



# Biodiversity Desktop Assessment for the Pella Bulk Water Pipeline Project

## Pella, Northern Cape

January 2020

CLIENT



Prepared by:

**The Biodiversity Company**





Cell: +27 81 319 1225

Fax: +27 86 527 1965

[info@thebiodiversitycompany.com](mailto:info@thebiodiversitycompany.com)

[www.thebiodiversitycompany.com](http://www.thebiodiversitycompany.com)



Report Name	<b>Biodiversity Desktop Assessment for the Pella Bulk Water Pipeline Project</b>
Submitted to	
Report Writer	<p><b>Martinus Erasmus</b> </p> <p>Martinus Erasmus (Cand Sci Nat) obtained his B-Tech degree in Nature Conservation in 2016 at the Tshwane University of Technology. Martinus has been conducting EIAs, basic assessments and assisting specialists in the field during his studies since 2015.</p>
Report Writer	<p><b>Lindi Steyn</b> </p> <p>Lindi Steyn has a Ph.D. in Biodiversity and Conservation from the University of Johannesburg. She specialises in avifauna and has worked in this specialisation since 2013.</p>
Report Reviewer	<p><b>Andrew Husted</b> </p> <p>Andrew Husted is Pr Sci Nat registered (400213/11) in the following fields of practice: Ecological Science, Environmental Science and Aquatic Science. Andrew is an Aquatic, Wetland and Biodiversity Specialist with more than 12 years' experience in the environmental consulting field. Andrew has completed numerous wetland training courses, and is an accredited wetland practitioner, recognised by the DWS, and also the Mondi Wetlands programme as a competent wetland consultant.</p>
Declaration	<p>The Biodiversity Company and its associates operate as independent consultants under the auspice of the South African Council for Natural Scientific Professions. We declare that we have no affiliation with or vested financial interests in the proponent, other than for work performed under the Environmental Impact Assessment Regulations, 2014 (as amended). We have no conflicting interests in the undertaking of this activity and have no interest in secondary developments resulting from the authorisation of this project. We have no vested interest in the project, other than to provide a professional service within the constraints of the project (timing, time and budget) based on the principles of science.</p>

## DECLARATION

I, Lindi Steyn, declare that:

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the National Environmental Management Act, 1998 (Act No. 107 of 1998), regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the National Environmental Management Act, 1998 (Act No. 107 of 1998), regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by the competent authority; and the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence and is punishable in terms of Section 24F of the National Environmental Management Act, 1998 (Act No. 107 of 1998).



Lindi Steyn

Terrestrial Ecologist

The Biodiversity Company

January 2020

## DECLARATION

I, Martinus Erasmus, declare that:

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
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- I realise that a false declaration is an offence and is punishable in terms of Section 24F of the National Environmental Management Act, 1998 (Act No. 107 of 1998).



Martinus Erasmus

Terrestrial Ecologist

The Biodiversity Company

January 2020

## Executive Summary

The Biodiversity Company was commissioned by SLR Consulting (South Africa) (Pty) Ltd to conduct a desktop biodiversity assessment as part of the Environmental Impact Assessment (EIA), the Environmental Authorisation Process for an underground Pella Bulk Water Pipeline that forms part of the Pella Water Supply Scheme in the Northern Cape, South Africa. The new 44MI/day underground Pella Bulk Water Pipeline will replace the old 28MI/day which will be used to supply water to the proposed Gamsberg Smelter Project and existing Gamsberg Zinc Mine, Black Mountain Mine and the surrounding towns (Aggeneys, Pella, Pofadder and local landowners).

### Baseline Environment

Based on the desktop review, the proposed Pella Bulk Water Pipeline project area is considered to be sensitive. This can be determined from the ecological datasets reviewed for this assessment. Based on the desktop ecological review the habitat is still regarded to be in a semi-natural condition (as it may have recovered from the original disturbance in 2012) and will provide habitat for several faunal species including some threatened species. A total of 215 protected flora species area expected in the project area, this number is made up of three protected trees (NFA, 2014), ten under schedule 1 of the NCNCA (2009), 196 protected under schedule 2 of the NCNCA (2009) and seven by the IUCN (2017). This expected diversity is indicative of the importance of these habitats to collectively provide refugia, food, and corridors for dispersal in and through the surrounding area. Despite this largely natural condition expected for the area, only Low and Very Low levels of impact significance are expected for the project should mitigation measures be implemented for the project. A recommendation is provided for the implementation of a rehabilitation plan to facilitate this project.

The following conclusions have been summarised for the desktop assessment:

- Based on the Terrestrial Critical Biodiversity Area (CBA) map, the project area falls within an area classified as CBA1, CBA2 and Ecological Support Area (ESA);
- The proposed project area was superimposed on the Succulent Karoo Ecosystem Programme (SKEP, 2013) priority area spatial data. According to this, the project area falls across the Bushmanland Inselbergs Region;
- The project area was superimposed on the ecosystem protection level map to assess the protection status of terrestrial ecosystems associated with the development (Skonwo *et al.*, 2019). Based on this the terrestrial ecosystems associated with the proposed project area is rated as *not protected* and *poorly protected*;
- Based on the National Freshwater Ecosystem Priority Area (NFEPA) (Nel *et al.*, 2011) spatial data the project area falls across a true FEPA wetland;
- The project area intercepts a portion of the Haramoep and Black Mountain Mine Important Bird and Biodiversity Area (IBA) (Birdlife, 2017);
- The project area is situated across seven vegetation types; Aggeneys Gravel Vygieland, Bushmanland Arid Grassland, Bushmanland Inselberg Shrubland,

Bushmanland Sandy Grassland, Eastern Gariep Plains Desert, Eastern Gariep Rocky Desert, and Namaqualand Klipkoppe Shrubland according to SANBI (2019);

- Based on the Plants of Southern Africa database, 621 plant species are expected to occur in the project area (BODATSA-POSA, 2016). Ten of the expected species are protected under schedule 1 of the NCNCA (2009), while a further 196 are protected under schedule 2. Of the 621-plant species, seven (7) species are listed as being SCCs by the IUCN and three are protected trees based on the NFA (2014) list
- Based on the South African Bird Atlas Project, Version 2 (SABAP2) database 149 bird species are expected to occur in the vicinity of the project area of which eight (8) species are listed as SCC either on a regional scale or international scale;
- Sixty-five mammal species are expected of which 7 are SCCs, 61 reptile species are expected and 2 are SCCs while 15 amphibians species with 1 SCC are expected. Majority of these species have a high likelihood of occurring in the project area;
- Based on the desktop spatial results the proposed project area has an overall high sensitivity.

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## 1 Introduction

The Biodiversity Company was commissioned by SLR Consulting (South Africa) (Pty) Ltd to conduct a desktop biodiversity assessment as part of the Environmental Impact Assessment (EIA), the Environmental Authorisation Process for the underground Pella Bulk Water Pipeline that forms part of the Pella Water Supply Scheme in the Northern Cape, South Africa.

The new 28ML/day underground pipeline will replace the old 12.5ML/day which will be used, together with the existing above ground pipeline to supply 44ML/day water to the proposed Gamsberg Smelter Project and existing Gamsberg Zinc Mine, Black Mountain Mine and the surrounding towns (Aggeneys, Pella, Pofadder and local landowners). The proposed underground Pella Bulk Water Pipeline will be located within the existing servitude, with water sourced from the Orange River through an existing intake pump house located at Pella Drift, almost 30 km to the North East of the Gamsberg Zinc Mine (Figure 1).

The proposed Pella Bulk Water Pipeline project area ranges from its start at Pella Drift Water Treatment Plant 39km North East of the town of Aggeneys (Northern Cape) and runs South West till ending at the Horseshoe Reservoir. Due to the minimal rainfall and dry climate of the area, water is a scarce commodity with the Orange River serving as the main source of water for surrounding land uses which includes mining.

Pella Bulk Water Pipeline

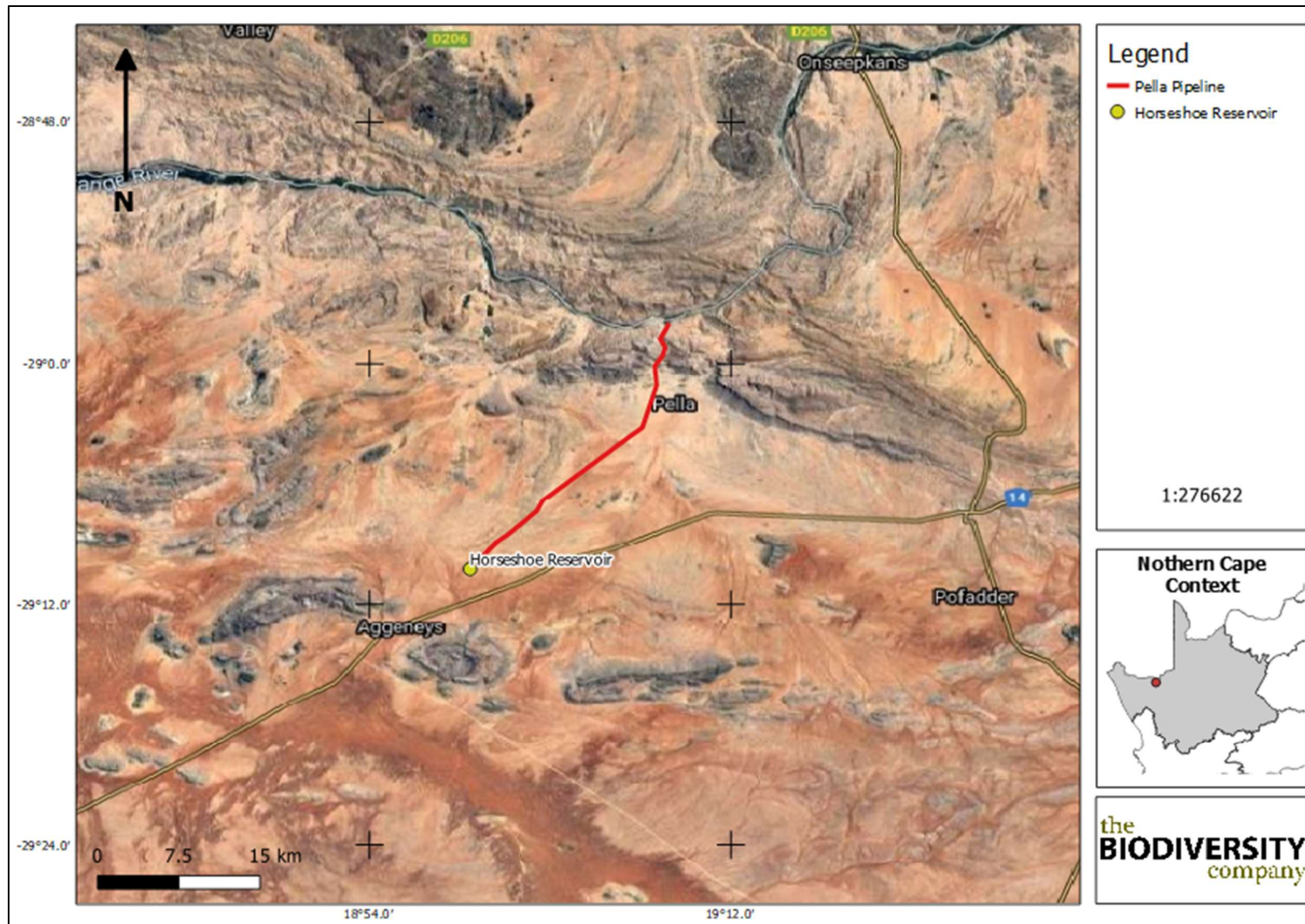


Figure 1 The general location of the proposed Pella Bulk Water Pipeline Project Area

## 2 Scope of Work

The Terms of Reference (ToR) included the following:

- Desktop description of the baseline biodiversity (faunal, floral and general ecology) receiving environment specific to the field of expertise (general surrounding area as well as site specific biodiversity);
- Identification and description of any sensitive biodiversity (faunal, floral and general ecology) receptors in terms of relevant specialist disciplines (biodiversity) that occur in the area, and the manner in which these sensitive receptors may be affected by the activity;
- Identify 'significant' ecological, botanical and faunal features within the proposed project area;
- Identification of conservation significant habitats around the area which might be impacted by the proposed project;
- Identification and listing of any potentially occurring threatened or protected species;
- Screening to identify any critical issues (potential fatal flaws) that may result in project delays or rejection of the application;
- Provide a map to identify sensitive receptors in the project area, based on available maps and database information; and
- Suggest possible impacts, mitigation and rehabilitation measures to prevent or reduce the possible impacts.

## 3 Limitations

The following limitations should be noted for the study:

- As per the scope of work, the assessment consisted of a desktop assessment only, all the impacts assessed were also only based on the desktop information.

## 4 Methodologies

### 4.1 Geographic Information Systems (GIS) Mapping

Existing data layers were incorporated into GIS software to establish how the proposed project might interact with any ecologically important entities. Emphasis was placed around the following spatial datasets:

- Vegetation Map of South Africa, Lesotho and Swaziland (SANBI, 2019);
- Northern Cape C-plan (SANBI, 2017a);
- The National Freshwater Ecosystem Priority Areas (Nel *et al.*, 2011); and

- Important Bird and Biodiversity Areas (Birdlife, 2017).

## 4.2 Botanical Assessment

The botanical component encompassed a desktop assessment of all the vegetation units and habitat types within the proposed Pella Bulk Water Pipeline Project Area. The focus was on an ecological assessment of habitat types as well as identification of any Red Data species within the known distribution of the project area. The South African National Biodiversity Institute (SANBI) provides an electronic database system, namely the Botanical Database of Southern Africa (BODATSA), to access distribution records on southern African plants. This is a new database that replaces the old Plants of Southern Africa (POSA) database. The POSA database provided distribution data of flora at the quarter degree square (QDS) resolution.

The Red List of South African Plants website (SANBI, 2017b) was utilized to provide the most current account of the national status of flora. In addition all Threatened or Protected Species as listed by the National Environmental Management Biodiversity Act, 2004 (Act No. 10 of 2004) Regulations, all categories of protected species listed by the Northern Cape Nature Conservation Act, 2009 (Act No. 9 of 2009) as well as the latest IUCN Red data lists were also consulted and listed. In addition all Protected Trees as listed by the National Forest Act, 1998 (Act No. 84 of 1998) was also listed.

Additional information regarding ecosystems, vegetation types, and species of conservation concern (SCC) included the following sources:

- The Vegetation of South Africa, Lesotho and Swaziland (Mucina & Rutherford, 2006); and
- Red List of South African Plants (Raimondo *et al.*, 2009; SANBI, 2017b).

## 4.3 Faunal Assessment (Mammals & Avifauna)

The faunal desktop assessment included the following:

- Compilation of expected species lists;
- Identification of any Red Data or SCC potentially occurring in the area; and
- Emphasis was placed on the probability of occurrence of species of provincial, national and international conservation importance. This include species listed by the Threatened or Protected Species as listed by the National Environmental Management Biodiversity Act, 2004 (Act No. 10 of 2004), all categories of protected species listed by the Northern Cape Nature Conservation Act, 2009 (Act No. 9 of 2009) as well as the latest IUCN Red data lists.

Mammal distribution data were obtained from the following information/literature sources:

- The Mammals of the Southern African Subregion (Skinner & Chimimba, 2005);
- Bats of Southern and Central Africa (Monadjem *et al.*, 2010);

- The 2016 Red List of Mammals of South Africa, Lesotho and Swaziland ([www.ewt.org.za](http://www.ewt.org.za)) (EWT, 2016); and
- Animal Demography Unit (ADU) - MammalMap Category (MammalMap, 2017) ([mammalmap.adu.org.za](http://mammalmap.adu.org.za)).

While the Avifauna distribution and other pertinent data was obtained from:

- Southern African Bird Atlas Project 2 (SABAP2, 2019);
- Birdlife South Africa (2015);
- Birdlife. (2017). Important Bird Areas Factsheets;
- Checklist of the Birds of the World (Del Hoyo *et al.*, 1996);
- Book of birds of South Africa, Lesotho and Swaziland (Taylor *et al.*, 2015); and
- Roberts – Birds of Southern Africa (Hockey *et al.*, 2005).

#### 4.4 Herpetology (Reptiles & Amphibians)

A herpetofauna desktop assessment of the possible species in the area was done and attention was paid to the SCCs, sources used included the IUCN (2017) and ADU (2019). Herpetofauna distributional data were obtained from the following information sources:

- South African Reptile Conservation Assessment (SARCA) ([sarca.adu.org](http://sarca.adu.org));
- A Guide to the Reptiles of Southern Africa (Alexander & Marais, 2007);
- Field guide to Snakes and other Reptiles of Southern Africa (Branch, 1998);
- Atlas and Red list of Reptiles of South Africa, Lesotho and Swaziland (Bates *et al.*, 2014);
- A Complete Guide to the Frogs of Southern Africa (du Preez & Carruthers, 2009);
- Animal Demography Unit (ADU) – FrogMAP, 2017 ([frogmap.adu.org.za](http://frogmap.adu.org.za));
- Atlas and Red Data Book of Frogs of South Africa, Lesotho and Swaziland (Mintner *et al.*, 2004); and
- Ensuring a future for South Africa's frogs (Measey, 2011).

## 5 Key Legislative Requirements

The legislation, policies, and guidelines listed below are applicable to the current project in terms of biodiversity and ecological support systems (Table 1). The list below, although extensive, may not be exhaustive and other legislation, policies and guidelines may apply in addition to those listed below.

Explanation of certain documents, organisations or legislation is provided (below Table 1). where these have a high degree of relevance to the project and/or are referred to in this assessment.

**Table 1** *A list of key legislative requirements relevant to biodiversity, aquatics and conservation in the Northern Cape*

<b>INTERNATIONAL</b>	<p>Convention on Biological Diversity, 1983 (CBD, 1993);</p> <p>The United Nations Framework Convention on Climate Change; 1994 (UNFCCC, 1994);</p> <p>The Convention on International Trade in Endangered Species of Wild Fauna and Flora, 1973 (CITES 1973); and</p> <p>The Convention on the Conservation of Migratory Species of Wild Animals, 1979 (Bonn Convention, 1979).</p>
<b>NATIONAL</b>	<p>Constitution of the Republic of South Africa, 2006 (Act No. 108 of 2006);</p> <p>The National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA);</p> <p>The National Environmental Management Protected Areas Act, 2002 (Act No. 57 of 2003) (NEMPAA);</p> <p>The National Environmental Management Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA);</p> <p>The National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) (NEMWA);</p> <p>The Environment Conservation Act, 1989 (Act No. 73 of 1989) (ECA);</p> <p>National Environmental Management Air Quality Act, 2004 (Act No. 39 of 2004) (NEMAQA);</p> <p>Natural Scientific Professions Act, 2003 (Act No. 27 of 2003) (NSPA);</p> <p>National Biodiversity Framework (NBF, 2009);</p> <p>National Forest Act, 1998 (Act No. 84 of 1998) (NFA);</p> <p>National Veld and Forest Fire Act, 1998 (Act No. 101 of 1998) (NVFA);</p> <p>National Water Act, 1998 (Act No. 36 of 1998) (NWA);</p> <p>National Freshwater Ecosystem Priority Areas, 2011 (NFEPA's) (Nel <i>et al.</i>, 2011);</p> <p>World Heritage Convention Act, 1999 (Act No. 49 of 1999) (WHCA);</p> <p>National Heritage Resources Act, 1999 (Act No. 25 of 1999) (WHRA);</p> <p>Municipal Systems Act, 2000 (Act No. 32 of 2000) (MSA);</p> <p>NEMBA: Alien and Invasive Species Regulations, 2014;</p> <p>South Africa's National Biodiversity Strategy and Action Plan (NBSAP, 2011);</p> <p>Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) (CARA);</p> <p>Draft Sustainable Utilisation of Agricultural Resources Bill (Draft Legislation) (2003); and.</p> <p>White paper on the Conservation and Sustainable use of South Africa's biological diversity (1997)</p>
<b>PROVINCIAL</b>	<p>Northern Cape Planning and Development Act, 1998 (Act No. 7 of 1998) (NCPDA); and</p> <p>Northern Cape Nature Conservation Act, 2009 (Act act No. 9 of 2009).</p>

## 6 Desktop Assessment

The following features describe the general area and habitat, this assessment is based on spatial data that are provided by various sources such as the provincial environmental authority and SANBI. The desktop analysis and their relevance to this project are listed in Table 2.

**Table 2** *Desktop spatial features examined.*

Desktop Information Considered	Relevant/Not relevant	Section
Northern Cape Conservation Plan	The project area falls across areas classified as CBA1, CBA2 and ESA	7.1
NBA: Ecosystem Threat Status	Falls across two ecosystem which are listed as EN and LT.	7.2.1



## Pella Bulk Water Pipeline

<b>NBA: Ecosystem Protection Level</b>	The terrestrial ecosystems associated with the proposed project area are rated as <i>not protected</i> , while the northern point of the project area falls in a <i>poorly protected area</i> .	7.2.2
<b>Protected Areas</b>	The project area is found in close proximity to the newly proclaimed Gamsberg Nature Reserve was proclaimed under the NEMPAA on 5 August 2019 (See Northern Cape Provincial Gazette No. 2287 5 Aug 2019).	-
<b>SKEP Priority Area</b>	The project area falls across the Bushmanland Inselberg SKEP (SKEP, 2013)	7.4
<b>Important Bird and Biodiversity Areas</b>	The project area is found within 10km of the Haramoep and Black Mountain Mine IBA	8.1.2.1.1
<b>NFEPA Wetlands and Rivers</b>	The project area falls across a true FEPA and a non-FEPA wetland	7.3

## 6.1 The Northern Cape Biodiversity Sector Plan

### 6.1.1 Aim and objectives

The Northern Cape Department of Environment and Nature Conservation (DENC) has developed the Northern Cape CBA Map which identifies biodiversity priority areas for the province, called Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs). These biodiversity priority areas, together with protected areas, are important for the persistence of a viable representative sample of all ecosystem types and species as well as the long-term ecological functioning of the landscape as a whole.

CBAs are terrestrial and aquatic areas of the landscape that need to be maintained in a natural or near-natural state to ensure the continued existence and functioning of species and ecosystems and the delivery of ecosystem services. CBAs are areas of high biodiversity value and need to be kept in a natural state, with no further loss of habitat or species. Thus, if these areas are not maintained in a natural or near natural state then biodiversity targets cannot be met. Maintaining an area in a natural state can include a variety of biodiversity compatible land uses and resource uses (SANBI-BGIS, 2017).

ESAs are not essential for meeting biodiversity targets but play an important role in supporting the ecological functioning of Critical Biodiversity Areas and/or in delivering ecosystem services. Critical Biodiversity Areas and Ecological Support Areas may be terrestrial or aquatic (SANBI-BGIS, 2017).

The identification of CBAs for the Northern Cape was undertaken using a Systematic Conservation Planning approach. Available data on biodiversity features (incorporating both pattern and process, and covering terrestrial and inland aquatic realms), their condition, current Protected Areas and Conservation Areas, and opportunities and constraints for effective conservation were collated.

The Northern Cape CBA Map updates, revises and replaces all older systematic biodiversity plans and associated products for the province. These include the:

- Namakwa District Biodiversity Sector Plan (2008);
- Cape Fine-Scale Plan (only the extent of the areas in the Northern Cape i.e. Bokkeveld and Nieuwoudvillei) (2008); and
- Richtersveld Municipality Biodiversity Assessment (2012).

## Pella Bulk Water Pipeline

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The Northern Cape CBA Map depicts sites which were assigned to the following CBA categories based on their biodiversity characteristics, spatial configuration and requirement for meeting targets for both biodiversity patterns and ecological processes:

- Critical Biodiversity Area 1 (CBA1). Defined as areas that are irreplaceable for meeting biodiversity targets. There are no other options for conserving the ecosystems, species or ecological processes in these areas (SANBI, 2018).;
- Critical Biodiversity Area 2 (CBA2). Defined as areas that are the best option for meeting biodiversity targets, in the smallest area, while avoiding conflict with other land uses (SANBI, 2018);
- ESA;
- Other Natural Area (ONA). ONAs consist of all those areas in a good or fair ecological condition that fall outside the protected area network and have not been identified as CBAs or ESAs. A biodiversity sector plan or bioregional plan must not specify the desired state/management objectives for ONAs or provide land-use guidelines for ONAs (SANBI, 2018); and
- Protected Area (PA). Areas that are formally protected in terms of the Protected Areas Act (SANBI, 2018).

The project area falls across areas classified as CBA1, CBA2, and ESA. (Figure 2). Some small areas as can be seen in Figure 2 has not been classified, most likely because these areas are developed.

Pella Bulk Water Pipeline

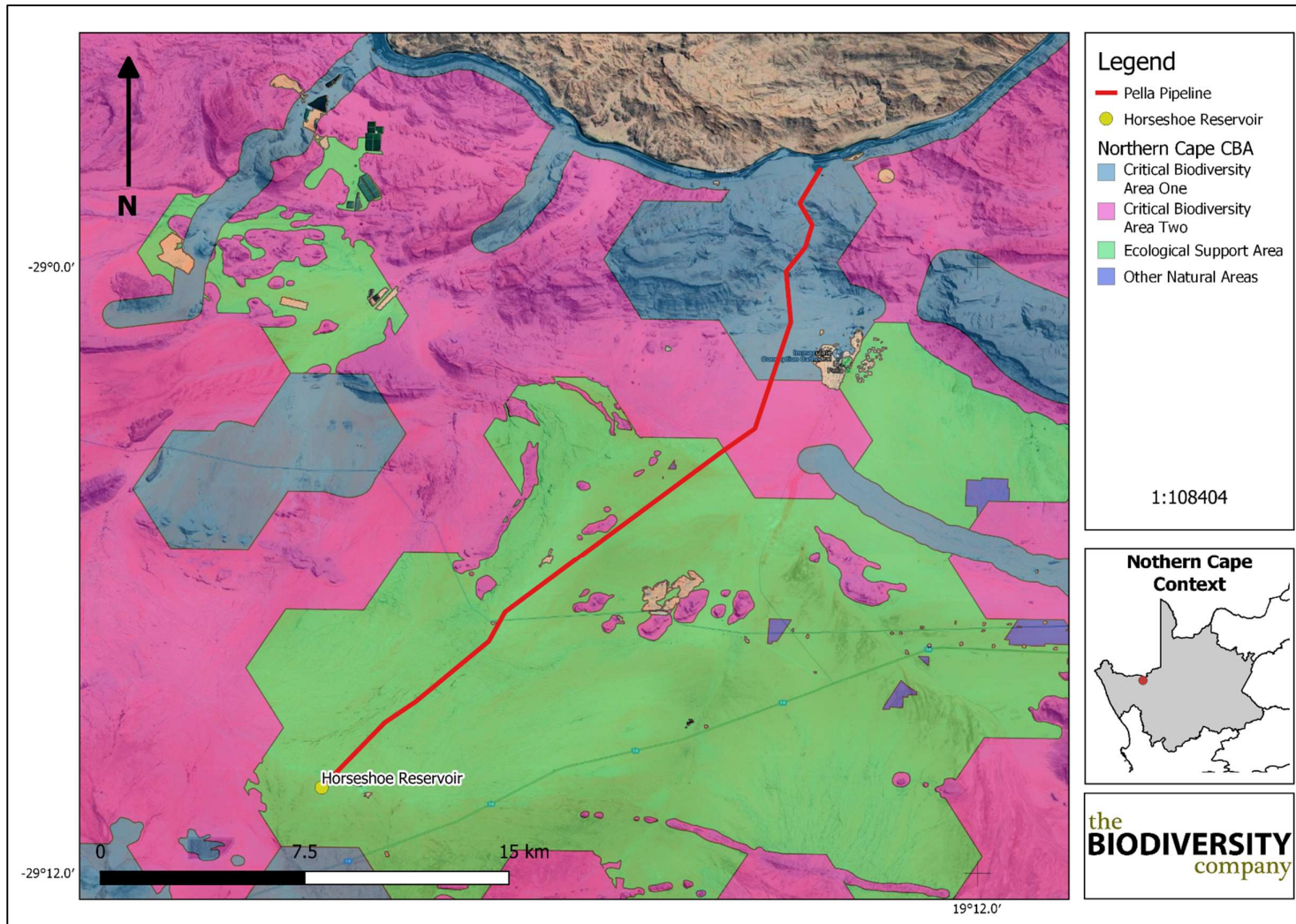


Figure 2 The proposed Pella Bulk Water Pipeline Project Area superimposed on the Northern Cape C-plan (SANBI, 2017a)

## 6.2 National Biodiversity Assessment

The National Biodiversity Assessment (NBA) (2019) was completed as a collaboration between the South Africa National Biodiversity Institute (SANBI), the National Department of Environmental Affairs (DEA) and other stakeholders, including scientists and biodiversity management experts throughout the country over three years (Skonwo *et al.*, 2019).

The purpose of the NBA (2019) is to assess the state of South Africa's biodiversity with a view to understanding trends over time and informing policy and decision-making across a range of sectors (Skonwo *et al.*, 2019).

The two headline indicators assessed in the NBA are *ecosystem threat status* and *ecosystem protection level* (Skonwo *et al.*, 2019).

### 6.2.1 Ecosystem Threat Status

Ecosystem threat status outlines the degree to which ecosystems are still intact or alternatively losing vital aspects of their structure, function, and composition, on which their ability to provide ecosystem services ultimately depends (Skonwo *et al.*, 2019).

Ecosystem types are categorised as Critically Endangered (CR), Endangered (EN), Vulnerable (VU) or Least Threatened (LT), based on the proportion of each ecosystem type that remains in good ecological condition (Skonwo *et al.*, 2019). These terms are different to the norm (as defined by the IUCN) and is based on amongst others; the number of ecosystems, the extent of the natural habitat (km<sup>2</sup>) and the historical loss of the ecosystem. A full description on how these various categories are determined refer to Skonwo *et al.*, 2019.

The project area was superimposed on the terrestrial ecosystem threat status map (Figure 3). As seen in this figure the area falls across two ecosystems which are listed as EN and LT.

