

APPENDIX D: SPECIALIST REPORT

APPENDIX D1: BIODIVERSITY DESKTOP ASSESSMENT



Biodiversity Desktop Assessment for the Pella Bulk Water Pipeline Project

Pella, Northern Cape

January 2020

CLIENT



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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;
- 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;
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- 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).



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.

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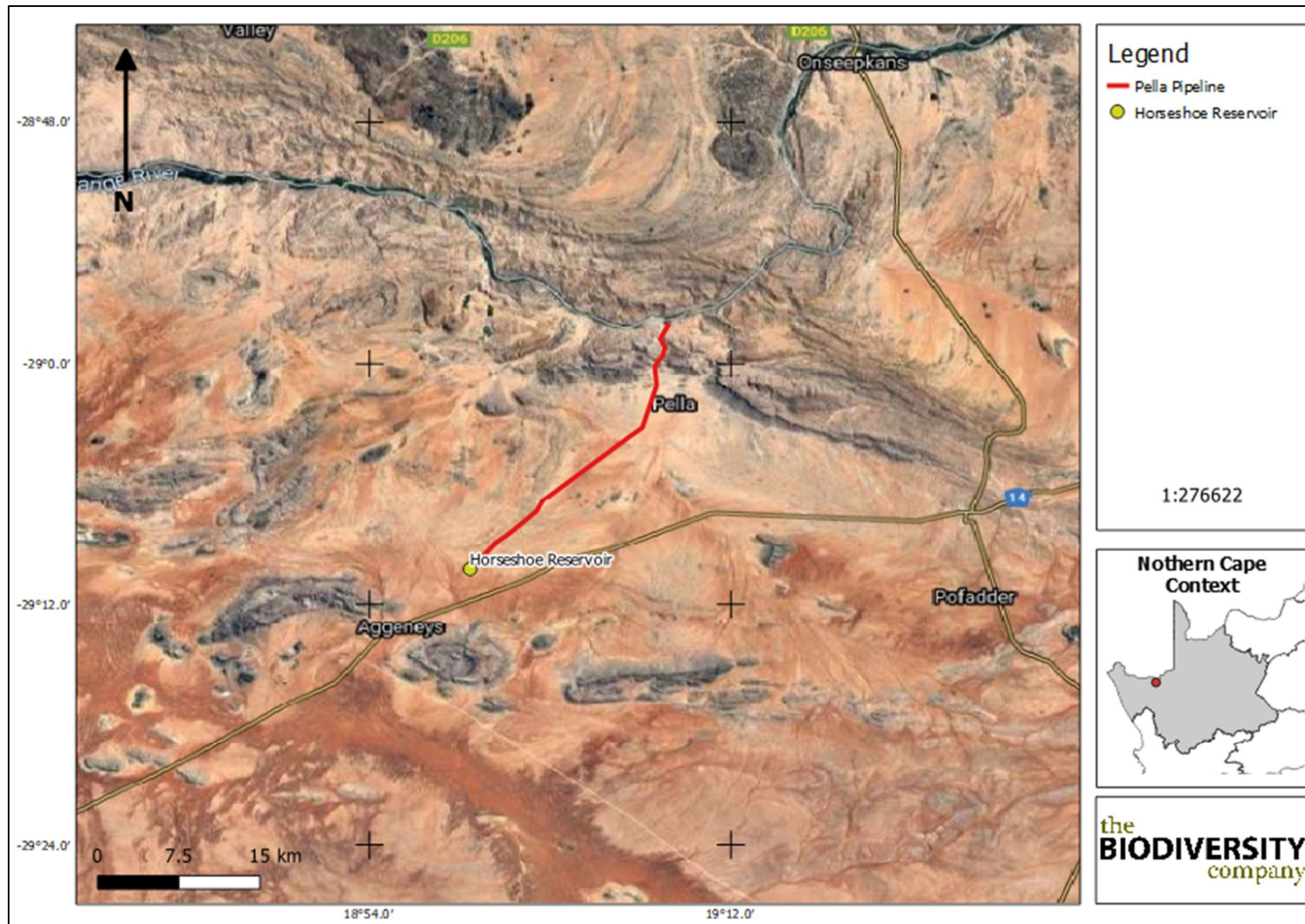


Figure 1 The general location of the proposed Pella Bulk Water Pipeline Project Area

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) (EWT, 2016); and
- Animal Demography Unit (ADU) - MammalMap Category (MammalMap, 2017) (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);
- 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);
- 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*

INTERNATIONAL	<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>
NATIONAL	<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>
PROVINCIAL	<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

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NBA: Ecosystem Protection Level	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
Protected Areas	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).	-
SKEP Priority Area	The project area falls across the Bushmanland Inselberg SKEP (SKEP, 2013)	7.4
Important Bird and Biodiversity Areas	The project area is found within 10km of the Haramoep and Black Mountain Mine IBA	8.1.2.1.1
NFEPA Wetlands and Rivers	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 Nieuwoudville) (2008); and
- Richtersveld Municipality Biodiversity Assessment (2012).

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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

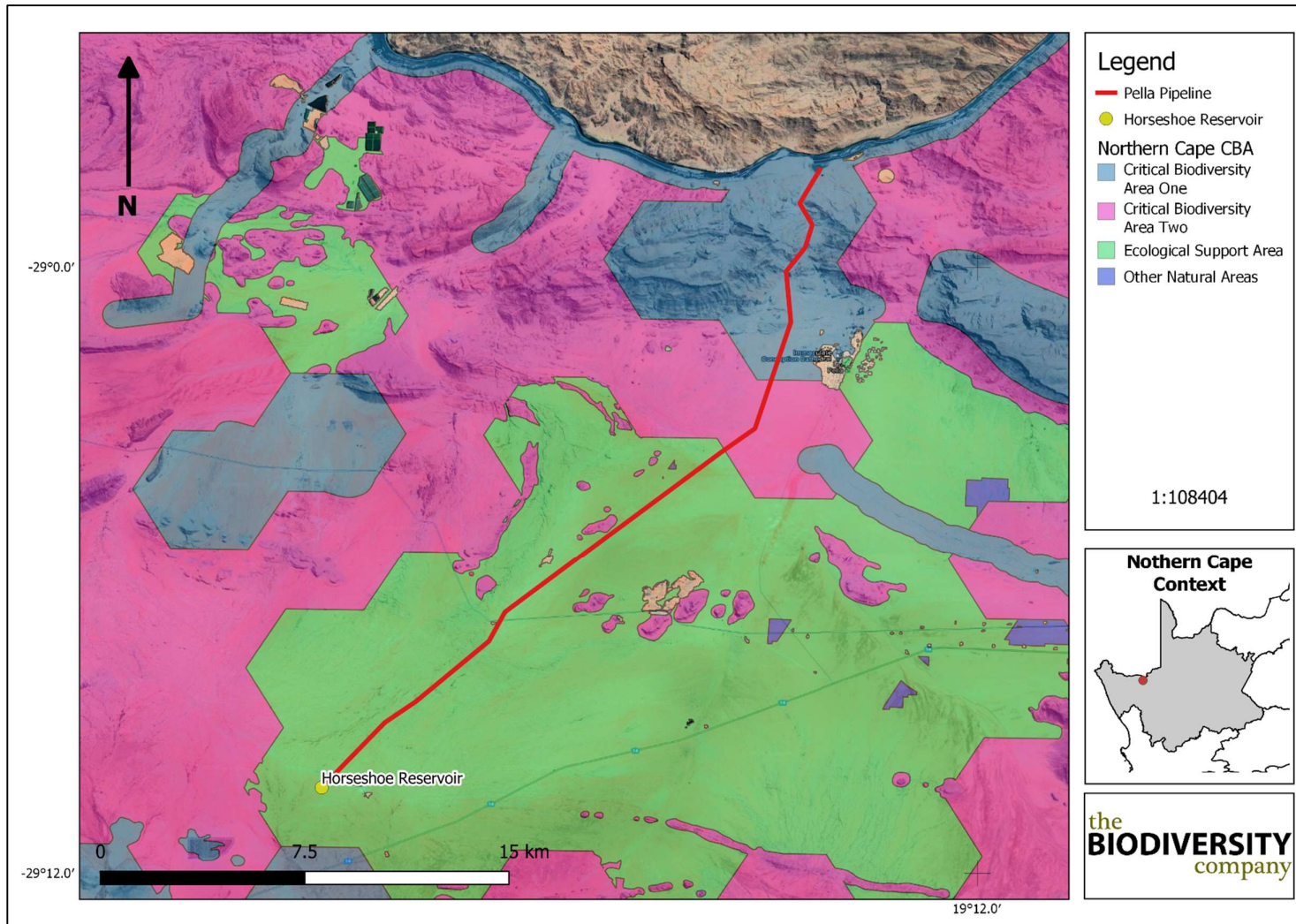


Figure 2 The proposed Pella Bulk Water Pipeline Project Area superimposed on the Northern Cape C-plan (SANBI, 2017a)

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 (km²) 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.

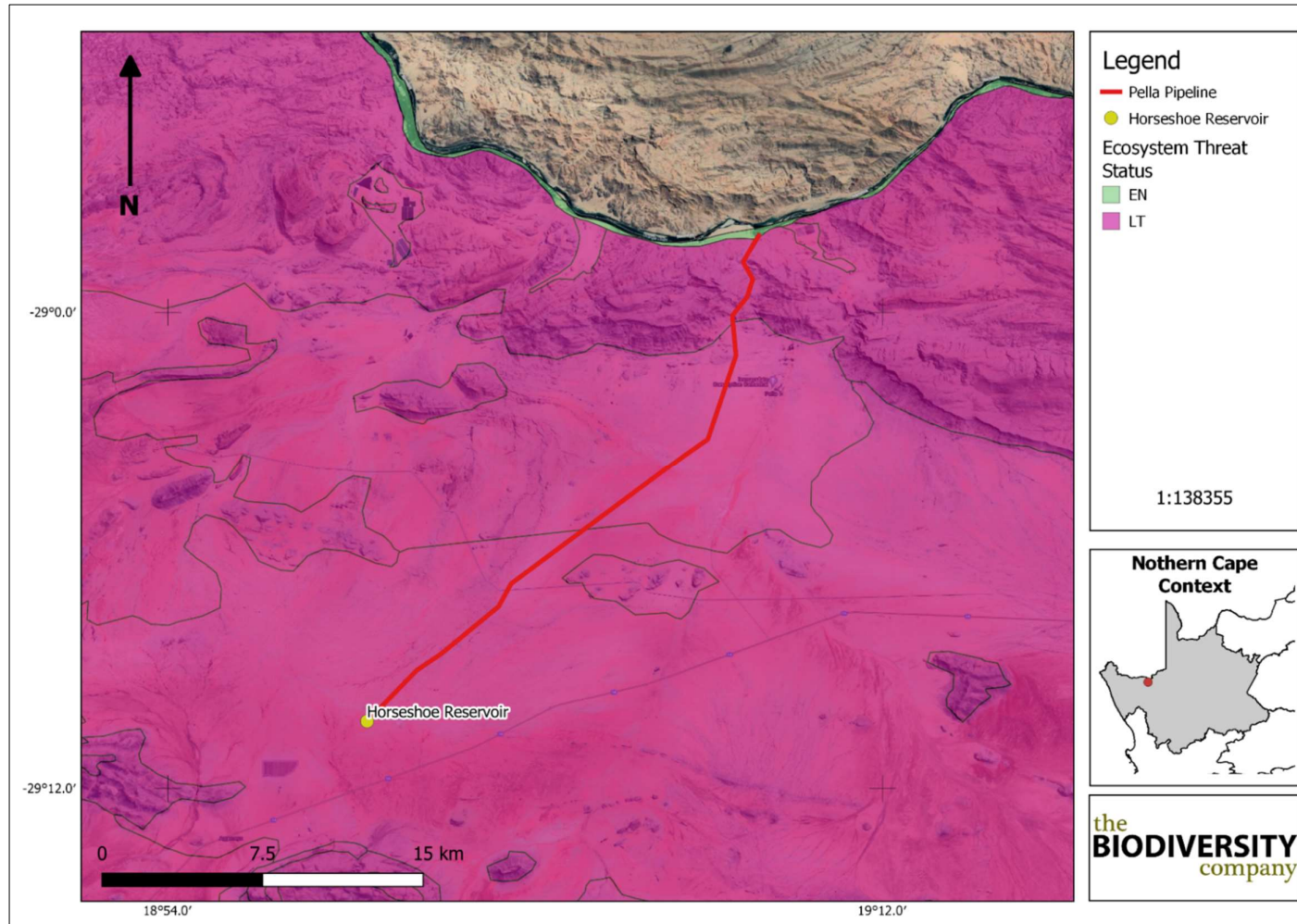


Figure 3 The proposed Pella Bulk Water Pipeline Project Area showing the ecosystem threat status of the associated terrestrial ecosystems (NBA, 2018)

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).

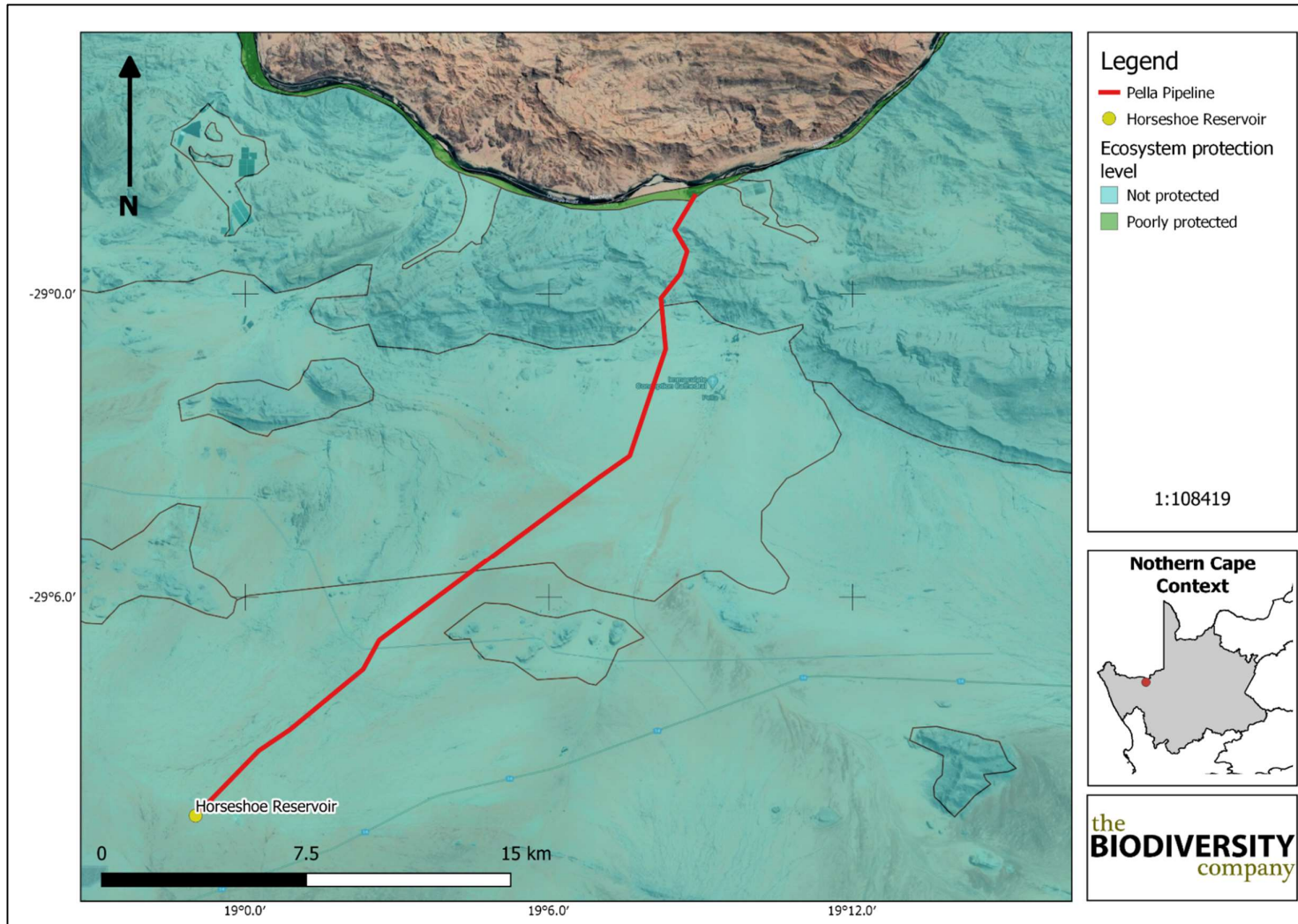


Figure 4 The proposed Pella Bulk Water Pipeline Project Area showing the level of protection of terrestrial ecosystems (NBA, 2018)

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.

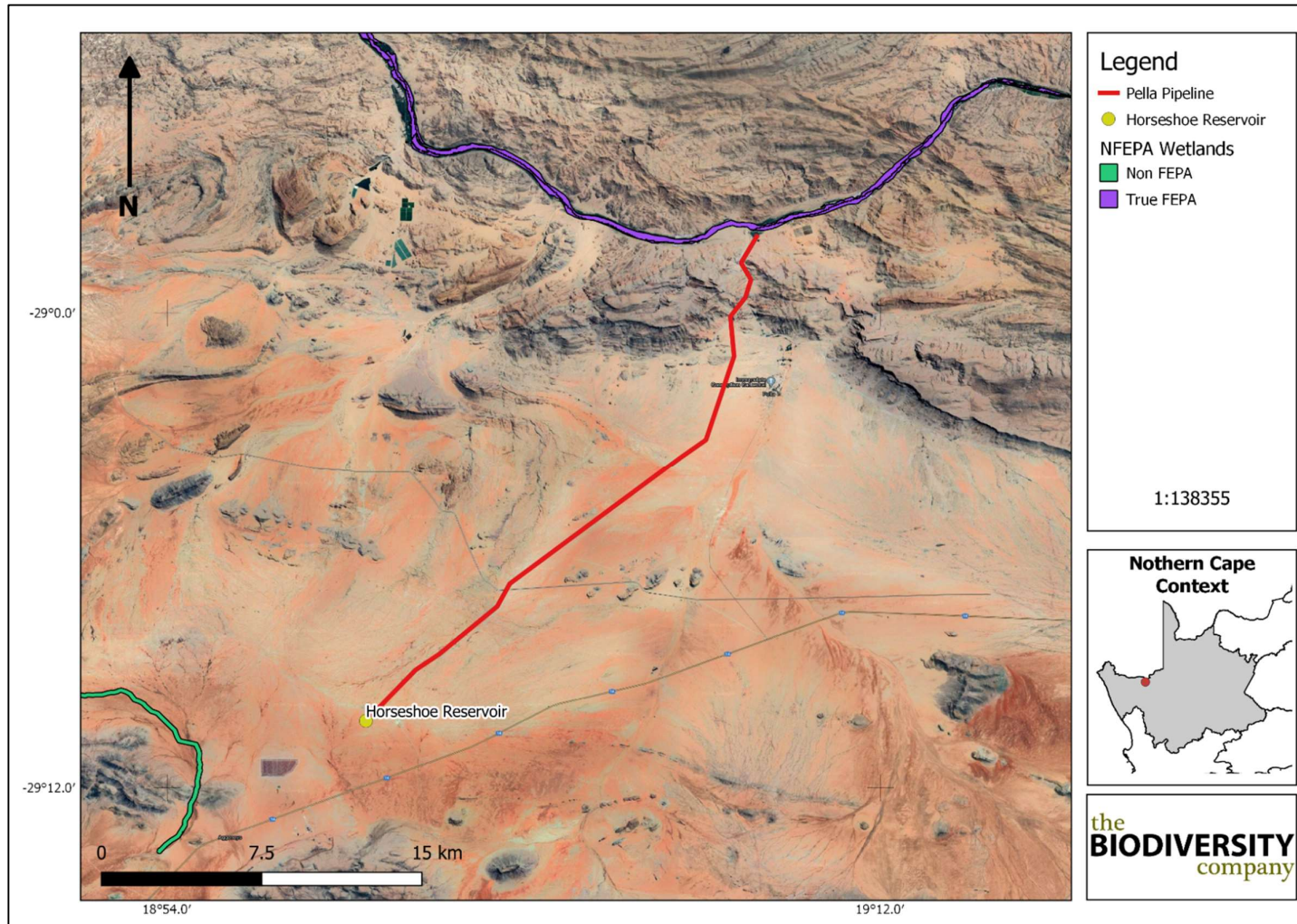


Figure 5 The proposed Pella Bulk Water Pipeline Project Area in relation to the National Freshwater Ecosystem Priority Areas (NFEPA, 2011)

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).

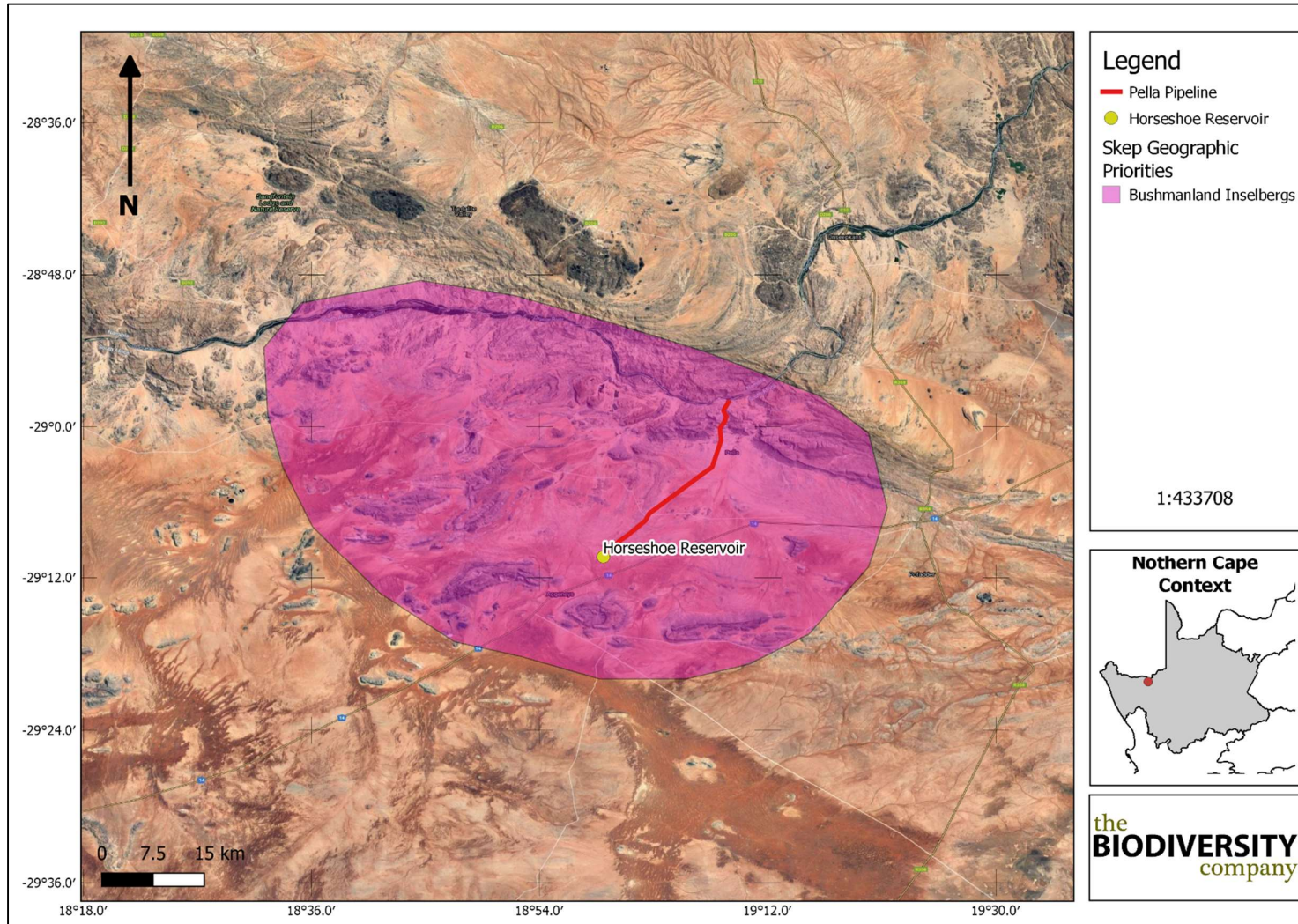


Figure 6 The proposed Pella Bulk Water Pipeline Project Area superimposed on the SKEP spatial dataset (2013)

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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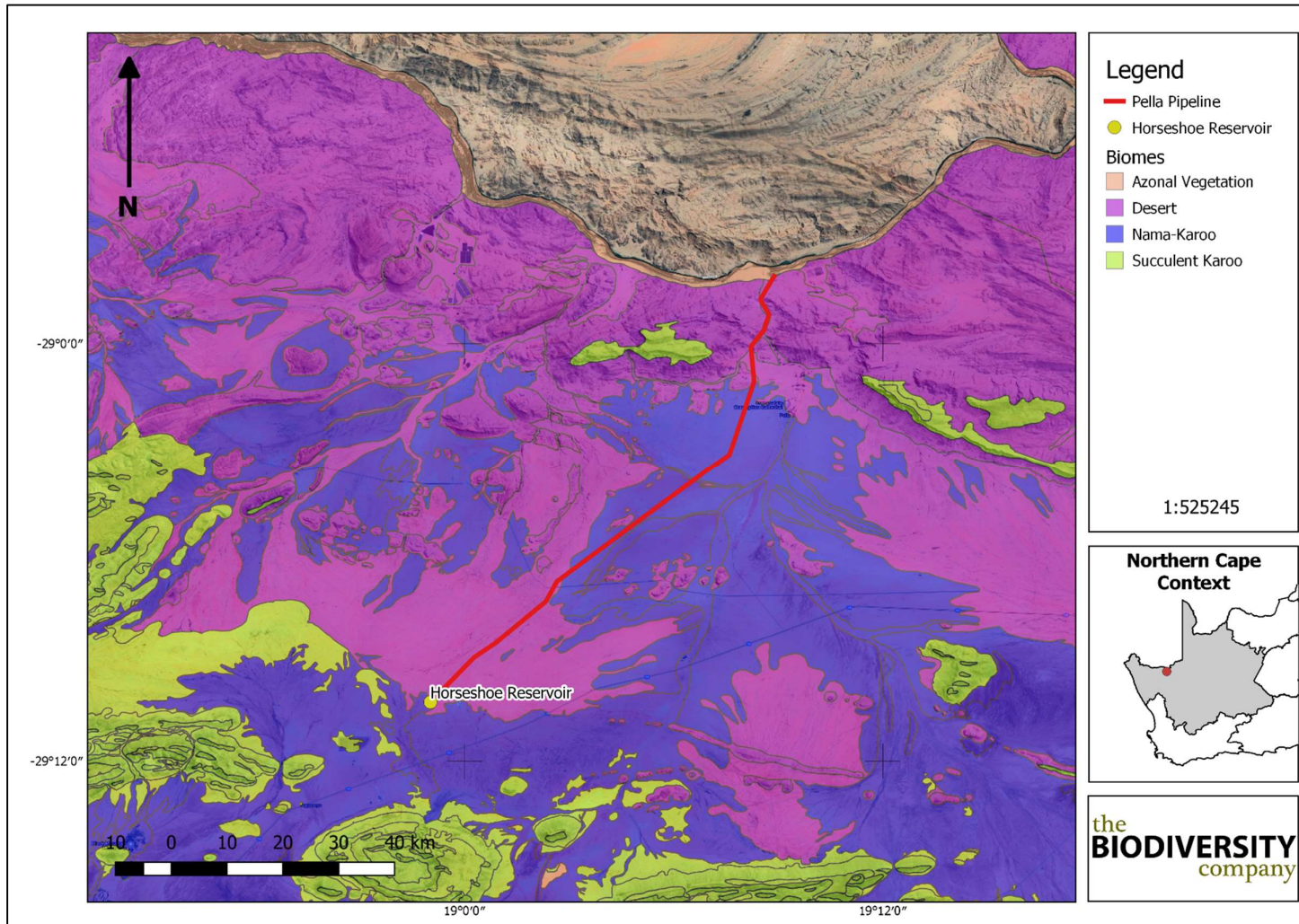


