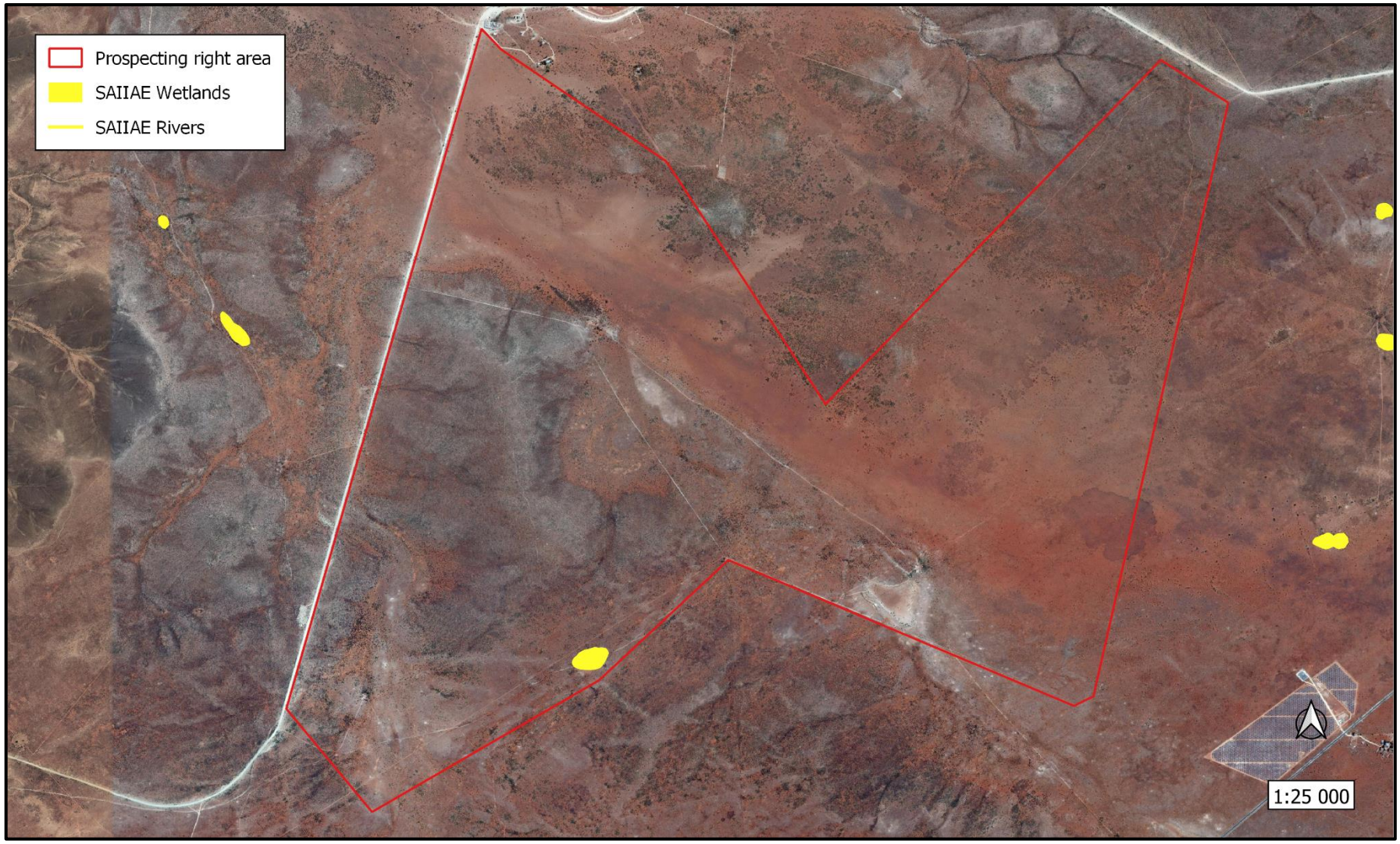


Figure 20. The location of SAIIAE wetlands on, and nearby, the proposed prospecting right area.

3.5.2. Watercourse delineation and classification

Two depressional wetlands (colloquially known as ephemeral pans) and a few drainage lines were identified on Brakfontein. All these watercourses are indicated in Figure 21. A minimum GIS buffer of 200 m is indicated here for wetlands and the post-mitigation buffer requirements for the drainage lines is 20 m. However, it is recommended that a conservative approach be opted for, and that the pre-mitigation buffer width of 30 m be adopted.

The depressional wetlands combined cover a total area of ± 8.6 ha, with Pan 1 being 1.6 ha and Pan 2, 6.9 ha in size. The wetland surface areas fall entirely within the boundaries of the prospecting right area. Their local upslope catchments combined total an area of ± 811 ha, of which 64 % fall within the prospecting right area (Figure 22). Pan 1 has a much smaller catchment area of 52 ha, compared to Pan 2, which covers 759 ha. The drainage lines flow from the sandy plains, southwards towards the depression in the east, with total combined length of ± 5.5 km, of which 5 km occurs within the study area. The depressional wetlands are the main assessment units considered for this report. Therefore, the ephemeral drainage lines will not be further defined, but their buffer requirements should be honoured during the prospecting operation to minimise impacts to these systems.

The depressional wetlands are found on plains terrain and their Hydrogeomorphic Unit (HGMU) classification is described below, up to Level 6.

HGMU1: NATURAL ENDORHEIC DEPRESSIONS (EPHEMERAL PANS)

The wetlands are all classified as endorheic depressions (colloquially known as pans), with high a confidence rating (Table 11). A conceptual illustration of a depressional wetland, according to Ollis et al. (2013) is presented in Figure 23. Pan 1 is a natural depression and Pan 2 is suspected to have been a natural depression originally, but cultivation practises in the 1980s leaves its status questionable. Due to its geomorphic setting however, it is classified here as a depressional wetland. Water enters both depressions primarily through direct precipitation and overland inflow. The wetlands are only filled after substantial summer rainfall events and are therefore intermittently and rarely inundated (ephemeral). Pan 1 has fresh water (EC = 88.25 µS/cm), with a neutral (6.8) pH. Pan 2 is also fresh (EC = 148.4 µS/cm), but alkaline (pH = 8.2). The soils are only intermittently saturated, and the soils do not show any soil wetness indicators. The substrata comprised sandy loam soil on Pan 1 and silty clay soil on Pan 2 (Figure 24).

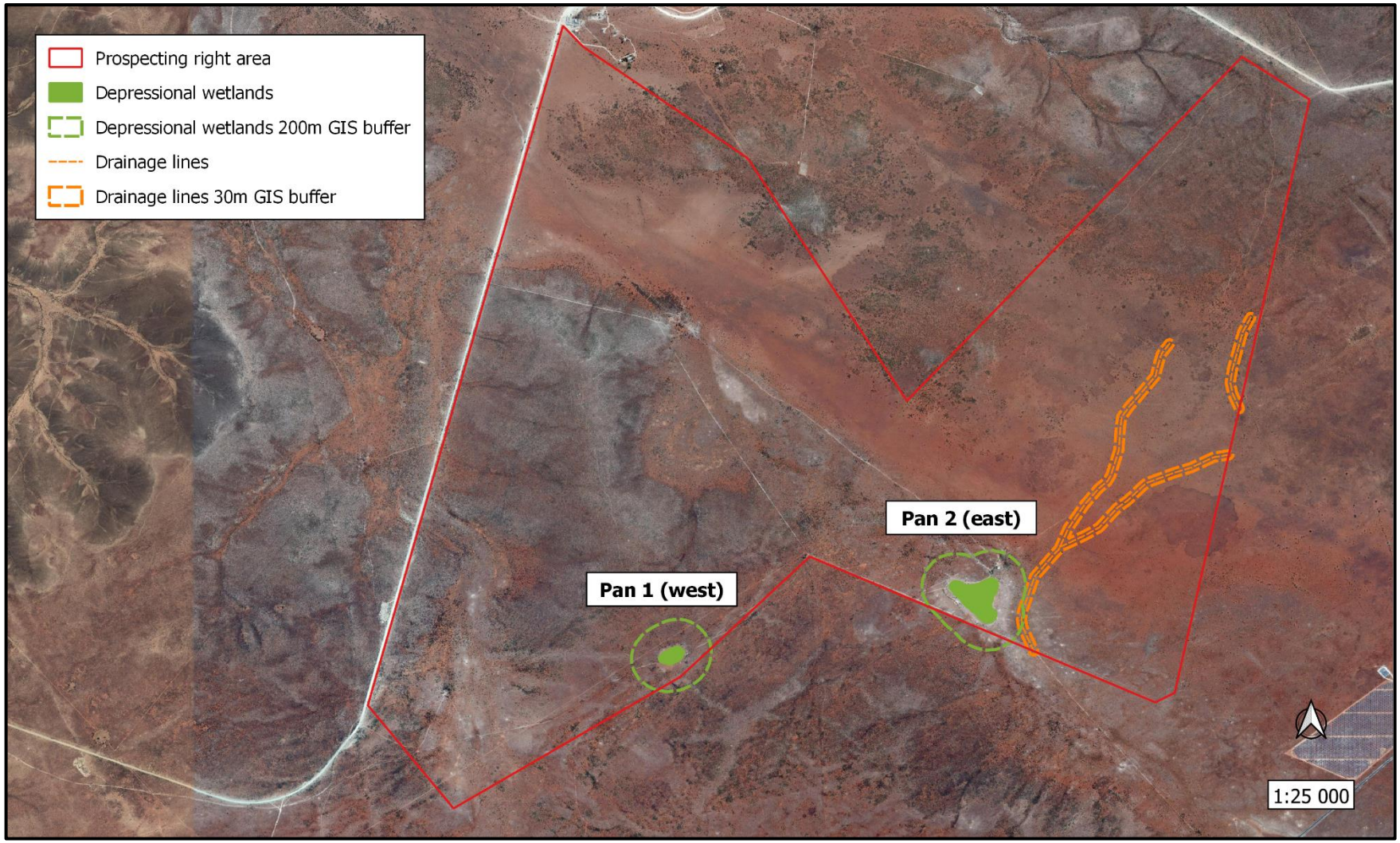


Figure 21. The delineation of watercourses in the prospecting right area, along with their GIS buffer requirements.

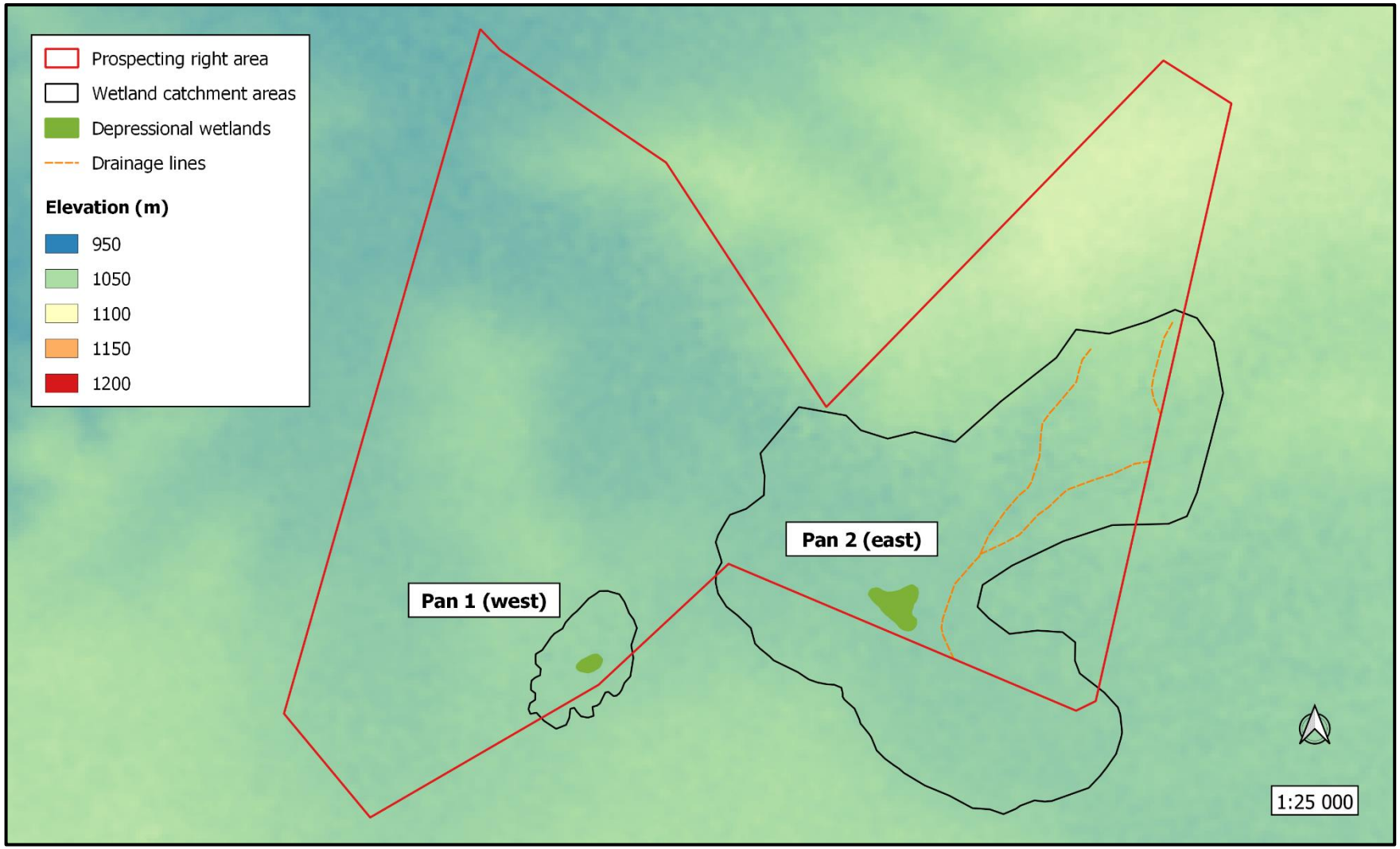


Figure 22. A digital elevation model, indicating the catchment areas of the depressional wetlands on Brakfontein.

Table 11. Summary of the results for the application of Levels 1 to 6 of the Classification System (Ollis et al. 2013), to the depressional wetlands. Confidence ratings at each level are given in brackets.

Level 1	Level 2		Level 3	Level 4: HGM Unit		
System type	**DWA Ecoregion**	**Wetland Bioregion**	**Landscape Unit**	**4A**	**4B**	**4C**
INLAND	Nama Karoo	Northern Upper Karoo	Plain (high)	Depression (high)	Endorheic (high)	Without channelled inflow (high)

Level 5: Hydroperiod		
5A	**5B**	**5C**
Intermittently inundated (high)	Intermittently saturated (high)	n/a

Level 6: Substratum type [Proportional rating (0-6)]

Pan 1 (west)											
Mineral soil (<10% organic carbon) (high)											
6A											6B
Bedrock	Boulders	Cobbles	Pebbles/ Gravel	**Sandy soil**	Silt	Clayey soil	**Loamy soil**	Organic soil	Salt crust	Other	Sandy loam
0	0	0	0	**3**	0	0	**3**	0	0	0	

Level 6: Vegetation cover, Form & Status [Proportional rating (0-6)]					
6A		6B		6C	
Vegetation cover (high)		**Vegetation form** (high)			
Vegetated	**5**	Aquatic	0	n/a	
Unvegetated	**1**	**Herbaceous**	**4**	Geophytes	0
				Grasses	**4**
				Herbs/Forbs	**2**
				Sedges/Rushes	0
				Reeds	0
				Restios	0
				Palmiet	0
		Shrubs	**2**	n/a	
		Forest	0	n/a	

6D			6E	
Vegetation form (high)			**Vegetation status** (high)	
Herbaceous	**Grasses**	n/a	**Indigenous**	**6**
			Alien	0
			Crop	0
	Herbs/Forbs	n/a	**Indigenous**	**5**
			Alien	**1**
			Crop	0
Shrubs	n/a		**Indigenous**	**1**
			Alien	**5**

Pan 2 (east)											
Mineral soil (<10% organic carbon) (high)											
6A											6B
Bedrock	Boulders	Cobbles	Pebbles/ Gravel	Sandy soil	**Silt**	**Clayey soil**	Loamy soil	Organic soil	Salt crust	Other	Silty clay
0	0	0	0	0	**3**	**3**	0	0	0	0	

Level 6: Vegetation cover, Form & Status [Proportional rating (0-6)]					
6A		6B		6C	
Vegetation cover (high)		**Vegetation form** (high)			
Vegetated	**3**	Aquatic	0	n/a	
Unvegetated	**3**	Herbaceous	0	Geophytes	0
				Grasses	0
				Herbs/Forbs	0
				Sedges/Rushes	0
				Reeds	0
				Restios	0
				Palmiet	0
		Shrubs	**6**	n/a	
		Forest	0	n/a	

6D		6E	
Vegetation form (high)		**Vegetation status** (high)	
Shrubs	n/a	**Indigenous**	**1**
		Alien	**5**

The depression floors are vegetated, with Pan 1 having a high vegetation cover (5:1), while Pan 2 comprised a large proportion of bare ground (3:3). The floristic compositions differed, with Pan 1 being dominated by grassland, and Pan 2 by shrubland (Table 11 and Figure 24). A more comprehensive description of floristic composition is presented in Section 3.3.2 of this report. In general, Pan 1 was dominated by indigenous grasses and herbs, but heavily infested by the invasive shrub *Prosopis velutina*. The naturalised exotic herb *Boerhavia diffusa* also occurred here. Pan 2 was dominated by alien invasive shrubs, with *Atriplex nummularia* and *Prosopis velutina* occurring in high densities. No aquatic plant components were present in the pans during the field survey because it was dry. The aquatic communities are expected to only be activated after the pans are fully inundated for sufficient periods.