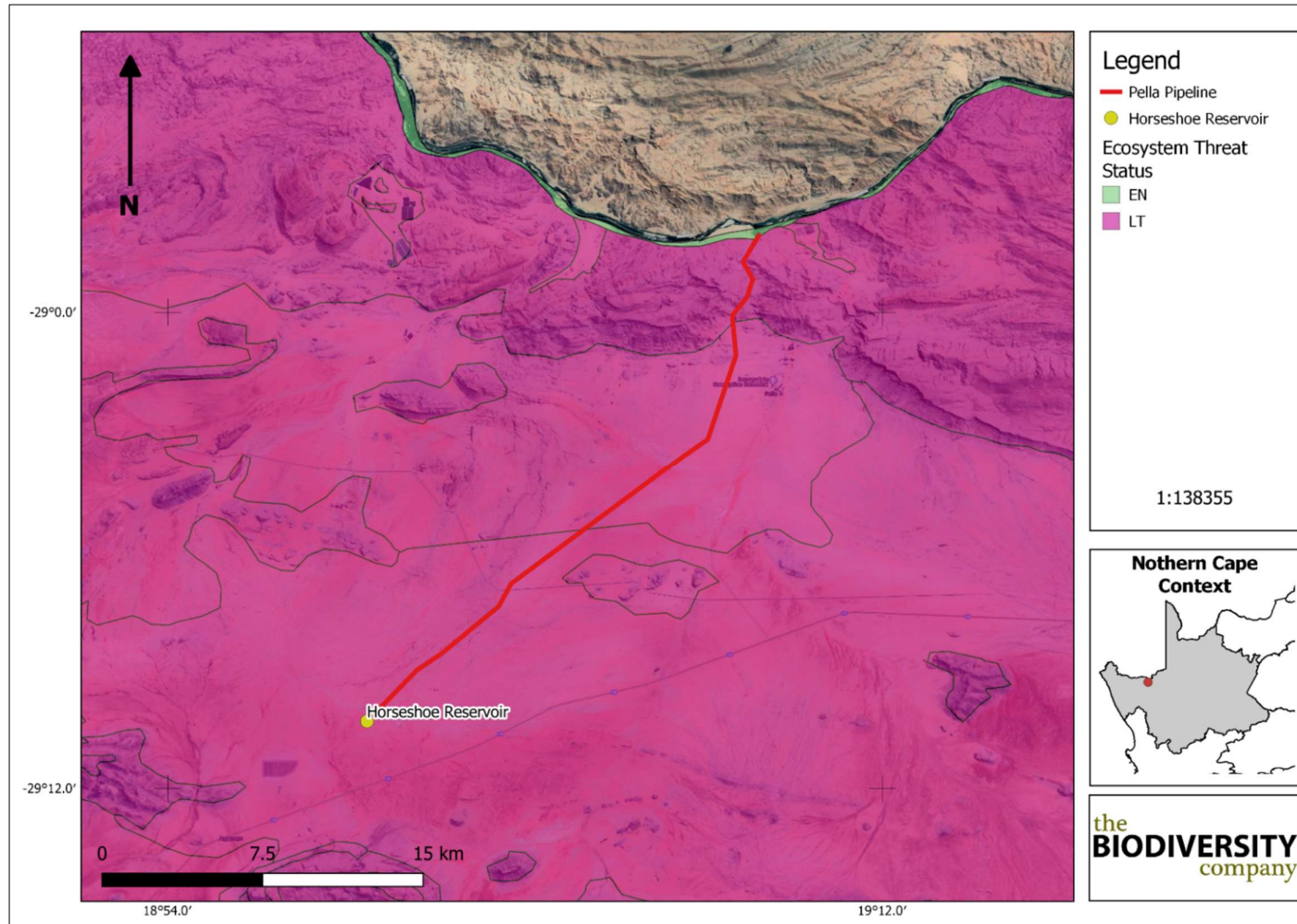


Figure 3 The proposed Pella Bulk Water Pipeline Project Area showing the ecosystem threat status of the associated terrestrial ecosystems (NBA, 2018)

### 6.2.2 Ecosystem Protection Level

The ecosystem protection level (NBA, 2018) tells us whether ecosystems are adequately protected or under-protected. Ecosystem types are categorised as not protected, poorly protected, moderately protected or well protected, based on the proportion of each ecosystem type that occurs within a protected area recognised in the Protected Areas Act (Skonwo *et al.*, 2019).

The area was superimposed on the ecosystem protection level map to assess the protection status of terrestrial ecosystems associated with the development (Figure 4). Based on this the majority of the terrestrial ecosystems associated with the proposed project area are rated as *not protected*, while the northern point of the project area falls in a *poorly protected area*. This means that these ecosystem types (and associated habitats) are not protected anywhere or poorly protected in the country (such as in nationally protected areas).

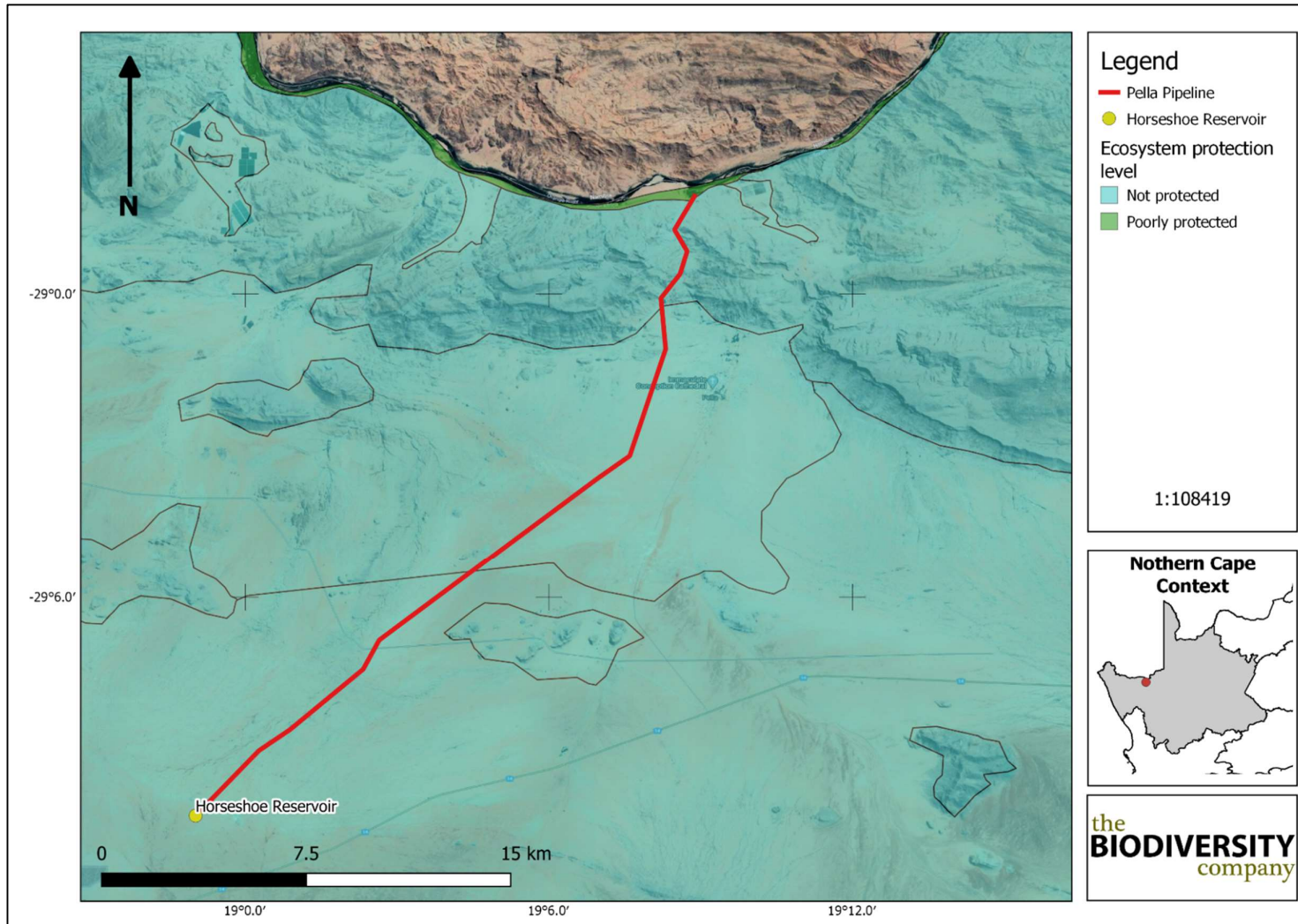


Figure 4 The proposed Pella Bulk Water Pipeline Project Area showing the level of protection of terrestrial ecosystems (NBA, 2018)

### 6.3 National Freshwater Ecosystem Priority Area (NFEPA) Status

In an attempt to better conserve aquatic ecosystems, South Africa has recently categorised its river systems according to set ecological criteria (i.e. ecosystem representation, water yield, connectivity, unique features, and threatened taxa) to identify Freshwater Ecosystem Priority Areas (FEPAs) (Driver *et al.*, 2011). The FEPAs are intended to be conservation support tools and envisioned to guide the effective implementation of measures to achieve the National Environment Management Biodiversity Act, 2004 (Act No. 10 of 2004) (NEM:BA) biodiversity goals (Nel *et al.*, 2011). The NFEPA status mapping for the project area is depicted in Figure 5. The pipeline originates next to a true FEPA wetland area but does not cross any other FEPA wetlands for the length of the pipeline.



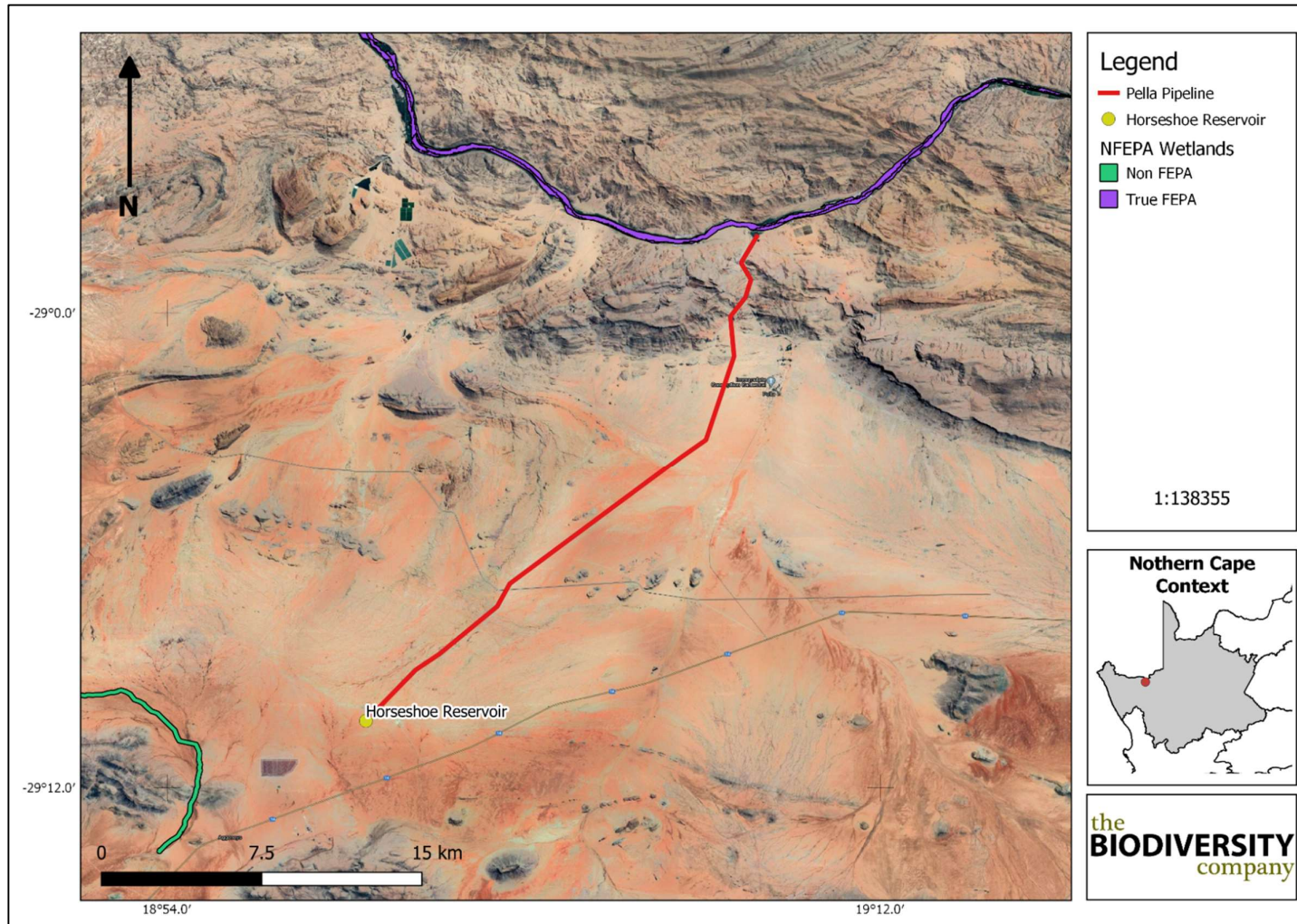


Figure 5 The proposed Pella Bulk Water Pipeline Project Area in relation to the National Freshwater Ecosystem Priority Areas (NFEPA, 2011)

#### 6.4 Succulent Karoo Programme Priority Area

Nine priority geographic areas were identified as the most efficient locations for achieving the conservation targets of the Succulent Karoo Programme (SKEP, 2013). These geographic priority areas were refined based on their ability to contribute to the maintenance of Red Data List species and maintain important ecological processes, particularly in the face of climate change. The nine identified geographic priority areas have conservation value and are most vulnerable to increasing land-use pressures. In these priority areas, SKEP will seek to establish informal conservation networks that will achieve vegetation and process targets.

The Bushmanland Inselbergs area is located on the northeast margin of the Succulent Karoo Hotspot, just south of the Orange River and the border between Namibia and South Africa. The area is dominated by a plain of desert grasslands and peppered by Inselbergs and ancient rocky outcrops in irregular patterns.

These Inselbergs are important refugia for plants and animals and act as stepping-stones for rock-loving species migrating east-west across the sand-covered plains of Bushmanland. Isolation of populations has led to diversification within the dwarf succulent shrub lands.

According to SKEP (2013), the 31 400-hectare area includes 429 plant species, of which 67 are found only in this hotspot and 87 are Red Data List species. Mining has impacted many of the Inselbergs, the spectacularly diverse Gamsberg Inselberg is home to two flagship endemics: *Conophytum ratum* and *Lithops dorotheae*. The Red Lark (*Certhilauda albescens*) is also an important endemic species, although severe overgrazing on communal lands in this part of the Bushmanland plateau is impacting its habitat. Flagship species in this area include: Living stones (*Lithops dorotheae*), the Red Lark (*Calendulauda burra*), Burger's onion (*Conophytum burgeri*) (SKEP, 2013). The project area falls across the Bushmanland Inselberg SKEP area (Figure 6).

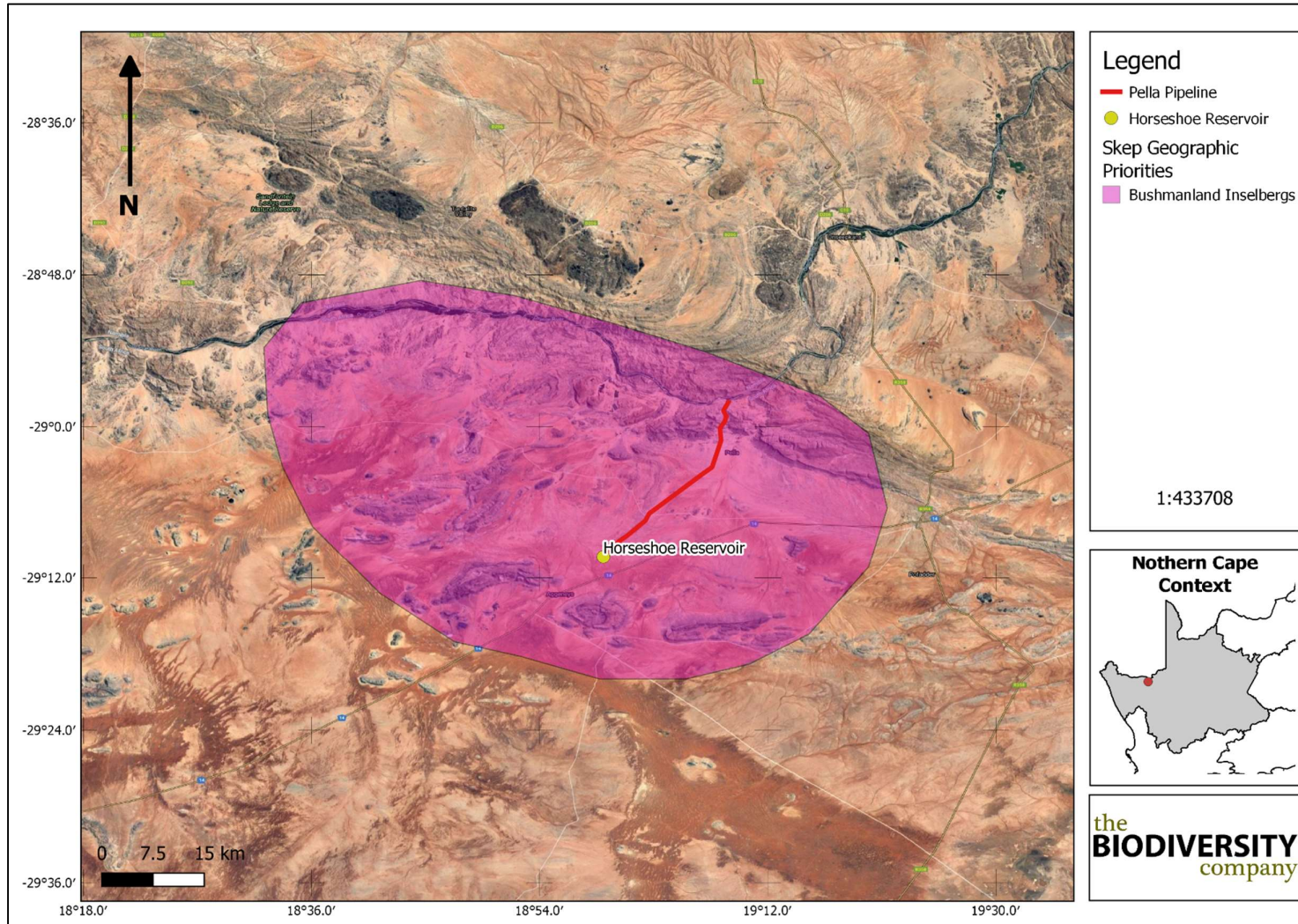


Figure 6 The proposed Pella Bulk Water Pipeline Project Area superimposed on the SKEP spatial dataset (2013)

## 7 Results & Discussion

### 7.1 Desktop Assessment

For the desktop assessment the following previous studies were also included:

- Dismet (2013). Gamsberg Zinc Project: Vegetation Baseline and Impact Assessment Report;
- Ground Truth (2013). Terrestrial Fauna and Aquatic Biodiversity Report for proposed Zinc Mine on Gamsberg, Northern Cape; and
- Todd (2013). Proposed establishment of the Gamsberg zinc mine, concentrator plant and associated infrastructure near the town of Aggeneys, Northern Cape fauna & flora specialist report for ESIA.

The list of species recorded in the various studies can be found in Appendix F, G and H.

#### 7.1.1 Vegetation Assessment

The proposed Pella Bulk Water Pipeline Project Area is situated across three biomes: Nama Karoo, Azonal Vegetation and Desert (Figure 7).

The Nama Karoo Biome is found in the central plateau of the western half of South Africa. The geology underlying the biome is varied, as the distribution of this biome is determined primarily by rainfall. The rain falls in summer and varies between 100 and 520 mm per year (Low & Rebelo, 1996). This also determines the predominant soil type - over 80% of the area is covered by a lime-rich, weakly developed soil over rock. Although less than 5% of rain reaches the rivers, the high erodibility of soils poses a major problem where overgrazing occurs (SANBI, 2019). The dominant vegetation is a grassy, dwarf shrubland. Grasses tend to be more common in depressions and on sandy soils, and less abundant on clayey soils. Grazing rapidly increases the relative abundance of shrubs. Most of the grasses are of the C4 type and, like the shrubs, are deciduous in response to rainfall events (SANBI, 2019).

The Succulent Karoo biome covers a flat to gently undulating plain, with some hilly and "broken" veld, mostly situated to the west and south of the escarpment, and north of the Cape Fold Belt. The altitude is mostly below 800 m, but in the east, it may reach 1 500 m (SANBI, 2019). The Succulent Karoo Biome is primarily determined by the presence of low winter rainfall and extreme summer aridity. Rainfall varies between 20 and 290 mm per year. Because the rains are cyclonic, and not due to thunderstorms, the erosive power is far less than of the summer rainfall biomes. During summer, temperatures in excess of 40°C are common, while fog is common nearer to the coast (SANBI, 2019). The vegetation is dominated by dwarf, succulent shrubs, of which the Vygies (Mesembryanthemaceae) and Stonecrops (Crassulaceae) are particularly prominent. Mass flowering displays of annuals (mainly Daisies / Asteraceae) occur in spring, often on degraded or fallow lands. Grasses are rare, except in some sandy areas, and are of the C3 type. The number of plant species mostly succulents - is very high and unparalleled elsewhere in the world for an arid area of this size (SANBI, 2019).

Azonal vegetation is formed in and around flowing and stagnant freshwater bodies. Habitats with high levels of salt concentration form a highly stressed environment for most plants and

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often markedly affect the composition of plant communities. Invariably, both waterlogged and salt-laden habitats appear as 'special', deviating strongly from the typical surrounding zonal vegetation. They are considered to be of azonal character (SANBI, 2019).

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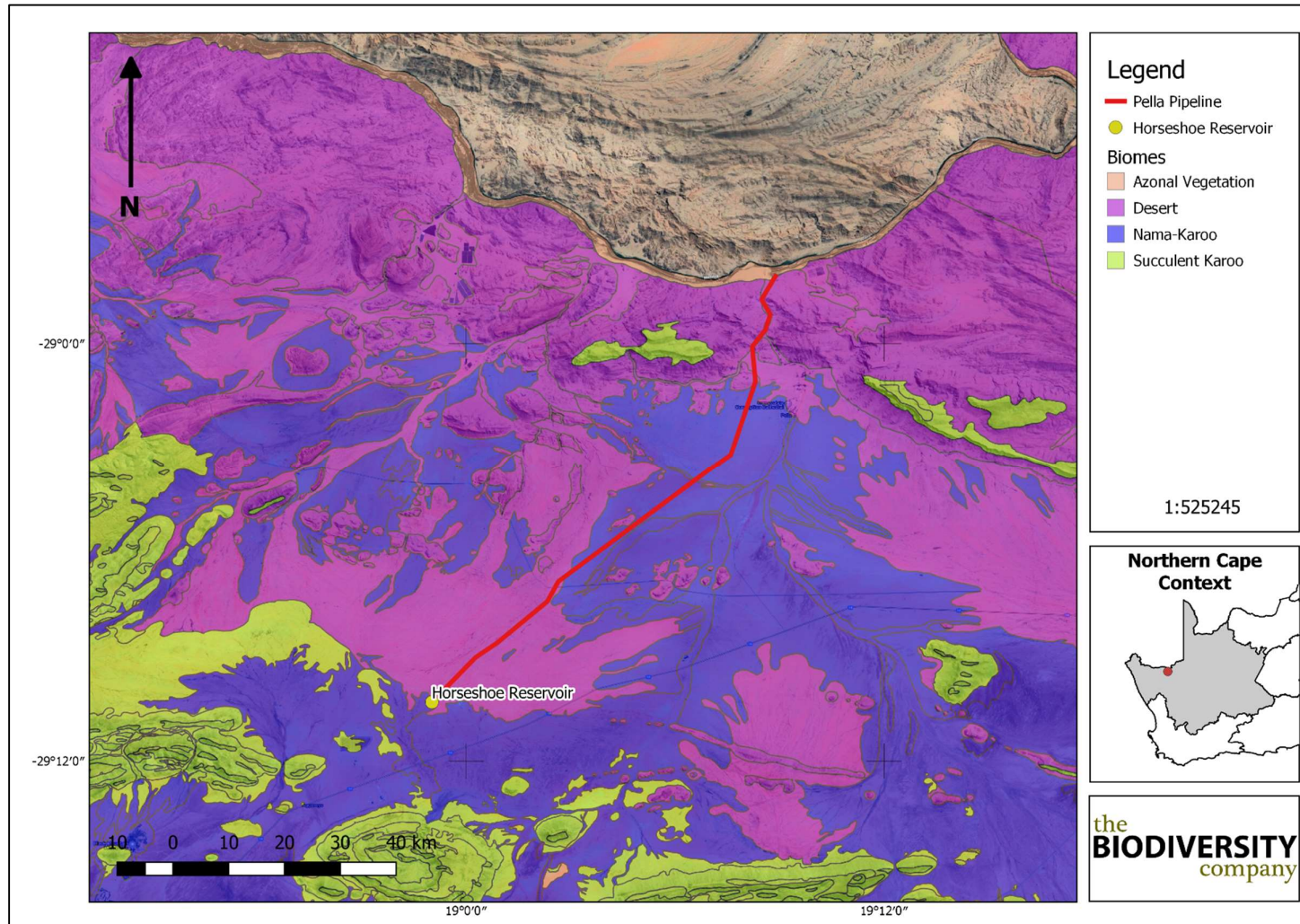


Figure 7 The project area in relation to the biomes of South Africa South Africa, Lesotho & Swaziland (BGIS, 2018)

### **7.1.1.1 Vegetation Types**

The project area is situated across four vegetation types; Bushmanland Arid Grassland, Bushmanland Sandy Grassland, Eastern Gariep Plains Desert and Eastern Gariep Rocky Desert, according to SANBI (2019) (Figure 8). The majority of the project area falls across the Bushmanland Arid Grassland.

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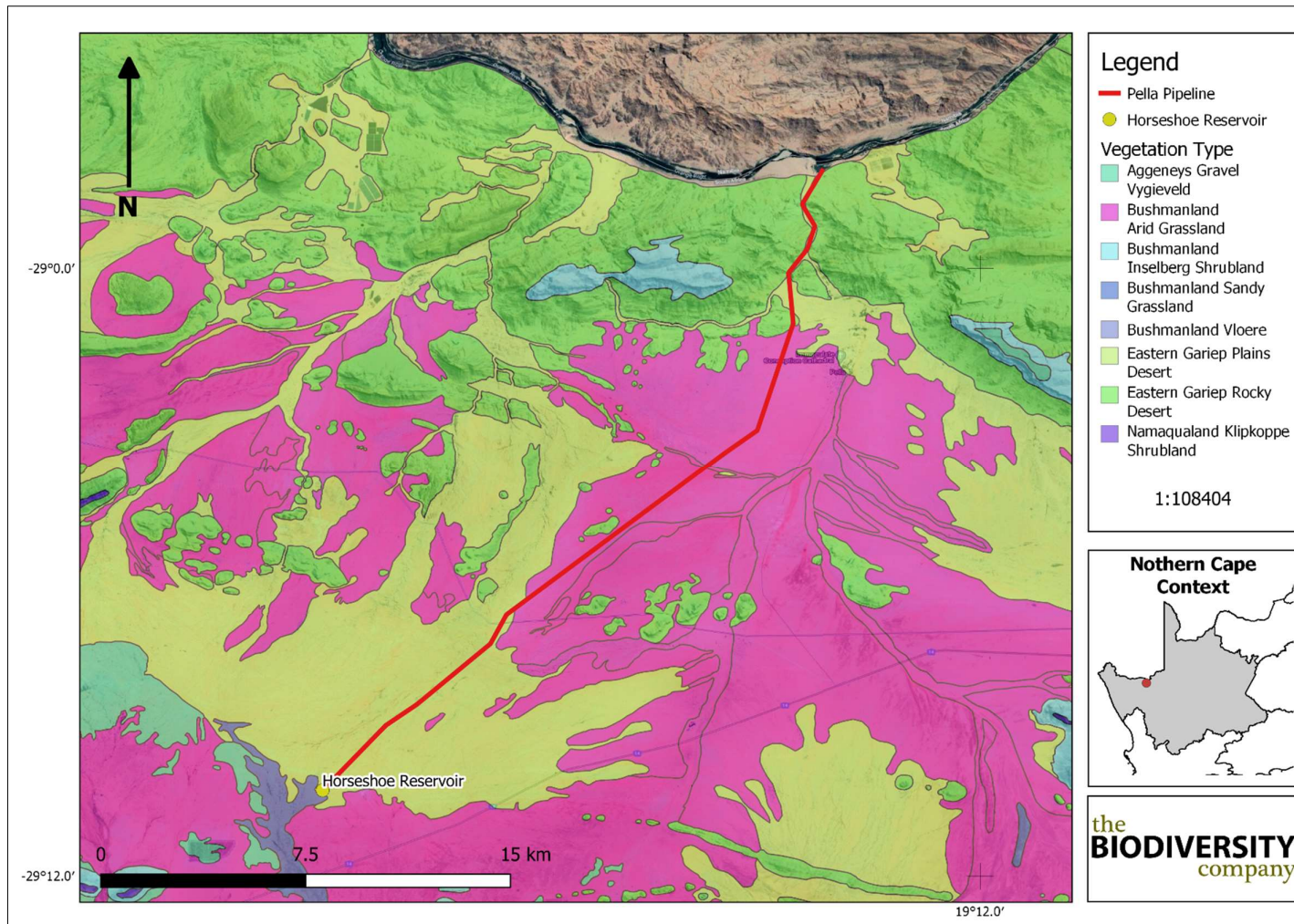


Figure 8 The project area showing the vegetation type based on the Vegetation Map of South Africa, Lesotho & Swaziland (BGIS, 2018)



### 7.1.1.2 Bushmanland Arid Grassland

The Bushmanland Arid Grassland consists of irregular plains on a slightly sloping plateau. It is sparsely vegetated by grass species, mainly dominated by white grasses (*Stipagrostis* species). In places, low shrubs of *Salsola* change the vegetation structure. In years of abundant rainfall rich displays of annual herbs can be expected (Mucina & Rutherford, 2006).

#### 7.1.1.2.1 Important Plant Taxa

Important plant taxa are those species that have a high abundance, a frequent occurrence or are prominent in the landscape within a particular vegetation type (Mucina & Rutherford, 2006). The following species are important in the Bushmanland Arid Grassland (<sup>W</sup>Western and <sup>E</sup>Eastern regions of the unit).

Graminoids: *Aristida adscensionis*, *A. congesta*, *Enneapogon desvauxii*, *Eragrostis nindensis*, *Schmidtia kalahariensis*, *Stipagrostis ciliata*, *S. obtusa*, *Cenchrus ciliaris*, *Enneapogon scaber*, *Eragrostis annulata*<sup>E</sup>, *E. porosa*<sup>E</sup>, *E. procumbens*, *Panicum lanipes*<sup>E</sup>, *Setaria verticillata*<sup>E</sup>, *Sporobolus nervosus*, *Stipagrostis brevifolia*<sup>W</sup>, *S. uniplumis*, *Tragus berteronianus*, *T. racemosus*<sup>E</sup>.

Small Trees: *Acacia mellifera* subsp. *detinens*<sup>E</sup>, *Boscia foetida* subsp. *foetida*.

Tall Shrubs: *Lycium cinereum*, *Rhigozum trichotomum*, *Cadaba aphylla*, *Parkinsonia africana*.

Low Shrubs: *Aptosimum spinescens*, *Hermannia spinosa*, *Pentzia spinescens*, *Aizoon asbestinum*<sup>E</sup>, *A. schellenbergii*<sup>E</sup>, *Aptosimum elongatum*, *A. lineare*<sup>E</sup>, *A. marlothii*<sup>E</sup>, *Barleria rigida*, *Berkheya annectens*, *Blepharis mitrata*, *Eriocephalus ambiguus*, *E. spinescens*, *Limeum aethiopicum*, *Lophiocarpus polystachyus*, *Monechma incanum*, *M. spartioides*, *Pentzia pinnatisecta*, *Phaeoptilum spinosum*<sup>E</sup>, *Polygala seminuda*, *Pteronia leucoclada*, *P. mucronata*, *P. sordida*, *Rosenia humilis*, *Senecio niveus*, *Sericocoma avolans*, *Solanum capense*, *Talinum arnotii*<sup>E</sup>, *Tetragonia arbuscula*, *Zygophyllum microphyllum*.

Succulent Shrubs: *Kleinia longiflora*, *Lycium bosciifolium*, *Salsola tuberculata*, *S. glabrescens*.

Herbs: *Acanthopsis hoffmannseggiana*, *Aizoon canariense*, *Amaranthus praetermissus*, *Barleria lichtensteiniana*<sup>E</sup>, *Chamaesyce inaequilatera*, *Dicoma capensis*, *Indigastrium argyraeum*, *Lotononis platycarpa*, *Sesamum capense*, *Tribulus pterophorus*, *T. terrestris*, *Vahlia capensis*.

Succulent Herbs: *Gisekia pharnacioides*<sup>E</sup>, *Psilocaulon coriarium*, *Trianthema parvifolia*.

Geophytic Herb: *Moraea venenata*.

#### 7.1.1.2.2 Biogeographically Important Taxa

Succulent Herb: *Tridentea dwequensis*.

#### 7.1.1.2.3 Endemic Taxa

Succulent Shrubs: *Dinteranthus pole-evansii*, *Larryleachia dinteri*, *L. marlothii*, *Ruschia kenhardtensis*.

Herbs: *Lotononis oligocephala*, *Nemesia maxii*.