Figure 7 The project area in relation to the biomes of South Africa South Africa, Lesotho & Swaziland (BGIS, 2018)

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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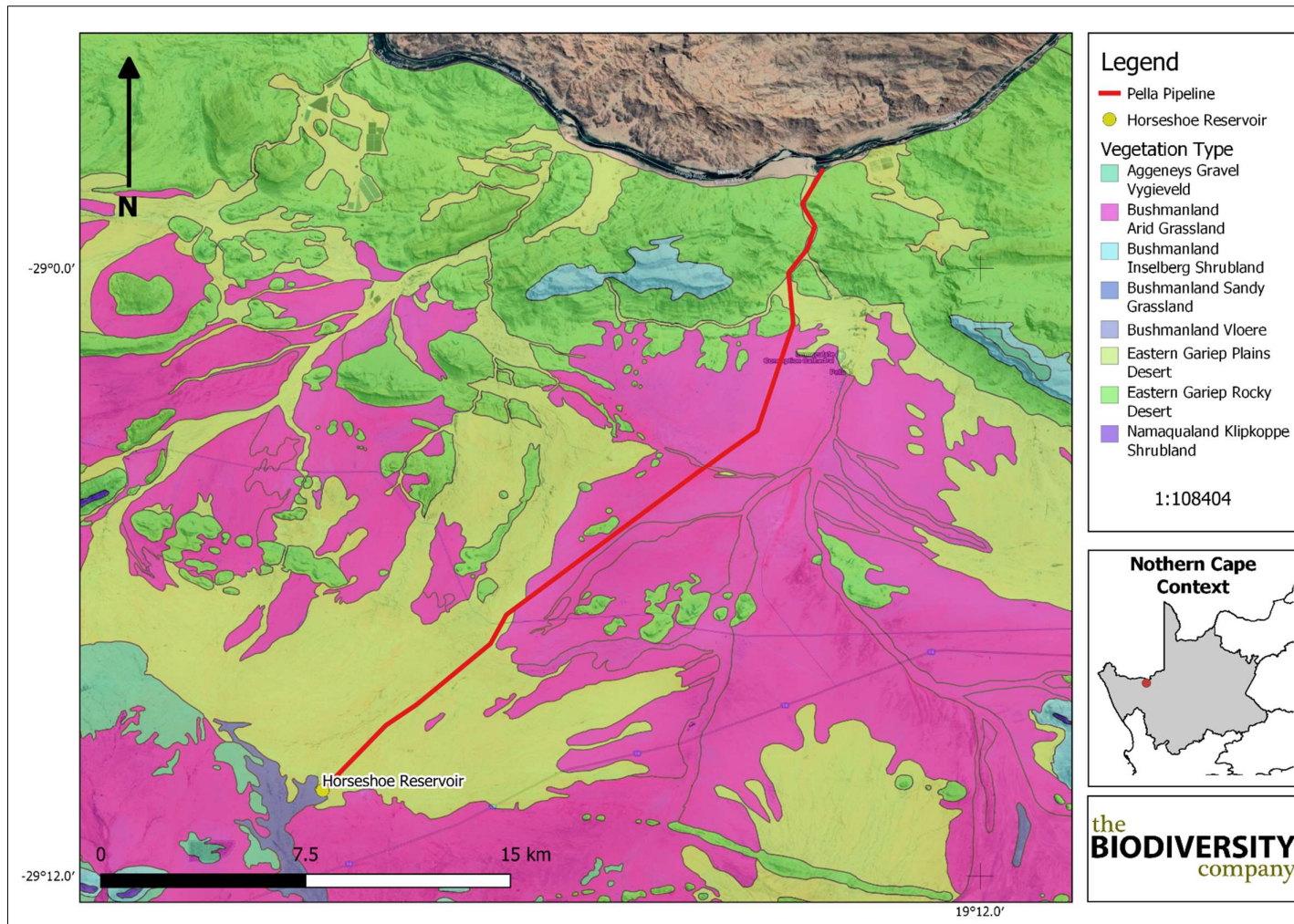


Figure 8 The project area showing the vegetation type based on the Vegetation Map of South Africa, Lesotho & Swaziland (BGIS, 2018)

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 (^WWestern and ^EEastern 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*^E, *E. porosa*^E, *E. procumbens*, *Panicum lanipes*^E, *Setaria verticillata*^E, *Sporobolus nervosus*, *Stipagrostis brevifolia*^W, *S. uniplumis*, *Tragus berteronianus*, *T. racemosus*^E.

Small Trees: *Acacia mellifera* subsp. *detinens*^E, *Boscia foetida* subsp. *foetida*.

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

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

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

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

Succulent Herbs: *Gisekia pharnacioides*^E, *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)
Aggeneys Gravel Vygieveld					8 515,75
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					
Bushman Inselberg					3 623,26
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
Arid Grasslands					7 718,45
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
Mobile sandy dunes; Flexible LC	71,03			112,33	71,03
Azonal habitats					1 735,63
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					-
Total	7 980,98	4 535,87	5 049,13	4 278,09	21 664,12

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).

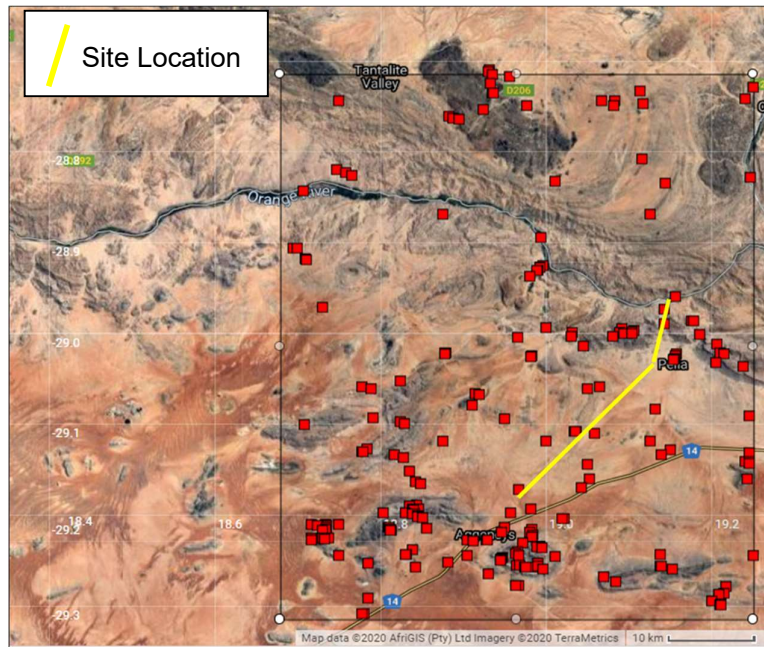


Figure 9 Map showing the grid drawn to compile an expected species list (BODATSA-POSA, 2016)

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 marmorolepis</i>	NT		Indigenous; Endemic	Grows in Sandveld.
Aizoaceae	<i>Lithops dinteri subsp. frederici</i>	VU		Indigenous; Endemic	Grows in barren mineral 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 naboroupp* (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 tracterac* (Tracterac 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 impetuanii* (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* (Pririt 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.

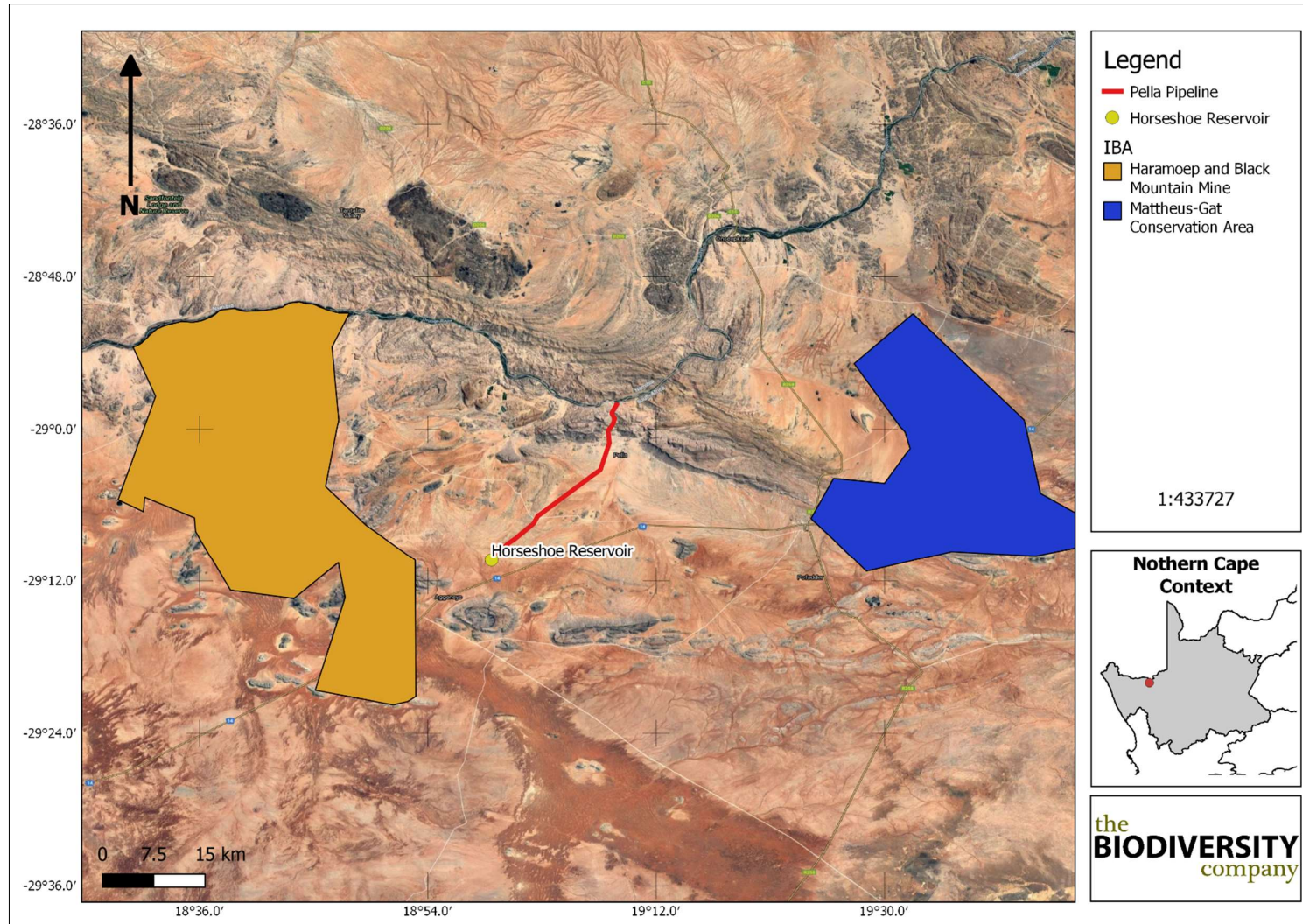


Figure 10 The project area in relation to defined IBAs (Birdlife, 2017)

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>Parahyaena 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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	L	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.
	VL	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.
	VL+	Negligible change or improvement. Almost no benefits. Change not measurable/will remain in the current range.
	L+	Minor change or improvement. Minor benefits. Change not measurable/will remain in the current range. Few people will experience benefits.
	M+	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.
	H+	Prominent change or improvement. Real and substantial benefits. Will be better than current conditions. Many people will experience benefits. General community support.
	VH+	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.
Criteria for ranking the DURATION of impacts	VL	Very short, always less than a year. Quickly reversible
	L	Short-term, occurs for more than 1 but less than 5 years. Reversible over time.
	M	Medium-term, 5 to 10 years.
	H	Long term, between 10 and 20 years. (Likely to cease at the end of the operational life of the activity)
	VH	Very long, permanent, +20 years (Irreversible. Beyond closure)
Criteria for ranking the EXTENT of impacts	VL	A part of the site/property.
	L	Whole site.
	M	Beyond the site boundary, affecting immediate neighbours
	H	Local area, extending far beyond site boundary.
	VH	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	
Significance	Decision guideline
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					Significance (S)
			Intensity (I)	Duration (D)	Extent (E)	Probability	Consequences (C)	
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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Disturbance of surface vegetation	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
Disturbance of surface vegetation	Flora	Loss of Threatened or Protected Species, Protected species and Protected trees	H	M	VH	H	H	H
Maintenance of the system	Biodiversity	Disturbance and mortalities of species due to maintenance of the system	H	L	M	H	M	M
Wind and stormwater over disturbed area	Flora	Erosion due to the disturbed area	H	H	H	H	H	H
Conducting maintenance	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

Disturbance of vegetation for the removal of the pipeline and removal of the contractor camps	Flora	Destruction of, and fragmentation of, portions of the vegetation community	H	L	L	H	M	H
Disturbance of vegetation for the removal of the pipeline and removal of the contractor camps	Flora	Loss of Threatened or Protected Species, Protected species and Protected trees	H	M	VH	H	H	H
Removal of pipeline and associated infrastructure	Biodiversity	Loss of CBA1, CBA2, ESA, sections of and SKEP	H	M	VH	H	H	H
Removal 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

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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Installation of pipeline and associated infrastructure	Flora	Loss of Threatened or Protected Species, Protected species and Protected trees	H	L	M	M	M	L
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.	L	L	L	L	L	VL
Operational Phase								
Disturbance of surface vegetation	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
Maintenance of the system	Biodiversity	Disturbance and mortalities of species due to maintenance of the system	L	L	L	L	L	VL
Wind and stormwater over disturbed area	Flora	Erosion due to the disturbed area	L	L	L	L	L	VL
Maintenance of the system	Flora	Loss of Threatened or Protected Species, Protected species and Protected trees	L	L	L	L	L	VL
Conducting maintenance	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
Decommissioning and Rehabilitation								
Disturbance of vegetation for the removal of the pipeline	Flora	Destruction of, and fragmentation of, portions of the vegetation community	M	L	L	M	M	L
Disturbance of vegetation for the	Flora	Loss of Threatened or Protected Species, Protected species and Protected trees	H	L	M	M	M	L

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removal of the pipeline								
Removal of pipeline and associated infrastructure	Biodiversity	Loss of CBA1, CBA2, ESA, sections of SKEP	H	L	M	M	M	L
Removal 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.	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>				
Fabaceae	<i>Bauhinia bowkeri</i>	NT	Indigenous; Endemic		
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>Crassosiphon 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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Amaranthaceae	<i>Hermbsstaedtia glauca</i>	LC	Indigenous		
Iridaceae	<i>Hesperantha rupicola</i>	LC	Indigenous; Endemic	Sched 2	
Amaryllidaceae	<i>Hessea speciosa</i>	LC	Indigenous	Sched 2	
Malvaceae	<i>Hibiscus elliotiae</i>	LC	Indigenous		
Malvaceae	<i>Hibiscus engleri</i>	LC	Indigenous		
Asteraceae	<i>Hirpicium echinus</i>	LC	Indigenous		
Apocynaceae	<i>Hoodia alstonii</i>	LC	Indigenous	Sched 2	
Hydnoraceae	<i>Hydnora africana</i>	LC	Indigenous		
Orobanchaceae	<i>Hyobanche rubra</i>	LC	Indigenous		
Molluginaceae	<i>Hypertelis spergulacea</i>	LC	Indigenous		
Asteraceae	<i>Ifliga molluginoides</i>	LC	Indigenous		
Aizoaceae	<i>Ihlenfeldtia excavata</i>	LC	Indigenous; Endemic	Sched 2	
Aizoaceae	<i>Ihlenfeldtia vanzylii</i>	LC	Indigenous; Endemic	Sched 2	
Fabaceae	<i>Indigastrum argyroides</i>	LC	Indigenous		
Fabaceae	<i>Indigastrum niveum</i>		Indigenous		
Fabaceae	<i>Indigofera auricomata</i>	LC	Indigenous		
Fabaceae	<i>Indigofera heterotricha</i>	LC	Indigenous		
Fabaceae	<i>Indigofera heterotricha subsp. pechuelii</i>		Indigenous		
Fabaceae	<i>Indigofera meyeriana</i>	LC	Indigenous; Endemic		
Fabaceae	<i>Indigofera pungens</i>	LC	Indigenous		
Fabaceae	<i>Indigofera sp.</i>				
Cyperaceae	<i>Isolepis hemiuncialis</i>	LC	Indigenous		
Scrophulariaceae	<i>Jamesbrittenia aridicola</i>	LC	Indigenous	Sched 2	
Scrophulariaceae	<i>Jamesbrittenia maxii</i>	LC	Indigenous	Sched 2	
Scrophulariaceae	<i>Jamesbrittenia ramosissima</i>	LC	Indigenous	Sched 2	
Scrophulariaceae	<i>Jamesbrittenia sp.</i>			Sched 2	
Euphorbiaceae	<i>Jatropha orangeana</i>	LC	Indigenous	Sched 2	
Acanthaceae	<i>Justicia australis</i>		Indigenous		
Acanthaceae	<i>Justicia divaricata</i>		Indigenous		
Acanthaceae	<i>Justicia dregei</i>		Indigenous		
Acanthaceae	<i>Justicia guerkeana</i>	LC	Indigenous		
Acanthaceae	<i>Justicia incana</i>		Indigenous		
Acanthaceae	<i>Justicia leucoderme</i>		Indigenous		
Acanthaceae	<i>Justicia saxatilis</i>		Indigenous; Endemic		
Acanthaceae	<i>Justicia spartioides</i>		Indigenous		
Acanthaceae	<i>Justicia thymifolia</i>	LC	Indigenous; Endemic		
Cucurbitaceae	<i>Kedrostis capensis</i>	LC	Indigenous		
Kewaceae	<i>Kewa salsoloides</i>	LC	Indigenous		
Loasaceae	<i>Kissenia capensis</i>	LC	Indigenous		
Asteraceae	<i>Kleinia cephalophora</i>	LC	Indigenous		
Asteraceae	<i>Kleinia longiflora</i>	LC	Indigenous		
Rubiaceae	<i>Kohautia caespitosa subsp. brachyloba</i>	LC	Indigenous		
Hyacinthaceae	<i>Lachenalia giessii</i>		Indigenous		
Hyacinthaceae	<i>Lachenalia polypodantha</i>		Indigenous; Endemic	Sched 2	
Hyacinthaceae	<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</i> subsp. <i>littoralis</i>	LC	Indigenous	Sched 2
Iridaceae	<i>Lapeirousia plicata</i> subsp. <i>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</i> sp.			Sched 2
Hyacinthaceae	<i>Ledebouria</i> sp.			
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</i> sp.			Sched 1
Poaceae	<i>Leucophrys mesocoma</i>	LC	Indigenous	
Amaranthaceae	<i>Leucosphaera bainesii</i>	LC	Indigenous	
Limeaceae	<i>Limeum aethiopicum</i> var. <i>intermedium</i>	NE	Indigenous; Endemic	
Limeaceae	<i>Limeum aethiopicum</i> var. <i>lanceolatum</i>	NE	Indigenous	
Limeaceae	<i>Limeum arenicolum</i>	LC	Indigenous	
Limeaceae	<i>Limeum dinteri</i>	LC	Indigenous	
Aizoaceae	<i>Lithops dinteri</i> subsp. <i>frederici</i>	VU	Indigenous; Endemic	Sched 2
Aizoaceae	<i>Lithops olivacea</i>	VU	Indigenous; Endemic	Sched 2
Aizoaceae	<i>Lithops</i> sp.			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</i> subsp. <i>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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Aizoaceae	<i>Stomatium fulleri</i>	LC	Indigenous; Endemic	Sched 2
Molluginaceae	<i>Suessenguthiella scleranthoides</i>	LC	Indigenous	
Tamaricaceae	<i>Tamarix usneoides</i>	LC	Indigenous	
Loranthaceae	<i>Tapinanthus oleifolius</i>	LC	Indigenous	
Fabaceae	<i>Tephrosia dregeana</i> var. <i>dregeana</i>	LC	Indigenous	
Fabaceae	<i>Tephrosia limpopoensis</i>	LC	Indigenous	
Zygophyllaceae	<i>Tetraena microcarpa</i>		Indigenous	
Zygophyllaceae	<i>Tetraena retrofracta</i>		Indigenous	
Zygophyllaceae	<i>Tetraena rigida</i>		Indigenous	
Zygophyllaceae	<i>Tetraena simplex</i>		Indigenous	
Aizoaceae	<i>Tetragonia arbuscula</i>	LC	Indigenous	Sched 2
Aizoaceae	<i>Tetragonia reduplicata</i>	LC	Indigenous	Sched 2
Aizoaceae	<i>Tetragonia</i> sp.			Sched 2
Pottiaceae	<i>Tortula atrovirens</i>		Indigenous	
Asphodelaceae	<i>Trachyandra divaricata</i>	LC	Indigenous; Endemic	Sched 2
Asphodelaceae	<i>Trachyandra jacquiniana</i>	LC	Indigenous; Endemic	Sched 2
Asphodelaceae	<i>Trachyandra laxa</i> var. <i>laxa</i>	LC	Indigenous	Sched 2
Asphodelaceae	<i>Trachyandra</i> sp.			Sched 2
Poaceae	<i>Tragus berteronianus</i>	LC	Indigenous	
Aizoaceae	<i>Trianthera parvifolia</i>		Indigenous	Sched 2
Aizoaceae	<i>Trianthera parvifolia</i> var. <i>parvifolia</i>	LC	Indigenous	Sched 2
Aizoaceae	<i>Trianthera parvifolia</i> var. <i>rubens</i>	LC	Indigenous	Sched 2
Zygophyllaceae	<i>Tribulus cristatus</i>	LC	Indigenous	
Zygophyllaceae	<i>Tribulus pterophorus</i>	LC	Indigenous	
Zygophyllaceae	<i>Tribulus terrestris</i>	LC	Indigenous	
Zygophyllaceae	<i>Tribulus zeyheri</i> subsp. <i>zeyheri</i>	LC	Indigenous	
Boraginaceae	<i>Trichodesma africanum</i>	LC	Indigenous	
Aizoaceae	<i>Trichodiadema littlewoodii</i>	LC	Indigenous	Sched 2
Aizoaceae	<i>Trichodiadema setuliferum</i>	LC	Indigenous; Endemic	Sched 2
Aizoaceae	<i>Trichodiadema</i> sp.			Sched 2
Poaceae	<i>Tricholaena capensis</i> subsp. <i>capensis</i>	LC	Indigenous	
Poaceae	<i>Tricholaena monachne</i>	LC	Indigenous	
Pottiaceae	<i>Trichostomum brachydontium</i>		Indigenous	
Poaceae	<i>Triraphis ramosissima</i>	LC	Indigenous	
Iridaceae	<i>Tritonia karoocica</i>	LC	Indigenous; Endemic	Sched 2
Cucurbitaceae	<i>Trochomeria debilis</i>	LC	Indigenous	
Crassulaceae	<i>Tylecodon reticulatus</i>		Indigenous	Sched 2
Crassulaceae	<i>Tylecodon reticulatus</i> subsp. <i>phyllopodium</i>	LC	Indigenous	Sched 2
Crassulaceae	<i>Tylecodon reticulatus</i> subsp. <i>reticulatus</i>	LC	Indigenous	Sched 2
Crassulaceae	<i>Tylecodon rubrovenosus</i>	LC	Indigenous	Sched 2
Crassulaceae	<i>Tylecodon</i> sp.			Sched 2
Crassulaceae	<i>Tylecodon sulphureus</i>		Indigenous; Endemic	Sched 2
Crassulaceae	<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>Wellstedia dinteri</i>		Indigenous		
Boraginaceae	<i>Wellstedia 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 rufufuscus</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 lineoocellata lineoocellata</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

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<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

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<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)
Avian			
<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
Mammals			
<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

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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, Pirit	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
Mammals			
<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
Reptiles			
<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
Amphibians			
<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. meiziana</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>Piaranthus decorus</i> subsp. <i>cornutus</i>
Apocynaceae	<i>Piaranthus 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>

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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>

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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>

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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>Nymanya 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>

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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 muricinux</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</i> sp.
Hyacinthaceae	<i>Lachenalia giessii</i>
Hyacinthaceae	<i>Ledebouria</i> sp.
Hyacinthaceae	<i>Ornithogalum glandulosum</i>
Hyacinthaceae	<i>Ornithogalum pruinosum</i>
Hyacinthaceae	<i>Ornithogalum</i> sp.
Hyacinthaceae	<i>Schizobasis</i> sp.
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</i> subsp. <i>congesta</i>
Poaceae	<i>Aristida</i> sp.
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</i> aff. <i>namaquensis</i>
Poaceae	<i>Stipagrostis anomala</i>
Poaceae	<i>Stipagrostis brevifolia</i>
Poaceae	<i>Stipagrostis</i> cf. <i>uniplumis</i>
Poaceae	<i>Stipagrostis ciliata</i>
Poaceae	<i>Stipagrostis namaquensis</i>
Poaceae	<i>Stipagrostis obtusa</i>
Poaceae	<i>Stipagrostis</i> sp.
Poaceae	<i>Stipagrostis uniplumis</i> var. <i>uniplumis</i>
Pteridophyta	<i>Ceterach cordatum</i>
Pteridophyta	<i>Cheilanthes deltoidea</i>

The following is a summary of species that could possibly trigger a permit application in the project area associated with the upgrade of the pipeline in the Pela area. As per the TBC 2020 desktop report the following species of conservation concern could possibly occur in the area (Table 1- Table 5). A full list of the species likely to be encountered in the project area was included in the report under Appendix A-E. The lists and likelihoods of occurrences are based solely on desktop information. It should also be noted that some of the species listed in the full list of species (Appendix A-E) are provincially protected and will also require a permit (as per the lists included below for Schedule 1 (Table 6) and Schedule 2 (Table 7) of the Northern Cape conservation act no. 9 of 2009) should they be encountered on site. Ocean based species has been removed from Table 6 and Table 7 and all other species including species that would be restricted to protected areas are still presented below. Should any of these species or their ovum in the case of herpetofauna and avifauna be found they will need to be relocated.