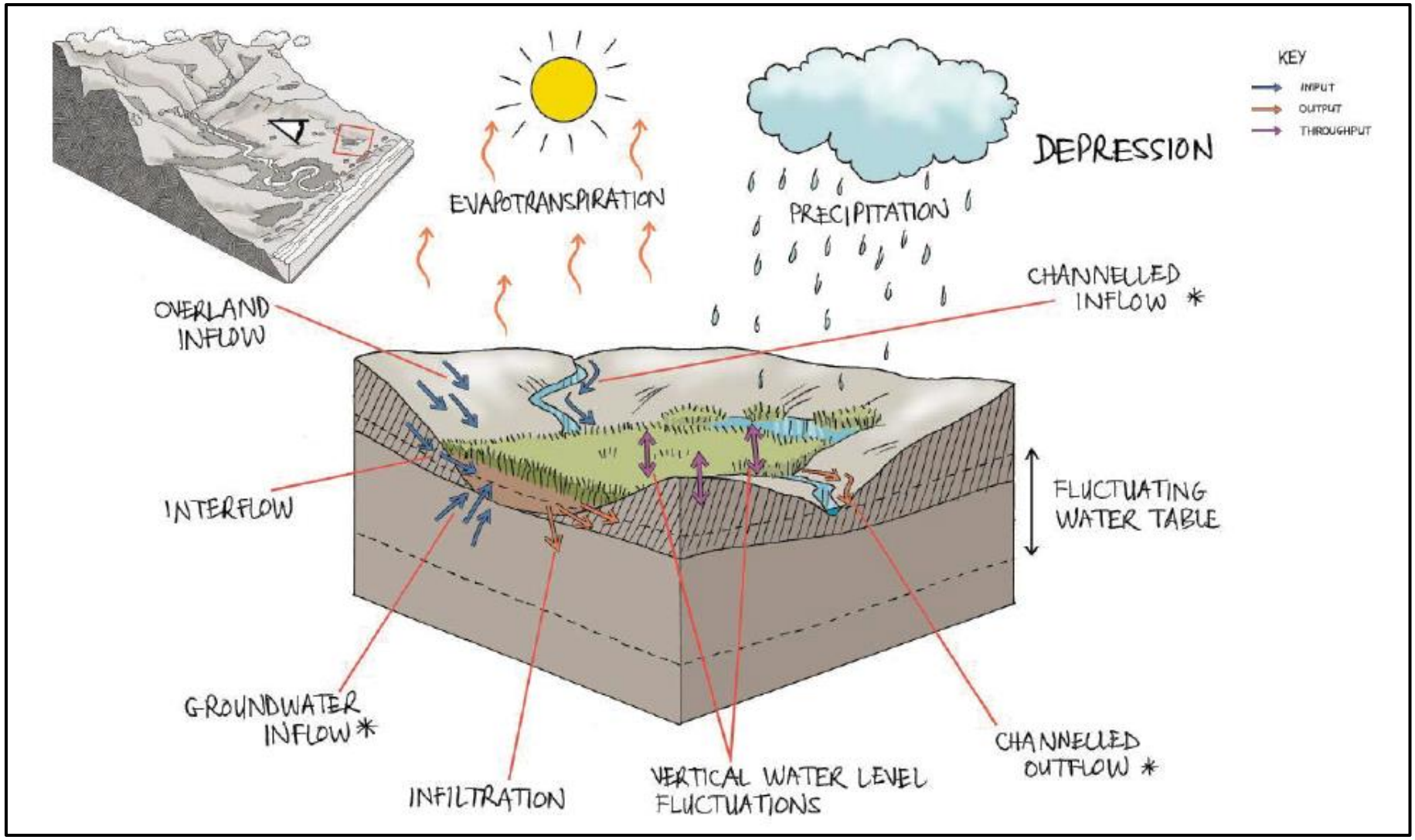


Figure 23. Conceptual illustration of a depressional wetland, showing the typical landscape setting and the dominant inputs, throughputs and outputs of water (Ollis et al. 2013).

Pan 1

Pan 2

Figure 24. Key wetland descriptors for the depressional wetlands on Brakfontein. The substrata comprised sandy loam soil on Pan 1 and silty clay soil on Pan 2. The floristic compositions differed, with Pan 1 being dominated by grassland, and Pan 2 by shrubland. Both pans were highly infested by the declared invasive *Prosopis velutina*.

3.5.3. Wetland Health Assessment (PES)

Pan 1 on Brakfontein is considered to be largely natural (PES B, Table 12, Figure 25), i.e., a small change in natural habitats and biota may have taken place but the ecosystem functions are still predominantly unchanged. Pan 2 however considered to be moderately modified (PES C, Table 12, Figure 25), i.e., loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged. All impact sources are described in Figure 26 and refined landcover categories for the wetland catchment areas are depicted in Figure 27.

Table 12. Summarised results of Wet-Health level 2 assessments (Macfarlane et al. 2020) to the Brakfontein wetlands.

	Wetland PES Summary
Wetland name	**Brakfontein Depressions**

Assessment Unit	**Pan 1**			
HGM type	Depression without flushing			
Areal extent (Ha)	1.6 Ha			
Final (adjusted) Scores				
PES Assessment	**Hydrology**	**Geomorphology**	**Water Quality**	**Vegetation**
Impact Score	0.6	1.4	1.5	3.8
PES Score (%)	94%	86%	85%	62%
Ecological Category	**A**	**B**	**B**	**C**
Trajectory of change (no prospecting)	→	→	→	↓
Confidence (revised results)	High	High	High	High
Combined Impact Score	1.7			
Combined PES Score (%)	83%			
Combined Ecological Category	**B**			
Hectare Equivalents	1.3 Ha			

Assessment Unit	**Pan 2**			
HGM type	Depression without flushing			
Areal extent (Ha)	6.9 Ha			
Final (adjusted) Scores				
PES Assessment	**Hydrology**	**Geomorphology**	**Water Quality**	**Vegetation**
Impact Score	1.3	2.3	1.6	5.5
PES Score (%)	87%	77%	84%	45%
Ecological Category	**B**	**C**	**B**	**D**
Trajectory of change (no prospecting)	→	→	→	↓
Confidence (revised results)	High	High	High	High
Combined Impact Score	2.5			
Combined PES Score (%)	75%			
Combined Ecological Category	**C**			
Hectare Equivalents	5.2 Ha			

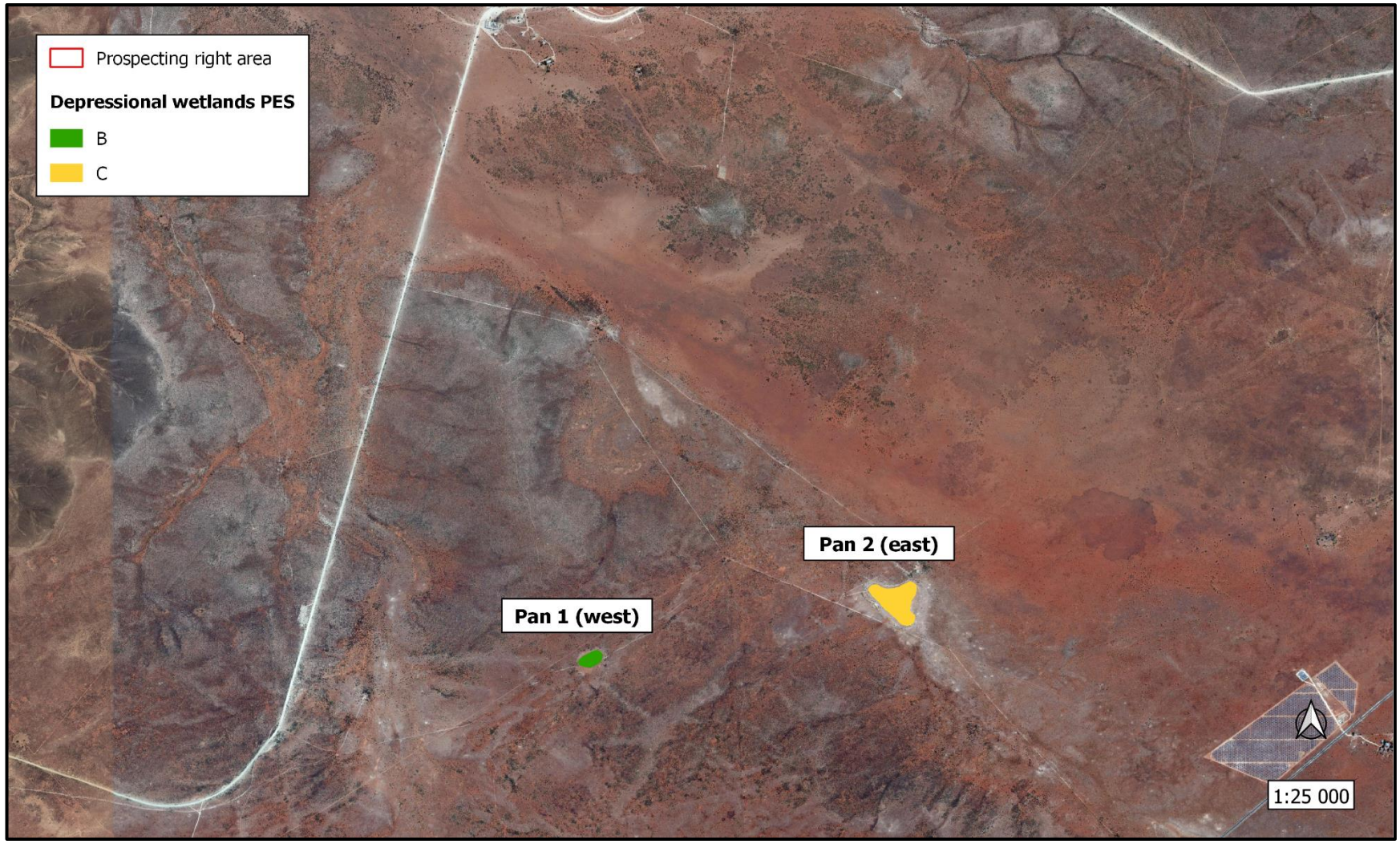


Figure 25. The depressional wetland assessment units on Brakfontein, indicating their PES.

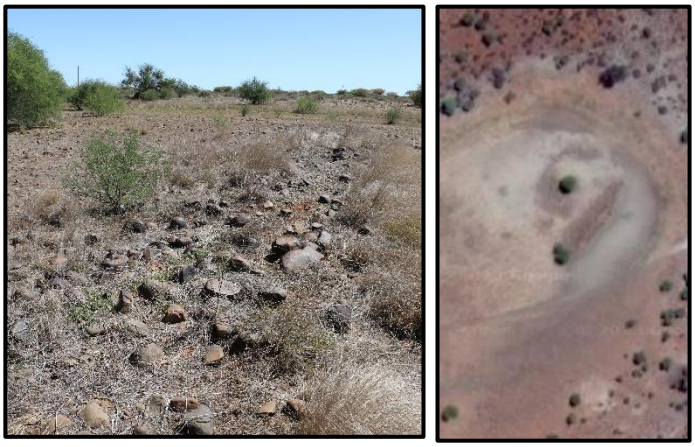
	**Farm roads** A farm road traverses Pan 1. **Source:** External **Associated impacts:** - Altered surface roughness - Increased compaction - Loss of indigenous flora - Altered flow regime
	**Impeding structure** An impeding feature has been constructed in Pan 1. **Source:** External **Associated impacts:** - Channel modifications - Altered flood peaks - Increased erosion and sedimentation - Altered surface roughness - Infilling and excavations
	**Infestation of alien species** Pan 1 and Pan 2 have been infested by invasive species. **Source:** External **Associated impacts:** - Loss of indigenous flora - Reduced biodiversity - Altered habitat function
	**Old fields** Cultivation occurred in Pan 2. **Source:** External **Associated impacts:** - Impeded natural water flow - Increased erosion and sedimentation - Loss of indigenous flora - Artificial input of nutrients - Pollution of water resource - Change in surface roughness

Figure 26. Features impacting the PES of the Brakfontein depressional wetlands.

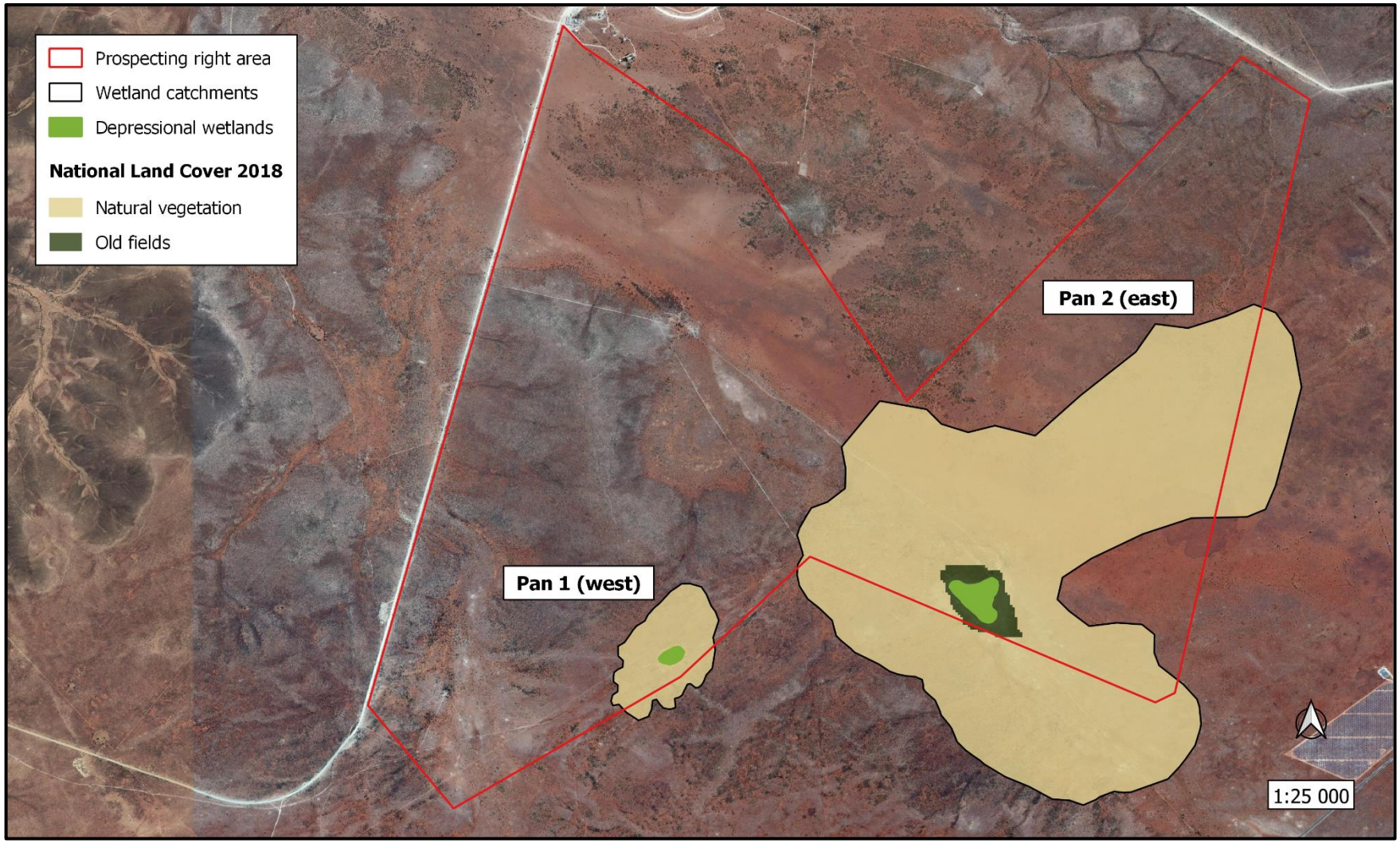


Figure 27. Refined landcover categories and disturbance units according to NLC2018, associated with the depressional wetlands on Brakfontein.

