NC 30/5/1/1/2/11639 PR

Boscia
ECOLOGICAL CONSULTING

ECOLOGICAL ASSESSMENT REPORT

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Viegulands Put Diamond Prospecting Site

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The Remaining Extent of Portion 1 of the Farm Viegulands Put 42

District of Prieska

Northern Cape Province

Ecological Assessment Report in application for Environmental Authorisation related to a Prospecting Right Application (Ref: NC 30/5/1/1/2/11639 PR) that was lodged with the Department of Mineral Resources

September 2017

EXECUTIVE SUMMARY

Paul Seun Thukgwi is proposing the prospecting of diamonds on The Remaining Extent of Portion 1 of the Farm Viegulands Put 42. The prospecting right area is located within the Prieska District Municipality of the Northern Cape Province. This ecological assessment report describes the characteristics of terrestrial and aquatic 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 investigation was performed to obtain ecological information for the proposed study area and identify the ecological characteristics and sensitivity of the site. Five plant communities were identified on site of which all are included in the earmarked area to be affected by prospecting activities. The watercourses include several ephemeral pans and drainage lines, which are considered to be of very high sensitivity due to their vital ecological and hydrological functionality and significance. The calcrete ridge, calcrete plains, thornveld and grassland on sand are all considered to be of high sensitivity, on account of the high number or frequency of species of conservation concern found here and/or the important faunal habitats they provide. The most profound impacts are expected to be related to the destruction of watercourses and the alteration of aquatic habitats; which in turn will cause cumulative fragmentation of important ecological corridors in the area.

Species of conservation concern that are found in these earmarked habitats will most likely also be lost locally. These include the widespread *Boscia albitrunca* as well as *Nymania capensis* and *Aloe claviflora* commonly found on the calcrete plains and ridge, respectively. Similarly, the prospecting operation will result in the large-scale clearance of indigenous vegetation. Additionally, any disturbances to the Aardvark burrows will displace this protected species locally. Permit applications regarding protected fauna and flora as well as the harvesting of indigenous vegetation need to be lodged with the Northern Cape Department of Environment and Nature Conservation prior to any clearance of vegetation or destruction of Aardvark burrows. Furthermore, a licence application regarding protected trees should be lodged with Department of Agriculture, Forestry and Fisheries prior to any potential disturbances to *B. albitrunca*.

The significance of the impacts will be affected by the success of the mitigation and rehabilitation measures implemented. Therefore, authorisation should only be granted if the applicant commits to the adherence of effective avoidance, management, mitigation and rehabilitation measures.

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1. INTRODUCTION

1.1. Background information

Paul Seun Thukgwi is proposing the prospecting of diamonds on the Remaining Extent of Portion 1 of the Farm Viegulands Put 42 (from heron referred to as Viegulands Put). The prospecting right area is located within the Prieska District Municipality of the Northern Cape Province and lies 48 km north-east of the town Prieska and 72 km south-west of the town Douglas on the R357 (Figure 1). The total extent of the prospecting right area is 1 676.89 ha and comprises a number of wetlands, known as ephemeral pans.

An ecological assessment is required in order to consider the impacts that the proposed activities might have on the terrestrial- and wetland ecosystems of Viegulands Put and therefore Boscia Ecological Consulting has been appointed by the applicant to conduct an assessment and provide an ecological assessment report.

This assessment report describes the characteristics of terrestrial and aquatic habitats in the proposed prospecting area, identifies 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.

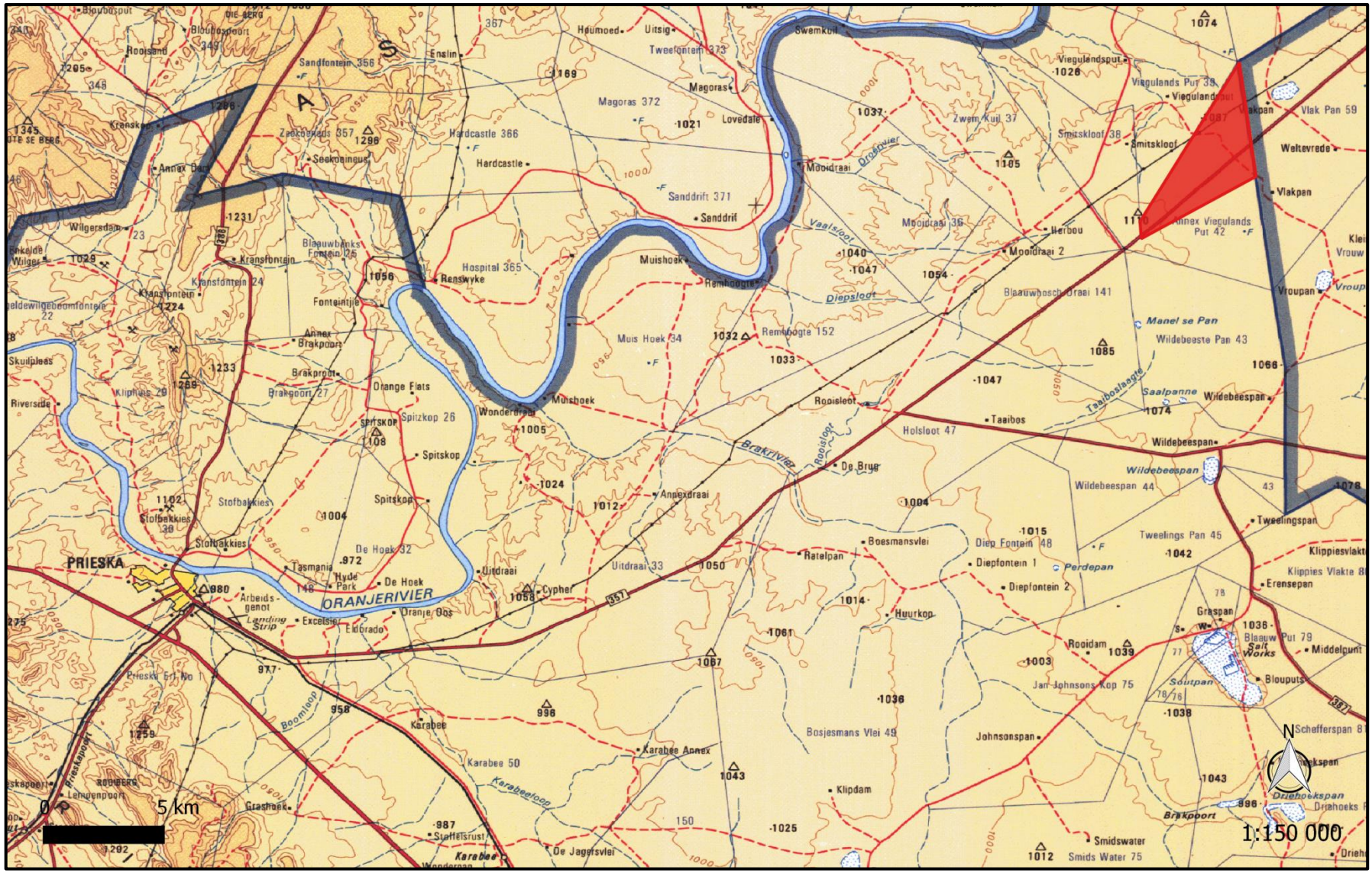


Figure 1. The location of the Viegulands Put prospecting area is indicated in red.

1.2. Scope of study

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

- conduct a desktop study and field investigation in order to identify and describe different ecological habitats (terrestrial and aquatic) and provide an inventory of 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,
  - indicates the ecological sensitivity of habitats and conservation values of species,
  - determines the potential impacts of the project on the ecological integrity,
  - provides mitigation measures and recommendations to limit project impacts,
  - indicate 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	PostNet Suite #194 Private Bag X2 Diamond 8305		
Contact Person	Dr Elizabeth (Betsie) Milne		
Contact Details	Cell: 082 992 1261	Email: BosciaEcology@gmail.com	
Qualifications	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 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 diamondiferous gravel deposits that are associated with the alluvial terraces of the Middle Orange River. These gravels are confined to tertiary deposits, which covers the entire study site (Figure 2). The presence of diamondiferous gravels on Viegulands Put will be evaluated by means of a standard phased approach. Initially, non-invasive desktop studies will be conducted to delineate and define areas underlain by alluvial gravels. Thereafter, an opencast pitting programme will be performed over anomalous target areas using predefined grids. At least 20 pits of ± 2 m long, 1 m wide and 0.5 – 5 m in depth are expected to be excavated.

Pitting will concurrently be followed by opencast trenching using heavy earthmoving machinery on pits that prove to contain diamondiferous gravels. Each trench is expected to be ± 200 m long, 100 m wide and 0.5 – 5 m in depth Vegetated soil and overburden are stripped where required and the underlying gravels are excavated and screened, before treated through a rotary pan plant. For final recovery concentrate will be fed to a Flowsort X-Ray Machine and the rough diamond product will then be removed from site for further beneficiation. No ore processing reagents are required or used in the treatment of the ore. An estimated total volume of 800 000 m^3 will be sampled over three years.

Prospecting activities will primarily make use of existing roads and tracks to gain access to the prospecting right area, but additional roads will be created in order to access drilling locations, excavations and the processing site. A typical diamond processing plant, with associated infrastructure will also be erected. Planned infrastructure include a mobile office complex, ablutions, workshop facilities, storage facilities, security office, diesel depot, wash bay and salvage yard.

Figure 2. The locality of the core prospecting area is indicated in white, while the border of the proposed prospecting right area is indicated in red. The blue lines represent a hypothetical grid on which the pitting and trenching programme will be based.

2. METHODOLOGY

2.1. Data collection

The study comprised a combination of field and desktop surveys for data collection on fauna, flora and wetland habitats in order to obtain the most comprehensive data set for the assessment. The fieldwork component was conducted on 19 and 20 August 2017 and most data for the desktop component was obtained from the quarter degree squares that include the study area (2923AC and 2923 CA).

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 in order 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 and their conservation status.

The South African National Biodiversity Institute's (SANBI) BGIS database was also consulted to obtain information on biodiversity information for the Siyathemba Local Municipality (NC077), in which the study area falls.

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 for the quarter degree squares that include the study area. 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 2017).

2.3. Fauna

2.3.1. Desktop survey

A desktop survey was undertaken to obtain lists of mammals, reptiles, amphibians and birds which are likely to occur in the study area. These were derived 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 and Gibbon (2006) for birds.

Additional information on faunal distribution was extracted from the various databases hosted by the ADU web portal, http://adu.org.za. A map of important bird areas (BirdLifeSA 2015) was also consulted. 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; Bates et al. 2014; Taylor et al. 2015; ADU 2016) and comparing their habitat preferences with the habitat described from the field survey. The conservation status of each species is also listed, based on the IUCN Red List Categories and Criteria (IUCN 2015) and/or the various red data books for the respective taxa.

2.3.2. Field survey

The faunal field survey was conducted concurrent with the vegetation survey. 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).

2.4. Wetlands

2.4.1. Information collection

a) Desktop survey

A desktop survey was undertaken to obtain general information regarding the significance and ecological functioning of wetlands. Maps delineating wetland boundaries were generated using 1:50 000 topographic maps, satellite images and other geographic information systems. The National Freshwater Ecosystem Priority Areas (Nel et al. 2011) was inspected and the geological wetland descriptors were also determined using desktop information. Guidelines, including Ollis et al. (2013), DWAF (2007), Macfarlane et al. (2007) and Kotze et al. (2007) were consulted in order to classify and assess wetlands on Viegulands Put.

b) Field survey

The wetland survey was conducted concurrent with the vegetation and fauna survey to assess and delineate the wetlands on Viegulands Put. The following elements were assessed:

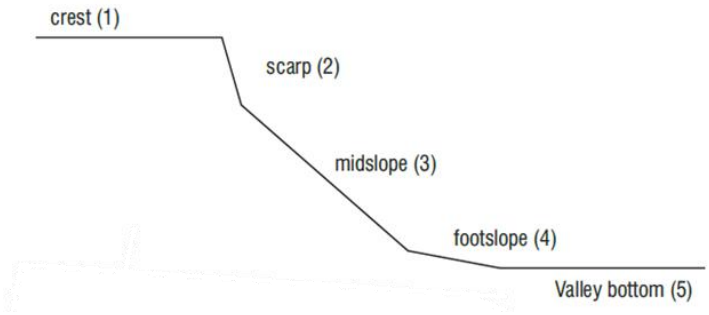
- Wetland descriptors
- Present ecological state
- Features of ecological importance and functionality
- Current impacts

2.4.2. Wetland assessment procedures

a) Wetland Delineation

Wetlands were delineated according to the delineation procedure as set out by DWAF (2005). The delineation procedure considered the following four attributes to determine the limitations of the wetland:

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



- **Soil Form Indicator** identifies the soil forms, as defined by SCWG (1991). A hydromorphic soil displays unique characteristics resulting from its prolonged and repeated saturation.

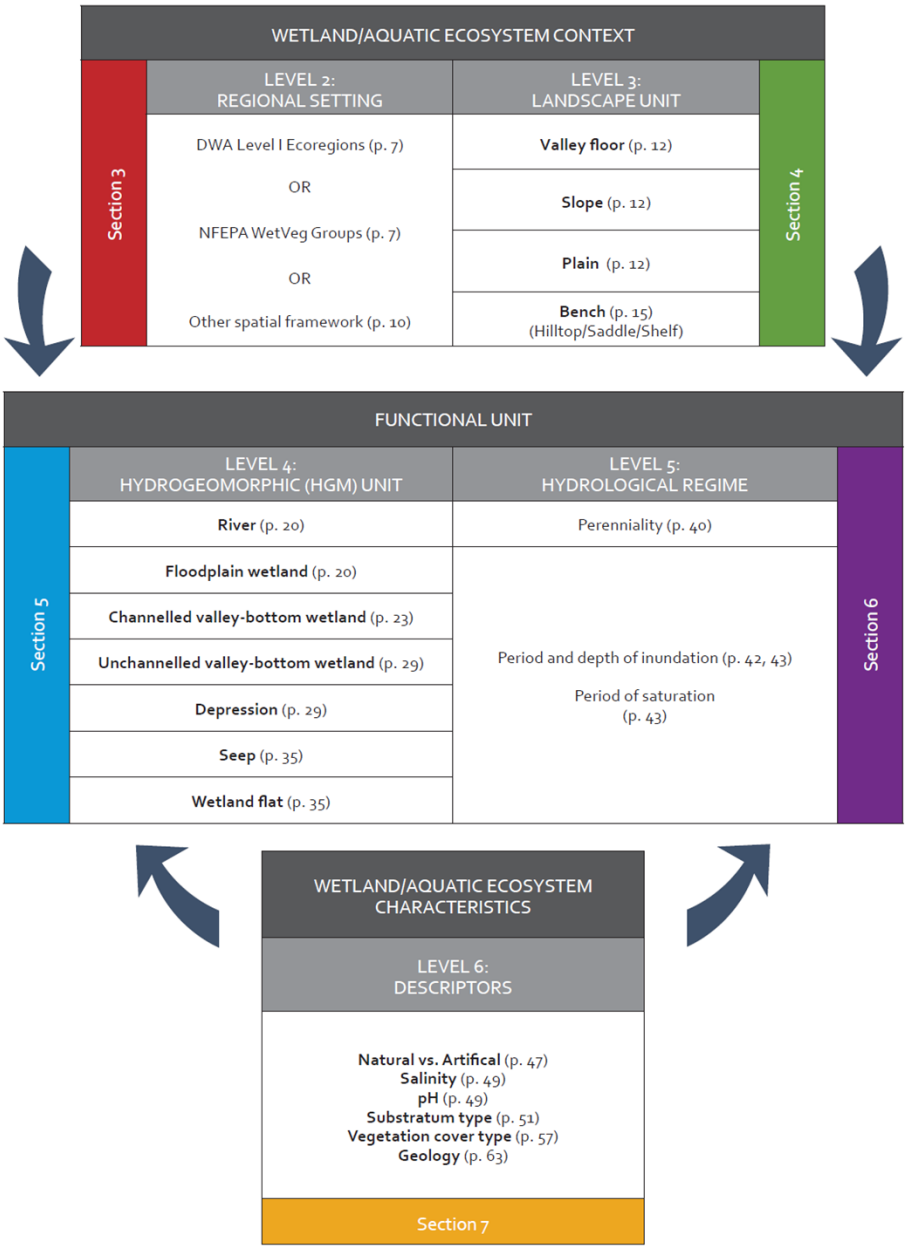
- **Soil Wetness Indicator** identifies the morphological "signatures" developed in the soil profile as a result of prolonged and frequent saturation. In practice, this indicator is used as the primary indicator.

- **Vegetation Indicator** identifies hydrophilic vegetation associated with frequently saturated soils. Plant communities undergo distinct changes in species composition along the wetness gradient.

The presence of all indicators provides a logical, defensible, and technical basis for identifying an area as wetland, but an area should display a minimum of either soil wetness or vegetation indicators in order to be classified as a wetland. Verification of the terrain unit and soil form indicators increases the level of confidence in deciding the boundary. In other words, the more indicators present, the higher the confidence in the delineation.

b) Wetland Classification

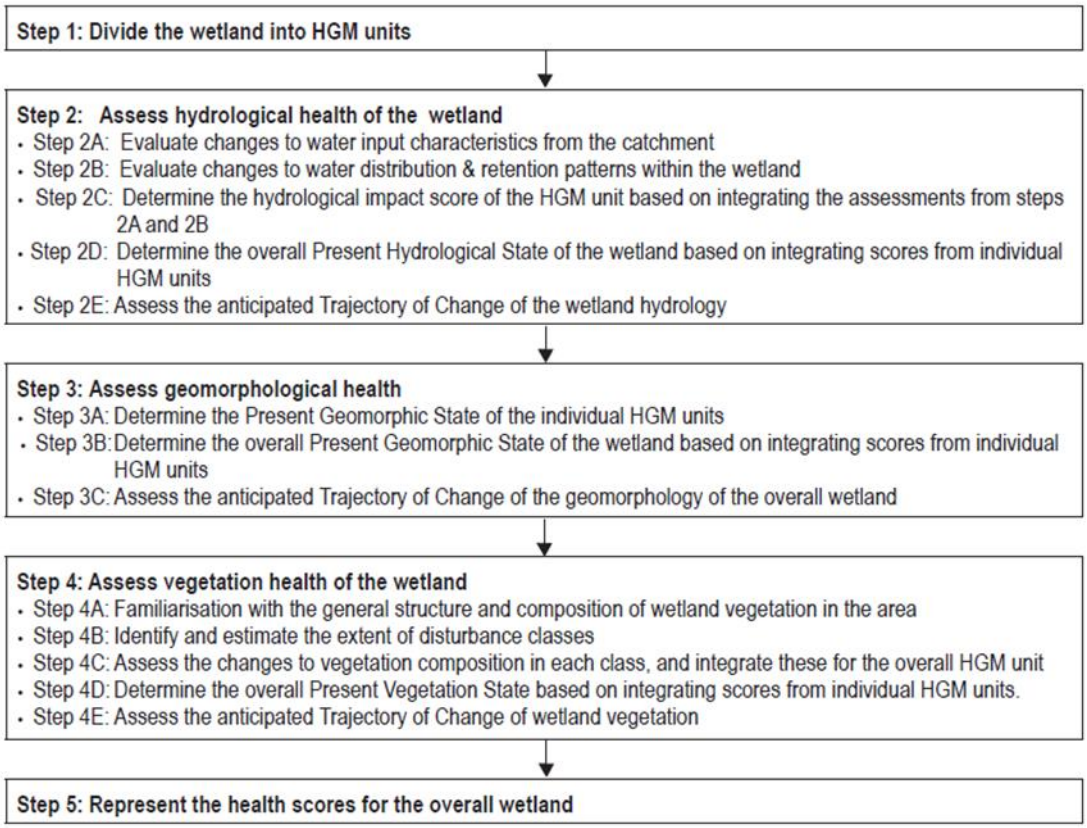
The wetlands were subsequently classified according to the classification procedure for inland systems (Level 2) developed by Ollis et al. (2013). The inland component of the Classification System has a tiered structure (see below diagram), which progresses from Regional Setting (Level 2) and Landscape 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 the wetlands, based on WET-Health (Macfarlane et al. 2007). WET-Health requires the identification of hydrogeomorphic (HGM) units and then assists in assessing the health of the identified HGM units using indicators based on geomorphology, hydrology and vegetation. A Wet-Health level 1 assessment was conducted to determine the PES of the wetlands on Viegulands Put.

