



ECOLOGICAL ASSESSMENT REPORT

Roidam Plaas (Pty) Ltd

Roidam diamond prospecting operation



Address:

PostNet Suite #194

Private Bag X2

Diamond

8305

Tel: 082 992 1261

Email: BosciaEcology@gmail.com

Rooidam Plaas (Pty) Ltd

**Portion 1 (Jonas Kopje) and the Remaining Extent of the Farm Rooidam
101**

**District of Warrenton
Northern Cape Province**

**Ecological Assessment Report in application for Environmental
Authorisation related to a Prospecting Right Application (Ref: NC
30/5/1/1/2/11299 PR) that was lodged with the Department of
Mineral Resources**

February 2019

EXECUTIVE SUMMARY

Rooidam (Pty) Ltd is proposing the prospecting of diamonds on Portion 1 (Jonas Kopje) and the Remaining Extent of the Farm Rooidam 101. The prospecting right area is located within the Warrenton District Municipality of the Northern Cape Province. This ecological assessment report describes the characteristics of 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 the open shrubland on shallow red soil, shrubland on rocky ridges and open woodland on deep red sand are included in the earmarked area to be affected by prospecting activities. Of these three, the shrubland on rocky ridges and open woodland on deep red sand are considered to be the most sensitive, with a High Sensitivity to prospecting activities due to the species of conservation concern found here. The most profound impacts are expected to be related to the fragmentation of pristine habitat, which in turn will increase the cumulative effect of important ecological corridors in the region.

Species of conservation concern that are found in these earmarked habitats will most likely also be lost locally. This includes the plants *Boscia albitrunca*, *Vachellia erioloba* and *Kalanchoe paniculata*. Similarly, the prospecting operation could result in the large-scale clearance of indigenous vegetation. 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.

To conclude, the destruction of the natural habitats 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 pristine condition, although some portions of the rocky ridges have been transformed by historic mining activities. In my opinion, authorisation can be granted as long as the applicant commits to the adherence of effective avoidance, management, mitigation and rehabilitation measures.

TABLE OF CONTENTS

EXECUTIVE SUMMARY.....	i
TABLE OF CONTENTS.....	ii
LIST OF FIGURES.....	iv
LIST OF TABLES.....	vi
LIST OF APPENDICES.....	vii
1. INTRODUCTION.....	1
1.1. Background information	1
1.2. Scope of study	2
1.3. Details of the specialist consultant	3
1.4. Description of the proposed activity.....	4
2. METHODOLOGY	5
2.1. Data collection.....	5
2.2. Flora.....	5
2.2.1. Field survey	5
2.2.2. Desktop survey.....	5
2.3. Fauna	6
2.3.1. Desktop survey.....	6
2.3.2. Field survey	6
2.4. Sensitivity mapping and assessment	7
2.5. Impact assessment and mitigation	8
2.6. Assumptions and limitations	10
3. DESCRIPTION OF THE AFFECTED ENVIRONMENT.....	12
3.1. Current and historic land use	12
3.2. Drainage and Quaternary Catchment	12
3.3. Geology, soils and topography.....	15
3.4. Vegetation	15
3.4.1. Broad-scale vegetation patterns.....	15
3.4.2. Fine-scale vegetation patterns.....	19
3.4.3. Population of sensitive, threatened and protected plant species.....	24
3.4.4. Weeds and invader plant species	29

3.4.5.	Indicators of bush encroachment	30
3.5.	Faunal communities	30
3.5.1.	Mammals	31
3.5.2.	Reptiles.....	32
3.5.3.	Amphibians	33
3.5.4.	Avifauna	33
3.5.5.	Fish	36
3.5.6.	Invertebrates.....	37
3.6.	Critical biodiversity areas and broad-scale processes	39
3.7.	Site sensitivity.....	42
4.	ECOLOGICAL IMPACT ASSESSMENT	44
4.1.	Topography, soil erosion and associated degradation of landscapes	44
4.1.1.	Loss of soil fertility	44
4.1.2.	Soil erosion.....	47
4.2.	Vegetation and floristics	48
4.2.1.	Loss of indigenous vegetation.....	48
4.2.2.	Loss of Red data and/or protected floral species	48
4.2.3.	Introduction or spread of alien species	49
4.2.4.	Encouraging bush encroachment	50
4.3.	Fauna	51
4.3.1.	Habitat fragmentation	51
4.3.2.	Disturbance, displacement and killing of fauna.....	52
4.4.	Broad-scale ecological processes	53
5.	CONCLUSION, RECOMMENDATIONS AND OPINION REGARDING AUTHORISATION ..	54
6.	REFERENCES.....	55

LIST OF FIGURES

Figure 1.	The location of the Rooidam prospecting area is indicated in red.....	1
Figure 2.	The locality of the core footprint for the prospecting operation is indicated in white, while the border of the proposed prospecting right area is indicated in red.	4
Figure 3.	A large section of the vegetation on Rooidam was destroyed by a fire in December 2018 and due to the drought the vegetation had not yet recovered by the time the field visit was performed.....	11
Figure 4.	Evidence of the land use history on Rooidam.	13
Figure 5.	The locality of the proposed prospecting area in relation to the quaternary catchments of the Lower Vaal Water Management Area.	14
Figure 6.	The location of formally mapped watercourses on the proposed prospecting right area.	14
Figure 7.	The distribution of geological features in the study area according to (CDSL 1993).	16
Figure 8.	Land types of the study site.	16
Figure 9.	The broad-scale vegetation units (Mucina and Rutherford 2012) present in the study area.	17
Figure 10.	The open shrubland on shallow red soil is dominated by the shrubs <i>Senegalia mellifera</i> and <i>Grewia flava</i>	19
Figure 11.	The distribution of fine-scale plant communities in the study area.	20
Figure 12.	The shrubland on rocky ridges is dominated by <i>Senegalia mellifera</i> and is found on andesitic rocky outcrops and ridges.....	21
Figure 13.	The open woodland on deep red sand is dominated by tall trees scattered in a grassy matrix.	22
Figure 14.	The riparian woodland associated with the Vaal River and drainage ways is represented as a woodland with tall trees that form a dense canopy, with the undergrowth being well developed.	23

Figure 15. The ephemeral pan is densely vegetated by grassland, with trees lining the periphery. 24

Figure 16. Trees of the study site, protected according to the National Forest Act, include *Boscia albitrunca* (top) and *Vachellia erioloba* (bottom). 27

Figure 17. Riet Puts (indicated in red) lies in the vicinity of three Important Bird Areas (BirdLifeSA 2015), i.e. Spitskop Dam, Kamfers Dam and the Dronfield Nature Reserve (indicated in yellow). 34

Figure 18. The study area in relation to the Northern Cape Critical Biodiversity areas. 39

Figure 19. The study area in relation to the Mining and Biodiversity Guidelines. 40

Figure 20. The proposed buffers within the Magareng Local Municipality. 41

Figure 21. The status of wetlands occurring in the vicinity of the proposed prospecting right area. 42

Figure 22. A sensitivity map for the Rooidam prospecting area. 43

LIST OF TABLES

Table 1.	Criteria used to assess the significance of the impacts.	9
Table 2.	Catchment characteristics for the quaternary catchments associated with the study site, as presented by (Delpont and Mallory 2002).	12
Table 3.	Plant species found in the study region that are of conservation concern.	26
Table 4.	A projection of community sizes and species of conservation concern found in the study area.	28
Table 5.	The categorisation of weeds and invader plant species, according to NEMBA and CARA.	29
Table 6.	A list of declared weeds and invasive species recorded in the study area.	29
Table 7.	A list of declared indicators of bush encroachment in the Northern Cape recorded in the study area.	30
Table 8.	A list of mammal species found in the study area, which are of conservation concern in terms of the international (IUCN) Red List and the South African Red Data Book (SA RDB). Their respective NCNCA schedule numbers are indicated in superscript.	32
Table 9.	Bird species found in the study area that are of conservation concern.	35
Table 10.	Fish species expected to occur in the active channel of the Vaal River, along with their IUCN status and sensitivity to physico-chemical and no-flow conditions.	36
Table 11.	Invertebrate species found in the Northern Cape that are of conservation concern.	37
Table 12.	A detailed analysis of ecological impacts identified for the Rooidam prospecting operation.	45

LIST OF APPENDICES

APPENDIX 1: Plant species list

APPENDIX 2: Fauna species list

APPENDIX 3: A photographic guide for species of conservation concern that were encountered on site

1. INTRODUCTION

1.1. Background information

Rooidam Plaas (Pty) Ltd is proposing the prospecting of diamonds on Portion 1 (Jonas Kopje) and the Remaining Extent of the Farm Rooidam 101 (from heron referred to as Rooidam). The prospecting right area is located within the Warrenton District Municipality of the Northern Cape Province and lies 13 km north of the town Windsorton on a gravel road that turns from the R374 (Figure 1). The total extent of the prospecting right area is 1 934.8367 ha and lines the western banks of the Vaal River for ± 3 km.

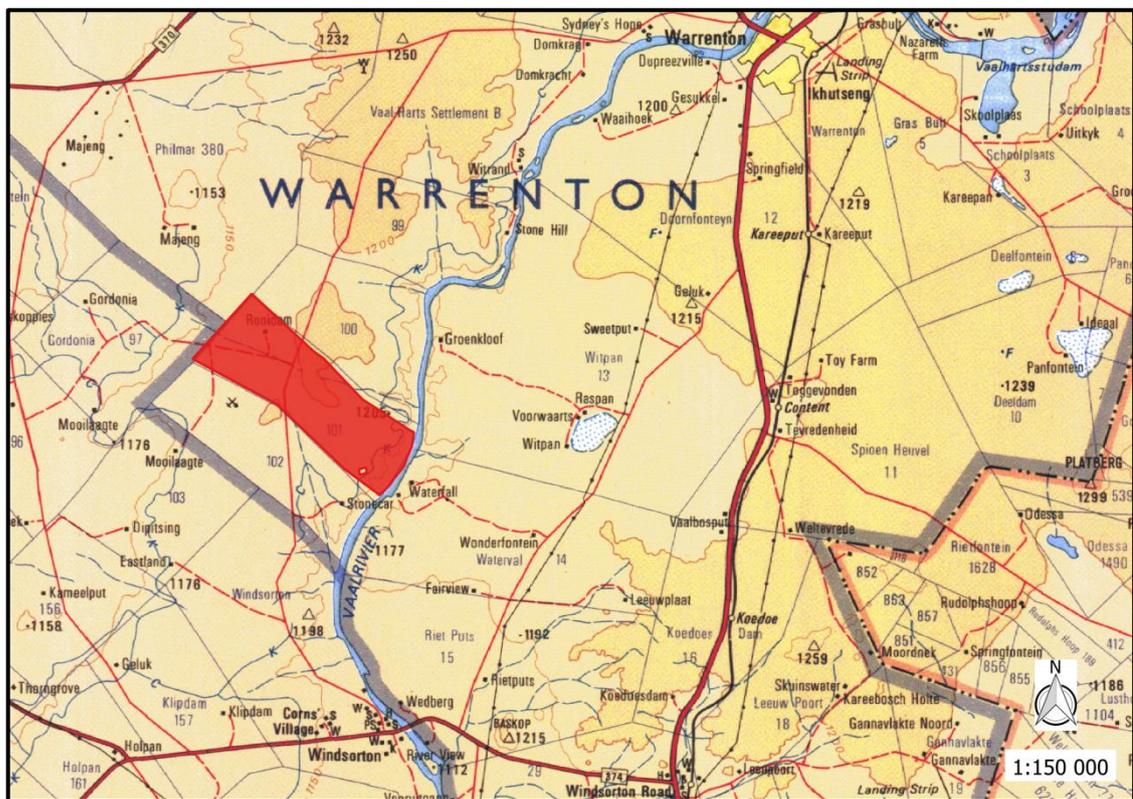


Figure 1. The location of the Rooidam prospecting area is indicated in red.

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

This assessment report describes the characteristics of 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.

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 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 ecological 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,
 - indicates ecological responsibilities pertaining to relevant conservation legislation.

1.3. Details of the specialist consultant

Company Name	Boscia Ecological Consulting cc	Registration no:	2011/048041/23
Address	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	<p>I, Elizabeth (Betsie) Milne declare that I:</p> <ul style="list-style-type: none"> • 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. <div style="text-align: center;">  </div>		

1.4. Description of the proposed activity

The prospecting operation is primarily based on alluvial diamond deposits that are found along the ancient river terraces and alluvial fills at 66 m, 33m and 23m levels, west of the river (Figure 2). The deposits will be sampled in pits (2 m x 1 m) and trenches (200 m x 100 m) by means of an opencast method using heavy earthmoving machinery. Vegetated soil or overburden will be stripped and the underlying gravels will be excavated, screened and treated through a rotary plan plant before fed to an x-ray machine for final recovery. The rough diamond product will then be removed for further beneficiation. No ore processing reagents are required or used in the treatment of the ore. An estimated total volume of 800 000 m³ will be processed over 5 years. Prospecting activities will primarily make use of existing roads created during past activities, but temporary infrastructure and additional haul roads will be created in order to access new prospecting pits. The proposed infrastructure and prospecting related footprint include access roads, office complexes, workshops, oil and diesel depot floors, wash bay floors, break test ramps, plant ramps, central processing plants, slimes dams, pipeline infrastructure for the transportation of water and slimes, open pits and trenches, overburden stockpiles and gravel stockpiles.



Figure 2. The locality of the core footprint for the prospecting operation is indicated in white, while the border of the proposed prospecting right area is indicated in red.

2. METHODOLOGY

2.1. Data collection

The study comprised a combination of field and desktop surveys for data collection on fauna and flora in order to obtain the most comprehensive data set. The fieldwork component was conducted on 4 February 2019 and most data for the desktop component was obtained from the quarter degree squares that include the study area (2824BA and 2824BC).

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 Magareng District Municipality (NC093), 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, birds, fish and invertebrates which are likely to occur in the study area. These were derived from distribution records in the literature, e.g. Friedmann and Daly (2004) and Stuart and Stuart (2015) for mammals, Alexander and Marais (2007) and Bates et al. (2014) for reptiles, Du Preez and Carruthers (2009) for amphibians, Gibbon (2006) for birds, (Kleynhans 2007) for fish and Picker et al. (2004), Griffiths et al. (2015) and (Thirion 2007) for invertebrates.

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. 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.

2.5. 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:

$$\begin{array}{c} \textit{CONSEQUENCE} \\ \text{(Severity + Spatial Scope + Duration)} \end{array} \quad \times \quad \begin{array}{c} \textit{PROBABILITY} \\ \text{(Frequency of activity + Frequency of impact)} \end{array}$$

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

2.6. 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 included.

The site visit for the study took place during mid-summer. This is generally a favourable time of the year for vegetation surveys, if some early summer rain occurred and the vegetation has responded and is in an actively growing state. This was however not the case during this survey. A large part of the natural vegetation on site was destroyed during a fire that ravaged the property in December 2018 (Figure 3). Therefore, those areas that were not destroyed during the fire were used as proxies for community descriptions based on geological similarities. Unfortunately, the vegetation occurring in areas that were not affected by the fire was very dry and most grasses, annuals and other flowering plants were not in a suitable condition for the survey. The results presented here can therefore only reflect the condition of the vegetation. It is expected that many species of conservation concern were not visible during the time of sampling. Nevertheless, most of the common and significant species encountered were identifiable.

Similarly, the aquatic element of the ephemeral pan is best represented when inundated after good rainfall events. The pan was dry during the survey and consequently, the timing of the site visit is considered to be a limiting factor. The aridity and patchy rainfall of the region however rarely provides ideal conditions for these urgent types of surveys and therefore the field investigation was supplemented by desktop surveys to obtain comprehensive understanding of the overall ecology on site.

A wetland assessment report was compiled by *Eko Environmental*, which is expected to provide detailed information on the wetlands found on site. Therefore, this ecological assessment report focuses on describing the terrestrial habitats. It will nevertheless make reference to the wetlands in order to provide a complete depiction of the ecosystems on the prospecting right area.

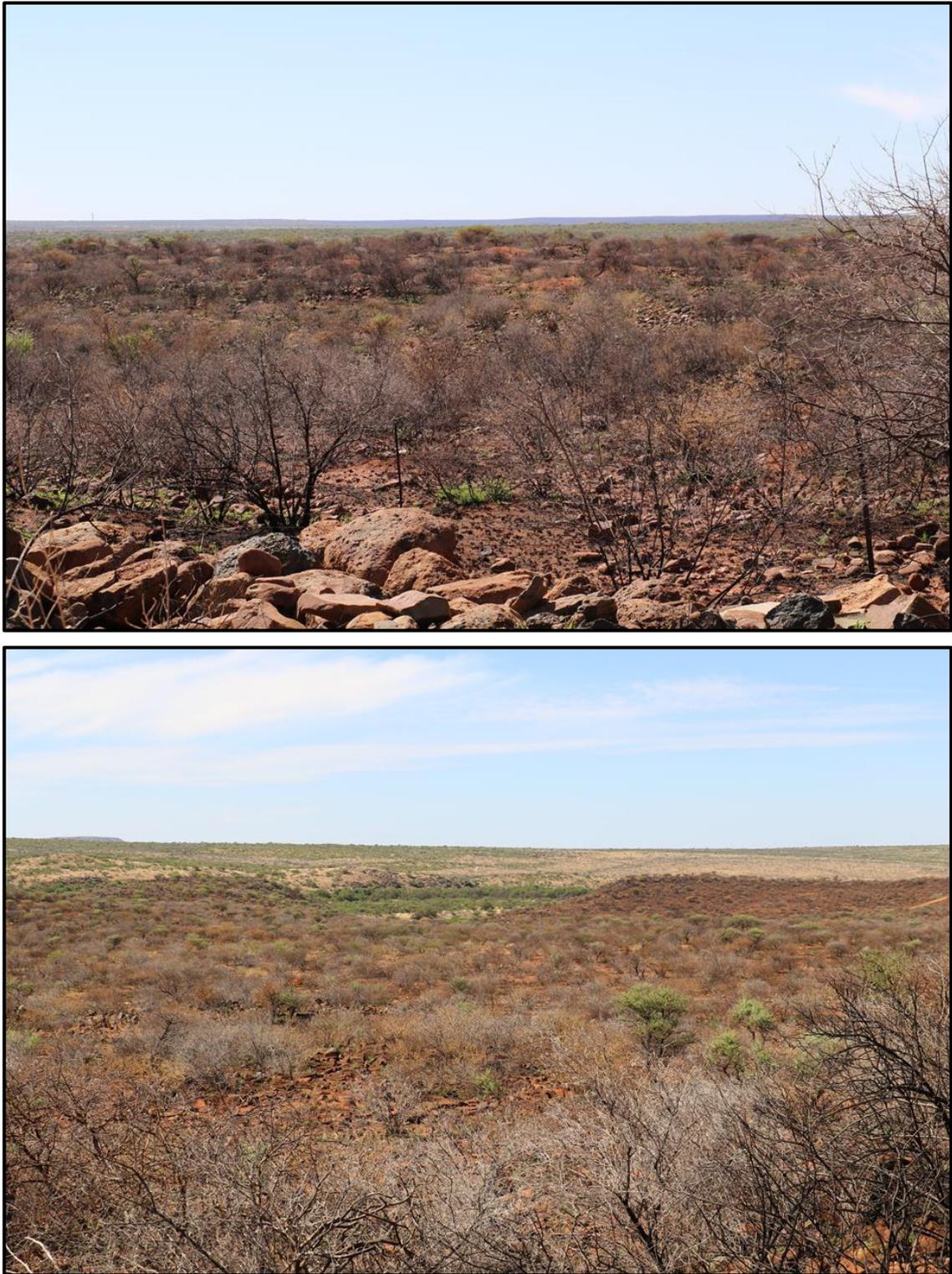


Figure 3. A large section of the vegetation on Rooidam was destroyed by a fire in December 2018 and due to the drought the vegetation had not yet recovered by the time the field visit was performed.

3. DESCRIPTION OF THE AFFECTED ENVIRONMENT

3.1. Current and historic land use

The major land uses in the region are diamond mining, crop irrigation and livestock farming. The site is classified as non-arable land with moderate potential for grazing. The main agricultural enterprise in the region is cattle, with a proposed stocking rate of 9 Ha per large stock unit. According to the Department of Agriculture, Forestry and Fisheries the area has a marginal potential for cotton, groundnut, maize and wheat production.

Apart from the current prospecting application by Rooidam, activities associated to a mining permit (NC 10377 MP) are also currently taking place in a 5.5 Ha exclusion in the south-eastern part of the site (Figure 4). A canal runs through the property in the east and two public gravel roads traverse the property. Evidence of historic diamonds mining activities is also visible on site. The majority of the property is currently used for cattle and game farming.