The buffer zones and catchment areas of both pans are primarily still in pristine condition, with only a few impact sources, such as roads and general surface disturbances. The most significant direct modifications to both pans have occurred through the infestation of alien invasive plants, which dominate the pans and have significantly affected their vegetation impact score, due to the loss of indigenous vegetation (Figure 26). Another major impact in Pan 2 is past cultivation practises, which has significantly affected its geomorphology impact score. Deposition of material in Pan 1, assumingly to create a dam to retain rainwater for livestock (Figure 26) has affected its geomorphology and water quality but only to a very small degree. Minor surface disturbances also occur through farm roads that cut through the pan, altering its surface roughness and flow regime. However, these low-level modifications do not have a significant effect on the overall PES of the pan.

The current state of the water quality, geomorphology and hydrology is expected to remain stable for both pans, if no prospecting activities are planned near these depressional wetlands. However, a deterioration in the natural vegetation is expected to occur if the alien invasive species in these pans and their buffer zones are not controlled. Due to their aggressive nature, these species are expected to outcompete natural vegetation and put pressure on the water resources.

3.5.4. Wetland Ecological Importance and Sensitivity

Pan 1 is rated to have a High EIS (Table 13) and is considered to be ecologically important and sensitive. The biodiversity of this wetland may be sensitive to habitat modifications. Pan 2 however is rated to have a Moderate EIS (Table 13) and is considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of this wetland is no longer considered to be sensitive to habitat modifications. This EIS assessment was mainly based on a “wet scenario” because the ecological importance of the depressional wetlands on Brakfontein will only manifest during times of inundation. However, activities impacting the wetlands during the dry phase have direct implications on its ability to maintain the ecological integrity and sensitivity of the wet phase.

The Near Threatened Giant Bull Frog and a number of red listed water birds are expected to occur in Pan 1 when inundated. The hatching trials revealed that freshwater crustaceans are present in both pans. These are highly unique to depressions on a national scale. Their egg banks are found in the topsoil layers, which make them vulnerable to modifications.

Table 13. Summary of the results for the application of an EIS assessment (Duthie 1999) to the depressional wetlands on Brakfontein.

Pan 1 (west)		
DETERMINANT	**SCORE**	**CONFIDENCE**
PRIMARY DETERMINANTS		
1. Rare & Endangered Species	4	3
2. Populations of Unique Species	4	4
3. Species/taxon Richness	2	3
4. Diversity of Habitat Types or Features	2	4
5 Migration route/breeding and feeding site for wetland species	2	3
6. Sensitivity to Changes in the Natural Hydrological Regime	1	3
7. Sensitivity to Water Quality Changes	1	3
8. Flood Storage, Energy Dissipation & Particulate/Element Removal	1	3
MODIFYING DETERMINANTS		
9. Protected Status	3	4
10. Ecological Integrity	3	4
TOTAL	**23**	
MEAN	**2.3**	
OVERALL ECOLOGICAL SENSITIVITY AND IMPORTANCE	**High**	

Pan 2 (east)		
DETERMINANT	**SCORE**	**CONFIDENCE**
PRIMARY DETERMINANTS		
1. Rare & Endangered Species	0	3
2. Populations of Unique Species	4	4
3. Species/taxon Richness	1	3
4. Diversity of Habitat Types or Features	1	4
5 Migration route/breeding and feeding site for wetland species	1	3
6. Sensitivity to Changes in the Natural Hydrological Regime	1	3
7. Sensitivity to Water Quality Changes	1	3
8. Flood Storage, Energy Dissipation & Particulate/Element Removal	1	3
MODIFYING DETERMINANTS		
9. Protected Status	3	4
10. Ecological Integrity	2	4
TOTAL	**15**	
MEAN	**1.5**	
OVERALL ECOLOGICAL SENSITIVITY AND IMPORTANCE	**Moderate**	

The exact species richness hosted by these wetlands is however not known. Although a number of species are expected to occur in these habitats, they are only expected to have a moderate significance, as they are only expected to have significant taxa richness at a local scale. Furthermore, Pan 1 in particular is expected to be an important breeding and feeding link in terms of connectivity, especially for wetland birds in South Africa during wet periods by providing stepping-stone corridors in an arid landscape. Pan 2 is not expected to provide a significant role in that regard, due to its altered state.

All depressional wetlands on Brakfontein have low sensitivity to changes in hydrology and water quality, because they flood infrequently (< annually). However, if these systems are inundated anthropogenically and for prolonged periods, they will lose their ability to sustain the unique aquatic communities, which are adapted for ephemerality, e.g. branchiopod eggs require periods of desiccation for their life cycles to complete. Furthermore, the wetlands have marginal food storage, energy dissipation and element removal ability, mainly based on fairly low roughness associated with the vegetation in these habitats.

All watercourses are protected under the National Water Act, which reflects their importance for the conservation of ecological diversity at a national scale and therefore they have high protected status. Pan 1 has not been significantly affected by human activity, and therefore it still has high ecological integrity. However, Pan 2 has been modified and therefore it has low ecological integrity.

3.5.5. Wetland functional importance

The Brakfontein wetlands scored very low on most of the typical ecosystem services provided by wetlands (Table 14 and Table 15). Most of the regulating and supporting services provided by the wetlands are compromised by the fact that the wetlands are strictly ephemeral. Pan 1 however scored very high in the maintenance of biodiversity and moderately high in provision of food for livestock (Table 14 and Table 15). The very high importance in the maintenance of biodiversity is attributable to the branchiopod communities that occur here, the suitable habitat the wetlands provide for the Near Threatened Giant Bull frog and the red listed waterbirds these wetlands would attract during periods of inundation. The grass species found in these systems increase their provision of food for livestock. Although they occur as dense stands in the wetlands, not many people are dependent on this resource.

Table 14. Summary of the results of a WET-EcoServices (Version 2) assessment (Kotze et al. 2020), to Pan 1 on Brakfontein.

ECOSYSTEM SERVICE			Supply	Demand	Importance Score	Importance
REGULATING AND SUPPORTING SERVICES	Flood attenuation	Refers to the effectiveness of wetlands at spreading out and slowing down storm flows and thereby reducing the severity of floods and associated impacts.	0.0	0.0	0.0	Very Low
	Stream flow regulation	Refers to the effectiveness of wetlands in sustaining flows in downstream areas during low-flow periods.	0.0	0.0	0.0	Very Low
	Sediment trapping	Refers to the effectiveness of wetlands in trapping and retaining sediments from sources in the catchment.	0.8	0.0	0.0	Very Low
	Erosion control	Refers to the effectiveness of wetlands in controlling the loss of soil through erosion.	0.9	0.0	0.0	Very Low
	Phosphate assimilation	Refers to the effectiveness of wetlands in retaining, removing or destroying nutrients and toxicants such as nitrates, phosphates, salts, biocides and bacteria from inflowing sources, essentially providing a water purification benefit.	0.7	0.0	0.0	Very Low
	Nitrate assimilation		0.7	0.0	0.0	Very Low
	Toxicant assimilation		0.8	0.0	0.0	Very Low
	Carbon storage	Refers to the ability of wetlands to act as carbon sinks by actively trapping and retaining carbon as soil organic matter.	1.2	0.0	0.0	Very Low
	Biodiversity maintenance	Refers to the contribution of wetlands to maintaining biodiversity through providing natural habitat and maintaining natural ecological processes.	3.8	2.0	3.3	**Very High**
PROVISIONING SERVICES	Water for human use	Refers to the ability of wetlands to provide a relatively clean supply of water for local people as well as animals	0.0	0.0	0.0	Very Low
	Harvestable resources	Refers to the effectiveness of wetlands in providing a range of harvestable natural resources including firewood, material for construction, medicinal plants and grazing material for livestock.	1.0	0.0	0.0	Very Low
	Food for livestock	Refers to the ability of wetlands to provide suitable vegetation as food for livestock.	4.0	0.3	2.7	**Moderately High**
	Cultivated foods	Refers to the ability of wetlands to provide suitable areas for cultivating crops and plants for use as food, fuel or building materials.	3.0	0.0	1.5	Moderately Low
CULTURAL SERVICES	Tourism and Recreation	Refers to the value placed on wetlands in terms of the tourism related and recreational benefits provided.	1.1	0.0	0.0	Very Low
	Education and Research	Refers to the value of wetlands in terms of education and research opportunities, particularly concerning their strategic location in terms of catchment hydrology.	0.8	0.0	0.0	Very Low
	Cultural and Spiritual	Refers to the special cultural significance of wetlands for local communities	2.0	0.0	0.5	Very Low

Table 15. Summary of the results of a WET-EcoServices (Version 2) assessment (Kotze et al. 2020), to Pan 2 on Brakfontein.

ECOSYSTEM SERVICE			Supply	Demand	Importance Score	Importance
REGULATING AND SUPPORTING SERVICES	Flood attenuation	Refers to the effectiveness of wetlands at spreading out and slowing down storm flows and thereby reducing the severity of floods and associated impacts.	0.0	0.0	0.0	Very Low
	Stream flow regulation	Refers to the effectiveness of wetlands in sustaining flows in downstream areas during low-flow periods.	0.0	0.0	0.0	Very Low
	Sediment trapping	Refers to the effectiveness of wetlands in trapping and retaining sediments from sources in the catchment.	0.8	0.0	0.0	Very Low
	Erosion control	Refers to the effectiveness of wetlands in controlling the loss of soil through erosion.	0.4	0.3	0.0	Very Low
	Phosphate assimilation	Refers to the effectiveness of wetlands in retaining, removing or destroying nutrients and toxicants such as nitrates, phosphates, salts, biocides and bacteria from inflowing sources, essentially providing a water purification benefit.	0.7	0.0	0.0	Very Low
	Nitrate assimilation		0.6	0.0	0.0	Very Low
	Toxicant assimilation		0.8	0.0	0.0	Very Low
	Carbon storage	Refers to the ability of wetlands to act as carbon sinks by actively trapping and retaining carbon as soil organic matter.	0.5	0.0	0.0	Very Low
	Biodiversity maintenance	Refers to the contribution of wetlands to maintaining biodiversity through providing natural habitat and maintaining natural ecological processes.	0.6	2.0	0.1	Very Low
PROVISIONING SERVICES	Water for human use	Refers to the ability of wetlands to provide a relatively clean supply of water for local people as well as animals	0.0	0.0	0.0	Very Low
	Harvestable resources	Refers to the effectiveness of wetlands in providing a range of harvestable natural resources including firewood, material for construction, medicinal plants and grazing material for livestock.	0.5	0.0	0.0	Very Low
	Food for livestock	Refers to the ability of wetlands to provide suitable vegetation as food for livestock.	2.0	0.3	0.7	Very Low
	Cultivated foods	Refers to the ability of wetlands to provide suitable areas for cultivating crops and plants for use as food, fuel or building materials.	3.0	0.0	1.5	Moderately Low
CULTURAL SERVICES	Tourism and Recreation	Refers to the value placed on wetlands in terms of the tourism related and recreational benefits provided.	0.2	0.0	0.0	Very Low
	Education and Research	Refers to the value of wetlands in terms of education and research opportunities, particularly concerning their strategic location in terms of catchment hydrology.	0.0	0.0	0.0	Very Low
	Cultural and Spiritual	Refers to the special cultural significance of wetlands for local communities	2.0	0.0	0.5	Very Low

The low scores for the provisional services are because all wetlands on Brakfontein lack the ability to directly supply water or medicinal plants. No crop farming, hunting, or fishing is possible in these systems either. The wetlands are not used as public tourism or recreation destinations and is not associated with any cultural practises or beliefs. The wetlands have also not been subject to research in the past and the fact that Brakfontein is situated in a rural area, relatively far away from the nearest academic institution, and has restrictive access control; lowers their importance for education and research.

3.5.6. Recommended wetland buffer zone

The aquatic buffer segment identified for the depressional wetlands on Brakfontein (Figure 28) have gentle sloping land and shallow, moderately drained soils (Table 16). The wetland buffer requirements are low in general, due to the arid climate, lack of organic soils, and limited human use. For both pans, a pre-and post-mitigation buffer width of 35 m is deemed acceptable during the construction phase, and a 25 m during the operational phase to protect core wetland habitat and aquatic functioning from the operation. It is not clear if any prospecting activities are planned in or near these units, but the main impact risks are expected to be in the form of dust-fall that could increase the sediment input and turbidity of the wetlands. If pits are planned within the vicinity of the pans, then major associated impacts include increase in sediment inputs and turbidity, inputs of toxic heavy metal contaminants through possible petrochemical spills, as well as the alteration in pH. With effective mitigation, the impacts can be reduced and therefor the post-mitigation and final buffer requirements for these units are 35m.

Table 16. The recommended final aquatic impact buffer requirements for the Brakfontein wetlands.

Assessment Units	Differentiating characteristics of buffer	Pre-mitigation width (m)		Post-mitigation width (m)	
Pan 1 & 2	Slope: Very Gentle (0 - 2%) Vegetation: Good; Moderately robust vegetation with good interception potential Soil permeability: Moderately low; Shallow (<30cm) moderately drained soils Micro-topography: Dominantly uniform topography: Dominantly smooth topography with few/minor concentrated flow paths to reduce interception.	Construction Phase	35	Construction Phase	35
		Operational Phase	25	Operational Phase	25
		Final aquatic impact buffer requirement			**35**

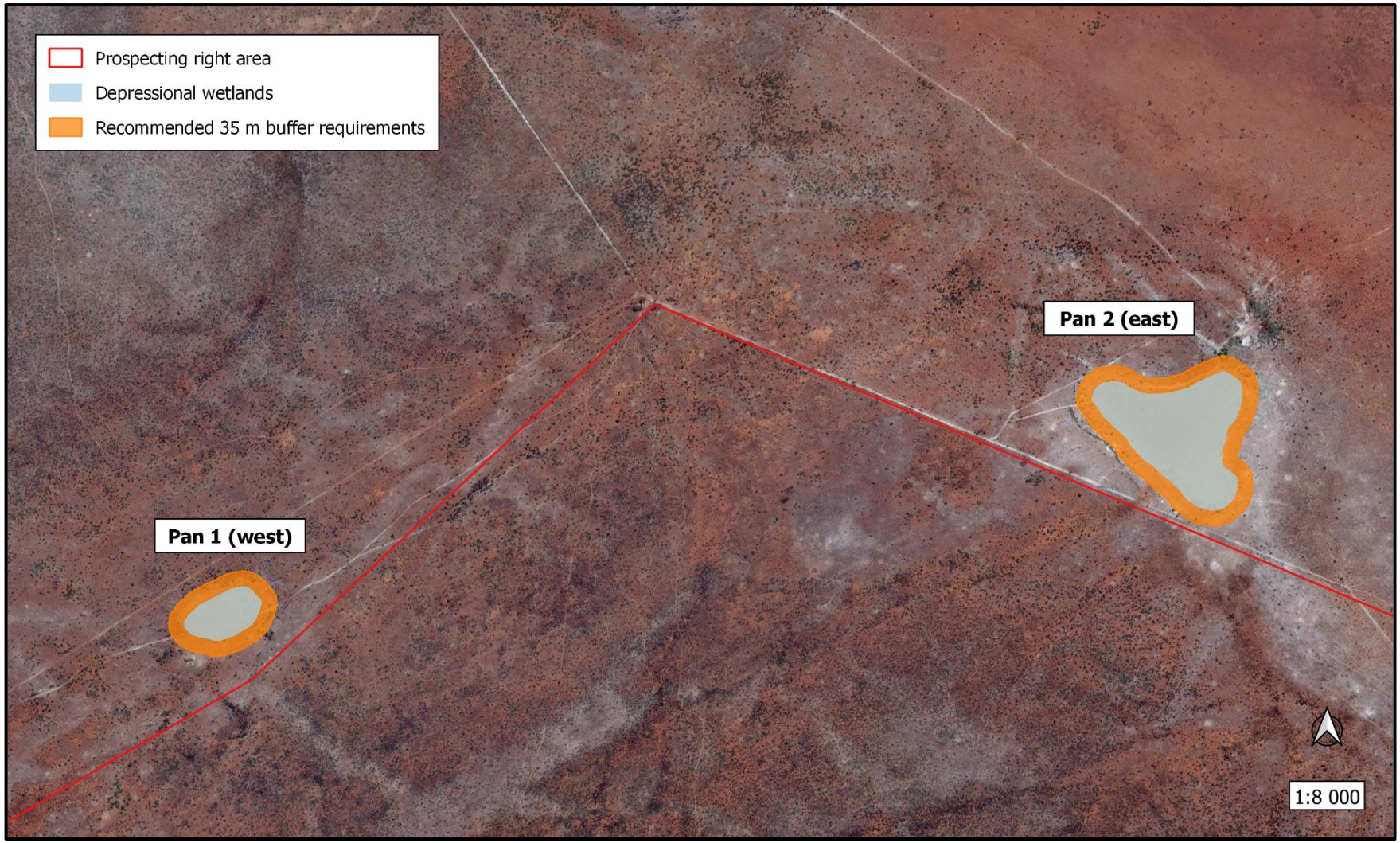


Figure 28. Final aquatic impact buffer requirements, including practical management considerations, for the depressional wetlands on Brakfontein.

