(NC) 30/5/1/1/2/12842 PR

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ECOLOGICAL CONSULTING

ECOLOGICAL ASSESSMENT REPORT

THUNDERFLEX 78 (PTY) LTD

Kannikwa Diamond Prospecting Operation

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THUNDERFLEX 78 (PTY) LTD

The Farm Kannikwa 156

The Farm Kannikwa Vlakte 157

District of Namakwa

Northern Cape Province

Ecological Assessment Report in application for Environmental Authorisation related to a Prospecting Right Application ((NC) 30/5/1/ 2/2/12842 PR) that was lodged with the Department of Mineral Resources

June 2022

EXECUTIVE SUMMARY

Thunderflex 78 (Pty) Ltd is proposing the prospecting of diamonds on the Farm Kannikwa 156 and the Farm Kannikwa Vlakte 157. The prospecting right area is located within the Namakwa District Municipality of the Northern Cape Province. Thunderflex 78 has submitted a Prospecting Right application, which triggers the requirement to apply for Environmental Authorisation. An ecological assessment is required to consider the impacts that the proposed activities might have on the ecological integrity of the property. This terrestrial ecological assessment report describes the ecological characteristics and biodiversity of the proposed prospecting area, identifies the source of impacts from the 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 identify the ecological characteristics and sensitivity of the site. Five plant communities were identified within the area earmarked for prospecting activities in the study area. Of these, the Kamma River is most sensitive (Very High), primarily based on its national protection status as a watercourse. The remainder of the site is of High sensitivity based on several red listed plant species recorded here, and potential important habitat it provides to red listed mammals, birds, reptiles, amphibian, and invertebrate species. The most profound impacts expected to be related to the proposed prospecting operation include cumulative loss of intact Succulent Karoo habitat and associated range-restricted flora and fauna species. Permit applications need to be lodged with the Northern Cape Department of Environment and Nature Conservation three months prior to any destruction, death or displacement of protected flora and fauna species.

The destruction of sensitive natural habitats on site is inevitable. The significance of the impacts will ultimately be affected by the success of the mitigation measures implemented during the prospecting operation. Authorisation for the proposed operation should therefore not be granted unless the applicant commits to strictly adhere to effective avoidance, management, mitigation and rehabilitation measures.

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1. INTRODUCTION

1.1. Background information

Thunderflex 78 (Pty) Ltd is proposing the prospecting of diamonds on the Farm Kannikwa 156 and the Farm Kannikwa Vlakte 157 (from hereon referred to as Kannikwa). It is located within the Namakwa District Municipality of the Northern Cape Province and lies approximately 15 km south-east of the town Port Nolloth on the R382 that leads to Steinkopf (Figure 1). The total extent of the prospecting right area is ± 11 873 ha. Thunderflex 78 has submitted a Prospecting Right application, which triggers the requirement for Environmental Authorisation. An ecological assessment is required to consider the impacts that the proposed activities might have on the ecological integrity of the property and therefore Boscia Ecological Consulting has been appointed by the applicant to conduct a desktop assessment and field investigation and provide an ecological assessment report. This assessment report describes the characteristics of 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 and residual impacts after closure. 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, which should be included in the EMPR.

1.2. Scope of study

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

- conduct a desktop study and field investigation to identify and describe different ecological habitats 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,
  - indicates the ecological sensitivity of habitats and conservation values of species,
  - determines the potential impacts of the project on the ecological integrity,
  - provides mitigation measures and recommendations to limit project impacts,
  - indicate ecological responsibilities pertaining to relevant conservation legislation.

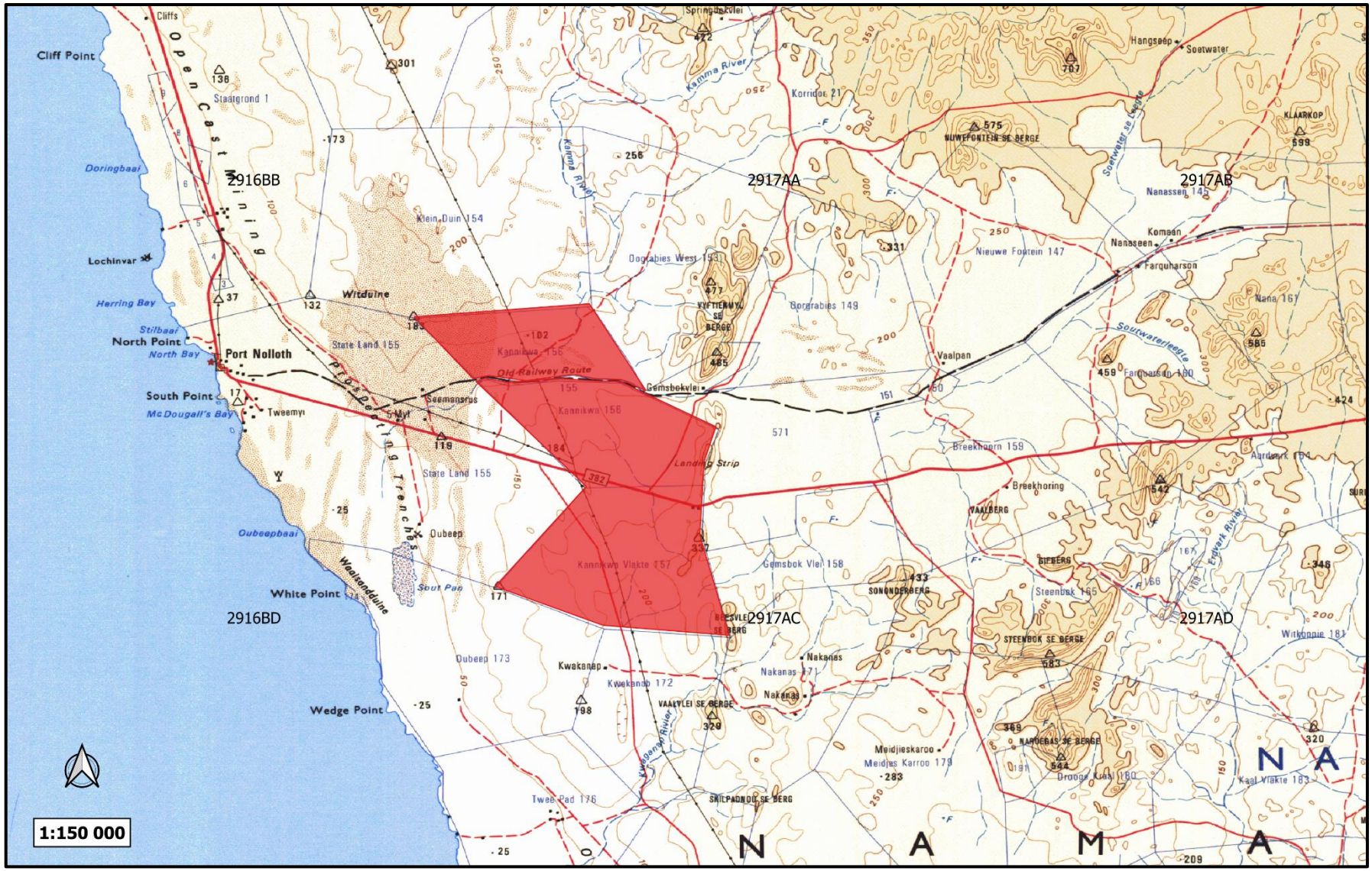


Figure 1. The location of the Kannikwa prospecting area is indicated in red.

1.3. Details of the specialist consultant

Company Name	Boscia Ecological Consulting cc	**Registration no:**	2011/048041/23
Address	PostNet Suite 0216 Private Bag X37 Lynnwood Ridge 0040		
Contact Person	Dr Elizabeth (Betsie) Milne (Pr. Sci. Nat)		
Contact Details	Cell: 082 992 1261	Email: BosciaEcology@gmail.com	
Qualifications	Professional Natural Scientist - Ecological Science (Registration No: 131395) PhD Botany (Nelson Mandela Metropolitan University), Masters Environmental Management (University of the Free State), BTech Nature Conservation (Tshwane University of Technology)		
Declaration of independence	I, Elizabeth (Betsie) Milne, owner of Boscia Ecological Consulting, declare that I: • act as the independent specialist in this application, • regard the information contained in this report as it relates to my specialist input/study to be true and correct, • do not have, and will not have any financial interest in the undertaking of the activity; other than the remuneration of work performed in terms of the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act, • have and will not have any vested interest in the activity proceedings, • have no, and will not engage in conflicting interest in the undertaking of the activities, • undertake to disclose to the component authority any material information that have or may have the potential to influence the decision of the competent authority, or the objectivity of any report, plan or document required in terms of the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act, • will provide the competent authority with access to all information at my disposal regarding the study.  ……		

1.4. Description of the proposed activity

The prospecting operation is primarily based on diamond deposits that are restricted to the alluvial terraces of the paleo-alluvial channels of the Kamma River (Figure 2). The deposits will be sampled by means of drilling, pitting, and trenching, using a phased approached.

First, approximately 100 – 200 reverse circulation boreholes of 20 – 40 m deep will be drilled across a grid on the alluvial terraces in the study area to determine the distribution of the gravel body. Thereafter, 20 trenches (150 m x 100 m x 0.5 - 7 m each) will be created to test the gravels, of which five will undergo bulk sampling. This will be performed by means of an opencast method using heavy earthmoving machinery. Vegetated soil or overburden will be stripped, and the underlying gravels will be excavated, screened, and treated through a rotary plan plant before fed to a sorting plant for final recovery. The rough diamond product will then be removed for further beneficiation. No ore processing reagents are required or used in the treatment of the ore. An estimated total volume of 300 000 m^3 and 157 500 m^3 for trenching and bulk sampling will be processed, respectively over 5 years.

Prospecting activities will make use of existing roads where possible, but haul roads will be created to access the prospecting areas. Supporting infrastructure include temporary office, workshop and ablution facilities with chemical toilets, storm water control berms, water tanks, fuel storage facility, wash bay, salvage yard, waste disposal site, a central processing plant and pipeline infrastructure.

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 a relatively comprehensive data set for the assessment.

The fieldwork component was conducted on 15 - 17 November 2021 and most data for the desktop assessment was obtained from the quarter degree squares that include the study area (2916BB, 2916BD, 2917AA and 2917AC).

Figure 2. The proposed core footprint area of prospecting activities on Kannikwa.

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, associated species 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 Richtersveld (NC061) Local Municipality, in which the study area falls.

Further searches were undertaken specifically for Red List plant species within the current study area. Historical occurrences of Red List plant species were obtained from the SANBI: POSA database for the broad geographical area that includes the study site (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).

2.3. Fauna

2.3.1. Desktop Survey

A desktop survey was undertaken to obtain lists of mammals, reptiles, amphibians, birds, fish, and invertebrate species which are likely to occur in the study area.

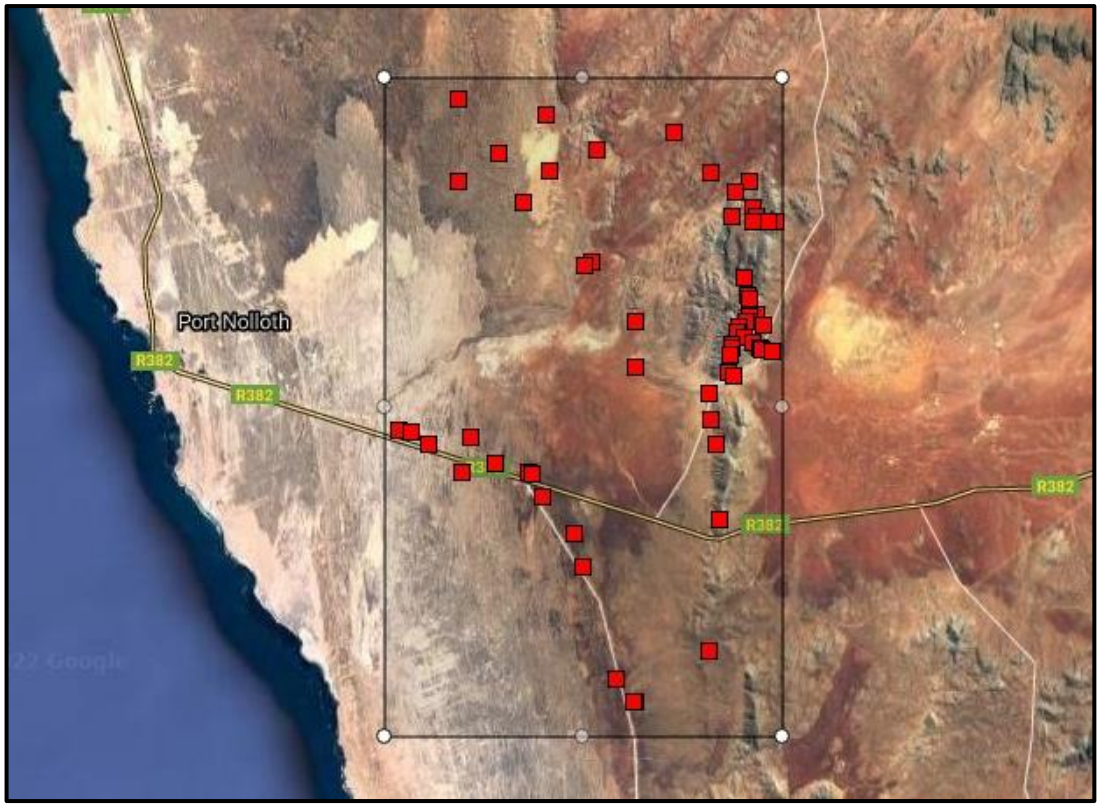


Figure 3. The extent of the map filter applied on the POSA website to extract species information is shown by the large black square. The small red squares indicate historical data points.

The faunal species lists 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, Kleynhans (2007) for fish and Thirion (2007), Picker et al. (2004) and Griffiths et al. (2015) for invertebrates. A map of important bird areas (BirdLifeSA 2015) was also consulted.

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

The likelihood of Red Data species occurring on site was determined using the distribution maps in the Red Data reference books (Friedmann and Daly 2004, Minter et al. 2004, Bates et al. 2014, Taylor et al. 2015, ADU 2016) and comparing their habitat preferences with the habitats described from the field survey. The conservation status of each species is also listed, based on the IUCN Red List Categories and Criteria (IUCN 2019) and the various red lists/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. Assumptions and limitations

The field survey took place during early summer. This was not an optimal time of the year for this succulent karoo habitat, because it predominantly receives winter rainfall. According to the landowner the area has also been experiencing severe drought. Most of the succulents were dead or dormant, but some shrubs and grasses were flowering or in fruit. The vegetation was therefore not in the most favourable state for the assessment. Furthermore, due to the brief duration of the survey, the species list obtained cannot be regarded as comprehensive. Ideally, a site should be visited several times during different seasons to ensure a full complement of plant and animal species present, are captured. However, this is rarely possible due to time and cost constraints related to prospecting right application processes.

No access was granted for the areas south of the R382 and therefore these areas could not be fully assessed and potentially compromised the accuracy of this assessment. Nevertheless, the survey focussed on the larger portion north of the R382, for which landowners' permission could be obtained. The findings obtained from these areas were then extrapolated to the entire prospecting right area. The hills lining the eastern border of the study area were not included in this assessment, since they have not been earmarked for the prospecting activities.

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

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

3. DESCRIPTION OF THE AFFECTED ENVIRONMENT

3.1. Current and historic land use

The major land uses in the area are mining and agriculture. The land capability of the study site is non-arable with variable potential grazing land, i.e., moderate (north-western corner), low (most of the remaining parts) and very low (hills in the east). The grazing capacity is 60 - 72 ha/LSU, with the agricultural region being demarcated for sheep farming.

Apart from the proposed prospecting activities, the Kannikwa Vlakte Wind Farm Project was granted on the Farm Kannikwa Vlakte 157, and the Eskom's Gromis-Oranjemund Transmission Power Line servitude runs through the study area (Figure 4). Furthermore, the regional route R382 as well as the Kleinsee- and Lekkersing public gravel roads cut through the study area. An old rail route, which has been left abandoned for decades runs in between the property boundaries in the north and has therefore been excluded from the application area.

Currently, the study area is used as natural pastures for livestock grazing. Existing infrastructure includes a landing strip and numerous farm tracks (Figure 4). Ample evidence of historic diggings, for road construction and diamonds, are also present, along with old buildings and ruins. Besides the alluvial diamond deposits, other minerals known to occur here include Kieselguhr and Dimension Stone (quartzite).

3.2. Geology, soils, and topography

According to the 1:250 000 Geological Map of 2916 Springbok, published by the Council for Geoscience in 2001, the geological features on Kannikwa comprise Quaternary, Namibian and Kheisian deposits. Most of the site comprise sand, with white to light pink sand in the west, transitioning to red wind-blown sand and semiconsolidated piedmont deposits eastwards (Figure 5). The hills in the north-east and some rocky outcrops in the centre of the study area are associated with feldspathic quartzite, arkose and intermediate to felsic lava and tuff (Vredefontein Formation) of the Stinkfontein subgroup (Port Nolloth Group - Gariep Supergroup). The hills in the south-east comprise Lekkersing quartzite and flagstone of the Stinkfontein subgroup, surrounding a very small portion of pinkish Nonoemaasberg Gneiss of the Gladkop suite (Figure 5). The earmarked diamondiferous gravels lie beneath the sandy deposits of the study area.

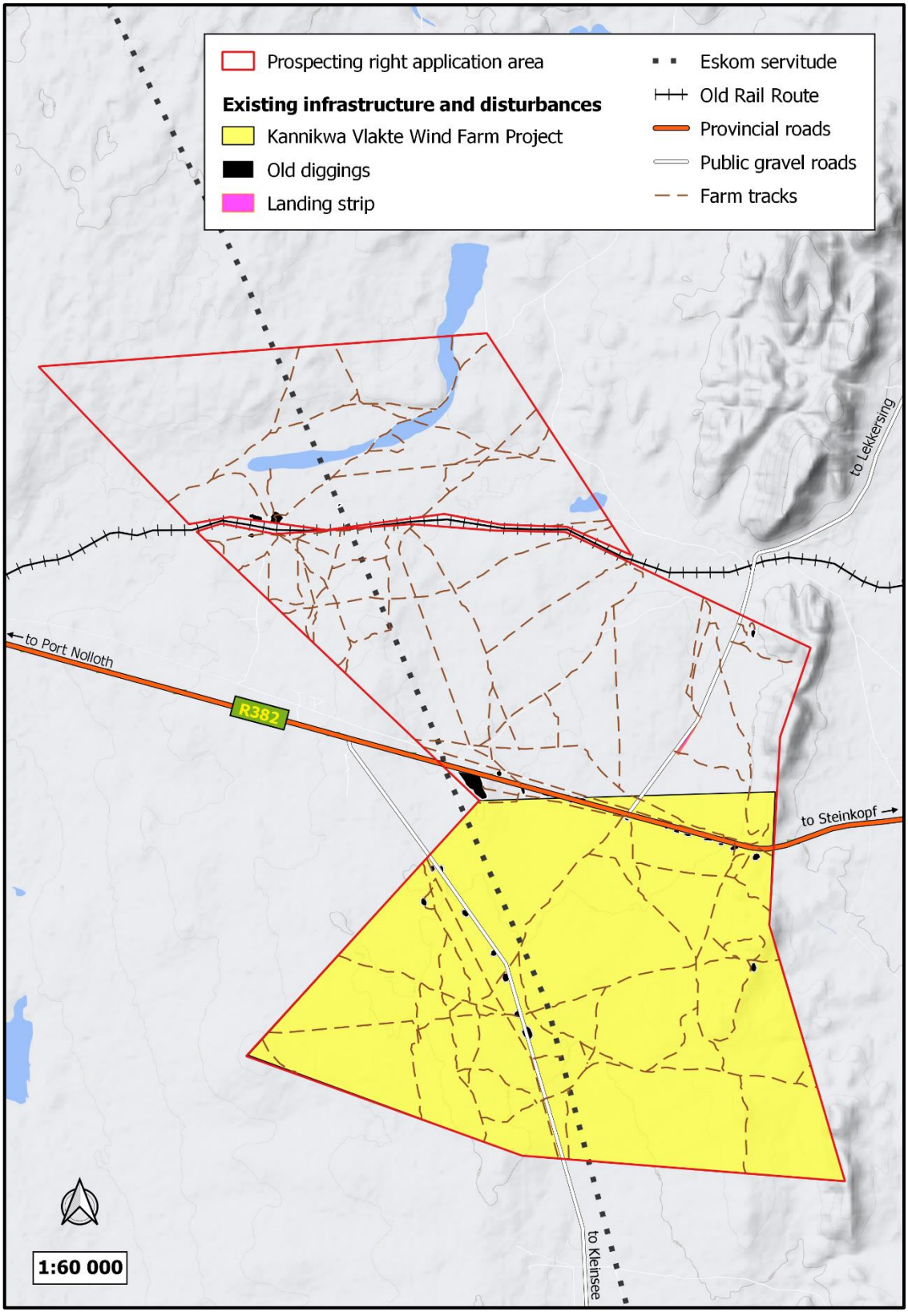


Figure 4. Evidence of existing infrastructure and past disturbances in the study area.

