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ECOLOGICAL CONSULTING

ECOLOGICAL & WETLAND ASSESSMENT REPORT

ALET MARITZ MYNBOU (Pty) Ltd

Walton & Erith Kieselguhr Prospecting Operation

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Remaining Extent of the Farm Erith 389

Portion 3 of the Farm Erith 389

Remaining Extent of Portion 2 of the Farm Walton 390

District Kuruman

Northern Cape Province

Ecological & Wetland Assessment Report in application for Environmental Authorisation related to a Prospecting Right Application that was lodged with the Department of Mineral Resources

July 2022

EXECUTIVE SUMMARY

Alet Maritz Mynbou is proposing the prospecting of kieselguhr on the Remaining Extent of the Farm Erith 389, Portion 3 of the Farm Erith 389, and Remaining Extent of Portion 2 of the Farm Walton 390. The prospecting right area is located within the Kuruman District Municipality of the Northern Cape Province. Alet Maritz Mynbou has submitted a Prospecting Right application, which triggers the requirement to apply for Environmental Authorisation. This ecological and wetland assessment report considers the impacts that the proposed activities might have on the ecological integrity of the property. It describes the characteristics of terrestrial, aquatic, and wetland habitats in the proposed prospecting area, identifies the source of impacts from the prospecting operation and assesses these impacts, as well as the residual impacts after closure.

A desktop study and field investigation were performed to obtain ecological and biodiversity information for the proposed study area and to identify the ecological characteristics and sensitivity of the site. Two distinct plant communities were identified on site, i.e., Open woodland on calcareous sand and Woodland on red sand. Both have a high occurrence of plant species of conservation concern that occur widespread across each unit as well as important habitat associations for animal species of conservation concern. However, the open woodland on calcareous sand is most sensitive to disturbances based on the associated hydrological functioning of Vlermuisleegte, which is classified as a lowland river. The most profound impacts are expected to be related to risks associated to the degradation of Vlermuisleegte as a watercourse, potential erosion of the sandy substrate, the loss of plant species of conservation concern as well as the disruption of ecological corridors. Nevertheless, these impacts are all considered to have moderate effect, which can be reduced if mitigated.

Species of national conservation concern that are found in the area earmarked for prospecting include *Vachellia erioloba* and *V. haematoxylon.* A licence application regarding protected trees should be lodged with Department of Agriculture, Forestry and Fisheries three months prior to any potential disturbances to these trees. The prospecting operation will also result in the removal of provincially protected plant species and the large-scale clearance of indigenous vegetation. Permit applications regarding removal of protected plants and the large-scale harvesting of indigenous vegetation need to be lodged with the Northern Cape Department of Environment and Nature Conservation three months prior to any clearance of vegetation.

Furthermore, the core earmarked area for the proposed operation falls within a watercourse (Vlermuisleegte), that has been moderately modified (PES C) and regarded to be of low ecological importance and sensitivity. To alter the beds and banks of Vlermuisleegte, a water use license should be obtained from DWS prior to such activities.

The degradation of natural habitats and removal of nationally protected trees are inevitable during the proposed operation, but the significance of the impacts will be affected by the success of the mitigation measures implemented and the rehabilitation programme for the prospecting area. Authorisation can be granted if the applicant adheres to the suggested avoidance, management, mitigation, and rehabilitation measures.

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1. INTRODUCTION

1.1. Background information

Alet Maritz Mynbou is proposing the prospecting of kieselguhr on the Remaining Extent of the Farm Erith 389, Portion 3 of the Farm Erith 389, and Remaining Extent of Portion 2 of the Farm Walton 390 (from hereon referred to as the study/prospecting area). The prospecting right area is located within the Kuruman District Municipality of the Northern Cape Province. It lies approximately 28 km north-west of the town Kathu along the R380 towards Hotazel (Figure 1). The total extent of the prospecting right area is ± 3 247 ha.

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

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

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

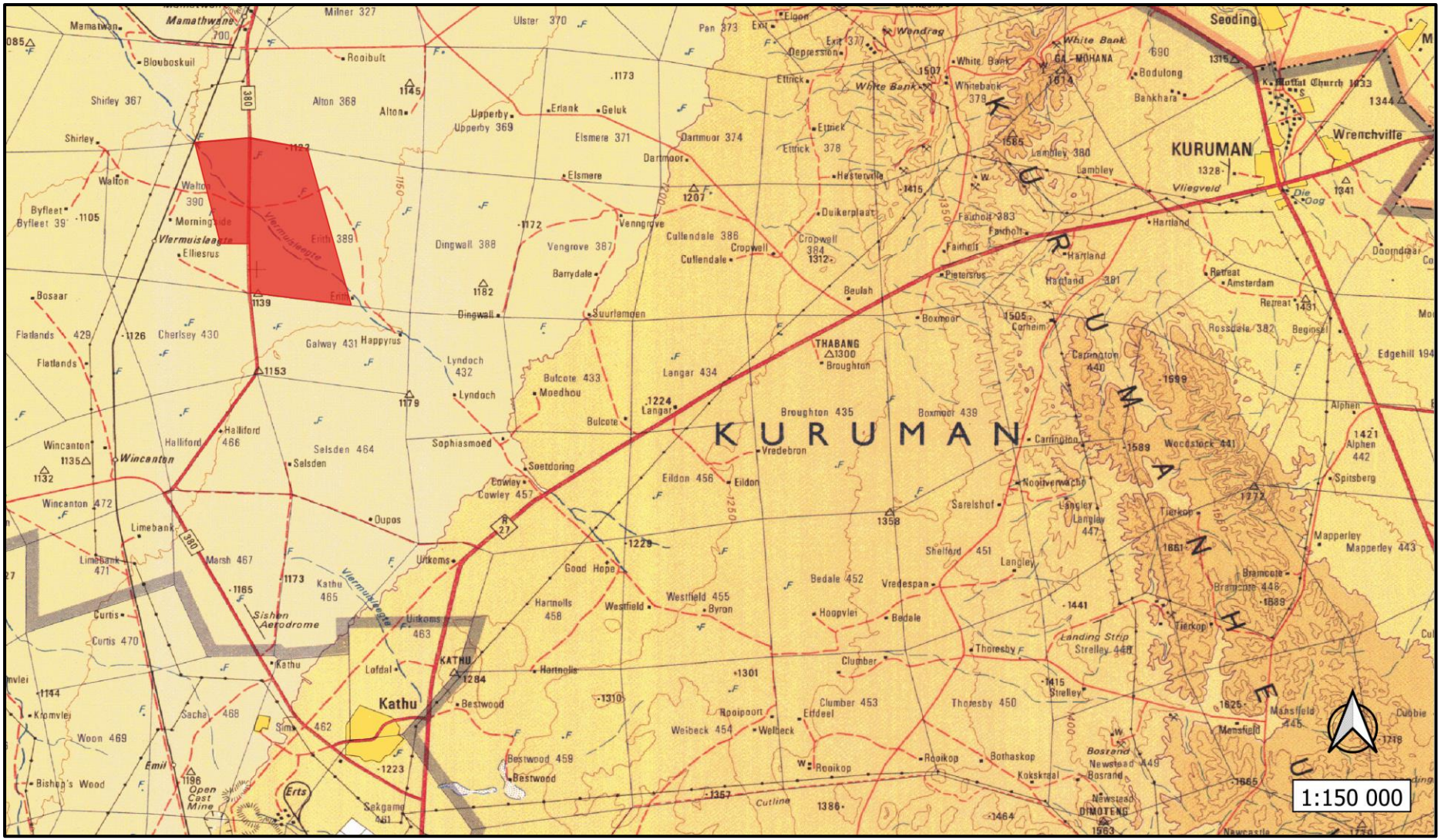


Figure 1. The location of the prospecting area is indicated in red.

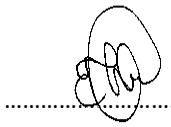
1.2. Scope of study

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

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

1.3. Details of the specialist consultant

Company Name	Boscia Ecological Consulting cc	**Registration No:**	2011/048041/23
Address	PostNet Suite #194 Private Bag X2 Diamond 8305		
Contact Person	Dr Elizabeth (Betsie) Milne (Pr. Sci. Nat)		
Contact Details	Cell: 082 992 1261	Email: BosciaEcology@gmail.com	
Qualifications	Professional Natural Scientist - Ecological Science (Registration No: 131395) PhD Botany (Nelson Mandela Metropolitan University), Masters Environmental Management (University of the Free State), BTech Nature Conservation (Tshwane University of Technology)		

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

1.4. Description of the proposed activity

The prospecting operation is based on kieselguhr deposits associated with the Kalahari Basin. These are diatomaceous earth composed of the fossilised skeletons of diatoms and spicules of sponges and grass skeletons found below the unconsolidated sands of the Gordonia Formation.

The deposits will be sampled by means of pitting and trenching. Prospecting pits will be positional along a grid and approximately 20 pits (2m x 3m x 0.5 - 1m each) are planned to verify feasibility of deposits. Thereafter, bulk sampling will be performed in feasible areas, during which 10 trenches (100m x 50 m x 0.5 - 1m each) will be created. This will be performed by means of an opencast method using heavy earthmoving machinery. Vegetated soil or overburden will be stripped, and the underlying deposits will be excavated and stockpiled before being hauled off-site to a processing facility. An estimated total ore volume of 360 m^3 and 150 000 m^3 for pitting and trenching will be processed, respectively over 4 years.

Prospecting activities will make use of existing roads where possible, but new haul roads will be created to access new prospecting trenches. The proposed infrastructure and prospecting related footprint include access roads, temporary office and workshop complex, ablution facilities, storm water control berms, water tank, fuel storage facility, wash bay, salvage yard, waste disposal site, open pits and trenches, overburden stockpiles and ore stockpiles.

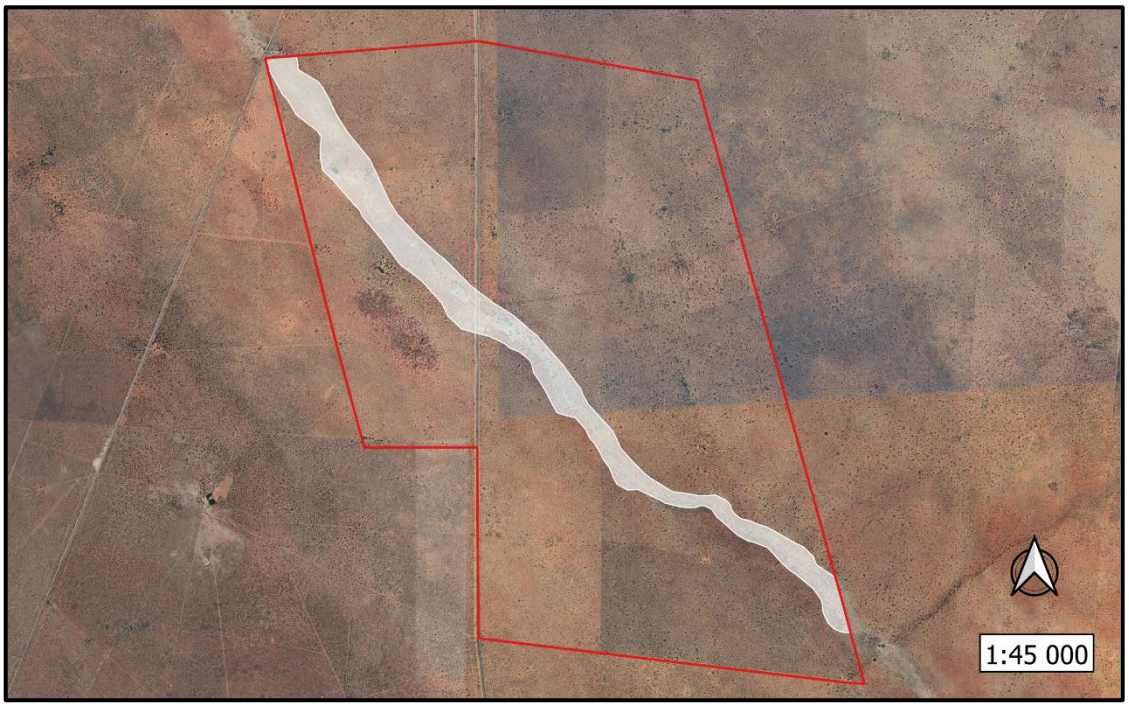


Figure 2. The proposed core footprint of prospecting activities in the study area is indicated in white.

2. METHODOLOGY

2.1. Data collection

The study comprised a combination of field and desktop surveys for data collection on fauna and flora to obtain the most comprehensive data set for the assessment. The fieldwork component was conducted on 13 October 2021 and 9 June 2022. Most data for the desktop component was obtained from the quarter degree squares that includes the study area (2722BD, 2722DB, 2723AC and 2723CA).

2.2. Flora

2.2.1. Field survey

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

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

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

2.2.2. Desktop survey

For the desktop component, the South African National Vegetation Map (Mucina and Rutherford 2006) was used to obtain data on broad scale vegetation types 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 Gamagara (NC453) - John Taolo Gaetsewe District Municipality, in which the study area falls. The Environmental Management Framework for this municipality was also consulted to understand the municipality's conservation strategies.

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 (Figure 3). The IUCN conservation status of plants in the species list was also extracted from the SANBI database and is based on the Threatened Species Programme (SANBI 2020).

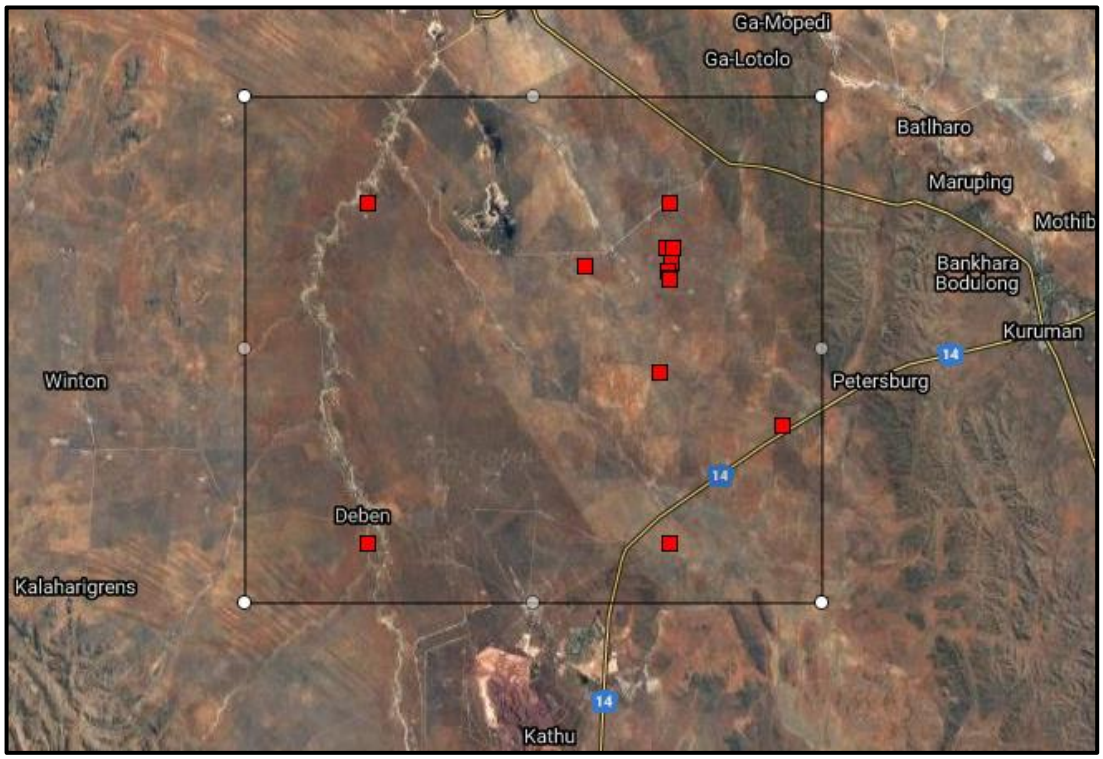


Figure 3. The extent of the map filter applied on the POSA website to extract species information is shown by the large black square. The small red squares indicate historical data points.

2.3. Fauna

2.3.1. Desktop survey

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

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

The likelihood of Red Data species occurring on site has been determined using the distribution maps in the Red Data reference books (Friedmann and Daly 2004; Minter et al. 2004; Bates et al. 2014; Taylor et al. 2015; ADU 2016) and comparing their habitat preferences with the habitat described from the field survey. The conservation status of each species is also listed, based on the IUCN Red List Categories and Criteria, 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. Freshwater resources assessment procedures

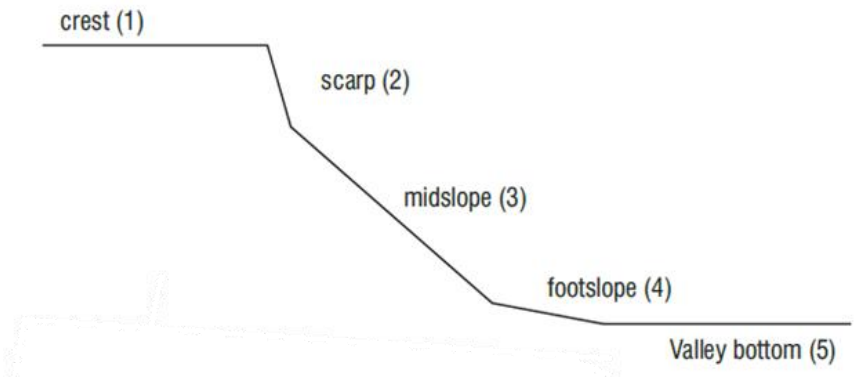
a) Water resource delineation

Water resources were delineated according to methodology adapted from the delineation procedure as set out by Rountree et al. (2008). Even though the presence of all indicators included in this delineation procedure provides a logical, defensible, and technical basis for identifying an area as wetland or riparian area; these procedures were primarily developed for wetlands and riparian areas in mesic and humid regions. The soil and vegetation descriptors outlined in these procedures do not fully accommodate those wetland and riparian areas found in more arid regions.

Therefore, delineation of wetlands and riparian areas were performed by estimating their boundaries from satellite imagery and topographical maps, and then drawing it onto the site map, using clues such as topography, differences in colour, shading, texture, and elevation. These boundaries were then verified in the field. The field verification further considered topography, vegetation and alluvial soils or deposited material.

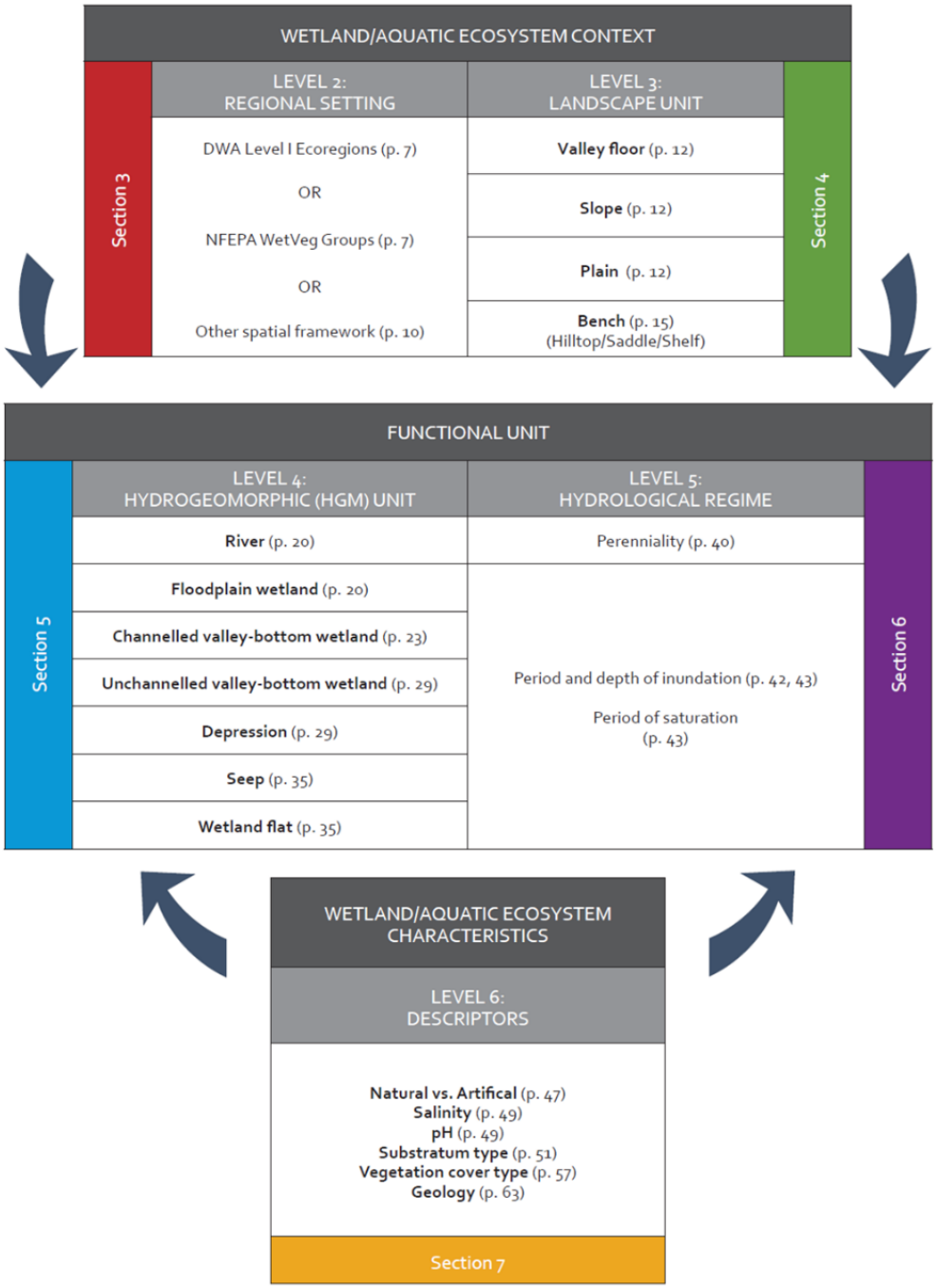
In terms of topography, terrain unit indicators were considered:

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



b) <u>Water resource classification</u>

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



c) Present Ecological Status (PES)

The Index of Habitat Integrity tool (Kleynhans et al. 2008) was used to determine the integrity of Vlermuisleegte. The habitat integrity of a river refers to the maintenance of a balanced composition of physico-chemical and habitat characteristics on a temporal and spatial scale that are comparable to the characteristics of natural habitats of the region. Habitat integrity assessments are approached from an instream and/or riparian zone perspective.