#### **7.1.1.2.4 Conservation Status of the Vegetation Type**

According to Mucina and Rutherford (2006), this vegetation type is classified as Least Threatened. The national target for conservation protection for this vegetation type is 21%, with only small patches statutorily conserved in Augrabies Falls National Park and Goegab Nature Reserve. Very little of the area has been transformed. The risk of erosion in this vegetation type is very low (60%) and low (33%).

The Gamsberg Nature Reserve was proclaimed under the NEMPAA on 5 August 2019. The Gamsberg Nature Reserve forms part of the BMM Gamsberg Biodiversity Offset Agreement that was signed between BMM and DENC on 26 October 2014. The Gamsberg Nature Reserve includes the following farms and farm Portions (pers. Communication JHL Smit (Biodiversity Manager, 2020):

- The farm Achab 59,
- Portion 2 of the farms Rozybosch 41
- REM of the Rozybosch 41; and
- REM of the farm Vogelstruishoek 88.

The total surface area of the Gamsberg Nature Reserve covers an area of approximately 21 664,12 ha. The estimated ha of the different vegetation types of the Gamsberg Nature Reserve are summarized in Table 3 below:

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**Table 3** Summary of property wise biodiversity contribution regarding vegetation types and habitats of the Gamsberg Nature Reserve (all four farms secured and proclaimed as Protected Area under NEMPAA) (as provided by Biodiversity Manager – BMM)

Vegetation Types and Habitat units used in the Offset Agreement	Achab 59	Rozynbosch 41 - Ptn 2	Rozynbosch 41 - REM	Vogelstruishoek 88 REM	Total ha)
<b>Aggeneys Gravel Vygieveld</b>					<b>8 515,75</b>
Mountain plateau; Constrained (VU)	316,98	219,02	8,50	9,01	553,50
Plains Gravel quartz plateau	75,95	15,76			91,71
Plains quartz gravel; Irreplaceable (VU)	623,49		250,41	14,02	887,92
Plains quartz gravel intermediate; Constr. LC	252,25				252,25
Plains feldspar gravel; Constrained LC		7,16	1 095,09		1 102,25
Rocky Plains	1 424,59	2 101,33	1 881,41	220,80	5 628,12
Plains rocky; Constrained LC					
Plains Rocky; Flexible LC					
<b>Bushman Inselberg</b>					<b>3 623,26</b>
Mountains; Flexible LC	1 170,16	853,46	572,82	417,46	3 013,89
Southern Slopes; Irreplaceable (VU)	309,44	47,69	55,66	196,59	609,37
<b>Arid Grasslands</b>					<b>7 718,45</b>
Flat sandy plains; Flexible LC	2 291,44	1 113,13	1 163,91	2 254,30	6 822,78
Hummocky sandy plains; Flexible LC	312,55			360,77	673,32
Calcrete gravel plains; Irreplaceable EN	171,99			50,37	222,36
<b>Mobile sandy dunes; Flexible LC</b>	<b>71,03</b>			<b>112,33</b>	<b>71,03</b>
<b>Azonal habitats</b>					<b>1 735,63</b>
Kloof; (Irreplaceable)	1				-
Wash; (Constrained)	893,50	178,33	21,34	642,46	1 735,63
Freshwater springs & Head-water Seep; (Irreplaceable)					-
River (Wash with sub-surface flow); Flexible					-
<b>Total</b>	<b>7 980,98</b>	<b>4 535,87</b>	<b>5 049,13</b>	<b>4 278,09</b>	<b>21 664,12</b>

### 7.1.1.2.5 Plant Species of Conservation Concern

Based on the Plants of Southern Africa (BODATSA-POSA, 2016) database, 621 plant species are expected to occur in the project area. Figure 9 shows the extent of the grid that was used to compile the expected species list based on the Plants of Southern Africa (BODATSA-POSA, 2016) database. The full list of expected plant species is provided in Appendix A, this list also include the species provincially protected under NCNCA (2009). Ten of the expected species are protected under schedule 1 of the NCNCA, while a further 196 are protected under schedule . Of the 621-plant species, seven (7) species are listed as being SCCs by the IUCN and three are protected trees based on the NFA (2014) list (Table 4).

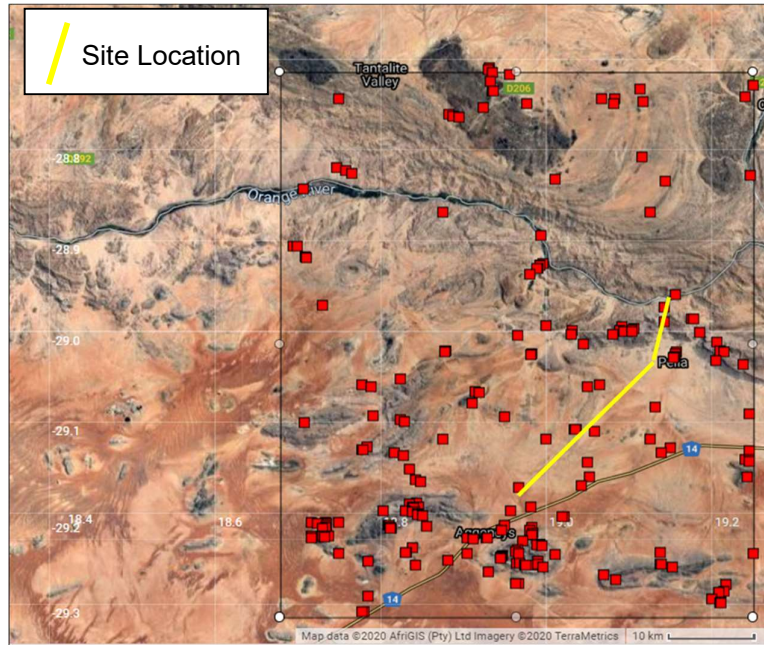


Figure 9 Map showing the grid drawn to compile an expected species list (BODATSA-POSA, 2016)

Table 4 Plant Species of Conservation Concern expected to occur in the project area (BODATSA-POSA, 2016)

Family	Taxon	IUCN	NFA Protected tree	Ecology	Habitat requirements
Asphodelaceae	<i>Aloidendron dichotomum</i>	VU		Indigenous	It grows on north-facing rocky slopes
Capparaceae	<i>Boscia albitrunca</i>	LC	Protected	Indigenous	Found in drier sandy soil
Fabaceae	<i>Crotalaria pearsonii</i>	VU		Indigenous; Endemic	Found along the Orange river
Apocynaceae	<i>Ectadium virgatum</i>	NT		Indigenous	Grows in dry areas
Ebenaceae	<i>Euclea pseudebenus</i>	LC	Protected		Stony and sandy desert

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					and semi-desert areas
Asteraceae	<i>Helichrysum marmarolepis</i>	NT		Indigenous; Endemic	Grows in Sandveld.
Aizoaceae	<i>Lithops dinteri subsp. frederici</i>	VU		Indigenous; Endemic	Grows in barren minerals terrains
Aizoaceae	<i>Lithops olivacea</i>	VU		Indigenous; Endemic	Grows in quartz plains
Fabaceae	<i>Vachellia erioloba</i>	LC	Protected	Indigenous	Direr areas

## 7.1.2 Faunal Assessment

### 7.1.2.1 Avifauna

Based on the South African Bird Atlas Project, Version 2 (SABAP2, 2019) database, 149 bird species are expected to occur in the vicinity of the project area (pentads 2915\_1845; 2910\_1845; 2915\_1850; 2910\_1850; 2915\_1855; 2910\_1855; 2905\_1900; 2900\_1900; 2905\_1905; 2855\_1905; 2855\_1905; 2855\_1910). The full list of potential bird species is provided in Appendix B, along with their NCNCA (2009) schedule listings.

Of the expected bird species, nine (9) species are listed as SCC either on a regional scale or international scale (Table 5). The SCC include the following:

- Two (2) species that are listed as EN on a regional basis;
- Four (4) species that are listed as VU on a regional basis; and
- Three (3) species that are listed as NT on a regional basis.

**Table 5** List of bird species of regional or global conservation importance that are expected to occur in the pendants mentioned above (SABAP2, 2019, SANBI, 2016; IUCN, 2017).

Species	Common Name	Conservation Status		Likelihood of occurrence
		Regional (SANBI, 2016)	IUCN (2017)	
<i>Aquila verreauxii</i>	Eagle, Verreaux's	VU	LC	Moderate
<i>Calendulauda burra</i>	Lark, Red	VU	VU	High
<i>Cursorius rufus</i>	Cursor, Burchell's	VU	LC	High
<i>Eupodotis vigorsii</i>	Korhaan, Karoo	NT	LC	High
<i>Falco biarmicus</i>	Falcon, Lanner	VU	LC	High
<i>Neotis ludwigii</i>	Bustard, Ludwig's	EN	EN	High
<i>Oxyura maccoa</i>	Duck, Maccoa	NT	NT	Moderate
<i>Polemaetus bellicosus</i>	Eagle, Martial	EN	VU	High
<i>Spizocorys sclateri</i>	Lark, Sclaters	NT	NT	High

*Aquila verreauxii* (Verreaux's Eagle) is listed as VU on a regional scale and LC on a global scale. This species is locally persecuted in southern Africa where it coincides with livestock farms, but because the species does not take carrion, is little threatened by poisoned carcasses. Where hyraxes are hunted for food and skins, eagle populations have declined (IUCN, 2017). These species could possibly be seen moving over the area but is unlikely to be a resident.

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*Calendulauda burra* (Red Lark) is listed as VU both locally and internationally (IUCN, 2017). Their habitat consists of tropical dry shrubland to dry lowland grassland. This species is threatened by habitat destruction and loss. The likelihood of this species occurring in the project area is high due to the known presence in the IBA.

*Cursorius rufus* (Burchell's Courser) is categorised as VU on a regional scale. It inhabits open short-sward grasslands, dry savannas, fallow fields, overgrazed or burnt grasslands and pastures, bare or sparsely vegetated sandy or gravelly deserts, stony areas dotted with small shrubs and saltpans (IUCN, 2017). The species is threatened in the south of its range by habitat degradation as a result of poor grazing practices and agricultural intensification. The likelihood of occurrence in the project area is rated as high as suitable habitat is present and it is known to occur in the IBA.

*Eupodotis vigorsii* (Karoo Korhaan) is listed as NT on a regional scale and as LC on a global scale. This species is known to occur in shrubland habitat. The likelihood of the species occurring in the project area is rated as high as this species is known to have a moderate density in this habitat type.

*Falco biarmicus* (Lanner Falcon) is native to South Africa and inhabits a wide variety of habitats, from lowland deserts to forested mountains (IUCN, 2017). They may occur in groups of up to 20 individuals but have also been observed solitary. Their diet is mainly composed of small birds such as pigeons and francolins. The likelihood of incidental records of this species in the project area is rated as high due to the natural veld condition and the presence of many bird species on which Lanner Falcons may predate.

*Neotis ludwigii* (Ludwig's Bustard) is listed as EN both locally and internationally. This species is found in the desert, grassland, and shrubland specifically in rocky areas such as mountains and cliffs. The main reason for the decline in the numbers is ascribed to the collisions with power lines. The species has a high likelihood of occurrence.

*Oxyura maccoa* (Maccoa Duck) has a large northern and southern range, South Africa is part of its southern distribution. During the species' breeding season, it inhabits small temporary and permanent inland freshwater lakes, preferring those that are shallow and nutrient-rich with extensive emergent vegetation such as reeds (*Phragmites spp.*) and cattails (*Typha spp.*) on which it relies for nesting (IUCN, 2017). As the project area end in the Orange river, the species has a moderate likelihood of occurrence.

*Polemaetus bellicosus* (Martial Eagle) is listed as EN on a regional scale and VU on a global scale. This species has an extensive range across much of sub-Saharan Africa, but populations are declining due to deliberate and incidental poisoning, habitat loss, reduction in available prey, pollution and collisions with power lines (IUCN, 2017). It inhabits open woodland, wooded savanna, bushy grassland, thorn-bush and, in southern Africa, more open country and even sub-desert (IUCN, 2017). Even though large tree species are mostly absent from the project area, this species has been known to adapt and nest on telephone poles and as such the likelihood of occurrence is rated as high.

*Spizocorys sclateri* (Sclaters Lark) is classified as NT both locally and internationally. This species is native to South Africa and Namibia. It is found in dry shrubland, where its habitat is threatened by increased numbers of livestock in its habitat. The habitat for this species is regarded as suitable as such they have a high likelihood of occurrence.

### 7.1.2.1.1 Important Bird & Biodiversity Areas

Important Bird & Biodiversity Areas (IBAs) are the sites of international significance for the conservation of the world's birds and other conservation significant species as identified by BirdLife International. These sites are also all Key Biodiversity Areas; sites that contribute significantly to the global persistence of biodiversity (Birdlife, 2017).

According to Birdlife International (2020), the selection of IBAs is achieved through the application of quantitative ornithological criteria and grounded in up-to-date knowledge of the sizes and trends of bird populations. The criteria ensure that the sites selected as IBAs have true significance for the international conservation of bird populations and provide a common currency that all IBAs adhere to, thus creating consistency among, and enabling comparability between, sites at national, continental and global levels.

The project area is found within 10km of the Haramoep and Black Mountain Mine IBA (Figure 10). This IBA is found 12km northwest of Aggeneys. This is one of few sites that protect the globally threatened *Calendulauda burra* (Red Lark) (700–900 pairs), which inhabits the red sand-dunes, and the NT *Spizocorys sclateri* (Sclaters Lark) (up to 500 individuals), which occurs sporadically on the barren stony plains. This site also holds most of the species restricted to the Namib–Karoo biome and a host of other arid-zone birds. The rocky outcrops of the Haramoep mountain support *Geocolaptes olivaceus* (Ground Woodpecker), *Euryptila subcinnamomea* (Cinnamon-breasted Warbler), *Anthus crenatus* (African Rock Pipit), and *Onychognathus nabouroup* (Pale-winged Starling).

The extensive plains support *Circus maurus* (Black Harrier), *Polemaetus bellicosus* (Martial Eagle), *Neotis ludwigii* (Ludwig's Bustard), *Eupodotis vigorsii* (Karoo Korhaan), *Cursorius rufus* (Burchell's Courser), *Pterocles namaqua* (Namaqua Sandgrouse), *Eremalauda starki* (Stark's lark), *Cercomela tractrac* (Tractrac Chat), *C. sinuata* (Sickle-winged Chat), *C. schlegelii* (Karoo Chat), *Eremomela gregalis* (Karoo eremomela) and *Malcorus pectoralis* (Rufous-eared warbler). During good rains the nomadic *Eremopterix verticalis* (Grey-backed Sparrow-lark), *E. australis* (Black-eared Sparrow-lark) and *Emberiza impetواني* (Lark-like Bunting) can be superabundant. Low scrubby vegetation holds *Parus afer* (Grey Tit), *Anthoscopus minutus* (Cape Penduline Tit), *Nectarinia fusca* (Dusky Sunbird), *Sylvia layardi* (Layard's Warbler), *Batis pririt* (Pirit Batis), *Bradornis infuscatus* (Chat Flycatcher), *Stenostira scita* (Fairy Flycatcher), *Sporopipes squamifrons* (Scaly-feathered Weaver) and *Serinus albogularis* (White-throated Canary). Some large trees hold the communal nests of *Philetairus socius* (Sociable Weaver) with the associated *Polihierax semitorquatus* (Pygmy Falcon) in attendance. The newly recognized *Certhilauda subcoronata* (Karoo long-billed lark) occurs at the site (Birdlife International, 2020).

This SCC list provided is different from the list above as the IBA covers an area of 54,408 ha while the project area falls just outside of that, however, these species must be regarded as species with a high likelihood of occurrence.

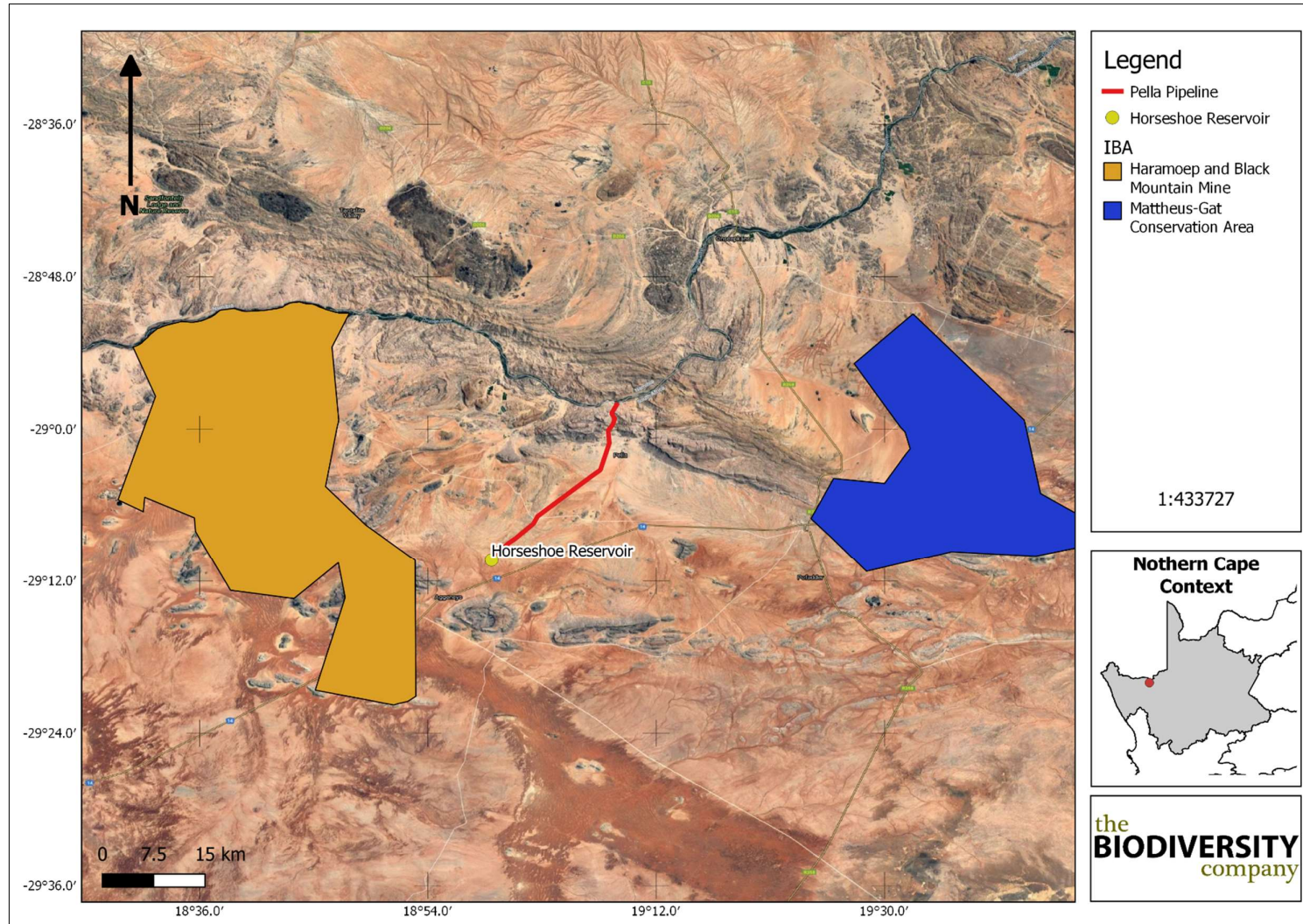


Figure 10 The project area in relation to defined IBAs (Birdlife, 2017)



### 7.1.2.2 Mammals

The IUCN Red List Spatial Data (IUCN, 2017) lists 65 mammal species that could be expected to occur within the vicinity of the project area (Appendix C). Of these species, 3 are medium to large conservation dependent species, such as *Ceratotherium simum* (Southern White Rhinoceros) that, in South Africa, are generally restricted to protected areas such as game reserves. These species are not expected to occur in the project area and are removed from the expected SCC list. They are however still included in Appendix C. Also included in the appendix C list is the NCNCA schedule listings of the various species.

Of the remaining 58 small to medium-sized mammal species, seven (7) are listed as being of conservation concern on a regional or global basis (Table 6). The list of potential species includes:

- Two (2) that are listed as VU on a regional basis; and
- Four (4) that are listed as NT on a regional scale (Table 6).

**Table 6** List of mammal species of conservation concern that may occur in the project area as well as their global and regional conservation statuses (IUCN, 2017; SANBI, 2016)

Species	Common Name	Conservation Status		Likelihood of occurrence
		Regional (SANBI, 2016)	IUCN (2017)	
<i>Aonyx capensis</i>	Cape Clawless Otter	NT	NT	High
<i>Eidolon helvum</i>	African Straw-coloured Fruit Bat	LC	NT	Low
<i>Felis nigripes</i>	Black-footed Cat	VU	VU	High
<i>Graphiurus rupicola</i>	Stone Dormouse	NT	LC	High
<i>Panthera pardus</i>	Leopard	VU	VU	High
<i>Parahaena brunnea</i>	Brown Hyaena	NT	NT	High
<i>Parotomys littledalei</i>	Littledale's Whistling Rat	NT	LC	High

*Aonyx capensis* (Cape Clawless Otter) is the most widely distributed otter species in Africa (IUCN, 2017). This species is predominantly aquatic, and it is seldom found far from water. The project area starts in the Orange River as such the likelihood of occurrence is rated as high.

*Eidolon helvum* (African Straw-coloured Fruit Bat) is listed as LC on a regional scale and NT on a global scale. This species has been recorded from a very wide range of habitats across the lowland rainforest and savanna zones of Africa (IUCN, 2017). Although considered to be widespread and abundant across its range, certain populations are decreasing due to severe deforestation, hunting for food and medicinal use (IUCN, 2017). This species is known to form large roosts and colonies numbering in the thousands to even millions of individuals (IUCN, 2017). No colonies of this species are known to occur in the project area or in the immediate vicinity and, although individuals may occasionally be recorded, it is not expected to be resident within the project area and therefore its likelihood of occurrence is rated as low.

*Felis nigripes* (Black-footed cat) is endemic to the arid regions of southern Africa. This species is naturally rare, has cryptic colouring is small in size and is nocturnal. These factors have contributed to a lack of information on this species. Given that the highest densities of this species have been recorded in the more arid Karoo region of South Africa, the habitat in the

project area can be considered ideal for the species and the likelihood of occurrence is rated as high.

*Graphiurus rupicola* (Stone Dormouse) is categorised as NT on a regional scale. This species occurs in a narrow belt predominantly along the escarpment of Namibia and marginally into northwestern South Africa. This species as a nocturnal rock dormouse, inhabiting mountainous and entirely treeless. The likelihood of occurrence in the project area is listed as high.

*Panthera pardus* (Leopard) has a wide distributional range across Africa and Asia, but populations have become reduced and isolated, and they are now extirpated from large portions of their historic range (IUCN, 2017). Impacts that have contributed to the decline in populations of this species include continued persecution by farmers, habitat fragmentation, increased illegal wildlife trade, excessive harvesting for ceremonial use of skins, prey base declines and poorly managed trophy hunting (IUCN, 2017). Although known to occur and persist outside of formally protected areas, the densities in these areas are considered to be low. The likelihood of occurrence in the project area is considered high.

*Parahyaena brunnea* (Brown Hyaena) is endemic to southern Africa. This species occurs in dry areas, generally with annual rainfall less than 100 mm, particularly along the coast, semi-desert, open scrub and open woodland savanna. Given its known ability to persist outside of formally protected areas the likelihood of occurrence of this species in the project area is moderate to good. The presence of moderate to large herbivores in the area increases the likelihood of occurrence of this species.

*Parotomys littledalei* (Littledale's Whistling Rat) is listed as NT on a regional scale. This diurnal species occurs in shrubland and is dependent on ground cover. Littledale's Whistling Rat is herbivorous only, feeding on fresh plant material, including annuals, succulent perennials, non-succulent perennials, and grasses. The presence of suitable ground cover increases their likelihood of occurrence in the project area.

### 7.1.2.3 Herpetofauna (Reptiles & Amphibians)

#### 7.1.2.3.1 Reptiles

Based on the IUCN Red List Spatial Data (IUCN, 2017) and the ReptileMap database provided by the Animal Demography Unit (ADU, 2019) 61 reptile species are expected to occur in the project area (Appendix D). Two (2) reptile SCC are expected to be present in the area (Table 7). The NCNCA (2009) listings of the various species are also included in Appendix D.

Table 7 Expected reptile species of conservation concern that may occur in the project area

Species	Common Name	Conservation Status		Likelihood of Occurrence
		Regional (SANBI, 2016)	IUCN (2017)	
<i>Chersobius signatus</i>	Speckled Dwarf Tortoise	EN	EN	High
<i>Psammobates tentorius verroxii</i>	Tent Tortoise	NT	NT	High

*Chersobius signatus* (Speckled Cape Tortoise) is categorised as EN both locally and internationally. This species is naturally restricted to the little Namaqualand, where it lives on rocky outcrops and forages on succulent plants. The likelihood of occurrence in the project area is rated as high as suitable habitat and food species are present.

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*Psammobates tentorius veroxii* (Tent Tortoise) is categorised as NT both locally and internationally. This species can be found in low densities in the Karoo and semi-desert areas of South Africa and Namibia. It is threatened because of the pet trade and destruction of its habitat. The likelihood of occurrence in the project area is rated as high due to the presence of Mesembryanthemum plant, which is suitable food sources for this species.

**7.1.2.3.2 Amphibians**

Based on the IUCN Red List Spatial Data (IUCN, 2017) and the AmphibianMap database provided by the Animal Demography Unit (ADU, 2017) fourteen (14) amphibian species are expected to occur in the project area (Appendix E).

One amphibian SCCs could be present in the project area according to the above-mentioned sources (Table 8).

*Table 8 Amphibian SCC expected in the project area*

Species	Common Name	Conservation Status		Likelihood of occurrence
		Regional (SANBI, 2016)	IUCN (2017)	
<i>Strongylopus springbokensis</i>	Namaqua Stream Frog	VU	LC	High

*Strongylopus springbokensis* (Namaqua Stream Frog) is listed as VU on a regional scale. It lives in springs and streams in rocky hills and mountains in the Succulent Karoo and Fynbos biomes. It breeds in springs and streams, small permanent and temporary ponds, as well as small artificial dams. The likelihood of occurrence is rated as high as suitable habitat is present in the project area.

**8 Impact Assessment**

The impact assessment is based on the desktop assessment only. The methodology used in determining the significance of potential environmental impacts relating to the Pella Bulk Water Pipeline project was supplied by SLR (Table 9).

*Table 9 Impact methodology supplied by SLR*

PART A: DEFINITIONS AND CRITERIA*		
Definition of SIGNIFICANCE	Significance = consequence x probability	
Definition of CONSEQUENCE	Consequence is a function of intensity, spatial extent and duration	
Criteria for ranking INTENSITY of Environmental Impacts	VH	Severe change, disturbance or degradation. Associated with severe consequences. May result in severe illness, injury or death. Targets, limits, and thresholds of concern continually exceeded. Substantial intervention will be required. Vigorous/widespread community mobilization against project can be expected. May result in legal action if impact occurs.
	H	Prominent change, disturbance or degradation. Associated with real and substantial consequences. May result in illness or injury. Targets, limits and thresholds of concern regularly exceeded. Will definitely require intervention. Threats of community action. Regular complaints can be expected when the impact takes place.
	M	Moderate change, disturbance or discomfort. Associated with real but not substantial consequences. Targets, limits and thresholds of concern may occasionally be exceeded. Likely to require some intervention. Occasional complaints can be expected.

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	<b>L</b>	Minor (Slight) change, disturbance or nuisance. Associated with minor consequences or deterioration. Targets, limits and thresholds of concern rarely exceeded. Require only minor interventions or clean-up actions. Sporadic complaints could be expected.
	<b>VL</b>	Negligible change, disturbance or nuisance. Associated with very minor consequences or deterioration. Targets, limits and thresholds of concern never exceeded. No interventions or clean-up actions required. No complaints anticipated.
	<b>VL+</b>	Negligible change or improvement. Almost no benefits. Change not measurable/will remain in the current range.
	<b>L+</b>	Minor change or improvement. Minor benefits. Change not measurable/will remain in the current range. Few people will experience benefits.
	<b>M+</b>	Moderate change or improvement. Real but not substantial benefits. Will be within or marginally better than the current conditions. Small number of people will experience benefits.
	<b>H+</b>	Prominent change or improvement. Real and substantial benefits. Will be better than current conditions. Many people will experience benefits. General community support.
	<b>VH+</b>	Substantial, large-scale change or improvement. Considerable and widespread benefit. Will be much better than the current conditions. Favourable publicity and/or widespread support expected.
<b>Criteria for ranking the DURATION of impacts</b>	<b>VL</b>	Very short, always less than a year. Quickly reversible
	<b>L</b>	Short-term, occurs for more than 1 but less than 5 years. Reversible over time.
	<b>M</b>	Medium-term, 5 to 10 years.
	<b>H</b>	Long term, between 10 and 20 years. (Likely to cease at the end of the operational life of the activity)
	<b>VH</b>	Very long, permanent, +20 years (Irreversible. Beyond closure)
<b>Criteria for ranking the EXTENT of impacts</b>	<b>VL</b>	A part of the site/property.
	<b>L</b>	Whole site.
	<b>M</b>	Beyond the site boundary, affecting immediate neighbours
	<b>H</b>	Local area, extending far beyond site boundary.
	<b>VH</b>	Regional/National

**PART B: DETERMINING CONSEQUENCE**

		EXTENT				
		A part of the site/property	Whole site	Beyond the site, affecting neighbours	Local area, extending far beyond site.	Regional/National
		VL	L	M	H	VH

**INTENSITY = VL**

DURATION	Very long	VH	Low	Low	Medium	Medium	High
	Long term	H	Low	Low	Low	Medium	Medium
	Medium term	M	Very Low	Low	Low	Low	Medium
	Short term	L	Very low	Very Low	Low	Low	Low
	Very short	VL	Very low	Very Low	Very Low	Low	Low

**INTENSITY = L**

DURATION	Very long	VH	Medium	Medium	Medium	High	High
	Long term	H	Low	Medium	Medium	Medium	High
	Medium term	M	Low	Low	Medium	Medium	Medium
	Short term	L	Low	Low	Low	Medium	Medium
	Very short	VL	Very low	Low	Low	Low	Medium

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INTENSITY = M							
DURATION	Very long	VH	Medium	High	High	High	Very High
	Long term	H	Medium	Medium	Medium	High	High
	Medium term	M	Medium	Medium	Medium	High	High
	Short term	L	Low	Medium	Medium	Medium	High
	Very short	VL	Low	Low	Low	Medium	Medium
INTENSITY = H							
DURATION	Very long	VH	High	High	High	Very High	Very High
	Long term	H	Medium	High	High	High	Very High
	Medium term	M	Medium	Medium	High	High	High
	Short term	L	Medium	Medium	Medium	High	High
	Very short	VL	Low	Medium	Medium	Medium	High
INTENSITY = VH							
DURATION	Very long	VH	High	High	Very High	Very High	Very High
	Long term	H	High	High	High	Very High	Very High
	Medium term	M	Medium	High	High	High	Very High
	Short term	L	Medium	Medium	High	High	High
	Very short	VL	Low	Medium	Medium	High	High

PART C: DETERMINING SIGNIFICANCE							
PROBABILITY (of exposure to impacts)	Definite/ Continuous	VH	Very Low	Low	Medium	High	Very High
	Probable	H	Very Low	Low	Medium	High	Very High
	Possible/ frequent	M	Very Low	Very Low	Low	Medium	High
	Conceivable	L	Insignificant	Very Low	Low	Medium	High
	Unlikely/ improbable	VL	Insignificant	Insignificant	Very Low	Low	Medium
			VL	L	M	H	VH
CONSEQUENCE							

PART D: INTERPRETATION OF SIGNIFICANCE	
<b>Significance</b>	<b>Decision guideline</b>
Very High	Potential fatal flaw unless mitigated to lower significance.
High	It must have an influence on the decision. Substantial mitigation will be required.
Medium	It should have an influence on the decision. Mitigation will be required.
Low	Unlikely that it will have a real influence on the decision. Limited mitigation is likely to be required.
Very Low	It will not have an influence on the decision. Does not require any mitigation
Insignificant	Inconsequential, not requiring any consideration.