Table 1: Flora species of conservation concern expected to occur in the project area

Family	Taxon	Author	IUCN	Ecology	Habitat requirements
Aizoaceae	<i>Conophytum limpidum</i>	S.A.Hammer	NT	Indigenous; Endemic	It grows on quartz slopes and on sheer faces, usually half shaded.
Fabaceae	<i>Crotalaria pearsonii</i>	Baker f.	VU	Indigenous; Endemic	Found along the Orange river
Apocynaceae	<i>Ectadium virgatum</i>	E.Mey.	NT	Indigenous	Grows in dry areas
Asteraceae	<i>Helichrysum marmarolepis</i>	S.Moore	NT	Indigenous; Endemic	Grows in Sandveld.
Aizoaceae	<i>Lithops dinteri subsp. frederici</i>	Schwantes	VU	Indigenous; Endemic	Grows in barren minerals terrains
Aizoaceae	<i>Lithops olivacea</i>	L.Bolus	VU	Indigenous; Endemic	Grows in quartz plains

Table 2: Avifauna species of conservation concern expected to occur in the project area

Species	Common Name	Conservation Status		Likelihood of occurrence
		Regional (SANBI, 2016)	IUCN (2017)	
<i>Aquila verreauxii</i>	Eagle, Verreaux's	VU	LC	Low
<i>Calendulauda burra</i>	Lark, Red	VU	VU	High
<i>Cursorius rufus</i>	Cursorer, 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

Table 3: Mammal species of conservation concern expected to occur in the project area

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	Moderate
<i>Parahyaena brunnea</i>	Brown Hyaena	NT	NT	High
<i>Parotomys littledalei</i>	Littledale's Whistling Rat	NT	LC	High

Table 4: Reptile species of conservation concern expected to 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

Table 5: Amphibian species of conservation concern expected to occur 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

Table 6: Specially protected species in Schedule 1

Schedule 1	
SPECIALLY PROTECTED	SPECIES
Scientific name	Common
FAUNA	
CLASS: MAMMALIA	
Order: CARNIVORA	
<i>Acinonyx jubatus</i> Cheetah	
<i>Cants adustus</i>	Side-striped jackal
<i>Civettictis civetta</i>	African civet
<i>Crocuta crocuta</i>	Spotted hyaena
<i>Felis nigripes</i>	Black-footed cat



<i>Felis silvestris</i>	African wild cat
<i>Ictonyx striatus</i>	Striped polecat
<i>Leptailurus serval</i>	Serval
<i>Lutra maculicollis</i>	Spotted-necked otter
<i>Lycaon pictus</i>	African Wild dog
<i>Mellivora capensis</i>	Honey badger
<i>Otocyon megalotis</i>	Bat-eared fox
<i>Panthera leo</i>	Lion
<i>Panthera pardus</i>	Leopard
<i>Paracynictis selousi</i>	Selous' mongoose
<i>Parahyaena brunnea</i>	Brown hyaena
<i>Poecilogale albinucha</i>	mongoose Strip
<i>Proteles cristatus</i>	Aardwolf
<i>Rhynchogale melleri</i>	Meller's mongoose
<i>Vulpes chama</i>	Silver Jackal
Order: EULIPOTYPHILA (insectivora)	
<i>Atelerix frontalis</i>	Southern African
Order: LAGOMORPHA	
<i>Bunolagus monticularis</i>	Riverine rabbit
Order: PERISSODACTYLA	
<i>Ceratotherium simum</i>	White Rhino
<i>Diceros bicornis</i>	Black Rhino
<i>Equus zebra hartmannae</i>	Hartmann's mountain
<i>Equus zebra zebra</i>	Cape mountain zebra
Order: PHOLIDOTA	
<i>Manis temminckii</i>	African Scaly anteater
Order: PRIMATES	
<i>Cercopithecus albogularis</i>	Samango monkey
<i>Galago moholi</i>	Lesser bushbaby
<i>Otolemur crassicaudatus</i>	Thick tailed Galago
Order: TUBULIDENTATA	
<i>Orycteropus afer</i>	Aardvark / Ant-bear
CLASS: AVES	
Order: ANSERIFORMES	All migratory exotic species of anseriformes
Order: BUSEROTIFORMES	
<i>Bucorvus leadbeateri</i>	Southern Ground hornbill
Order: CHARADRIIFORMES	
<i>Charadrius pallidus</i>	Chestnut-banded Plover
<i>Glareola nordmanni</i>	Black-winged Praticole



<i>Glareola pratincola</i>	Collared pratincole
<i>Haematopus moquini</i>	African Black Oystercatcher
<i>Rostratula benghalensis</i>	Greater Painted snipe
<i>Sterna balaenarum</i>	Damara Tern
<i>Sterna caspia</i>	Caspian Tern
Order: CICONIIFORMES	
<i>Ciconia nigra</i>	Black Stork
<i>Ephippiorhynchus senegalensis</i>	Saddlebill Stork
<i>Geronticus calvus</i>	Southern Bald Ibis
<i>Gorsachius leuconotus</i>	Whitebacked Night Heron
<i>Leptoptilos crumeniferus</i>	Marabou Stork
<i>Mycteria ibis</i>	Yellowbilled Stork
<i>Pelecanus onocrotalus</i>	Great White Pelican
<i>Pelecanus rufescens</i>	Pink-backed Pelican
<i>Phalacrocorax capensis</i>	Cape Cormorant
<i>Phalacrocorax coronatus</i>	Crowned Cormorant
<i>Phalacrocorax neglectus</i>	Bank Cormorant
<i>Phoenicopterus minor</i>	Lesser Flamingo
<i>Phoenicopterus ruber</i>	Greater Flamingo
Order: FALCONIFORMES	
<i>Accipiter badius</i>	Shikra
<i>Accipiter melanoleucus</i>	Black Sparrow-hawk
<i>Accipiter minullus</i>	Little Sparrow-hawk
<i>Accipiter ovampensis</i>	Ovambo Sparrow-hawk
<i>Accipiter rufiventris</i>	Rufous-chested Sparrow-hawk
<i>Accipiter tachiro</i>	African Goshawk
<i>Aegypius occipitalis</i>	White-headed Vulture
<i>Aegypius tracheliotus</i>	Lapped-faced Vulture
<i>Aquila ayresii</i>	Ayres's Hawk-Eagle
<i>Aquila nipalensis</i>	Steppe Eagle
<i>Aquila pennatus</i>	Booted Eagle
<i>Aquila pomarina</i>	Lesser Spotted Eagle
<i>Aquila rapax</i>	Tawny Eagle
<i>Aquila spilogaster</i>	African Hawk-Eagle
<i>Aquila verreauxii</i>	Verreaux's Eagle
<i>Aquila wahlbergi</i>	Wahlberg's Eagle
<i>Aviceda cuculoides</i>	African Cuckoo Hawk
<i>Buteo augur</i>	Augur Buzzard
<i>Buteo rufinus</i>	Long-legged Buzzard



<i>Buteo rufofuscus</i>	Jackal Buzzard
<i>Buteo trizonatus</i>	Forest Buzzard
<i>Buteo vulpinus</i>	Steppe Buzzard
<i>Circaetus cinereus</i>	Brown Snake-Eagle
<i>Circaetus fasciolatus</i>	Southern Banded Snake-Eagle
<i>Circaetus pectoralis</i>	Blackchested Snake-Eagle
<i>Circus aeruginosus</i>	Western Marsh-Harrier
<i>Circus macrourus</i>	Pallid Harrier
<i>Circus maurus</i>	Black Harrier
<i>Circus pygargus</i>	Montagu's Harrier
<i>Circus ranivorus</i>	African Marsh-Harrier
<i>Elanus caeruleus</i>	Black-shouldered Kite
<i>Falco amurensis</i>	Amur Falcon
<i>Falco biarmicus</i>	Lanner Falcon
<i>Falco chicquera</i>	Rednecked Falcon
<i>Falco concolor</i>	Sooty Falcon
<i>Falco cuvierii</i>	African Hobby
<i>Falco dickinsoni</i>	Dickinson's Kestrel
<i>Falco eleonora</i>	Eleonora's Falcon
<i>Falco fasciinucha</i>	Taita Falcon
<i>Falco naumanni</i>	Lesser Kestrel
<i>Falco peregrinus</i>	Peregrine Falcon
<i>Falco rupicoloides</i>	Greater Kestrel
<i>Falco rupicolus</i>	Rock Kestrel
<i>Falco subbuteo</i>	Eurasian Hobby
<i>Falco vespertinus</i>	Redfooted Falcon
<i>Gypaetus barbatus</i>	Bearded Vulture
<i>Gypohierax angolensis</i>	Palmnut Vulture
<i>Gyps africanus</i>	Whitebacked Vulture
<i>Gyps coprotheres</i>	Cape Vulture
<i>Gyps rueppellii</i>	Rüppell's Vulture
<i>Haliaeetus vocifer</i>	African Fish-Eagle
<i>Kaupifalco monogrammicus</i>	Lizard Buzzard
<i>Lophaetus occipitalis</i>	Long-crested Eagle
<i>Macheirhamphus alcinus</i>	Bat Hawk
<i>Melierax canorus</i>	Southern Pale Chanting Goshawk
<i>Melierax gabar</i>	Gabar Goshawk
<i>Melierax metabates</i>	Dark Chanting Goshawk
<i>Milvus migrans</i>	Black Kite



<i>Necrosyrtes monachus</i>	Hooded Vulture
<i>Neophron percnopterus</i>	Egyptian Vulture
<i>Pandion haliaetus</i>	Osprey
<i>Pernis apivorus</i>	European Honey-Buzzard
<i>Polemaetus bellicosus</i>	Martial Eagle
<i>Polihierax semitorquatus</i>	Pygmy Falcon
<i>Polyboroides typus</i>	African Harrier-Hawk
<i>Sagittarius serpentarius</i>	Secretarybird
<i>Stephanoaetus coronatus</i>	African Crowned Eagle
<i>Terathopius ecaudatus</i>	Bateleur
<i>Neotis denhami</i>	Denham's Bustard
<i>Neotis ludwigii</i>	Ludwig's Bustard
Order: MUSOPHAGIFORMES	
<i>Tauraco corythaix</i>	Knysna Turaco
Order: PASSERIFORMES	
<i>Buphagus africanus</i>	Yellow-billed Oxpecker
<i>Buphagus erythrorhynchus</i>	Red-billed Oxpecker
<i>Calendulauda barlowi</i>	Barlow's Lark
<i>Calendulauda burra</i>	Red Lark
<i>Hirundo artrocaerulea</i>	Blue Swallow
<i>Hypargos margaritatus</i>	Pink-throated Twinspot
<i>Lamprotornis mevesii</i>	Meves's Starling
<i>Mandingoa nitidula</i>	Green Twinspot
<i>Spizocorys sclateri</i>	Sclater's Lark
Order: PSITTACIFORMES	
<i>Poicephalus robustus</i>	Cape Parrot
<i>Poicephalus fuscicollis</i>	Grey-headed Parrot
Order: STRIGIFORMES	
<i>Asio capensis</i>	Marsh Owl
<i>Bubo africanus</i>	Spotted Eagle-Owl
<i>Bubo capensis</i>	Cape Eagle-Owl
<i>Bubo lacteus</i>	Verreaux's Eagle-Owl
<i>Caprimulgus europaeus</i>	European Nightjar
<i>Caprimulgus fossii</i>	Square-tailed Nightjar
<i>Caprimulgus natalensis</i>	Swamp Nightjar
<i>Caprimulgus pectoralis</i>	Fiery-necked Nightjar
<i>Caprimulgus rufigena</i>	Rufous-cheeked Nightjar
<i>Caprimulgus tristigma</i>	Freckled Nightjar
<i>Glaucidium capense</i>	African Barred Owlet



<i>Glaucidium perlatum</i>	Pearl-spotted Owlet
<i>Macrodipteryx texillarius</i>	Pennant-winged Nightjar
<i>Otus senegalensis</i>	African Scops-Owl
<i>Ptilopsis granti</i>	Southern White-faced Scops-Owl
<i>Scotopelia peli</i>	Pel's Fishing Owl
<i>Strix woodfordii</i>	African Wood-Owl
<i>Tyto alba</i>	Barn Owl
<i>Tyto capensis</i>	African Gross-Owl
<i>Tyto capensis</i>	African Gross Owl
CLASS: REPTILIA	
Order: CHELONIA	
<i>Homopus signatus</i>	Southern Speckled Padloper
<i>Psammobates geometricus</i>	Geometric Tortoise
Order: SQUAMATA	
Family: Chamaeleonidae	Chamaeleons, all species
Family: Cordylidae	Girdled lizard, all species
<i>Bradypodion teaniabronchum</i>	Smith's Dwarf Chamaeleon
<i>Cordylus cataphractus</i>	Armadillo Girdled Lizard
<i>Cordylus giganteus</i>	Gaint Girdled Lizard
Family: Boideae	
<i>Python sebae</i>	African Rock Python
CLASS: AMPHIBIA	
<i>Cacosternum capense</i>	Cape Caco
<i>Microbatrachella capensis</i>	Micro Frog
<i>Pyxicephalus adspersus</i>	Giant Bullfrog
<i>Pyxicephalus edulus</i>	African Bullfrog
<i>Xenopus gilli</i>	Cape Platanna
CLASS: ARACHNIDA	
Order: MYGALOMORPHAE	
<i>Ceratogyrus spp.</i>	Horned Baboon Spiders, all species
<i>Harpactira spp.</i>	Common Baboon Spiders, all species
<i>Pterinochilus spp.</i>	
<i>Goldenbrown Baboon species</i>	Spiders, all
CLASS: INSECTA	
Order: COLEOPTERA	
<i>Circellium bacchus</i>	Cape dung beetle
<i>Colophon spp.</i>	Stag Beetles, all species
CLASS: ONYCHOPHORA	
All species	



FLORA

Family: AMARYLIDACEAE

Clivia mirabilis Oorlogskloof Bush Lily

Haemanthus graniticus

Hessea pusilla

Strumaria bidentata

Strumaria perryae

Family: ANACARDIACEAE

Ozoroa spp. All species

Family: APIACEAE

Centella tridentata

Chamarea snijmaniae

Family: APOCYNACEAE

Hoodia gordonii

Pachypodium namaquanum

Family: ASPHODELACEAE

Aloe buhrii

Aloe dichotoma

Aloe dichotoma var. *rumossima* Maiden quiver tree

Aloe dabenorisana Cliff aloe

Aloe erinacea

Aloe meyeri Cliff aloe

Aloe pearsonii Pearson aloe

Aloe pillansii Giant quiver tree

Trachyandra prolifera

Family: ASTERACEAE

Athanasia adenantha

Athanasia spathulata

Cotula filifolia

Euryops mirus

Euryops rosulatus

Euryops virgatus

Felicia diffusa subsp. *khamiesbergensis* subsp.

Othonna armiana

Family: CRASSULACEAE

Tylecodon torulosus

Family: DIOSCOREACEAE

Dioscorea spp. Elephant's foot all species

Family: ERIOSPERMACEAE



Eriospermum erinum

Eriospermum glaciale

Family: FABACEAE

Amphithalea obtusiloba

Lotanonis acutiflora

Lotononis polycephala

Lessertia spp.

Sceletium toruosum

Sutherlandia spp.

Cancer Bush, all species

Wilborgia fusca subsp. *marcocarpa*

macrocarpa

Family: GERANIACEAE

Pelargonium spp.

Pelargonium, all species

Family: HYACINTHACEAE

Drimia nana

Ornithogalum bicornutum

Ornithogalum inclusum

Family: IRIDACEAE

Babiana framesii

Ferraria kamiesbergensis

Freesia marginata

Geissorhiza subrigida

Hesperantha minima

Hesperantha oligantha

Hesperantha rivulicola

Lapeirousia verecunda

Moraea kamiesensis

Moraea namaquana

Romulea albiflora

Romulea discifera

Romulea maculate

Romulea rupestris

Family: MOLLUGINACEAE

Hypertelis trachysperma

Psammotropha spicata

Family: ORCHIDACEAE

Corycium ingeanum

Disa macrostachya

Family: OXALIDACEAE

Oxalis pseudohirta



Family: PEDALIACEAE

Harpagophytum spp. Devil's claw

Family: POACEAE

Prionanthium dentatum

Secale strictum subsp. africanum Wild rye

Family: PROTEACEAE

Leucadendron meyerianum

Mimetes spp. All species

Orothamnus zeyheri

Family: ROSACEAE

Cliffortia arborea Sterboom

Family: SCROPHULARIACEAE

Charadrophila capensis Cape Gloxinia

Family: STANGERIACEAE

Stangeria spp. Cycad's, All species

Family: ZAMIACEAE

Encephalartos spp. Cycad's, All species

Table 7: Protected species Schedule 2

Schedule 2 PROTECTED SPECIES

FAUNA

CLASS: MAMMALIA

Order: AFROSORICIDA

Amblysomus corriae Fynbos golden mole

Amblysomus hottentotus Hottentot golden

Amblysomus marleyi Marley's golden mole

Amblysomus robustus Robust golden mole

Amblysomus septentrionalis Highveld Golden Mole

Calcochloris obtusirostris Yellow golden mole

Chlorotalpa duthieae Duthie's golden mole

Chlorotalpa sclateri Sclater's golden mole

Chrysochloris asiatica Cape golden mole

Chrysochloris visagiei Visagie's golden mole

Chrysospalax trevelyani Giant golden mole

Chrysospalax villosus Roughhaired golden

Cryptochloris wintoni De Winton's golden

Cryptochloris zyli Zyl's golden mole

Eremitalpa granti Grant's golden mole



<i>Neamblysomus gunningi</i>	Gunning's golden mole
<i>Neamblysomus julianae</i>	Juliana's golden mole
Order: EULIPOTYPHILA (INSECTIVORA)	
Family: SORICIDAE	
<i>Crocidura cyanea</i>	Reddishgrey musk shrew
<i>Crocidura flavescens</i>	Greater red musk shrew
<i>Crociduru fuscomurina</i>	Tiny musk shrew
<i>Crociduru hirta</i>	Lesser red musk shrew
<i>Crocidura maquassiensis</i>	Maquassie musk
<i>Crociduru mariquensis</i>	Swamp musk
<i>Crocidura silacea</i>	Lesser greybrown musk
<i>Myosorex cafer</i>	Darkfooted forest shrew
<i>Myosorex longicaudatus</i>	Longtailed forest shrew
<i>Myosorex sclateri</i>	Sclater's forest shrew
<i>Myosorex varius</i>	Forest shrew
<i>Suncus infinitesimus</i>	Least dwarf shrew
<i>Suncus lixus</i>	Greater dwarf shrew
<i>Suncus varilla</i>	Lesser dwarf shrew
Order: CHIROPTERA	
<i>Chaerephon ansorgei</i>	Ansorge's freetailed bat
<i>Chaerephon pumila</i>	Little freetailed bat
<i>Cistugo lesueuri</i>	Lesueur's hairy bat
<i>Cistugo scabrai</i>	Angolan hairy bat
<i>Cloeotis percivali</i>	Shorteared trident bat
<i>Eidolon helvum</i>	Strawcoloured fruit bat
<i>Epomophorus gambianus</i>	Gambian epauletted fruit
<i>Epomophorus wahlbergi</i>	Wahlberg's epauletted fruit
<i>Eptesicus hottentotus</i>	Longtoiled serotine
<i>Glauconycteris variegata</i>	Butterfly bat
<i>Hipposideros caffer</i>	Sundevall's roundleaf bat
<i>Hipposideros commersoni</i>	Commerson's roundleaf bat
<i>Hypsugo anchietae</i>	Anchieta's pipistrelle
<i>Kerivoula argentata</i>	Damara woolly bat
<i>Kerivoula lanosa</i>	Lesser woolly
<i>Laephotis botswanae</i>	Botswana longeared bat
<i>Laephotis wintoni</i>	De Winton's longeared
<i>Miniopterus fraterculus</i>	Lesser longfingered bat
<i>Miniopterus schreibersii</i>	Schreibers' longfingered bat
<i>Mops condylurus</i>	Angolan freetailed



<i>Mops midas</i>	Midas freetailed bat
<i>Mormopterus acetabulosus</i>	Natal freetailed bat
<i>Myotis bocagei</i>	Rufous mouseeared bat
<i>Myotis tricolor</i>	Temminck's hairy bat
<i>Myotis welwitschii</i>	Welwitsch's hairy bat
<i>Neoromicia capensis</i>	Cape serotme bat
<i>Neoromicia nanus</i>	Banana bat
<i>Neoromicia rendalli</i>	Rendall's serotine bat
<i>Neoromicia zuluensis</i>	Aloe serotine bat
<i>Nycteris hispida</i>	Hairy slitfaced
<i>Nycteris thebaica</i>	Egyptian slitfaced bat
<i>Nycteris woodi</i>	Wood's slitfaced
<i>Nycticeinops schlieffenii</i>	Schlieffen's bat
<i>Otomops martiensseni</i>	Largeeared freetailed bat
<i>Pipistrellus hesperidus</i>	African pipistrelle
<i>Pipistrellus rueppellii</i>	Ruppell's pipistrelle
<i>Pipistrellus rusticus</i>	Rusty pipistrelle
<i>Rhinolophus blasii</i>	Blasius's horseshoe bat
<i>Rhinolophus capensis</i>	Cape horseshoe bat
<i>Rhinolophus clivosus</i>	Geoffroy's horseshoe bat
<i>Rhinolophus darlingi</i>	Darling's horseshoe
<i>Rhinolophus denti</i>	Dent's horseshoe bat
<i>Rhinolophus fumigatus</i>	Ruppell's horseshoe bat
<i>Rhinolophus hildebrandtii</i>	Hildebrandt's horseshoe bat
<i>Rhinolophus landeri</i>	Lander's horseshoe bat
<i>Rhinolophus simulator</i>	Bushveld horseshoe
<i>Rhinolophus swinnyi</i>	Swinny's horseshoe bat
<i>Rousettus aegyptiacus</i>	Egyptian rousette
<i>Sauromys petrophilus</i>	Flatheaded freetailed bat
<i>Scotoecus albofuscus</i>	Lightwinged lesser house
<i>Scotophilus dinganii</i>	African yellow bat
<i>Scotophilus viridis</i>	Greenish yellow bat
<i>Tadarida aegyptiaca</i>	Egyptian freetailed bat
<i>Tadarida fulminans</i>	Madagascan large freetailed
<i>Tadarida ventralis</i>	African freetailed bat
<i>Taphozous mauritanus</i>	Mauritian tomb bat
<i>Taphozous perforatus</i>	Egyptian tomb bat

Order: MACROSCELIDEA

(INSECTIVORA)



<i>Elephantulus brachyrhynchus</i>	Shortheaded elephant-shrew
<i>Elephantulus edwardii</i>	Cape rock elephant-shrew
<i>Elephantulus intufi</i>	Bushveld elephants shrew
<i>Elephantulus myurus</i>	Eastern rock elephants shrew
<i>Elephantulus rupestris</i>	Western rock elephants shrew
<i>Macroscelides proboscideus</i>	Roundeared elephants shrew
<i>Petrodromus tetradactylus</i>	Fourtoed elephants shrew
Order: HYRACOIDEA	
<i>Dendrohyrax arboreus</i>	Tree hyrax
<i>Heterohyrax brucei</i>	Yellowspotted rock hyrax
<i>Procarica capensis</i>	Rock hyrax
Order: LAGOMORPHA	
<i>Lepus capensis</i>	Cape hare
<i>Lepus saxatilis</i>	Scrub hare
<i>Pronolagus crassicaudatus</i>	Natal red rock rabbit
<i>Pronolagus randensis</i>	Jameson's red rock
<i>Pronolagus rupestris</i>	Smith's red
<i>Pronolagus saundersiae</i>	Hewitt's red rock
Order: RODENTIA	
<i>Acomys spinosissimus</i>	Spiny mouse
<i>Acomys subspinosus</i>	Cape spiny mouse
<i>Aethomys chrysophilus</i>	Red veld
<i>Aethomys granti</i>	Grant's rock mouse
<i>Aethomys ineptus</i>	Tete Veld Rat
<i>Aethomys namaquensis</i>	Namaqua rock mouse
<i>Bathyergus janetta</i>	Namaqua dune mole-rat
<i>Bathyergus suillus</i>	Cape dune mole-rat
<i>Cricetomys gambianus</i>	Gambian giant rat
<i>Cryptomys damarensis</i>	Damaraland molerat
<i>Cryptomys hottentotus</i>	African molerat
<i>Dasymys capensis</i>	Cape marsh rat
<i>Dasymys incommutatus</i>	African marsh rat
<i>Dasymys sp.</i>	Roberts' marsh rat
<i>Dendromus melanotis</i>	Grey climbing
<i>Dendromus mesomelas</i>	Brantr's climbing mouse
<i>Dendromus mystacalis</i>	Chestnut climbing mouse
<i>Dendromus nyikae</i>	Nyika climbing mouse
<i>Desmodillus auricularis</i>	Shorttailed gerbil
<i>Georchus capensis</i>	Cape molerat



<i>Gerbillurus paeba</i>	Hairyfooted gerbil
<i>Gerbillurus vullinus</i>	Brushtailed hairyfooted gerbil
<i>Grammomys cometes</i>	Mocambique thicket rat
<i>Grammomys dolichurus</i>	Woodland thicket rat
<i>Graphiurus murinus</i>	Woodland dormouse
<i>Graphiurus oculus</i>	Spectacled dormouse
<i>Graphiurus platyops</i>	Rock dormouse
<i>Hystrix africae australis</i>	Cape porcupine
<i>Lemniscomys rosalia</i>	Singlestriped grass mouse
<i>Malacothrix typica</i>	Gerbil mouse
<i>Mastomys coucha</i>	Southern multimammate
<i>Mastomys natalensis</i>	Natal multimammate
<i>Mus indutus</i>	Desert pygmy mouse
<i>Mus minutoides</i>	Pygmy mouse
<i>Mus neavei</i>	Neave's pygmy mouse
<i>Mus orangiae</i>	Free State pygmy
<i>Myomyscus verreauxi</i>	Verreaux's mouse
<i>Mystromys albicaudatus</i>	Whitetailed mouse
<i>Otomys angoniensis</i>	Angoni vlei rat
<i>Otomys irroratus</i>	Vlei rat
<i>Otomys laminatus</i>	Laminate vlei rat
<i>Otomys saundersiae</i>	Saunders' vlei rat
<i>Otomys sloggetti</i>	Sloggett's vlei rat
<i>Otomys unisulcatus</i>	Bush vlei
<i>Paraxerus cepapi</i>	Tree squirrel
<i>Paraxerus palliatus</i>	Red bush squirrel
<i>Parotomys brantsii</i>	Brants' whistling
<i>Parotomys littedalei</i>	Littedale's whistling rat
<i>Pedetes capensis</i>	Springhare
<i>Petromus typicus</i>	Dassie rat
<i>Petromyscus barbouri</i>	Barbour's rock mouse
<i>Petromyscus collinus</i>	Pygmy rock mouse
<i>Petromyscus monticularis</i>	Brukkaros pygmy rock mouse
<i>Rhabdomys pumilio</i>	Fourstriped grass mouse
<i>Saccostomus campestris</i>	Pouched mouse
<i>Steatomys krebsii</i>	Krebs's fat mouse
<i>Steatomys pratensis</i>	Fat mouse
<i>Tatera afra</i>	Cape gerbil
<i>Tatera brantsii</i>	Highveld gerbil