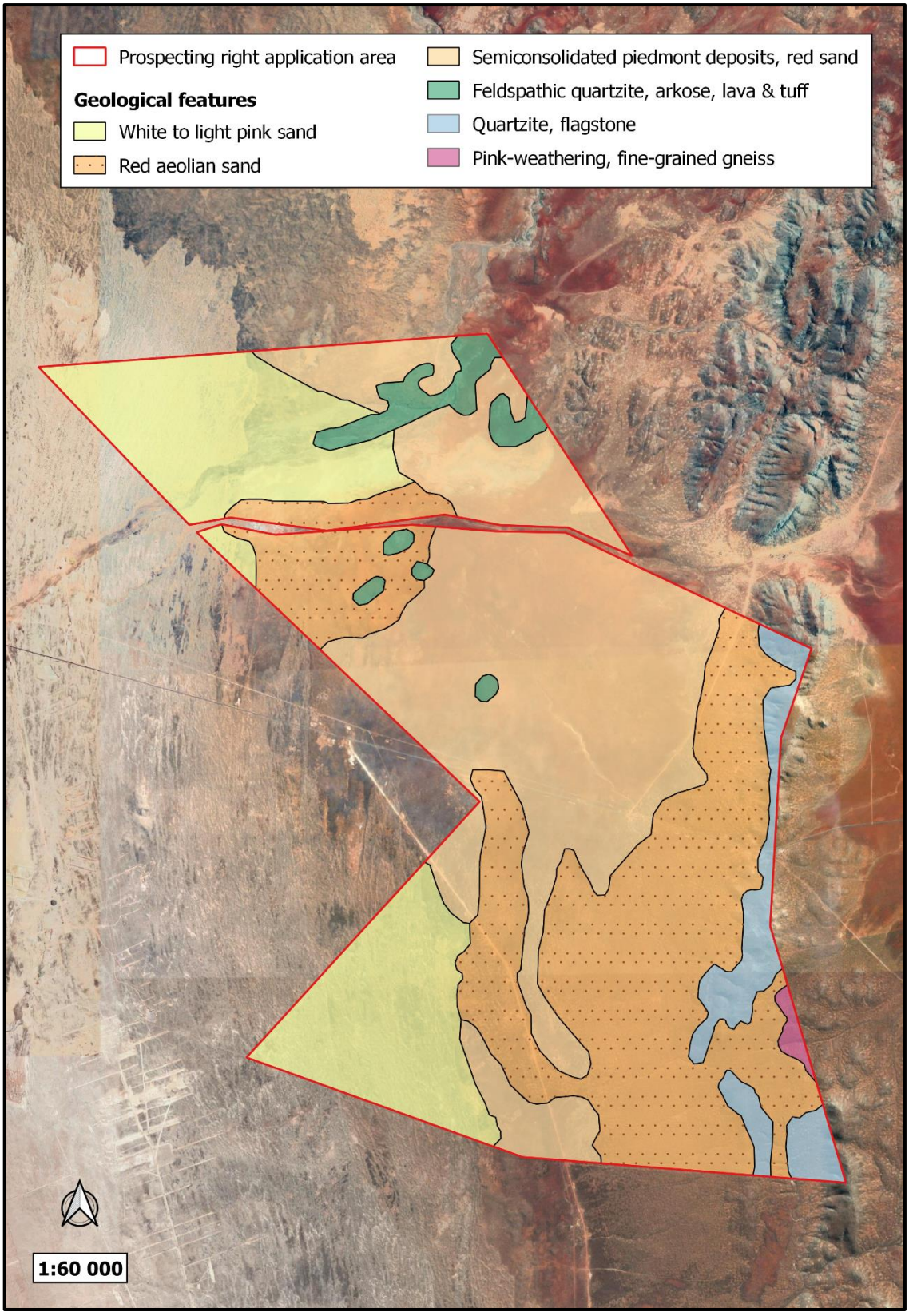


Figure 5. The distribution of geological features in the study area.

The terrain varies from plains with open high hills or ridges in the north, level plains with some relief in the west, plains with open low hills or ridge in the centre, and irregular plains with low mountains in the east. is characterised by irregular plains, with low hills or ridges in the east. Altitude ranges from 100 - 200 m above sea level on the plans, 220 – 280 m on the hill slopes, and 300 – 350 m along the hill tops. The terrain on the plains varies between a gentle slope of 1 % to moderate slopes of up to 5 %. Steeper slopes (11 – 22 %) are found on the hills and ridges.

Land types found on the property include Ae71, Af17, Ag52, Ai12, Ah33 and Ha32 (Figure 6). Most of the property, especially the central parts, is characterised by red-yellow apedal, well drained soils, red with high base status and deeper than 300 mm. This depicts the Ae71 and Af17 landtypes, with Af17 usually associated with dunes while Ae71 is not. Ai12 and Ah33 are also associated with red-yellow apedal, well drained soils, but with yellow (Ai12) or red and yellow (Ah33) soil, with high base status and usually contain less than 15% clay. In the Ha32 landtype, grey sandy soils are dominant, while Ag52 represents soils with minimal development, usually shallow, on hard or weathering rock, with or without intermittent diverse soils. Lime generally present in part or most of the landscape.

The terrain has low to moderately low susceptibility in terms of erosion and flooding hazards. However, the susceptibility of soils to wind erosion is very high, with high to moderately high susceptibility to water erosion. The soils also have a high to very high susceptibility to compaction.

3.3. 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.

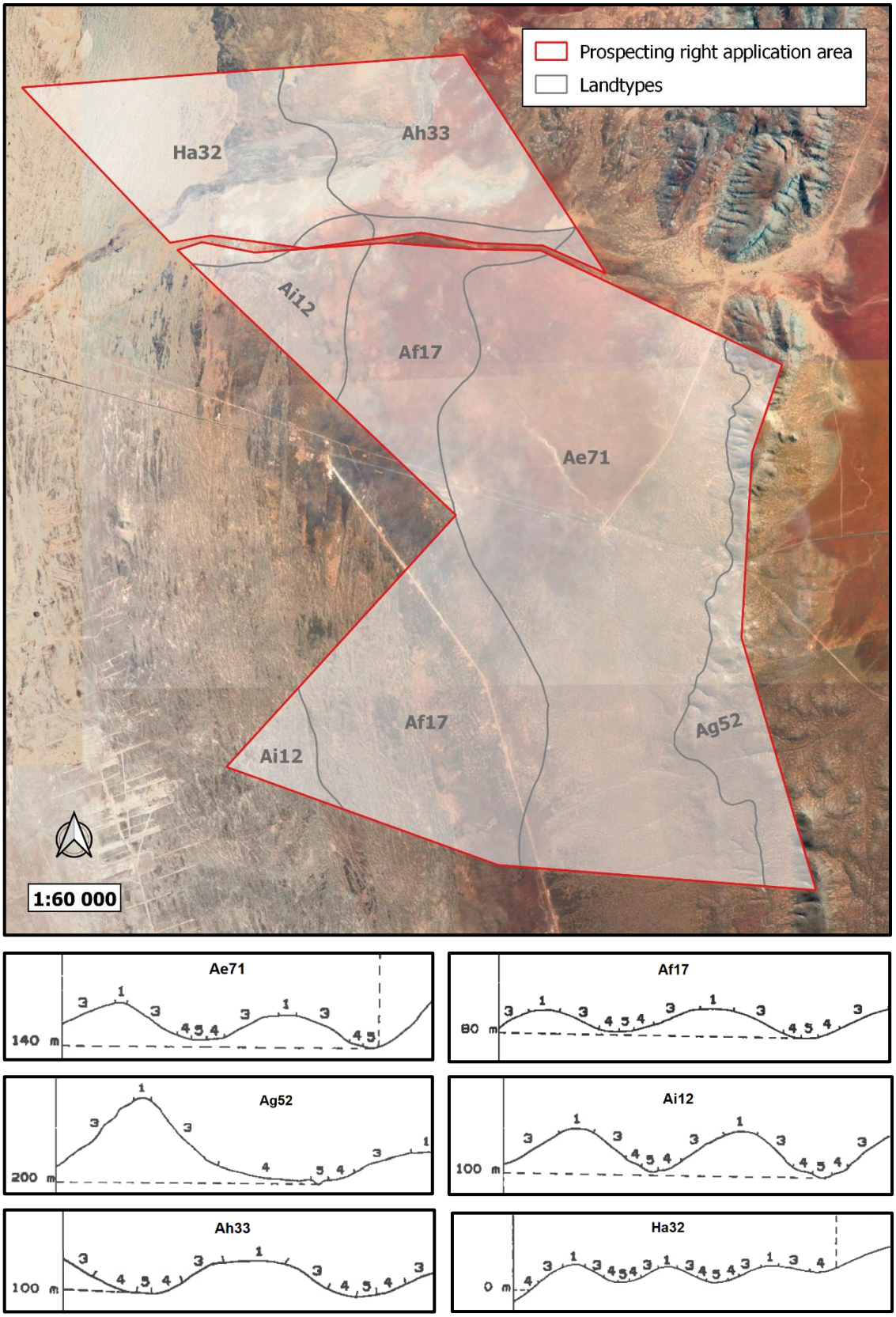


Figure 6. The distribution of land types in the study area (top) and their terrain form sketches (bottom).

The purpose of this Act (Section 2) is to ensure that the nation's water resources are protected, used, developed, conserved, managed and controlled in ways which take into account amongst other factors - (g) protecting aquatic and associated ecosystems and their biological diversity and (h) reducing and preventing pollution and degradation of water resources. No activity may take place within a watercourse unless authorised by the Department of Water and Sanitation (DWS). Any area within a wetland or riparian zone is therefore excluded from development unless authorisation is obtained from the DWS in terms of Section 21 (c) and (i).

The Kannikwa study area falls within the Coastal quaternary catchments F20B, F20C, F20D, F20E of the Lower Orange Water Management Area (Figure 7). These quaternary catchments have all been allocated a Present Ecological State (PES) of 'Largely Natural' (B) by Smook et al. (2002) and information regarding their mean annual rainfall, evaporation potential and runoff is provided in Table 2.

According to the South African Inventory of Inland Aquatic Ecosystems (SAIIAE), the study area falls within the Namaqualand Sandveld Bioregion, where about 1.9 % (17 797 ha) of the land area is covered by inland wetlands, including depressions, floodplains, seeps, and valley-bottom wetland types (Van Deventer et al. 2019). The spatial extent according to the present ecological status per wetland type is depicted in Table 3. Basically, all floodplains and valley-bottom wetlands have been severely modified, but most of the seep wetlands are still in natural or near-natural condition. Many of the depressional wetlands have been moderately (60 %) to severely (22 %) modified, but about 16 % are still in a largely natural condition.

Table 2. Catchment characteristics for the Coastal quaternary catchments in which the study area falls, as presented by Smook et al. (2002).

Quaternary catchment	Catchment Area (km^2)	Mean Annual Rainfall (mm)	Mean Annual Evaporation (mm)	Mean Annual Runoff (10^6 m^3)
F20B	514	91	2 100	0.18
F20C	613	80	2 100	0.13
F20D	455	71	2 100	0.06
F20E	435	92	2 100	0.15

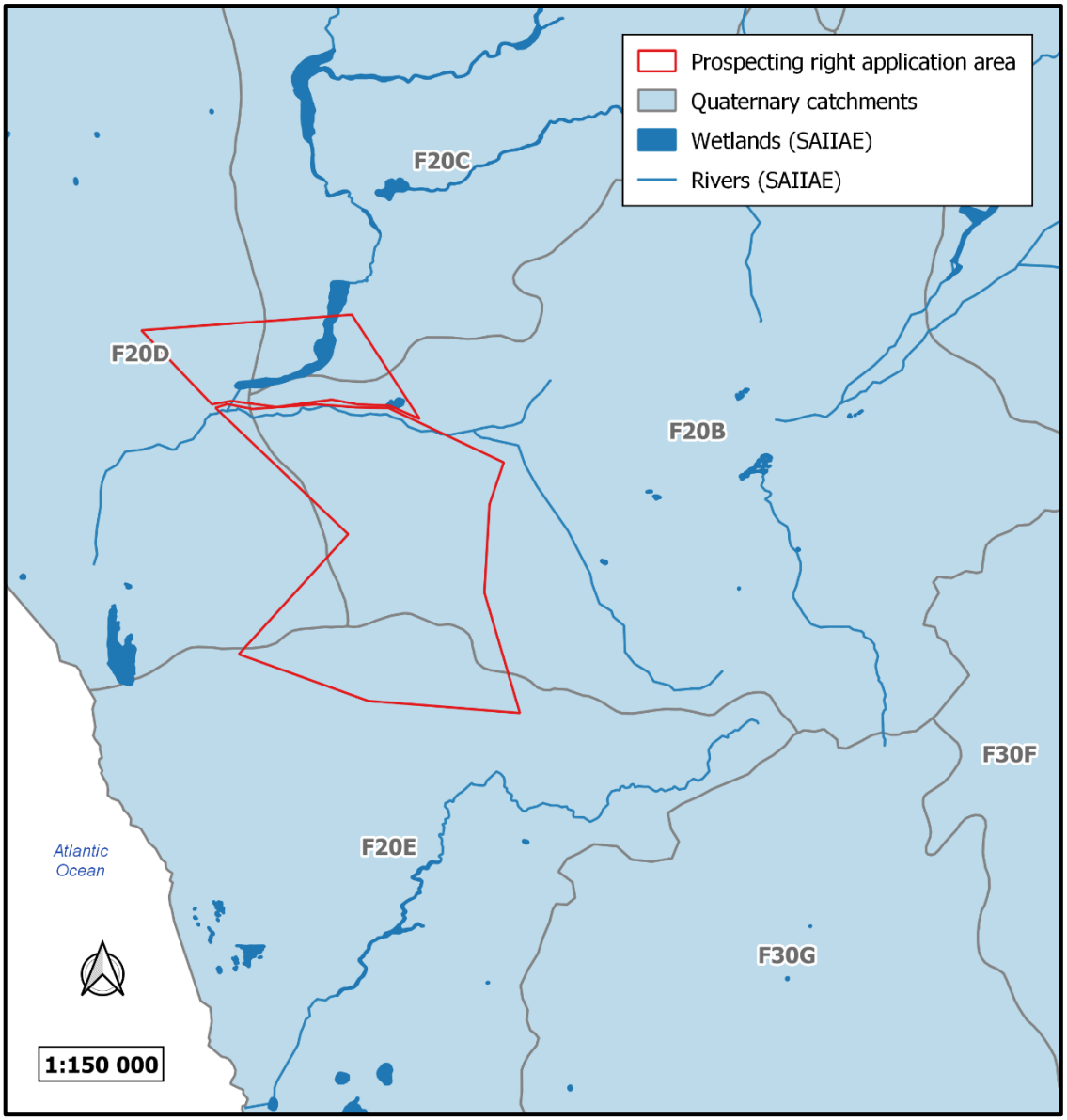


Figure 7. The locality of the proposed prospecting area in relation to the Coastal quaternary catchments of the Lower Orange Water Management Area.

Table 3. Percentage of inland wetland spatial extent according to the present ecological status per wetland type of the Namaqua Sandveld Bioregion.

Wetland type	Total Extent (%)	% Natural or near-natural (A/B)	% Moderately modified (C)	% Heavily to severely/critically modified (D/E/F)
Depression	82.8	16.9	60.7	22.4
Floodplains	4.1	-	-	100
Seeps	4.7	96.9	-	3.1
Valley-bottom	8.5	1.6	0.2	98.2

One depression occurs on Kannikwa, and two branches of the Kamma River flows through the property, along with several drainage lines (Figure 8). According to SAIIAE, the Kamma River is Largely Natural, Least Threatened and moderately- to well protected. SAIIAE has also classified the depression to be Largely Natural, but in reality, the entire depression has been subject to ploughing (Figure 8) and is therefore assumed to be severely modified. It has been classified as threatened by SAIIAE.

3.4. Vegetation

3.4.1. Broad-scale vegetation patterns

Kannikwa falls within the Succulent Karoo Biome (Mucina and Rutherford 2006). According to the vegetation map of Mucina and Rutherford (2012), the site is represented by six broad-scale vegetation units, i.e. Richtersveld Coastal Duneveld, Richtersveld Sandy Coastal Scorpionstailveld, Lekkersing Succulent Shrubland, Southern Richtersveld Yellow Duneveld, Namaqualand Strandveld, and Southern Richtersveld Inselberg Shrubland (Figure 9).

Richtersveld Coastal Duneveld is restricted to a broad belt of 1 to 12 km along the Atlantic Ocean coast in the Northern Cape. It stretches from a point between Boegoe Twins and Alexander Bay to about halfway between Port Nolloth and Kleinzee. It lies at altitudes between 0 and 200 m and is found on wind-blown white sands of coastal origin overlying rocks from the Holgate and Grootderm Formations (Gariep Supergroup). Around Port Nolloth and the Holgate River mouth active dune fields are prominent. Extreme wind speeds and sand blasting occur from the south. The terrain is generally flat with some large, gently rolling hills. Relatively homogenous vegetation covers stable sand sheets where *Stoeberia utilis* typically grows on dune crests and *S. beetzii* on stabilised sand sheets, while the pioneers *Lampranthus hoerleinianus* and *Cladoraphis cyperoides* settle in habitats created by recent sand deflation. This unit is classified as least threatened and it is estimated that about 10 % of it has been transformed, mainly by diamond mining. None is currently being conserved within a statutory conservation area. Namaqualand endemics include *Stoeberia beetzi* and *Arctotis scullyi*, while the Richtersveld endemic *Amphibolia succulenta* also occur in this unit.

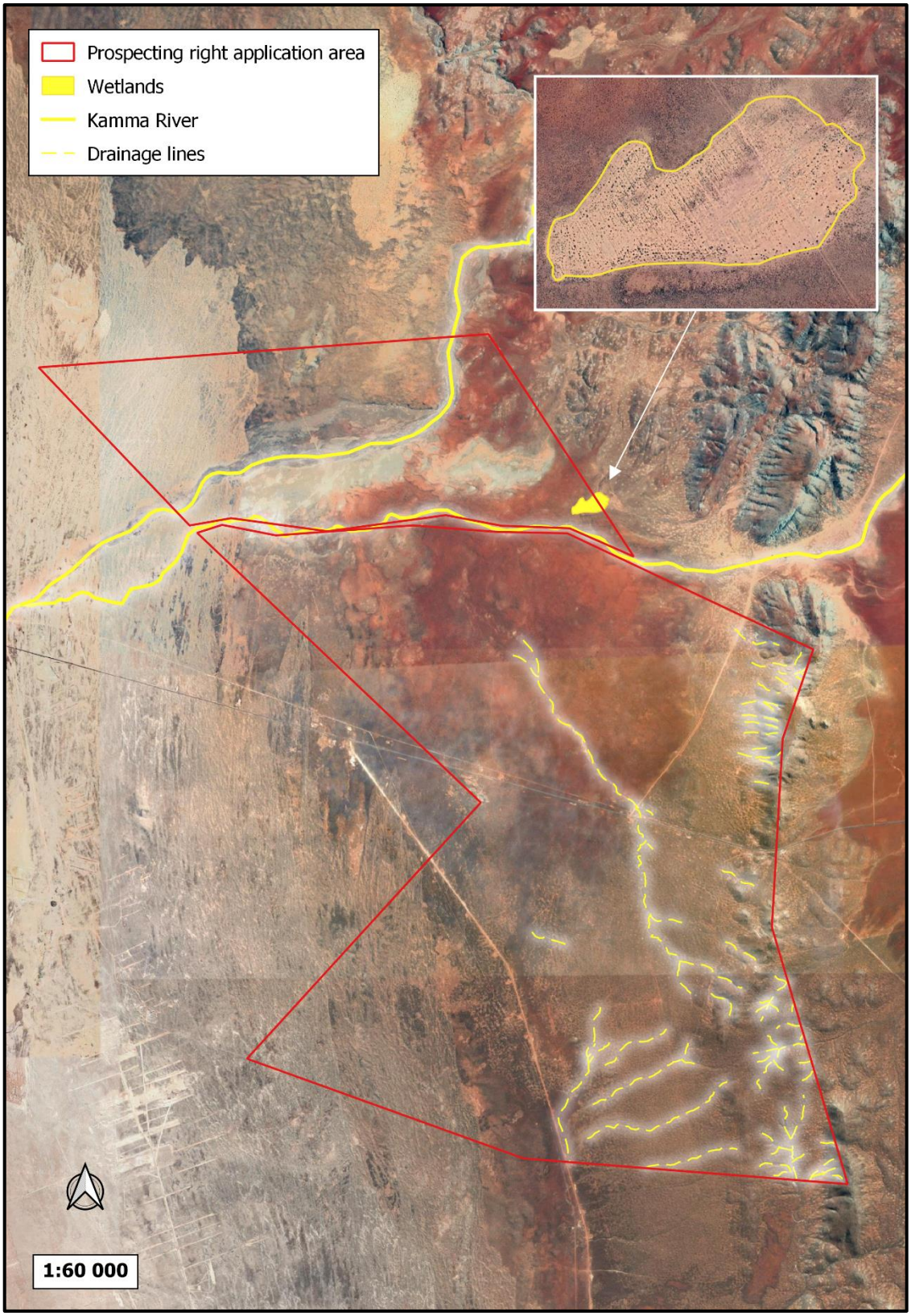


Figure 8. The location of SAIIAE wetlands, rivers and drainage lines on the proposed prospecting right area, with a closer look at the plough lines across the depression (insert).