### 8.1 Identification of Potential Impacts

The proposed project activity may lead to the loss and destruction of habitats, direct mortalities, and displacement of fauna and flora. The removal of natural vegetation to accommodate the pipeline and the associated access roads may reduce the habitat available for fauna species and could reduce animal populations and species compositions within the

area, at least temporarily. The potential impacts associated with the various project stages are discussed below.

### **8.1.1 Planning Phase**

The planning phase activities are considered low risk as they typically involve desktop assessments and initial site inspections. This phase of the assessment would include, amongst others, site visits of various Business Partners, environmental and social impact assessment and compiling of management plans. Only one minor impact was assessed regarding the planning phase:

- Temporary disturbance of wildlife due to increased human presence and possible use of machinery and/or vehicles.

### **8.1.2 Construction Phase**

The following potential impacts were considered on biodiversity (including fauna and flora) based on the clearance for infrastructure as well as disturbances such as dust and noise:

- Destruction of, and fragmentation of, portions of the vegetation community;
- Loss of CBA1, CBA2, ESA, sections of an IBA and SKEP;
- Potential loss of Threatened or Protected Plant Species (NEMBA: TOPS List); Protected Species (NCNCA protected species) and Protected Trees (NFA); and
- Displacement of the faunal community (including possible threatened or protected species) due to habitat loss, disturbance (noise, dust, and vibration) and/or direct mortalities.

### **8.1.3 Operational Phase**

The following potential impacts were considered on biodiversity (fauna and flora) during the operational phase:

- Continued disturbance of vegetation communities (including portions of a CBA1, CBA2, ESA, and SKEP) and encroachment by alien invasive plant species;
- Disturbance and mortalities of species due to maintenance of the system;
- Potential loss of Threatened or Protected Plant Species (NEMBA: TOPS List); Protected Species (NCNCA protected species) and Protected Trees (NFA) due to unauthorized access, plant collectors, vehicles driving off-road;
- Erosion due to the disturbed area; and
- Ongoing displacement and disturbance of faunal community (including multiple threatened species) due to habitat loss and disturbances because of the access roads and possible footpaths created by the pipeline.

### **8.1.4 Decommissioning and Rehabilitation Phase**

The following potential impacts were considered on biodiversity (fauna and flora) during the decommissioning and rehabilitation phase:

- Continued disturbance of vegetation communities (including portions of a CBA1, CBA2, ESA, and SKEP) and encroachment by alien invasive plant species;
- Potential loss of Threatened or Protected Plant Species (NEMBA: TOPS List); Protected Species (NCNCA protected species) and Protected Trees (NFA) due to rehabilitation and decommission activities. Can also have positive impact during re0vegetation as Threatened or protected species, protected species from Aggeneys Nursery can be used during re-vegetation (required permit and approval from DAFF and DENC will be required);
- Erosion due to the disturbed area; and
- Ongoing displacement and disturbance of faunal community (including multiple threatened species) due to habitat loss and disturbances because of the access roads and possible footpaths created by the pipeline.

## 9 Assessment of Significance

The summary tables below show the significance of the potential impacts. The impacts were based on the desktop information and the general processes that will be followed for the project. The impact significance on the CBA1, CBA2, ESA, and SKEP areas were rated as High (pre-mitigation), this was lowered to Low level of significance should mitigation measures, such as demarcation of the area of the servitude that was previously disturbed to reduce the overall impact footprint, be implemented (Table 10). Post mitigation all the significances were rated either Low or Very Low, this is based on the assumption that the prescribed mitigation will be affectively implemented (Table 11).

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*Table 10 Impact matrix for the proposed project pre-mitigation*

ACTIVITY	APPLICABLE AREA	POTENTIAL ENVIRONMENTAL IMPACT	ENVIRONMENTAL SIGNIFICANCE					
			Intensity (I)	Duration (D)	Extent (E)	Probability	Consequences (C)	Significance (S)
Planning Phase								
Site visits of various Business Partners, environmental and social impact assessment	Fauna and Flora	Temporary disturbance of wildlife due to increased human presence and possible use of machinery and/or vehicles.	L	VL	L	L	L	VL
Construction Phase								
Construction vehicles, removal of vegetation for installation of new infrastructure and construction of contractor camps	Flora	Destruction of, and fragmentation of, portions of the vegetation community	H	L	L	H	M	H
Removal of vegetation for installation of new infrastructure and construction of contractor camps	Flora	Loss of Threatened or Protected Species, Protected species and Protected	H	M	VH	H	H	H
Installation of pipeline and associated infrastructure	Biodiversity	Loss of CBA1, CBA2, ESA, sections of and SKEP	H	M	VH	H	H	H
Installation of pipeline and associated infrastructure	Flora	Loss of Threatened or Protected Species, Protected species and Protected	H	M	VH	H	H	H
Installation of pipeline and associated infrastructure.	Fauna	Displacement of the faunal community (including possible threatened or protected species) due to habitat loss, disturbance (noise, dust, and vibration) and/or direct mortalities.	M	M	M	M	M	L
Operational Phase								



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<b>Disturbance of surface vegetation</b>	Biodiversity	Continued disturbance of vegetation communities (including portions of a CBA1, CBA2, ESA, IBA, and SKEP) and encroachment by alien invasive plant species	M	M	M	M	M	L
<b>Disturbance of surface vegetation</b>	Flora	Loss of Threatened or Protected Species, Protected species and Protected trees	H	M	VH	H	H	H
<b>Maintenance of the system</b>	Biodiversity	Disturbance and mortalities of species due to maintenance of the system	H	L	M	H	M	M
<b>Wind and stormwater over disturbed area</b>	Flora	Erosion due to the disturbed area	H	H	H	H	H	H
<b>Conducting maintenance</b>	Fauna	Ongoing displacement and disturbance of faunal community (including multiple threatened species) due to habitat loss and disturbances because of the access roads and possible footpaths created by the pipeline.	M	L	M	M	M	L

**Decommissioning and Rehabilitation**

<b>Disturbance of vegetation for the removal of the pipeline and removal of the contractor camps</b>	Flora	Destruction of, and fragmentation of, portions of the vegetation community	H	L	L	H	M	H
<b>Disturbance of vegetation for the removal of the pipeline and removal of the contractor camps</b>	Flora	Loss of Threatened or Protected Species, Protected species and Protected trees	H	M	VH	H	H	H
<b>Removal of pipeline and associated infrastructure</b>	Biodiversity	Loss of CBA1, CBA2, ESA, sections of and SKEP	H	M	VH	H	H	H
<b>Removal of pipeline and associated infrastructure.</b>	Fauna	Displacement of the faunal community (including possible threatened or protected species) due to habitat loss, disturbance (noise, dust, and vibration) and/or direct mortalities.	M	M	M	M	M	L

Very high – VH; High – H; High; Moderate - M; L – Low; Very Low – VL

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*Table 11 Impact matrix for the proposed project post-mitigation*

ACTIVITY	APPLICABLE AREA	POTENTIAL ENVIRONMENTAL IMPACT	ENVIRONMENTAL SIGNIFICANCE					
			Intensity (I)	Duration (D)	Extent (E)	Probability	Consequences (C)	Significance (S)
Planning Phase								
Site visits of various Business Partners, environmental and social impact assessment	Fauna and Flora	Temporary disturbance of wildlife due to increased human presence and possible use of machinery and/or vehicles.	VL	VL	VL	VL	VL	Insignificant
Construction Phase								
Construction vehicles, removal of vegetation for installation of new infrastructure and contractor camps	Flora	Destruction of, and fragmentation of, portions of the vegetation community	M	L	L	M	M	L
Construction vehicles, removal of vegetation for installation of new infrastructure and contractor camps	Flora	Loss of Threatened or Protected Species, Protected species and Protected trees	M	L	L	M	M	L
Installation of pipeline and associated infrastructure	Biodiversity	Loss of CBA1, CBA2, ESA, sections of SKEP	H	L	M	M	M	L

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<b>Installation of pipeline and associated infrastructure</b>	Flora	Loss of Threatened or Protected Species, Protected species and Protected trees	H	L	M	M	M	L
<b>Installation of pipeline and associated infrastructure.</b>	Fauna	Displacement of the faunal community (including possible threatened or protected species) due to habitat loss, disturbance (noise, dust, and vibration) and/or direct mortalities.	L	L	L	L	L	VL
<b>Operational Phase</b>								
<b>Disturbance of surface vegetation</b>	Biodiversity	Continued disturbance of vegetation communities (including portions of a CBA1, CBA2, ESA and SKEP) and encroachment by alien invasive plant species	L	L	L	L	L	VL
<b>Maintenance of the system</b>	Biodiversity	Disturbance and mortalities of species due to maintenance of the system	L	L	L	L	L	VL
<b>Wind and stormwater over disturbed area</b>	Flora	Erosion due to the disturbed area	L	L	L	L	L	VL
<b>Maintenance of the system</b>	Flora	Loss of Threatened or Protected Species, Protected species and Protected trees	L	L	L	L	L	VL
<b>Conducting maintenance</b>	Fauna	Ongoing displacement and disturbance of faunal community (including multiple threatened species) due to habitat loss and disturbances because of the access roads and possible footpaths created by the pipeline.	L	VL	L	L	L	VL
<b>Decommissioning and Rehabilitation</b>								
<b>Disturbance of vegetation for the removal of the pipeline</b>	Flora	Destruction of, and fragmentation of, portions of the vegetation community	M	L	L	M	M	L
<b>Disturbance of vegetation for the</b>	Flora	Loss of Threatened or Protected Species, Protected species and Protected trees	H	L	M	M	M	L

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<b>removal of the pipeline</b>								
<b>Removal of pipeline and associated infrastructure</b>	Biodiversity	Loss of CBA1, CBA2, ESA, sections of SKEP	H	L	M	M	M	L
<b>Removal of pipeline and associated infrastructure.</b>	Fauna	Displacement of the faunal community (including possible threatened or protected species) due to habitat loss, disturbance (noise, dust, and vibration) and/or direct mortalities.	L	L	L	L	L	VL

*Very high – VH; High – H; High; Moderate - M; L – Low; Very Low – VL*

## 10 Mitigation Measures

### 10.1 Mitigation Measure Objectives

The focus of mitigation measures should be to reduce the significance of potential impacts associated with the project and thereby to:

- Prevent the unnecessary destruction of, and fragmentation, of the vegetation community (including areas classified as CBA, ESA, IBA, and SKEP);
- Prevent the destruction of Threatened or protected plant species (NEMBA:TOPS: list), Protected Plant Species (NCNCA listed species) and Protected Tree Species (NFA) by means of search and rescue and transplantation to Aggeneys Nursery for care, maintenance and utilisation during rehabilitation phase; and
- Prevent the loss of the faunal community (including potentially occurring species of conservation concern) associated with these vegetation communities.

#### 10.1.1 General mitigations relevant to the project

Small laydown areas will be moved along the pipeline as construction progresses.

- The planning and design for the small laydown areas must avoid sensitive areas, and preferably be established in an already disturbed or developed area;
- A detailed screening of the development area by botanist/arid-ecologist needs to be conducted and any Threatened or protected plant species (NEMBA:TOPS: list), Protected Plant Species (NCNCA listed species) and Protected Tree Species (NFA) observed needs to be recorded with their GPS coordinates. The relevant permit applications must be compiled and submitted to the relevant authority and once permits are approved a search and rescue protocol must be developed and implemented. Plants can be translocated to the Aggeneys Nursery for care, maintenance and storage until commencement of rehabilitation where plant can be utilised to re-vegetate the areas post construction and/or decommissioning;
- Care and Maintenance, as well as monthly monitoring of plants translocation, (according Nursery Management Plant and Monitoring Programme) needs to be implemented;
- The Business Partner should inform all site staff to the use of supplied ablution facilities and under no circumstances shall indiscriminate excretion and urinating be allowed other than in supplied facilities;
- The Business Partner must supply sealable and properly marked domestic waste collection bins and all solid waste collected shall be disposed of at a licensed disposal facility;
- Where a registered disposal facility is not available close to the project area, the Business Partner must provide a method statement with regard to waste management. Under no circumstances may domestic waste be burned on site;

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- Refuse bins must be emptied and secured;
- Temporary storage of domestic waste must be in covered waste skips;
- Maximum domestic waste storage period will be 10 days;
- Any possible contamination of topsoil by hydrocarbons, concrete or concrete water must be avoided;
- Materials must be stored in leak-proof, sealable containers or packaging;
- No storage of vehicles or equipment will be allowed outside of the designated project area;
- Drip trays or any form of oil absorbent material must be placed underneath vehicles/machinery and equipment when not in use;
- No servicing of equipment on site unless absolutely necessary;
- Leaking equipment must be repaired immediately or be removed from the site to facilitate repair;
- The Business Partner must be in possession of an emergency spill kit that must be complete and available at all times on site;
- All vehicles and equipment must be well maintained to ensure that there are no oil or fuel leakages;
- All contaminated soil / yard stone must be treated *in situ* or removed and be placed in containers;
- All personnel and Business Partners to undergo Environmental and Biodiversity Awareness Training. A signed register of attendance must be kept for proof. Discussions are required on sensitive environmental receptors within the project area to inform Business Partners and site staff of the presence of Red / Orange List species, their identification, conservation status and importance, biology, habitat requirements and management requirements;
- Project area footprints must be kept to a minimum, and must be demarcated to ensure no person/vehicle goes into adjacent areas;
- Schedule project activities and operations during least sensitive periods, in order to avoid migration, nesting and breeding seasons of SCC;
- Clearing of vegetation should be minimized to the pipeline route. Excavation of any vegetation outside the pipeline servitude should be avoided;
- Construction at night must be prohibited in order to reduce the impact on faunal species;
- Construction vehicles must be restricted to existing roads and new pathways must be restricted;

- The area must be walk through prior to construction to chase up any animals that could be hiding in burrows or under vegetation;
- A qualified ECO must be on site when construction begins to identify species that will be directly disturbed and to relocate fauna/flora (including nests of SCCs) that is found during the project activities;
- Removal and translocation of any Threatened or protected plant species (NEMBA:TOPS: list), Protected Plant Species (NCNCA listed species) and Protected Tree Species (NFA) needs to be conducted prior to the clearing of any vegetation;
- Prior to and during vegetation clearance any larger fauna species noted should be given the opportunity to move away from the construction machinery;
- Dust reducing mitigation measures must be put in place and must be strictly adhered to, during the construction phase of the project;
- No trapping, killing or poisoning of any wildlife is to be allowed on site, including snakes, birds, lizards, frogs, insects or mammals;
- Rehabilitation of the disturbed areas existing in the project area must be made a priority. Topsoil must also be utilised, and any disturbed area must be re-vegetated with plant and grass species which are endemic to this vegetation type;
- Areas must be stabilised using appropriate indigenous vegetation (along the length of the pipeline) and geotextile matting (in areas with a gradient exceeding 20°). Indigenous grasses and shrubs found within the project area and surrounds would sustain the arid environment and are the preferred options. During the first year of establishment, these plants should be watered as often as possible to ensure their establishment. The first two to three weeks should be daily, thereafter weekly is recommended. This is subject to how the vegetation fairs during this time, and should be adapted accordingly. There is a risk of vagrant livestock impacting on this vegetation and fencing of these areas could be considered.
- An alien invasive plant management plan needs to be compiled and implemented post construction to control current invaded areas and prevent the growth of invasives on cleared areas, monitoring must be done on a monthly basis by the ECO for the duration of the construction period and then as stated in the management plan;
- As a portion of the pipeline is replaced, the section of the pipeline must be rehabilitated. Rehabilitation must be concurrent with the upgrading of the pipeline; and
- An erosion control plan and an alien vegetation management plan must be compiled and implemented for the site.

## 11 Rehabilitation Guidelines

The following are guidelines to consider for the rehabilitation of the area, they should be incorporated into a more comprehensive rehabilitation plan.

### **11.1 Removal of all infrastructure**

All infrastructure not part of the end land use planning must be removed. The foundations must be removed up to a depth of 1m and the rubble must be discarded at the nearest landfill that allows waste of this kind. Access roads that will not be used must be ripped and revegetated with indigenous vegetation (refer to Appendix A for a list of species found in this vegetation type). Plants translocated to the Aggeneys Nursery must be utilized during re-vegetation as far as practical possible.

During the rehabilitation effort, movement of large machinery, as well as staff, will resemble roles and movement as per the operational phase, thus management measures are similar, such as demarcating the footprint area and/or “no go” areas will prevent unregulated access and activities. Reducing the dust generated, especially the earthmoving machinery, through wetting the soil surface (with “dirty water”) and putting up signs to enforce speed limit as well as speed bumps built to force slow speeds. Ongoing dust and alien plant species monitoring monthly until the end of the rehabilitation and closure phase.

### **11.2 Rehabilitation**

Re-establishment of the vegetation community/ecosystem will rely on the land capability of the area to provide suitable conditions for plant growth and succession. Soil composition and landscape are fundamental to the process. These must be investigated, and management measures must be described accordingly. Plants translocated to the Aggeneys Nursery must be utilized during re-vegetation as far as practical possible

Areas where the pipeline will be decommissioned must be landscaped back to original contours and rehabilitated to the designated land capability. The replacement of the topsoil must be done within the rehabilitated areas. The topsoil will be ripped and reseeded with indigenous plant species. Any contamination of the topsoil must be avoided by ensuring machinery is well maintained and leak-free. If contamination has occurred the area must be ameliorated immediately. The infringement by local people and the associated impacts such as livestock will hinder the rehabilitation process, thus accessibility to the rehabilitated areas must be prohibited.

The rehabilitated areas must be revegetated as soon as possible to reduce the risk of increased erosion in bare areas. Plants translocated to the Aggeneys Nursery can be utilized during re-vegetation as far as practical possible. However, a limiting factor for seedling establishment is moisture availability which is directly related to rainfall timing and amount. It is thus recommended that the rehabilitation be started in the rainfall season. For successful rehabilitation it is suggested that the nutrient level be increased in the area to ensure successful seed germination. A specialist must be consulted on suitable products to be used, we noticed that slime or sludge format products has been used successfully in the Northern Cape. Sand burial, sand accumulation, erosion and sand stabilization are all a problem in this region and can reduce the success of seeds germinating. Mechanical windbreaks such as nets, brushwood barriers and other such features provides some stabilization for the area, however as soon as suitable cover has established the windbreak must be removed. Vehicles will be driving around on-site and must stay within the designated routes. This will prevent the compaction of soils outside of the disturbed area. If areas have been compacted the soil must be ripped to remedy the effects of compaction.



### 11.3 Post-Closure Monitoring and Maintenance

Monitoring is an essential tool in ensuring that time, money and effort that was put into the rehabilitation isn't wasted, the following is a list of monitoring protocols that would need to be put in place for the post-closure phases;

- Monthly monitoring on the emergence of the species and the effectivity of the alien management plan, and action is taken where needed regarding alien invasive plant species;
- The rehabilitated area must be assessed by the appropriate specialist, once a year for compaction, fertility, and erosion; and
- If erosion occurs, corrective actions (e.g. netting) must be taken to minimize any further erosion from taking place.

### 11.4 Rehabilitation regarding Fauna

Improving the state and condition of the footprint area to a more natural state will result in an increase of faunal species within the area due to viable habitat for refugia and food being available, i.e. returning to a more natural state. The rehabilitation process may initially still displace the faunal species due to the large earth-moving machines as well as the human presence. However, the post-closure phase may result in fauna systematically returning in the best-case scenario if the rehabilitation efforts are well executed.

## 12 Recommendations

The following recommendations are applicable:

- Prior to construction the footprint area be walked / traversed by an ecologist to identify any potential issues / flags. In the event that something is identified, then an appropriate specialist should be consulted for specific mitigation.
- Compilation of Search and Rescue Protocol, as well monitoring protocol must be compiled for translocation of any Threatened or protected plant species (NEMBA:TOPS: list), Protected Plant Species (NCNCA listed species);
- Search and rescue of threatened or protected species as listed by the National Environmental Management Biodiversity Act, 2004 (Act No. 10 of 2004) and the Northern Cape Nature Conservation Act, 2009 (Act No. 9 of 2009) needs to be implemented and species recorded needs to be rescue and translocate to the BMM Nursery in Aggeneys for storage, care and maintenance for the re-vegetation of disturbed areas after construction and during the rehabilitation process; and
- A rehabilitation plan must be compiled for the project, to be implemented from the onset of the activities. The plan must provide guidelines on how to restore the disturbed area to (as close as possible to) its natural state. The plan must also include the incorporation of natural vegetation, sloping plans as well as storm water management.

### 13 Conclusion

Based on the desktop review, the project area is considered situated in a sensitive area. This can be determined from the ecological datasets reviewed for this assessment. Based on the desktop ecological review the habitat is still regarded to be in a largely natural condition, though the pipeline servitude is a previously disturbed area and will provide habitat for several faunal species including some threatened species. A total of 215 protected flora species area expected in the project area, this number is made up of three protected trees (NFA, 2014), ten under schedule 1 of the NCNCA (2009), 196 protected under schedule 2 of the NCNCA (2009) and seven by the IUCN (2017). This expected diversity is indicative of the importance of these habitats to collectively provide refugia, food, and corridors for dispersal in and through the surrounding area. Despite this largely natural condition expected for the area, only Low and Very Low levels of impact significance are expected for the project should mitigation measures be implemented for the project. A recommendation is provided for the implementation of a rehabilitation plan to facilitate this project.

The following conclusions have been summarised for the desktop assessment:

- Based on the Terrestrial Critical Biodiversity Area (CBA) map, the project area falls within an area classified as CBA1, CBA2 and Ecological Support Area (ESA);
- The proposed project area was superimposed on the Succulent Karoo Ecosystem Programme (SKEP, 2013) priority area spatial data. According to this, the project area falls across the Bushmanland Inselbergs Region;
- The project area was superimposed on the ecosystem protection level map to assess the protection status of terrestrial ecosystems associated with the development (Skonwo *et al.*, 2019). Based on this the terrestrial ecosystems associated with the proposed project area is rated as *not protected* and *poorly protected*;
- Based on the National Freshwater Ecosystem Priority Area (NFEPA) (Nel *et al.*, 2011) spatial data the project area falls across a true FEPA wetland;
- The project area intercepts a portion of the Haramoep and Black Mountain Mine Important Bird and Biodiversity Area (IBA) (Birdlife, 2017);
- The project area is situated across seven vegetation types; Aggeneys Gravel Vygieland, Bushmanland Arid Grassland, Bushmanland Inselberg Shrubland, Bushmanland Sandy Grassland, Eastern Gariep Plains Desert, Eastern Gariep Rocky Desert, and Namaqualand Klipkoppe Shrubland according to SANBI (2019);
- Based on the Plants of Southern Africa database, 621 plant species are expected to occur in the project area (BODATSA-POSA, 2016). Ten of the expected species are protected under schedule 1 of the NCNCA (2009), while a further 196 are protected under schedule 2. Of the 621-plant species, seven (7) species are listed as being SCCs by the IUCN and three are protected trees based on the NFA (2014) list
- Based on the South African Bird Atlas Project, Version 2 (SABAP2) database 149 bird species are expected to occur in the vicinity of the project area of which eight (8) species are listed as SCC either on a regional scale or international scale;

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- Sixty-five mammal species are expected of which 7 are SCCs, 61 reptile species are expected and 2 are SCCs while 15 amphibians species with 1 SCC are expected. Majority of these species have a high likelihood of occurring in the project area;

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## APPENDIX A: Floral species expected to occur in the project area

Family	Taxon	IUCN	Ecology	NCNCA	NFA (2014) Protected Tree list
Malvaceae	<i>Abutilon pycnodon</i>	LC	Indigenous		
Acanthaceae	<i>Acanthopsis disperma</i>	LC	Indigenous		
Lamiaceae	<i>Acrotome pallescens</i>	LC	Indigenous		
Passifloraceae	<i>Adenia repanda</i>	LC	Indigenous		
Molluginaceae	<i>Adenogramma glomerata</i>	LC	Indigenous		
Fabaceae	<i>Adenolobus garipensis</i>	LC	Indigenous		
Crassulaceae	<i>Adromischus nanus</i>	LC	Indigenous; Endemic		
Cyperaceae	<i>Afroscirpoides dioeca</i>		Indigenous		
Aizoaceae	<i>Aizoon asbestinum</i>	LC	Indigenous	Sched 2	
Aizoaceae	<i>Aizoon burchellii</i>		Indigenous	Sched 2	
Aizoaceae	<i>Aizoon canariense</i>	LC	Indigenous	Sched 2	
Hyacinthaceae	<i>Albuca glandulifera</i>	LC	Indigenous		
Hyacinthaceae	<i>Albuca setosa</i>	LC	Indigenous		
Hyacinthaceae	<i>Albuca suaveolens</i>	LC	Indigenous		
Asphodelaceae	<i>Aloe claviflora</i>	LC	Indigenous	Sched 2	
Asphodelaceae	<i>Aloe dabenorisana</i>	LC	Indigenous; Endemic	Sched 1	
Asphodelaceae	<i>Aloe gariepensis</i>	LC	Indigenous	Sched 2	
Asphodelaceae	<i>Aloe microstigma</i>	LC	Indigenous	Sched 2	
Asphodelaceae	<i>Aloidendron dichotomum</i>	VU	Indigenous	Sched 1	
Amaranthaceae	<i>Amaranthus capensis</i> subsp. <i>capensis</i>	LC	Indigenous; Endemic		
Asteraceae	<i>Amellus epaleaceus</i>	LC	Indigenous		
Asteraceae	<i>Amphiglossa tomentosa</i>	LC	Indigenous		
Anacampserotaceae	<i>Anacampseros albissima</i>	LC	Indigenous		
Anacampserotaceae	<i>Anacampseros baeseckeii</i>	LC	Indigenous		
Anacampserotaceae	<i>Anacampseros filamentosa</i> subsp. <i>namaquensis</i>		Indigenous		
Anacampserotaceae	<i>Anacampseros papyracea</i> subsp. <i>namaensis</i>	LC	Indigenous		
Anacampserotaceae	<i>Anacampseros quinaria</i>	LC	Indigenous		
Anacampserotaceae	<i>Anacampseros recurvata</i> subsp. <i>minuta</i>	DD	Indigenous; Endemic		
Apiaceae	<i>Anginon jaarsveldii</i>	EN	Indigenous; Endemic	Sched 2	
Scrophulariaceae	<i>Antherothamnus pearsonii</i>	LC	Indigenous		
Rubiaceae	<i>Anthospermum spathulatum</i> subsp. <i>spathulatum</i>	LC	Indigenous		
Scrophulariaceae	<i>Anticharis</i> sp.				
Aizoaceae	<i>Antimima hantamensis</i>	LC	Indigenous; Endemic	Sched 2	
Aizoaceae	<i>Antimima tuberculosa</i>	LC	Indigenous; Endemic	Sched 2	
Aizoaceae	<i>Antimima vanzylii</i>	LC	Indigenous; Endemic	Sched 2	
Menispermaceae	<i>Antizoma miersiana</i>	LC	Indigenous		
Scrophulariaceae	<i>Aptosimum albomarginatum</i>	LC	Indigenous		
Scrophulariaceae	<i>Aptosimum procumbens</i>	LC	Indigenous		
Scrophulariaceae	<i>Aptosimum spinescens</i>	LC	Indigenous		
Scrophulariaceae	<i>Aptosimum tragacanthoides</i>	LC	Indigenous		

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Asteraceae	<i>Arctotis dimorphocarpa</i>	LC	Indigenous; Endemic		
Asteraceae	<i>Arctotis leiocarpa</i>	LC	Indigenous		
Asteraceae	<i>Arctotis venusta</i>	LC	Indigenous		
Poaceae	<i>Aristida adscensionis</i>	LC	Indigenous		
Poaceae	<i>Aristida congesta subsp. congesta</i>	LC	Indigenous		
Poaceae	<i>Aristida engleri var. engleri</i>	LC	Indigenous		
Asparagaceae	<i>Asparagus asparagoides</i>	LC	Indigenous		
Asparagaceae	<i>Asparagus exuvialis forma exuvialis</i>	NE	Indigenous		
Asparagaceae	<i>Asparagus ovatus</i>	LC	Indigenous; Endemic		
Asparagaceae	<i>Asparagus pearsonii</i>	LC	Indigenous		
Asparagaceae	<i>Asparagus suaveolens</i>	LC	Indigenous		
Aspleniaceae	<i>Asplenium cordatum</i>	LC	Indigenous		
Zygophyllaceae	<i>Augea capensis</i>	LC	Indigenous		
Salvadoraceae	<i>Azima tetraacantha</i>	LC	Indigenous		
Acanthaceae	<i>Barleria lichtensteiniana</i>	LC	Indigenous		
Acanthaceae	<i>Barleria papillosa</i>	LC	Indigenous; Near-endemic	Sched 2	
Acanthaceae	<i>Barleria rigida</i>	LC	Indigenous		
Acanthaceae	<i>Barleria sp.</i>				
<b>Fabaceae</b>	<b><i>Bauhinia bowkeri</i></b>	<b>NT</b>	<b>Indigenous; Endemic</b>		
Asteraceae	<i>Berkheya canescens</i>	LC	Indigenous		
Asteraceae	<i>Berkheya chamaepeuce</i>	LC	Indigenous		
Asteraceae	<i>Berkheya spinosissima subsp. spinosissima</i>	LC	Indigenous		
Acanthaceae	<i>Blepharis macra</i>	LC	Indigenous		
Acanthaceae	<i>Blepharis mitrata</i>	LC	Indigenous		
Acanthaceae	<i>Blepharis sp.</i>				
Capparaceae	<i>Boscia albitrunca</i>	LC	Indigenous	Sched 2	Protected Tree
Capparaceae	<i>Boscia foetida subsp. foetida</i>	LC	Indigenous	Sched 2	
Hyacinthaceae	<i>Bowiea volubilis subsp. gariepensis</i>	LC	Indigenous		
Poaceae	<i>Brachiaria glomerata</i>	LC	Indigenous		
Amaryllidaceae	<i>Brunsvigia bosmaniae</i>	LC	Indigenous	Sched 2	
Amaryllidaceae	<i>Brunsvigia comptonii</i>	LC	Indigenous; Endemic	Sched 2	
Amaryllidaceae	<i>Brunsvigia namaquana</i>	LC	Indigenous; Endemic	Sched 2	
Amaryllidaceae	<i>Brunsvigia sp.</i>			Sched 2	
Bryaceae	<i>Bryum argenteum</i>		Indigenous		
Asphodelaceae	<i>Bulbine praemorsa</i>	LC	Indigenous	Sched 2	
Asphodelaceae	<i>Bulbine striata</i>	LC	Indigenous; Endemic	Sched 2	
Amaranthaceae	<i>Calicorema capitata</i>	LC	Indigenous		
Fabaceae	<i>Calobota spinescens</i>	LC	Indigenous		
Apocynaceae	<i>Carissa bispinosa</i>	LC	Indigenous	Sched 2	
Poaceae	<i>Cenchrus ciliaris</i>	LC	Indigenous		
Poaceae	<i>Centropodia glauca</i>	LC	Indigenous		
Aizoaceae	<i>Cephalophyllum fulleri</i>	LC	Indigenous; Endemic	Sched 2	
Aizoaceae	<i>Cephalophyllum parvibracteatum</i>	LC	Indigenous; Endemic	Sched 2	