The PES assessment is conducted by following a 5 step process:



The overall PES is then calculated using the following formula, to give a score ranging from 0 (pristine) to 10 (critically impacted in all respects):

$$\frac{((\text{Hydrology score}) \times 3) + ((\text{Geomorphology score}) \times 2) + ((\text{Vegetation score}) \times 2)}{7}$$

The PES categories used by WET-Health to describe the integrity of the wetlands are:

Description	Combined impact score	PES Category
Unmodified, natural.	0 – 0.9	**A**
Largely natural with few modifications. A slight change in ecosystem processes is discernible and a small loss of natural habitats and biota may have taken place.	1 – 1.9	**B**
Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact.	2 – 3.9	**C**
Largely modified. A large change in ecosystem processes and loss of natural habitat and biota and has occurred.	4 – 5.9	**D**
The change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat features are still recognizable.	6 – 7.9	**E**
Modifications have reached a critical level and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota.	8 - 10	**F**

Trajectory of Change classes, scores 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	Change score	Class Range	Symbol
Improve markedly	Condition is likely to improve substantially over the next five years	2	1.1 to 2.0	↑↑
Improve	Condition is likely to improve over the next 5 years	1	0.3 to 1.0	↑
Remain stable	Condition is likely to remain stable over the next 5 years	0	-0.2 to 0.2	→
Deterioration slight	Condition is likely to deteriorate slightly over the next 5 years	-1	-0.3 to -1.0	↓
Deterioration substantial	Condition is likely to deteriorate substantially over the next 5 years	-2	-1.1 to -2.0	↓↓

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 mean 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

a) <u>Wetland Functional Assessment</u>

To assessment of the ecosystem services supplied by the wetlands on Viegulands Put was conducted according to guidelines provided for a Level 2 assessment in WET-EcoServices (Kotze et al. 2007). 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.
			Provision of cultivated foods		The provision of areas in the wetland favourable for the cultivation of foods
		Cultural benefits	Cultural heritage		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

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

Due to the brief duration of the survey and the lack of seasonal coverage, the species list obtained during the site visit cannot be regarded as comprehensive. Ideally, a site should be visited several times during different seasons to ensure that the full complement of plant and animal species present is captured. However, this is rarely possible due to time and cost constraints. The survey was nevertheless conducted in such a manner to ensure all representative communities are traversed and therefore is likely to have included the majority of the dominant and common species present.

The site visit for the study took place during late winter-early spring, which is generally not a favourable time of the year, unless some early spring rain occurred. This was however not the case and therefore most grasses, annuals and other flowering plants were not in the most suitable condition for the survey. The best time to evaluate vegetation in the study area is after at least some summer rain when the vegetation has responded and is in an actively growing state. The aridity and patchy rainfall of the region however rarely provides ideal conditions for these urgent types of surveys. The results presented here can therefore only reflect the condition of the vegetation. Consequently, the timing of the site visit is considered to be a limiting factor and it is expected that some species of conservation concern were not visible during the time of sampling. Nevertheless, most of the common and significant species encountered were identifiable and therefore the condition of the veld did not have a major effect on the results.

The methodology used to assess the wetlands on site were mainly developed for- and best applied to the more temperate wetlands of South Africa. The suit of methodologies available to date do not provide for a comprehensive assessment of the ephemeral wetlands (pans) in the Northern Cape. This is mainly due to the fact that they are rarely wet and do not display those indicators typically used for wetland assessments in other parts of South Africa. Until recently, these systems have also received little attention in terms of scientific research. Therefore, the nature of the pans on site and the lack of fully applicable methodologies are regarded as a limiting factor to justify the impacts to- and sensitivity of these systems on site. Fortunately, the South African Environmental Observation Network is currently running a project that aims to characterise the ephemeral pans in the province. This will assist in the classification and more effective assessments of these pans in future.

3. DESCRIPTION OF THE AFFECTED ENVIRONMENT

3.1. Current and historic land use

The major land uses in the region are mining and agriculture. The site is classified as non-arable with low potential for grazing land and is generally not suited for cultivation.

Apart from the current prospecting application by Paul Thukgwi for diamonds, Viegulands Put is mainly used as grazing land for goats and cattle. A farmstead, with kraals and workers quarters, is also situated on the property. Historic activities on site are signified by remnants of burrow pit excavations and old cultivation fields, which are still clearly visible today (Figure 3).

3.2. Drainage and Quaternary Catchment

The study area falls within the Boegoeberg quaternary catchments D71C and D71D of the Lower Orange Water Management Area (Figure 4). The quaternary catchments have both been allocated a Present Ecological State (PES) of 'Moderately Modified' (C) by Smook et al. (2002) and information regarding mean annual rainfall, evaporation potential and runoff for the quaternary catchments is provided in Table 2. Watercourses on the study site that have been formally mapped include four ephemeral pans as well as drainage lines (Figure 5). However, after ground-truthing the site during the field survey, more ephemeral pans were discovered and the one second from the southern border was omitted. Please refer to the wetland assessment section for a complete account.

Table 2. Catchment characteristics for the Boesak quaternary catchments, as presented by Smook et al. (2002).

Quaternary catchment	Mean Annual Rainfall (mm)	Mean Annual Evaporation (mm)	Mean Annual Runoff (10^6 m^3)
D71C	250	2 350	4.75
D71D	248	2 350	4.96

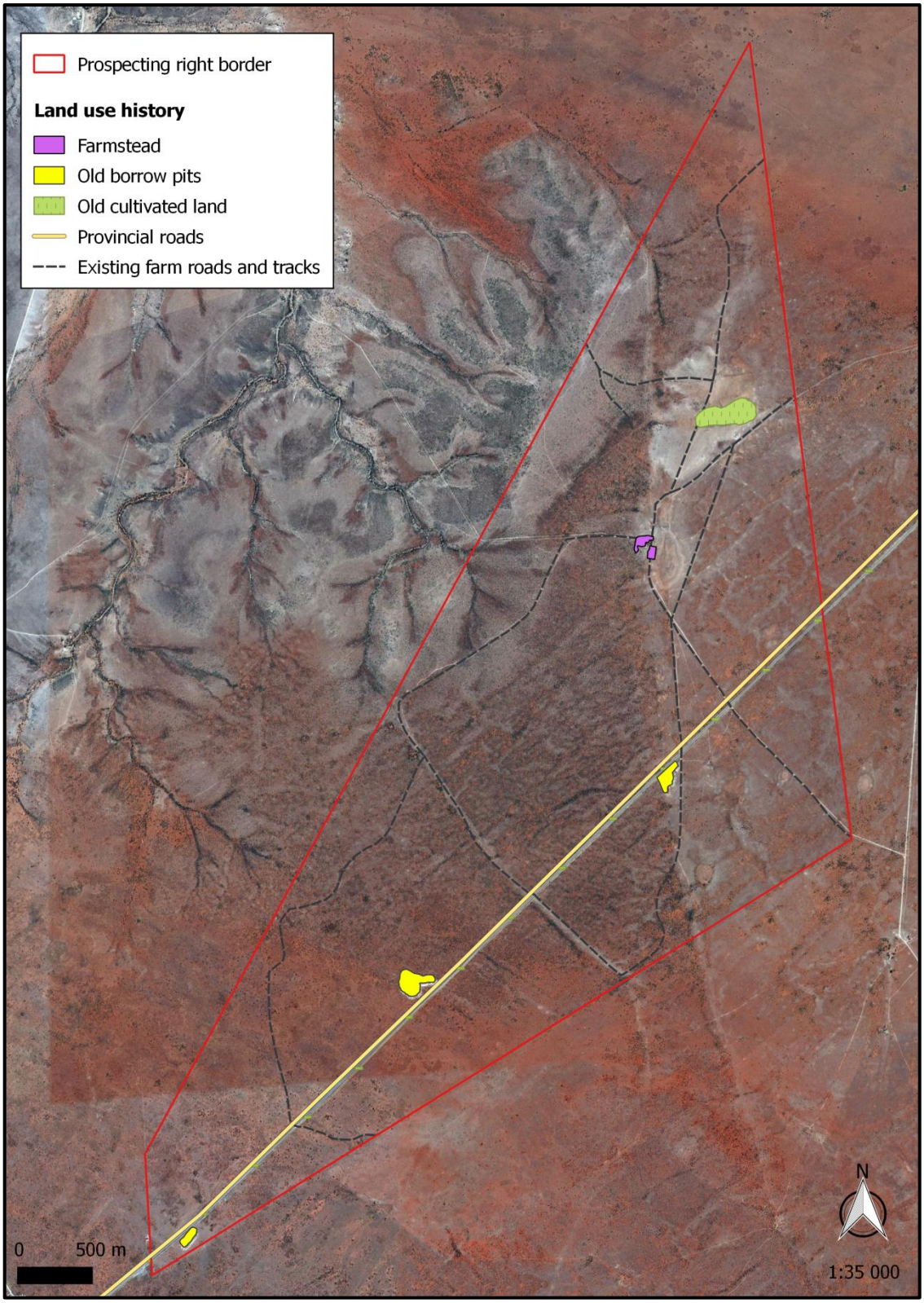


Figure 3. Evidence of the land use history on Viegulands Put.

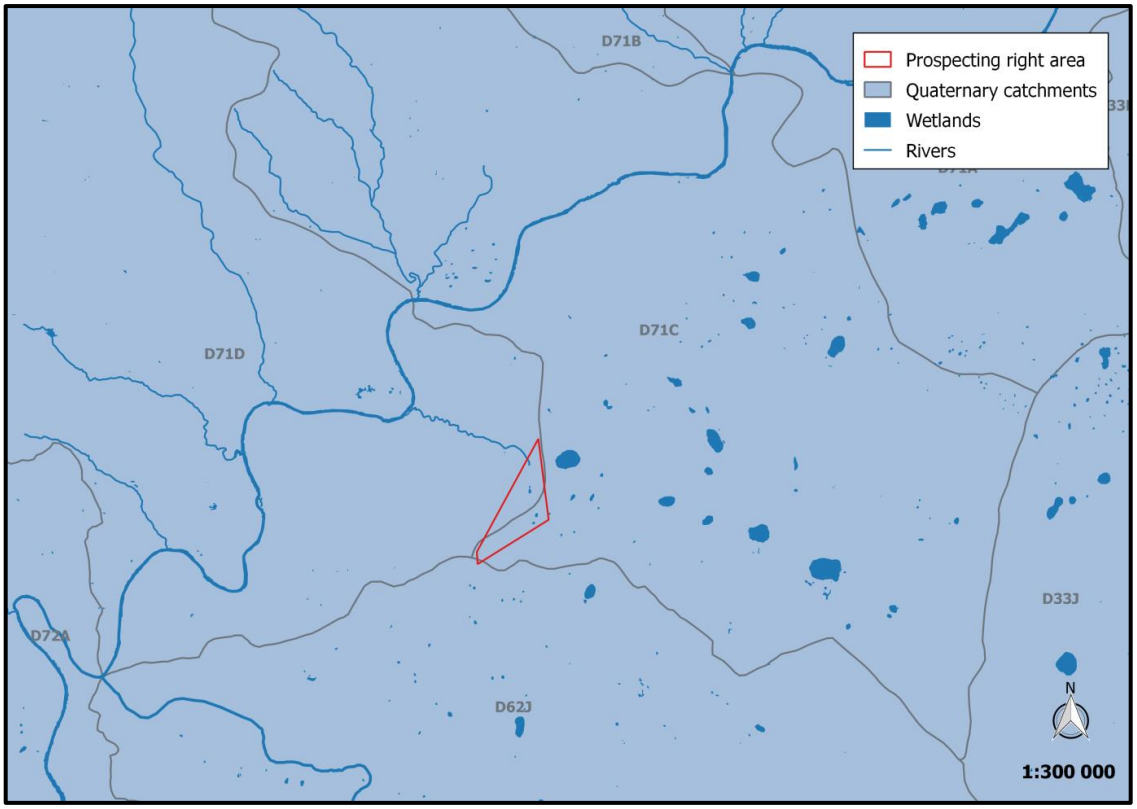


Figure 4. The locality of the proposed prospecting area in relation to the quaternary catchments of the Lower Orange Water Management Area.

3.3. Geology, soils and topography

According to Thomas (1995) the geological features on Viegulands Put mainly comprise tertiary deposits, where calcrete covers almost the entire site (Figure 6). Quaternary deposits of red sand from the Gordonia Formation occur in the northern corner, while Dwyka tillites of the Karoo Supergroup comprise the south-western corner of the study site.

Diamondiferous gravels are restricted to the alluvial terraces, mainly associated with the tertiary deposits of calcrete. It is important to note that the map of Thomas (1995) does not accurately reflect the geology on site and should be revisited by a geological survey. However, surface features are portrayed in the plant community descriptions.

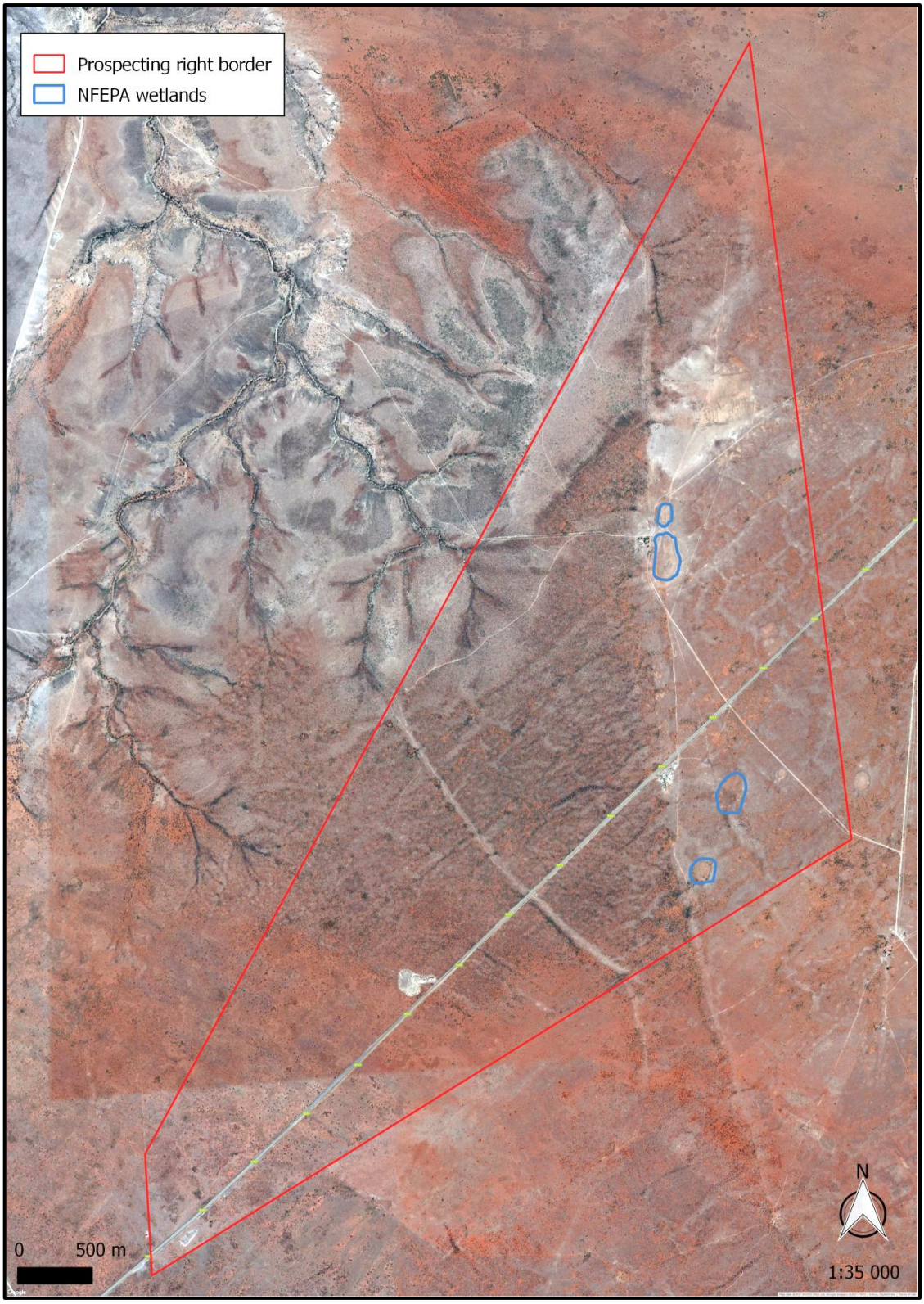


Figure 5. The location of formally mapped watercourses on the proposed prospecting right area.

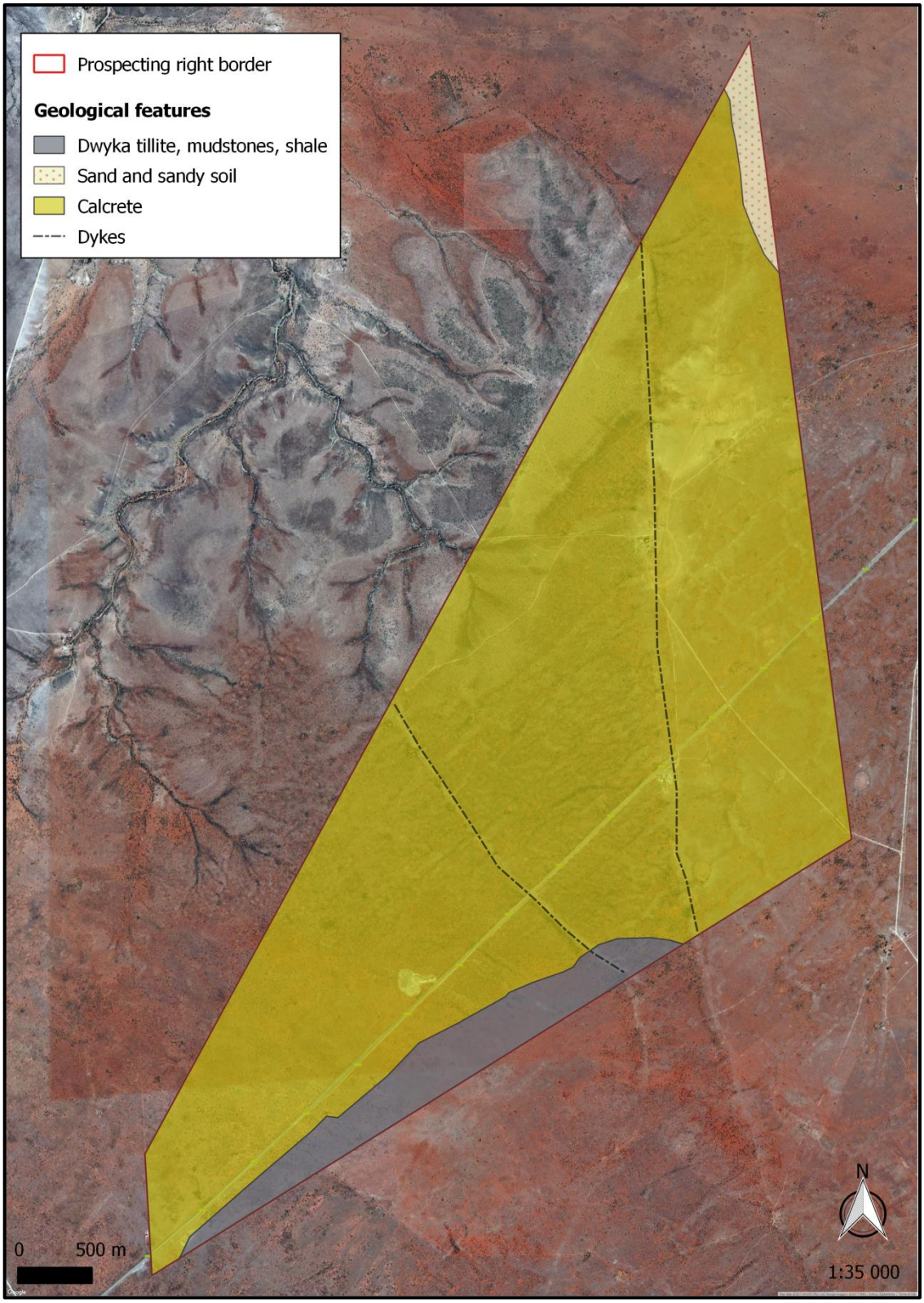


Figure 6. The distribution of geological features in the study area according to Thomas (1995).