Both are formulated according to metric groups, each with several metrics that enable the assessment of habitat integrity. Assessment of habitat integrity is based on an interpretation of the deviation from the reference condition. Specification of the reference condition follows an impact based approach where the intensity and extent of anthropogenic changes are used to interpret the impact on the habitat integrity of the system. To accomplish this, information on abiotic changes that can potentially influence river habitat integrity are obtained from surveys or available data sources. These changes are all related and interpreted in terms of modification of the drivers of the system, namely hydrology, geomorphology, and physico-chemical conditions and how these changes would impact on the natural riverine habitats. Metrics are rated according to:

IMPACT/SEVERITY CLASS	DESCRIPTION	RATING
None: reference	No discernible impact or the modification is located in such a way that it has no impact on habitat quality, diversity, size and variability.	0
Small	The modification is limited to very few localities and the impact on habitat quality, diversity, size and variability are very small.	0.5 – 1.0
Moderate	The modifications are present at a small number of localities and the impact on habitat quality, diversity, size and variability are limited.	1.5 – 2.0
Large	The modification is generally present with a clearly detrimental impact on habitat quality, diversity, size and variability. Large areas are not influenced.	2.5 – 3.0
Serious	The modification is frequently present and the habitat quality, diversity, size and variability in almost the whole of the defined area are affected. Only small areas are not influenced.	3.5 – 4.0
Critical	The modification is present overall with a high intensity. The habitat quality, diversity, size and variability in almost the whole of the defined section are influenced detrimentally.	4.5 – 5.0

The habitat integrity index values are generically interpreted as follows:

HABITAT INTEGRITY CATEGORY	DESCRIPTION	RATING (% OF TOTAL)
A	Unmodified, natural.	90 – 100
B	Largely natural with few modifications. The flow regime has been slightly modified and pollution is limited to sediment. A small change in natural habitats may have taken place. However, the ecosystem functions are essentially unchanged.	80 – 89
C	Moderately modified. Loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged.	60 -79
D	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.	40 – 59
E	Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive.	20 – 39
F	Critically / Extremely modified. Modifications have reached a critical level and the system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible.	0 – 19

d) Ecological Importance and Sensitivity

The ecological importance of a river is an expression of its importance to the maintenance of biological diversity and ecological functioning on local and wider scales. Ecological sensitivity (or fragility) refers to the system's ability to resist disturbance and its capability to recover from disturbance once it has occurred (resilience). Both abiotic and biotic components of the system are taken into consideration in the assessment of ecological importance and sensitivity. An Ecological Importance and Sensitivity (EIS) assessment was conducted by using methodology from Kleynhans (1999). For this assessment procedure, a series of determinants are considered using a five point (0 to 4) scoring system, i.e. Very high = 4; High = 3, Moderate = 2; Marginal = 1; None = 0:

Determinants
BIOTIC DETERMINANTS
1. Rare & Endangered biota
2. Unique biota
3. Intolerant biota
4. Species/taxon richness
HABITAT DETERMINANTS
5. Diversity of aquatic habitat types or features
6. Refuge value of habitat types
7. Sensitivity of habitat to flow changes
8. Sensitivity to flow related water quality changes
9. Migration route/corridor for instream and riparian biota
10. National parks, Wilderness areas, Nature reserves, Natural Heritage sites, Natural areas

The median of the determinants is used to assign the Ecological Importance and Sensitivity (EIS):

EIS Category	Mean range
Very high Unique on a national or even international level based on unique biodiversity. These rivers are usually very sensitive to flow modifications and have no or only a small capacity for use.	> 3 and ≤ 4
High Unique on a national scale due to biodiversity. These rivers may be sensitive to flow modifications but may have a substantial capacity for use.	> 2 and ≤ 3
Moderate Unique on a provincial or local scale due to biodiversity. These rivers are usually not very sensitive to flow modifications and often have a substantial capacity for use.	> 1 and ≤ 2
Low/marginal Not unique at any scale. These rivers are generally not very sensitive to flow modifications and usually have a substantial capacity for use.	> 0 and ≤ 1

e) Determining the recommended buffer zone

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

2.5. Sensitivity mapping and assessment

An ecological sensitivity map of the site was produced by integrating 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 was rated according to the following scale:

Low:	Areas of natural or transformed habitat with a low sensitivity where there is likely to be a negligible impact on ecological processes and biodiversity. Most types of activities can proceed within these areas with little ecological impact.
Medium:	Areas of natural or previously transformed land where the impacts are likely to be largely local and the risk of secondary impact such as erosion low. Activities within these areas can proceed with relatively little ecological impact provided that appropriate mitigation measures are taken.
High:	Areas of natural or transformed land where a high impact is anticipated due to the high biodiversity value, sensitivity or important ecological role of the area. These areas may contain or be important habitat for faunal species or provide important ecological services such as water flow regulation or forage provision. Activities within these areas are undesirable and should only proceed with caution as it may not be possible to mitigate all impacts appropriately.
Very High:	Critical and unique habitats that serve as habitat for species of conservation concern or perform critical ecological roles. These areas are essentially no-go areas for activities and should be avoided as much as possible.

2.6. Impact assessment and mitigation

The criteria used to assess the significance of the impacts are shown in Table 1. The different project activities and associated infrastructure were identified and considered in order to identify and analyse the various possible impacts. The limits were defined in relation to project characteristics. Those for severity, extent, duration and probability are subjective, based on rule-of-thumb and experience. Natural and existing mitigation measures were considered. These natural mitigation measures were defined as natural conditions, conditions inherent in the project design and existing management measures, which alleviate impacts. The Consequence value of the impacts was calculated by using the following formula:

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

Consequence of impacts is defined as follows:

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

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

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

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

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

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

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

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

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

CONSEQUENCE
(Severity + Spatial Scope + Duration)

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

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

2.7. Assumptions and limitations

Due to the brief duration of the surveys and the lack of comprehensive seasonal coverage, the species list obtained during the site visits cannot be regarded as comprehensive. Ideally, a site should be visited several times during different seasons to ensure that the full complement of plant species present is captured. However, this is rarely possible due to time and cost constraints related to the mining and prospecting right application processes. The survey was nevertheless conducted in such a manner to ensure all representative communities are traversed and therefore is likely to have included most of the dominant and common species present. The surveys also took place during spring and winter, which are not the most optimal time of the year. The best time to evaluate vegetation in the study area is in summer after the first rain, when the vegetation has had a chance to respond and is in an actively growing state. Grasses were dormant, but some shrubs and forbs started flowering. Therefore, the results presented here can only reflect the condition of the vegetation at the time of the field visit.

3. DESCRIPTION OF THE AFFECTED ENVIRONMENT

3.1. Current and historic land use

The major land uses in the region include activities related to agriculture, hunting and mining. The land capability of the study area is non-arable, with moderately low potential for grazing and wildlife. The agricultural region is demarcated for cattle farming, with the grazing capacity estimated at 11 Ha/LSU. The study area is not suitable for crop irrigation. Currently, the farms are utilised as natural pastures for domestic livestock. A few small-scale historic diggings and old fields are also present. Existing infrastructure include roads, homesteads, and farm buildings (Figure 4). A provincial road dissects the study area, and it is currently being upgraded, with a road construction site established on Erith.

3.2. Geology, soils, and topography

According to Coetsee (1979) the entire study area comprises Quaternary deposits in the form of red to flesh-coloured wind-blown sand (Figure 5). The kieselguhr deposits on both properties are however associated with alluvials that have not been formally mapped.

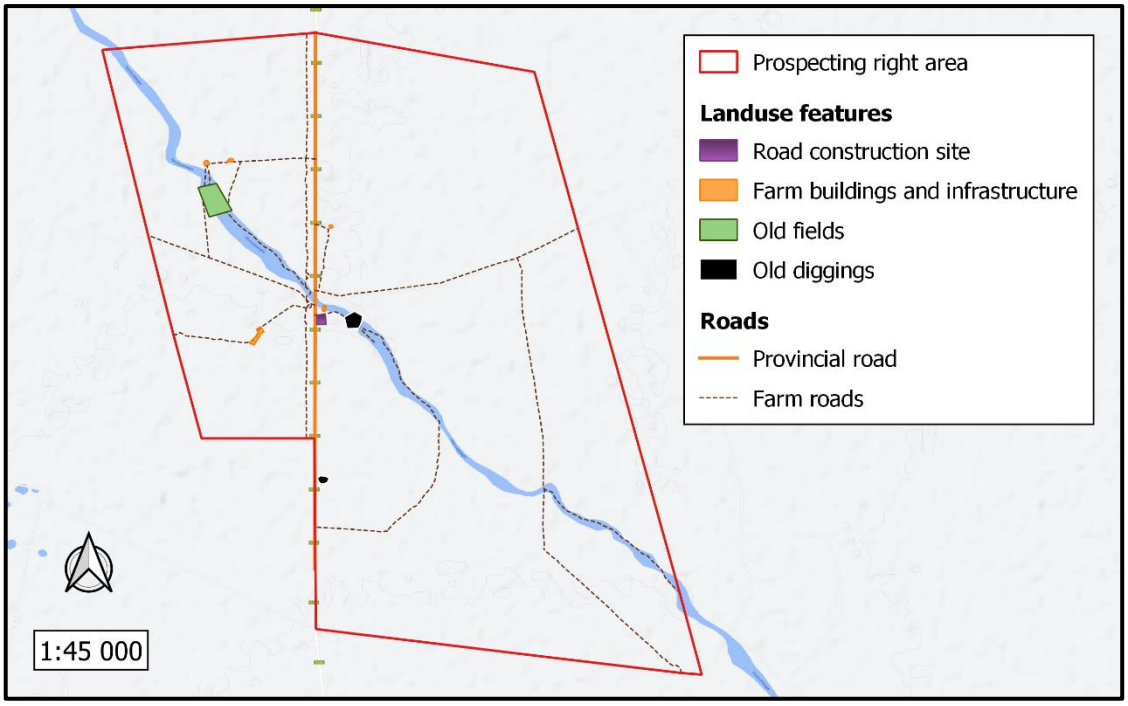


Figure 4. The existing land use features on the prospecting right area.

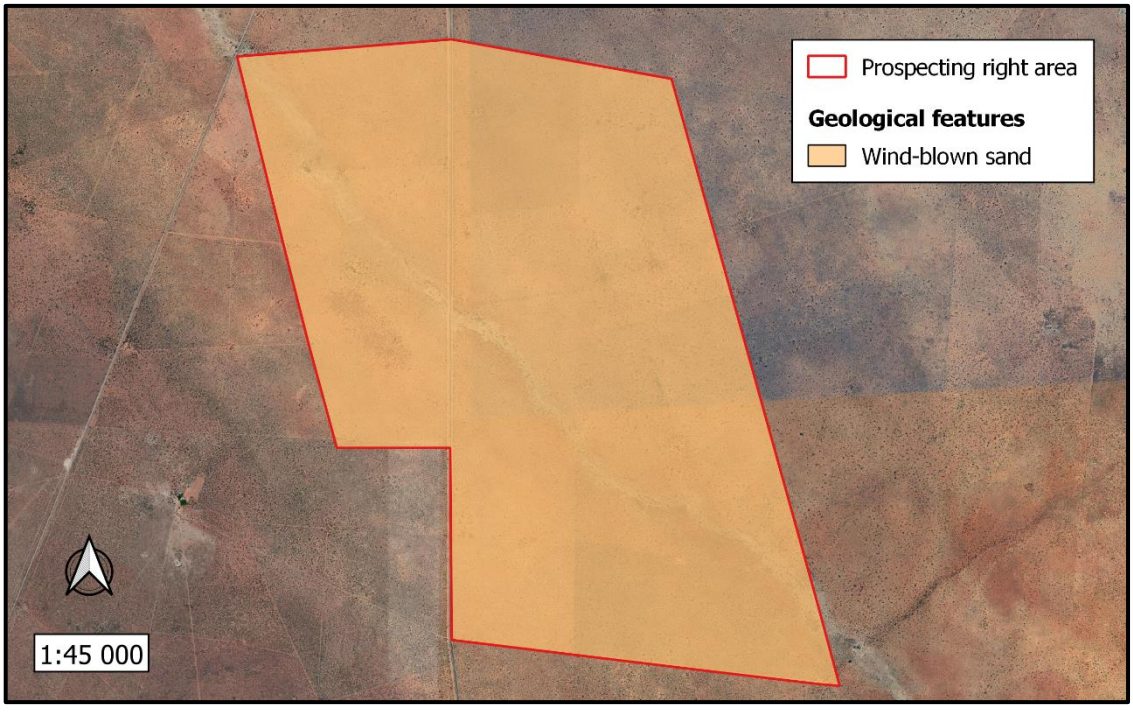


Figure 5. The distribution of geological features in the study area.

The topography of the study area is characterised by flat to gently undulating plains, with altitudes between 1 106 and 1 135 m above sea level. The terrain is indicated by a very gentle slope of < 1 %. Land types found on the property include Ag110 and Ah9 (Figure 6). Almost the entire study area is associated with red-yellow apedal, freely drained soils (red and yellow), with a high base status and usually contains less than 15% clay (Ah9). Along the south-western corner of the prospecting right boundary, it transitions to red-yellow apedal, freely drained soils (red), with a high base status and is less than 300 mm deep (Ag110). The generally level to gently sloping land of the plains produces low water erosion risk, but because the soils are primarily sandy, the wind erosion risk is increased significantly after disturbances to the natural vegetation cover. If badly eroded, the soils have a low potential to regenerate.

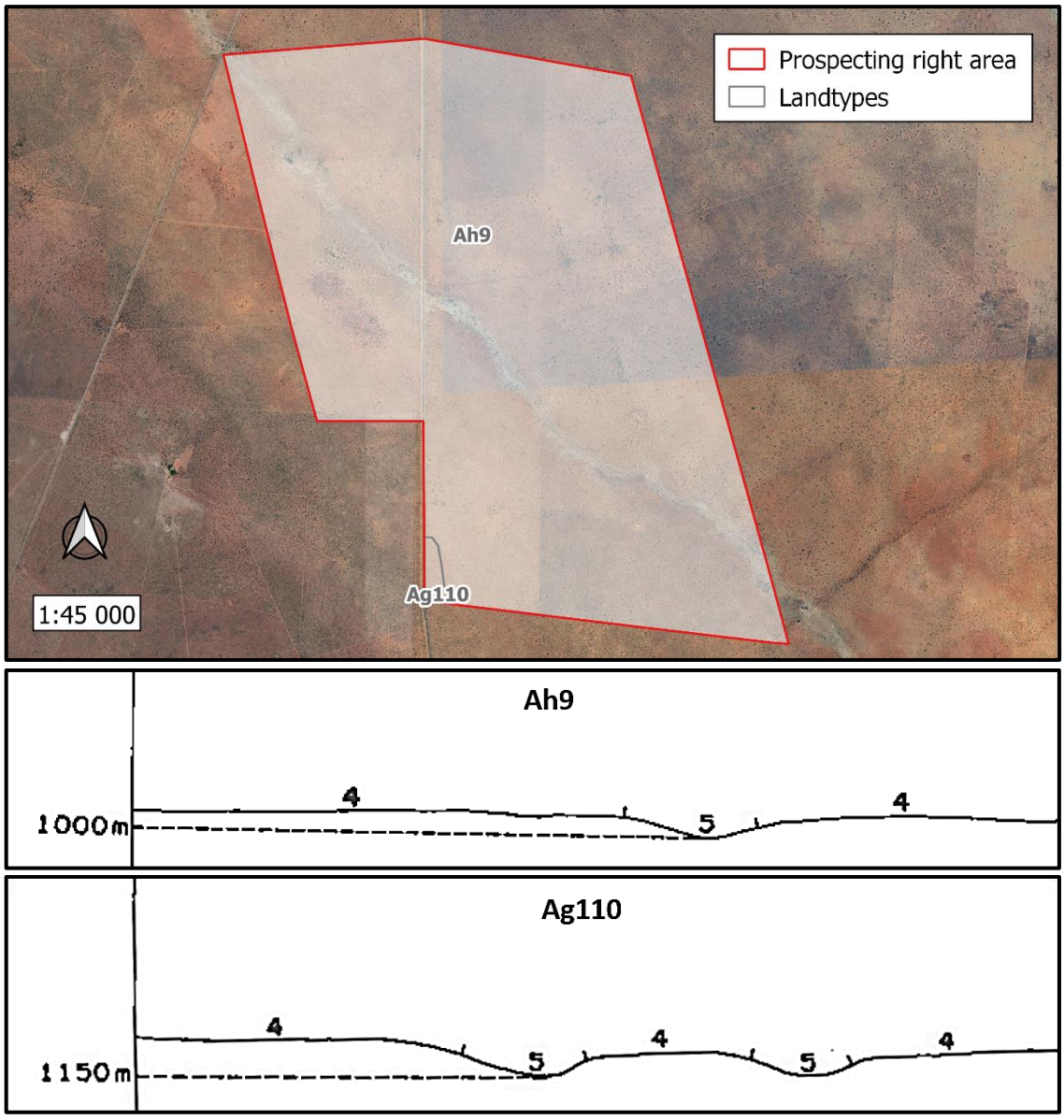


Figure 6. The distribution of land types in the study area, along with their terrain form sketches.

3.3. Vegetation

3.3.1. Broad-scale vegetation patterns

The study area falls within the Savanna Biome (Mucina and Rutherford 2006). According to the vegetation map of Mucina and Rutherford (2012), the site is represented by one broad-scale vegetation unit, i.e. Kathu Bushveld (Figure 7).

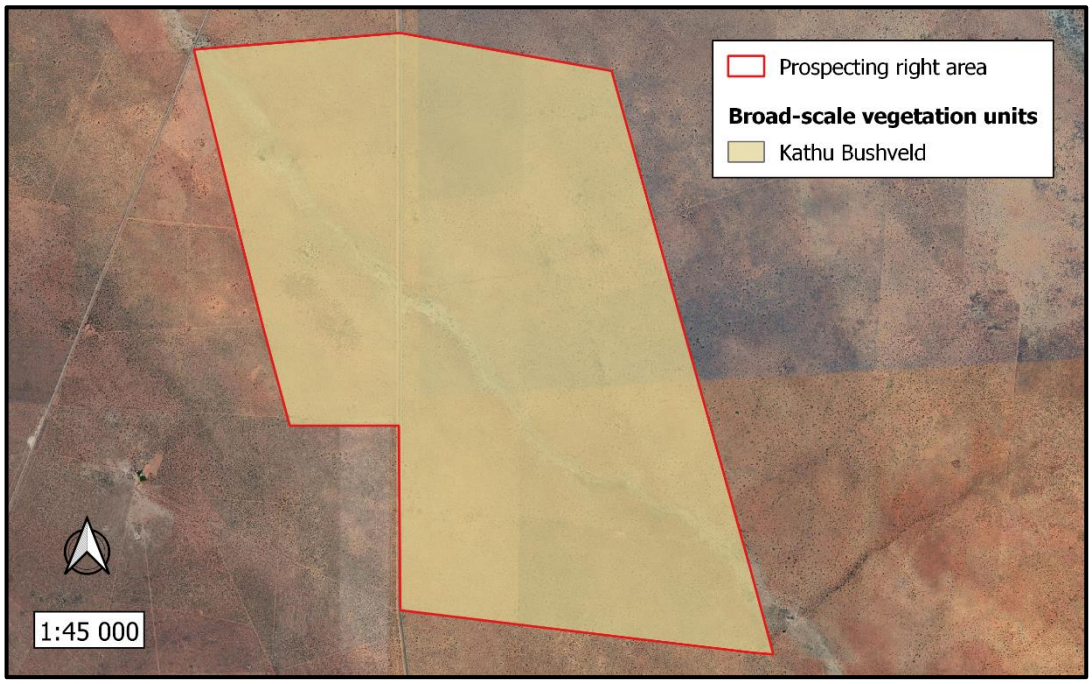


Figure 7. The broad-scale vegetation unit (Mucina and Rutherford 2012) present in the study area.

Kathu Bushveld is found in the Northern Cape on plains from Kathu and Dibeng (south), through Hotazel, to the Botswana border between Van Zylsrus and McCarthysrus (north). It occurs at altitudes between 960 and 1 300 m, with the vegetation presented as open savanna. *Vachellia erioloba* and *Boscia albitrunca* are dominant trees, while *Senegalia mellifera, Diospyros lycioides* and *Lycium hirsutum* are important shrubs. The geology comprises aeolian red sand and surface calcrete, with deep sandy soils of Hutton and Clovelly forms. The unit is considered least threatened, with none being statutorily conserved. More than 1% of this unit has been transformed mainly through mining, but erosion is very low.

3.3.2. Fine-scale vegetation patterns

Plant communities in the study area are delineated according to plant species correspondences and changes in soil structure. Two distinct units have been identified (Figure 8) and although they share very similar species, their species composition and soil structure are different. Community descriptions below include unique characteristics and the dominant species found in each unit. A complete plant species list, including those species likely to occur here is presented in Appendix 1.

i) *Senegalia mellifera - Eragrostis echinochloidea* open woodland on calcareous sand

This community is associated with Vlermuisleegte (Figure 8) and occurs on calcareous sand. Light-coloured sand intermixed with calcareous soil constitutes about 10 % of the ground cover. The vegetation is presented as an open woodland where tall trees and shrubs are scattered in a grassy matrix (Figure 9).

Senegalia mellifera dominates the woody layer overall, but *Vachellia erioloba* dominates the tall tree stratum. Other common trees and shrubs scattered across the unit include *Vachellia haematoxylon, V. hebeclada, Tarchonanthus camphoratus, Rhigozum trichotomum, Grewia flava* and *Leonotis ocymifolia*. *Prosopis glandulosa* has also extensively invaded this community in places. Low shrubs intermixed with the grassland matrix include *Pentzia calcarea, Aptosimum marlothii*, *A. albomarginatum, A. elongatum, Chrysocoma ciliata, Felicia muricata, Justicia incana, J. divaricata, Melolobium calycinum, Pteronia glauca, Oedera humilis, Selago densiflora, Lasiosiphon polycephalus, Peliostomum leucorrhizum, Leonotis pentadentata, Lycium* sp. and *Salsola* sp.

The grassy matrix is dominated by *Eragrostis echinochloidea*, but *E. lehmanniana* and *Aristida congesta* subsp*. barbicollis* are also very abundant. Other common grasses include *Stipagrostis uniplumis, Schmidtia pappophoroides, Eragrostis rigidior, Pogonarthria squarrosa* and *Aristida congesta* ssp*. congesta*.

Herb species include *Hermannia tomentosa*, *H. abrotanoides, H. comosa, Senna italica, Arctotis leiocarpa, Helichrysum argyrosphaerum, Osteospermum microcarpum, Geigeria ornativa, Oxalis lawsonii,* as well as the bulbs *Dipcadi viride* and *Nerine laticoma*.

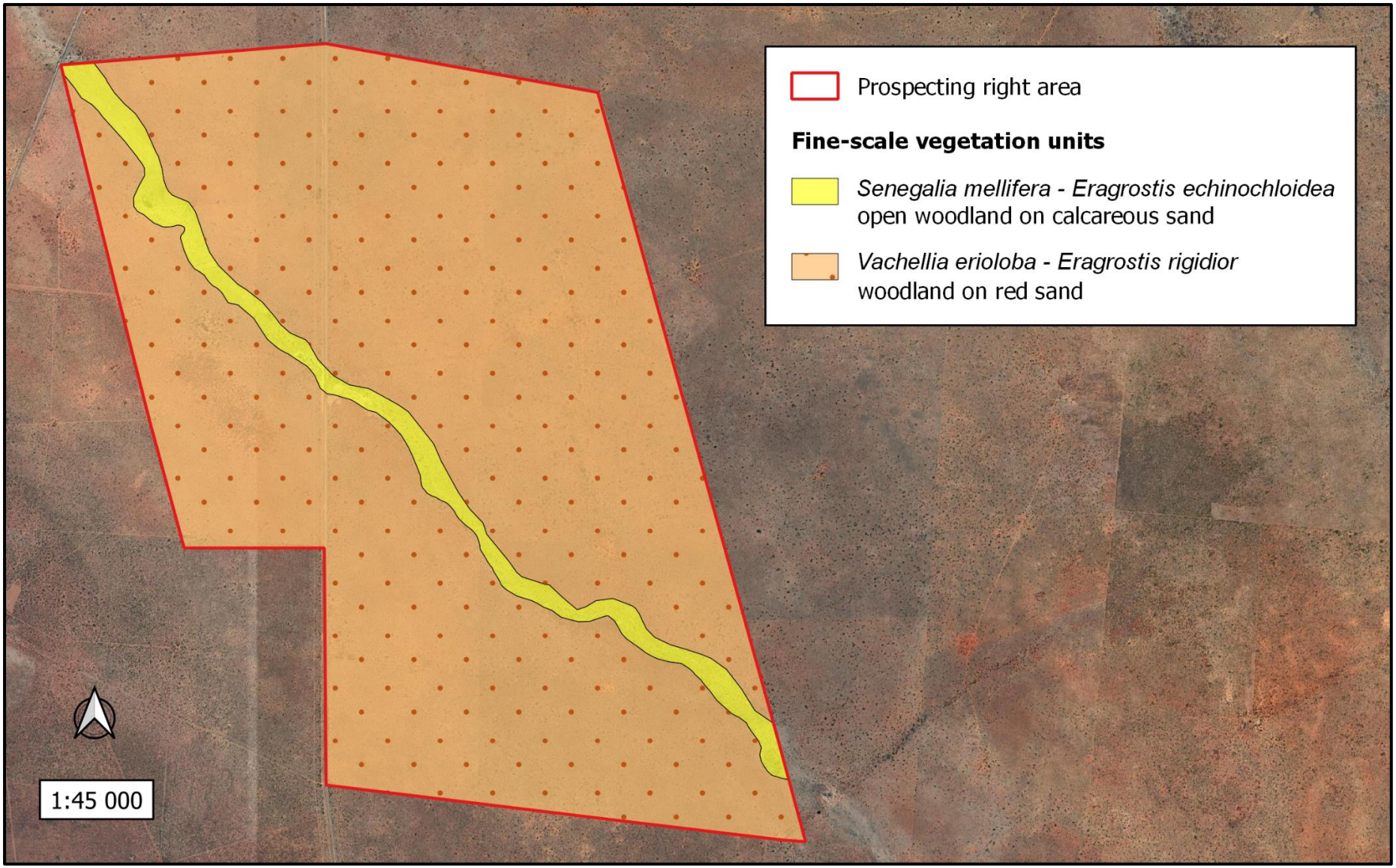


Figure 8. The distribution of fine-scale plant communities in the study area.