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Aizoaceae	<i>Cephalophyllum staminodiosum</i>	LC	Indigenous; Endemic	Sched 2
Gigaspermaceae	<i>Chamaebryum pottioides</i>		Indigenous	
Verbenaceae	<i>Chascanum garipense</i>	LC	Indigenous	
Verbenaceae	<i>Chascanum namaquanum</i>	LC	Indigenous	
Verbenaceae	<i>Chascanum pumilum</i>	LC	Indigenous	
Pteridaceae	<i>Cheilanthes deltoidea</i> subsp. <i>deltoidea</i>	LC	Indigenous	
Aizoaceae	<i>Cheiridopsis schlechteri</i>	LC	Indigenous; Endemic	Sched 2
Agavaceae	<i>Chlorophytum</i> sp.			
Asteraceae	<i>Chrysocoma microphylla</i>	LC	Indigenous	
Asteraceae	<i>Chrysocoma sparsifolia</i>	LC	Indigenous; Endemic	
Asteraceae	<i>Cineraria canescens</i> var. <i>canescens</i>	LC	Indigenous	
Cleomaceae	<i>Cleome angustifolia</i> subsp. <i>diandra</i>	LC	Indigenous	
Cleomaceae	<i>Cleome foliosa</i> var. <i>lutea</i>	LC	Indigenous	
Cleomaceae	<i>Cleome oxyphylla</i> var. <i>oxyphylla</i>	LC	Indigenous	
Cucurbitaceae	<i>Coccinia rehmannii</i>	LC	Indigenous	
Boraginaceae	<i>Codon royenii</i>	LC	Indigenous	
Colchicaceae	<i>Colchicum bellum</i>		Indigenous	
Colchicaceae	<i>Colchicum melanthoides</i> subsp. <i>melanthoides</i>	LC	Indigenous	
Burseraceae	<i>Commiphora gracilifrons</i>	LC	Indigenous	
Aizoaceae	<i>Conophytum angelicae</i>		Indigenous	Sched 2
Aizoaceae	<i>Conophytum calculus</i> subsp. <i>vanzylii</i>	LC	Indigenous; Endemic	Sched 2
Aizoaceae	<i>Conophytum friedrichiae</i>	LC	Indigenous	Sched 2
Aizoaceae	<i>Conophytum fulleri</i>	LC	Indigenous; Endemic	Sched 2
Aizoaceae	<i>Conophytum limpidum</i>	NT	Indigenous; Endemic	Sched 2
Aizoaceae	<i>Conophytum longum</i>	LC	Indigenous; Endemic	Sched 2
Aizoaceae	<i>Conophytum marginatum</i> subsp. <i>haramoepense</i>	LC	Indigenous; Endemic	Sched 2
Aizoaceae	<i>Conophytum marginatum</i> subsp. <i>littlewoodii</i>	LC	Indigenous	Sched 2
Aizoaceae	<i>Conophytum maughanii</i> subsp. <i>maughanii</i>	LC	Indigenous	Sched 2
Aizoaceae	<i>Conophytum</i> sp.			Sched 2
Aizoaceae	<i>Conophytum subfenestratum</i>	LC	Indigenous; Endemic	Sched 2
Cucurbitaceae	<i>Corallocarpus dissectus</i>	LC	Indigenous	
Asteraceae	<i>Cotula coronopifolia</i>	LC	Indigenous	
Crassulaceae	<i>Cotyledon orbiculata</i> var. <i>orbiculata</i>	LC	Indigenous	Sched 2
Asteraceae	<i>Crassothonna sedifolia</i>	LC	Indigenous	
Crassulaceae	<i>Crassula brevifolia</i> subsp. <i>brevifolia</i>	LC	Indigenous	Sched 2
Crassulaceae	<i>Crassula campestris</i>	LC	Indigenous	Sched 2
Crassulaceae	<i>Crassula columnaris</i> subsp. <i>prolifera</i>	LC	Indigenous	Sched 2
Crassulaceae	<i>Crassula corallina</i> subsp. <i>macrorrhiza</i>	LC	Indigenous	Sched 2
Crassulaceae	<i>Crassula cotyledonis</i>	LC	Indigenous	Sched 2
Crassulaceae	<i>Crassula deltoidea</i>	LC	Indigenous	Sched 2

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Crassulaceae	<i>Crassula elegans</i> subsp. <i>elegans</i>	LC	Indigenous	Sched 2
Crassulaceae	<i>Crassula exilis</i> subsp. <i>exilis</i>	LC	Indigenous; Endemic	Sched 2
Crassulaceae	<i>Crassula exilis</i> subsp. <i>sedifolia</i>	LC	Indigenous	Sched 2
Crassulaceae	<i>Crassula garibina</i> subsp. <i>garibina</i>	LC	Indigenous	Sched 2
Crassulaceae	<i>Crassula macowaniana</i>	LC	Indigenous	Sched 2
Crassulaceae	<i>Crassula muscosa</i> var. <i>muscosa</i>	NE	Indigenous	Sched 2
Crassulaceae	<i>Crassula sericea</i> var. <i>sericea</i>	NE	Indigenous	Sched 2
Crassulaceae	<i>Crassula sericea</i> var. <i>velutina</i>	NE	Indigenous	Sched 2
Crassulaceae	<i>Crassula subaphylla</i> var. <i>subaphylla</i>	LC	Indigenous	Sched 2
Crassulaceae	<i>Crassula tabularis</i>	LC	Indigenous	Sched 2
Crassulaceae	<i>Crassula tenuipedicellata</i>	LC	Indigenous	Sched 2
Crassulaceae	<i>Crassula tomentosa</i> var. <i>glabrifolia</i>	LC	Indigenous	Sched 2
Amaryllidaceae	<i>Crinum bulbispermum</i>	LC	Indigenous	Sched 2
Fabaceae	<i>Crotalaria meyeriana</i>	LC	Indigenous	
Fabaceae	<i>Crotalaria pearsonii</i>	VU	Indigenous; Endemic	Sched 2
Fabaceae	<i>Crotalaria virgultalis</i>	LC	Indigenous	
Apocynaceae	<i>Cryptolepis decidua</i>	LC	Indigenous	Sched 2
Cucurbitaceae	<i>Cucumis africanus</i>	LC	Indigenous	
Cucurbitaceae	<i>Cucumis rigidus</i>	LC	Indigenous	
Cucurbitaceae	<i>Cucumis sagittatus</i>	LC	Indigenous	
Tecophilaeaceae	<i>Cyanella lutea</i>		Indigenous	Sched 2
Apocynaceae	<i>Cynanchum viminale</i> subsp. <i>thunbergii</i>		Indigenous	Sched 2
Poaceae	<i>Cynodon dactylon</i>	LC	Indigenous	
Cyperaceae	<i>Cyperus indecorus</i> var. <i>namaquensis</i>	NE	Indigenous	
Cyperaceae	<i>Cyperus laevigatus</i>	LC	Indigenous	
Poaceae	<i>Danthoniopsis ramosa</i>	LC	Indigenous	
Caryophyllaceae	<i>Dianthus micropetalus</i>	LC	Indigenous	Sched 2
Caryophyllaceae	<i>Dianthus namaensis</i>		Indigenous	Sched 2
Caryophyllaceae	<i>Dianthus namaensis</i> var. <i>dinteri</i>	LC	Indigenous	Sched 2
Scrophulariaceae	<i>Diascia engleri</i>	LC	Indigenous	Sched 2
Asteraceae	<i>Dicoma capensis</i>	LC	Indigenous	
Asteraceae	<i>Didelta carnosus</i> var. <i>carnosus</i>	LC	Indigenous	
Poaceae	<i>Digitaria eriantha</i>	LC	Indigenous	
Asteraceae	<i>Dimorphotheca polyptera</i>	LC	Indigenous	
Asteraceae	<i>Dimorphotheca sinuata</i>	LC	Indigenous	
Aizoaceae	<i>Dinteranthus puberulus</i>	LC	Indigenous; Endemic	Sched 2
Ebenaceae	<i>Diospyros acocksii</i>	LC	Indigenous	
Ebenaceae	<i>Diospyros ramulosa</i>	LC	Indigenous	
Hyacinthaceae	<i>Dipcadi gracillimum</i>	LC	Indigenous	
Asteraceae	<i>Doellia cafra</i>	LC	Indigenous	
Hyacinthaceae	<i>Drimia intricata</i>	LC	Indigenous	
Aizoaceae	<i>Drosanthemum albens</i>	LC	Indigenous	Sched 2
Aizoaceae	<i>Drosanthemum hispidum</i>	LC	Indigenous	Sched 2

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Aizoaceae	<i>Drosanthemum intermedium</i>	LC	Indigenous; Endemic	Sched 2	
Aizoaceae	<i>Drosanthemum karrooense</i>	LC	Indigenous; Endemic	Sched 2	
Aizoaceae	<i>Drosanthemum luederitzii</i>	LC	Indigenous	Sched 2	
Aizoaceae	<i>Drosanthemum praecultum</i>	LC	Indigenous; Endemic	Sched 2	
Aizoaceae	<i>Drosanthemum schoenlandianum</i>	LC	Indigenous; Endemic	Sched 2	
Aizoaceae	<i>Drosanthemum sp.</i>			Sched 2	
Aizoaceae	<i>Drosanthemum subcompressum</i>	LC	Indigenous; Endemic	Sched 2	
Plumbaginaceae	<i>Dyerophytum africanum</i>	LC	Indigenous		
Aizoaceae	<i>Ebracteola fulleri</i>	LC	Indigenous	Sched 2	
Apocynaceae	<i>Ectadium virgatum</i>	NT	Indigenous	Sched 2	
Boraginaceae	<i>Ehretia sp.</i>				
Poaceae	<i>Ehrharta calycina</i>	LC	Indigenous		
Poaceae	<i>Ehrharta pusilla</i>	LC	Indigenous		
Poaceae	<i>Eleusine coracana subsp. africana</i>	LC	Indigenous		
Hypoxidaceae	<i>Empodium sp.</i>				
Poaceae	<i>Enneapogon cenchroides</i>	LC	Indigenous		
Poaceae	<i>Enneapogon desvauxii</i>	LC	Indigenous		
Poaceae	<i>Enneapogon scaber</i>	LC	Indigenous		
Poaceae	<i>Enneapogon scaber var. scaber</i>		Indigenous		
Poaceae	<i>Eragrostis brizantha</i>	LC	Indigenous		
Poaceae	<i>Eragrostis homomalla</i>	LC	Indigenous		
Poaceae	<i>Eragrostis mexicana subsp. virescens</i>	NE	Not indigenous; Naturalised		
Poaceae	<i>Eragrostis nindensis</i>	LC	Indigenous		
Poaceae	<i>Eragrostis rotifer</i>	LC	Indigenous		
Poaceae	<i>Eragrostis trichophora</i>	LC	Indigenous		
Asteraceae	<i>Eriocephalus africanus var. paniculatus</i>	LC	Indigenous; Endemic		
Asteraceae	<i>Eriocephalus merxmulleri</i>	LC	Indigenous		
Asteraceae	<i>Eriocephalus scariosus</i>	LC	Indigenous		
Asteraceae	<i>Eriocephalus sp.</i>				
Asteraceae	<i>Eriocephalus spinescens</i>	LC	Indigenous; Endemic		
Ruscaceae	<i>Eriospermum bakerianum subsp. bakerianum</i>	LC	Indigenous		
Ruscaceae	<i>Eriospermum ernstii</i>	LC	Indigenous; Endemic		
Ruscaceae	<i>Eriospermum pusillum</i>	LC	Indigenous; Endemic		
Ruscaceae	<i>Eriospermum sp.</i>				
Ebenaceae	<i>Euclea pseudebenus</i>	LC	Indigenous		Protected Tree
Ebenaceae	<i>Euclea undulata</i>	LC	Indigenous		
Euphorbiaceae	<i>Euphorbia dregeana</i>	LC	Indigenous	Sched 2	
Euphorbiaceae	<i>Euphorbia gariepina</i>		Indigenous	Sched 2	
Euphorbiaceae	<i>Euphorbia gariepina subsp. gariepina</i>	LC	Indigenous	Sched 2	
Euphorbiaceae	<i>Euphorbia gregaria</i>	LC	Indigenous	Sched 2	
Euphorbiaceae	<i>Euphorbia inaequilatera var. inaequilatera</i>	NE	Indigenous	Sched 2	
Euphorbiaceae	<i>Euphorbia mauritanica</i>	LC	Indigenous	Sched 2	

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Euphorbiaceae	<i>Euphorbia phylloclada</i>	LC	Indigenous	Sched 2	
Euphorbiaceae	<i>Euphorbia rhombifolia</i>	LC	Indigenous	Sched 2	
Euphorbiaceae	<i>Euphorbia</i> sp.			Sched 2	
Euphorbiaceae	<i>Euphorbia spinea</i>	LC	Indigenous	Sched 2	
Euphorbiaceae	<i>Euphorbia virosa</i>	LC	Indigenous	Sched 2	
Euphorbiaceae	<i>Euphorbia virosa</i> subsp. <i>virosa</i>		Indigenous	Sched 2	
Asteraceae	<i>Euryops dregeanus</i>	LC	Indigenous		
Asteraceae	<i>Euryops multifidus</i>	LC	Indigenous; Endemic		
Asteraceae	<i>Euryops</i> sp.				
Asteraceae	<i>Euryops subcarnosus</i> subsp. <i>vulgaris</i>	LC	Indigenous		
Fabroniaceae	<i>Fabronia</i> sp.				
Asteraceae	<i>Felicia clavipilosa</i>		Indigenous		
Asteraceae	<i>Felicia hirsuta</i>	LC	Indigenous		
Asteraceae	<i>Felicia muricata</i> subsp. <i>muricata</i>	LC	Indigenous		
Asteraceae	<i>Felicia namaquana</i>	LC	Indigenous		
Iridaceae	<i>Ferraria variabilis</i>	LC	Indigenous; Endemic	Sched 2	
Moraceae	<i>Ficus cordata</i>		Indigenous		
Moraceae	<i>Ficus cordata</i> subsp. <i>cordata</i>	LC	Indigenous		
Moraceae	<i>Ficus ilicina</i>	LC	Indigenous		
Cyperaceae	<i>Fimbristylis bisumbellata</i>	LC	Indigenous		
Poaceae	<i>Fingerhuthia africana</i>	LC	Indigenous		
Apocynaceae	<i>Fockea comaru</i>	LC	Indigenous	Sched 2	
Urticaceae	<i>Forsskaolea candida</i>	LC	Indigenous		
Asteraceae	<i>Foveolina dichotoma</i>	LC	Indigenous		
Frankeniaceae	<i>Frankenia pulverulenta</i>	LC	Indigenous		
Aizoaceae	<i>Galenia africana</i>	LC	Indigenous	Sched 2	
Aizoaceae	<i>Galenia crystallina</i> var. <i>crystallina</i>	LC	Indigenous	Sched 2	
Aizoaceae	<i>Galenia fruticosa</i>	LC	Indigenous	Sched 2	
Aizoaceae	<i>Galenia namaensis</i>	LC	Indigenous	Sched 2	
Aizoaceae	<i>Galenia papulosa</i>	LC	Indigenous	Sched 2	
Aizoaceae	<i>Galenia sarcophylla</i>	LC	Indigenous	Sched 2	
Asteraceae	<i>Gazania jurineifolia</i> subsp. <i>jurineifolia</i>	LC	Indigenous; Endemic		
Asteraceae	<i>Gazania lichtensteinii</i>	LC	Indigenous		
Asteraceae	<i>Geigeria pectidea</i>	LC	Indigenous		
Asteraceae	<i>Geigeria vigintiquamea</i>	LC	Indigenous		
Gisekiaceae	<i>Gisekia africana</i> var. <i>africana</i>	LC	Indigenous		
Iridaceae	<i>Gladiolus saccatus</i>	LC	Indigenous	Sched 2	
Apocynaceae	<i>Gomphocarpus filiformis</i>	LC	Indigenous	Sched 2	
Funariaceae	<i>Goniomitrium africanum</i>		Indigenous		
Asteraceae	<i>Gorteria alienata</i>		Indigenous; Endemic		
Asteraceae	<i>Gorteria corymbosa</i>	LC	Indigenous		
Asteraceae	<i>Gorteria integrifolia</i>		Indigenous; Endemic		
Neuradaceae	<i>Grielum humifusum</i> var. <i>humifusum</i>	LC	Indigenous		
Neuradaceae	<i>Grielum sinuatum</i>	LC	Indigenous		

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Asteraceae	<i>Gymnodiscus linearifolia</i>	LC	Indigenous; Endemic		
Celastraceae	<i>Gymnosporia heterophylla</i>	LC	Indigenous	Sched 2	
Amaryllidaceae	<i>Haemanthus sp.</i>			Sched 2	
Asphodelaceae	<i>Haworthiopsis tessellata var. tessellata</i>		Indigenous	Sched 2	
Scrophulariaceae	<i>Hebenstretia parviflora</i>	LC	Indigenous		
Scrophulariaceae	<i>Hebenstretia sp.</i>				
Asteraceae	<i>Helichrysum gariepinum</i>	LC	Indigenous		
Asteraceae	<i>Helichrysum herniarioides</i>	LC	Indigenous		
Asteraceae	<i>Helichrysum mamarolepis</i>	NT	Indigenous; Endemic		
Asteraceae	<i>Helichrysum micropoides</i>	LC	Indigenous		
Asteraceae	<i>Helichrysum obtusum</i>	LC	Indigenous		
Asteraceae	<i>Helichrysum pulchellum</i>	LC	Indigenous; Endemic		
Asteraceae	<i>Helichrysum pumilio</i>		Indigenous		
Asteraceae	<i>Helichrysum pumilio subsp. fleckii</i>		Indigenous		
Asteraceae	<i>Helichrysum pumilio subsp. pumilio</i>	LC	Indigenous; Endemic		
Asteraceae	<i>Helichrysum tomentosulum subsp. aromaticum</i>	LC	Indigenous		
Asteraceae	<i>Helichrysum zeyheri</i>	LC	Indigenous		
Brassicaceae	<i>Heliophila carnosa</i>	LC	Indigenous		
Brassicaceae	<i>Heliophila crithmifolia</i>	LC	Indigenous		
Brassicaceae	<i>Heliophila deserticola var. deserticola</i>	LC	Indigenous		
Brassicaceae	<i>Heliophila deserticola var. micrantha</i>	LC	Indigenous		
Brassicaceae	<i>Heliophila lactea</i>	LC	Indigenous		
Brassicaceae	<i>Heliophila minima</i>	LC	Indigenous		
Brassicaceae	<i>Heliophila sp.</i>				
Brassicaceae	<i>Heliophila trifurca</i>	LC	Indigenous		
Boraginaceae	<i>Heliotropium ciliatum</i>	LC	Indigenous		
Boraginaceae	<i>Heliotropium tubulosum</i>	LC	Indigenous		
Aizoaceae	<i>Hereroa hesperantha</i>	LC	Indigenous	Sched 2	
Aizoaceae	<i>Hereroa pallens</i>	LC	Indigenous; Endemic	Sched 2	
Malvaceae	<i>Hermannia affinis</i>	LC	Indigenous		
Malvaceae	<i>Hermannia bicolor</i>	LC	Indigenous		
Malvaceae	<i>Hermannia cernua</i>	LC	Indigenous		
Malvaceae	<i>Hermannia comosa</i>	LC	Indigenous		
Malvaceae	<i>Hermannia confusa</i>	LC	Indigenous; Endemic		
Malvaceae	<i>Hermannia disermifolia</i>	LC	Indigenous		
Malvaceae	<i>Hermannia gariepina</i>	LC	Indigenous		
Malvaceae	<i>Hermannia leucantha</i>	LC	Indigenous		
Malvaceae	<i>Hermannia macra</i>	LC	Indigenous		
Malvaceae	<i>Hermannia minutiflora</i>	LC	Indigenous		
Malvaceae	<i>Hermannia modesta</i>	LC	Indigenous		
Malvaceae	<i>Hermannia pulchella</i>	LC	Indigenous		
Malvaceae	<i>Hermannia sp.</i>				
Malvaceae	<i>Hermannia spinosa</i>	LC	Indigenous		
Malvaceae	<i>Hermannia stricta</i>	LC	Indigenous		

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<b>Amaranthaceae</b>	<i>Hermbsstaedtia glauca</i>	LC	Indigenous		
<b>Iridaceae</b>	<i>Hesperantha rupicola</i>	LC	Indigenous; Endemic	Sched 2	
<b>Amaryllidaceae</b>	<i>Hessea speciosa</i>	LC	Indigenous	Sched 2	
<b>Malvaceae</b>	<i>Hibiscus elliotiae</i>	LC	Indigenous		
<b>Malvaceae</b>	<i>Hibiscus engleri</i>	LC	Indigenous		
<b>Asteraceae</b>	<i>Hirpicium echinus</i>	LC	Indigenous		
<b>Apocynaceae</b>	<i>Hoodia alstonii</i>	LC	Indigenous	Sched 2	
<b>Hydnoraceae</b>	<i>Hydnora africana</i>	LC	Indigenous		
<b>Orobanchaceae</b>	<i>Hyobanche rubra</i>	LC	Indigenous		
<b>Molluginaceae</b>	<i>Hypertelis spergulacea</i>	LC	Indigenous		
<b>Asteraceae</b>	<i>Ifliga molluginoides</i>	LC	Indigenous		
<b>Aizoaceae</b>	<i>Ihlenfeldtia excavata</i>	LC	Indigenous; Endemic	Sched 2	
<b>Aizoaceae</b>	<i>Ihlenfeldtia vanzylii</i>	LC	Indigenous; Endemic	Sched 2	
<b>Fabaceae</b>	<i>Indigastrum argyroides</i>	LC	Indigenous		
<b>Fabaceae</b>	<i>Indigastrum niveum</i>		Indigenous		
<b>Fabaceae</b>	<i>Indigofera auricomata</i>	LC	Indigenous		
<b>Fabaceae</b>	<i>Indigofera heterotricha</i>	LC	Indigenous		
<b>Fabaceae</b>	<i>Indigofera heterotricha subsp. pechuelii</i>		Indigenous		
<b>Fabaceae</b>	<i>Indigofera meyeriana</i>	LC	Indigenous; Endemic		
<b>Fabaceae</b>	<i>Indigofera pungens</i>	LC	Indigenous		
<b>Fabaceae</b>	<i>Indigofera sp.</i>				
<b>Cyperaceae</b>	<i>Isolepis hemiuncialis</i>	LC	Indigenous		
<b>Scrophulariaceae</b>	<i>Jamesbrittenia aridicola</i>	LC	Indigenous	Sched 2	
<b>Scrophulariaceae</b>	<i>Jamesbrittenia maxii</i>	LC	Indigenous	Sched 2	
<b>Scrophulariaceae</b>	<i>Jamesbrittenia ramosissima</i>	LC	Indigenous	Sched 2	
<b>Scrophulariaceae</b>	<i>Jamesbrittenia sp.</i>			Sched 2	
<b>Euphorbiaceae</b>	<i>Jatropha orangeana</i>	LC	Indigenous	Sched 2	
<b>Acanthaceae</b>	<i>Justicia australis</i>		Indigenous		
<b>Acanthaceae</b>	<i>Justicia divaricata</i>		Indigenous		
<b>Acanthaceae</b>	<i>Justicia dregei</i>		Indigenous		
<b>Acanthaceae</b>	<i>Justicia guerkeana</i>	LC	Indigenous		
<b>Acanthaceae</b>	<i>Justicia incana</i>		Indigenous		
<b>Acanthaceae</b>	<i>Justicia leucoderme</i>		Indigenous		
<b>Acanthaceae</b>	<i>Justicia saxatilis</i>		Indigenous; Endemic		
<b>Acanthaceae</b>	<i>Justicia spartioides</i>		Indigenous		
<b>Acanthaceae</b>	<i>Justicia thymifolia</i>	LC	Indigenous; Endemic		
<b>Cucurbitaceae</b>	<i>Kedrostis capensis</i>	LC	Indigenous		
<b>Kewaceae</b>	<i>Kewa salsoloides</i>	LC	Indigenous		
<b>Loasaceae</b>	<i>Kissenia capensis</i>	LC	Indigenous		
<b>Asteraceae</b>	<i>Kleinia cephalophora</i>	LC	Indigenous		
<b>Asteraceae</b>	<i>Kleinia longiflora</i>	LC	Indigenous		
<b>Rubiaceae</b>	<i>Kohautia caespitosa subsp. brachyloba</i>	LC	Indigenous		
<b>Hyacinthaceae</b>	<i>Lachenalia giessii</i>		Indigenous		
<b>Hyacinthaceae</b>	<i>Lachenalia polypodantha</i>		Indigenous; Endemic	Sched 2	
<b>Hyacinthaceae</b>	<i>Lachenalia undulata</i>	LC	Indigenous; Endemic	Sched 2	

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Hyacinthaceae	<i>Lachenalia xerophila</i>	LC	Indigenous; Endemic	Sched 2
Santalaceae	<i>Lacomucinaea lineata</i>		Indigenous	
Iridaceae	<i>Lapeirousia littoralis</i>		Indigenous	Sched 2
Iridaceae	<i>Lapeirousia littoralis subsp. littoralis</i>	LC	Indigenous	Sched 2
Iridaceae	<i>Lapeirousia plicata subsp. foliosa</i>		Indigenous	Sched 2
Aizoaceae	<i>Lapidaria margaretae</i>	LC	Indigenous	Sched 2
Apocynaceae	<i>Larryleachia picta</i>	LC	Indigenous	Sched 2
Apocynaceae	<i>Larryleachia sp.</i>			Sched 2
Hyacinthaceae	<i>Ledebouria sp.</i>			
Hyacinthaceae	<i>Ledebouria undulata</i>	LC	Indigenous	
Aizoaceae	<i>Leipoldtia schultzei</i>	LC	Indigenous; Endemic	Sched 2
Fabaceae	<i>Leobordea platycarpa</i>	LC	Indigenous	
Brassicaceae	<i>Lepidium englerianum</i>		Indigenous	
Brassicaceae	<i>Lepidium trifurcum</i>	LC	Indigenous	
Fabaceae	<i>Lessertia depressa</i>	LC	Indigenous	Sched 1
Fabaceae	<i>Lessertia incana</i>	LC	Indigenous	Sched 1
Fabaceae	<i>Lessertia sp.</i>			Sched 1
Poaceae	<i>Leucophrys mesocoma</i>	LC	Indigenous	
Amaranthaceae	<i>Leucosphaera bainesii</i>	LC	Indigenous	
Limeaceae	<i>Limeum aethiopicum var. intermedium</i>	NE	Indigenous; Endemic	
Limeaceae	<i>Limeum aethiopicum var. lanceolatum</i>	NE	Indigenous	
Limeaceae	<i>Limeum arenicolum</i>	LC	Indigenous	
Limeaceae	<i>Limeum dinteri</i>	LC	Indigenous	
Aizoaceae	<i>Lithops dinteri subsp. frederici</i>	VU	Indigenous; Endemic	Sched 2
Aizoaceae	<i>Lithops olivacea</i>	VU	Indigenous; Endemic	Sched 2
Aizoaceae	<i>Lithops sp.</i>			Sched 2
Asteraceae	<i>Litogyne gariepina</i>	LC	Indigenous	
Lophiocarpaceae	<i>Lophiocarpus polystachyus</i>	LC	Indigenous	
Asteraceae	<i>Lopholaena cneorifolia</i>	LC	Indigenous	
Fabaceae	<i>Lotononis falcata</i>	LC	Indigenous	
Fabaceae	<i>Lotononis fruticoides</i>	LC	Indigenous; Endemic	
Fabaceae	<i>Lotononis parviflora</i>	LC	Indigenous; Endemic	
Fabaceae	<i>Lotononis rabenaviana</i>	LC	Indigenous	
Scrophulariaceae	<i>Lyperia tristis</i>	LC	Indigenous	
Scrophulariaceae	<i>Manulea gariepina</i>	LC	Indigenous	Sched 2
Scrophulariaceae	<i>Manulea nervosa</i>	LC	Indigenous; Endemic	Sched 2
Hyacinthaceae	<i>Massonia bifolia</i>	LC	Indigenous	
Meliantaceae	<i>Melianthus elongatus</i>	LC	Indigenous; Endemic	
Poaceae	<i>Melinis repens subsp. grandiflora</i>	LC	Indigenous	
Fabaceae	<i>Melolobium adenodes</i>	LC	Indigenous	
Fabaceae	<i>Melolobium canescens</i>	LC	Indigenous	
Fabaceae	<i>Melolobium microphyllum</i>	LC	Indigenous	
Aizoaceae	<i>Mesembryanthemum amplexens</i>		Indigenous; Endemic	Sched 2
Aizoaceae	<i>Mesembryanthemum arenosum</i>		Indigenous	Sched 2

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Aizoaceae	<i>Mesembryanthemum articulatum</i>		Indigenous	Sched 2
Aizoaceae	<i>Mesembryanthemum coriarium</i>		Indigenous	Sched 2
Aizoaceae	<i>Mesembryanthemum crystallinum</i>	LC	Indigenous	Sched 2
Aizoaceae	<i>Mesembryanthemum guerichianum</i>	LC	Indigenous	Sched 2
Aizoaceae	<i>Mesembryanthemum inachabense</i>	LC	Indigenous	Sched 2
Aizoaceae	<i>Mesembryanthemum latipetalum</i>		Indigenous; Endemic	Sched 2
Aizoaceae	<i>Mesembryanthemum lignescens</i>		Indigenous	Sched 2
Aizoaceae	<i>Mesembryanthemum noctiflorum</i> subsp. <i>stramineum</i>		Indigenous	Sched 2
Aizoaceae	<i>Mesembryanthemum nucifer</i>		Indigenous	Sched 2
Aizoaceae	<i>Mesembryanthemum oculatum</i>		Indigenous	Sched 2
Aizoaceae	<i>Mesembryanthemum schenkii</i>		Indigenous	Sched 2
Aizoaceae	<i>Mesembryanthemum subnodosum</i>		Indigenous	Sched 2
Aizoaceae	<i>Mesembryanthemum tetragonum</i>		Indigenous	Sched 2
Fabaceae	<i>Microcharis disjuncta</i> var. <i>disjuncta</i>	LC	Indigenous	
Apocynaceae	<i>Microloma incanum</i>	LC	Indigenous	Sched 2
Apocynaceae	<i>Microloma sagittatum</i>	LC	Indigenous; Endemic	Sched 2
Geraniaceae	<i>Monsonia ciliata</i>	LC	Indigenous; Endemic	
Geraniaceae	<i>Monsonia crassicaulis</i>	LC	Indigenous	
Geraniaceae	<i>Monsonia glauca</i>	LC	Indigenous	
Geraniaceae	<i>Monsonia parvifolia</i>	LC	Indigenous	
Geraniaceae	<i>Monsonia umbellata</i>	LC	Indigenous	
Montiniaceae	<i>Montinia caryophyllacea</i>	LC	Indigenous	
Iridaceae	<i>Moraea polystachya</i>	LC	Indigenous	Sched 2
Asteraceae	<i>Myxopappus acutilobus</i>	LC	Indigenous	
Scrophulariaceae	<i>Nemesia anisocarpa</i>	LC	Indigenous	Sched 2
Scrophulariaceae	<i>Nemesia fleckii</i>	DD	Indigenous	Sched 2
Scrophulariaceae	<i>Nemesia maxii</i>	LC	Indigenous; Endemic	Sched 2
Solanaceae	<i>Nicotiana glauca</i>		Not indigenous; Naturalised; Invasive	
Asteraceae	<i>Nidorella resedifolia</i> subsp. <i>resedifolia</i>	LC	Indigenous	
Meliaceae	<i>Nymania capensis</i>	LC	Indigenous	Sched 2
Poaceae	<i>Odyssea paucinervis</i>	LC	Indigenous	
Asteraceae	<i>Oncosiphon piluliferus</i>	LC	Indigenous	
Asteraceae	<i>Orbivestus cinerascens</i>	LC	Indigenous	
Hyacinthaceae	<i>Ornithogalum bicornutum</i>	LC	Indigenous; Endemic	Sched 1
Hyacinthaceae	<i>Ornithogalum dubium</i>	LC	Indigenous; Endemic	Sched 2
Hyacinthaceae	<i>Ornithogalum nanodes</i>	LC	Indigenous	Sched 2
Hyacinthaceae	<i>Ornithogalum pruinatum</i>	LC	Indigenous	Sched 2
Colchicaceae	<i>Ornithoglossum dinteri</i>	LC	Indigenous	
Colchicaceae	<i>Ornithoglossum undulatum</i>	LC	Indigenous	
Colchicaceae	<i>Ornithoglossum vulgare</i>	LC	Indigenous	
Asteraceae	<i>Osteospermum armatum</i>	LC	Indigenous	
Asteraceae	<i>Osteospermum karrooicum</i>	LC	Indigenous	