<i>Tatera leucogaster</i>	Bushveld gerbil
<i>Thallomys nigricauda</i>	Blacktailed tree rat
<i>Thallomys paedulcus</i>	Acacia rat
<i>Thryonomus winderianus</i>	Greater canerat
<i>Xerus inauris</i>	South African ground
<i>Xerus princeps</i>	Damara or Kaokoveld Ground squirrel
<i>Zelotomys woosnami</i>	Woosnam's desert mouse
Order: CARNIVORA	
<i>Aonyx capensis</i>	African / Cape clawless otter
<i>Atilax paludinosus</i>	Marsh mongoose
<i>Cynictis penicillata</i>	Yellow mongoose
<i>Galerella pulverulenta</i>	Cape grey mongoose
<i>Galerella sanguinea</i>	Slender mongoose
<i>Genetta genetta</i>	Smallspotted genet
<i>Genetta maculata</i>	Common largespotted genet
<i>Genetta tigrina</i>	South African large-spotted genet
<i>Helogale parvula</i>	Dwarf mongoose
<i>Herpestes ichneumon</i>	Large grey mongoose
<i>Ichneumia albicauda</i>	Whitetailed mongoose
<i>Mungos mungo</i>	Banded mongoose
<i>Suricala suricatta</i>	Meerkat / Suricate
Order: PERISSODACTYLA	
<i>Equus quagga</i>	Plains zebra
Order: SUIFORMES	
<i>Phacochoerus africanus</i>	Common warthog
Order: WHIPPOMORPHA	
<i>Hippopotamus amphibius</i>	Hippopotamus
Order: RUMINANTIA	
<i>Aepyceros melampus</i>	Impala
<i>Alcelaphus buselaphus</i>	Red hartebeest
<i>Alcelaphus lichtensteinii</i>	Lichtenstein's hartebeest
<i>Antidorcas marsupialis</i>	Springbok
<i>Cephalophus natalensis</i>	Red duiker
<i>Connochaetes gnou</i>	Black wildebeest
<i>Connochaetes taurinus</i>	Blue wildebeest
<i>Damaliscus lunatus</i>	Tsessebe
<i>Damaliscus pygargus</i>	Blesbok
<i>Damaliscus pygargus</i>	Bontebok
<i>Giraffa camelopardalis</i>	Giraffe



<i>Hippotragus equinus</i>	Roan
<i>Hippotragus niger</i>	Sable antelope
<i>Kobus ellipsiprymnus</i>	Waterbuck
<i>Neotragus moschatus</i>	Suni
<i>Oreotragus oreotragus</i>	Klipspringer
<i>Oryx gazella</i>	Oryx / Gemsbok
<i>Ourebia ourebi</i>	Oribi
<i>Pelea capreolus</i>	Grey rhebok
<i>Philantomba monticola</i>	Blue duiker
<i>Rhaphicerus campestris</i>	Steenbok
<i>Raphicerus melanotis</i>	Cape grysbok
<i>Raphicerus sharpei</i>	Sharpe's grysbok
<i>Redunca arundinum</i>	Southern reedbuck
<i>Redunca fulvorufula</i>	Mountain reedbuck
<i>Sylvicapra grimmia</i>	Common duiker
<i>Syncerus caffer</i>	African buffalo
<i>Tragelaphus angasii</i>	Nyala
<i>Tragelaphus oryx</i>	Eland
<i>Tragelaphus scriptus</i>	Bushbuck
<i>Tragelaphus strepsiceros</i>	Greater kudu
CLASS: AVES	All indigenous birds, except those listed in schedule 1,3,6
Order: ANSERIFORMES	
<i>Alpochen aegyptiaca</i>	Egyptian Goose
<i>Anas acuta</i>	Northern Pintail
<i>Anas capensis</i>	Cape Teal
<i>Anas clypeata</i>	Northern Shoveler
<i>Anas erythrorhyncha</i>	Redbilled Teal
<i>Anas hottentota</i>	Hottentot Teal
<i>Anas querquedula</i>	Garganey
<i>Anas smithii</i>	Cape Shoveler
<i>Anas sparsa</i>	African Black Duck
<i>Anas undulate</i>	Yellowbilled Duck
<i>Dendrocygna bicolor</i>	Fulvous Duck
<i>Dendrocygna viduata</i>	Whitefaced Duck
<i>Netta erythrophthalma</i>	Southern Pochard
<i>Nettapus auritus</i>	African Pygmygoose
<i>Oxyura maccoa</i>	Maccoa Duck
<i>Plectropterys gambensis</i>	Spurwinged Goose
<i>Sardidiornis melanotos</i>	Comb Duck



<i>Tadorna cana</i>	South African Shelduck
<i>Thalassornis leuconotus</i>	Whitebacked Duck
Order: APODIFORMES	
<i>Apus affinis</i>	Little Swift
<i>Apus apus</i>	Common Swift
<i>Apus barbatus</i>	African Black Swift
<i>Apus bradfieldi</i>	Bradfield's Swift
<i>Apus caffer</i>	Whiterumped Swift
<i>Alpus horus</i>	Horus Swift
<i>Apus pallidus</i>	Pallid Swift
<i>Cypsiurus parvus</i>	African PalmSwift
<i>Neafrapus boehmi</i>	Böhm's Spinetail
<i>Tachymarpis melba</i>	Alpine Swift
<i>Telacanthura ussheri</i>	Mottled Spinetail
Order: BUCEROTIFORMES	
<i>Bycanistes bucinator</i>	Trumpeter Hombill
<i>Tockus alboterminatus</i>	Crowned Hornbill
<i>Tockus erythrorhynchus</i>	Redbilled Hornbill
<i>Tockus leucomelas</i>	Southern Yellowbilled Hombill
<i>Tockus nasutus</i>	African Grey Hombill
Order: CUCULIFORMES	
<i>Centropus burchellii</i>	Burchell's Coucal
<i>Centropus grillii</i>	Black Coucal
<i>Centropus senegalensis</i>	Senegal Coucal
<i>Centropus superciliosus</i>	Whitebrowed Coucal
<i>Ceuthmochares aereus</i>	Green Malkoha
<i>Chrysococcyx caprius</i>	Diderick Cuckoo
<i>Chrysococcyx cupreus</i>	African Emerald Cuckoo
<i>Chrysococcyx Klaas</i>	Klaas's Cuckoo
<i>Clamator glandarius</i>	Great Spotted Cuckoo
<i>Clamator jacobinus</i>	Jacobin Cuckoo
<i>Clamator leuallantii</i>	Levallant's Cuckoo
<i>Cuculus canorus</i>	Common Cuckoo
<i>Cuculus clamosus</i>	Black Cuckoo
<i>Cuculus gularis</i>	African Cuckoo
<i>Cuculus poliocephalus</i>	Lesser Cuckoo
<i>Cuculus rochii</i>	Madagascar Cuckoo
<i>Cuculus solitarius</i>	Redchested Cuckoo
<i>Pachycoccyx audeberti</i>	Thickbilled Cuckoo



Order: COLUMBIFORMES

<i>Aplopelia larvata</i>	Lemon Dove
<i>Columba arquatrix</i>	African Olivepigeon
<i>Columba delegorguei</i>	Eastern Bronzenaped Pigeon
<i>Columba guinea</i>	Speckled Pigeon
<i>Columba livia</i>	Rock Dove
<i>Oena capensis</i>	Namaqua Dove
<i>Streptopelia capicola</i>	Cape TurtleDove
<i>Streptopelia decipiens</i>	African Mourning Dove
<i>Streptopelia semitorquata</i>	Redeyed TurtleDove
<i>Streptopelia senegalensis</i>	Laughing Dove
<i>Streptopelia turtur</i>	European TurtleDove
<i>Treron calvus</i>	African GreenPigeon
<i>Turtur afer</i>	Bluespotted WoodDove
<i>Turtur chalcospilos</i>	Emeraldspotted WoodDove
<i>Turtur tympanistria</i>	Tambourine Dove

Order: CORACIIFORMES

<i>Alcedo cristata</i>	Malachite Kingfisher
<i>Alcedo semitorquata</i>	Halfcollared Kingfisher
<i>Ceryle rudis</i>	Pied Kingfisher
<i>Coracias caudatus</i>	Lilacbreasted Roller
<i>Coracias garrulous</i>	European Roller
<i>Coracias naevius</i>	Purple Roller
<i>Coracias spatulatus</i>	Rackettailed Roller
<i>Eurystomus glaucurus</i>	Broadbilled Roller
<i>Halcyon albiventris</i>	Brownhooded Kingfisher
<i>Halcyon chelicuti</i>	Striped Kingfisher
<i>Halcyon leucocephala</i>	Greyheaded Kingfisher
<i>Halcyon senegalensis</i>	Woodland Kingfisher
<i>Halcyon senegaloides</i>	Mangrove Kingfisher
<i>Ispidina picta</i>	African PygmyKingfisher
<i>Megaceryle maxima</i>	Giant Kingfisher
<i>Merops albicollis</i>	Whitethroated Beeeater
<i>Merops apiaster</i>	European Beeeater
<i>Merops bullockoides</i>	Whitefronted Beeeater
<i>Merops birundineus</i>	Swallowtailed Beeeater
<i>Merops nubicoides</i>	Southern Carmine Beeeater
<i>Merops persicus</i>	Bluecheeked Beeeater
<i>Merops pusillus</i>	Little Beeeater



<i>Merops superciliosus</i>	Madagascar Beeeater
Order: CHARADRIIFORMES	
<i>Actitis hypoleucos</i>	Common Sandpiper
<i>Actophilornis qfricanus</i>	African Jacana
<i>Anous stolidus</i>	Brown Noddy
<i>Anous tenuirostris</i>	Lesser Noddy
<i>Arenaria interpres</i>	Ruddy Turnstone
<i>Burhinus capensis</i>	Spotted Thickknee
<i>Burhinus vermiculatus</i>	Water Thickknee
<i>Calidris alba</i>	Sanderling
<i>Calidris alpina</i>	Dunlin
<i>Calidris bairdii</i>	Baird's Sandpiper
<i>Calidris canutus</i>	Red Knot
<i>Calidris ferruginea</i>	Curlew Sandpiper
<i>Calidris fuscicollis</i>	Whiterumped Sandpiper
<i>Calidris melanotos</i>	Pectoral Sandpiper
<i>Calidris minuta</i>	Little Stint
<i>Calidris ruficollis</i>	Rednecked Stint
<i>Calidris subminuta</i>	Longtoed Stint
<i>Calidris temminckii</i>	Temminck's Stint
<i>Calidris tenuirostris</i>	Great Knot
<i>Catharacta Antarctica</i>	Subantarctic Skua
<i>Catharacta maccormicki</i>	South Polar Skua
<i>Charadrius alexandrinus</i>	Kentish Plover
<i>Charadrius asiaticus</i>	Caspian Plover
<i>Charadrius hiaticula</i>	Common Ringed Plover
<i>Charadrius leschenauillii</i>	Greater Sand Plover
<i>Charadrius marginatus</i>	Whitefronted Plover
<i>Charadrius mongolus</i>	Lesser Sand Plover
<i>Charadrius pecuarius</i>	Kittlitz's Plover
<i>Charadrius tricollaris</i>	Threebanded Plover
<i>Chionis albus</i>	Greater Sheathbill
<i>Chlidonias hybrida</i>	Whiskered Tern
<i>Chlidonias leucopterus</i>	Whitewinged Tern
<i>Chlidonias niger</i>	BlackTem
<i>Cursorius rufus</i>	Burchell's Courser
<i>Cursorius temminckii</i>	Temminck's Courser
<i>Dromas ardeola</i>	Crab Plover
<i>Gallinago media</i>	Great Snipe



<i>Gallinago nigripennis</i>	African Snipe
<i>Glareola nuchalis</i>	Rock Pratincole
<i>Haematopus ostralegus</i>	Eurasian Oystercatcher
<i>Himantopus himantopus</i>	Blackwinged Stilt
<i>Larus cirrocephalus</i>	Greyheaded Gull
<i>Larus dominicanus</i>	Kelp Gull
<i>Larus fuscus</i>	Lesser Blackbacked Gull
<i>Larus genei</i>	Slenderbilled Gull
<i>Larus hartlaubii</i>	Hartlaub's Gull
<i>Larus heuglini</i>	Heuglins Gull
<i>Larus pipixcan</i>	Franklin's Gull
<i>Larus ridibundus</i>	Common Blackheaded Gull
<i>Larus sabini</i>	Sabine's Gull
<i>Limicola falcinellus</i>	Broadbilled Sandpiper
<i>Limosa haemastica</i>	Hudsonian Godwit
<i>Limosa lapponica</i>	Bartailed Godwit
<i>Limosa limosa</i>	Blacktailed Godwit
<i>Microparra capensis</i>	Lesser Jacana
<i>Numenius arquata</i>	Eurasian Curlew
<i>Numenius phaeopus</i>	Common Whimbrel
<i>Phalaropus fulicarius</i>	Red Phalarope
<i>Phalaropus lobatus</i>	Rednecked Phalarope
<i>Philomachus pugnax</i>	Ruff
<i>Pluvialis dominica</i>	American Golden Plover
<i>Pluvialis fulva</i>	Pacific Golden Plover
<i>Pluvialis squatarola</i>	Grey Plover
<i>Pterocles bicinctus</i>	Doublebanded Sandgrouse
<i>Pterocles burchelli</i>	Burchell's Sandgrouse
<i>Pterocles gutturalis</i>	Yellowthroated Sandgrouse
<i>Pterocles namaqua</i>	Namaqua Sandgrouse
<i>Recurvirostra avosetta</i>	Pied Avocet
<i>Rhinoptilus africanus</i>	Doublebanded Courser
<i>Rhinoptilus chalcopterus</i>	Bronzewinged Courser
<i>Rhinoptilus cinctus</i>	Threebanded Courser
<i>Rissa tridactyla</i>	Blacklegged Kittiwake
<i>Rynchops flavirostris</i>	African Skimmer
<i>Steganopus tricolor</i>	Wilson's Phalarope
<i>Stercorarius longicaudus</i>	Longtailed Jaeger
<i>Stercorarius parasiticus</i>	Parasitic Jaeger



<i>Stercorarius pomarinus</i>	Pomarine Jaeger
<i>Sterna albifrons</i>	Little Tern
<i>Sterna anaethetus</i>	Bridled Tern
<i>Sterna bengalensis</i>	Lesser Crested Tern
<i>Sterna bergii</i>	Swift Tern
<i>Sterna dougallii</i>	Roseate Tern
<i>Sterna fuscata</i>	Sooty Tern
<i>Sterna hirundo</i>	Common Tern
<i>Sterna nilotica</i>	Gullbilled Tern
<i>Sterna paradisaea</i>	Arctic Tern
<i>Sterna repressa</i>	Whitecheeked Tern
<i>Sterna sandvicensis</i>	Sandwich Tern
<i>Sterna sumatrana</i>	Blackraped Tern
<i>Sterna vittata</i>	Antarctic Tern
<i>Tringa erythropus</i>	Spotted Redshank
<i>Tringa flavipes</i>	Lesser Yellowlegs
<i>Tringa glareola</i>	Wood Sandpiper
<i>Tringa melanoleuca</i>	Greater Yellowlegs
<i>Tringa nebularia</i>	Common Greenshank
<i>Tringa ochropus</i>	Green Sandpiper
<i>Tringa stagnatilis</i>	Marsh Sandpiper
<i>Tringa totanus</i>	Common Redshank
<i>Tryngites subruficollis</i>	Buffbreasted Sandpiper
<i>Vanellus albiceps</i>	Whitecrowned Lapwing
<i>Vanellus armatus</i>	Blacksmith Lapwing
<i>Vanellus coronatus</i>	Crowned Lapwing
<i>Vanellus crassirostris</i>	Longtoed Lapwing
<i>Vanellus lugubris</i>	Senegal Lapwing
<i>Vanellus melanopterus</i>	Blackwinged Lapwing
<i>Vanellus senegallus</i>	African Wattled Lapwing
<i>Vanellus spinosus</i>	Spurwinged Lapwing
<i>Xenus cinereus</i>	Terek Sandpiper
Order: CICONIIFORMES	
<i>Anastomus lamelligerus</i>	African Openbill
<i>Anhinga rufa</i>	African Darter
<i>Aptenodytes patagonicus</i>	King Penguin
<i>Ardea cinerea</i>	Grey Heron
<i>Ardea goliath</i>	Goliath Heron
<i>Ardea melanocephala</i>	Blackheaded Heron



<i>Ardea purpurea</i>	Purple Heron
<i>Ardeola ralloides</i>	Squacco Heron
<i>Ardeola rufiventris</i>	Rufousbellied Heron
<i>Bostrychia hagedash</i>	Hadedea Ibis
<i>Botaurus stellaris</i>	Eurasian Bittern
<i>Bubulcus ibis</i>	Cattle Egret
<i>Bubweria bulwerii</i>	Bulwer's Petrel
<i>Bulweria fallax</i>	Jouanin's Petrel
<i>Butorides striata</i>	Greenbacked Heron
<i>Calonectris diomedea</i>	Cory's Shearwater
<i>Calonectris leucomelas</i>	Streaked Shearwater
<i>Ciconia abdimii</i>	Abdim's Stork
<i>Ciconia ciconia</i>	White Stork
<i>Ciconia episcopus</i>	Woollynecked Stork
<i>Daption capense</i>	Pintado Petrel
<i>Diomedea dabbenena</i>	Tristan Albatross
<i>Diomedea epomophora</i>	Southern Royal Albatross
<i>Diomedea exulans</i>	Wandering Albatross
<i>Diomedea sanfordi</i>	Northern Royal Albatross
<i>Egretta alba</i>	Great Egret
<i>Egretta ardesiaca</i>	Black Heron
<i>Egretta caerulea</i>	Little Blue Heron
<i>Egretta garzetta</i>	Little Egret
<i>Egretta gularis</i>	Western Reef Hero
<i>Egretta intermedia</i>	Yellowbilled Egret
<i>Egretta thula</i>	Snowy Egret
<i>Egretta vinaceigula</i>	Slaty Egret
<i>Fregata ariel</i>	Lesser Frigatebird
<i>Fregata minor</i>	Greater Frigatebird
<i>Fregatta grallaria</i>	Whitebellied StormPetrel
<i>Fregatta tropica</i>	Blackbellied StormPetrel
<i>Fulmarus glacialoides</i>	Southern Fulmar
<i>Halobaena caerulea</i>	Blue Petrel
<i>Hydrobates pelagicus</i>	European StormPetrel
<i>Ixobrychus minutus</i>	Little Bittern
<i>Ixobrychus sturmii</i>	Dwarf Bittern
<i>Lugensa brevirostris</i>	Kerguelen Petrel
<i>Macronectes giganteus</i>	Southern GiantPetrel
<i>Macronectes halli</i>	Northern GiantPetrel



<i>Morus capensis</i>	Cape Gannet
<i>Morus serrator</i>	Australian Gannet
<i>Nycticorax nycticorax</i>	Blackcrowned NightHeron
<i>Octanites oceanicus</i>	Wilson's StormPetrel
<i>Oceanodroma leucorhoa</i>	Leach's StormPetrel
<i>Oceanodroma matsudairae</i>	Marsudaira's StormPetrel
<i>Pachyptila belcheri</i>	Slenderbilled Prion
<i>Pachyptila desolata</i>	Antarctic Prion
<i>Pachyptila salvini</i>	Salvin's Prion
<i>Pachyptila turtur</i>	Fairy Prion
<i>Pachyptila vittata</i>	Broadbilled Prion
<i>Pelagodroma marina</i>	Whitefaced StormPetrel
<i>Phaethon aethereus</i>	Redbilled Tropicbird
<i>Phaethon lepturus</i>	Whitetailed Tropicbird
<i>Phaethon rubricauda</i>	Redtailed Tropicbird
<i>Phalacrocorax africanus</i>	Reed Cormorant
<i>Phalacrocorax lucidus</i>	Whitebreasted Cormorant
<i>Phoebastria immutabilis</i>	Laysan Albatross
<i>Phoebetria fusca</i>	Sooty Albatross
<i>Phoebetria palpebrata</i>	Lightmantled Albatross
<i>Platalea alba</i>	African Spoonbill
<i>Plegadis falcinellus</i>	Glossy Ibis
<i>Podiceps cristatus</i>	Great Crested Grebe
<i>Podiceps nigricollis</i>	Blacknecked Grebe
<i>Procellaria cinerea</i>	Grey Petrel
<i>Procellaria conspicilluta</i>	Spectacled Petrel
<i>Pterodroma barau</i>	Barau's Petrel
<i>Pterodroma incerta</i>	Atlantic Petrel
<i>Pterodroma lessonii</i>	Whiteheaded Petrel
<i>Pterodroma macroptera</i>	Greatwinged Petrel
<i>Pterodroma mollis</i>	Softplumaged Petrel
<i>Puffinus assimilis</i>	Little Shearwater
<i>Puffinus bailloni</i>	Tropical Shearwater
<i>Puffinus carneipes</i>	Fleshfooted Shearwater
<i>Puffinus gravis</i>	Great Shearwater
<i>Puffinus griseus</i>	Sooty Shearwater
<i>Puffinus mauretanicus</i>	Balearic Shearwater
<i>Puffinus pacificus</i>	Wedgetailed Shearwater
<i>Puffinus puffinus</i>	Manx Shearwater



<i>Scopus umbretta</i>	Hamerkop
<i>Spheniscus demersus</i>	African Penguin
<i>Sula leucogaster</i>	Brown Booby
<i>Sula sula</i>	Redfooted Booby
<i>Tachybaptus ruficollis</i>	Little Grebe
<i>Thalassarche bulleri</i>	Buller's Albatross
<i>Thalassarche cauta</i>	Shy Albatross
<i>Thalassarche chlororhynchos</i>	Atlantic Yellownosed Albatross
<i>Thalassarche eremite</i>	Chatham Albatross
<i>Thalassarche melanophrys</i>	Blackbrowed Albatross
<i>Thalassarche salvini</i>	Salvin's Albatross
<i>Thalassoica antarctica</i>	Antarctic Petrel
<i>Threskiornis aethiopicus</i>	African Sacred Ibis
Order: FALCONIFORMES	All species not listed in Schedule 1
Order: GALLIFORMES	
<i>Coturnix adansonii</i>	Blue Quail
<i>Coturnix coturnix</i>	Common Quail
<i>Coturnix delegorguei</i>	Harlequin Quail
<i>Dendroperdix sephaena</i>	Crested Francolin
<i>Guttera edouardi</i>	Crested guineafowl
<i>Numida meleagris</i>	Helmeted guineafowl
<i>Pternistis adspersus</i>	Redbilled Spurfowl
<i>Pternistis afer</i>	Rednecked Spurfowl
<i>Pternistis capensis</i>	Cape Spurfowl
<i>Pternistis natalensis</i>	Natal Spurfowl
<i>Pternistis swainsoni</i>	Swainson's Spurfowl
<i>Scleroptila africanus</i>	Greywing Francolin
<i>Scleroptila levillantii</i>	Redwing Francolin
<i>Scleroptila levillantoides</i>	Orange River Francolin
<i>Scleroptila shelleyi</i>	Shelley's Francolin
Order: GRUIFORMES	
<i>Aenigmatolimnas marginalis</i>	Striped Crake
<i>Afrotis afra</i>	Southern Black Korhaan
<i>Afrotis afraoides</i>	Northern Black Korhaan
<i>Amaurornis flavirostra</i>	Black Crake
<i>Crex egregia</i>	African Crake
<i>Crex crex</i>	Corncrake
<i>Eupodotis senegalensis</i>	Whitebellied Korhaan
<i>Eupodotis vigorsii</i>	Karoo Korhaan



<i>Fulica cristata</i>	RedKnobbed Coot
<i>Gallinula angulata</i>	Lesser Moorhen
<i>Gallinula chloropus</i>	Common Moorhen
<i>Lissotis melanogaster</i>	Blackbellied Bustard
<i>Lophotis ruficrista</i>	Redcrested Korhaan
<i>Podica senegalensis</i>	African Finfoot
<i>Porphyrio alleni</i>	Allen's Gallinule
<i>Porphyrio madagascariensis</i>	African Purple Swamphen
<i>Porphyrio martinicus</i>	American Purple Gallinule
<i>Porzana porzana</i>	Spotted Crake
<i>Porzana pusilla</i>	Baillon's Crake
<i>Rallus caerulescens</i>	African Rail
<i>Sarothrura affinis</i>	Striped Flufftail
<i>Sarothrura ayresi</i>	Whitewinged Flufftail
<i>Sarothrura boehmi</i>	Streakybreasted Flufftail
<i>Sarothrura elegans</i>	Buffspotted Flufftail
<i>Sarothrura rufa</i>	Redchested Flufftail
Order: MUSOPHAGIFORMES	
<i>Corythaixoides concolor</i>	Grey Goawaybird
<i>Gallirex porphyreolophus</i>	Purplecrested Turaco
<i>Tauraco livingstonii</i>	Livingstone's Turaco
Order: PASSERIFORMES	
<i>Acrocephalus arundinaceus</i>	Great ReedWarbler
<i>Acrocephalus baeticatus</i>	African ReedWarbler
<i>Acrocephalus gracilirostris</i>	Lesser SwampWarbler
<i>Acrocephalus griseldis</i>	Basra ReedWarbler
<i>Acrocephalus palustris</i>	Marsh Warbler
<i>Acrocephalus schoenobaenus</i>	Sedge Warbler
<i>Acrocephalus scirpaceus</i>	Eurasian ReedWarbler
<i>Amadina crythrocephala</i>	Redheaded Finch
<i>Amadina fasciata</i>	Cutthroat Finch
<i>Amblyospiza albifrons</i>	Thickbilled Weaver
<i>Anaplectes melanotis</i>	Redheaded Weaver
<i>Andropadus importunes</i>	Sombre Greenbul
<i>Anomalospiza imberbis</i>	Cuckoo Finch
<i>Anthobaphes violacea</i>	Orangebreasted Sunbird
<i>Anthoscopus caroli</i>	Grey PendulineTit
<i>Anthoscopus minutus</i>	Cape PendulineTit
<i>Anthreptes reichenowi</i>	Plainbacked Sunbird