The area is generally flat, characterised by level plains with some relief and altitudes around 1 060 m above sea level. Almost the entire study area occurs on a plateau, situated above a complex of ridges that drains north-westerly towards the Orange River. The terrain on site is indicated by a very gentle slope of 1 % running north-east.

The plains are closely associated with the Ag136 landtype (Figure 7). Here, red-yellow apedal soils, which are freely drained, with a high base status and a depth of less than 300 mm are found. The ridge represents the Fc568 landtype (Figure 7), where soils with minimal development (predominantly Glenrosa or Mispah forms) and usually shallow, occur on hard or weathering rock. Lime is generally present in the landscape.

3.4. Vegetation

3.4.1. 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), only one broad-scale vegetation units is present on site (Figure 8), i.e. Northern Upper Karoo. This vegetation map however does not reflect the true character of the site, because it has not been mapped at a very fine scale.

Northern Upper Karoo is found in the Northern Cape and Free State at altitudes between 1 000 and 1 500 m. It is mostly 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, but isolated hills of the Upper Karoo Hardeveld (in the south) and Vaalbos Rocky Shrubland (in the northeast) and 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. Geology include 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 soils to very shallow Glenrosa and Mispah forms. The most dominant landtypes are Ae, Ag and Fc. It is estimated that about 4 % of the unit 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.

Figure 7. Land types associated with the study area.

Figure 8. The broad-scale vegetation units (Mucina and Rutherford 2012) present in the study area.

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*. *Prosopis glandulosa,* a significant alien invader, is widely distributed in this unit.

3.4.2. Fine-scale vegetation patterns

The plant communities within the study area are delineated according to plant species correspondences, change in soil structure, topographical changes and disturbance regimes. The vegetation on site can be divided into five distinct units (Figure 9) and are described below. These community descriptions include unique characteristics and the dominant species found in each unit. A complete plant species list, including those species likely to occur in the area is presented in Appendix 1.

i) *Rosenia humilis - Enneapogon desvauxii* grassy shrubland on calcrete plains

This community falls in the east of the property (Figure 9) and occurs on shallow soil and calcrete, which constitute 10 % of the ground cover. It is typically represented as a low shrubland with the low-growing grass *Enneapogon desvauxii* occurring in between the shrubs (Figure 10). Taller shrubs are scattered very sparsely, but becomes slightly denser in the transition-zone with the Thornveld.

The low shrub layer is dominated by *Rosenia humilis*, but *Zygophyllum lichtensteinianum* is also very dominant. *Pentzia incana, Chrysocoma ciliata* and *Gnidia polycephala* is also very conspicuous. Other low-shrubs include *Lycium cinereum, Pentzia calcarea, Asparagus burchellii, Hertia pallens, Pteronia mucronata, Aptosimum spinescens, Barleria rigida, Cadaba aphylla, Eriocephalus eximius* and *Leonotis pentadentata. Phaeoptilum spinosum* is the most common taller shrub scattered across this community, while *Senegalia mellifera, Boscia albitrunca, Searsia burchellii, Searsia lancea* and *Ziziphus mucronata* subsp. *mucronata* is more sparsely distributed.

Apart from the dominant *E. desvauxii*, the grass layer is not well developed. Other grasses found here include *Eragrostis echinochloidea, Fingerhuthia africana, Aristida adscensionis, Eragrostis porosa* and *Stipagrostis obtusa*. *Setaria verticillata* is also found here, but only grows among the branches of some of the taller shrubs.

The herb layer is not well developed, or it might have been underrepresented as a result of the season during which the survey was undertaken. Nevertheless, the most common perennial herb found here, was *Aloe claviflora*.

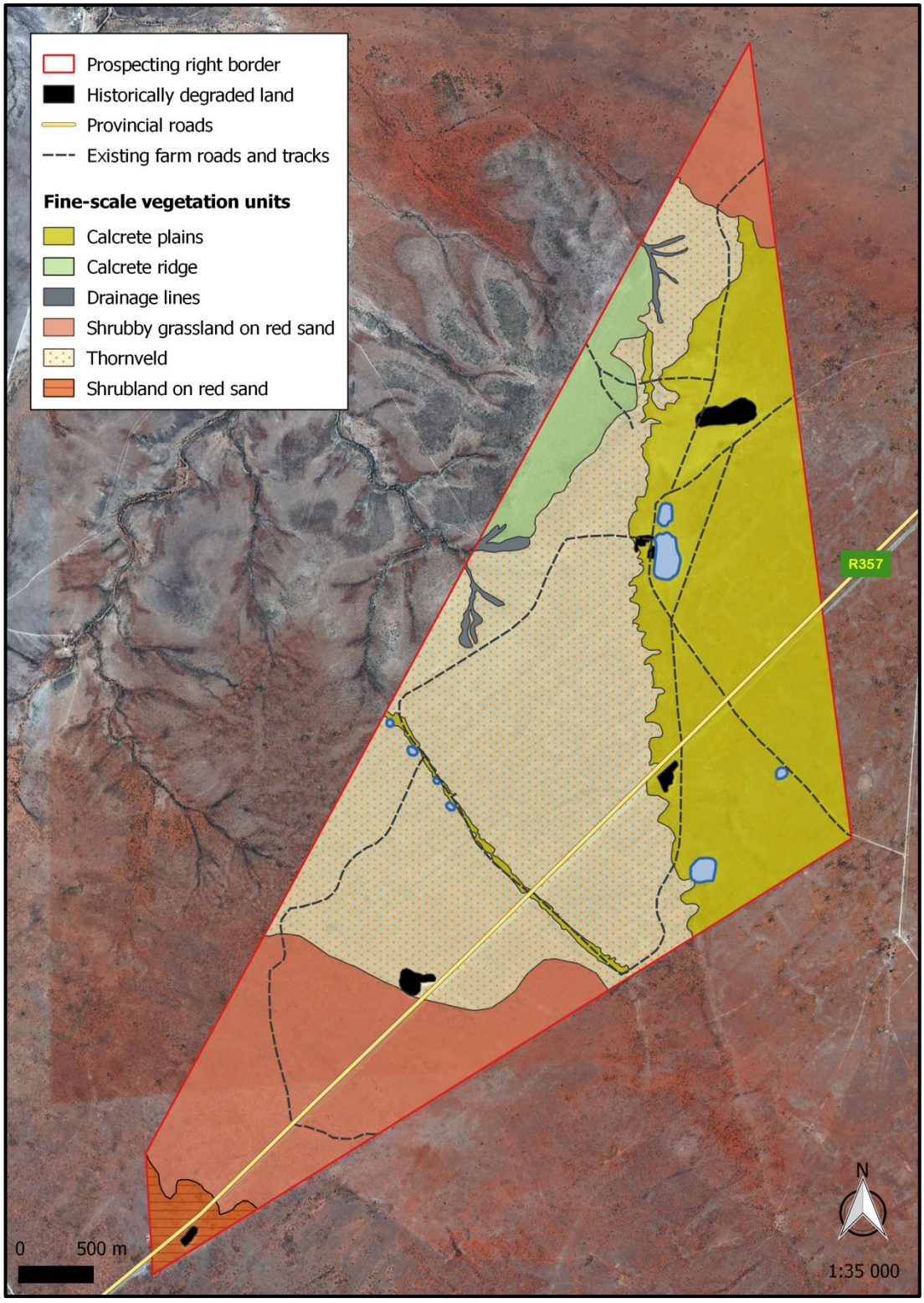


Figure 9. The distribution of fine-scale plant communities in the study area.

Figure 10. The calcrete plains are presented by low-shrubs occurring in a grassy matrix dominated by *Enneapogon desvauxii* (top) and are associated with shallow soils and calcrete (bottom).

Aloe claviflora is also protected in terms on the NCNCA. Other species protected in terms of this act include *Boscia albitrunca* (further protected according to the NFA), *Euphorbia braunsii, Hoodia gordonii, Larryleachia* sp. and *Lithops* sp. The latter four species were not recorded during the survey, but were confirmed to occur here through personal conversation with the landowner. No alien species were recorded here.

The portion in this community that was subject to historic cultivation constitutes a similar community structure as described above. However, the degradation has replaced *E. desvauxii* with bare soil and *Aristida adscensionis* occur in dense stands in

places. The fringes between the pristine communities are also dominated by dense *Aristida vestita* patches.

ii) *Senegalia mellifera* thornveld on rocky soil

This community is found in the centre of the property (Figure 9). The vegetation is presented as thornveld, where *Senegalia mellifera* shrubs are densely distributed in a shrubby grassland matrix on red sandy soil and rocks, which constitute 20 – 30% of the ground cover (Figure 11). A section of this community in the north, which occurs towards the ridges, grows on a calcrete substrate.

Figure 11. The Thornveld community is dominated by densely distributed *Senegalia mellifera shrubs* (top) and occurs on red sandy soil with rocks (bottom).

As mentioned above, *S. mellifera* is by far the most dominant tall shrub in this community, but *Boscia albitrunca* is also very common. *Phaeoptilum spinosum, Rhigozum trichotomum* and *R. obovatum* on the other are more sparsely scattered.

Low shrubs include *Zygophyllum lichtensteinianum, Barleria rigida, Eriocephalus eximius, Pentzia calcarea, Rosenia humilis, Asparagus burchellii, Lycium cinereum, Chrysocoma ciliata, Aptosimum marlothii, Tapinanthus oleifolius, Kleinia longiflora* and *Aizoon burchellii*.

The grass layer is dominated by *Aristida* and *Eragrostis* species, such as *Eragrostis annulata, E. curvula, Aristida adscensionis* and *Aristida congesta* subsp. *congesta*, but *Enneapogon desvauxii* is also very common. Other grasses, such as *Chloris virgata* and *Cenchrus ciliaris* is also found here. No herbs were encountered during the survey.

The nationally and provincially protected tree *Boscia albitrunca* was the only species of conservation concern encountered here and no exotic species were found in this community.

iii) *Stipagrostis uniplumis - Chrysocoma ciliata* shrubby grassland on red sand

This community is primarily located in the southern half of the study site, but a small portion also occurs in the northern corner of the property (Figure 9). It is primarily a grassland community with low-growing and tall shrubs scattered among the grasses (Figure 12). It is found on red sand, which constitutes approximately 20 % of the ground cover.

The grass stratum is well developed and dominated by *Stipagrostis* species, such as *S. uniplumis, S. ciliata* and *S. obtusa*. Other common grasses include *Enneapogon cenchroides, Eragrostis lehmanniana* and *Schmidtia pappophoroides,* while *Aristida congesta* subsp. *congesta*, *A. vestita, Eragrostis annulata, Triraphis purpurea* and *Setaria verticillata* occur more sporadically.

The shrub layer is dominated by low-shrubs, with *Chrysocoma ciliata* being most dominant, followed by *Pentzia calcarea* and *Monechma incanum*, but *Gnidia polycephala* and *Rosenia humilis* are also very common.

Figure 12. The vegetation on red sand (top) is predominantly a grassland community, with low-growing and tall shrubs scattered among the grasses (bottom). The bottom picture also depicts a patch of *Rhigozum trichotomum* that form dense stands in places across this community.

Other lower shrubs recorded here include *Asparagus burchellii, Lycium cinereum, Thesium lineatum, Aptosimum marlothii* and *Eriocephalus eximius*. The taller shrub *Rhigozum trichotomum* forms dense stands in places (Figure 12), while *Phaeoptilum spinosum* occurs as a sparsely scattered, but common shrub across this community. *Lycium hirsutum* is less common. Trees and tall shrubs are very sparsely scattered, but include *Boscia albitrunca*, *Prosopis glandulosa*, *Searsia burchellii* and *Senegalia mellifera*.

The herb layer was not well presented, but includes *Dicoma capensis* and *Sesamum capense. Boscia albitrunca* is the only species of conservation concern recorded here, while *Prosopis glandulosa* was the only exotic species found here.

iv) *Rhigozum trichotomum* shrubland on red sand

This community occurs as a very small patch in the southern corner of the study site Figure 9). The shrub *Rhigozum trichotomum* is conspicuously dominant and forms dense stands in a short grassy matrix (Figure 13). Red sandy soil and rock constitute 20 % of the ground cover (Figure 13).

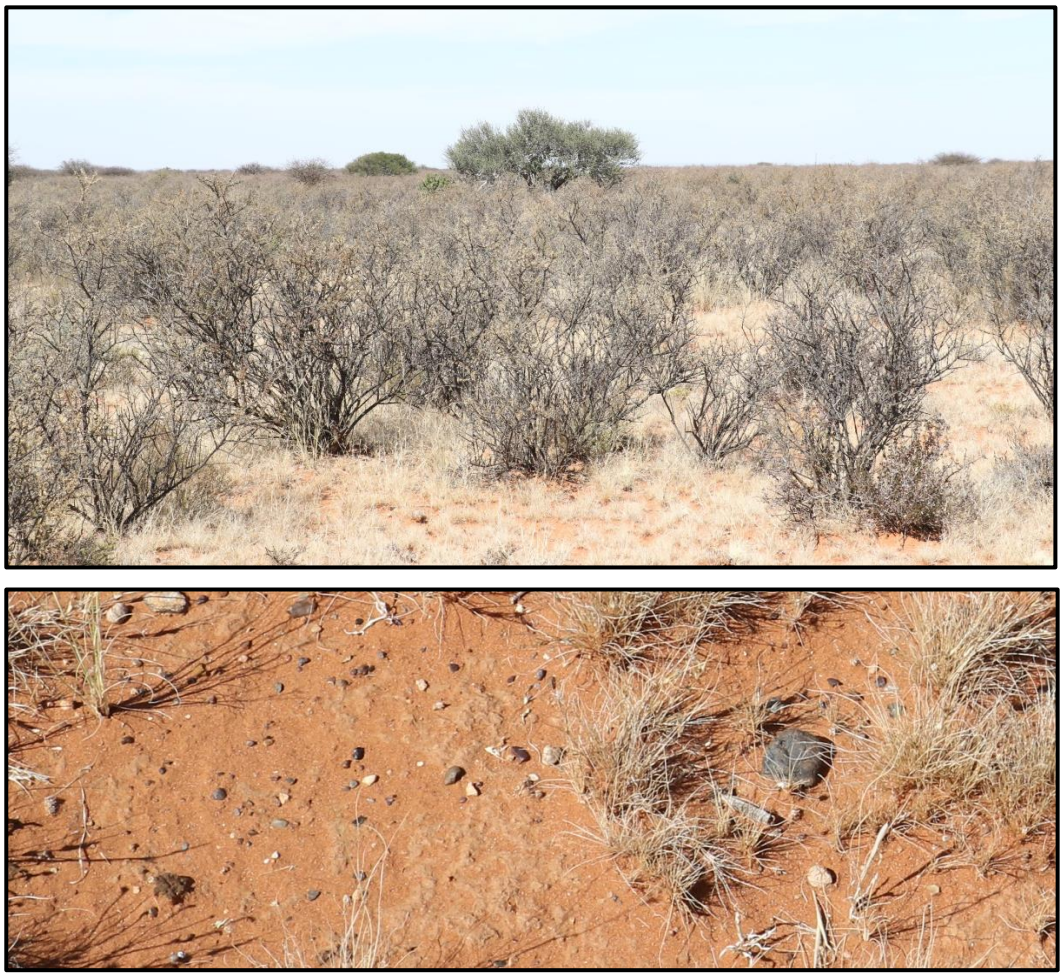


Figure 13. The vegetation in the southern corner of the study site is dominated by *Rhigozum trichotomum* (top) and grows on red, sandy, rocky soil.

Although *R. trichotomum* is most dominant, other shrubs found here include *Chrysocoma ciliata, Zygophyllum lichtensteinianum, Rosenia humilis, Asparagus capensis, Aptosimum marlothii, Lycium cinereum* and *L. hirsutum.* The protected tree *Boscia albitrunca* occurs scattered across this community.

The grass layer is dominated by *Enneapogon desvauxii,* but *Stipagrostis obtusa, S. uniplumis* and *Cenchrus ciliaris* are also found here. No herbs or exotic species were recorded in this community.

v) *Zygophyllum lichtensteinianum* - *Enneapogon desvauxii* shrubland on calcrete ridge

This community is located on the ridge that lines the property in the north-west (Figure 9). It is represented by shrubs in a short, grassy matrix and grows on shallow soils and calcrete, which constitutes 10 % of the ground cover (Figure 14).

The woody stratum is dominated by low shrub *Zygophyllum lichtensteinianum* but *Nymania capensis* is also very conspicuous and unique to this unit. Other common shrubs include *Thesium lineatum*, *Pteronia mucronata, Lycium cinereum, Rosenia humilis* and *Pentzia incana,* while *Hertia pallens, Chrysocoma ciliata, Asparagus burchellii, Aptosimum albomarginatum, Tapinanthus oleifolius, Peliostomum origanoides* and *Cadaba aphylla* occur more sporadically. Tall trees and shrubs such as *Boscia albitrunca, Rhigozum obovatum* and *Senegalia mellifera* are scattered across the unit.

Figure 14. The community that grows on the calcrete ridge comprise shrubs in a short, grassy matrix.

The grassy matrix is dominated by *Enneapogon desvauxii,* but *Stipagrostis obtusa, Fingerhuthia africana, Aristida vestita* and *Setaria verticillata* are also found here. The herb layer was underrepresented and no exotic species were recorded. Species of conservation concern include *B. albitrunca* and *Nymania capensis.*

vi) Ephemeral pans

Numerous pans occur on Viegulands Put (Figure 9). All of them are ephemeral and endorheic (Figure 15). Most of them are vegetated by herby grasslands, but differ somewhat in terms of species composition, depending on the grazing intensity and disturbances that these pans have been subjected to.

The pans of the study site is primarily dominated by grasses such as *Eragrostis truncata* and *Chloris virgata,* but *Aristida congesta* subsp. *congesta*, *Enneapogon desvauxii* and *Setaria verticillata* are also found on the pans. Low-growing herbs such as *Lotononis* sp. and *Hermannia cernua* are very common, but other herbs include *Geigeria filifolia* and *Selago albida*. Common low shrubs include *Pentzia calcarea*, *P. incana* and *Hertia pallens*, which all grow towards the edges of the pans.

Most of the pans towards the east do not have a woody fringe, while the pans towards the west are circled by a woody layer including *Ziziphus mucronata* subsp*. mucronata, Senegalia mellifera, Searsia burchellii, Lycium cinereum, Ehretia rigida* subsp*. rigida, Boscia albitrunca, Asparagus burchellii, Diospyros lycioides* subsp*. lycioides* and *Vachellia tortilis.*

Grazing pressure on some of these pans is evident and a trampling effect was observed during the site visit (Figure 16). Pans that have been heavily disturbed are infested by aliens such as *Prosopis glandulosa, Argemone ochroleuca, Datura ferox* and *Xanthium spinosum*.

Boscia albitrunca is the only species of conservation concern associated with the pans and is only found around the small pans in the west.

Figure 15. An example of ephemeral pans found on Viegulands Put.