3.2. Drainage and Quaternary Catchment

The study area falls within the quaternary catchments C33B, C33C (Vaalhartz) and C91D (Vaal D/S Bloemhof) of the Lower Vaal Water Management Area (Figure 5). These quaternary catchments have been allocated a Present Ecological State (PES) of 'Largely Modified' (D) and 'Moderately Modified' (C) respectively, by (Delpont and Mallory 2002). 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 the Vaal River, an ephemeral pan, and a seep (Figure 6).

Table 2. Catchment characteristics for the quaternary catchments associated with the study site, as presented by (Delpont and Mallory 2002).

Quaternary catchment	Catchment Area (km ²)	Mean Annual Rainfall (mm)	Mean Annual Evaporation (mm)	Mean Annual Runoff (10 ⁶ m ³)
C33B	2 835	422	2 100	13.66
C33C	4 149	397	2 150	11.37
C91D	2 697	397	2 050	4.22

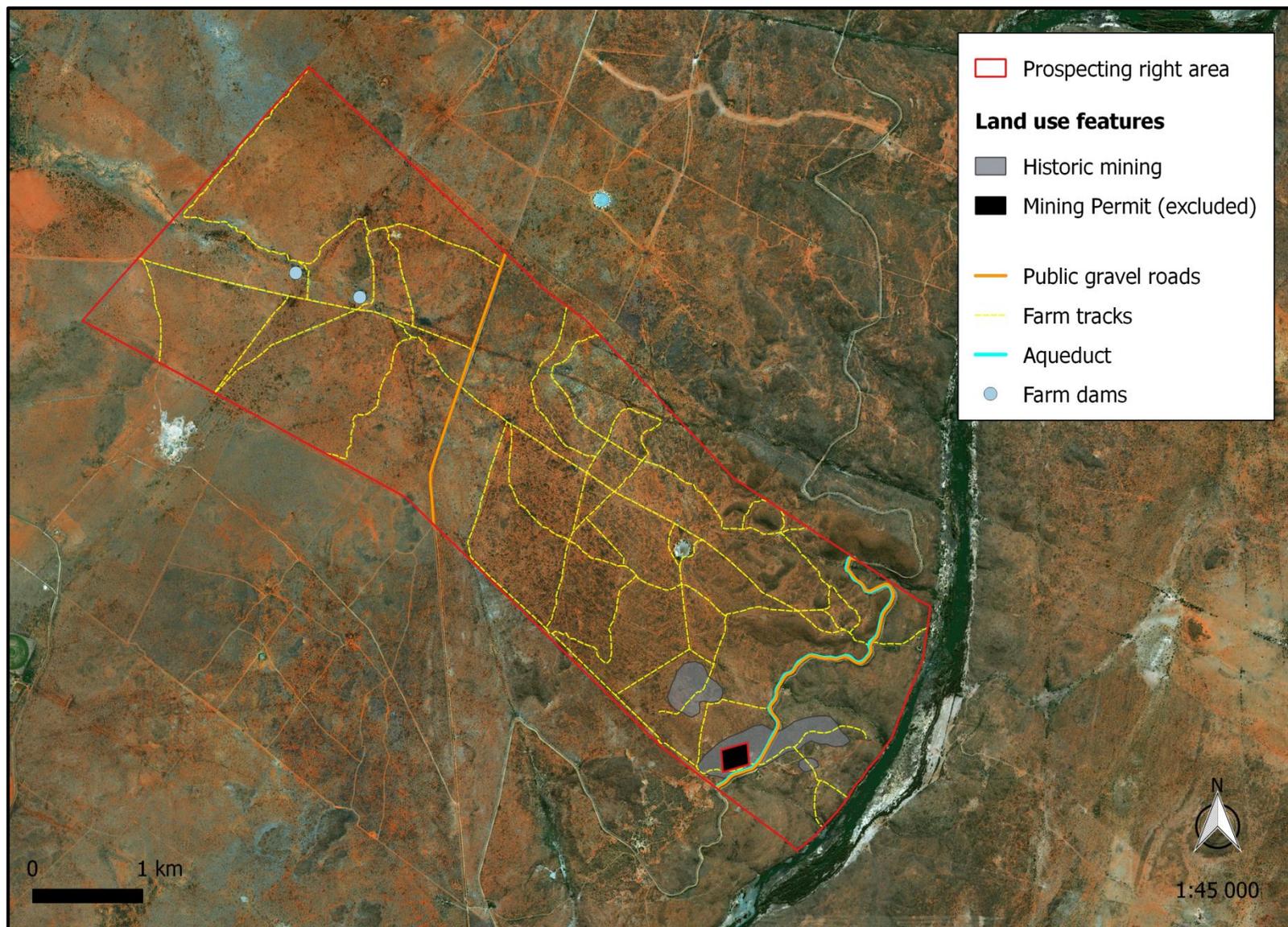


Figure 4. Evidence of the land use history on Rooidam.

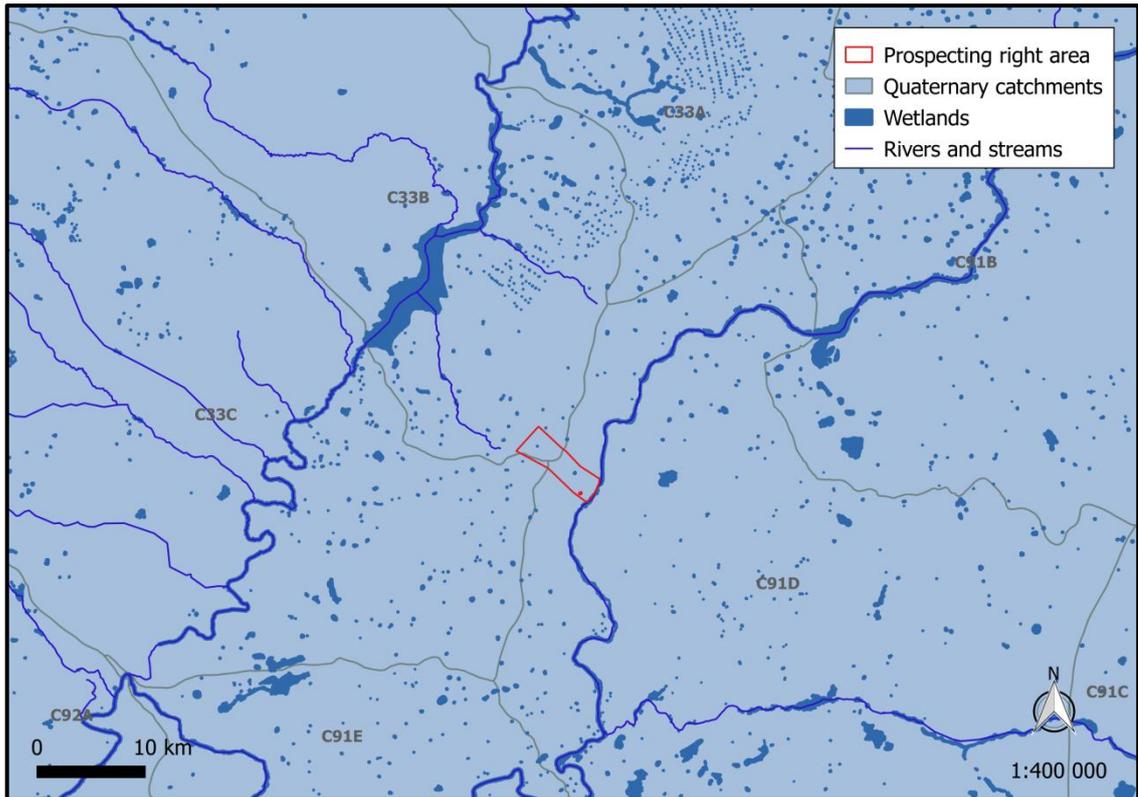


Figure 5. The locality of the proposed prospecting area in relation to the quaternary catchments of the Lower Vaal Water Management Area.

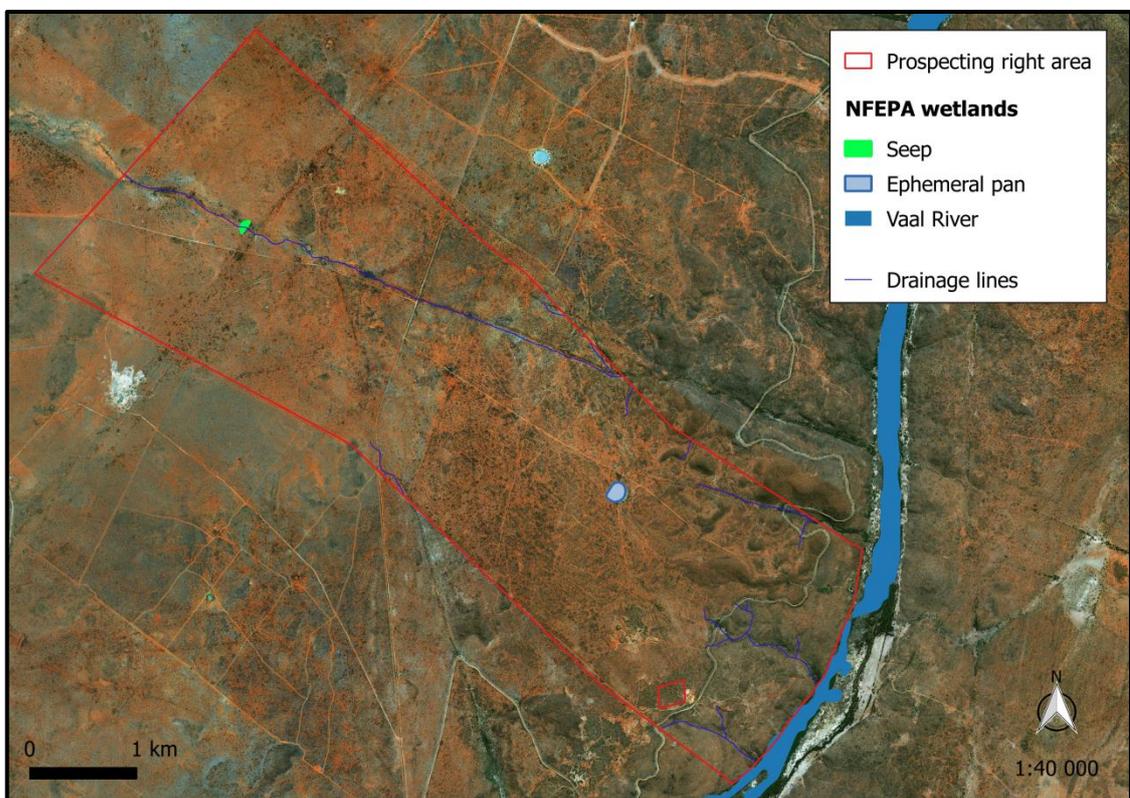


Figure 6. The location of formally mapped watercourses on the proposed prospecting right area.

3.3. Geology, soils and topography

According to CDSL (1993) the geological features on Rooidam comprise randian deposits. The site is underlain with amygdaloidal and porphyritic andesites from the Allen Ridge Formation of the Platberg Group, Ventersdorp Supergroup (Figure 7). The surface comprises a combination of aeolian sand, calcrete, Dwyka tillites and scree, which covers a series of ancient river terraces and alluvial fills. The diamond resources are primarily associated with these terraces.

The region is characterised by slightly irregular plains and pans, with altitudes ranging between 1 126 m above sea level in the riverbed and 1 204 m on the higher lying areas. The terrain is divided by a central high-lying area at 1 200 m, with a gentle slope of 2 % running south-east towards the Vaal River, and another gentle slope of 2 % running north-west.

The site is closely associated with Ae44, Ah21 and Ag10 land types (Figure 8). Soils associated with the Ae44 land type is red-yellow apedal, freely drained with a red, high base status and > 300 mm deep, but no dunes are present. Soils of the Ah21 land type is red-yellow apedal, freely drained with red and yellow, high base status and usually < 15% clay. The Ag10 land type soils are red-yellow apedal, freely drained with red, high base status and < 300 mm deep. The soils on Rooidam have a low to moderate erodibility against wind and water erosion.

3.4. Vegetation

3.4.1. Broad-scale vegetation patterns

The study area falls within the Savanna and Azonal Vegetation biomes (Mucina and Rutherford 2006). According to the vegetation map of Mucina and Rutherford (2012), three broad-scale vegetation units are present on site (Figure 9), i.e. Kimberley Thornveld, Schmidtsdrif Thornveld and Highveld Alluvial Vegetation. This vegetation map however does not reflect the true character of the site, because it has not been mapped at a very fine scale and therefore it is necessary to survey plant communities on site to delineate the vegetation at a finer scale.

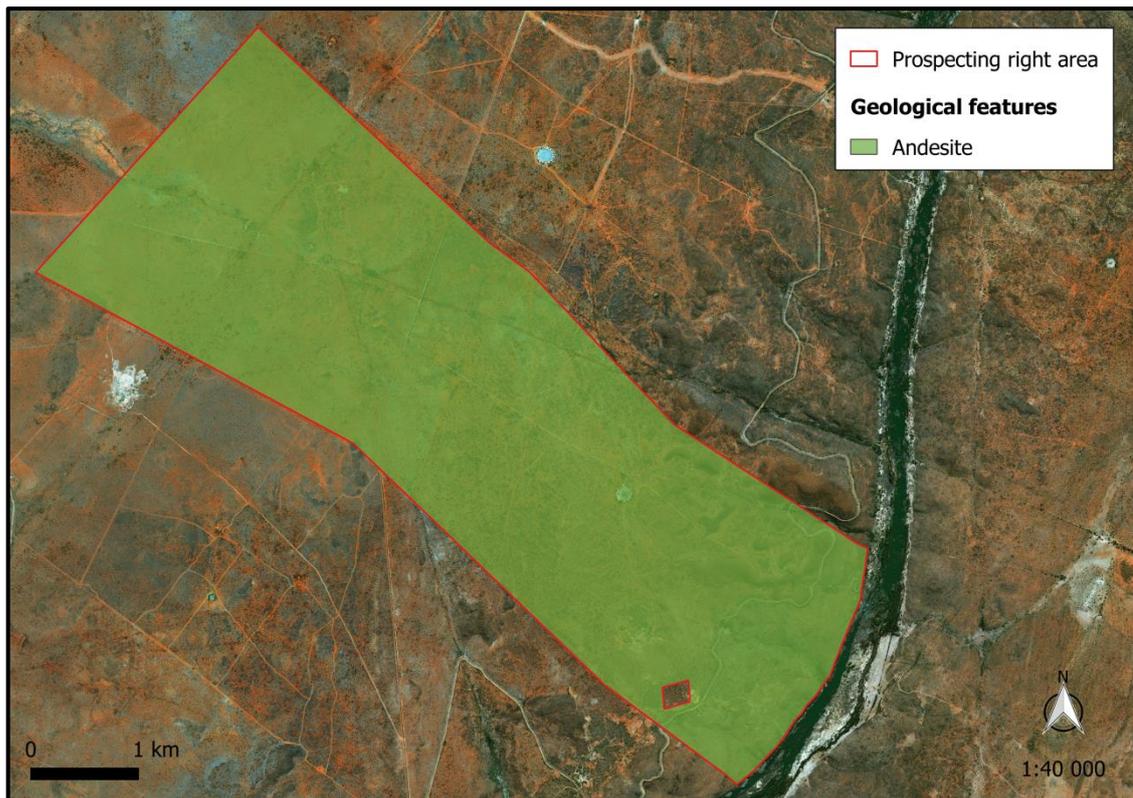


Figure 7. The distribution of geological features in the study area according to (CDSL 1993).

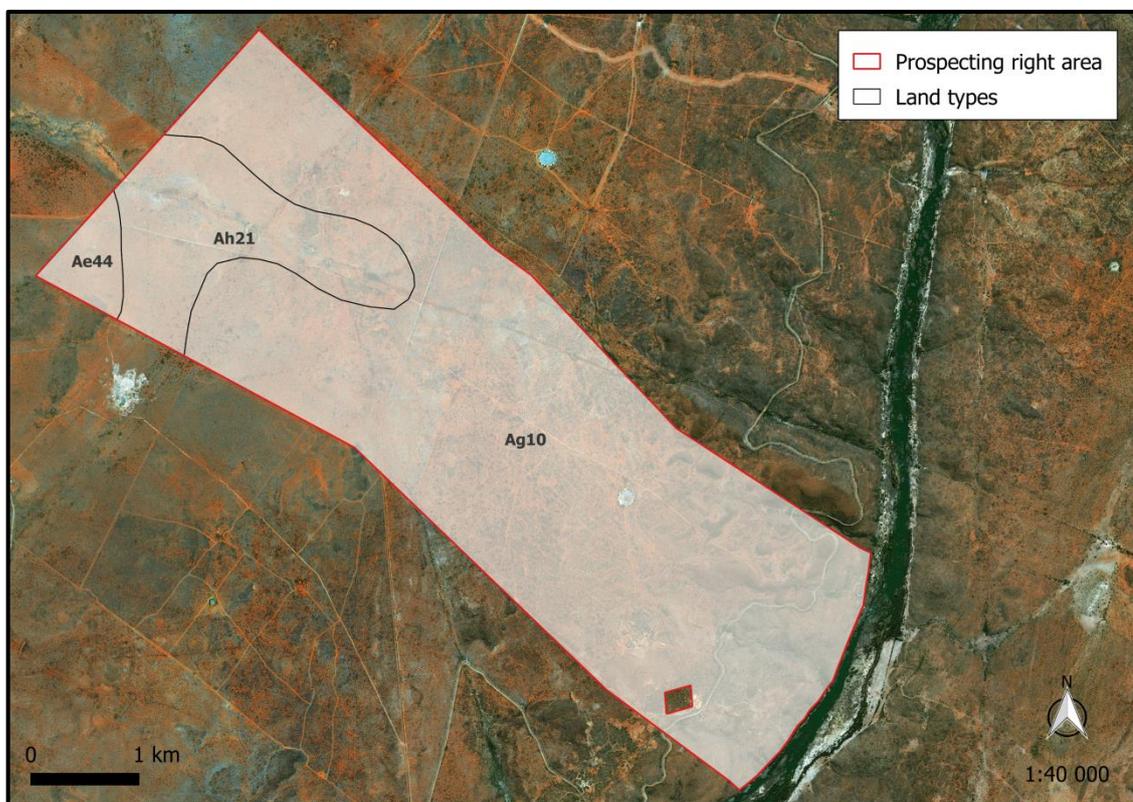


Figure 8. Land types of the study site.

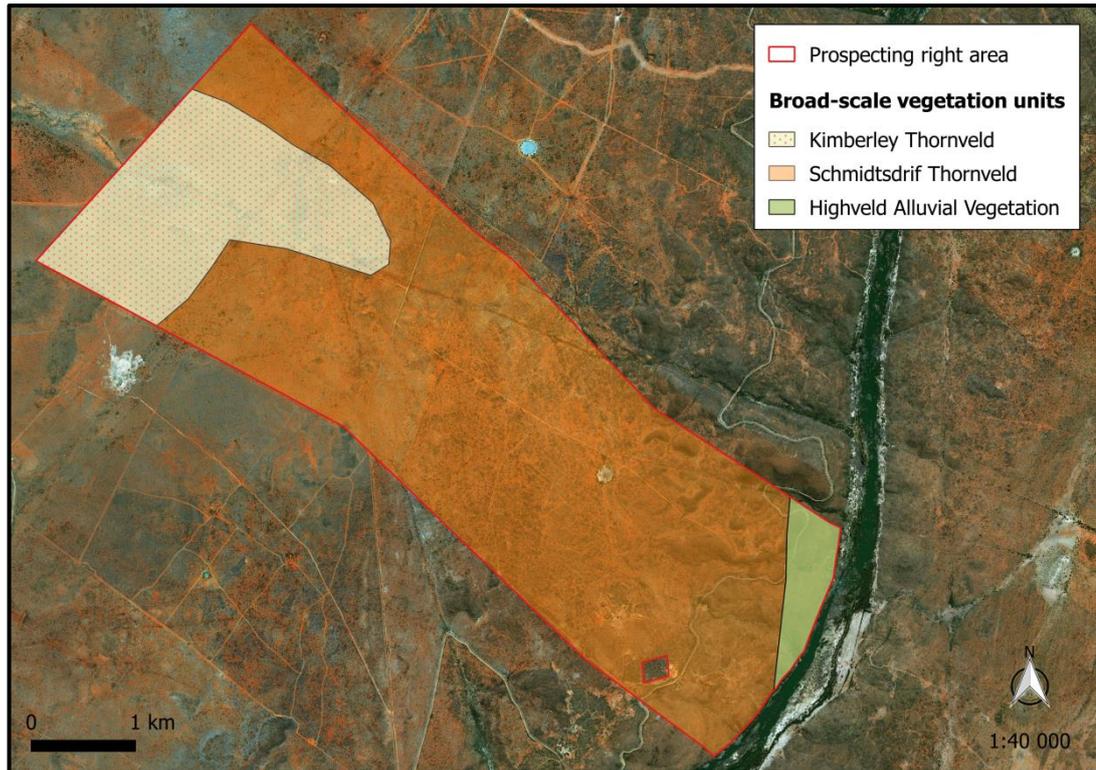


Figure 9. The broad-scale vegetation units (Mucina and Rutherford 2012) present in the study area.