Figure 9. The open woodland on calcareous sand is represented by a tall tree and shrub layer, dominated by *Senegalia mellifera,* surrounded by a grassland matrix where *Eragrostis echinochloidea* dominates.

ii) *Vachellia erioloba - Eragrostis rigidior* woodland on red sand

This community comprises most of the study area (Figure 8) and due to land use practices, its species composition and distribution patterns varies slightly between farms. Here, red sand constitutes about 20 % of the ground cover and it is presented as a woodland scattered in a grassy matrix (Figure 10).

The woody layer is dominated by *Vachellia erioloba,* but *V. haematoxylon* and *Senegalia mellifera* is also very common. Other common trees and shrubs include *Tarchonanthus camphoratus, Terminalia sericea, Diospyros lycioides, Grewia flava* and *Gymnosporia buxifolia.* Low shrubs include *Pteronia glauca, Plinthus karooicus, Asparagus exuvialis, Aptosimum marlothii, Justicia incanum* and *Pentzia calcarea*.

The grass layer is well developed, with dominating species including *Eragrostis rigidior* and *Stipagrostis uniplumis.* Other grasses include *Aristida congesta* subsp. *congesta, A. meridionalis, Pogonarthria squarrosa, Centropodia glauca* and *Schmidtia pappophoroides*. Herbs include *Hermannia tomentosa* and *Senna italica*.

Figure 10. The woodland on red sand is represented by tree and shrub layer, dominated by *Vachellia erioloba,* surrounded by a grassland matrix where *Eragrostis rigidior* dominates.

3.3.3. Population of sensitive, threatened, and protected plant species

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

All species recorded in the area are classified as least concern; a category which includes widespread and abundant taxa (Table 2). Species protected in terms of the National Forests (NFA) Act No 84 of 1998 include *Vachellia erioloba* and *V. haematoxylon* (Table 2). They are associated with both plant communities on site (Figure 11 and Figure 12) but occur at different densities in each. *Vachellia haematoxylon* occurs at higher densities in the woodland on red sand (± 10 individuals per hectare), compared to the open woodland on calcareous sand (± 4 – 8 ind/ha). On the other hand, *V. erioloba* is more abundant in the open woodland on calcareous sand (± 5 - 10 ind/ha) compared to the woodland on red sand (± 1 - 5 ind/ha). Across the site, *V. haematoxylon* is predominantly found as small (1 m (h) x 80 cm - 1 m (d)) to medium-sized (1 - 2 m (h) x 1 cm - 2 m (d)) trees and shrubs (Figure 11), but trees up to 3 m in height are also present. *Vachellia erioloba* is represented across its size range, i.e. saplings (30 cm (h) x 40 cm (d)), young trees (1 - 2 m (h) x 80 cm - 1 m (d)), and large adult trees (3 - 4 m (h) x 6 - 8 m (d)) (Figure 12). To damage or remove any of these protected trees (seedlings to adults) an application must be submitted to the Northern Cape Department of Agriculture, Forestry and Fisheries (DAFF) and a licence obtained from DAFF at least three months prior to such activities.

Protected species in terms of Schedule 1 and 2 of the Northern Cape Nature Conservation (NCNCA) Act No. 9 of 2009 is listed in Table 2. *Gymnosporia buxifolia* occurs at low densities in the woodland on red sand, while *Nerine laticoma* and *Oxalis lawsonii* were common in the open woodland on calcareous sand. None of the remainder species were recorded during the survey.

Table 2. Plant species found in the region that are of conservation concern.

FAMILY	Scientific name	Status	NFA	NCNCA
AMARYLLIDACEAE	*Nerine laticoma*	LC		S2
APIACEAE	*Deverra burchellii*	LC		S2
APOCYNACEAE	*Fockea angustifolia*	LC		S2
	Microloma armatum var. *burchellii*	LC		S2
	Raphionacme velutina	LC		S2
CELASTRACEAE	*Gymnosporia buxifolia*	LC		S2
EUPHORBIACEAE	*Euphorbia crassipes*	LC		S2
	Euphorbia inaequilatera	LC		S2
FABACEAE	*Lessertia frutescens* subsp. *frutescens*	LC		S1
	Vachellia erioloba	LC	X	
	Vachellia haematoxylon	LC	X	
IRIDACEAE	*Lapeirousia littoralis*	LC		S2
OXALIDACEAE	*Oxalis lawsonii*	LC		S2
PEDALIACEAE	*Harpagophytum procumbens*	LC		S1
SCROPHULARIACEAE	*Jamesbrittenia atropurpurea*	LC		S2
	Jamesbrittenia integerrima	LC		S2

Harpagophytum procumbens subsp. *procumbens* and *Lessertia frutescens* subsp. *frutescens* (Schedule 1) is known from the region, and both have a high likelihood to occur in the woodland on red sand. Similarly, the bulb species, *Lapeirousia littoralis* (Schedule 2) is likely to be found in the open woodland on calcareous sand but will only be visible in the rainy season.

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

3.3.4. Weeds and invader plant species

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

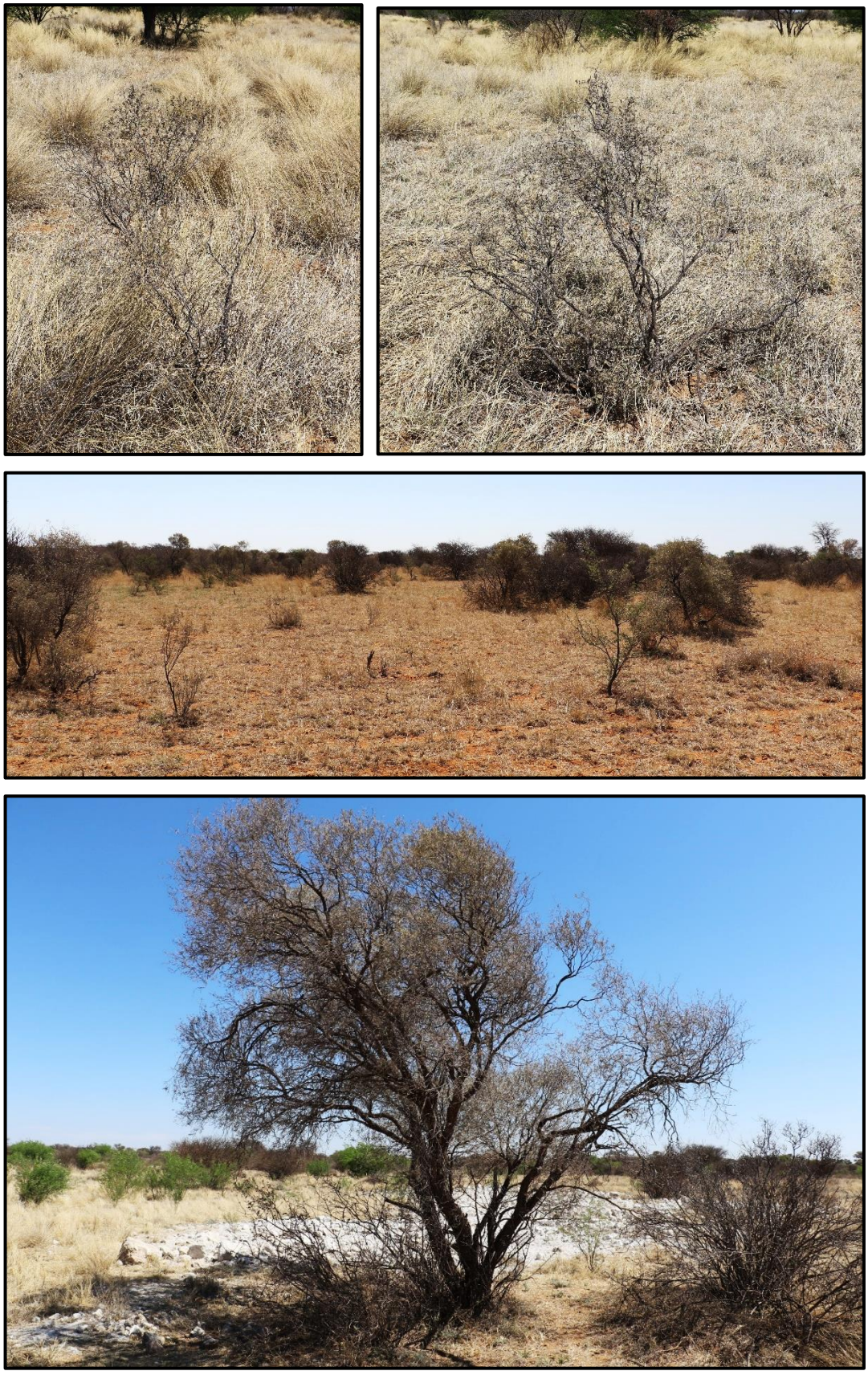


Figure 11. The protected tree *Vachellia haematoxylon* is widespread across the study area, but most abundant in the woodland on red sand, where it predominantly occurs as small to medium-sized shrubs and trees (top and centre). Larger trees are however also present (bottom).

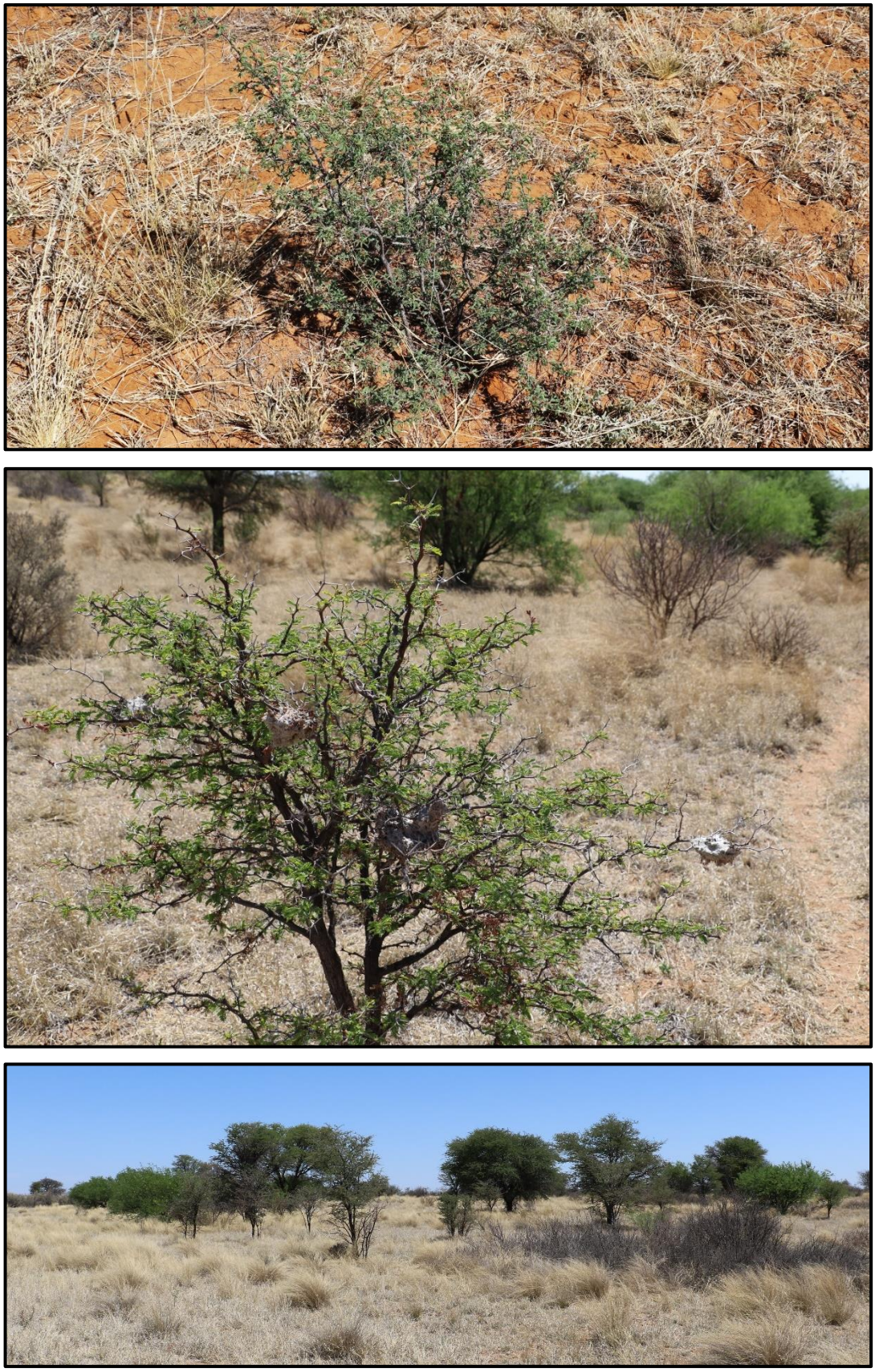


Figure 12. The protected tree *Vachellia erioloba* is widespread across the open woodland on calcareous sand and occurs al lower densities in the woodland on red sand. It is found as saplings (top), young trees (centre) and large adult trees (bottom).

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

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

All declared weeds and invasive species recorded in and around the study area are listed in Table 4, along with their categories according to CARA, NEMBA and NCNCA.

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

Scientific name	Common name	CARA	NEMBA	NCNCA
Prosopis glandulosa var. *glandulosa*	Honey mesquite	2	3	S6

3.3.5. Indicators of bush encroachment

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

Table 5. Declared indicators of bush encroachment in the Northern Cape recorded in the study area.

Scientific name	Common name
Euclea undulata	Common Guarri
Grewia flava	Velvet Raisin
Rhigozum trichotomum	Three-thorn Rhigozum
Senegalia mellifera	Black thorn
Tarchonanthus camphoratus	Camphor Bush
Terminalia sericea	Silver Cluster-leaf
Vachellia karroo	Sweet Thorn

3.4. Faunal communities

According to Section 3(a) and 4(a) of the Northern Cape Nature Conservation (NCNCA) Act No. 9 of 2009, no person may, without a permit by any means hunt, kill, poison, capture, disturb, or injure any protected 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 in the study area does not provide diverse habitat opportunities to faunal communities, but the vegetation and sandy substrates provide many micro habitats. Animals likely to be found in the study area are discussed in their respective faunal groups below.

3.4.1. Mammals

As many as 54 terrestrial mammals and seven bat species have been recorded in the region (see Appendix 2). Of these, six terrestrial mammal species and two bat species are listed either according to the IUCN or South African Mammal Red List (Table 6). The two listed bat species, Ground Pangolin, African Striped Weasel, South African Hedgehog and Black-footed Cat have a high chance of occurring across the site, given their wide habitat tolerances or preference for savanna habitats. Leopard and Brown Hyaena have a low potential to be found on site mainly since farm fences are restricting their occurrences across their natural distribution range, and they are also persecuted by livestock farmers.

Virtually all mammals of the study area are protected; either according to Schedule 1, 2 or 3 of NCNCA (see Appendix 2). Apart from the red listed species already discussed above, those that are specially protected (Schedule 1) include Aardvark, Cape Fox, Bat-eared Fox, Honey Badger, Striped Polecat, Aardwolf, and African Wild Cat. Of these, many Aardvark burrows (Figure 13), as well as a family of Bat-eared foxes were encountered on site.

Table 6. Mammal species of conservation concern that are likely to occur in the region. Conservation values are indicated in terms of the international (IUCN) Red List, the South African Mammal Red List (SA MRL) and Schedule 1 of the Northern Cape Nature Conservation Act (NCNCA).

Scientific name	Common name	IUCN	SA MRL	NCNCA
Eidolon helvum	African Straw-coloured Fruit-bat	NT		
Rhinolophus denti	Dent's Horseshoe Bat		NT	
Atelerix frontalis	South African Hedgehog		NT	X
Smutsia temminckii	Ground Pangolin	VU	VU	X
Orycteropus afer	Aardvark			X
Vulpes chama	Cape Fox			X
Otocyon megalotis	Bat-eared Fox			X
Mellivora capensis	Honey Badger			X
Poecilogale albinucha	African Striped Weasel		NT	X
Ictonyx striatus	Striped Polecat			X
Hyaena brunnea	Brown Hyena	NT		X
Proteles cristata	Aardwolf			X
Felis silvestris	African Wild Cat			X
Felis nigripes	Black-footed Cat	VU	VU	X
Panthera pardus	Leopard	VU	VU	X

The remaining protected species all have an affinity for open woodland or savanna and therefore a high likelihood to occur on site.

The sandy substrate of the study area provides ample habitat for fossorial mammals and their presence was signified through many burrows, observed during the field survey (Figure 13). Damara Mole-rat mounds were also observed in the woodland on red sand (Figure 13) and African Ground-squirrel was encountered frequently during the survey.

Problem animals (Schedule 4) with a high likelihood to occur on site include Black-backed Jackal and Caracal.

3.4.2. Reptiles

The proposed prospecting area lies within the distribution range of at least 46 reptile species (see Appendix 2), of which none are red listed. However, most are protected either according to Schedule 1, 2 or 3 of NCNCA (see Appendix 2). Specially protected species (Schedule 1) include *Chamaeleo dilepis dilepis* (Common Flap-neck Chameleon), *Karusasaurus polyzonus* (Southern Karusa Lizard) and *Python natalensis* (Southern African Python).

Figure 13. Burrows occur across the study area signifying the presence of many fossorial mammals and mounds of the Damara Mole-rat was also observed.

The Southern Karusa Lizard has a low likelihood to be found on site due to their preference for dolerite rock outcrops. The Southern African Python is associated with a variety of habitats but prefers riverine or rocky areas and therefore also does not have a high likelihood to be found on site. The Namaqua Chameleon, however, has a high chance of occurring on site. They occur in a variety of habitats and is expected to be found high up in shrubs or trees.

The only South African endemic known from the region is *Acontias gracilicauda* (Thin-tailed Legless Skink). It is fossorial and usually found in moderately mesic soils in open or partly wooded habitats up to 1 600 m.a.s.l. It therefore also has a high likelihood to occur on site.

Images of these reptile species of special importance known from the study region, are shown in Figure 14.

Southern Karusa Lizard

South African Python

Common Flap-neck Chameleon

Thin-tailed Legless Skink

Figure 14. Reptile species of special importance that are expected to occur in the study area.

3.4.3. Amphibians

Ten amphibian species are known from the region (Appendix 2), of which none are red listed. However, all amphibians of the study area are protected according to Schedule 2 of NCNCA (see Appendix 2). One South African endemic, i.e., *Vandijkophrynus gariepensis* (Karoo Toad) is known from the region. It is adapted to a wide variety of terrestrial habitats and breeds in different types of permanent and temporary waterbodies. It therefore could potentially be found on site, but their presence will only be evident during summer in places where rainwater collects. Similarly, any pool or stream formed after large rainfall events are expected to attract most of the remaining frog species for breeding. However, the Bushveld Rain Frog is independent of water and is expected to be found across the study area. Those species that are dependent on perennial waters, i.e., Common Platanna and Common River Frog are not expected to occur on site.

3.4.4. Avifauna

The study site does not fall within or near (< 150 km) any of the Important Bird Areas (IBA) defined by Birdlife South Africa. A total number of 267 bird species have been recorded from the region (see Appendix 2), of which 28 are listed either in the IUCN or South African Red Data Book of Birds (Table 7). Furthermore, all birds are protected either according to Schedule 1, 2 or 3 of NCNCA (see Appendix 2). Those that are specially protected (Schedule 1) are also listed in Table 7. Among these, those with a high affinity for open woodland habitat, i.e. Martial Eagle, Tawny Eagle, Bateleur, Lanner Falcon, Red-necked Falcon, Red-footed Falcon, White-backed Vulture, Lappet-faced Vulture, Kori Bustard, Roller and Owl species, have the highest likelihood to occur on site, either by occasionally passing over, foraging or nesting (Figure 15). None of the protected water birds (i.e., Chestnut-banded Plover, Storks, Black-winged Pratincole, Maccoa Duck, Lesser Flamingo and Greater Flamingo) or high-altitude rock associated species (Verreaux's Eagle, African Rock Pipit and Cape Vulture) are expected to occur on site.

3.4.5. Fish

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

3.4.6. Invertebrates

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

Table 7. Bird species of conservation concern recorded from the study region.

Scientific name	Common name	IUCN	SA RDB	NCNCA (S1)
Accipiter badius	Shikra	LC	LC	X
Anthropoides paradisea	Blue Crane	**VU**	**NT**	
Anthus crenatus	African Rock Pipit	**NT**	**NT**	
Aquila rapax	Tawny Eagle	**VU**	**EN**	X
Aquila verreauxii	Verreaux's Eagle	LC	**VU**	X
Ardeotis kori	Kori Bustard	**NT**	**NT**	
Bubo africanus	Spotted Eagle-Owl	LC	LC	X
Bubo lacteus	Verreaux's Eagle-Owl	LC	LC	X
Buteo rufofuscus	Jackal Buzzard	LC	LC	X
Buteo vulpinus	Steppe Buzzard	LC	LC	X
Caprimulgus europaeus	European Nightjar	LC	LC	X
Caprimulgus rufigena	Rufous-cheeked Nightjar	LC	LC	X
Charadrius pallidus	Chestnut-banded Plover	**NT**	**NT**	X
Ciconia abdimii	Abdim's Stork	LC	**NT**	
Ciconia nigra	Black Stork	LC	**VU**	X
Circaetus cinereus	Brown Snake-Eagle	LC	LC	
Circaetus pectoralis	Black-chested Snake-Eagle	LC	LC	X
Circus maurus	Black Harrier	**EN**	**EN**	X
Circus pygargus	Montagu's Harrier	LC	LC	X
Coracias garrulus	European Roller	LC	**NT**	
Cursorius rufus	Burchell's Courser	LC	**VU**	
Elanus caeruleus	Black-shouldered Kite	LC	LC	X
Falco biarmicus	Lanner Falcon	LC	**VU**	X
Falco chicquera	Red-necked Falcon	**NT**	**LC**	X
Falco naumanni	Lesser Kestrel	LC	LC	X
Falco peregrinus	Peregrine Falcon	LC	LC	X
Falco rupicolis	Rock Kestrel	LC	LC	X
Falco rupicoloides	Greater Kestrel	LC	LC	X
Falco vespertinus	Red-footed Falcon	**VU**	**NT**	X
Glareola nordmanni	Black-winged Pratincole	**NT**	**NT**	X
Glaucidium perlatum	Pearl-spotted Owlet	LC	LC	X
Gyps africanus	White-backed Vulture	**CR**	**CR**	X
Gyps coprotheres	Cape Vulture	**EN**	**EN**	X
Haliaeetus vocifer	African Fish-Eagle	LC	LC	X
Hieraaetus pennatus	Booted Eagle			X
Leptoptilos crumeniferus	Marabou Stork	LC	**NT**	X
Melierax canorus	Southern Pale Chanting Goshawk	LC	LC	X
Melierax gabar	Gabar Goshawk	LC	LC	X
Milvus migrans	Black Kite	LC	LC	X
Mycteria ibis	Yellow-billed Stork	LC	**EN**	X
Neotis ludwigii	Ludwig's bustard	**EN**	**VU**	X
Otus senegalensis	African Scops-Owl			X
Oxyura maccoa	Maccoa Duck	**VU**	**NT**	
Phoenicopterus minor	Lesser Flamingo	**NT**	**NT**	X
Phoenicopterus ruber	Greater Flamingo	LC	**NT**	X
Polemaetus bellicosus	Martial Eagle	**EN**	**EN**	X
Polihierax semitorquatus	Pygmy Falcon	LC	LC	X
Polyboroides typus	African Harrier-Hawk	LC	LC	X
Ptilopsus granti	Southern White-faced Scops-Owl	LC	LC	X
Sagittarius serpentarius	Secretarybird	**EN**	**VU**	X
Terathopius ecaudatus	Bateleur	**EN**	**EN**	X
Torgos tracheliotus	Lappet-faced Vulture	**EN**	**EN**	X
Tyto alba	Barn Owl	LC	LC	X

Kori Bustard

Martial Eagle

Bateleur

Tawny Eagle

White-backed Vulture

European Roller

Lanner Falcon

Red-necked Falcon

Figure 15. The most common bird species of conservation concern that are expected to occur in the earmarked area.