Figure 16. The ephemeral pans found on Viegulands Put are subjected to grazing (top) and the trampling effect is evident through surface disturbances (bottom).

vii) Drainage lines

The drainage lines are restricted to the ridges in the north of the property, where it originates and drains towards the Orange River (Figure 9). The drainage channels are not well defined, but are distinguishable by the dense stands of *Cenchrus ciliaris* and high occurrence of rocks on the surface (Figure 17). *Enneapogon cenchroides* is also very common and *Setaria verticillata* is mainly restricted to the canopies of the trees and shrubs that form a "riparian" community along the drainage channels. These include *Boscia albitrunca* (protected)*, Ehretia rigida* subsp*. rigida, Senegalia mellifera, Rhigozum obovatum, Searsia burchellii* and *Ziziphus mucronata* subsp*. mucronata*.

Figure 17. The drainage lines are distinguishable from the adjacent communities by the dense stands of *Cenchrus ciliaris* that occupy the channels (top), as well as the high occurrence of rocks on the surface (bottom).

3.4.3. 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 recorded in the area are classified as least concern; a category which includes widespread and abundant taxa (Table 3). One species, i.e. *Hoodia gordonii* is classified as Data Deficient - Insufficient Information (DDD). According to SANBI (2017), it is a widespread species that has undergone decline since 2001 as a result of indiscriminate harvesting for its appetite suppressant properties. Unfortunately, data do not exist to quantify the degree of decline to the population. As a result, research on population recovery post harvesting and degree of impact of the harvesting over the past 10 years is required before this species can be accurately assessed. This species was not encountered during the site visit, but the landowner confirmed that they do occur on site. They are most likely to be found on the stony habitats of the study area.

Table 3. Plant species found in the study region that are of conservation concern.

FAMILY	Scientific name	Status	NFA	NCNCA
APOCYNACEAE	***Hoodia gordonii***	**DDD**		**S1**
APOCYNACEAE	*Larryleachia sp.*	-		S2
ASPHODELACEAE	*Aloe claviflora*	LC		S2
CAPPARACEAE	*Boscia albitrunca*	LC	X	S2
EUPHORBIACEAE	*Euphorbia braunsii*	LC		S2
MELIACEAE	*Nymania capensis*	LC		S2
MESEMBRYANTHEMACEAE	*Lithops* sp.	-		S2

Species from the study area that are protected in terms of the National Forests (NFA) Act No 84 of 1998 (Table 3) includes *Boscia albitrunca*. This species is also protected according the NCNCA. It is widespread across the property, with the most pronounced occurrence in the Thornveld and drainage lines at high densities of five individuals per hectare. They are mainly found as trees of up to 3 m in height and 5 m in canopy width, but smaller individuals as small as 80 cm x 80 cm also occur (Figure 18). It is predicted that many of these individuals will be affected by the Viegulands Put prospecting operation. In order to damage or remove any protected trees (seedlings to adults) an application must be submitted to the Northern Cape Department of Agriculture, Forestry and Fisheries (DAFF) and a licence obtained from DAFF at least three months prior to such activities.

Specially protected species in terms of Schedule 1 of the Northern Cape Nature Conservation (NCNCA) Act No. 9 of 2009 (Table 3) that are known from the study area include *Hoodia gordonii.* Those protected in terms of Schedule 2 of the NCNCA are listed in Table 3. Apart from the already mentioned *Boscia albitrunca,* others that were encountered during the site visit include *Aloe claviflora* and *Nymania capensis*. *Aloe claviflora* is mainly found on the calcrete plains at low densities of <1 per hectare and an average size of 50 cm x 60 cm, while *N. capensis* is restricted to the calcrete ridge at high densities of eight individuals per hectare and an average size of 1 m in height and 50 cm in width (Figure 19). The remaining species (*Euphorbia braunsii*, *Lithops* sp. and *Larryleachia* sp.) were not encountered during the field survey, but the land owner confirmed that they also occur on the rocky habitats of the property.

A projection for species of conservation concern is presented in Table 4 and a photographic guide to those species is attached as Appendix 3. Please note that the projections are only rough estimates to provide some form if indication as a guideline for species to be affected. It is impossible to confirm at this stage how large the final affected area will be as well as exactly where the project activities will take place. Therefore a “worst-case scenario” approach was applied on the assumption that at least half of each community will be transformed by the operation.

In addition to those protected species listed above; according to Section 51(2) of NCNCA, a permit is required from the Northern Cape, Department of Environment and Nature Conservation (DENC) for any large-scale clearance of all indigenous (Schedule 3) vegetation, before such activities commence.

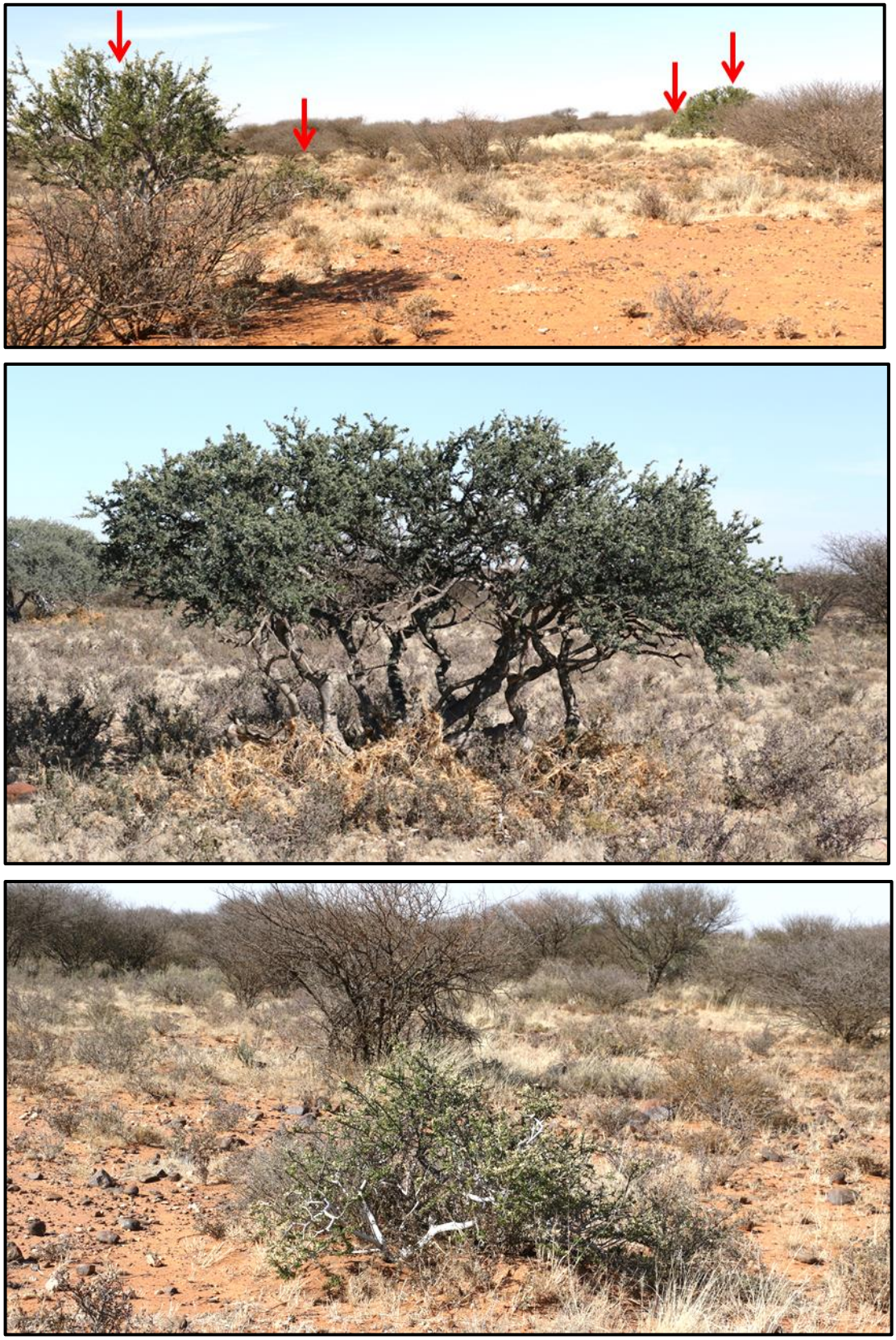


Figure 18. The protected tree *Boscia albitrunca* occurs widespread across the study site, but are more pronounced in the Thornveld, where they occur at high densities (top). They are primarily found as large trees (middle) but smaller individuals also occur (bottom).

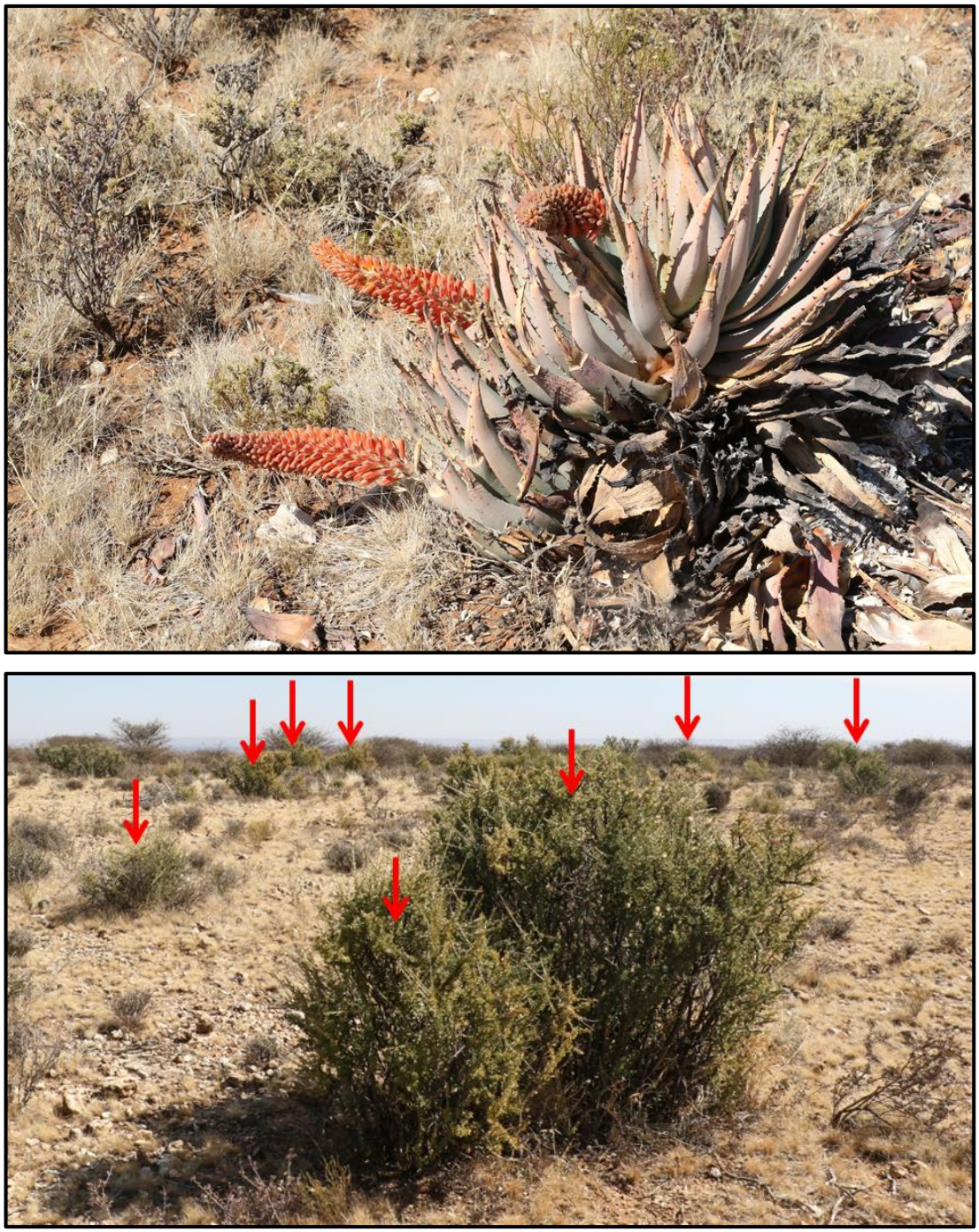


Figure 19. The protected *Aloe claviflora* (top) is mainly found on the calcrete plains, while *Nymania capensis* (bottom) is restricted to the calcrete ridge, where it occurs at high densities.

Table 4. A projection of community sizes and species of conservation concern found in the study area.

Communities	Total size	Predicted extent to be affected	Associated species of conservation concern	Population density (ind/ha)	Estimated population to be affected
Senegalia mellifera thornveld on rocky soil	± 740 ha	± 370 ha	*Boscia albitrunca*	5	± 1 850
Stipagrostis uniplumis - Chrysocoma ciliata shrubby grassland on red sand	± 340 ha	± 170 ha	*Boscia albitrunca*	1	± 170
Rhigozum trichotomum shrubland on red sand	± 26 ha	13 ha	*Boscia albitrunca*	1	± 13
Rosenia humilis - Enneapogon desvauxii grassy shrubland on calcrete plains	± 500 ha	250 ha	*Boscia albitrunca* *Aloe claviflora*	<1 <1	> 200 > 200
Zygophyllum lichtensteinianum - Enneapogon desvauxii shrubland on calcrete ridge	± 74 ha	37 ha	*Boscia albitrunca* *Nymania capensis*	1 8	± 37 ± 297
Drainage lines	± 10 ha	5 ha	*Boscia albitrunca*	3	± 15
Ephemeral pans	± 10 ha	5 ha	*Boscia albitrunca*	<1	< 5

3.4.4. 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 5). All declared weeds and invasive species recorded in and around the study area are listed in Table 6, along with their categories according to CARA, NEMBA and NCNCA.

Table 5. 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 6. A list of declared weeds and invasive species recorded in the study area.

Scientific name	Common name	CARA	NEMBA	NCNCA
Argemone ochroleuca	White - flowered Mexican poppy	1	1b	S6
Datura ferox	Large thorn apple	1	1b	S6
Prosopis glandulosa var. *glandulosa*	Honey mesquite	2	3	S6
Xanthium spinosum	Spiny cocklebur	1	1b	S6

3.4.5. 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, which were recorded in and around the study area, are listed in Table 7.

Table 7. A list of declared indicators of bush encroachment in the Northern Cape recorded in the study area.

Scientific name	Common name
Senegalia mellifera	Black thorn
Vachellia tortilis subsp. *heteracantha*	Umbrella thorn
Rhigozum trichotomum	Three-thorn rhigozum

3.5. 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 or specially protected 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.

The landscape features, i.e. plains, ridges, ephemeral pans and drainage lines provide the potential for a variety of habitats to faunal communities. The micro-habitats provided by pristine terrestrial vegetation are likely to host a variety of small mammals and reptiles, while the ephemeral pans are likely to accommodate a number of aquatic species and important bird species when inundated. The number of trees and tall shrubs across the site also provide ample breeding and nesting sites for birds.

3.5.1. Mammals

As many as 50 terrestrial mammals and nine bat species have been recorded in the region (see Appendix 2), of which Steenbok, South African Ground Squirrel, Yellow Mongoose and signs of recent Aardvark, Cape Porcupine and African Mole Rat activity were encountered during the site visit.

Virtually all mammals of the study area are protected; either according to Schedule 1, 2 or 3 of NCNCA (see Appendix 2). Eighteen mammal species of conservation concern potentially occur in the area (Table 8), of which 12 are listed either in the IUCN or South African Red Data Book. Those that are specially protected are also indicated in Table 8.

Table 8. Mammal species of conservation concern that are likely to occur in the region Conservation values are indicated in terms of the international (IUCN) Red List, the South African Red Data Book (SA RDB) and Schedule 1 of the Northern Cape Nature Conservation Act (NCNCA).

Scientific name	Common name	IUCN	SA RDB	NCNCA
Eidolon helvum	African Straw-coloured Fruit-bat	NT		
Rhinolophus denti	Dent's Horseshoe Bat		NT	
Rhinolophus clivosus	Geoffroy's Horseshoe Bat		NT	
Rhinolophus darlingi	Darling's Horseshoe Bat		NT	
Orycteropus afer	Aardvark			X
Gerbilliscus leucogaster	Bushveld Gerbil		DD	
Manis temminckii	Ground Pangolin	VU	VU	X
Suncus varilla	Lesser Dwarf Shrew		DD	
Atelerix frontalis	South African Hedgehog		NT	
Proteles cristata	Aardwolf			X
Felis silvestris	African Wild Cat			X
Felis nigripes	Black-footed Cat	VU		X
Vulpes chama	Cape Fox			X
Hyaena brunnea	Brown Hyena	NT		X
Otocyon megalotis	Bat-eared Fox			X
Poecilogale albinucha	African Striped Weasel		DD	X
Ictonyx striatus	Striped Polecat			X
Mellivora capensis	Honey Badger		NT	X

Of these, Aardvark activities were evident on site, especially in the shrubby grassland on red sand, where many active aardvark holes occur, but also on the calcrete plains (Figure 20). Termitaria are also scattered prominent features of the sandveld communities (Figure 21) and are strongly linked to aardvark activities. The protected bat species, Bushveld Gerbil, Aardwolf, Cape Fox, Bat-eared Fox, African Striped Weasel, African Wild Cat, Honey Badger and Striped Polecat all have a high chance of occurring across the site, given their wide habitat tolerances and preference for the habitat found on site. The Lesser Dwarf Shrew also has a high possibility to occur on site based on its termite mound affinity.

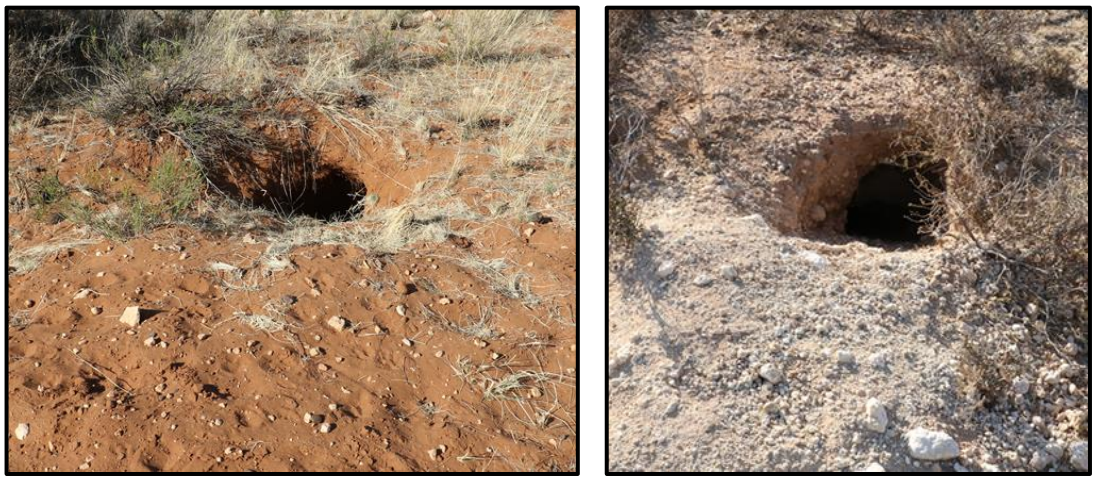


Figure 20. Aardvark burrows that were encountered on site.

Figure 21. Termitaria are prominent features on the plains of the study area.

Ground Pangolin, South African Hedgehog and Black-footed cat may potentially occur on site on account of their preferences for arid areas. They are however rather skittish and therefore they will most likely occur very seldomly. The Brown Hyaena might be present, but has a low potential to be found on site mainly based on the fact that farm fences are restricting their occurrences across their natural distribution range.

3.5.2. Reptiles

The Viegulands Put prospecting area lies within the distribution range of at least 36 reptile species (see Appendix 2) of which the spotted sand lizard was encountered during the field survey. Reptiles expected to be associated with the ephemeral pans, include the marsh terrapin, especially during periods of inundation. 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 (see Appendix 2). Specially protected species include *Karusasaurus polyzonus* (Southern Karusa Lizard) and *Chamaeleo dilepis dilepis* (Namaqua Chamaeleon).