<i>Anthus brachyurus</i>	Shorttailed Pipit
<i>Anthus caffer</i>	Bushveld Pipit
<i>Anthus cervinus</i>	Redthroated Pipit
<i>Anthus chloris</i>	Yellowbreasted Pipit
<i>Anthus cinnamomeus</i>	African Pipit
<i>Anthus crenatus</i>	African Rock Pipit
<i>Anthus hoeschi</i>	Mountain Pipit
<i>Anthus leucophrys</i>	Plainbacked Pipit
<i>Anthus lineiventris</i>	Striped Pipit
<i>Anthus longicaudatus</i>	Longtailed Pipit
<i>Anthus pseudosimilis</i>	Kimberley Pipit
<i>Anthus similis</i>	Longbilled Pipit
<i>Anthus trivialis</i>	Tree Pipit
<i>Anthus vaalensis</i>	Buffy Pipit
<i>Apalis flavida</i>	Yellowbreasted Apalis
<i>Apalis ruddi</i>	Rudd's Apalis
<i>Apalis thoracica</i>	Barthroated Apalis
<i>Batis capensis</i>	Cape Batis
<i>Baits fratrum</i>	Woodward's Batis
<i>Batis molitor</i>	Chinspot Batis
<i>Batis pririt</i>	Pirit Batis
<i>Bias musicus</i>	Blackandwhite Flycatcher
<i>Bradornis infuscatus</i>	Chat Flycatcher
<i>Bradornis mariquensis</i>	Marico Flycatcher
<i>Bradornis pallidus</i>	Pale Flycatcher
<i>Bradypterus baboecala</i>	Little RushWarbler
<i>Bradypterus barratti</i>	Barratt's Warbler
<i>Bradypterus sylvaticus</i>	Knysna Warbler
<i>Bubalornis niger</i>	Redbilled BuffaloWeaver
<i>Calamonastes fasciolatus</i>	Barred WrenWarbler
<i>Calamonastes stierlingi</i>	Stierling's WrenWarbler
<i>Calandrella cinerea</i>	Redcapped Lark
<i>Calendulauda africanoides</i>	Fawncoloured Lark
<i>Calendulauda albescens</i>	Karoo Lark
<i>Calendulauda sabota</i>	Sabota Lark
<i>Camaroptera brachyura</i>	Greenbacked Camaroptera
<i>Camaroptera brevicaudata</i>	Graybacked Camaroptera
<i>Campephaga flava</i>	Black Cuckooshrike
<i>Cercomela familiaris</i>	Familiar Chat



<i>Cercomela schlegelii</i>	Karoo Chat
<i>Cercomela sinuate</i>	Sicklewinged Chat
<i>Cercomela tractrac</i>	Tractrac Chat
<i>Cercotrichas coryphoeus</i>	Karoo ScrubRobin
<i>Cercotrichas leucophrys</i>	Whitebrowed ScrubRobin
<i>Cercotrichas paena</i>	Kalahari ScrubRobin
<i>Cercotrichas quadrivirgata</i>	Bearded ScrubRobin
<i>Cercotrichas signata</i>	Brown ScrubRobin
<i>Certhilauda brevirostris</i>	Agulhas Longbilled Lark
<i>Certhilauda chuana</i>	Shortclawed Lark
<i>Certhilauda curvirostris</i>	Cape Longbilled Lark
<i>Certhilauda semitorquata</i>	Eastern Longbilled Lark
<i>Certhilauda subcoronata</i>	Karoo Longbilled Lark
<i>Chaetops aurantius</i>	Drakensberg Rockjumper
<i>Chaetops frenatus</i>	Cape Rockjumper
<i>Chalcomitra amethystina</i>	Amethyst Sunbird
<i>Chalcomitra senegalensis</i>	Scarletched Sunbird
<i>Chersomanes albofasciata</i>	Spikeheeled Lark
<i>Chlorocichla flaviventris</i>	Yellowbellied Greenbul
<i>Chloropeta natalensis</i>	Darkcapped Yellow Warbler
<i>Cichladusa arquata</i>	Collared PalmThrush
<i>Cinnyricinclus leucogaster</i>	Violetbacked Starling
<i>Cinnyris afer</i>	Greater Doublecollared Sunbird
<i>Cinnyris bifasciatus</i>	Purplebanded Sunbird
<i>Cinnyris chalybeus</i>	Southern Doublecollared Sunbird
<i>Cinnyris fuscus</i>	Dusk Sunbird
<i>Cinnyris mariquensis</i>	Marico Sunbird
<i>Cinnyris neergaardi</i>	Neergaard's Sunbird
<i>Cinnyris talatala</i>	Whitebellied Sunbird
<i>Cinnyris venustus</i>	Variable Sunbird
<i>Cisticola aberrans</i>	Lazy Cisticola
<i>Cisticola aridulus</i>	Desert Cisticola
<i>Cisticola ayresii</i>	Wingsnapping Cisticola
<i>Cisticola chiniana</i>	Rattling Cisticola
<i>Cisticola cinnamomeus</i>	Palecrowned Cisticola
<i>Cisticola erythrops</i>	Redfaced Cisticola
<i>Cisticola fulvicapilla</i>	Neddicky
<i>Cisticola galactotes</i>	Rufouswinged Cisticola
<i>Cisticola juncidis</i>	Zitting Cisticola



<i>Cisticola lais</i>	Wailing Cisticola
<i>Cisticola natalensis</i>	Croaking Cisticola
<i>Cisticola rufilatus</i>	Tinkling Cisticola
<i>Cisticola subruficapilla</i>	Greybacked Cisticola
<i>Cisticola textrix</i>	Cloud Cisticola
<i>Cisticola tinniensi</i>	Levaillant's Cisticola
<i>Coccyzygia melanotis</i>	Sweet Waxbill
<i>Coracina caesia</i>	Grey Cuckooshrike
<i>Coracina pectoralis</i>	Whitebreasted Cuckooshrike
<i>Corvinella melanoleuca</i>	Magpie Shrike
<i>Corvus albicollis</i>	Whitenecked Raven
<i>Cossypha caffra</i>	Cape RobinChat
<i>Cossypha dichroa</i>	Chorister RobinChat
<i>Cossypha heuglini</i>	Whitebrowed RobinChat
<i>Cossypha humeralis</i>	Whitethroated RobinChat
<i>Cossypha natalensis</i>	Redcapped RobinChat
<i>Creatophora cinerea</i>	Wattled Starling
<i>Crithagra albogularis</i>	Whitethroated Canary
<i>Crithagra atrogularis</i>	Blackthroated Canary
<i>Crithagra citrinipecta</i>	Lemonbreasted Canary
<i>Crithagra flaviventris</i>	Yellow Canary
<i>Crithagra gularis</i>	Streakyheaded Seedeater
<i>Crithagra leucoptera</i>	Protea Seedeater
<i>Crithagra mozambica</i>	Yellowfronted Canary
<i>Crithagra scotops</i>	Forest Canary
<i>Crithagra sulphurata</i>	Brimstone Canary
<i>Crithagra symonsi</i>	Drakensberg Siskin
<i>Crithagra totta</i>	Cape Siskin
<i>Cryptillas victorini</i>	Victorin's Warbler
<i>Cyanomitra olivacea</i>	Olive Sunbird
<i>Cyanomitra veroxii</i>	Grey Sunbird
<i>Delichon urbicum</i>	Common HouseMartin
<i>Dicrurus adsimilis</i>	Forktailed Drongo
<i>Dicrurus ludwigii</i>	Squaretailed Drongo
<i>Dryoscopus cubla</i>	Blackbacked Puffback
<i>Elminia albonotata</i>	Whitetailed Crested Flycatcher
<i>Emberiza capensis</i>	Cape Bunting
<i>Emberiza flaviventris</i>	Goldenbreasted Bunting
<i>Emberiza impetuani</i>	Larklike Bunting



<i>Emberiza tahapisi</i>	Cinnamonbreasted Bunting
<i>Eremomela gregalis</i>	Karoo Eremomela
<i>Eremomela icteropygialis</i>	Yellowbellied Eremomela
<i>Eremomela scotops</i>	Greencapped Eremomela
<i>Eremomela usticollis</i>	Burntnecked Eremomela
<i>Eremopterix australis</i>	Blackeared Sparrowlark
<i>Eremopterix leucotis</i>	Chestnutbacked Sparrowlark
<i>Eremopterix verticalis</i>	Greybacked Sparrowlark
<i>Estrilda astrild</i>	Common Waxbill
<i>Estrilda erythronotos</i>	Blackfaced Waxbill
<i>Estrilda perreini</i>	Grey Waxbill
<i>Euptetes afer</i>	Yellowcrowned Bishop
<i>Euplectes albonotatus</i>	Whitewinged Widowbird
<i>Euplectes ardens</i>	Redcollared Widowbird
<i>Euplectes axillaris</i>	Fantailed Widowbird
<i>Euplectes capensis</i>	Yellow Bishop
<i>Euplectes progne</i>	Longtailed Widowbird
<i>Eurocephalus anguimans</i>	Southern Whitecrowned Shrike
<i>Euryptila subcinnamomea</i>	Cinnamonbreasted Warbler
<i>Ficedula albicollis</i>	Collared Flycatcher
<i>Galerida magnirostris</i>	Largebilled Lark
<i>Granatina granalina</i>	Violeteared Waxbill
<i>Hedydipna collaris</i>	Collared Sunbird
<i>Heteromirafra ruddi</i>	Rudd's Lark
<i>Hippolais icterina</i>	Icterine Warbler
<i>Hippolais olivetorum</i>	Olivetree Warbler
<i>Hirundo abyssinica</i>	Lesser Striped Swallow
<i>Hirundo albigularis</i>	Whitethroated Swallow
<i>Hirundo cucullata</i>	Greater Striped Swallow
<i>Hirundo dimidiata</i>	Pearlbreasted Swallow
<i>Hirundo fuligula</i>	Rock Martin
<i>Hirundo rustica</i>	Barn Swallow
<i>Hirundo semirufa</i>	Redbreasted Swallow
<i>Hirundo senegalensis</i>	Mosque Swallow
<i>Hirundo smithii</i>	Wiretailed Swallow
<i>Hirundo spilodera</i>	South African CliffSwallow
<i>Hypargos niveoguttatus</i>	Redthroated Twinspot
<i>Lagonosticta rhodopareia</i>	Jameson's Firefinch
<i>Lagonosticta rubricate</i>	African Firefinch



<i>Lagonosticta senegala</i>	Redbilled Firefinch
<i>Lamprotornis australis</i>	Burchell's Starling
<i>Lamprotornis chalybaeus</i>	Greater Blueeared Starling
<i>Lamprotornis corruscus</i>	Blackbellied Starling
<i>Lamprotornis Elisabeth</i>	Miombo Blueeared Starling
<i>Lamprotornis mevesii</i>	Meves's Starling
<i>Lamprotornis nitens</i>	Cape Glossy Starling
<i>Laniarius aethiopicus</i>	Tropical Boubou
<i>Laniarius atrococcineus</i>	Crimsonbreasted Shrike
<i>Laniarius ferrugineus</i>	Southern Boubou
<i>Lanius collaris</i>	Common Fiscal
<i>Lanius collurio</i>	Redbacked Shrike
<i>Lanius minor</i>	Lesser Grey Shrike
<i>Lioptilus nigricapillus</i>	Bush Blackcap
<i>Locustella fluviatilis</i>	River Warbler
<i>Luscinia luscinia</i>	Thrush Nightingale
<i>Macronyx ameliae</i>	Rosythroated Longclaw
<i>Macronyx capensis</i>	Cape Longclaw
<i>Macronyx croceus</i>	Yellowthroated Longclaw
<i>Malaconotus blanchoti</i>	Greyheaded BushShrike
<i>Malcorus pectoralis</i>	Rufouseared Warbler
<i>Melaenornis pammelaina</i>	Southern Black Flycatcher
<i>Mirafra Africana</i>	Rufousnaped Lark
<i>Mirafra apiata</i>	Cape Clapper Lark
<i>Mirafra cheniana</i>	Melodious Lark
<i>Mirafra fasciolata</i>	Eastern Clapper Lark
<i>Mirafra passerine</i>	Monotonous Lark
<i>Mirafra rufocinnamomea</i>	Flappet Lark
<i>Monticola brevipes</i>	Shorttoed RockThrush
<i>Monticola exploration</i>	Sentinel RockThrush
<i>Monticola rupestris</i>	Cape RockThrush
<i>Motacilla aguimp</i>	African Pied Wagtail
<i>Motacilla capensis</i>	Cape Wagtail
<i>Motacilla cinerea</i>	Grey Wagtail
<i>Motacilla citreola</i>	Citrine Wagtail
<i>Motacilla clara</i>	Mountain Wagtail
<i>Motacilla flava</i>	Yellow Wagtail
<i>Muscicapa adusta</i>	African Dusky Flycatcher
<i>Muscicapa caerulescens</i>	Ashy Flycatcher



<i>Muscicapa striata</i>	Spotted Flycatcher
<i>Myioparus plumbeus</i>	Grey TitFlycatcher
<i>Myrmecocichla arnoti</i>	Arnot's Chat
<i>Myrmecocichla formicivora</i>	Anteating Chat
<i>Nectarinia famosa</i>	Malachite Sunbird
<i>Nicator gularis</i>	Eastern Nicator
<i>Nilaus afer</i>	Brubru
<i>Oenanthe bifasciata</i>	Buffstreaked Chat
<i>Oenanthe monticola</i>	Mountain Wheatear
<i>Oenanthe oenante</i>	Northern Wheatear
<i>Oenanthe pileata</i>	Capped Wheatear
<i>Oenanthe pleschanka</i>	Pied Wheatear
<i>Onychognathus nabouroup</i>	Palewinged Starling
<i>Oriolus auratus</i>	African Golden Oriole
<i>Oriolus chlorocephalus</i>	Greenheaded Oriole
<i>Oriolus larvatus</i>	Blackheaded Oriole
<i>Oriolus oriolus</i>	Eurasian Golden Oriole
<i>Ortygospiza atricollis</i>	African Quailfinch
<i>Porisoma layardi</i>	Layard's TitBabbler
<i>Porisoma subcaeruleum</i>	Chestnutvented TitBabbler
<i>Parus afer</i>	Grey Tit
<i>Parus carpi</i>	Carp's Tit
<i>Parus cinerascens</i>	Ashy Tit
<i>Parus niger</i>	Southern Black Tit
<i>Passer diffuses</i>	Southern Greyheaded Sparrow
<i>Passer motitensis</i>	Great Sparrow
<i>Petronia superciliaris</i>	Yellowthroated Petronia
<i>Philetairus socius</i>	Sociable Weaver
<i>Phoenicurus phoenicurus</i>	Common Redstart
<i>Phragmacia substriata</i>	Namaqua Warbler
<i>Phyllastrephus flavostriatus</i>	Yellowstreaked Greenbul
<i>Phyllastrephus terrestris</i>	Terrestrial Brownbul
<i>Phylloscopus ruficapilla</i>	Yellowthroated WoodlandWarbler
<i>Phylloscopus trochilus</i>	Willow Warbler
<i>Pinarocorys nigricans</i>	Dusky Lark
<i>Pinarornis plumosus</i>	Boulder Chat
<i>Pitta angolensis</i>	African Pitta
<i>Platysteira peltata</i>	Blackthroated Wattleeye
<i>Plocepasser mahali</i>	Whitebrowed SparrowWeaver



<i>Ploceus bicolor</i>	Darkbacked Weaver
<i>Ploceus cucullatus</i>	Village Weaver
<i>Ploceus intermedius</i>	Lesser Masked Weaver
<i>Ploceus ocularis</i>	Spectacled Weaver
<i>Ploceus rubiginosus</i>	Chestnut Weaver
<i>Ploceus subaureus</i>	Yellow Weaver
<i>Ploceus xanthops</i>	Golden Weaver
<i>Ploceus xanthopterus</i>	Southern Brownthroated Weaver
<i>Pogonocichla stellata</i>	Whitestarred Robin
<i>Prinia flavicans</i>	Blackchested Prinia
<i>Prinia hypoxantha</i>	Drakensberg Prinia
<i>Prinia maculosa</i>	Karoo Prinia
<i>Prinia subflava</i>	TawnyRanked Prinia
<i>Prionops plumatus</i>	Whitecrested HelmetShrike
<i>Prionops retzii</i>	Retz's HelmetShrike
<i>Prionops scopifrons</i>	Chestnutfronted HelmetShrike
<i>Promerops cafer</i>	Cape Sugarbird
<i>Promerops gurneyi</i>	Gurney's Sugarbird
<i>Psalidoprocne albiceps</i>	Whiteheaded Sawwing
<i>Psalidoprocne holomelas</i>	Black Sawwing
<i>Pseudhirundo griseopyga</i>	Greyrumped Swallow
<i>Psophocichla litsitsirupa</i>	Groundscraper Thrush
<i>Pytilia afra</i>	Orangewinged Pytilia
<i>Pytilia melba</i>	Greenwinged Pytilia
<i>Quelea erythrops</i>	Redheaded Quelea
<i>Riparia cincta</i>	Banded Martin
<i>Riparia paludicola</i>	Brownthroated Martin
<i>Riparia riparia</i>	Sand Martin
<i>Saxicola rubetra</i>	Whinchat
<i>Saxicola torquatus</i>	African Stonechat
<i>Schoenicola brevirostris</i>	Broadtailed Warbler
<i>Serinus alario</i>	Blackheaded Canary
<i>Serinus canicollis</i>	Cape Canary
<i>Sigelus silens</i>	Fiscal Flycatcher
<i>Smithornis capensis</i>	African Broadbill
<i>Spermestes bicolor</i>	Redbacked Mannikin
<i>Spermestes cucullata</i>	Bronze Mannikin
<i>Spermestes fringilloides</i>	Magpie Mannikin
<i>Sphenoeacus afer</i>	Cape Grassbird



<i>Spizocorys conirostris</i>	Pinkbilled Lark
<i>Spizocorys fringillaris</i>	Botha's Lark
<i>Spizocorys starki</i>	Stark's Lark
<i>Sporaeginthus subflavus</i>	Orangebreasted Waxbill
<i>Sporopipes squamifrons</i>	Scalyfeathered Finch
<i>Spreo bicolor</i>	Pied Starling
<i>Stenostira scita</i>	Fairy Flycatcher
<i>Sylvia atricapilla</i>	Blackcap
<i>Sylvia borin</i>	Garden Warbler
<i>Sylvia communis</i>	Common Whitethroat
<i>Sylvietta rufescens</i>	Longbilled Crombec
<i>Tchagra australis</i>	Browncrowned Tchagra
<i>Tchagra senegalus</i>	Blackcrowned Tchagra
<i>Tchagra tchagra</i>	Southern Tchagra
<i>Telophorus nigrifrons</i>	Blackfronted BushShrike
<i>Telophorus olivaceus</i>	Olive BushShrike
<i>Telophorus sulfureopectus</i>	Orangebreasted BushShrike
<i>Telophorus viridis</i>	Gorgeous BushShrike
<i>Telophorus zeylonus</i>	Bokmakierie
<i>Terpsiphone viridis</i>	African ParadiseFlycatcher
<i>Thamnolaea cinnamomeiventris</i>	Mocking CliffChat
<i>Tmetothylacus tenellus</i>	Golden Pipit
<i>Trochocercus cyanomelas</i>	Bluemantled Crested Flycatcher
<i>Turdoides bicolor</i>	Southern Pied Babbler
<i>Turdoides jardineii</i>	Arrowmarked Babbler
<i>Turdus libonyana</i>	Kurrichane Thrush
<i>Turdus olivaceus</i>	Olive Thrush
<i>Turdus smithi</i>	Karoo Thrush
<i>Uraeginthus angolensis</i>	Blue Waxbill
<i>Vidua chalybeata</i>	Village Indigobird
<i>Vidua funerea</i>	Dusky Indigobird
<i>Vidua macroura</i>	Pintailed Whydah
<i>Vidua paradisaea</i>	Longtailed ParadiseWhydah
<i>Vidua purpurascens</i>	Purple Indigobird
<i>Vidua regia</i>	Shafttailed Whydah
<i>Zoothera gurneyi</i>	Orange GroundThrush
<i>Zoothera guttata</i>	Spotted GroundThrush
<i>Zosterops pallidus</i>	Orange River Whiteeye
<i>Zosterops sengalensis</i>	African Yellow Whiteeye



<i>Zosterops virens</i>	Cape Whiteeye
Order: PICIFORMES	
<i>Campethera abingoni</i>	Goldentailed Woodpecker
<i>Campethera bennettii</i>	Bennett's Woodpecker
<i>Campethera notata</i>	Knysna Woodpecker
<i>Dendropicos fuscescens</i>	Cardinal Woodpecker
<i>Dendropicos griseocephalus</i>	Olive Woodpecker
<i>Dendropicos namaquus</i>	Bearded Woodpecker
<i>Geocolaptes olivaceus</i>	Ground Woodpecker
<i>Indicator indicator</i>	Greater Honeyguide
<i>Indicator minor</i>	Lesser Honeyguide
<i>Indicator variegates</i>	Scalythroated Honeyguide
<i>Jynx ruficollis</i>	Redthroated Wryneck
<i>Lybius torquatus</i>	Blackcollared Barbet
<i>Pogoniulus bilineatus</i>	Yellowrumped Tinkerbird
<i>Pogoniulus chrysocous</i>	Yellowfronted Tinkerbird
<i>Pogoniulus pusillus</i>	Redfronted Tinkerbird
<i>Prodotiscus regulus</i>	Brownbacked Honeybird
<i>Prodotiscus zambesiae</i>	Greenbacked Honeybird
<i>Stactolaema leucotis</i>	Whiteeared Barbet
<i>Stactolaema olivacea</i>	Green Barbet
<i>Stactolaema whytii</i>	Whyte's Barbet
<i>Trachyphonus vaillantii</i>	Crested Barbet
<i>Tricholaema leucomelas</i>	Acacia Pied Barbet
Order: PSITTACIFORMES	
<i>Agapornis roseicollis</i>	Rosyfacd Lovebird
<i>Poicephalus cryptoxanthus</i>	Brownheaded Parrot
<i>Poicephalus meyeri</i>	Meyer's Parrot
Order: TROGONIFORMES	
<i>Apaloderma narina</i>	Narina Trogon
Order: TURNICIFORMES	
<i>Turnix hottentottus</i>	Hottentot Buttonquail
<i>Turnix nanus</i>	Blackrumped Buttonquail
<i>Turnix sylvaticus</i>	Kurrichane Burtonquail
Order: UPUIFORMES	
<i>Phoeniculus purpureus</i>	Green WoodHoopoe
<i>Rhinopomastus cyanomelas</i>	Common Scimitarbill
<i>Upupa Africana</i>	African Hoopoe
Order: STRUTHIONIFORMES	



<i>Struthio camelus</i>	Ostrich, within extensive wildlife
systems.	
CLASS: REPTILIA	
Order: CHELONIA	(TESTUDINATA)
Family: TESTUDINIDAE	All land tortoises
Order: SQUAMATA	
Family: Cordylidae	
<i>All species</i>	Girdled lizards, all species not listed in schedule 1
<i>Varanus albigularis</i>	Veld monitor / Rock monitor
Family: LACERTIDAE	All lizards, except those listed in schedule 1,3,4,5 and 6
Sub order: Serpentes	
<i>Bitis gabonica</i>	Gaboon Adder
<i>Bitis schneideri</i>	Namaqua Dwarf Adder / Schneider's adder
<i>Dasypeltis spp.</i>	Eggeaters, all species
<i>Duberria spp.</i>	Slugeaters, all species
<i>Lamprophis spp.</i>	House Snakes, all species
<i>Lycodonomorphus spp.</i>	Water Snakes, all species
<i>Lycophidion spp.</i>	Wolf Snakes, all species
<i>Mehelya capensis</i>	Cape File Snake
<i>Mehelya nyassae</i>	Black File Snake
<i>Mehelya spp.</i>	File snakes, all species
<i>Philothammus spp.</i>	Green and Bush Snakes, all
<i>Prosymna spp.</i>	Shovelsnout Snakes, all species
<i>Pseudaspis spp.</i>	Mole Snakes, all species
<i>Varanus niloticus</i>	Water monitor / leguaan
Order: CROCODILIA	
<i>Crocodylus niloticus</i>	Nile Crocodile
CLASS: AMPHIBIA	
Order: ANURA	All frogs and toads, except those listed in schedule 1,3,4,5 and 6
CLASS: ARACHNIDA	
Order: SCORPIONES	
<i>Hadogenes spp.</i>	Rock Scorpions, all species
<i>Opistacanthus spp.</i>	Creeping Scorpions, all species
<i>Opisththalmus spp.</i>	Burrowing Scorpions, all species
CLASS: INSECTA	
Order: COLEOPTERA	
<i>Dromica spp.</i>	Tiger Beetles, all species
<i>Graphipterus assimilis</i>	Velvet Ground Beetle
<i>Ichneustoma spp.</i>	Fruit Chafer Beetles, all species



<i>Manticora spp.</i>	Monster Tiger Beetles, all species
<i>Megacephala asperata</i>	Tiger Beetle
<i>Megacephala regalis</i>	Tiger Beetle
<i>Nigidius auriculatus</i>	Stag Beetle
<i>Oonotus adspersus</i>	Stag Beetle
<i>Oonotus interioris</i>	Stag Beetle
<i>Oonotus rex</i>	Stag Beetle
<i>Oonotus sericeus</i>	Stag Beetle
<i>Platychile pallida</i>	Tiger Beetle
<i>Prosopocoelus petitierrri</i>	Stag Beetle
<i>Prothyma guttipennis</i>	Tiger Beetle
Order: LEPIDOPTERA	
Family: LYCAENIDAE	All species
Family: HEPIALIDAE	All species
Family: HESPERIIDAE	All species
Family: NYMPHALIDAE	All species
Family: SATYRIDAE	All species
<i>Alaena margaritacea</i>	
<i>Aloeides clarki</i>	Coega Copper Butterfly
<i>Aloeidis dentatis</i>	dentatis Scarce Copper
<i>Aloeides egerides</i>	Scarce Copper
<i>Aloeides lutescens</i>	Scarce Copper
<i>Argyrocupha malagrida</i>	Autumn Copper / Lion's Head
<i>Charaxes spp.</i>	Emperor butterflies, all species
<i>Charaxes xiphares</i>	xiphares Western / Forest Emperor
<i>Charexes foccidentalis</i>	Forest King
<i>Lepidochrysops bacchus</i>	Wineland Blue
<i>Lepidochrysops lotana</i>	Lotana blue butterfly
<i>Leto venus</i>	Silverspotted Ghost Moth
<i>Metisella syrinx</i>	Bamboo Sylph
<i>Oxychaeta dicksoni</i>	Dickson's Copper
<i>Poecilmitis aureus</i>	Golden Copper
<i>Poecilmitis endymion</i>	Golden Copper
<i>Poecilmitis nigricans</i>	aurivillius Blue Jewel Copper
<i>Poecilmitis rileyi</i>	Blue Jewel Copper
<i>Poedilmitis lyncurium</i>	Tsomo River Copper
<i>Stygionympha dicksoni</i>	Dickson's Brown
<i>Thestor dicksoni</i>	dicksoni Dickson's Thestor
<i>Thestor kaplani</i>	Kaplan's Thestor