3.6. Critical biodiversity areas and broad-scale processes

The proposed prospecting site falls within critical biodiversity areas, as defined by the Northern Cape Critical Biodiversity Areas Map (Holness and Oosthuysen 2016). This map identifies biodiversity priority areas, called Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs), which, together with protected areas, are important for the persistence of a viable representative sample of all ecosystem types and species as well as the long-term ecological functioning of the landscape as a whole. The ephemeral pan in the west, along with some calcrete terraces comprise of *Ecological Support Areas,* while the remainder of the study area comprise of *Other Natural Areas* (Figure 29). No protected areas occur in or near the study site.

According to the Mining and Biodiversity Guidelines (DEA 2013) no area on Brakfontein has been classified with biodiversity importance. These guidelines were developed to identify and categorize biodiversity priority areas sensitive to the impacts of mining, to support mainstreaming of biodiversity issues in decision making in the mining sector.

Furthermore, according to the National Web based Environmental Screening Tool the study area is considered to have sensitive environmental features (Figure 30). This tool is a geographically based web-enabled application which allows a proponent intending to apply for environmental authorisation in terms of the Environmental Impact Assessment (EIA) Regulations 2014 (as amended), to screen their proposed site for any environmental sensitivity. According to the screening tool, the Brakfontein study area is considered to be of low sensitivity based on the *Plant species Theme* but is considered to be of medium sensitivity based on the *Animal Species Theme.* This sensitivity is attributed to the suitable habitat and overlapping distribution range of the listed Ludwig's Bustard and Tawny Eagle, of which both are expected to occur here. Only the pan in the west is considered to be of very high sensitivity based on the *Aquatic Biodiversity Theme*. The same pan, along with the calcrete terraces in the west are of very high sensitivity based on the *Terrestrial Biodiversity* Themes, which is a direct function of the Ecological Support Areas on the Northern Cape Critical Biodiversity Areas Map.

According to the Pixley ka Seme Spatial Development Framework, all rivers and wetlands, including a generic buffer of 100m, are regarded as ecological corridors. Their mandate is to conserve existing ecological corridors and rehabilitate any remnants of corridors. Therefore, the pans on Brakfontein, including a 100m buffer should be conserved.

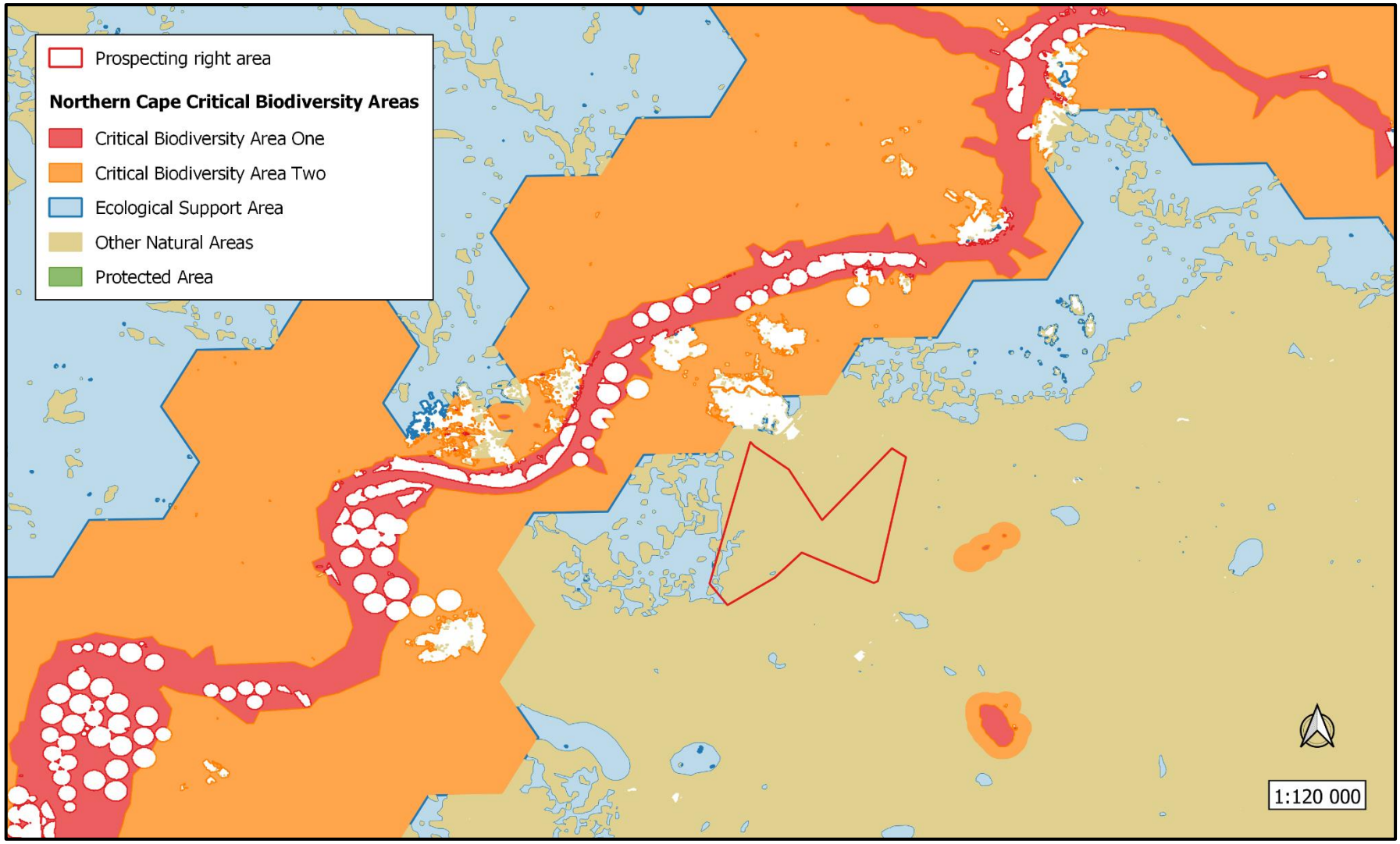


Figure 29. The study area in relation to the Northern Cape Critical Biodiversity Areas.

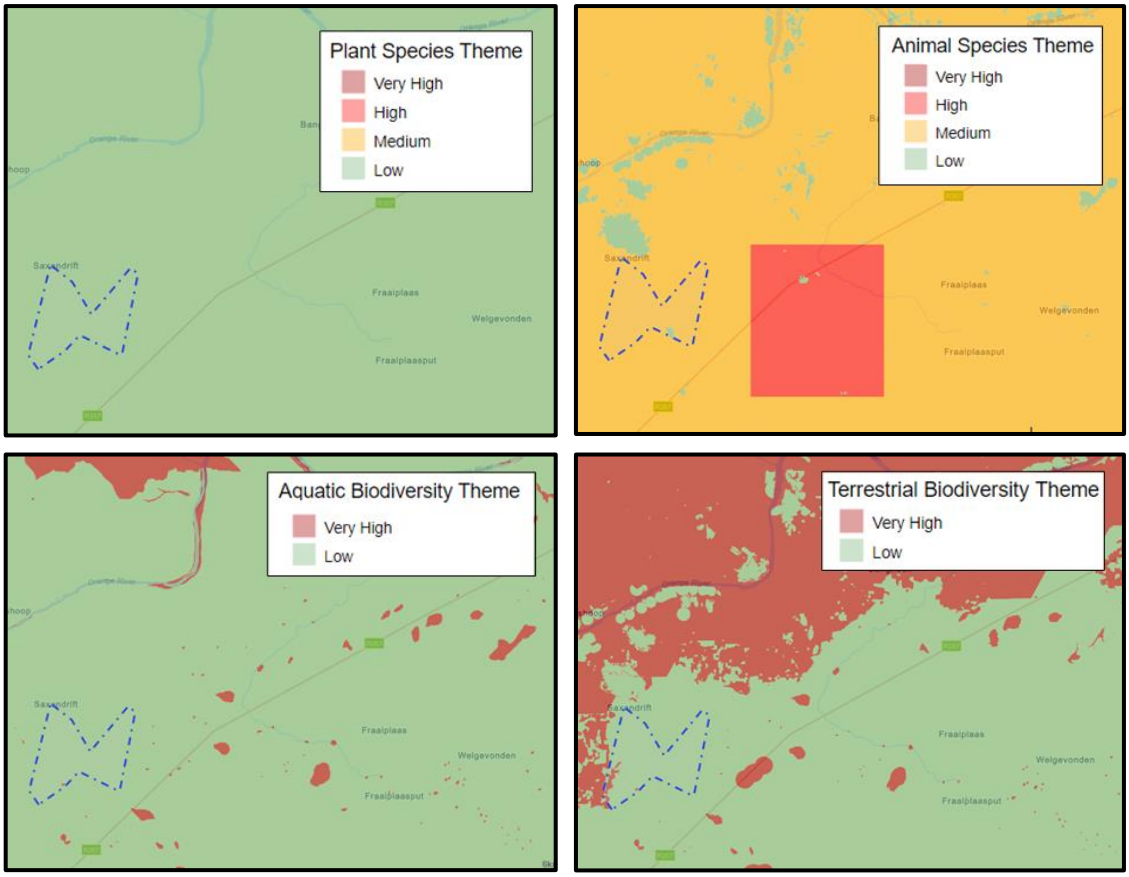


Figure 30. Environmental sensitivities in the study area, according to the National Web based Environmental Screening Tool.

Finally, the study area falls within a region where one of South Africa's largest economically most important alluvial diamond deposits are found (Figure 31), i.e. along the Orange and Vaal Rivers (Gresse 2003). The most significant crop irrigation in the Northern Cape also stretches along these rivers (Durand 2006). These factors increase the proposed operation's cumulative impacts. The Brakfontein prospecting activities are therefore expected to contribute to the cumulative effect of mining and habitat disturbances in the region.

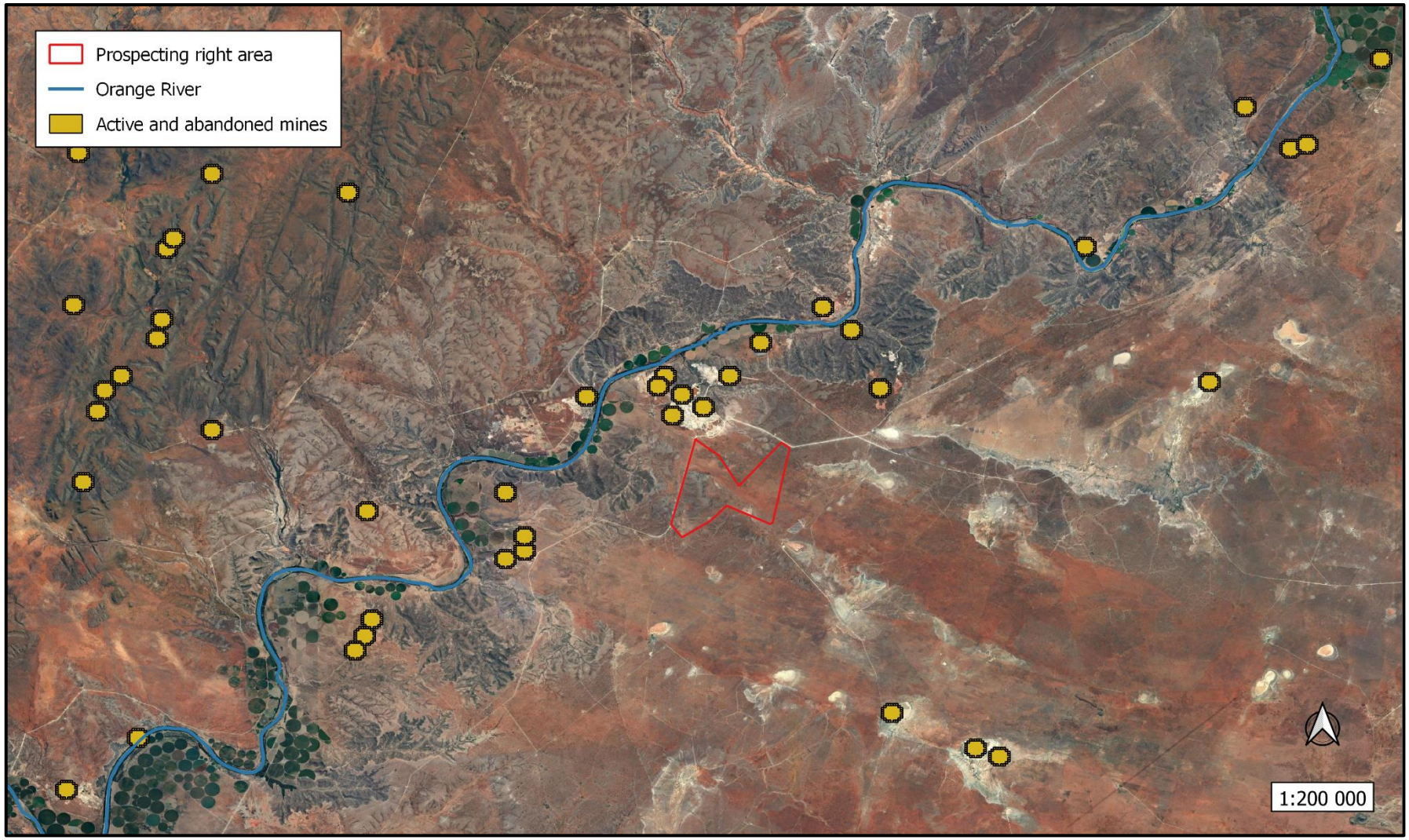


Figure 31. The distribution of mining properties and crop irrigation in the study region.

3.7. Site sensitivity

The sensitivity map for the Brakfontein prospecting operation is illustrated in Figure 32. The depressional wetlands (ephemeral pans), along with their buffer requirements are of **very high** sensitivity due to their vital ecological functionality and significance, which was discussed in this report. The wetlands, albeit intermittent, are also protected in terms of the National Water Act (Act No 36 of 1998) and are important ecological corridors according to the Pixley ka Seme Spatial Development Framework. They are therefore regarded as important features for the conservation of biodiversity and broad-scale ecological processes and are essentially no-go areas.

The calcrete terraces are of **high** sensitivity, primarily because of the widespread occurrence of nationally and provincially protected plant species, specifically *Boscia albitrunca*, as discussed in section 3.3.3 of this report. Furthermore, these areas overlap with the distribution range of- and provides suitable habitat for the red listed Ludwig's Bustard and Tawny Eagle (see section 3.4.4). Although these units are not regarded as no-go areas, activities should only proceed with caution as it may not be possible to mitigate all impacts appropriately.

The grassland is considered to be of **medium** sensitivity. Although it also overlaps with the distribution range of those listed bird species discussed above, it does not harbour a significant population of plant species of conservation concern. Impacts are likely to be largely local here and activities within these areas can proceed with relatively little ecological impact provided that appropriate mitigation measures are taken.

Figure 32. A sensitivity map for the Brakfontein prospecting area.

4. ECOLOGICAL IMPACT ASSESSMENT

In this section, all potential impacts and associated risk factors that may be generated by the Brakfontein operation are identified and described. A detailed analysis of each impact is provided in Table 17. Impacts are assessed in terms of the relevant ecological aspects and each impact is associated with specific mitigation measures, which with proper implementation, will serve to reduce the significance of the impact.

4.1. Topography, soil erosion and associated degradation of landscapes

4.1.1. Alteration of soil character and quality

Source of the impact

During clearing of an area for the excavation of minerals, construction of infrastructure and roads, stockpiling, oil and petrochemical spills.

Description of the impact

Topsoil contains living organisms and seed banks that provide ecological resilience against disturbances, and any disturbances to the intact soil profile will change its ability to sustain natural ecological functioning. Vehicles and prospecting equipment may potentially leak hazardous fluids on the soil surface, which will cause soil pollution. Apart from the direct disturbances caused by the prospecting activities, soil compaction by dump loads as well as heavy machinery and vehicles will causes a decrease in large pores, and subsequently the water infiltration rate into soil.

Mitigation and monitoring

- Topsoil needs to be removed and stored separately during prospecting and the construction of roads, infrastructure and stockpile areas.
- These topsoil stockpiles must be kept as small as possible in order to prevent compaction and the formation of anaerobic conditions.
- Topsoil must be stockpiled for the shortest possible timeframes to ensure that the quality of the topsoil is not impaired.
- Topsoil must not be handled when the moisture content exceeds 12 %.
- Topsoil stockpiles must by no means be mixed with sub-soils.
- The topsoil should be replaced as soon as possible on to the disturbed areas, thereby allowing for the re-growth of the seed bank contained within the topsoil.