3.5.3. Amphibians

Eleven amphibian species are known from the region (Appendix 2), indicating that the site does not potentially have a diverse frog community. This is however normal for an arid area. No natural permanent water was observed in site that would represent suitable breeding habitats for most of these species, but the ephemeral pans will be important during periods of inundation. As a result, only those species which are relatively independent of water are likely to occur regularly in the area.

The Giant Bull Frog (*Pyxicephalus adspersus*) is listed as Near Threatened 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 numerous ephemeral pans on site could potentially provide the ideal habitat for this species. All other amphibians of the study area are protected according to Schedule 2 of NCNCA (see Appendix 2).

3.5.4. Avifauna

The study site does not fall within or near; i.e. within 100 km, of 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 and all of these species are protected either according to Schedule 1, 2 or 3 of NCNCA (see Appendix 2). This suggests that the area has been reasonably well sampled and that the species list is likely to be fairly comprehensive.

As many as 25 listed bird species are known from the region, all of which are classified as Vulnerable, Near Threatened or Endangered (Table 9). Trees and shrubs, especially *Senegalia mellifera* was observed to be key hosts for bird nests on site (Figure 22).

All birds are protected either according to Schedule 1, 2 or 3 of NCNCA (see Appendix 2). Those that are specially protected (Schedule 1) are also listed in Table 9. A number of these are expected to occur on site either as residents or by occasionally passing over the area. Of these, the Kori Bustard was seen during the site visit. The ephemeral pans could potentially attract protected water birds, such as Chestnut-banded Plover, Maccoa Duck, Lesser Flamingo, Greater Flamingo and Greater Painted-snipe when inundated.

Figure 22. *Senegalia mellifera* shrubs were observed to be key hosts for bird nests on site.

Table 9. Bird of conservation concern that are likely to occur on site. Species are indicated in terms of the SA Bird Atlas and Schedule 1 of the Northern Cape Nature Conservation Act (NCNCA).

Scientific name	Common name	SA Bird Atlas	NCNCA
Accipiter badius	Shikra		X
Anthropoides paradisea	Blue Crane	NT	
Aquila rapax	Tawny Eagle	EN	X
Aquila verreauxii	Verreaux's Eagle	VU	X
Ardeotis kori	Kori Bustard	NT	
Bubo africanus	Spotted Eagle-Owl		X
Bubo lacteus	Verreaux's Eagle-Owl		X
Buteo rufofuscus	Jackal Buzzard		X
Buteo vulpinus	Steppe Buzzard		X
Caprimulgus europaeus	European Nightjar		X
Caprimulgus rufigena	Rufous-cheeked Nightjar		X
Caprimulgus tristigma	Freckled Nightjar		X
Charadrius pallidus	Chestnut-banded Plover	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	X
Glaucidium perlatum	Pearl-spotted Owlet		X
Gyps africanus	White-backed Vulture	CR	X
Gyps coprotheres	Cape Vulture	EN	X
Haliaeetus vocifer	African Fish-Eagle		X
Hieraaetus pennatus	Booted Eagle		X
Leptoptilos crumeniferus	Marabou Stork	NT	X
Melierax gabar	Gabar Goshawk		X
Milvus migrans	Black Kite		X
Neotis ludwigii	Ludwig's Bustard	EN	X
Oxyura maccoa	Maccoa Duck	NT	
Phoenicopterus minor	Lesser Flamingo	NT	X
Phoenicopterus ruber	Greater Flamingo	NT	X
Polemaetus bellicosus	Martial Eagle	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	VU	X
Torgos tracheliotus	Lappet-faced Vulture	EN	X
Tyto alba	Barn Owl		X

3.6. Wetlands

The National Water Act (36 of 1998) (NWA) provides a framework to protect water resources. According to this Act, 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.

3.6.1. Wetland delineation and classification

At least eight wetlands and two drainage lines were identified on site. The wetlands have a total area of ± 10 ha of which all fall within the study site. The drainage lines originate on the ridges in the north of the site and runs from south-east to north-west where they eventually flow into the Orange River. They have a total length of ± 12 km, of which only the first 400 - 600 m occur within the study site. The drainage lines are not considered to be true wetlands, but they are also regarded as watercourses. All the watercourses found on Viegulands Put are indicated in Figure 23, along with their buffer zones. These 100 m buffers are required by the NWA to be assigned to all watercourses that fall within an area earmarked for development, to minimise anthropogenic impacts.

All the wetlands and drainage lines are found on slope terrain on soils underlain by calcrete. The drainage lines are natural, ephemeral watercourses that only flow during precipitation runoff events. They are characterised by dense stands of *Cenchrus ciliaris* and high occurrence of pebbles and rocks on the surface (Figure 17).

The wetlands are all classified as natural endorheic depressions (Figure 24 and Table 10). Water enters the depressions primarily through direct precipitation and overland inflow. The wetlands are however rarely inundated.

The depression floors are primarily vegetated with grasses and low-growing herbs (see section 3.4.2), with some pans (nr 4 to 8) having a woody fringe. No aquatic plants were recorded on the pans. Some bare patches occur on the pans, but these are most likely a function of the grazing and trampling intensities. However, Pan 2 is primarily bare, which is attributable to the alterations made to the pan (see section 3.6.2). The soils are characterised by shallow clay loam soil (average depth of > 20 cm) and no visible evaporites occur (Figure 25). Rocks and pebbles lie scattered on the surface of most pans (Figure 26).

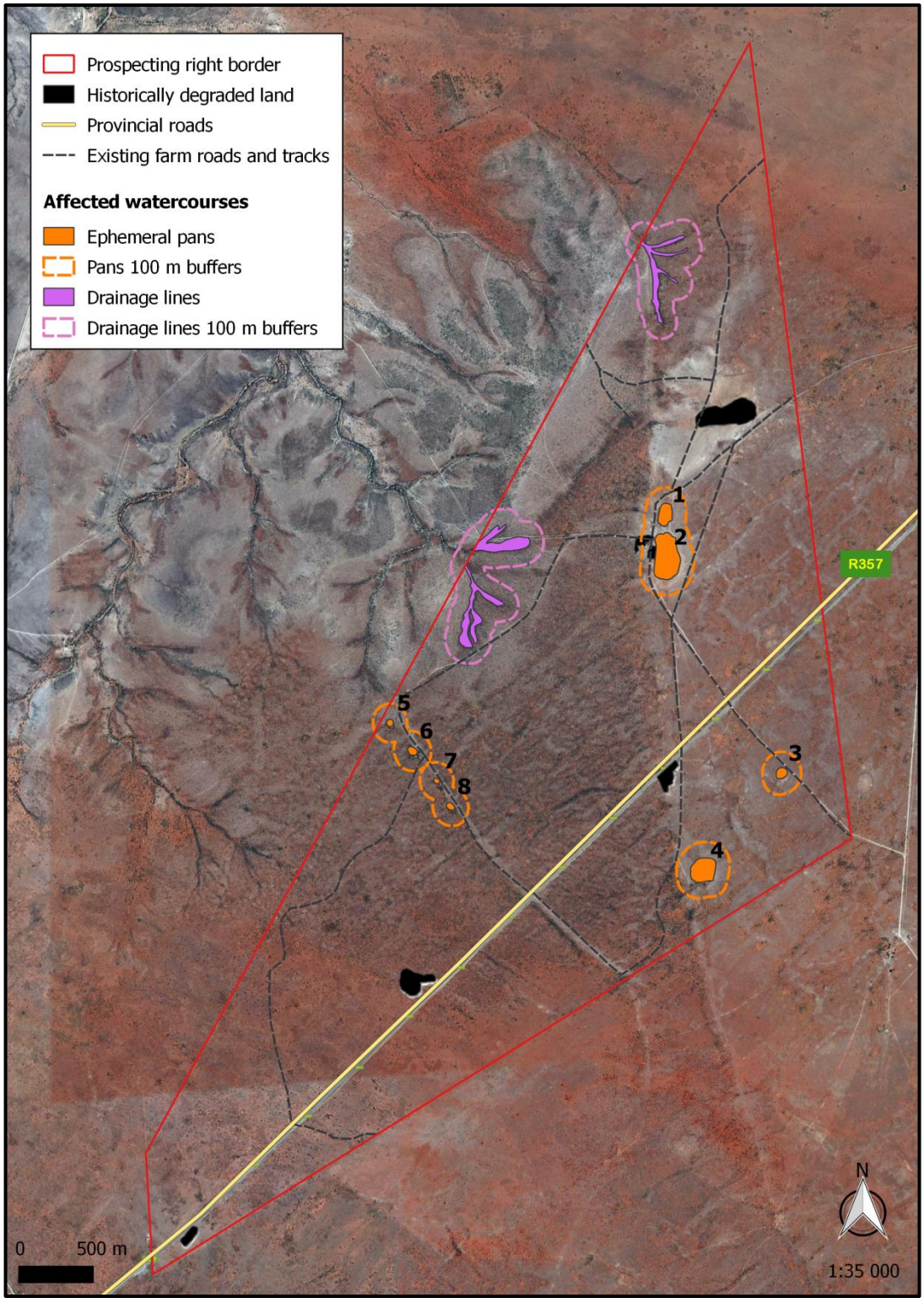


Figure 23. Watercourses identified within the study area.

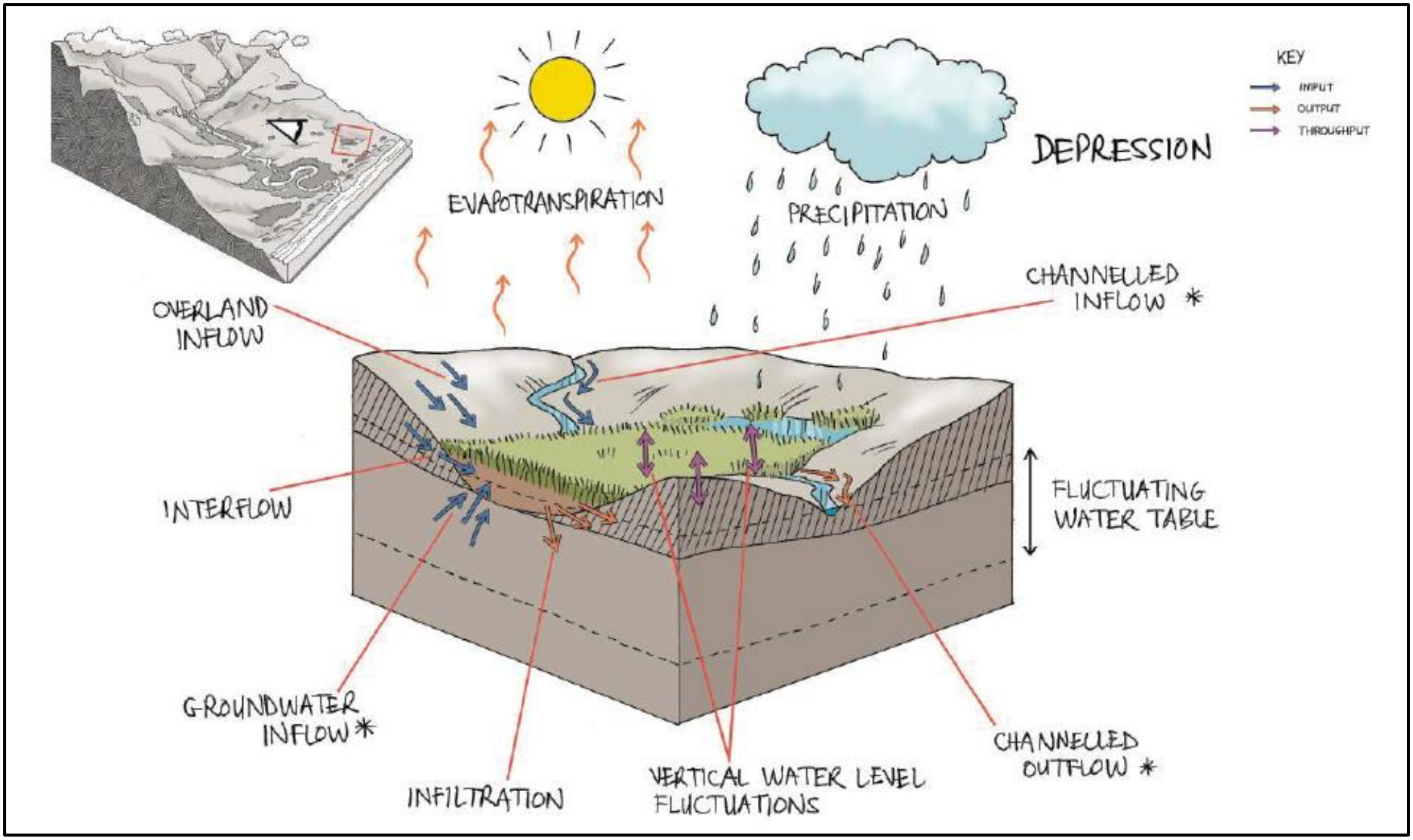


Figure 24. Conceptual illustration of a depression, showing the typical landscape setting and the dominant inputs, throughputs and outputs of water (Ollis et al. 2013).

Table 10. Summary of the results for the application of Levels 1 to 4 of the Classification System (Ollis et al. 2013), to the ephemeral pans on Viegulands Put. The confidence rating of classification at each level is given in brackets.

	Level 1	Level 2		Level 3	Level 4: HGM Unit		
	System type	DWA Ecoregion	NFEPA WetVeg Group	Landscape Unit	4A	4B	4C
PAN 1	INLAND (high)	Nama Karoo (high)	Upper Nama Karoo (high)	Slope (high)	Depression (high)	Endorheic (high)	Without channelled inflow (high)
PAN 2	INLAND (high)	Nama Karoo (high)	Upper Nama Karoo (high)	Slope (high)	Depression (high)	Endorheic (high)	Without channelled inflow (high)
PAN 3	INLAND (high)	Nama Karoo (high)	Upper Nama Karoo (high)	Slope (high)	Depression (high)	Endorheic (high)	Without channelled inflow (high)
PAN 4	INLAND (high)	Nama Karoo (high)	Upper Nama Karoo (high)	Slope (high)	Depression (high)	Endorheic (high)	With channelled inflow (medium)
PAN 5	INLAND (high)	Nama Karoo (high)	Upper Nama Karoo (high)	Slope (high)	Depression (high)	Endorheic (high)	Without channelled inflow (high)
PAN 6	INLAND (high)	Nama Karoo (high)	Upper Nama Karoo (high)	Slope (high)	Depression (high)	Endorheic (high)	Without channelled inflow (high)
PAN 7	INLAND (high)	Nama Karoo (high)	Upper Nama Karoo (high)	Slope (high)	Depression (high)	Endorheic (high)	Without channelled inflow (high)
PAN 8	INLAND (high)	Nama Karoo (high)	Upper Nama Karoo (high)	Slope (high)	Depression (high)	Endorheic (high)	Without channelled inflow (high)

Figure 25. The pans are characterised by shallow clay loam soil, with no visible evaporites on the surface.

Figure 26. Rocks and pebbles lie scattered across the surfaces of the pans.

Please Note: The pan second from the southern border (Figure 5), which has been formally mapped, was omitted as a true wetland after the field assessment. This is based on the fact that the vegetation found in this area does not correspond to that of the other pans. It lacks all of the species typically found in the pans on site, i.e. *Chloris virgata, Lotononis* sp., *Hermannia cernua* and *Eragrostis truncata*. The community composition best replicates the calcrete plains matrix in having the dominant *Rosenia humilis,* but they are scattered among a dense grassy patch dominated by *Aristida* species (Figure 27). It also does not have a clear delineation signature that validates it to be a true wetland.

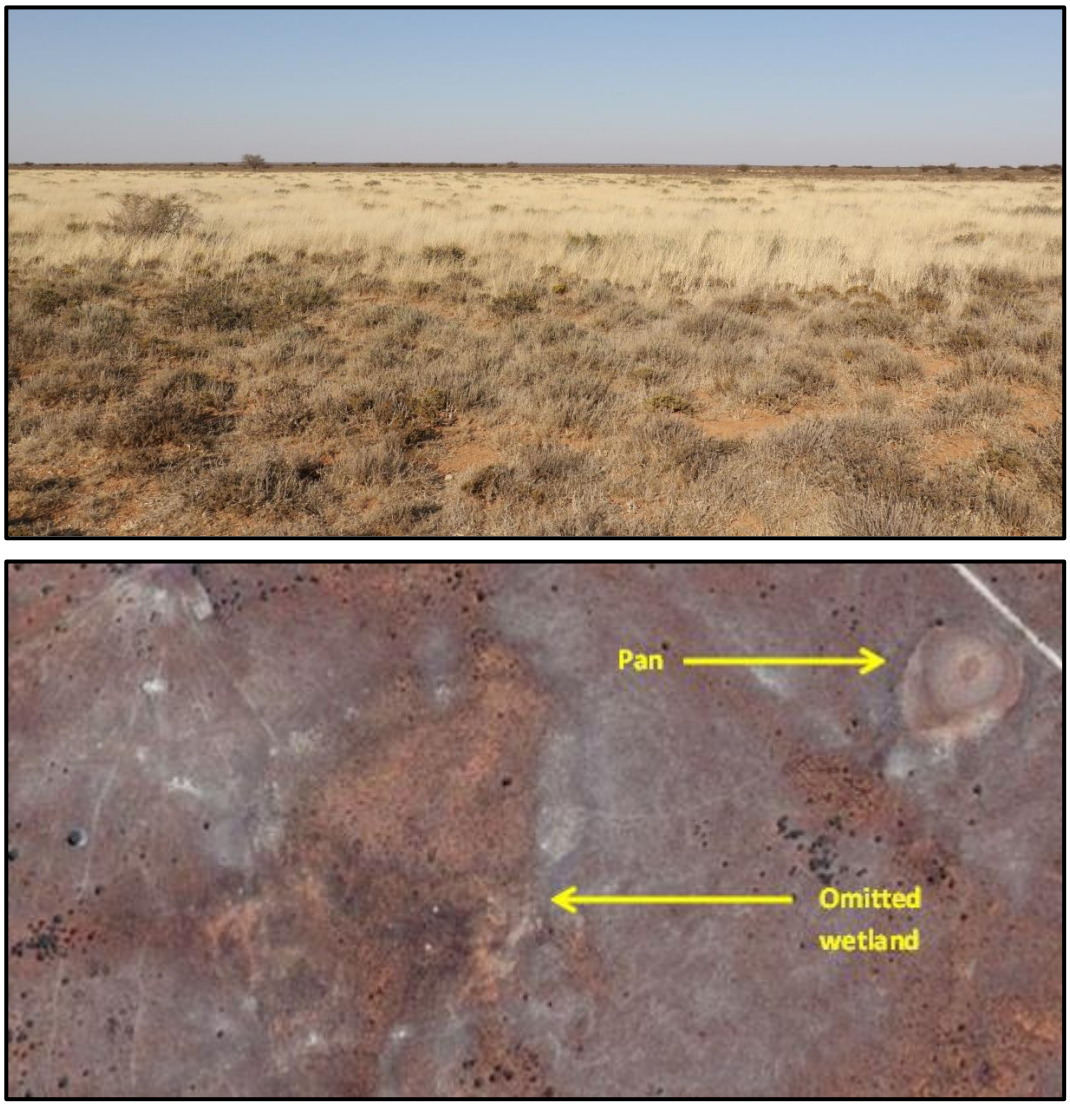


Figure 27. The community composition of the omitted wetland best replicates the calcrete plains matrix, but a dense *Aristida* patch is found among the shrubs (top) and the omitted pan does not have the typical pan signature (bottom).

3.6.2. Wetland Health Assessment (PES)

The drainage lines were not comprehensively assessed in terms of PES, EIS or functionality, but its hydrological function has not been modified, at least not in the direct vicinity of the study site, and therefore its ecological integrity is still intact.

Most of the pans on Viegulands Put are largely natural (PES A, Table 11), while Pans 2 and 4 are regarded to be largely natural with few modifications (PES B, Table 11) and Pan 1 is regarded as being largely modified (PES D, Table 11). Key impacts identified on these pans are shown in Figure 28.