Kimberley Thornveld is distributed in the North-West, Free State and Northern Cape Provinces at altitudes between 1 050 and 1 400 m. It is found in the Kimberley, Hartswater, Bloemhof and Hoopstad Districts, but is also within the Warrenton, Christiana, Taung, Boshof and Barkly West Districts. The unit is typically presented as slightly undulating sandy plains with a well-developed tree and shrub layer and an open grass layer. Andesitic lavas of the Allanridge Formation occur in the north and west, while fine-grained sediments of the Karoo Supergroup are found in the south and east. Soils are deep, sandy to loamy, and of the Hutton form. The most common land types are Ae and Ah. The unit is classified as being least threatened, but 18 % has already been transformed, predominantly by cultivation. Only 2 % is currently conserved in statutory reserves and no endemic species are known from this unit. It is specifically prone to *Acacia mellifera* encroachment following overgrazing, but the occurrence and risk of erosion is very low.

Schmidtsdrif Thornveld is distributed in the Northern Cape, Free State and North-West Provinces at altitudes between 1 000 and 1 350 m. It stretches from the footslopes and midslopes to the southeast and below the Ghaap Plateau from around Douglas in the southwest via Schmidtsdrif towards Taung in the northeast. A small less typical section is

found east of the Ghaap Plateau from Warrenton towards Hertzogville. The unit is typically presented as a closed shrubby thornveld dominated by *Senegalia mellifera* and *Vachellia tortilis*. Apart from grasses, bulbs and annual herbs are also prominent. The vegetation is very disturbed in some areas due to overgrazing by goats and other browsers. Dwyka diamictites and Ecca shales of the Karoo Supergroup are the most significant geological features in this unit, Shale and dolomite of the Schmidtsdrif Subgroup (Griqualand West Supergroup) are also present. Surface limestone occurs sporadically. The soils are well-drained, stony and shallow (< 0.3 m), with large angular rocks found on the surface. A soil-rock complex with Mispah soil form is typical, while the unit is mainly associated with the Ae and Dc land types. The unit is classified as being least threatened, with 13 % being transformed mainly by cultivation. A very small portion (0.2 %) used to be conserved in the de-proclaimed Vaalbos National Park, but it is not currently known to be statutorily conserved. Erosion is very low to low. No endemic species are known from this unit and *Prosopis* spp. is significant alien invaders.

Highveld Alluvial Vegetation falls within the Azonal Vegetation Biome and is mainly distributed in the Free State, North-West, Mpumalanga and Gauteng Provinces, but is also found in alluvial drainage lines and floodplains along marginal (eastern) units of the Savanna Biome in Northern Cape. Altitude ranges between 1 000 and 1 500 m. The unit is typically presented with flat topography supporting riparian thickets, mostly dominated by *Vachellia karroo*. It is accompanied by seasonally flooded grasslands and disturbed herblands often dominated by alien plants. The geology comprise of deep sandy to clayey (but mostly coarse sand) alluvial soils that developed over Quaternary alluvial sediments. Oakleaf, Dundee, Shortlands, Glenrosa and Mispah soil forms were identified in the Vaal River floodplain. Rivers are perennial and often flood in summer. Erosion of the banks and deposition of new fine soil on alluvium can be of considerable extent. Some smaller anastomosing channels of major rivers can dry out in winter. The unit is classified as being least threatened, with 10% being conserved within formal conservation areas, e.g. Bloemhof Dam, Christiana, Baberspan, Wolwespruit, Sandvlei, Schoonspruit, Faan Meintjes and Soetdoring Nature Reserves. More than a quarter has been transformed for cultivation and by building of dams. The unit is highly prone to invasion by alien weeds, while the undergrowth suffers from overgrazing. No endemic species are known from 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 11) and are described below. A complete plant species list, including those species likely to occur in the area is presented in Appendix 1.

i) *Senegalia mellifera* – *Grewia flava* open shrubland on shallow red soil

This community comprises the majority of the study area (Figure 11). It is found on shallow red soil, which constitutes about 10 % of the ground cover. It is typically represented as an open shrubland with *Senegalia mellifera* being the most dominant shrub, followed by *Grewia flava* (Figure 10). Other tall shrubs found here include *Tarchonanthus camphoratus*, *Vachellia tortilis*, *Ziziphus mucronata*, *Ehretia rigida* and *Opuntia ficus-indica*. Low shrubs include *Pentzia incana*, *Monechma incanum*, *Hermannia affinis*, *Lycium* sp. and *Solanum* sp. The grass layer was very dry during the survey, but common grasses that were identifiable include *Eragrostis lehmanniana*, *E. rigidior* and *Aristida congesta* subsp. *barbicollis*.



Figure 10. The open shrubland on shallow red soil is dominated by the shrubs *Senegalia mellifera* and *Grewia flava*.

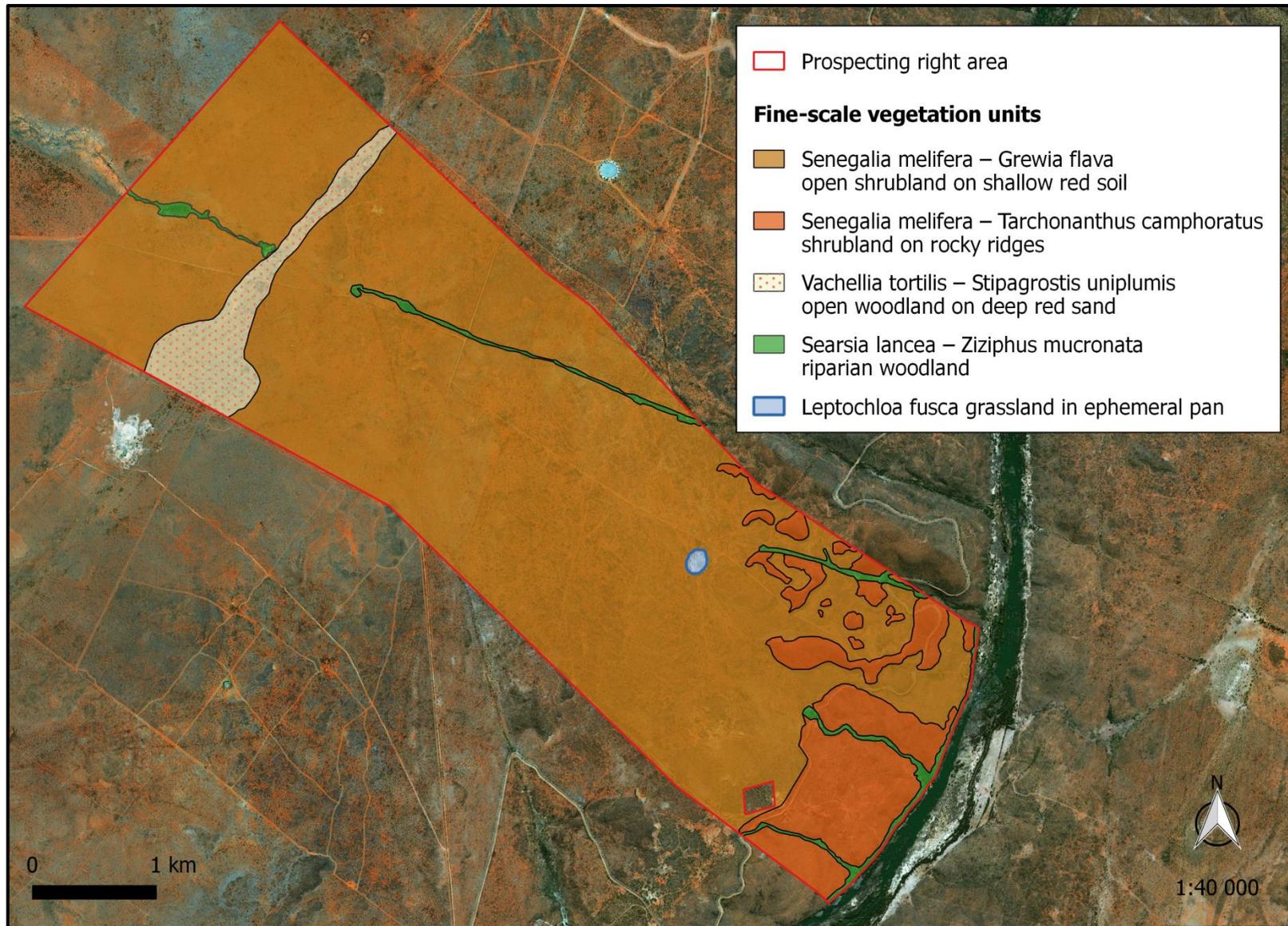


Figure 11. The distribution of fine-scale plant communities in the study area.

ii) *Senegalia mellifera* – *Tarchonanthus camphoratus* shrubland on rocky ridges

This community is found in the east of the study area (Figure 11) on red andesitic rocky outcrops and ridges, where rock constitutes approximately 30 % of the ground cover. Unfortunately, the majority of this community was destroyed in a fire, but small isolated outcrops west of the canal were used as proxies to describe the vegetation for this unit.

It is typically represented as a shrubland with *Senegalia mellifera* being the most dominant shrub (Figure 12). Other tall shrubs found here include *Tarchonanthus camphoratus*, *Vachellia luederitzii* var. *luederitzii*, *Boscia albitrunca*, *Grewia flava* and *Ehretia rigida*. Low shrubs include *Kalanchoe paniculata* and *Asparagus* sp. The grass layer includes species such as *Aristida vestita*, *Enneapogon scoparius*, *Heteropogon contortus* and *Cenchrus ciliaris*.



Figure 12. The shrubland on rocky ridges is dominated by *Senegalia mellifera* and is found on andesitic rocky outcrops and ridges.

iii) *Vachellia tortilis* – *Stipagrostis uniplumis* open woodland on deep red sand

This community is found in the west of the study area (Figure 11) on deep red sand that constitutes approximately 10 % of the ground cover. It is typically represented as an open woodland, where tall trees are scattered in a grassy matrix (Figure 13).

The tree layer is dominated by *Vachellia tortilis*, but *Vachellia erioloba* is also conspicuous. Tall shrubs found here include *Grewia flava*, *Senegalia mellifera*, *Tarchonanthus camphoratus* and *Ehretia rigida*. Low shrubs include *Vachellia hebeclada*, *Searsia tridactyla*, *Chrysocoma ciliata*, *Aptosimum marlothii* and the hemiparasite *Viscum rotundifolium*.

The grass layer is dominated by *Stipagrostis uniplumis*, but other species such as *Aristida congesta* subsp. *barbicollis* and *Eragrostis rigidior* are also common. Herbs include *Senna italica*, *Chamaecrista capensis* and *Cucumis africanus*.



Figure 13. The open woodland on deep red sand is dominated by tall trees scattered in a grassy matrix.

iv) *Searsia lancea* – *Ziziphus mucronata* riparian woodland

This community is found along the Vaal River that lines the study area in the east, its tributaries, as well as drainage ways in the west of the study area (Figure 11). It is typically represented as a woodland, where tall trees form a dense canopy over a well-developed undergrowth (Figure 14).

The tree layer is dominated by *Searsia lancea* and *Ziziphus mucronata*, but other trees include *Salix mucronata*, *Acacia karroo* and *Diospyros lycioides*. The undergrowth is primarily dominated by graminoids such as *Panicum coloratum*, *Paspalum distichum* and *Cyperus denudatus* as well as weedy forbs such as *Cirsium vulgare* and *Tagetes minuta*.



Figure 14. The riparian woodland associated with the Vaal River and drainage ways is represented as a woodland with tall trees that form a dense canopy, with the undergrowth being well developed.

v) *Leptochloa fusca* grassland in ephemeral pan

One ephemeral pan is situated in the eastern half of the study area (Figure 11). The pan is densely vegetated by grassland, which is densely dominated by *Leptochloa fusca* (Figure 15). The periphery of the pan is lined with trees such as *Ziziphus mucronata*, *Searsia lancea*, *Grewia flava*, *Tarchonanthus camphoratus* and *Vachellia tortilis*.



Figure 15. The ephemeral pan is densely vegetated by grassland, with trees lining the periphery.

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.

All species recorded in the area are classified as least concern; a category which includes widespread and abundant taxa (Table 3). Three of the species from the study region, i.e. *Boscia albitrunca*, *Vachellia erioloba* and *Vachellia haematoxylon*, are protected in terms of the National Forests (NFA) Act No 84 of 1998. However, only *Boscia albitrunca* and *Vachellia erioloba* was observed on site (Figure 16). *Boscia albitrunca* is found on the rocky ridges at low densities. They occur as adult shrubs of ± 2 m (h) x 2 m (w). *Vachellia erioloba* is associated with the open woodland on deep red sand and occur at high densities, as adult trees of up to ± 5 m (h) x 8 m (w) in size.

No specially protected species in terms of Schedule 1 of the Northern Cape Nature Conservation (NCNCA) Act No. 9 of 2009 (Table 3) were recorded in the study area. Those protected in terms of Schedule 2 of the NCNCA are *Boscia albitrunca* and *Kalanchoe paniculata*. The latter was found in the shrubland on rocky ridges, along with *Boscia albitrunca* that was already discussed above. The remaining protected species were historically recorded in the region but was not encountered on site. Nevertheless, it is possible that they might occur on site, especially after the vegetation has had time to respond after the recent summer rain. A projection for species of conservation concern is presented in Table 4 and a photographic guide to those species that were encountered on site is attached as Appendix 3. Please note that the projections are only rough estimates to provide some form of indication as a guideline for those species that will be most 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. It is crucial that the earmarked areas be traversed in order to determine the exact number of species of conservation concern to be affected.

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 (> 1 Ha) clearance of all indigenous (Schedule 3) vegetation, before such activities commence.

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

FAMILY	Scientific name	Status	NFA	NCNCA
AIZOACEAE	<i>Mesembryanthemum crystallinum</i>	LC		S2
AIZOACEAE	<i>Mesembryanthemum guerichianum</i>	LC		S2
AIZOACEAE	<i>Mesembryanthemum stenandrum</i>	LC		S2
AIZOACEAE	<i>Mesembryanthemum subnodosum</i>	LC		S2
APIACEAE	<i>Deverra burchellii</i>	LC		S2
APOCYNACEAE	<i>Adenium oleifolium</i>	LC		S2
APOCYNACEAE	<i>Gomphocarpus fruticosus subsp. fruticosus</i>	LC		S2
APOCYNACEAE	<i>Orbea knobelii</i>	LC		S2
APOCYNACEAE	<i>Orbea lugardii</i>	LC		S2
APOCYNACEAE	<i>Orbea lutea subsp. vaga</i>	LC		S2
APOCYNACEAE	<i>Orthanthera jasminiflora</i>	LC		S2
APOCYNACEAE	<i>Pergularia daemia subsp. Daemia</i>	LC		S2
APOCYNACEAE	<i>Pergularia daemia subsp. garipensis</i>	LC		S2
APOCYNACEAE	<i>Stapelia olivacea</i>	LC		S2
APOCYNACEAE	<i>Tridentea marientalensis</i>	LC		S2
BRASSICACEAE	<i>Boscia albitrunca</i>	LC	X	S2
CELASTRACEAE	<i>Gymnosporia linearis subsp. lanceolata</i>	LC		S2
COMBRETACEAE	<i>Combretum erythrophyllum</i>	LC		S2
CRASSULACEAE	<i>Kalanchoe paniculata</i>	LC		S2
Euphorbiaceae	<i>Euphorbia braunsii</i>	LC		S2
Euphorbiaceae	<i>Euphorbia crassipes</i>	LC		S2
Euphorbiaceae	<i>Euphorbia davyi</i>	LC		S2
Euphorbiaceae	<i>Euphorbia glanduligera</i>	LC		S2
Euphorbiaceae	<i>Euphorbia gregaria</i>	LC		S2
Euphorbiaceae	<i>Euphorbia inaequilatera var. inaequilatera</i>	LC		S2
Euphorbiaceae	<i>Euphorbia spartaria</i>	LC		S2
Euphorbiaceae	<i>Euphorbia spinea</i>	LC		S2
Fabaceae	<i>Lessertia macrostachya var. macrostachya</i>	LC		S1
Fabaceae	<i>Vachellia erioloba</i>	LC	X	
Fabaceae	<i>Vachellia haematoxylon</i>	LC	X	
Iridaceae	<i>Duthieastrum linifolium</i>	LC		S2
Iridaceae	<i>Moraea simulans</i>	LC		S2



Figure 16. Trees of the study site, protected according to the National Forest Act, include *Boscia albitrunca* (top) and *Vachellia erioloba* (bottom).

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
 <i>Senegalia mellifera</i> – <i>Grewia flava</i> open shrubland on shallow red soil	± 1 600 ha	± 500 ha	None encountered during survey	N/A	None predicted
 <i>Senegalia mellifera</i> – <i>Tarchonanthus camphoratus</i> shrubland on rocky ridges	± 200 ha	± 200 ha	<i>Boscia albitrunca</i> <i>Kalanchoe paniculata</i>	1 1	± 200 ± 200
 <i>Vachellia tortilis</i> – <i>Stipagrostis uniplumis</i> open woodland on deep red sand	± 90 ha	± 70 ha	<i>Vachellia erioloba</i>	± 10	± 700
 <i>Searsia lancea</i> – <i>Ziziphus mucronata</i> riparian woodland	± 40 ha	0 ha	None encountered during survey	N/A	None predicted
 <i>Leptochloa fusca</i> grassland in ephemeral pan	± 3 ha	0 ha	None encountered during survey	N/A	None predicted

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 (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
<i>Opuntia ficus-indica</i>	Sweet prickly pear	1	1b	S6
<i>Cirsium vulgare</i>	Scotch thistle	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 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
<i>Senegalia mellifera</i>	Black thorn
<i>Vachellia karroo</i>	Sweet thorn
<i>Vachellia tortilis</i> subsp. <i>heteracantha</i>	Umbrella thorn
<i>Grewia flava</i>	Wild raisin
<i>Vachellia luederitzii</i>	False umbrella thorn
<i>Tarchonanthus camphoratus</i>	Camphor bush

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 on Rooidam provide diverse habitat opportunities to faunal communities, and these are discussed in their respective faunal groups below.

3.5.1. Mammals

As many as 11 listed terrestrial mammal species and four listed bat species potentially occur in the area (Table 8). The African Straw-coloured Fruit-bat, Geoffroy's Horseshoe Bat, African Striped Weasel and Honey Badger have a high chance of occurring across the site, given their wide habitat tolerances. The Dent's Horseshoe Bat, Darling's Horseshoe Bat, Bushveld Gerbil and Lesser Dwarf Shrew have a high potential of occurring in the open woodland or shrubland in the east due to their preference for savanna, grassland or woodland habitats. The Cape Clawless Otter and Spotted-necked Otter both have a high potential to occur in the vicinity of the Vaal River due to their preference for aquatic habitats.

The South African Hedgehog, Black-footed cat and Ground Pangolin 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 Sclater's Golden Mole has a low potential of occurring on site due to its preference for higher altitude hills, while the Brown Hyaena might have occurred on site in the past, 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.

Virtually all mammals of the study area are protected; either according to Schedule 1, 2 or 3 of NCNCA (see Appendix 2). Those that are specially protected include Spotted-necked Otter, Honey Badger, Striped Polecat, Bat-eared Fox, Brown hyena, Cape Fox, Black-footed cat, African Wild Cat, Aardwolf, African Striped Weasel, South African Hedgehog, Ground Pangolin and Aardvark. Problem animals (Schedule 4) include Black-backed Jackal, Vervet Monkey, Chacma Baboon and Caracal.

The core prospecting activities are associated with the ridges and shrubland directly east of the Vaal River as well as the open woodland in the far south-west of the site. Listed mammals that are most likely to be impacted in the form of species- and/or habitat loss resulting from the prospecting activities include those associated with these rocky, savanna and woodland habitats.