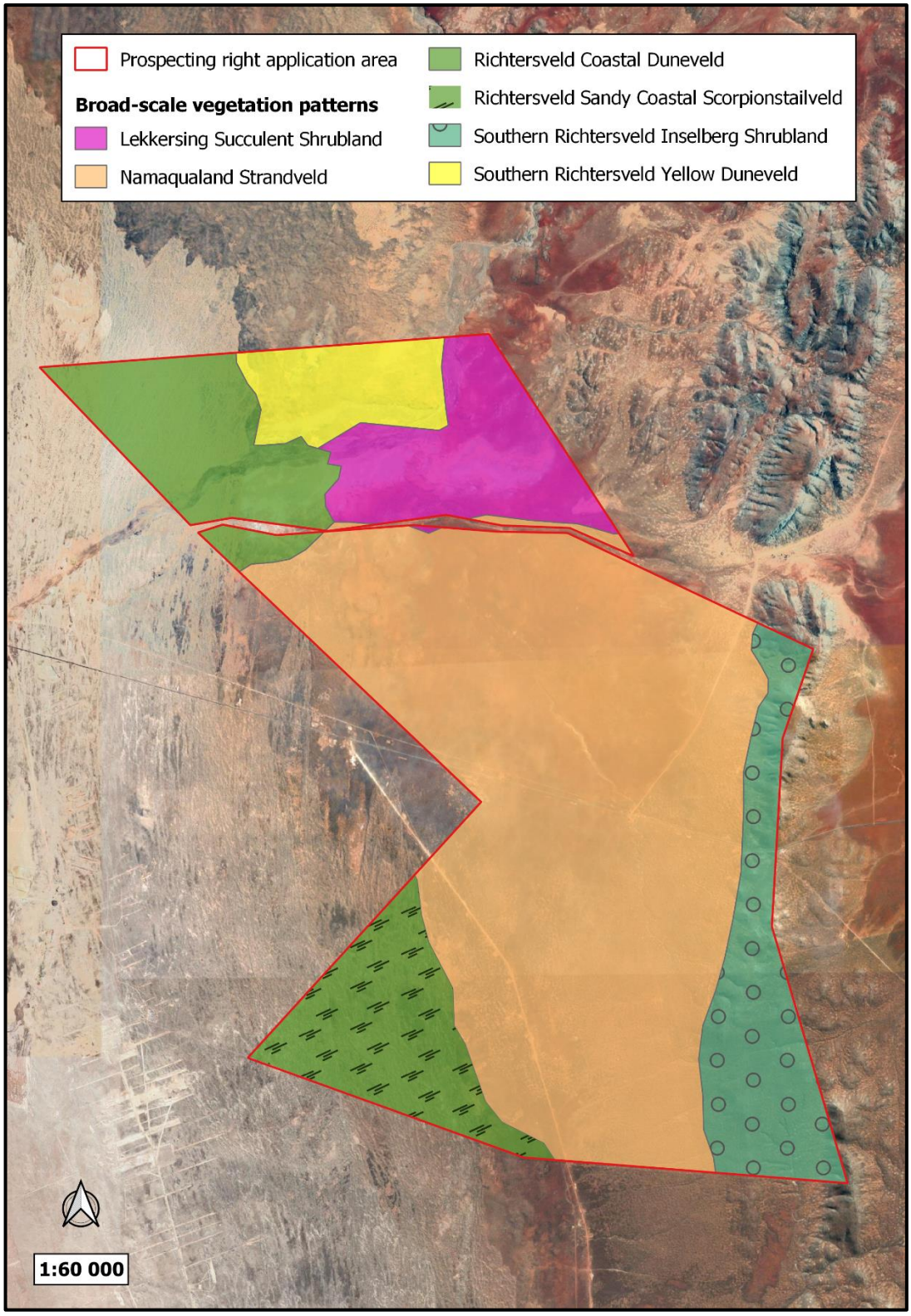


Figure 9. The broad-scale vegetation units (Mucina and Rutherford 2012) present in the study area.

Richtersveld Sandy Coastal Scorpionstailveld is restricted to the Northern Cape along a fragmented band running parallel to the coast, 8 to 28 km inland, from the southwestern corner of the Annisvlakte (north), to 30km south of Holgat River. It also occurs between Alexander Bay and Jakkalsputs. Altitudes range between 100 and 400 m. The terrain is flat and comprise intense biological soil surface crusts. Sandy loam soils are dominant, partly covered by yellow and red wind-blown sand. The vegetation is dominated by *Brownanthus pseudoschlichtianus*, intermixed with other common species like *Stoeberia beetzii, Othonna cylindrica, Lebeckia multiflora, Cephalophyllum ebracteatum* and *Phyllobolus decurvatus*. The unit is classified as least threatened with very little transformation, and none being protected in statutory conservation areas. Namaqualand endemics include *Phyllobolus decurvatus, Stoeberia beetzi* and *Mesembryanthemum pellitum*, while Gariep endemics include *Eberlanzia ebracteata* and *Brownanthus pseudoschlichtianus*.

Lekkersing Succulent Shrubland is found in the Northern Cape, along a longitudinal band in the Southwestern Richtersveld. It occurs in the lowlands west and southwest of the central mountain ridge of the Richtersveld, with the core area stretching for 70km from near the Goariep Mountain in the north to just east of Port Nolloth in the south. It lies at altitudes between 150 and 550 m. The terrain is characterised by a mosaic of hills, flat or slightly rolling plans, with embedded quartz fields and ridges, some sand sheets and dunes, rocky gorges, and some mountains. Most of the area is hilly with shallow loam or sand cover and gravel above bedrock. The vegetation occurs as leaf-succulent dwarf shrubland. This unit is classified as least threatened, but in some places the vegetation is highly degraded by overgrazing, especially around Lekkersing. None of the unit is currently being conserved in any statutory conservation areas, but the protection of the quartz fields near Vlakmyn, as well as the Quartzitic rocks south of Lekkersing, including Karachabpoort, is recommended.

Southern Richtersveld Yellow Duneveld is restricted to the Richtersveld region in the Northern Cape where it forms a strip running parallel to the coastline (5 to 12 km inland), from the Holgat River in the north to east of Port Nolloth in the south. A small, isolated patch also occurs east of Vyftienmyl se Berge. Altitudes range from 50 to 300 m. It is associated with flat to undulating sand shields, but also dunes forming flat whale-backs. Vegetation grows on yellow wind-blown sands of coastal origin, with dune tops being covered with *Stoeberia utilis,* while interdune valleys are dominated by *Brownanthus pseudoschlichtianus, B. arenosus, Cheiridopsis robusta* and *Cephalophyllum ebracteatum.* The unit is classified as least threatened and it is slightly transformed by mining, without any statutory protection.

Namaqualand Strandveld is found in the Northern and Western Cape from Gemsbokvlei to Donkins Bay. Most of it is situated deep inland (40 km) but approaches the coast near the river mouths of the Buffels- Swartlintjies-, Spoeg- Bitter- and Groen Rivers. Altitudes range between 20 and 380 m. The terrain is flat to slightly undulating coastal peneplain and soils are quaternary sand (stabilised aeolian, deep, red, stable dunes and deep sand) overlying marine sediments and granite gneisses. The vegetation is presented as species-rich low shrubland, dominated by many succulent and non-succulent shrubs. It is classified as least threatened, but 10% has already been transformed and major threats include the coastal mining for heavy metals in the Brand-se-Baai area. It is also subject to extensive grazing. None of the unit is statutorily conserved, but small private reserves (Bojaansklip, Donkins Bay, Doorspring, Molyneux and Zeven Puts) protect some of its vegetation.

Southern Richtersveld Inselberg Shrubland is restricted to inselbergs in the Southern Richtersveld of the Northern Cape, scattered across the plains between Anenous Pass and Port Nolloth and includes Klaarkop, Kabies se Berg, Rooidam se Koppe, Steenbok se Berge, and Beesvlei se Berg. It however excludes Vyftienmyl se Berge. Altitudes range from 100 to 600 m. Each inselberg is unique in terms of size, altitude, steepness, rockiness, and spatial aggregation, but smaller inselbergs are more arid than higher ones. They are associated with shallow loamy sand over granites, gneiss, and schist of the Gladkop and Hoogoor Suites. The lower parts are covered by sparse chamaephyte vegetation, dominated by *Zygophyllum prismatocarpum*, while on higher altitudes dense vegetation of dwarf leaf-succulents and lichens occur. The unit is classified as least threatened, and none is statutorily conserved. The inselbergs house many endemics (e.g., *Euphorbia ephedroides, Namaquanthus vanheerdei, Polymita steenbokensis, Tylecodon cordiformis* and *Crassula alstonii*) in need of pro tection status, but besides small stock grazing there is no specific threat.

3.4.2. Fine-scale vegetation patterns

Plant communities in the study area are delineated according to plant species correspondences and changes in soil structure. They can be divided into five distinct units (Figure 10), which are described below. These descriptions 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.

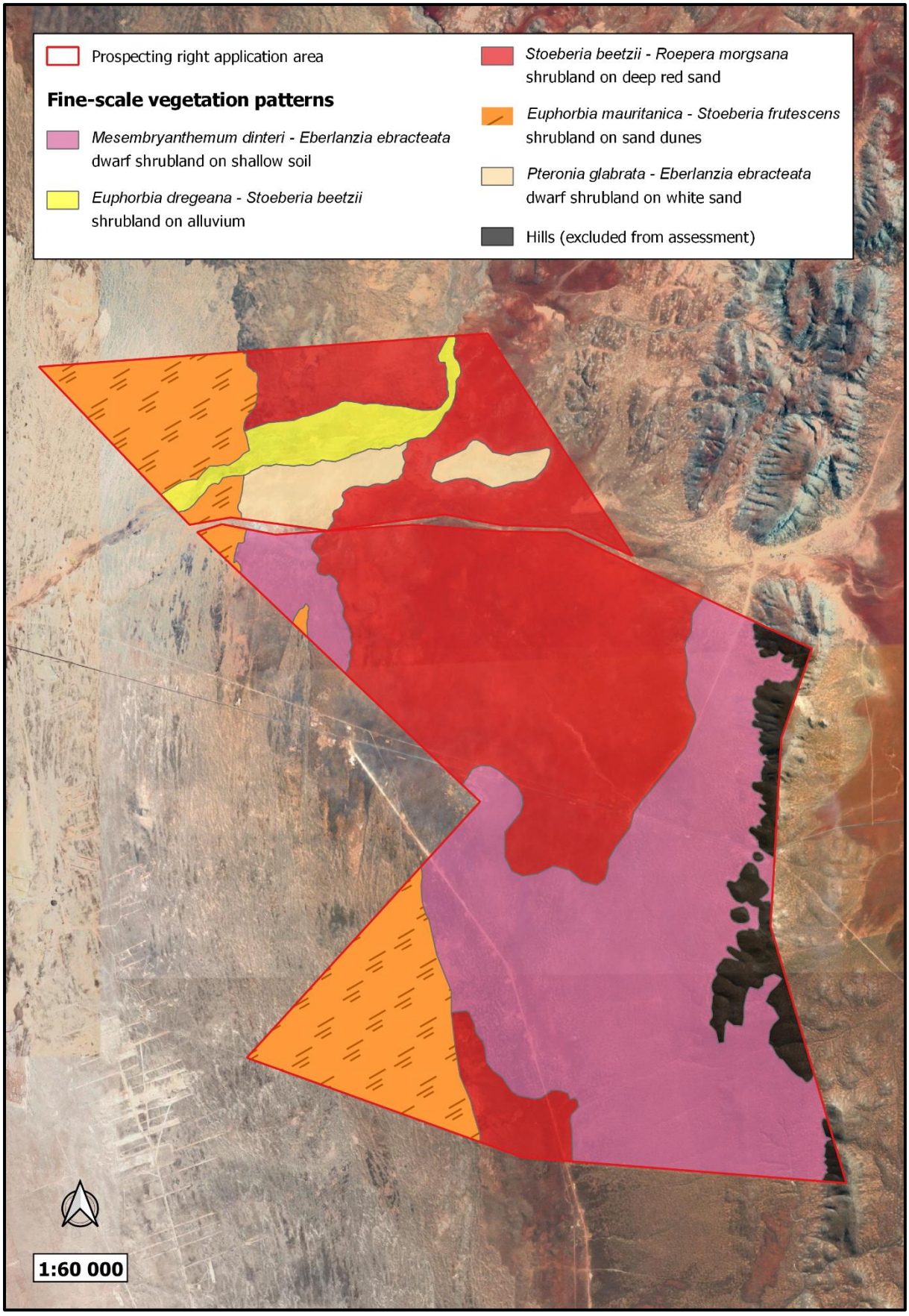


Figure 10. The distribution of fine-scale plant communities in the study area.

i) *Stoeberia beetzii – Roepera morgsana* low shrubland on deep red sand

This community covers the northern central parts of the study area (Figure 10). The vegetation is presented as low shrubland, defined by a sparse succulent shrub layer, intermixed with annual succulents, herbs, bulbs and a weakly developed grass layer. Deep, red, consolidated sand constitute at least 20% of the ground cover (Figure 11).

Stoeberia beetzii and *Roepera morgsana* dominated the shrub layer, but *Asparagus capensis* and *Euphorbia mauritanica* were also abundant. Common species included *Roepera cordifolia, Cheiridopsis denticulata, Mesembryanthemum pseudoschlichtianum, Pteronia glabrata, Osteospermum oppositifolium, Crassothonna sedifolia,* and *Salsola* sp., but other species also present here included *Stoeberia frutescens, Pelargonium crithmifolium, Ruschia viridifolia, Atriplex vestita, A. lindleyi, Aizoon sarcophyllum, Lycium tetrandrum, L. cinereum, Jordaaniella cuprea, Tylecodon wallichii, Pentzia incana, P. quinquefida, Cotyledon orbiculata, Euphorbia rhombifolia, Euphorbia dregeana, Cephalophyllum inaequale, Quaqua parviflora, Nolletia gariepina, Calobota sericea* and *Didelta carnosa.*

Annual and biennial succulents were dominated by *Mesembryanthemum pellitum,* with *M. hypertrophicum, M. articulatum* and *M. barklyi* also being common. Herbs included *Wahlenbergia asparagoides, Manulea altissima*, *Dimorphotheca sinuata, Arctotis fastuosa, Lyperia tristis* and *Grielum grandiflorum*, while the bulb species visible during the survey included *Ornithoglossum undulatum* and *Gethyllis namaquensis*. The grass layer consisted of *Schismus schismoides*, *Ehrharta pusilla, Stipagrostis ciliata, Cladoraphis spinosa* and *C. cyperoids*.

Figure 11. The low shrubland on deep, red, consolidated sand is defined by a sparse succulent shrub layer, intermixed with annual succulents, herbs, bulbs and a weakly developed grass layer.

ii) *Mesembryanthemum dinteri – Eberlanzia ebracteata* dwarf shrubland on shallow soil

This community covers the south-eastern parts of the study area, with a small patch in the north-west (Figure 10). The vegetation is defined by dwarf shrubland growing on shallow, rocky soils, with Heuweltjies scattered across the unit and a conspicuous presence of lichens and biological soil crusts (Figure 12).

Most of the vegetation on the Heuweltjies were dormant and dried out during the time of the survey, but dominating perennials included *Stoeberia beetzii*, *Euphorbia ephedroides* and *Asparagus graniticus.* The surrounding matrix was dominated by *Mesembryanthemum dinteri* and *Eberlanzia ebracteata*, but *Euphorbia rhombifolia, Jordaaniella cuprea, Crassula muscosa, Drosanthemum tardum, Cheiridopsis robusta* and *Amphibolia succulenta* were also common. Other species found here include *Tylecodon reticulatus, Monsonia ciliata, Pelargonium crithmifolium, Asparagus graniticus, Mesembryanthemum pseudoschlichtianum, M. pellitum, M. delum Euphorbia mauritanica, E. caput-medusae, E. dregeana Ruschia viridifolia, R. leucosperma, Drosanthemum luederitzii* and *Crassothonna sedifolia.* The grass *Schismus schismoides* occurs sporadically.

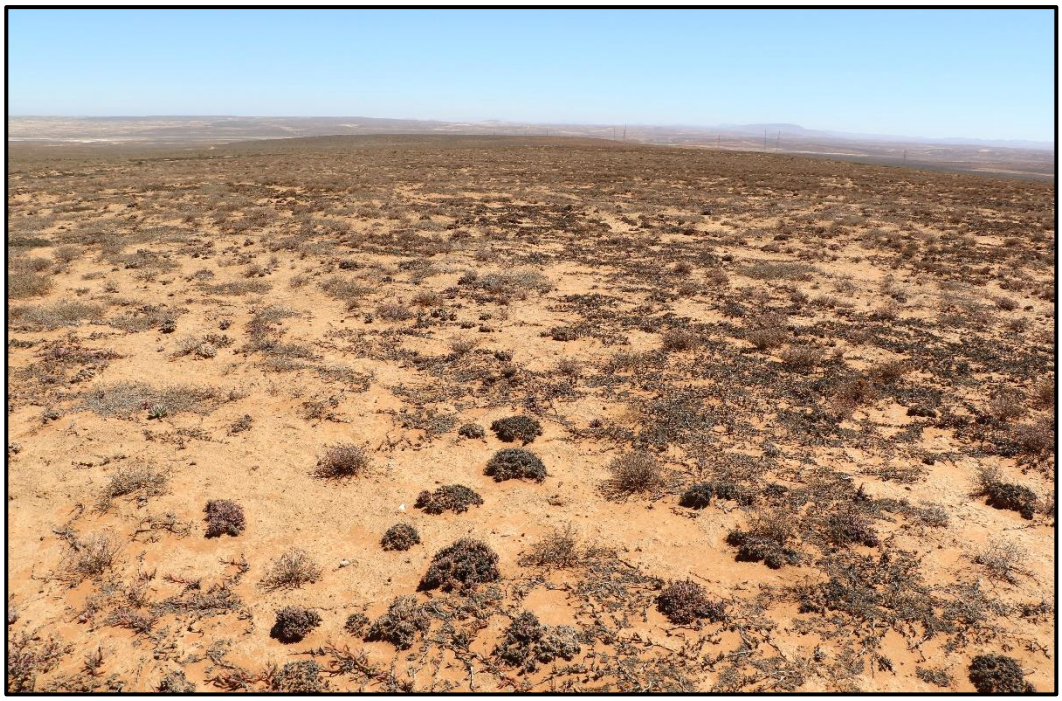


Figure 12. The dwarf shrubland on shallow soil is defined by very low-growing succulents.