Seventeen invertebrate species of the Northern Cape appear on the IUCN Red Data list of threatened species and are listed in Table 8. Of these, one species, i.e., *Anthene lindae*, Linda's Hairtail (**Near Threatened**) (Figure 16) is known from the study region and could potentially occur on site. The adult butterflies are usually found on sparsely scattered *Vachellia erioloba* trees, which is believed to be the larval host plant.

In addition, those species that are specially protected according to Schedule 1 of the NCNCA include all Velvet worms as well as some baboon spider species, Stag Beetles and the Flightless Dung Beetle (Table 8). Of these, Common Baboon Spiders (*Harpactira baviana*) have been recorded in the region and could potentially also be found on site (Figure 16). It prefers arid and semi-arid grassland and is found under stones, generally in shallow excavations but sometimes in short burrows a few centimetres deep. All Rock- Creeping- and Burrowing Scorpions are protected according to Schedule 2 of the NCNCA, along with several beetles, butterflies and moths (Table 8). Of these, several burrowing scorpions (*Opistophthalmus fitzsimonsi, O. carinatus, O. wahlbergii,* and *O. pluridens),* Monster Tiger Beetles (*Manticora* sp.), Gossamer-winged Butterflies, Skippers, Brush-footed Butterflies and Satyrs have been recorded in the region and have a high likelihood to be found on site.

Two major habitat delimits possible invertebrate communities in the study area:

i. **Terrestrial vegetation classified as bushveld for insect preference (Picker et al. 2004)**
   Species associated with this habitat type are diverse and are widely distributed. The study area itself is expected to host high invertebrate richness and density, due to the diverse micro habitat opportunities on site. Insect activity during the field survey was limited by the state of the vegetation, but Community Nest Spiders (*Stegodyphus* sp.) were common across the site (Figure 16).

ii. **Temporary aquatic pools along Vlermuisleegte**
   Temporary pools are present in some areas along Vlermuisleegte. These pools seemed to have formed through anthropogenic diggings but created shallow temporary aquatic habitats that host crustacean species, including Copepods and Cladocerans (Figure 16). No large branchiopods (Notostraca, Anostraca, Spinicaudata) were observed during the time of the survey. This could be due to the timing of the survey, or the pools might be too shallow for them to survive. Generalist insects, such as backswimmers (Notonectidae), water boatmen (Corixidae), predaceous diving beetles (Dytiscidae), and dipterans are also expected to occur in these pools after good rains.

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

CLASS	ORDER	Scientific Name	Common name	Status
ARACHNIDA	MYGALOMORPHAE	*Ceratogyrus* spp.	Horned Baboon Spiders	S1
		Harpactira spp.	Common Baboon Spiders	S1
		Pterinochilus spp.	Goldenbrown Baboon Spiders	S1
	SCORPIONES	*Hadogenes* spp.	All Rock Scorpions	S2
		Opisthacanthus spp.	All Creeping Scorpions	S2
		Opistophthalmus spp.	All Burrowing Scorpions	S2
DIPLOPODA	SPIROSTREPTIDA	*Harpagophora monodus*	Millipede	**NT**
INSECTA	COLEOPTERA	*Circellium bacchus*	Flightless Dung Beetle	S1
		Colophon spp.	All Stag Beetles	S1
		Dromica spp.	Tiger Beetles (all species)	S2
		Graphipterus assimilis	Velvet Ground Beetle	S2
		Ichnestoma spp.	All Fruit Chafer Beetles	S2
		Manticora spp.	All Monster Tiger Beetles	S2
		Megacephala asperata	Tiger Beetle	S2
		Megacephala regalis	Tiger Beetle	S2
		Nigidius auriculatus	Stag Beetle	S2
		Oonotus adspersus	Stag Beetle	S2
		Oonotus interioris	Stag Beetle	S2
		Oonotus rex	Stag Beetle	S2
		Oonotus sericeus	Stag Beetle	S2
		Platychile pallida	Tiger Beetle	S2
		Prosopocoilus petitclerci	Stag Beetle	S2
		Prothyma guttipennis	Tiger Beetle	S2
		Scarabaeus canaliculatus	Dung Beetle	**DD**
	LEPIDOPTERA	*Anthene lindae*	Linda's Hairtail	**NT**
		Chrysoritis trimeni	Trimen's Opal	**VU**
		Lepidochrysops penningtoni	Pennington's Blue	**DD**
		Lycaenidae	All Gossamer-winged Butterflies	S2
		Hepialidae	All Swift Moths	S2
		Hesperiidae	All Skippers	S2
		Nymphalidae	All Brush-footed Butterflies	S2
		Satyridae	All Satyrs	S2
	ORTHOPTERA	*Africariola longicauda*	Richtersveld Katydid	**VU**
		Afrotettix fursti	Bokkeveld Earless Grasshopper	**VU**
		Alfredectes browni	Brown's Shieldback	**DD**
		Brinckiella aptera	Mute Winter Katydid	**VU**
		Brinckiella arboricola	Tree Winter Katydid	**EN**
		Brinckiella karooensis	Karoo Winter Katydid	**VU**
		Brinckiella mauerbergerorum	Mauerberger's Winter Katydid	**VU**
		Brinckiella serricauda	Serrated Winter Katydid	**DD**
		Bullacris boschimana	Bladder grasshopper	**DD**
		Bullacris obliqua	Bladder grasshopper	**VU**
		Pachyphymus samwaysi	Samways's Agile Grasshopper	**DD**
		Peringueyacris namaqua	Bladder grasshopper	**VU**
ONYCHOPHORA			All Velvet worms	S1

Figure 16. Community Nest Spiders (top left) were observed on site, while Linda's hairtail butterfly (top centre) and Common Baboon Spiders (top right) have been recorded in the region before. Anthropogenic diggings have created shallow temporary pools along Vlermuisleegte (centre) in which crustaceans, including Copepods (bottom left) and Cladocerans (bottom right) were observed.

3.5. Water resources

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

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

Any reference to a watercourse includes its bed and banks and a water resource does not only include the water within the system, but also the entire water cycle; i.e., evaporation, precipitation, the habitats and processes. The purpose of this Act (Section 2) is to ensure that the nation's water resources are protected, used, developed, conserved, managed and controlled in ways which take into account amongst other factors - (g) protecting aquatic and associated ecosystems and their biological diversity and (h) reducing and preventing pollution and degradation of water resources.

No activity may take place within a watercourse unless it is authorised by the Department of Water and Sanitation (DWS). Any area within a wetland or riparian zone is therefore excluded from development unless authorisation is obtained from DWS in terms of Section 21 (c) and (i).

3.5.1. Water resources setting

The study area falls within the Molopo quaternary catchment D41K of the Lower Vaal Water Management Area (Figure 17). It has been allocated a Present Ecological State (PES) of 'largely natural' (B) by Delport and Mallory (2002). Information regarding mean annual rainfall, evaporation potential and runoff for D41K is provided in Table 9.

According to the South African Inventory of Inland Aquatic Ecosystems (SAIIAE), the study area falls within the Eastern Kalahari Bushveld Bioregion, where 1.3 % of the land comprises inland wetlands, i.e., depressions, floodplains, seeps and valley-bottom wetland types (Van Deventer et al. 2019).

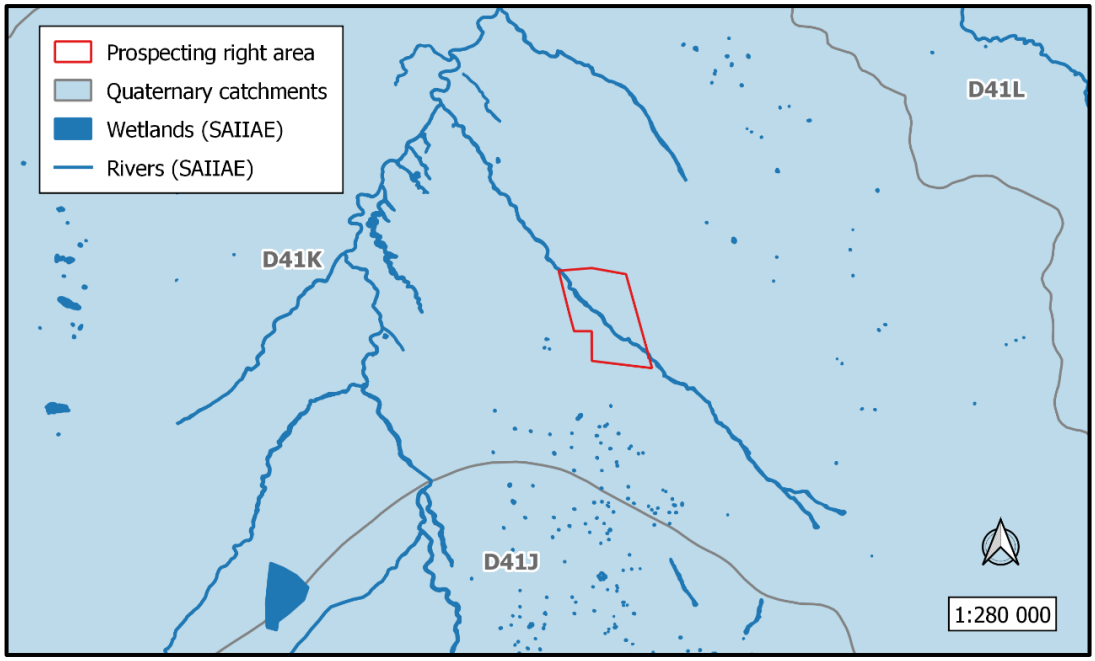


Figure 17. The locality of the proposed prospecting area in relation to the quaternary catchments of the Lower Vaal Water Management Area.

Table 9. Catchment characteristics for the Molopo quaternary catchment in which the study area falls, as presented by Delport and Mallory (2002).

Quaternary catchment	Catchment Area (km^2)	Mean Annual Rainfall (mm)	Mean Annual Evaporation (mm)	Mean Annual Runoff (10^6 m^3)
D41K	4 216	344	2 350	4.43

The spatial extent according to SAIIAE Present Ecological Status per wetland type is depicted in Table 10. Depressions are most abundant in the bioregion, with the majority in natural or near-natural condition. The remaining wetland types have been moderately to severely modified.

The study area comprises one ephemeral river identified by SAIIE, i.e., Vlermuisleegte (Figure 18). It is moderately modified according to NFEPA and threatened according to SAIIAE. Its channel runs through the prospecting right area from the south-east to the north-western corner. No information is available on its hydrology.

Table 10. Percentage of inland wetland spatial extent according to the present ecological status per wetland type of the Eastern Kalahari Bushveld Bioregion.

Wetland type	Total Extent (%)	% Natural or near-natural (A/B)	% Moderately modified (C)	% Heavily to severely/ critically modified (D/E/F)
Depression	57.1	70.5	5.7	23.8
Floodplain	2.2	0.6	48.8	50.5
Seep	17.2	10	15.1	75
Valley-bottom	23.5	0.9	29.6	69.5

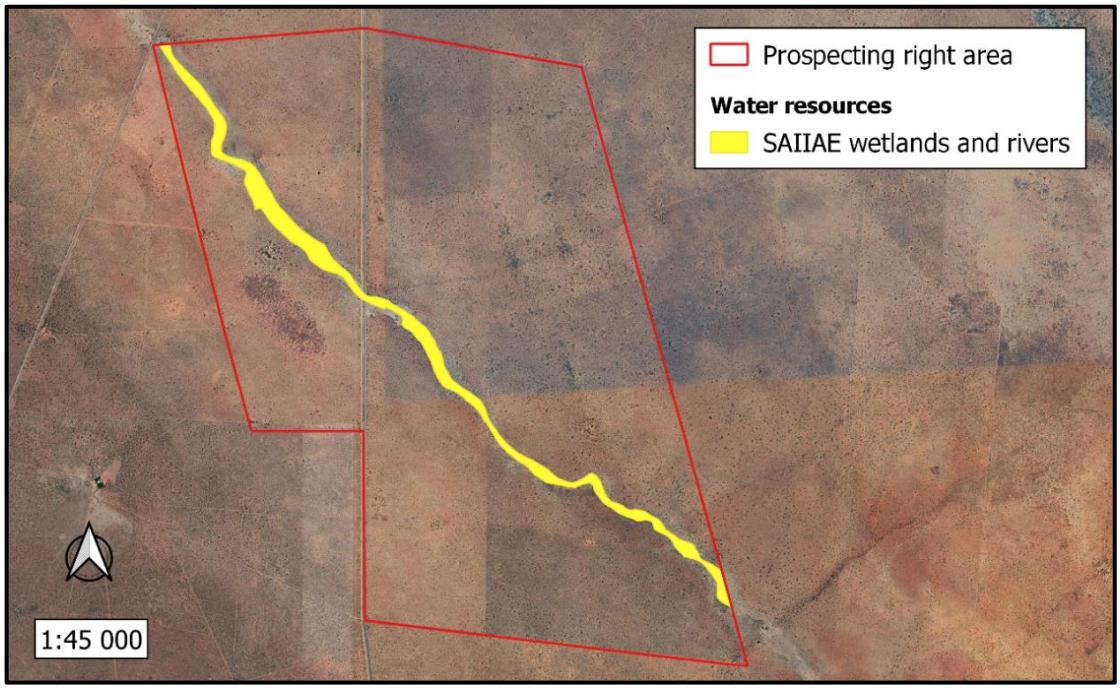


Figure 18. The location of SAIIAE water resources on the proposed prospecting right area.

3.5.2. Water resource delineation and classification

One river, i.e., Vlermuisleegte was identified on site. The gradual slopes of the plains terrain obscured the presence of drainage lines and therefore no drainage lines were delineated. Vlermuisleegte is indicated in Figure 19, along with its local upslope catchment and a minimum GIS buffer of 200 m. Vlermuisleegte covers a total length of ± 42 km, of which 21 % (9 km) falls within the boundaries of Walton and Erith. It originates ± 17 km to the south-east of the site, with its upstream catchment comprising a total area of ± 244 km^2 (Figure 20). From Walton and Erith, it flows north-westwards where it connects with Ga-Mogara ± 16 km downstream. Ga-Mogara then meanders further north for ± 33 km, before it flows into the Kuruman River (Figure 20).

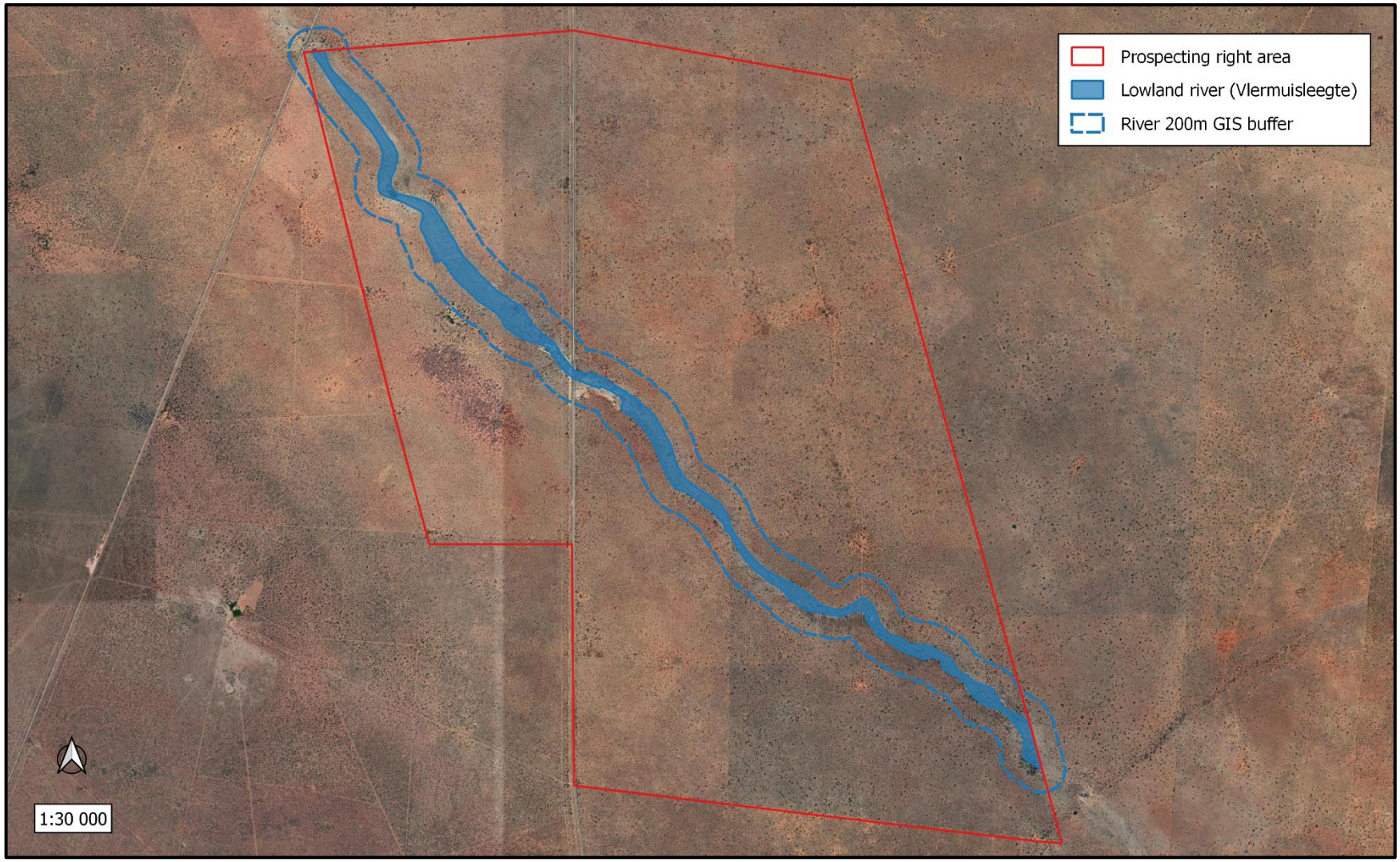


Figure 19. The delineation of watercourses in the prospecting right area, along with their required GIS buffers.

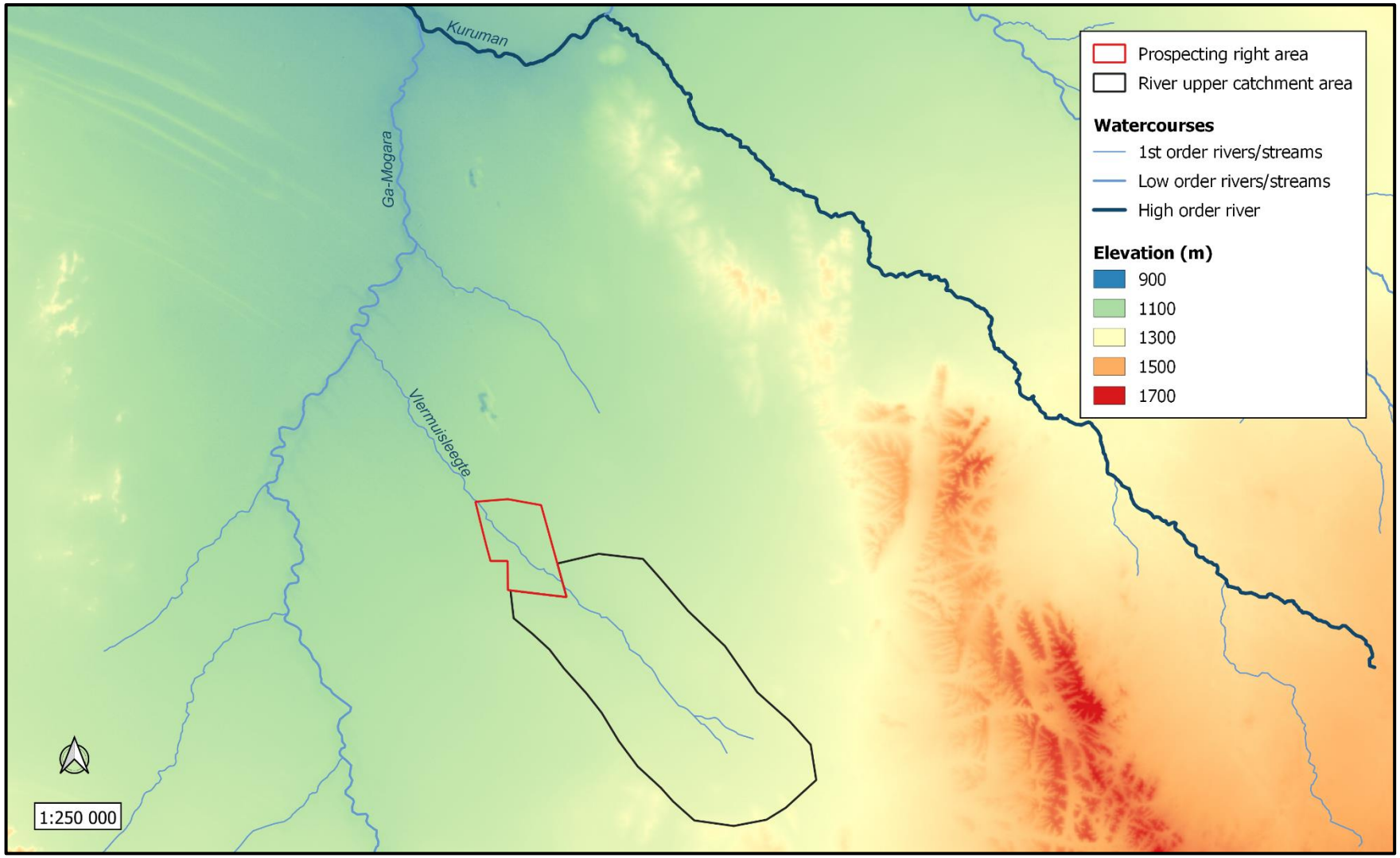


Figure 20. Vlermuisleegte originates ± 17 km to the south-east of Walton and Erith and merges downstream with Ga-Mogara, before it eventually flows into the Kuruman River further north.

Vlermuisleegte is the main assessment unit considered for this prospecting right area and its Hydrogeomorphic Unit (HGMU) classification is described below. It is found on plains terrain. The HGMU was classified up to Level 6.

HGMU1: LOWLAND RIVER

Vlermuisleegte is classified as a natural lowland river, with an active channel cutting through a low gradient landscape (Table 11). A conceptual illustration of a river, according to Ollis et al. (2013) is presented in Figure 21. The hydrology of Vlermuisleegte is unknown, but it is expected to only carry water after substantial summer rainfall events. It is therefore non-perennial and intermittent. This hydrological regime limits quantitative baseline information on the water quality associated with the river. The soil is also only intermittently saturated, and the soil does not show any soil wetness indicators. The substratum primarily comprises sand (Figure 22), but calcrete gravel is also present. Biological crusts also occur sporadically across the surface (Figure 22). The river channel is predominantly vegetated, comprising indigenous species. The vegetation form is best described as an open woodland (Figure 22), dominated by trees, shrubs, and grasses, although forbs are also present (as described in section 3.3.2). No aquatic or riparian vegetation is present.