For most pans, disturbances caused by grazing and trampling are evident, but these effects are most significant on Pans 1, 2 and 4. Pan 2 has also been slightly modified with a number of roads and infrastructure that traverses the edge of the pan in the west. Pan 1 is also traversed by fence-lines and roads, but has been largely modified, primarily due to the dam wall that has been erected at the southern end of the pan. This wall is also expected to have modified the hydrological regime of Pan 2 slightly. The wall dams water in Pan 1 and retains it for longer than what it naturally would have. This is expected to alter its hydrological regime and associated aquatic ecosystem dependent on it. This prolonged availability of water most likely also increases the trampling affect around the water point and therefore this pan is primarily bare, with a high occurrence of alien invasive species. Pan 4 also has a number of *Prosopis* trees in the pan centre as well as along the fringe.

Table 11. Summary of results of a Wet-Health level 1 assessment (Macfarlane et al. 2007) to the pans on Viegulands Put.

Pan	Ha	HGM Extent (%)	Hydrology		Geomorphology		Vegetation	
			Impact score	Change score	Impact score	Change score	Impact score	Change score
1	1.2	100	3	0	1	0	1.5	0
	Present State Categories		C	→	B	→	B	→
							Overall PES	**4 (D)**
2	4.8	100	0.7	0	1	0	0.4	0
	Present State Categories		A	→	B	→	A	→
							Overall PES	**1.5 (B)**
3	0.5	100	0	0	0.4	0	0.3	0
	Present State Categories		A	→	A	→	A	→
							Overall PES	**0.5 (A)**
4	2.6	100	0	0	1	0	0.5	0
	Present State Categories		A	→	A	→	A	→
							Overall PES	**1.5 (B)**
5	0.2	100	0	0	0.5	0	0.3	0
	Present State Categories		A	→	A	→	A	→
							Overall PES	**0.5 (A)**
6	0.3	100	0	0	0.5	0	0.4	0
	Present State Categories		A	→	A	→	A	→
							Overall PES	**0.5 (A)**
7	0.1	100	0	0	0.5	0	0.4	0
	Present State Categories		A	→	A	→	A	→
							Overall PES	**0.5 (A)**
8	0.2	100	0	0	0.5	0	0.4	0
	Present State Categories		A	→	A	→	A	→
							Overall PES	**0.5 (A)**

Dam wall
This facility has been constructed onto the wetland's surface of Pan 1 and comprises of a compacted earth wall.

Associated impacts:
- Alteration to the natural hydrological regime of Pan 1 and Pan 2
- Prolonged water availability to stock increases trampling affect
- Increased disturbances causes proliferation of weeds

Roads and infrastructure
Pans 1 and 2 have a network of roads and fence lines that traverses the edges in the west

Associated impacts:
- Reduction in overland flow
- Deterioration of pan surface
- Replacement of natural vegetation

Alien species
Pans 1 and 4 have a number of alien invasive weeds

Associated impacts:
- Replacement of natural vegetation
- Reduction of pan water yield

Other general disturbances
General disturbance of the pan surfaces were noted during the site visit and have presumably been caused by grazing and trampling.

Associated impacts
- Loss of organic matter
- Disturbance of natural vegetation
- Increased erosion

Figure 28. Features directly impacting pans on Viegulands Put.

3.6.3. Wetland Ecological Importance and Sensitivity

The EIS of pans on Viegulands Put were assessed as a collective, due to the fact that they are all similar in terms of ecological importance and sensitivity. The pans were rated to have a High EIS (Table 12) and are considered to be ecologically important and sensitive. The biodiversity of these pans may be sensitive to flow and habitat modifications.

The assessment was mainly based on a "wet scenario" and related information from similar wetlands in the region, because their ecological importance will primarily only manifest during times of inundation. A number of red listed water birds are expected to occur in the pans when they are inundated. These include the Chestnut-banded Plover, Maccoa Duck, Lesser Flamingo, Greater Flamingo and Greater Painted-snipe; which are all classified as Near-Threatened. Unfortunately, the pans of the Northern Cape have not yet been comprehensively surveyed for invertebrates and therefore it is difficult to state with confidence which species are present. However, it is known that the ephemeral pans host a number of Branchiopod species, which are unique to these wetlands. The egg-banks of these organisms are also found in the top soil layers of these pans.

The pans host fairly low species richness and habitat diversity compared to perennial wetlands, but they are considered to be moderately important breeding and feeding links in terms of connectivity, especially for the survival of wetland birds in South Africa during wet periods by providing stepping-stone corridors in an arid landscape.

The pans are considered to have a low sensitivity to changes in hydrology and water quality, because they flood infrequently (< annually). However, if these pans are inundated anthropogenically and for a prolonged period of time, 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. The pans have moderate food storage, energy dissipation and element removal ability, mainly based on moderate roughness associated with the vegetation on these pans. The pans do not fall within any category of protected status that reflects its importance for conservation of ecological diversity at any scale, but are classified as a watercourse and therefore are protected on a National scale in terms of the National Water Act. Therefore they have been considered to have a high protected status. Furthermore, the reference flood regime and habitat have been insignificantly affected by human activity, which causes them to be rated with high ecological integrity.

Table 12. Summary of the results for the application of an EIS assessment (Duthie 1999) to the pans on Viegulands Put.

DETERMINANT	SCORE	CONFIDENCE
PRIMARY DETERMINANTS		
1. Rare & Endangered Species	4	4
2. Populations of Unique Species	2	2
3. Species/taxon Richness	1	4
4. Diversity of Habitat Types or Features	1	4
5 Migration route/breeding and feeding site for wetland species	2	3
6. Sensitivity to Changes in the Natural Hydrological Regime	1	4
7. Sensitivity to Water Quality Changes	1	4
8. Flood Storage, Energy Dissipation & Particulate/Element Removal	2	3
MODIFYING DETERMINANTS		
9. Protected Status	3	3
10. Ecological Integrity	3	3
TOTAL	**10**	
AVERAGE	**2.0**	
OVERALL ECOLOGICAL SENSITIVITY AND IMPORTANCE	**High**	

3.6.4. Wetland Functional Assessment

The functionality of pans on Viegulands Put was also assessed as a collective, due to the fact that they all provide similar ecosystem services. They scored high in the maintenance of biodiversity, provision of harvestable natural resources, and education and research (Figure 29).

Their maintenance of biodiversity is attributable to the suitable habitat these pans provide for Red Data water birds and the fact that they are largely in pristine condition. The provision of natural resources is significant, mainly in the form of grazing pastures for livestock, due to the ample grasses and herbs found on the pans. The significance of this benefit increases due to the fact that the study site is located in a rural area, where the poverty level is moderately high. The pans also contribute to the education and research value due to their high suitability as reference sites in a field of research that is yet to be fully understood. The pans are also highly accessible from the R357, which further increases their value to research and education.

The current state and functionality of the pans are likely to change as a result of the planned prospecting activities, with the most profound threats being the complete

destruction of the wetlands from excavating for diamonds. Related impacts also include erosion, as well as changes in the sediment input and hydrologic regime. These secondary threats are however inconsequential due to the low frequency of rainfall and subsequent flooding in the area.

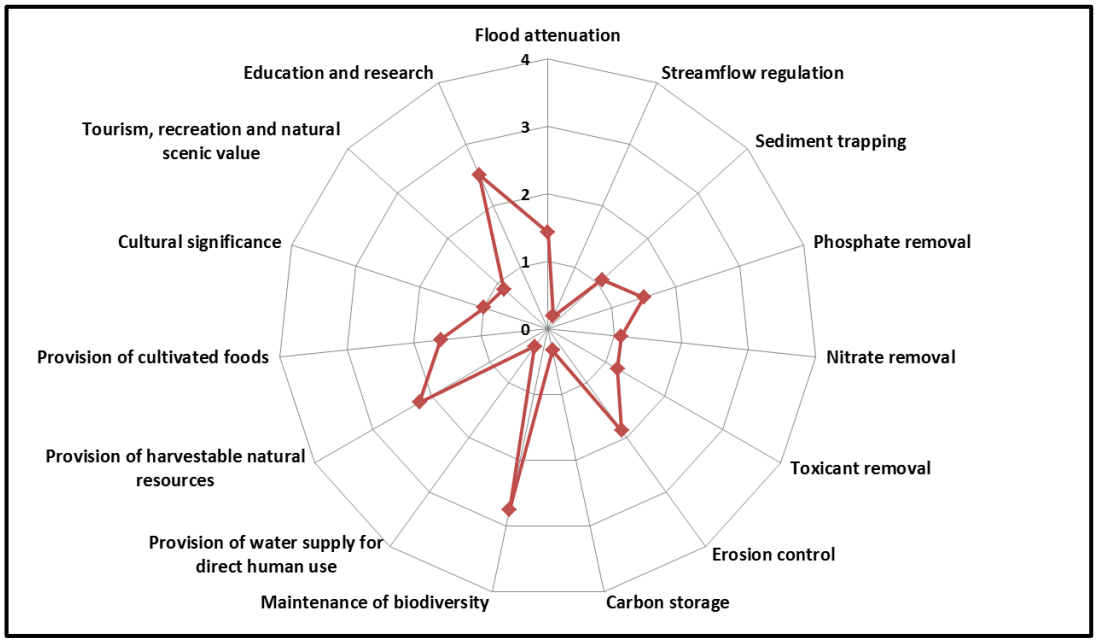


Figure 29. A spider diagram representing different ecosystem services provided by the pans on Viegulands Put. Ecosystem services are scored form 0 (no importance) to 4 (very important).

3.6.5. Wetland cumulative impact evaluation

According to NFEPA, most wetlands (80%) which occur in the Upper Nama Karoo vegetation group have been critically transformed, with only 17 % being in a good condition. The remaining 3 % have been moderately transformed. Within the direct vicinity of the proposed prospecting operation most wetlands have been rated to be in good condition, with only a few being moderately or critically modified (Figure 30).

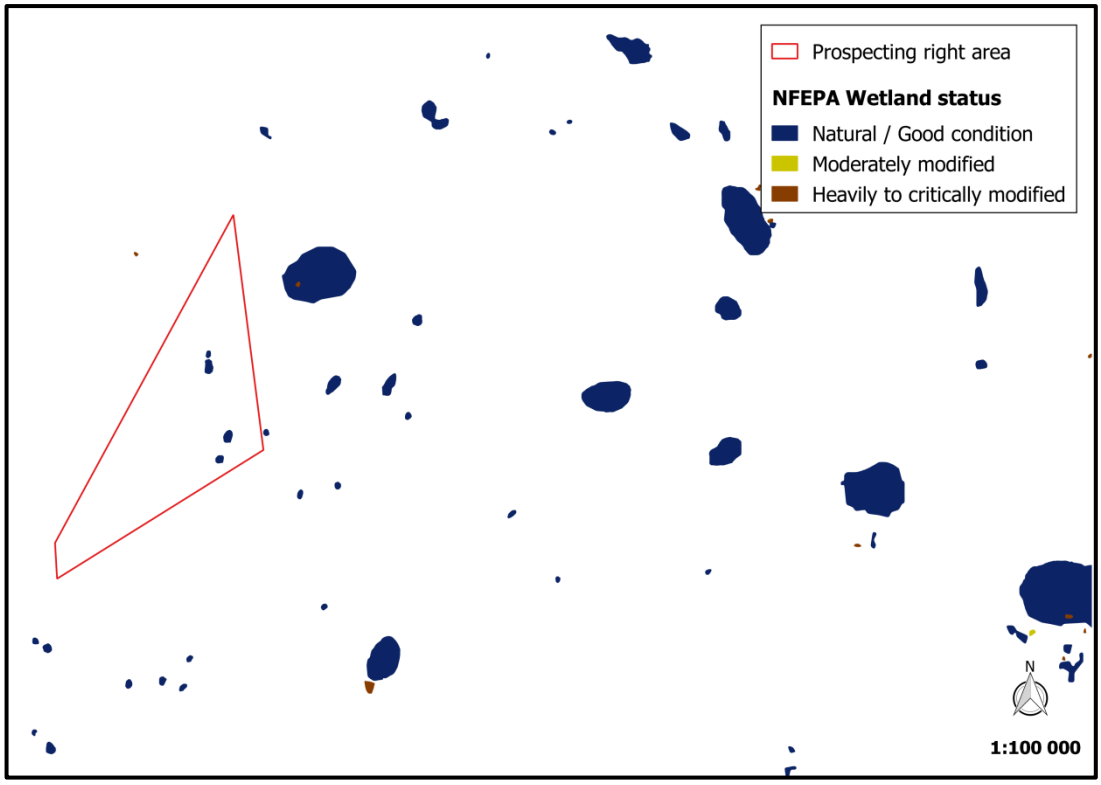


Figure 30. The status of wetlands occurring in the vicinity of the proposed prospecting right area.

3.7. Critical biodiversity areas and broad-scale processes

The proposed prospecting site does not fall within any formally protected area or within a National Protected Areas Expansion Strategy Focus Area. Furthermore, the broad-scale vegetation unit of the study area (Northern Upper Karoo) is classified as least threatened and therefore no formal fine-scale conservation planning has been conducted.

However, the site does contain a number of Critical Biodiversity Areas in relation to the Northern Cape Critical Biodiversity Areas Map (Figure 31). Three formally mapped pans in the south-east (although one has been omitted as a pan in this assessment) are classified as Critical Biodiversity areas, along with their buffer zones. The pans in the north-east are classified as Ecological Support Areas, along with the ridge and drainage lines in the north. The Siyathemba Integrated Development Plan also promotes the conservation of ridges and wetland areas within the district.

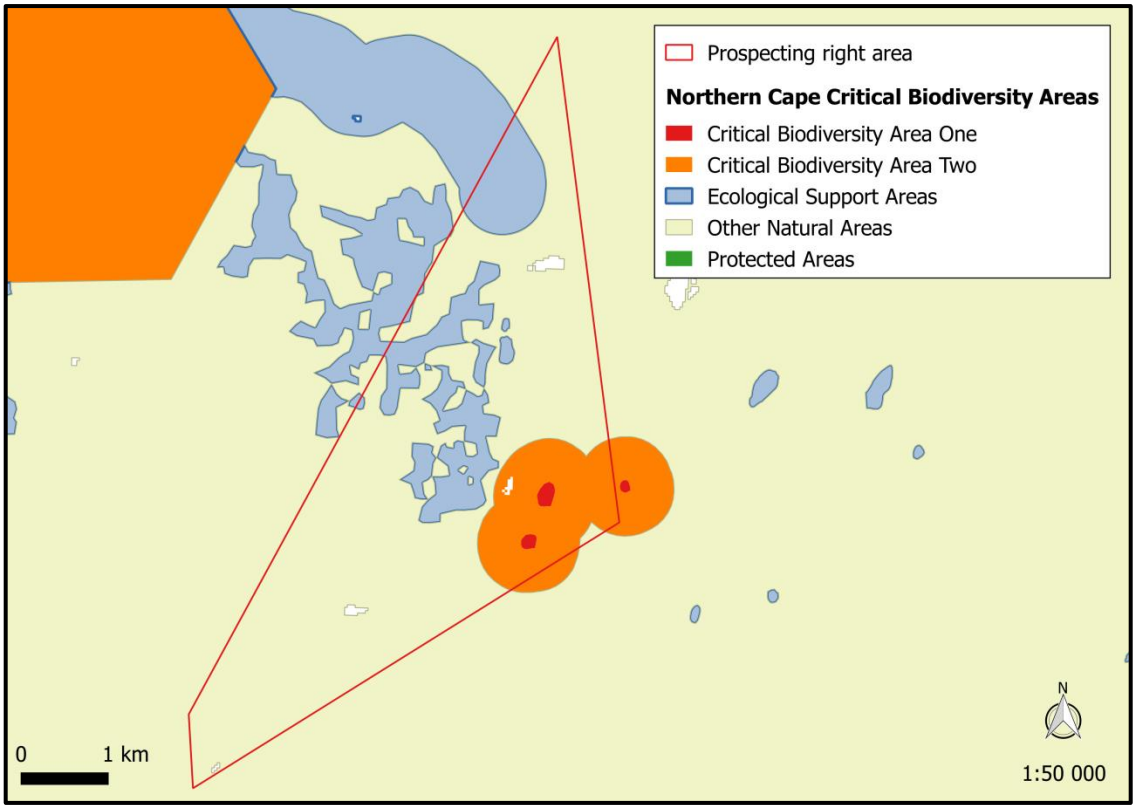


Figure 31. The study area in relation to the Northern Cape Critical Biodiversity areas.

All of the ephemeral pans of the study area have been classified by the Wetland Freshwater Priority Areas project as wetlands with a Present Ecological State (PES) of "AB", which means that the pans are in a Natural or Good condition. Furthermore, none of the pans have been identified as significant wetlands in terms of Ramsar sites, IUCN Frog localities, threatened water bird localities or Crane breeding grounds.

The mine itself is expected to cause habitat transformation through the excavation of large open pits, and will thereby contribute to cumulative habitat loss and the disruption of the broad-scale landscape connectivity in the region. The study area falls within a zone where one of South Africa's largest economically most important alluvial deposits of diamonds are found (Figure 32). The primary secondary source of alluvial diamond deposits in the Northern Cape extends along the Orange and Vaal Rivers (Gresse 2003), while the most significant crop irrigation in the Northern Cape also stretches along these rivers (Durand 2006). According to Mucina et al. (2005), the highest proportion of any type of transformation in the Nama-Karoo Biome is the clearance of the Northern Upper Karoo for cultivation. The cumulative impacts in the vicinity of the study area are therefore considered to be very high.

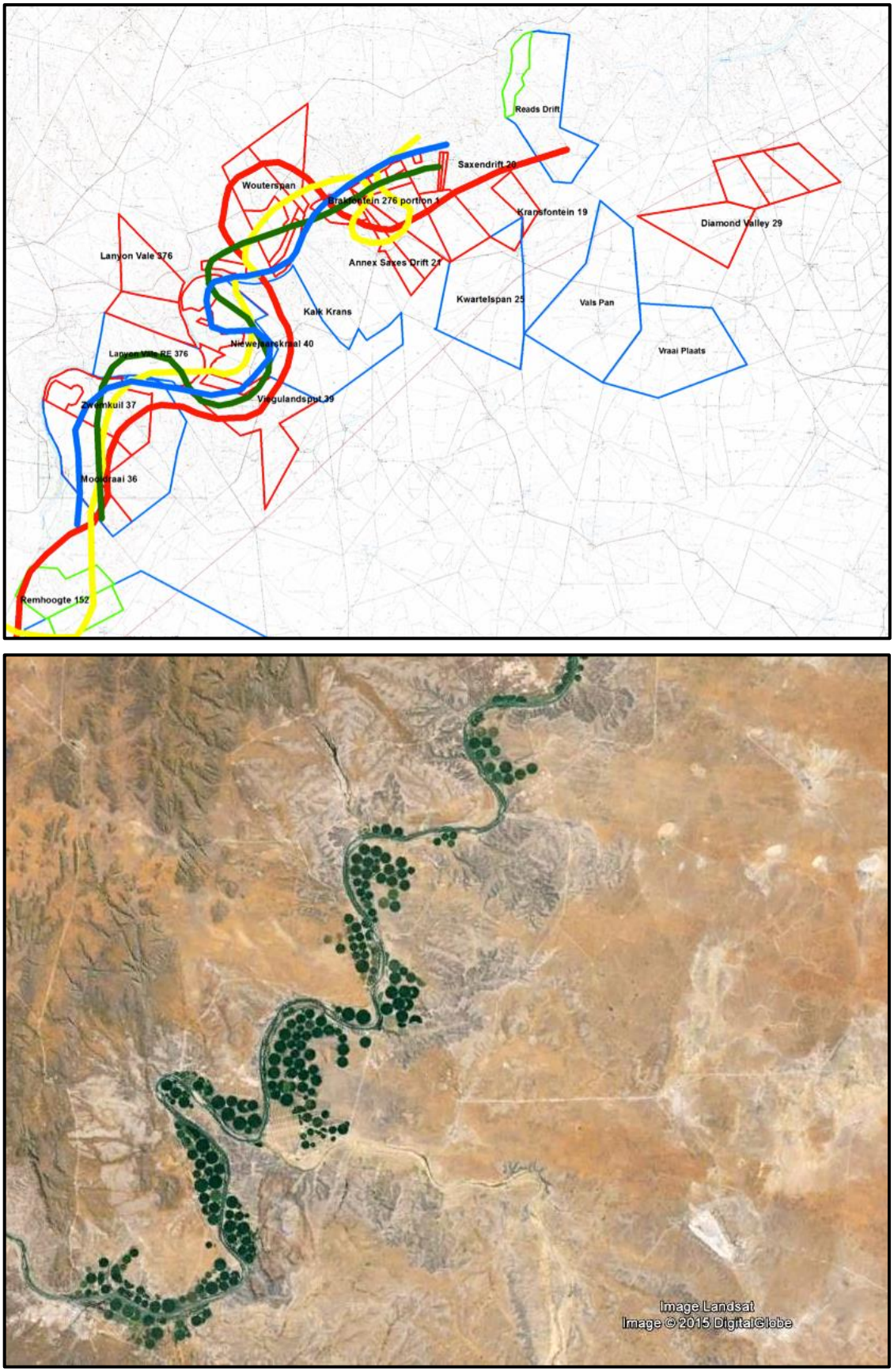


Figure 32. The distribution of mining properties (top) and crop irrigation along the Orange River (bottom) north of Prieska.