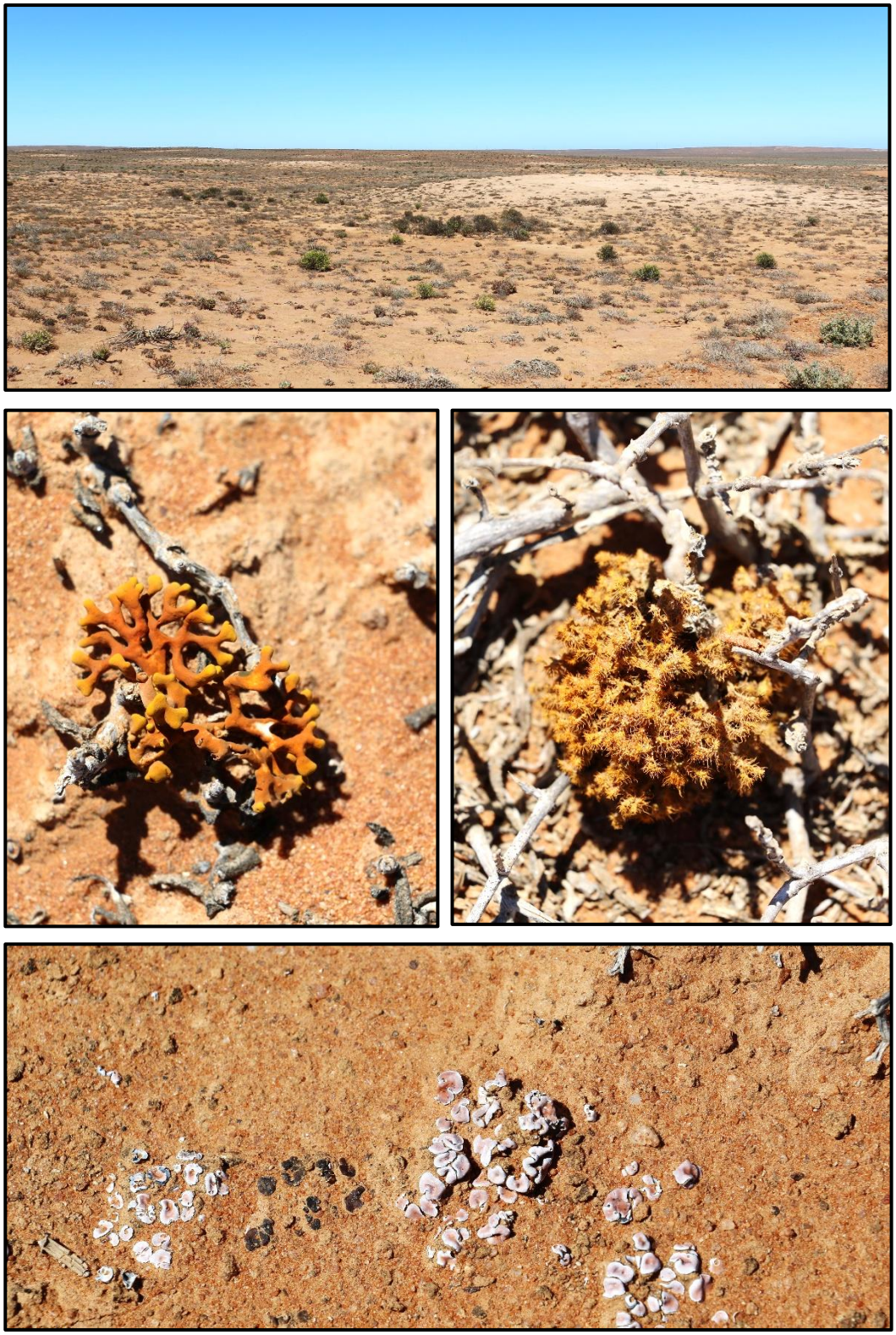


Figure 13. Heuweltjies are scattered across the dwarf shrubland (top) and there is a conspicuous presence of lichens (middle) and biological soil crusts (bottom).

iii) *Euphorbia dregeana – Stoeberia beetzii* shrubland on alluvium

This community lies within the ephemeral channels of the Kamma River in the north (Figure 10). The vegetation is presented as a shrubland growing on alluvium (Figure 14). Here, *Euphorbia dregeana* and *Stoeberia beetzii* dominated, but *Enarganthe octonaria* was also very common. Other species included *Osteospermum oppositifolium, Lycium cinereum, Stoeberia frutescens, Roepera morgsana, Tetraena retrofracta, Jordaaniella cuprea, Mesembryanthemum pellitum, M. dinteri, Eberlanzia ebracteata, Senecio sarcoides, Atriplex vestita, A. lindleyi, A. nummularia, Aizoon sarcophyllum* and *Salsola* spp. The grass *Schismus schismoides* was widespread at low densities.

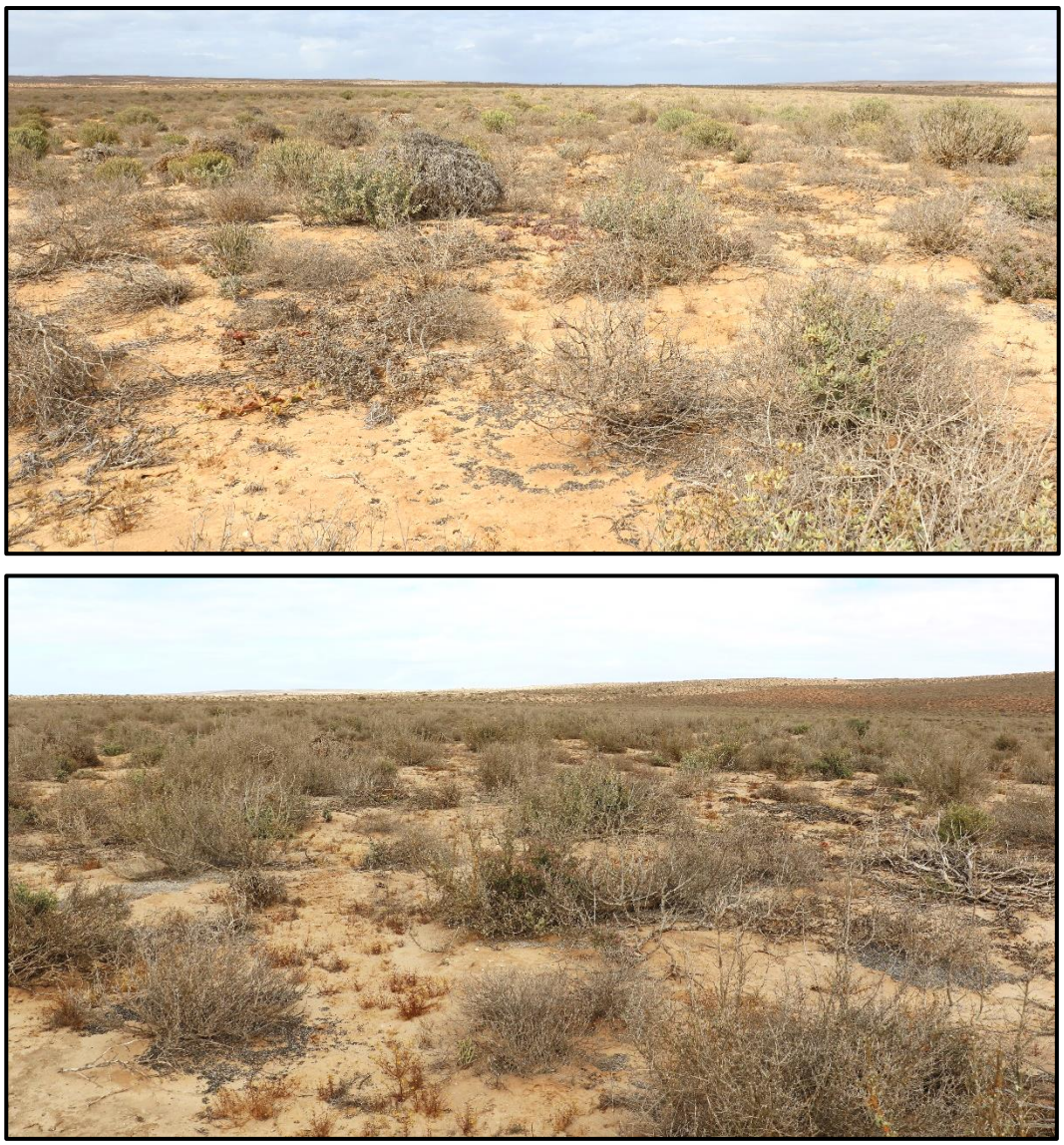


Figure 14. The shrubland on alluvium is restricted the ephemeral channels of the Kamma River.

iv) *Pteronia glabrata*– *Eberlanzia ebracteata* dwarf shrubland on white sand

This community covers two disjunct pockets in the northern parts of the study area (Figure 10). Here, the vegetation grows on white wind-blown sand and is presented as a sparse dwarf shrubland (Figure 15), dominated by *Pteronia glabrata* and *Eberlanzia ebracteata*. Apart from the dominant species, *Eberlanzia ebracteata* was also abundant. Other shrubs and succulents included *Asparagus capensis, A graniticus, Pentzia quinquefida, Senecio aloides, Crassothonna sedifolia*, *Stoeberia beetzii, Amphibolia rupis-arcuatae, Tylecodon reticulatus, Roepera cordifolia, Pelargonium crithmifolium, Mesembryanthemum hypertrophicum, M. dinteri, M. pellitum, Jordaaniella cuprea, Euphorbia ephedroides, E. rhombifolia, E. caput-medusae, Cheiridopsis denticulata* and *Salsola* spp. The herbs *Kewa salsoloides* and *Felicia namaquana* as well as the bulb *Gethyllis namaquensis* were also recorded here. Grasses included *Cladoraphis cyperoids* and *Stipagrostis ciliata.*

Figure 15. The community on white wind-blown sand is presented as a sparse dwarf shrubland.

v) *Euphorbia mauritanica* – *Stoeberia frutescens* shrubland on sand dunes

This community falls within the north-western and north-eastern corners of the study area, where it occurs on white to light-coloured sand dunes (Figure 10). The vegetation is presented as shrubland, defined by a sparse shrub layer, intermixed with herbs, bulbs and a weakly developed grass layer (Figure 16). Lichens were growing abundantly on shrubs (Figure 17).

Euphorbia mauritanica and *Stoeberia frutescens* were the dominant taller shrubs, and *Pentzia quinquefida* dominated the lower shrub layer. Other common shrubs included *Roepera morgsana, Osteospermum oppositifolium, Crassothonna sedifolia, Senecio aloides, Stoeberia beetzii, Asparagus capensis, Lycium tetrandrum, Tetraena retrofracta, Jordaaniella cuprea, Euphorbia ephedroides, E. caput-medusae, Pelargonium crithmifolium* and *Nolletia gariepina.*

Grielum grandiflorum dominated the herb layer, but *Lessertia diffusa, Wahlenbergia asparagoides* and *Felicia namaquana* were also common. The bulb *Gethyllis namaquensis* occurred widespread, and the grasses *Schismus schismoides, Stipagrostis ciliata* and *Cladoraphis cyperoids* were abundant.

Figure 16. The community on sand dunes is defined by a sparse shrub layer, intermixed with herbs, bulbs and a weakly developed grass layer.

Figure 17. Lichens were growing abundantly on the shrubs in the dunes.

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

The SANBI Red List provides information on the national conservation status of South Africa's indigenous plants, which are protected under the National Environmental: Biodiversity Act (Act No. 10 of 2004) (NEMBA), while the National Forests Act (No. 84 of 1998) (NFA) and the Northern Cape Nature Conservation Act (Act No. 9 of 2009) (NCNCA) restricts activities regarding sensitive plant species. Section 15 of the NFA prevents any person to cut, disturb, damage, destroy or remove any protected tree; or collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a licence granted by the Minister. Section 49 (1) and 50 (1) of the NCNCA states that no person may, without a permit pick, transport, possess, or trade in a specimen of a specially protected (Schedule 1) or protected (Schedule 2) plants. Furthermore, Section 51(2) states that no person may, without a permit, pick an indigenous plant (Schedule 3) in such manner that it constitutes large-scale harvesting.

Most species from the region are classified as least concern; a category which includes widespread and abundant taxa. However, a total of 19 species are red listed and are indicated in Appendix 1, of which two were recorded during the field survey and another three potentially occur in or near the areas earmarked for mining (Table 4). Many of the remaining species may potentially occur on the hills in the east, but no mining activities are expected to take place here. In addition to these, specially protected species (Schedule 1) and protected species (Schedule 2) of the NCNCA known from the study region are also indicated in Appendix 1. These include *Lessertia diffusa, Senecio albopunctatus,* all *Euphorbia* spp., *Pelargonium* spp., *Manulea* spp., *Nemesia* spp., Aizoaceae (Mesembryanthemaceae), Amaryllidaceae, Apocynaceae, Asphodelaceae, Crassulaceae, and Iridaceae. A photo guide to all species of conservation concern recorded in the study area is provided in Appendix 3.

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

No species from the study area are protected in terms of the NFA.

Table 4. Red listed plant species recorded from the study region. Those species expected to occur on site are highlighted in red. The hills have not been earmarked for mining.

FAMILY	Scientific name	Status	Threats/Deficits	Habitat	Occurrence on site
ACANTHACEAE	*Acanthopsis insueta*	CR	Not threatened	Well-drained sandy soils, quartzite rocks on mountain slopes and summits	Potentially on Hills
	Amphibolia succulenta	NT	Ongoing habitat loss and degradation.	Loamy places among rocks and gravel in the coastal fog zone.	Confirmed: Dwarf shrubland on shallow soil
	Cephalophyllum herrei	VU	Livestock overgrazing and trampling.	Shale slopes.	Potentially on Hills
	Conophytum bolusiae subsp. *bolusiae*	VU	Succulent collecting.	Vertical quartzitic rock faces.	Potentially on Hills
	Conophytum jucundum subsp. *marlothii*	Rare	Not threatened.	Quartz terraces, small vertical cliff faces in succulent shrubland.	Potentially on Hills
	Conophytum stephanii subsp. *stephanii*	VU	Succulent collection.	Shaded cracks and crevices on quartz and vertical cliff faces.	Potentially on Hills
	Mitrophyllum mitratum	VU	Habitat degradation due to overgrazing.	South-east facing slopes with quartzitic stones.	Potentially on Hills
	Nelia schlechteri	Rare	Not threatened.	Sheets of quartzite schist on gentle hill slope.	Potentially on Hills
	Schlechteranthus maximilianii	VU	Habitat loss to mining and overgrazing.	Stony, quartzitic slopes.	Potentially on Hills
AMARYLLIDACEAE	*Haemanthus pubescens* subsp. *arenicola*	Rare	Not threatened.	Deep, windblown, red coastal sands.	Highly likely in the three shrublands on sand
ANACAMPSEROTACEAE	*Anacampseros scopata*	Rare	Not threatened.	Low quartzite cliffs, in narrow, protected, east-facing gorges.	Potentially on Hills
ASPHODELACEAE	*Bulbine torsiva*	DDT	Not clearly distinct from *B. quartzicola*.	Shallow soils among quartzitic boulders and rock shelves in steep gorges	Potentially on Hills
	Bulbine vitrea	VU	Succulent collection.	Cracks and shelves on vertical, east-facing quartzitic cliffs.	Potentially on Hills
CAMPANULACEAE	*Wahlenbergia asparagoides*	NT	Habitat loss to mining and crop cultivation.	Sandveld in acid-alkaline sand ecotones.	Confirmed: Dunes and shrubland on deep red sand
CRASSULACEAE	*Crassula columella*	Rare	Not threatened.	Upper slopes in crevices of quartzite outcrops	Potentially on Hills
CRASSULACEAE	*Tylecodon buchholzianus* subsp. *fasciculatus*	DDT	Difficult to distinguish from subsp. *buchholzianus*.	Sheltered crevices on eastern aspect of steep mountain slopes.	Potentially on Hills
IRIDACEAE	*Babiana hirsuta*	NT	Diamond mining (north) and grazing (south).	Sandy flats and dunes, coastal	Highly likely on the dunes
	Babiana tritonioides	VU	Livestock grazing.	Stony, granitic slopes.	Potentially on Hills
SCROPHULARIACEAE	*Nemesia saccata*	VU	Overgrazing and habitat loss to mining.	Sandy areas near the coast (Alexander Bay to Hondeklipbaai).	Highly likely in the three shrublands on sand

3.4.4. Weeds and invader plant species

Weeds and invasive species are controlled in terms of the National Environmental Management: Biodiversity (NEMBA) Act 10 of 2004, the Conservation of Agricultural Resources (CARA) Act 43 of 1993, as well as the NCNCA (Schedule 6). These are species that do not naturally occur in a given area and exhibit tendencies to invade that area, and others; at the cost of locally indigenous species. To govern the control of such species, NEMBA and CARA have divided weeds and invader species into categories (see Table 5). All declared weeds and invasive species recorded on site are listed in Table 6, along with their categories according to CARA, NEMBA and NCNCA.

Table 5. The categorisation of weeds and invader plant species, according to NEMBA and CARA.

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

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

Scientific name	Common name	CARA	NEMBA	NCNCA
Atriplex lindleyi	Sponge - fruit saltbush	3	1b	S6
Atriplex nummularia	Old man saltbush	2	2	S6

3.4.5. Indicators of bush encroachment

Bush encroacher species are controlled in terms of Regulation 16 of CARA; where land users of an area in which natural vegetation occurs and that contains communities of encroacher indicator plants are required to follow sound practices to prevent the deterioration of natural resources and to combat bush encroachment where it occurs. No declared indicators of bush encroachment in the Northern Cape, were recorded on site.

3.5. Faunal communities

According to Section 3(a) and 4(a) of the Northern Cape Nature Conservation (NCNCA) Act No. 9 of 2009, no person may, without a permit by any means hunt, kill, poison, capture, disturb, or injure any protected (Schedule 2) or specially protected (Schedule 1) wild animals. Furthermore, Section 12 (1) of NCNCA states that no person may, on a land of which he or she is not the owner, hunt a wild animal without the written permission from the landowner. According to the act “wild animal” means live vertebrate or invertebrate animal, and the egg or spawn of such animal. Landscape features on Kannikwa provide habitat opportunities to faunal communities and those likely to be found on site are discussed in their respective faunal groups.

3.5.1. Mammals

As many as 50 terrestrial mammals and eight bat species have been recorded in the region (see Appendix 2), of which eight are listed either in the IUCN or the Mammal Red List of South Africa, Lesotho and Swaziland (Table 7). Virtually all mammals of the study area are protected; either according to Schedule 1, 2 or 3 of NCNCA (see Appendix 2). Those that are specially protected are also indicated in Table 7.

Geoffroy's horseshoe Bat, Honey Badger, Striped Polecat, Aardwolf and African Wild Cat have a high probability to occur across the site based on their wide habitat tolerance. Similarly, Cape Fox and Bat-eared Fox have a high probability to occur on most of the habitats but are not expected on the hills based on their affinity for open arid habitats or plains. Aardvark and Grant’s Golden Mole are expected to occur in the sandy habitats, while Littledale's Whistling Rat is expected in the dunes and dry riverbed. Leopard is primarily expected to be found on the hills but may perhaps very seldomly wander across the remaining habitats. Grey Rhebok is not expected on site but may be found along the hills.

Table 7. Mammals of conservation concern known from the region. Conservation values are indicated in terms of the international (IUCN) Red List, the Mammal Red List of South Africa, Lesotho and Swaziland (SAMRL) and Schedule 1 of the Northern Cape Nature Conservation Act (NCNCA).

Scientific name	Common name	IUCN	SAMRL	NCNCA
Rhinolophus clivosus	Geoffroy's horseshoe Bat		NT	
Cistugo seabrae	Angolan Wing-gland Bat		NT	
Eidolon helvum	African Straw-coloured Fruit-bat	NT		
Eremitalpa granti	Grant's Golden Mole		VU	
Graphiurus rupicola	Stone Dormouse		NT	
Parotomys littledalei	Littledale's Whistling Rat		NT	
Vulpes chama	Cape Fox			X
Otocyon megalotis	Bat-eared Fox			X
Mellivora capensis	Honey Badger			X
Ictonyx striatus	Striped Polecat			X
Proteles cristata	Aardwolf			X
Felis silvestris	African Wild Cat			X
Panthera pardus	Leopard	VU	VU	X
Orycteropus afer	Aardvark			X
Pelea capreolus	Grey Rhebok	NT	NT	

The remaining protected bat species and Stone dormouse are not expected on site. The Angolan Wing-gland Bat prefers riverine habitat, while the African Straw-coloured Fruit-bat requires trees. The Stone Dormouse is restricted to rocky areas along escarpments.