Table 8. A list of mammal species found in the study area, which are of conservation concern in terms of the international (IUCN) Red List and the South African Red Data Book (SA RDB). Their respective NCNCA schedule numbers are indicated in superscript.

Scientific name	Common name	IUCN Status	SA RDB Status
² <i>Eidolon helvum</i>	African Straw-coloured Fruit-bat	NT	Not listed
² <i>Rhinolophus denti</i>	Dent's Horseshoe Bat	LC	NT
² <i>Rhinolophus clivosus</i>	Geoffroy's Horseshoe Bat	LC	NT
² <i>Rhinolophus darlingi</i>	Darling's Horseshoe Bat	LC	NT
² <i>Chlorotalpa sclateri</i>	Sclater's Golden Mole	LC	DD
² <i>Gerbilliscus leucogaster</i>	Bushveld Gerbil	LC	DD
¹ <i>Smutsia temminckii</i>	Ground Pangolin	VU	VU
² <i>Suncus varilla</i>	Lesser Dwarf Shrew	LC	DD
¹ <i>Atelerix frontalis</i>	South African Hedgehog	LC	NT
¹ <i>Felis nigripes</i>	Black-footed cat	VU	LC
² <i>Aonyx capensis</i>	Cape Clawless Otter	NT	LC
¹ <i>Hydrictis maculicollis</i>	Spotted-necked Otter	NT	NT
¹ <i>Hyaena brunnea</i>	Brown Hyena	NT	NT
¹ <i>Poecilogale albinucha</i>	African Striped Weasel	LC	DD
¹ <i>Mellivora capensis</i>	Honey Badger	LC	NT

3.5.2. Reptiles

The Rooidam prospecting area lies within the distribution range of at least 55 reptile species (see Appendix 2), of which none are of international or national conservation concern. Three species are endemic to South Africa, i.e. *Homopus femoralis* (Greater Padloper), *Pachydactylus mariquensis* (Common Banded Gecko) and *Agama aculeata distanti* (Eastern Ground Agama) and most area are protected either according to Schedule 1, 2 or 3 of NCNCA, except for agamas, geckos and skinks (see Appendix 2). Specially protected species include *Karusasaurus polyzonus* (Southern Karusa Lizard) and *Chamaeleo dilepis dilepis* (Namaqua Chamaeleon).

The habitat diversity for reptiles in the study area is high and includes the aquatic and riparian zones, rocky ridges, sandy plains and ephemeral drainage lines. The rocky ridges are considered to be the most important habitat for reptiles at the site and the prospecting activities will take place on some of these ridges.

3.5.3. Amphibians

Fifteen amphibian species are known from the region (Appendix 2). Low amphibian diversity is normal for an arid area, but is likely to increase within the aquatic and wetland ecosystem of the Vaal River as well as in the ephemeral pan once inundated. As a result, a higher amphibian diversity is most likely to be found in the latter, while only those species which are relatively independent of water are likely to be common in the area further east of the river.

Pyxicephalus adspersus (Giant Bull Frog) is the amphibian species of conservation concern that potentially occur in the study area. It is listed as Near Threatened in terms of the Red Data Book of Frogs and is protected according to Schedule 1 of the NCNCA. All other amphibians of the study area are protected according to Schedule 2 of NCNCA (see Appendix 2). No prospecting activities are planned near the river or within the ephemeral pan, but impacts on amphibians at Rooidam are likely to be associated with the riparian habitats of the drainage lines and streams.

3.5.4. Avifauna

The study site does not fall within any of the Important Bird Areas (IBA) defined by Birdlife South Africa, but lies near (< 50 km) three IBAs (Figure 17); i.e. Spitskop Dam (17 km), Dronfield (40 km) and Kamfers Dam (50 km).

Spitskop Dam is one of the largest wetlands in the Northern Cape region and holds water permanently, providing a vital habitat when many temporary wetlands have dried up. It is an important habitat for the Greater- and Lesser Flamingo, Chestnut-banded Plover, Caspian Tern, Pink-backed Pelican and Yellow-billed Stork. One of the most important threats is the poor water quality of the dam fed by the Hart River. The water quality of the latter deteriorates due to irrigation return flows with increasing concentrations of sodium, magnesium, chloride, sulphate and nutrients. Releases from Spitskop Dam could also impact on the quality of the Vaal River. Other important threats to Spitskop Dam include the hunting or poaching of water birds, fishing activities and livestock grazing and trampling. The dam edges are threatened by the common reed, the dominance of which reduces the foraging area for flamingos and waders that prefer open shoreline.

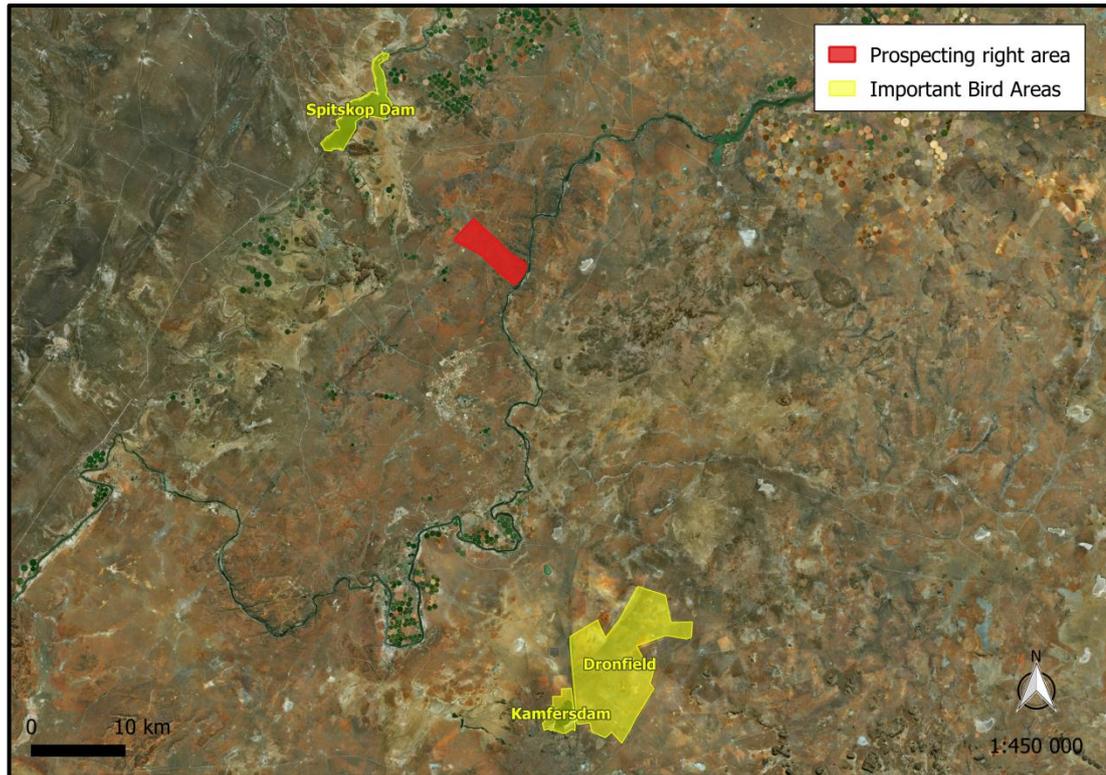


Figure 17. Riet Puts (indicated in red) lies in the vicinity of three Important Bird Areas (BirdLifeSA 2015), i.e. Spitskop Dam, Kamfers Dam and the Dronfield Nature Reserve (indicated in yellow).

Dronfield supports large numbers of breeding White-backed Vulture, which comprises 41 % of the breeding pairs in the Kimberley region. These birds forage over wide areas and a pair was encountered soaring over the study area during the site visit. The use of poisons in farming areas to combat mammalian predators still poses a threat to scavenging raptors, and hundreds of vultures can be killed in a single poisoning incident. Collisions with transmission power lines and electrocutions on reticulation and distribution power lines also pose an ongoing threat to vultures and other trigger species.

Kamfersdam is an endorheic pan that has been transformed into a permanent wetland over the past decade due to an increase in sewage effluent inflow. Hence, it has become an important habitat for birds, especially the Greater- and Lesser Flamingos. The dam supports the largest permanent population of Lesser Flamingos in southern Africa. The most significant threats to Kamfersdam are poor water quality, flooding and expansion of urban development, while threats to the bird population include illegal hunting of water birds and the collisions and mortality of flamingos and other water birds caused by power lines and the electrical transmission lines along the railway.

A total number of 295 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). Twenty-four listed bird species are known from the region, all of which are classified as Vulnerable, Near Threatened or Endangered (Table 9).

Table 9. Bird species found in the study area that are of conservation concern.

Scientific name	Common name	Status
<i>Aquila rapax</i>	Tawny Eagle	EN
<i>Circus ranivorus</i>	African Marsh-Harrier	EN
<i>Gyps africanus</i>	White-backed Vulture	EN
<i>Gyps coprotheres</i>	Cape Vulture	EN
<i>Mycteria ibis</i>	Yellow-billed Stork	EN
<i>Polemaetus bellicosus</i>	Martial Eagle	EN
<i>Torgos tracheliotus</i>	Lappet-faced Vulture	EN
<i>Anthropoides paradisea</i>	Blue Crane	NT
<i>Ardeotis kori</i>	Kori Bustard	NT
<i>Charadrius pallidus</i>	Chestnut-banded Plover	NT
<i>Ciconia abdimii</i>	Abdim's Stork	NT
<i>Eupodotis caerulescens</i>	Blue Korhaan	NT
<i>Glareola nordmanni</i>	Black-winged Pratincole	NT
<i>Leptoptilos crumeniferus</i>	Marabou Stork	NT
<i>Limosa limosa</i>	Black-tailed Godwit	NT
<i>Numenius arquata</i>	Eurasian Curlew	NT
<i>Oxyura maccoa</i>	Maccoa Duck	NT
<i>Phoenicopterus minor</i>	Lesser Flamingo	NT
<i>Phoenicopterus ruber</i>	Greater Flamingo	NT
<i>Aquila verreauxii</i>	Verreaux's Eagle	VU
<i>Circus maurus</i>	Black Harrier	VU
<i>Falco biarmicus</i>	Lanner Falcon	VU
<i>Rostratula benghalensis</i>	Greater Painted-snipe	VU
<i>Sagittarius serpentarius</i>	Secretarybird	VU

In general, bird species of the study area are likely to experience some disturbances as a result of the Rooidam prospecting activities. The most significant impacts are however expected to be in the form of riparian habitat destruction if any of the drainage lines are to be excavated. Not only will the birds that rely on these habitats for breeding, nesting and foraging be displaced, but the subsequent loss of ecological corridors and connectivity will occur. None of the protected species directly associated with the ephemeral wetland and aquatic habitats of the Vaal River are however expected to be affected.

Terrestrial birds are likely to experience local disturbances, where habitat loss will be confined to the footprint of core sites and their activities will cause disturbances in the form of noise and movement. Birds are however highly mobile and are expected to move to similar adjacent habitats, if necessary. Therefore, the Rooidam activities would not constitute a significant loss that would compromise the available habitat for any of the terrestrial resident bird species. Apart from general disturbances and habitat loss, other potential impacts would come from accidental or intentional killing of birds.

3.5.5. Fish

Fish species expected to occur in the active channel of the Vaal River is listed in Table 10, along with their IUCN status and sensitivity to physico-chemical and no-flow conditions. No prospecting activities are however planned near the river and therefore the Rooidam operation is not expected to have any impacts on the fish communities of the region.

Table 10. Fish species expected to occur in the active channel of the Vaal River, along with their IUCN status and sensitivity to physico-chemical and no-flow conditions.

Scientific Name	Common name	IUCN	Phys-Chem sensitivity	No-Flow sensitivity
<i>Austroglanis sclateri</i>	Rock Catfish	LC	Moderate	High
<i>Labeobarbus aeneus</i>	Vaal-orange Smallmouth Yellowfish	LC	Moderate	High
<i>Clarias gariepinus</i>	African Catfish	LC	Low	Low
<i>Labeo capensis</i>	Orange River Mudfish	LC	Moderate	High
<i>Labeo umbratus</i>	Moggel	LC	Low	Moderate
<i>Pseudocrenilabrus philander</i>	Southern Mouthbrooder	-	Low	Low
<i>Tilapia sparrmanii</i>	Banded Tilapia	LC	Low	Low

3.5.6. Invertebrates

Invertebrates dominate inland habitats and play a significant role in the overall function of the ecosystem (Kremen et al. 1993; Weisser and Siemann 2004). Their immense species diversity makes it almost impossible to list all species that may possibly occur on site. Nevertheless, key morphospecies as well as species of conservation concern are discussed here.

Eight invertebrate species of the Northern Cape appear on the IUCN Red Data list of threatened species and are listed in Table 11, along with species that are specially protected according to Schedule 1 of the NCNCA. All other invertebrates from the class Insecta and Arachnida are protected either according to Schedule 2 or 3 of the NCNCA.

Table 11. Invertebrate species found in the Northern Cape that are of conservation concern.

CLASS	ORDER	Scientific Name	Common name	Status
ARACHNIDA	MYGALOMORPHAE	<i>Ceratogyrus</i> spp.	Horned Baboon Spiders	S1
		<i>Harpactira</i> spp.	Common Baboon Spiders	S1
		<i>Pterinochilus</i> spp.	Goldenbrown Baboon Spiders	S1
INSECTA	COLEOPTERA	<i>Circellium bacchus</i>	Cape Dung Beetle	S1
		<i>Colophon</i> spp.	All Stag Beetles	S1
	LEPIDOPTERA	<i>Lepidochrysops penningtoni</i>	Pennington's Blue	DD
	ORTHOPTERA	<i>Africariola longicauda</i>	Richtersveld Katydid	VU
		<i>Alfredectes browni</i>	Brown's Shieldback	DD
		<i>Brinckiella serricauda</i>	Serrated Winter Katydid	DD
		<i>Brinckiella arboricola</i>	Tree Winter Katydid	EN
		<i>Brinckiella aptera</i>	Mute Winter Katydid	VU
		<i>Brinckiella karoensis</i>	Karoo Winter Katydid	VU
	<i>Brinckiella mauerbergerorum</i>	Mauerberger's Winter Katydid	VU	
ONYCHOPHORA			Velvet worms	S1

Three major habitats delimit possible invertebrate communities on site, i.e. the aquatic habitat of the perennial Vaal River channel, the ephemeral pan and variety of terrestrial habitats collectively classified as Bushveld vegetation for insect preference, according to Picker et al. (2004).

i. Perennial Vaal River

Invertebrates expected to be associated with the Vaal River include Flatworms, earthworms, leeches, freshwater crabs and shrimps, mayflies, damselflies, dragonflies, moths, giant water bugs, boatmen, water striders, marsh treaders, creeping water bugs, waterscorpions, backswimmers, riffle bugs, caddisflies, diving beetles, riffle beetles, whirligig beetles, small water beetles, water scavenger beetles, water snipe flies, midges, shore flies, house flies, drain flies, black flies, hoverflies, horseflies, crane flies and freshwater limpets, snails, clams and mussels. The prospecting operation does not envisage altering the active channel of the Vaal River and is therefore not expected to have any impacts on the river invertebrate communities.

ii. Ephemeral pan

Ephemeral pans host species specifically adapted to ephemerality. Crustaceans in particular are specialists of these pans and dominate them. Their eggs lie dormant in the soil until the pans are inundated. Not much is known about the species distribution or conservation status of species in the Northern Cape, but typical taxa to be expected in the ephemeral pan on Rooidam include Notostraca, Anostraca, Cladocera, Copepoda, Ostracoda and Conchostraca. Within a few days after the pan is wet these species will hatch out and attract a number of wetland birds. Therefore, these pans also act as important breeding and feeding links to birds in terms of connectivity, by providing stepping-stone corridors in an arid landscape. The disturbance or destruction of these pans will not only impact the specialised pan invertebrate communities locally, but is expected to also have a regional and landscape-level effect. However, no prospecting activities are expected to take place near the pan.

iii. Terrestrial Bushveld vegetation

The majority of the study site is included in the bushveld vegetation for insect preference. Invertebrate communities associated with this habitat are widely distributed and extremely diverse. Therefore, it is not possible to list specialised communities that occur here. However, those species of conservation concern listed in Table 11 are most likely to be associated with this habitat. Those invertebrates that occur in this habitat will be most affected, because the core activities will take place here. Key impacts will be in the form of habitat loss and the inevitable death of those that occur in the direct path of project activities.

3.6. 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 units of the study area are all classified as least threatened and therefore no formal fine-scale conservation planning has been conducted.

The prospecting site does however fall within critical biodiversity areas, as defined by the Northern Cape Critical Biodiversity Areas Map (Holness and Oosthuysen 2016). This map identifies biodiversity priority areas, called Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs), which, together with protected areas, are important for the persistence of a viable representative sample of all ecosystem types and species as well as the long-term ecological functioning of the landscape as a whole. The majority of the study site is regarded as Ecological Support Areas, while the north-eastern portion along the Vaal River and main drainage ways is classified as Critical Biodiversity Area Two (Figure 18).

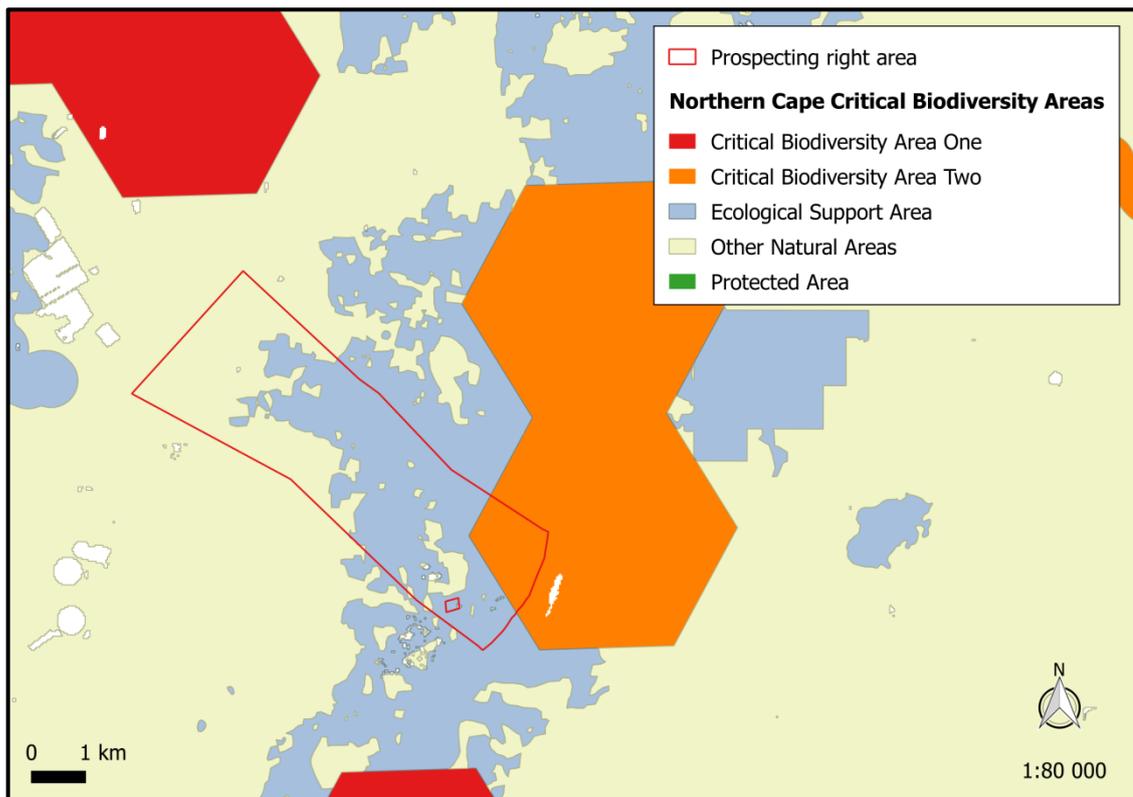


Figure 18. The study area in relation to the Northern Cape Critical Biodiversity areas.

Similarly, the Mining and Biodiversity Guidelines (DENC et al. 2013) also classifies the north-eastern portion of the study area to have High Biodiversity Importance, which constitute a high risk for mining (Figure 19). These guidelines were developed to identify and categorize biodiversity priority areas sensitive to the impacts of mining in order to support mainstreaming of biodiversity issues in decision making in the mining sector.