Table 17. A detailed analysis of ecological impacts identified for the Brakfontein prospecting operation.

	IMPACT	Phase			Extent	Duration	Severity	Probability	Significance	Significance after Mitigation
		C	O	D						
Soil	Alteration of soil character and quality	✓	✓	✓	On-site (1)	Residual (4)	High (3)	Certain for life of operation (10)	Medium - High (80)	Low-Medium
	Loss of topsoil and soil fertility	✓	✓	✓	On-site (1)	Residual (4)	High (3)	Certain for life of operation (10)	Medium - High (80)	Low-Medium
	Increase in soil erosion	✓	✓		Local (2)	Decommissioning (3)	Medium (2)	Possible, frequently (8)	Low - Medium (56)	Low
Flora	Loss of indigenous vegetation	✓	✓		On-site (1)	Residual (4)	Medium (2)	Certain for life of operation (10)	Low - Medium (70)	Low-Medium
	Loss of Red data and/or protected floral species	✓	✓		On-site (1)	Residual (4)	High (3)	Certain for life of operation (10)	Medium - High (80)	Low-Medium
	Introduction or spread of alien species	✓	✓	✓	Local (2)	Residual (4)	Medium (2)	Possible, frequently (8)	Low-Medium (64)	Very low
	Bush encroachment	✓	✓	✓	On-site (1)	Residual (4)	Medium (2)	Possible, infrequently (7)	Low (49)	Very low
Fauna	Habitat fragmentation	✓	✓		Regional (3)	Residual (4)	High (3)	Certain for life of operation (10)	Medium - High (100)	Low-Medium
	Disturbance, displacement and killing of fauna	✓	✓	✓	Local (2)	Decommissioning (2)	Medium (2)	Certain, for life of operation (10)	Low-Medium (60)	Low

Table 17 (cont.). A detailed analysis of ecological impacts identified for the Brakfontein prospecting operation.

	IMPACT	Phase			Extent	Duration	Severity	Probability	Significance	Significance after Mitigation
		C	O	D						
Water resources	Alteration/destruction of watercourses	✓	✓		Regional (3)	Permanent (5)	High (3)	Possible, infrequent (7)	Medium - High (77)	Low-Medium
	Siltation of surface water	✓	✓	✓	Regional (3)	Residual (4)	High (3)	Possible, infrequent (7)	Low-Medium (70)	Low
Cumulative	Compromise of broadscale ecological processes	✓	✓		Regional (3)	Residual (4)	High (2)	Certain for life of operation (10)	Medium - High (90)	Low-Medium

- For restoration of the affected areas without topsoil, soils can be sourced from other sustainable areas and chemically changed to match with the surrounding environment.
- To restore areas where compacted soil occurs, a ripper blade or deep plow can be pulled across the affected area to alleviate compaction.
- Encourage the growth of natural plant species in all affected areas by sowing indigenous seeds or by planting seedlings.
- Vehicles and machinery should be regularly serviced and maintained.
- Refuelling and vehicle maintenance must take place in well demarcated areas and over suitable drip trays to prevent soil pollution.
- Drip trays must be available on site and installed under all stationary vehicles.
- Spill kits to clean up accidental spills from any accidental spillages must be well-marked and available on site.
- Workers must undergo induction to ensure they are prepared for rapid clean-up procedures.
- Any soil or area that is contaminated must be cleaned immediately by removing the soil and disposing it as hazardous waste in the correct manner.

4.1.2. Loss of soil fertility

Source of the impact

During clearing of an area for the excavation of minerals, construction of infrastructure and roads, stockpiling.

Description of the impact

Topsoil contains living organisms that naturally regulate the ecological functioning of a habitat. Therefore, any disturbances to the intact soil profile can result in soil sterilisation which will directly affect vegetation communities. Apart from the direct disturbances caused by the prospecting activities, loss of soil fertility can also occur through soil compaction by dump loads as well as heavy machinery and vehicles.

Mitigation and monitoring

- Topsoil needs to be removed and stored separately during prospecting and the construction of roads, infrastructure and stockpile areas.
- These topsoil stockpiles must be kept as small as possible in order to prevent compaction and the formation of anaerobic conditions.

- Topsoil must be stockpiled for the shortest possible timeframes to ensure that the quality of the topsoil is not impaired.
- Topsoil must not be handled when the moisture content exceeds 12 %.
- Topsoil stockpiles must by no means be mixed with sub-soils.
- The topsoil should be replaced as soon as possible on to the disturbed areas, thereby allowing for the re-growth of the seed bank contained within the topsoil.
- For restoration of the affected areas without topsoil, soils can be sourced from other sustainable areas and chemically changed to match with the surrounding environment.
- To restore areas where compacted soil occurs, a ripper blade or deep plow can be pulled across the affected area to alleviate compaction.
- Encourage the growth of natural plant species in all affected areas by sowing indigenous seeds or by planting seedlings.

4.1.3. Soil erosion

Source of the impact

During clearing of an area for the excavation of minerals, construction of infrastructure and roads, stockpiling, natural events.

Description of the impact

Vegetation will be stripped for construction of new roads and prospecting areas and these areas will be bare and highly susceptible to erosion. Any topsoil-, overburden- and ore stockpiles can be eroded by wind, rain and flooding. Exposed sediments in the ephemeral wetland catchments can be carried away during runoff causing downstream sediment deposition and changing the geomorphology of the water resources. Any leaking pipes can also cause additional water erosion.

Mitigation and monitoring

- Bare ground exposure should be minimised at all times in terms of surface area and duration.
- Re-establishment of plant cover on disturbed areas must take place as soon as possible once activities in the area have ceased.
- No new roads, infrastructure or prospecting areas should be developed over the wetlands.
- Disturbances during the rainy season should be monitored and controlled.
- Any potential run-off from exposed ground should be controlled with flow retarding barriers.
- Regular monitoring during the prospecting operation should be carried out to identify areas where erosion is occurring; followed by appropriate remedial actions.

4.2. Vegetation and floristics

4.2.1. Loss of indigenous vegetation

Source of the impact

During clearing of an area for the excavation of minerals, construction of infrastructure and roads, stockpiling.

Description of the impact

The Brakfontein prospecting activities are expected to destroy a large area of natural vegetation. It is expected that the ecological functioning and biodiversity will take many years to fully recover. Vehicle traffic and prospecting activities generate lots of dust which can also reduce the growth success and seed dispersal of many small plant species in the adjacent pristine areas.

Mitigation and monitoring

- Implement best practise principles to minimise the footprint of transformation, by keeping to existing roads and earmarked areas where possible.
- Implement effective avoidance measures to limit any activities in the highly sensitive areas, by applying the no-go principles.
- Ensure measures for the adherence to a maximum speed limit of 40 km/h to minimise dust fallout and associated effects on plants in the adjacent pristine areas.
- Develop an effective dust suppression system to limit dust fallout risks.
- Encourage the growth of natural plant species in all affected areas by sowing indigenous seeds or by planting seedlings.
- The setup of a small nursery is advisable to maximise translocation and re-establishment efforts of affected areas.
- Apply for permits to authorise the large-scale clearance of indigenous plants from DENC at least three months before such activities will commence.

4.2.2. Loss of Red data and/or protected floral species

Source of the impact

Removal of plant species of conservation concern during clearing of an area for excavations, construction of infrastructure and roads, stockpiling. Intentional removal of plant species for non-mine related purposes, e.g. illegal plant trade, fire-wood, medicinal, ornamental use.

Description of the impact

There are a number of plant species of conservation concern present on the Brakfontein Prospecting Right area as discussed in section 3.3.3 of this report. Many of the species are found in the core prospecting area and therefore it is likely that the prospecting operation will impact on their population dynamics. The most significant concern is the loss of *Boscia albitrunca* recruits. Saplings are rarely visible during clearance operations and therefore the younger populations often get wiped out. Furthermore, any illegal harvesting of any other protected plants for whatever reason by staff, contractors or secondary land users could have devastating effects on the population of these species.

Mitigation and monitoring

- The footprint areas of the prospecting activities must be scanned for Red Listed and protected plant species prior to any destructive activities by means of a search-and-rescue operation.
- These plants should be identified and marked prior to intended activity and should ideally be incorporated into the design layout and left in situ. However, due to the nature of the proposed prospecting activities they will most likely all be removed or relocated if possible. The relevant permits from DAFF / DENC should be obtained at least three months before such activities will commence.
- The setup of a small nursery is advisable to maximise translocation and re-establishment efforts of all the rescued plants.
- A management plan should be implemented to ensure proper establishment of ex situ individuals and should include a monitoring programme for at least two years after re-establishment in order to ensure successful translocation.
- The designation of an environmental officer is recommended to render guidance to the staff and contractors with respect to suitable areas for all related disturbance and must ensure that all contractors and workers undergo Environmental Induction prior to commencing with work on site. The environmental induction should occur in the appropriate languages for the workers who may require translation.
- All those working on site must be educated about the conservation importance of the flora occurring on site as well as the legislation relating to protected species.
- Employ regulatory measures to ensure that no illegal harvesting takes place.

4.2.3. Introduction or spread of alien species

Source of the impact

During clearing of an area for the excavation of minerals, construction of infrastructure and roads, stockpiling, improper rehabilitation practises.

Description of the impact

Several weeds and invasive species occur on site, as discussed in section 3.3.4 of this report with *Prosopis* being particularly abundant. Any anthropogenic disturbances to natural vegetation, especially the clearance of large areas of land, provide the opportunity for invasive plants to increase. This is due to their opportunistic nature of dispersal and establishing in disturbed areas. If invasive plants establish in disturbed areas, it may cause an impact beyond the boundaries of the prospecting site, because they spread easily to neighbouring habitats where they outcompete indigenous species. These alien invasive species are thus a threat to surrounding natural vegetation and can result in the decrease of biodiversity as well as reduction in the ecological value and land use potential of the area. Therefore, if alien invasive species are not controlled and managed, their propagation into new areas could have a high impact on the surrounding natural vegetation in the long term. With proper mitigation, the impacts can be substantially reduced.

Mitigation and monitoring

- Implement best practise principles to minimise the footprint of transformation, by keeping to existing roads and earmarked areas where possible.
- Mechanical methods of control should be implemented pro-actively as soon as invasive species start to emerge.
- Regular follow-up monitoring of invasive control areas needs to be implemented to ensure effective eradication.
- Encourage proper rehabilitation of disturbed areas through soil restoration and reseeding of indigenous plant species.

4.2.4. Encouraging bush encroachment

Source of the impact

During clearing of an area for the excavation of minerals, construction of infrastructure and roads, stockpiling, improper rehabilitation practises.

Description of the impact

The extent of bush encroaching species on site is high, especially regarding the densities of *Senegalia mellifera* and *Rhigozum trichotomum*. Bush encroachment is a natural phenomenon characterised by the excessive expansion of certain indigenous shrub species at the expense of other indigenous plant species. Any surface disturbances where the grassland matrix is removed can lead to the expansion of encroaching shrubs and trees. When the areas surrounding the shrubs area cleared, it causes an open niche for these competitive species to establish and outcompete the surrounding plants, eventually forming dense and impenetrable stands. This lowers the potential for future land use and decreases biodiversity. With proper mitigation, the impacts can be substantially reduced. In fact, the proposed prospecting activities could reduce the extent of these shrubs significantly. By clearing large stands of shrubs and subsequently effectively rehabilitating the cleared areas, it can benefit biodiversity.

Mitigation and monitoring

- Mechanical methods of control should be implemented pro-actively when encroaching species form dense stands.
- Regular follow-up monitoring of encroached control areas needs to be implemented to ensure effective eradication.
- Encourage proper rehabilitation of disturbed areas through soil restoration and reseeding of indigenous plant species.

4.3. Fauna

4.3.1. Habitat fragmentation

Source of the impact

During clearing of an area for the excavation of minerals, construction of infrastructure and roads, stockpiling.

Description of the impact

Fragmentation of habitats typically leads to the loss of migration corridors, in turn resulting in degeneration of the affected population's genetic make-up. This can be in the form of small-scale fragmentation for reptiles, amphibians, and invertebrates, to more large-scale fragmentation that hinder dispersal of birds and plants. It also includes the degradation of aquatic habitats, like the ephemeral wetlands, which has regional connectivity and form

important links in the food-chain on a landscape level. Fragmentation of habitats usually results in a subsequent loss of genetic variability between meta-populations occurring within the region. Pockets of fragmented natural habitats hinder the growth and development of populations. The prospecting activities on Brakfontein are expected to result in the loss of connectivity and fragmentation of natural terrestrial habitats on a local and landscape scale, especially in terms of terrestrial habitats.

Mitigation and monitoring

- All activities associated with the prospecting operation must be planned, where possible to encourage faunal dispersal and should minimise dissection or fragmentation of any important faunal habitat type.
- The extent of the earmarked area should be demarcated on site layout plans. No staff, contractors or vehicles may leave the demarcated area except those authorised to do so.
- Those pristine areas surrounding the earmarked area that are not part of the demarcated area should be considered as a no-go zone for employees, machinery or even visitors.
- No new roads should be created across a wetland.
- No prospecting should take place in the wetlands.
- If wetland disturbances are unavoidable, a water use license to alter the beds and banks of each affected wetland should be obtained from DWS prior to such activities.
- Employ sound rehabilitation measures to restore characteristics of all affected terrestrial and aquatic habitats.

4.3.2. Disturbance, displacement and killing of fauna

Source of the impact

Vegetation clearing; increase in noise and vibration; human and vehicular movement on site resulting from prospecting activities.

Description of the impact

The transformation of natural habitats will result in the loss of micro-habitats, affecting individual species and ecological processes. This will result in the displacement of faunal species that depend on such habitats, e.g. birds that nest in trees or animals residing in holes in the ground or among rocks. It also includes the egg banks of specialised branchiopod crustaceans which is found in the sediment of the depressional wetlands. Furthermore, increased noise and vibration will disturb and possibly displace wildlife.

Fast moving vehicles cause road kills of small mammals, birds, reptiles, amphibians, and a large number of invertebrates. Intentional killing of snakes, reptiles, vultures and owls due to superstition or fear can negatively affect their local populations.

Mitigation and monitoring

- Careful planning of the operation is needed to avoid the destruction of pristine habitats and minimise the overall disturbance footprint.
- The extent of the prospecting activities should be demarcated on site layout plans, and no personnel or vehicles may leave the demarcated area except if authorised. Areas surrounding the earmarked site that are not part of the demarcated area should be considered as a no-go zone.
- No prospecting should take place in the ephemeral wetlands. If this is unavoidable, a water use license to alter the beds and banks of each affected wetland should be obtained from DWS prior to such activities.
- If any of the ephemeral wetlands will be excavated, it is vital that the top 5cm of the sediment, which contains the egg banks, be removed prior to such activities, and stored in a suitable location where it cannot be eroded by wind or rain or be compacted or crushed. These egg banks should then ideally be used to restore wetland characteristics if possible, during the rehabilitation phase. However, if this is not possible, the egg banks should be donated to the Albany Museum in Grahamstown, where the freshwater collection of South Africa is housed.
- If any of the protected wildlife species are directly threatened by habitat destruction or displacement during the prospecting operation, then the relevant permits from DENC should be obtained followed by the relevant mitigation procedures stipulated in the permits.
- Everyone on site must undergo environmental induction for awareness on not capturing or harming species that are often persecuted out of superstition and to be educated about the conservation importance of the fauna occurring on site.
- Reptiles, amphibians, mammals, special invertebrates, or active bird nests exposed during the clearing operations should be captured for later release or translocation by a qualified expert.
- Employ measures that ensure adherence to a speed limit of 40 km/h as well as driving mindfully to lower the risk of animals being killed on the roads or elsewhere in the prospecting area.

4.4. Water resources

4.4.1. Alteration/destruction of watercourses

Source of the impact

During excavation of minerals, construction of infrastructure and roads, stockpiling.

Description of the impact

Direct prospecting within the wetlands on site as well as development of roads, infrastructure or stockpiles within their active zones, catchment areas, or buffer zones can completely change the hydrologic regime, geomorphology, water quality and habitat conditions of the wetland, which will compromise their ecological functioning and status.

Mitigation and monitoring

- All activities associated with the prospecting operation must be planned to avoid any disturbances to the watercourses and their recommended buffer zones.
- No new roads should be created across the wetlands and no prospecting should take place in them. If this is unavoidable, a water use license to alter its beds and banks should be obtained from DWS prior to such activities.
- If any of the ephemeral wetlands will be excavated, it is vital that the top 5cm of the sediment, which contains the egg banks, be removed prior to such activities, and stored in a suitable location where it cannot be eroded by wind or rain or be compacted or crushed. These egg banks should then ideally be used to restore wetland characteristics if possible, during the rehabilitation phase. However, if this is not possible, the egg banks should be donated to the Albany Museum in Grahamstown, where the freshwater collection of South Africa is housed.
- Employ sound rehabilitation measures to restore characteristics of any affected watercourses.