3.5.3. Present Ecological Status Assessment

The PES of Vlermuisleegte is based on an instream habitat integrity assessment only since no riparian zone is present. According to the pre-development assessment, Vlermuisleegte is moderately modified (PES C) with a IHI of 76.4 % (Table 12), i.e., loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged. The post-development assessment decreased the IHI to 71.2 %, but the PES remains at moderately modified (PES C) (Table 12). These assessments were completed with medium confidence, primarily due to the ephemerality of the system. Based on evidence of physical alterations to the beds and banks of the river, the connectivity has been most affected. The ephemeral character of Vlermuisleegte provided for a low impact score in terms of physio-chemical and hydrological modifications. Impact sources are described in Figure 23. Refined landcover categories within Vlermuisleegte and its 500m buffer are depicted in Figure 24, while Figure 25 indicates landcover for the total upstream catchment area from the study site.

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

Level 1	**Level 2**		**Level 3**	**Level 4: HGM Unit**		
System type	**DWA Ecoregion**	**Wetland Bioregion**	**Landscape Unit**	**4A**	**4B**	**4C**
INLAND	Southern Kalahari	Eastern Kalahari Bushveld	Plain (high)	River (high)	Lowland river (High)	Active channel (High)

Level 5: Hydroperiod		
5A	**5B**	**5C**
Non-perennial (high)	Intermittent (high)	n/a

Level 6: Substratum type [Proportional rating (0-6)]											
Mineral soil (<10% organic carbon) (high)											
6A											**6B**
Bedrock	Boulders	Cobbles	Pebbles /Gravel	**Sandy soil**	Silt	Clayey soil	Loamy soil	Organic soil	Salt crust	**Other**	Sand + gravel
0	0	0	0	**5**	0	0	0	0	0	**1**	

Level 6: Vegetation cover, Form & Status [Proportional rating (0-6)]					
6A		**6B**		**6C**	
Vegetation cover (high)		**Vegetation form** (high)			
Vegetated	**5**	Aquatic	0	n/a	
Unvegetated	**1**	**Herbaceous**	**3**	**Geophytes**	**1**
				Grasses	**4**
				Herbs/Forbs	**1**
				Sedges/Rushes	0
				Reeds	0
				Restios	0
				Palmiet	0
		Shrubs	**3**	n/a	
		Forest	0	n/a	

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

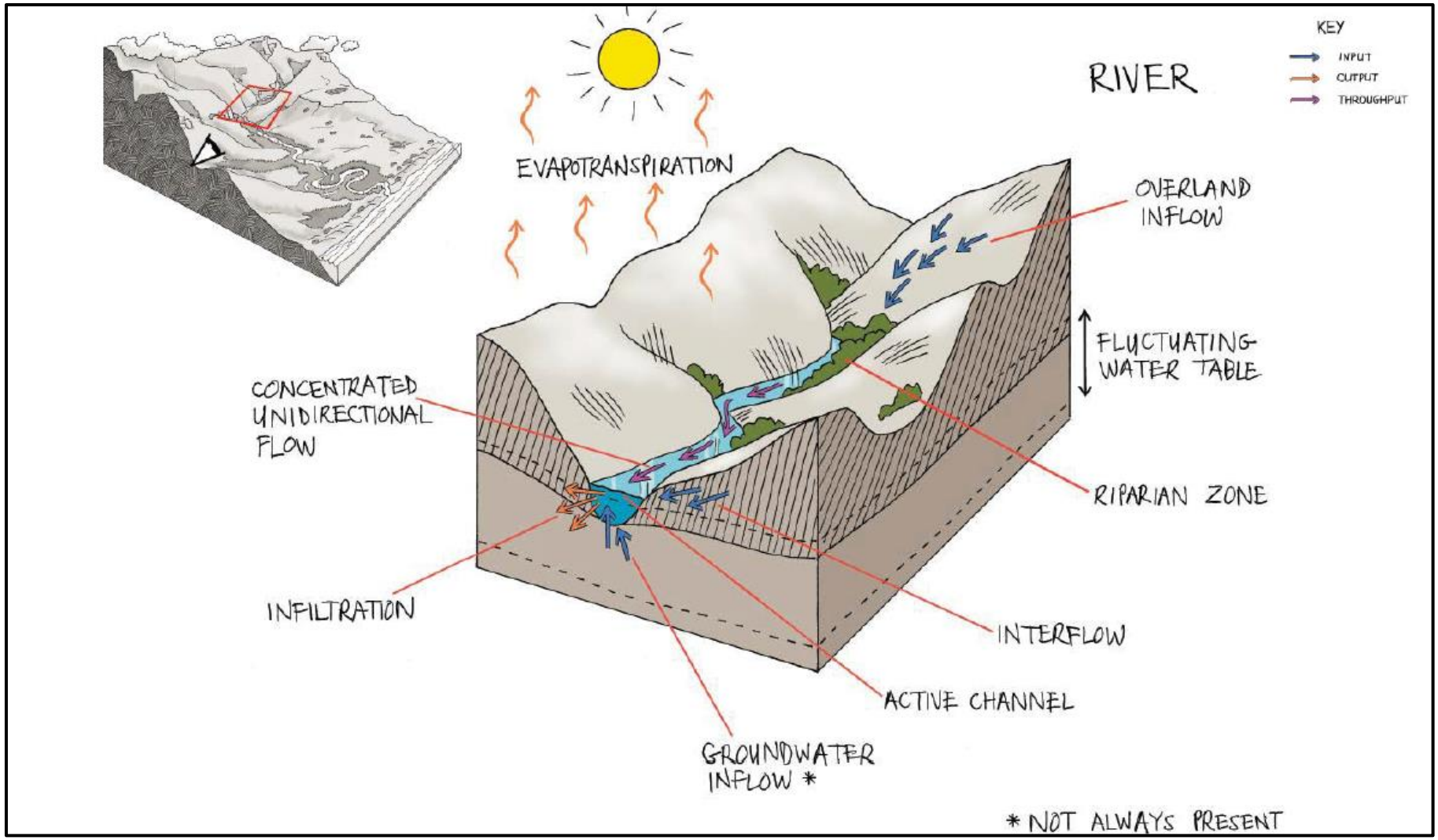


Figure 21. Conceptual illustration of a river, showing the typical landscape setting and the dominant inputs, throughputs and outputs of water (Ollis et al. 2013).

Figure 22. Key descriptors for the intermittent river (Vlermuisleegte) on Walton and Erith. The substratum is sandy (top) and biological soil crusts occur sporadically (centre). The river channel is vegetated and dominated by indigenous, terrestrial trees, shrubs and grasses (bottom).

Table 12. Summarised results of the pre- and post-development IHI (instream habitat only) assessment (Kleynhans et al. 2008) to Vlermuisleegte.

PRE-DEVELOPMENT PES SCORE (Before proposed prospecting activities)		
METRIC GROUP	**RATING**	**CONFIDENCE**
Hydrology modification	0.4	4.0
Physico-chemical modification	0.5	2.1
Bed modification	0.7	2.5
Bank modification	1.0	3.3
Connectivitty modification	4.1	3.5
INSTREAM IHI%	**76.4**	
CATEGORY	**C**	
Confidence	3.1	

POST-DEVELOPMENT PES SCORE (After proposed prospecting activities)		
METRIC GROUP	**RATING**	**CONFIDENCE**
Hydrology modification	0.5	4.0
Physico-chemical modification	0.8	2.1
Bed modification	0.8	2.5
Bank modification	1.5	3.3
Connectivitty modification	4.4	3.5
INSTREAM IHI%	**71.2**	
CATEGORY	**C**	
Confidence	3.0	

The most significant direct modifications have occurred in the form of general surface disturbances through the construction of roads, and associated burrow pits, that cut through the river channel, altering its connectivity, natural geomorphology, and hydrologic regime. Agricultural practices, including old fields and grazing camps, have also caused surface disturbances, potentially decreasing flows during flooding events, causing loss in connectivity and potentially increasing sedimentation risks.

Indirect, external impacts have been caused by upstream impeding structures (water holes, earth berms, roads, and farm buildings) that have been built across the river, intercepting flood waters and adding to erosion risks and sedimentation impacts.

The current state of the hydrology, physio-chemical character, beds- and bank conditions and connectivity are expected to deteriorate slightly due to the proposed prospecting activities. The prospecting activities will increase the severity of the impacts through modifications to the beds and banks of the river, which will decrease the integrity of the instream habitat. However, it will not affect the overall PES of Vlermuisleegte primarily due to its small-scale and local effects.

<table>
<tr>
<td> 
  </td>
<td>Public roads
The N14 connecting Kuruman and Kathu, as well as the R380 that connects Kathu with Hotazel, cut through Vlermuisleegte. However, culverts allow for water to pass under the road.

Source: External

Associated impacts:
- Alteration in natural hydrological regime
- Increased erosion and sedimentation risks
- Road runoff pollution
- Loss of connectivity</td>
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  </td>
<td>Heavily degraded land and excavations
General areas of surface disturbances, borrow pits and old diggings occur within the river channel and buffer zone.

Source: External

Associated impacts:
- Alteration of natural hydrological regime
- Increased erosion and sedimentation
- Loss of natural vegetation
- Loss of connectivity</td>
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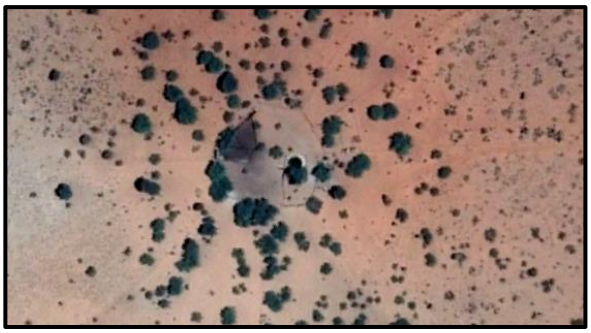
Figure 23. Features impacting the PES of Vlermuisleegte.



Grazing camps
High density grazing camps as well as designated watering and feeding points have been established in the river channel.

Source: External

Associated impacts:
- Increased soil compaction and trampling
- Increased erosion and sedimentation
- Loss of natural vegetation
- Invasion by Alien vegetation
- Loss of connectivity

Earth berms and impoundments
A number of water holes have been dug into the river channel and some small earth berms have been built across the channel.

Source: External

Associated impacts:
- Impeded natural flow of runoff water
- Reduction in flood peaks
- Increased erosion and sedimentation
- Loss of connectivity

Figure 23 (cont.). Features impacting the PES of Vlermuisleegte.

  	**Fixed infrastructure** A number of homesteads and farm buildings occur within the river channel upstream of the study site. A road construction site has also been established in the river buffer by Grinaker-LTA for the upgrading of the R380. **Source:** External **Associated impacts:** - Impeded natural flow of runoff water - Reduction in flood peaks - Increased erosion and sedimentation - Increased soil compaction - Loss of natural vegetation - Invasion by Alien vegetation - Loss of connectivity
	**Old fields** Fallow lands and old fields are present in the channel of Vlermuisleegte, its buffer zone and upper catchment. **Source:** External **Associated impacts:** - Alteration of natural hydrology - Increased erosion and sedimentation - Loss of natural vegetation - Loss of connectivity
	**Infestation of alien invasive species** Stands of declared invasive *Prosopis* spp. have infested the river channel. **Source:** External **Associated impacts:** - Reduction in flood peaks - Loss of biodiversity - Loss of connectivity

Figure 23 (cont.). Features impacting the PES of Vlermuisleegte.

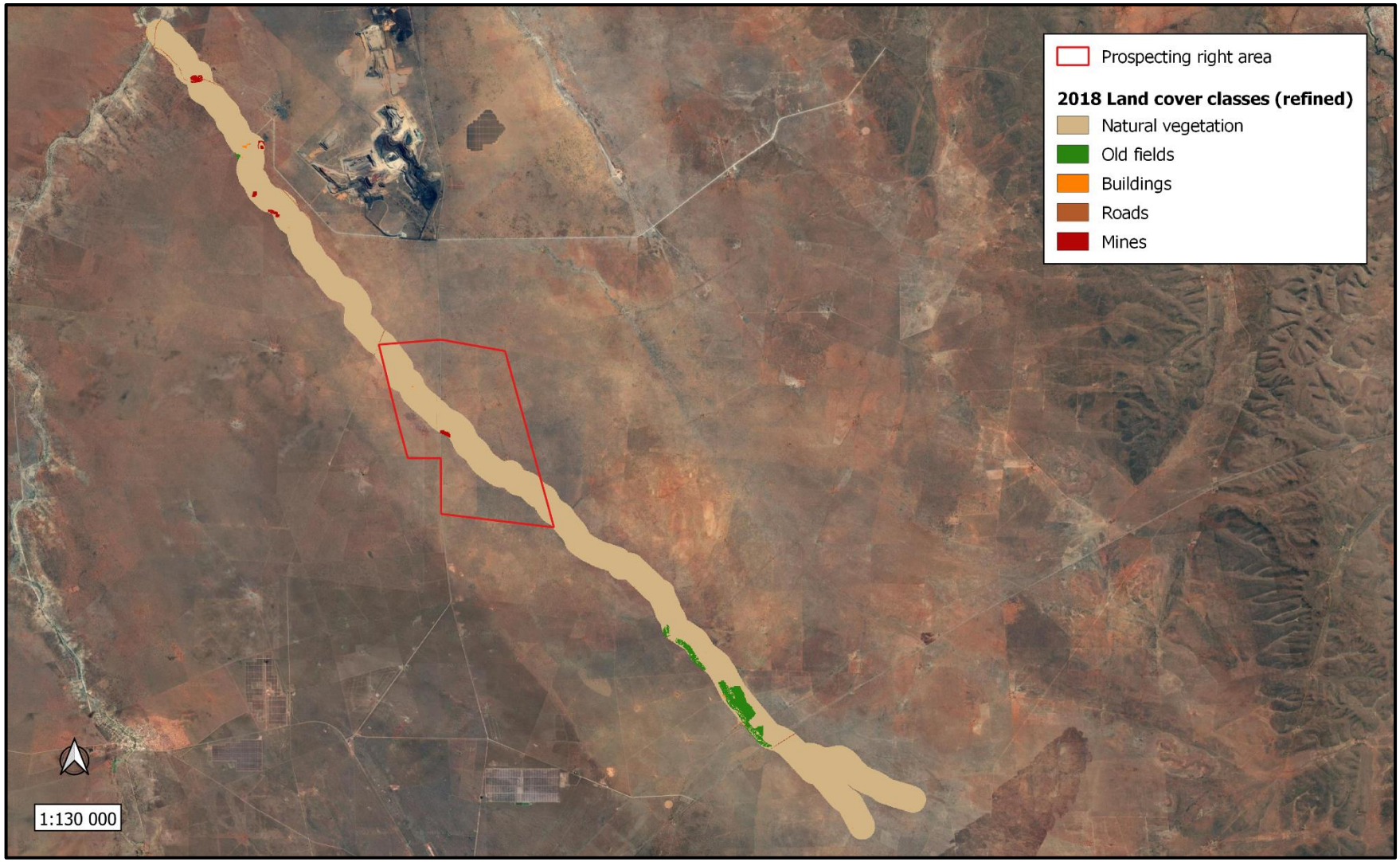


Figure 24. Refined landcover categories and disturbance units in Vlermuisleegte and its 500m buffer.

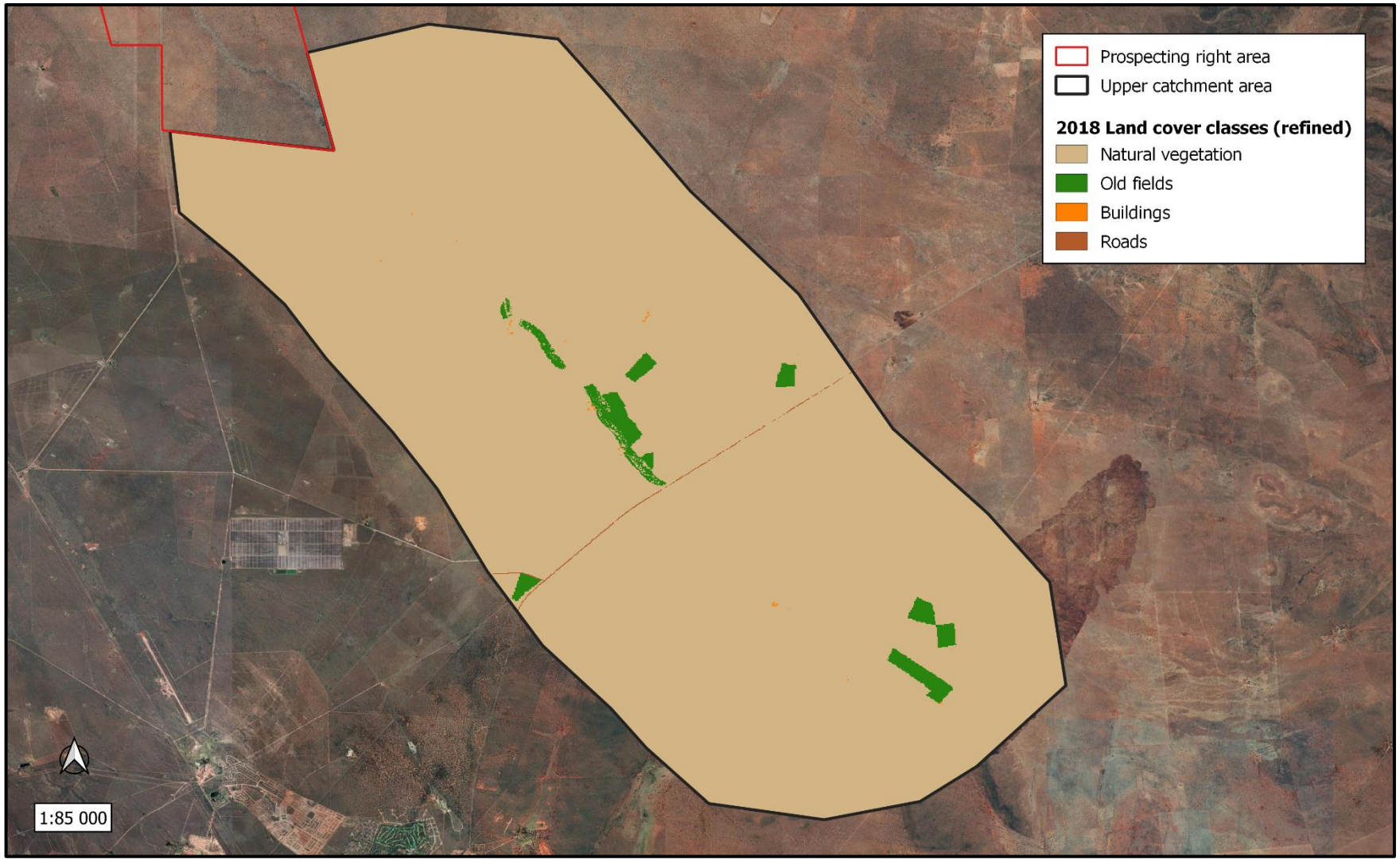


Figure 25. Refined landcover categories in the total upstream catchment of Vlermuisleegte from Walton and Erith.

3.5.4. Ecological Importance and Sensitivity

Vlermuisleegte was rated to have Low EIS (Table 13) and is therefore not considered to be unique at any scale or very sensitive. It provides suitable habitat for the nationally protected trees *Vachellia erioloba* and *V. haematoxylon* as well as the provincially protected *Nerine laticoma* and *Oxalis lawsonii*. These are however terrestrial species that are not restricted to the beds and banks of Vlermuisleegte. No population of unique biota are known to be restricted to the river habitat, but the artificial pools created along the beds of Vlermuisleegte might host specialised Branchiopods. No biota is expected to be dependent on flowing water and the species richness is not regarded significant at any scale.

Furthermore, Vlermuisleegte does not have a high diversity in aquatic habitat types or features. Its ability to provide refugia to biota during periods of environmental stress is mainly significant in terms of terrestrial species on a local scale. The habitat of Vlermuisleegte is not considered to be sensitive to flow decreases or increases, or water quality changes primarily based on its strong ephemerality. Vlermuisleegte is also not of any importance in terms of connectivity for the survival of biota upstream and downstream.

On the other hand, all watercourses are protected under the National Water Act and Vlermuisleegte is considered an Ecological Support Area (Northern Cape Critical Biodiversity Areas) and has Very High sensitivity according to the *Aquatic Biodiversity Theme* (Environmental Screening Tool), since it falls within a strategic Water Source area for groundwater. These factors reflect the importance for the conservation of ecological diversity at a national scale. For this reason, Vlermuisleegte has been considered to have high protected status, even though it is still currently being poorly protected.

3.5.5. Recommended buffer zone

The aquatic buffer segment identified for Vlermuisleegte (Figure 26) has gentle sloping land and sandy textured soils with high permeability (Table 14). The river's buffer requirements are low in general, due to Vlermuisleegte being a first order low land river, the arid climate of the region, the high pH buffering capacity linked to the calcareous soil and moderately robust vegetation with good interception potential. The final aquatic impact buffer requirement is 17 m, which is based on a pre- and post-mitigation assessment, mainly since core prospecting activities are planned to take place in the river itself and therefore the threats remain the same, even with mitigation.

Table 13. Summary of the results for the application of an EIS assessment (Kleynhans 1999) to Vlermuisleegte.

DETERMINANT	SCORE	CONFIDENCE
BIOTIC DETERMINANTS		
1. Rare & Endangered biota	4	3
2. Unique biota	2	3
3. Intolerant biota	0	3
4. Species/taxon richness	1	3
HABITAT DETERMINANTS		
5. Diversity of aquatic habitat types or features	1	3
6. Refuge value of habitat types	2	3
7. Sensitivity of habitat to flow changes	1	3
8. Sensitivity to flow related water quality changes	1	3
9. Migration route/corridor for instream and riparian biota	0	3
10. National parks, Wilderness areas, Nature reserves, Natural Heritage sites, Natural areas	3	4
MEDIAN	**1**	
OVERALL ECOLOGICAL SENSITIVITY AND IMPORTANCE	**Low**	

Table 14. The recommended final aquatic impact buffer requirements for Vlermuisleegte.