<i>Trimenia wallengrenii</i>	Wallengren's Copper
<i>Tsitana dicksoni</i>	Dickson's Sylph
CLASS: ONYCHOPHORA	
<i>Peripatopsis alba</i>	White Cave Velvet Worm
FLORA	
<i>All indigenous</i>	plants, except those listed in schedule 1,3,6
Family: ACANTHACEAE	
<i>Barleria papillosa</i>	
<i>Monechma saxatile</i>	
<i>Peristrophe spp.</i>	All species
Family: ADIANTHACEAE	
<i>Adiantum spp.</i>	Maidenhair Fern, all species
Family: AGAPANTHACEAE	
<i>Agapanthus spp.</i>	All species
Family: AIZOACEAE	
(MESEMBRYANTHEMACEAE) All	species
Family/Famille: AMARYLLIDACEAE	All species except those listed schedule 1
Family: ANTHERICACEAE	All species
Family: APIACEAE	All species except those listed schedule 1
Family: APOCYNACEAE	All species except those listed
Family: AQUIFOLIACEAE	
<i>Ilex mitis</i>	(Radlk.) Arum lilies, all species
Family: ARACEAE	
<i>Zantedeschia spp.</i>	
Family: ARALIACEAE	
<i>Cussonia spp.</i>	Cabbage trees, all species
Family: ASPHODELACEAE	All species except those listed schedule 1 and the species Aloe ferox
Family: ASTERACEAE	
<i>Helichrysum jubilatam</i>	
<i>Felicia deserti</i>	
<i>Gnaphalium simii</i>	
<i>Lopholaena longipes</i>	
<i>Senecio albopunctatus</i>	
<i>Senecio trachylaenus</i>	
<i>Trichogyne lerouxiae</i>	
<i>Tripteris pinnatilobata</i>	
<i>Troglophyton acocksianum</i>	
<i>Vellereophyton lasianthum</i>	



Family: BURMANNIACEAE

Burmattia madagascariensis Wild Ginger

Family: BURSERACEAE

Commiphora spp. All species

Family: CAPPARACEAE

Boscia spp. Sheperd's trees, all species

Family: CARYOPHYLLACEAE

Dinanthus spp. All species

Family: CELASTRACEAE

Gymnosporia spp. All species

Family: COLCHICACEAE

Androcymbium spp. All species

Gloriosa spp. All species

Family: COMBRETACEAE

Combretum spp. All species

Family: CRASSULACEAE All species except those listed in schedule 1

Family: CUPRESSACEAE

Widdringtonia spp. Wild cypress, all species

Family: CYATHEACEAE

Cyathea spp. Tree ferns, all species

Cyathea capensis Tree Ferns

Family: CYPERACEAE

Carex acocksii

Family: DROSERACEAE

Drosera spp. Sundew, all spesies

Family: DRYOPTERIDACEAE

Rumohro spp. Seven Weeks Fern, all species

Family: ERICACEAE Erica, all species

Family: EUPHORBIACEAE

Alchornea laxiflora

Euphorbia spp. All species

Family: FABACEAE

Aspalanthus spp. Tea bush, all spesies

Erythina zeyheri Plougbreaker

Argyrolobium petiolare

Caesalpinia bracteata

Calliandra redacta

Crotalaria pearsonii

Indigofero limosa



<i>Lebeckia bowieana</i>	
<i>Polhillia involucrate</i>	
<i>Rhynchosia emarginata</i>	
<i>Wiborgia humilis</i>	
Family: HYACINTHACEAE	
<i>Daubenyia spp.</i>	Daubenyia, all species
<i>Lachenalia spp.</i>	Viooltjie, all species
<i>Veltheimia spp.</i>	Forest Lily, all species
<i>Eucomis spp.</i>	Pineapple flower, all species
<i>Neopatersonia namaquensis</i>	
<i>Ornithogalum spp.</i>	All species
Family: IRIDACEAE	All species except those listed in schedule 1
Family: LAURACEAE	
<i>Ocotea spp.</i>	Stinkwood, all species
Family: MESEMBRYANTHEMACEAE	All species
Family: MELIACEAE	
<i>Nymanina capensis</i>	Chinese Lantern
Family: OLEACEAE	
<i>Olea europaea subsp. africana</i>	Wild olive
Family: ORCHIDACEAE	Orchids, all species except those in Schedule 1
Family: OROBANCHACEAE	
<i>Harveya spp.</i>	Harveya, all species
Family: OXALIDACEAE	
<i>Oxalis spp.</i>	Sorrel, all species except those in Schedule 1
Family: PLUMBAGINACEAE	
<i>Afrolimon namaquanum</i>	
Family: POACEAE	
<i>Brachiaria dura var. dura</i>	
<i>Dregeochloa calviniensis</i>	
<i>Pentaschistis lima</i>	
Family: PODOCARPACEAE	
<i>Podocarpus spp.</i>	Yellowwoods, all species
Family: PORTULACACEAE	
<i>Anacampseros spp.</i>	All species
<i>Avonia spp.</i>	All species
<i>Portulaca foliosa</i>	
Family: PROTEACEAE	All species except those listed in schedule 1
Family: RESTIONACEAE	All species
Family: RHAMNACEAE	



Phyllica spp. All species

Family: RUTACEAE

Agathosma spp. Buchu, all species

Family: SCROPHULARIACEAE

Diascia spp. All species

Halleria spp. All species

Jamesbrittenia spp. All species

Manulea spp. All species

Nemesia spp. All species

Phyllopodium spp. All species

Polycarena filiformis

Chaenostoma longipedicellatum

Family: STELITZIACEAE

Strelitzia spp. All species

Family: TECOPHILAEACEAE

Cyanella spp. All species

Family: THYMELAEACEAE

Gnidia leipoldtii

Family: ZINGIBERACEAE

Siphonochilus aethiopicus



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Pteridophyta	<i>Cheilanthes namaquensis</i>

APPENDIX D2: AQUATIC ASSESSMENT



Riverine Baseline Study & Risk Assessment for the proposed Pella Bulk Water Pipeline Project

Pella, Northern Cape, South Africa

January 2020

CLIENT



Prepared for:

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Pella Bulk Water Pipeline

Report Name	Riverine Baseline Study & Risk Assessment for the proposed Pella Bulk Water Pipeline Project
Submitted to	
Report Writer (Aquatics)	<p>Michael Ryan (Cand. Sci. Nat. 125128) <i>M. Ryan</i></p> <p>Michael Ryan is an Aquatic Ecologist and Hydrologist with 2 years of experience in baseline river assessments and aquatics and is SASS5 accredited. Michael Ryan received his B.Sc Honours degree (Geography) from the University of Witwatersrand.</p>
Report Reviewer	<p>Dale Kindler (Pr. Sci. Nat. 114743) <i>[Signature]</i></p> <p>Dale Kindler is Pr. Sci. Nat. registered (114743) in the Aquatic Science field of practice and is an experienced aquatic ecologist. He has over 5 years of experience conducting aquatic assessments across southern Africa, Guinea and Mozambique..</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 Ecological Assessment Regulations, 2017. We have no conflicting interests in the undertaking of this activity and have no interests 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 principals of science.</p>



The horseshoe reservoir at the end of the project area (January 2020)

Executive Summary

Specialist Opinion

It is the opinion of the specialist that provided the prescribed mitigation measures are implemented for all project related activities, the Pella pipeline project can commence as no fatal flaws were identified and the project qualifies for authorisation under the provisions of the General Authorisation.

The Biodiversity Company was commissioned by SLR Consulting (South Africa) (Pty) Ltd to conduct a riverine baseline study and impact (risk) assessment as part of the Environmental Impact Assessment (EIA), environmental authorisation process and Water Use Licence Application (WULA) for an underground pipeline that forms part of the Pella Water Supply Scheme in the Northern Cape, South Africa. Standard methodologies were applied at a single high flow survey conducted in January 2020

Baseline Environment

All rivers assessed at points where the proposed pipeline will cross a watercourse are ephemeral in nature and as a result could not be analysed. A downstream site for the project was assessed on the Orange River (O1). The results of the Present Ecological State (PES) assessment derived largely natural (class B) conditions in the Orange River reach considered in this assessment.

Habitat Integrity Assessments identified minimal habitat modification within the Orange River which indicates a largely natural state (class B). Sources of modification to the system are agriculture, regional water abstraction as part of transfer schemes as well as alien invasive plant species. *In situ* water quality for the Orange River indicates natural conditions as they conform with Target Water Quality Ranges (TWQR) with only water temperature being noncompliant but considered natural for the system. The South African Scoring System (SASS5) assessment results generated SASS scores that are categorised as a class A for the Orange River reach. The presence and wide distribution of specialist taxa across the biotopes along with high diversity of species indicates the current health of the system from a geomorphological, biological and chemical stance.

Two red listed fish species are expected within the river reaches in the study area. The Near Threatened species *Labeobarbus kimberleyensis* and the Vulnerable species is *Oreochromis mossambicus*. Both species were sampled in the Orange with the Fish Response Assessment Index (FRAI) derived scoring a moderately modified class D.

Risk Assessment

A variety of risks have been identified for the proposed project for both the construction and operational phases. The impacts of which all stem from construction within a defined watercourse. The associated risks are, however, significantly lowered due to the ephemeral nature of the watercourses but are not absent as the watercourse still forms important habitat for aquatic life when it does flow.

Taking into consideration that the project is for water reticulation, with a pipeline generally aligned in road reserves, the risks posed to watercourses are considered negligible. This is supported by the fact that the proposed pipeline will also replace existing structures, indicating the area to already be disturbed. This statement is however only considered valid provided the attributed mitigation measures are considered and implemented.

DOCUMENT GUIDE

The table below provides the NEMA (2014) Requirements for Ecological Assessments, and the relevant sections in the reports where these requirements are addressed:

GNR 326	Description	Section in the Report
Specialist Report		
Appendix 6 (a)	A specialist report prepared in terms of these Regulations must contain— details of— i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	Page i
Appendix 6 (b)	A declaration that the specialist is independent in a form as may be specified by the competent authority;	Page vii
Appendix 6 (c)	An indication of the scope of, and the purpose for which, the report was prepared;	Section 1
Appendix 6 (cA)	<u>An indication of the quality and age of base data used for the specialist report;</u>	Section 6
Appendix 6 (cB)	<u>A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;</u>	Section 6
Appendix 6 (d)	The <u>duration</u> , date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 6
Appendix 6 (e)	A description of the methodology adopted in preparing the report or carrying out the specialised process <u>inclusive of equipment and modelling used;</u>	Section 3
Appendix 6 (f)	<u>Details of an assessment of</u> the specific identified sensitivity of the site related to the <u>proposed activity or activities</u> and its associated structures and infrastructure, inclusive of a <u>site plan identifying site alternatives;</u>	Section 7
Appendix 6 (g)	An identification of any areas to be avoided, including buffers;	Section 7
Appendix 6 (h)	A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Not applicable
Appendix 6 (i)	A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 4
Appendix 6 (j)	A description of the findings and potential implications of such findings on the impact of the proposed activity [including identified alternatives on the environment] <u>or activities;</u>	Section 6
Appendix 6 (k)	Any mitigation measures for inclusion in the EMPr;	Section 7
Appendix 6 (l)	Any conditions for inclusion in the environmental authorisation;	Section 7

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Appendix 6 (m)	Any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 7
Appendix 6 (n)	<p>A reasoned opinion—</p> <p>i. [as to] whether the proposed activity, <u>activities</u> or portions thereof should be authorised;</p> <p><u>(iA) regarding the acceptability of the proposed activity or activities; and</u></p> <p>ii. if the opinion is that the proposed activity, <u>activities</u> or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;</p>	Section 8
Appendix 6 (o)	A description of any consultation process that was undertaken during the course of preparing the specialist report;	Not applicable
Appendix 6 (p)	A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	Not applicable
Appendix 6 (q)	Any other information requested by the competent authority.	None

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Table of Abbreviations

Abbreviations	Abbreviated Word
ASPT	Average Score Per Taxa
BAR	Basic Assessment Report
C	Consequences
DHSWS	Department of Human Settlement, Water and Sanitation
DO	Dissolved Oxygen
DWS	Department of Water and Sanitation
D	Duration
E	Extent
EAP	Environmental Assessment Practitioner
EC	Electrical Conductivity
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EMPr	Environmental Management Program
FRAI	Fish Response Assessment Index
GA	General Authorization
I	Intensity
IHIA	Intermediate Habitat Integrity Assessment
LC	Least Concern
NEMA	National Environmental Management Act
NFEPA	National Freshwater Ecosystem Priority Areas
NT	Near Threatened
NWA	National Water Act
PES	Present Ecological State
P	Probability
S	Significance
SASS5	South African Scoring System 5
SQR	Sub Quaternary Reach
TWQR	Target Water Quality Ranges
VU	Vulnerable
WMA	Water Management Area
WULA	Water Use License Application

Declaration

I, Michael Ryan 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 Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, 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 in terms of Regulation 71 and is punishable in terms of Section 24F of the Act.

MRyan

Michael Ryan

Aquatic Specialist

The Biodiversity Company

January 2020

Declaration

I, Dale Kindler 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 Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, 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 in terms of Regulation 71 and is punishable in terms of Section 24F of the Act.



Dale Kindler

Aquatic Specialist

The Biodiversity Company

January 2020

1 Introduction

The modification of land use within a river catchment has the potential to degrade local water resources (Wepener *et al.*, 2005). Infrastructure thus has the potential to negatively impact on local water resources and ecosystem services. In order to holistically manage water resources in South Africa, the use of standard water quality sampling methods is considered in-effective. Non-point and point source pollutants are dynamic and can fluctuate according to several factors such as rainfall, industrial discharges and extensive pollutant seepage. Aquatic ecology is permanently exposed to the dynamic conditions within water bodies and can therefore be an effective reflection of the environmental conditions within a management area. Considering this, the monitoring of aquatic ecology is regarded as an effective tool in water management strategies. This can therefore be used to assess the current state of a system.

The Biodiversity Company was commissioned by SLR Consulting (South Africa) (Pty) Ltd to conduct a riverine baseline study and impact (risk) assessment as part of the Environmental Impact Assessment (EIA), environmental authorisation process and Water Use Licence Application (WULA) for an underground pipeline that forms part of the Pella Water Supply Scheme in the Northern Cape, South Africa.

The new underground bulk water pipeline will replace the old underground bulk water pipeline and will supply water to the proposed Gamsberg Smelter Project and existing Gamsberg Mine, Black Mountain Mine and the surrounding towns (Aggeneys, Pella, Pofadder and local landowners). The proposed pipeline will be located within the existing servitude, with water sourced from the Orange River through an intake pump house located at Pella Drift, almost 30 km to the North East of the Gamsberg Zinc Mine.

The aquatics survey was conducted on the 15th and 17th of January 2020 which constitutes a dry season survey. The assessment included defining the extent of the project area and baseline conditions of the systems. Furthermore, the identification and description of any sensitive receptors were recorded across the project area where the pipeline crossed any river system as well as a downstream site in order to monitor the effects of the project as a whole.

The project was completed in accordance with the requirements of the Water Use Authorisation in terms of Section 21(c) and (i) of the National Water Act (Act 36 of 1998) (NWA). This assessment is in accordance with the 2014 EIA Regulations (No. R. 982-985, Department of Environmental Affairs, 4 December 2014) emanating from Chapter 5 of the National Environmental Management Act (Act No. 107 of 1998). The findings and information herein are in terms of Appendix 6 of the 2014 NEMA EIA Regulations (amended in 2017).

This report, after taking into consideration the findings and recommendations provided by the specialist herein, should inform and guide the Environmental Assessment Practitioner (EAP), enabling informed decision making as to the ecological viability of the proposed development and to provide an opinion on whether any environmental authorisation process or licensing is required for the proposed activities.

1.1 Scope/Objectives

The aim of the assessment is to provide the water resource baseline and impact assessment for the proposed pipeline project. This was achieved through the following:

- Determining the PES of the local watercourses:
 - The assessment of water quality;
 - The assessment of habitat quality;
 - The assessment of biological responses;
- A risk assessment for the proposed pipeline; and
- The prescription of mitigation measures and recommendations for identified risks.

2 Project Area

The project area begins at the abstraction tower in the Orange River and Pella Drift Water Treatment Plant, 39km North West of the town of Aggeney's (Northern Cape) and runs South East till ending at the Horseshoe Reservoir. The remaining stretch of the bulk water pipeline which enters the Gamsberg Zinc Mine property was not considered as a separate environmental authorisation will be undertaken for the remaining section of the bulk water pipeline which will form part of the Gamsberg Smelter Project environmental authorisation process (Figure 1). The project area is surrounded by dry natural bare soil with grasslands in patches with minimal agriculture due to the dry climate. Due to the minimal rainfall and dry climate in the area, water is a scarce commodity with the Orange River serving as the main source of water for surrounding land users, one of which includes mining.

The Pella pipeline project is situated in the D81G and D82A quaternary catchments, within the Lower Orange Water Management Area (WMA). The proposed reticulation network will be crossing multiple tributaries of the Orange River (D81F – 3445 Sub Quaternary Reach) (SQR), in the Orange River Gorge – Aquatic Ecoregion. These tributaries include the 3rd order, 20.61 km long T_Goob se Laagte River (D81G – 03731 SQR) and associated drainage lines (D81G-3789/D81G-3804/ D81G-3855 and D81G-3840 SQR). The T_Goob se Laagte River is a largely natural (class B) river with a moderate Ecological status and sensitivity (DWS, 2020). The remaining watercourses of concern are the unnamed tributary of the ephemeral D81G – 03840 SQR and a tributary of the ephemeral D82A – 03779 SQR (Mik River).

The system at a desktop level is regarded as largely natural (Class B by DWS, 2020) due to water abstraction, alien invasive plants in riparian zones and subsistence farming.

The Lower Orange WMA is situated in the western extremity of South Africa, bordering on Botswana, Namibia and the Atlantic Ocean. The region has a harsh semi-desert to desert climate. Rainfall is minimal, ranging from 20 to 400 mm per annum with prolonged droughts. The Lower Orange WMA is entirely dependent on flow in the Orange River from upstream WMAs, with the exception of intermittent runoff from local tributaries and occasional inflows from the Fish River in Namibia. Important conservation areas in the WMA include the Kgalagadi Transfrontier National Park, the Augrabies National Park, the Richtersveld National Park and a transboundary Ramsar





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wetland site at the Orange River mouth. The economy is driven by mining (alluvial diamonds & other mineral resources) and irrigated agriculture. Extensive irrigation occurs along the Orange River. Sheep and other livestock farming is practised where the climate is favourable. Water resources in this WMA are fully developed due to the fact that water has to travel 1 400 km from its release at Vanderkloof Dam to the most downstream point of use (StatsSA, 2010).







The sampling points for the study were selected to adequately assess the current state of the Orange River and all the associated tributaries to identify the potential risks that may result from construction and operation of the Pella Bulk Water Pipeline. Sites were named according to the river on which they fall. O1 is on the Orange River (representing a downstream monitoring point for the whole operation), T1, T2, T3, T4, T5, T6, T7, T8 and T9 fall along the Te Goob se Laagte River and sites M1 and M2 are on the Mik River.

As a result, each reach was assessed at the proposed location of a pipeline crossing with a watercourse to gain a holistic image of the system and which habitat may be affected. The selected sampling location and the location of each crossing can be seen in Table 1 as well as Figure 1.









Table 1: Photos, co-ordinates and descriptions for the sites sampled (January 2020)

	Upstream	Downstream
O1 (Orange River)		
GPS	28°58'7.97"S 19° 7'29.82"E	
	Upstream	Downstream
T1 (Te Goob se Laagte River)		
GPS	28°58'4.94"S 19° 8'52.23"E	







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	Upstream	Downstream
T2 (Te Goob se Laagte River)		
GPS	28°58'8.65"S 19° 8'49.90"E	
	Upstream	Downstream
T3 (Te Goob se Laagte River)		
GPS	28°58'11.13"S 19° 8'48.51"E	
	Upstream	Downstream
T4 (Te Goob se Laagte River)		
GPS	28°58'48.33"S 19° 8'31.45"E	

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	Upstream	Downstream
T5 (Te Goob se Laagte River)		
GPS	28°59'10.79"S 19° 8'43.47"E	
	Upstream	Downstream
T6 (Te Goob se Laagte River)		
GPS	28°59'37.92"S 19° 8'33.63"E	
	Upstream	Downstream
T7 (Te Goob se Laagte River)		
GPS	28°59'56.58"S 19° 8'19.06"E	
T8 (Te Goob se Laagte River)		

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	Upstream	Downstream
GPS	29° 0'11.15"S 19° 8'13.32"E	
	Upstream	Downstream
T9 (Te Goob se Laagte River)		
GPS	29° 3'55.07"S 19° 6'35.62"E	
	Upstream	Downstream
M1 (Mik River)		
GPS	29° 8'38.45"S 19° 0'50.44"E	
	Upstream	Downstream
M2 (Mik River)		
GPS	29° 9'1.82"S 19° 0'17.04"E	

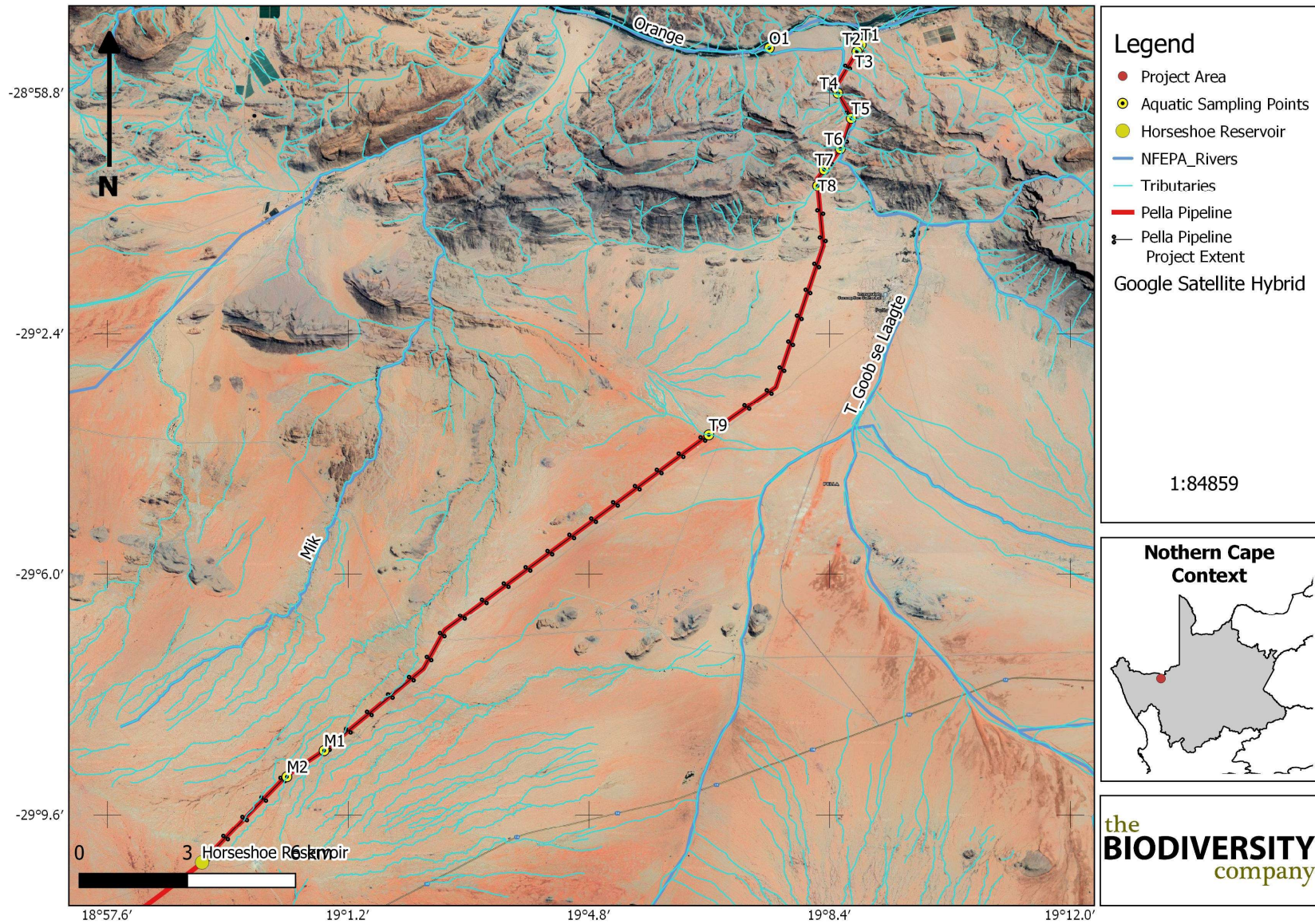


Figure 1: The location of the proposed pipeline and the assessed sites

3 Methodology

3.1 Aquatic Assessment

A single high flow survey was conducted in January 2020. While the period was considered high flow the region is experiencing a drought and therefore all ephemeral systems were dry. Standard methods were used to establish the baseline conditions of the considered river reaches. Details pertaining to the specific methodologies applied are provided in the relevant sections below.

3.1.1 Water Quality

Water quality was measured in situ using a handheld calibrated Extech® DO700 multi-meter. The constituents considered that were measured included: pH, conductivity ($\mu\text{S}/\text{cm}$), water temperature ($^{\circ}\text{C}$) and Dissolved Oxygen (DO) in mg/l.

3.1.2 Aquatic Habitat Integrity

The Intermediate Habitat Assessment Index (IHIA) as described in the Procedure for Rapid Determination of Resource Directed Measures for River Ecosystems (Section D), 1999 was used to define the ecological status of the Orange River reach.

The IHIA model will be used to assess the integrity of the habitats from a riparian and in-stream perspective. The habitat integrity of a river refers to the maintenance of a balanced composition of physico-chemical and habitat characteristics on a temporal and spatial scale which are comparable to the characteristics of natural habitats of the region (Kleynhans, 1996).

This model compares current conditions with reference conditions that are expected to have been present. Specification of the reference condition follows an impact based approach where the intensity and extent of anthropogenic changes are used to interpret the impact on the habitat integrity of the system. To accomplish this, information on abiotic changes that can potentially influence river habitat integrity are obtained from surveys or available data sources. These changes are all related and interpreted in terms of modification of the drivers of the system, namely hydrology, geomorphology and physico-chemical conditions and how these changes would impact on the natural riverine habitats. The criteria and ratings utilised in the assessment of habitat integrity in the current study are presented in Table 2 and Table 3 respectively.

Table 2: Criteria used in the assessment of habitat integrity (Kleynhans, 1996)

Criterion	Relevance
Water abstraction	Direct impact on habitat type, abundance and size. Also implicated in flow, bed, channel and water quality characteristics. Riparian vegetation may be influenced by a decrease in the supply of water.
Flow modification	Consequence of abstraction or regulation by impoundments. Changes in temporal and spatial characteristics of flow can have an impact on habitat attributes such as an increase in duration of low flow season, resulting in low availability of certain habitat types or water at the start of the breeding, flowering or growing season.
Bed modification	Regarded as the result of increased input of sediment from the catchment or a decrease in the ability of the river to transport sediment. Indirect indications of sedimentation are stream bank and catchment erosion. Purposeful alteration of the stream bed, e.g. the removal of rapids for navigation is also included.
Channel modification	May be the result of a change in flow, which may alter channel characteristics causing a change in marginal instream and riparian habitat. Purposeful channel modification to improve drainage is also included.