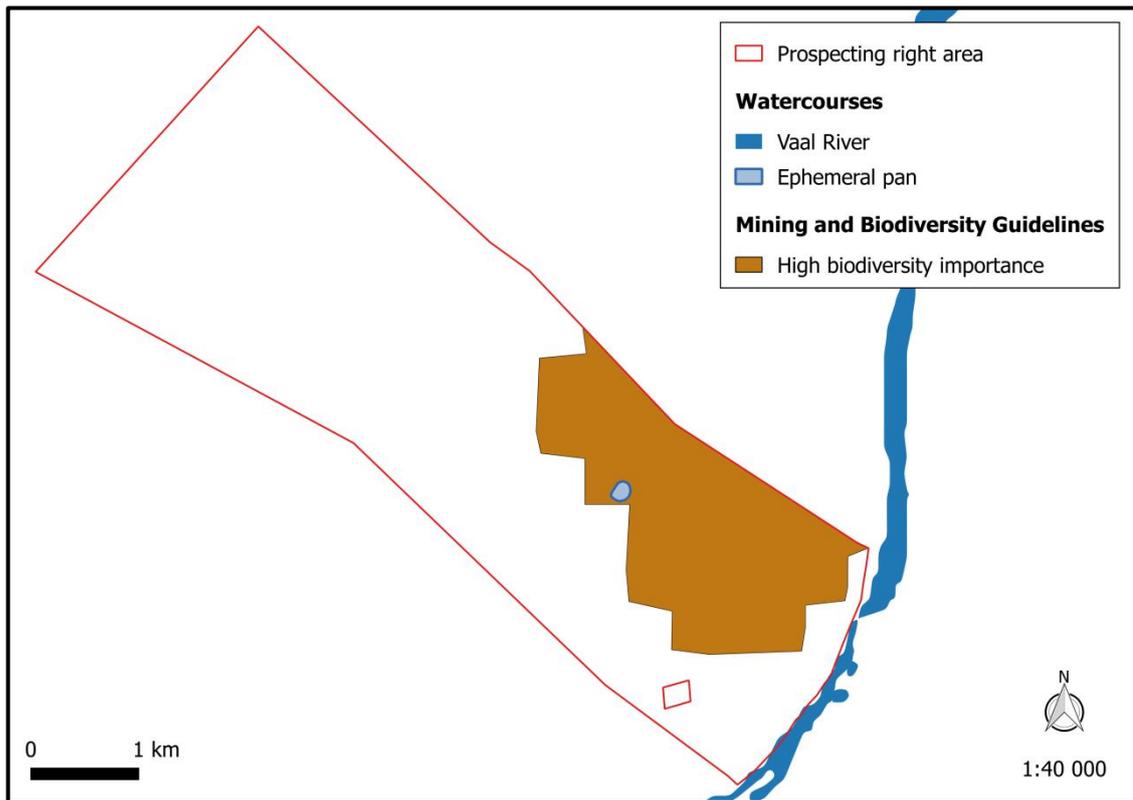


Figure 19. The study area in relation to the Mining and Biodiversity Guidelines.

Moreover, the riparian vegetation along the Vaal River has been identified for long-term maintenance of broad-scale ecological processes. The Magareng Spatial Development Framework (MLM 2014) proposed these to be maintained as ecological corridors in order to create an open space system throughout the municipal areas that promotes ecological ecosystems within the region (Figure 20).

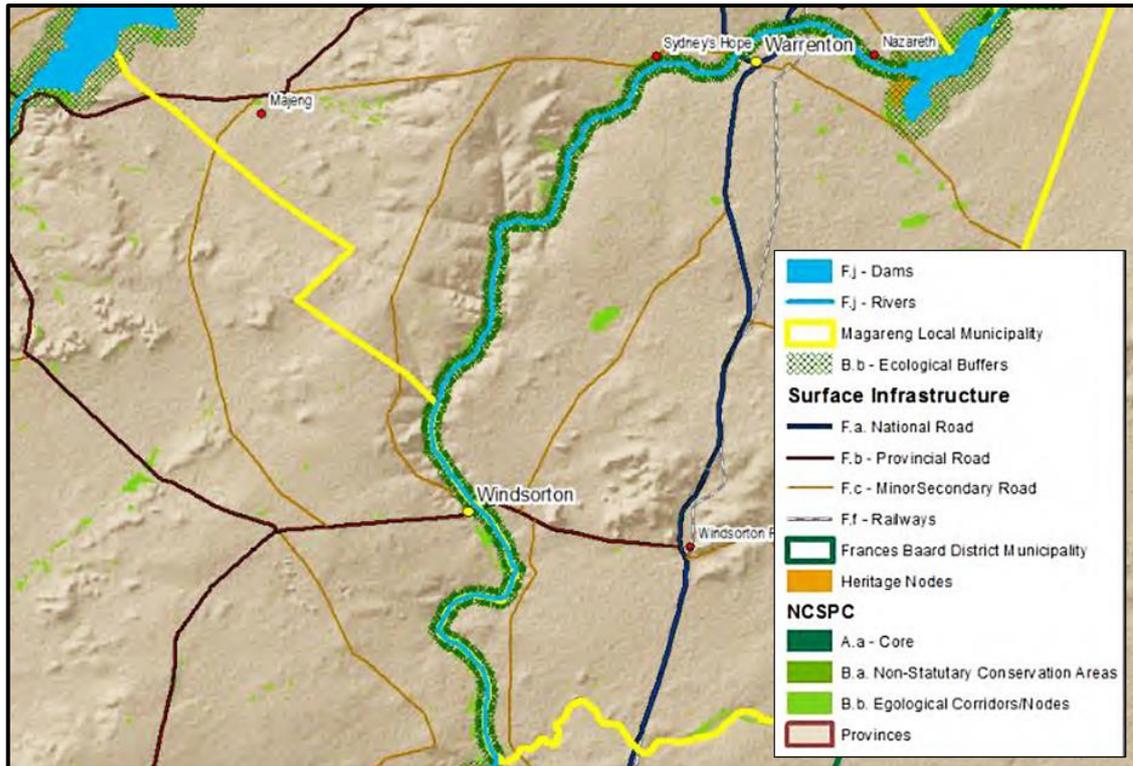


Figure 20. The proposed buffers within the Magareng Local Municipality.

The study area also falls within a zone where one of South Africa’s largest economically most important alluvial diamond deposits are found. 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 and Rutherford (2006), more than a quarter of the Highveld Alluvial Vegetation type has already been transformed for cultivation and dams, while Kimberley Thornveld is primarily being transformed by cultivation and mining.

According to the Wetland Freshwater Priority Areas project, half of the wetlands (50%) which occur in the Eastern Kalahari Bushveld Group 3 vegetation have been classified to have a Present Ecological State (PES) of critically transformed. Another 40 % is in natural or good condition, while 10 % have been moderately transformed. Within the direct vicinity of the proposed prospecting operation almost all wetlands have been transformed in some way (Figure 21).

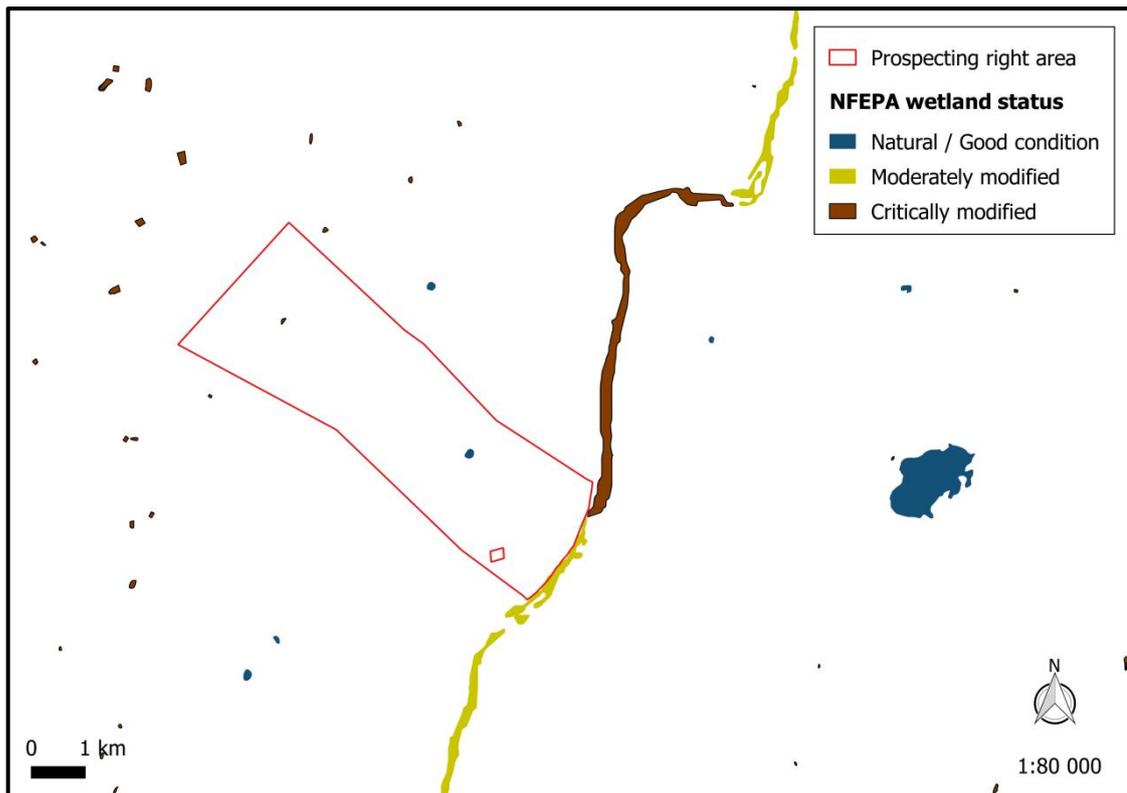


Figure 21. The status of wetlands occurring in the vicinity of the proposed prospecting right area.

The prospecting operation itself is expected to cause habitat transformation, in most part of the vegetation resembling Kimberley Thornveld and might also transform some of the riparian woodlands found along the ephemeral drainage lines. Due to the vast transformation of habitat in the region it is expected that the proposed prospecting right will contribute to cumulative habitat loss and the disruption of the broad-scale landscape connectivity in the region.

3.7. Site sensitivity

The sensitivity map for the Rooidam prospecting operation is illustrated in Figure 22. The riparian woodland and ephemeral pan are considered to be of **very high** sensitivity due to their vital ecological and hydrological functionality and significance. They are also a unique habitats protected in terms of the National Water Act (Act No 36 of 1998). These units are essentially no-go areas.

The open woodland on deep red sand and the shrubland on rocky ridges are considered to be of **high** sensitivity based on the species of conservation concern encountered in these units. Both these units are earmarked for prospecting activities. Although activities within these units are undesirable, they should only proceed with caution as it may not be possible to mitigate all impacts appropriately.

The open shrubland on red soil is considered to be of **medium** sensitivity. No significant plant species of conservation was encountered here, but it still comprise pristine habitat. This unit is also earmarked for prospecting activities, but impacts are likely to be largely local and the risk of secondary impact such as erosion low. Activities within this unit can proceed with relatively little ecological impact provided that appropriate mitigation measures are taken.

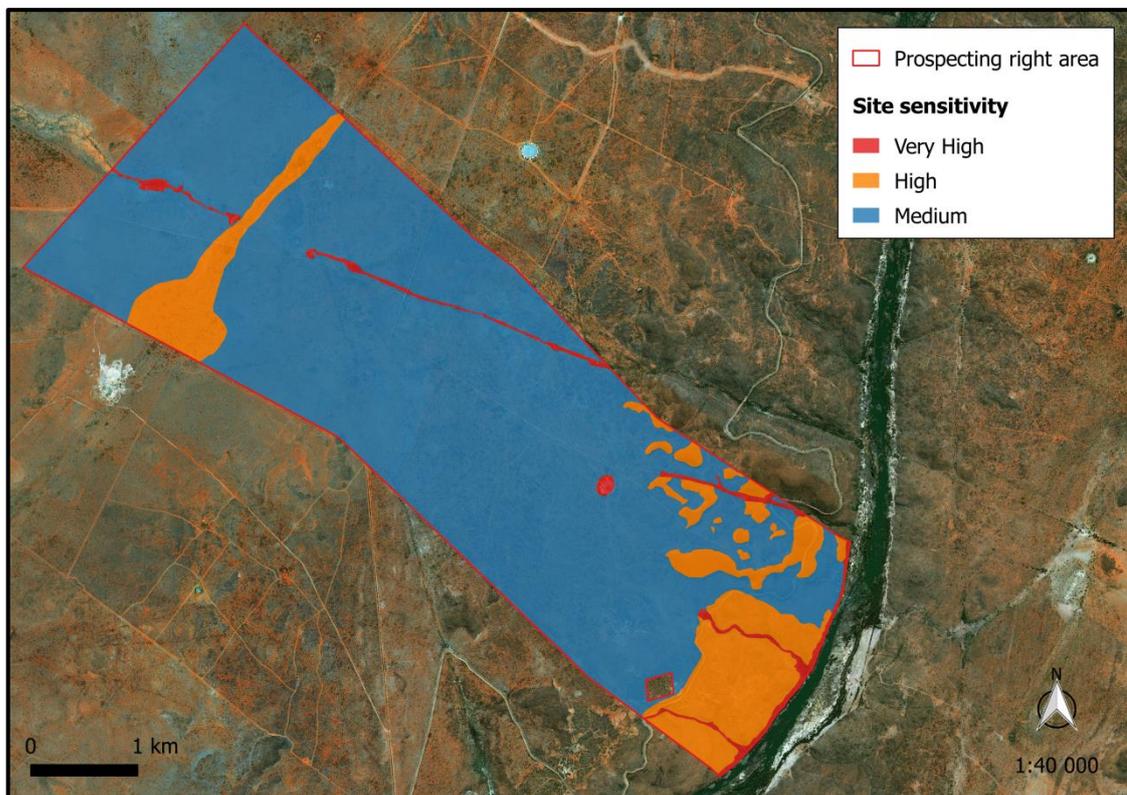


Figure 22. A sensitivity map for the Rooidam prospecting area.

4. ECOLOGICAL IMPACT ASSESSMENT

In this section, the potential impacts and associated risk factors that may be generated by the Rooidam prospecting operation are identified and described. A detailed analysis of each impact is provided in Table 12. 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 12. A detailed analysis of ecological impacts identified for the Rooidam prospecting operation.

	IMPACT	Phase			Extent	Duration	Severity	Probability	Significance	Significance after Mitigation
		C	O	D						
Landscape	Loss of soil fertility	✓	✓	✓	On-site (1)	Permanent (5)	High (3)	Possible for life of operation (9)	Medium - High (81)	Low-Medium
	Increase in soil erosion	✓	✓	✓	On-site (1)	Permanent (5)	High (3)	Certain, frequently (9)	Medium - High (81)	Low-Medium
Flora	Loss of indigenous vegetation	✓	✓	✓	On-site (1)	Residual (4)	Medium (2)	Certain for life of operation (10)	Low - Medium (70)	Low
	Loss of Red data and/or protected floral species	✓	✓		On-site (1)	Residual (4)	High (3)	Possible for life of operation (9)	Low - Medium (72)	Low
	Introduction or spread of alien species	✓	✓	✓	Local (2)	Residual (4)	High (3)	Possible, temporarily (6)	Low-Medium (54)	Low
	Bush encroachment			✓	On-site (1)	Residual (4)	Medium (2)	Possible, temporarily (6)	Low (42)	Very low

	IMPACT	Phase			Extent	Duration	Severity	Probability	Significance	Significance after Mitigation
		C	O	D						
Fauna	Habitat fragmentation	✓	✓	✓	Regional (3)	Residual (4)	Major (4)	Certain for life of operation (10)	High (110)	Low-Medium
	Disturbance, displacement and killing of fauna	✓	✓		On-site (2)	Decommissioning (3)	Medium (2)	Certain, frequently (9)	Low-Medium (63)	Low
Ecological Processes	Compromise of ecological processes	✓	✓		Regional (3)	Residual (4)	Major (4)	Certain for life of operation (10)	High (110)	Medium - High

4.1.2. Soil erosion

Source of the impact

Infrastructure; excavations.

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 and hydrological regime.

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.
- Effective rehabilitation of any altered watercourses should take place.

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 at least three plant species of conservation concern present, i.e. *Boscia albitrunca*, *Kalanchoe paniculata* and *Vachellia erioloba*. It is highly likely that many 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 shows the moderate levels of past disturbance interference in the natural ecosystem. 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 as well as the ecological and agricultural 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 moderate level of past disturbance interference in the natural ecosystem, primarily through prospecting and 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.

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 any affected riparian habitats.

4.3.2. Disturbance, displacement and killing of fauna

Source of the impact

Vegetation clearing; excavations; 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. 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.
- However, if any of the protected species are threatened by destruction, the relevant permits from DENC should be obtained followed by the relevant mitigation procedures stipulated in the permits.
- 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, and all excavated pits and trenches.

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 any riparian areas along the Vaal River and its tributaries will destroy connectivity of vital ecological corridors. Due to the amount of mining and agriculture in the area, the cumulative impact for the proposed prospecting operation is high.

Mitigation and monitoring

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

5. CONCLUSION, RECOMMENDATIONS AND OPINION REGARDING AUTHORISATION

Five plant communities were identified on site of which the open shrubland on shallow red soil, shrubland on rocky ridges and open woodland on deep red sand are included in the earmarked area to be affected by prospecting activities. Of these three, the shrubland on rocky ridges and open woodland on deep red sand are considered to be the most sensitive, with a High Sensitivity to prospecting activities due to the species of conservation concern found here. The most profound impacts are expected to be related to the fragmentation of pristine habitat, which in turn will increase the cumulative effect of important ecological corridors in the region.

Species of conservation concern that are found in these earmarked habitats will most likely also be lost locally. This includes the plants *Boscia albitrunca*, *Vachellia erioloba* and *Kalanchoe paniculata*. Similarly, the prospecting operation could result in the large-scale clearance of indigenous vegetation. 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.

To conclude, the destruction of the natural habitats 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 pristine condition, although some portions of the rocky ridges have been transformed by historic mining activities. In my opinion, authorisation can be granted as long as the applicant commits to the adherence of effective avoidance, management, mitigation and rehabilitation measures.

6. REFERENCES

- ADU. 2016. *Summary Data of the Frogs of South Africa, Lesotho and Swaziland* [Online]. Available: http://adu.org.za/frog_atlas.php.
- ALEXANDER, G. and MARAIS, J. 2007. *A guide to the reptiles of southern Africa*. Struik Nature, Cape Town.
- BATES, F., BRANCH, W. R., BAUER, A. M., BURGER, M., MARAIS, J., ALEXANDER, G. J. and DE VILLIERS, M. S. 2014. *Atlas and Red List of the Reptiles of South Africa, Lesotho and Swaziland. Suricata 1*. South African National Biodiversity Institute, Pretoria.
- BIRDLIFESA. 2015. *Important Bird Areas Map* [Online]. Available: <http://www.birdlife.org.za/conservation/important-bird-areas/iba-map>.
- CDSL. 1993. *2824 Kimberley, 1:250 000 scale published geological sheet*. Mowbray.
- DELPORT, C. and MALLORY, S. J. L. 2002. *Lower Vaal Water Management Area: Water Resources Situation Assessment Report. DWAF Report No: P 10000/00/0301*. Department of Water Affairs and Forestry, Pretoria.
- DENC, DMR, COM, SAMBF and SANBI. 2013. *Mining and Biodiversity Guideline: Mainstreaming biodiversity into the mining sector*. Pretoria.
- DU PREEZ, L. and CARRUTHERS, V. 2009. *A complete guide to the frogs of southern Africa*. Struik Nature, Cape Town.
- DURAND, W. 2006. *Assessing the impact of climate change on crop water use in South Africa. CEEPA Discussion Paper No 28*. ARC-Grain Crops Institute, Potchefstroom.
- FRIEDMANN, Y. and DALY, B. 2004. *Red data book of the mammals of South Africa: a conservation assessment*. CBSG-EWT, Johannesburg.
- GIBBON, G. 2006. *Robert's Multimedia Birds of Southern Africa version 3*. Southern African Birding cc.