Buffer segments	Differentiating characteristics	Pre-mitigation width (m)	Post-mitigation width (m)
Buffer Segment 1	Slope: Very Gentle (0 - 2%) Vegetation: Good; Moderately robust vegetation with good interception potential (e.g. good condition tufted grass stands). Soil permeability: High: Deep well-drained soils (e.g. sand and loamy sand & sand). Micro-topography: Dominantly uniform topography: Dominantly smooth topography with few/minor concentrated flow paths to reduce interception.	17	17

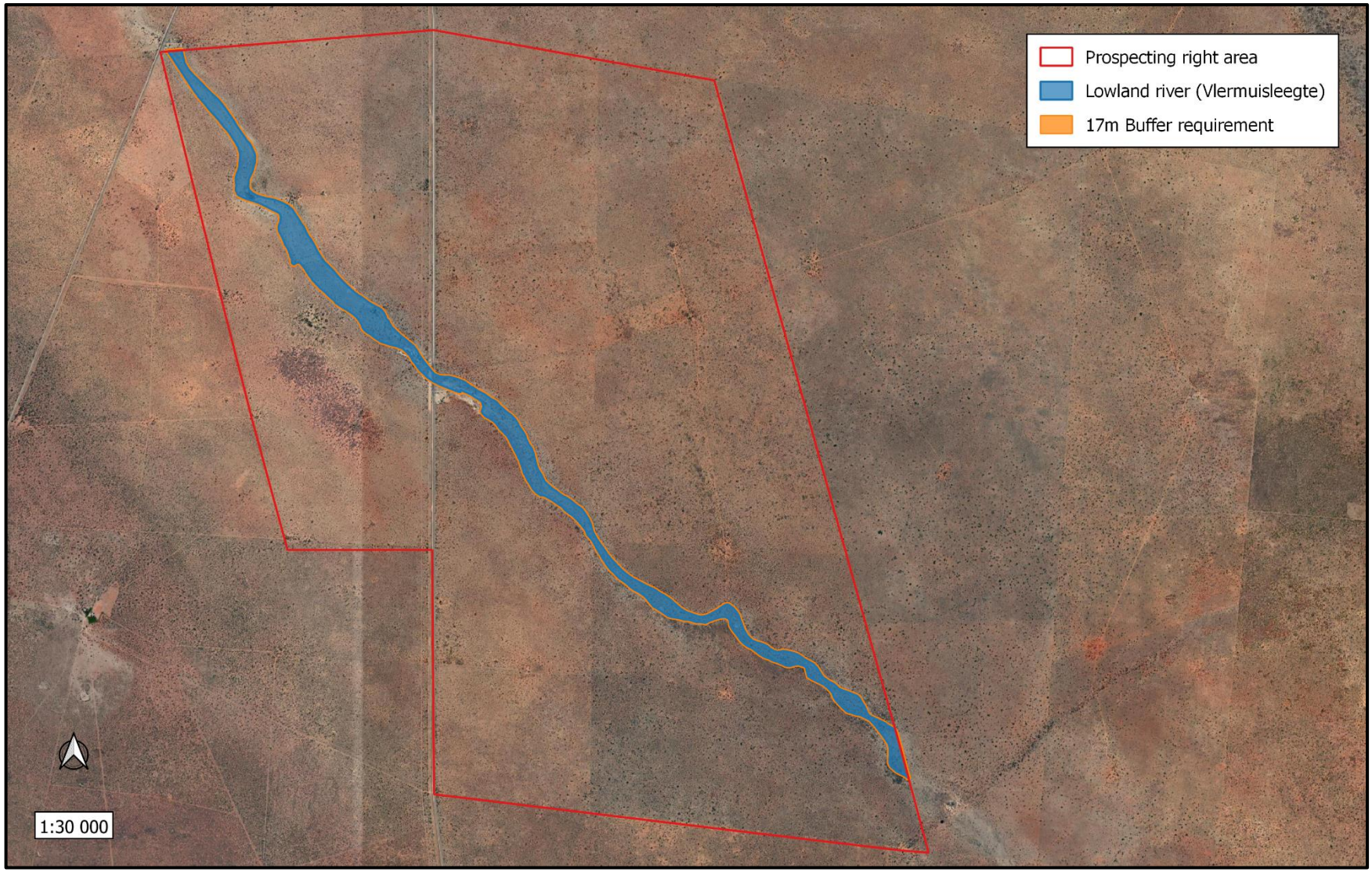


Figure 26. Final aquatic impact buffer requirements, including practical management considerations, for Vlermuisleegte.

3.6. Critical biodiversity areas and broad-scale processes

The proposed prospecting site falls within a critical biodiversity area, 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. Although most of the site comprises *Other Natural Areas*, Vlermuisleegte is classified as an *Ecological Support Area* (Figure 27). No *Critical Biodiversity Area One-*, *Two*, or *Protected Areas* occur in the vicinity of the study area.

On the other hand, the Mining and Biodiversity Guidelines (DENC et al. 2013) does not classify any section of the study area to have biodiversity importance, and therefore does not constitute a high risk for mining. These guidelines were developed to identify and categorize biodiversity priority areas sensitive to the impacts of mining to support mainstreaming of biodiversity issues in decision making in the mining sector. Furthermore, none of the habitats in the study had been identified as ecological corridors within the John Taolo Gaetsewe District Municipality.

Conversely, the National Web based Environmental Screening Tool does consider parts of the study area to be sensitive (Figure 28). This tool is a geographically based web-enabled application which allows a proponent intending to apply for environmental authorisation in terms of the Environmental Impact Assessment (EIA) Regulations 2014 (as amended), to screen their proposed site for any environmental sensitivity. According to this, the study area is of low sensitivity based on the *Plant*- and *Animal Species Themes,* but the entire site is of very high sensitivity based on the *Aquatic Biodiversity Theme*, because it falls within a strategic Water Source area for groundwater. Vlermuisleegte is of very high sensitivity based on the *Terrestrial Biodiversity Theme*, which is due it being an Ecological Support Area in the province's CBAs.

The study area also falls within the core area of the Griqualand West Centre (GWC) of Endemism as defined by Frisby et al. (2019) (Figure 29). A centre of plant endemism is an area with high concentrations of plant species with very restricted distributions, known as endemics (Van Wyk and Smith 2001). Relatively small disturbances in a centre of endemism may easily pose a serious threat to its many range-restricted species. Endemics are specifically vulnerable due to their restricted distribution ranges.

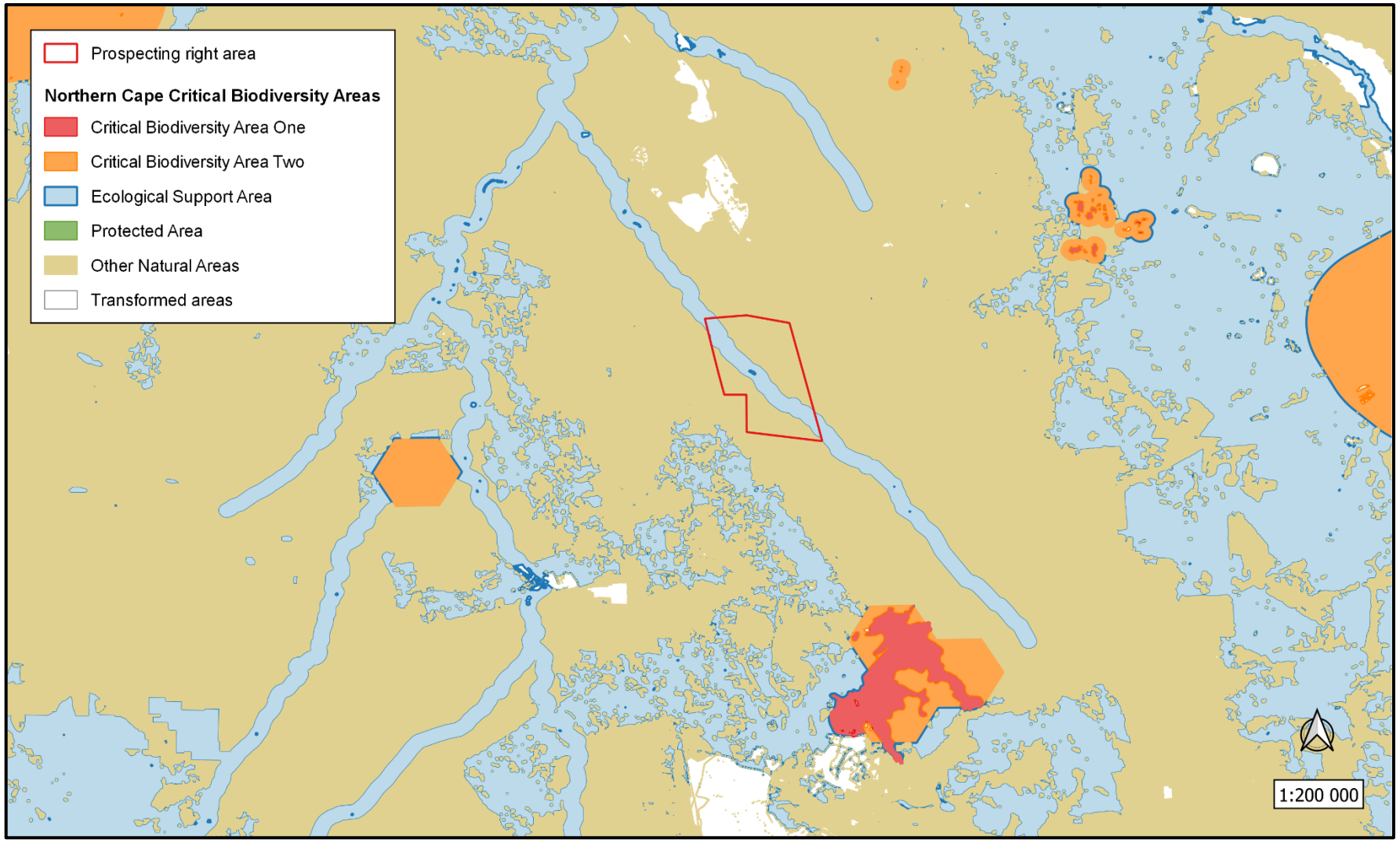


Figure 27. The study area in relation to the Northern Cape Critical Biodiversity Areas.

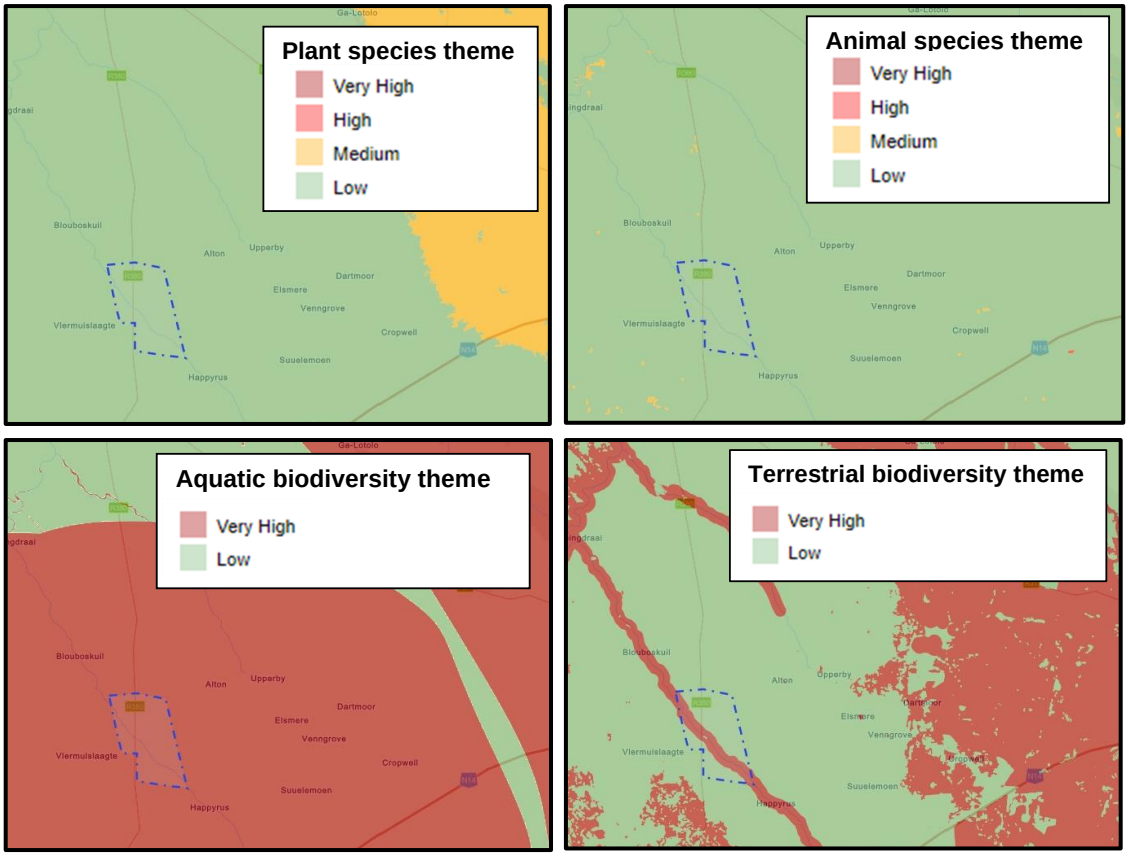


Figure 28. Environmental sensitivities associated with the study area, according to the National Web based Environmental Screening Tool.

Vlermuisleegte has been identified as an ecological corridor within the John Taolo Gaetsewe District Municipality. Here they consider all watercourses to important for the maintenance of ecological integrity and natural habitat.

With regards to the broad-scale vegetation units of the study area, according to Mucina and Rutherford (2012) the Kathu Bushveld vegetation is least threatened, with very little transformation (1%). However, mining has contributed significantly to habitat transformation in the region (Figure 30), and this prospecting operation will further contribute to the cumulative impacts thereof.

Figure 29. The study area in relation to the GWC core, according to Frisby et al. (2019).

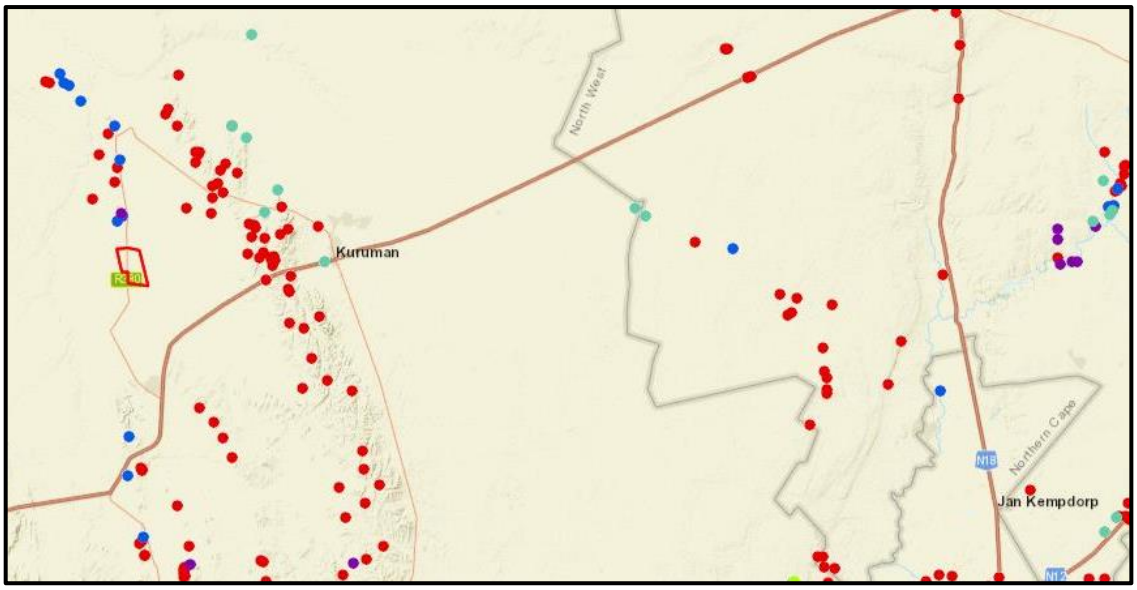


Figure 30. Past and present mining operations near the study area, which increases the cumulative impacts on habitat transformation in the region.

3.7. Site sensitivity

The sensitivity map for the proposed prospecting operation is illustrated in Figure 31. Vlermuisleegte is considered to be of **very high** sensitivity due to its vital hydrological functionality as well as the high density of nationally protected tree species that occur here. All natural channels in which water flows intermittently are also protected in terms of the National Water Act (Act No 36 of 1998). This unit is essentially a no-go area, but it has been earmarked for core project activities.

The remainder of the study site is considered to be of **high** sensitivity, primarily because of the high occurrences of nationally protected tree species that occur widespread across the entire site as well as potentially important habitat associations for faunal species of conservation concern. Although it is not regarded as no-go areas, activities should only proceed with caution as it may not be possible to mitigate all impacts appropriately. It has however not been earmarked for core project activities.

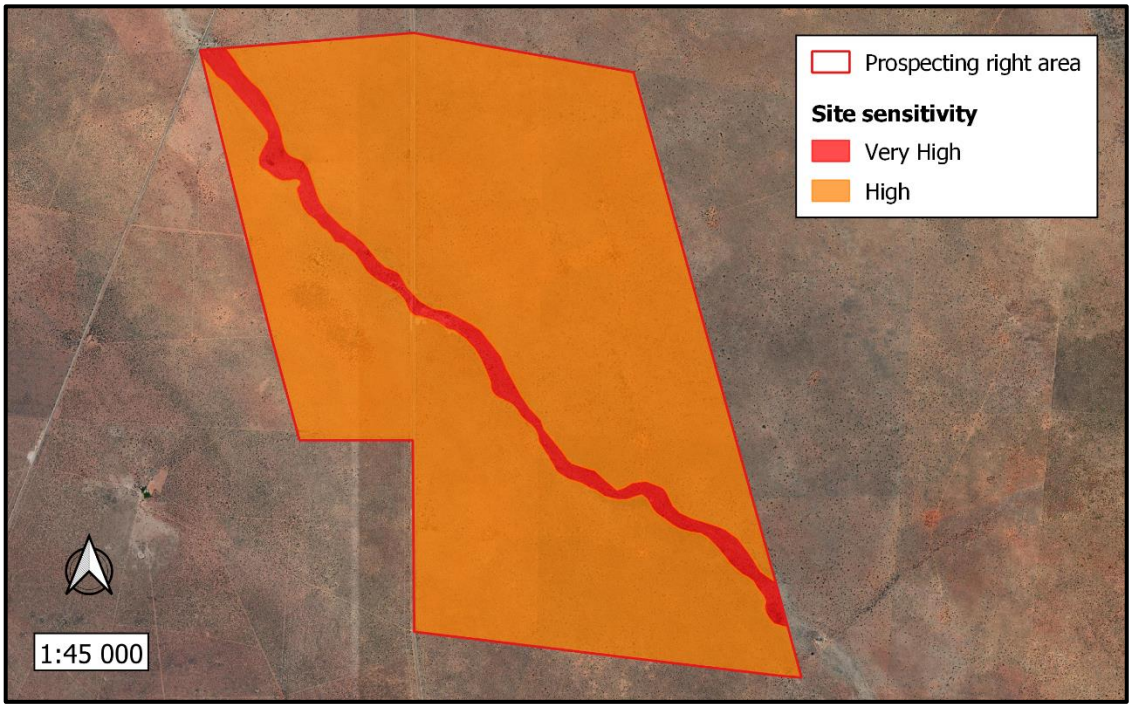


Figure 31. A sensitivity map for the proposed prospecting area.

4. ECOLOGICAL IMPACT ASSESSMENT

In this section, the potential impacts and associated risk factors that may be generated by the prospecting operation are identified and described. A detailed analysis of each impact is provided in Table 15. 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.

4.1. Topography, soil erosion and associated degradation of landscapes

4.1.1. Alteration of soil character and quality

Source of the impact

During clearing of an area for excavations, roads and infrastructure, the removal of topsoil, stockpiling, oil and petrochemical spills.

Description of the impact

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

Mitigation and monitoring

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

Table 15. A detailed analysis of ecological impacts identified for the proposed prospecting operation.

	IMPACT	Phase			Extent	Duration	Severity	Probability	Significance	Significance after Mitigation
		C	O	D						
Soil	Alteration of soil character and quality	✓	✓	✓	On-site (1)	Residual (4)	High (3)	Certain for life of operation (10)	Medium - High (80)	Low-Medium
	Loss of topsoil and soil fertility	✓	✓	✓	On-site (1)	Residual (4)	High (3)	Certain for life of operation (10)	Medium - High (80)	Low-Medium
	Increase in soil erosion	✓	✓		Local (2)	Decommissioning (3)	Medium (2)	Possible, frequently (8)	Low - Medium (56)	Low
Flora	Loss of indigenous vegetation	✓	✓		On-site (1)	Residual (4)	Medium (2)	Certain for life of operation (10)	Low - Medium (70)	Low-Medium
	Loss of Red data and/or protected floral species	✓	✓		On-site (1)	Residual (4)	Major (4)	Certain for life of operation (10)	Medium - High (90)	Low-Medium
	Introduction or spread of alien species	✓	✓	✓	Local (2)	Residual (4)	Medium (2)	Possible, infrequent (7)	Low-Medium (56)	Very low
	Bush encroachment	✓	✓	✓	On-site (1)	Residual (4)	Medium (2)	Possible, infrequent (7)	Low (49)	Very low
Fauna	Habitat fragmentation	✓	✓		Regional (3)	Residual (4)	High (3)	Certain for life of operation (10)	Medium - High (100)	Low-Medium
	Disturbance, displacement and killing of fauna	✓	✓	✓	Local (2)	Decommissioning (2)	High (3)	Certain, for life of operation (70)	Low-Medium (70)	Low

Table 15 (cont.). A detailed analysis of ecological impacts identified for the proposed prospecting operation.

	IMPACT	Phase			Extent	Duration	Severity	Probability	Significance	Significance after Mitigation
		C	O	D						
Water resources	Alteration/destruction of watercourses	✓	✓		Regional (3)	Permanent (5)	High (3)	Certain, life of operation (10)	High (110)	Medium-High
	Siltation of surface water	✓	✓	✓	Regional (3)	Decommissioning (3)	Medium (2)	Possible, infrequent (7)	Low-Medium (56)	Low
Cumulative	Compromise of broadscale ecological processes	✓	✓		Regional (3)	Residual (4)	High (3)	Certain for life of operation (10)	Medium - High (100)	Low-Medium

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

4.1.2. Loss of soil fertility

Source of the impact

During clearing of an area for excavations, roads and infrastructure, the removal of topsoil, stockpiling.

Description of the impact

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

Mitigation and monitoring

- Topsoil needs to be removed and stored separately during prospecting and the construction of roads, infrastructure and stockpile areas.
- These topsoil stockpiles must be kept as small as possible to prevent compaction and the formation of anaerobic conditions.
- Topsoil must be stockpiled for the shortest possible timeframes to ensure that the quality of the topsoil is not impaired.
- Topsoil must not be handled when the moisture content exceeds 12 %.

- Topsoil stockpiles must by no means be mixed with sub-soils.
- The topsoil should be replaced as soon as possible on to the disturbed areas, thereby allowing for the re-growth of the seed bank contained within the topsoil.
- For restoration of the affected areas without topsoil, soils can be sourced from other sustainable areas and chemically changed to match with the surrounding environment.
- To restore areas where compacted soil occurs, a ripper blade or deep plow can be pulled across the affected area to alleviate compaction.
- Encourage the growth of natural plant species in all affected areas by sowing indigenous seeds or by planting seedlings and succulent cuttings.

4.1.3. Soil erosion

Source of the impact

During clearing of an area for excavations, roads and infrastructure and roads, stockpiling, natural events.

Description of the impact

Vegetation will be stripped for construction of new roads, and excavations. As a result, these areas will be bare, and the sandy substrate is especially susceptible to wind erosion. Furthermore, any topsoil-, overburden- and ore stockpiles can be eroded by wind, rain, and flooding. Exposed sediments in the watercourses can be carried away during runoff causing downstream sediment deposition. Any leaking pipes can also cause additional water erosion.

Mitigation and monitoring

- Bare ground exposure should always be minimised in terms of the surface area and duration.
- Re-establishment of plant cover on disturbed areas must take place as soon as possible once activities in the area have ceased.
- New roads, infrastructure or prospecting areas that will be developed over a watercourse should be kept at a minimum, following a conservative approach and a water use license to alter the beds and banks of each earmarked watercourse should be obtained from DWS prior to such activities.
- Disturbances during the rainy season should be monitored and controlled.
- Any potential run-off from exposed ground should be controlled with flow retarding barriers.
- Regular monitoring during the prospecting operation should be carried out to identify areas where erosion is occurring; followed by appropriate remedial actions.

4.2. Vegetation and floristics

4.2.1. Loss of indigenous vegetation

Source of the impact

During the 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 destroy large areas of indigenous vegetation, which in turn will disrupt natural ecological process. It is not expected that the areas of high ecological function and biodiversity will fully rehabilitate following disturbance events. Vehicle traffic and prospecting activities also generates lots of dust which can reduce the growth success and seed dispersal of many small plant species.

Mitigation and monitoring

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

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

Source of the impact

Removal of listed or protected plant species during clearing of an area for excavations, roads, infrastructure, and placement of stockpiles. Intentional removal of listed or protected plant species for non-mine related purposes, e.g., illegal medicinal trade, cultural beliefs, or firewood collection.