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Water quality modification	Originates from point and diffuse point sources. Measured directly or alternatively agricultural activities, human settlements and industrial activities may indicate the likelihood of modification. Aggravated by a decrease in the volume of water during low or no flow conditions.
Inundation	Destruction of riffle, rapid and riparian zone habitat. Obstruction to the movement of aquatic fauna and influences water quality and the movement of sediments.
Exotic macrophytes	Alteration of habitat by obstruction of flow and may influence water quality. Dependent upon the species involved and scale of infestation.
Exotic aquatic fauna	The disturbance of the stream bottom during feeding may influence the water quality and increase turbidity. Dependent upon the species involved and their abundance.
Solid waste disposal	A direct anthropogenic impact which may alter habitat structurally. Also, a general indication of the misuse and mismanagement of the river.
Indigenous vegetation removal	Impairment of the buffer the vegetation forms to the movement of sediment and other catchment runoff products into the river. Refers to physical removal for farming, firewood and overgrazing.
Exotic vegetation encroachment	Excludes natural vegetation due to vigorous growth, causing bank instability and decreasing the buffering function of the riparian zone. Allocthonous organic matter input will also be changed. Riparian zone habitat diversity is also reduced.
Bank erosion	Decrease in bank stability will cause sedimentation and possible collapse of the riverbank resulting in a loss or modification of both instream and riparian habitats. Increased erosion can be the result of natural vegetation removal, overgrazing or exotic vegetation encroachment.

Table 3: Descriptions used for the ratings of the various habitat criteria

Impact Category	Description	Score
None	No discernible impact or the modification is located in such a way that it has no impact on habitat quality, diversity, size and variability.	0
Small	The modification is limited to very few localities and the impact on habitat quality, diversity, size and variability are also very small.	1-5
Moderate	The modifications are present at a small number of localities and the impact on habitat quality, diversity, size and variability are also limited.	6-10
Large	The modification is generally present with a clearly detrimental impact on habitat quality, diversity, size and variability. Large areas are, however, not influenced.	11-15
Serious	The modification is frequently present and the habitat quality, diversity, size and variability in almost the whole of the defined area are affected. Only small areas are not influenced.	16-20
Critical	The modification is present overall with a high intensity. The habitat quality, diversity, size and variability in almost the whole of the defined section are influenced detrimentally.	21-25

3.1.3 Aquatic Macroinvertebrate Assessment

Macroinvertebrate assemblages are good indicators of localised conditions because many benthic macroinvertebrates have limited migration patterns or a sessile mode of life. They are particularly well-suited for assessing site-specific impacts (upstream and downstream studies) (Barbour *et al.*, 1999). Benthic macroinvertebrate assemblages are made up of species that constitute a broad range of trophic levels and pollution tolerances, thus providing strong information for interpreting cumulative effects (Barbour *et al.*, 1999). The assessment and monitoring of benthic macroinvertebrate communities forms an integral part of the monitoring of the health of an aquatic ecosystem.

3.1.3.1 Invertebrate Habitat

The invertebrate habitat at the site was assessed using the South African Scoring System version 5 (SASS5) biotope rating assessment as applied in Tate and Husted (2015). A rating system of 0 to 5 was applied, 0 being not available. The weightings for lowland rivers (slope class F) were used to categorize biotope ratings (Rowntree *et al.* 2000; Rowntree & Ziervogel, 1999).

3.1.3.2 South African Scoring System

The South African Scoring System version 5 (SASS5) is the current index being used to assess the status of riverine macroinvertebrates in South Africa. According to Dickens and Graham (2002), the index is based on the presence of aquatic invertebrate families and the perceived sensitivity to water quality changes of these families. Different families exhibit different sensitivities to pollution, these sensitivities range from highly tolerant families (e.g. Chironomidae) to highly sensitive families (e.g. Perlidae). SASS results are expressed both as an index score (SASS score) and the Average Score Per recorded Taxon (ASPT value).

Sampled invertebrates were identified using the “Aquatic Invertebrates of South African Rivers” Illustrations book, by Gerber and Gabriel (2002). Identification of organisms was made to family level (Thirion *et al.*, 1995; Dickens and Graham, 2002; Gerber and Gabriel, 2002).

All SASS5 and ASPT scores are compared with the SASS5 Data Interpretation Guidelines (Dallas, 2007) for the Orange River Gorge - Ecoregion (Figure 3). This method seeks to develop biological bands depicting the various ecological states and is derived from data contained within the Rivers Database and supplemented with other data not yet in the database.

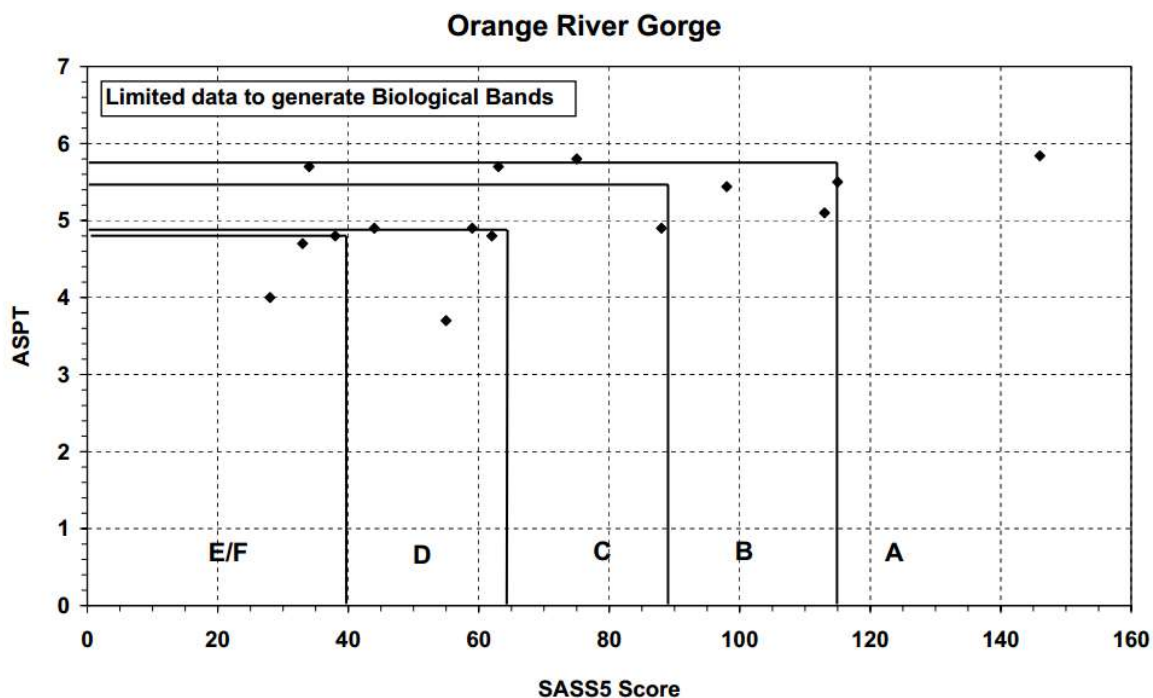


Figure 2: Biological Bands for the Orange River Gorge - Ecoregion, calculated using percentiles

3.2 Fish Presence

Fish were sampled through minnow traps and electroshocking (Figure 3). All fish were identified in the field and released at the point of capture, in order not to cross fish populations. Fish species were identified using the guide Freshwater Fishes of Southern Africa (Skelton, 2001). The identified fish species were compared to those expected to be present for the quaternary catchment. The expected fish species list for the reach was developed from a literature survey to

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compare to the sampled species at site. Different fish species represent different sensitivities to water chemistry, habitat and flow which considered as part of the Fish Response Assessment Index (FRAI) (Kleynhans *et al.*, 2007 and Skelton 2001).



Figure 3: Example of methodology used to catch fish species (KZN, 2019).

3.3 Fish Response Assessment Index

Fish have different sensitivities or levels of tolerance to various aspects that they are subjected to within the aquatic environment. These tolerance levels are rated with a sensitivity score as presented in Table 4. These tolerance levels are scored to show each fish species' sensitivity to flow and physico-chemical modifications. The results indicate that fish collected in the Orange River are moderately tolerant to flow and physico-chemical modifications, respectively (Table 4). This applies as an average of the whole class and not each individual species.

Table 4: Intolerance rating and sensitivity of fish species

Sensitivity Score	Tolerance/Sensitivity Level
0-1	Highly tolerant = Very low sensitivity
1-2	Tolerant = Low sensitivity
2-3	Moderately tolerant = Moderate sensitivity
3-4	Moderately intolerant = High sensitivity
4-5	Intolerant = Very high sensitivity

Biological responses are important to consider and therefore the qualitative data obtained from the surveys was utilized in the FRAI (Kleynhans, 2007) and with the results presented below (Table 13). The Frequency of Occurrence (FROC) of the sampled fish community is calculated as follows: 0 = Absent; 1 = Present at very few sites (<10%); 2 = Present at few sites (>10-25%); 3 = Present at about >25-50% of sites; 4 = Present at most sites (>50- 75%); 5 = Present at almost all sites (>75%).

3.4 Impact Assessment

The risk assessment was completed according to the rating system provided by SLR Consulting (South Africa) (Pty) Ltd (2019). Each impact identified must be assessed in terms of intensity (severity), duration (temporal scale) and extent (spatial scale) which is used to calculate the consequence. The consequence along with probability (likelihood of occurring) are then used to calculate the significance of each associated risk. The following criteria must be applied:

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 of the 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.
	L	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.
	VL	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.
	VL+	Negligible change or improvement. Almost no benefits. Change not measurable/will remain in the current range.
	L+	Minor change or improvement. Minor benefits. Change not measurable/will remain in the current range. Few people will experience benefits.
	M+	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.
	H+	Prominent change or improvement. Real and substantial benefits. Will be better than current conditions. Many people will experience benefits. General community support.
	VH+	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.
Criteria for ranking the DURATION of impacts	VL	Very short, always less than a year. Quickly reversible
	L	Short-term, occurs for more than 1 but less than 5 years. Reversible over time.
	M	Medium-term, 5 to 10 years.
	H	Long term, between 10 and 20 years. (Likely to cease at the end of the operational life of the activity)
	VH	Very long, permanent, +20 years (Irreversible. Beyond closure)
Criteria for ranking the EXTENT of impacts	VL	A part of the site/property.
	L	Whole site.
	M	Beyond the site boundary, affecting immediate neighbours
	H	Local area, extending far beyond site boundary.
	VH	Regional/National

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PART B: DETERMINING CONSEQUENCE							
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
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

VL	L	M	H	VH
A part of the site/ property	Whole site	Beyond the site, affecting neighbours	Extending far beyond site but localised	Regional/ National
EXTENT				

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							

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PART D: INTERPRETATION OF SIGNIFICANCE	
Significance	Decision guideline
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 required.
Very Low	It will not have an influence on the decision. Does not require any mitigation
Insignificant	Inconsequential, not requiring any consideration.

3.5 Risk Assessment

The risk assessment will be completed in accordance with the requirements of the DWS General Authorisation (GA) in terms of Section 39 of the NWA for water uses as defined in Section 21(c) or Section 21(i) (GN 509 of 2016). The significance of the impact is calculated according to Table 5.

Table 5: Significance ratings matrix

Rating	Class	Management Description
1 – 55	(L) Low Risk	Acceptable as is or consider requirement for mitigation. Impact to watercourses and resource quality small and easily mitigated. Wetlands may be excluded.
56 – 169	(M) Moderate Risk	Risk and impact on watercourses are notably and require mitigation measures on a higher level, which costs more and require specialist input. Wetlands are excluded.
170 – 300	(H) High Risk	Always involves wetlands. Watercourse(s) impacts by the activity are such that they impose a long-term threat on a large scale and lowering of the Reserve.

4 Limitations and Assumptions

The following aspects were considered as limitations of the assessment:

- A single aquatic ecology survey was completed for this assessment. Thus, temporal trends were not investigated.
- No baseline biomonitoring data/report(s) are available for the project area. Therefore, information presents the findings of the single aquatic survey.
- Due to the rapid nature of the assessment and the survey methods applied, fish diversity and abundance was likely to be underestimated.
- Invertebrates were only considered to the Family level and thus a defined species list for aquatic invertebrates was not completed. Therefore, the true sensitivities of macroinvertebrates species is not represented, causing an over or underestimation depending on the species.
- Due to the ephemeral nature of the river crossings these rivers could not be assessed.

5 Key Legislative Requirements

5.1 National Water Act (NWA, 1998)

The DHSWS is the custodian of South Africa's water resources and therefore assumes public trusteeship of water resources, which includes watercourses, surface water, estuaries, or aquifers. The National Water Act (Act No. 36 of 1998) (NWA) allows for the protection of water resources, which includes:

- The maintenance of the quality of the water resource to the extent that the water resources may be used in an ecologically sustainable way;
- The prevention of the degradation of the water resource; and
- The rehabilitation of the water resource.

A watercourse means:

- A river or spring;
- A natural channel in which water flows regularly or intermittently;
- A wetland, lake or dam into which, or from which, water flows; and
- Any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks.

The NWA recognises that the entire ecosystem and not just the water itself, and any given water resource constitutes the resource and as such needs to be conserved. No activity may therefore take place within a watercourse unless it is authorised by the DWS. Any area within a wetland or riparian zone is therefore excluded from development unless authorisation is obtained from the DWS in terms of Section 21 (c) and (i).

5.2 National Environmental Management Act (NEMA, 1998)

The National Environmental Management Act (NEMA) (Act 107 of 1998) and the associated Regulations as amended in December 2014, states that prior to any development taking place within a wetland or riparian area, an environmental authorisation process needs to be followed. This could follow either the Basic Assessment Report (BAR) process or the Environmental Impact Assessment (EIA) process depending on the scale of the impact.

6 Desktop Assessment

6.1.1 National Freshwater Ecosystem Priority Areas (NFEPA)

The National Freshwater Ecosystem Priority Areas (NFEPA) database forms part of a comprehensive approach to the sustainable and equitable development of South Africa's scarce water resources. This database provides guidance on how many rivers, wetlands and estuaries, and which ones, should remain in a natural or near-natural condition to support the water resource protection goals of the National Water Act (Act 36 of 1998). This directly applies to the National

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Water Act, which feeds into Catchment Management Strategies, water resource classification, reserve determination, and the setting and monitoring of resource quality objectives (Nel *et al.*, 2011). The NFEPAs are intended to be conservation support tools and envisioned to guide the effective implementation of measures to achieve the National Environment Management Biodiversity Act's biodiversity goals (NEM:BA) (Act 10 of 2004), informing both the listing of threatened freshwater ecosystems and the process of bioregional planning provided for by this Act (Nel *et al.*, 2011).

According to Nel *et al.* (2011), the construction of the Pella Bulk Water Pipeline project area falls predominantly within a Sub-quaternary catchment along the D81F-03445 and D81G – 03731 Sub-Quaternary Reach's as well as the ephemeral D81G-3789, D81G-3804, D81G-3855, D81G-3840, D81G – 03840 and D82A – 03779 SQR's (Figure 12). Due to scale, all catchment labels are not visible but fall within the yellow square. The catchment is considered a River FEPA as well as a fish sanctuary for threatened species. As a result, all abstraction projects need to consider the water balance within the Orange River and associated tributaries as the systems in the FEPA need consideration to protect its ecological reserve.

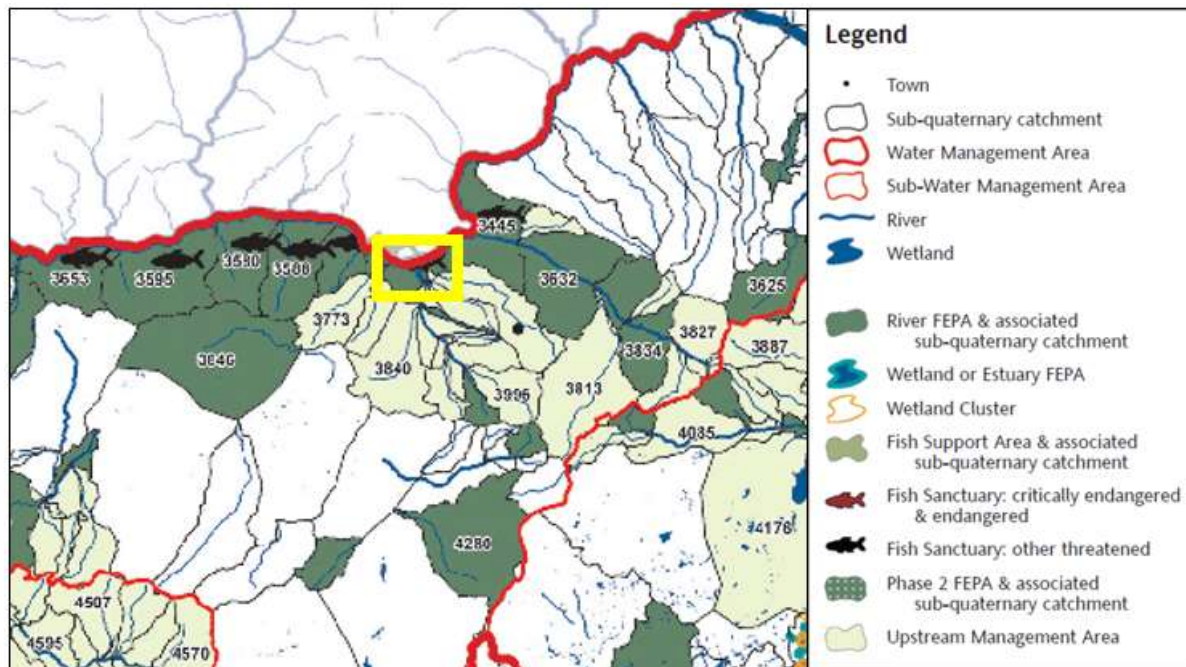


Figure 4: Map illustrating fish and river FEPAs for the project area, the project area is represented by the yellow square (Nel *et al.*, 2011)

6.2 Status of sub-quaternary reach D81F-03445 and D81G – 03731

Desktop information for SQR's was obtained from DWS, 2020. The D81F-03445 SQR is a 7th order stream which spans 42 km. The PES category of the reach is classed as largely natural (class B) (Table 5). The D81G – 03731 SQR is a 3rd order stream which spans 20.61 km. The PES category of the reach is classed as largely natural (class B) (Table 5). The largely natural state of these reaches is due to impacts to instream habitat, wetland and riparian zone continuity, flow modifications and moderate potential impacts on physico-chemical conditions (water quality). Anthropogenic impacts identified within the Orange River sub-quaternary catchment include

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water abstraction, flow modification and alien invasive plant species. Anthropogenic impacts identified within the T_Goob se Laagte River sub-quaternary catchment include rural settlements, subsistence farming and exotic species. DWS has no associate desktop PES information for any ephemeral systems which includes the ephemeral D81G-3789, D81G-3804, D81G-3855, D81G-3840, D81G – 03840 and D82A – 03779 (Mik River) SQR's

Table 6: Summary of the Present Ecological State of the SQRs associated with the Orange River reach (DWS, 2020)

SQR Importance and Sensitivity	Score
D81F-03445 (Orange River)	
Present Ecological Status	Largely Natural (class B)
Ecological Importance	High
Ecological Sensitivity	High
Default Ecological Category	B
D81G – 03731 (T_Goob se Laagte)	
SQR Importance and Sensitivity	Score
Present Ecological Status	Largely Natural (class B)
Ecological Importance	Moderate
Ecological Sensitivity	Moderate
Default Ecological Category	C

6.3 Expected Fish Species

An expected species list was generated from DWS (2020), and Skelton (2011) for the D81F-03445 SQR's. A total of 13 fish species are expected to occur in the Orange River reach which are presented in Table 7. The conservational status of fish species was assessed against the IUCN database 2020 (IUCN, 2020).

The expected species are generated on a reach basis, and the occurrence of all species in the system is unlikely as different species are specialists of different habitats which are present along a reach. The Orange River reach does however have great diversity of habitat and therefore a wide range of fish species are expected. This includes one Vulnerable (V) species and one Near Threatened (NT) species.

The Near Threatened species identified is *Labeobarbus kimberleyensis* (Largemouth Yellowfish) and the Vulnerable species is *Oreochromis mossambicus* (Mozambique Tilapia). *Labeobarbus kimberleyensis* are silvery when young but are olive grey or light yellow as adults with light orange anal fin. This is the largest scale-bearing indigenous fish species in southern Africa. These fish prefer flowing water in deep channels or below rapids but do well in dams. These large fish are expert predators of insects and small crustaceans. *Oreochromis mossambicus* is a silvery olive to deep blue/grey in colour with a wide distribution throughout the eastern coast of Southern Africa. *O. mossambicus* occur in most systems except where there are fast flowing waters. The species thrive in standing waters and have a high tolerance to salinity. *O. mossambicus* feeds on plant matter and algae, however larger specimens have been known to be piscivorous (Skelton, 2001).

Table 7: Expected fish species

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Species	Common Name	IUCN Status (2019)
<i>Austroglanis sclateri</i>	Rock Catfish	LC
<i>Clarias gariepinus</i>	Sharptooth Catfish / Barbel	LC
<i>Engraulicypris brevianalis</i>	Hyphen Barb	LC
<i>Enteromius hospes</i>	Namaquab Barb	LC
<i>Enteromius paludinosus</i>	Straightfin Barb	LC
<i>Enteromius trimaculatus</i>	Threespot Barb	LC
<i>Labeobarbus aeneus</i>	Vaal/Orange Smallmouth Yellowfish	LC
<i>Labeobarbus kimberleyensis</i>	Largemouth Yellowfish	NT
<i>Labeo capensis</i>	Orange River Mudfish	LC
<i>Labeo umbratus</i>	Moggel	LC
<i>Oreochromis mossambicus</i>	Mozambique Tilapia	VU
<i>Pseudocrenilabrus philander</i>	Southern mouth-brooder	LC
<i>Tilapia sparrmanii</i>	Banded Tilapia	LC

LC - Least Concern, NT – Near Threatened, VU - Vulnerable

7 Results and Discussion

7.1.1 *In situ* Water Quality

In situ water quality analysis was conducted during the study at each pipeline crossing which contained water as well as the downstream site. Results have been compared to limits stipulated in the Target Water Quality Range (TWQR) for aquatic ecosystems (DWS, 1996). The results of the January 2020 assessment are presented in Table 8.

Table 8: *In situ* surface water quality results (January 2020)

Site	pH	Electrical Conductivity (µS/cm)	Dissolved Oxygen (mg/l)	Temperature (°C)
TWQR*	6.5-9*	-	>5.00*	5-30*
O1	7.78	246	8.12	36

*TWQR – Target Water Quality Range; Levels exceeding guideline levels are indicated in red

In situ water quality for the Orange River indicates natural conditions as they conform with Target Water Quality Ranges (TWQR). The only parameter which was not compliant was water temperature. Water temperature affects other aspects of water chemistry. High water temperatures can increase the water solubility and thus toxicity from certain compounds such as heavy metals. This in turn effects conductivity as it affects the concentration, charge and mobility of the ions that EC measures. The solubility of oxygen and other gases will decrease as temperature increases (EPA, 2012). Lastly water temperatures have the potential to affect the metabolic rates and biological activity of aquatic organisms (Fink, 2005). The high-water temperatures in the Orange River are however due to heat transfer from solar radiation and considered natural for the system. The parameters indicate water quality which would not be a limiting factor to local aquatic biota. The construction of the reticulation network is not considered to modify the water quality of these systems significantly if appropriate mitigation measures prescribed in the risk assessment are followed.

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7.1.2 Habitat Integrity Assessment

The IHIA was completed for the Orange River as described in the IHIA methodology component of this study. The special framework of which constitutes a 5km reach of the Orange River which would potentially be affected by the Pella Bulk Water Pipeline. The results thereof are shown in Table 9.

Table 9: Intermediate Habitat Integrity Assessment for the Orange River reach

Criterion	Impact Score	Weighted Score
Instream		
Water abstraction	5	2.8
Flow modification	4	2.1
Bed modification	5	2.6
Channel modification	4	2.1
Water quality	4	2.2
Inundation	3	1.2
Exotic macrophytes	0	0.0
Exotic fauna	0	0.0
Solid waste disposal	0	0.0
Total Instream Score		87
Instream Category		B
Riparian		
Indigenous vegetation removal	5	2.6
Exotic vegetation encroachment	6	2.9
Bank erosion	2	1.1
Channel modification	5	2.4
Water abstraction	8	4.2
Inundation	3	1.3
Flow modification	5	2.4
Water quality	3	1.6
Total Riparian Score		81.56
Riparian Category		B

The results of the instream and riparian habitat assessment in the associated Orange River indicates a largely natural state (class B). This indicates a small change in natural habitats and biota may have taken place, but the ecosystem functions are essentially unchanged. The sources of modification to the system are agriculture which uses irrigation from the system, regional water abstraction (Figure 22) as part of transfer schemes as well as alien invasive plant species.



Figure 5: Existing water extraction point for the bulk water pipeline (January 2020)

7.1.3 Aquatic Macroinvertebrate Assessment

7.1.3.1 Macroinvertebrate Habitat

Biological assessments were completed at representative sites in the considered river reach. The results of the biotope assessment are provided below (Table 10).

Table 10: Biotope availability at the sites (Rating 0-5)

Biotope	Weighting (Lowland River)	01
Stones in current	15	4
Stones out of current	12	3
Bedrock	2	4
Aquatic Vegetation	0.5	2
Marginal Vegetation In Current	2	2.5
Marginal Vegetation Out Of Current	2	1
Gravel	0.5	2
Sand	4	2.5
Mud	1.5	0.5
Biotope Score		55
Weighted Biotope Score (%)		21.5
Biotope Category (Tate and Husted, 2015)		C

The habitat availability within the Orange River represents fair habitat conditions (class C) within the reach. There is a good distribution of habitat for macroinvertebrates to inhabit with no biotopes missing, however the abundance and distribution of vegetation out of current and mud were limited. The biotope results within the reach indicate that the habitat availability would not be a limiting factor for the macroinvertebrate communities within the Orange River.

7.1.3.2 South African Scoring System

The aquatic macroinvertebrate results for the survey are presented in Table 11.

Table 11: Macroinvertebrate assessment results recorded during the survey (January 2020)

Site	SASS Score	No. of Taxa	ASPT*	Category (Dallas, 2007)**
01	159	30	5.3	A

*ASPT: Average score per taxon; ** Orange River Gorge ecoregion

The SASS5 assessment results generated SASS scores that are categorised as a class A for the Orange River reach (Dallas, 2007) which indicates natural conditions within the reach. The high number of taxa sampled during the survey are a clear indication that the sampled reach is in a natural condition (30). This high number of taxa increases the SASS Score which is one axis used to find the Dallas bands. This is considered significant as the reach is classed an A based on SASS score, but a C based on average score per taxon (ASPT). Both are considered for Dallas bands in an attempt to remove bias from highly intolerant and highly tolerant species in systems with low numbers of taxa. The ASPT indicated that not only tolerant taxa but also intolerant macroinvertebrates were collected during this survey. The tolerant macroinvertebrates include Oligochaeta (earthworms), Chironomidae (Blood worms) with some of the intolerant macroinvertebrates including three species of Baetidae, Leptophlebiidae (Prongills) and Tricorythidae (Stout Crawlers) to mention a few. The presence and wide distribution of specialist taxa across the biotopes along with high diversity of species indicates the current health of the system from a geomorphological, biological and chemical stance.