4.4.2. Siltation of surface water

Source of the impact

During clearing of an area for the excavation of minerals, construction of infrastructure and roads, stockpiling, natural events.

Description of the impact

Vegetation will be stripped in preparation for the prospecting areas and associated infrastructure. These bare areas will be very susceptible to wind and water erosion without plants to stabilise the soil, creating potential sediment source zones. High runoff events

could potentially cause the ephemeral wetlands to be filled with silt from prospecting areas if the sediment source zones lie along the drainage paths towards these water resources. Wind can also carry dust from the prospecting site to the wetlands, increasing siltation risks. This may lead to a change in hydrologic regime, water quality, character and PES of the wetlands.

Mitigation and monitoring

- Bare ground exposure should always be minimised in terms of the surface area and duration.
- Re-establishment of plant cover on disturbed areas must take place as soon as possible once activities in the area have ceased.
- No new roads, infrastructure or prospecting areas should be developed over the wetlands.
- Disturbances during the rainy season should be monitored and controlled.
- Any potential run-off from exposed ground should be controlled with flow retarding barriers.
- Regular monitoring during the prospecting operation should be carried out to identify areas where erosion is occurring; followed by appropriate remedial actions.
- Ensure measures for the adherence to a maximum speed limit of 40 km/h to minimise dust fallout and associated effects on wetlands in the adjacent areas.
- Develop an effective dust suppression system to limit dust fallout risks.

4.5. Broad-scale ecological processes

Source of the impact

Clearing of vegetation and disturbance during the construction of roads and prospecting activities; alterations to watercourse habitat characteristics.

Description of the impact

Transformation of intact habitat on a cumulative basis would contribute to the fragmentation of the landscape and would potentially disrupt the connectivity of the landscape for fauna and flora and impair their ability to respond to environmental fluctuations. The habitats on site are vulnerable to cumulative disturbances, due to the vast extent of transformation through mining and agriculture in the region. Fragmentation of these habitats through loss of keystone species will destroy connectivity of vital ecological corridors and it will disrupt the food web, which might have cascading effects on a landscape level over the long-term.

Mitigation and monitoring

- Implement best practise principles to minimise the footprint of transformation, by keeping to existing roads and earmarked areas where possible.
- Apply for the relevant permits from DENC and DAFF relating to terrestrial flora and fauna.
- No new roads should be created across a wetland and no prospecting should take place in them. If this is unavoidable, a water use license should be obtained from DWS prior to such activities.
- Employ sound rehabilitation measures to restore characteristics of all affected habitats.
- For restoration of the affected terrestrial areas without topsoil, soils can be sourced from other sustainable areas and chemically changed to match with the surrounding environment.
- To restore areas where compacted soil occurs, a ripper blade or deep plow can be pulled across the affected area to alleviate compaction.
- Encourage the growth of natural plant species in all affected areas by sowing indigenous seeds or by planting seedlings.
- The setup of a small nursery is advisable to maximise translocation and re-establishment efforts of affected areas.
- If any of the ephemeral wetlands will be excavated, it is vital that the top 5cm of the sediment, which contains the egg banks, be removed prior to such activities, and stored in a suitable location where it cannot be eroded by wind or rain or be compacted or crushed. These egg banks should then ideally be used to restore wetland characteristics if possible, during the rehabilitation phase. However, if this is not possible, the egg banks should be donated to the Albany Museum in Grahamstown, where the freshwater collection of South Africa is housed.

5. CONCLUSION, RECOMMENDATIONS AND OPINION REGARDING AUTHORISATION

Three plant communities occur on site, including terrestrial and aquatic habitats. The two depressional wetlands are both considered to be of very high sensitivity due to their vital ecological and hydrological functionality and significance, which is portrayed in the various sections of this report. The calcrete terraces are of high sensitivity, primarily because of the high number of the nationally protected tree (*Boscia albitrunca*) that occur here and the suitable habitat and overlapping distribution range for protected birds. The grassland is of medium sensitivity.

The most profound impacts are expected to be related to the cumulative loss of natural terrestrial habitat on a landscape scale as well as the removal of the nationally protected tree, *Boscia albitrunca.* A number of provincially protected species also occur on site. Before any of these species are damaged or removed, permits need to be obtained from the Northern Cape Department of Environment and Nature Conservation and/or Department of Agriculture, Forestry and Fisheries, at least three months prior to any clearance of affected species.

The wetland in the west is in a near-natural condition, with high ecological importance and sensitivity, while the wetland in the east has been moderately modified. The most profound functional importance of the wetlands relates to the maintenance of biodiversity in the form of unique habitats they provide for freshwater crustaceans. Even though rarely wet, these wetlands harbour egg banks of these specialised freshwater invertebrates in the dry sediment, which allows for the continuation of the species once the wetlands flood. Protecting the sediment in-situ is therefore vital. It is not currently known if the wetlands are within the core areas earmarked for prospecting, but before any direct activities can take place within a wetland, a water use licence needs to be obtained for Department of Water and Sanitation prior to such activities.

To conclude, disturbances to ecological communities and the destruction of natural habitats are inevitable during prospecting operations. The significance of related impacts however depends on the mitigation and rehabilitation measures implemented by the prospecting company. In my opinion, authorisation for the proposed prospecting operation can be granted if the applicant commits to strictly adhere to effective avoidance, management, mitigation, and rehabilitation measures.

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Boscia
ECOLOGICAL CONSULTING

APPENDICES

APPENDIX 1

Plant species list

FAMILY	SPECIES	STATUS	NFA	NCNCA
ACANTHACEAE	***Acanthopsis hoffmannseggiana***	**DDT**		
	Justicia incana	LC		
AIZOACEAE	*Aizoon asbestinum*	LC		
	Mesembryanthemum coriarium	LC		**S2**
	Plinthus karooicus	LC		
	Ruschia spinosa	LC		**S2**
AMARANTHACEAE	***Atriplex nummularia***	**Decl. Inv.**		
	Chenopodium album	**Nat. Exot.**		
	Salsola glabrescens	LC		
	Salsola rabieana	LC		
	Salsola smithii	**DDT**		
	Sericocoma avolans	LC		
	Sericorema remotiflora	LC		
ANACARDIACEAE	*Searsia tridactyla*	LC		
APOCYNACEAE	*Microloma armatum* var. *armatum*	LC		**S2**
ASPARAGACEAE	*Asparagus retrofractus*	LC		
	Asparagus suaveolens	LC		
ASTERACEAE	*Chrysocoma ciliata*	LC		
	Eriocephalus merxmuelleri	LC		
	Felicia fascicularis	LC		
	Gazania krebsiana subsp. *arctotoides*	LC		
	Geigeria ornativa	LC		
	Helichrysum argyrosphaerum	LC		
	Helichrysum lucilioides	LC		
	Kleinia longiflora	LC		
	Lasiopogon glomerulatus	LC		
	Osteospermum muricatum	LC		
	Pegolettia retrofracta	LC		
	Pentzia calcarea	LC		
	Pentzia globosa	LC		
	Pentzia incana	LC		
	Pteronia glauca	LC		
	Pteronia mucronata	LC		
	Rosenia humilis	LC		
BIGNONIACEAE	*Rhigozum trichotomum*	**Encr.**		
BORAGINACEAE	*Heliotropium ciliatum*	LC		
BRASSICACEAE	*Boscia albitrunca*	LC	**X**	**S2**
	Cadaba aphylla	LC		
CACTACEAE	***Cylindropuntia fulgida* var. *fulgida***	**Decl. Inv.**		
CAMPANULACEAE	*Wahlenbergia nodosa*	LC		
CARYOPHYLLACEAE	*Herniaria erckertii* subsp. *erckertii*	LC		
CUCURBITACEAE	*Cucumis myriocarpus* subsp. *leptodermis*	LC		
FABACEAE	*Indigofera alternans*	LC		
	Lotononis laxa	LC		
	Melolobium microphyllum	LC		

FAMILY	SPECIES	STATUS	NFA	NCNCA
FABACEAE	*Prosopis velutina*	Decl. Inv.		
	Schotia afra var. *afra*	LC		
	Senegalia mellifera	Encr.		
	Senna italica	LC		
GISEKIACEAE	*Gisekia pharnaceoides*	LC		
IRIDACEAE	*Moraea simulans*	LC		S2
LAMIACEAE	*Acrotome inflata*	LC		
	Stachys spathulata	LC		
LIMEACEAE	*Limeum aethiopicum*	LC		
	Limeum pterocarpum	LC		
	Limeum viscosum	LC		
MALVACEAE	*Hermannia erodioides*	LC		
	Melhania rehmannii	LC		
NYCTAGINACEAE	*Boerhavia diffusa*	Nat. Exot.		
	Phaeoptilum spinosum	LC		
PAPAVERACEAE	*Argemone ochroleuca*	Decl. Inv.		
POACEAE	*Aristida congesta* subsp. *congesta*	LC		
	Aristida junciformis	LC		
	Cenchrus ciliaris	LC		
	Enneapogon desvauxii	LC		
	Eragrostis bicolor	LC		
	Eragrostis echinochloidea	LC		
	Eragrostis lehmanniana	LC		
	Eragrostis nindensis	LC		
	Eragrostis obtusa	LC		
	Eragrostis rigidior	LC		
	Eragrostis truncata	LC		
	Fingerhuthia africana	LC		
	Panicum coloratum	LC		
	Stipagrostis ciliata	LC		
	Stipagrostis namaquensis	LC		
	Stipagrostis obtusa	LC		
	Stipagrostis uniplumis	LC		
	Tragus racemosus	LC		
POLYGALACEAE	*Polygala krumanina*	LC		
POLYGONACEAE	*Oxygonum alatum* var. *alatum*	LC		
RANUNCULACEAE	*Ranunculus multifidus*	LC		
SANTALACEAE	*Thesium hystrix*	LC		
	Thesium lineatum	LC		
SCROPHULARIACEAE	*Aptosimum albomarginatum*	LC		
	Aptosimum marlothii	LC		
	Aptosimum spinescens	LC		
	Chaenostoma halimifolium	LC		
	Selago albida	LC		
	Selago densiflora	LC		

FAMILY	SPECIES	STATUS	NFA	NCNCA
SOLANACEAE	*Lycium bosciifolium*	LC		
SOLANACEAE	*Lycium pilifolium*	LC		
ZYGOPHYLLACEAE	*Fagonia minutistipula*	LC		
	Roepera lichtensteiniana	LC		
	Tribulus zeyheri	LC		

APPENDIX 2

Fauna species list

LIST OF MAMMALS

Mammals protected according to NCNCA are indicated with their respective Schedule no. in superscript

	Scientific name	Common name	IUCN	SAMRL	Habitat	Potential occurrence
CHIROPTERA	[2]*Eidolon helvum*	African Straw-coloured Fruit-bat	**NT**	LC	Wide habitat tolerance.	Low
	[2]*Eptesicus hottentotus*	Long-tailed Serotine Bat	LC	LC	Mainly close to rivers and surrounding habitats.	Low
	[2]*Neoromicia capensis*	Cape Bat	LC	LC	Wide habitat tolerance, but found in arid areas, grassland, bushveld and *Acacia* woodland. Roosts under the bark of trees and similar vegetation.	Moderate
	[3]*Miniopterus natalensis*	Natal Long-fingered Bat	LC	LC	Mainly roosts in caves or mine shafts, but also in crevices and holes in trees.	Low
	[2]*Nycteris thebaica*	Common Slit-faced Bat	LC	LC	Savanna species with wide habitat tolerance. Roosts in caves, mine adits, aardvark holes, rock crevices and hollow trees in open savanna.	Low
	[2]*Rhinolophus denti*	Dent's Horseshoe Bat	LC	**NT**	Savanna habitats in broken country with rocky outcrops or suitable caves	Low
	[2]*Rhinolophus clivosus*	Geoffroy's Horseshoe Bat	LC	LC	Wide habitat tolerance.	High
	[2]*Rhinolophus darlingi*	Darling's Horseshoe Bat	LC	LC	Savanna habitats.	Low
	[2]*Tadarida aegyptiaca*	Egyptian Free-tailed Bat	LC	LC	Wide habitat tolerance.	High

LIST OF MAMMALS (continued)

Mammals protected according to NCNCA are indicated with their respective Schedule no. in superscript

	Scientific name	Common name	IUCN	SAMRL	Habitat	Potential occurrence
MACROSCELIDIDAE	[2]*Macroscelides proboscideus*	Round-eared Sengi	LC	LC	Restricted to gravel plains associated with alluvial plains and relatively flat areas between higher elevation areas such as outcrops, hills and mountains.	Low
	[2]*Elephantulus rupestris*	Western Rock Sengi	LC	LC	Arid habitats, including deserts, dry savannas, and dry shrublands. Associated with rocky ridges, outcrops or koppies, and boulder fields at the bases of mountains.	High
TUBULENTATA	[1]*Orycteropus afer*	Aardvark	LC	LC	Wide habitat tolerance, being found in open woodland, scrub and grassland, especially associated with sandy soil.	High
HYRACOIDEA	[2]*Procavia capensis*	Rock Hyrax	LC	LC	Outcrops of rocks, especially granite formations and dolomite intrusions in the Karoo. Also erosion gullies.	Low

LIST OF MAMMALS (continued)

Mammals protected according to NCNCA are indicated with their respective Schedule no. in superscript

	Scientific name	Common name	IUCN	SAMRL	Habitat	Potential occurrence
PRIMATES	[4]*Papio ursinus*	Chacma Baboon	LC	LC	Fynbos, montane grasslands, riverine courses in deserts. Only needs water and access to refuge.	Low
	[4]*Chlorocebus pygerythrus*	Vervet Monkey	LC	LC	Woodland savanna, riverine woodland, isolated stands of trees along rivers.	High
LAGOMORPHA	[2]*Lepus capensis*	Cape Hare	LC	LC	Dry, open regions, with palatable bush and grass.	High
	[2]*Lepus saxatilis*	Scrub Hare	LC	LC	Common in crop-growing areas or in fallow lands where there is some bush development.	High
	[2]*Pronolagus rupestris*	Smith's Red Rock Rabbit	LC	LC	Rocky habitats, from isolated outcrops to mountain ranges; in high and low rainfall areas but absent from true desert.	High
RODENTIA	[2]*Hystrix africaeaustralis*	Cape Porcupine	LC	LC	Catholic in habitat requirements.	High
	[2]*Xerus inauris*	South African Ground Squirrel	LC	LC	Open terrain with a sparse bush cover and hard substrate.	High
	[2]*Pedetes capensis*	Springhare	LC	LC	Occurs widespread: open sandy ground, sandy scrub, overgrazed grassland, edges of vleis and dry riverbeds.	High
	[2]*Graphiurus ocularis*	Spectacled Dormouse	LC	LC	Rocky habitats, but also trees.	High

LIST OF MAMMALS (continued)

Mammals protected according to NCNCA are indicated with their respective Schedule no. in superscript

	Scientific name	Common name	IUCN	SAMRL	Habitat	Potential occurrence
RODENTIA	[2]*Malacothrix typica*	Large-eared (Gerbil) Mouse	LC	LC	Short grass habitats over hard soil.	High
	[2]*Saccostomus campestris*	Pouched Mouse	LC	LC	Wide habitat tolerance but prefers soft, particularly sandy soils; can be found in open and dense vegetation and in rocky areas; annual rainfall of 250 - 1 200 mm.	Moderate
	[2]*Malacothrix typica*	Large-eared (Gerbil) Mouse	LC	LC	Short grass habitats over hard soil.	High
	[2]*Desmodillus auricularis*	Cape Short-tailed Gerbil	LC	LC	Occurs on hard ground, unlike other gerbil species, with some cover of grass or karroid bush.	High
	[2]*Gerbillurus paeba*	Pygmy Hairy-footed Gerbil	LC	LC	Nama and Succulent Karoo, preferring sandy soil or sandy alluvium with a grass, scrub or light woodland cover.	High
	[2]*Gerbilliscus leucogaster*	Bushveld Gerbil	LC	LC	Sandy soils; wooded and more open grassland; areas of cultivation.	Moderate
	[2]*Gerbilliscus brantsii*	Highveld Gerbil	LC	LC	Sandy soils; wooded and more open grassland; areas of cultivation.	Moderate
	[2]*Micaelamys namaquensis*	Namaqua Rock Mouse	LC	LC	Catholic habitat requirements, but prefer rocky hills, outcrops or boulder-strewn hillsides.	High

LIST OF MAMMALS (continued)

Mammals protected according to NCNCA are indicated with their respective Schedule no. in superscript