Description of the impact

Species of national conservation concern present in the area earmarked for prospecting include *Vachellia erioloba* and *V. haematoxylon*. A few provincially protected species also occur on site. Many individuals belonging to these species will most certainly be damaged or removed during the operation. Furthermore, any illegal firewood- or ornamental collection by staff, contractors or secondary land users could potentially have a negative impact on the population of these species.

Mitigation and monitoring

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

4.2.3. Introduction or spread of alien species

Source of the impact

During the clearing of vegetation, and general disturbances caused by prospecting activities.

Description of the impact

The extent of alien invasive species in the area shows some level of past disturbance interference in the natural ecosystem and primarily include *Prosopis glandulosa*. 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. In fact, if the prospecting activities involve the removal of entire shrubs and trees to gain access to underlying minerals it could help with the control of existing infestations in the earmarked areas.

Mitigation and monitoring

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

4.2.4. Encouraging bush encroachment

Source of the impact

During the clearing of vegetation, and general disturbances cause through prospecting activities.

Description of the impact

The extent of bush encroaching species on site shows fairly high levels of past disturbance interference in the natural ecosystem, presumably through grazing practises.

Bush encroachment is a natural phenomenon characterised by the excessive expansion of certain shrub species at the expense of other plant species, especially grasses. In the area earmarked for prospecting, these include *Senegalia mellifera, Tarchonanthus camphoratus, Rhigozum trichotomum, Terminalia sericea* and *Grewia flava.* While general clearing of the area and prospecting activities destroy natural vegetation, bush encroaching plants may increase due to their aggressive nature in disturbed areas. If encroaching plants establish in disturbed areas, it may lower the potential for future land use and decrease biodiversity. With proper mitigation, the impacts can be substantially reduced. In fact, the proposed prospecting activities could potentially reduce the extent of these shrubs. By clearing large stands of these species and effectively rehabilitating the cleared areas, it can have a positive effect on the biodiversity.

Mitigation and monitoring

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

4.3. Fauna

4.3.1. Habitat fragmentation

Source of the impact

During the clearing of vegetation, and general disturbances cause through prospecting activities.

Description of the impact

Fragmentation of habitats typically leads to the loss of migration corridors, in turn resulting in degeneration of the affected population's genetic make-up. This can be in the form of small-scale fragmentation for reptiles, amphibians, and invertebrates, to more large-scale fragmentation that hinder dispersal of birds and plants. It also includes the destruction of burrows, tunnels, and chambers as well as the degradation of ephemeral aquatic habitats in the Vlermuisleegte channel.

Small-scale fragmentation disconnects breeding and foraging links, increasing stress and energy budget deficits, which is especially taxing on animals living in arid environments. Larger scale fragmentation 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. The prospecting activities is expected to result in the loss of connectivity and fragmentation of natural micro-habitats primarily on a local scale.

Mitigation and monitoring

- All activities associated with the prospecting operation must be planned, where possible to encourage faunal dispersal and should minimise dissection or fragmentation of any important faunal habitat type.
- The footprint areas of the prospecting activities must be scanned for any burrow complexes prior to any destructive activities by means of a search-and-rescue operation.
- It is recommended that nest, burrows, tunnels or complexes are identified and marked prior to intended activity and should be incorporated into the design layout and left in situ. However, due to the nature of the proposed prospecting activities they will most likely be destroyed. The relevant permits from DENC should be applied for at least three months before such activities will commence.
- 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.
- Ideally, no new roads should be created across a watercourse and no prospecting should take place in a watercourse or along its banks. However, for this proposed activity this is unavoidable and therefore all new roads, infrastructure or prospecting areas that will be developed over a watercourse should be kept at a minimum, following a conservative approach. A water use license to alter the beds and banks of each earmarked watercourse should be obtained from DWS prior to such activities.
- Employ sound rehabilitation measures to restore characteristics of all affected 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, excavations.

Description of the impact

The site provides suitable habitat for several faunal species of conservation concern. The proposed prospecting activities could lead to the death and displacement of some of these species. The transformation of natural habitats will result in the loss of micro-habitats, affecting individual species and ecological processes. This will result in the displacement of faunal species that depend on such habitats, e.g., birds that nest in trees or animals residing in holes in the ground, among rocks or underneath plants. For example, when tunnels of Damara Mole-rats are destroyed through excavations. 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 many 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 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.
- The footprint areas of the prospecting activities must be scanned for any protected faunal species prior to any destructive activities by means of a search-and-rescue operation.
- If any of the protected wildlife species are directly threatened by habitat destruction or displacement during the prospecting operation, then the relevant permits from DENC should be obtained followed by the relevant mitigation procedures stipulated in the permits.
- It is recommended that these individuals be rescued and relocated by a registered professional prior to intended activities.
- Ideally, no prospecting should take place in a watercourse. However, for this proposed activity this is unavoidable and therefore prospecting areas that will be developed over a watercourse should be kept at a minimum, following a conservative approach. A water use license to alter the beds and banks of each earmarked watercourse should be obtained from DWS prior to such activities.

- Everyone on site must undergo environmental induction for awareness on not capturing or harming species that are often persecuted out of superstition and to be educated about the conservation importance of the fauna occurring on site.
- All reptiles, amphibians as well as bird nests and small mammal litters and dens 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 a maximum speed limit of 40 km/h as well as driving mindfully on site to lower the risk of animals being killed on the roads or elsewhere in the prospecting area.

4.4. Water resources

4.4.1. Alteration/destruction of watercourses

Source of the impact

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

Description of the impact

During prospecting activities, the watercourse on site (Vlermuisleegte) might be altered and indirectly affected. This includes direct prospecting within the watercourses as well as development of roads, infrastructure or stockpiles within their channels, catchment areas, or buffer zones. Such activities can completely change the hydrologic regime or habitat conditions of the watercourses, which will not only compromise their ecological functioning, but also have downstream effects.

Mitigation and monitoring

- All activities associated with the prospecting operation must be planned to avoid any unnecessary additional disturbances to the watercourses and their buffer zones.
- Any new roads created across a watercourse should be done with a conservative approach and should be done in such a way as to preserve the hydrological regime as far as is possible.
- Before any prospecting takes place in Vlermuisleegte, a water use license to alter its beds and banks should be obtained from DWS prior to such activities.
- Employ sound rehabilitation measures to restore characteristics of all affected watercourses.

4.4.2. Siltation of surface water

Source of the impact

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

Description of the impact

Vegetation will be stripped in preparation for the prospecting areas and associated infrastructure. These bare areas will be very susceptible to water erosion without plants to stabilise the soil, creating potential sediment source zones. High runoff events could potentially cause Vlermuisleegte to be filled with silt from prospecting areas if the sediment source zones lie along its drainage paths. This may lead to a change in hydrologic regime and character of the watercourse.

Mitigation and monitoring

- Bare ground exposure should always be minimised in terms of the surface area and duration.
- Re-establishment of plant cover on disturbed areas must take place as soon as possible once activities in the area have ceased.
- Any new roads created across a watercourse should be done with a conservative approach and should be done in such a way as to preserve the hydrological regime as far as is possible.
- Disturbances during the rainy season should be monitored and controlled.
- Any potential run-off from exposed ground should be controlled with flow retarding barriers.
- Regular monitoring during the prospecting operation should be carried out to identify areas where erosion is occurring; followed by appropriate remedial actions.

4.5. Broad-scale ecological processes

Source of the impact

During the clearing of vegetation for excavations and the construction of roads and infrastructure.

Description of the impact

The prospecting operation itself is expected to cause habitat transformation through the excavation of open pits and will thereby contribute moderately to cumulative habitat loss and the disruption of the broad-scale landscape connectivity in the region.

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. A high amount of habitat transformation, specifically through mining, exist in the region, but the footprint of the proposed activity is fairly small and therefore the cumulative impact for the proposed prospecting operation is moderately high.

Mitigation and monitoring

- Implement best practise principles to minimise the footprint of transformation.
- Ideally, no new roads should be created across a watercourse and no prospecting should take place in a watercourse or along its banks. However, for this proposed activity this is unavoidable and therefore all new roads, infrastructure or prospecting areas that will be developed over a watercourse should be kept at a minimum, following a conservative approach. A water use license to alter the beds and banks of each earmarked watercourse should be obtained from DWS prior to such activities.
- Employ sound rehabilitation measures to restore characteristics of all affected habitats.
- The footprint areas must be scanned for protected species prior to any destructive activities by means of a search-and-rescue operation and the relevant permits from DENC should be applied for at least three months before any species are threatened by destruction, death or displacement.

5. CONCLUSION, RECOMMENDATIONS AND OPINION REGARDING AUTHORISATION

Two distinct plant communities were identified on site, i.e., Open woodland on calcareous sand and Woodland on red sand. Both have a high occurrence of plant species of conservation concern that occur widespread across each unit as well as important habitat associations for animal species of conservation concern. However, the open woodland on calcareous sand is most sensitive to disturbances based on the associated hydrological functioning of Vlermuisleegte, which is classified as a lowland river. The most profound impacts are expected to be related to risks associated to the degradation of Vlermuisleegte as a watercourse, potential erosion of the sandy substrate, the loss of plant species of conservation concern as well as the disruption of ecological corridors. Nevertheless, these impacts are all considered to have moderate effect, which can be reduced if mitigated.

Species of national conservation concern that are found in the area earmarked for prospecting include *Vachellia erioloba* and *V. haematoxylon.* A licence application regarding protected trees should be lodged with Department of Agriculture, Forestry and Fisheries three months prior to any potential disturbances to these trees. The prospecting operation will also result in the removal of provincially protected plant species and the large-scale clearance of indigenous vegetation. Permit applications regarding removal of protected plants and the large-scale harvesting of indigenous vegetation need to be lodged with the Northern Cape Department of Environment and Nature Conservation three months prior to any clearance of vegetation.

Furthermore, the core earmarked area for the proposed operation falls within a watercourse (Vlermuisleegte), that has been moderately modified (PES C) and regarded to be of low ecological importance and sensitivity. To alter the beds and banks of Vlermuisleegte, a water use license should be obtained from DWS prior to such activities.

To conclude, the degradation of natural habitats and removal of nationally protected trees are inevitable during the proposed operation. The significance of the impacts will be affected by the success of the mitigation measures implemented and the rehabilitation programme for the prospecting area. In my opinion, authorisation should only be granted if the applicant commits to the adherence of effective avoidance, management, mitigation, and rehabilitation measures.

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Boscia
ECOLOGICAL CONSULTING

APPENDICES

APPENDIX 1

Plant species list

FAMILY	SPECIES	STATUS	NFA	NCNCA
ACANTHACEAE	*Barleria irritans*	LC		
	Barleria rigida	LC		
	Blepharis integrifolia var. *integrifolia*	LC		
	Blepharis marginata	LC		
	Glossochilus burchellii	LC		
	Hypoestes forskaolii	LC		
	Justicia divaricata	LC		
	Justicia incana	LC		
	Justicia puberula	LC		
AIZOACEAE	*Plinthus karooicus*	LC		
AMARANTHACEAE	*Alternanthera pungens*	Nat. Exot.		
	Kyphocarpa angustifolia	LC		
	Gomphrena celosioides	Nat. Exot.		
	Hermbstaedtia odorata	LC		
	Pupalia lappacea var. *lappacea*	LC		
	Salsola sp.	-		
	Sericorema remotiflora	LC		
	Sericorema sericea	LC		
AMARYLLIDACEAE	***Nerine laticoma***	LC		**S2**
ANACARDIACEAE	*Searsia burchellii*	LC		
	Searsia ciliata	LC		
	Searsia tenuinervis	LC		
	Searsia tridactyla	LC		
APIACEAE	***Deverra burchellii***	LC		**S2**
APOCYNACEAE	***Fockea angustifolia***	LC		**S2**
	Microloma armatum* var. *burchellii	LC		**S2**
	Raphionacme velutina	LC		**S2**
ASPARAGACEAE	*Asparagus exuvialis*	LC		
	Asparagus laricinus	LC		
	Asparagus retrofractus	LC		
ASTERACEAE	*Arctotis leiocarpa*	LC		
	Chrysocoma ciliata	LC		
	Dicoma macrocephala	LC		
	Dicoma schinzii	LC		
	Eriocephalus ericoides subsp. *griquensis*	LC		
	Felicia muricata	LC		
	Gazania krebsiana subsp. *arctotoides*	LC		
	Geigeria brevifolia	LC		
	Geigeria ornativa subsp. *ornativa*	LC		
	Helichrysum argyrosphaerum	LC		
	Helichrysum cerastioides var. *cerastioides*	LC		
	Helichrysum zeyheri	LC		
	Hirpicium echinus	LC		
	Oedera humilis	LC		
	Osteospermum microcarpum	LC		

FAMILY	SPECIES	STATUS	NFA	NCNCA
ASTERACEAE	*Pegolettia retrofracta*	LC		
	Pentzia calcarea	LC		
	Pteronia glauca	LC		
	Tarchonanthus camphoratus	**Encr.**		
BIGNONIACEAE	***Rhigozum trichotomum***	**Encr.**		
BORAGINACEAE	*Heliotropium nelsonii*	LC		
CARYOPHYLLACEAE	*Pollichia campestris*	LC		
CELASTRACEAE	***Gymnosporia buxifolia***	LC		**S2**
CLEOMACEAE	*Cleome angustifolia* subsp. *diandra*	LC		
COLCHICACEAE	*Ornithoglossum vulgare*	LC		
COMBRETACEAE	***Terminalia sericea***	**Encr.**		
CONVOLVULACEAE	*Convolvulus multifidus*	LC		
	Convolvulus ocellatus var. *ocellatus*	LC		
	Ipomoea obscura var. *obscura*	LC		
	Merremia verecunda	LC		
	Seddera capensis	LC		
	Xenostegia tridentata subsp. *angustifolia*	LC		
CUCURBITACEAE	*Acanthosicyos naudinianus*	LC		
	Corallocarpus triangularis	LC		
	Cucumis africanus	LC		
	Cucumis myriocarpus subsp. *myriocarpus*	LC		
	Kedrostis crassirostrata	LC		
CYPERACEAE	*Bulbostylis burchellii*	LC		
	Bulbostylis hispidula subsp. *pyriformis*	LC		
	Cyperus decurvatus	LC		
	Cyperus margaritaceus var. *margaritaceus*	LC		
	Cyperus marlothii	LC		
	Cyperus squarrosus	LC		
EBENACEAE	*Diospyros lycioides*	LC		
	Euclea undulata	**Encr.**		
EUPHORBIACEAE	***Euphorbia crassipes***	LC		**S2**
	Euphorbia inaequilatera	LC		**S2**
FABACEAE	*Calobota cuspidosa*	LC		
	Chamaecrista biensis	LC		
	Crotalaria orientalis subsp. *orientalis*	LC		
	Crotalaria spartioides	LC		
	Cyamopsis serrata	LC		
	Elephantorrhiza elephantina	LC		
	Indigofera alternans var. *alternans*	LC		
	Indigofera daleoides	LC		
	Indigofera sessilifolia	LC		
	Lessertia frutescens* subsp. *frutescens	LC		**S1**
	Lotononis crumanina	LC		
	Melolobium calycinum	LC		
	Melolobium macrocalyx var. *macrocalyx*	LC		

FAMILY	SPECIES	STATUS	NFA	NCNCA
FABACEAE	*Prosopis glandulosa*	Decl. Inv.		S6
	Requienia pseudosphaerosperma	LC		
	Rhynchosia totta	LC		
	Senegalia mellifera	Encr.		
	Senna italica	LC		
	Tephrosia burchellii	LC		
	Vachellia erioloba	LC	X	
	Vachellia haematoxylon	LC	X	
	Vachellia hebeclada	LC		
	Vachellia karroo	Encr.		
GISEKIACEAE	*Gisekia africana* var. *africana*	LC		
	Gisekia pharnaceoides var. *pharnaceoides*	LC		
HYACINTHACEAE	*Dipcadi viride*	LC		
IRIDACEAE	***Lapeirousia littoralis***	LC		S2
LAMIACEAE	*Leonotis ocymifolia* var. *schinzii*	LC		
	Leonotis pentadentata	LC		
	Salvia verbenaca	Nat. Exot.		
	Stachys spathulata	LC		
	Limeum aethiopicum var. *intermedium*	LC		
	Limeum viscosum subsp. *transvaalense*	LC		
MALVACEAE	*Abutilon austro-africanum*	LC		
	Grewia flava	Encr.		
	Hermannia abrotanoides	LC		
	Hermannia comosa			
	Hermannia tomentosa	LC		
	Hibiscus ludwigii	LC		
	Hibiscus pusillus	LC		
	Melhania burchellii	LC		
	Melhania virescens	LC		
	Pavonia burchellii	LC		
	Sida chrysantha	LC		
	Sida cordifolia subsp. *cordifolia*	LC		
	Sida ovata	LC		
	Waltheria indica	LC		
NYCTAGINACEAE	*Phaeoptilum spinosum*	LC		
ONAGRACEAE	*Ludwigia adscendens* subsp. *diffusa*	LC		
OXALIDACEAE	***Oxalis lawsonii***	LC		S2
PEDALIACEAE	***Harpagophytum procumbens***	LC		S1
PHYLLANTHACEAE	*Phyllanthus parvulus* var. *parvulus*	LC		
POACEAE	*Andropogon chinensis*	LC		
	Andropogon schirensis	LC		
	Anthephora argentea	LC		
	Aristida congesta subsp. *barbicollis*	LC		
	Aristida congesta subsp. *congesta*	LC		
	Aristida meridionalis	LC		

FAMILY	SPECIES	STATUS	NFA	NCNCA
POACEAE	*Aristida stipitata* subsp. *spicata*	LC		
	Aristida vestita	LC		
	Brachiaria brizantha	LC		
	Brachiaria nigropedata	LC		
	Cenchrus ciliaris	LC		
	Centropodia glauca	LC		
	Cymbopogon caesius	LC		
	Cymbopogon pospischilii	**Nat. Exot.**		
	Cynodon dactylon	LC		
	Digitaria eriantha	LC		
	Digitaria polyphylla	LC		
	Digitaria sanguinalis	**Nat. Exot.**		
	Eleusine coracana subsp. *africana*	LC		
	Elionurus muticus	LC		
	Enneapogon cenchroides	LC		
	Enneapogon scoparius	LC		
	Eragrostis barrelieri	**Nat. Exot.**		
	Eragrostis biflora	LC		
	Eragrostis curvula	LC		
	Eragrostis echinochloidea	LC		
	Eragrostis lehmanniana var. *lehmanniana*	LC		
	Eragrostis mexicana subsp. *virescens*	**Nat. Exot.**		
	Eragrostis nindensis	LC		
	Eragrostis pallens	LC		
	Eragrostis rigidior	LC		
	Eragrostis trichophora	LC		
	Eustachys paspaloides	LC		
	Fingerhuthia africana	LC		
	Heteropogon contortus	LC		
	Lamarckia aurea	**Nat. Exot.**		
	Leptochloa fusca	LC		
	Melinis repens subsp. *grandiflora*	LC		
	Melinis repens subsp. *repens*	LC		
	Panicum coloratum	LC		
	Panicum maximum	LC		
	Pogonarthria squarrosa	LC		
	Schmidtia pappophoroides	LC		
	Setaria verticillata	LC		
	Sporobolus fimbriatus	LC		
	Stipagrostis uniplumis var. *uniplumis*	LC		
	Tragus berteronianus	LC		
	Tragus racemosus	LC		
	Trichoneura grandiglumis	LC		
	Urochloa panicoides	LC		
	Urochloa stolonifera	LC		

FAMILY	SPECIES	STATUS	NFA	NCNCA
POLYGALACEAE	*Polygala leptophylla* var. *leptophylla*	LC		
PORTULACACEAE	*Portulaca hereroensis*	LC		
	Portulaca kermesina	LC		
RUBIACEAE	*Anthospermum rigidum* subsp. *rigidum*	LC		
	Vangueria macrocalyx	LC		
SCROPHULARIACEAE	*Aptosimum elongatum*	LC		
	Aptosimum albomarginatum	LC		
	Aptosimum marlothii	LC		
	Jamesbrittenia atropurpurea* subsp. *atropurpurea	LC		**S2**
	Jamesbrittenia integerrima	LC		**S2**
	Peliostomum leucorrhizum	LC		
	Selago densiflora	LC		
SOLANACEAE	*Solanum burchellii*	LC		
	Solanum lichtensteinii	LC		
THYMELAEACEAE	*Lasiosiphon polycephalus*	LC		
VAHLIACEAE	*Vahlia capensis* subsp. *vulgaris*	LC		
VERBENACEAE	*Chascanum adenostachyum*	LC		
	Chascanum hederaceum var. *hederaceum*	LC		
	Chascanum pinnatifidum var. *pinnatifidum*	LC		
	Chascanum schlechteri	LC		
ZYGOPHYLLACEAE	*Tribulus terrestris*	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 MRL	Habitat	Potential of occurrence
CHIROPTERA	[2]*Eidolon helvum*	African Straw-coloured Fruit-bat	**NT**	LC	Wide habitat tolerance.	High
	[2]*Neoromicia capensis*	Cape Bat	LC	LC	Wide habitat tolerance, but often found in arid areas, grassland, bushveld and *Acacia* woodland. Animals roost under the bark of trees and similar vegetation.	High
	[3]*Miniopterus natalensis*	Natal Long-fingered Bat	LC	*Not listed*	Mainly roosts in caves or mine shafts, but also in crevices and holes in trees.	Moderate
	[2]*Nycteris thebaica*	Common Slit-faced Bat	LC	LC	Savanna species with wide habitat tolerance. Roosts in caves, mine adits, aardvark holes, rock crevices and hollow trees in open savanna woodland.	High
	[2]*Rhinolophus denti*	Dent's Horseshoe Bat	LC	**NT**	Savanna habitats.	High
	[2]*Rhinolophus darlingi*	Darling's Horseshoe Bat	LC	LC	Savanna habitats.	High
	[2]*Tadarida aegyptiaca*	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 MRL	Habitat	Potential of occurrence
MACROSCELIDIDAE	[2]*Elephantulus intufi*	Bushveld Sengi	LC	LC	Arid terrain, including dry savannah woodlands, bushveld, steppe, and semi-deserts. Cover is an essential habitat requirement and is provided by low bushes in open grasslands.	High
	[2]*Macroscelides proboscideus*	Karoo Round-eared Sengi	LC	LC	Open country with a preference for shrubs and areas with sparse grass cover on gravel plains associated with alluvial plains and relatively flat areas between higher elevation areas such as outcrops, scarps, hills, and mountains.	Low
LAGOMORPHA	[2]*Lepus capensis*	Cape Hare	LC	LC	Lives in a wide variety of grassland and open habitat, avoiding only bushy or closed habitats. Preferring dry, open habitats.	High
	[2]*Lepus saxatilis*	Scrub Hare	LC	LC	Typically absent from forest, desert and open grassland regions and prefers savanna woodland and scrub. Adapts well to modified agricultural areas, occurring commonly in croplands and fallow or dilapidated lands, where some degree of bush encroachment has taken place.	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 MRL	Habitat	Potential of occurrence
RODENTIA	[2]*Hystrix africaeaustralis*	Cape Porcupine	LC	LC	Catholic in habitat requirements.	High
	[2]*Xerus inauris*	South African Ground Squirrel	LC	LC	Open terrain with a sparse bush cover and hard substrate.	Confirmed
	[2]*Pedetes capensis*	Springhare	LC	LC	Wide distribution but absent in deserts and forests. Prefers flat, arid and semi-arid areas with short grass.	High
	[2]*Fukomys damarensis*	Damara Mole-rat	LC	LC	Semi-arid regions consisting of red Kalahari sands and sandy soils; habitats include grassland, savannah, thornveld and woodland.	Confirmed
	[2]*Graphiurus microtis*	Small-eared Dormouse	LC	LC	Widespread across a range of savannah and woodland habitats, as well as within rocky areas, caves and disturbed areas.	High
	[2]*Zelotomys woosnami*	Woosnam's Desert Mouse	LC	LC	Associated with riverbeds and pans in sparsely vegetated Acacia woodlands, savannahs and open shrublands with *Vachellia*, *Grewia*, *Terminalia*, and *Rhigozum*. Prefers sandy to fine, consolidated Kalahari-type soils and lime-clay silty soils.	High
	[2]*Saccostomus campestris*	Pouched Mouse	LC	LC	Wide habitat tolerance; prefers soft, sandy soils; open and dense vegetation; rocky areas.	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 MRL	Habitat	Potential of occurrence
RODENTIA	[2]*Steatomys krebsii*	Krebs's Fat Mouse	LC	LC	A variety of habitat types but prefers open grasslands and savannas. Absent from forests and montane grasslands.	High
	[2]*Dendromus melanotis*	Grey Climbing Mouse	LC	LC	Grassland and savanna, where it prefers tall, rank grassland. Can also inhabit riparian-, Afromontane-, and sand forests, wetlands, drainage lines and thickets.	High
	[2]*Malacothrix typica*	Large-eared (Gerbil) Mouse	LC	LC	Short grass habitats over hard soil.	Low
	[2]*Desmodillus auricularis*	Cape Short-tailed Gerbil	LC	LC	Hard ground, unlike other gerbil species, with some cover of grass or karroid bush.	Low
	[2]*Gerbilliscus paeba*	Hairy-footed Gerbil	LC	LC	Open habitat specialist, prefers sandy soils, or sandy alluvium associated with grass, scrub, or thin woodland cover.	Moderate
	[2]*Gerbilliscus leucogaster*	Bushveld Gerbil	LC	LC	Associated with a wide variety of habitats, including bushveld and grasslands and highly transformed habitats.	High
	[2]*Gerbilliscus brantsii*	Highveld Gerbil	LC	LC	Open areas or plains with grass, scrub or open woodland. Avoids heavy consolidated sands or very loose sandy soils.	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 MRL	Habitat	Potential of occurrence
RODENTIA	[2]*Micaelamys namaquensis*	Namaqua Rock Mouse	LC	LC	Catholic habitat requirements, but prefer rocky hills, outcrops, or boulder-strewn hillsides.	Low
	[2]*Aethomys chrysophilus*	Red Veld Rat	LC	LC	Habitat generalist occupying a variety of savannah woodlands.	High
	[2]*Rhabdomys pumilio*	Four-striped Grass Mouse	LC	LC	Essentially a grassland species; occurs in wide variety of habitats where there is good grass cover.	High
	[3]*Mus musculus*	House Mouse	LC	*Not listed*	Wide habitat tolerance.	High
	[2]*Thallomys nigricauda*	Black-tailed Tree Rat	LC	LC	Arid savannas, especially Acacia bushland habitats and Kalahari thornveld with *Vachellia erioloba*, *V. luederitzii, Boscia albitrunca* and *Terminalia sericea* trees.	High
	[2]*Mastomys coucha*	Southern Multimammate Mouse	LC	LC	Wide habitat tolerance.	High
	[2]*Parotomys brantsii*	Brants' Whistling Rat	LC	LC	It is restricted to areas with consolidated sands in semi-desert landscapes, with a low percentage plant cover of 34 - 40%.	Moderate

LIST OF MAMMALS (cont.)