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

3.5.2. Reptiles

The Kannikwa prospecting area lies within the distribution range of at least 67 reptile species (see Appendix 2). Two red listed species occurs in the area. *Cordylus macropholis* (Large-scaled Girdled Lizard) is listed as Near Threatened and experiences a continued decline in area, extent and habitat quality due to coastal development and mining. It prefers the succulent *Euphorbia caput-medusae* as shelter, which was common on site, especially in the sandy habitats. Therefore, this Girdled Lizard has a high likelihood to occur on site. *Homopus signatus* (Speckled Dwarf Tortoise) is listed as Vulnerable. Its population has decreased with 30% over the last 75 years due to anthropogenic land transformation. They prefer rocky terrain and Heuweltjieveld. They are therefore expected to occur in the dwarf shrubland on shallow soil, as well as on the hills.

Most of the remainder reptiles of the study area are protected either according to Schedule 1 or 2 of NCNCA (see Appendix 2). Specially protected species include *Bradypodion occidentale* (Western Dwarf Chameleon), *Chamaeleo namaquensis* (Namaqua Chameleon), *Karusasaurus polyzonus* (Southern Karusa Lizard), *Namazonurus lawrenci* (Lawrence's Nama Lizard) and *Ouroborus cataphractus* (Armadillo Lizard).

The Western Dwarf Chameleon prefers undisturbed strandveld and Namaqua Chameleon inhabits gravel plains and sandy substrates. These species therefore are expected to occur in most of the habitats on site, especially the sandy habitats and shallow soil dwarf shrublands. The Southern Karusa Lizard, Lawrence's Nama Lizard and Armadillo Lizard are all rock-dwelling species and will most likely only be restricted to the hills.

During the field survey, *Bitis arietans schneideri* (Namaqua Dwarf Adder), *Meroles ctenodactylus* (Giant Desert Lizard) and *Meroles suborbitalis* (Spotted Desert Lizard) were encountered in the sandy shrubland habitats. Spotted Barking Geckos were also vocal along the sandy substrates. Images of the above-mentioned reptile species of conservation concern and those observed on site are shown in Figure 18.

3.5.3. Amphibians

Five amphibian species are known from the region (Appendix 2), of which one is listed and three are endemic. The Desert Rain Frog (*Breviceps macrops*) is listed as Near Threatened (IUCN) and Vulnerable (SA Frog Atlas), while *Vandijkophrynus robinsoni* (Paradise Toad), *Breviceps namaquensis* (Namaqua Rain Frog), and *Cacosternum namaquense* (Namaqua Caco) are regional endemics (Figure 19). All the frog species from the study region are protected according to Schedule 2 of the NCNCA.

The Rain frogs are terrestrial species independent of waterbodies. The Desert Rain Frog normally burrows into sand dunes vegetated with low, succulent shrubs during the day and emerges at night to feed. It is most active during foggy nights. It is a terrestrial breeder, presumably laying a batch of eggs in a chamber below the surface on vegetated dunes. The Namaqua Rain Frog is also a fossorial species that lives in scrub-covered sandy areas. It breeds by direct development and is not associated with water. The Namaqua Caco and Paradise Toad are mainly associated with rocky outcrops where they shelter under stones during the dry season. They breed during the rainy season in various small waterbodies.

Large-scaled Girdled Lizard (NT)

Speckled Dwarf Tortoise (VU)

Western Dwarf Chameleon

Namaqua Chameleon

Lawrence's Nama Lizard

Southern Karusa Lizard

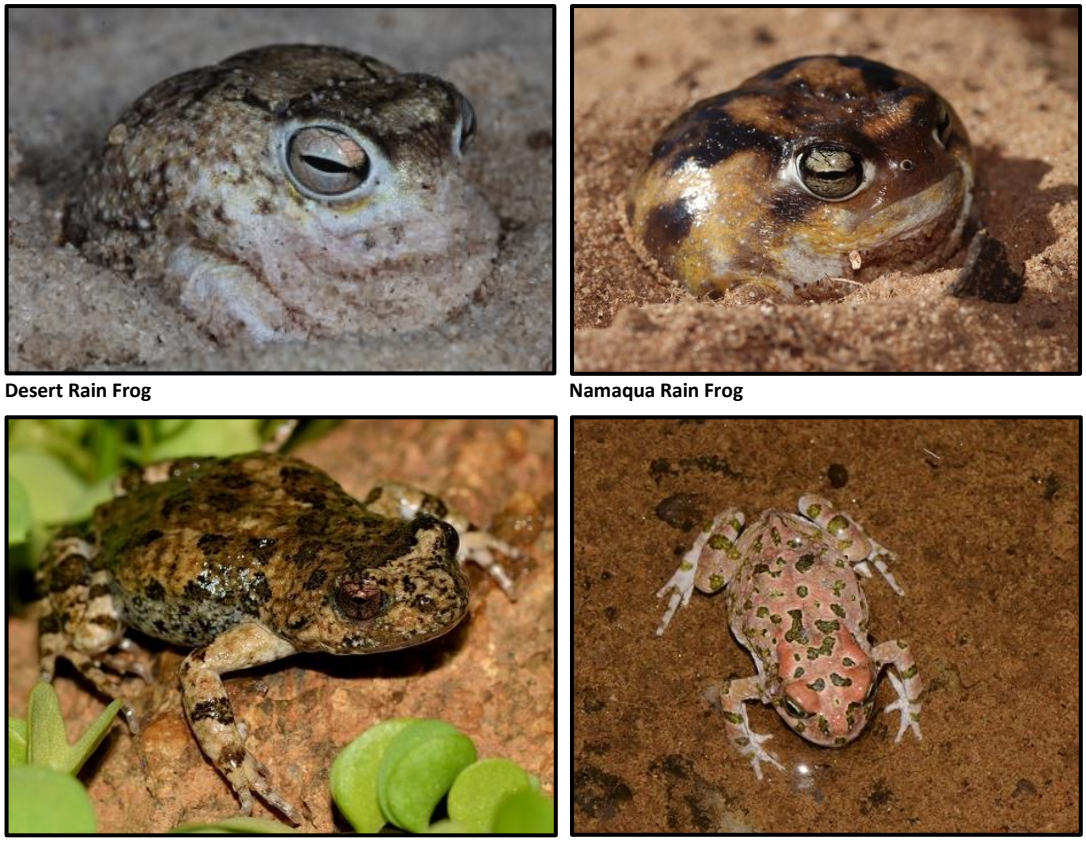
Armadillo Lizard

Giant Desert Lizard

Spotted Desert Lizard

Namaqua Dwarf Adder

Figure 18. Reptile species of conservation concern that are known from the area, as well as the Spotted Desert Lizard which was abundant and very active during the field survey.



Desert Rain Frog **Namaqua Rain Frog**

Namaqua Caco **Paradise Toad**

Figure 19. Amphibian species of conservation concern that are known from the area.

3.5.4. Avifauna

Kannikwa does not fall within or near (< 80km) any of the Important Bird Areas (IBA) defined by Birdlife South Africa. A total number of 171 bird species have been recorded from the study area, of which 17 are listed either according to the IUCN or the SA Red Data Book of Birds (Table 8). Furthermore, all birds are protected either according to Schedule 1, 2 or 3 of NCNCA (see Appendix 2). Specially protected species (Schedule 1) are also listed in Table 8.

The hills in the east, sandy substrates, succulents and shrubland vegetation provide ample micro-habitats to several bird species on Kannikwa. Greater Kestrel was observed breeding along the Eskom powerlines and using the surrounding shrubland as hunting grounds. Other bird species of conservation concern expected to occur in the earmarked areas include Black Harrier and Burchell's Courser. Verreaux's Eagle, known from the region, is primarily expected to breed in the hills, but could use the rest of the site as hunting grounds. Images of these bird species of conservation concern are shown in Figure 20.

Table 8. Bird of conservation concern that are likely to occur on site. Species are indicated in terms of the IUCN, SA Bird Atlas and Schedule 1 of the Northern Cape Nature Conservation Act (NCNCA).

Scientific name	Common name	IUCN status	SA RDB	NCNCA
Aquila verreauxii	Verreaux's Eagle		VU	x
Ardeotis kori	Kori Bustard	NT	NT	x
Bubo africanus	Spotted Eagle-Owl			x
Bubo capensis	Cape Eagle-Owl			x
Buteo rufofuscus	Jackal Buzzard			x
Buteo vulpinus	Steppe Buzzard			x
Calidris canutus	Red Knot	NT	NT	x
Calidris ferruginea	Curlew Sandpiper	NT		
Caprimulgus rufigena	Rufous-cheeked Nightjar			x
Caprimulgus tristigma	Freckled Nightjar			x
Charadrius pallidus	Chestnut-banded Plover	NT	NT	x
Ciconia nigra	Black Stork		VU	x
Circaetus pectoralis	Black-chested Snake-Eagle			x
Circus maurus	Black Harrier	EN		x
Cursorius rufus	Burchell's Courser		VU	
Elanus caeruleus	Black-shouldered Kite			x
Falco biarmicus	Lanner Falcon		VU	x
Falco chicquera	Red-necked Falcon	NT		x
Falco naumanni	Lesser Kestrel			x
Falco peregrinus	Peregrine Falcon			x
Falco rupicolis	Rock Kestrel			x
Falco rupicoloides	Greater Kestrel			x
Geocolaptes olivaceus	Ground Woodpecker	NT		
Melierax canorus	Southern Pale Chanting Goshawk			x
Neotis ludwigii	Ludwig's Bustard	EN	EN	x
Oxyura maccoa	Maccoa Duck	VU	NT	
Pelecanus onocrotalus	Great White Pelican			x
Phoenicopterus minor	Lesser Flamingo	NT	NT	x
Phoenicopterus ruber	Greater Flamingo		NT	x
Polemaetus bellicosus	Martial Eagle	EN	EN	x
Polyboroides typus	African Harrier-Hawk			x
Sagittarius serpentarius	Secretarybird	EN	VU	x
Sterna balaenarum	Damara Tern			
Tyto alba	Barn Owl			x

Most of the remaining protected birds of prey are also expected to traverse the site, but none of the wetland or marine birds are expected to occur here.

Black Harrier

Burchell's Courser

Verreaux's Eagle

Greater Kestrel

Figure 20. Bird species of conservation concern that are expected to occur in the study area (top). The Greater Kestrel is breeding along the Eskom Powerlines (bottom).

3.5.5. 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 species are expected to be found in the Kamma River.

3.5.6. Invertebrates

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

Eight invertebrate species of the Northern Cape appear on the IUCN Red Data list of threatened species and are listed in Table 9. Of these, the distribution range of *Brinckiella mauerbergerorum* (Mauerberger's Winter Katydid) overlaps with that of the study area. It is listed as Vulnerable and currently known from only ten locations. The area and extent of its habitat are estimated to be in decline because of habitat destruction by livestock grazing. It is usually found on succulent shrubs.

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 9). None of these taxa are known to occur in the study region.

All Rock- Creeping- and Burrowing Scorpions are protected according to Schedule 2 of the NCNCA, along with several beetles, butterflies and moths (Table 9). Of these, the Sand Burrowing Scorpion, *Opistophthalmus ammopus*, Brush-footed Butterflies, *Vanessa cardui* (Painted lady) and several Gossamer-winged Butterflies, i.e., *Chrysoritis trimeni* (Diamond opal), *Aloeides nollothi* (Port Nolloth russet), *Leptomyrina lara* (Cape black-eye), *Trimenia macmasteri mijburghi* (Karoo silver-spotted copper) and *Cacyreus dicksoni* (Karoo geranium bronze) occur in the study area (Figure 21).

One major habitat delimits possible invertebrate communities in the study area, i.e., vegetation classified as Karoo (Picker et al. 2004). This habitat represents unique species assemblages, with an above-average representation of beetles, grasshoppers, flies, wasps, and lacewings. The protected Katydid, butterflies and scorpions discussed above are expected to be associated with this habitat. The snail, *Trigonephrus* sp. was especially abundant on the sandy substrates, while Blister Beetles, Longleg Tokkies, Frantic Surface Beetles and Tawny Balbyter Sugar Ant were also observed (Figure 21).

Table 9. 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
INSECTA	COLEOPTERA	*Circellium bacchus*	Flightless Dung Beetle	S1
		Colophon spp.	All Stag Beetles	S1
		Dromica spp.	Tiger Beetles (all species)	S2
		Graphipterus assimilis	Velvet Ground Beetle	S2
		Ichnestoma spp.	All Fruit Chafer Beetles	S2
		Manticora spp.	All Monster Tiger Beetles	S2
		Megacephala asperata	Tiger Beetle	S2
		Megacephala regalis	Tiger Beetle	S2
		Nigidius auriculatus	Stag Beetle	S2
		Oonotus adspersus	Stag Beetle	S2
		Oonotus interioris	Stag Beetle	S2
		Oonotus rex	Stag Beetle	S2
		Oonotus sericeus	Stag Beetle	S2
		Platychile pallida	Tiger Beetle	S2
		Prosopocoilus petitclerci	Stag Beetle	S2
		Prothyma guttipennis	Tiger Beetle	S2
	LEPIDOPTERA	*Lepidochrysops penningtoni*	Pennington's Blue	**DD**
		Lycaenidae	All Gossamer-winged Butterflies	S2
		Hepialidae	All Swift Moths	S2
		Hesperiidae	All Skippers	S2
		Nymphalidae	All Brush-footed Butterflies	S2
		Satyridae	All Satyrs	S2
	ORTHOPTERA	*Africariola longicauda*	Richtersveld Katydid	**VU**
		Alfredectes browni	Brown's Shieldback	**DD**
		Brinckiella serricauda	Serrated Winter Katydid	**DD**
		Brinckiella arboricola	Tree Winter Katydid	**EN**
		Brinckiella aptera	Mute Winter Katydid	**VU**
		Brinckiella karooensis	Karoo Winter Katydid	**VU**
		Brinckiella mauerbergerorum	Mauerberger's Winter Katydid	**VU**
ONYCHOPHORA			All Velvet worms	S1

***Brinckiella mauerbergerorum* (VU)**

***Opistophthalmus ammopus* (S2)**

***Leptomyrina lara* (S2)**

Vanessa cardui (S2)

***Chrysoritis trimeni* (S2)**

Aloeides nollothi

Trimenia macmasteri mijburghi

Cacyreus dicksoni

***Trigonephrus* sp.**

Blister Beetle

Longleg Tokkie

Frantic Surface Beetle

Tawny Balbyter Sugar Ant

Figure 21. Species of conservation concern from the study area, as well as common species encountered on site.

3.6. Critical biodiversity areas and broad-scale processes

The proposed prospecting site falls within critical biodiversity areas (Figure 22), 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. The area along the Kamma River, including its catchment is classified as *Critical Biodiversity Area One.* The remaining sections in the north and south is classified as *Critical Biodiversity Area Two*. A new portion of the Richtersveld National Park (*Protected Area*) lines the border of the study site in the north (Figure 22).

Similarly, the Mining and Biodiversity Guidelines (DENC et al. 2013) recognises the watercourse and hills to be of *Highest Biodiversity Importance* (Figure 23), which constitute the highest risk for mining. Most of the remaining sections are of *High Biodiversity Importance*, with a small portion in the south-east with *Moderate Biodiversity Importance*. The Richtersveld National Park is legally protected and therefore Mining in this area is prohibited. These guidelines were developed to identify and categorize biodiversity priority areas sensitive to the impacts of mining to support mainstreaming of biodiversity issues in decision making in the mining sector.

Furthermore, according to the National Web based Environmental Screening Tool the study area is considered to have sensitive environmental features (Figure 24). 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 Kannikwa study area is of medium sensitivity based on the Plant Species Theme. This sensitivity is attributed to the fairly high number of specialised, sensitive and protected plant species found in the habitats on site. The medium sensitivity in the central parts of the site is based on the suitable habitat and known distribution of the invertebrates *Brinckiella mauerbergerorum* (Mauerberger's Winter Katydid) and *Chrysoritis trimeni* (Diamond opal). The high sensitivity in the northern- and southern sections of the site is based on the suitable habitat for Black Harrier and Verreaux's Eagle. The northern- and southern parts of the study site is further considered to be of very high sensitivity based on the Aquatic Biodiversity Theme, attributed to the Kamma River as well as the freshwater ecosystem priority area quinary catchments. Finally, the Terrestrial Biodiversity Theme is also of very high sensitivity, as a direct function of the Northern Cape Critical Biodiversity Areas Map (discussed above).

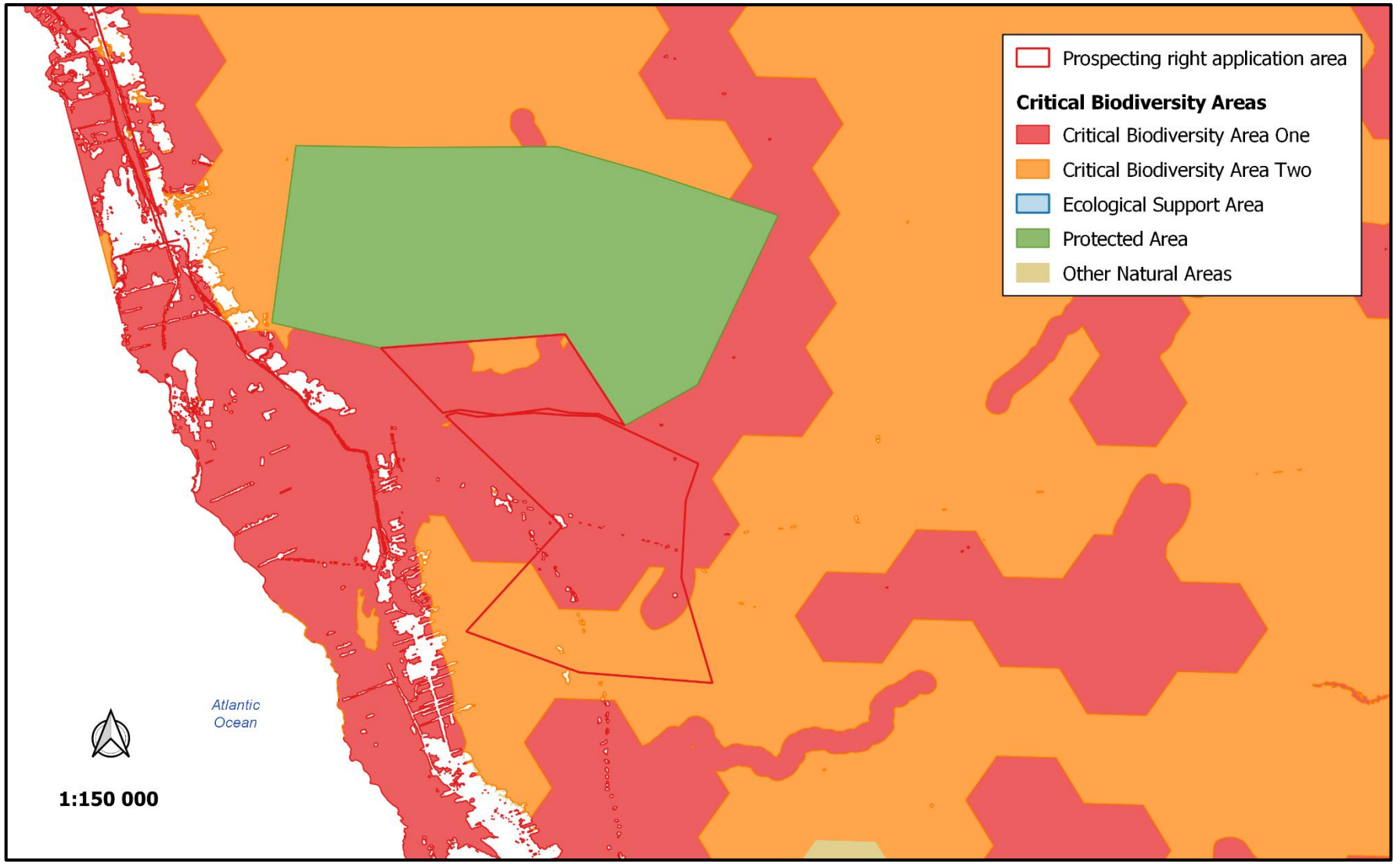


Figure 22. The study area in relation to the Northern Cape Critical Biodiversity Areas.

Figure 23. The study area in relation to the Mining and Biodiversity Guidelines.