3.8. Site sensitivity

The sensitivity map for the Viegulands Put prospecting operation is illustrated in Figure 33. The ephemeral pans and drainage lines are considered to be of very high sensitivity due to their vital ecological and hydrological functionality and significance. All watercourses in the study area are also unique habitats protected in terms of the National Water Act (Act No 36 of 1998). These units are essentially no-go areas.

The calcrete ridge, calcrete plains, thornveld and grassland on sand are all considered to be of high sensitivity. These are also earmarked for prospecting activities. The high sensitivity of the calcrete ridge and calcrete plains is attributable to the high number of plant species of conservation that have been found here and that are expected to occur here, i.e. *Boscia albitrunca, Aloe claviflora, Nymania capensis, Hoodia gordonii, Euphorbia braunsii*, *Larryleachia* sp. and *Lithops* sp.

The thornveld is considered to be of high sensitivity on account of the high density of *B. albitrunca* found here and the crucial nesting habitat that the dominant *S. mellifera* provides to birds. The grassland on sand is considered to be highly sensitive due to the high number of Aardvark burrows encountered here.

The shrubland on sand is considered to be of medium sensitivity. This area hosts a low density of species of conservation concern and a high density of the encroaching *R. trichotomum*. It is expected to be affected by the prospecting operation, but impacts are likely to be largely local. Activities within this area can proceed with relatively little ecological impact provided that appropriate mitigation measures are taken.

The transformed areas include the farmstead, old cultivated land and three old quarries. These areas are considered to be of low ecological sensitivity on account of the transformation of natural habitats that were caused here. Activities may proceed with little ecological impact. However, social impacts in the vicinity of the farmstead should not be ignored.

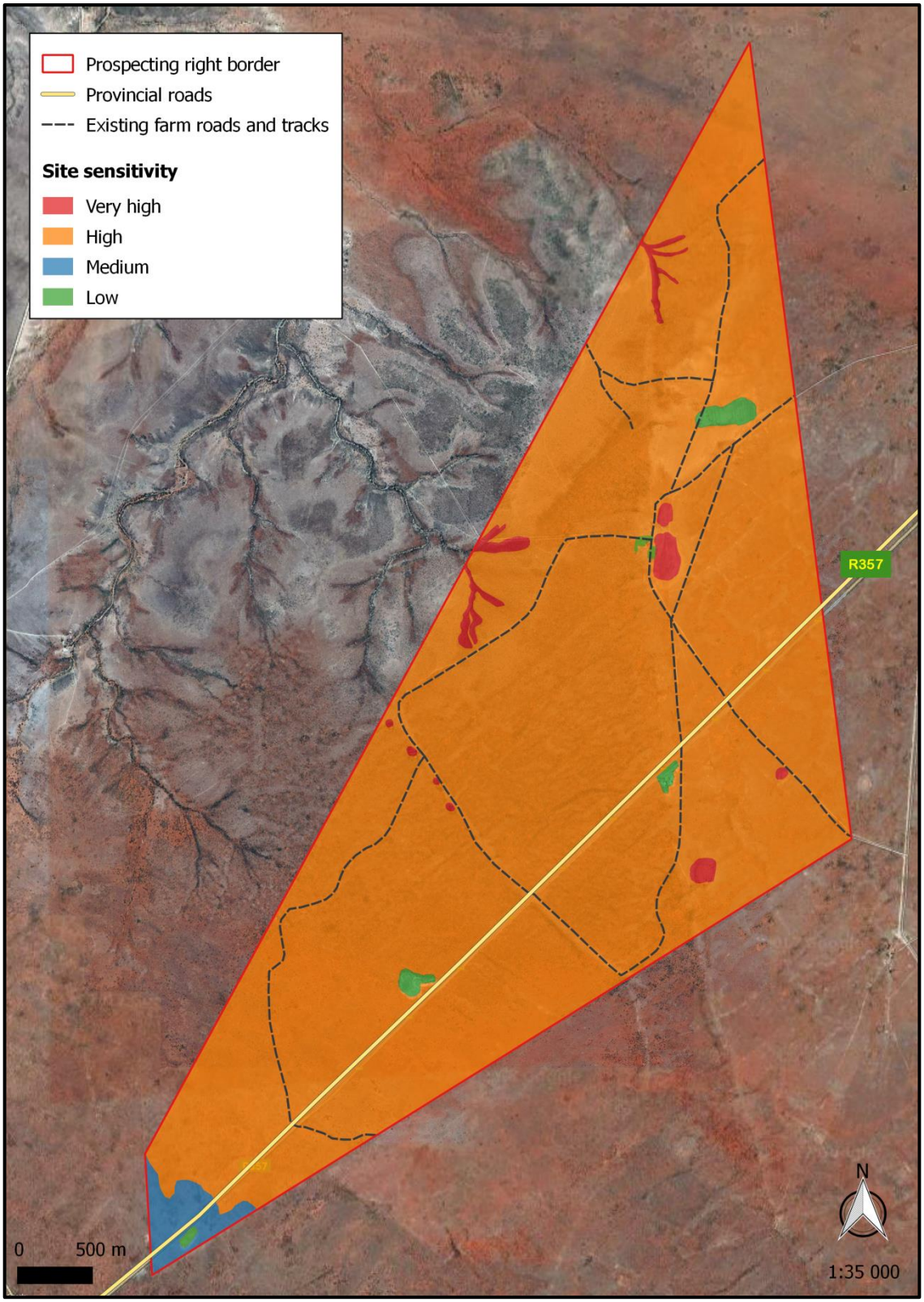


Figure 33. A sensitivity map for the Viegulands Put prospecting area.

4. ECOLOGICAL IMPACT ASSESSMENT

In this section, the potential impacts and associated risk factors that may be generated by the Viegulands Put prospecting operation are identified and described. A detailed analysis of each impact is provided in Table 13. The impacts are assessed in terms of the relevant ecological aspects and each impact is associated with an outline of specific mitigation measures, which with proper implementation, monitoring and auditing, will serve to reduce the significance of the impact. In order to ensure that the impacts identified are broadly applicable and inclusive, all the likely or potential impacts that may be associated with the prospecting activities are listed.

4.1. Topography, soil erosion and associated degradation of landscapes

4.1.1. Loss of soil fertility

Source of the impact

During the removal of topsoil; stockpiling.

Description of the impact

Improper stockpiling and soil compaction can result in soil sterilisation. Leaching can also occur, resulting in the loss of nutrients.

Mitigation and monitoring

- 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 in order 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 be kept separate from sub-soils.
- The topsoil should be replaced as soon as possible on to the backfilled areas, thereby allowing for the re-growth of the seed bank contained within the topsoil.

Table 13. A detailed analysis of ecological impacts identified for the Viegulands Put prospecting operation.

	IMPACT	Phase			Extent	Duration	Severity	Probability	Significance	Significance after Mitigation
		C	O	D						
Landscape	Loss of soil fertility	✓	✓	✓	Local (2)	Residual (4)	High (3)	Possible for life of operation (9)	Medium-High (81)	Low-Medium
	Increase in soil erosion	✓	✓	✓	Local (2)	Decommissioning (3)	High (3)	Possible infrequently (7)	Low-Medium (56)	Low
Flora	Loss of indigenous vegetation	✓	✓	✓	Local (2)	Decommissioning (3)	Medium (2)	Certain for life of operation (10)	Low-Medium (70)	Low-Medium
	Loss of Red data and/or protected floral species	✓	✓		Local (2)	Residual (4)	High (3)	Possible for life of operation (9)	Medium-High (81)	Low-Medium
	Introduction or spread of alien species	✓	✓	✓	Local (3)	Residual (4)	High (4)	Probable (5)	Low-Medium (55)	Very low/Positive
	Bush encroachment			✓	On-site (2)	Residual (4)	High (4)	Probable (5)	Low (50)	Very low/Positive

	IMPACT	Phase			Extent	Duration	Severity	Probability	Significance	Significance after Mitigation
		C	O	D						
Fauna	Habitat fragmentation	✓	✓	✓	Regional (3)	Decommissioning (3)	High (4)	Possible for life of operation (9)	Medium-High (90)	Low-Medium
	Disturbance, displacement and killing of fauna	✓	✓	✓	On-site (2)	Decommissioning (3)	Medium(3)	Possible for life of operation (9)	Low-Medium (72)	Low-Medium
Ecological Processes	Compromise of ecological processes	✓	✓	✓	Regional (3)	Residual (4)	High (4)	Possible for life of operation (9)	Medium-High (99)	Low-Medium

4.1.2. Soil erosion

Source of the impact

Infrastructure; excavations; alterations of the beds and banks of the watercourses.

Description of the impact

Vegetation will be stripped in preparation for placement of infrastructure and excavations, and therefore the areas will be bare and susceptible to erosion. Topsoil and overburden that is stripped and piled on surrounding areas can be eroded by wind, rain and flooding. The soil/sediments will be carried away during runoff. The affected areas will be rehabilitated, but full restoration might only occur over a number of years, subsequent to the re-establishment of vegetation.

Mitigation and monitoring

- Re-establishment of plant cover on disturbed areas must take place as soon as possible, once activities in the area have ceased.
- Ground exposure should be minimised in terms of the surface area and duration.
- The operation must co-ordinate different activities in order to optimise the excavated trenches and thereby prevent repeated and unnecessary excavations.
- Construction/excavations during the rainy season (November to March) should be monitored and controlled.
- Run-off from exposed ground should be controlled with flow retarding barriers.
- All stockpiles must be kept as small as possible, with gentle slopes (18 degrees) in order to avoid excessive erosional induced losses.
- Excavated and stockpiled soil material are to be stored on the higher lying areas of the footprint area and not in any storm water run-off channels or any other areas where it is likely to cause erosion, or where water would naturally accumulate.
- Regular audits carried out to identify areas where erosion is occurring (incl. linear activities such as roads and pipelines); followed by appropriate remedial actions.

4.2. Vegetation and floristics

4.2.1. Loss of indigenous vegetation

Source of the impact

Construction of roads and other necessary infrastructure; the placement of stockpiles; and the clearing of vegetation for excavations, materials storage and topsoil stockpiles; vehicular movement.

Description of the impact

Construction and prospecting activities on site will reduce the natural habitat for ecological systems to continue their operation. It is not expected that the areas of high ecological function will rehabilitate following disturbance events. Vehicle traffic generates lots of dust which can reduce the growth success and seed dispersal of many small plant species.

Mitigation and monitoring

- Minimise the footprint of transformation.
- Encourage proper rehabilitation of excavated areas, by effective backfilling.
- Encourage the growth of natural plant species by sowing indigenous seeds or by planting seedlings.
- Ensure measures for the adherence to the speed limit to minimise dust plumes.

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

Source of the impact

Removal of listed or protected plant species; during the construction of roads and other necessary infrastructure; the placement of stockpiles; and the clearing of vegetation for excavations.

Description of the impact

There are a number of listed and protected species present at the site, such as *Hoodia gordonii, Aloe claviflora, Boscia albitrunca, Euphorbia braunsii, Nymania capensis, Larryleachia* sp. and *Lithops* sp. It is highly likely that some of these species might be damaged or removed during the operation.

Furthermore, any illegal fire wood collection or illegal harvesting of the plants for trade or medicinal use by staff, contractors or secondary land users could potentially have a negative impact on the population of these species. It is possible that prospecting activities will destroy protected species and other species of conservation concern.

Mitigation and monitoring

- Footprint areas of the prospecting activities must be scanned for Red Listed and protected plant species prior to excavations.
- It is recommended that these plants are identified and marked prior to intended activity.
- These plants should, where possible, be incorporated into the design layout and left in situ.
- However, if threatened by destruction, these plants should be removed (with the relevant permits from DAFF and/or DENC) and relocated if possible.
- 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 appointment of a full-time ECO must 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.

4.2.3. Introduction or spread of alien species

Source of the impact

Clearing of vegetation; prospecting activities.

Description of the impact

The extent of alien invasive species in the area is fairly low. However, while general clearing of the area and excavation activities destroy natural vegetation, invasive plants can increase due to their opportunistic nature in disturbed areas. If invasive plants establish in disturbed areas, it may cause an impact beyond the boundaries of the prospecting site. These alien invasive species are thus a threat to surrounding natural vegetation and can result in the decrease of biodiversity and ecological value 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

- Minimise the footprint of transformation.
- Encourage proper rehabilitation of excavated areas.
- Encourage the growth of natural plant species.
- Mechanical methods of control to be implemented extensively.
- Annual follow-up operations to be implemented.

4.2.4. Encouraging bush encroachment

Source of the impact

Clearing of vegetation; disturbances through prospecting activities.

Description of the impact

The extent of bush encroaching species on site shows the possible moderate level of past disturbance interference in the natural ecosystem, primarily through grazing practises.

While general clearing of the area and prospecting activities destroy natural vegetation, bush encroaching plants can increase due to their opportunistic nature in disturbed areas.

If encroaching plants establish in disturbed areas, it may the lower potential for future land use and decrease biodiversity. With proper mitigation, the impacts can be substantially reduced.

Mitigation and monitoring

- Minimise the footprint of transformation.
- Encourage proper rehabilitation of disturbed areas.
- Encourage the growth of a diverse selection of natural plant species.
- Mechanical methods of control to be implemented selectively.
- Annual follow-up monitoring to be implemented.

4.3. Fauna

4.3.1. Habitat fragmentation

Source of the impact

Clearance of vegetation; prospecting activities.

Description of the impact

Prospecting activities and associated infrastructure will result in the loss of connectivity and fragmentation of natural habitat. Fragmentation of habitat will lead to the loss of migration corridors, in turn resulting in degeneration of the affected population's genetic make-up. This results in a subsequent loss of genetic variability between meta-populations occurring within the study site. Pockets of fragmented natural habitats hinder the growth and development of populations. This impact will be most profound in the watercourses.

Mitigation and monitoring

- All activities associated with the prospecting operation must be planned, where possible in order 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.
- Employ sound rehabilitation measures to restore the characteristics of the affected aquatic and riparian 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 habitat, affecting individual species and ecological processes. This will result in the displacement of faunal species that depend on such habitats. This impact is likely to be most significant to the resident (and protected) Aardvark population. Increased noise and vibration will also disturb and possibly displace birds and other 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 will negatively affect the local populations.

Mitigation and monitoring

- Careful planning of the operation is needed in order 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 to do so. Areas surrounding the earmarked site that are not part of the demarcated area should be considered as a no go zone.

- A full-time ECO must render guidance to the staff and contractors with respect to suitable areas for all related disturbance.
- Everyone on site must undergo environmental induction for awareness on not harming or collecting species that are often persecuted out of superstition and to be educated about the conservation importance of the fauna occurring on site.
- Reptiles and amphibians that are exposed during the clearing operations should be captured for later release or translocation by a qualified expert.
- Employ measures that ensure adherence to the speed limit.

4.4. Broad-scale ecological processes

Source of the impact

The construction of roads, plant site, as well as other necessary infrastructure; the clearing of vegetation for excavations; alterations of the beds and banks of the watercourses.

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 fragmentation of the watercourses will destroy connectivity of vital ecological and aquatic linkages. Due to the amount of mining and agriculture in the area, this is a likely cumulative impact of the proposed prospecting operation.

Mitigation and monitoring

- Minimise the footprint of transformation.
- Encourage proper rehabilitation of affected areas.
- Encourage the growth of natural plant species.
- Employ sound rehabilitation measures to restore the characteristics of the affected watercourses.

5. CONCLUSION, RECOMMENDATIONS AND OPINION REGARDING AUTHORISATION

Five plant communities were identified on site of which all are included in the earmarked area to be affected by prospecting activities. The watercourses include several ephemeral pans and drainage lines, which are considered to be of very high sensitivity due to their vital ecological and hydrological functionality and significance. The calcrete ridge, calcrete plains, thornveld and grassland on sand are all considered to be of high sensitivity, on account of the high number or frequency of species of conservation concern found here and/or the important faunal habitats they provide. The most profound impacts are expected to be related to the destruction of watercourses and the alteration of aquatic habitats; which in turn will cause cumulative fragmentation of important ecological corridors in the area.

Species of conservation concern that are found in these earmarked habitats will most likely also be lost locally. These include the widespread *Boscia albitrunca* as well as *Nymania capensis* and *Aloe claviflora* commonly found on the calcrete plains and ridge, respectively. Similarly, the prospecting operation will result in the large-scale clearance of indigenous vegetation. Additionally, any disturbances to the Aardvark burrows will displace this protected species locally. Permit applications regarding protected fauna and flora as well as the harvesting of indigenous vegetation need to be lodged with the Northern Cape Department of Environment and Nature Conservation prior to any clearance of vegetation or destruction of Aardvark burrows.

Furthermore, a licence application regarding protected trees should be lodged with Department of Agriculture, Forestry and Fisheries prior to any potential disturbances to *B. albitrunca*.

To conclude, it is clear that the destruction of the natural habitat within the study area is inevitable. The significance of the impacts will be affected by the success of the mitigation measures implemented and the rehabilitation programme for the prospecting area. The majority of the site is in a pristine condition and are expected to be adversely affected. In my opinion, authorisation should not be granted unless the applicant commits to the adherence of effective avoidance, management, mitigation and rehabilitation measures.