- GRESSE, P. G. 2003. The preservation of alluvial diamond deposits in abandoned meanders of the middle-Orange River. *SAIMM Colloquium: Diamonds - Source to use, Oct. 2003*.
- GRIFFITHS, C., DAY, J. and PICKER, M. 2015. *Freshwater Life: A field guide to the plants and animals of Southern Africa*. Struik Nature, Cape Town.
- HOLNESS, S. and OOSTHUYSEN, E. 2016. *Critical Biodiversity Areas of the Northern Cape*. Northern Cape Department of Environment and Nature Conservation, <http://bgis.sanbi.org>.
- HORNSVELD, H. 1977. *2822 Postmasburg, 1:250 000 scale published geological sheet*. The Government Printer, Pretoria.
- IUCN. 2015. *IUCN Red List of Threatened Species. Version 2015.3* [Online]. Available: www.iucnredlist.org.
- KLEYNHANS, C. J. 2007. Module D: Fish Response Assessment Index in River EcoClassification: Manual for EcoStatus Determination (version 2). Joint Water Research Commission and Department of Water Affairs and Forestry, Pretoria.
- KREMEN, C., COLWELL, R. K., ERWIN, T. L., MURPHY, D. D., NOSS, R. F. and SANJAYAN, M. A. 1993. Terrestrial arthropod assemblages: their use in conservation planning. *Conservation Biology* 7 (4): 796-808.
- MLM. 2014. Magareng Local Municipality Spatial Development Framework: 2014 - 2019. Frances Baard District Municipality, Kimberley.
- MUCINA, L. and RUTHERFORD, M. C. 2006. *The Vegetation Map of South Africa, Lesotho and Swaziland*. SANBI, Pretoria, South Africa.
- MUCINA, L. and RUTHERFORD, M. C. 2012. *Vegetation Map of South Africa, Lesotho and Swaziland*. SANBI, Claremont.
- PICKER, M., GRIFFITHS, C. and WEAIVING, A. 2004. *Field Guide to the Insects of South Africa*. Struik Nature, Cape Town.

SANBI. 2017. *Red List of South African Plants. Version 2017.1* [Online]. Available: <http://redlist.sanbi.org>.

TAYLOR, M. R., PEACOCK, F. and WANLESS, R. M. 2015. *The 2015 Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland*. BirdLife South Africa, Dunkeld West.

THIRION, C. 2007. Module E: Macroinvertebrate Response Assessment Index in River EcoClassification: Manual for EcoStatus Determination (version 2). *WRC Report No. TT 332/08*. Joint Water Research Commission and Department of Water Affairs and Forestry, Pretoria.

WEISSER, W. W. and SIEMANN, E. 2004. The various effects of insects on ecosystem functioning. *In: WEISSER, W. W. & SIEMANN, E. (eds.) Insects and Ecosystem Function, Ecological Studies Series, Volume 173*. Springer-Verlag, Berlin.



APPENDICES

APPENDIX 1

Plant species list

Family	Scientific name	Status	NFA	NCNCA
ACANTHACEAE	<i>Monechma incanum</i>	LC		
AIZOACEAE	<i>Aizoon schellenbergii</i>	LC		
	<i>Galenia africana</i>	LC		
	<i>Galenia papulosa</i>	LC		
	<i>Galenia sarcophylla</i>	LC		
	<i>Mesembryanthemum crystallinum</i>	LC		S2
	<i>Mesembryanthemum guerichianum</i>	LC		S2
	<i>Mesembryanthemum stenandrum</i>	LC		S2
	<i>Mesembryanthemum subnodosum</i>	LC		S2
	<i>Plinthus cryptocarpus</i>	LC		
	<i>Plinthus karooicus</i>	LC		
	<i>Plinthus sericeus</i>	LC		
	<i>Tetragonia arbuscula</i>	LC		
	<i>Tetragonia virgata</i>	LC		
	<i>Trianthema parvifolia</i> var. <i>parvifolia</i>	LC		
AMARANTHACEAE	<i>Amaranthus dinteri</i> subsp. <i>dinteri</i>	-		
	<i>Amaranthus graecizans</i> subsp. <i>graecizans</i>	Nat. Ex.		
	<i>Hermestaedtia fleckii</i>	LC		
	<i>Leucosphaera bainesii</i>	LC		
	<i>Salsola albida</i>	LC		
	<i>Salsola barbata</i>	LC		
	<i>Salsola melanantha</i>	LC		
	<i>Salsola tuberculata</i>	LC		
	<i>Sericocoma avolans</i>	LC		
	<i>Sericorema remotiflora</i>	LC		
	<i>Suaeda fruticosa</i>	LC		
ANACARDIACEAE	<i>Searsia ciliata</i>	LC		
	<i>Searsia lancea</i>	LC		
	<i>Searsia pendulina</i>	LC		
	<i>Searsia tenuinervis</i>	LC		
	<i>Searsia tridactyla</i>	LC		
APIACEAE	<i>Deverra burchellii</i>	LC		S2
APOCYNACEAE	<i>Adenium oleifolium</i>	LC		S2
	<i>Gomphocarpus fruticosus</i> subsp. <i>fruticosus</i>	LC		S2
	<i>Orbea knobelii</i>	LC		S2
	<i>Orbea lugardii</i>	LC		S2
	<i>Orbea lutea</i> subsp. <i>vaga</i>	LC		S2
	<i>Orthanthera jasminiflora</i>	LC		S2
	<i>Pergularia daemia</i> subsp. <i>Daemia</i>	LC		S2
	<i>Pergularia daemia</i> subsp. <i>garipensis</i>	LC		S2
	<i>Stapelia olivacea</i>	LC		S2
	<i>Tridentea marientalensis</i> subsp. <i>marientalensis</i>	LC		S2
ASPARAGACEAE	<i>Asparagus suaveolens</i>	LC		
ASTERACEAE	<i>Arctotis leiocarpa</i>	LC		

Family	Scientific name	Status	NFA	NCNCA
ASTERACEAE	<i>Chrysocoma ciliata</i>	LC		
	<i>Cirsium vulgare</i>	<i>Decl. Inv.</i>		
	<i>Dicoma capensis</i>	LC		
	<i>Dimorphotheca polyptera</i>	LC		
	<i>Euryops subcarnosus subsp. foetidus</i>	LC		
	<i>Helichrysum lineare</i>	LC		
	<i>Hirpicium echinus</i>	LC		
	<i>Hirpicium gazanioides</i>	LC		
	<i>Kleinia longiflora</i>	LC		
	<i>Lasiospermum pedunculare</i>	LC		
	<i>Osteospermum scariosum var. scariosum</i>	LC		
	<i>Pentzia calcarea</i>	LC		
	<i>Pentzia incana</i>	LC		
	<i>Pentzia lanata</i>	LC		
	<i>Platycarphella carlinoides</i>	LC		
	<i>Platycarphella parvifolia</i>	LC		
	<i>Rosenia humilis</i>	LC		
	<i>Senecio arenarius</i>	LC		
	<i>Tagetes minuta</i>	<i>Nat. Ex.</i>		
	<i>Tarchonanthus camphoratus</i>	LC		
BORAGINACEAE	<i>Ehretia rigida</i>	LC		
BRASSICACEAE	<i>Boscia albitrunca</i>	LC	X	S2
	<i>Coronopus integrifolius</i>	<i>Nat. Ex.</i>		
	<i>Erucastrum griquense</i>	LC		
	<i>Heliophila minima</i>	LC		
	<i>Heliophila remotiflora</i>	LC		
	<i>Rapistrum rugosum</i>	<i>Nat. Ex.</i>		
CACTACEAE	<i>Opuntia ficus-indica</i>	<i>Decl. Inv.</i>		
CAPPARACEAE	<i>Maerua gilgii</i>	LC		
CARYOPHYLLACEAE	<i>Pollichia campestris</i>	LC		
CELASTRACEAE	<i>Gymnosporia linearis subsp. lanceolata</i>	LC		S2
CLEOMACEAE	<i>Cleome angustifolia subsp. diandra</i>	LC		
	<i>Cleome monophylla</i>	LC		
	<i>Cleome paxii</i>	LC		
	<i>Cleome rubella</i>	LC		
COMBRETACEAE	<i>Combretum erythrophyllum</i>	LC		S2
	<i>Terminalia sericea</i>	LC		
CRASSULACEAE	<i>Kalanchoe paniculata</i>	LC		S2
CUCURBITACEAE	<i>Cucumis africanus</i>	LC		
CYPERACEAE	<i>Cyperus denudatus</i>	LC		
	<i>Cyperus longus var. tenuiflorus</i>	-		
	<i>Isolepis setacea</i>	LC		
EBENACEAE	<i>Diospyros austro-africana var. microphylla</i>	LC		
	<i>Diospyros lycioides</i>	LC		

Family	Scientific name	Status	NFA	NCNCA
EBENACEAE	<i>Euclea pseudebenus</i>	LC		
ELATINACEAE	<i>Bergia anagalloides</i>	LC		
EUPHORBIACEAE	<i>Acalypha segetalis</i>	LC		
	<i>Euphorbia braunsii</i>	LC		S2
	<i>Euphorbia crassipes</i>	LC		S2
	<i>Euphorbia davyi</i>	LC		S2
	<i>Euphorbia glanduligera</i>	LC		S2
	<i>Euphorbia gregaria</i>	LC		S2
	<i>Euphorbia inaequilatera</i> var. <i>inaequilatera</i>	LC		S2
	<i>Euphorbia spartaria</i>	LC		S2
	<i>Euphorbia spinea</i>	LC		S2
FABACEAE	<i>Calobota linearifolia</i>	LC		
	<i>Calobota spinescens</i>	LC		
	<i>Chamaecrista capensis</i>	LC		
	<i>Crotalaria leubnitziana</i>	LC		
	<i>Crotalaria spartioides</i>	LC		
	<i>Crotalaria sphaerocarpa</i> subsp. <i>sphaerocarpa</i>	LC		
	<i>Crotalaria virgultalis</i>	LC		
	<i>Cullen tomentosum</i>	LC		
	<i>Dichilus lebeckioides</i>	LC		
	<i>Elephantorrhiza elephantina</i>	LC		
	<i>Indigofera charlieriana</i> var. <i>charlieriana</i>	LC		
	<i>Indigofera heterotricha</i>	LC		
	<i>Indigofera hochstetteri</i> subsp. <i>streyana</i>	LC		
	<i>Indigofera holubii</i>	LC		
	<i>Leobordea platycarpa</i>	LC		
	<i>Lessertia macrostachya</i> var. <i>macrostachya</i>	LC		S1
	<i>Melolobium candicans</i>	LC		
	<i>Melolobium canescens</i>	LC		
	<i>Melolobium macrocalyx</i> var. <i>longifolium</i>	LC		
	<i>Melolobium macrocalyx</i> var. <i>macrocalyx</i>	LC		
	<i>Parkinsonia africana</i>	LC		
	<i>Pomaria burchellii</i> subsp. <i>burchellii</i>	LC		
	<i>Requienia sphaerosperma</i>	LC		
	<i>Rhynchosia totta</i>	LC		
	<i>Senegalia melifera</i>	LC		
	<i>Senna italica</i>	LC		
	<i>Tephrosia burchellii</i>	LC		
	<i>Tephrosia dregeana</i> var. <i>dregeana</i>	LC		
	<i>Vachellia erioloba</i>	LC	X	
	<i>Vachellia haematoxylon</i>	LC	X	
	<i>Vachellia hebeclada</i> subsp. <i>hebeclada</i>	LC		
	<i>Vachellia karroo</i>	LC		
	<i>Vachellia luederitzii</i> var. <i>luederitzii</i>	LC		
	<i>Vachellia tortilis</i> subsp. <i>heteracantha</i>	LC		

Family	Scientific name	Status	NFA	NCNCA
GISEKIACEAE	<i>Gisekia africana</i> var. <i>africana</i>	LC		
HYACINTHACEAE	<i>Dipcadi rigidifolium</i>	LC		
	<i>Drimia angustifolia</i>	LC		
	<i>Ledebouria undulata</i>	LC		
HYDROCHARITACEAE	<i>Lagarosiphon muscoides</i>	LC		
IRIDACEAE	<i>Duthieastrum linifolium</i>	LC		S2
	<i>Moraea simulans</i>	LC		S2
LAMIACEAE	<i>Stachys burchelliana</i>	LC		
LIMEACEAE	<i>Limeum aethiopicum</i> var. <i>aethiopicum</i>	LC		
	<i>Limeum arenicolum</i>	LC		
	<i>Limeum argute-carinatum</i> var. <i>argute-carinatum</i>	LC		
	<i>Limeum argute-carinatum</i> var. <i>kwebense</i>	LC		
	<i>Limeum fenestratum</i> var. <i>fenestratum</i>	LC		
	<i>Limeum myosotis</i> var. <i>confusum</i>	LC		
	<i>Limeum myosotis</i> var. <i>myosotis</i>	LC		
	LOBELIACEAE	<i>Lobelia thermalis</i>	LC	
LOPHIOPHYLLACEAE	<i>Lophiocarpus polystachyus</i>	LC		
	<i>Lophiocarpus tenuissimus</i>	LC		
LORANTHACEAE	<i>Tapinanthus oleifolius</i>	LC		
MALVACEAE	<i>Abutilon austro-africanum</i>	LC		
	<i>Abutilon dinteri</i>	LC		
	<i>Corchorus asplenifolius</i>	LC		
	<i>Grewia flava</i>	LC		
	<i>Hermannia abrotanoides</i>	LC		
	<i>Hermannia affinis</i>	LC		
	<i>Hermannia bicolor</i>	LC		
	<i>Hermannia burkei</i>	LC		
	<i>Hermannia coccocarpa</i>	LC		
	<i>Hermannia comosa</i>	LC		
	<i>Hermannia erodioides</i>	LC		
	<i>Hermannia linearifolia</i>	LC		
	<i>Hermannia tomentosa</i>	LC		
	<i>Hibiscus elliotiae</i>	LC		
	<i>Hibiscus marlothianus</i>	LC		
	<i>Hibiscus micranthus</i> var. <i>micranthus</i>	LC		
	<i>Hibiscus pusillus</i>	LC		
	<i>Melhania burchellii</i>	LC		
	<i>Melhania virescens</i>	LC		
	<i>Pavonia burchellii</i>	LC		
<i>Radyera urens</i>	LC			
MOLLUGINACEAE	<i>Pharnaceum brevicaule</i>	LC		
MORACEAE	<i>Ficus cordata</i> subsp. <i>cordata</i>	LC		
NEURADACEAE	<i>Grielum sinuatum</i>	LC		
	<i>Neuradopsis austro-africana</i>	LC		

Family	Scientific name	Status	NFA	NCNCA
NYCTAGINACEAE	<i>Boerhavia coccinea</i> var. <i>coccinea</i>	LC		
	<i>Boerhavia hereroensis</i>	LC		
	<i>Boerhavia repens</i> subsp. <i>repens</i>	LC		
	<i>Phaeoptilum spinosum</i>	LC		
OLEACEAE	<i>Olea europaea</i> subsp. <i>cuspidata</i>	LC		
PAPAVERACEAE	<i>Papaver aculeatum</i>	LC		
PEDALIACEAE	<i>Sesamum capense</i>	LC		
	<i>Sesamum triphyllum</i> var. <i>triphyllum</i>	LC		
PHYLLANTHACEAE	<i>Phyllanthus maderaspatensis</i>	LC		
	<i>Phyllanthus parvulus</i> var. <i>garipensis</i>	LC		
POACEAE	<i>Anthephora argentea</i>	LC		
	<i>Anthephora pubescens</i>	LC		
	<i>Aristida adscensionis</i>	LC		
	<i>Aristida congesta</i> subsp. <i>barbicollis</i>	LC		
	<i>Aristida congesta</i> subsp. <i>congesta</i>	LC		
	<i>Aristida engleri</i> var. <i>ramosissima</i>	LC		
	<i>Aristida scabrivalvis</i> subsp. <i>scabrivalvis</i>	LC		
	<i>Aristida stipitata</i> subsp. <i>graciliflora</i>	LC		
	<i>Aristida stipitata</i> subsp. <i>spicata</i>	LC		
	<i>Aristida vestita</i>	LC		
	<i>Brachiaria glomerata</i>	LC		
	<i>Brachiaria marlothii</i>	LC		
	<i>Cenchrus ciliaris</i>	LC		
	<i>Centropodia glauca</i>	LC		
	<i>Chrysopogon serrulatus</i>	LC		
	<i>Digitaria eriantha</i>	LC		
	<i>Digitaria polyphylla</i>	LC		
	<i>Digitaria seriata</i>	LC		
	<i>Echinochloa colona</i>	LC		
	<i>Enneapogon desvauxii</i>	LC		
	<i>Enneapogon scaber</i>	LC		
	<i>Enneapogon scoparius</i>	LC		
	<i>Eragrostis barrelieri</i>	Nat. Ex.		
	<i>Eragrostis brizantha</i>	LC		
	<i>Eragrostis curvula</i>	LC		
	<i>Eragrostis homomalla</i>	LC		
	<i>Eragrostis lehmanniana</i> var. <i>lehmanniana</i>	LC		
	<i>Eragrostis porosa</i>	LC		
<i>Eragrostis rigidior</i>	LC			
<i>Eragrostis rotifer</i>	LC			
<i>Eragrostis superba</i>	LC			
<i>Eragrostis trichophora</i>	LC			
<i>Eustachys paspaloides</i>	LC			
<i>Heteropogon contortus</i>	LC			

Family	Scientific name	Status	NFA	NCNCA
POACEAE	<i>Leptochloa fusca</i>	LC		
	<i>Megaloprotachne albescens</i>	LC		
	<i>Melinis repens</i> subsp. <i>repens</i>	LC		
	<i>Odyssea paucinervis</i>	LC		
	<i>Panicum coloratum</i>	LC		
	<i>Panicum stapfianum</i>	LC		
	<i>Paspalum distichum</i>	LC		
	<i>Schmidtia kalahariensis</i>	LC		
	<i>Schmidtia pappophoroides</i>	LC		
	<i>Setaria incrassata</i>	LC		
	<i>Sporobolus coromandelianus</i>	LC		
	<i>Sporobolus discosporus</i>	LC		
	<i>Stipagrostis ciliata</i> var. <i>capensis</i>	LC		
	<i>Stipagrostis obtusa</i>	LC		
	<i>Stipagrostis uniplumis</i> var. <i>neesii</i>	LC		
	<i>Stipagrostis uniplumis</i> var. <i>uniplumis</i>	LC		
	<i>Tragus berteronianus</i>	LC		
	<i>Tragus racemosus</i>	LC		
	<i>Triraphis purpurea</i>	LC		
	<i>Urochloa panicoides</i>	LC		
POLYGALACEAE	<i>Polygala leptophylla</i> var. <i>armata</i>	LC		
	<i>Polygala leptophylla</i> var. <i>leptophylla</i>	LC		
	<i>Polygala seminuda</i>	LC		
	<i>Oxygonum alatum</i> var. <i>alatum</i>	LC		
	<i>Oxygonum delagoense</i>	LC		
	<i>Persicaria madagascariensis</i>	-		
	<i>Rumex crispus</i>	Nat. Ex.		
PORTULACACEAE	<i>Portulaca kermesina</i>	LC		
	<i>Portulaca quadrifida</i>	LC		
RHAMNACEAE	<i>Ziziphus mucronata</i> subsp. <i>mucronata</i>	LC		
SALICACEAE	<i>Salix mucronata</i> subsp. <i>mucronata</i>	LC		
SANTALACEAE	<i>Thesium lacinulatum</i>	LC		
	<i>Viscum rotundifolium</i>	LC		
SAPINDACEAE	<i>Pappea capensis</i>	LC		
SCROPHULARIACEAE	<i>Aptosimum marlothii</i>	LC		
TALINACEAE	<i>Talinum tenuissimum</i>	LC		
THYMELAEACEAE	<i>Lasiosiphon polycephalus</i>	LC		
VAHLIACEAE	<i>Vahlia capensis</i> subsp. <i>vulgaris</i>	LC		
ZYGOPHYLLACEAE	<i>Fagonia isotricha</i> var. <i>isotricha</i>	-		
	<i>Roepera pubescens</i>	LC		
	<i>Sisyndite sparteae</i>	LC		
	<i>Tetraena microcarpa</i>	LC		
	<i>Tribulus cristatus</i>	LC		
	<i>Tribulus terrestris</i>	LC		
	<i>Tribulus zeyheri</i> subsp. <i>zeyheri</i>	LC		

APPENDIX 2

Fauna species list

LIST OF MAMMALS

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

	Scientific name	Common name	IUCN	SA RDB	Habitat	Potential of occurrence
CHIROPTERA	² <i>Eidolon helvum</i>	African Straw-coloured Fruit-bat	NT	Not listed	Wide habitat tolerance.	High
	² <i>Neoromicia capensis</i>	Cape Bat	LC	LC	Wide habitat tolerance, but often found in arid areas, grassland, bushveld and <i>Acacia</i> woodland. Animals roost under the bark of trees and similar vegetation.	High
	³ <i>Miniopterus natalensis</i>	Natal Long-fingered Bat	LC	Not listed	Mainly roosts in caves or mine shafts, but also in crevices and holes in trees.	Moderate
	² <i>Nycteris thebaica</i>	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 <i>Pipistrellus hesperidus</i>	Dusk Pipistrelle	LC	LC	Wide habitat tolerance, but close proximity to open water may be a limiting factor.	High
	² <i>Rhinolophus denti</i>	Dent's Horseshoe Bat	LC	NT	Savanna habitats.	High
	² <i>Rhinolophus clivosus</i>	Geoffroy's Horseshoe Bat	LC	NT	Wide habitat tolerance.	High
	² <i>Rhinolophus darlingi</i>	Darling's Horseshoe Bat	LC	NT	Savanna habitats.	High
	² <i>Tadarida aegyptiaca</i>	Egyptian Free-tailed Bat	LC	LC	Wide habitat tolerance.	High

LIST OF MAMMALS (cont.)