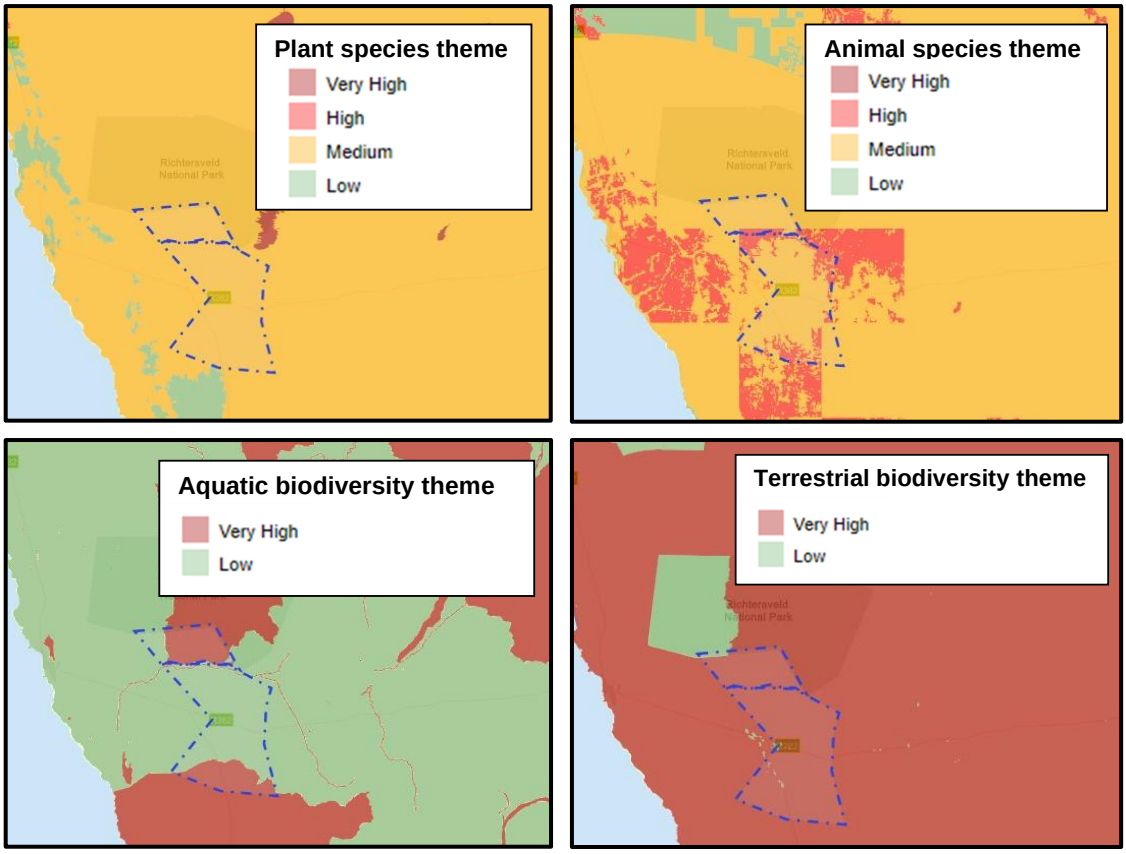


Figure 24. Environmental sensitivities in the study area, according to the National Web based Environmental Screening Tool.

According to the Environmental Management Framework and Strategic Environmental Management Plan for the Namakwa District Municipality (2011) the hills in the east fall within their Environmental Management Zones: A – Critical. This zone includes several environmentally sensitive features and development should be avoided. If the development is critical to the economic and social wellbeing of the local population, utmost care should be taken to avoid impacts and mitigate where possible.

The remainder of the site falls within Zone B – High. Several environmentally sensitive features are present, and development should be restricted. This rating is not very lenient in terms of development but does recognise that development cannot be excluded where compelling economic and social benefits will be derived for the local and regional population. All legislative requirements should be adhered to, and a fully inclusive consideration of the biophysical receptors should be undertaken. Development in these areas will also require a comprehensive public participation process with input from stakeholders and government organisations.

Finally, mining is one of the major sectors within the Namakwa District Municipalities, with current and historic activities already impacting the indigenous vegetation between Port Nolloth and the study area (Figure 25). These factors increase the proposed operation's cumulative impacts.

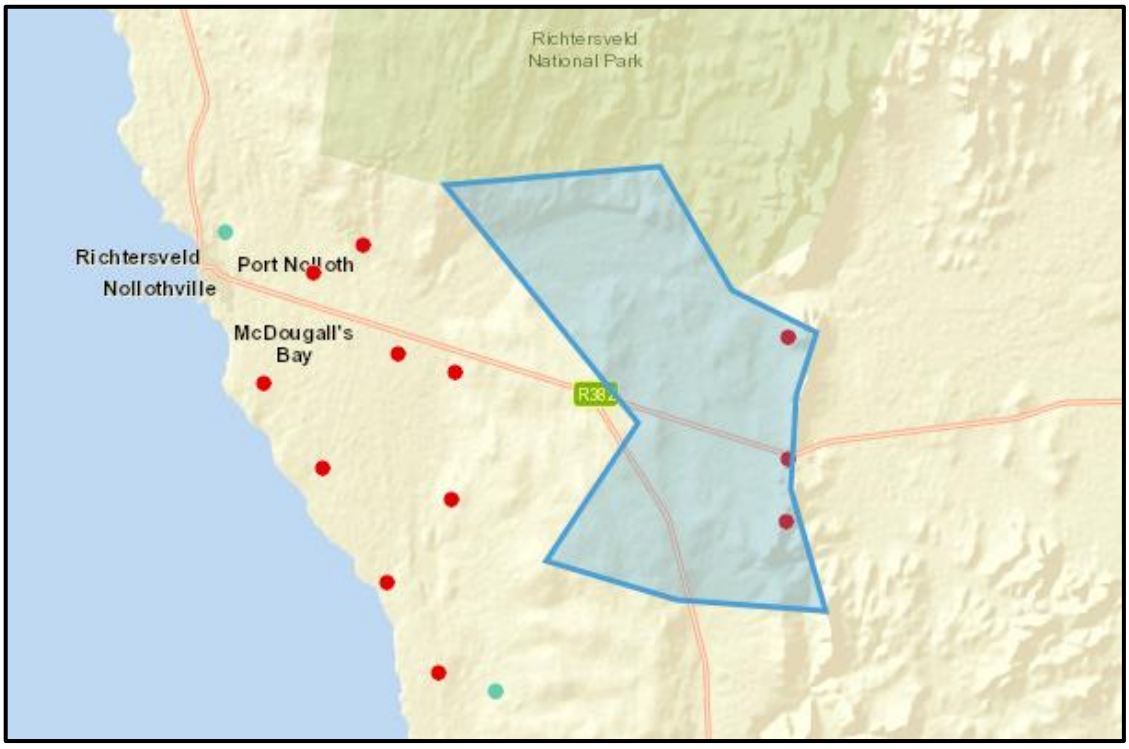


Figure 25. The extent of past and present mining near the study area.

3.7. Site sensitivity

The ecological sensitivity map for Kannikwa is illustrated in Figure 26. The Kamma River, drainage lines and the hills in the east are all considered to be of **very high** sensitivity. The Kamma River and drainage lines are highly sensitive due to their vital ecological and hydrological functionality and significance. All watercourses are unique habitats protected in terms of the National Water Act (Act No 36 of 1998). The hills in the east is expected to harbour a high number of very specialised, sensitive, protected endemic plants and provides potential habitat for protected bird-, reptile-, and frog species. These highly sensitive areas should be considered as **no-go areas**.

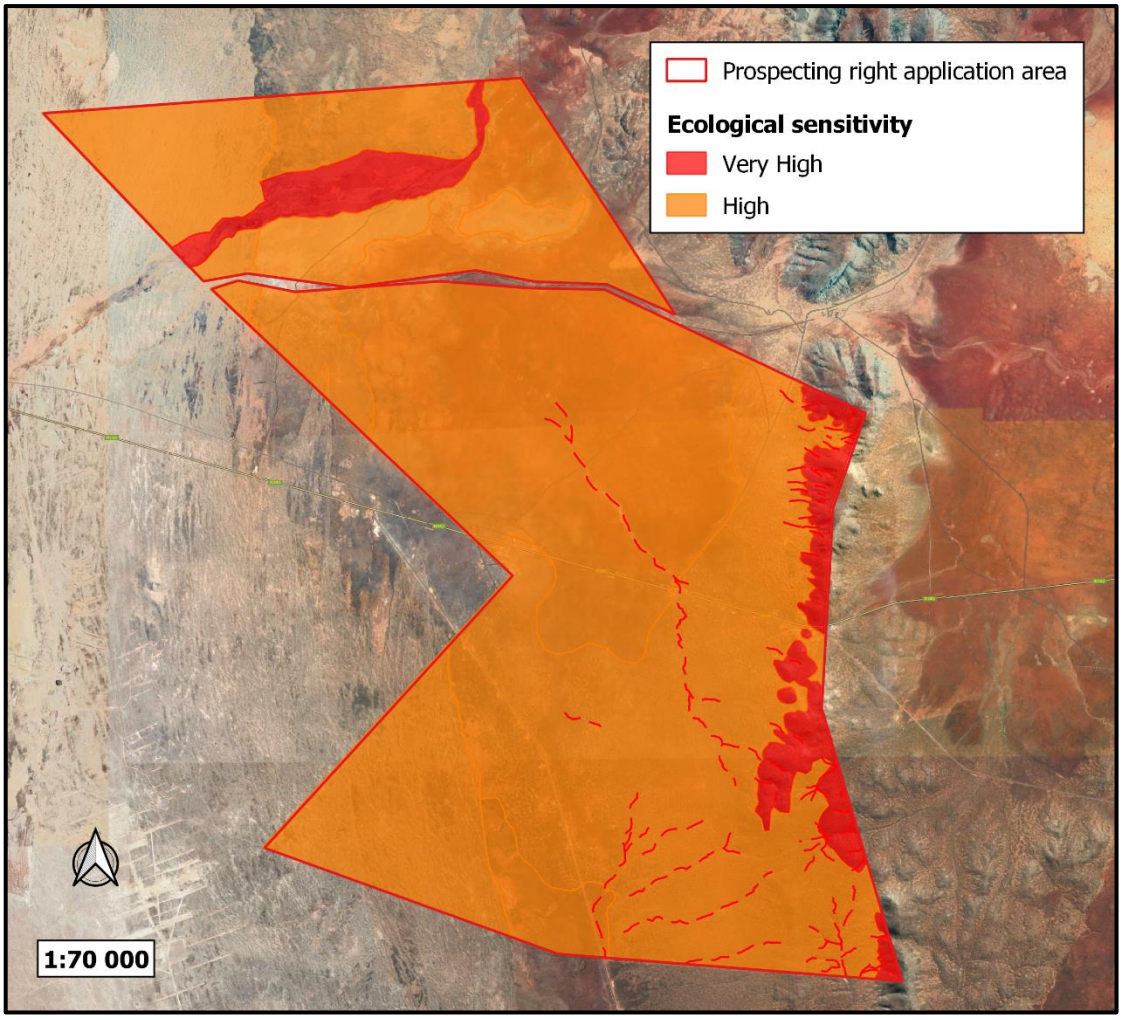


Figure 26. A sensitivity map for the Kannikwa prospecting area.

The remainder of the site is of **high** sensitivity. These areas also host several plant species of conservation concern and provide suitable habitat to faunal species of conservation concern. The sandy substrates are also highly susceptible to wind erosion. However, the Richtersveld National Park next to the site guarantees protection for similar habitat types. Therefore, these areas of high sensitivity are not regarded as no-go areas, but activities should proceed with caution as it may not be possible to mitigate all impacts appropriately.

4. ECOLOGICAL IMPACT ASSESSMENT

In this section, the potential impacts and associated risk factors that may be generated by the Kannikwa prospecting operation are identified and described. A detailed analysis of each impact is provided in Table 10. 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 drill pads, the excavation of minerals, construction of infrastructure and roads, stockpiling, oil and petrochemical spills.

Description of the impact

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

Mitigation and monitoring

- Topsoil needs to be removed and stored separately during prospecting and the construction of roads, infrastructure, and stockpile areas.
- These topsoil stockpiles must be kept as small as possible 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 10. A detailed analysis of ecological impacts identified for the Kannikwa 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)	Minimal (1)	Highly unlikely, annually or less (2)	Very Low (12)	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 10 (cont.). A detailed analysis of ecological impacts identified for the Kannikwa prospecting operation.

	IMPACT	Phase			Extent	Duration	Severity	Probability	Significance	Significance after Mitigation
		C	O	D						
Water	Alteration/destruction of watercourses	✓	✓		Regional (3)	Permanent (5)	High (3)	Possible, life of operation (9)	Medium - High (99)	Low-Medium
	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 drill pads, the excavation of minerals, construction of infrastructure and roads, stockpiling.

Description of the impact

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

Mitigation and monitoring

- Topsoil needs to be removed and stored separately during prospecting and the construction of roads, infrastructure and stockpile areas.
- These topsoil stockpiles must be kept as small as possible 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 drill pads, the excavation of minerals, construction of infrastructure and roads, stockpiling, natural events.

Description of the impact

Vegetation will be stripped for construction of drill pads, 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.
- No new roads, infrastructure or prospecting areas should be developed over watercourses, including drainage lines.
- Disturbances during the rainy season should be monitored and controlled.
- Any potential run-off from exposed ground should be controlled with flow retarding barriers.
- Regular monitoring during the prospecting operation should be carried out to identify areas where erosion is occurring; followed by appropriate remedial actions.

4.2. Vegetation and floristics

4.2.1. Loss of indigenous vegetation

Source of the impact

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

Description of the impact

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

Mitigation and monitoring

- Implement best practise principles to minimise the footprint of transformation, by keeping to existing roads and earmarked areas where possible.
- Implement effective avoidance measures to limit any activities in the highly sensitive areas, by applying the no-go principles.
- Ensure measures for the adherence to a maximum speed limit of 40 km/h to minimise dust fallout and associated effects on plants in the adjacent pristine areas.
- 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 drill pads, the excavation of minerals, construction of infrastructure and roads, stockpiling. Intentional removal of listed or protected plant species for non-mine related purposes, e.g., illegal succulent trade.

Description of the impact

There are numerous plant species of conservation concern present in the Kannikwa Prospecting Right area, including the red listed *Amphibolia succulenta* (**NT**) and *Wahlenbergia asparagoides* (**NT**), which was recorded in the earmarked area. *Haemanthus pubescens* subsp. *arenicola* (**Rare**), *Babiana hirsuta* (**NT**) and *Nemesia saccata* (**VU**) also potentially occurs here. Therefore, it is likely that the prospecting operation could potentially have a major impact on these species if their local population is destroyed. Furthermore, any illegal harvesting of the succulent plants of conservation concern for trade by staff, contractors or secondary land users could have devastating effects on the population of these species.

Mitigation and monitoring

- The footprint areas of the prospecting activities must be scanned for Red Listed and protected plant species prior to any destructive activities by means of a search-and-rescue operation.
- 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 clearing of an area for drill pads, the excavation of minerals, construction of infrastructure and roads, stockpiling, improper rehabilitation practises. Existing populations.

Description of the impact

Only two invasive species (*Atriplex* spp.) occur in the study area. Nevertheless, any anthropogenic disturbances to natural vegetation, especially the clearance of large areas of land, provide the opportunity for invasive plants to increase. This is due to their opportunistic nature of dispersal and establishing in disturbed areas. If invasive plants establish in disturbed areas, it may cause an impact beyond the boundaries of the prospecting site. These alien invasive species are thus a threat to surrounding natural vegetation and can result in the decrease of biodiversity as well as reduction in the ecological value and land use potential of the area. Therefore, if alien invasive species are not controlled and managed, their propagation into new areas could have a high impact on the surrounding natural vegetation in the long term. With proper mitigation, the impacts can be substantially reduced.

Mitigation and monitoring

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

4.2.4. Encouraging bush encroachment

Source of the impact

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

Description of the impact

Bush encroachment is a natural phenomenon characterised by the excessive expansion of certain shrub species at the expense of other plant species. While general clearing of the area and prospecting activities destroy natural vegetation, bush encroaching plants can 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. However, no bush encroaching species were recorded on site. Therefore, this impact is highly unlikely during the prospecting operation.

Mitigation and monitoring

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

4.3. Fauna

4.3.1. Habitat fragmentation

Source of the impact

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

Description of the impact

Fragmentation of habitats typically leads to the loss of migration corridors, in turn resulting in degeneration of the affected population's genetic make-up. This can be in the form of small-scale fragmentation for reptiles, amphibians, and invertebrates, to more large-scale fragmentation that hinder dispersal of birds and plants. It also includes the destruction of burrows, tunnels, and chambers as well as the degradation of ephemeral aquatic habitats in the Kamma River 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 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.
- No new roads should be created across a watercourse.
- No prospecting should take place in the Kamma River or along its banks. If this is unavoidable, a water use license to alter the beds and banks of the river 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; 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 species of conservation concern. Red listed species that are known from the area include Grant’s Golden Mole, Littledale's Whistling Rat, Large-scaled Girdled Lizard, Speckled Dwarf Tortoise, Desert Rain Frog, Verreaux's Eagle, Black Harrier, and Mauerberger's Winter Katydid. 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. Increased noise and vibration will disturb and possibly displace wildlife. Fast moving vehicles cause road kills of small mammals, birds, reptiles, amphibians, and many invertebrates. Intentional killing of snakes, reptiles, and owls will negatively affect their local populations.

Mitigation and monitoring

- Careful planning of the operation is needed to avoid the destruction of pristine habitats and minimise the overall disturbance footprint.
- The extent of the prospecting activities should be demarcated on site layout plans, and no personnel or vehicles may leave the demarcated area except if authorised 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.
- No prospecting should take place in the Kamma River and no new roads should be created across drainage lines. If this is unavoidable, 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 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 drilling, excavation of minerals, construction of infrastructure and roads, stockpiling.

Description of the impact

During prospecting activities there is a possibility that the watercourses on site (i.e., drainage lines and Kamma River) might be altered or 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 disturbances to the watercourses and their buffer zones.
- No new roads should be created across a watercourse and no prospecting should take place in the Kamma River. If this is unavoidable, 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 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 the drainage lines and Kamma River to be filled with silt from prospecting areas if the sediment source zones lie along the drainage paths towards these watercourses. This may lead to a change in hydrologic regime or character of the watercourses.

Mitigation and monitoring

- Bare ground exposure should always be minimised in terms of the surface area and duration.
- Re-establishment of plant cover on disturbed areas must take place as soon as possible once activities in the area have ceased.
- No new roads, infrastructure or prospecting areas should be developed over watercourses.
- 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

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

Description of the impact

Transformation of intact habitat on a cumulative basis would contribute to the fragmentation of the landscape and would potentially disrupt the connectivity of the landscape for fauna and flora and impair their ability to respond to environmental fluctuations. The Succulent Karoo harbours many range-restricted species and are vulnerable to such cumulative disturbances through species losses. However, the adjacent Richtersveld National Park guarantees some protection to the terrestrial habitats and therefore potentially alleviates some of the cumulative losses to endemic species. Habitat alterations will also destroy connectivity of vital ecological corridors of aquatic food webs in the ephemeral Kamma River, which could have cascading effects on a catchment level.

Mitigation and monitoring

- Implement best practise principles to minimise the footprint of transformation.
- No new roads should be created across a watercourse and no prospecting should take place in the Kamma River. If this is unavoidable, 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

Five plant communities were identified within the area earmarked for prospecting activities in the study area. Of these, the Kamma River is most sensitive (Very High), primarily based on its national protection status as a watercourse. The remainder of the site is of High sensitivity based on several red listed plant species recorded here, and potential important habitat it provides to red listed mammals, birds, reptiles, amphibian, and invertebrate species. The most profound impacts expected to be related to the proposed prospecting operation include cumulative loss of intact Succulent Karoo habitat and associated range-restricted flora and fauna species. Permit applications need to be lodged with the Northern Cape Department of Environment and Nature Conservation three months prior to any destruction, death or displacement of protected flora and fauna species.

The destruction of sensitive natural habitats on site is inevitable. The significance of the impacts will ultimately be affected by the success of the mitigation measures implemented during the prospecting operation. In my opinion, authorisation for the proposed operation should not be granted unless the applicant commits to strictly adhere to effective avoidance, management, mitigation and rehabilitation measures.