7.1.4 Fish Communities

The results of the qualitative fish community assessment are provided in Table 12. Eight fish species fish were observed during the survey. The most common species observed was *Labeo capensis* and *Oreochromis mossambicus* which were present throughout the survey. While there were five species which were not sampled it is assumed that, with increased efforts, these fish would be sampled due to presence of habitat required by these specialists. The two Near Threatened species identified of *Labeobarbus kimberleyensis* and *Oreochromis mossambicus* were sampled from the Orange River reach.

These fish were sampled from the downstream site in the Orange River which is expected to be minimally impacted on by the Pella Bulk Water Pipeline. The remaining watercourses are ephemeral and therefore dry.

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Table 12: Fish community assessment for January 2020 (Orange River)

Species/Site	O1	Sensitivity	
		No-flow	Phys-chem
<i>Austroglanis sclateri</i>	-	3.2	2.6
<i>Clarias gariepinus</i>	5	1.7	1
<i>Engraulicypris brevianalis</i>	28	2.3	
<i>Enteromius hospes</i>	-	*	
<i>Enteromius paludinosus</i>	-	2.3	1.8
<i>Enteromius trimaculatus</i>	-	2.7	1.8
<i>Labeobarbus aeneus</i>	40	3.3	2.5
<i>Labeobarbus kimberleyensis</i>	2	3.8	3.6
<i>Labeo capensis</i>	88	3.1	
<i>Labeo umbratus</i>	-	2.7	1.6
<i>Oreochromis mossambicus</i>	62	0.9	1.3
<i>Pseudocrenilabrus philander</i>	15	1	1.4
<i>Tilapia sparrmanii</i>	58	0.9	1.4
Total Native Species	8		
Total Expected Native Species	12	2.3	2.03
% Fish Community Sampled	67		

0 = Absent; 1 = Present; * - no data available

Table 13: Fish Response Assessment Index for the 2020 survey

Scientific Name of Reference Species	Reference FROC*	FROC
		Orange River
<i>Austroglanis sclateri</i>	1	0
<i>Clarias gariepinus</i>	4	5
<i>Engraulicypris brevianalis</i>	2	5
<i>Enteromius hospes</i>	2	0
<i>Enteromius paludinosus</i>	3	0
<i>Enteromius trimaculatus</i>	3	0
<i>Labeobarbus aeneus</i>	5	5
<i>Labeobarbus kimberleyensis</i>	2	5
<i>Labeo capensis</i>	3	5
<i>Labeo umbratus</i>	2	0
<i>Oreochromis mossambicus</i>	3	5
<i>Pseudocrenilabrus philander</i>	3	5
<i>Tilapia sparrmanii</i>	3	5
FRAI % (Automated)		67.4

EC FRAI

class C

*FROC = Frequency of Occurrence

The results of the FRAI derived a moderately modified (class D) fish community structure for the sampled Orange River reach. The results need to be analysed with great precaution as the methodology requires multiple sites, with only one selected on the Orange River reach (Avenant., 2010). All tributary systems were dry and therefore not sampled, with multiple sites not selected on the Orange River as it was not the focus of the study. Due to the rapid nature of sampling there were species which were not collected; however, habitat was present, and the species are expected to be present. Therefore, provided more thorough analysis is undertaken, the system is suspected to score in a higher class (A/B). Only 33% of the fish species were not sampled with the vulnerable and near threatened species sampled which indicated good water quality and available habitat. The instillation of the underground Pella pipeline is expected to have minimal effects on the Orange River and its associated fish species.

8 Impact / Risk Assessment

The project is for the construction of the proposed Pella Bulk Water Pipeline, that will traverse several ephemeral watercourses. The entire proposed pipeline is aligned with existing dirt road and infrastructure servitudes with existing areas of impact. There are however points of crossing with ephemeral rivers. As this project is for the installation of a buried water pipeline, with all watercourses directly impacted being dry, impacts associated with the area are potentially low. Modifications to watercourses are likely to occur during construction with negligible impacts in the operation phase. The project will entail the clearing of minor amounts of re-established vegetation and levelling of areas for the construction activities. This has the potential to increase erosion and sedimentation of downstream habitats due to surface runoff during the wet season. This will however occur in an area which has been previously impacted by the same activities (existing pipeline).

Soluble construction materials have the potential to dissolve in runoff from the area. This can result in the increase of dissolved solids in downstream waterbodies resulting in a water quality impact. Further to this, suspended materials emanating from the construction area may alter the physical water parameters and result in the sedimentation of downstream areas which will have negative effects to local aquatic ecology. This impact will only occur during the construction phase as negligible impacts are foreseen beyond the construction phase. Further mitigating the potential effects is all assessed watercourses being dry allowing for large temporal scales in order to address spills before flow begins.

The impact assessment considered both direct and indirect impacts to the water resources. The mitigation hierarchy as discussed by the Department of Environmental Affairs (2013) will be considered for this component of the study (Figure 6). Risks which are assigned to the decommissioning phase of the pipeline are considered the same as during the construction phase.

In accordance with the mitigation hierarchy, the preferred mitigatory measure is to first avoid impacts by considering options in project location, siting, scale, layout, technology and phasing.

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If avoidance isn't possible, associated risks should be minimised. In instances where impacts are unavoidable, rehabilitation will be required.

Findings from the impact assessment are provided in Table 14, Table 15 and Table 16. Findings from the DWS risk assessment are provided in Table 17 and Table 18.

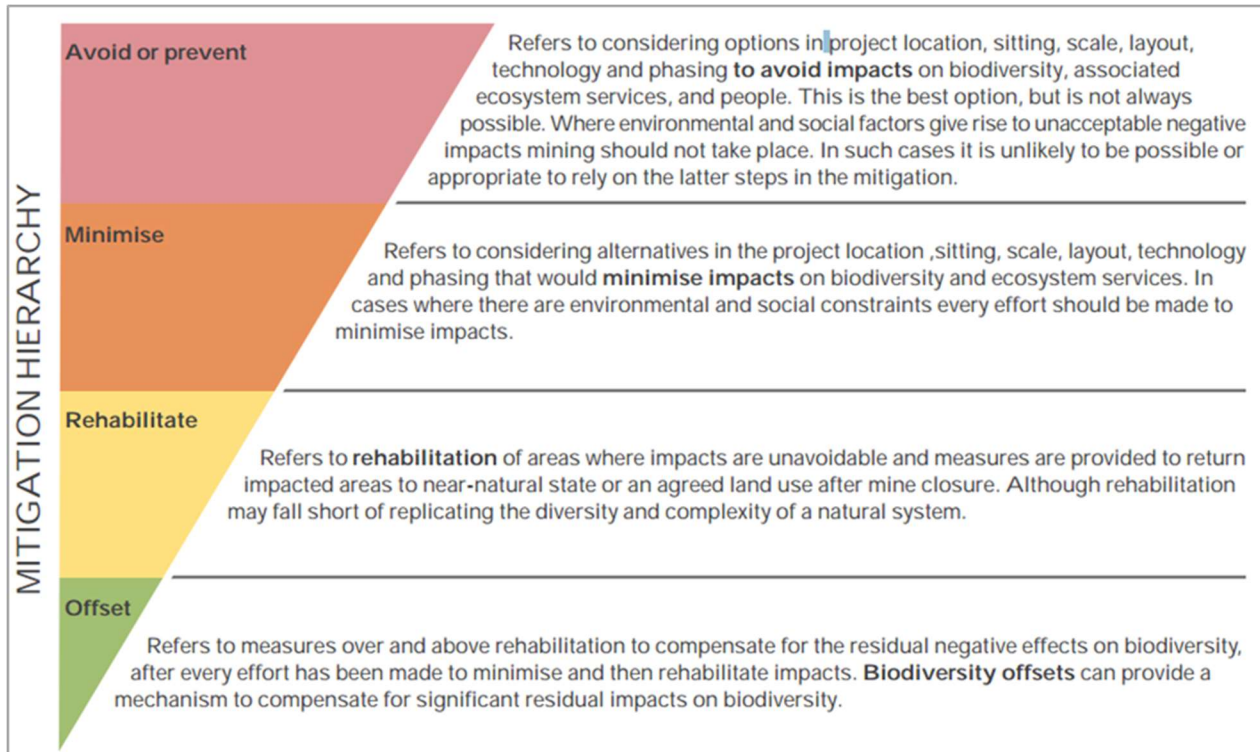


Figure 6: The mitigation hierarchy as described by the DEA (2013)

Table 14: Potential impacts associated with the project

Dale Kindler	Pr Sci Nat	114743
Activity	Aspect	Impacts
Construction of Pipeline	<ul style="list-style-type: none"> • Drainage patterns change due to crossing • Excavated streambed • Removal of embankment vegetation areas • Cutting/reshaping of embankments • Operation of equipment and machinery in riparian areas. • Soil and building material stockpile management • Domestic and industrial waste • Storage of chemicals, mixes and fuel • Final landscaping and post-construction rehabilitation 	<ul style="list-style-type: none"> • Loss of embankments. • Siltation of watercourse. • Erosion of watercourse. • Increase in sediment inputs • Vegetation removal • Loss of seepage areas • Inundation of aquatic habitat • Alteration to future flow volumes
Operation of Pipeline	<ul style="list-style-type: none"> • Alteration of surface drainage and runoff • Storm water management • Establishment of alien plants on disturbed areas • Conducting maintenance 	<ul style="list-style-type: none"> • Alteration to flow volumes (impediment) • Alteration of patterns of flows (increased flood peaks) • Solid waste

8.1 Impact / Risk Significance

A variety of risks have been identified for the proposed project. The construction of the Pella bulk water pipeline will entail the clearing of areas and digging of trenches, laying of pipeline and attachment of the pipeline to the existing crossing structures which will pose risks to the identified watercourses, with the level of risk determined to vary from low to very low.

An expected risk with buried pipeline projects would normally be a temporary channel diversion however this will not be required provided the construction is completed in the dry season. The impacted watercourses are ephemeral in nature and therefore with no water in the system, channel diversion will not be required. This also removes the concern of damming and inundation upstream from construction provided construction is completed swiftly.

It is however important to note that the ephemeral nature of the system is not reason to ignore appropriate protocols and mitigations as there is established habitat which becomes niches for aquatic macroinvertebrates and associated aquatic life when flow begins.

The risks barring two were determined to be low for the construction phase of the project. These result from work required within the watercourse such as machinery excavating streambeds at crossing points. This may result in spillages of chemicals, fuels and waste which can result in soil and future water degradation. It has the potential to result in flow modification from altered watercourses through construction which result in bed and channel modification. These are all considered as a low risk using the DWS risk matrix (Table 17 and Table 18).

The operation of the pipeline does pose a risk to the identified water resources, with the level of risk determined to be low in both the impact assessment and DWS risk assessment. While having the same assigned category as for many risks of the construction phase, the impact assessment does not assist in understanding the extent of each category, as the associated risks for the construction phase are considered more significant than the operational phase. The lower risk significance is largely attributed to the study being for a water reticulation project.

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Taking into consideration that the project is for water reticulation, and that pipelines are generally aligned in road reserves and then branch up to the existing homesteads or storage facilities, the risks posed to watercourses is considered to be negligible. This is supported by the fact that the proposed pipeline will be replacing existing structures, indicating the area to already be disturbed.

The low risk ratings were re-allocated a very low status due to implementation of additional mitigation methodologies for the operational phase of the project. While the categories don't change the intensities, consequences of multiple risks are minimized during the construction phase.

Due to the low risks assigned to the project by the DWS risk assessment, authorisation under the provisions of the General Authorisation (GA) is deemed appropriate, provided mitigation measures and the recommendations are implemented.

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Table 15: Impact Matrix for the proposed project – Pre Mitigation

ACTIVITY	APPLICABLE AREA	POTENTIAL ENVIRONMENTAL IMPACT	ENVIRONMENTAL SIGNIFICANCE					
			Intensity (I)	Duration (D)	Extent (E)	Consequences (C)	Probability (P)	Significance (S)
Construction Phase								
Drainage patterns change due to crossing	Watercourse	Flow modification due to artificial structures such as gabions if required, as well as infiltration changes due to soil stratification and artificial material	M	L	VL	L	H	L
Excavated streambed	Watercourse	Habitat destruction for potential aquatic life. Changes in bed and channel modification which causes flow modification	H	VL	VL	L	VH	L
Removal of embankment vegetation areas	Watercourse and Riparian Areas	Removal of vegetation which keeps soil intact increases the risk of erosion as well as for alien vegetation to establish in its place.	M	L	VL	L	VH	L
Cutting/reshaping of embankments	Watercourse and Riparian Areas	Habitat destruction for potential aquatic life. Changes in bed and channel modification which causes flow modification	M	L	VL	L	VH	L
Operation of equipment and machinery in riparian areas	Riparian Areas	Habitat destruction for potential aquatic life. Changes in bed and channel modification which causes flow modification	M	L	VL	L	VH	L
Soil and building material stockpile management	Floodplain	Poor soil management causes changes in the soil profile which decreases fertility as well as increase the erosion potential. Erosion of stockpiles is high	L	L	VL	L	H	L
Domestic and industrial waste	Floodplain	Contamination risk if spills occur. Impaired soil and water quality.	VL	M	VL	VL	H	VL
Storage of chemicals, fuels & materials	Floodplain	Contamination risk if spills occur. Impaired soil and water quality.	VL	VL	VL	VL	H	VL
Final landscaping and post-construction rehabilitation	Watercourse and Riparian Areas	Considered a positive change to the landscape as the affected area by construction is returned to the state before construction began.	L+	L	VL	L	VH	L
Operational Phase								
Alteration of surface drainage and runoff	Watercourse	Disturbed soils and potential artificial surfaces influence infiltration and runoff amounts and directions which effect course flow modification.	L	VH	VL	L	VH	L
Storm water management	Watercourse	Disturbed soils and potential artificial surfaces influence infiltration and runoff amounts and directions which affect course flow modification, exasperated by storm events.	VL	VH	L	L	H	L
Establishment of alien plants on disturbed areas	Riparian Areas and Floodplain	Due to disturbed soils and lack of competition from established vegetation, which was removed by construction, alien vegetation will establish	L	M	L	L	H	L
Conducting maintenance	Complete Project Area	When maintenance or repair is required the pipeline will need to be uncovered which has the assigned risk of all above risks at a smaller scale.	M	VL	L	L	VH	L

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

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Table 16: Impact Matrix for the proposed project – Post Mitigation

ACTIVITY	APPLICABLE AREA	POTENTIAL ENVIRONMENTAL IMPACT	ENVIRONMENTAL SIGNIFICANCE					
			Intensity (I)	Duration (D)	Extent (E)	Consequences (C)	Probability (P)	Significance (S)
Construction Phase								
Drainage patterns change due to crossing	Watercourse	Flow modification due to artificial structures such as gabions if required, as well as infiltration changes due to soil stratification and artificial material	L	L	VL	L	M	VL
Excavated streambed	Watercourse	Habitat destruction for potential aquatic life. Changes in bed and channel modification which causes flow modification	M	VL	VL	L	VH	L
Removal of embankment vegetation areas	Watercourse and Riparian Areas	Removal of vegetation which keeps soil intact increases the risk of erosion as well as for alien vegetation to establish in its place.	L	L	VL	L	VH	L
Cutting/reshaping of embankments	Watercourse and Riparian Areas	Habitat destruction for potential aquatic life. Changes in bed and channel modification which causes flow modification	M	L	VL	L	H	L
Operation of equipment and machinery in riparian areas	Riparian Areas	Habitat destruction for potential aquatic life. Changes in bed and channel modification which causes flow modification	L	L	VL	L	VH	L
Soil and building material stockpile management	Floodplain	Poor soil management causes changes in the soil profile which decreases fertility as well as increase the erosion potential. Erosion of stockpiles is high	L	L	VL	L	H	L
Domestic and industrial waste	Floodplain	Contamination risk if spills occur. Impaired soil and water quality.	VL	M	VL	VL	M	VL
Storage of chemicals, fuels & materials	Floodplain	Contamination risk if spills occur. Impaired soil and water quality.	VL	VL	VL	VL	H	VL
Final landscaping and post-construction rehabilitation	Watercourse and Riparian Areas	Considered a positive change to the landscape as the affected area by construction is returned to the state before construction began.	L+	L	VL	L	VH	L
Operational Phase								
Alteration of surface drainage and runoff	Watercourse	Disturbed soils and potential artificial surfaces influence infiltration and runoff amounts and directions which affect cause flow modification.	VL	VH	VL	L	L	VL
Storm water management	Watercourse	Disturbed soils and potential artificial surfaces influence infiltration and runoff amounts and directions which affect cause flow modification, exasperated by storm events.	VL	VH	VL	L	L	VL
Establishment of alien plants on disturbed areas	Riparian Areas and Floodplain	Due to disturbed soils and lack of competition from established vegetation, which was removed by construction, alien vegetation will establish	VL	L	L	VL	M	VL
Conducting maintenance	Complete Project Area	When maintenance or repair is required the pipeline will need to be uncovered which as the assigned risk of all above risks at a smaller scale.	L	VL	VL	VL	VH	VL

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

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Table 17: DWS Risk Impact Matrix for the proposed project

Aspect	Flow Regime	Water Quality	Habitat	Biota	Severity	Spatial scale	Duration	Consequence
Construction Phase								
Drainage patterns change due to crossing	2	1	1	1	1.33	1	2	4.33
Excavated streambed	1	1	2	1	1.25	1	2	4.25
Removal of embankment vegetation areas	2	1	3	1	1.75	2	2	5.75
Cutting/reshaping of embankments	3	1	2	1	1.75	1	2	4.75
Operation of equipment and machinery in riparian areas	2	2	2	1	1.75	2	2	5.75
Soil and building material stockpile management	1	2	1	1	1.25	1	2	4.25
Domestic and industrial waste	1	2	1	1	1.25	2	2	5.25
Storage of chemicals, mixes and fuel	1	2	2	1	1.5	1	2	4.5
Final landscaping and post-construction rehabilitation	1	1	2	1	1.25	2	2	5.25
Operational Phase								
Alteration of surface drainage and runoff	1	1	2	1	1.25	1	4	6.25
Storm water management	1	2	1	1	1.25	2	4	7.25
Establishment of alien plants on disturbed areas	1	2	1	1	1.25	2	2	5.25
Conducting maintenance	2	2	2	1	1.75	2	4	7.75

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Table 18: DWS Risk Impact Matrix for the proposed project continued

Aspect	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Sig.	Without Mitigation	With Mitigation
Construction Phase								
Drainage patterns change due to crossing	1	2	5	3	11	47.67	Low	Low
Excavated streambed	1	4	5	1	11	46.75	Low	Low
Removal of embankment vegetation areas	1	3	1	2	7	40.25	Low	Low
Cutting/reshaping of embankments	1	2	5	1	9	42.75	Low	Low
Operation of equipment and machinery in riparian areas.	1	3	1	1	6	34.5	Low	Low
Soil and building material stockpile management	1	1	1	1	4	17	Low	Low
Domestic and industrial waste	4	1	1	2	8	42	Low	Low
Storage of chemicals, mixes and fuel	1	1	1	2	5	22.5	Low	Low
Final landscaping and post-construction rehabilitation	1	1	1	1	4	21	Low	Low
Operational Phase								
Alteration of surface drainage and runoff	1	1	5	1	8	50	Low	Low
Storm water management	2	2	1	1	6	43.5	Low	Low
Establishment of alien plants on disturbed areas	2	2	1	2	7	36.75	Low	Low
Conducting maintenance	1	1	1	1	4	31	Low	Low

8.2 Mitigation Measures

The prescribed mitigation measures for the project include the following:

8.2.1.1 Water pipeline installation specific mitigation measures

- The footprint area of the pipeline must be kept to a minimum. The footprint area must be clearly demarcated to avoid unnecessary disturbances to adjacent areas;
- The footprint area must be aligned with the existing pipeline or existing road reserves wherever possible. Disturbed areas should be sought as the preferred alignment area;
- Pipeline trenches and sandy bedding material may produce preferential flow paths for water across the project area perpendicular to the general direction of flow. This risk can be reduced by installing clay plugs at intervals down the length of the trench to force water out of the trench and down the natural topographical gradient;
- Due to the flat gradient of these watercourses, it is imperative that after burial the trenches are not raised or depressed as it will produce artificial flow directions.
- Pipelines buried underground should be buried at a sufficient depth below ground level such that the pipelines do not interfere with surface water movement or create obstructions, where flows can cause erosion;
- The pipeline should be regularly inspected (yearly) for any signs of failure, damage or leaks. Adequate maintenance measures need to be implemented upon finding pipeline issues and failures; and
- Inspection points must be located outside of watercourses.

8.2.1.2 General mitigation measures

The following general mitigation measures are provided:

- The construction vehicles and machinery must make use of existing access routes as much as possible, before adjacent areas are considered for access;
- Laydown yards, camps and storage areas must be beyond the aquatic areas delineated watercourse extend and associated buffer zones). Where possible, the construction of the pipeline and crossings must take place from the existing road servitudes and not from within the aquatic systems;
- The contractors used for the project should have spill kits available to ensure that any fuel or oil spills are cleaned-up and discarded correctly;
- It is preferable that construction takes place during the dry season to reduce the erosion potential of the exposed surfaces; as well as guarantee dry watercourses. If construction will exceed this temporal scale (one season), construction should be halted during storm events only;
- Prevent uncontrolled access of vehicles through the rivers that can cause future significant adverse impact on the hydrology and alluvial soil structure of these areas;

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- All chemicals and toxicants to be used for the pipeline construction must be stored outside the channel system and in a bunded area;
- All machinery and equipment should be inspected regularly for faults and possible leaks, these should be serviced off-site;
- All contractors and employees should undergo induction which is to include a component of environmental awareness. The induction is to include aspects such as the need to avoid littering, the reporting and cleaning of spills and leaks and general good “housekeeping”;
- Adequate sanitary facilities and ablutions on the servitude must be provided for all personnel throughout the project area. Use of these facilities must be enforced (these facilities must be kept clean so that they are a desired alternative to the surrounding vegetation);
- All removed soil and material must not be stockpiled within the system. Stockpiling should take place outside of the watercourse. All stockpiles must be protected from erosion, stored on flat areas where run-off will be minimised, and be surrounded by bunds;
- Erosion and sedimentation into drainage channels must be minimised through the effective stabilisation if required (gabions and Reno mattresses) (see site M1) and the re-vegetation of any disturbed banks;
- Any exposed earth should be rehabilitated promptly by planting suitable vegetation (vigorous indigenous grasses) to protect the exposed soil. Large portions of the natural area is bare soil and should be kept as such;
- No dumping of construction material on-site may take place;
- All waste generated on-site during construction must be adequately managed. Separation and recycling of different waste materials should be supported; and
- 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.

8.2.2 Recommendations

The following are recommendations made in support of the Riverine Baseline assessment:

- A soil management strategy must be compiled and implemented for the excavation and back-filling of trenches. A proposed soil handling sequence is presented in Figure 7.
- An infrastructure monitoring and service plan must be compiled and implemented during the operational phase. Selected points must avoid watercourses.
- An Environmental Control Officer (ECO) must oversee the construction phase of the project.

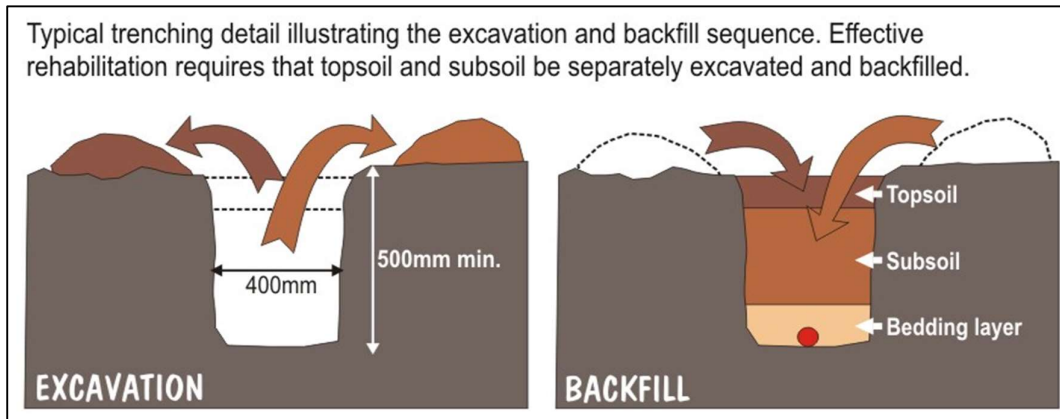


Figure 7: The proposed excavation and back-filling handling of soil

9 Conclusion

9.1 Aquatics baseline

The Orange River (D81F-03445 SQR's) from which water will be sourced for the proposed reticulation network is considered to be largely natural (B) at desktop level (PES). The reach has high Ecological Importance and Ecological Sensitivity. This was confirmed through the baseline survey where water quality indicated natural conditions. Aquatic macroinvertebrate species were found to be both abundant and diverse indicating the current health of the system from a geomorphological, biological and chemical stance. The SASS5 assessment results generated SASS scores that are categorised as a class A for the Orange River reach.

A total of 13 indigenous fish species are expected within the reach, with one near threatened species (*Labeobarbus kimberleyensis*) and one vulnerable species (*Oreochromis mossambicus*). Eight of the thirteen species were sampled during the survey which included both red list species. FRAI derived a score of moderately modified (class D) with a higher expected score with increased sampling efforts as habitat for missing species was present.

The available habitat within the reach was in a largely natural state in both the riparian and instream areas. The largest modifiers were water abstraction and exotic vegetation encroachment.

All watercourses are expected to experience minimal impacts from the proposed pipeline due to their temporal and spatial reference to the project.

9.2 Risk Assessment

A variety of risks have been identified for the proposed project for both the construction and operational phase. The impacts of which all stem from construction within a defined watercourse. The associated risks are however significantly lowered due to the ephemeral nature of the watercourses but are not absent as the watercourse still forms important habitat for aquatic life when they do flow.

Taking into consideration that the project is for water reticulation, and that pipelines are generally aligned in road reserves and then branch up to the existing homesteads, the risks posed to watercourses are considered negligible. This is supported by the fact that the

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proposed pipeline will also replace existing structures, indicating the area to already be disturbed. This statement is however only considered valid provided the attributed mitigation measures are considered and implemented.

9.3 Specialist Recommendation

It is the opinion of the specialists that the project poses no fatal flaws and the project qualifies for authorisation under the provisions of the General Authorisation. After burial the pipeline will have negligible effects on the associated watercourse.

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