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Asteraceae	<i>Osteospermum muricatum</i> subsp. <i>muricatum</i>	LC	Indigenous		
Asteraceae	<i>Othonna daucifolia</i>	LC	Indigenous; Endemic		
Asteraceae	<i>Othonna furcata</i>	LC	Indigenous		
Asteraceae	<i>Othonna perfoliata</i>	LC	Indigenous		
Asteraceae	<i>Othonna quercifolia</i>	LC	Indigenous; Endemic		
Asteraceae	<i>Othonna</i> sp.				
Oxalidaceae	<i>Oxalis annae</i>	LC	Indigenous; Endemic	Sched 2	
Oxalidaceae	<i>Oxalis pes-caprae</i> var. <i>pes-caprae</i>	LC	Indigenous	Sched 2	
Oxalidaceae	<i>Oxalis</i> sp.			Sched 2	
Anacardiaceae	<i>Ozoroa dispar</i>	LC	Indigenous		
Anacardiaceae	<i>Ozoroa namaensis</i>	LC	Indigenous		
Apocynaceae	<i>Pachypodium namaquanum</i>	LC	Indigenous	Sched 1	
Poaceae	<i>Panicum arbusculum</i>	LC	Indigenous		
Sapindaceae	<i>Pappea capensis</i>	LC	Indigenous		
Fabaceae	<i>Parkinsonia africana</i>	LC	Indigenous		
Hypoxidaceae	<i>Pauridia scullyi</i>	LC	Indigenous; Endemic		
Asteraceae	<i>Pegolettia oxydonta</i>	LC	Indigenous		
Asteraceae	<i>Pegolettia retrofracta</i>	LC	Indigenous		
Asteraceae	<i>Pegolettia</i> sp.				
Geraniaceae	<i>Pelargonium carnosum</i> subsp. <i>carnosum</i>	LC	Indigenous	Sched 1	
Geraniaceae	<i>Pelargonium crithmifolium</i>	LC	Indigenous	Sched 1	
Geraniaceae	<i>Pelargonium spinosum</i>	LC	Indigenous	Sched 1	
Geraniaceae	<i>Pelargonium xerophyton</i>	LC	Indigenous	Sched 1	
Scrophulariaceae	<i>Peliostomum junceum</i>		Indigenous		
Scrophulariaceae	<i>Peliostomum leucorrhizum</i>	LC	Indigenous		
Asteraceae	<i>Pentatrichia petrosa</i>	LC	Indigenous		
Asteraceae	<i>Pentzia argentea</i>	LC	Indigenous		
Asteraceae	<i>Pentzia globosa</i>	LC	Indigenous		
Asteraceae	<i>Pentzia lanata</i>	LC	Indigenous		
Asteraceae	<i>Pentzia</i> sp.				
Asteraceae	<i>Pentzia spinescens</i>	LC	Indigenous		
Apocynaceae	<i>Pergularia daemia</i> subsp. <i>garipensis</i>	LC	Indigenous	Sched 2	
Acanthaceae	<i>Petalidium setosum</i>	LC	Indigenous		
Molluginaceae	<i>Pharnaceum croceum</i>	LC	Indigenous		
Molluginaceae	<i>Pharnaceum</i> sp.				
Molluginaceae	<i>Pharnaceum viride</i>	LC	Indigenous; Endemic		
Poaceae	<i>Phragmites australis</i>	LC	Indigenous		
Phyllanthaceae	<i>Phyllanthus loandensis</i>	LC	Indigenous		
Phyllanthaceae	<i>Phyllanthus parvulus</i> var. <i>parvulus</i>	LC	Indigenous		
Rubiaceae	<i>Plocama crocylis</i>	LC	Indigenous		
Scrophulariaceae	<i>Polycarena pubescens</i>	LC	Indigenous		
Polygalaceae	<i>Polygala leptophylla</i>		Indigenous		
Polygalaceae	<i>Polygala leptophylla</i> var. <i>armata</i>	LC	Indigenous		
Polygalaceae	<i>Polygala seminuda</i>	LC	Indigenous		

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Poaceae	<i>Polypogon monspeliensis</i>	NE	Not indigenous; Naturalised		
Fabaceae	<i>Pomaria lactea</i>	LC	Indigenous		
Portulacaceae	<i>Portulaca kermesina</i>	LC	Indigenous		
Portulacaceae	<i>Portulaca pilosa</i>	LC	Indigenous		
Didiereaceae	<i>Portulacaria fruticulosa</i>	LC	Indigenous		
Didiereaceae	<i>Portulacaria namaquensis</i>	LC	Indigenous		
Pottiaceae	<i>Pottia</i> sp.				
Fabaceae	<i>Prosopis glandulosa</i> var. <i>glandulosa</i>	NE	Not indigenous; Naturalised		
Fabaceae	<i>Prosopis pubescens</i>	NE	Not indigenous; Naturalised		
Fabaceae	<i>Prosopis</i> sp.				
Fabaceae	<i>Prosopis velutina</i>	NE	Not indigenous; Naturalised; Invasive		
Pottiaceae	<i>Pseudocrossidium crinitum</i>		Indigenous		
Asteraceae	<i>Pteronia glauca</i>	LC	Indigenous		
Asteraceae	<i>Pteronia lucilioides</i>	LC	Indigenous		
Asteraceae	<i>Pteronia mucronata</i>	LC	Indigenous		
Asteraceae	<i>Pteronia scariosa</i>	LC	Indigenous		
Asteraceae	<i>Pteronia</i> sp.				
Asteraceae	<i>Pteronia unguiculata</i>	LC	Indigenous		
Malvaceae	<i>Radyera urens</i>	LC	Indigenous		
Fabaceae	<i>Requienia sphaerosperma</i>	LC	Indigenous		
Bignoniaceae	<i>Rhigozum trichotomum</i>	LC	Indigenous		
Fabaceae	<i>Rhynchosia totta</i> var. <i>totta</i>	LC	Indigenous		
Ricciaceae	<i>Riccia cavernosa</i>		Indigenous		
Zygophyllaceae	<i>Roepera foetida</i>		Indigenous		
Zygophyllaceae	<i>Roepera pubescens</i>		Indigenous		
Aizoaceae	<i>Ruschia centrocapsula</i>	LC	Indigenous; Endemic	Sched 2	
Aizoaceae	<i>Ruschia cradockensis</i>		Indigenous; Endemic	Sched 2	
Aizoaceae	<i>Ruschia cradockensis</i> subsp. <i>cradockensis</i>	LC	Indigenous; Endemic	Sched 2	
Aizoaceae	<i>Ruschia cradockensis</i> subsp. <i>triticiformis</i>	LC	Indigenous; Endemic	Sched 2	
Aizoaceae	<i>Ruschia divaricata</i>	LC	Indigenous	Sched 2	
Aizoaceae	<i>Ruschia kenhardtensis</i>	LC	Indigenous; Endemic	Sched 2	
Aizoaceae	<i>Ruschia muricata</i>	LC	Indigenous	Sched 2	
Aizoaceae	<i>Ruschia robusta</i>	LC	Indigenous; Endemic	Sched 2	
Aizoaceae	<i>Ruschia</i> sp.			Sched 2	
Aizoaceae	<i>Ruschia spinosa</i>	LC	Indigenous	Sched 2	
Aizoaceae	<i>Ruschia uncinata</i>	LC	Indigenous; Endemic	Sched 2	
Amaranthaceae	<i>Salsola barbata</i>	LC	Indigenous		
Amaranthaceae	<i>Salsola columnaris</i>	LC	Indigenous		
Amaranthaceae	<i>Salsola kalaharica</i>	LC	Indigenous; Endemic		
Amaranthaceae	<i>Salsola kali</i>		Not indigenous; Naturalised; Invasive		
Amaranthaceae	<i>Salsola patentiopilosa</i>	LC	Indigenous; Endemic		
Amaranthaceae	<i>Salsola rabieana</i>	LC	Indigenous		
Amaranthaceae	<i>Salsola</i> sp.				
Lamiaceae	<i>Salvia garipensis</i>	LC	Indigenous		

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Poaceae	<i>Schismus barbatus</i>	LC	Indigenous		
Poaceae	<i>Schismus schismoides</i>	LC	Indigenous		
Aizoaceae	<i>Schlechteranthus stylosus</i>		Indigenous; Endemic	Sched 2	
Poaceae	<i>Schmidtia kalahariensis</i>	LC	Indigenous		
Aizoaceae	<i>Schwantesia marlothii</i>	LC	Indigenous; Endemic	Sched 2	
Aizoaceae	<i>Schwantesia ruedebuschii</i>	LC	Indigenous	Sched 2	
Aizoaceae	<i>Schwantesia sp.</i>			Sched 2	
Aizoaceae	<i>Schwantesia triebneri</i>	LC	Indigenous; Endemic	Sched 2	
Anacardiaceae	<i>Searsia burchellii</i>	LC	Indigenous		
Anacardiaceae	<i>Searsia pendulina</i>	LC	Indigenous		
Anacardiaceae	<i>Searsia populifolia</i>	LC	Indigenous		
Anacardiaceae	<i>Searsia undulata</i>	LC	Indigenous		
Scrophulariaceae	<i>Selago divaricata</i>	LC	Indigenous		
Scrophulariaceae	<i>Selago sp.</i>				
Asteraceae	<i>Senecio bulbiniifolius</i>	LC	Indigenous		
Asteraceae	<i>Senecio eenii</i>	LC	Indigenous		
Asteraceae	<i>Senecio flavus</i>	LC	Indigenous		
Asteraceae	<i>Senecio niveus</i>	LC	Indigenous		
Asteraceae	<i>Senecio pinguifolius</i>		Indigenous		
Asteraceae	<i>Senecio sarcoides</i>	LC	Indigenous		
Asteraceae	<i>Senecio sisymbriifolius</i>	LC	Indigenous		
Fabaceae	<i>Senegalia mellifera subsp. detinens</i>	LC	Indigenous		
Loranthaceae	<i>Septulina glauca</i>	LC	Indigenous		
Amaranthaceae	<i>Sericocoma avolans</i>	LC	Indigenous		
Amaranthaceae	<i>Sericocoma pungens</i>	LC	Indigenous		
Pedaliaceae	<i>Sesamum capense</i>	LC	Indigenous		
Zygophyllaceae	<i>Sisyndite spartea</i>	LC	Indigenous		
Solanaceae	<i>Solanum burchellii</i>	LC	Indigenous		
Solanaceae	<i>Solanum capense</i>	LC	Indigenous		
Solanaceae	<i>Solanum humile</i>		Indigenous		
Solanaceae	<i>Solanum tomentosum</i>		Indigenous		
Poaceae	<i>Sporobolus nervosus</i>	LC	Indigenous		
Lamiaceae	<i>Stachys flavescens</i>	LC	Indigenous; Endemic		
Lamiaceae	<i>Stachys linearis</i>	LC	Indigenous		
Lamiaceae	<i>Stachys rugosa</i>	LC	Indigenous		
Apocynaceae	<i>Stapelia similis</i>	LC	Indigenous	Sched 2	
Apocynaceae	<i>Stapelia sp.</i>			Sched 2	
Poaceae	<i>Stipagrostis anomala</i>	LC	Indigenous		
Poaceae	<i>Stipagrostis brevifolia</i>	LC	Indigenous		
Poaceae	<i>Stipagrostis ciliata var. capensis</i>	LC	Indigenous		
Poaceae	<i>Stipagrostis hochstetteriana var. hochstetteriana</i>	LC	Indigenous		
Poaceae	<i>Stipagrostis hochstetteriana var. secalina</i>	LC	Indigenous		
Poaceae	<i>Stipagrostis obtusa</i>	LC	Indigenous		
Poaceae	<i>Stipagrostis uniplumis var. uniplumis</i>	LC	Indigenous		

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<b>Aizoaceae</b>	<i>Stomatium fulleri</i>	LC	Indigenous; Endemic	Sched 2
<b>Molluginaceae</b>	<i>Suessenguthiella scleranthoides</i>	LC	Indigenous	
<b>Tamaricaceae</b>	<i>Tamarix usneoides</i>	LC	Indigenous	
<b>Loranthaceae</b>	<i>Tapinanthus oleifolius</i>	LC	Indigenous	
<b>Fabaceae</b>	<i>Tephrosia dregeana</i> var. <i>dregeana</i>	LC	Indigenous	
<b>Fabaceae</b>	<i>Tephrosia limpopoensis</i>	LC	Indigenous	
<b>Zygophyllaceae</b>	<i>Tetraena microcarpa</i>		Indigenous	
<b>Zygophyllaceae</b>	<i>Tetraena retrofracta</i>		Indigenous	
<b>Zygophyllaceae</b>	<i>Tetraena rigida</i>		Indigenous	
<b>Zygophyllaceae</b>	<i>Tetraena simplex</i>		Indigenous	
<b>Aizoaceae</b>	<i>Tetragonia arbuscula</i>	LC	Indigenous	Sched 2
<b>Aizoaceae</b>	<i>Tetragonia reduplicata</i>	LC	Indigenous	Sched 2
<b>Aizoaceae</b>	<i>Tetragonia</i> sp.			Sched 2
<b>Pottiaceae</b>	<i>Tortula atrovirens</i>		Indigenous	
<b>Asphodelaceae</b>	<i>Trachyandra divaricata</i>	LC	Indigenous; Endemic	Sched 2
<b>Asphodelaceae</b>	<i>Trachyandra jacquiniana</i>	LC	Indigenous; Endemic	Sched 2
<b>Asphodelaceae</b>	<i>Trachyandra laxa</i> var. <i>laxa</i>	LC	Indigenous	Sched 2
<b>Asphodelaceae</b>	<i>Trachyandra</i> sp.			Sched 2
<b>Poaceae</b>	<i>Tragus berteronianus</i>	LC	Indigenous	
<b>Aizoaceae</b>	<i>Trianthema parvifolia</i>		Indigenous	Sched 2
<b>Aizoaceae</b>	<i>Trianthema parvifolia</i> var. <i>parvifolia</i>	LC	Indigenous	Sched 2
<b>Aizoaceae</b>	<i>Trianthema parvifolia</i> var. <i>rubens</i>	LC	Indigenous	Sched 2
<b>Zygophyllaceae</b>	<i>Tribulus cristatus</i>	LC	Indigenous	
<b>Zygophyllaceae</b>	<i>Tribulus pterophorus</i>	LC	Indigenous	
<b>Zygophyllaceae</b>	<i>Tribulus terrestris</i>	LC	Indigenous	
<b>Zygophyllaceae</b>	<i>Tribulus zeyheri</i> subsp. <i>zeyheri</i>	LC	Indigenous	
<b>Boraginaceae</b>	<i>Trichodesma africanum</i>	LC	Indigenous	
<b>Aizoaceae</b>	<i>Trichodiadema littlewoodii</i>	LC	Indigenous	Sched 2
<b>Aizoaceae</b>	<i>Trichodiadema setuliferum</i>	LC	Indigenous; Endemic	Sched 2
<b>Aizoaceae</b>	<i>Trichodiadema</i> sp.			Sched 2
<b>Poaceae</b>	<i>Tricholaena capensis</i> subsp. <i>capensis</i>	LC	Indigenous	
<b>Poaceae</b>	<i>Tricholaena monachne</i>	LC	Indigenous	
<b>Pottiaceae</b>	<i>Trichostomum brachydontium</i>		Indigenous	
<b>Poaceae</b>	<i>Triraphis ramosissima</i>	LC	Indigenous	
<b>Iridaceae</b>	<i>Tritonia karoica</i>	LC	Indigenous; Endemic	Sched 2
<b>Cucurbitaceae</b>	<i>Trochomeria debilis</i>	LC	Indigenous	
<b>Crassulaceae</b>	<i>Tylecodon reticulatus</i>		Indigenous	Sched 2
<b>Crassulaceae</b>	<i>Tylecodon reticulatus</i> subsp. <i>phyllopodium</i>	LC	Indigenous	Sched 2
<b>Crassulaceae</b>	<i>Tylecodon reticulatus</i> subsp. <i>reticulatus</i>	LC	Indigenous	Sched 2
<b>Crassulaceae</b>	<i>Tylecodon rubrovenosus</i>	LC	Indigenous	Sched 2
<b>Crassulaceae</b>	<i>Tylecodon</i> sp.			Sched 2
<b>Crassulaceae</b>	<i>Tylecodon sulphureus</i>		Indigenous; Endemic	Sched 2
<b>Crassulaceae</b>	<i>Tylecodon sulphureus</i> var. <i>armianus</i>	LC	Indigenous; Endemic	Sched 2

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Crassulaceae	<i>Tylecodon sulphureus</i> var. <i>sulphureus</i>	LC	Indigenous; Endemic	Sched 2	
Asteraceae	<i>Ursinia cakilefolia</i>	LC	Indigenous; Endemic		
Asteraceae	<i>Ursinia nana</i> subsp. <i>nana</i>	LC	Indigenous		
Asteraceae	<i>Ursinia speciosa</i>	LC	Indigenous		
Fabaceae	<i>Vachellia erioloba</i>	LC	Indigenous		Protected Tree
Vahliaceae	<i>Vahlia capensis</i> subsp. <i>vulgaris</i>	NE	Indigenous		
Verbenaceae	<i>Verbena litoralis</i>		Not indigenous; Naturalised; Invasive		
Santalaceae	<i>Viscum rotundifolium</i>	LC	Indigenous		
Campanulaceae	<i>Wahlenbergia annularis</i>	LC	Indigenous		
Campanulaceae	<i>Wahlenbergia meyeri</i>	LC	Indigenous; Endemic		
Campanulaceae	<i>Wahlenbergia prostrata</i>	LC	Indigenous		
Campanulaceae	<i>Wahlenbergia</i> sp.				
Boraginaceae	<i>Wellstedtia dinteri</i>		Indigenous		
Boraginaceae	<i>Wellstedtia dinteri</i> subsp. <i>dinteri</i>	LC	Indigenous		
Scrophulariaceae	<i>Zaluzianskya benthamiana</i>	LC	Indigenous		
Scrophulariaceae	<i>Zaluzianskya diandra</i>	LC	Indigenous		
Scrophulariaceae	<i>Zaluzianskya sanorum</i>	LC	Indigenous; Endemic		
Rhamnaceae	<i>Ziziphus mucronata</i> subsp. <i>mucronata</i>	LC	Indigenous		
Zygophyllaceae	<i>Zygophyllum dregeanum</i>	LC	Indigenous		

## APPENDIX B: Avifaunal species expected to occur in the project area

Species	Common Name	Conservation Status		NCNCA
		Regional (SANBI, 2016)	IUCN (2017)	
<i>Acrocephalus baeticatus</i>	Reed-warbler, African	Unlisted	Unlisted	Schedule 2
<i>Acrocephalus gracilirostris</i>	Swamp-warbler, Lesser	Unlisted	LC	Schedule 2
<i>Actitis hypoleucos</i>	Sandpiper, Common	Unlisted	LC	Schedule 2
<i>Afrotis afraoides</i>	Korhaan, Northern Black	Unlisted	LC	Schedule 2
<i>Alcedo cristata</i>	Kingfisher, Malachite	Unlisted	Unlisted	Schedule 2
<i>Alopochen aegyptiacus</i>	Goose, Egyptian	Unlisted	LC	
<i>Amadina erythrocephala</i>	Finch, Red-headed	Unlisted	LC	
<i>Anas capensis</i>	Teal, Cape	Unlisted	LC	Schedule 2
<i>Anas erythrorhyncha</i>	Teal, Red-billed	Unlisted	LC	Schedule 2
<i>Anas smithii</i>	Shoveler, Cape	Unlisted	LC	Schedule 2
<i>Anas sparsa</i>	Duck, African Black	Unlisted	LC	Schedule 2
<i>Anas undulata</i>	Duck, Yellow-billed	Unlisted	LC	
<i>Anhinga rufa</i>	Darter, African	Unlisted	LC	Schedule 2
<i>Anthus cinnamomeus</i>	Pipit, African	Unlisted	LC	Schedule 2
<i>Anthus similis</i>	Pipit, Long-billed	Unlisted	LC	Schedule 2
<i>Apus affinis</i>	Swift, Little	Unlisted	LC	Schedule 2
<i>Apus bradfieldi</i>	Swift, Bradfield's	Unlisted	LC	Schedule 2
<i>Apus caffer</i>	Swift, White-rumped	Unlisted	LC	Schedule 2
<i>Aquila pennatus</i>	Eagle, Booted	Unlisted	LC	Schedule 1
<i>Aquila verreauxii</i>	Eagle, Verreaux's	VU	LC	Schedule 1
<i>Ardea cinerea</i>	Heron, Grey	Unlisted	LC	Schedule 2

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<i>Ardea goliath</i>	Heron, Goliath	Unlisted	LC	Schedule 2
<i>Ardea melanocephala</i>	Heron, Black-headed	Unlisted	LC	Schedule 2
<i>Batis pririt</i>	Batis, Pirit	Unlisted	LC	Schedule 2
<i>Bostrychia hagedash</i>	Ibis, Hadedda	Unlisted	LC	Schedule 2
<i>Bradornis infuscatus</i>	Flycatcher, Chat	Unlisted	LC	Schedule 2
<i>Bubo africanus</i>	Eagle-owl, Spotted	Unlisted	LC	Schedule 1
<i>Bubulcus ibis</i>	Egret, Cattle	Unlisted	LC	Schedule 2
<i>Burhinus capensis</i>	Thick-knee, Spotted	Unlisted	LC	Schedule 2
<i>Buteo rufofuscus</i>	Buzzard, Jackal	Unlisted	LC	Schedule 1
<i>Calandrella cinerea</i>	Lark, Red-capped	Unlisted	LC	Schedule 2
<i>Calendulauda africanooides</i>	Lark, Fawn-coloured	Unlisted	LC	Schedule 2
<i>Calendulauda burra</i>	Lark, Red	VU	VU	Schedule 1
<i>Calendulauda sabota</i>	Lark, Sabota	Unlisted	LC	Schedule 2
<i>Calidris minuta</i>	Stint, Little	LC	LC	Schedule 2
<i>Cercomela familiaris</i>	Chat, Familiar	Unlisted	LC	Schedule 2
<i>Cercomela schlegelii</i>	Chat, Karoo	Unlisted	LC	Schedule 2
<i>Cercomela sinuata</i>	Chat, Sickle-winged	Unlisted	LC	
<i>Cercomela tractrac</i>	Chat, Tractrac	Unlisted	LC	Schedule 2
<i>Cercotrichas coryphoeus</i>	Scrub-robin, Karoo	Unlisted	LC	Schedule 2
<i>Cercotrichas paena</i>	Scrub-robin, Kalahari	Unlisted	LC	Schedule 2
<i>Certhilauda subcoronata</i>	Lark, Karoo Long-billed	Unlisted	LC	Schedule 2
<i>Ceryle rudis</i>	Kingfisher, Pied	Unlisted	LC	Schedule 2
<i>Charadrius tricollaris</i>	Plover, Three-banded	Unlisted	LC	Schedule 2
<i>Chersomanes albofasciata</i>	Lark, Spike-heeled	Unlisted	LC	Schedule 2
<i>Cinnyris chalybeus</i>	Sunbird, Southern Double-collared	Unlisted	LC	Schedule 2
<i>Cinnyris fuscus</i>	Sunbird, Dusky	Unlisted	LC	Schedule 2
<i>Circaetus pectoralis</i>	Snake-eagle, Black-chested	Unlisted	LC	Schedule 1
<i>Cisticola aridulus</i>	Cisticola, Desert	Unlisted	LC	Schedule 2
<i>Cisticola subruficapilla</i>	Cisticola, Grey-backed	Unlisted	LC	Schedule 2
<i>Colius colius</i>	Mousebird, White-backed	Unlisted	LC	
<i>Columba guinea</i>	Pigeon, Speckled	Unlisted	LC	Schedule 2
<i>Columba livia</i>	Dove, Rock	Unlisted	LC	Schedule 2
<i>Corvus albus</i>	Crow, Pied	Unlisted	LC	
<i>Corvus capensis</i>	Crow, Cape	Unlisted	LC	
<i>Cosypha caffra</i>	Robin-chat, Cape	Unlisted	LC	Schedule 2
<i>Coturnix coturnix</i>	Quail, Common	Unlisted	LC	Schedule 2
<i>Crithagra albogularis</i>	White-throated Canary	LC	LC	Schedule 2
<i>Crithagra atrogularis</i>	Canary, Black-throated	Unlisted	LC	Schedule 2
<i>Crithagra flaviventris</i>	Canary, Yellow	Unlisted	LC	Schedule 2
<i>Cursorius rufus</i>	Cursorer, Burchell's	VU	LC	Schedule 2
<i>Cypsiurus parvus</i>	Palm-swift, African	Unlisted	LC	Schedule 2
<i>Dendropicos fuscescens</i>	Woodpecker, Cardinal	Unlisted	LC	Schedule 2
<i>Egretta garzetta</i>	Egret, Little	Unlisted	LC	
<i>Elanus caeruleus</i>	Kite, Black-shouldered	Unlisted	LC	Schedule 1
<i>Emberiza capensis</i>	Bunting, Cape	Unlisted	LC	Schedule 2
<i>Emberiza impetuani</i>	Bunting, Lark-like	Unlisted	LC	Schedule 2

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<i>Eremomela gregalis</i>	Eremomela, Karoo	Unlisted	LC	Schedule 2
<i>Eremomela icteropygialis</i>	Eremomela, Yellow-bellied	Unlisted	LC	Schedule 2
<i>Eremopterix australis</i>	Sparrow-lark, Black-eared	Unlisted	LC	Schedule 2
<i>Eremopterix verticalis</i>	Sparrowlark, Grey-backed	Unlisted	LC	Schedule 2
<i>Estrilda astrild</i>	Waxbill, Common	Unlisted	LC	Schedule 2
<i>Euplectes orix</i>	Bishop, Southern Red	Unlisted	LC	
<i>Eupodotis vigorsii</i>	Korhaan, Karoo	NT	LC	Schedule 2
<i>Euryptila subcinnamomea</i>	Warbler, Cinnamon-breasted	Unlisted	LC	Schedule 2
<i>Falco biarmicus</i>	Falcon, Lanner	VU	LC	Schedule 1
<i>Falco rupicoloides</i>	Kestrel, Greater	Unlisted	LC	Schedule 1
<i>Falco rupicolus</i>	Kestrel, Rock	Unlisted	LC	Schedule 1
<i>Fulica cristata</i>	Coot, Red-knobbed	Unlisted	LC	Schedule 2
<i>Galerida magnirostris</i>	Lark, Large-billed	Unlisted	LC	Schedule 2
<i>Haliaeetus vocifer</i>	Fish-eagle, African	Unlisted	LC	Schedule 1
<i>Himantopus himantopus</i>	Stilt, Black-winged	Unlisted	LC	Schedule 2
<i>Hirundo albigularis</i>	Swallow, White-throated	Unlisted	LC	Schedule 2
<i>Hirundo fuligula</i>	Martin, Rock	Unlisted	Unlisted	Schedule 2
<i>Hirundo rustica</i>	Swallow, Barn	Unlisted	LC	Schedule 2
<i>Lanius collaris</i>	Fiscal, Common (Southern)	Unlisted	LC	Schedule 2
<i>Malcorus pectoralis</i>	Warbler, Rufous-eared	Unlisted	LC	Schedule 2
<i>Melierax canorus</i>	Goshawk, Southern Pale Chanting	Unlisted	LC	Schedule 1
<i>Merops apiaster</i>	Bee-eater, European	Unlisted	LC	Schedule 2
<i>Merops hirundineus</i>	Bee-eater, Swallow-tailed	Unlisted	LC	
<i>Mirafra apiata</i>	Lark, Cape Clapper	Unlisted	LC	Schedule 2
<i>Mirafra fasciolata</i>	Lark, Eastern Clapper	Unlisted	LC	Schedule 2
<i>Monticola brevipes</i>	Rock-thrush, Short-toed	Unlisted	LC	Schedule 2
<i>Motacilla aguimp</i>	Wagtail, African Pied	Unlisted	LC	Schedule 2
<i>Motacilla capensis</i>	Wagtail, Cape	Unlisted	LC	Schedule 2
<i>Muscicapa striata</i>	Flycatcher, Spotted	Unlisted	LC	Schedule 2
<i>Myrmecocichla formicivora</i>	Chat, Anteating	Unlisted	LC	Schedule 2
<i>Neotis ludwigii</i>	Bustard, Ludwig's	EN	EN	Schedule 1
<i>Netta erythrophthalma</i>	Pochard, Southern	Unlisted	LC	Schedule 2
<i>Numida meleagris</i>	Guineafowl, Helmeted	Unlisted	LC	Schedule 2
<i>Oena capensis</i>	Dove, Namaqua	Unlisted	LC	Schedule 2
<i>Oenanthe monticola</i>	Wheatear, Mountain	Unlisted	LC	Schedule 2
<i>Oenanthe pileata</i>	Wheatear, Capped	Unlisted	LC	Schedule 2
<i>Onychognathus nabouroup</i>	Starling, Pale-winged	Unlisted	LC	Schedule 2
<i>Oxyura maccoa</i>	Duck, Maccoa	NT	NT	Schedule 2
<i>Passer domesticus</i>	Sparrow, House	Unlisted	LC	
<i>Passer melanurus</i>	Sparrow, Cape	Unlisted	LC	
<i>Phalacrocorax africanus</i>	Cormorant, Reed	Unlisted	LC	Schedule 2
<i>Phalacrocorax carbo</i>	Cormorant, White-breasted	LC	LC	
<i>Philetairus socius</i>	Weaver, Sociable	Unlisted	LC	Schedule 2
<i>Philomachus pugnax</i>	Ruff	Unlisted	LC	Schedule 2
<i>Phragmacia substriata</i>	Warbler, Namaqua	Unlisted	Unlisted	Schedule 2
<i>Phylloscopus trochilus</i>	Warbler, Willow	Unlisted	LC	Schedule 2