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

	Scientific name	Common name	IUCN	SA RDB	Habitat	Potential of occurrence
CHRYSOCHLORIDAE	² <i>Chlorotalpa sclateri</i>	Sclater's Golden Mole	LC	DD	Restricted to high-altitude grasslands, scrub and forested kloofs in the Nama Karoo and Grassland biomes of South Africa.	Low
MACROSCELIDIDAE	² <i>Elephantulus myurus</i>	Eastern Rock Sengi	LC	LC	Rocky environments.	High
TUBULENTATA	¹ <i>Orycteropus afer</i>	Aardvark	LC	LC	Wide habitat tolerance, being found in open woodland, scrub and grassland, especially associated with sandy soil.	High
HYRACOIDEA	² <i>Procavia capensis</i>	Rock Hyrax	LC	LC	Outcrops of rocks, especially granite formations and dolomite intrusions in the Karoo. Also erosion gullies.	High

LIST OF MAMMALS (cont.)

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

	Scientific name	Common name	IUCN	SA RDB	Habitat	Potential of occurrence
LAGOMORPHA	² <i>Lepus capensis</i>	Cape Hare	LC	LC	Dry, open regions, with palatable bush and grass.	High
	² <i>Lepus saxatilis</i>	Scrub Hare	LC	LC	Common in agriculturally developed areas, especially in crop-growing areas or in fallow lands where there is some bush development.	Moderate
	² <i>Pronolagus rupestris</i>	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 <i>Hystrix africaeaustralis</i>	Cape Porcupine	LC	LC	Catholic in habitat requirements.	High
	² <i>Xerus inauris</i>	South African Ground Squirrel	LC	LC	Open terrain with a sparse bush cover and hard substrate.	High
	² <i>Pedetes capensis</i>	Springhare	LC	LC	Occurs widespread: open sandy ground, sandy scrub, overgrazed grassland, edges of vleis and dry river beds.	High
	² <i>Graphiurus ocularis</i>	Spectacled Dormouse	LC	LC	Rocky habitats, but also trees.	High

LIST OF MAMMALS (cont.)

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

	Scientific name	Common name	IUCN	SA RDB	Habitat	Potential of occurrence
RODENTIA	² <i>Saccostomus campestris</i>	Pouched Mouse	LC	LC	Wide habitat tolerance; prefers soft, sandy soils; open and dense vegetation; rocky areas; annual rainfall of 250 - 1 200 mm.	High
	² <i>Malacothrix typica</i>	Large-eared (Gerbil) Mouse	LC	LC	Short grass habitats over hard soil.	Moderate
	² <i>Rhabdomys pumilio</i>	Four-striped Grass Mouse	LC	LC	Essentially a grassland species; occurs in wide variety of habitats where there is good grass cover.	Moderate
	² <i>Mus minutoides</i>	Pygmy Mouse	LC	LC	Wide habitat tolerance.	High
	³ <i>Mus musculus</i>	House Mouse	LC	<i>Not listed</i>	Wide habitat tolerance.	High
	² <i>Mastomys natalensis</i>	Natal Multimammate Mouse	LC	LC	Wide habitat tolerance.	High
	² <i>Mastomys coucha</i>	Southern Multimammate Mouse	LC	LC	Wide habitat tolerance.	High
	² <i>Micaelamys namaquensis</i>	Namaqua Rock Mouse	LC	LC	Catholic habitat requirements, but prefer rocky hills, outcrops or boulder-strewn hillsides.	High
² <i>Myotomys unisulcatus</i>	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.	Moderate	

LIST OF MAMMALS (cont.)

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

	Scientific name	Common name	IUCN	SA RDB	Habitat	Potential of occurrence
RODENTIA	² <i>Desmodillus auricularis</i>	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
	² <i>Gerbillurus paeba</i>	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 <i>Gerbilliscus leucogaster</i>	Bushveld Gerbil	LC	DD	Sandy soils; wooded and more open grassland; areas of cultivation.	High
	² <i>Gerbilliscus brantsii</i>	Highveld Gerbil	LC	LC	Sandy soils; wooded and more open grassland; areas of cultivation.	High
PRIMATES	⁴ <i>Papio ursinus</i>	Chacma Baboon	LC	LC	Can exploit fynbos, montane grasslands, riverine courses in deserts, and simply need water and access to refuges.	High
	⁴ <i>Chlorocebus pygerythrus</i>	Vervet Monkey	LC	LC	Woodland savanna, riverine woodland, isolated stands of trees along river courses.	High
PHOLIDOTA	¹ <i>Smutsia temminckii</i>	Ground Pangolin	VU	VU	Low to high rainfall areas; open grassland, woodland and rocky hills; absent in forest and true desert, but present in Kalahari.	Medium

LIST OF MAMMALS (cont.)

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

	Scientific name	Common name	IUCN	SA RDB	Habitat	Potential of occurrence
EULIPTYPHLA	² <i>Crocidura cyanea</i>	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.	Moderate
	² <i>Suncus varilla</i>	Lesser Dwarf Shrew	LC	DD	Generally associated with termite mounds, grassland habitat.	High
	¹ <i>Atelerix frontalis</i>	South African Hedgehog	LC	NT	Generally found in semi-arid and sub-temperate environments with ample ground cover.	Moderate
CARNIVORA	¹ <i>Proteles cristata</i>	Aardwolf	LC	LC	Common in the 100-600mm rainfall range of country, Nama-Karoo, Succulent Karoo Grassland and Savanna biomes.	High
	⁴ <i>Caracal caracal</i>	Caracal	LC	LC	Caracals tolerate arid regions, occur in semi-desert and karroid conditions.	High
	¹ <i>Felis silvestris</i>	African Wild Cat	LC	LC	Wide habitat tolerance.	High
	¹ <i>Felis nigripes</i>	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.	Moderate

LIST OF MAMMALS (cont.)

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

	Scientific name	Common name	IUCN	SA RDB	Habitat	Potential of occurrence
CARNIVORA	² <i>Genetta genetta</i>	Common (Small-spotted) Genet	LC	LC	Occur in open arid habitats.	High
	² <i>Suricata suricatta</i>	Suricate	LC	LC	Open arid country with hard and stony substrate. Occur in Nama- and Succulent Karoo but also fynbos.	High
	² <i>Cynictis penicillata</i>	Yellow Mongoose	LC	LC	Semi-arid country on a sandy substrate.	High
	² <i>Galerella pulverulentus</i>	Cape (Small) Grey Mongoose	LC	LC	Wide habitat tolerance.	High
	² <i>Herpestes sanguineus</i>	Slender Mongoose	LC	LC	Wide habitat tolerance, but areas with adequate cover.	High
	² <i>Atilax paludinosus</i>	Water (Marsh) Mongoose	LC	LC	Associated with well-watered areas, along rivers and streams, around dams, lakes, estuaries and swamps wherever there is cover.	High
	¹ <i>Vulpes chama</i>	Cape Fox	LC	LC	Associated with open country, open grassland, grassland with scattered thickets and coastal or semi-desert scrub.	High
	⁴ <i>Canis mesomelas</i>	Black-backed Jackal	LC	LC	Wide habitat tolerance.	High
	² <i>Aonyx capensis</i>	Cape Clawless Otter	NT	LC	Rivers, marshes, dams and lakes; dry stream beds if pools of water exist.	High

LIST OF MAMMALS (cont.)

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

	Scientific name	Common name	IUCN	SA RDB	Habitat	Potential of occurrence
CARNIVORA	¹ <i>Hydriectis maculicollis</i>	Spotted-necked Otter	NT	NT	Larger rivers or rivers with permanent pools; lakes, dams and well-watered swamps.	High
	¹ <i>Hyaena brunnea</i>	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 <i>Otocyon megalotis</i>	Bat-eared Fox	LC	LC	Open country with mean annual rainfall of 100-600 mm.	High
	¹ <i>Poecilogale albinucha</i>	African Striped Weasel	LC	DD	Wide habitat tolerance, but most common in grassland areas.	High
	¹ <i>Ictonyx striatus</i>	Striped Polecat	LC	LC	Widely distributed throughout the sub-region.	High
	¹ <i>Mellivora capensis</i>	Honey Badger	LC	NT	Wide habitat tolerance.	High
SUIFORMES	² <i>Phacochoerus africanus</i>	Common Warthog	LC	LC	Open country, lightly wooded areas and savanna; also penetrates otherwise unsuitable country along watercourses.	Low

LIST OF MAMMALS (cont.)

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

	Scientific name	Common name	IUCN	SA RDB	Habitat	Potential of occurrence
CETARTIODACTYLA	² <i>Tragelaphus strepsiceros</i>	Greater Kudu	LC	LC	Wooded savanna and arid areas where there are stands of bush; wooded watercourses, acacia woodland and rocky hill country.	Confirmed
	² <i>Oryx gazella</i>	Gemsbok	LC	LC	Semi-arid and arid bushland and grassland of the Kalahari and Karoo and adjoining regions of Southern Africa.	Low
	² <i>Connochaetes gnou</i>	Black Wildebeest	LC	LC	Open plains grasslands and karoo shrublands of South Africa and Lesotho.	Low
	² <i>Connochaetes taurinus</i>	Blue Wildebeest	LC	LC	Open savanna woodland and open grassland with access to drinking water.	Low
	² <i>Alcelaphus caama</i>	Red Hartebeest	LC	LC	Open savanna country and open woodland.	Confirmed
	² <i>Damaliscus pygargus phillipsi</i>	Blesbok	LC	LC	Open grassland with water.	Low
	² <i>Antidorcas marsupialis</i>	Springbok	LC	LC	Open arid plains with short vegetation	Low
	² <i>Raphicerus campestris</i>	Steenbok	LC	LC	Inhabits open country.	High
² <i>Sylvicapra grimmia</i>	Common Duiker	LC	LC	Presence of bushes is 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
PELOMEDUSIDAE	<i>Pelomedusa subrufa</i>	Helmeted Terrapin	LC
TESTUDINIDAE	² <i>Homopus femoralis</i>	Greater Padloper	LC
	² <i>Psammobates oculifer</i>	Serrated Tent Tortoise	LC
	² <i>Stigmochelys pardalis</i>	Leopard Tortoise	LC
GEKKONIDAE	<i>Chondrodactylus bibronii</i>	Bibron's Gecko	LC
	<i>Lygodactylus capensis capensis</i>	Common Dwarf Gecko	LC
	<i>Pachydactylus capensis</i>	Cape Gecko	LC
	<i>Pachydactylus mariquensis</i>	Common Banded Gecko	LC
	<i>Ptenopus garrulus garrulus</i>	Common Barking Gecko	LC
AMPHISBAENIDAE	<i>Monopeltis capensis</i>	Cape Worm Lizard	LC
	<i>Monopeltis infuscata</i>	Dusky Spade-snouted Worm Lizard	LC
LACERTIDAE	² <i>Meroles squamulosus</i>	Savanna Lizard	LC
	² <i>Nucras holubi</i>	Holub's Sandveld Lizard	LC
	² <i>Nucras intertexta</i>	Spotted Sandveld Lizard	LC
	² <i>Pedioplanis lineocellata lineocellata</i>	Spotted Sand Lizard	LC
	² <i>Pedioplanis namaquensis</i>	Namaqua Sand Lizard	LC
CORDYLIDAE	¹ <i>Karusasaurus polyzonus</i>	Southern Karusa Lizard	LC LC
GERRHOSAURIDAE	<i>Gerrhosaurus flavigularis</i>	Yellow-throated Plated Lizard	
SCINCIDAE	<i>Acontias occidentalis</i>	Savanna Legless Skink	LC
	<i>Afroablepharus wahlbergii</i>	Wahlberg's Snake-eyed Skink	LC
	<i>Trachylepis capensis</i>	Cape Skink	LC
	<i>Trachylepis punctatissima</i>	Speckled Rock Skink	LC
	<i>Trachylepis punctulata</i>	Speckled Sand Skink	LC
	<i>Trachylepis spilogaster</i>	Kalahari Tree Skink	LC
	<i>Trachylepis sulcata sulcata</i>	Western Rock Skink	LC
	<i>Trachylepis varia</i>	Variable Skink	LC
	<i>Trachylepis variegata</i>	Variiegated Skink	LC
VARANIDAE	² <i>Varanus albigularis albigularis</i>	Southern Rock Monitor	LC
	² <i>Varanus niloticus</i>	Nile Monitor	LC
CHAMAELEONIDAE	¹ <i>Chamaeleo dilepis dilepis</i>	Common Flap-neck Chameleon	LC
AGAMIDAE	<i>Agama aculeata aculeata</i>	Western Ground Agama	LC
	<i>Agama aculeata distanti</i>	Eastern Ground Agama	LC
	<i>Agama atra</i>	Southern rock Agama	LC

LIST OF REPTILES (cont.)

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

Family	Scientific name	Common name	IUCN status
TYPHLOPIDAE	³ <i>Rhinotyphlops lalandei</i>	Delalande's Beaked Blind Snake	LC
LEPTOTYPHLOPIDAE	³ <i>Leptotyphlops scutifrons</i>	Peter's Thread Snake	LC
VIPERIDAE	³ <i>Bitis arietans arietans</i>	Puff Adder	LC
LAMPROPHIIDAE	³ <i>Aparallactus capensis</i>	Black-headed Centipede-eater	LC
	³ <i>Atractaspis bibronii</i>	Bibron's Stiletto Snake	LC
	³ <i>Xenocalamus bicolor bicolor</i>	Bicoloured Quill-snouted Snake	LC
	² <i>Boaedon capensis</i>	Brown House Snake	LC
	² <i>Lamprophis aurora</i>	Aurora Snake	LC
	² <i>Lycodonomorphus rufulus</i>	Brown Water Snake	LC
	² <i>Lycophidion capense capense</i>	Cape Wolf Snake	LC
	³ <i>Psammophis brevirostris</i>	Short-snouted Grass Snake	LC
	³ <i>Psammophis notostictus</i>	Karoo Sand Snake	LC
	³ <i>Psammophis trinasalis</i>	Fork-marked Sand Snake	LC
	³ <i>Psammophylax tritaeniatus</i>	Striped Grass Snake	LC
	² <i>Prosymna bivittata</i>	Two-striped Shovel-snout	LC
² <i>Pseudaspis cana</i>	Mole Snake	LC	
ELAPIDAE	³ <i>Elapsoidea sundevallii media</i>	Sundevall's Garter Snake	LC
	³ <i>Naja nivea</i>	Cape Cobra	LC
COLUBRIDAE	³ <i>Crotaphopeltis hotamboeia</i>	Red-lipped Snake	LC
	² <i>Dasypeltis scabra</i>	Rhombic Egg-eater	LC
	³ <i>Dispholidus typus</i>	Boomslang	LC
	² <i>Philothamnus semivariegatus</i>	Spotted Bush Snake	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 <i>Amietophrynus poweri</i>	Western Olive Toad	LC
	² <i>Amietophrynus rangeri</i>	Raucous Toad	LC
	² <i>Bufo gutturalis</i>	Guttural Toad	LC
	² <i>Poyntonophrynus vertebralis</i>	Southern Pygmy Toad	LC
	² <i>Vandijkophrynus gariepensis</i>	Karoo Toad	LC
HYPEROLIIDAE	² <i>Kassina senegalensis</i>	Bubbling Kassina	LC
PHRYNOBATRACHIDAE	² <i>Phrynobatrachus natalensis</i>	Snoring Puddle Frog	LC
PIPIDAE	² <i>Xenopus laevis</i>	Common Platanna	LC
PYXICEPHALIDAE	² <i>Cacosternum boettgeri</i>	Boettger's Caco	LC
	² <i>Amietia quecketti</i>	Common River Frog	LC
	² <i>Amietia fuscigula</i>	Cape River Frog	LC
	¹ <i>Pyxicephalus adspersus</i>	Giant Bullfrog	NT
	² <i>Tomopterna cryptotis</i>	Tremolo Sand Frog	LC
	² <i>Tomopterna tandyi</i>	Tandy's Sand Frog	LC

LIST OF BIRDS

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

Scientific name	Common name	IUCN status
² <i>Acrocephalus arundinaceus</i>	Great Reed-Warbler	LC
² <i>Acrocephalus baeticatus</i>	African Reed-Warbler	LC
² <i>Acrocephalus gracilirostris</i>	Lesser Swamp-Warbler	LC
² <i>Actitis hypoleucos</i>	Common Sandpiper	LC
² <i>Actophilornis africanus</i>	African Jacana	LC
² <i>Alcedo cristata</i>	Malachite Kingfisher	LC
² <i>Alopochen aegyptiacus</i>	Egyptian Goose	LC
² <i>Amadina erythrocephala</i>	Red-headed Finch	LC
² <i>Amaurornis flavirostris</i>	Black Crake	LC
² <i>Anas capensis</i>	Cape Teal	LC
² <i>Anas erythrorhyncha</i>	Red-billed Teal	LC
² <i>Anas hottentota</i>	Hottentot Teal	LC
² <i>Anas smithii</i>	Cape Shoveler	LC
² <i>Anas sparsa</i>	African Black Duck	LC
² <i>Anas undulata</i>	Yellow-billed Duck	LC
² <i>Anhinga rufa</i>	African Darter	LC
² <i>Anthoscopus minutus</i>	Cape Penduline-Tit	LC
² <i>Anthropoides paradisea</i>	Blue Crane	NT
² <i>Anthus cinnamomeus</i>	African Pipit	LC
² <i>Anthus leucophrys</i>	Plain-backed Pipit	LC
² <i>Anthus vaalensis</i>	Buffy Pipit	LC
² <i>Apus affinis</i>	Little Swift	LC
² <i>Apus apus</i>	Common Swift	LC
² <i>Apus barbatus</i>	African Black Swift	LC
² <i>Apus bradfieldi</i>	Bradfield's Swift	LC
² <i>Apus caffer</i>	White-rumped Swift	LC
² <i>Apus horus</i>	Horus Swift	LC
² <i>Aquila rapax</i>	Tawny Eagle	EN
² <i>Aquila verreauxii</i>	Verreaux's Eagle	VU
² <i>Ardea cinerea</i>	Grey Heron	LC
² <i>Ardea goliath</i>	Goliath Heron	LC
² <i>Ardea melanocephala</i>	Black-headed Heron	LC
² <i>Ardea purpurea</i>	Purple Heron	LC
² <i>Ardeola ralloides</i>	Squacco Heron	LC
² <i>Ardeotis kori</i>	Kori Bustard	NT
¹ <i>Asio capensis</i>	Marsh Owl	LC
² <i>Batis pririt</i>	Pririt Batis	LC
² <i>Bostrychia hagedash</i>	Hadedda Ibis	LC
² <i>Bradornis infuscatus</i>	Chat Flycatcher	LC
² <i>Bradornis mariquensis</i>	Marico Flycatcher	LC

LIST OF BIRDS (cont.)