	Scientific name	Common name	IUCN	SAMRL	Habitat	Potential occurrence
RODENTIA	[3]*Rhabdomys dilectus*	Mesic Four-striped Grass Mouse	LC	LC	Wide habitat tolerance, from desert fringe to high-rainfall montane areas with grass cover.	High
	[2]*Rhabdomys pumilio*	Four-striped Grass Mouse	LC	LC	Occurs in wide variety of habitats where there is good grass cover.	High
	[2]*Mastomys coucha*	Southern Multimammate Mouse	LC	LC	Wide habitat tolerance.	High
	[3]*Mus musculus*	House Mouse	LC	*Not assessed*	Wide habitat tolerance.	High
	[2]*Thallomys nigricauda*	Black-tailed Tree Rat	LC	LC	Arboreal species generally associated with *Acacia* bushland habitats.	Low
	[2]*Parotomys littledalei*	Littledale's Whistling Rat	LC	**NT**	Occurs in shrublands, specifically in coastal hummocks, sand dunes, gravel plains and dry riverine systems. Avoids open habitats.	Low
	[2]*Myotomys unisulcatus*	Bush Karoo Rat	LC	LC	Shrub and fynbos associations in areas with rocky outcrops. Tend to avoid damp situations but exploit the semi-arid Karoo through behavioural adaptation.	High
	[2]*Cryptomys hottentotus*	African Mole Rat	LC	LC	Occurs in a wide range of substrates and habitats	High

LIST OF MAMMALS (continued)

Mammals protected according to NCNCA are indicated with their respective Schedule no. in superscript

	Scientific name	Common name	IUCN	SAMRL	Habitat	Potential occurrence
PHOLIDOTA	[1]Smutsia temminckii	Ground Pangolin	**VU**	**VU**	Low to high rainfall areas, including open grassland, woodland and rocky hills, but excluding forest and true desert; nevertheless, present throughout the Kalahari sand country.	High
EULIPOTYPHLA	[2]*Crocidura cyanea*	Reddish-Grey Musk Shrew	LC	LC	Occurs in relatively dry terrain, with a mean annual rainfall of less than 500 mm. Occur in karroid scrub and in fynbos often in association with rocks.	High
	[2]*Suncus varilla*	Lesser Dwarf Shrew	LC	LC	Generally associated with termite mounds, grassland habitat.	Low
	[1]*Atelerix frontalis*	South African Hedgehog	LC	**NT**	Generally found in semi-arid and sub-temperate environments with ample ground cover.	High
CARNIVORA	[1]*Vulpes chama*	Cape Fox	LC	LC	Associated with open country, open grassland, grassland with scattered thickets and coastal or semi-desert scrub.	High
	[1]*Otocyon megalotis*	Bat-eared Fox	LC	LC	Prefers short-grass plains, shrub lands and open arid savanna. Absent from true desert or afforested areas.	High

LIST OF MAMMALS (continued)

Mammals protected according to NCNCA are indicated with their respective Schedule no. in superscript

	Scientific name	Common name	IUCN	SAMRL	Habitat	Potential occurrence
CARNIVORA	[4]*Canis mesomelas*	Black-backed Jackal	LC	LC	Wide habitat tolerance.	High
	[2]*Aonyx capensis*	Cape Clawless Otter	**NT**	**NT**	Rivers, marshes, dams and lakes; dry stream beds if pools of water exist.	Low
	[1]*Mellivora capensis*	Honey Badger	LC	LC	Wide habitat tolerance.	High
	[1]*Poecilogale albinucha*	African Striped Weasel	LC	**NT**	Wide habitat tolerance, but most common in grassland areas.	High
	[1]*Ictonyx striatus*	Striped Polecat	LC	LC	Widely distributed throughout the sub-region.	High
	[2]*Cynictis penicillata*	Yellow Mongoose	LC	LC	Semi-arid country on a sandy substrate.	Confirmed
	[2]*Herpestes sanguineus*	Slender Mongoose	LC	LC	Wide habitat tolerance, but areas with adequate cover.	High
	[2]*Suricata suricatta*	Suricate	LC	LC	Open arid country with hard and stony substrate. Occur in Nama- and Succulent Karoo but also fynbos.	High
	[2]*Genetta genetta*	Common (Small-spotted) Genet	LC	LC	Occur in open arid habitats.	High

LIST OF MAMMALS (continued)

Mammals protected according to NCNCA are indicated with their respective Schedule no. in superscript

	Scientific name	Common name	IUCN	SAMRL	Habitat	Potential occurrence
CARNIVORA	[1]*Hyaena brunnea*	Brown Hyena	**NT**	**NT**	Found in dry areas, generally with annual rainfall of 100 - 700 mm, particularly along the coast, semi-desert, open scrub and open woodland savanna.	Low
	[1]*Proteles cristata*	Aardwolf	LC	LC	Common in the 100-600mm rainfall range of country, Nama-Karoo, Succulent Karoo Grassland and Savanna biomes. Absent from true desert and forests.	High
	[1]*Felis silvestris*	African Wild Cat	LC	LC	Wide habitat tolerance.	High
	[1]*Felis nigripes*	Black-footed cat	**VU**	**VU**	Associated with arid country, particularly areas with open habitat that provides some cover in the form of tall stands of grass or scrub.	Moderate
	[4]*Caracal caracal*	Caracal	LC	LC	Caracals tolerate arid regions, occur in semi-desert and karroid conditions.	High

LIST OF MAMMALS (continued)

Mammals protected according to NCNCA are indicated with their respective Schedule no. in superscript

	Scientific name	Common name	IUCN	SAMRL	Habitat	Potential occurrence
CETARTIODACTYLA	[2]*Oryx gazella*	Gemsbok	LC	LC	Semi-arid and arid bushland and grassland of the Kalahari and Karoo and adjoining regions of Southern Africa.	Confirmed
	[2]*Tragelaphus strepsiceros*	Greater Kudu	LC	LC	Wooded savanna	Confirmed
	[2]*Antidorcas marsupialis*	Springbok	LC	LC	Open arid plains with short vegetation	Confirmed
	[2]*Raphicerus campestris*	Steenbok	LC	LC	Inhabits open country.	Confirmed
	[2]*Sylvicapra grimmia*	Common Duiker	LC	LC	Presence of bushes are important.	High

LIST OF REPTILES

Reptiles protected according to NCNCA are indicated with their respective Schedule no. in superscript. South African endemics are indicated with [E].

Family	Scientific name	Common name	IUCN status
AGAMIDAE	[3]*Agama aculeata aculeata*	Western Ground Agama	LC
	[3]*Agama atra*	Southern Rock Agama	LC
AMPHISBAENIDAE	[3]*Monopeltis capensis*	Cape Worm Lizard	LC
	[3]*Monopeltis infuscata*	Dusky Worm Lizard	LC
	[3]*Zygaspis quadrifrons*	Kalahari Dwarf Worm Lizard	LC
CHAMAELEONIDAE	[1]*Chamaeleo dilepis dilepis*	Common Flap-neck Chameleon	LC
COLUBRIDAE	[2]*Dispholidus typus*	Boomslang	LC
	[2]*Philothamnus semivariegatus*	Spotted Bush Snake	LC
CORDYLIDAE	[1]*Karusasaurus polyzonus*	Southern Karusa Lizard	LC
ELAPIDAE	[3]*Naja nivea*	Cape Cobra	LC
GEKKONIDAE	[3]*Chondrodactylus bibronii*	Bibron's Gecko	LC
	[3]*Pachydactylus capensis*	Cape Gecko	LC
	[3]*Pachydactylus mariquensis*[E]	Common Banded Gecko	LC
	[3]*Ptenopus garrulus garrulus*	Common Barking Gecko	LC
GERRHOSAURIDAE	[3]*Gerrhosaurus flavigularis*	Yellow-throated Plated Lizard	LC
LACERTIDAE	[2]*Heliobolus lugubris*	Bushveld Lizard	LC
	[2]*Nucras intertexta*	Spotted Sandveld Lizard	LC
	[2]*Pedioplanis lineoocellata lineoocellata*	Spotted Sand Lizard	LC
	[2]*Pedioplanis namaquensis*	Namaqua Sand Lizard	LC
LAMPROPHIIDAE	[2]*Boaedon capensis*	Common House Snake	LC
	[2]*Lamprophis aurora*[E]	Aurora Snake	LC
	[3]*Psammophis trinasalis*	Fork-marked Sand Snake	LC
	[3]*Psammophylax tritaeniatus*	Striped Grass Snake	LC
	[3]*Pseudaspis cana*	Mole Snake	LC
LEPTOTYPHLOPIDAE	[3]*Leptotyphlops scutifrons*	Peter's Thread Snake	LC
PELOMEDUSIDAE	[3]*Pelomedusa subrufa*	Marsh Terrapin	LC
SCINCIDAE	[3]*Trachylepis capensis*	Cape Skink	LC
	[3]*Trachylepis sulcata sulcata*	Western Rock Skink	LC
	[3]*Trachylepis variegata*	Variegated Skink	LC

LIST OF REPTILES (continued)

Reptiles protected according to NCNCA are indicated with their respective Schedule no. in superscript. South African endemics are indicated with [E].

Family	Scientific name	Common name	IUCN status
TESTUDINIDAE	[3]*Homopus femoralis*[E]	Greater Dwarf Tortoise	LC
	[3]*Psammobates oculifer*	Serrated Tent Tortoise	LC
	[3]*Psammobates tentorius*	Tent Tortoise	LC
	[3]*Stigmochelys pardalis*	Leopard Tortoise	LC
TYPHLOPIDAE	[3]*Rhinotyphlops lalandei*	Delalande's Beaked Blind Snake	LC
VARANIDAE	[2]*Varanus albigularis albigularis*	Southern Rock Monitor	LC
VIPERIDAE	[3]*Bitis arietans arietans*	Puff Adder	LC

LIST OF AMPHIBIANS

Amphibians protected according to NCNCA are indicated with their respective Schedule no. in superscript. South African endemics are indicated with [E].

Family	Scientific name	Common name	IUCN status
BUFONIDAE	[2]*Amietophrynus gutturalis*	Guttural Toad	LC
	[2]*Amietophrynus poweri*	Western Olive Toad	LC
	[2]*Amietophrynus rangeri*[E]	Raucous Toad	LC
	[2]*Poyntonophrynus vertebralis*[E]	Southern Pygmy Toad	LC
	[2]*Bufo gariepensis*	Karoo Toad	LC
HYPEROLIIDAE	[2]*Kassina senegalensis*	Bubbling Kassina	LC
MICROHYLIDAE	[2]*Breviceps adspersus*	Bushveld Rain Frog	LC
PIPIDAE	[2]*Xenopus laevis*	Common Platanna	LC
PYXICEPHALIDAE	[2]*Amietia fuscigula*	Cape River Frog	LC
	[2]*Amietia quecketti*	Common River Frog	LC
	[2]*Cacosternum boettgeri*	Boettger's Caco	LC
	[1]*Pyxicephalus adspersus*	Giant Bullfrog	**NT**
	[2]*Tomopterna cryptotis*	Tremolo Sand Frog	LC
	[2]*Tomopterna tandyi*	Tandy's Sand Frog	LC

LIST OF BIRDS

Birds protected according to the NCNCA are indicated with their respective Schedule no. in superscript.

Scientific name	Common name	IUCN status	SA RDB
[1] *Accipiter badius*	Shikra	LC	LC
[2] *Acrocephalus baeticatus*	African Reed-Warbler	LC	LC
[2] *Acrocephalus gracilirostris*	Lesser Swamp-Warbler	LC	LC
[2] *Actitis hypoleucos*	Common Sandpiper	LC	LC
[2] *Alcedo cristata*	Malachite Kingfisher	LC	LC
[2] *Alopochen aegyptiacus*	Egyptian Goose	LC	LC
[2] *Amadina erythrocephala*	Red-headed Finch	LC	LC
[2] *Amaurornis flavirostris*	Black Crake	LC	LC
[2] *Anas capensis*	Cape Teal	LC	LC
[2] *Anas erythrorhyncha*	Red-billed Teal	LC	LC
[2] *Anas hottentota*	Hottentot Teal	LC	LC
[2] *Anas smithii*	Cape Shoveler	LC	LC
[2] *Anas sparsa*	African Black Duck	LC	LC
[2] *Anas undulata*	Yellow-billed Duck	LC	LC
[2] *Anhinga rufa*	African Darter	LC	LC
[2] *Anthoscopus minutus*	Cape Penduline-Tit	LC	LC
[2] *Anthropoides paradisea*	Blue Crane	**VU**	**NT**
[2] *Anthus cinnamomeus*	African Pipit	LC	LC
[2] *Anthus vaalensis*	Buffy Pipit	LC	LC
[2] *Apus affinis*	Little Swift	LC	LC
[2] *Apus apus*	Common Swift	LC	LC
[2] *Apus bradfieldi*	Bradfield's Swift	LC	LC
[2] *Apus caffer*	White-rumped Swift	LC	LC
[2] *Apus horus*	Horus Swift	LC	LC
[1] *Aquila rapax*	Tawny Eagle	**VU**	**EN**
[1] *Aquila verreauxii*	Verreaux's Eagle	LC	**VU**
[2] *Ardea cinerea*	Grey Heron	LC	LC
[2] *Ardea goliath*	Goliath Heron	LC	LC
[2] *Ardea melanocephala*	Black-headed Heron	LC	LC
[2] *Ardea purpurea*	Purple Heron	LC	LC
[2] *Ardeola ralloides*	Squacco Heron	LC	LC
[1] *Ardeotis kori*	Kori Bustard	**NT**	**NT**
[2] *Batis pririt*	Pririt Batis	LC	LC
[2] *Bostrychia hagedash*	Hadeda Ibis	LC	LC
[2] *Bradornis infuscatus*	Chat Flycatcher	LC	LC
[2] *Bradornis mariquensis*	Marico Flycatcher	LC	LC
[1] *Bubo africanus*	Spotted Eagle-Owl	LC	LC
[1] *Bubo lacteus*	Verreaux's Eagle-Owl	LC	LC
[2] *Bubulcus ibis*	Cattle Egret	LC	LC
[2] *Burhinus capensis*	Spotted Thick-knee	LC	LC
[1] *Buteo rufofuscus*	Jackal Buzzard	LC	LC

LIST OF BIRDS (Cont.)

Birds protected according to the NCNCA are indicated with their respective Schedule no. in superscript.

Scientific name	Common name	IUCN status	SA RDB
[1] *Buteo vulpinus*	Steppe Buzzard	LC	LC
[2] *Calandrella cinerea*	Red-capped Lark	LC	LC
[2] *Calendulauda africanoides*	Fawn-coloured Lark	LC	LC
[2] *Calendulauda bradfieldi*	Bradfield's Lark	-	LC
[2] *Calidris alba*	Sanderling	LC	LC
[2] *Calidris ferruginea*	Curlew Sandpiper	**NT**	LC
[2] *Calidris minuta*	Little Stint	LC	LC
[2] *Campethera abingoni*	Golden-tailed Woodpecker	LC	LC
[1] *Caprimulgus europaeus*	European Nightjar	LC	LC
[1] *Caprimulgus rufigena*	Rufous-cheeked Nightjar	LC	LC
[1] *Caprimulgus tristigma*	Freckled Nightjar	LC	LC
[2] *Cercomela familiaris*	Familiar Chat	LC	LC
[2] *Cercomela sinuata*	Sickle-winged Chat	LC	LC
[2] *Cercotrichas coryphoeus*	Karoo Scrub-Robin	LC	LC
[2] *Cercotrichas paena*	Kalahari Scrub-Robin	LC	LC
[2] *Ceryle rudis*	Pied Kingfisher	LC	LC
[2] *Charadrius asiaticus*	Caspian Plover	LC	LC
[2] *Charadrius hiaticula*	Common Ringed Plover	LC	LC
[1] *Charadrius pallidus*	Chestnut-banded Plover	**NT**	**NT**
[2] *Charadrius pecuarius*	Kittlitz's Plover	LC	LC
[2] *Charadrius tricollaris*	Three-banded Plover	LC	LC
[2] *Chersomanes albofasciata*	Spike-heeled Lark	LC	LC
[2] *Chlidonias hybridus*	Whiskered Tern	LC	LC
[2] *Chlidonias leucopterus*	White-winged Tern	LC	LC
[2] *Chrysococcyx caprius*	Diderick Cuckoo	LC	LC
[2] *Ciconia abdimii*	Abdim's Stork	LC	**NT**
[2] *Ciconia ciconia*	White Stork	LC	LC
[1] *Ciconia nigra*	Black Stork	LC	**VU**
[2] *Cinnyris fusca*	Dusky Sunbird	LC	LC
[2] *Cinnyris mariquensis*	Marico Sunbird	LC	LC
[1] *Circaetus pectoralis*	Black-chested Snake-Eagle	LC	LC
[1] *Circus maurus*	Black Harrier	**EN**	LC
[1] *Circus pygargus*	Montagu's Harrier	LC	LC
[1] *Circus ranivorus*	African Marsh-Harrier	LC	**EN**
[2] *Cisticola aridulus*	Desert Cisticola	LC	LC
[2] *Cisticola fulvicapillus*	Neddicky	LC	LC
[2] *Cisticola juncidis*	Zitting Cisticola	LC	LC
[2] *Cisticola subruficapillus*	Grey-backed Cisticola	LC	LC
[2] *Cisticola tinniens*	Levaillant's Cisticola	LC	LC
[2] *Clamator glandarius*	Great Spotted Cuckoo	LC	LC
[2] *Clamator jacobinus*	Jacobin Cuckoo	LC	LC

LIST OF BIRDS (Cont.)