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<i>Plocepasser mahali</i>	Sparrow-weaver, White-browed	Unlisted	LC	Schedule 2
<i>Ploceus velatus</i>	Masked-weaver, Southern	Unlisted	LC	
<i>Polemaetus bellicosus</i>	Eagle, Martial	EN	VU	Schedule 1
<i>Polihierax semitorquatus</i>	Falcon, Pygmy	Unlisted	LC	Schedule 1
<i>Prinia flavicans</i>	Prinia, Black-chested	Unlisted	LC	Schedule 2
<i>Prinia maculosa</i>	Prinia, Karoo	Unlisted	LC	Schedule 2
<i>Pterocles bicinctus</i>	Sandgrouse, Double-banded	Unlisted	LC	Schedule 2
<i>Pterocles namaqua</i>	Sandgrouse, Namaqua	Unlisted	LC	Schedule 2
<i>Pycnonotus nigricans</i>	Bulbul, African Red-eyed	Unlisted	LC	
<i>Quelea quelea</i>	Quelea, Red-billed	Unlisted	LC	
<i>Rhinopomastus cyanomelas</i>	Scimitarbill, Common	Unlisted	LC	Schedule 2
<i>Rhinoptilus africanus</i>	Cursorer, Double-banded	Unlisted	LC	Schedule 2
<i>Riparia paludicola</i>	Martin, Brown-throated	Unlisted	LC	Schedule 2
<i>Scopus umbretta</i>	Hamerkop	Unlisted	LC	Schedule 2
<i>Serinus alario</i>	Canary, Black-headed	Unlisted	LC	Schedule 2
<i>Sigelus silens</i>	Flycatcher, Fiscal	Unlisted	LC	Schedule 2
<i>Spizocorys starki</i>	Lark, Stark's	Unlisted	LC	Schedule 2
<i>Sporopipes squamifrons</i>	Finch, Scaly-feathered	Unlisted	LC	Schedule 2
<i>Stenostira scita</i>	Flycatcher, Fairy	Unlisted	LC	Schedule 2
<i>Streptopelia capicola</i>	Turtle-dove, Cape	Unlisted	LC	Schedule 2
<i>Streptopelia semitorquata</i>	Dove, Red-eyed	Unlisted	LC	Schedule 2
<i>Streptopelia senegalensis</i>	Dove, Laughing	Unlisted	LC	Schedule 2
<i>Sylvietta rufescens</i>	Crombec, Long-billed	Unlisted	LC	Schedule 2
<i>Tachybaptus ruficollis</i>	Grebe, Little	Unlisted	LC	Schedule 2
<i>Tachymarpis melba</i>	Swift, Alpine	Unlisted	LC	Schedule 2
<i>Tadorna cana</i>	Shelduck, South African	Unlisted	LC	Schedule 2
<i>Telophorus zeylonus</i>	Bokmakierie, Bokmakierie	Unlisted	LC	Schedule 2
<i>Tricholaema leucomelas</i>	Barbet, Acacia Pied	Unlisted	LC	Schedule 2
<i>Tringa glareola</i>	Sandpiper, Wood	Unlisted	LC	Schedule 2
<i>Tringa nebularia</i>	Greenshank, Common	Unlisted	LC	Schedule 2
<i>Turdus smithi</i>	Thrush, Karoo	Unlisted	LC	Schedule 2
<i>Upupa africana</i>	Hoopoe, African	Unlisted	LC	Schedule 2
<i>Urocolius indicus</i>	Mousebird, Red-faced	Unlisted	LC	
<i>Vanellus armatus</i>	Lapwing, Blacksmith	Unlisted	LC	Schedule 2
<i>Vanellus coronatus</i>	Lapwing, Crowned	Unlisted	LC	Schedule 2
<i>Zosterops pallidus</i>	White-eye, Orange River	Unlisted	LC	Schedule 2



## APPENDIX C: Mammals species expected to occur in the project area

Species	Common Name	Conservation Status		NCNCA
		Regional (SANBI, 2016)	IUCN (2017)	
<i>Aethomys namaquensis</i>	Namaqua rock rat	LC	LC	Schedule 2
<i>Antidorcas marsupialis</i>	Sclater's Shrew	LC	LC	Schedule 2
<i>Aonyx capensis</i>	Cape Clawless Otter	NT	NT	Schedule 2
<i>Atilax paludinosus</i>	Water Mongoose	LC	LC	Schedule 2
<i>Canis mesomelas</i>	Black-backed Jackal	LC	LC	
<i>Caracal caracal</i>	Caracal	LC	LC	
<i>Ceratotherium simum</i>	White Rhinoceros	NT	NT	Schedule 1
<i>Chlorocebus pygerythrus</i>	Vervet Monkey	LC	LC	
<i>Crociodura cyanea</i>	Reddish-grey Musk Shrew	LC	LC	Schedule 2
<i>Cynictis penicillata</i>	Yellow Mongoose	LC	LC	Schedule 2
<i>Desmodillus auricularis</i>	Short-tailed Gerbil	LC	LC	Schedule 2
<i>Diceros bicornis</i>	Black Rhinoceros	EN	CR	Schedule 1
<i>Eidolon helvum</i>	African Straw-colored Fruit Bat	LC	NT	Schedule 2
<i>Elephantulus rupestris</i>	Western rock sengi	LC	LC	Schedule 2
<i>Eptesicus hottentotus</i>	Long-tailed Serotine Bat	LC	LC	Schedule 2
<i>Felis nigripes</i>	Black-footed Cat	VU	VU	Schedule 1
<i>Felis silvestris</i>	African Wildcat	LC	LC	Schedule 1
<i>Genetta genetta</i>	Small-spotted Genet	LC	LC	Schedule 2
<i>Gerbilliscus brantsii</i>	Highveld Gerbil	LC	LC	
<i>Gerbilliscus leucogaster</i>	Bushveld Gerbil	LC	LC	
<i>Gerbillurus pæba</i>	Hairy-footed Gerbil	LC	LC	Schedule 2
<i>Gerbillurus vullinus</i>	Bushy-tailed Hairy-footed Gerbil	LC	LC	Schedule 2
<i>Graphiurus rupicola</i>	Stone Dormouse	NT	LC	
<i>Herpestes pulverulentus</i>	Cape Grey Mongoose	LC	LC	
<i>Herpestes sanguineus</i>	Slender Mongoose	LC	LC	
<i>Hystrix africaeaustralis</i>	Cape Porcupine	LC	LC	Schedule 2
<i>Ictonyx striatus</i>	Striped Polecat	LC	LC	Schedule 1
<i>Lepus capensis</i>	Cape Hare	LC	LC	Schedule 2
<i>Lepus saxatilis</i>	Scrub Hare	LC	LC	Schedule 2
<i>Macroselides proboscideus</i>	Karoo Round-eared Sengi	LC	LC	Schedule 2
<i>Malacothrix typica</i>	Gerbil Mouse	LC	LC	Schedule 2
<i>Mellivora capensis</i>	Honey Badger	LC	LC	Schedule 1
<i>Mus musculus</i>	House Mouse	Unlisted	LC	
<i>Neoromicia capensis</i>	Cape Serotine Bat	LC	LC	Schedule 2
<i>Nycteris thebaica</i>	Egyptian Slit-faced Bat	LC	LC	Schedule 2
<i>Oreotragus oreotragus</i>	Klipspringer	LC	LC	Schedule 2
<i>Orycteropus afer</i>	Aardvark	LC	LC	Schedule 1
<i>Oryx gazella</i>	Gemsbok	LC	LC	Schedule 2
<i>Otocyon megalotis</i>	Bat-eared Fox	LC	LC	Schedule 1
<i>Otomys unisulcatus</i>	Karoo Bush Rat	LC	LC	Schedule 2
<i>Panthera pardus</i>	Leopard	VU	VU	Schedule 1
<i>Papio ursinus</i>	Chacma Baboon	LC	LC	
<i>Parahaena brunnea</i>	Brown Hyaena	NT	NT	Schedule 1

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<i>Parotomys brantsii</i>	Brants' Whistling Rat	LC	LC	Schedule 2
<i>Parotomys littledalei</i>	Littledale's Whistling Rat	NT	LC	Schedule 2
<i>Pedetes capensis</i>	Springhare	LC	LC	Schedule 2
<i>Petromus typicus</i>	Dassie Rat	LC	LC	Schedule 2
<i>Petromyscus collinus</i>	Pygmy Rock Mouse	LC	LC	Schedule 2
<i>Petromyscus monticularis</i>	Brukkaros Pygmy Rock Mouse	LC	LC	Schedule 2
<i>Procavia capensis</i>	Rock Hyrax	LC	LC	
<i>Pronolagus rupestris</i>	Smith's Red Rock Hare	LC	LC	Schedule 2
<i>Proteles cristata</i>	Aardwolf	LC	LC	
<i>Raphicerus campestris</i>	Steenbok	LC	LC	
<i>Rhabdomys pumilio</i>	Xeric Four-striped Mouse	LC	LC	Schedule 2
<i>Rhinolophus clivosus</i>	Geoffroy's Horseshoe Bat	LC	LC	Schedule 2
<i>Rhinolophus darlingi</i>	Darling's Horseshoe Bat	LC	LC	Schedule 2
<i>Saccostomus campestris</i>	Pouched Mouse	LC	LC	Schedule 2
<i>Sauromys petrophilus</i>	Flat-headed Free-tail Bat	LC	LC	Schedule 2
<i>Suncus varilla</i>	Lesser Dwarf Shrew	LC	LC	Schedule 2
<i>Suricata suricatta</i>	Suricate	LC	LC	
<i>Sylvicapra grimmia</i>	Common Duiker	LC	LC	Schedule 2
<i>Thallomys nigricauda</i>	Black-tailed Tree Rat	LC	LC	Schedule 2
<i>Thallomys shortridgei</i>	Shortridge's Rat	DD	DD	
<i>Vulpes chama</i>	Cape Fox	LC	LC	Schedule 1
<i>Xerus inauris</i>	Cape Ground Squirrel	LC	LC	Schedule 2

*APPENDIX D: Reptile species expected to occur within the project area*

Species	Common Name	Conservation Status		NCNCA
		Regional (SANBI, 2016)	IUCN (2017)	
<i>Acontias lineatus</i>	Striped Dwarf Legless Skink	LC	LC	
<i>Acontias namaquensis</i>	Namaqualand Legless Skink	LC	LC	
<i>Acontias tristis</i>	Namaqualand Dwarf Legless Skink	LC	LC	
<i>Agama aculeata aculeata</i>	Western Ground Agama	LC	Unlisted	
<i>Agama anchietae</i>	Anchieta's Agama	LC	Unlisted	
<i>Agama atra</i>	Southern Rock Agama	LC	LC	
<i>Agama hispida</i>	Southern Spiny Agama	LC	LC	
<i>Aspidelaps lubricus lubricus</i>	Coral Shield Snake	LC	LC	
<i>Bitis arietans arietans</i>	Puff Adder	LC	Unlisted	
<i>Boaedon capensis</i>	Brown House Snake	LC	LC	Schedule 2
<i>Chamaeleo namaquensis</i>	Namaqua Chameleon	LC	LC	Schedule 1
<i>Chersobius signatus</i>	Speckled Dwarf Tortoise	EN	EN	Schedule 2
<i>Chondrodactylus angulifer</i>	Common Giant Gecko	LC	LC	
<i>Chondrodactylus bibronii</i>	Bibron's Gecko	LC	Unlisted	
<i>Chondrodactylus turneri</i>	Turner's Gecko	LC	Unlisted	
<i>Cordylus subcaeruleus</i>	Dwarf Plated Lizard	LC	LC	Schedule 2
<i>Dasypeltis scabra</i>	Rhombic Egg-eater	LC	LC	Schedule 2
<i>Dipsosaurus multimaculatus</i>	Dwarf Beaked Snake	LC	Unlisted	Schedule 2
<i>Goggia lineata</i>	Striped Pygmy Gecko	LC	LC	
<i>Karusasaurus polyzonus</i>	Southern Karusa Lizard	LC	LC	Schedule 2
<i>Lamprophis fiskii</i>	Fisk's Snake	LC	LC	Schedule 2
<i>Lygodactylus bradfieldi</i>	Bradfield's Dwarf Gecko	LC	Unlisted	
<i>Meroles knoxii</i>	Knox's Desert Lizard	LC	LC	Schedule 2
<i>Meroles suborbitalis</i>	Spotted Desert Lizard	LC	Unlisted	Schedule 2
<i>Monopeltis infusca</i>	Dusky Worm Lizard	LC	Unlisted	Schedule 2
<i>Naja nigricincta woodi</i>	Black Spitting Cobra	LC	Unlisted	
<i>Naja nivea</i>	Cape Cobra	LC	Unlisted	
<i>Nucras tessellata</i>	Western Sandveld Lizard	LC	Unlisted	Schedule 2
<i>Pachydactylus atorquatus</i>	Augrabies gecko	Unlisted	LC	
<i>Pachydactylus capensis</i>	Cape Gecko	LC	Unlisted	
<i>Pachydactylus haackei</i>	Haacke's Gecko	LC	Unlisted	
<i>Pachydactylus latirostris</i>	Quartz Gecko	LC	Unlisted	
<i>Pachydactylus montanus</i>	Namaqua Mountain Gecko	LC	LC	
<i>Pachydactylus punctatus</i>	Speckled Gecko	LC	LC	
<i>Pachydactylus purcelli</i>	Purcell's Gecko	LC	Unlisted	
<i>Pachydactylus rugosus</i>	Common Rough Gecko	LC	Unlisted	
<i>Pachydactylus weberi</i>	Weber's Gecko	LC	LC	
<i>Pedioplanis inornata</i>	Plain Sand Lizard	LC	Unlisted	Schedule 2
<i>Pedioplanis laticeps</i>	Karoo Sand Lizard	LC	LC	Schedule 2
<i>Pedioplanis lineocellata lineocellata</i>	Spotted Sand Lizard	LC	Unlisted	Schedule 2
<i>Pedioplanis namaquensis</i>	Namaqua Sand Lizard	LC	Unlisted	Schedule 2
<i>Platysaurus broadleyi</i>	Augrabies Flat Lizard	LC	LC	Schedule 2
<i>Platysaurus capensis</i>	Namaqua Flat Lizard	LC	LC	Schedule 2

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<i>Prosymna bivittata</i>	Two-Striped Shovel-Snout	LC	Unlisted	Schedule 2
<i>Prosymna frontalis</i>	South-western Shovel-snout	LC	LC	Schedule 2
<i>Psammobates tentorius verroxii</i>	Tent Tortoise	NT	NT	Schedule 2
<i>Psammophis namibensis</i>	Namib Sand Snake	LC	Unlisted	
<i>Psammophis notostictus</i>	Karoo Sand Snake	LC	Unlisted	
<i>Psammophis trinasalis</i>	Fork-marked Sand Snake	LC	Unlisted	
<i>Pseudaspis cana</i>	Mole Snake	LC	Unlisted	
<i>Ptenopus garrulus maculatus</i>	Spotted Barking Gecko	LC	Unlisted	
<i>Rhinotyphlops lalandei</i>	Delalande's Beaked Blind Snake	LC	Unlisted	
<i>Rhinotyphlops schinzi</i>	Schinz's Beaked Blind Snake	LC	Unlisted	
<i>Telescopus beetzii</i>	Beetz's Tiger Snake	LC	Unlisted	
<i>Telescopus semiannulatus polystictus</i>	Damara Tiger Snake	LC	Unlisted	
<i>Trachylepis occidentalis</i>	Western Three-striped Skink	LC	Unlisted	
<i>Trachylepis sparsa</i>	Karasburg Tree Skink	LC	Unlisted	
<i>Trachylepis spilogaster</i>	Kalahari Tree Skink	LC	Unlisted	
<i>Trachylepis sulcata sulcata</i>	Westren Rock Skink	LC	Unlisted	
<i>Trachylepis variegata</i>	Variiegated Skink	LC	Unlisted	
<i>Varanus albigularis albigularis</i>	Southern Rock Monitor	LC	Unlisted	Schedule 2

*APPENDIX E: Amphibian species expected to occur within the project area*

Species	Common Name	Conservation Status		NCNCA
		Regional (SANBI, 2016)	IUCN (2017)	
<i>Amietia delalandii</i>	Delalande's River Frog	LC	Unlisted	Schedule 2
<i>Amietia fuscigula</i>	Common River Frog	LC	LC	Schedule 2
<i>Bufo robinsoni</i>	Paradise Toad	LC	LC	Schedule 2
<i>Cacosternum boettgeri</i>	Common Caco	LC	LC	Schedule 2
<i>Cacosternum namaquense</i>	Namaqua Caco	LC	LC	Schedule 2
<i>Phrynomantis annectens</i>	Marbled Rubber Frog	LC	LC	Schedule 2
<i>Sclerophrys capensis</i>	Raucous Toad	LC	LC	Schedule 2
<i>Sclerophrys gutturalis</i>	Guttural Toad	LC	LC	Schedule 2
<i>Strongylopus springbokensis</i>	Namaqua Stream Frog	VU	LC	Schedule 2
<i>Tomopterna cryptotis</i>	Tremelo Sand Frog	LC	LC	Schedule 2
<i>Tomopterna delalandii</i>	Cape Sand Frog	LC	LC	Schedule 2
<i>Tomopterna tandyi</i>	Tandy's Sand Frog	LC	LC	Schedule 2
<i>Vandijkophrynus garipeensis garipeensis</i>	Karoo Toad	Not listed	Not listed	Schedule 2
<i>Xenopus laevis</i>	Common Platanna	LC	LC	Schedule 2

*Appendix F: Species observed by Todd (2013).*

Avian species list provided by Todd was based on the SABAP data and only species highlighted in text are preseted below.

Flora Species	Family
<i>Abutilon pycnodon</i>	Malvaceae
<i>Acanthopsis hoffmannseggiana</i>	Acanthaceae
<i>Adenolobus garipensis</i>	Fabaceae
<i>Aizoon asbestinum</i>	Aizoaceae
<i>Aloe claviflora</i>	Asphodelaceae
<i>Aloe dichotoma</i>	Asphodelaceae
<i>Anacampseros filamentosa subsp. Namaquensis</i>	Anacampserotaceae
<i>Antherothamnus pearsonii</i>	Scrophulariaceae
<i>Antizoma miersiana</i>	Menispermaceae
<i>Aptosimum albomarginatum</i>	Scrophulariaceae
<i>Aptosimum junceum</i>	Scrophulariaceae
<i>Aptosimum marlothii</i>	Scrophulariaceae
<i>Aptosimum spinescens</i>	Scrophulariaceae
<i>Aridaria noctiflora subsp. Straminea</i>	Poaceae
<i>Aristida congesta subsp. Congesta</i>	Poaceae
<i>Asparagus capensis</i>	Asparagaceaea
<i>Asparagus retrofractus</i>	Asparagaceaea
<i>Avonia albissima</i>	Portulacaceae
<i>Barleria lichtensteiniana</i>	Acanthaceae
<i>Barleria rigida</i>	Acanthaceae
<i>Berkheya spinosissima subsp. Spinosissima</i>	Asteraceae
<i>Blepharis mitrata</i>	Acanthaceae

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<i>Boscia foetida</i> subsp. <i>foetida</i>	Capparaceae
<i>Brownanthus arenosus</i>	Aizoaceae
<i>Calicorema capitata</i>	Amaranthaceae
<i>Cephalophyllum staminodosum</i>	Aizoaceae
<i>Ceraria namaquensis</i>	Didieraceae
<i>Chascanum garipense</i>	Verbenaceae
<i>Chrysocoma longifolia</i>	Asteraceae
<i>Cleome foliosa</i> var. <i>lutea</i>	Cleomaceae
<i>Codon royenii</i>	Boraginaceae
<i>Commiphora gracilifrons</i>	Burseraceae
<i>Crassula corallina</i> subsp. <i>Macrorrhiza</i>	Crassulaceae
<i>Crassula deltoidea</i>	Crassulaceae
<i>Cryptolepis decidua</i>	Apocynaceae
<i>Deverra denudata</i>	Apiaceae
<i>Dicoma capensis</i>	Asteraceae
<i>Drosanthemum schoenlandianum</i>	Aizoaceae
<i>Dyerophytum africanum</i>	Plumbaginaceae
<i>Ehretia rigida</i> subsp. <i>rigida</i>	Boraginaceae
<i>Enneapogon desvauxii</i>	Poaceae
<i>Enneapogon scaber</i>	Poaceae
<i>Eriocephalus merxmuelleri</i>	Asteraceae
<i>Euclea pseudebenus</i>	Ebenaceae
<i>Euphorbia braunsii</i>	Euphorbiaceae
<i>Euphorbia dregeana</i>	Euphorbiaceae
<i>Euphorbia gariepina</i> subsp. <i>Gariepina</i>	Euphorbiaceae
<i>Euphorbia gregaria</i>	Euphorbiaceae
<i>Euphorbia mauritanica</i> var. <i>mauritanica</i>	Euphorbiaceae
<i>Euphorbia spinea</i>	Euphorbiaceae
<i>Forsskaolea candida</i>	Urticaceae
<i>Gaillonia crocylis</i>	Rubiaceae
<i>Galenia fruticosa</i>	Aizoaceae
<i>Galenia papulosa</i>	Aizoaceae
<i>Gazania lichtensteinii</i>	Asteraceae
<i>Gonialoe variegata</i>	Asphodelaceae
<i>Grielum humifusum</i> var. <i>humifusum</i>	Neuradaceae
<i>Gymnosporia heterophylla</i>	Celastraceae
<i>Heliophila carnosa</i>	Brassicaceae
<i>Hermannia cuneifolia</i>	Sterculiaceae
<i>Hermannia spinosa</i>	Malvaceae
<i>Hermannia stricta</i>	Malvaceae
<i>Hermannia tomentosa</i>	Malvaceae
<i>Hermbsstaedtia glauca</i>	Amaranthaceae
<i>Hirpicium alienatum</i>	Asteraceae
<i>Hoodia gordonii</i>	Apocynaceae
<i>Hypertelis salsoloides</i> var. <i>salsoloides</i>	Kewaceae

## Pella Bulk Water Pipeline

<i>Jamesbrittenia maxii</i>	Scrophulariaceae
<i>Jamesbrittenia ramosissima</i>	Scrophulariaceae
<i>Justicia thymifolia</i>	Acanthaceae
<i>Kissenia capensis</i>	Loasaceae
<i>Kleinia longiflora</i>	Asteraceae
<i>Ledebouria undulata</i>	Hyacinthaceae
<i>Leucosphaera bainesii</i>	Amaranthaceae
<i>Leysera tenella</i>	Asteraceae
<i>Limeum aethiopicum</i>	Limeaceae
<i>Lithops julii</i> subsp. <i>fulleri</i>	Aizoaceae
<i>Lithops olivacea</i>	Aizoaceae
<i>Litogyne gariepina</i>	Asteraceae
<i>Lycium oxycarpum</i>	Solanaceae
<i>Melolobium microphyllum</i>	Fabaceae
<i>Mesembryanthemum crystallinum</i>	Aizoaceae
<i>Microloma incanum</i>	Apocynaceae
<i>Monechma incanum</i>	Acanthaceae
<i>Monechma spartioides</i>	Acanthaceae
<i>Montinia caryophyllacea</i>	Montiniaceae
<i>Myxopappus acutilobus</i>	Asteraceae
<i>Nymania capensis</i>	Meliaceae
<i>Oropetium capense</i>	Poaceae
<i>Pappea capensis</i>	Sapindaceae
<i>Parkinsonia africana</i>	Fabaceae
<i>Peliostomum leucorrhizum</i>	Scrophulariaceae
<i>Pentatrichia petrosa</i>	Asteraceae
<i>Petalidium setosum</i>	Acanthaceae
<i>Polygala leptophylla</i> var. <i>armata</i>	Polygalaceae
<i>Portulaca kermesina</i>	Portulacaceae
<i>Psilocaulon coriarium</i>	Aizoaceae
<i>Pteronia mucronata</i>	Asteraceae
<i>Rhigozum trichotomum</i>	Bignoniaceae
<i>Salsola aphylla</i>	Amaranthaceae
<i>Salsola kalaharica</i>	Amaranthaceae
<i>Salsola tuberculata</i>	Amaranthaceae
<i>Sarcostemma viminale</i> subsp. <i>Viminale</i>	Apocynaceae
<i>Schmidtia kalahariensis</i>	Poaceae
<i>Scirpoides dioecus</i>	Cyperaceae
<i>Searsia burchellii</i>	Anacardiaceae
<i>Senegalia mellifera</i> subsp. <i>detinens</i>	Fabaceae
<i>Septulina glauca</i>	Loranthaceae
<i>Sericocoma avolans</i>	Amaranthaceae
<i>Sisyndite sparteae</i>	Zygophyllaceae
<i>Sporobolus nervosus</i>	Poaceae
<i>Stipagrostis anomala</i>	Poaceae

## Pella Bulk Water Pipeline

<i>Stipagrostis brevifolia</i>	Poaceae
<i>Stipagrostis ciliata var. capensis</i>	Poaceae
<i>Stipagrostis namaquensis</i>	Poaceae
<i>Stipagrostis obtusa</i>	Poaceae
<i>Tamarix usneoides</i>	Tamaricaceae
<i>Tetragonia arbuscula</i>	Aizoaceae
<i>Thesium lineatum</i>	Santalaceae
<i>Titanopsis calcarea</i>	Aizoaceae
<i>Tribulus terrestris</i>	Zygophyllaceae
<i>Trichodesma africanum</i>	Boraginaceae
<i>Tricholaena capensis subsp. Capensis</i>	Poaceae
<i>Tripteris sinuata var. sinuata</i>	Asteraceae
<i>Vachellia erioloba</i>	Fabaceae
<i>Ziziphus mucronata</i>	Rhamnaceae
<i>Zygophyllum dregeanum</i>	Zygophyllaceae
<i>Zygophyllum pubescens</i>	Zygophyllaceae
<i>Zygophyllum retrofractum</i>	Zygophyllaceae
<i>Zygophyllum simplex</i>	Zygophyllaceae

Species	Common Name	Conservation Status	
		Regional (SANBI, 2016)	IUCN (2017)
<b>Avian</b>			
<i>Alopochen aegyptiacus</i>	Goose, Egyptian	Unlisted	LC
<i>Anas capensis</i>	Teal, Cape	Unlisted	LC
<i>Anas smithii</i>	Shoveler, Cape	Unlisted	LC
<i>Charadrius tricollaris</i>	Plover, Three-banded	Unlisted	LC
<i>Himantopus himantopus</i>	Stilt, Black-winged	Unlisted	LC
<i>Oxyura maccoa</i>	Duck, Maccoa	NT	NT
<i>Phoenicopterus minor</i>	Flamingo, Lesser	NT	NT
<i>Tachybaptus ruficollis</i>	Grebe, Little	Unlisted	LC
<i>Tadorna cana</i>	Shelduck, South African	Unlisted	LC
<b>Mammals</b>			
<i>Aethomys namaquensis</i>	Namaqua rock rat	LC	LC
<i>Antidorcas marsupialis</i>	Slater's Shrew	LC	LC
<i>Aonyx capensis</i>	Cape Clawless Otter	NT	NT
<i>Cynictis penicillata</i>	Yellow Mongoose	LC	LC
<i>Hystrix africaeaustralis</i>	Cape Porcupine	LC	LC
<i>Orycteropus afer</i>	Aardvark	LC	LC
<i>Papio ursinus</i>	Chacma Baboon	LC	LC
<i>Procavia capensis</i>	Rock Hyrax	LC	LC
<i>Proteles cristata</i>	Aardwolf	LC	LC
<i>Raphicerus campestris</i>	Steenbok	LC	LC
<i>Suricata suricatta</i>	Suricate	LC	LC
<i>Tragelaphus strepsiceros</i>	Greater Kudu	LC	LC
<i>Xerus inauris</i>	Cape Ground Squirrel	LC	LC



## Pella Bulk Water Pipeline

Reptiles			
<i>Agama aculeata aculeata</i>	Western Ground Agama	LC	Unlisted
<i>Agama anchietae</i>	Anchieta's Agama	LC	Unlisted
<i>Trachylepis sulcata</i>	Western Rock Skink	LC	Unlisted
<i>Meroles suborbitalis</i>	Spotted Desert Lizard	LC	Unlisted
<i>Pedioplanis inornata</i>	Plain Sand Lizard	LC	Unlisted
<i>Psammobates tentorius verroxii</i>	Tent Tortoise	NT	NT

## Appendix G: Species observed by Groundtruth (2013)

Species	Common Name	Conservation Status	
		Regional (SANBI, 2016)	IUCN (2017)
Avian			
<i>Afrotis afraoides</i>	Korhaan, Northern Black	Unlisted	LC
<i>Amadina erythrocephala</i>	Finch, Red-headed	Unlisted	LC
<i>Anthoscopus minutus</i>	Penduline-tit, Cape	Unlisted	LC
<i>Apus affinis</i>	Swift, Little	Unlisted	LC
<i>Aquila verreauxii</i>	Eagle, Verreaux's	VU	LC
<i>Batis pririt</i>	Batis, Pririt	Unlisted	LC
<i>Bradornis infuscatus</i>	Flycatcher, Chat	Unlisted	LC
<i>Bubo capensis</i>	Eagle-Owl, Cape	Unlisted	LC
<i>Buteo rufofuscus</i>	Buzzard, Jackal	Unlisted	LC
<i>Buteo rufofuscus</i>	Buzzard, Jackal	Unlisted	LC
<i>Calendulauda africanoides</i>	Lark, Fawn-coloured	Unlisted	LC
<i>Calendulauda burra</i>	Lark, Red	VU	VU
<i>Calendulauda sabota</i>	Lark, Sabota	Unlisted	LC
<i>Cercomela familiaris</i>	Chat, Familiar	Unlisted	LC
<i>Cercomela schlegelii</i>	Chat, Karoo	Unlisted	LC
<i>Cercomela sinuata</i>	Chat, Sickle-winged	Unlisted	LC
<i>Cercomela tractrac</i>	Chat, Tractrac	Unlisted	LC
<i>Cercotrichas coryphoeus</i>	Scrub-robin, Karoo	Unlisted	LC
<i>Certhilauda subcoronata</i>	Lark, Karoo Long-billed	Unlisted	LC
<i>Chersomanes albofasciata</i>	Lark, Spike-heeled	Unlisted	LC
<i>Cinnyris fuscus</i>	Sunbird, Dusky	Unlisted	LC
<i>Circaetus pectoralis</i>	Snake-eagle, Black-chested	Unlisted	LC
<i>Cisticola subruficapilla</i>	Cisticola, Grey-backed	Unlisted	LC
<i>Colius colius</i>	Mousebird, White-backed	Unlisted	LC
<i>Columba guinea</i>	Pigeon, Speckled	Unlisted	LC
<i>Corvus albus</i>	Crow, Pied	Unlisted	LC
<i>Corvus capensis</i>	Crow, Cape	Unlisted	LC
<i>Crithagra albogularis</i>	White-throated Canary	LC	LC
<i>Crithagra flaviventris</i>	Canary, Yellow	Unlisted	LC
<i>Emberiza capensis</i>	Bunting, Cape	Unlisted	LC
<i>Emberiza impetuani</i>	Bunting, Lark-like	Unlisted	LC
<i>Eremomela gregalis</i>	Eremomela, Karoo	Unlisted	LC
<i>Eremomela icteropygialis</i>	Eremomela, Yellow-bellied	Unlisted	LC

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<i>Eremopterix australis</i>	Sparrow-lark, Black-eared	Unlisted	LC
<i>Eremopterix verticalis</i>	Sparrowlark, Grey-backed	Unlisted	LC
<i>Estrilda astrild</i>	Waxbill, Common	Unlisted	LC
<i>Eupodotis vigorsii</i>	Korhaan, Karoo	NT	LC
<i>Euryptila subcinnamomea</i>	Warbler, Cinnamon-breasted	Unlisted	LC
<i>Falco biarmicus</i>	Falcon, Lanner	VU	LC
<i>Falco rupicoloides</i>	Kestrel, Greater	Unlisted	LC
<i>Hirundo fuligula</i>	Martin, Rock	Unlisted	Unlisted
<i>Hirundo rustica</i>	Swallow, Barn	Unlisted	LC
<i>Lanius collaris</i>	Fiscal, Common (Southern)	Unlisted	LC
<i>Malcorus pectoralis</i>	Warbler, Rufous-eared	Unlisted	LC
<i>Mirafrapa apiata</i>	Lark, Cape Clapper	Unlisted	LC
<i>Monticola brevipes</i>	Rock-thrush, Short-toed	Unlisted	LC
<i>Myrmecocichla formicivora</i>	Chat, Anteating	Unlisted	LC
<i>Neotis ludwigii</i>	Bustard, Ludwig's	EN	EN
<i>Oena capensis</i>	Dove, Namaqua	Unlisted	LC
<i>Oenanthe monticola</i>	Wheatear, Mountain	Unlisted	LC
<i>Oenanthe pileata</i>	Wheatear, Capped	Unlisted	LC
<i>Onychognathus nabouroup</i>	Starling, Pale-winged	Unlisted	LC
<i>Parus afer</i>	Tit, Grey	Unlisted	Unlisted
<i>Parus cinerascens</i>	Tit, Ashy	Unlisted	LC
<i>Passer melanurus</i>	Sparrow, Cape	Unlisted	LC
<i>Philetairus socius</i>	Weaver, Sociable	Unlisted	LC
<i>Plocepasser mahali</i>	Sparrow-weaver, White-browed	Unlisted	LC
<i>Ploceus velatus</i>	Masked-weaver, Southern	Unlisted	LC
<i>Polemaetus bellicosus</i>	Eagle, Martial	EN	VU
<i>Prinia flavicans</i>	Prinia, Black-chested	Unlisted	LC
<i>Pterocles namaqua</i>	Sandgrouse, Namaqua	Unlisted	LC
<i>Pycnonotus nigricans</i>	Bulbul, African Red-eyed	Unlisted	LC
<i>Saxicola torquatus</i>	Stonechat, African	Unlisted	LC
<i>Serinus alario</i>	Canary, Black-headed	Unlisted	LC
<i>Spizocorys starki</i>	Lark, Stark's	Unlisted	LC
<i>Sporopipes squamifrons</i>	Finch, Scaly-feathered	Unlisted	LC
<i>Stenostira scita</i>	Flycatcher, Fairy	Unlisted	LC
<i>Streptopelia capicola</i>	Turtle-dove, Cape	Unlisted	LC
<i>Streptopelia senegalensis</i>	Dove, Laughing	Unlisted	LC
<i>Sylvietta rufescens</i>	Crombec, Long-billed	Unlisted	LC
<i>Tachymarpis melba</i>	Swift, Alpine	Unlisted	LC
<i>Tadorna cana</i>	Shelduck, South African	Unlisted	LC
<i>Telophorus zeylonus</i>	Bokmakierie, Bokmakierie	Unlisted	LC
<i>Tricholaema leucomelas</i>	Barbet, Acacia Pied	Unlisted	LC
<i>Vanellus coronatus</i>	Lapwing, Crowned	Unlisted	LC
<i>Zosterops pallidus</i>	White-eye, Orange River	Unlisted	LC
<b>Mammals</b>			
<i>Aethomys namaquensis</i>	Namaqua rock rat	LC	LC
<i>Antidorcas marsupialis</i>	Sclater's Shrew	LC	LC