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

	Scientific name	Common name	IUCN	SA MRL	Habitat	Potential of occurrence
EULIPOTYPHLA	[1]*Atelerix frontalis*	South African Hedgehog	LC	**NT**	Generally found in semi-arid savanna and grassland habitats.	High
PRIMATES	[4]*Papio ursinus*	Chacma Baboon	LC	LC	Can exploit fynbos, montane grasslands, riverine courses in deserts, and simply need water and access to refuges.	Low
PHOLIDOTA	[1]*Smutsia temminckii*	Ground Pangolin	**VU**	**VU**	Various woodland and savannah habitats, preferring arid and mesic savannah and semi-arid environments at lower altitudes, often with thick undergrowth. Also found on rocky hills but absent in forest and true desert.	High
TUBULENTATA	[1]*Orycteropus afer*	Aardvark	LC	LC	Wide habitat tolerance, being found in open woodland, scrub and grassland, especially associated with sandy soil.	High

LIST OF MAMMALS (cont.)

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

	Scientific name	Common name	IUCN	SA MRL	Habitat	Potential of occurrence
CARNIVORA	[1]*Vulpes chama*	Cape Fox	LC	LC	Associated with open country, open grassland, grassland with scattered thickets and coastal or semi-desert scrub.	High
	[1]*Otocyon megalotis*	Bat-eared Fox	LC	LC	Mainly short-grass plains, but also in arid, semi-arid or winter rainfall shrublands, and open arid savannah.	Confirmed
	[4]*Canis mesomelas*	Black-backed Jackal	LC	LC	Wide habitat tolerance.	High
	[1]*Mellivora capensis*	Honey Badger	LC	LC	Wide habitat tolerance.	High
	[1]*Poecilogale albinucha*	African Striped Weasel	LC	**NT**	Wide habitat tolerance, but most common in grassland areas.	High
	[1]*Ictonyx striatus*	Striped Polecat	LC	LC	Widely distributed throughout the sub-region.	High
	[2]*Herpestes sanguineus*	Slender Mongoose	LC	LC	Wide habitat tolerance, but areas with adequate cover.	High
	[2]*Cynictis penicillata*	Yellow Mongoose	LC	LC	Semi-arid country on a sandy substrate.	High
	[2]*Suricata suricatta*	Suricate	LC	LC	Open arid country with hard and stony substrate. Occur in Nama- and Succulent Karoo but also fynbos.	Moderate

LIST OF MAMMALS (cont.)

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

	Scientific name	Common name	IUCN	SA MRL	Habitat	Potential of occurrence
CARNIVORA	[2]*Genetta genetta*	Common (Small-spotted) Genet	LC	LC	Occur in open arid habitats.	High
	[1]*Hyaena brunnea*	Brown Hyena	**NT**	**NT**	Found in dry areas, generally with annual rainfall of 100 - 700 mm, particularly along the coast, semi-desert, open scrub, and open woodland savanna.	Low
	[1]*Proteles cristata*	Aardwolf	LC	LC	Common in the 100-600mm rainfall range of country, Nama-Karoo, Succulent Karoo Grassland and Savanna biomes.	High
	[1]*Felis silvestris*	African Wild Cat	LC	LC	Wide habitat tolerance.	High
	[1]*Felis nigripes*	Black-footed cat	**VU**	**VU**	Dry, open savannah, grasslands and Karoo semi-desert with sparse shrub and tree cover and a mean annual rainfall of 100 - 500 mm at altitudes up to 2 000 m.	High
	[4]*Caracal caracal*	Caracal	LC	LC	Caracals tolerate arid regions, occur in semi-desert and karroid conditions.	High
	[1]*Panthera pardus*	Leopard	**VU**	**VU**	Wide habitat tolerance, including woodland, grassland savanna and mountain habitats, but prefers densely wooded and rocky areas.	Low

LIST OF MAMMALS (cont.)

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

	Scientific name	Common name	IUCN	SA MRL	Habitat	Potential of occurrence
SUIFORMES	[2]*Phacochoerus africanus*	Common Warthog	LC	LC	Open country, lightly wooded areas and savanna; also penetrates otherwise unsuitable country along watercourses.	Low
CETARTIODACTYLA	[2]*Tragelaphus strepsiceros*	Greater Kudu	LC	LC	Wooded savanna and arid areas with stands of bush; wooded watercourses, acacia woodland and rocky hill country.	High
	[2]*Oryx gazella*	Gemsbok	LC	LC	Semi-arid and arid bushland and grassland of the Kalahari and Karoo and adjoining regions of Southern Africa.	Moderate
	[2]*Connochaetes taurinus*	Blue Wildebeest	LC	LC	Open savanna woodland and open grassland with access to drinking water.	Low
	[2]*Alcelaphus caama*	Red Hartebeest	LC	LC	Open savanna country and open woodland.	Low
	[2]*Antidorcas marsupialis*	Springbok	LC	LC	Open arid plains with short vegetation	Low
	[2]*Oreotragus oreotragus*	Klipspringer	LC	LC	Steep rocky and mountainous habitats, i.e., granite outcrops, koppies and gorges with rocky embankments	Low
	[2]*Raphicerus campestris*	Steenbok	LC	LC	Wide habitat tolerance.	High
	[2]*Sylvicapra grimmia*	Common Duiker	LC	LC	Wide habitat tolerance.	High

LIST OF REPTILES

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

Family	Scientific name	Common name	IUCN status
AGAMIDAE	[3]*Agama aculeata aculeata*	Western Ground Agama	LC
	[3]*Agama atra*	Southern Rock Agama	LC
AMPHISBAENIDAE	[3]*Monopeltis infuscata*	Dusky Worm Lizard	LC
	[3]*Monopeltis mauricei*	Maurice's Spade-snouted Worm Lizard	LC
CHAMAELEONIDAE	[1]*Chamaeleo dilepis dilepis*	Common Flap-neck Chameleon	LC
COLUBRIDAE	[3]*Dispholidus typus*	Boomslang	LC
	[2]*Philothamnus semivariegatus*	Spotted Bush Snake	LC
	[3]*Telescopus semiannulatus semiannulatus*	Eastern Tiger Snake	LC
CORDYLIDAE	[1]*Karusasaurus polyzonus*	Southern Karusa Lizard	LC
ELAPIDAE	[3]*Aspidelaps scutatus scutatus*	Common Shield Cobra	LC
	[3]*Naja nigricincta woodi*	Black Spitting Cobra	LC
	[3]*Naja nivea*	Cape Cobra	LC
GEKKONIDAE	[3]*Chondrodactylus angulifer angulifer*	Common Giant Gecko	LC
	[3]*Chondrodactylus bibronii*	Bibron's Gecko	LC
	[3]*Colopus wahlbergii wahlbergii*	Kalahari Ground Gecko	LC
	[3]*Pachydactylus capensis*	Cape Gecko	LC
	[3]*Pachydactylus rugosus*	Common Rough Gecko	LC
	[3]*Ptenopus garrulus garrulus*	Common Barking Gecko	LC
	[3]*Ptenopus garrulus maculatus*	Spotted Barking Gecko	LC
LACERTIDAE	[2]*Heliobolus lugubris*	Bushveld Lizard	LC
	[2]*Meroles squamulosus*	Common rough-scaled Lizard	LC
	[2]*Meroles suborbitalis*	Spotted Desert Lizard	LC
	[2]*Nucras intertexta*	Spotted Sandveld Lizard	LC
	[2]*Pedioplanis lineoocellata lineoocellata*	Spotted Sand Lizard	LC
	[2]*Pedioplanis namaquensis*	Namaqua Sand Lizard	LC
LAMPROPHIIDAE	[2]*Boaedon capensis*	Common House Snake	LC
	[2]*Lycophidion capense capense*	Cape Wolf Snake	LC
	[2]*Prosymna sundevallii*	Sundevall's Shovel-snout	LC
	[3]*Psammophis trinasalis*	Fork-marked Sand Snake	LC
	[3]*Pseudaspis cana*	Mole Snake	LC
	[3]*Xenocalamus bicolor bicolor*	Bicoloured Quill-snouted Snake	LC
PELOMEDUSIDAE	[3]*Pelomedusa subrufa*	Marsh Terrapin	LC
PYTHONIDAE	[1]*Python natalensis*	Southern African Python	LC

LIST OF REPTILES (cont.)

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

Family	Scientific name	Common name	IUCN status
SCINCIDAE	[3]*Acontias gracilicauda*[E]	Thin-tailed Legless Skink	LC
	[3]*Acontias kgalagadi kgalagdi*	Kgalagadi Legless Skink	LC
	[3]*Trachylepis occidentalis*	Western Three-striped Skink	LC
	[3]*Trachylepis punctulata*	Speckled Sand Skink	LC
	[3]*Trachylepis sparsa*	Karasburg Tree Skink	LC
	[3]*Trachylepis spilogaster*	Kalahari Tree Skink	LC
	[3]*Trachylepis sulcata sulcata*	Western Rock Skink	LC
	[3]*Trachylepis variegata*	Variegated Skink	LC
TESTUDINIDAE	[2]*Psammobates oculifer*	Serrated Tent Tortoise	LC
	[2]*Stigmochelys pardalis*	Leopard Tortoise	LC
VARANIDAE	[2]*Varanus albigularis albigularis*	Southern Rock Monitor	LC
VIPERIDAE	[3]*Bitis arietans arietans*	Puff Adder	LC
	[3]*Bitis caudalis*	Horned Adder	LC

LIST OF AMPHIBIANS

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

Family	Scientific name	Common name	IUCN status
BUFONIDAE	[2]*Amietophrynus gutturalis*	Guttural Toad	LC
	[2]*Amietophrynus poweri*	Western Olive Toad	LC
	[2]*Amietophrynus garmani*	Garman's Toad	LC
	[2]*Vandijkophrynus gariepensis*[E]	Karoo Toad	LC
HYPEROLIIDAE	[2]*Kassina senegalensis*	Bubbling Kassina	LC
MICROHYLIDAE	[2]*Breviceps adspersus*	Bushveld Rain Frog	LC
PIPIDAE	[2]*Xenopus laevis*	Common Platanna	LC
PYXICEPHALIDAE	[2]*Amietia angolensis*	Common River Frog	LC
	[2]*Cacosternum boettgeri*	Boettger's Caco	LC
	[2]*Tomopterna cryptotis*	Tremolo 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	SA Red Data Book of Birds
1	*Accipiter badius*	Shikra		
2	*Acrocephalus baeticatus*	African Reed-Warbler		
2	*Acrocephalus schoenobaenus*	Sedge Warbler		
2	*Actitis hypoleucos*	Common Sandpiper		
2	*Alario alario*	Black-headed Canary		
2	*Alcedo cristata*	Malachite Kingfisher		
2	*Alopochen aegyptiacus*	Egyptian Goose		
2	*Amadina erythrocephala*	Red-headed Finch		
2	*Amaurornis flavirostris*	Black Crake		
2	*Anas capensis*	Cape Teal		
2	*Anas erythrorhyncha*	Red-billed Teal		
2	*Anas hottentota*	Hottentot Teal		
2	*Anas smithii*	Cape Shoveler		
2	*Anas sparsa*	African Black Duck		
2	*Anas undulata*	Yellow-billed Duck		
2	*Anhinga rufa*	African Darter		
2	*Anthoscopus minutus*	Cape Penduline-Tit		
2	*Anthropoides paradisea*	Blue Crane	**VU**	**NT**
2	*Anthus cinnamomeus*	African Pipit		
2	*Anthus crenatus*	African Rock Pipit	**NT**	**NT**
2	*Anthus vaalensis*	Buffy Pipit		
2	*Apus affinis*	Little Swift		
2	*Apus apus*	Common Swift		
2	*Apus bradfieldi*	Bradfield's Swift		
2	*Apus caffer*	White-rumped Swift		
1	*Aquila rapax*	Tawny Eagle	**VU**	**EN**
1	*Aquila verreauxii*	Verreaux's Eagle		**VU**
2	*Ardea cinerea*	Grey Heron		
2	*Ardea melanocephala*	Black-headed Heron		
2	*Ardea purpurea*	Purple Heron		
2	*Ardeotis kori*	Kori Bustard	**NT**	**NT**
2	*Batis pririt*	Pririt Batis		
2	*Bostrychia hagedash*	Hadeda Ibis		
2	*Bradornis infuscatus*	Chat Flycatcher		
2	*Bradornis mariquensis*	Marico Flycatcher		
2	*Bubalornis niger*	Red-billed Buffalo-Weaver		
1	*Bubo africanus*	Spotted Eagle-Owl		
1	*Bubo lacteus*	Verreaux's Eagle-Owl		
2	*Bubulcus ibis*	Cattle Egret		
2	*Burhinus capensis*	Spotted Thick-knee		
1	*Buteo rufofuscus*	Jackal Buzzard		

LIST OF BIRDS (cont.)

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

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

LIST OF BIRDS (cont.)

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

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

LIST OF BIRDS (cont.)

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

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

LIST OF BIRDS (cont.)

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

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

LIST OF BIRDS (cont.)

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

	Scientific name	Common name	IUCN Status	SA Red Data Book of Birds
2	*Psophocichla litsipsirupa*	Groundscraper Thrush		
2	*Pternistis adspersus*	Red-billed Francolin		
2	*Pterocles bicinctus*	Double-banded Sandgrouse		
2	*Pterocles burchelli*	Burchell's Sandgrouse		
2	*Pterocles namaqua*	Namaqua Sandgrouse		
1	*Ptilopsus granti*	Southern White-faced Scops-Owl		-
3	*Pycnonotus nigricans*	African Red-eyed Bulbul		
2	*Pytilia melba*	Green-winged Pytilia		
3	*Quelea quelea*	Red-billed Quelea		
2	*Rallus caerulescens*	African Rail		
2	*Recurvirostra avosetta*	Pied Avocet		
2	*Rhinopomastus cyanomelas*	Common Scimitarbill		
2	*Rhinoptilus africanus*	Double-banded Courser		
2	*Rhinoptilus chalcopterus*	Bronze-winged Courser		
2	*Riparia cincta*	Banded Martin		
2	*Riparia paludicola*	Brown-throated Martin		
2	*Riparia riparia*	Sand Martin		
1	*Sagittarius serpentarius*	Secretarybird	**EN**	**VU**
2	*Saxicola torquatus*	African Stonechat		
2	*Scleroptila levaillantoides*	Orange River Francolin		
2	*Scopus umbretta*	Hamerkop		
2	*Serinus albogularis*	White-throated Canary		
2	*Serinus atrogularis*	Black-throated Canary		
2	*Serinus flaviventris*	Yellow Canary		
2	*Sigelus silens*	Fiscal Flycatcher		
2	*Spizocorys conirostris*	Pink-billed Lark		
2	*Spizocorys starki*	Stark's Lark		
2	*Sporopipes squamifrons*	Scaly-feathered Finch		
2	*Spreo bicolor*	Pied Starling		
2	*Stenostira scita*	Fairy Flycatcher		
2	*Streptopelia capicola*	Cape Turtle-Dove		
2	*Streptopelia semitorquata*	Red-eyed Dove		
2	*Streptopelia senegalensis*	Laughing Dove		
2	*Struthio camelus*	Common Ostrich		
2	*Sylvia borin*	Garden Warbler		
2	*Sylvietta rufescens*	Long-billed Crombec		
2	*Tachybaptus ruficollis*	Little Grebe		
2	*Tachymarptis melba*	Alpine Swift		
2	*Tadorna cana*	South African Shelduck		
2	*Tchagra australis*	Brown-crowned Tchagra		
2	*Telophorus zeylonus*	Bokmakierie		

LIST OF BIRDS (cont.)

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

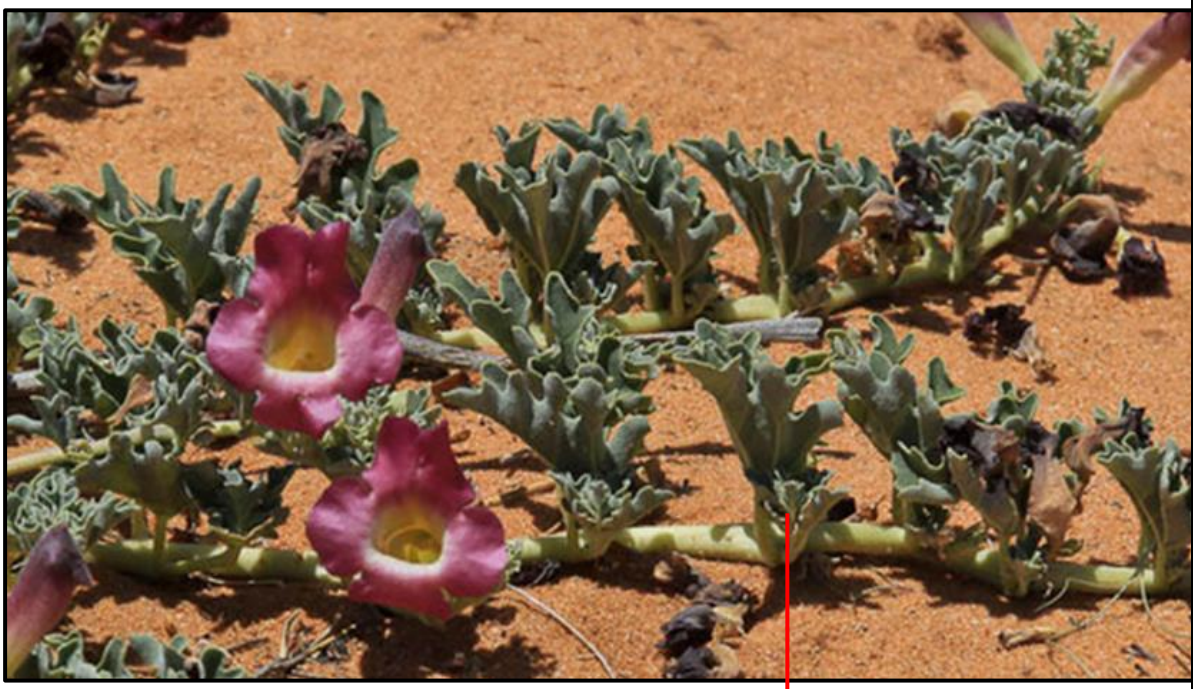
	Scientific name	Common name	IUCN Status	SA Red Data Book of Birds
1	*Terathopius ecaudatus*	Bateleur	**EN**	**EN**
2	*Threskiornis aethiopicus*	African Sacred Ibis		
2	*Tockus leucomelas*	Southern Yellow-billed Hornbill		
2	*Tockus nasutus*	African Grey Hornbill		
1	*Torgos tracheliotus*	Lappet-faced Vulture	**EN**	**EN**
2	*Tricholaema leucomelas*	Acacia Pied Barbet		
2	*Tringa glareola*	Wood Sandpiper		
2	*Tringa nebularia*	Common Greenshank		
2	*Tringa stagnatilis*	Marsh Sandpiper		
2	*Turdoides bicolor*	Southern Pied Babbler		
2	*Turdus smithi*	Karoo Thrush		
2	*Turnix sylvatica*	Small Buttonquail		
1	*Tyto alba*	Barn Owl		-
2	*Upupa africana*	African Hoopoe		
3	*Urocolius indicus*	Red-faced Mousebird		
2	*Vanellus armatus*	Blacksmith Lapwing		
2	*Vanellus coronatus*	Crowned Lapwing		
2	*Vidua chalybeata*	Village Indigobird		
2	*Vidua macroura*	Pin-tailed Whydah		
2	*Vidua regia*	Shaft-tailed Whydah		
2	*Zosterops pallidus*	Orange River White-eye		

APPENDIX 3

A photographic guide for species of conservation concern that was encountered on site and those with a high potential to occur on site

Harpagophytum procumbens subsp. *procumbens*

This species is protected in terms of Schedule 1 of the NCNCA



A perennial, prostrate creeper with annual stems

Rough, shallowly-lobed leaves

Dry seed head (Devil's claw)

Lessertia frutescens

All *Lessertia* spp. are protected in terms of Schedule 1 of NCNCA

- Small shrublet with leaves being:
  - Hairy
  - Imparipinnate; i.e. leaflets arranged on either side of the stem, typically in pairs opposite each other, with a single leaflet at the apex.
- Pods are membranous, slightly inflated or compressed
- Typical pea flowers

Gymnosporia buxifolia

All *Gymnosporia* spp. are protected under Schedule 2 of the NCNCA

Spiny shrub or small tree. Leaves in tufts, obovate, toothed above. Highly variable

Many white flowers with an unpleasant smell in axillary cymes.

Lapeirousia littoralis

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

Above-ground part is 5 - 35 cm tall, carrying up to 12 flowers.

Flower colours in shades of white to cream, rarely purple, with or without markings on lower tepals.

Oxalis lawsonii

All *Oxalis* spp. are protected under Schedule 2 of the NCNCA

Nerine laticoma

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

Vachellia erioloba

This species is protected under the NFA

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

Vachellia haematoxylon

This species is protected under the NFA

Leaves and young stems are grey-velvety; giving this species their characteristic grey appearance.

Spines are straight and slender