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APPENDICES

APPENDIX 1

Plant species list

FAMILY	SPECIES	STATUS	NFA	NCNCA
ACANTHACEAE	***Acanthopsis insueta***	**CR**		
AIZOACEAE	*Aizoon sarcophyllum*	LC		
	Amphibolia rupis-arcuatae	LC		S2
	Amphibolia succulenta	**NT**		S2
	Antimima alborubra	LC		S2
	Antimima maleolens	LC		S2
	Cephalophyllum goodii	LC		S2
	Cephalophyllum herrei	**VU**		S2
	Cephalophyllum inaequale	LC		S2
	Cheiridopsis denticulata	LC		S2
	Cheiridopsis pillansii	LC		S2
	Cheiridopsis robusta	LC		S2
	Conicosia pugioniformis subsp. *alborosea*	LC		S2
	Conophytum bilobum	LC		S2
	Conophytum bolusiae* subsp. *bolusiae	**VU**		S2
	Conophytum flavum subsp. *flavum*	LC		S2
	Conophytum hians	LC		S2
	Conophytum jucundum* subsp. *marlothii	**Rare**		S2
	Conophytum meyeri	LC		S2
	Conophytum obscurum	LC		S2
	Conophytum pageae	LC		S2
	Conophytum saxetanum	LC		S2
	Conophytum stephanii* subsp. *stephanii	**VU**		S2
	Drosanthemum luederitzii	LC		S2
	Drosanthemum tardum	LC		S2
	Eberlanzia cyathiformis	LC		S2
	Eberlanzia ebracteata	LC		S2
	Enarganthe octonaria	LC		S2
	Fenestraria rhopalophylla subsp. *aurantiaca*	LC		S2
	Hallianthus planus	LC		S2
	Jordaaniella cuprea	LC		S2
	Lampranthus stipulaceus	LC		S2
	Mesembryanthemum amplectens	LC		S2
	Mesembryanthemum articulatum	LC		S2
	Mesembryanthemum barklyi	LC		S2
	Mesembryanthemum brevicarpum	LC		S2
	Mesembryanthemum delum	LC		S2
	Mesembryanthemum dinteri	LC		S2
	Mesembryanthemum hypertrophicum	LC		S2
	Mesembryanthemum neglectum	LC		S2
	Mesembryanthemum neofoliosum	LC		S2
	Mesembryanthemum noctiflorum subsp. *noctiflorum*	LC		S2
	Mesembryanthemum oculatum	LC		S2
	Mesembryanthemum pellitum	LC		S2
	Mesembryanthemum pseudoschlichtianum	LC		S2
	Mesembryanthemum serotinum	LC		S2
	Mesembryanthemum subnodosum	LC		S2
	Meyerophytum meyeri	LC		S2

FAMILY	SPECIES	STATUS	NFA	NCNCA
AIZOACEAE	*Mitrophyllum clivorum*	LC		S2
	Mitrophyllum mitratum	VU		S2
	Nelia schlechteri	Rare		S2
	Ruschia leucosperma	LC		S2
	Ruschia viridifolia	LC		S2
	Schlechteranthus hallii	LC		S2
	Schlechteranthus maximilianii	VU		S2
	Stoeberia beetzii	LC		S2
	Stoeberia frutescens	LC		S2
	Stoeberia utilis	LC		S2
AMARANTHACEAE	***Atriplex lindleyi***	Decl. Inv.		
	Atriplex nummularia	Decl. Inv.		
	Atriplex vestita	LC		
AMARYLLIDACEAE	*Gethyllis namaquensis*	LC		S2
AMARYLLIDACEAE	***Haemanthus pubescens* subsp. *arenicola***	Rare		S2
ANACAMPSEROTACEAE	*Anacampseros albissima*	LC		
	Anacampseros lanceolata subsp. *lanceolata*	LC		
	Anacampseros namaquensis	LC		
	Anacampseros scopata	Rare		
APOCYNACEAE	*Gomphocarpus cancellatus*	LC		S2
	Microloma calycinum	LC		S2
	Orbea namaquensis	LC		S2
	Quaqua parviflora	LC		S2
	Tromotriche aperta	LC		S2
ASPARAGACEAE	*Asparagus capensis* var. *litoralis*	LC		
	Asparagus graniticus	LC		
ASPHODELACEAE	***Bulbine torsiva***	DDT		S2
	Bulbine vitrea	VU		S2
	Haworthia arachnoidea var. *namaquensis*	LC		S2
ASTERACEAE	*Arctotis fastuosa*	LC		
	Crassothonna sedifolia	LC		
	Didelta carnosa	LC		
	Dimorphotheca sinuata	LC		
	Felicia namaquana	LC		
	Nolletia gariepina	LC		
	Osteospermum oppositifolium	LC		
	Othonna furcata	LC		
	Pentzia incana	LC		
	Pentzia quinquefida	LC		
	Pteronia glabrata	LC		
	Senecio albopunctatus	LC		S2
	Senecio aloides	LC		
	Senecio sarcoides	LC		
CAMPANULACEAE	***Wahlenbergia asparagoides***	NT		
	Wahlenbergia prostrata	LC		
COLCHICACEAE	*Ornithoglossum undulatum*	LC		
CRASSULACEAE	*Cotyledon orbiculata* var. *orbiculata*	LC		S2
	Crassula columella	Rare		S2

FAMILY	SPECIES	STATUS	NFA	NCNCA
CRASSULACEAE	*Crassula columnaris* subsp. *prolifera*	LC		S2
	Crassula deceptor	LC		S2
	Crassula grisea	LC		S2
	Crassula macowaniana	LC		S2
	Crassula muscosa	LC		S2
	Tylecodon buchholzianus* subsp. *fasciculatus	DDT		S2
	Tylecodon pearsonii	LC		S2
	Tylecodon racemosus	LC		S2
	Tylecodon reticulatus	LC		S2
	Tylecodon wallichii	LC		S2
CYPERACEAE	*Ficinia brevifolia*	LC		
EUPHORBIACEAE	*Euphorbia caput-medusae*	LC		S2
	Euphorbia dregeana	LC		S2
	Euphorbia ephedroides	LC		S2
	Euphorbia mauritanica	LC		S2
	Euphorbia rhombifolia	LC		S2
FABACEAE	*Calobota sericea*	LC		
	Lessertia diffusa	LC		S1
GERANIACEAE	*Monsonia ciliata*	LC		
	Pelargonium crithmifolium	LC		S1
	Pelargonium fulgidum	LC		S1
	Pelargonium praemorsum subsp. *praemorsum*	LC		S1
HYACINTHACEAE	*Lachenalia anguinea*	LC		S2
	Massonia bifolia	LC		
	Ornithogalum deltoideum	LC		S2
IRIDACEAE	***Babiana hirsuta***	NT		S2
	Babiana tritonioides	VU		S2
	Ferraria schaeferi	LC		S2
	Lapeirousia dolomitica	LC		S2
KEWACEAE	*Kewa salsoloides*	LC		
MALVACEAE	*Hermannia desertorum*	LC		
MELIANTHACEAE	*Melianthus pectinatus* subsp. *pectinatus*	LC		
MOLLUGINACEAE	*Coelanthum grandiflorum*	LC		
NEURADACEAE	*Grielum grandiflorum*	LC		
POACEAE	*Cladoraphis cyperoides*	LC		
	Cladoraphis spinosa	LC		
	Ehrharta pusilla	LC		
	Schismus schismoides	LC		
	Stipagrostis ciliata	LC		
SCROPHULARIACEAE	*Lyperia tristis*	LC		
	Manulea altissima	LC		S2
	Nemesia saccata	VU		S2
SOLANACEAE	*Lycium cinereum*	LC		
	Lycium tetrandrum	LC		
ZYGOPHYLLACEAE	*Roepera cordifolia*	LC		
	Roepera leptopetala	LC		
	Roepera macrocarpon	LC		
ZYGOPHYLLACEAE	*Roepera morgsana*	LC		
	Tetraena prismatocarpa	LC		
	Tetraena retrofracta	LC		

APPENDIX 2

Fauna species list

LIST OF MAMMALS

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

	Scientific name	Common name	IUCN	SAMRL	Habitat	Potential occurrence
CHIROPTERA	[2]*Nycteris thebaica*	Common Slit-faced Bat	LC	LC	Savanna species with wide habitat tolerance. Roosts in caves, mine adits, aardvark holes, rock crevices and hollow trees in open savanna.	Low
	[2]*Rhinolophus clivosus*	Geoffroy's horseshoe Bat	LC	**NT**	Wide habitat tolerance. Roosting in caves, rock crevices, disused mines, and various rural and urban buildings.	Low
	[2]*Rhinolophus darlingi*	Darling's Horseshoe Bat	LC	LC	Savanna habitats	Low
	[2]*Cistugo seabrae*	Angolan Wing-gland Bat	LC	**NT**	Not well-known. Have been found in riverine vegetation of arid regions.	Low
	[2]*Eidolon helvum*	African Straw-coloured Fruit-bat	**NT**	LC	Wide habitat tolerance, but the presence of trees are important.	Low
	[2]*Neoromicia capensis*	Cape Bat	LC	LC	Wide habitat tolerance, but found in arid areas, grassland, bushveld and *Acacia* woodland. Roosts under the bark of trees and similar vegetation.	Low
	[2]*Miniopterus natalensis*	Natal Long-fingered Bat	LC	LC	Wide habitat tolerance. Mainly roosts in caves or mine shafts, but also in crevices and holes in trees.	Low

LIST OF MAMMALS (continued)

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

	Scientific name	Common name	IUCN	SAMRL	Habitat	Potential occurrence
AFROSORICIDA	[2]*Eremitalpa granti*	Grant's Golden Mole	LC	**VU**	Limited to Strandveld and Succulent Karoo. Prefers soft sands of coastal dune crests or interdune swales with quite dense vegetation, containing *Aristida sabulicola, Cladoraphis spinosa* and *Stipagrostis ciliata*.	High (Sandy habitats)
	[2]*Chrysochloris asiatica*	Cape Golden Mole	LC	LC	Occurs within sandy soils in the Fynbos and Nama-Karoo biomes and has been recorded from a wide variety of vegetation types, most commonly in Renosterveld, Fynbos and Strandveld Succulent Karoo	High (Sandy habitats)
MACROSCELIDIDAE	[2]*Macroscelides proboscideus*	Round-eared Sengi	LC	LC	Restricted to gravel plains associated with alluvial plains and relatively flat areas between higher elevation areas such as outcrops, hills and mountains.	Low
	[2]*Elephantulus rupestris*	Western Rock Sengi	LC	LC	Arid habitats, including deserts, dry savannas, and dry shrublands. Associated with rocky ridges, outcrops or koppies, and boulder fields at the bases of mountains.	High (hills)

LIST OF MAMMALS (continued)

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

	Scientific name	Common name	IUCN	SAMRL	Habitat	Potential occurrence
EULIPOTYPHLA	[2]*Crocidura cyanea*	Reddish-Grey Musk Shrew	LC	LC	Wide habitat tolerance, but prefers areas with deep leaf litter, moist soil and ground level vegetation	Moderate (across site)
	[2]*Myosorex varius*	Forest Shrew	LC	LC	Occurs in every biome in South Africa and therefore its name is misleading. It however prefers dense moist grassland and is commonly found along the banks of rivers or dams.	Moderate (across site)
	[2]*Suncus varilla*	Lesser Dwarf Shrew	LC	LC	Generally associated with termite mounds, grassland habitat.	Low
PRIMATES	[4]*Papio ursinus*	Chacma Baboon	LC	LC	Fynbos, montane grasslands, riverine courses in deserts. Only needs water and access to refuge.	Low
	[4]*Chlorocebus pygerythrus*	Vervet Monkey	LC	LC	Woodland savanna, riverine woodland, isolated stands of trees along rivers.	Low
LAGOMORPHA	[2]*Lepus capensis*	Cape Hare	LC	LC	Dry, open regions, with palatable bush and grass.	Confirmed (Dry riverbed)
	[2]*Lepus saxatilis*	Scrub Hare	LC	LC	Common in crop-growing areas or in fallow lands where there is some bush development.	Moderate (across site)

LIST OF MAMMALS (continued)

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

	Scientific name	Common name	IUCN	SAMRL	Habitat	Potential occurrence
RODENTIA	[2]*Graphiurus rupicola*	Stone Dormouse	LC	**NT**	Limited to rocky areas along escarpments from altitudes of 400 m - 1 586 m.	Low
	[2]*Bathyergus janetta*	Namaqua Dune Mole-rat	LC	LC	Sand dunes along the coast / loam and consolidated alluvial soils inland, with geophytes and succulents.	High (Sandy habitats)
	[2]*Hystrix africaeaustralis*	Cape Porcupine	LC	LC	Catholic in habitat requirements.	High (Across site)
	[2]*Petromus typicus*	Dassie Rat	LC	LC	Rocky outcrops, seeking shelter for nest sites in crevices and under large boulders.	High (Hills)
	[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	Occurs on hard ground, unlike other gerbil species, with some cover of grass or karroid bush.	Moderate (Shallow soil habitat)
	[2]*Gerbillurus paeba*	Pygmy Hairy-footed Gerbil	LC	LC	Nama and Succulent Karoo, preferring sandy soil or sandy alluvium with a grass, scrub or light woodland cover.	High (Sandy habitats)
	[2]*Micaelamys namaquensis*	Namaqua Rock Mouse	LC	LC	Catholic habitat requirements, but prefer rocky hills, outcrops or boulder-strewn hillsides.	High (Hills)
	[2]*Otomys unisulcatus*	Karoo Bush Rat	LC	LC	Succulent Karoo habitat, Nama-Karoo and fynbos scrub	High (Across the site)

LIST OF MAMMALS (continued)

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

	Scientific name	Common name	IUCN	SAMRL	Habitat	Potential occurrence
RODENTIA	[2]*Rhabdomys pumilio*	Four-striped Grass Mouse	LC	LC	Occurs in wide variety of habitats where there is good grass cover.	Moderate (Sandy habitats)
	[2]*Mus minutoides*	Pygmy Mouse	LC	LC	Wide habitat tolerance.	High (Across the site)
	[3]*Mus musculus*	House Mouse	LC	*Not assessed*	Wide habitat tolerance.	High (Across the site)
	[2]*Parotomys brantsii*	Brants's Whistling Rat	LC	LC	Restricted to areas with consolidated sands in semi-desert landscapes, with a low percentage plant cover.	High (Deep red sand habitat)
	[2]*Parotomys littledalei*	Littledale's Whistling Rat	LC	**NT**	Occurs in shrublands, specifically in coastal hummocks, sand dunes, gravel plains and dry riverine systems. Avoids open habitats.	High (Dunes and dry riverbed)
	[2]*Petromyscus barbouri*	Barbour's Rock Mouse	LC	LC	Restricted to the arid regions of western South Africa, specifically within rocky areas of succulent shrubland	High (Hills)
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 (Entire site except hills)
	[1]*Otocyon megalotis*	Bat-eared Fox	LC	LC	Prefers short-grass plains, shrub lands and open arid savanna. Absent from true desert or afforested areas.	High (Entire site except hills)

LIST OF MAMMALS (continued)

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

	Scientific name	Common name	IUCN	SAMRL	Habitat	Potential occurrence
CARNIVORA	[4]*Canis mesomelas*	Black-backed Jackal	LC	LC	Wide habitat tolerance.	High (Across the site)
	[1]*Mellivora capensis*	Honey Badger	LC	LC	Wide habitat tolerance.	High (Across the site)
	[1]*Ictonyx striatus*	Striped Polecat	LC	LC	Widely distributed through sub-region.	High (Across the site)
	[2]*Herpestes pulverulentus*	Cape Grey Mongoose	LC	LC	Wide habitat tolerance, but prefers Karoo and karroid bushveld and sclerophyllous scrub	High (Across the site)
	[2]*Cynictis penicillata*	Yellow Mongoose	LC	LC	Semi-arid country on a sandy substrate.	High (Sandy habitats)
	[2]*Suricata suricatta*	Suricate	LC	LC	Open arid country with hard and stony substrate. Occur in Nama- and Succulent Karoo but also fynbos.	High (Shallow soil habitat)
	[2]*Genetta genetta*	Common (Small-spotted) Genet	LC	LC	Occur in open arid habitats.	High (Across the site)
	[1]*Proteles cristata*	Aardwolf	LC	LC	Common in the 100-600mm rainfall range, Nama-Karoo, Succulent Karoo Grassland and Savanna biomes. Absent from true desert and forests.	High (Across the site)
	[1]*Felis silvestris*	African Wild Cat	LC	LC	Wide habitat tolerance.	High (Across the site)
	[4]*Caracal caracal*	Caracal	LC	LC	Caracals tolerate arid regions, occur in semi-desert and karroid conditions.	High (Across the site)
	[1]*Panthera pardus*	Leopard	**VU**	**VU**	Wide habitat tolerance, but prefers densely wooded and rocky areas.	High (Hills)

LIST OF MAMMALS (continued)

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

	Scientific name	Common name	IUCN	SAMRL	Habitat	Potential occurrence
TUBULENTATA	[1]*Orycteropus afer*	Aardvark	LC	LC	Wide habitat tolerance, being found in open woodland, scrub and grassland, especially associated with sandy soil.	High (Sandy habitats)
HYRACOIDEA	[2]*Procavia capensis*	Rock Hyrax	LC	LC	Outcrops of rocks, especially granite formations and dolomite intrusions in the Karoo. Also erosion gullies.	High (Hills)
CETARTIODACTYLA	[2]*Oryx gazella*	Gemsbok	LC	LC	Semi-arid and arid bushland and grassland of the Kalahari and Karoo and adjoining regions of Southern Africa.	Low
	[2]*Oreotragus oreotragus*	Klipspringer	LC	LC	Steep rocky and mountain habitats, including granite outcrops, koppies and gorges with rocky embankments	High (Hills)
	[2]*Pelea capreolus*	**Grey Rhebok**	**NT**	**NT**	Rocky hills, grassy mountain slopes and plateaus	Moderate (Hills)
	[2]*Antidorcas marsupialis*	Springbok	LC	LC	Open arid plains with short vegetation	Low
	[2]*Raphicerus campestris*	Steenbok	LC	LC	Inhabits open country.	Confirmed
	[2]*Sylvicapra grimmia*	Common Duiker	LC	LC	Occurs extensively across a variety of habitats, except deserts and rainforests.	High (Across the site)

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 atra*	Southern Rock Agama	LC
	[3]*Agama hispida*	Southern Spiny Agama	LC
CHAMAELEONIDAE	[1]*Bradypodion occidentale*[E]	Western Dwarf Chameleon	LC
	[1]*Chamaeleo namaquensis*	Namaqua Chameleon	LC
COLUBRIDAE	[2]*Dasypeltis scabra*	Rhombic Egg-eater	LC
	[2]*Telescopus beetzii*	Beetz's Tiger Snake	LC
CORDYLIDAE	[1]*Cordylus macropholis*[E]	Large-scaled Girdled Lizard	**NT**
	[1]*Karusasaurus polyzonus*	Southern Karusa Lizard	LC
	[1]*Namazonurus lawrenci*[E]	Lawrence's Nama Lizard	LC
	[1]*Ouroborus cataphractus*[E]	Armadillo Lizard	LC
ELAPIDAE	[3]*Aspidelaps lubricus lubricus*	Coral Shield Cobra	LC
	[3]*Naja nigricincta woodi*	Black Spitting Cobra	LC
	[3]*Naja nivea*	Cape Cobra	LC
GEKKONIDAE	[3]*Afroedura africana namaquensis*[E]	Namaqua Flat Gecko	LC
	[3]*Chondrodactylus angulifer angulifer*	Common Giant Gecko	LC
	[3]*Chondrodactylus bibronii*	Bibron's Gecko	LC
	[3]*Chondrodactylus turneri*	Turner's Gecko	LC
	[3]*Goggia lineata*	Striped Pygmy Gecko	LC
	[3]*Goggia rupicola*[E]	Namaqua Pygmy Gecko	LC
	[3]*Pachydactylus amoenus*[E]	Namaqua Banded Gecko	LC
	[3]*Pachydactylus austeni*[E]	Austen's Gecko	LC
	[3]*Pachydactylus barnardi*[E]	Barnard's Rough Gecko	LC
	[3]*Pachydactylus labialis*[E]	Western Cape Gecko	LC
	[3]*Pachydactylus macrolepis*[E]	Large-scaled Banded Gecko	LC
	[3]*Pachydactylus weberi*	Weber's Gecko	LC
	[3]*Phelsuma ocellata*	Namaqua Day Gecko	LC
	[3]*Ptenopus garrulus maculatus*	Spotted Barking Gecko	LC
GERRHOSAURIDAE	[3]*Cordylosaurus subtessellatus*	Dwarf Plated Lizard	LC
	[3]*Gerrhosaurus typicus*[E]	Karoo Plated Lizard	LC
LACERTIDAE	[2]*Meroles ctenodactylus*	Giant Desert Lizard	LC
	[2]*Meroles knoxii*	Knox's Desert Lizard	LC
	[2]*Meroles suborbitalis*	Spotted Desert Lizard	LC
	[2]*Nucras tessellata*	Western Sandveld Lizard	LC
	[2]*Pedioplanis inornata*	Plain Sand Lizard	LC
	[2]*Pedioplanis lineoocellata pulchella*	Common Sand Lizard	LC
	[2]*Pedioplanis namaquensis*	Namaqua Sand Lizard	LC