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<i>Atilax paludinosus</i>	Water Mongoose	LC	LC
<i>Canis mesomelas</i>	Black-backed Jackal	LC	LC
<i>Caracal caracal</i>	Caracal	LC	LC
<i>Desmodillus auricularis</i>	Short-tailed Gerbil	LC	LC
<i>Elephantulus rupestris</i>	Western rock sengi	LC	LC
<i>Felis silvestris</i>	African Wildcat	LC	LC
<i>Herpestes sanguineus</i>	Slender Mongoose	LC	LC
<i>Genetta genetta</i>	Small-spotted Genet	LC	LC
<i>Gerbillurus paeba</i>	Hairy-footed Gerbil	LC	LC
<i>Parahyaena brunnea</i>	Brown Hyaena	NT	NT
<i>Hystrix africaeaustralis</i>	Cape Porcupine	LC	LC
<i>Ictonyx striatus</i>	Striped Polecat	LC	LC
<i>Lepus saxatilis</i>	Scrub Hare	LC	LC
<i>Macroselides proboscideus</i>	Karoo Round-eared Sengi	LC	LC
<i>Oreotragus oreotragus</i>	Klipspringer	LC	LC
<i>Orycteropus afer</i>	Aardvark	LC	LC
<i>Otocyon megalotis</i>	Bat-eared Fox	LC	LC
<i>Otomys unisulcatus</i>	Karoo Bush Rat	LC	LC
<i>Panthera pardus</i>	Leopard	VU	VU
<i>Papio ursinus</i>	Chacma Baboon	LC	LC
<i>Parotomys littledalei</i>	Littledale's Whistling Rat	NT	LC
<i>Pedetes capensis</i>	Springhare	LC	LC
<i>Petromus typicus</i>	Dassie Rat	LC	LC
<i>Petromyscus collinus</i>	Pygmy Rock Mouse	LC	LC
<i>Procavia capensis</i>	Rock Hyrax	LC	LC
<i>Pronolagus rupestris</i>	Smith's Red Rock Hare	LC	LC
<i>Rhabdomys pumilio</i>	Xeric Four-striped Mouse	LC	LC
<i>Raphicerus campestris</i>	Steenbok	LC	LC
<i>Rhinolophus capensis</i>	Cape Horseshoe Bat	LC	LC
<i>Rhinolophus darlingi</i>	Darling's Horseshoe Bat	LC	LC
<i>Sauromys petrophilus</i>	Flat-headed Free-tail Bat	LC	LC
<i>Sylvicapra grimmia</i>	Common Duiker	LC	LC
<i>Vulpes chama</i>	Cape Fox	LC	LC
<i>Xerus inauris</i>	Cape Ground Squirrel	LC	LC
<b>Reptiles</b>			
<i>Acontias tristis</i>	Namaqualand Dwarf Legless Skink	LC	LC
<i>Agama anchietae</i>	Anchieta's Agama	LC	Unlisted
<i>Aspidelaps lubricus</i>	Cape Coral Snake	Unlisted	LC
<i>Bitis xeropaga</i>	Dessert Mountain Adder	LC	Unlisted
<i>Chondrodactylus angulifer</i>	Common Giant Gecko	LC	LC
<i>Chondrodactylus bibronii</i>	Bibron's Gecko	LC	Unlisted
<i>Goggia lineata</i>	Striped Pygmy Gecko	LC	LC
<i>Karusasaurus polyzonus</i>	Southern Karusa Lizard	LC	LC
<i>Naja nigricollis</i>	Black-necked spitting cobra	Unlisted	LC
<i>Naja nivea</i>	Cape Cobra	LC	Unlisted
<i>Pachydactylus haackei</i>	Haacke's Gecko	LC	Unlisted

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<i>Pachydactylus latirostris</i>	Quartz Gecko	LC	Unlisted
<i>Pachydactylus montanus</i>	Namaqua Mountain Gecko	LC	LC
<i>Pachydactylus rugosus</i>	Common Rough Gecko	LC	Unlisted
<i>Pedioplanis inornata</i>	Plain Sand Lizard	LC	Unlisted
<i>Pedioplanis namaquensis</i>	Namaqua Sand Lizard	LC	Unlisted
<i>Psammobates tentorius</i>	Tent Tortoise	LC	LC
<i>Psammophis notostictus</i>	Karoo Sand Snake	LC	Unlisted
<i>Ptenopus garrulus maculatus</i>	Spotted Barking Gecko	LC	Unlisted
<i>Rhinotyphlops schinzi</i>	Schinzi's Beaked Blind Snake	LC	Unlisted
<i>Telescopus beetzi</i>	African Tiger Snake	Unlisted	LC
<i>Trachylepis occidentalis</i>	Western Three-striped Skink	LC	Unlisted
<i>Trachylepis sulcata</i>	Western Rock Skink	LC	Unlisted
<i>Trachylepis variegata</i>	Variegated Skink	LC	Unlisted
<b>Amphibians</b>			
<i>Vandijkophrynus robonsoni</i>	Paradise Toad	Unlisted	LC
<i>Tomopterna delalandii</i>	Cape Sand Frog	LC	LC
<i>Phynomantis annectens</i>	Marble Rubber Frog	Unlisted	LC

## Appendix H: Species observed by Desmet (2013)

Family	Species
Acanthaceae	<i>Acanthopsis annual</i>
Acanthaceae	<i>Acanthopsis hoffmannseggiana</i>
Acanthaceae	<i>Barleria rigida</i>
Acanthaceae	<i>Blepharis micra</i>
Acanthaceae	<i>Blepharis mitrata</i>
Acanthaceae	<i>Justicia thymifolia</i>
Acanthaceae	<i>Monechma spartioides</i>
Aizoaceae	<i>Aizoon asbestinum</i>
Aizoaceae	<i>Galenia africana</i>
Aizoaceae	<i>Galenia cf. meziana</i>
Aizoaceae	<i>Galenia fruticosa</i>
Aizoaceae	<i>Galenia sarcophylla</i>
Aizoaceae	<i>Pharnaceum sp.</i>
Aizoaceae	<i>Tetragonia reduplicata</i>
Aizoaceae	<i>Tetragonia spicata</i>
Aizoaceae	<i>Trianthema parvifolium</i>
Aizoaceae	<i>Aridaria cf. serotina</i>
Aizoaceae	<i>Aridaria noctiflora subsp. noctiflora</i>
Aizoaceae	<i>Aridaria noctiflora subsp. straminea</i>
Aizoaceae	<i>Brownanthus ciliatus</i>
Aizoaceae	<i>Cephalophyllum fullerii</i>
Aizoaceae	<i>Cephalophyllum sp. nov. -2014</i>
Aizoaceae	<i>Conophytum angelicae (Pofadder form)</i>
Aizoaceae	<i>Conophytum angelicae subsp. angelicae</i>
Aizoaceae	<i>Conophytum calculus subsp. vanzylii</i>

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Aizoaceae	<i>Conophytum fulleri</i>
Aizoaceae	<i>Conophytum limpidum</i>
Aizoaceae	<i>Conophytum marginatum</i> var. <i>karamoepense</i>
Aizoaceae	<i>Conophytum maughanii</i>
Aizoaceae	<i>Conophytum praesectum</i>
Aizoaceae	<i>Conophytum ratum</i>
Aizoaceae	<i>Conophytum ratum</i>
Aizoaceae	<i>Dinteranthus microspermus</i>
Aizoaceae	<i>Drosanthemum</i> cf. <i>breve</i>
Aizoaceae	<i>Drosanthemum godmaniae</i>
Aizoaceae	<i>Drosanthemum hispidum</i>
Aizoaceae	<i>Drosanthemum karoense</i>
Aizoaceae	<i>Ebracteola fulleri</i>
Aizoaceae	<i>Hereroa bergeriana</i>
Aizoaceae	<i>Hereroa puttkameriana</i>
Aizoaceae	<i>Ihlenfeldtia excavata</i>
Aizoaceae	<i>Ihlenfeldtia vanzylii</i>
Aizoaceae	<i>Lithops julii</i> subsp. <i>fulleri</i>
Aizoaceae	<i>Lithops olivacea</i> var. <i>olivacea</i>
Aizoaceae	<i>Mesembryanthemum guerichianum</i>
Aizoaceae	<i>Mesembryanthemum inachabense</i>
Aizoaceae	<i>Mesembryanthemum longistylum</i>
Aizoaceae	<i>Phyllobolus latipetalus</i>
Aizoaceae	<i>Phyllobolus lignescens</i>
Aizoaceae	<i>Psilocaulon articulatum</i>
Aizoaceae	<i>Psilocaulon coriarium</i>
Aizoaceae	<i>Psilocaulon subnodosum</i>
Aizoaceae	<i>Ruschia</i> aff. <i>divaricata</i>
Aizoaceae	<i>Ruschia barnardii</i>
Aizoaceae	<i>Ruschia divaricata</i>
Aizoaceae	<i>Ruschia griquensis</i>
Aizoaceae	<i>Ruschia inclusa</i>
Aizoaceae	<i>Ruschia muricata</i>
Aizoaceae	<i>Ruschia robusta</i>
Aizoaceae	<i>Schwantesia pillansii</i>
Aizoaceae	<i>Schwantesia ruedebuschii</i>
Aizoaceae	<i>Titanopsis hugo-schlechteri</i> var. <i>hugoschlechteri</i>
Aizoaceae	<i>Trichodiadema obliquum</i>
Amaranthaceae	<i>Hermbstaedtia glauca</i>
Amaranthaceae	<i>Sericocoma avolans</i>
Amaranthaceae	<i>Sericocoma pungens</i>
Anacardiaceae	<i>Ozoroa dispar</i>
Anacardiaceae	<i>Rhus incisa</i>
Anacardiaceae	<i>Rhus undulata</i>
Apocynaceae	<i>Fockea comaru</i>
Apocynaceae	<i>Hoodia alstonii</i>

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Apocynaceae	<i>Hoodia gordonii</i>
Apocynaceae	<i>Huernia campanulata</i> subsp. <i>ingeae</i>
Apocynaceae	<i>Lavrania cactiformis</i>
Apocynaceae	<i>Lavrania marlothii</i>
Apocynaceae	<i>Microlooma incanum</i>
Apocynaceae	<i>Piранthus decorus</i> subsp. <i>cornutus</i>
Apocynaceae	<i>Piранthus geminatus</i>
Apocynaceae	<i>Quaqua mammillaris</i>
Apocynaceae	<i>Sarcostemma pearsonii</i>
Apocynaceae	<i>Sarcostemma viminale</i>
Apocynaceae	<i>Stapelia similis</i>
Asteraceae	<i>Amellus tridactylus</i> subsp.
Asteraceae	<i>Amphiglossa thuja</i>
Asteraceae	<i>Amphiglossa triflora</i>
Asteraceae	<i>Arctotis</i> cf. <i>leiocarpa</i>
Asteraceae	<i>Arctotis</i> sp1
Asteraceae	<i>Berkheya canescens</i>
Asteraceae	<i>Berkheya spinosissima</i> subsp. <i>spinosissima</i>
Asteraceae	<i>Chrysocoma ciliata</i>
Asteraceae	<i>Chrysocoma microphylla</i>
Asteraceae	<i>Chrysocoma sparsifolia</i>
Asteraceae	<i>Cineraria alchemilloides</i>
Asteraceae	<i>Cotula microglossa</i>
Asteraceae	<i>Dicoma capensis</i>
Asteraceae	<i>Didelta carnosa</i> var. <i>carnosa</i>
Asteraceae	<i>Eriocephalus ambiguus</i>
Asteraceae	<i>Eriocephalus microphyllus</i> var. <i>pubescens</i>
Asteraceae	<i>Eriocephalus pauperrimus</i>
Asteraceae	<i>Eriocephalus scariosus</i>
Asteraceae	<i>Eriocephalus</i> sp.
Asteraceae	<i>Euryops subcamosus</i> subsp. <i>vulgaris</i>
Asteraceae	<i>Felicia</i> cf. <i>clavipilosa</i>
Asteraceae	<i>Felicia muricata</i>
Asteraceae	<i>Felicia namaquana</i>
Asteraceae	<i>Felicia</i> sp.
Asteraceae	<i>Foveolina albida</i>
Asteraceae	<i>Gazania lichtensteinii</i>
Asteraceae	<i>Geigeria vigintiquamea</i>
Asteraceae	<i>Gorteria corymbosa</i>
Asteraceae	<i>Helichrysum herniarioides</i>
Asteraceae	<i>Helichrysum pentzioides</i>
Asteraceae	<i>Helichrysum pumilio</i> subsp. <i>pumilio</i>
Asteraceae	<i>Helichrysum zeyheri</i>
Asteraceae	<i>Hirpicium alienatum</i>
Asteraceae	<i>Hirpicium</i> cf. <i>gazanioides</i>
Asteraceae	<i>Hirpicium echinus</i>

## Pella Bulk Water Pipeline

Asteraceae	<i>Kleinia cephalophora</i>
Asteraceae	<i>Kleinia longiflora</i>
Asteraceae	<i>Leysera tenella</i>
Asteraceae	<i>Lopholaena cneorifolia</i>
Asteraceae	<i>Osteospermum armatum</i>
Asteraceae	<i>Osteospermum pinnatum</i> var. <i>breve</i>
Asteraceae	<i>Osteospermum scariosum</i>
Asteraceae	<i>Othonna abrotanifolia</i>
Asteraceae	<i>Othonna</i> cf. <i>cuneata</i>
Asteraceae	<i>Othonna floribunda</i>
Asteraceae	<i>Othonna protecta</i>
Asteraceae	<i>Othonna quercifolia</i>
Asteraceae	<i>Othonna quercifolia</i>
Asteraceae	<i>Othonna sedifolia</i>
Asteraceae	<i>Othonna</i> sp. <i>nov.</i>
Asteraceae	<i>Othonna</i> sp. <i>nov.</i>
Asteraceae	<i>Pegolettia retrofracta</i>
Asteraceae	<i>Pentatrachia petrosa</i>
Asteraceae	<i>Pentzia argentea</i>
Asteraceae	<i>Pentzia lanata</i>
Asteraceae	<i>Pteronia acuminata</i>
Asteraceae	<i>Pteronia</i> cf. <i>unguiculata</i>
Asteraceae	<i>Pteronia ciliata</i>
Asteraceae	<i>Pteronia glauca</i>
Asteraceae	<i>Pteronia leucoclada</i>
Asteraceae	<i>Pteronia mucronata</i>
Asteraceae	<i>Pteronia</i> sp.
Asteraceae	<i>Rosenia humilis</i>
Asteraceae	<i>Senecio bulbiniifolius</i>
Asteraceae	<i>Senecio radicans</i>
Asteraceae	<i>Senecio sarcooides</i>
Asteraceae	<i>Senecio sisymbriifolius</i>
Asteraceae	<i>Tripteris microcarpa</i> subsp. <i>microcarpa</i>
Asteraceae	<i>Tripteris pinnatilobata</i>
Asteraceae	<i>Tripteris sinuata</i>
Asteraceae	<i>Ursinia nana</i>
Bignoniaceae	<i>Rhigozum trichotomum</i>
Boraginaceae	<i>Ehretia rigida</i>
Boraginaceae	<i>Trichodesma africanum</i>
Brassicaceae	<i>Coronopus integrifolius</i>
Brassicaceae	<i>Heliophila arenaria</i> var. <i>arenaria</i>
Brassicaceae	<i>Heliophila</i> cf. <i>acuminata</i>
Brassicaceae	<i>Heliophila deserticola</i>
Brassicaceae	<i>Heliophila trifurca</i>
Burseraceae	<i>Commiphora gracilifrons</i>
Campanulaceae	<i>Wahlenbergia</i> cf. <i>nodosa</i>

## Pella Bulk Water Pipeline

Campanulaceae	<i>Wahlenbergia oxyphylla</i>
Campanulaceae	<i>Wahlenbergia prostrata</i>
Campanulaceae	<i>Wahlenbergia</i> sp.
Capparaceae	<i>Boscia albitrunca</i> var.
Capparaceae	<i>Boscia foetida</i> subsp. <i>foetida</i>
Capparaceae	<i>Cadaba aphylla</i>
Capparaceae	<i>Cleome</i> cf. <i>oxyphylla</i>
Caryophyllaceae	<i>Dianthus namaensis</i>
Chenopodiaceae	<i>Chenopod</i> sp.
Chenopodiaceae	<i>Salsola aphylla</i>
Chenopodiaceae	<i>Salsola kali</i>
Chenopodiaceae	<i>Salsola</i> sp.
Crassulaceae	<i>Adromischus alstonii</i>
Crassulaceae	<i>Adromischus diabolicus</i>
Crassulaceae	<i>Adromischus marianiae hallii ovate</i>
Crassulaceae	<i>Adromischus nanus</i>
Crassulaceae	<i>Cotyledon orbiculata</i> var. <i>orbiculata</i>
Crassulaceae	<i>Crassula alstonii</i>
Crassulaceae	<i>Crassula brevifolia</i> subsp. <i>brevifolia</i>
Crassulaceae	<i>Crassula columnaris</i> subsp. <i>prolifera</i>
Crassulaceae	<i>Crassula corallina</i> subsp. <i>macrorrhiza</i>
Crassulaceae	<i>Crassula deceptor</i>
Crassulaceae	<i>Crassula deltoidea</i>
Crassulaceae	<i>Crassula exilis</i> subsp. <i>sedifolia</i>
Crassulaceae	<i>Crassula garibina</i>
Crassulaceae	<i>Crassula mesembrianthemopsis</i>
Crassulaceae	<i>Crassula muscosa</i> var. <i>muscosa</i>
Crassulaceae	<i>Crassula namaquensis</i> subsp. <i>namaquensis</i>
Crassulaceae	<i>Crassula sericea</i> var. <i>sericea</i>
Crassulaceae	<i>Crassula sericea</i> var. <i>velutina</i>
Crassulaceae	<i>Crassula subaphylla</i> subsp. <i>subaphylla</i>
Crassulaceae	<i>Crassula tomentosa</i> var. <i>glabrifolia</i>
Crassulaceae	<i>Tylecodon paniculatus</i>
Crassulaceae	<i>Tylecodon reticulatus</i> subsp. <i>phyllopodium</i>
Crassulaceae	<i>Tylecodon rubrovenosus</i>
Crassulaceae	<i>Tylecodon sulphureus</i> var. <i>sulphureus</i>
Crassulaceae	<i>Tylecodon wallichii</i>
Cucurbitaceae	<i>Corallocarpus dissectus</i>
Cucurbitaceae	<i>Cucumis rigidus</i>
Ebenaceae	<i>Diospyros lycioides</i>
Ebenaceae	<i>Diospyros ramulosa</i>
Ebenaceae	<i>Euclea undulata</i>
Euphorbiaceae	<i>Euphorbia avasmontana</i>
Euphorbiaceae	<i>Euphorbia braunsii</i>
Euphorbiaceae	<i>Euphorbia decussata</i>
Euphorbiaceae	<i>Euphorbia gariiepina</i>



## Pella Bulk Water Pipeline

Euphorbiaceae	<i>Euphorbia gregaria</i>
Euphorbiaceae	<i>Euphorbia guerichiana</i>
Euphorbiaceae	<i>Euphorbia mauritanica</i>
Euphorbiaceae	<i>Euphorbia rectirama</i>
Euphorbiaceae	<i>Euphorbia spinea</i>
Fabaceae	<i>Acacia erioloba</i>
Fabaceae	<i>Acacia karoo</i>
Fabaceae	<i>Indigastrium argyroides</i>
Fabaceae	<i>Indigofera cf. auricoma</i>
Fabaceae	<i>Indigofera daleoides</i>
Fabaceae	<i>Indigofera heterotricha</i>
Fabaceae	<i>Indigofera sp.</i>
Fabaceae	<i>Lebeckia spinosa</i>
Fabaceae	<i>Lessertia brachypus</i>
Fabaceae	<i>Lotononis falcata</i>
Fabaceae	<i>Lotononis furcata</i>
Fabaceae	<i>Lotononis rabenaviana</i>
Fabaceae	<i>Melolobium candicans</i>
Fabaceae	<i>Parkinsonia africana</i>
Fabaceae	<i>Prosopis glandulosa</i>
Fabaceae	<i>Sutherlandia frutescens</i>
Fabaceae	<i>Tephrosia dregeana</i>
Gentianaceae	<i>Chironia sp.</i>
Geraniaceae	<i>Monsonia parviflora</i>
Geraniaceae	<i>Pelargonium cf. carnosum</i>
Geraniaceae	<i>Pelargonium crithmifolium</i>
Geraniaceae	<i>Pelargonium sp.</i>
Geraniaceae	<i>Pelargonium spinosum</i>
Geraniaceae	<i>Pelargonium xerophyton</i>
Geraniaceae	<i>Sarcocaulon crassicaule</i>
Geraniaceae	<i>Sarcocaulon salmoniflorum</i>
Hydnoraceae	<i>Hydnora africana</i>
Hydrophyllaceae	<i>Codon royenii</i>
Lamiaceae	<i>Stachys rugosa</i>
Loganiaceae	<i>Buddleja saligna</i>
Loranthaceae	<i>Septulina glauca</i>
Malvaceae	<i>Abutilon pycnodon</i>
Malvaceae	<i>Hibiscus engleri</i>
Meliaceae	<i>Nymania capensis</i>
Menispermaceae	<i>Cissampelos capensis</i>
Molluginaceae	<i>Adenogramma sp.</i>
Molluginaceae	<i>Hypertelis salsoloides</i>
Molluginaceae	<i>Limeum aethiopicum subsp. namaense</i>
Montiniaceae	<i>Montinia caryophyllacea</i>
Moraceae	<i>Ficus cordata</i>
Moraceae	<i>Ficus ilicina</i>

## Pella Bulk Water Pipeline

Neuradaceae	<i>Grielum humifusum</i>
Oxalidaceae	<i>Oxalis annae</i>
Oxalidaceae	<i>Oxalis eckloniana</i> var. <i>eckloniana</i>
Oxalidaceae	<i>Oxalis obtusa</i>
Oxalidaceae	<i>Oxalis pulchella</i>
Pedaliaceae	<i>Rogeria longiflora</i>
Pedaliaceae	<i>Sesamum capense</i>
Plumbaginaceae	<i>Dyerophytum africanum</i>
Polygalaceae	<i>Polygala seminuda</i>
Portulacaceae	<i>Anacampseros baeseckei</i>
Portulacaceae	<i>Anacampseros filamentosa</i>
Portulacaceae	<i>Anacampseros karasmontana</i>
Portulacaceae	<i>Anacampseros bayeriana</i>
Portulacaceae	<i>Avonia albissima</i>
Portulacaceae	<i>Avonia papyracea</i> subsp. <i>papyracea</i>
Portulacaceae	<i>Avonia quinaria</i> subsp. <i>alstonii</i>
Portulacaceae	<i>Avonia recurvata</i> subsp. <i>minuta</i>
Portulacaceae	<i>Avonia recurvata</i> subsp. <i>recurvata</i>
Portulacaceae	<i>Avonia ruschii</i>
Portulacaceae	<i>Ceraria fruticulosa</i>
Portulacaceae	<i>Ceraria namaquensis</i>
Portulacaceae	<i>Portulaca collina</i>
Rubiaceae	<i>Anthospermum spathulatum</i> subsp. <i>spathulatum</i>
Salvadoraceae	<i>Azima tetracantha</i>
Santalaceae	<i>Thesium lineatum</i>
Sapindaceae	<i>Pappea capensis</i>
Scrophulariaceae	<i>Antherothamnus pearsonii</i>
Scrophulariaceae	<i>Aptosimum annual</i>
Scrophulariaceae	<i>Aptosimum indivisum</i>
Scrophulariaceae	<i>Aptosimum spinescens</i>
Scrophulariaceae	<i>Dischisma</i> sp.
Scrophulariaceae	<i>Hebenstretia namaquensis</i>
Scrophulariaceae	<i>Jamesbrittenia aridicola</i>
Scrophulariaceae	<i>Manulea nervosa</i>
Scrophulariaceae	<i>Manulea</i> sp.
Scrophulariaceae	<i>Nemesia</i> sp.
Scrophulariaceae	<i>Peliostomum leucorrhizum</i>
Scrophulariaceae	<i>Selago namaquensis</i>
Scrophulariaceae	<i>Sutera ramosissima</i>
Scrophulariaceae	<i>Sutera tomentosa</i>
Scrophulariaceae	<i>Walafrida</i> cf. <i>geniculata</i>
Scrophulariaceae	<i>Zaluzianskya</i> cf. <i>villosa</i>
Solanaceae	<i>Lycium</i> cf. <i>bosciifolium</i>
Solanaceae	<i>Lycium cinereum</i>
Solanaceae	<i>Lycium prunus-spinosa</i>
Solanaceae	<i>Solanum burchellii</i>

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Solanaceae	<i>Solanum giftbergense</i>
Solanaceae	<i>Solanum nigrum</i>
Sterculiaceae	<i>Hermannia cf. coccocarpa</i>
Sterculiaceae	<i>Hermannia disermifolia</i>
Sterculiaceae	<i>Hermannia gariepina</i>
Sterculiaceae	<i>Hermannia minutiflora</i>
Sterculiaceae	<i>Hermannia spinosa</i>
Sterculiaceae	<i>Hermannia stricta</i>
Tamaricaceae	<i>Tamarix usneoides</i>
Urticaceae	<i>Forsskaolea candida</i>
Verbenaceae	<i>Chascanum garipensis</i>
Viscaceae	<i>Viscum capense</i>
Viscaceae	<i>Viscum rotundifolium</i>
Zygophyllaceae	<i>Augea capensis</i>
Zygophyllaceae	<i>Fagonia capensis</i>
Zygophyllaceae	<i>Sisyndite spartea</i>
Zygophyllaceae	<i>Tribulus cf. zeyheri</i>
Zygophyllaceae	<i>Zygophyllum cf. decumbens</i>
Zygophyllaceae	<i>Zygophyllum cf. meyeri</i>
Zygophyllaceae	<i>Zygophyllum cf. microphyllum</i>
Zygophyllaceae	<i>Zygophyllum retrofractum</i>
Zygophyllaceae	<i>Zygophyllum simplex</i>
Amaryllidaceae	<i>Brunsvigia comptonii</i>
Amaryllidaceae	<i>Brunsvigia sp. nov.</i>
Amaryllidaceae	<i>Brunsvigia sp. nov.</i>
Anthericaceae	<i>Chlorophytum sp.</i>
Asparagaceae	<i>Asparagus capensis</i>
Asparagaceae	<i>Asparagus cf. larinus</i>
Asparagaceae	<i>Asparagus retrofractus</i>
Asparagaceae	<i>Asparagus sp.</i>
Asphodelaceae	<i>Aloe dichotoma</i>
Asphodelaceae	<i>Aloe gariensis</i>
Asphodelaceae	<i>Aloe microstigma</i>
Asphodelaceae	<i>Bulbine namaensis</i>
Asphodelaceae	<i>Bulbine striata</i>
Asphodelaceae	<i>Haworthia venosa subsp. tessellata</i>
Asphodelaceae	<i>Trachyandra cf. jacquiniana</i>
Asphodelaceae	<i>Trachyandra sp. nov.</i>
Colchicaceae	<i>Ornithoglossum viride</i>
Cyperaceae	<i>Bulbostylis hispidula</i>
Cyperaceae	<i>Cyperus bellus</i>
Cyperaceae	<i>Cyperus marginatus</i>
Cyperaceae	<i>Cyperus squarrosus</i>
Cyperaceae	<i>Mariscus cf. aristatus</i>
Cyperaceae	<i>Schoenoplectus cf. erectus</i>
Cyperaceae	<i>Schoenoplectus muricinax</i>

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Dracaenaceae	<i>Sansevieria aethiopica</i>
Eriospermaceae	<i>Eriospermum bakerianum</i>
Eriospermaceae	<i>Eriospermum pusillum</i>
Hyacinthaceae	<i>Albuca spiralis</i>
Hyacinthaceae	<i>Drimia sp.</i>
Hyacinthaceae	<i>Lachenalia giessii</i>
Hyacinthaceae	<i>Ledebouria sp.</i>
Hyacinthaceae	<i>Ornithogalum glandulosum</i>
Hyacinthaceae	<i>Ornithogalum pruinosum</i>
Hyacinthaceae	<i>Ornithogalum sp.</i>
Hyacinthaceae	<i>Schizobasis sp.</i>
Hyacinthaceae	<i>Whiteheadia bifolia</i>
Iridaceae	<i>Gladiolus saccatus</i>
Iridaceae	<i>Hesperantha rupicola</i>
Iridaceae	<i>Lapeirousia plicata</i>
Iridaceae	<i>Moraea fugax</i>
Iridaceae	<i>Tritonia karoocica</i>
Juncaceae	<i>Juncus krausii</i>
Poaceae	<i>Aristida adscensionis</i>
Poaceae	<i>Aristida congesta subsp. congesta</i>
Poaceae	<i>Aristida sp</i>
Poaceae	<i>Cenchrus ciliaris</i>
Poaceae	<i>Digitaria eriantha</i>
Poaceae	<i>Ehrharta calycina</i>
Poaceae	<i>Enneapogon cenchroides</i>
Poaceae	<i>Enneapogon desvauxii</i>
Poaceae	<i>Enneapogon scaber</i>
Poaceae	<i>Eragrostis annulata</i>
Poaceae	<i>Eragrostis curvula</i>
Poaceae	<i>Eragrostis nindensis</i>
Poaceae	<i>Oropetium capense</i>
Poaceae	<i>Panicum arbusculum</i>
Poaceae	<i>Phragmites australis</i>
Poaceae	<i>Schmidtia kalahariensis</i>
Poaceae	<i>Sporobolus nervosus</i>
Poaceae	<i>Stipagrostis aff. namaquensis</i>
Poaceae	<i>Stipagrostis anomala</i>
Poaceae	<i>Stipagrostis brevifolia</i>
Poaceae	<i>Stipagrostis cf. uniplumis</i>
Poaceae	<i>Stipagrostis ciliata</i>
Poaceae	<i>Stipagrostis namaquensis</i>
Poaceae	<i>Stipagrostis obtusa</i>
Poaceae	<i>Stipagrostis sp.</i>
Poaceae	<i>Stipagrostis uniplumis var. uniplumis</i>
Pteridophyta	<i>Ceterach cordatum</i>
Pteridophyta	<i>Cheilanthes deltoidea</i>

Pella Bulk Water Pipeline

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Pteridophyta	<i>Cheilanthes namaquensis</i>