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Boscia
ECOLOGICAL CONSULTING

APPENDICES

APPENDIX 1

Plant species list

Family	Scientific name	Status	NFA	NCNCA
ACANTHACEAE	*Acanthopsis disperma*	LC		
	Barleria lichtensteiniana	LC		
	Barleria rigida	LC		
	Blepharis mitrata	LC		
	Monechma distichotrichum	LC		
	Monechma incanum	LC		
AIZOACEAE	*Aizoon burchellii*	-		
	Aizoon schellenbergii	LC		
AMARANTHACEAE	*Sericocoma avolans*	LC		
ANACARDIACEAE	*Searsia burchellii*	LC		
	Searsia lancea	LC		
APOCYNACEAE	***Hoodia gordonii***	**DDD**		**S1**
	Larryleachia sp.	-		**S2**
ASPARAGACEAE	*Asparagus burchellii*	LC		
	Asparagus capensis	LC		
ASPHODELACEAE	***Aloe claviflora***	LC		**S2**
ASTERACEAE	*Chrysocoma ciliata*	LC		
	Dicoma capensis	LC		
	Eriocephalus ambiguus	LC		
	Eriocephalus eximius	LC		
	Euryops subcarnosus subsp. vulgaris	LC		
	Felicia burkei	LC		
	Felicia clavipilosa subsp. clavipilosa	LC		
	Geigeria filifolia	LC		
	Hertia pallens	LC		
	Kleinia longiflora	LC		
	Pentzia calcarea	LC		
	Pentzia incana	LC		
	Phymaspermum pubescens	LC		
	Pteronia mucronata	LC		
	Rosenia humilis	LC		
ASTERACEAE	*Xanthium spinosum*	Inv. Alien		
BIGNONIACEAE	*Rhigozum obovatum*	LC		
	Rhigozum trichotomum	LC		
BORAGINACEAE	*Ehretia rigida subsp. rigida*	LC		
CAPPARACEAE	***Boscia albitrunca***	LC	**X**	**S2**
	Cadaba aphylla	LC		
CHENOPODIACEAE	*Salicornia meyeriana*	LC		
CUCURBITACEAE	*Corallocarpus schinzii*	LC		
EBENACEAE	*Diospyros lycioides subsp. lycioides*	LC		
EUPHORBIACEAE	***Euphorbia braunsii***	LC		**S2**
FABACEAE	*Calobota spinescens*	LC		
	Indigofera alternans var. alternans	LC		
	Lotononis sp.	-		
	Melolobium candicans	LC		
	Prosopis glandulosa var. glandulosa	Inv. Alien		

Family	Scientific name	Status	NFA	NCNCA
FABACEAE	*Senegalia mellifera*	LC		
	Senna italica subsp. arachoides	LC		
	Vachellia tortilis	LC		
FRANKENIACEAE	*Frankenia pulverulenta*	LC		
LAMIACEAE	*Leonotis pentadentata*	LC		
	Stachys cuneata	LC		
LORANTHACEAE	*Tapinanthus oleifolius*	LC		
MALVACEAE	*Hermannia cernua*	LC		
	Hermannia desertorum	LC		
	Hermannia spinosa	LC		
MELIACEAE	***Nymania capensis***	LC		**S2**
MESEMBRYANTHEMACEAE	***Lithops sp.***	-		**S2**
NYCTAGINACEAE	*Phaeoptilum spinosum*	LC		
PAPAVERACEAE	*Argemone ochroleuca*	Inv. Alien		
PEDALIACEAE	*Sesamum capense*	LC		
POACEAE	*Aristida adscensionis*	LC		
	Aristida congesta subsp. congesta	LC		
	Aristida vestita	LC		
	Cenchrus ciliaris	LC		
	Chloris virgata	LC		
	Enneapogon cenchroides	LC		
	Enneapogon desvauxii	LC		
	Eragrostis annulata	LC		
	Eragrostis curvula	LC		
	Eragrostis echinochloidea	LC		
	Eragrostis homomalla	LC		
	Eragrostis lehmanniana	LC		
	Eragrostis porosa	LC		
	Eragrostis truncata	LC		
	Fingerhuthia africana	LC		
	Melinis repens subsp. grandiflora	LC		
	Schmidtia pappophoroides	LC		
	Setaria verticillata	LC		
	Stipagrostis ciliata	LC		
	Stipagrostis obtusa	LC		
	Stipagrostis uniplumis	LC		
	Stipagrostis uniplumis var. neesii	LC		
	Triraphis purpurea	LC		
RHAMNACEAE	*Ziziphus mucronata subsp. mucronata*	LC		
SANTALACEAE	*Thesium hystrix*	LC		
	Thesium lineatum	LC		
SCROPHULARIACEAE	*Aptosimum albomarginatum*	LC		
	Aptosimum marlothii	LC		
	Aptosimum spinescens	LC		
	Peliostomum origanoides	LC		
	Selago albida	LC		

Family	Scientific name	Status	NFA	NCNCA
SINOPTERIDACEAE	*Cheilanthes hirta var. hirta*	LC		
SOLANACEAE	*Datura ferox*	Inv. Alien		
	Lycium cinereum	LC		
	Lycium hirsutum	LC		
	Lycium schizocalyx	LC		
THYMELACEAE	*Gnidia polycephala*	LC		
ZYGOPHYLLACEAE	*Fagonia isotricha var. isotricha*	LC		
	Tribulus terrestris	LC		
	Zygophyllum lichtensteinianum	LC		

APPENDIX 2

Fauna species list

LIST OF MAMMALS (continued)

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

	Scientific name	Common name	IUCN	RDB	Habitat	Potential occurrence
CHIROPTERA	[2]*Eidolon helvum*	African Straw-coloured Fruit-bat	**NT**	*Not listed*	Wide habitat tolerance.	High
	[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 often found in arid areas, grassland, bushveld and *Acacia* woodland. Animals roost under the bark of trees and similar vegetation.	High
	[3]*Miniopterus natalensis*	Natal Long-fingered Bat	LC	*Not listed*	Mainly roosts in caves or mine shafts, but also in crevices and holes in trees.	High
	[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 woodland.	High
	[2]*Rhinolophus denti*	Dent's Horseshoe Bat	LC	**NT**	Savanna habitats.	High
	[2]*Rhinolophus clivosus*	Geoffroy's Horseshoe Bat	LC	**NT**	Wide habitat tolerance.	High
	[2]*Rhinolophus darlingi*	Darling's Horseshoe Bat	LC	**NT**	Savanna habitats.	High
	[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	RDB	Habitat	Potential occurrence
MACROSCELIDIDAE	[2]*Macroscelides proboscideus*	Round-eared Sengi	LC	LC	A habitat specialist occupying gravel plains associated with alluvial plains and relatively flat areas between higher elevation areas such as outcrops, scarps, hills, and mountains .	High
	[2]*Elephantulus rupestris*	Western Rock Sengi	LC	LC	Arid habitats, including deserts, dry savannas, and dry shrublands. Typically associated with rocky ridges, outcrops or koppies (rocky hills), 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.	Confirmed
HYRACOIDEA	[2]*Procavia capensis*	Rock Hyrax	LC	LC	Outcrops of rocks, especially granite formations and dolomite intrusions in the Karoo. Also erosion gullies.	High

LIST OF MAMMALS (continued)

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

	Scientific name	Common name	IUCN	RDB	Habitat	Potential occurrence
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 agriculturally developed areas, especially in crop-growing areas or in fallow lands where there is some bush development.	Medium
	[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.	Confirmed
	[2]*Xerus inauris*	South African Ground Squirrel	LC	LC	Open terrain with a sparse bush cover and hard substrate.	Confirmed
	[2]*Pedetes capensis*	Springhare	LC	LC	Occurs widespread: open sandy ground, sandy scrub, overgrazed grassland, edges of vleis and dry river beds.	High
	[2]*Graphiurus ocularis*	Spectacled Dormouse	LC	LC	Rocky habitats, but also trees.	High

LIST OF MAMMALS (continued)

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	Scientific name	Common name	IUCN	RDB	Habitat	Potential occurrence
RODENTIA	[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.	High
	[2]*Malacothrix typica*	Large-eared (Gerbil) Mouse	LC	LC	Short grass habitats over hard soil.	Medium
	[3]*Rhabdomys dilectus*	Mesic Four-striped Grass Mouse	LC	*Not listed*	Wide habitat tolerance, from desert fringe to high-rainfall montane areas with grass cover.	High
	[2]*Rhabdomys pumilio*	Four-striped Grass Mouse	LC	LC	Essentially a grassland species; occurs in wide variety of habitats where there is good grass cover.	High
	[3]*Mus musculus*	House Mouse	LC	*Not listed*	Wide habitat tolerance.	High
	[2]*Thallomys nigricauda*	Black-tailed Tree Rat	LC	LC	Arboreal species generally associated with *Acacia* bushland habitats.	Medium

LIST OF MAMMALS (continued)

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

	Scientific name	Common name	IUCN	RDB	Habitat	Potential occurrence
RODENTIA	[2]*Mastomys coucha*	Southern Multimammate Mouse	LC	LC	Wide habitat tolerance.	High
	[2]*Parotomys littledalei*	Littledale's Whistling Rat	LC	NT	Occurs in shrublands and is not known to persist in disturbed or modified habitats.	High
	[2]*Micaelamys namaquensis*	Namaqua Rock Mouse	LC	LC	Catholic habitat requirements, but prefer rocky hills, outcrops or boulder-strewn hillsides.	High
	[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 anf habitats	Confirmed
	[2]*Desmodillus auricularis*	Cape Short-tailed Gerbil	LC	LC	Tend to occur on hard ground, unlike other gerbil species, with some cover of grass or karroid bush.	High

LIST OF MAMMALS (continued)

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

	Scientific name	Common name	IUCN	RDB	Habitat	Potential occurrence
RODENTIA	[2]*Gerbillurus paeba*	Pygmy Hairy-footed Gerbil	LC	LC	Associated with 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	**DD**	Sandy soils; wooded and more open grassland; areas of cultivation.	High
	[2]*Gerbilliscus brantsii*	Highveld Gerbil	LC	LC	Sandy soils; wooded and more open grassland; areas of cultivation.	High
PRIMATES	[4]*Papio ursinus*	Chacma Baboon	LC	LC	Can exploit fynbos, montane grasslands, riverine courses in deserts, and simply need water and access to refuges.	Medium
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.	Medium

LIST OF MAMMALS (continued)

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	Scientific name	Common name	IUCN	RDB	Habitat	Potential occurrence
EULIPOTYPHLA	[2]*Crocidura cyanea*	Reddish-Grey Musk Shrew	LC	DD	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	**DD**	Generally associated with termite mounds, grassland habitat.	High
	[1]*Atelerix frontalis*	South African Hedgehog	LC	**NT**	Generally found in semi-arid and sub-temperate environments with ample ground cover.	Medium
CARNIVORA	[1]*Proteles cristata*	Aardwolf	LC	LC	Common in the 100-600mm rainfall range of country, Nama-Karoo, Succulent Karoo Grassland and Savanna biomes.	High
	[4]*Caracal caracal*	Caracal	LC	LC	Caracals tolerate arid regions, occur in semi-desert and karroid conditions.	High
	[1]*Felis silvestris*	African Wild Cat	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	RDB	Habitat	Potential occurrence
CARNIVORA	[1]*Felis nigripes*	Black-footed cat	**VU**	LC	Associated with arid country, particularly areas with open habitat that provides some cover in the form of tall stands of grass or scrub.	Medium
	[2]*Genetta genetta*	Common (Small-spotted) Genet	LC	LC	Occur in open arid habitats.	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]*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
	[1]*Vulpes chama*	Cape Fox	LC	LC	Associated with open country, open grassland, grassland with scattered thickets and coastal or semi-desert scrub.	High

LIST OF MAMMALS (continued)

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

	Scientific name	Common name	IUCN	RDB	Habitat	Potential occurrence
CARNIVORA	[4]*Canis mesomelas*	Black-backed Jackal	LC	LC	Wide habitat tolerance.	High
	[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]*Otocyon megalotis*	Bat-eared Fox	LC	LC	Open country with mean annual rainfall of 100-600 mm.	High
	[1]*Poecilogale albinucha*	African Striped Weasel	LC	**DD**	Wide habitat tolerance, but most common in grassland areas.	High
	[1]*Ictonyx striatus*	Striped Polecat	LC	LC	Widely distributed throughout the sub-region.	High
	[1]*Mellivora capensis*	Honey Badger	LC	**NT**	Wide habitat tolerance.	High
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.	Low
	[2]*Tragelaphus strepsiceros*	Greater Kudu	LC	LC	Wooded savanna	High

LIST OF MAMMALS (continued)

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

	Scientific name	Common name	IUCN	RDB	Habitat	Potential occurrence
CETARTIODACTYLA	[2]*Antidorcas marsupialis*	Springbok	LC	LC	Open arid plains with short vegetation	High
	[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.

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*	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*	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

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Family	Scientific name	Common name	IUCN status
TESTUDINIDAE	[3]*Homopus femoralis*	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.

Family	Scientific name	Common name	IUCN status
BUFONIDAE	[2]*Amietophrynus gutturalis*	Guttural Toad	LC
	[2]*Amietophrynus poweri*	Western Olive 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 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

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

LIST OF BIRDS

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

LIST OF BIRDS

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

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

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

LIST OF BIRDS

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

	Scientific name	Common name	IUCN status
2	*Podiceps cristatus*	Great Crested Grebe	
2	*Podiceps nigricollis*	Black-necked Grebe	
1	*Polemaetus bellicosus*	Martial Eagle	**EN**
1	*Polihierax semitorquatus*	Pygmy Falcon	-
1	*Polyboroides typus*	African Harrier-Hawk	-
2	*Porphyrio madagascariensis*	African Purple Swamphen	
2	*Prinia flavicans*	Black-chested Prinia	
2	*Psophocichla litsipsirupa*	Groundscraper Thrush	
2	*Pterocles burchelli*	Burchell's Sandgrouse	
2	*Pterocles namaqua*	Namaqua Sandgrouse	
1	*Ptilopsus granti*	Southern White-faced Scops-Owl	-
2	*Pycnonotus nigricans*	African Red-eyed Bulbul	
2	*Pytilia melba*	Green-winged Pytilia	
2	*Quelea quelea*	Red-billed Quelea	
2	*Rallus caerulescens*	African Rail	
2	*Recurvirostra avosetta*	Pied Avocet	
2	*Rhinopomastus cyanomelas*	Common Scimitarbill	
2	*Rhinoptilus africanus*	Double-banded Courser	
2	*Riparia paludicola*	Brown-throated Martin	
2	*Riparia riparia*	Sand Martin	
1	*Rostratula benghalensis*	Greater Painted-snipe	**NT**
1	*Sagittarius serpentarius*	Secretarybird	**VU**
2	*Scleroptila levaillantoides*	Orange River Francolin	
2	*Scopus umbretta*	Hamerkop	
2	*Serinus albogularis*	White-throated Canary	
2	*Serinus atrogularis*	Black-throated Canary	
2	*Serinus flaviventris*	Yellow Canary	
2	*Sigelus silens*	Fiscal Flycatcher	
2	*Spizocorys conirostris*	Pink-billed Lark	
2	*Sporopipes squamifrons*	Scaly-feathered Finch	
2	*Spreo bicolor*	Pied Starling	
2	*Stenostira scita*	Fairy Flycatcher	
2	*Streptopelia capicola*	Cape Turtle-Dove	
2	*Streptopelia semitorquata*	Red-eyed Dove	
2	*Streptopelia senegalensis*	Laughing Dove	
2	*Struthio camelus*	Common Ostrich	
2	*Sylvia borin*	Garden Warbler	
2	*Sylvietta rufescens*	Long-billed Crombec	
2	*Tachybaptus ruficollis*	Little Grebe	
2	*Tachymarptis melba*	Alpine Swift	

LIST OF BIRDS

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

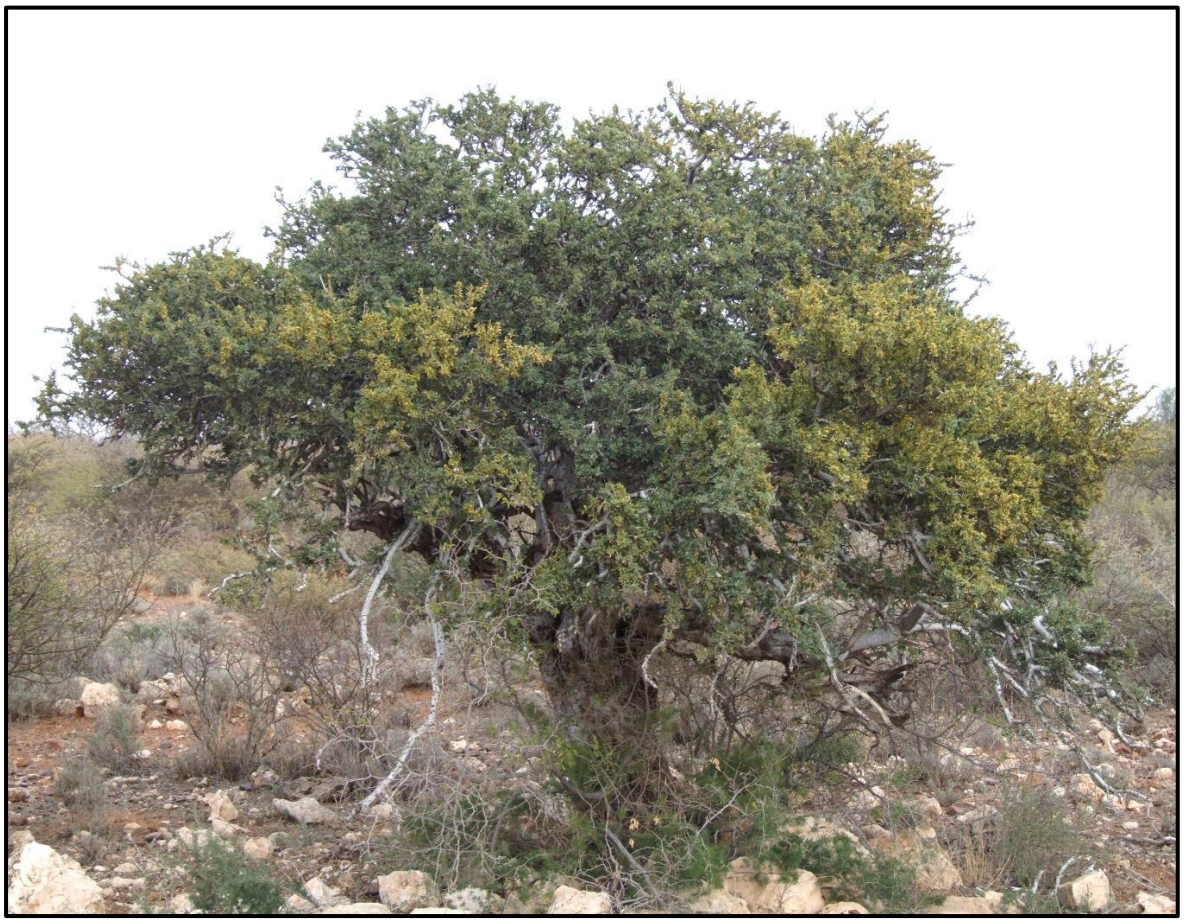
	Scientific name	Common name	IUCN status
2	*Tadorna cana*	South African Shelduck	
2	*Tchagra australis*	Brown-crowned Tchagra	
2	*Telophorus zeylonus*	Bokmakierie	
2	*Threskiornis aethiopicus*	African Sacred Ibis	
2	*Tockus leucomelas*	Southern Yellow-billed Hornbill	
2	*Tockus nasutus*	African Grey Hornbill	
1	*Torgos tracheliotus*	Lappet-faced Vulture	**EN**
2	*Trachyphonus vaillantii*	Crested Barbet	
2	*Tricholaema leucomelas*	Acacia Pied Barbet	
2	*Tringa glareola*	Wood Sandpiper	
2	*Tringa nebularia*	Common Greenshank	
2	*Tringa stagnatilis*	Marsh Sandpiper	
2	*Turdus smithi*	Karoo Thrush	
2	*Turnix sylvatica*	Small Buttonquail	
1	*Tyto alba*	Barn Owl	-
2	*Upupa africana*	African Hoopoe	
2	*Urocolius indicus*	Red-faced Mousebird	
2	*Vanellus armatus*	Blacksmith Lapwing	
2	*Vanellus coronatus*	Crowned Lapwing	
2	*Vidua chalybeata*	Village Indigobird	
2	*Vidua macroura*	Pin-tailed Whydah	
2	*Vidua regia*	Shaft-tailed Whydah	
2	*Zosterops pallidus*	Orange River White-eye	

APPENDIX 3

A photographic guide for species of conservation concern that were encountered or potentially occur on site

Boscia albitrunca

(Protected under the NFA and Schedule 2 of the NCNCA)



Hoodia gordonii

(Listed as DDD and protected under Schedule 1 of the NCNCA)

Larryleachia sp.

(APOCYNACEAE spp. are protected under Schedule 2 of the NCNCA)

Aloe claviflora
(ASPHODELACEAE spp. are protected under Schedule 2 of the NCNCA)


***Lithops* sp.**
(MESEMBRYANTHEMACEAE spp. are protected under Schedule 2 of NCNCA)


Nymania capensis
(Protected under Schedule 2 of the NCNCA)

Euphorbia braunsii

(*Euphorbia* spp. are protected under Schedule 2 of the NCNCA)