Birds protected according to the NCNCA are indicated with their respective Schedule no. in superscript.

Scientific name	Common name	IUCN status	SA RDB
[3] *Colius colius*	White-backed Mousebird	LC	LC
[2] *Columba guinea*	Speckled Pigeon	LC	LC
[2] *Columba livia*	Rock Dove	LC	LC
[2] *Coracias caudata*	Lilac-breasted Roller	LC	LC
[2] *Coracias garrulus*	European Roller	LC	**NT**
[2] *Coracias naevia*	Purple Roller	LC	LC
[3] *Corvus albus*	Pied Crow	LC	LC
[3] *Corvus capensis*	Cape Crow	LC	LC
[2] *Cossypha caffra*	Cape Robin-Chat	LC	LC
[2] *Coturnix coturnix*	Common Quail	LC	LC
[2] *Creatophora cinerea*	Wattled Starling	LC	LC
[2] *Cuculus clamosus*	Black Cuckoo	LC	LC
[2] *Cursorius rufus*	Burchell's Courser	LC	**VU**
[2] *Cursorius temminckii*	Temminck's Courser	LC	LC
[2] *Cypsiurus parvus*	African Palm-Swift	LC	LC
[2] *Dendrocygna bicolor*	Fulvous Duck	LC	LC
[2] *Dendrocygna viduata*	White-faced Duck	LC	LC
[2] *Dendropicos fuscescens*	Cardinal Woodpecker	LC	LC
[2] *Dicrurus adsimilis*	Fork-tailed Drongo	LC	LC
[2] *Egretta alba*	Great Egret	LC	LC
[2] *Egretta garzetta*	Little Egret	LC	LC
[2] *Egretta intermedia*	Yellow-billed Egret	LC	LC
[1] *Elanus caeruleus*	Black-shouldered Kite	LC	LC
[2] *Emberiza capensis*	Cape Bunting	LC	LC
[2] *Emberiza flaviventris*	Golden-breasted Bunting	LC	LC
[2] *Emberiza impetuani*	Lark-like Bunting	LC	LC
[2] *Emberiza tahapisi*	Cinnamon-breasted Bunting	LC	LC
[2] *Eremomela icteropygialis*	Yellow-bellied Eremomela	LC	LC
[2] *Eremopterix verticalis*	Grey-backed Sparrowlark	LC	LC
[2] *Estrilda astrild*	Common Waxbill	LC	LC
[2] *Estrilda erythronotos*	Black-faced Waxbill	LC	LC
[2] *Euplectes afer*	Yellow-crowned Bishop	LC	LC
[3] *Euplectes orix*	Southern Red Bishop	LC	LC
[2] *Eupodotis afraoides*	Northern Black Korhaan	LC	LC
[2] *Eupodotis ruficrista*	Red-crested Korhaan	LC	LC
[1] *Falco biarmicus*	Lanner Falcon	LC	**VU**
[1] *Falco naumanni*	Lesser Kestrel	LC	LC
[1] *Falco peregrinus*	Peregrine Falcon	LC	LC
[1] *Falco rupicolis*	Rock Kestrel	LC	LC
[1] *Falco rupicoloides*	Greater Kestrel	LC	LC

LIST OF BIRDS (Cont.)

Birds protected according to the NCNCA are indicated with their respective Schedule no. in superscript.

Scientific name	Common name	IUCN status	SA RDB
[2] *Fulica cristata*	Red-knobbed Coot	LC	LC
[2] *Gallinago nigripennis*	African Snipe	LC	LC
[2] *Gallinula chloropus*	Common Moorhen	LC	LC
[1] *Glareola nordmanni*	Black-winged Pratincole	**NT**	**NT**
[1] *Glaucidium perlatum*	Pearl-spotted Owlet	LC	LC
[2] *Granatina granatina*	Violet-eared Waxbill	LC	LC
[1] *Gyps africanus*	White-backed Vulture	**CR**	**CR**
[1] *Gyps coprotheres*	Cape Vulture	**VU**	**EN**
[2] *Halcyon chelicuti*	Striped Kingfisher	LC	LC
[1] *Haliaeetus vocifer*	African Fish-Eagle	LC	LC
[1] *Hieraaetus pennatus*	Booted Eagle	LC	LC
[2] *Himantopus himantopus*	Black-winged Stilt	LC	LC
[2] *Hippolais icterina*	Icterine Warbler	LC	LC
[2] *Hirundo albigularis*	White-throated Swallow	LC	LC
[2] *Hirundo cucullata*	Greater Striped Swallow	LC	LC
[2] *Hirundo dimidiata*	Pearl-breasted Swallow	LC	LC
[2] *Hirundo fuligula*	Rock Martin	LC	LC
[2] *Hirundo rustica*	Barn Swallow	LC	LC
[2] *Hirundo semirufa*	Red-breasted Swallow	LC	LC
[2] *Hirundo spilodera*	South African Cliff-Swallow	LC	LC
[2] *Indicator indicator*	Greater Honeyguide	LC	LC
[2] *Ixobrychus minutus*	Little Bittern	LC	LC
[2] *Lagonosticta senegala*	Red-billed Firefinch	LC	LC
[2] *Lamprotornis nitens*	Cape Glossy Starling	LC	LC
[2] *Laniarius atrococcineus*	Crimson-breasted Shrike	LC	LC
[2] *Lanius collaris*	Common Fiscal	LC	LC
[2] *Lanius collurio*	Red-backed Shrike	LC	LC
[2] *Lanius minor*	Lesser Grey Shrike	LC	LC
[2] *Larus cirrocephalus*	Grey-headed Gull	LC	LC
[1] *Leptoptilos crumeniferus*	Marabou Stork	LC	**NT**
[2] *Malcorus pectoralis*	Rufous-eared Warbler	LC	LC
[2] *Megaceryle maxima*	Giant Kingfisher	LC	LC
[1] *Melierax canorus*	Southern Pale Chanting Goshawk	LC	LC
[1] *Melierax gabar*	Gabar Goshawk	LC	LC
[2] *Merops apiaster*	European Bee-eater	LC	LC
[2] *Merops hirundineus*	Swallow-tailed Bee-eater	LC	LC
[2] *Milvus aegyptius*	Yellow-billed Kite	LC	LC
[1] *Milvus migrans*	Black Kite	LC	LC
[2] *Mirafra fasciolata*	Eastern Clapper Lark	LC	LC
[2] *Mirafra passerina*	Monotonous Lark	LC	LC

LIST OF BIRDS (Cont.)

Birds protected according to the NCNCA are indicated with their respective Schedule no. in superscript.

Scientific name	Common name	IUCN status	SA RDB
[2] *Monticola brevipes*	Short-toed Rock-Thrush	LC	LC
[2] *Motacilla capensis*	Cape Wagtail	LC	LC
[2] *Muscicapa striata*	Spotted Flycatcher	LC	LC
[2] *Myrmecocichla formicivora*	Anteating Chat	LC	LC
[1] *Neotis ludwigii*	Ludwig's Bustard	**EN**	**EN**
[2] *Netta erythrophthalma*	Southern Pochard	LC	LC
[2] *Nilaus afer*	Brubru	LC	LC
[2] *Numenius phaeopus*	Common Whimbrel	LC	LC
[2] *Numida meleagris*	Helmeted Guineafowl	LC	LC
[2] *Nycticorax nycticorax*	Black-crowned Night-Heron	LC	LC
[2] *Oena capensis*	Namaqua Dove	LC	LC
[2] *Oenanthe monticola*	Mountain Wheatear	LC	LC
[2] *Oenanthe pileata*	Capped Wheatear	LC	LC
[2] *Onychognathus nabouroup*	Pale-winged Starling	LC	LC
[2] *Oriolus oriolus*	Eurasian Golden Oriole	LC	LC
[2] *Ortygospiza atricollis*	African Quailfinch	LC	LC
[2] *Oxyura maccoa*	Maccoa Duck	**VU**	**NT**
[2] *Parisoma layardi*	Layard's Tit-Babbler	LC	LC
[2] *Parisoma subcaeruleum*	Chestnut-vented Tit-Babbler	LC	LC
[2] *Parus cinerascens*	Ashy Tit	LC	LC
[2] *Passer diffusus*	Southern Grey-headed Sparrow	LC	LC
[3] *Passer domesticus*	House Sparrow	LC	LC
[3] *Passer melanurus*	Cape Sparrow	LC	LC
[2] *Passer motitensis*	Great Sparrow	LC	LC
[2] *Phalacrocorax africanus*	Reed Cormorant	LC	LC
[2] *Phalacrocorax lucidus*	White-breasted Cormorant	LC	LC
[2] *Philetairus socius*	Sociable Weaver	LC	LC
[2] *Philomachus pugnax*	Ruff	LC	LC
[1] *Phoenicopterus minor*	Lesser Flamingo	**NT**	**NT**
[1] *Phoenicopterus ruber*	Greater Flamingo	LC	**NT**
[2] *Phylloscopus trochilus*	Willow Warbler	LC	LC
[2] *Platalea alba*	African Spoonbill	LC	LC
[2] *Plectropterus gambensis*	Spur-winged Goose	LC	LC
[2] *Plegadis falcinellus*	Glossy Ibis	LC	LC
[2] *Plocepasser mahali*	White-browed Sparrow-Weaver	LC	LC
[3] *Ploceus velatus*	Southern Masked-Weaver	LC	LC
[2] *Podiceps cristatus*	Great Crested Grebe	LC	LC
[2] *Podiceps nigricollis*	Black-necked Grebe	LC	LC
[1] *Polemaetus bellicosus*	Martial Eagle	**EN**	**EN**
[1] *Polihierax semitorquatus*	Pygmy Falcon	LC	LC
[1] *Polyboroides typus*	African Harrier-Hawk	LC	LC

LIST OF BIRDS (Cont.)

Birds protected according to the NCNCA are indicated with their respective Schedule no. in superscript.

Scientific name	Common name	IUCN status	SA RDB
[2] *Porphyrio madagascariensis*	African Purple Swamphen	LC	LC
[2] *Prinia flavicans*	Black-chested Prinia	LC	LC
[2] *Psophocichla litsitsirupa*	Groundscraper Thrush	LC	LC
[2] *Pterocles burchelli*	Burchell's Sandgrouse	LC	LC
[2] *Pterocles namaqua*	Namaqua Sandgrouse	LC	LC
[1] *Ptilopsus granti*	Southern White-faced Scops-Owl	-	LC
[3] *Pycnonotus nigricans*	African Red-eyed Bulbul	LC	LC
[2] *Pytilia melba*	Green-winged Pytilia	LC	LC
[3] *Quelea quelea*	Red-billed Quelea	LC	LC
[2] *Rallus caerulescens*	African Rail	LC	LC
[2] *Recurvirostra avosetta*	Pied Avocet	LC	LC
[2] *Rhinopomastus cyanomelas*	Common Scimitarbill	LC	LC
[2] *Rhinoptilus africanus*	Double-banded Courser	LC	LC
[2] *Riparia paludicola*	Brown-throated Martin	LC	LC
[2] *Riparia riparia*	Sand Martin	LC	LC
[1] *Rostratula benghalensis*	Greater Painted-snipe	LC	**NT**
[1] *Sagittarius serpentarius*	Secretarybird	**EN**	**VU**
[2] *Scleroptila levaillantoides*	Orange River Francolin	LC	LC
[2] *Scopus umbretta*	Hamerkop	LC	LC
[2] *Serinus albogularis*	White-throated Canary	LC	LC
[2] *Serinus atrogularis*	Black-throated Canary	LC	LC
[2] *Serinus flaviventris*	Yellow Canary	LC	LC
[2] *Sigelus silens*	Fiscal Flycatcher	LC	LC
[2] *Spizocorys conirostris*	Pink-billed Lark	LC	LC
[2] *Sporopipes squamifrons*	Scaly-feathered Finch	LC	LC
[2] *Spreo bicolor*	Pied Starling	LC	LC
[2] *Stenostira scita*	Fairy Flycatcher	LC	LC
[2] *Streptopelia capicola*	Cape Turtle-Dove	LC	LC
[2] *Streptopelia semitorquata*	Red-eyed Dove	LC	LC
[2] *Streptopelia senegalensis*	Laughing Dove	LC	LC
[2] *Struthio camelus*	Common Ostrich	LC	LC
[2] *Sylvia borin*	Garden Warbler	LC	LC
[2] *Sylvietta rufescens*	Long-billed Crombec	LC	LC
[2] *Tachybaptus ruficollis*	Little Grebe	LC	LC
[2] *Tachymarptis melba*	Alpine Swift	LC	LC
[2] *Tadorna cana*	South African Shelduck	LC	LC
[2] *Tchagra australis*	Brown-crowned Tchagra	LC	LC
[2] *Telophorus zeylonus*	Bokmakierie	LC	LC
[2] *Threskiornis aethiopicus*	African Sacred Ibis	LC	LC
[2] *Tockus leucomelas*	Southern Yellow-billed Hornbill	LC	LC

LIST OF BIRDS (Cont.)

Birds protected according to the NCNCA are indicated with their respective Schedule no. in superscript.

Scientific name	Common name	IUCN status	SA RDB
[2] *Tockus nasutus*	African Grey Hornbill	LC	LC
[1] *Torgos tracheliotus*	Lappet-faced Vulture	**EN**	**EN**
[2] *Trachyphonus vaillantii*	Crested Barbet	LC	LC
[2] *Tricholaema leucomelas*	Acacia Pied Barbet	LC	LC
[2] *Tringa glareola*	Wood Sandpiper	LC	LC
[2] *Tringa nebularia*	Common Greenshank	LC	LC
[2] *Tringa stagnatilis*	Marsh Sandpiper	LC	LC
[2] *Turdus smithi*	Karoo Thrush	-	LC
[2] *Turnix sylvatica*	Small Buttonquail	LC	LC
[1] *Tyto alba*	Barn Owl	LC	LC
[2] *Upupa africana*	African Hoopoe	LC	LC
[3] *Urocolius indicus*	Red-faced Mousebird	LC	LC
[2] *Vanellus armatus*	Blacksmith Lapwing	LC	LC
[2] *Vanellus coronatus*	Crowned Lapwing	LC	LC
[2] *Vidua chalybeata*	Village Indigobird	LC	LC
[2] *Vidua macroura*	Pin-tailed Whydah	LC	LC
[2] *Vidua regia*	Shaft-tailed Whydah	LC	LC
[2] *Zosterops pallidus*	Orange River White-eye	LC	LC

APPENDIX 3

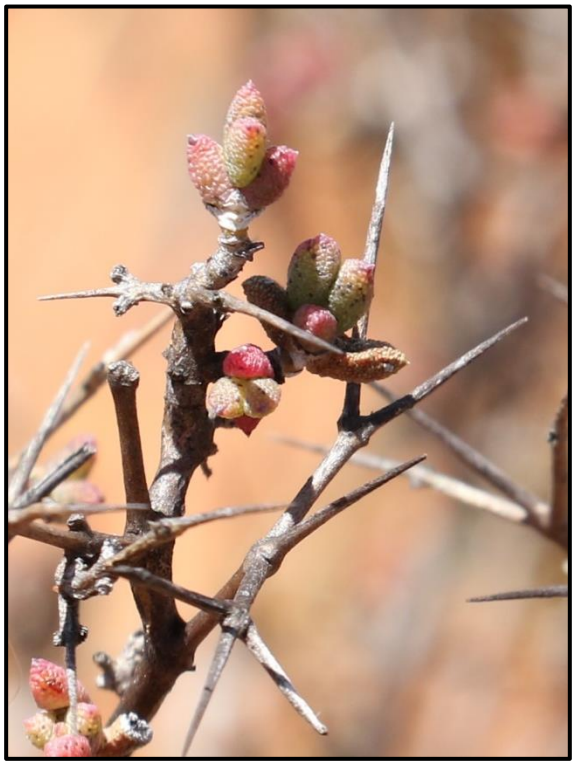
A photographic guide for species of conservation concern that occur on site

Boscia albitrunca

Protected under the NFA and Schedule 2 of the NCNCA

Ruschia spinosa

All Mesembryanthemaceae spp. are protected under Schedule 2 of the NCNCA



Mesembryanthemum coriarium

All Mesembryanthemaceae spp. are protected under Schedule 2 of the NCNCA

Moraea simulans

All Iridaceae spp. are protected under Schedule 2 of the NCNCA