LIST OF REPTILES (continued)

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

Family	Scientific name	Common name	IUCN status
LAMPROPHIIDAE	[3]*Homoroselaps lacteus*[E]	Spotted Harlequin Snake	LC
	[3]*Boaedon capensis*	Common House Snake	LC
	[2]*Lamprophis fiskii*[E]	Fisk's Snake	LC
	[2]*Lamprophis guttatus*[E]	Spotted Rock Snake	LC
	[3]*Dipsina multimaculata*	Dwarf Beaked Snake	LC
	[3]*Psammophis crucifer*	Cross-marked Grass Snake	LC
	[3]*Psammophis namibensis*	Namib Sand Snake	LC
	[3]*Psammophis notostictus*	Karoo Sand Snake	LC
	[3]*Psammophylax rhombeatus rhombeatus*	Spotted Grass Snake	LC
	[2]*Prosymna bivittata*	Two-striped Shovel-snout	LC
	[2]*Prosymna frontalis*	Southwestern Shovel-snout	LC
	[2]*Pseudaspis cana*	Mole Snake	LC
SCINCIDAE	[3]*Acontias litoralis*[E]	Coastal Dwarf Legless Skink	LC
	[3]*Acontias namaquensis*[E]	Namaqualand Legless Skink	LC
	[3]*Acontias tristis*[E]	Namaqualand Dwarf Legless Skink	LC
	[3]*Typhlosaurus vermis*[E]	Pink Blind Legless Skink	LC
	[3]*Trachylepis capensis*	Cape Skink	LC
	[3]*Trachylepis occidentalis*	Western Three-striped Skink	LC
	[3]*Trachylepis sulcata sulcata*	Western Rock Skink	LC
	[3]*Trachylepis variegata*	Variegated Skink	LC
	[3]*Scelotes caffer*[E]	Cape Dwarf Burrowing Skink	LC
	[3]*Scelotes sexlineatus*[E]	Striped Dwarf Burrowing Skink	LC
TESTUDINIDAE	[3]*Chersina angulata*	Angulate Tortoise	LC
	[1]*Homopus signatus*	Speckled Dwarf Tortoise	**VU**
	[3]*Psammobates tentorius*	Tent Tortoise	LC
TYPHLOPIDAE	[3]*Rhinotyphlops lalandei*	Delalande's Beaked Blind Snake	LC
	[3]*Rhinotyphlops schinzi*	Schinz's Beaked Blind Snake	LC
VIPERIDAE	[3]*Bitis arietans arietans*	Puff Adder	LC
	[3]*Bitis arietans caudalis*	Horned Adder	LC
	[3]*Bitis arietans cornuta*	Many-horned Adder	LC
	[3]*Bitis arietans schneideri*	Namaqua Dwarf Adder	LC

LIST OF AMPHIBIANS

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

Family	Scientific name	Common name	IUCN status	SA Frog Atlas
BUFONIDAE	[2]*Vandijkophrynus robinsoni*[E]	Paradise Toad	LC	LC
MICROHYLIDAE	[2]*Breviceps macrops*	Desert Rain Frog	**NT**	**VU**
	[2]*Breviceps namaquensis*[E]	Namaqua Rain Frog	LC	LC
PIPIDAE	[2]*Xenopus laevis*	Common Platanna	LC	LC
PYXICEPHALIDAE	[2]*Cacosternum namaquense*[E]	Namaqua Caco	LC	LC

LIST OF BIRDS

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

Scientific name	Common name	IUCN status	SA RDB
[2] *Acrocephalus baeticatus*	African Reed-Warbler	LC	LC
[2] *Actitis hypoleucos*	Common Sandpiper	LC	LC
[2] *Alario alario*	Black-headed Canary	LC	LC
[2] *Alopochen aegyptiacus*	Egyptian Goose	LC	LC
[2] *Anas capensis*	Cape Teal	LC	LC
[2] *Anas erythrorhyncha*	Red-billed Teal	LC	LC
[2] *Anas smithii*	Cape Shoveler	LC	LC
[2] *Anas sparsa*	African Black Duck	LC	LC
[2] *Anas undulata*	Yellow-billed Duck	LC	LC
[2] *Anhinga rufa*	African Darter	LC	LC
[2] *Anthoscopus minutus*	Cape Penduline-Tit	LC	LC
[2] *Anthus cinnamomeus*	African Pipit	LC	LC
[2] *Apus affinis*	Little Swift	LC	LC
[2] *Apus apus*	Common Swift	LC	LC
[2] *Apus bradfieldi*	Bradfield's Swift	LC	LC
[2] *Apus caffer*	White-rumped Swift	LC	LC
[1] *Aquila verreauxii*	Verreaux's Eagle	LC	**VU**
[2] *Ardea cinerea*	Grey Heron	LC	LC
[2] *Ardea melanocephala*	Black-headed Heron	LC	LC
[1] *Ardeotis kori*	Kori Bustard	**NT**	**NT**
[2] *Arenaria interpres*	Ruddy Turnstone	LC	LC
[2] *Bradornis infuscatus*	Chat Flycatcher	LC	LC
[1] *Bubo africanus*	Spotted Eagle-Owl	LC	LC
[1] *Bubo capensis*	Cape Eagle-Owl	LC	LC
[2] *Bubulcus ibis*	Cattle Egret	LC	LC
[2] *Burhinus capensis*	Spotted Thick-knee	LC	LC
[2] *Burhinus vermiculatus*	Water Thick-knee	LC	LC
[1] *Buteo rufofuscus*	Jackal Buzzard	LC	LC
[1] *Buteo vulpinus*	Steppe Buzzard	LC	LC
[2] *Calandrella cinerea*	Red-capped Lark	LC	LC
[2] *Calendulauda albescens*	Karoo Lark	LC	LC
[2] *Calidris alba*	Sanderling	LC	LC
[2] *Calidris canutus*	Red Knot	**NT**	**NT**
[2] *Calidris ferruginea*	Curlew Sandpiper	**NT**	LC
[2] *Calidris minuta*	Little Stint	LC	LC
[1] *Caprimulgus rufigena*	Rufous-cheeked Nightjar	LC	LC
[1] *Caprimulgus tristigma*	Freckled Nightjar	LC	LC
[2] *Cercomela familiaris*	Familiar Chat	LC	LC
[2] *Cercomela schlegelii*	Karoo Chat	LC	LC
[2] *Cercomela sinuata*	Sickle-winged Chat	LC	LC
[2] *Cercomela tractrac*	Tractrac Chat	LC	LC
[2] *Cercotrichas coryphoeus*	Karoo Scrub-Robin	LC	LC

LIST OF BIRDS (Cont.)

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

Scientific name	Common name	IUCN status	SA RDB
[2] *Certhilauda curvirostris*	Cape Long-billed Lark	LC	LC
[2] *Ceryle rudis*	Pied Kingfisher	LC	LC
[2] *Charadrius asiaticus*	Caspian Plover	LC	LC
[2] *Charadrius hiaticula*	Common Ringed Plover	LC	LC
[2] *Charadrius marginatus*	White-fronted Plover	LC	LC
[1] *Charadrius pallidus*	Chestnut-banded Plover	**NT**	**NT**
[2] *Charadrius pecuarius*	Kittlitz's Plover	LC	LC
[2] *Charadrius tricollaris*	Three-banded Plover	LC	LC
[2] *Chersomanes albofasciata*	Spike-heeled Lark	LC	LC
[2] *Ciconia ciconia*	White Stork	LC	LC
[1] *Ciconia nigra*	Black Stork	LC	**VU**
[2] *Cinnyris chalybeus*	Southern Double-collared Sunbird	LC	LC
[2] *Cinnyris fusca*	Dusky Sunbird	LC	LC
[1] *Circaetus pectoralis*	Black-chested Snake-Eagle	LC	LC
[1] *Circus maurus*	Black Harrier	**EN**	LC
[2] *Cisticola subruficapillus*	Grey-backed Cisticola	LC	LC
[3] *Colius colius*	White-backed Mousebird	LC	LC
[2] *Columba guinea*	Speckled Pigeon	LC	LC
[2] *Columba livia*	Rock Dove	LC	LC
[3] *Corvus albus*	Pied Crow	LC	LC
[3] *Corvus capensis*	Cape Crow	LC	LC
[2] *Cossypha caffra*	Cape Robin-Chat	LC	LC
[2] *Coturnix coturnix*	Common Quail	LC	LC
[2] *Creatophora cinerea*	Wattled Starling	LC	LC
[2] *Cursorius rufus*	Burchell's Courser	LC	**VU**
[2] *Egretta garzetta*	Little Egret	LC	LC
[1] *Elanus caeruleus*	Black-shouldered Kite	LC	LC
[2] *Emberiza capensis*	Cape Bunting	LC	LC
[2] *Emberiza impetuani*	Lark-like Bunting	LC	LC
[2] *Eremomela gregalis*	Karoo Eremomela	LC	LC
[2] *Eremomela icteropygialis*	Yellow-bellied Eremomela	LC	LC
[2] *Eremopterix australis*	Black-eared Sparrowlark	LC	LC
[2] *Eremopterix verticalis*	Grey-backed Sparrowlark	LC	LC
[2] *Estrilda astrild*	Common Waxbill	LC	LC
[3] *Euplectes orix*	Southern Red Bishop	LC	LC
[1] *Falco biarmicus*	Lanner Falcon	LC	**VU**
[1] *Falco chicquera*	Red-necked Falcon	**NT**	LC
[1] *Falco naumanni*	Lesser Kestrel	LC	LC
[1] *Falco peregrinus*	Peregrine Falcon	LC	LC
[1] *Falco rupicolis*	Rock Kestrel	LC	LC
[1] *Falco rupicoloides*	Greater Kestrel	LC	LC
[2] *Fulica cristata*	Red-knobbed Coot	LC	LC
[2] *Galerida magnirostris*	Large-billed Lark	LC	LC

LIST OF BIRDS (Cont.)

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

Scientific name	Common name	IUCN status	SA RDB
[2] *Gallinula chloropus*	Common Moorhen	LC	LC
[2] *Geocolaptes olivaceus*	Ground Woodpecker	**NT**	LC
[2] *Hieraaetus pennatus*	Booted Eagle	LC	LC
[2] *Himantopus himantopus*	Black-winged Stilt	LC	LC
[2] *Hirundo albigularis*	White-throated Swallow	LC	LC
[2] *Hirundo cucullata*	Greater Striped Swallow	LC	-
[2] *Hirundo fuligula*	Rock Martin	LC	LC
[2] *Hirundo rustica*	Barn Swallow	LC	LC
[2] *Ixobrychus minutus*	Little Bittern	LC	LC
[2] *Lamprotornis nitens*	Cape Glossy Starling	LC	LC
[2] *Lanius collaris*	Common Fiscal	LC	LC
[2] *Larus cirrocephalus*	Grey-headed Gull	LC	LC
[2] *Larus hartlaubii*	Hartlaub's Gull	LC	LC
[2] *Limosa lapponica*	Bar-tailed Godwit	**NT**	**NT**
[2] *Malcorus pectoralis*	Rufous-eared Warbler	LC	LC
[1] *Melierax canorus*	Southern Pale Chanting Goshawk	LC	LC
[2] *Motacilla capensis*	Cape Wagtail	LC	LC
[2] *Muscicapa striata*	Spotted Flycatcher	LC	LC
[2] *Myrmecocichla formicivora*	Anteating Chat	LC	LC
[2] *Nectarinia famosa*	Malachite Sunbird	LC	LC
[1] *Neotis ludwigii*	Ludwig's Bustard	**EN**	**EN**
[2] *Netta erythrophthalma*	Southern Pochard	LC	LC
[2] *Numenius arquata*	Eurasian Curlew	**NT**	**NT**
[2] *Numenius phaeopus*	Common Whimbrel	LC	LC
[2] *Numida meleagris*	Helmeted Guineafowl	LC	LC
[2] *Oena capensis*	Namaqua Dove	LC	LC
[2] *Oenanthe monticola*	Mountain Wheatear	LC	LC
[2] *Oenanthe pileata*	Capped Wheatear	LC	LC
[2] *Onychognathus nabouroup*	Pale-winged Starling	LC	LC
[2] *Oxyura maccoa*	Maccoa Duck	**VU**	**NT**
[2] *Parisoma layardi*	Layard's Tit-Babbler	LC	LC
[2] *Parisoma subcaeruleum*	Chestnut-vented Tit-Babbler	LC	LC
[2] *Parus afer*	Grey Tit	LC	LC
[3] *Passer domesticus*	House Sparrow	LC	LC
[3] *Passer melanurus*	Cape Sparrow	LC	LC
[1] *Pelecanus onocrotalus*	Great White Pelican	LC	LC
[2] *Phalacrocorax lucidus*	White-breasted Cormorant	LC	LC
[2] *Philomachus pugnax*	Ruff	LC	LC
[1] *Phoenicopterus minor*	Lesser Flamingo	**NT**	**NT**
[1] *Phoenicopterus ruber*	Greater Flamingo	LC	**NT**
[2] *Phragmacia substriata*	Namaqua Warbler	LC	LC
[2] *Phylloscopus trochilus*	Willow Warbler	LC	LC

LIST OF BIRDS (Cont.)

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

Scientific name	Common name	IUCN status	SA RDB
[2] *Plectropterus gambensis*	Spur-winged Goose	LC	LC
[3] *Ploceus capensis*	Cape Weaver	LC	LC
[3] *Ploceus velatus*	Southern Masked-Weaver	LC	LC
[2] *Pluvialis squatarola*	Grey Plover	LC	LC
[1] *Polemaetus bellicosus*	Martial Eagle	**EN**	**EN**
[1] *Polyboroides typus*	African Harrier-Hawk	LC	LC
[2] *Porphyrio madagascariensis*	African Purple Swamphen	LC	LC
[2] *Prinia maculosa*	Karoo Prinia	LC	LC
[2] *Pternistis capensis*	Cape Francolin	LC	LC
[2] *Pterocles namaqua*	Namaqua Sandgrouse	LC	LC
[3] *Pycnonotus nigricans*	African Red-eyed Bulbul	LC	LC
[2] *Recurvirostra avosetta*	Pied Avocet	LC	LC
[2] *Rhinoptilus africanus*	Double-banded Courser	LC	LC
[2] *Riparia paludicola*	Brown-throated Martin	LC	LC
[1] *Sagittarius serpentarius*	Secretarybird	**EN**	**VU**
[2] *Saxicola torquata*	African Stonechat	LC	LC
[2] *Scopus umbretta*	Hamerkop	LC	LC
[2] *Serinus albogularis*	White-throated Canary	LC	LC
[2] *Serinus flaviventris*	Yellow Canary	LC	LC
[2] *Stenostira scita*	Fairy Flycatcher	LC	LC
[1] *Sterna balaenarum*	Damara Tern	LC	LC
[2] *Streptopelia capicola*	Cape Turtle-Dove	LC	LC
[2] *Streptopelia senegalensis*	Laughing Dove	LC	LC
[2] *Struthio camelus*	Common Ostrich	LC	LC
[6] *Sturnus vulgaris*	Common Starling	LC	Invasive
[2] *Sylvietta rufescens*	Long-billed Crombec	LC	LC
[2] *Tachybaptus ruficollis*	Little Grebe	LC	LC
[2] *Tachymarptis melba*	Alpine Swift	LC	LC
[2] *Tadorna cana*	South African Shelduck	LC	LC
[2] *Telophorus zeylonus*	Bokmakierie	LC	LC
[2] *Threskiornis aethiopicus*	African Sacred Ibis	LC	LC
[2] *Tockus leucomelas*	Southern Yellow-billed Hornbill	LC	LC
[2] *Tringa glareola*	Wood Sandpiper	LC	LC
[2] *Tringa nebularia*	Common Greenshank	LC	LC
[2] *Tringa stagnatilis*	Marsh Sandpiper	LC	LC
[2] *Turdus smithi*	Karoo Thrush	-	LC
[1] *Tyto alba*	Barn Owl	LC	LC
[2] *Upupa africana*	African Hoopoe	LC	LC
[3] *Urocolius indicus*	Red-faced Mousebird	LC	LC
[2] *Vanellus armatus*	Blacksmith Lapwing	LC	LC
[2] *Xenus cinereus*	Terek Sandpiper	LC	LC
[2] *Zosterops pallidus*	Orange River White-eye	LC	LC

APPENDIX 3

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

Amphibolia succulenta

Listed as Near Threatened

Extent of occurrence is 7 339 km². It is a common species, occurring at more than 10 locations, but continues to decline across its range due to ongoing habitat loss and degradation.

Wahlenbergia asparagoides

Listed as Near Threatened

Extent of occurrence is 11 275 km², known from 10 - 11 locations. Sandveld endemic threatened by habitat loss due to mining and expansion of crop cultivation (wheat).

Lessertia diffusa

All *Lessertia* spp. are protected under Schedule 1 of the NCNCA

Flowers

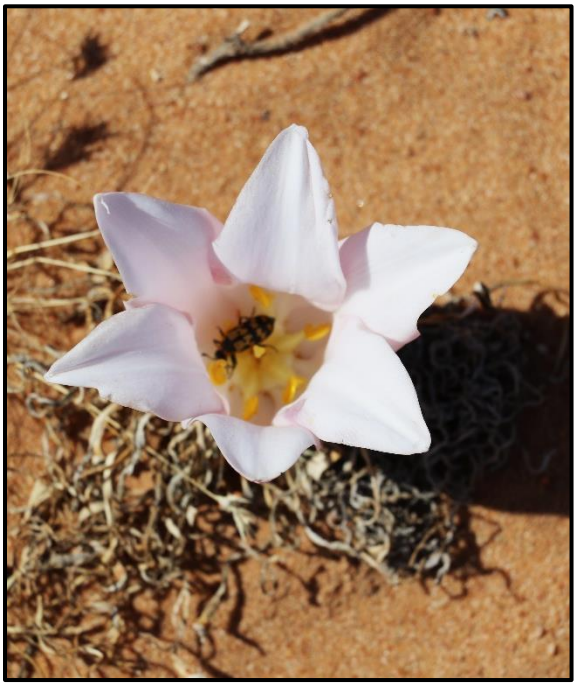
Pods

Pelargonium crithmifolium

All *Pelargonium* spp. are protected under Schedule 1 of the NCNCA

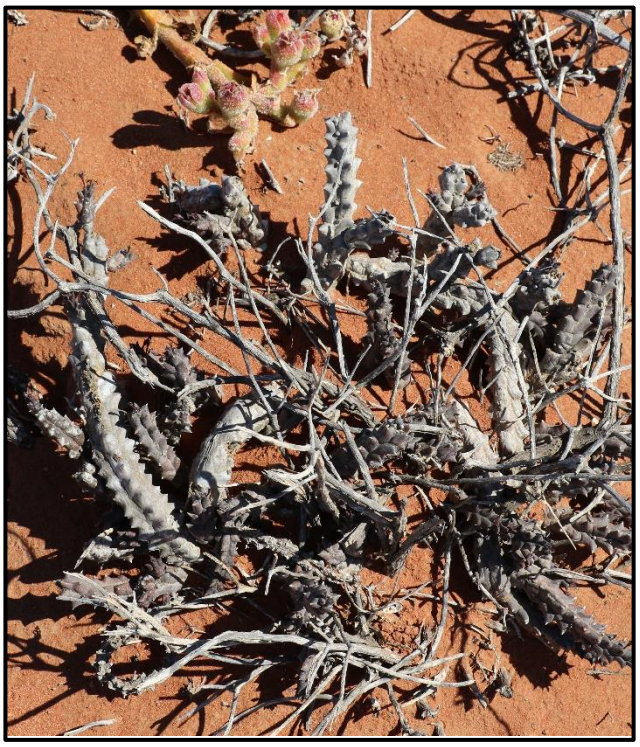
Gethyllis namaquensis

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



Quaqua parviflora

All Apocynaceae are protected under Schedule 2 of the NCNCA



Manulea altissima

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

Mesembs

All Aizoaceae (Mesembryanthemaceae) are protected under Schedule 2 of the NCNCA








Stonecrops

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

Euphorbias

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