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

	Scientific name	Common name	IUCN status
¹	<i>Bubo africanus</i>	Spotted Eagle-Owl	LC
¹	<i>Bubo lacteus</i>	Verreaux's Eagle-Owl	LC
²	<i>Bubulcus ibis</i>	Cattle Egret	LC
²	<i>Burhinus capensis</i>	Spotted Thick-knee	LC
¹	<i>Buteo rufofuscus</i>	Jackal Buzzard	LC
¹	<i>Buteo vulpinus</i>	Steppe Buzzard	LC
²	<i>Butorides striatus</i>	Green-backed Heron	LC
²	<i>Calandrella cinerea</i>	Red-capped Lark	LC
²	<i>Calendulauda africanoides</i>	Fawn-coloured Lark	LC
²	<i>Calendulauda sabota</i>	Sabota Lark	LC
²	<i>Calidris alba</i>	Sanderling	LC
²	<i>Calidris ferruginea</i>	Curlew Sandpiper	LC
²	<i>Calidris minuta</i>	Little Stint	LC
²	<i>Campethera abingoni</i>	Golden-tailed Woodpecker	LC
¹	<i>Caprimulgus europaeus</i>	European Nightjar	LC
¹	<i>Caprimulgus rufigena</i>	Rufous-cheeked Nightjar	LC
²	<i>Centropus burchellii</i>	Burchell's Coucal	LC
²	<i>Cercomela familiaris</i>	Familiar Chat	LC
²	<i>Cercomela schlegelii</i>	Karoo Chat	LC
²	<i>Cercotrichas coryphoeus</i>	Karoo Scrub-Robin	LC
²	<i>Cercotrichas paena</i>	Kalahari Scrub-Robin	LC
²	<i>Ceryle rudis</i>	Pied Kingfisher	LC
²	<i>Charadrius asiaticus</i>	Caspian Plover	LC
²	<i>Charadrius hiaticula</i>	Common Ringed Plover	LC
¹	<i>Charadrius pallidus</i>	Chestnut-banded Plover	NT
²	<i>Charadrius pecuarius</i>	Kittlitz's Plover	LC
²	<i>Charadrius tricollaris</i>	Three-banded Plover	LC
²	<i>Chersomanes albofasciata</i>	Spike-heeled Lark	LC
²	<i>Chlidonias hybridus</i>	Whiskered Tern	LC
²	<i>Chlidonias leucopterus</i>	White-winged Tern	LC
²	<i>Chrysococcyx caprius</i>	Diderick Cuckoo	LC
²	<i>Ciconia abdimii</i>	Abdim's Stork	NT
²	<i>Ciconia ciconia</i>	White Stork	LC
¹	<i>Ciconia nigra</i>	Black Stork	LC
²	<i>Cinnyris fusca</i>	Dusky Sunbird	LC
²	<i>Cinnyris talatala</i>	White-bellied Sunbird	LC
¹	<i>Circaetus pectoralis</i>	Black-chested Snake-Eagle	LC
¹	<i>Circus aeruginosus</i>	Western Marsh-Harrier	LC
¹	<i>Circus maurus</i>	Black Harrier	VU
¹	<i>Circus pygargus</i>	Montagu's Harrier	LC
¹	<i>Circus ranivorus</i>	African Marsh-Harrier	EN

LIST OF BIRDS (cont.)

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

Scientific name	Common name	IUCN status
² <i>Cisticola aridulus</i>	Desert Cisticola	LC
² <i>Cisticola fulvicapillus</i>	Neddicky	LC
² <i>Cisticola juncidis</i>	Zitting Cisticola	LC
² <i>Cisticola rufilatus</i>	Tinkling Cisticola	LC
² <i>Cisticola textrix</i>	Cloud Cisticola	LC
² <i>Cisticola tinniens</i>	Levaillant's Cisticola	LC
² <i>Clamator glandarius</i>	Great Spotted Cuckoo	LC
² <i>Clamator jacobinus</i>	Jacobin Cuckoo	LC
³ <i>Colius colius</i>	White-backed Mousebird	LC
² <i>Columba guinea</i>	Speckled Pigeon	LC
² <i>Columba livia</i>	Rock Dove	LC
² <i>Coracias caudata</i>	Lilac-breasted Roller	LC
² <i>Coracias garrulus</i>	European Roller	LC
² <i>Coracias naevia</i>	Purple Roller	LC
³ <i>Corvus albus</i>	Pied Crow	LC
³ <i>Corvus capensis</i>	Cape Crow	LC
² <i>Cossypha caffra</i>	Cape Robin-Chat	LC
² <i>Coturnix coturnix</i>	Common Quail	LC
² <i>Creatophora cinerea</i>	Wattled Starling	LC
² <i>Cuculus solitarius</i>	Red-chested Cuckoo	LC
² <i>Cursorius rufus</i>	Burchell's Courser	LC
² <i>Cursorius temminckii</i>	Temminck's Courser	LC
² <i>Cypsiurus parvus</i>	African Palm-Swift	LC
² <i>Delichon urbica</i>	Common House-Martin	LC
² <i>Dendrocygna bicolor</i>	Fulvous Duck	LC
² <i>Dendrocygna viduata</i>	White-faced Duck	LC
² <i>Dendropicos fuscescens</i>	Cardinal Woodpecker	LC
² <i>Dicrurus adsimilis</i>	Fork-tailed Drongo	LC
² <i>Egretta alba</i>	Great Egret	LC
² <i>Egretta ardesiaca</i>	Black Heron	LC
² <i>Egretta garzetta</i>	Little Egret	LC
² <i>Egretta intermedia</i>	Yellow-billed Egret	LC
¹ <i>Elanus caeruleus</i>	Black-shouldered Kite	LC
² <i>Emberiza capensis</i>	Cape Bunting	LC
² <i>Emberiza flaviventris</i>	Golden-breasted Bunting	LC
² <i>Emberiza impetuani</i>	Lark-like Bunting	LC
² <i>Emberiza tahapisi</i>	Cinnamon-breasted Bunting	LC
² <i>Eremomela icteropygialis</i>	Yellow-bellied Eremomela	LC
² <i>Eremopterix leucotis</i>	Chestnut-backed Sparrowlark	LC
² <i>Eremopterix verticalis</i>	Grey-backed Sparrowlark	LC

LIST OF BIRDS (cont.)

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

	Scientific name	Common name	IUCN status
²	<i>Estrilda astrild</i>	Common Waxbill	LC
²	<i>Estrilda erythronotos</i>	Black-faced Waxbill	LC
²	<i>Euplectes afer</i>	Yellow-crowned Bishop	LC
³	<i>Euplectes orix</i>	Southern Red Bishop	LC
²	<i>Euplectes progne</i>	Long-tailed Widowbird	LC
²	<i>Eupodotis afraoides</i>	Northern Black Korhaan	LC
²	<i>Eupodotis caerulescens</i>	Blue Korhaan	NT
²	<i>Eupodotis ruficrista</i>	Red-crested Korhaan	LC
¹	<i>Falco biarmicus</i>	Lanner Falcon	VU
¹	<i>Falco naumanni</i>	Lesser Kestrel	LC
¹	<i>Falco peregrinus</i>	Peregrine Falcon	LC
¹	<i>Falco rupicolis</i>	Rock Kestrel	LC
¹	<i>Falco rupicoloides</i>	Greater Kestrel	LC
²	<i>Fulica cristata</i>	Red-knobbed Coot	LC
²	<i>Gallinago nigripennis</i>	African Snipe	LC
²	<i>Gallinula chloropus</i>	Common Moorhen	LC
¹	<i>Glareola nordmanni</i>	Black-winged Pratincole	NT
¹	<i>Glaucidium perlatum</i>	Pearl-spotted Owlet	LC
²	<i>Granatina granatina</i>	Violet-eared Waxbill	LC
¹	<i>Gyps africanus</i>	White-backed Vulture	EN
¹	<i>Gyps coprotheres</i>	Cape Vulture	EN
²	<i>Halcyon albiventris</i>	Brown-hooded Kingfisher	LC
¹	<i>Haliaeetus vocifer</i>	African Fish-Eagle	LC
²	<i>Hieraaetus pennatus</i>	Booted Eagle	LC
²	<i>Himantopus himantopus</i>	Black-winged Stilt	LC
²	<i>Hippolais icterina</i>	Icterine Warbler	LC
²	<i>Hirundo albigularis</i>	White-throated Swallow	LC
²	<i>Hirundo cucullata</i>	Greater Striped Swallow	LC
²	<i>Hirundo dimidiata</i>	Pearl-breasted Swallow	LC
²	<i>Hirundo fuligula</i>	Rock Martin	LC
²	<i>Hirundo rustica</i>	Barn Swallow	LC
²	<i>Hirundo semirufa</i>	Red-breasted Swallow	LC
²	<i>Hirundo spilodera</i>	South African Cliff-Swallow	LC
²	<i>Indicator indicator</i>	Greater Honeyguide	LC
²	<i>Indicator minor</i>	Lesser Honeyguide	LC
²	<i>Ixobrychus minutus</i>	Little Bittern	LC
²	<i>Lagonosticta senegala</i>	Red-billed Firefinch	LC
²	<i>Lamprotornis nitens</i>	Cape Glossy Starling	LC
²	<i>Laniarius atrococcineus</i>	Crimson-breasted Shrike	LC
²	<i>Lanius collaris</i>	Common Fiscal	LC

LIST OF BIRDS (cont.)

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

Scientific name	Common name	IUCN status
² <i>Lanius collurio</i>	Red-backed Shrike	LC
² <i>Lanius minor</i>	Lesser Grey Shrike	LC
² <i>Larus cirrocephalus</i>	Grey-headed Gull	LC
¹ <i>Leptoptilos crumeniferus</i>	Marabou Stork	NT
² <i>Limosa limosa</i>	Black-tailed Godwit	NT
² <i>Macronyx capensis</i>	Cape Longclaw	LC
² <i>Malcorus pectoralis</i>	Rufous-eared Warbler	LC
² <i>Megaceryle maxima</i>	Giant Kingfisher	LC
¹ <i>Melierax canorus</i>	Southern Pale Chanting Goshawk	LC
¹ <i>Melierax gabar</i>	Gabar Goshawk	LC
² <i>Merops apiaster</i>	European Bee-eater	LC
² <i>Merops bullockoides</i>	White-fronted Bee-eater	LC
² <i>Merops hirundineus</i>	Swallow-tailed Bee-eater	LC
² <i>Merops persicus</i>	Blue-cheeked Bee-eater	LC
² <i>Milvus aegyptius</i>	Yellow-billed Kite	Not listed
¹ <i>Milvus migrans</i>	Black Kite	LC
² <i>Mirafrā africana</i>	Rufous-naped Lark	LC
² <i>Mirafrā fasciolata</i>	Eastern Clapper Lark	LC
² <i>Mirafrā passerina</i>	Monotonous Lark	LC
² <i>Monticola brevipes</i>	Short-toed Rock-Thrush	LC
² <i>Motacilla aguimp</i>	African Pied Wagtail	LC
² <i>Motacilla capensis</i>	Cape Wagtail	LC
² <i>Motacilla flava</i>	Yellow Wagtail	LC
² <i>Muscicapa striata</i>	Spotted Flycatcher	LC
¹ <i>Mycteria ibis</i>	Yellow-billed Stork	EN
² <i>Myrmecocichla formicivora</i>	Anteating Chat	LC
² <i>Netta erythrophthalma</i>	Southern Pochard	LC
² <i>Nilāus afer</i>	Brubru	LC
² <i>Numenius arquata</i>	Eurasian Curlew	NT
² <i>Numenius phaeopus</i>	Common Whimbrel	LC
² <i>Numida meleagris</i>	Helmeted Guineafowl	LC
² <i>Nycticorax nycticorax</i>	Black-crowned Night-Heron	LC
² <i>Oena capensis</i>	Namaqua Dove	LC
² <i>Oenanthe monticola</i>	Mountain Wheatear	LC
² <i>Oenanthe pileata</i>	Capped Wheatear	LC
² <i>Onychognathus nabouroup</i>	Pale-winged Starling	LC
² <i>Oriolus oriolus</i>	Eurasian Golden Oriole	LC
² <i>Ortygospiza atricollis</i>	African Quailfinch	LC
² <i>Oxyura maccoa</i>	Maccoa Duck	NT
¹ <i>Pandion haliaetus</i>	Osprey	LC

LIST OF BIRDS (cont.)

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

Scientific name	Common name	IUCN status
² <i>Parisoma subcaeruleum</i>	Chestnut-vented Tit-Babbler	LC
² <i>Parus cinerascens</i>	Ashy Tit	LC
² <i>Passer diffusus</i>	Southern Grey-headed Sparrow	LC
³ <i>Passer domesticus</i>	House Sparrow	LC
² <i>Passer melanurus</i>	Cape Sparrow	LC
² <i>Passer motitensis</i>	Great Sparrow	LC
² <i>Phalacrocorax africanus</i>	Reed Cormorant	LC
² <i>Phalacrocorax lucidus</i>	White-breasted Cormorant	LC
² <i>Philetairus socius</i>	Sociable Weaver	LC
² <i>Philomachus pugnax</i>	Ruff	LC
¹ <i>Phoenicopterus minor</i>	Lesser Flamingo	NT
¹ <i>Phoenicopterus ruber</i>	Greater Flamingo	NT
² <i>Phoeniculus purpureus</i>	Green Wood-Hoopoe	LC
² <i>Phylloscopus trochilus</i>	Willow Warbler	LC
² <i>Platalea alba</i>	African Spoonbill	LC
² <i>Plectropterus gambensis</i>	Spur-winged Goose	LC
² <i>Plegadis falcinellus</i>	Glossy Ibis	LC
² <i>Plocepasser mahali</i>	White-browed Sparrow-Weaver	LC
³ <i>Ploceus velatus</i>	Southern Masked-Weaver	LC
² <i>Podiceps cristatus</i>	Great Crested Grebe	LC
² <i>Podiceps nigricollis</i>	Black-necked Grebe	LC
¹ <i>Polemaetus bellicosus</i>	Martial Eagle	EN
¹ <i>Polihierax semitorquatus</i>	Pygmy Falcon	LC
¹ <i>Polyboroides typus</i>	African Harrier-Hawk	LC
² <i>Porphyrio madagascariensis</i>	African Purple Swamphen	LC
² <i>Porzana pusilla</i>	Baillon's Crake	LC
² <i>Prinia flavicans</i>	Black-chested Prinia	LC
² <i>Psophocichla litsipsirupa</i>	Groundscraper Thrush	LC
² <i>Pternistis natalensis</i>	Natal Francolin	LC
² <i>Pternistis swainsonii</i>	Swainson's Spurfowl	LC
² <i>Pterocles burchelli</i>	Burchell's Sandgrouse	LC
² <i>Pterocles namaqua</i>	Namaqua Sandgrouse	LC
¹ <i>Ptilopus granti</i>	Southern White-faced Scops-Owl	LC
³ <i>Pycnonotus nigricans</i>	African Red-eyed Bulbul	LC
² <i>Pytilia melba</i>	Green-winged Pytilia	LC
³ <i>Quelea quelea</i>	Red-billed Quelea	LC
² <i>Rallus caerulescens</i>	African Rail	LC
² <i>Recurvirostra avosetta</i>	Pied Avocet	LC
² <i>Rhinopomastus cyanomelas</i>	Common Scimitarbill	LC
² <i>Rhinoptilus africanus</i>	Double-banded Courser	LC

LIST OF BIRDS (cont.)

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

Scientific name	Common name	IUCN status
² <i>Riparia cincta</i>	Banded Martin	LC
² <i>Riparia paludicola</i>	Brown-throated Martin	LC
² <i>Riparia riparia</i>	Sand Martin	LC
¹ <i>Rostratula benghalensis</i>	Greater Painted-snipe	VU
¹ <i>Sagittarius serpentarius</i>	Secretarybird	VU
² <i>Sarkidiornis melanotos</i>	Comb Duck	LC
² <i>Saxicola torquata</i>	African Stonechat	LC
² <i>Scleroptila levaillantoides</i>	Orange River Francolin	LC
² <i>Scopus umbretta</i>	Hamerkop	LC
² <i>Serinus albogularis</i>	White-throated Canary	LC
² <i>Serinus atrogularis</i>	Black-throated Canary	LC
² <i>Serinus flaviventris</i>	Yellow Canary	LC
² <i>Sigelus silens</i>	Fiscal Flycatcher	LC
² <i>Spizocorys conirostris</i>	Pink-billed Lark	LC
² <i>Sporopipes squamifrons</i>	Scaly-feathered Finch	LC
² <i>Spreo bicolor</i>	Pied Starling	LC
² <i>Stenostira scita</i>	Fairy Flycatcher	LC
¹ <i>Sterna caspia</i>	Caspian Tern	LC
² <i>Streptopelia capicola</i>	Cape Turtle-Dove	LC
² <i>Streptopelia semitorquata</i>	Red-eyed Dove	LC
² <i>Streptopelia senegalensis</i>	Laughing Dove	LC
² <i>Struthio camelus</i>	Common Ostrich	LC
² <i>Sylvia borin</i>	Garden Warbler	LC
² <i>Sylvia communis</i>	Common Whitethroat	LC
² <i>Sylvietta rufescens</i>	Long-billed Crombec	LC
² <i>Tachybaptus ruficollis</i>	Little Grebe	LC
² <i>Tachymarptis melba</i>	Alpine Swift	LC
² <i>Tadorna cana</i>	South African Shelduck	LC
² <i>Tchagra australis</i>	Brown-crowned Tchagra	LC
² <i>Telophorus zeylonus</i>	Bokmakierie	LC
² <i>Terpsiphone viridis</i>	African Paradise-Flycatcher	LC
² <i>Thalassornis leuconotus</i>	White-backed Duck	LC
² <i>Threskiornis aethiopicus</i>	African Sacred Ibis	LC
² <i>Tockus leucomelas</i>	Southern Yellow-billed Hornbill	LC
² <i>Tockus nasutus</i>	African Grey Hornbill	LC
² <i>Torgos tracheliotus</i>	Lappet-faced Vulture	EN
² <i>Trachyphonus vaillantii</i>	Crested Barbet	LC
² <i>Tricholaema leucomelas</i>	Acacia Pied Barbet	LC
² <i>Tringa glareola</i>	Wood Sandpiper	LC
² <i>Tringa nebularia</i>	Common Greenshank	LC
² <i>Tringa stagnatilis</i>	Marsh Sandpiper	LC

LIST OF BIRDS (cont.)

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

Scientific name	Common name	IUCN status
² <i>Turdus smithi</i>	Karoo Thrush	<i>Not listed</i>
² <i>Turnix sylvatica</i>	Small Buttonquail	LC
¹ <i>Tyto alba</i>	Barn Owl	LC
² <i>Upupa africana</i>	African Hoopoe	LC
² <i>Uraeginthus angolensis</i>	Blue Waxbill	LC
³ <i>Urocolius indicus</i>	Red-faced Mousebird	LC
² <i>Vanellus armatus</i>	Blacksmith Lapwing	LC
² <i>Vanellus coronatus</i>	Crowned Lapwing	LC
² <i>Vidua chalybeata</i>	Village Indigobird	LC
² <i>Vidua macroura</i>	Pin-tailed Whydah	LC
² <i>Vidua paradisaea</i>	Long-tailed Paradise-Whydah	LC
² <i>Vidua regia</i>	Shaft-tailed Whydah	LC
² <i>Zosterops pallidus</i>	Orange River White-eye	LC

APPENDIX 3

**A photographic guide for species of conservation concern that were
encountered on site**

Boscia albitrunca

Protected under the NFA and Schedule 2 of the NCNCA



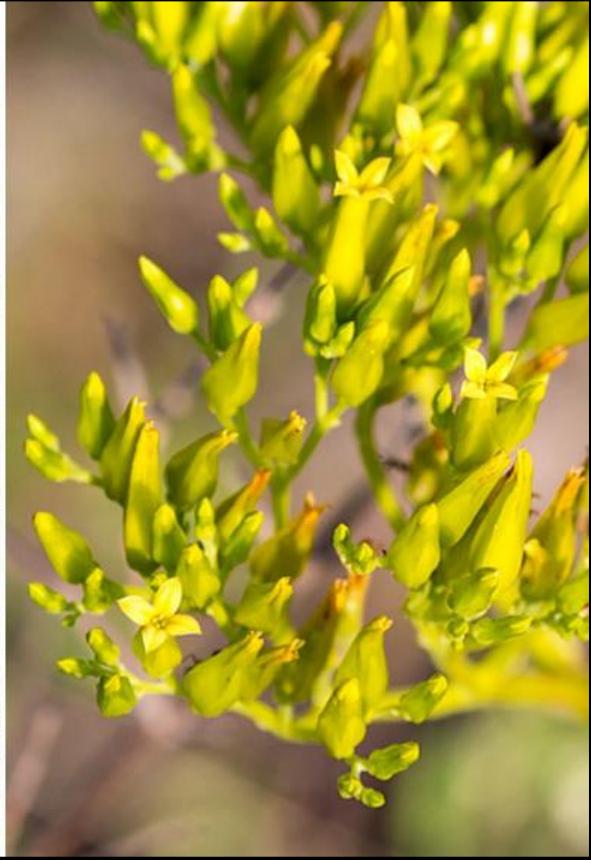
Vachellia erioloba
(Protected under the NFA)



- 1) Pods are thickened and velvety
- 2) Spines are often swollen and fused at the base

Kalanchoe paniculata

CRASSULACEAE spp. are protected under Schedule 2 of NCNCA



Dry flower heads



Leaves